TECHNICAL MEMORANDUM
RECOMMENDATION FOR MODIFICATIONS TO THE INTERIM OFFSHORE MONITORING PROGRAM FOR OU4 PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Interim offshore monitoring is currently being conducted at 14 monitoring stations adjacent to Portsmouth Naval Shipyard (PNS) in Kittery, Maine, and at four reference stations in the Piscataqua River. Figure 1 is a site location figure, Figure 2 shows the locations of the monitoring stations, and Figure 3 shows the locations of the reference stations. The objective of this Technical Memorandum is to summarize the results of the offshore investigations that have been conducted at each monitoring and reference station to data, and to present the rationale for recommending modifications to the monitoring program prior to the Round 10, which is scheduled for October 2008. These modifications to the monitoring program are being made to comply with the Navy Sediment Policy requiring an exit strategy for monitoring and limiting of investigations to areas linked to a Navy (Navy, February 2002).

Interim offshore monitoring is being conducted in accordance with the Interim Offshore Monitoring Plan for Operable Unit (OU) 4 (TtNUS, October 1999) and modifications based on the Baseline Report (TtNUS, July 2002) and the Rounds 1 through 7 Interim Offshore Monitoring Program Report (TtNUS, November 2004). As part of the monitoring program, interim remediation goals (IRGs) were developed for chemicals potentially causing the greatest offshore impact [i.e., copper, nickel, acenaphthylene, anthracene, fluorene, and high molecular weight (HMW) polycyclic aromatic hydrocarbons (PAHs)] (TtNUS, November 2001). The IRGs (along with the Effects Range-Median [ER-M] for lead) are used to make decisions as part of the Interim Offshore Monitoring Program. Chemical concentrations detected in sediment samples from monitoring stations are also compared to chemical concentrations in reference samples to determine whether the contamination is site-related or similar to reference concentrations.

OU4 includes the areas offshore of PNS that were potentially affected by PNS onshore Installation Restoration Program (IRP) sites. OU4 is divided into six areas of concern (AOCs) based on the nearshore habitats adjacent to PNS, Clark Cove AOC, Sullivan Point AOC, DRMO Storage Yard AOC, Dry Docks AOC, Back Channel AOC, and Jamaica Cove AOC. Figure 4 presents the locations of each AOC.

Two onshore IRP sites near the Dry Docks AOC (Sites 5 and 26) were considered to have offshore impacts but no onshore impacts. Therefore, these two sites were included only as part of OU4 and were not included in any onshore OUs. Operations at Site 5, Industrial Waste Outfalls, were discontinued in 1975. Operations for Site 26, Portable Oil/Water Tanks, have been modified so that the tanks only handle petroleum-related waste and so no longer impact the

offshore. A Decision Document for Site 26 was signed in August 2001 indicating that no further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, commonly referred to as Superfund) is necessary, and therefore Site 26 is no longer an IRP site (and no longer included in OU4) (Navy, August 2001). Previous releases from Sites 5 and 26 to the offshore area are being addressed as part of OU4.

Interim offshore monitoring at OU4 began in 1999, and nine rounds of samples have been collected as of November 2007. Samples were collected twice a year during Rounds 1 through 4, and once a year during Rounds 5 through 9. Generally, three locations were sampled at each monitoring station, and four locations were sampled at each reference station. Various modifications to this have occurred at a few stations during some sampling rounds. The sampling frequency at the monitoring and reference stations has been as follows:

- Seven rounds of sediment data were collected at monitoring stations MS-01 through MS-04, MS-06, MS-07, MS-11, and MS12.

- Eight rounds of sediment data were collected at monitoring stations MS-10, MS-13, MS-14 and reference stations RS-01, RS-03, and RS-04. Round 9 sampling was not conducted at these three reference stations and three monitoring stations for reasons presented in the Phase II Additional Scrutiny Quality Assurance Project Plan (QAPP) (TtNUS, September 2007).

- Nine rounds of sediment data were collected at monitoring stations MS-05, MS-08, MS-09 and reference station RS-02.

The sediment samples collected during Rounds 1 through 7 were analyzed for PAHs, pesticides, polychlorinated biphenyls (PCBs), metals, grain size, and total organic carbon (TOC). Sediment samples from MS-07 through MS-12 and RS-01 through RS-04 were also analyzed for dioxins/furans.

The analytical data from the first seven sampling rounds were evaluated in the Baseline Interim Offshore Monitoring Report (TtNUS, July 2002). The main objective of the Baseline Report was to recommend the appropriate season for future monitoring rounds. The report also provided a comparison of chemical concentrations in sediment to IRGs, evaluated the need for continued juvenile lobster sampling, contained a risk evaluation of dioxin data, and presented some additional evaluations. In summary, recommendations in the Baseline Report included: (1) discontinue analysis of sediment samples for acid volatile sulfides and simultaneously

extracted metals (AVS/SEM), (2) discontinue juvenile lobster sampling, and (3) continue sampling in late summer only. Because Round 5 sampling had been conducted prior to finalizing the Baseline Report, these changes were implemented beginning with the Round 6 sampling event.

The analytical data from the first seven sampling rounds were evaluated in the Rounds 1 through 7 Interim Offshore Monitoring Program Report (TtNUS, November 2004). The main objectives of the report were to determine the appropriate frequency of monitoring for each monitoring station for the next 5 years and to determine whether additional scrutiny was needed at any monitoring station. In addition, this report provided an evaluation of the Rounds 1 through 7 data to determine whether modifications to the program should be made. In particular, a risk evaluation was provided to determine whether to discontinue dioxin/furan analyses, and the mussel tissue data were evaluated to determine whether to discontinue mussel sampling and analysis for selected monitoring and/or reference stations. The following summarizes the recommendations of the Rounds 1 through 7 Report:

- Collect sediment samples at MS-05, MS-08, MS-09, MS-10, MS-13, and MS-14 during Rounds 8 and 9.

- Conduct additional scrutiny at MS-01, MS-03, MS-04, MS-05, MS-08, MS-09, MS-11, and MS-12. Additional scrutiny at monitoring stations MS-03 and MS-04 was not needed as part of the OU4 monitoring program for copper and nickel because additional scrutiny had occurred in the area represented by those stations as part of the Phase I Remedial Investigation (RI) for Site 32 (TtNUS, January 2004). PAHs will be evaluated in planning for the Phase 2 RI for Site 32 to determine the additional scrutiny that is recommended for these chemicals.

- Do not collect mussels until the next 5-year sampling event.

- Discontinue analysis of sediment and mussel samples for alkylated PAHs.

- Perform dioxin/furan analysis only at monitoring stations MS-08, MS-09, and the reference stations for Rounds 8 and 9, but perform dioxin/furan analysis for monitoring stations MS-07 through MS-12 and the reference stations during Round 10.

- Conduct further evaluation of 4,4'-DDT as part of the additional scrutiny for MS-01 and MS-08. Additional scrutiny for 4,4'-DDT was not conducted at MS-08 because the sediment with the elevated 4,4'-DDT detection was excavated as part of the OU3 remedial activities.

An Additional Scrutiny investigation was conducted based on the recommendations in the Rounds 1 through 7 Report, and the results were presented in the Additional Scrutiny Report (TtNUS, August 2007). A technical meeting between the Navy, regulators, and Tetra Tech was conducted on April 26, 2007, to discuss the Additional Scrutiny investigation. The minutes from that meeting are included as Appendix D of the Additional Scrutiny Report. Based on the results of that report, the Navy agreed to conduct Phase II Additional Scrutiny investigations at MS-01 and MS-12, as presented in the Phase II Additional Scrutiny QAPP (TtNUS, September 2007). Additional recommendations for modifications to the monitoring program were presented in two technical memoranda included in Appendix A of the Phase II Additional Scrutiny QAPP. The first memorandum recommended some modifications to monitoring stations at MS-05 and MS-09 as well as eliminating the reference locations from the Round 9 sampling event. The second memorandum recommended discontinuing monitoring at monitoring stations MS-10, MS-13, and MS-14. The regulators agreed with the recommendations in both memorandums with one exception. They requested that sediment samples be collected from one of the four reference stations. The Navy selected reference station 02 for sampling.

Table 1 presents a summary of the investigations conducted at each monitoring stations for the first nine rounds. The table also presents the samples collected during the previous investigations and the sampling recommended as part of this technical memorandum.

BACK CHANNEL AREA OF CONCERN

The Back Channel AOC is located in the back channel of the Piscataqua River. Monitoring stations located within this AOC include MS-01 through MS-04. Known IRP sites located immediately onshore of the Back Channel AOC include Sites 32 and 34. The following sections present the evaluations conducted and recommendations for the monitoring stations located within the Back Channel AOC.

MS-01

Monitoring station MS-01 is located offshore of Site 34 (OU9) and adjacent to the bridge leading to Gate No. 1 (see Figure 2). The primary environmental concern for this monitoring station is PAHs in sediment that may be from disposal of ash from Site 34 operations around Building 62. The ash was characterized as having concentrations of PAHs much greater than acceptable risk levels. A removal action was conducted at Site 34 in 2007 and included removal of all ash around Building 62 and 62 annex and stabilization of a portion of the shoreline. As part of the

removal action, ash and soil mixed with ash were removed by excavating from the ground surface until native material with no ash was observed. Native and non-native materials were identified based on their color. The excavated area was backfilled with clean fill material. One area of Site 34, a grassy area with large trees, was not included in the 2007 removal action. Based on the ash extent investigation conducted in April 2004, ash was generally found in the top 0.5 to 2 feet of soil and was found in relatively thin layers in the grassy area. Also, the adjacent shoreline (bedrock ledge) is stable, so erosion of ash along the shoreline is not likely. Therefore, the Navy determined that excavation of the ash in the grassy area was not warranted as part of the removal action.

Seven rounds of interim offshore monitoring and two Additional Scrutiny investigations were conducted at MS-01. Additional scrutiny was recommended at this monitoring station because concentrations of PAHs exceeded their respective IRGs (using the sampling results from the first seven monitoring rounds) and the trend lines indicated that concentrations are increasing (TtNUS, November 2004). Also, PAH concentrations in site sediment samples were greater than concentrations in reference samples. In accordance with the Additional Scrutiny QAPP (TtNUS, August 2005), additional sediment samples were collected at MS-01 to determine whether Site 34 was a primary source of PAHs at MS-01. The data from the additional sediment samples were evaluated in the Additional Scrutiny Report (TtNUS, August 2007), which concluded that Site 34 was not likely a current primary source but was likely a historical source of PAHs to the offshore area. This conclusion was based in part on a PAH forensics investigation conducted on sediment samples collected from the offshore area at MS-01 and in catch basins along storm water pipes that discharge to the offshore area and on soil samples collected from Site 34. In particular, a limited area of contamination near one sediment sample may be related to past sources of PAHs from Site 34.

A technical meeting was held with the Navy, regulators, and TtNUS on April 26, 2007, to discuss the Draft Additional Scrutiny Report. The minutes from this meeting are included in Appendix D of the Additional Scrutiny Report (TtNUS, August 2007). During the technical meeting, it was agreed that additional data were needed to understand the substrate and possibly determine the extent of PAH contamination in sediment at MS-01. It was recommended that the Navy continue the investigation in a phased approach and determine whether sufficient sediment is present in MS-01 to warrant consideration of a sediment removal action. It was noted during the meeting that if there was a significant amount of sediment at MS-01, sediment samples for PAH analysis could be collected as part of the remedial RI for Site 34 or as part of a subsequent OU4 investigation.

The Phase II Additional Scrutiny QAPP was prepared to present the methodologies to determine whether sufficient sediment is present at MS-01 to warrant consideration of a removal action (TtNUS, September 2007). The studies in the Phase II Additional Scrutiny QAPP were implemented in November 2007, and a Technical Memorandum was prepared to summarize the investigation results. It was concluded that there is a sufficient amount of sediment at MS-01 to warrant proceeding further with additional sampling. Therefore, sediment samples for PAH analysis are needed to determine the extent of PAHs in sediment at MS-01.

A Sampling and Analysis Plan (SAP) for the OU9 (Site 34) RI, which will include the collection of offshore sediment samples to determine the extent of the PAH contamination, is currently being prepared. To evaluate and make decisions regarding the onshore and offshore areas of Site 34, it is recommended that the offshore area defined by MS-01 be removed from OU4 and included in OU9. OU9 would then include Site 34 and MS-01 (western portion of the Back Channel AOC). The OU9 RI would include characterization of the nature and extent of contamination and risks and the OU9 Feasibility Study (FS) would evaluate remedies for onshore and offshore areas. The Sampling and Monitoring Plan (SMP) would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU9 would provide the required schedule for the RI and subsequent documents for OU9.

MS-02

Monitoring station MS-02 is located between Topeka Pier and the bridge leading to Gate No. 2 (see Figure 2). There are no known onshore IRP sites adjacent to MS-02 that may potentially impact the sediment at this monitoring station.

Seven rounds of interim offshore monitoring were conducted at this station. As presented in the Rounds 1 through 7 Report (TtNUS, November 2004), the concentrations of PAHs and metals were less than IRGs in the first seven rounds and were predicted to remain less than their IRGs for the next 5 years. Chemical concentration plots presenting the first seven rounds of PAH and metals data compared to their respective IRGs are presented in Attachment A.1. Additional scrutiny was not recommended for this monitoring station in the Rounds 1 through 7 Report because chemical concentrations were significantly less than IRGs.

No additional offshore monitoring or actions are needed for MS-02 because chemical concentrations in sediment are less than IRGs and there are no known IRP sites onshore of MS-02. In addition, the range of PAH and metals concentrations detected at MS-02 were similar to or within the range of concentrations in the reference samples. Therefore, it is recommended

that interim offshore monitoring be discontinued at MS-02 and that MS-02 be removed from the Back Channel AOC and OU4.

MS-03 and MS-04

Monitoring stations MS-03 and MS-04 are located offshore of Site 32 (OU7) (see Figure 2); foundry slag associated with Site 32 has been identified in the intertidal areas of MS-03 and MS-04 and is likely the source of elevated metals concentrations at those stations. Concentrations of PAHs were greater than IRGs in a few samples at MS-04.

Seven rounds of interim offshore monitoring were conducted at this station, along with Phase I Site 32 RI sampling as described below. Several chemicals detected in sediment at MS-03 and MS-04 were at concentrations that exceeded their respective IRGs and concentrations in reference samples. Additional scrutiny at these monitoring stations was not needed as part of the OU4 monitoring program for copper and nickel because the offshore area was investigated as part of the Phase I RI for Site 32 (TtNUS, January 2004 and June 2004). The Round 1 through 7 Report (TtNUS, November 2004) indicated that PAHs would be evaluated during planning for the Phase II RI for Site 32 to determine the additional scrutiny recommended for these chemicals.

During Phase I Site 32 RI sampling, the presence of foundry slag and copper and nickel concentrations in sediment in the intertidal area of Site 32 was further investigated. Slag mapping indicated that slag was generally in the mid- to high tide portion of the intertidal area, and potentially impacted finer-grained sediment was found in the mid- to low tide portion of the intertidal area. The sediment data showed that concentrations of copper and nickel in samples located further away from the shoreline were less than IRGs. Samples with exceedances of IRGs were located in the mid-tide area and were bounded by samples to the east, west, and north.

In June 2006, the Navy conducted an emergency removal action to address shoreline erosion north of Building 306. Based on the presence of debris, including foundry slag, the Navy removed surface debris and placed shoreline controls (e.g., geotextile fabric covered with rip-rap) along the entire length of the Site 32 shoreline (approximately 1,200 linear feet), in the mid- to high tide area (TtEC, September 2006).

Based on the results of the Interim Offshore Monitoring Program and Phase I RI, the Navy will conduct a Phase II RI that will include additional sediment sampling to determine the extent of copper and PAH IRG exceedances in the mid-to low tide area of the Site 32 shoreline. A Phase II RI SAP for OU7 is currently being prepared. To evaluate and make decisions regarding the

onshore area (Site 32) and the offshore area (MS-03 and MS-04), it is recommended that the offshore area defined by MS-03 and MS-04 be removed from OU4 and included in OU7. OU7 would then include Site 32 (onshore) and MS-03 and MS-04 (eastern portion of the Back Channel AOC). If this recommendation is implemented, the SMP would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU7 would provide the required schedule for Phase II RI and subsequent documents for OU7 (including MS-03 and MS-04).

JAMAICA COVE AND CLARK COVE AOCs

Monitoring stations MS-05 and MS-06 are located offshore of OU3 in Jamaica Cove and MS-07, MS-08, and MS-09 are located in Clark Cove. As part of the remedy for OU3, the Navy completed excavation and consolidation of contaminated soil/waste in the area adjacent to Jamaica Cove in September 2002 and completed construction of wetlands in June 2003. Other activities for the OU3 remedy began in spring 2003, including construction of shoreline erosion controls in Clark Cove, site compaction and grading, construction of drainage systems, followed by placement of geosynthetics on the northern portion of OU3. In the 2004 construction season, the geosynthethic materials were placed on the southern portion of OU3, a concrete wearing surface was placed on the boat storage area, an upper revetment was constructed along Clark Cove, landscaping plantings were installed, and topsoil was placed for construction of ballfields. In 2004, an area of waste was identified in Clark Cove outside the revetment, near MS-08. The area was excavated and the waste was placed under the geosynthetic material. The excavated area was backfilled with stone and silty sand.

During OU3 construction activities, turbidity curtains were used in Jamaica Cove and Clark Cove to minimize turbidity impacts from overland runoff.

The following sections describe the sampling activities and investigations that have occurred at each of the monitoring stations in the Jamaica Cove and Clark Cove AOCs.

MS-05

MS-05 is located in the offshore area of OU3 in Jamaica Cove and is adjacent to the wetland constructed as part of the remedy for OU3 (see Figure 2).

Nine rounds of interim offshore monitoring and Phase I Additional Scrutiny were conducted at this station. Sediment samples were also collected from an Additional Scrutiny location (AS05-SD15)

and an additional monitoring station location (MS-05, Location [Loc 4]) as part of the Round 9 sampling event. Based on the first seven rounds of data (metals were detected at concentrations that exceeded IRGs and reference concentrations) and because of the offshore impacts from OU3 construction activities, it was recommended in the Rounds 1 through 7 Report (TtNUS, November 2004), that interim offshore monitoring be continued on an annual basis until at least Round 10 (when the monitoring program was to be re-evaluated).

The objective of the Additional Scrutiny investigation at MS-05 was to determine the extent of copper and nickel concentrations in sediment that exceed IRGs and the extent of lead concentrations in sediment that exceed the ER-M. The extent of contamination was bounded with the Additional Scrutiny investigation samples and the one additional sample (at location AS05-SD15) collected as part of the Round 9 sampling event. In addition, a few changes were recommended for this monitoring station for the Round 9 interim offshore monitoring event. These modifications were presented in the Phase II Additional Scrutiny QAPP (TtNUS, September 2007) and are summarized as follows:

- Concentrations of copper and nickel were greater than IRGs and concentrations of lead were greater than its ER-M (Long et al., 1995) at MS-05, Loc. 1. The ER-M was used to evaluate lead because an IRG was not developed for lead. Therefore, a sediment sample was collected from an additional monitoring location (MS-05, Loc. 4), approximately 50 feet north of MS-05, Loc. 1, to ensure that the size of the area with elevated concentrations of metals was not increasing. The sample was only analyzed for copper and lead.

- Sediment samples from MS-05, Loc. 2 consistently had low chemical concentrations in the first eight rounds. Because of this, MS-05, Loc. 2 was moved approximately 200 feet to the southeast toward OU3 to better monitor the sediment in this area. This location will be designated as MS-1, Loc 2A in future monitoring rounds to differentiate it from the previous location.

The sample from AS05-SD15 had low concentrations of copper (27 mg/kg) and lead (40 mg/kg), as presented in the Round 9 and Phase II Additional Scrutiny Data Package (scheduled for submittal September 2008). The sample from MS-05, Loc. 4 also had low concentrations of copper (64 mg/kg) and lead (68 mg/kg). Therefore, the extent of contamination is defined in the areas of those samples.

The concentration of copper (501 mg/kg) was greater than its IRG, and the concentration of lead (509 mg/kg) was greater than its ER-M at MS-05, Loc. 2. Therefore, this new sample location will

provide better monitoring data for sediment in the area offshore of OU3 than its previous location. For Round 10, the following are recommended:

- Collect sediment samples from monitoring station locations MS-05, Locs. 1 through 3 for analysis of the same parameters that were analyzed for during the first nine rounds.

- Collect sediment samples from monitoring station location MS-05, Loc. 4 for analysis of copper and lead.

Figure 5 shows the locations of stations proposed for sampling during Round 10. Long-term groundwater monitoring is being conducted for OU3 as part of the Post-Remedial Operation, Maintenance, and Monitoring (OM&M) Plan (TtNUS, June 2006). Combining the onshore and offshore monitoring programs has the advantage of being able to evaluate both sets of data in the same reports, and implementing modifications to the monitoring program based on either the onshore or offshore data. Therefore, after the Round 10 sampling is completed, it is recommended that the offshore area defined by MS-05 be removed from OU4 and included in OU3. The OU3 remedy would be revised to include Jamaica Cove AOC (defined by MS-05), and the Post-Remedial OM&M Plan would be modified to include offshore sediment sampling. The SMP would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU3 would provide the required schedule for subsequent documents for OU3.

MS-06

MS-06 is located in the offshore area of OU3 in Jamaica Cove (see Figure 2). Seven rounds of interim offshore monitoring were conducted at this station. As presented in the Rounds 1 through 7 Report (TtNUS, November 2004), the concentrations of PAHs and metals were less than IRGs in the first seven rounds and were predicted to remain less than their IRGs for the next 5 years. Chemical concentration plots presenting the first seven rounds of PAH and metals data compared to their respective IRGs are presented in Attachment A.2. Additional scrutiny was not recommended for this monitoring station in the Rounds 1 through 7 Report because chemical concentrations were significantly less than the IRGs.

No additional offshore monitoring or actions are needed for MS-06 because chemical concentrations in sediment are less than IRGs and the current monitoring locations at MS-05 adequately monitor sediment offshore of OU3. In addition, the ranges of PAH and metals concentrations detected at MS-06 were similar to or within the ranges of concentrations in the

reference samples. Therefore, it is recommended that interim offshore monitoring be discontinued at MS-06 and that MS-06 be removed from the Jamaica Cove AOC and OU4.

MS-07

MS-07 is located in a recreational area in Clark Cove, but it is not immediately offshore of OU3 (see Figure 2). There are no known onshore IRP sites adjacent to MS-07 that may potentially impact the sediment at this monitoring station.

Seven rounds of interim offshore monitoring were conducted at this station. As presented in the Rounds 1 through 7 Report (TtNUS, November 2004), the concentrations of PAHs and metals were less than IRGs in the first seven rounds and were predicted to remain less than their IRGs for the next 5 years. Chemical concentration plots presenting the first seven rounds of PAH and metals data compared to their respective IRGs are presented in Attachment A.3. Additional scrutiny was not recommended for this monitoring station in the Rounds 1 through 7 Report because chemical concentrations were significantly less than IRGs. .

No additional offshore monitoring or actions are needed for MS-07 because chemical concentrations in sediment are less than IRGs and there are no known IRP sites onshore of MS-07. In addition, the ranges of PAH and metals concentrations detected at MS-07 were also similar to or within the ranges of concentrations in the reference samples. Therefore, it is recommended that interim offshore monitoring be discontinued at MS-06 and that MS-06 be removed from the Clark Cove AOC and OU4. However, the Navy may consider using this location as a reference station for MS-08 and MS-09 in future monitoring events as part of OU3 (see below).

MS-08

MS-08 is located in the offshore area of OU3 in Clark Cove (see Figure 2). As presented above, the intertidal area by MS-08 was excavated as part of the OU3 activities, and the excavated area was backfilled with clean material.

Nine rounds of interim offshore monitoring were conducted at this station. Based on the first seven rounds of data (metals were detected at concentrations that exceeded IRGs and reference concentrations, and PAH concentrations were projected to exceed IRGs within 5 years) and because of the offshore impacts from the OU3 construction activities, it was recommended in the Rounds 1 through 7 Report (TtNUS, November 2004) that interim offshore monitoring be

continued on an annual basis until at least Round 10 (when the monitoring program was to be re-evaluated). For Round 10, it is recommended that sediment samples from monitoring station locations MS-08, Locs. 1 through 3 be analyzed for the same parameters analyzed for during the first nine rounds. Figure 6 shows the locations of stations proposed for sampling during Round 10.

Long-term groundwater monitoring is being conducted for OU3 as part of the Post-Remedial OM &M Plan (TtNUS, June 2006). Combining the onshore and offshore monitoring programs has the advantage of being able to evaluate both sets of data in the same reports, and implementing modifications to the monitoring program based on either the onshore or offshore data. Therefore, after the Round 10 sampling is completed, it is recommended that the offshore area defined by MS-08 be removed from OU4 and included in OU3. The OU3 remedy would be revised to include Clark Cove AOC (defined by MS-08), and the Post-Remedial OM&M Plan would be modified to include offshore sediment sampling. The SMP would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU3 would provide the required schedule for subsequent documents for OU3.

MS-09

MS-09 is located in the offshore area of OU3 in Clark Cove (see Figure 2). As part of OU3 remedial activities, the small intertidal area that existed at MS-09 was covered with riprap, so there is no longer an intertidal area associated with MS-09.

Nine rounds of interim offshore monitoring and Phase I Additional Scrutiny were conducted at this station. Based on the first seven rounds of data (metals and PAHs were detected at concentrations that exceeded IRGs and reference concentrations) and because of the offshore impacts from the OU3 construction activities, it was recommended in the Rounds 1 through 7 Report (TtNUS, November 2004) that interim offshore monitoring be continued on an annual basis until at least Round 10 (when the monitoring program was to be re-evaluated).

During sampling Rounds 1 through 6, MS-09, Locs. 1 and 2 were intertidal and MS-09, Loc. 3 was a subtidal location. As described above, the intertidal area at MS-09 no longer exists. Therefore, MS-09, Loc. 1 was moved slightly offshore to the subtidal area for Rounds 1 though 9. MS-09, Loc. 2 was collected from a small intertidal area during Rounds 1 through 7. This intertidal area is no longer present as a result of the OU3 shoreline erosion controls, so during Round 8, the sample was collected from the subtidal area just offshore of the intertidal location. This placed MS-09, Loc. 2 very close to MS-09, Loc. 3, which is also subtidal, and therefore MS-

09, Loc. 3, MS-09 Loc. 2 was moved south along the shoreline near monitoring well JW-20 to obtain better spatial coverage at this station during Round 9 (see Figure 6).

For Round 10, it is recommended that sediment samples be collected from monitoring station locations MS-09, Locs. 1 through 3 (at the Round 9 locations) for analysis of the same parameters analyzed for during the first nine rounds. Figure 6 shows the locations of stations proposed for sampling during Round 10.

Long-term groundwater monitoring is being conducted for OU3 as part of the Post-Remedial OM&M Plan (TtNUS, June 2006). Combining the onshore and offshore monitoring programs has the advantage of being able to evaluate both sets of data in the same report, and implementing modifications to the monitoring program based on either the onshore or offshore data. Therefore, after the Round 10 sampling is completed, it is recommended that the offshore area defined by MS-09 be removed from OU4 and included in OU3. The OU3 remedy would be revised to include Clark Cove AOC (defined by MS-09), and the Post-Remedial OM&M Plan would be modified to include offshore sediment sampling. The SMP would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU3 would provide the required schedule for subsequent documents for OU3.

SULLIVAN POINT AOC

MS-10 is the only monitoring station within the Sullivan Point AOC, which is located in the southeastern corner of PNS (see Figure 2). In the Rounds 1 through 7 Report (TtNUS, November 2004), sampling during Rounds 8 and 9 was recommended for MS-10 because the 90th percentile upper confidence limits (UCLs) in the chemical trend line plots were projected to increase to greater than IRGs within the next 5 years for anthracene and HMW PAHs. The UCLs were projected to exceed IRGs within the next 5 years because the confidence interval was wide based on variability in the data. It was anticipated that having additional data before the next 5-year sampling event will provide a higher level of confidence regarding the exceedance of an IRG (TtNUS, November 2004).

Analytical data from the first eight rounds of sediment sampling at MS-10 were evaluated in a Technical Memorandum in Appendix A of the Phase II Additional Scrutiny QAPP (TtNUS, September 2007). Concentration plots presenting the first eight rounds of PAH data compared to their respective IRGs are presented in Attachment A.4. The concentration plots presenting the first seven rounds of copper, nickel, and 4,4'-DDT data are also presented in Attachment A.4 for informational purposes (the Round 8 samples were not analyzed for copper, nickel, or 4,4'-DDT).

PAH concentrations in most of sediment samples at MS-10 were less than their respective IRGs. Concentrations of acenaphthylene and anthracene were only greater than their IRGs at one location during two rounds. Concentrations of fluorene were less than its IRG during all eight rounds, and concentrations of HMW PAHs were only greater than the IRG at one location during one round. Most IRG exceedences occurred at subtidal station MS-10, Loc. 2. The intertidal location, MS-10, Loc. 1, consistently had the lowest concentrations of PAHs, which were significantly less than IRGs and similar to the concentrations at reference station 04.

Although no criteria or screening levels have been established for 4,4'-DDT in mussels, the concentration of 4,4'-DDT, in one sample during Round 1, was elevated (approximately 600 µg/kg) compared to the results for other samples during other rounds (less than 60 µg/kg) (see concentration plot in Attachment A.4). All 4,4'-DDT concentrations in the sediment samples were less than the sediment Primary Remediation Goal (PRG) of 66.4 µg/kg. Finally, the concentrations of copper and nickel in the sediment samples were much lower than their respective IRGs.

No additional offshore monitoring or actions are needed for MS-10 because of the infrequent number of IRG exceedences over the eight rounds of sampling, the relatively low concentrations of PAHs, copper, nickel, and 4,4'-DDT in most samples, and no known IRP sites associated with the monitoring station. Therefore, it is recommended that interim offshore monitoring be discontinued at MS-10 and that MS-10 be removed from the Sullivan Point AOC and OU4.

DRMO STORAGE YARD AOC

MS-11 is the only monitoring station within the DRMO Storage Yard AOC, which is located in the main channel of the Piscataqua River, just offshore of OU2 (Sites 6 and 29) (see Figure 2).

During the interim offshore monitoring program, sediment has been consistently available at one location (MS-11, Loc. 3) within a small depositional intertidal area east of the OU2 shoreline. During the first round of monitoring, a small amount of sediment (eroded soil) was found at another location (MS-11, Loc. 2). This location is within the area addressed by a 1999 emergency removal action (shoreline erosion controls), and subsequently, there has been no sediment or eroded soil at this location.

Additional scrutiny was recommended at this station because concentrations of copper and nickel in sediment exceeded their IRGs (and reference concentrations) and because contaminant

concentration trend lines for offshore sediment indicated that concentrations are increasing. Also, concentrations of lead exceeded the ER-M at this station, and trend lines indicated that concentrations are increasing.

Additional scrutiny was conducted at MS-11 to determine whether an IRP site was the source of metals in sediment (TtNUS, August 2005). It was concluded in the Additional Scrutiny Report that OU2 was likely the primary source of materials eroding to the offshore (TtNUS, August 2007).

Metal debris was observed along the shoreline east and west of the seawall during the Additional Scrutiny investigation, and elevated levels of metals were detected in soil samples collected onshore at OU2 (TtNUS, August 2007). Based on the presence of metal debris along the shoreline and elevated levels of metals in soil, the Navy conducted removal actions for the shoreline on the western and eastern portions of the seawall. In November 2005, erosion controls were placed along approximately 100 feet of shoreline west of the seawall. The erosion controls were similar to those placed along the shoreline to the west in 1999. However, because of the steep slope, the shoreline controls in the 100-foot section of shoreline west of the seawall were upgraded in 2008. In June 2006, surficial debris on the eastern portion of the seawall was removed, the area was covered, and erosion controls were placed along the shore at this time. Additional sediment sampling is not planned at MS-11 because there is only a small amount of sediment at this monitoring station and because erosion controls were placed along the shoreline. Also, a removal action for sediment is not planned at MS-11 because there is only a small amount of sediment present.

A supplemental RI and revised draft FS are being prepared for OU2 and include evaluations of the offshore area. Therefore, it is recommended that the offshore area defined by MS-11 be removed from OU4 and included in OU2. OU2 would then include Sites 6 and 29 (onshore) and MS-11 (offshore). It is also recommended that the DRMO Storage Yard AOC be removed from OU4. The SMP would be updated to reflect the recombination of onshore and offshore areas, and the SMP schedules for OU2 would provide the required schedule for RI investigation and subsequent documents for OU2 (including MS-011).

DRY DOCKS AOC

The Dry Docks AOC is located in the Piscataqua River, on the western side of the shipyard (see Figure 2). Monitoring stations located within this AOC include MS-12 through MS-14. Known IPR sites located immediately onshore of the Dry Docks AOC include Sites 5, 10, and 31. The

following sections present the evaluations conducted and recommendations for monitoring stations located within the Dry Docks AOC.

MS-12

Monitoring station MS-12 is located in adjacent to Building 178 and offshore of Sites 5 and 10 (see Figure 2). Seven rounds of interim offshore monitoring and two Additional Scrutiny investigations were conducted at this station. Additional scrutiny was recommended because concentrations of PAHs exceeded their respective IRGs and reference concentrations (using sampling results from the first seven monitoring rounds) and because trend lines indicated that concentrations are increasing (TtNUS, November 2004). Also, concentrations of lead in sediment exceeded its ER-M and were predicted to remain greater than the ER-M for the next 5 years.

In accordance with the Additional Scrutiny QAPP (TtNUS, August 2005), additional sediment samples were collected at MS-12 to determine whether either elevated lead and PAH concentrations in MS-12 sediments could be linked a current or historical IRP source or linked to a non-IRP source. Based on several lines of evidence used to evaluate the data, it was determined that past releases from IRP sites (Site 5 and Site 10) were the likely sources of contamination in the sediment, along with potential sources of contamination from historical activities in Building 178.

A technical meeting was held with the Navy, regulators, and TtNUS on April 26, 2007, to discuss the Draft Additional Scrutiny Report. The minutes from this meeting are included in Appendix D of the Additional Scrutiny Report (TtNUS, August 2007). Based on the recommendations from the meeting, additional sediment samples were collected to address data gaps (i.e., delineation of the spatial extent of contamination and approximate depth of sediment), and an eelgrass survey was conducted to determine the approximate size and location of the eelgrass bed.

The Phase II Additional Scrutiny QAPP was prepared to present the methodologies to conduct these investigations (TtNUS, September 2007), and the QAPP was implemented in November 2007 and April 2008. The Phase II Additional Scrutiny Report will be prepared to document the results of that investigation and provide recommendations for further actions.

It is recommended that the evaluation of the data collected from MS-12 be conducted as part of OU4 because there are no current IRP sources of contamination MS-12. The sources of contamination in sediment in this area include multiple inactive IRP sites (Sites, 5, 10, and 31). It is also recommended that future actions at MS-12 be conducted as part of OU4 and that this

portion of the Dry Docks AOC remain within OU4. It is not recommended that sediment samples be conducted during the Round 10 monitoring event, however, because enough data have been collected at MS-12 to make decisions for the site.

MS-13

MS-13 is located offshore of Sites 5 (Former Industrial Waste Outfalls) and 31 (West Timber Basin Landfill) (see Figure 2). Seven rounds of interim offshore monitoring were conducted at this station for all parameters (see Table 1), and Round 8 of offshore monitoring was conducted at MS-13 for analysis of PAHs in sediment. Offshore monitoring of sediment during Rounds 8 and 9 was recommended for MS-13 in the Rounds 1 through 7 Report because the UCL for fluorene exceeded the IRG based on the wide confidence interval caused by variability in the data. It was anticipated that having additional data before the next 5-year sampling event will provide a higher level of confidence regarding the exceedance of an IRG.

The analytical data from the first eight rounds of sediment sampling at MS-13 were evaluated in the Technical Memorandum in Appendix A of the Phase II Additional Scrutiny QAPP (TtNUS, September 2007). Chemical concentration plots presenting the first eight rounds of PAH data compared to their respective IRGs are presented in Attachment A.5. PAH concentrations in most of the samples were less than their respective IRGs. Concentrations of acenaphthylene and anthracene were greater than their IRGs during three and four rounds each, respectively, at one location during each of those rounds. Concentrations of fluorene and HMW PAHs were greater than their IRGs at one location during Rounds 2 and 3. Most concentrations during these rounds just slightly exceeded IRGs (see Attachment A.5). The concentrations of all four PAHs were less than their respective IRGs during Round 8. There is no current IRP site releasing chemicals to the offshore area at this location; therefore maintenance dredging, which occurs periodically in the dry dock where MS-13 is located, is a likely cause for some of the variability in the data. In fact, maintenance dredging was performed in the berth areas by the dry docks between Rounds 5 and 6, which may account for the spike in copper and nickel concentrations during that round.

Because of the infrequent number of exceedences of the IRGs over the eight rounds of sampling and because there are no known current IRP sites associated with the monitoring station, it is recommended that interim offshore monitoring be discontinued at MS-13 and that MS-13 be removed from the Dry Docks AOC and OU4.

MS-14

MS-14 is located in the back channel to monitor sediment potentially impacted by Sites 5 and 31 (see Figure 2). Seven rounds of interim offshore monitoring were conducted at this station for all parameters (see Table 1), and Round 8 offshore monitoring was conducted at MS-14 for analysis of PAHs in sediment. Offshore monitoring of sediment during Rounds 8 and 9 was recommended for this monitoring station because UCLs for acenaphthylene and anthracene were predicted to increase to greater than IRGs within the next 5 years based on the wide confidence interval caused by variability in the data. It was anticipated that having additional data before the next 5-year sampling event will provide a higher level of confidence regarding the exceedance of an IRG.

The analytical data from the first eight rounds of sediment sampling at MS-14 were evaluated in the Technical Memorandum in Appendix A of the Phase II Additional Scrutiny QAPP (TtNUS, September 2007). Trend plots presenting the first eight rounds of PAH data compared to their respective IRGs are presented in Attachment A.6. PAH concentrations in most of the samples are less than their respective IRGs. Concentrations of acenaphthylene and anthracene were only greater than their IRGs at one location during two rounds. Concentrations of fluorene and HMW PAHs were less than IRGs for all eight rounds. No concentrations of acenaphthylene have been greater than the IRG since Round 2. Concentrations of anthracene were slightly greater than the IRG for Rounds 5 and 6, but concentrations were much lower during Rounds 7 and 8.

Because of the infrequent number of exceedences of the IRGs over the eight rounds of sampling, the relatively low concentrations of PAHs in most samples, and because no known current IRP sources are associated with the monitoring station, it is recommended that interim offshore monitoring be discontinued and MS-14 and that MS-14 be removed from the Dry Docks AOC and OU4.

REFERENCE STATIONS

It was recommended in the Rounds 1 through 7 Report (TtNUS, November 2004) that sediment samples be collected at reference stations during Rounds 8 and 9 for analysis of PAHs, PCBs, dioxins/furans and TOC. Analysis for metals and pesticides at reference stations were not recommended because the concentrations of metals and pesticides at the reference stations were much lower than concentrations at the monitoring stations where sampling during Rounds 8 and 9 was recommended.

It is recommended that sampling at the reference stations be discontinued. Attachment A.7 contains concentration plots for the four reference stations. The concentration plots contain the first eight rounds of data for PAHs and the first seven rounds of data for copper, lead, nickel, and 4,4'-DDT (the Round 8 sediment samples from the reference stations were not analyzed for metals or pesticides).

With the exception of an elevated lead detection at one location at reference station RS-02 during Round 7, overall chemical concentrations were consistent across all rounds at a particular station. No increasing or decreasing trends in concentrations were observed in the data plots. Also, with one exception during Round 1, all detected concentrations in reference samples were less than IRGs. Also, the reference data are not currently being used for decision making because chemical concentrations are less than IRGs. Therefore, the Navy believes that the data set is adequate for making decisions after Round 10, so additional reference samples do not need to be collected during Round 10. The need to collect additional reference samples as part of monitoring programs for other OUs will be determined as part of the monitoring programs for those OUs.

MUSSEL SAMPLING

As described in the Interim Offshore Monitoring Plan (TtNUS, October 1999), sediment contaminant monitoring is the primary measure to determine whether the interim remedial action objectives for sediment exposure to the assessment communities are being met; contaminant concentrations in mussels are secondary measures of exposure.

The interim monitoring of biota (mussel and juvenile lobster) tissue concentrations was used to develop bioaccumulation factors, which were then used to estimate sediment concentrations at two locations at monitoring station MS-11 where mussels but not sediment were present. The juvenile lobster sampling was discontinued after Round 5 for reasons discussed in the baseline report (TtNUS, July 2002)..

In the Rounds 1 through 7 Report, the Navy recommended not collecting mussels during Rounds 8 and 9 for calculating bioaccumulation factors because the overall factors were not expected to change significantly. However, the Navy recommended collecting mussel samples as part of the next 5-year sampling event to determine if the bioaccumulation factors are similar to those calculated using data from the first seven rounds. It has since been determined that sediment monitoring at MS-11 is no longer needed, in part because of the erosion controls implemented along the shoreline at OU2 and because there is very little sediment present at this location.

Therefore, there is no need to recalculate the bioaccumulation factors and the Navy recommends discontinuing mussel sampling at all monitoring and reference stations.

NOAA ANALYTICAL METHODS

Currently, metals analysis of sediment samples collected as part of the Interim Offshore Monitoring Program is conducted using methods developed by the National Oceanic and Atmospheric Administration (NOAA) Status and Trends Program. These NOAA methods were selected to be consistent with methods used to analyze samples during previous investigations in the offshore area. In addition, these methods yield lower detection limits for some chemicals compared to standard United States Environmental Protection Agency (USEPA) analytical methods. However, NOAA methods for metals are typically four to five times more expensive than standard USEPA methods and can be conducted by only a few laboratories in the United States. Also, it has typically taken at least twice as long for the laboratory to process the samples and report the results using the NOAA methods.

On June 1, 2004, the Navy submitted a Technical Memorandum to the regulators that presented a comparison of NOAA and USEPA analytical methods. A copy of this memorandum is included in Attachment B. The memorandum contained an evaluation of the analytical methods for organic chemicals as well. It was recommended by the Navy and agreed to by the regulators that USEPA analytical methods were acceptable for organic chemicals, so the analytical methods for organic chemicals are not discussed further in this section.

For the primary metals of concern for OU4 (copper, nickel, and lead), the R^2 values were 0.95, 0.76, and 0.91, indicating a good correlation between the sample results obtained using the NOAA and USEPA analytical methods (R^2 values are a measure of how closely data fits a trend line, with 1 being a perfect fit). However, the results generated using the NOAA methods were nearly always greater than results generated using the USEPA methods (see Table 1 in Attachment 1). The ratios of the results using NOAA versus USEPA methods for these three metals (i.e., concentrations in samples analyzed by the NOAA method divided by the concentrations in samples analyzed by the USEPA method) ranged from 0.5 to 2.6 for copper, 0.4 to 2.6 for lead, and 0.5 to 3.1 for nickel, with average ratios of 1.4, 1.4, and 1.3, respectively. These results were expected because the NOAA analytical method utilizes a complete digestion of the sediment particle using hydrofluoric acid so metals that are incorporated into the sediment matrix are included in the sample results. The USEPA analytical method, on the other hand, utilizes a total recoverable digestion, which digests the material bound to the outer portion of the

sediment particle. This is done to determine the concentration of chemicals that will be more bioavailable to human and ecological receptors.

When the Technical Memorandum was submitted in 2004, the Navy decided to continue using the NOAA methods for metals analyses for reasons presented in the memorandum (see Attachment B). The primary reason was because of the uncertainties in switching analytical methods in the middle of the monitoring program, especially when evaluating trends.

The Navy now recommends using standard USEPA analytical methods for future metals analyses for several reasons. During the April 26, 2007, technical meeting, it was agreed that because of the variability in the data, the trend lines would be removed from the data plots. Therefore, the uncertainty in evaluating trends is no longer an issue. Also, the lower detection limits obtained by the NOAA methods are not needed because the detection limits obtained by standard USEPA analytical methods can meet IRGs. Because the IRGs were developed with analytical data generated using the NOAA method, there is some uncertainty in comparing sample results obtained using USEPA methods to IRGs. These uncertainties can be accounted for by adjusting either the IRGs or the chemical concentrations in the sample results obtained using USEPA methods. The ER-M, which is used to evaluate lead, is based on analytical data that was most likely obtained using standard USEPA analytical methods. However, the differences in metals concentrations obtained at a site using the two analytical methods should be considered when determining whether an action may be needed.

SUMMARY AND CONCLUSIONS

After nine rounds of interim offshore monitoring at PNS and two phases of additional scrutiny, the Navy recommends the following:

Sampling Recommended for Round 10 of the Interim Offshore Monitoring Program

- Conduct interim offshore monitoring of sediment at MS-05, MS-08, and MS-09 at the same monitoring locations as Round 9 sampling event and analyze the samples for the same parameters as the Round 9 sampling event.

- Do not conduct interim offshore monitoring at any of the other monitoring stations.

- Do not conduct interim offshore monitoring at any of the reference stations.

- Do not conduct mussel sampling at any of the monitoring or reference stations.

- Discontinue use of NOAA analytical methods and use USEPA Method 6020B for metals analysis.

Recommended Modifications to the Interim Offshore Monitoring Program:

- Modify the OU3 Post-Remedial OM&M Plan to include interim offshore sediment sampling at MS-05, MS-08, and MS-09.

- Discontinue sediment sampling at all interim offshore monitoring and reference stations except MS-05, MS-08, and MS-09 (as part of the modified OU3 Post-Remedial OM&M Plan).

- Discontinue mussel sampling at all monitoring and reference stations.

- Discontinue use of NOAA methods for analysis of metals in sediment. Use USEPA Method 6020B for analysis of metals in future offshore sampling events.

Modifications to OU4:

- Remove the following monitoring stations from OU4 and the IRP:
  - MS-02 (Back Channel AOC)
  - MS-06 (Jamaica Cove AOC)
  - MS-07 (Clark Cove AOC)
  - MS-10 (Sullivan Point AOC)
  - MS-13 and MS-14 (Dry Docks AOC)

- Remove the following monitoring stations from OU4 and include them with the adjacent onshore OU:
  - MS-01 (Western Portion of Back Channel AOC) - combine with OU9 (Site 34)
  - MS-03 and MS-04 (Eastern Portion of Back Channel AOC) - combine with OU7 (Site 32)
  - MS-05 (Jamaica Cove AOC), and MS-08 and MS-09 (Clark Cove AOC) - combine with OU3
  - MS-11 (DRMO Storage Yard AOC) - combine with OU2 (Sites 6 and 29)

- Retain MS-12 (Dry Docks AOC) in OU4 and redefine the AOC and based on removal of monitoring stations, the only AOC remaining in OU4 would be the redefined Dry Docks AOC.

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TtNUS, August 2007. Additional Scrutiny Report for Operable Unit 4, Portsmouth Naval Shipyard, Kittery, Maine. King of Prussia, Pennsylvania.

TtNUS, September 2007. Phase II Additional Scrutiny Quality Assurance Project Plan for Operable Unit 4, Portsmouth Naval Shipyard, Kittery, Maine. King of Prussia, Pennsylvania.

TABLE 1

OVERALL SUMMARY OF SAMPLING INVESTIGATIONS CONDUCTED AT MONITORING AND REFERENCE STATIONS
RECOMMENDATIONS FOR MODIFICATIONS TO THE INTERIM OFFSHORE MONITORING PROGRAM FOR OU4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

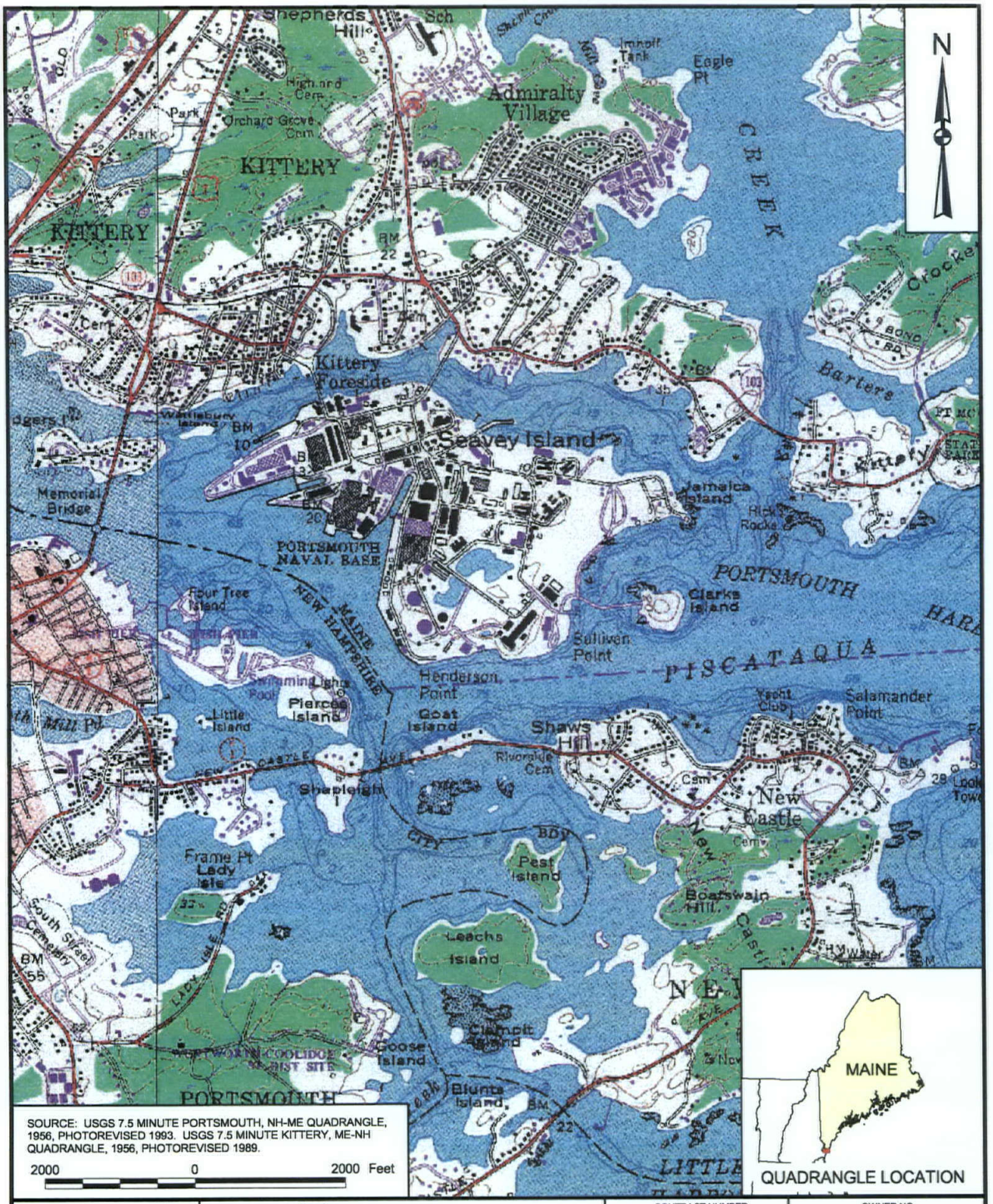
Stations	Samples Collected as Part of the Interim Offshore Monitoring Program				Investigations Conducted as Part of Additional Scrutiny		Samples Proposed for Round 10[3]
	Rounds 1 through 5[1]	Rounds 6 and 7[2]	Round 8[3]	Round 9[3]	Phase I	Phase II	
Monitoring Stations							
MS-1	SD, MU, LJ	SD, MU			Yes	Yes	
MS-2	SD, MU, LJ	SD, MU					
MS-3	SD, MU, LJ	SD, MU					
MS-4	SD, MU, LJ	SD, MU					
MS-5	SD, MU, LJ	SD, MU	Full Suite	Full Suite	Yes		Full Suite
MS-6	SD, MU, LJ	SD, MU					
MS-7	SD, MU, LJ	SD, MU					
MS-8	SD, MU, LJ	SD, MU	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans			Full Suite + Dioxins/Furans
MS-9	SD, MU, LJ	SD, MU	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans	Yes		Full Suite + Dioxins/Furans
MS-10	SD, MU, LJ	SD, MU	PAHs				
MS-11	SD, MU, LJ	SD, MU			Yes		
MS-12	SD, MU, LJ	SD, MU			Yes	Yes	
MS-13	SD, MU, LJ	SD, MU	PAHs				
MS-14	SD, MU, LJ	SD, MU	PAHs				
Reference Stations							
RS-01	SD, MU, LJ	SD, MU	PAHs, PCBs, Dioxins/Furans, TOC				
RS-02	SD, MU, LJ	SD, MU		PAHs, PCBs, Dioxins/Furans, TOC			
RS-03	SD, MU, LJ	SD, MU					
RS-04	SD, MU, LJ	SD, MU					

SD - Sediment samples MU - Mussel Samples LJ - Juvenile Lobster samples

1 - All samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), and metals.
Samples from MS-7 through MS-12 and all four reference stations were also analyzed for dioxins/furans.
- Sediment samples were additionally analyzed for grain size, total organic carbon (TOC), and acid volatile sulfide/simulataneously extracted metals (AVS/SEM).
- Mussel samples were additionally analyzed for percent lipids.

2 - Samples were analyzed for the same parameters as in Rounds 1 through 5 with the following expections:
- Sediment and mussel samples were not analyzed for alkylated PAHs.
- Sediment samples were not analyzed for AVS/SEM.

3 - Only sediment samples were collected during this sampling round, and the samples were analyzed for the parameters listed in the table.
- Full Suite includes: PAHs, pesticides, PCBs, metals, grain size, and TOC.



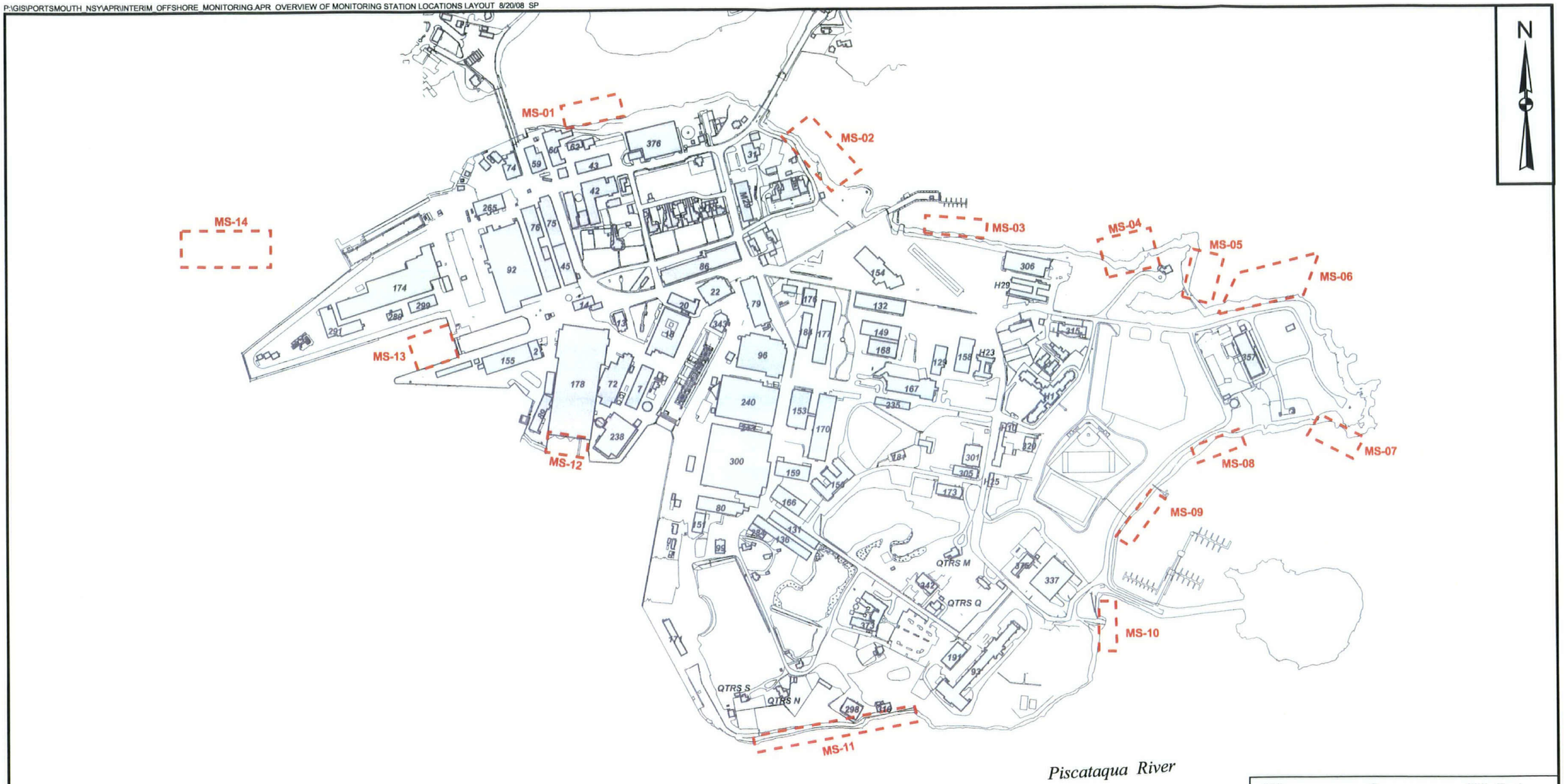
SOURCE: USGS 7.5 MINUTE PORTSMOUTH, NH-ME QUADRANGLE, 1956, PHOTOREVISED 1993. USGS 7.5 MINUTE KITTERY, ME-NH QUADRANGLE, 1956, PHOTOREVISED 1989.

2000 0 2000 Feet

DRAWN BY J. LAMEY	DATE 12/29/03	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0932 / OWNER NO. CTO 123
CHECKED BY A. BERNHARDT	DATE 8/20/08	PORTSMOUTH NAVAL SHIPYARD VICINITY MAP PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY — / DATE —
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV 0

P:/GIS/PORTSMOUTH_NSY/APR/INTERIM_OFFSHORE_MONITORING.APR VICINITY LAYOUT 8/20/08 SP

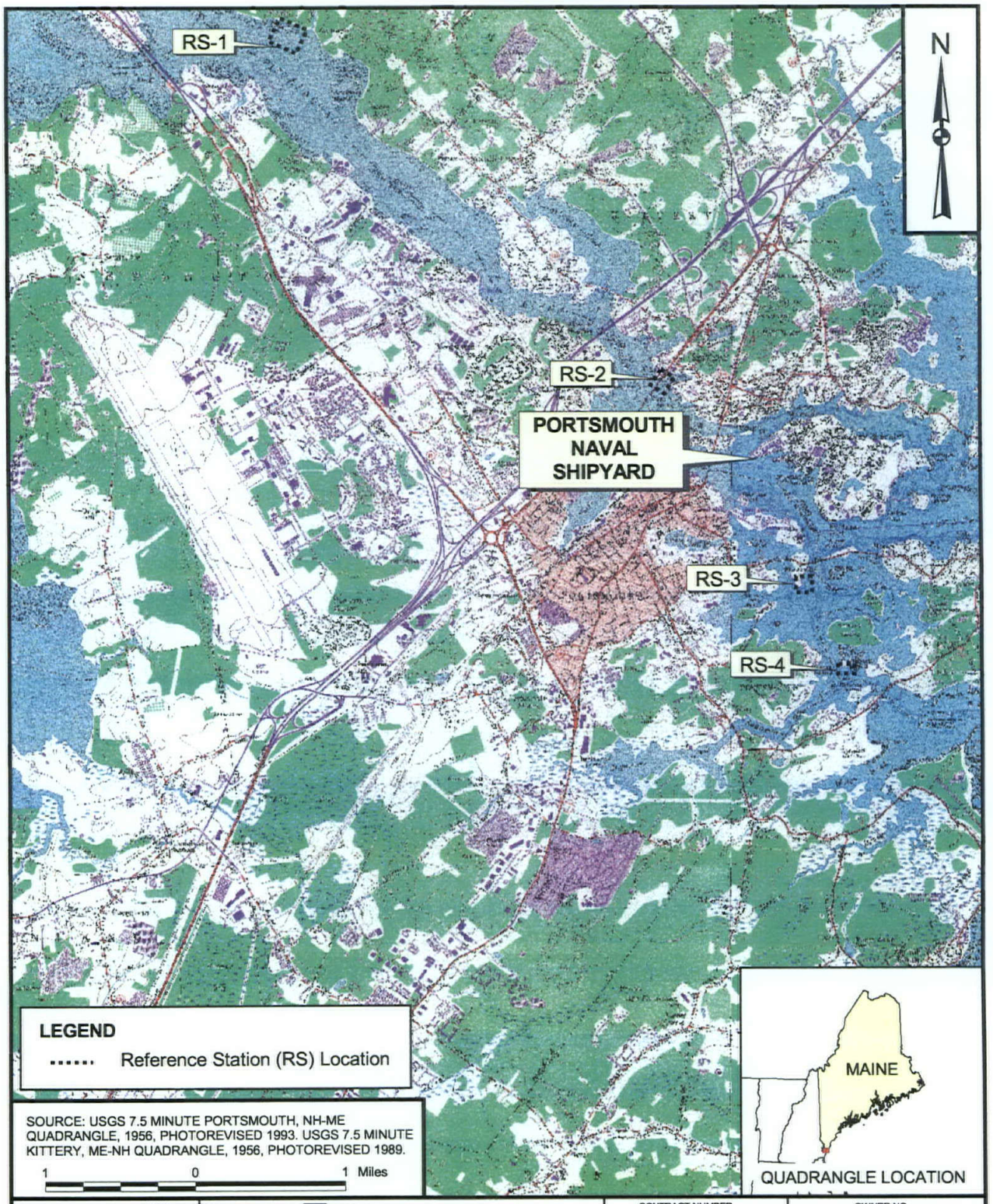
P:\GIS\PORTSMOUTH_NSY\APR\INTERIM_OFFSHORE_MONITORING.APR OVERVIEW OF MONITORING STATION LOCATIONS LAYOUT 8/20/08 SP



LEGEND

Monitoring Station Location

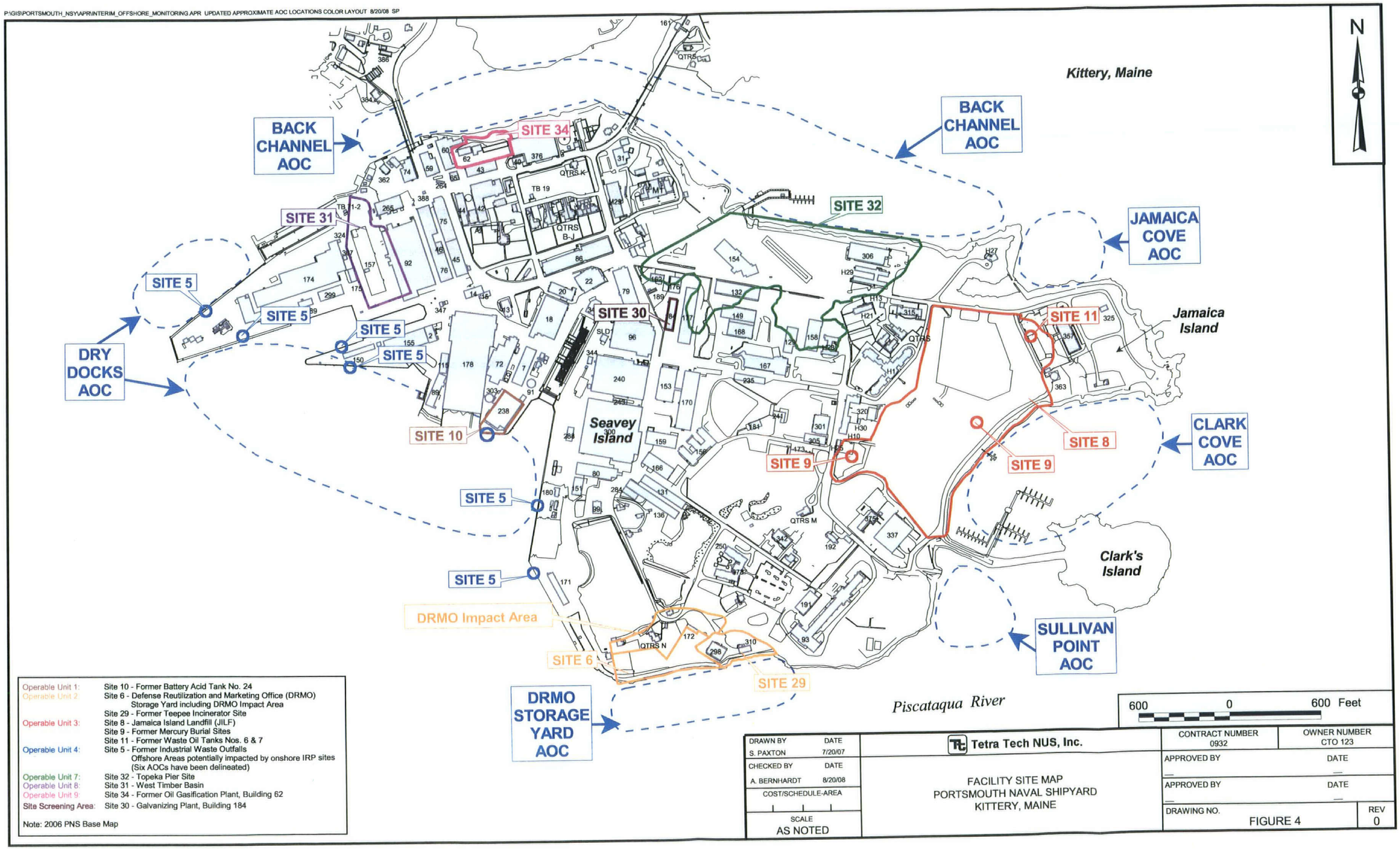
DRAWN BY J. LAMEY	DATE 4/20/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0932	OWNER NUMBER CTO 123
CHECKED BY A. BERNHARDT	DATE 8/20/08	OVERVIEW OF MONITORING STATION LOCATIONS PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY —	DATE —
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2	REV 0



DRAWN BY J. LAMEY — DATE 4/27/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0932	OWNER NO. CTO 123
CHECKED BY D. COHEN — DATE 8/20/08	OVERVIEW OF REFERENCE STATION LOCATIONS PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY — DATE —	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 3	REV 0

P:\GIS\PORTSMOUTH_NSY\APR\INTERIM_OFFSHORE_MONITORING.APR OVERVIEW OF REFERENCE STATION LOCATIONS 8/20/08 SP

P:\GIS\PORTSMOUTH_NSY\APR\INTERIM_OFFSHORE_MONITORING.APR UPDATED APPROXIMATE AOC LOCATIONS COLOR LAYOUT 8/20/08 SP



Operable Unit 1:	Site 10 - Former Battery Acid Tank No. 24
Operable Unit 2:	Site 6 - Defense Reutilization and Marketing Office (DRMO) Storage Yard including DRMO Impact Area
	Site 29 - Former Teepee Incinerator Site
Operable Unit 3:	Site 8 - Jamaica Island Landfill (JILF)
	Site 9 - Former Mercury Burial Sites
	Site 11 - Former Waste Oil Tanks Nos. 6 & 7
Operable Unit 4:	Site 5 - Former Industrial Waste Outfalls Offshore Areas potentially impacted by onshore IRP sites (Six AOCs have been delineated)
Operable Unit 7:	Site 32 - Topeka Pier Site
Operable Unit 8:	Site 31 - West Timber Basin
Operable Unit 9:	Site 34 - Former Oil Gasification Plant, Building 62
Site Screening Area:	Site 30 - Galvanizing Plant, Building 184

Note: 2006 PNS Base Map

DRAWN BY S. PAXTON	DATE 7/20/07	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0932 / OWNER NUMBER CTO 123
CHECKED BY A. BERNHARDT	DATE 8/20/08	FACILITY SITE MAP PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 4 / REV 0

P:\GIS\PORTSMOUTH_NSY\APR\ADD_SCR_INVESTIGATION_RND8.APR MS-05 GPS LOCATION LAYOUT 8/20/08 SP

Legend

- Interim Offshore Monitoring Program Station
- Mean High Water (100.36 ft, PNS 2002 Datum)
- Mean Low Water (92.23 ft, PNS 2002 Datum)

Aerial Photo Source:
Fly-over Survey by Aerial Survey and Photo, Inc., Norridgewock, Maine, July 2001, Under Subcontract to Tetra Tech NUS, Inc., King of Prussia, PA.

Base Map Source:
U.S. Naval Activities Seavey Island; Kittery, ME, Existing Conditions October 2006. Provided and drawn by Dan Allen with Portsmouth Naval Shipyard.

DRAWN BY	DATE
S. PAXTON	11/19/07
CHECKED BY	DATE
A. BERNHARDT	8/20/08
COST/SCHEDULE-AREA	
SCALE	
AS NOTED	

Tetra Tech NUS, Inc.

ROUND 10 SEDIMENT SAMPLING LOCATIONS
AT MS-05
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONTRACT NUMBER	OWNER NUMBER
0932	CTO 123
APPROVED BY	DATE
AMB	12/22/06
APPROVED BY	DATE
—	—
DRAWING NO.	REV
FIGURE 5	0

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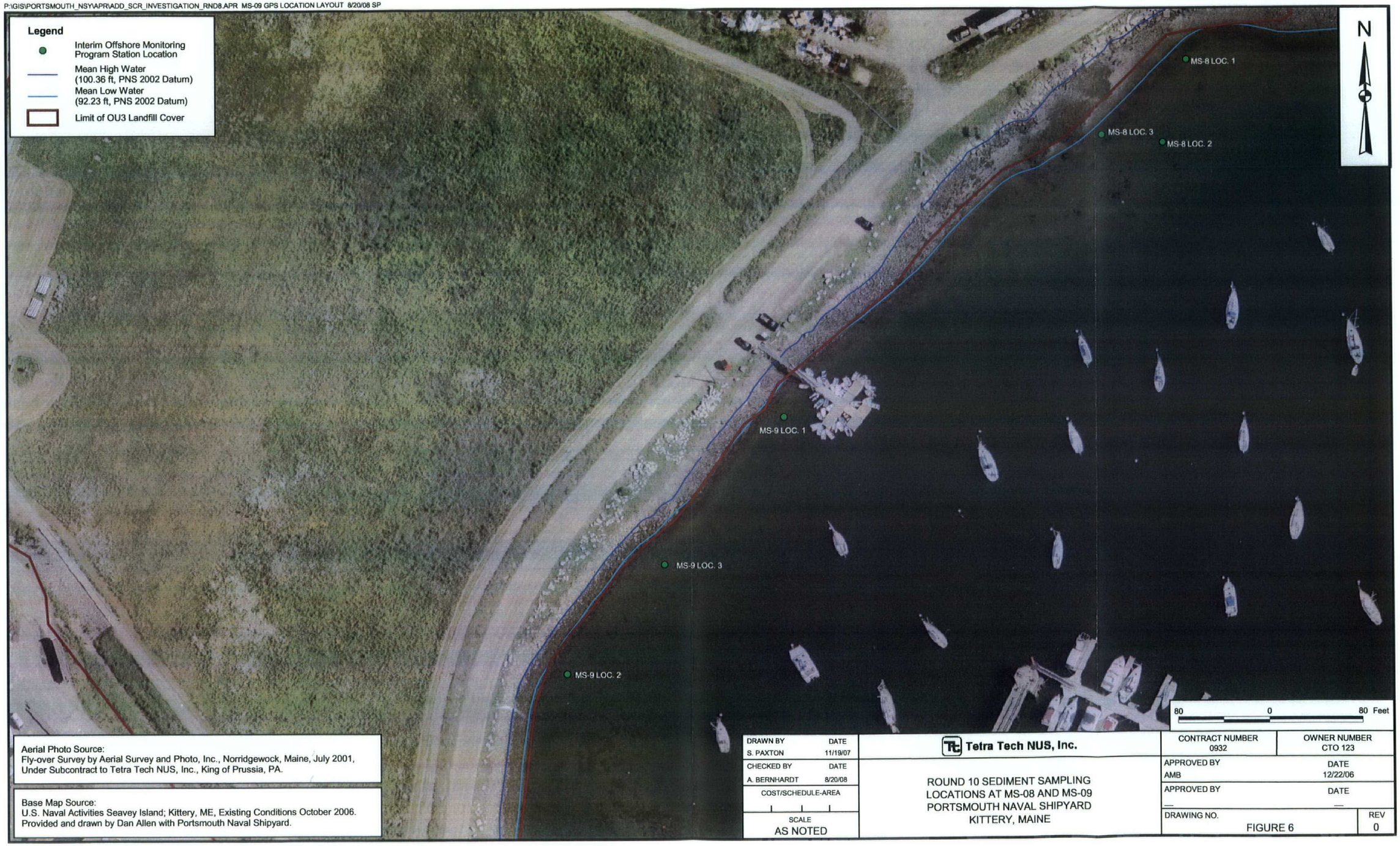


Aerial Photo Source:
Fly-over Survey by Aerial Survey and Photo, Inc., Norridgewock, Maine, July 2001, Under Subcontract to Tetra Tech NUS, Inc., King of Prussia, PA.

Base Map Source:
U.S. Naval Activities Seavey Island; Kittery, ME, Existing Conditions October 2006. Provided and drawn by Dan Allen with Portsmouth Naval Shipyard.

DRAWN BY S. PAXTON	DATE 11/19/07	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0932	OWNER NUMBER CTO 123
CHECKED BY A. BERNHARDT	DATE 8/20/08	ROUND 10 SEDIMENT SAMPLING LOCATIONS AT MS-08 AND MS-09 PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY AMB	DATE 12/22/06
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6	REV 0

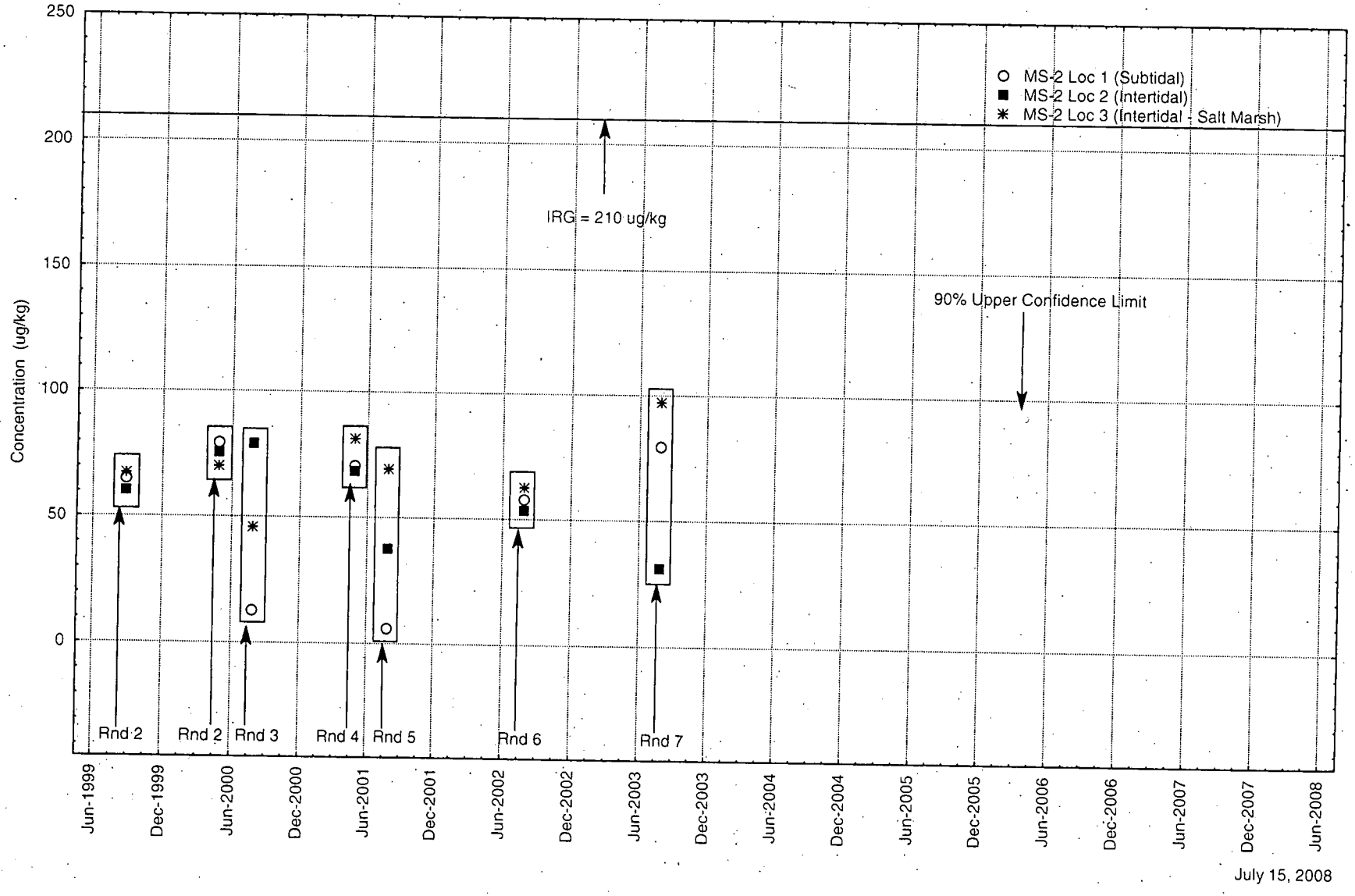
ATTACHMENT A

SUPPORTING INFORMATION

ATTACHMENT A.1

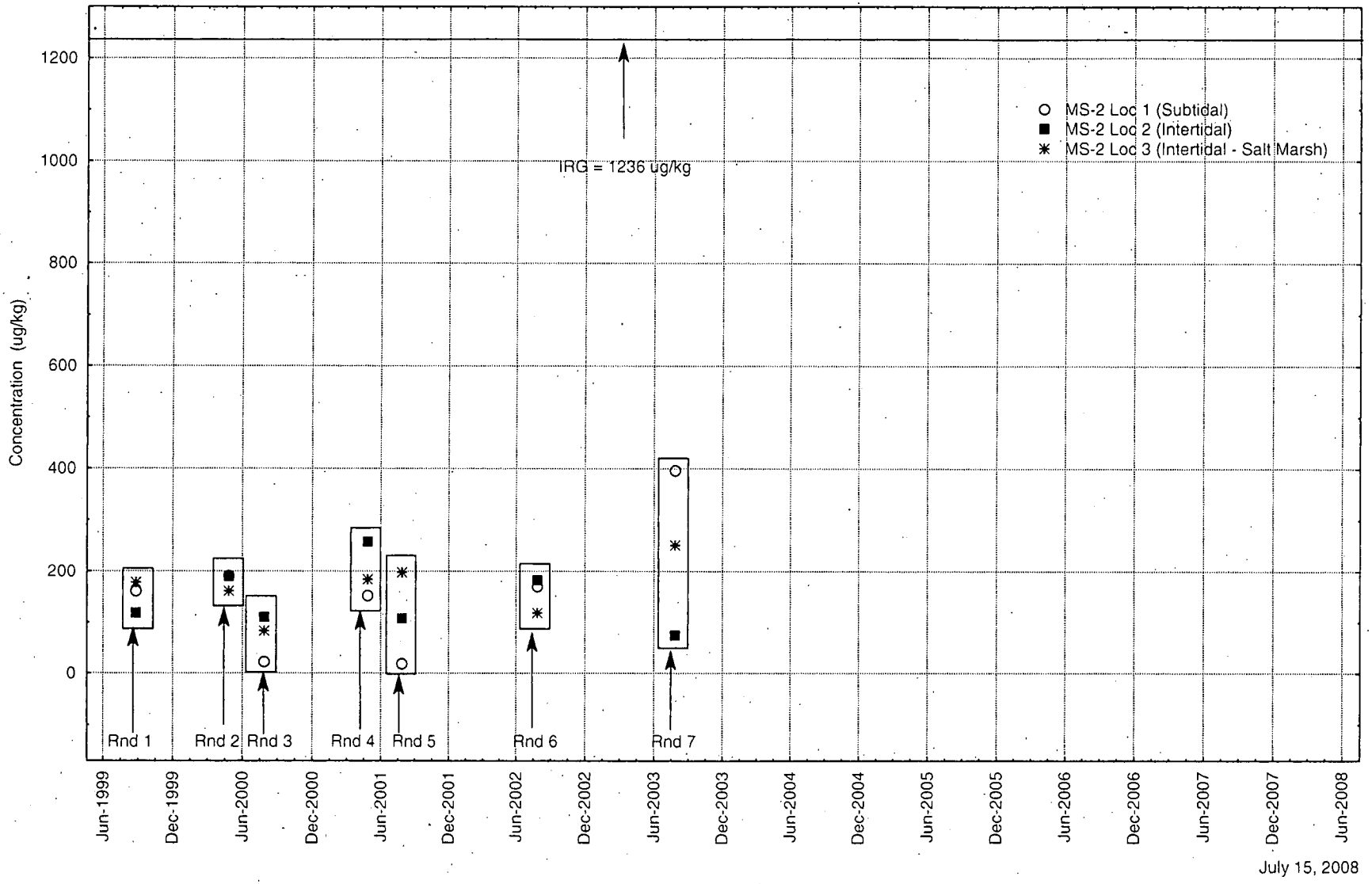
CONCENTRATION PLOTS AT MS-02

Monitoring Station 2 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



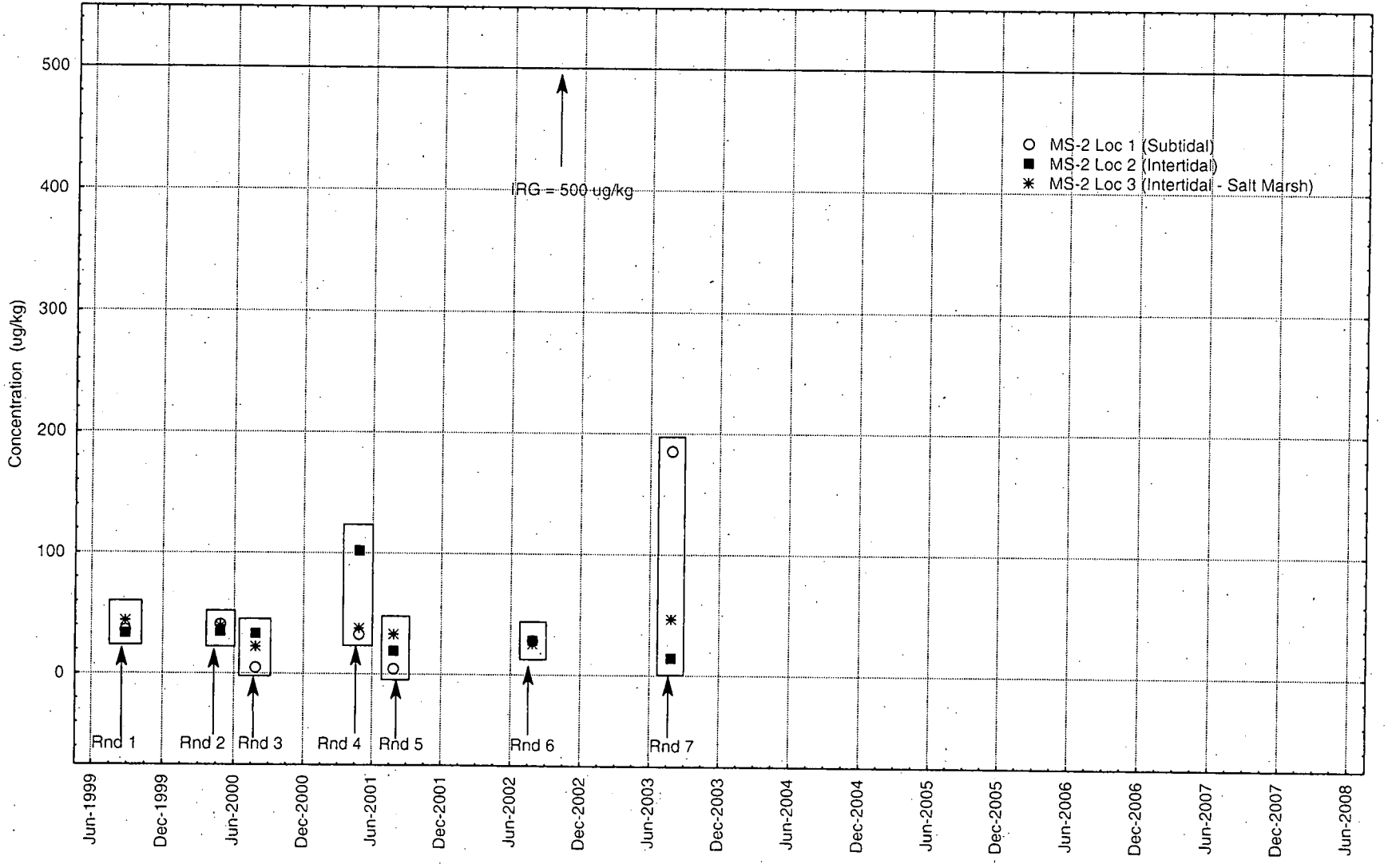
July 15, 2008

Monitoring Station 2 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



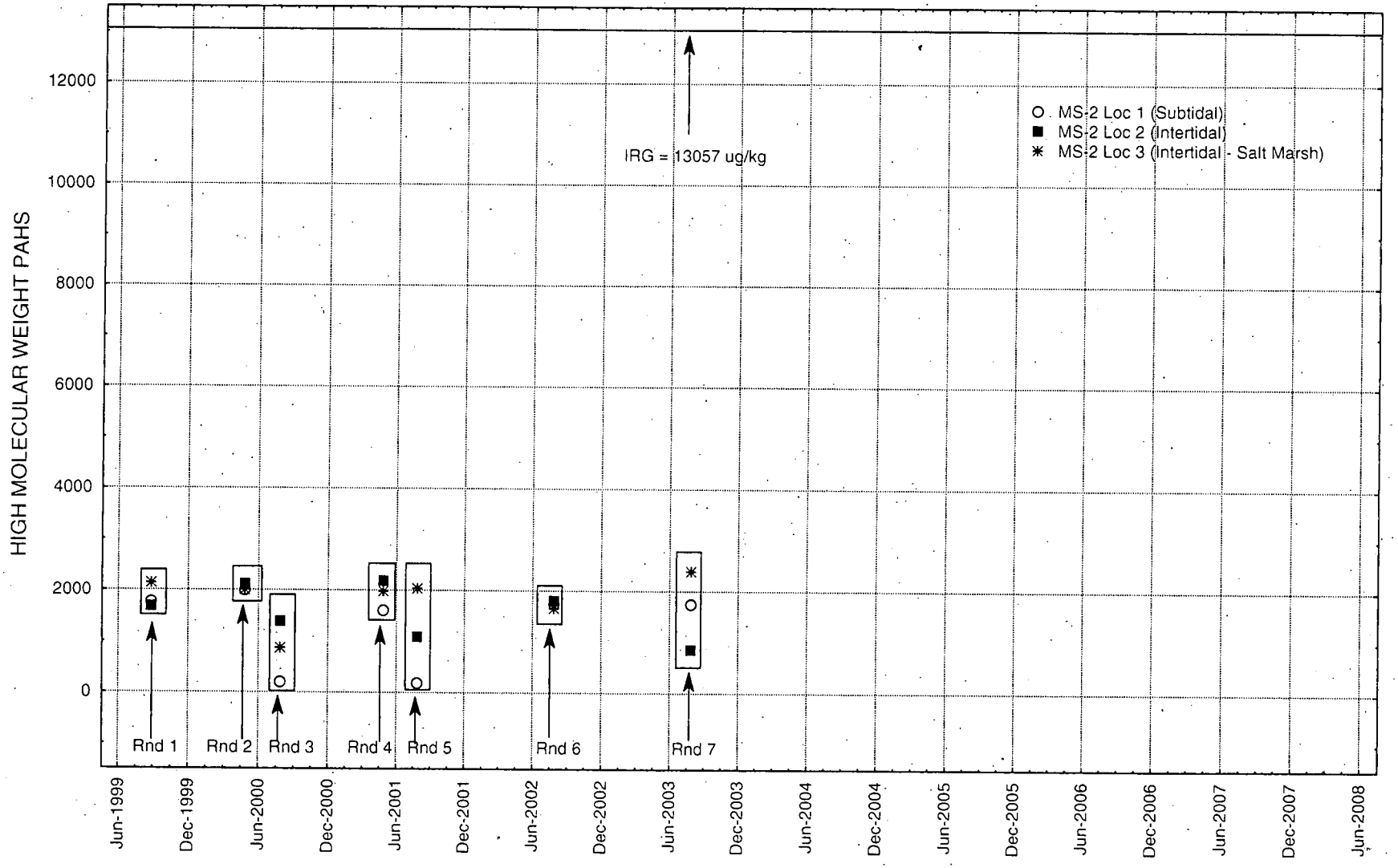
July 15, 2008

Monitoring Station 2 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



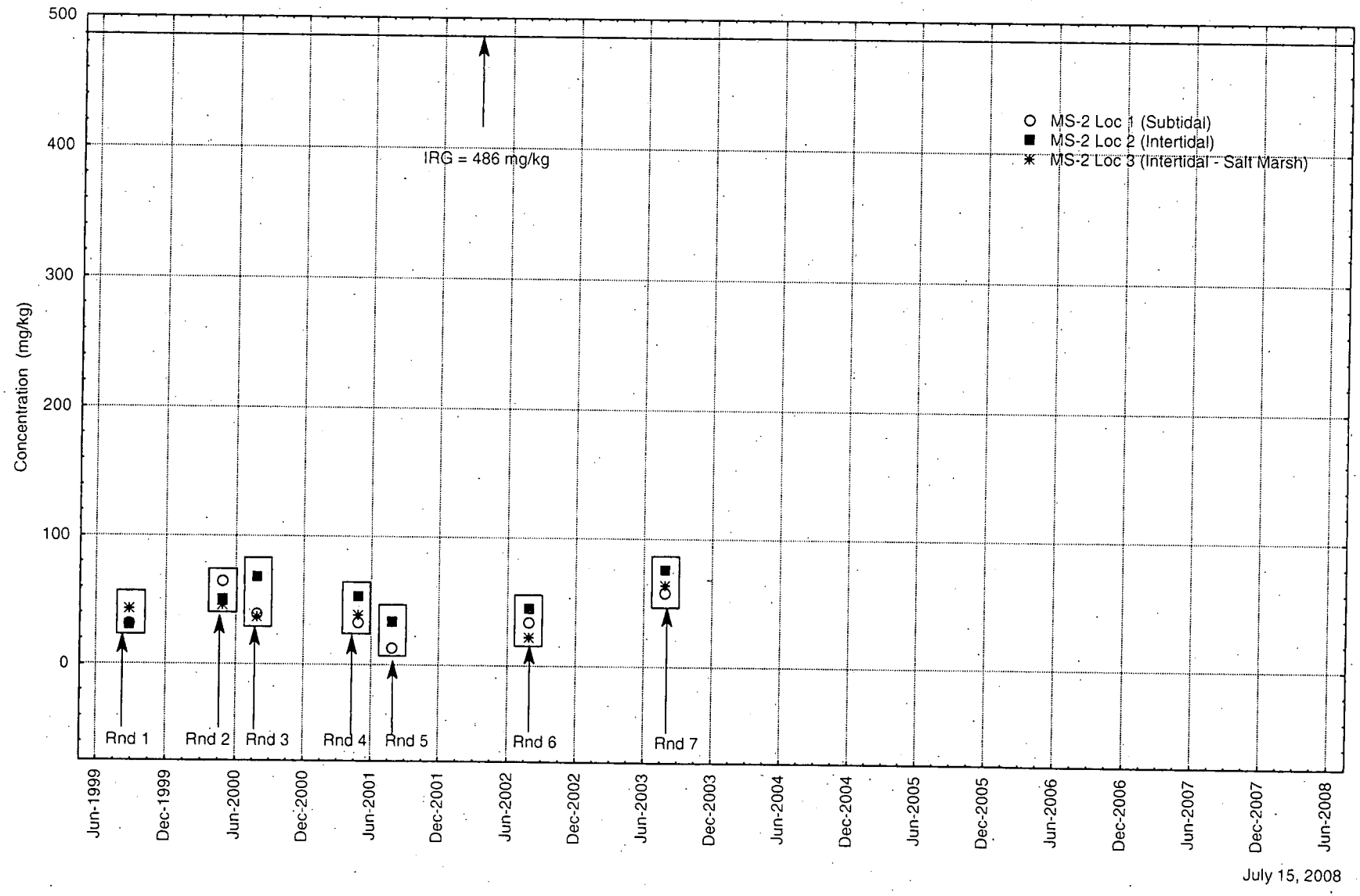
July 15, 2008

Monitoring Station 2 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



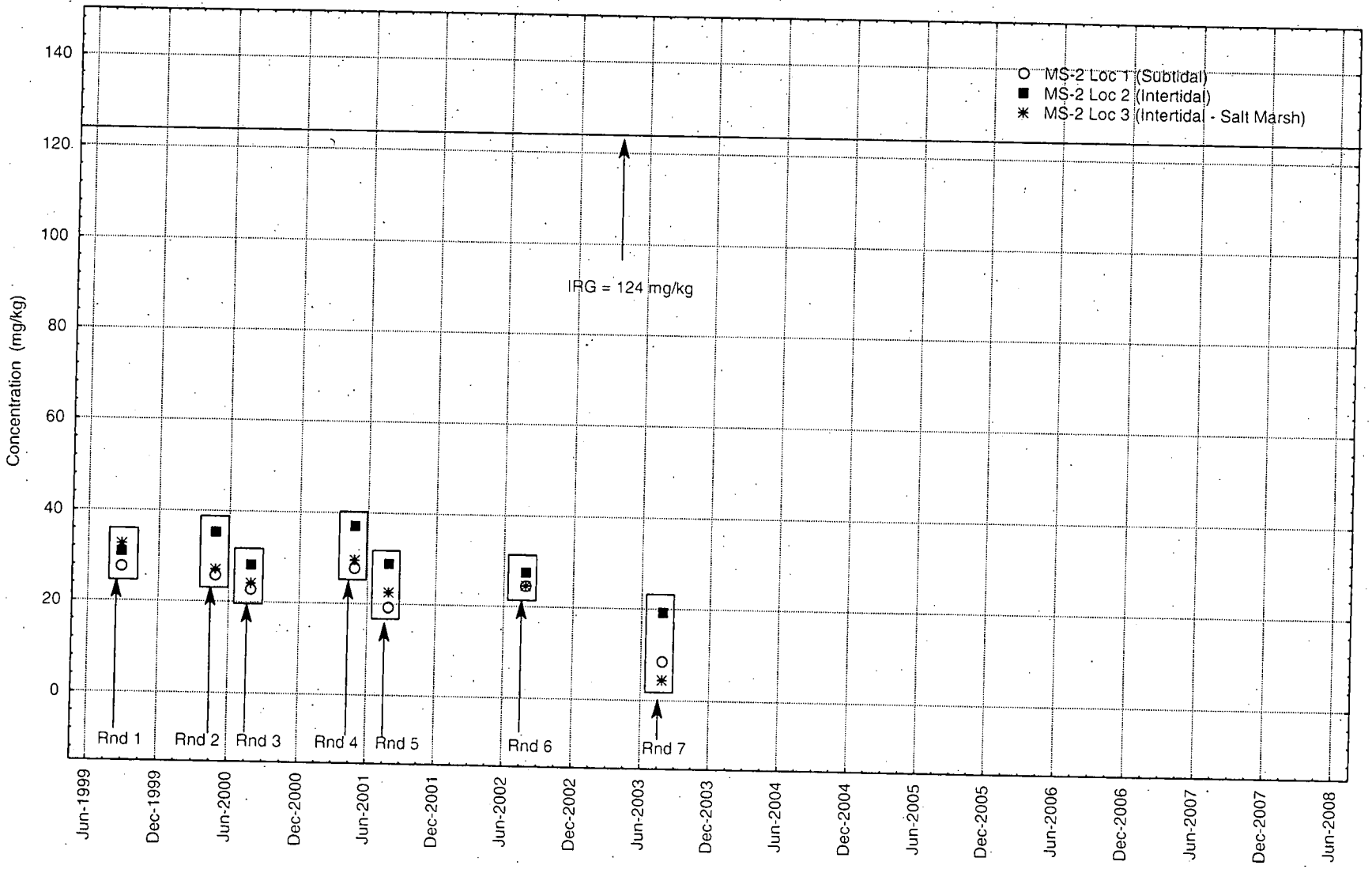
July 15, 2008

Monitoring Station 2 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 2 - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

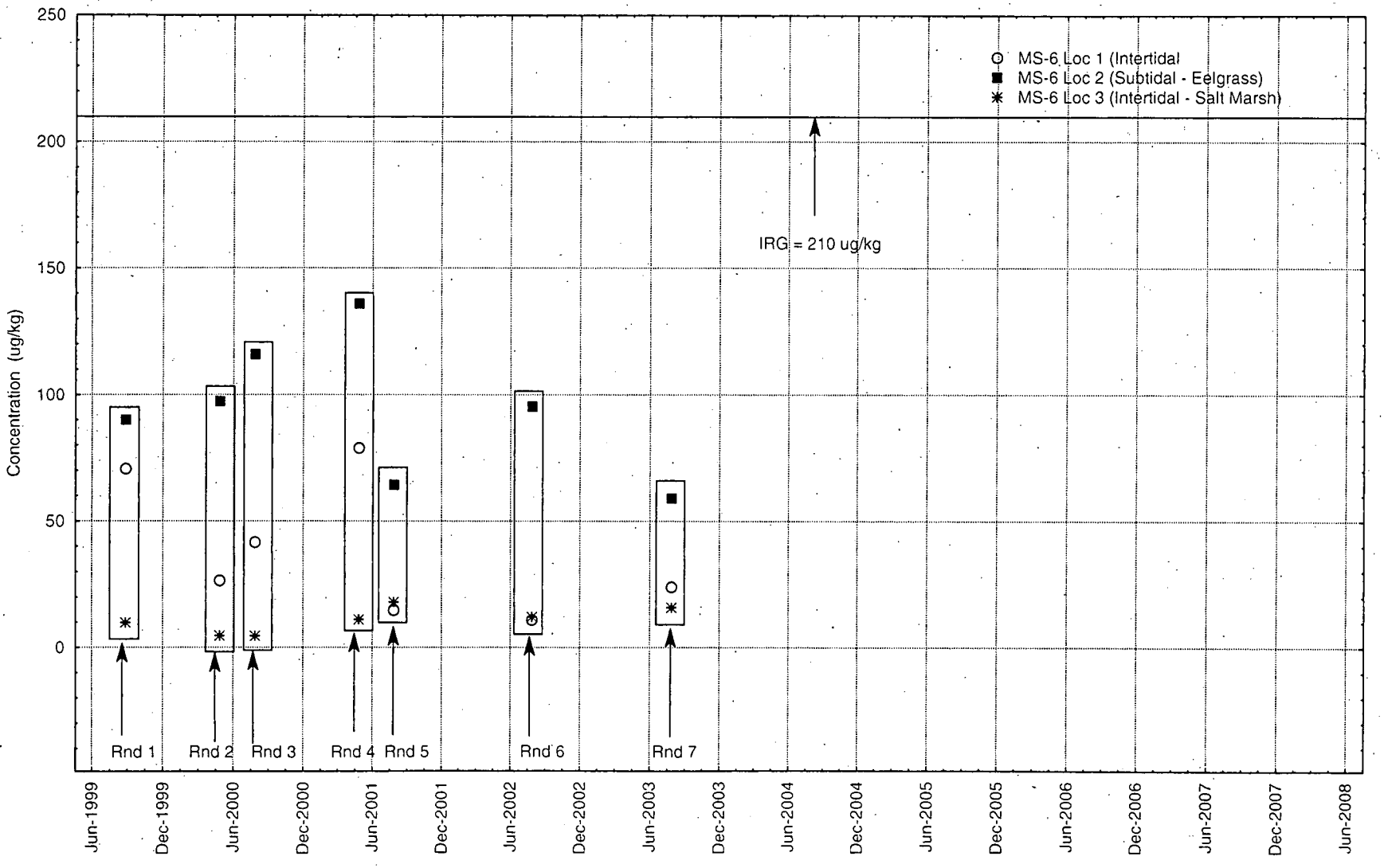


July 15, 2008

ATTACHMENT A.2

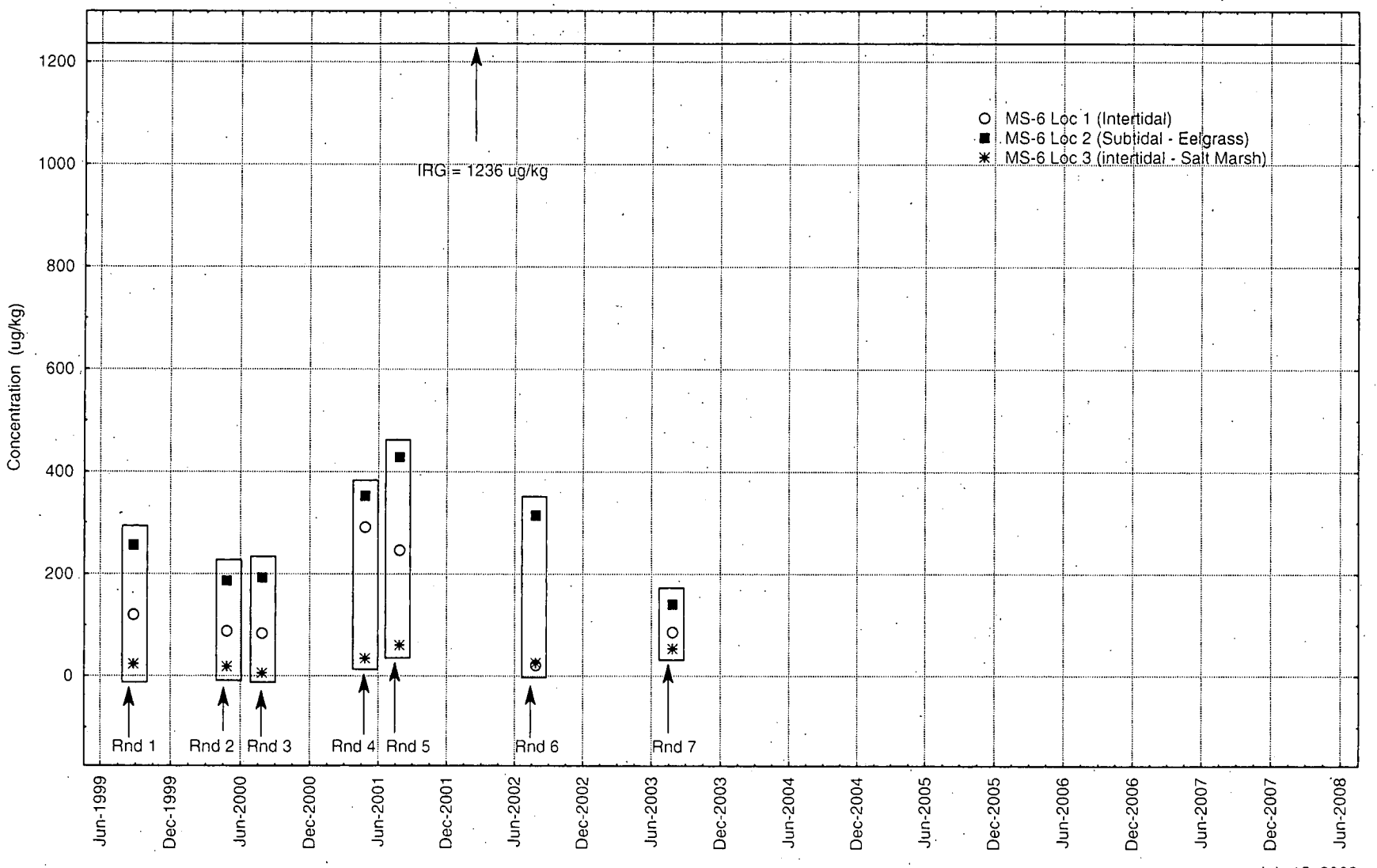
CONCENTRATION PLOTS AT MS-06

Monitoring Station 6 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



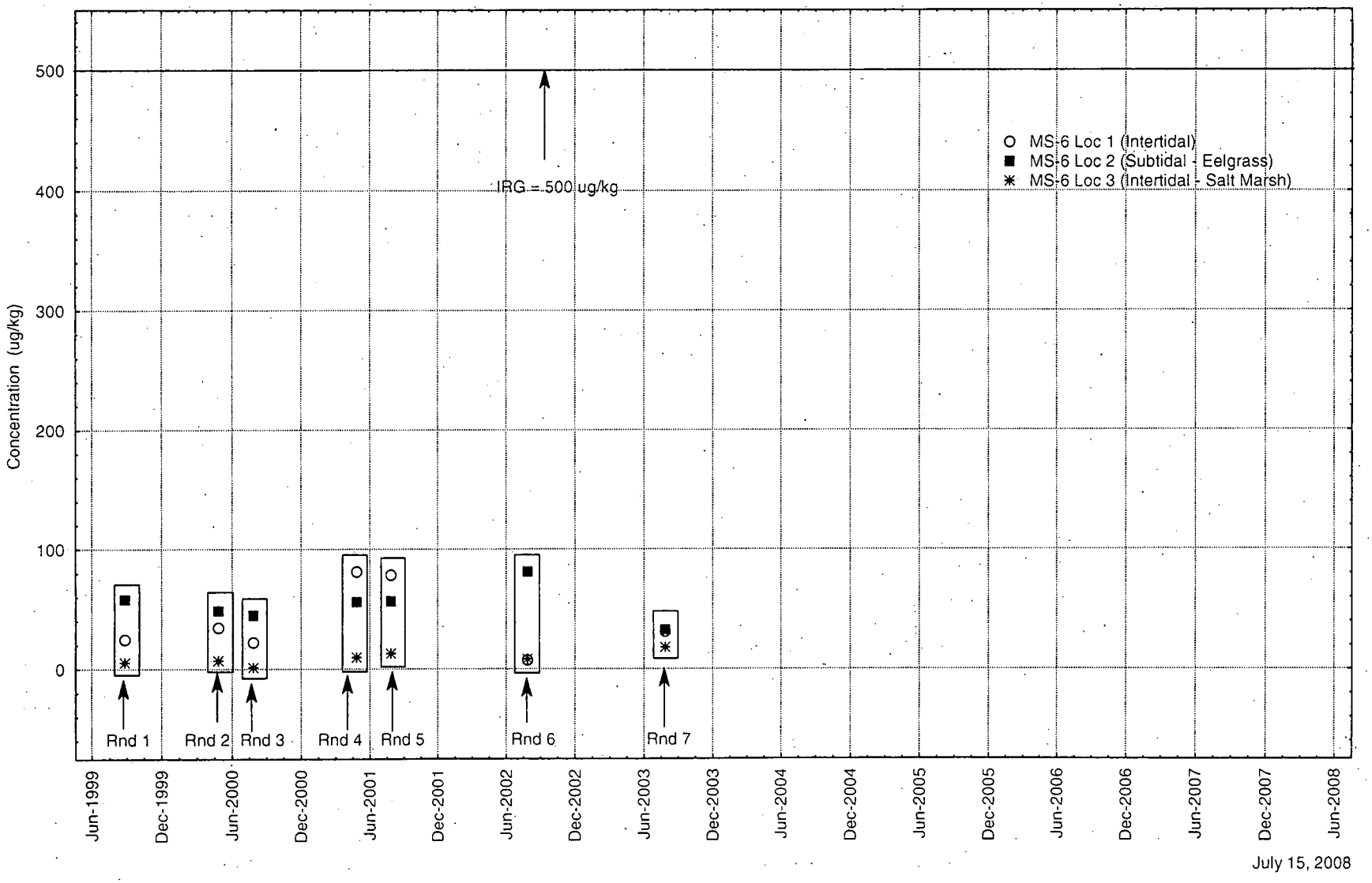
July 15, 2008

Monitoring Station 6 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



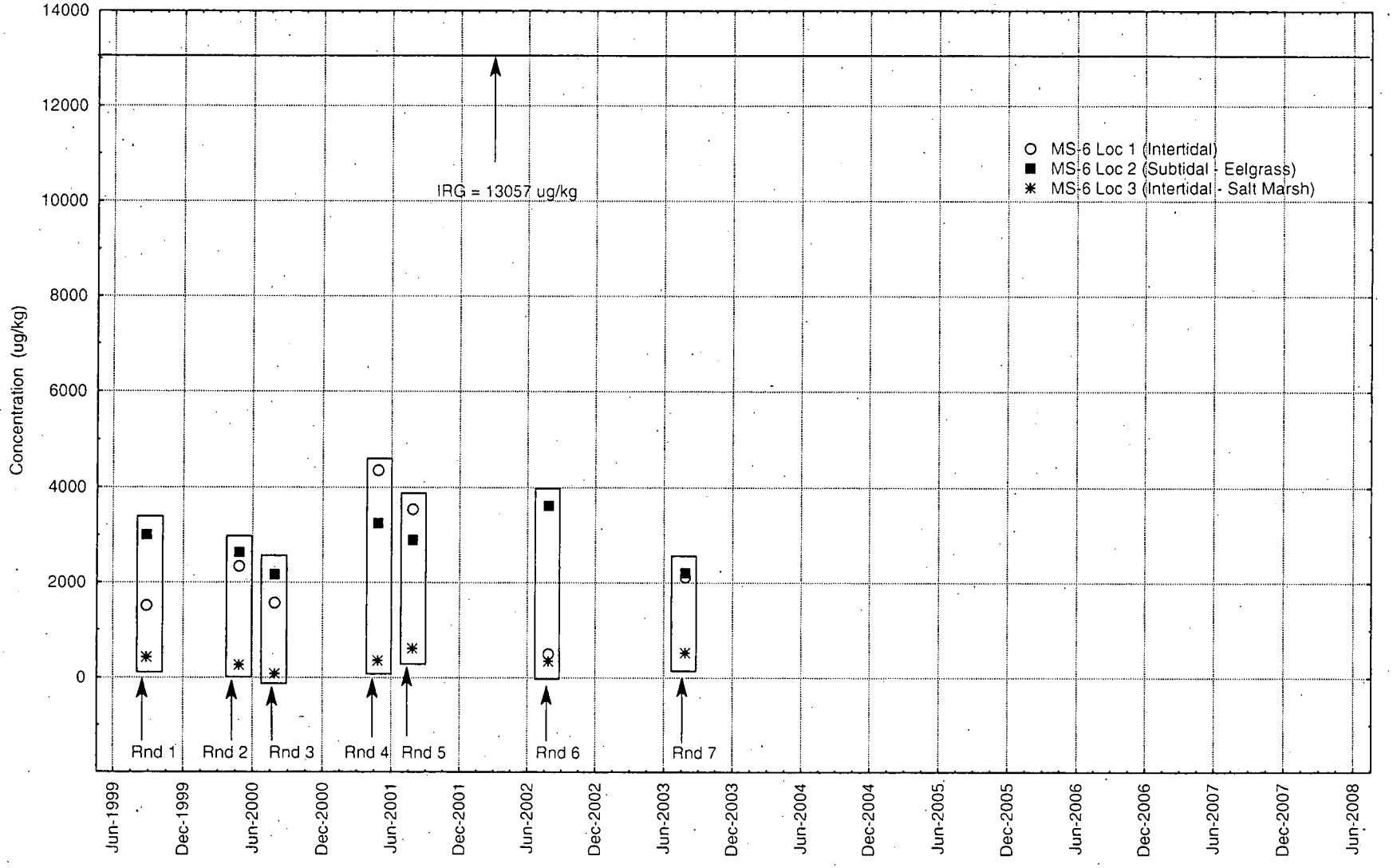
July 15, 2008

Monitoring Station 6 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



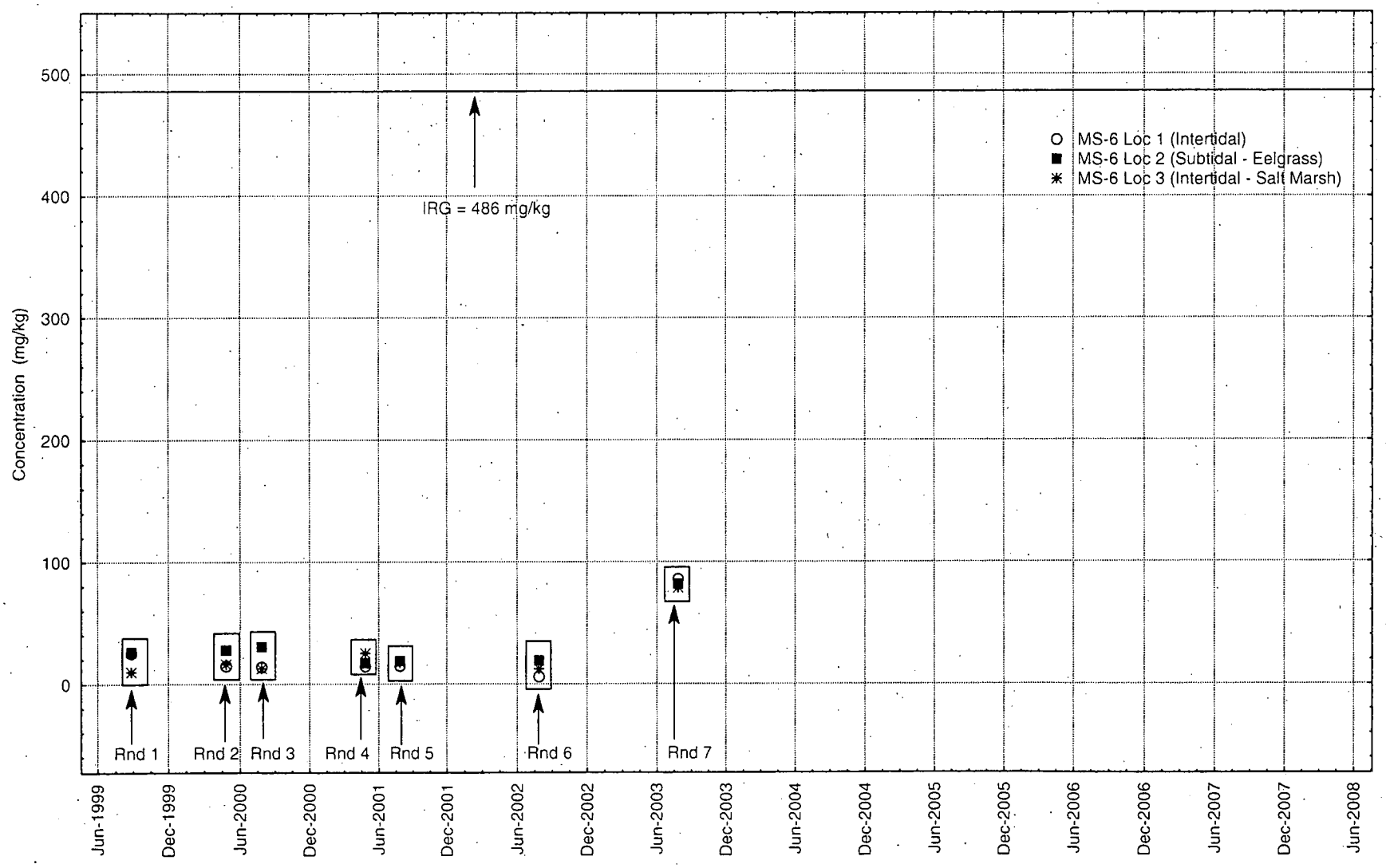
July 15, 2008

Monitoring Station 6 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



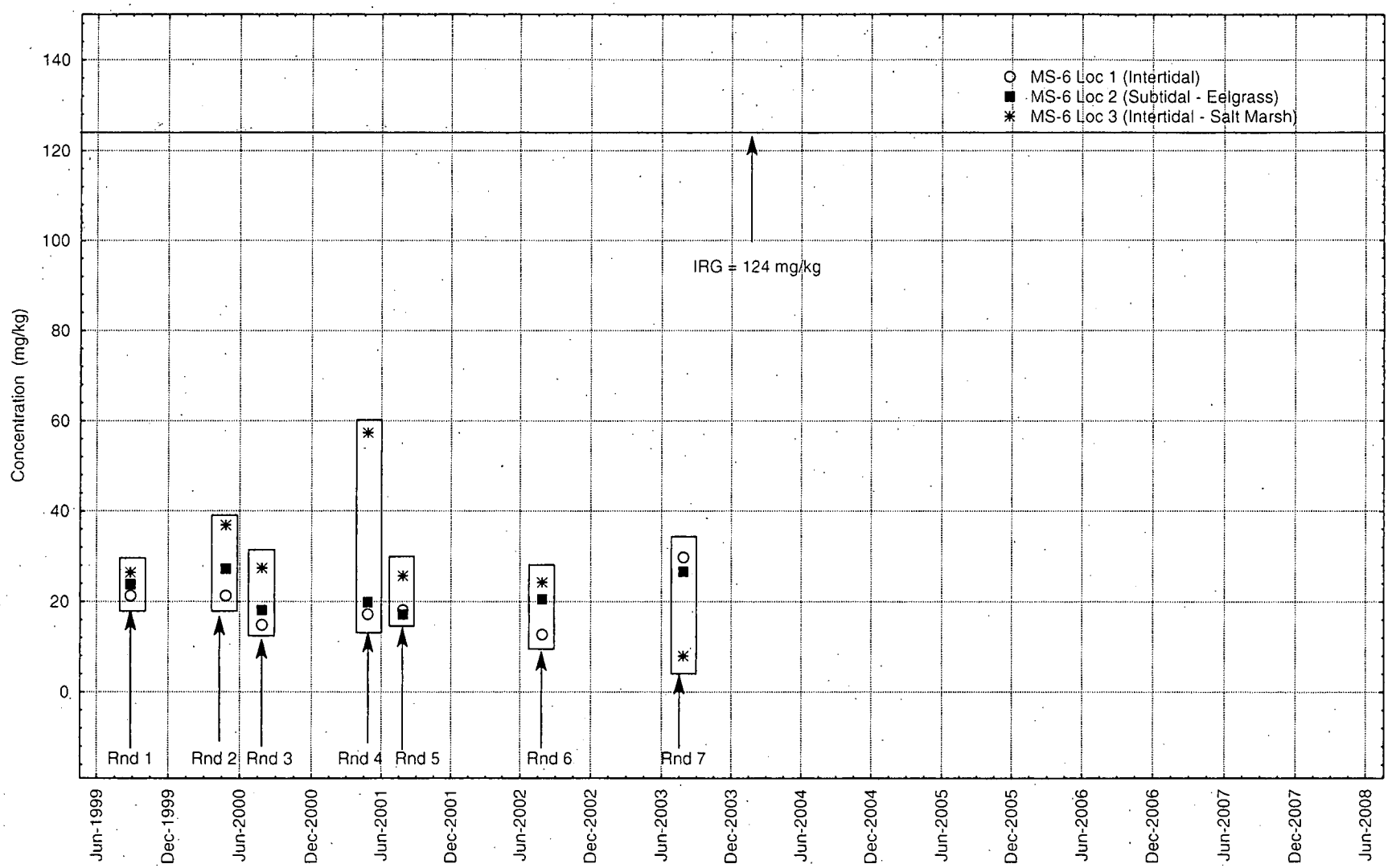
July 15, 2008

Monitoring Station 6 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 6 - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

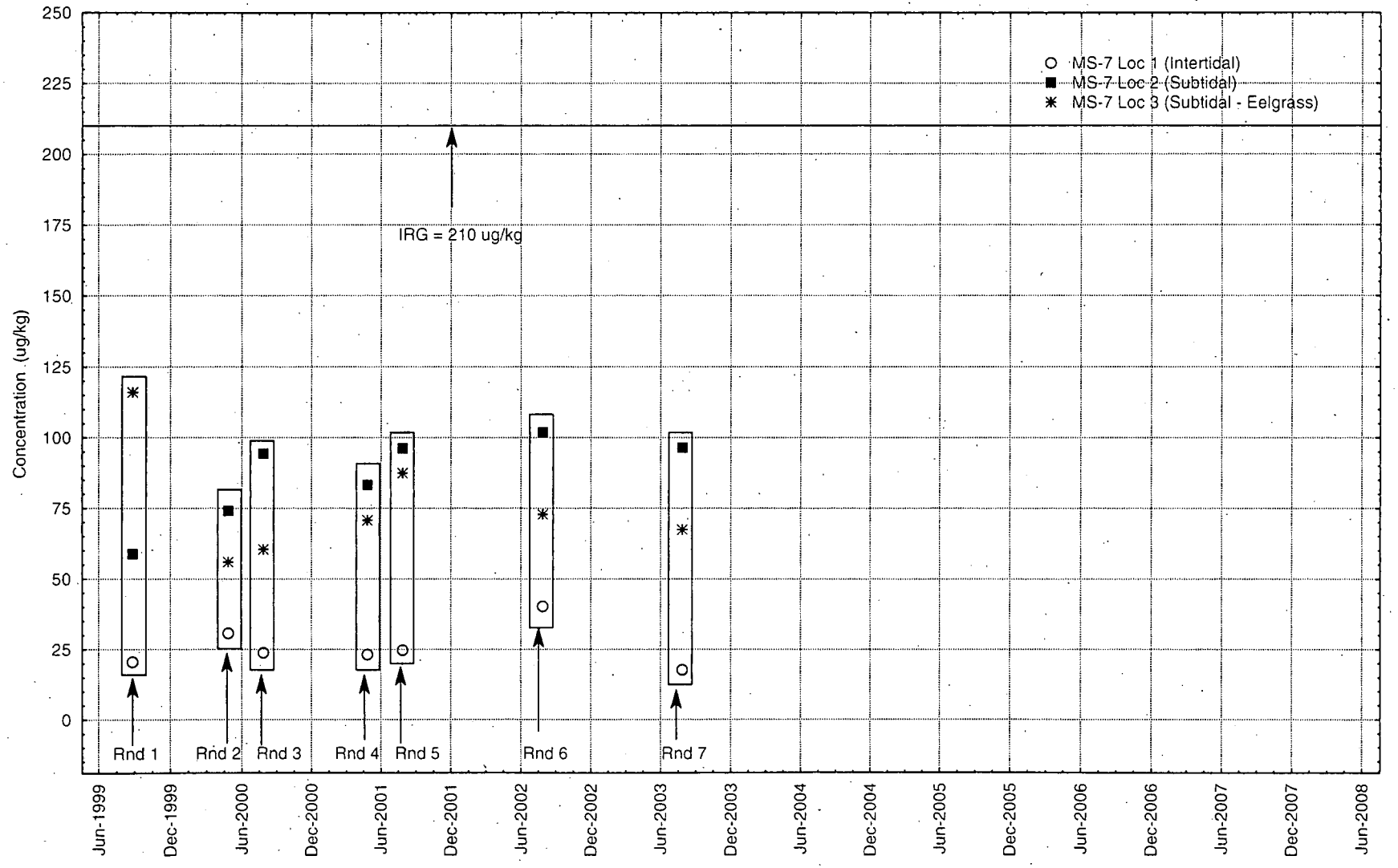


July 15, 2008

ATTACHMENT A.3

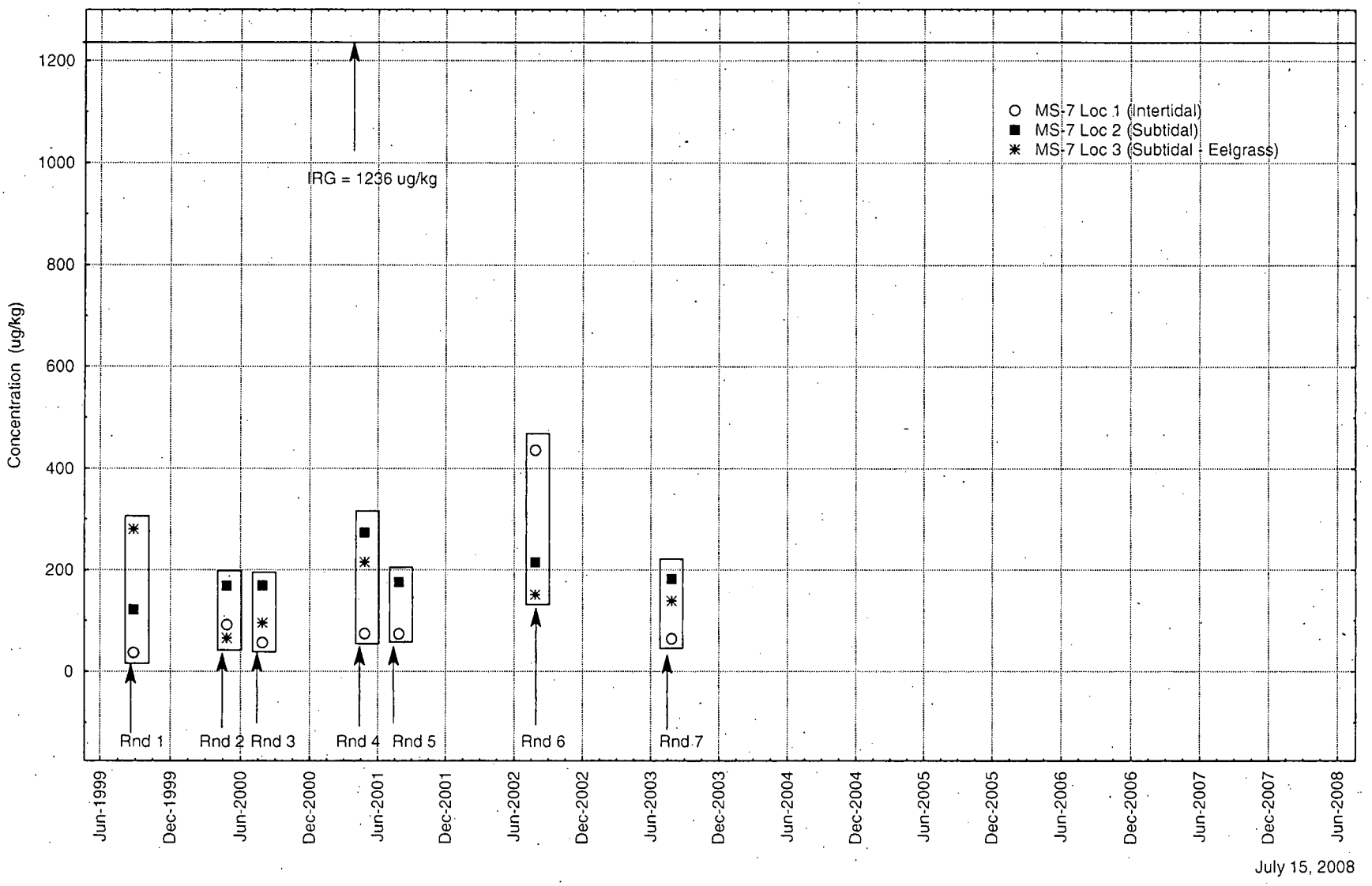
CONCENTRATION PLOTS AT MS-07

Monitoring Station 7 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



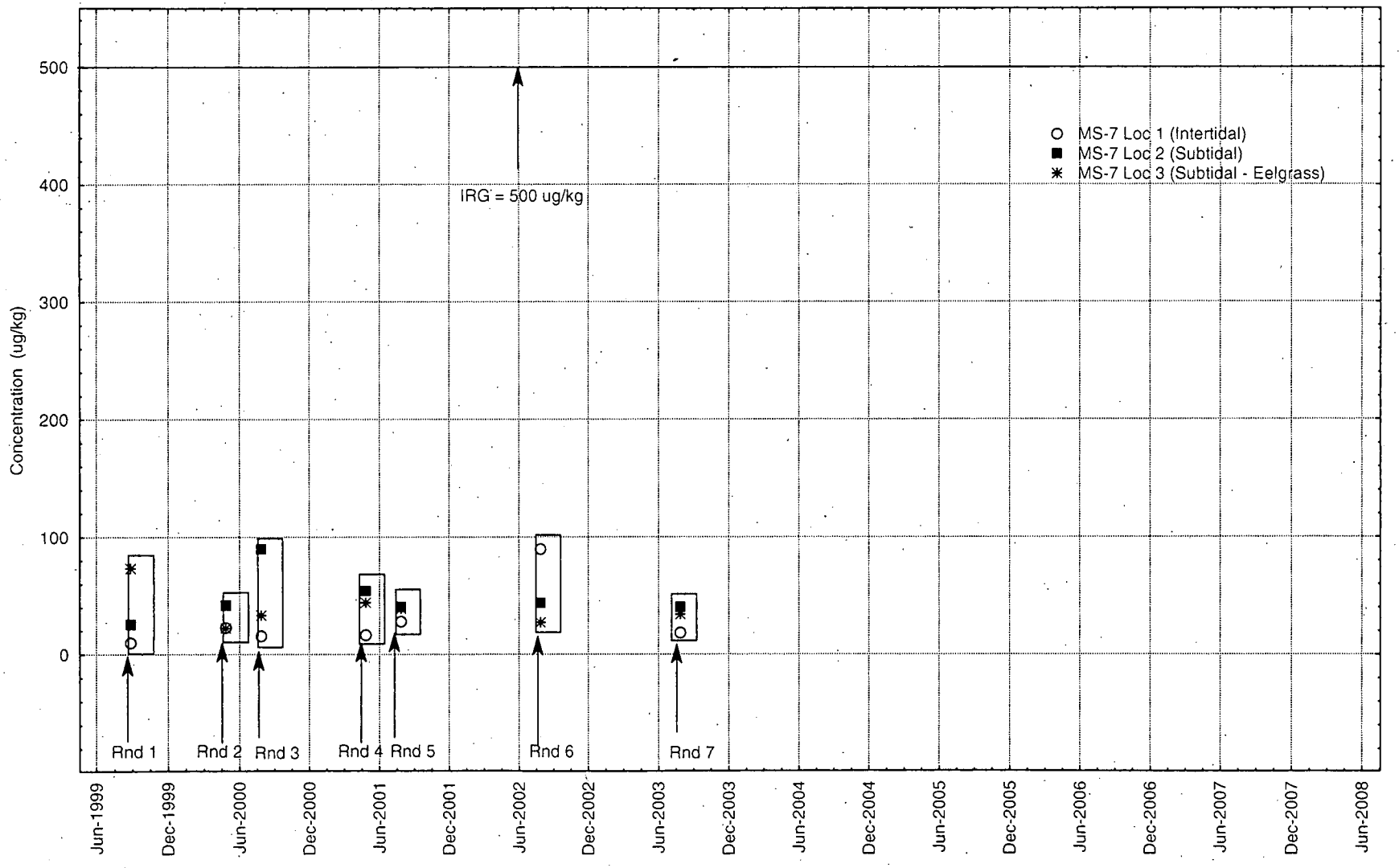
July 15, 2008

Monitoring Station 7 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



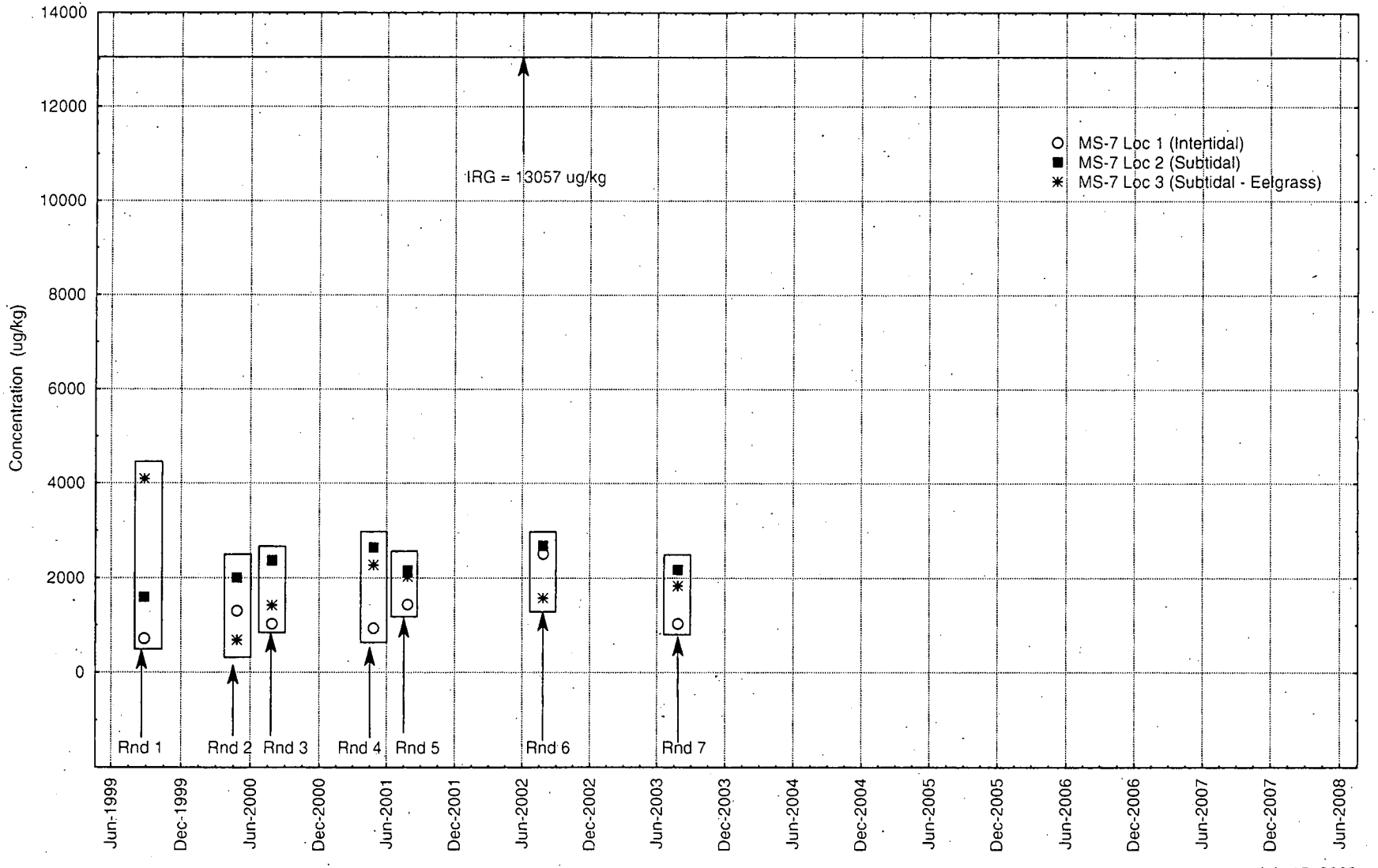
July 15, 2008

Monitoring Station 7 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



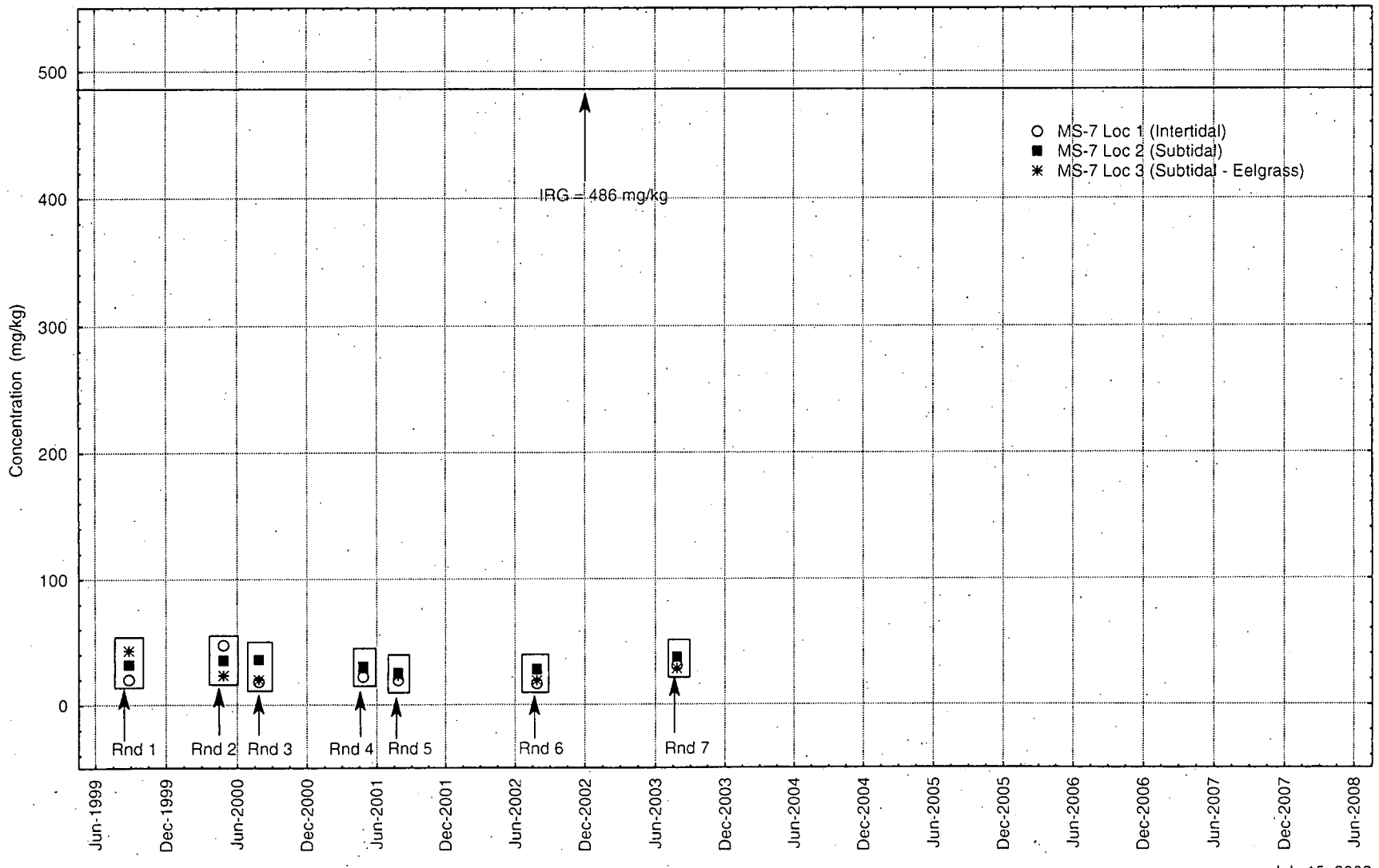
July 15, 2008

Monitoring Station 7 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



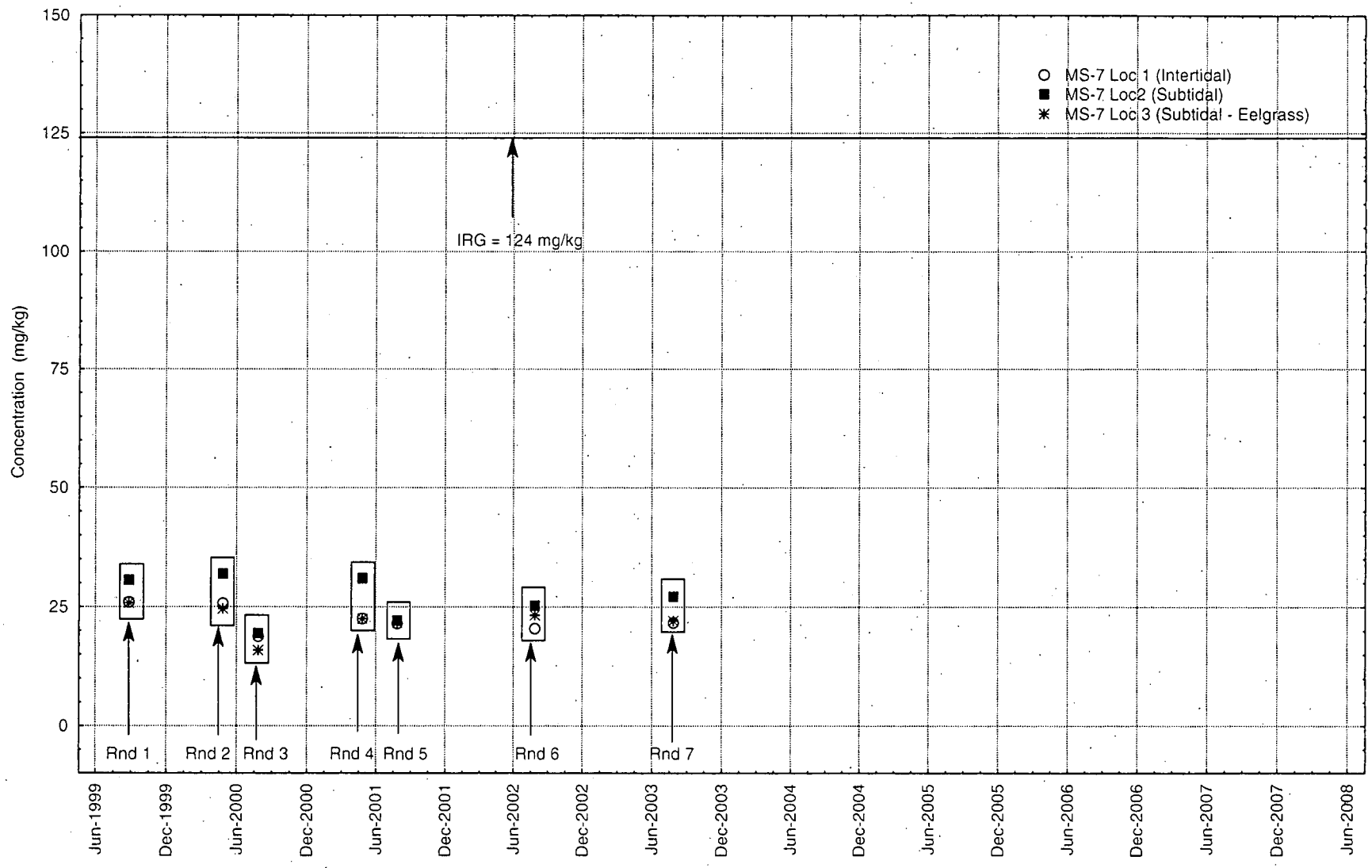
July 15, 2008

Monitoring Station 7 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 7 - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

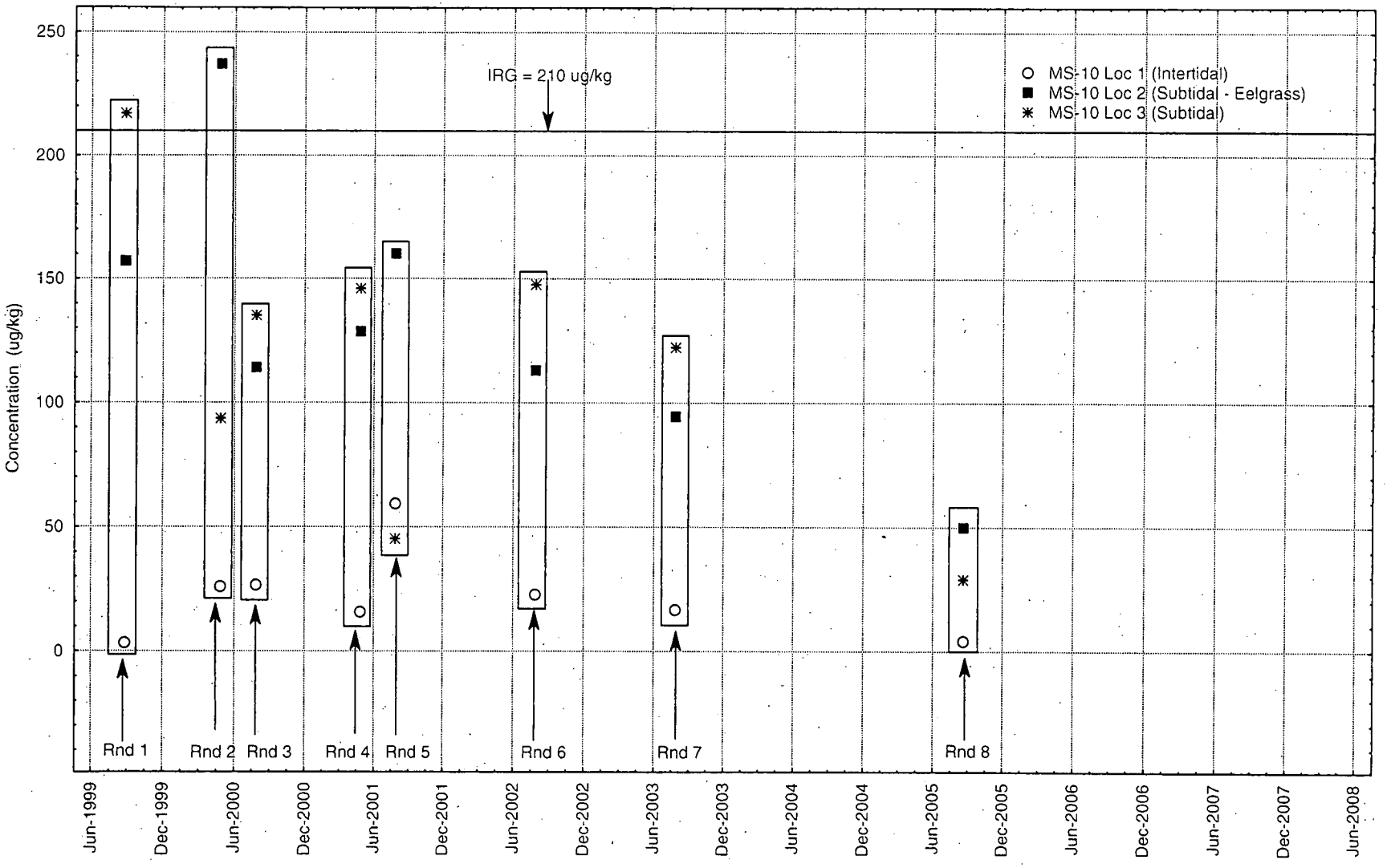


July 15, 2008

ATTACHMENT A.4

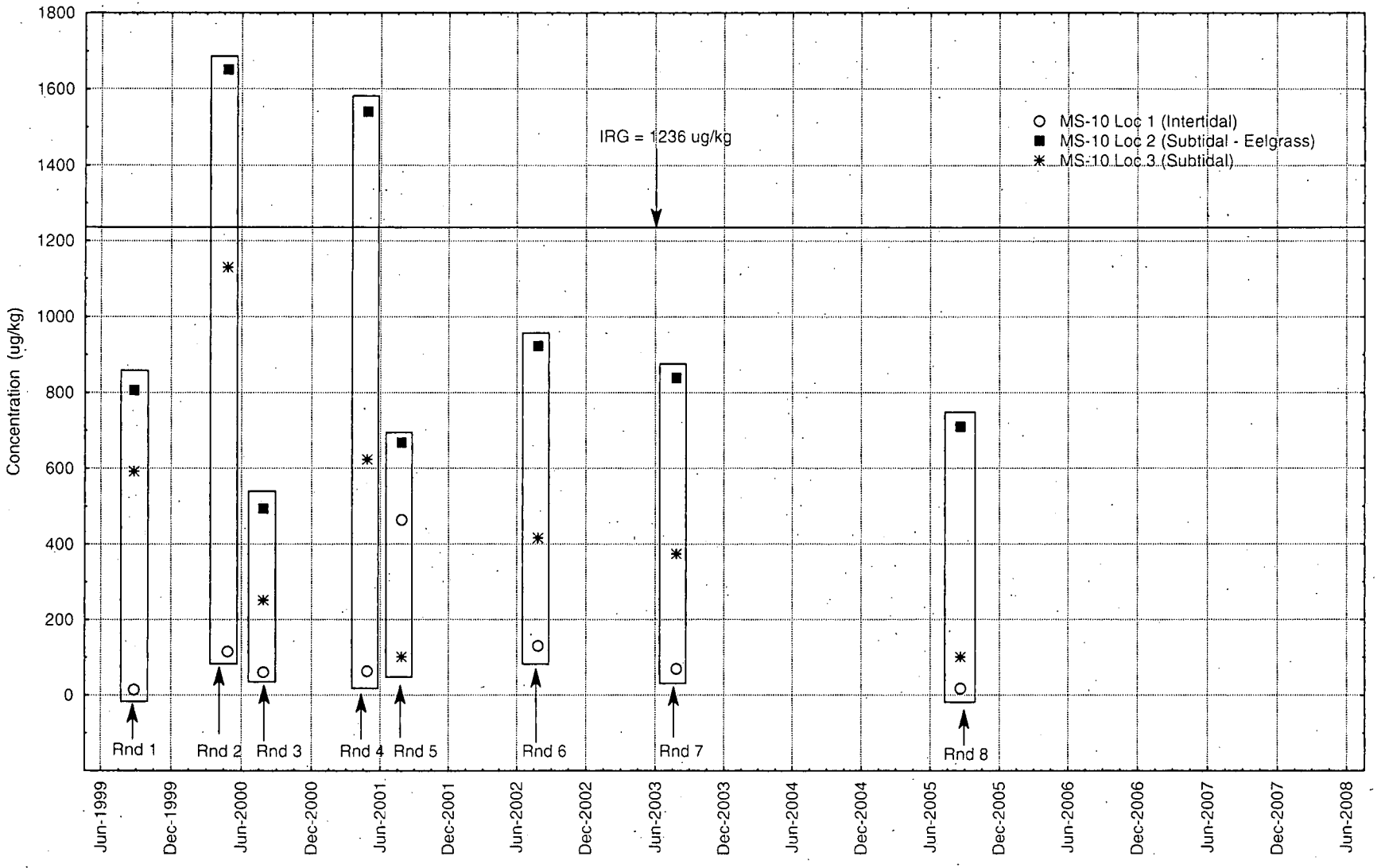
CONCENTRATION PLOTS AT MS-10

Monitoring Station 10 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



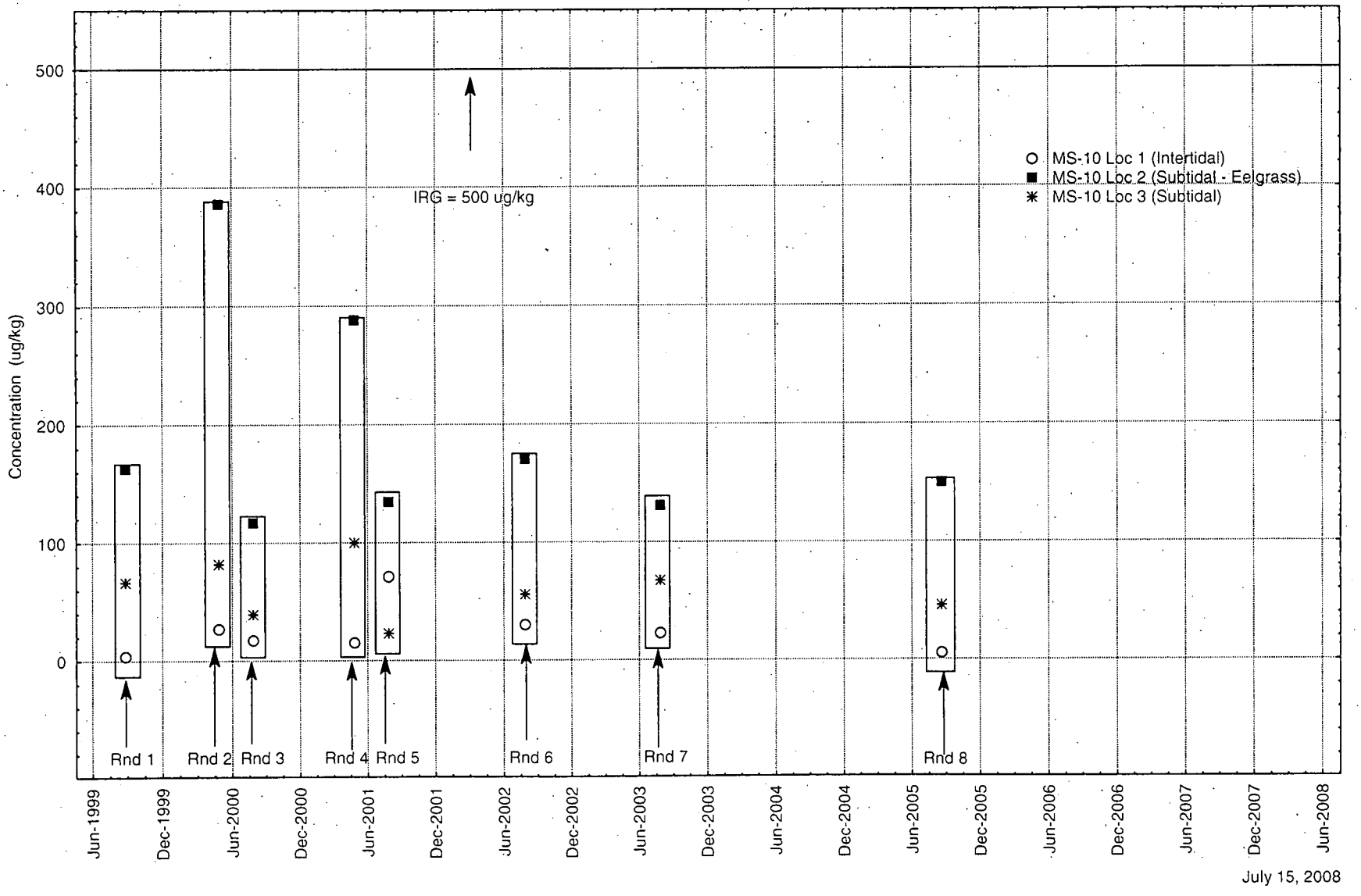
July 15, 2008

Monitoring Station 10 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



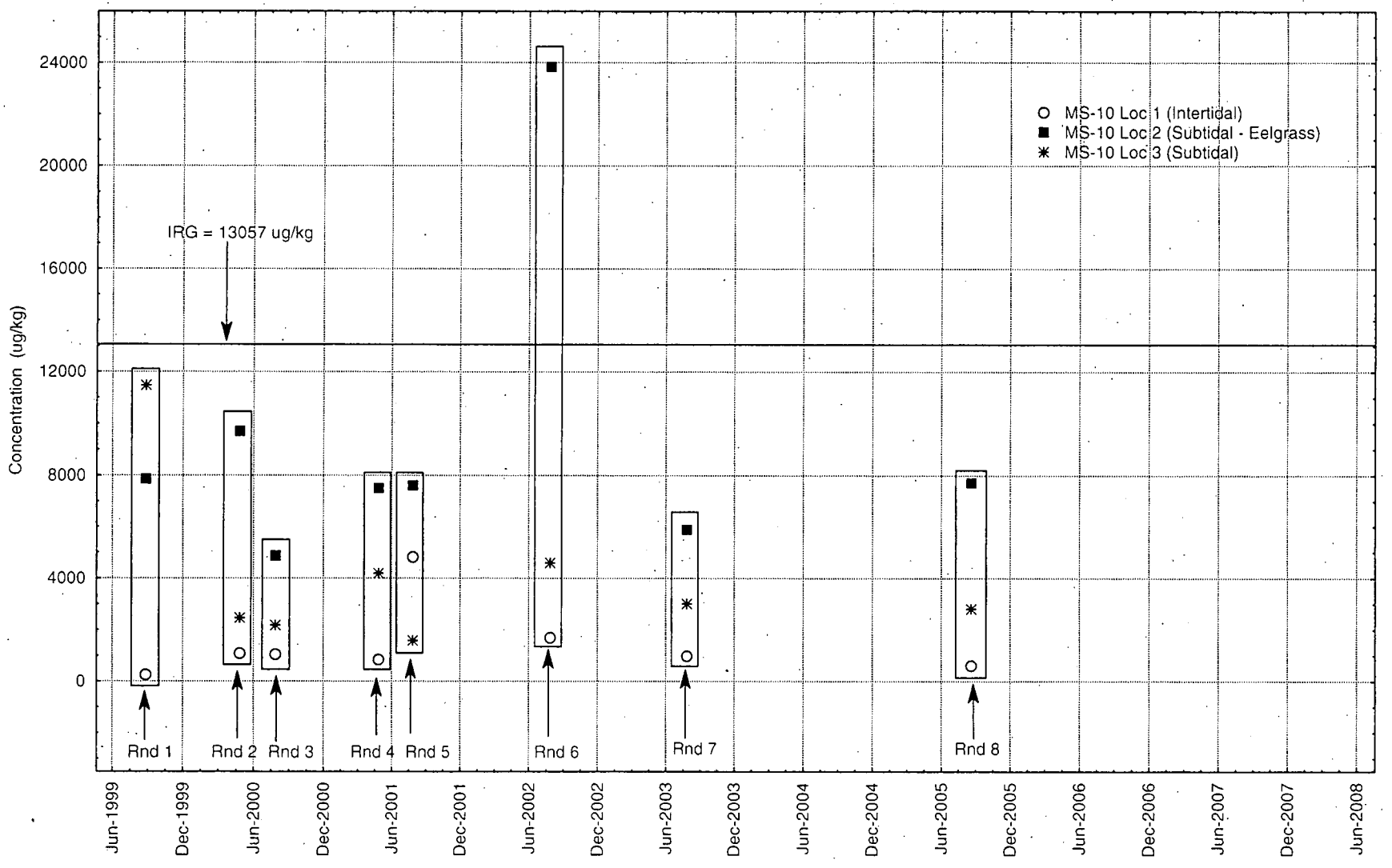
July 15, 2008

Monitoring Station 10 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



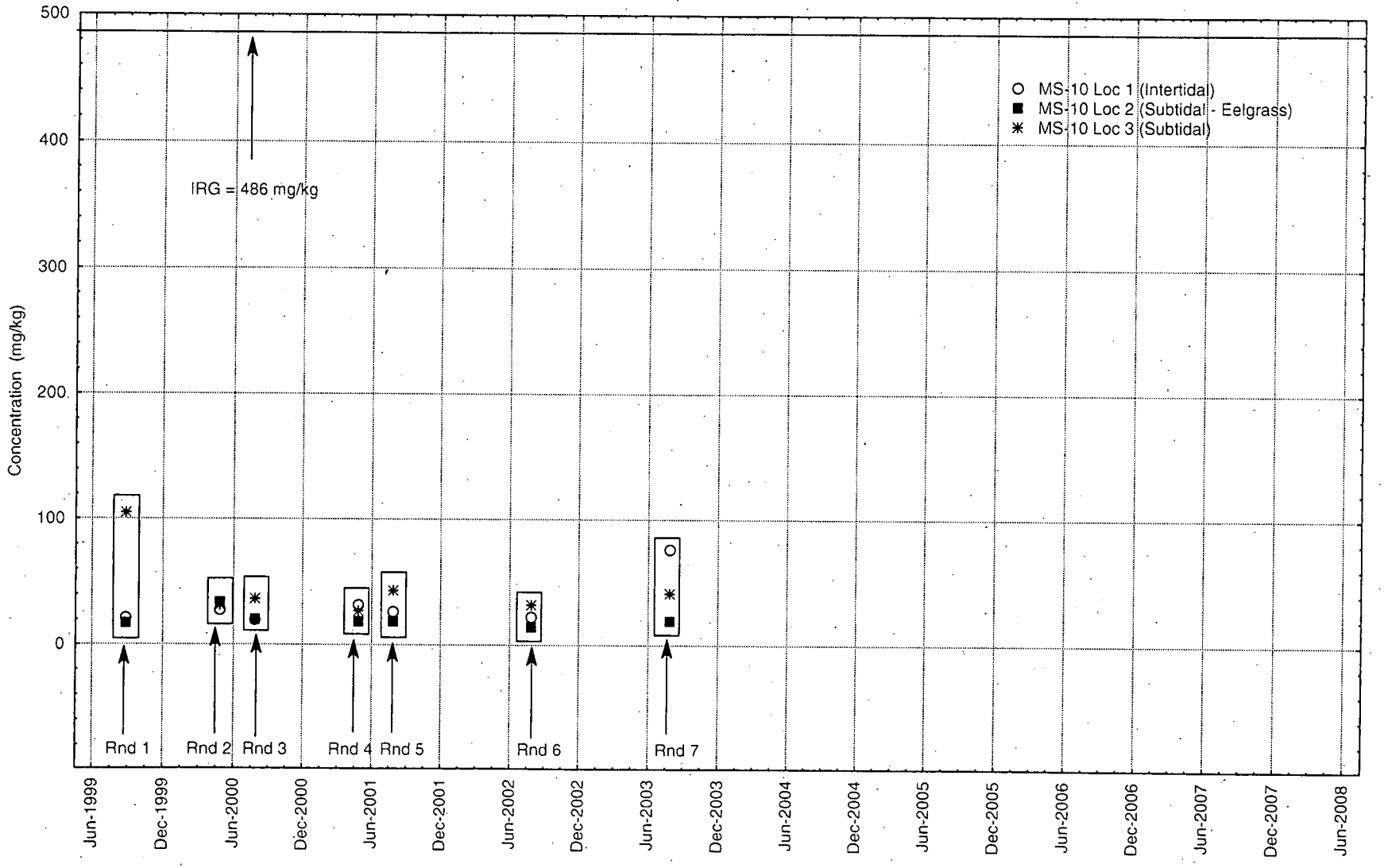
July 15, 2008

Monitoring Station 10 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



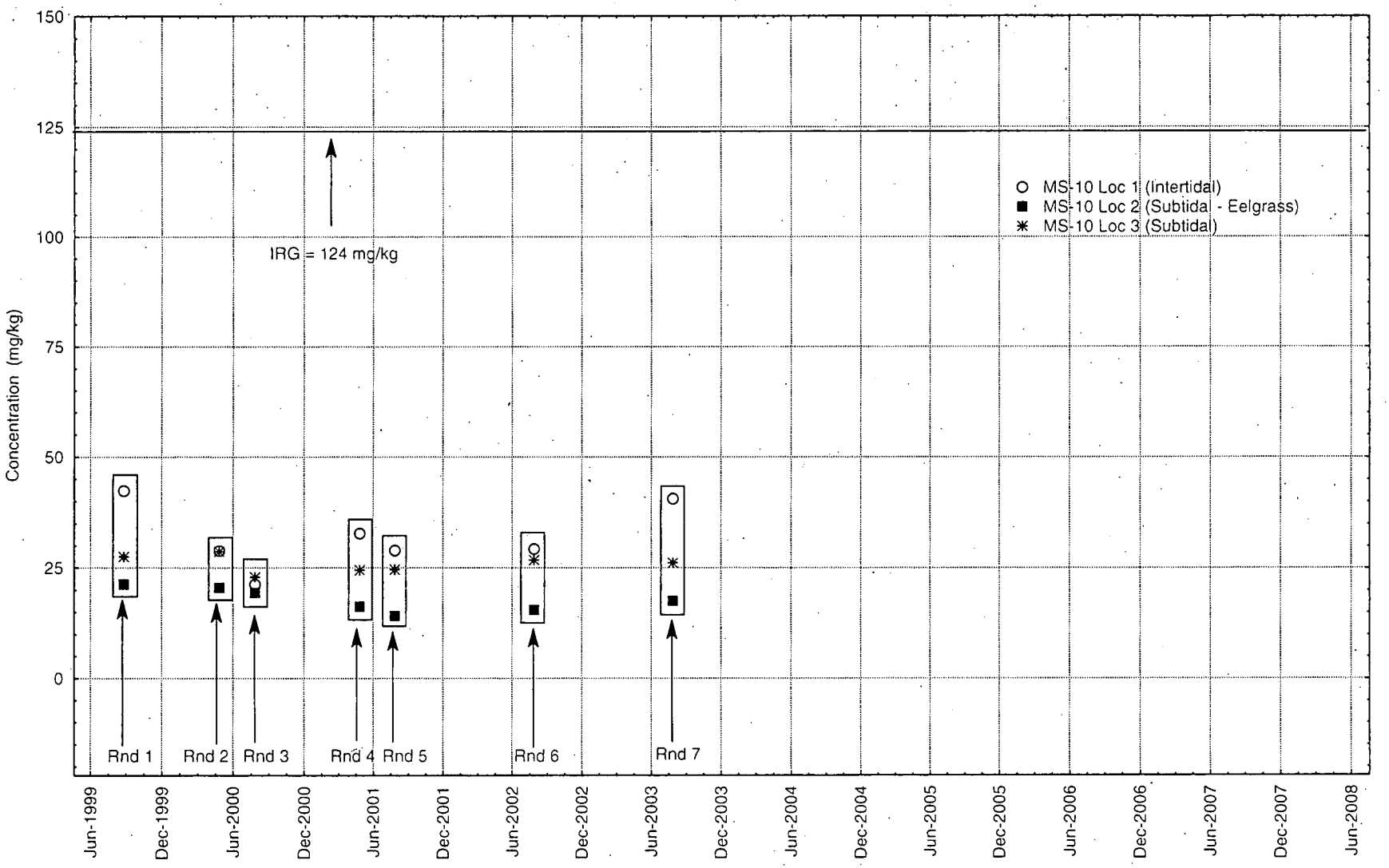
July 15, 2008

Monitoring Station 10 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



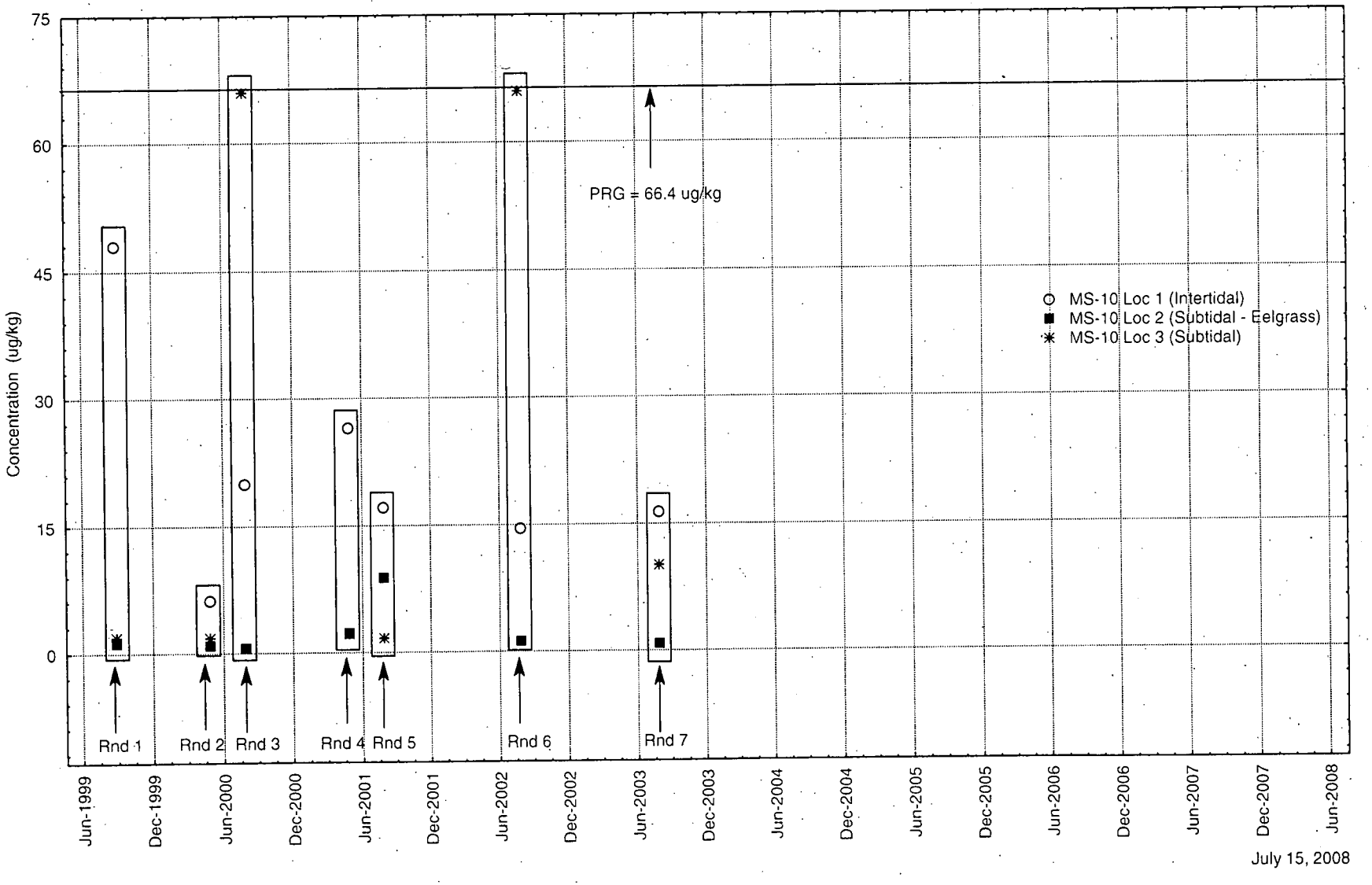
July 15, 2008

Monitoring Station 10 - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



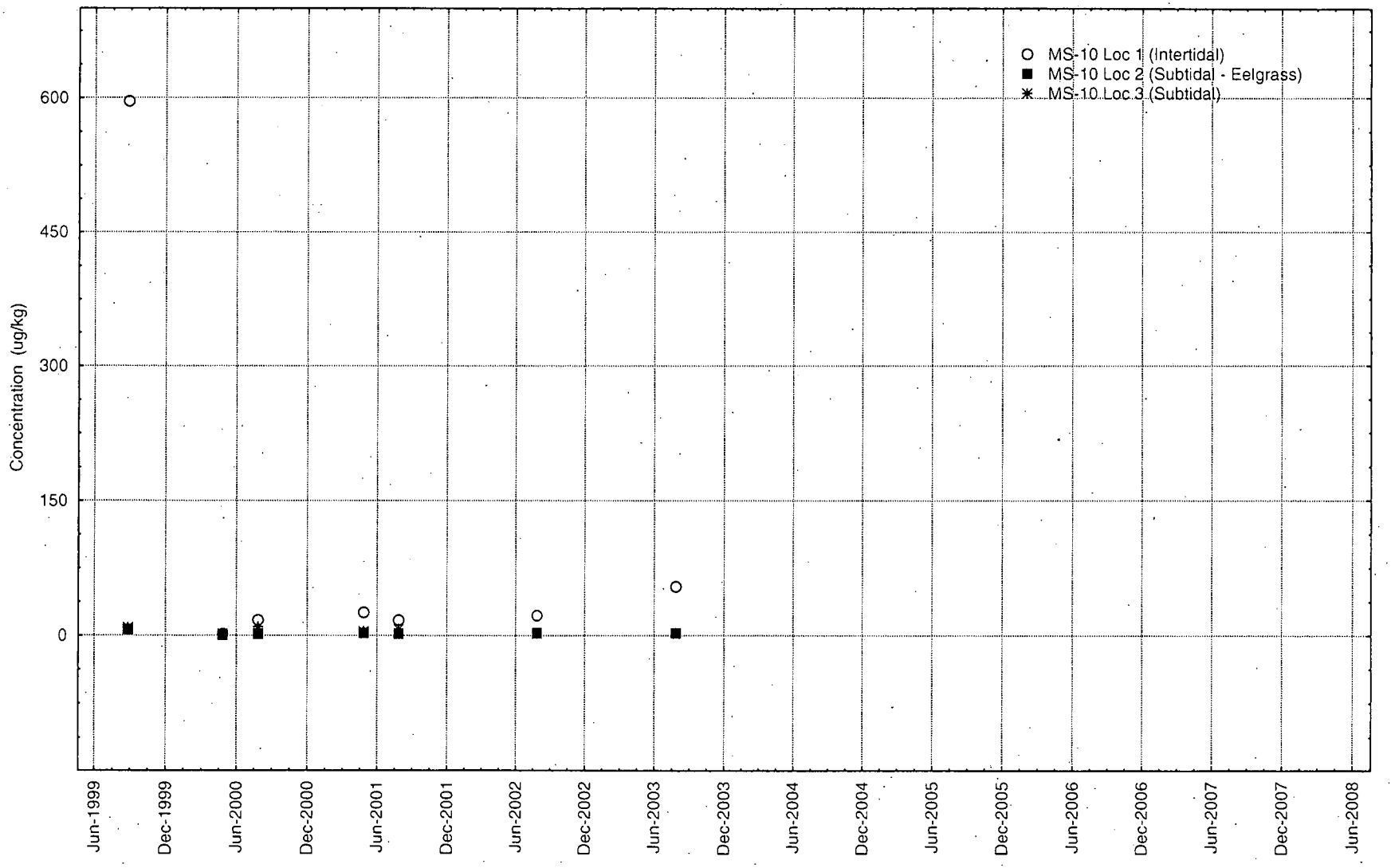
July 15, 2008

Monitoring Station 10 - Sediment
4,4'-DDT Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 10 - Mussel
4,4'-DDT Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

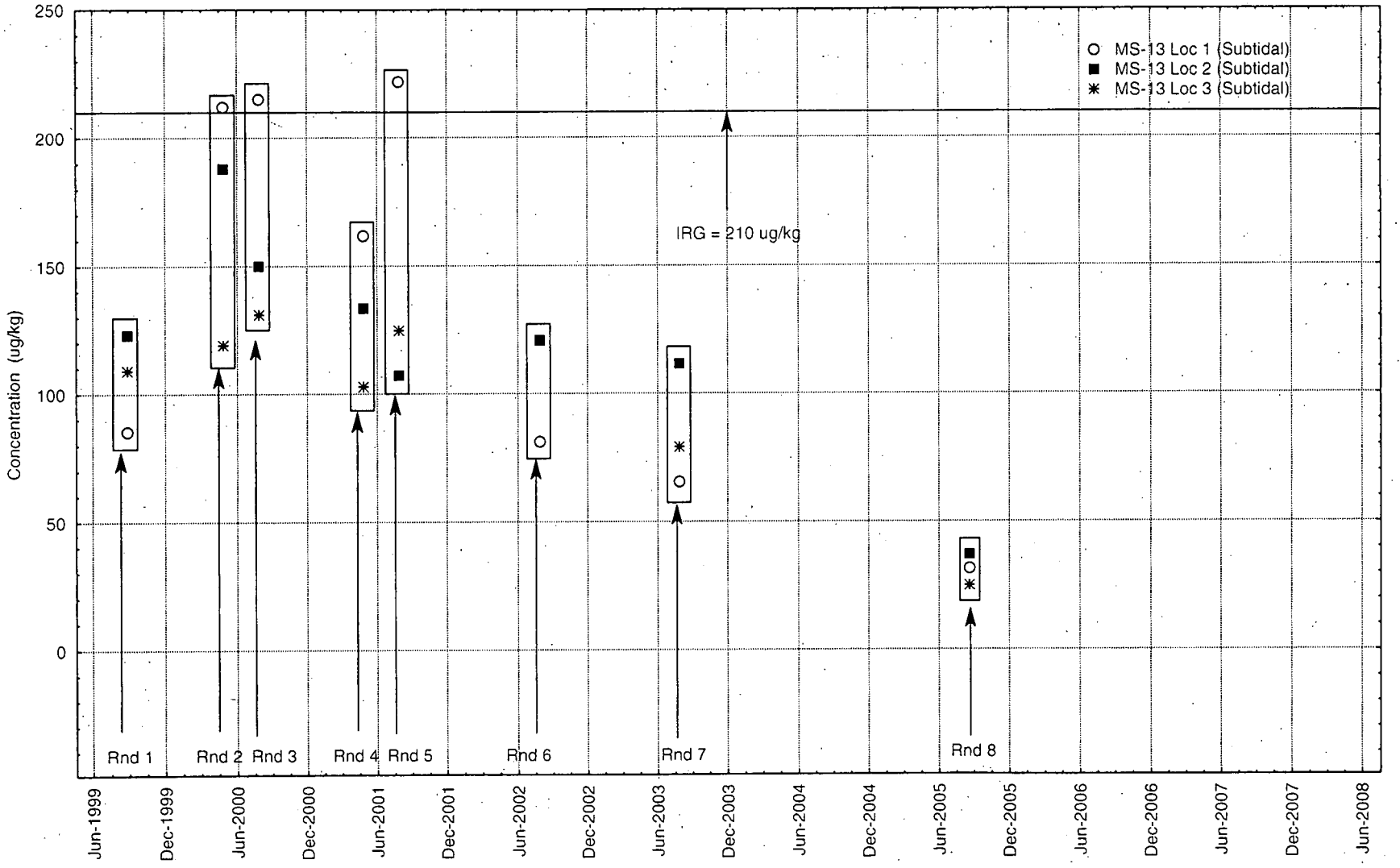


July 15, 2008

ATTACHMENT A.5

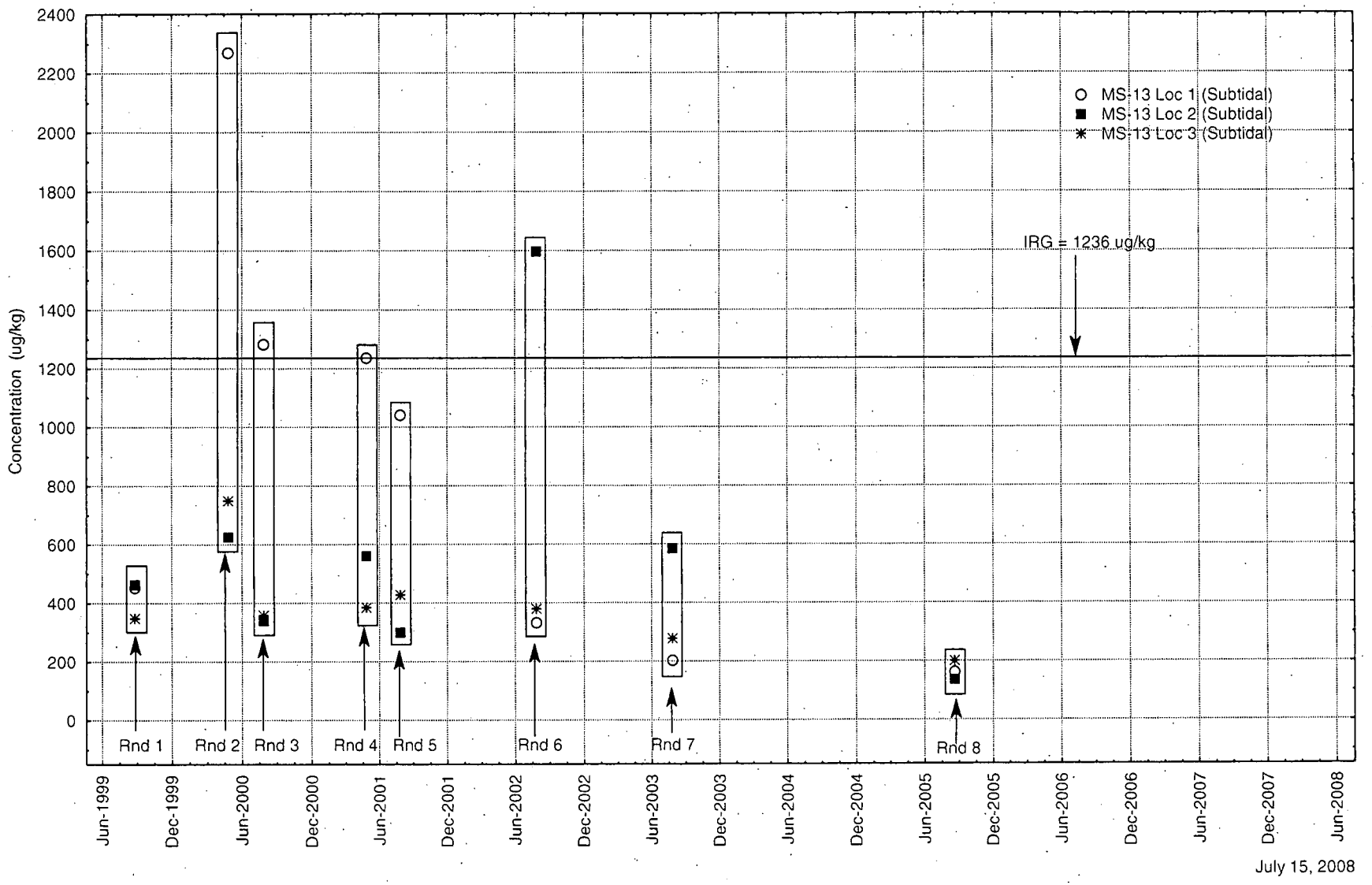
CONCENTRATION PLOTS AT MS-13

Monitoring Station 13 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



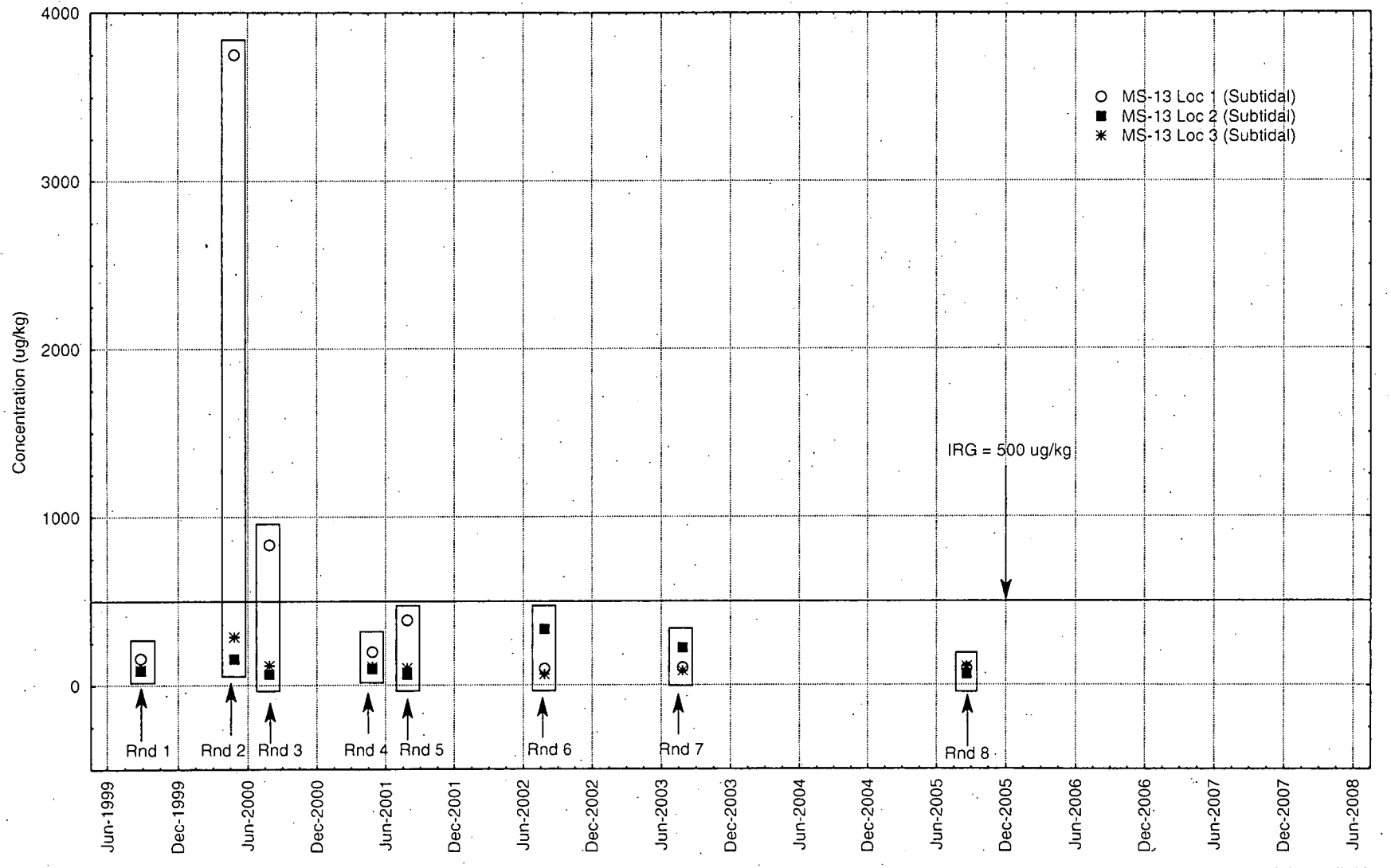
July 15, 2008

Monitoring Station 13 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



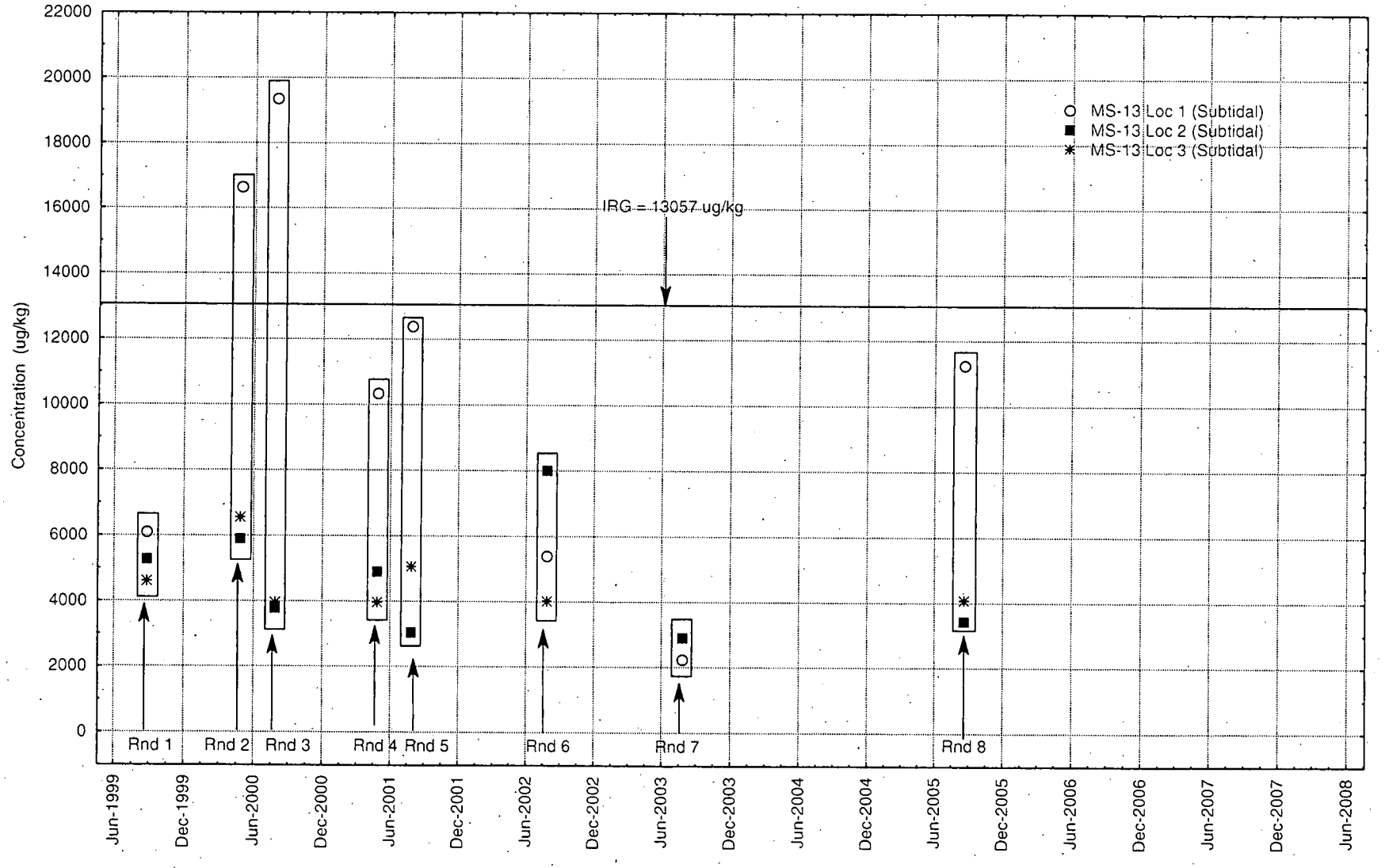
July 15, 2008

Monitoring Station 13 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



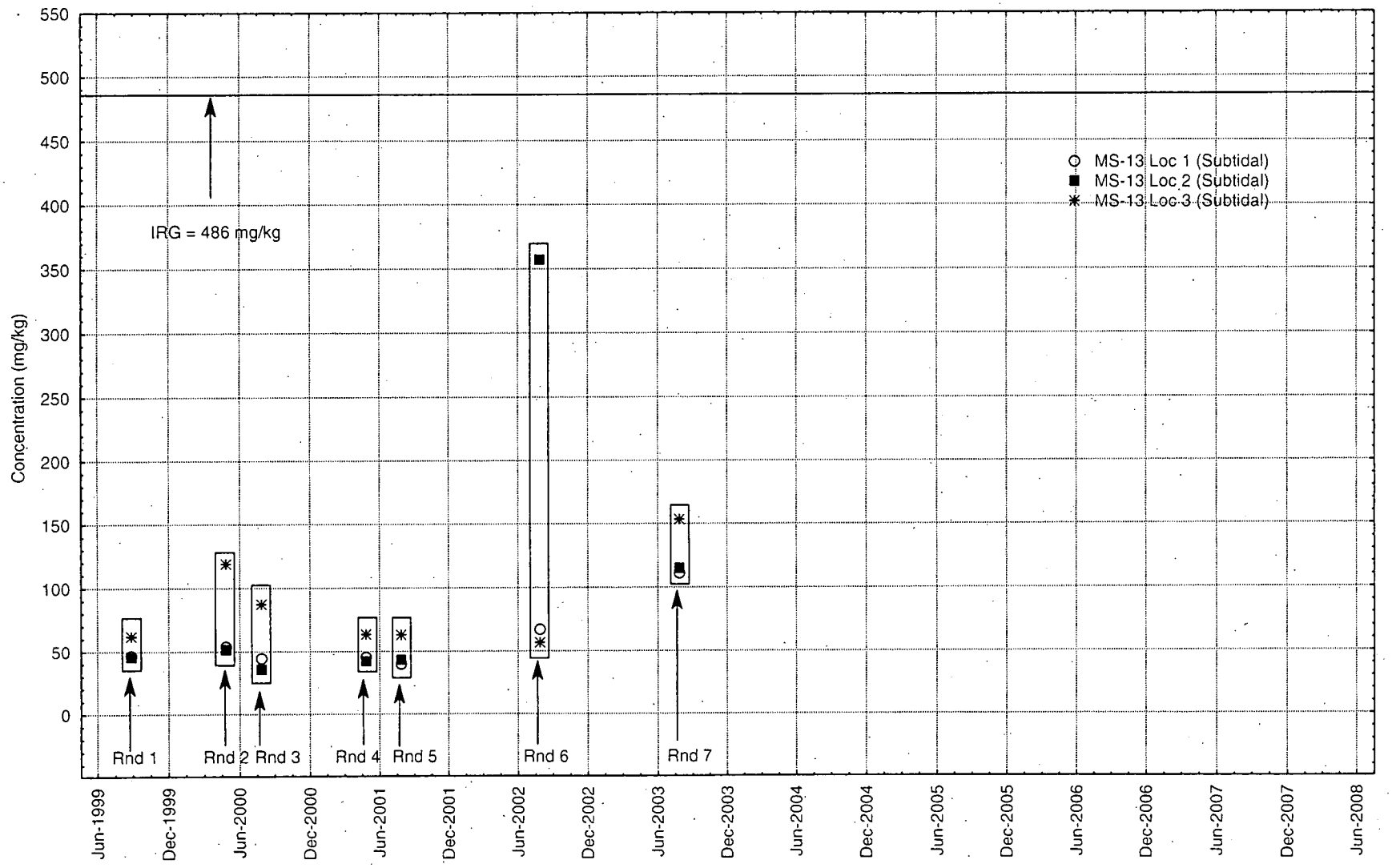
July 15, 2008

Monitoring Station 13 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



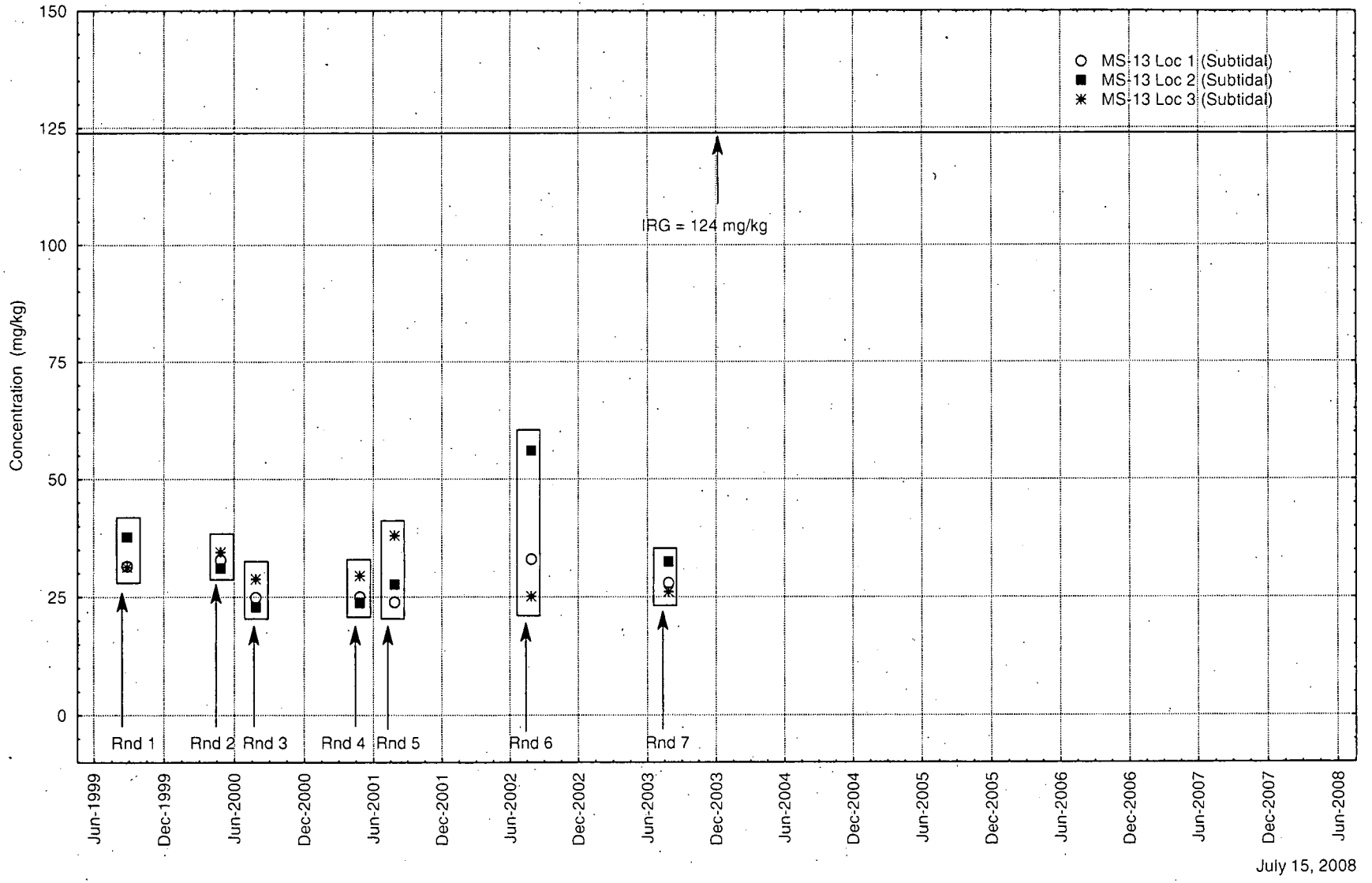
July 15, 2008

Monitoring Station 13 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 13 - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

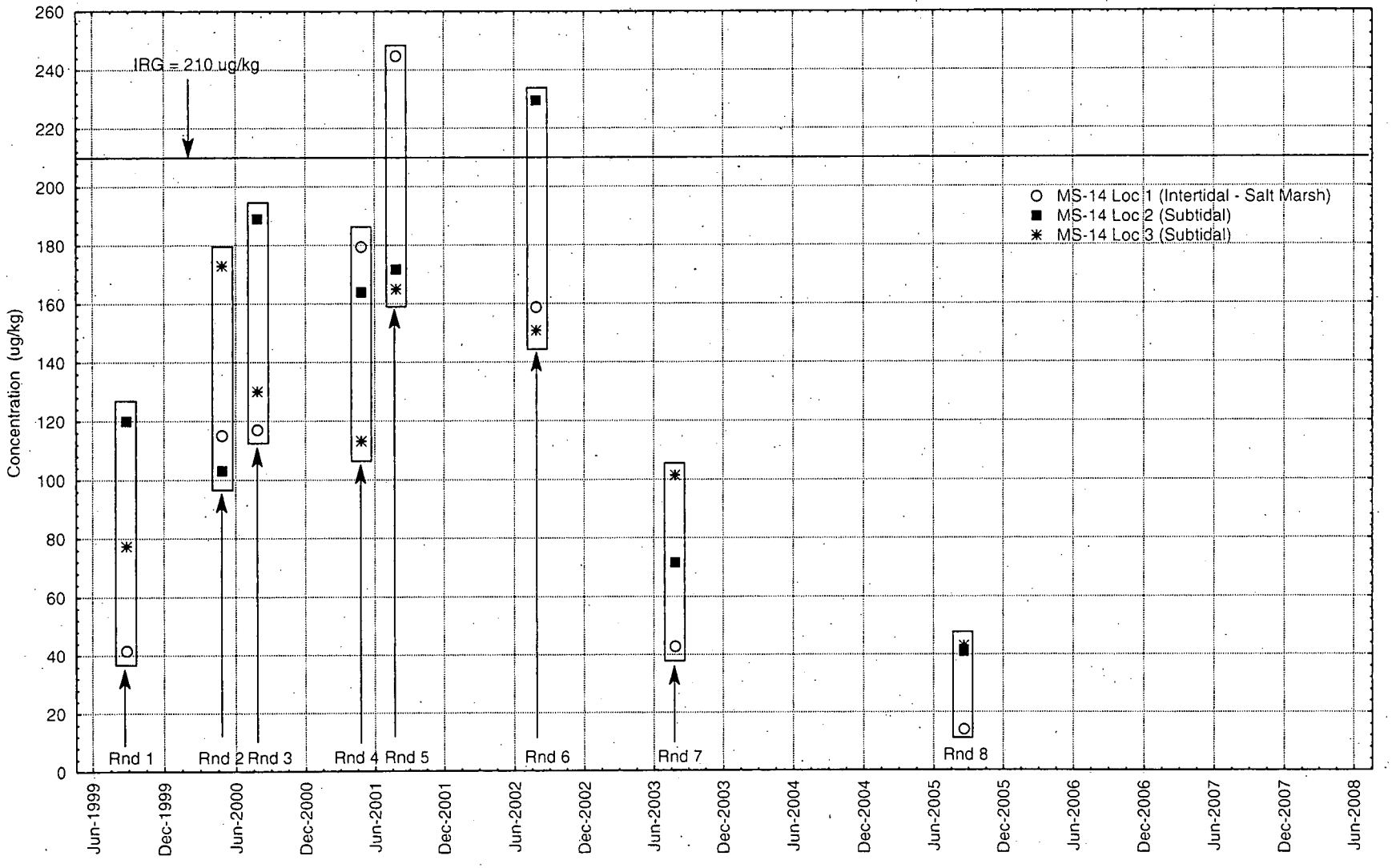


July 15, 2008

ATTACHMENT A.6

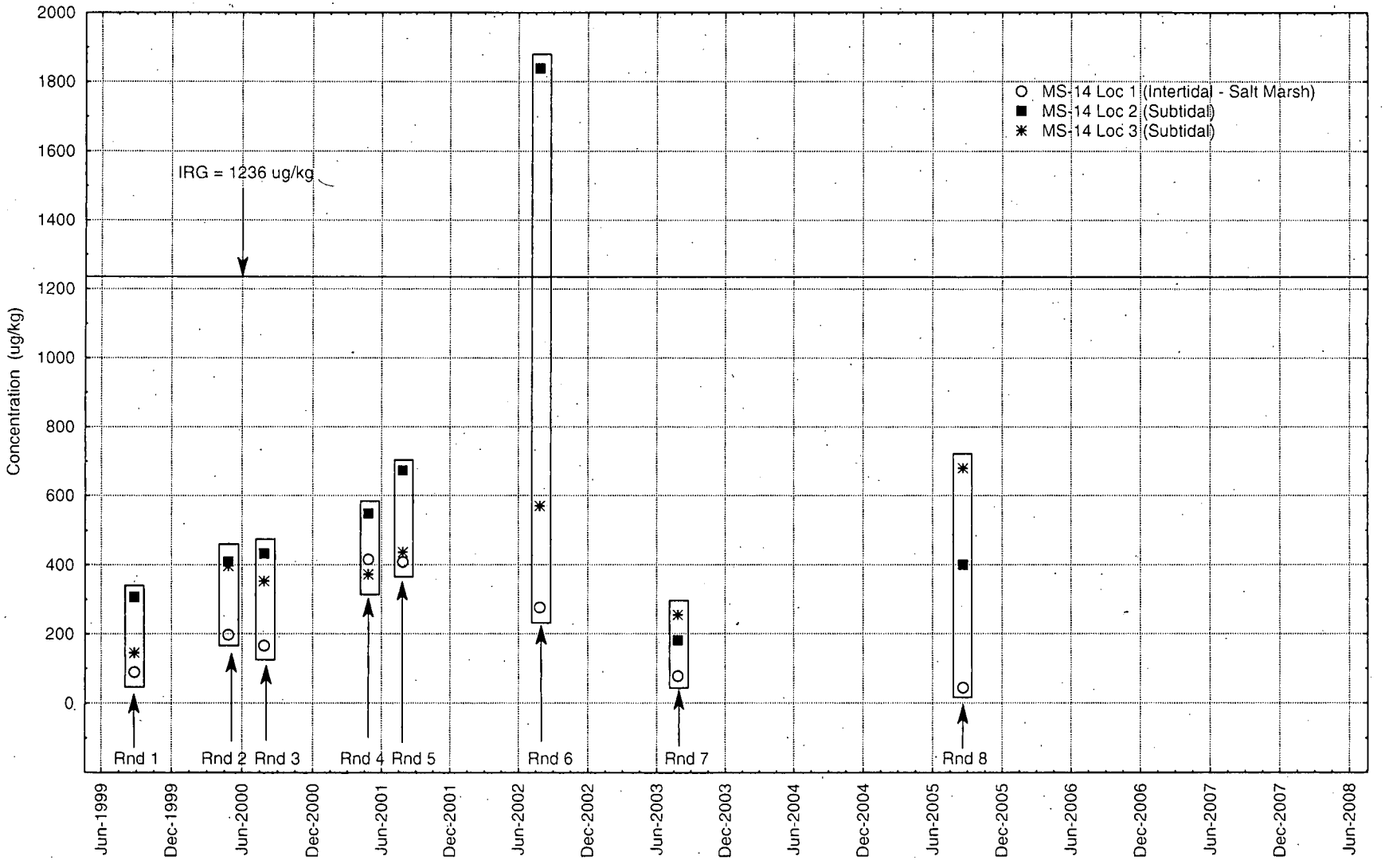
CONCENTRATION PLOTS AT MS-14

Monitoring Station 14 - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



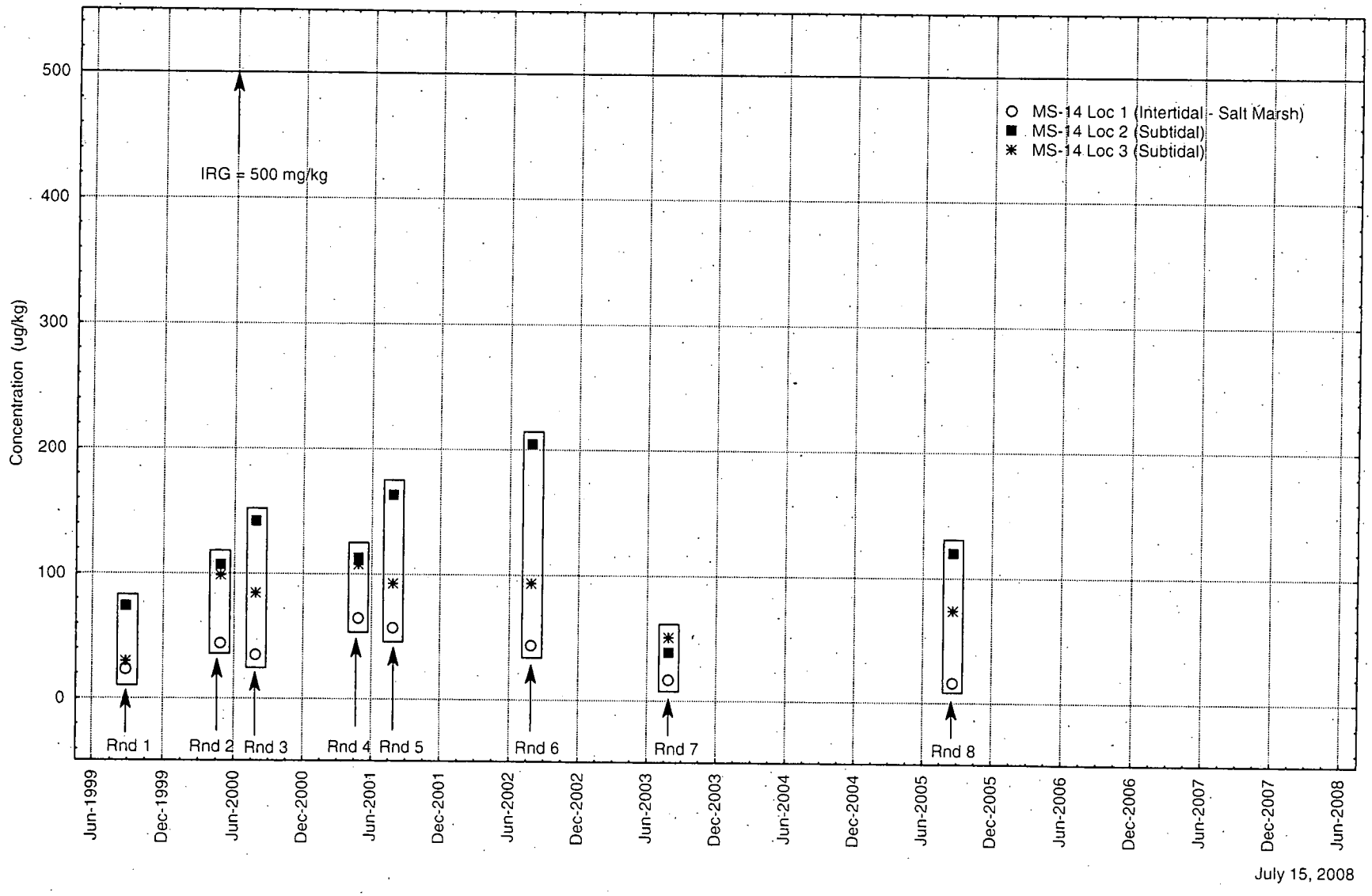
July 15, 2008

Monitoring Station 14 - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



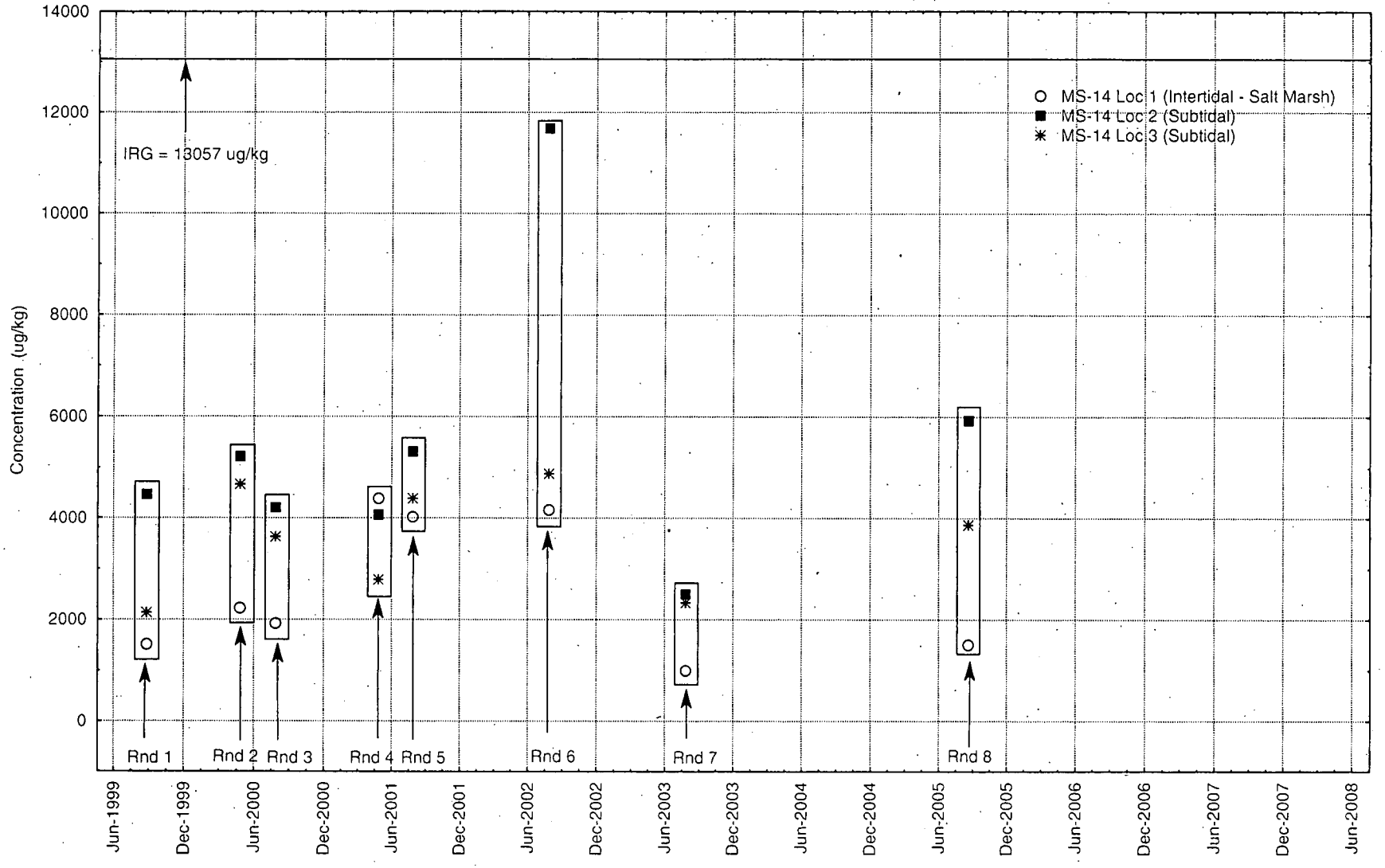
July 15, 2008

Monitoring Station 14 - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



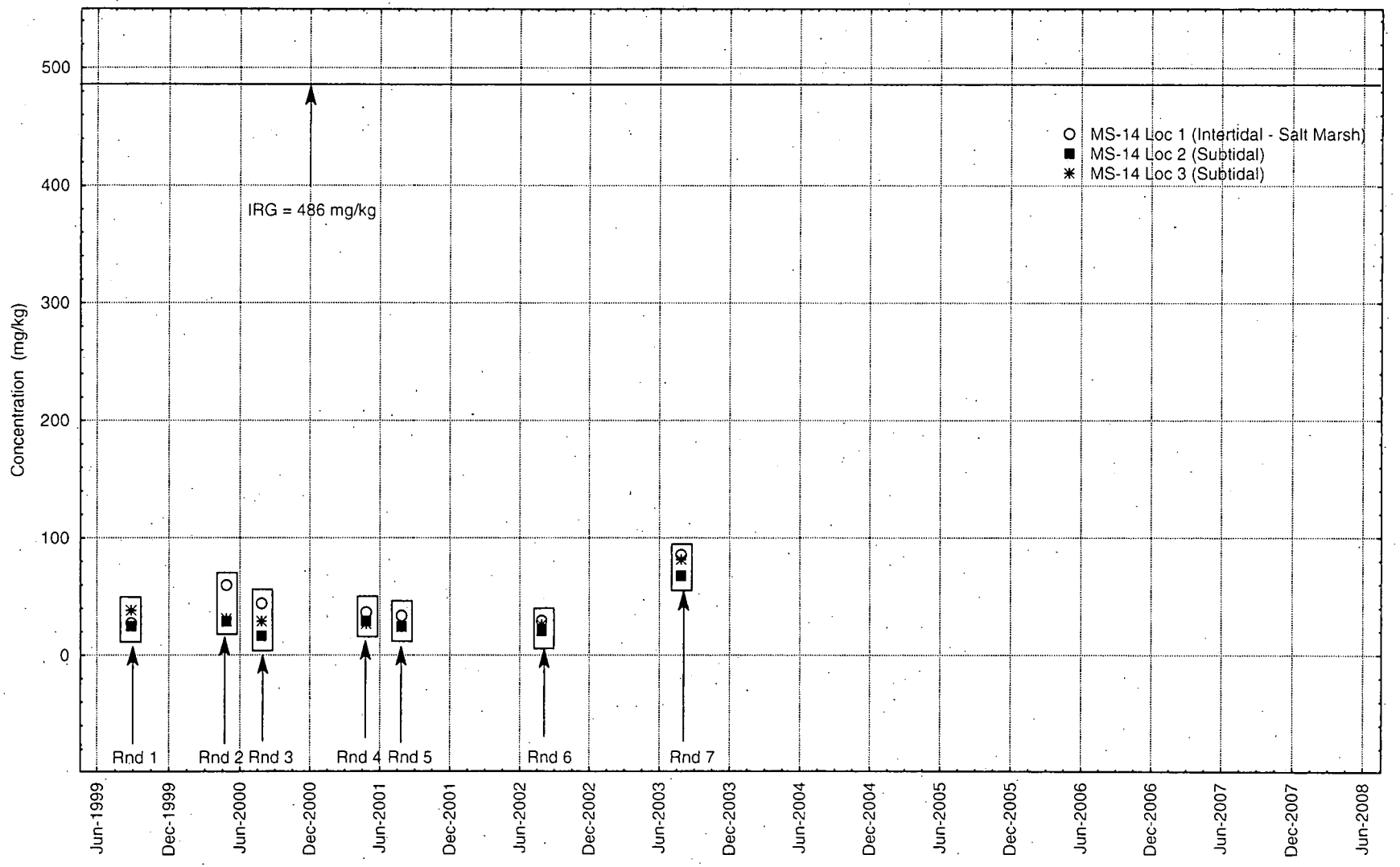
July 15, 2008

Monitoring Station 14 - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

Monitoring Station 14 - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine

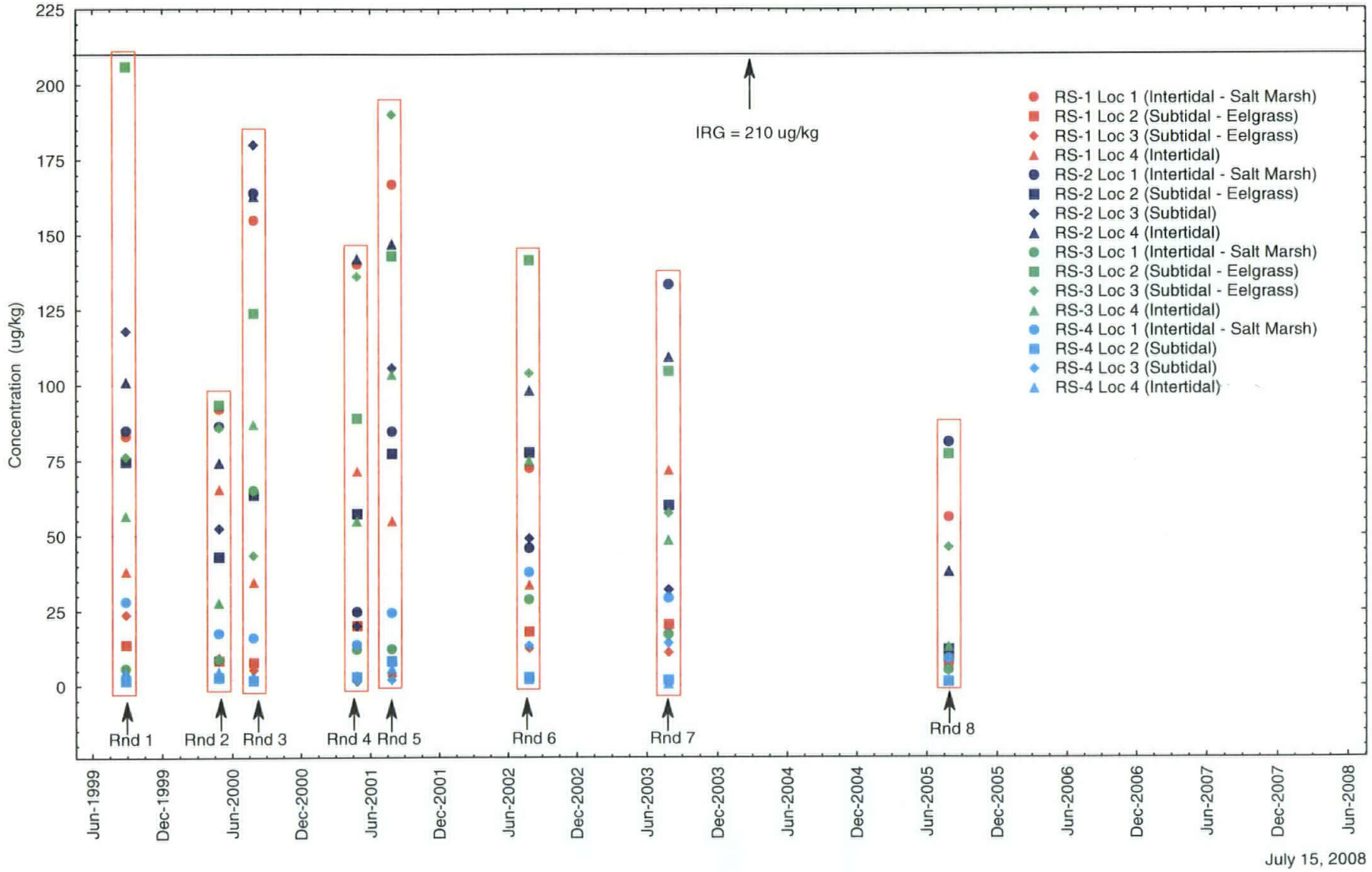


July 15, 2008

ATTACHMENT A.7

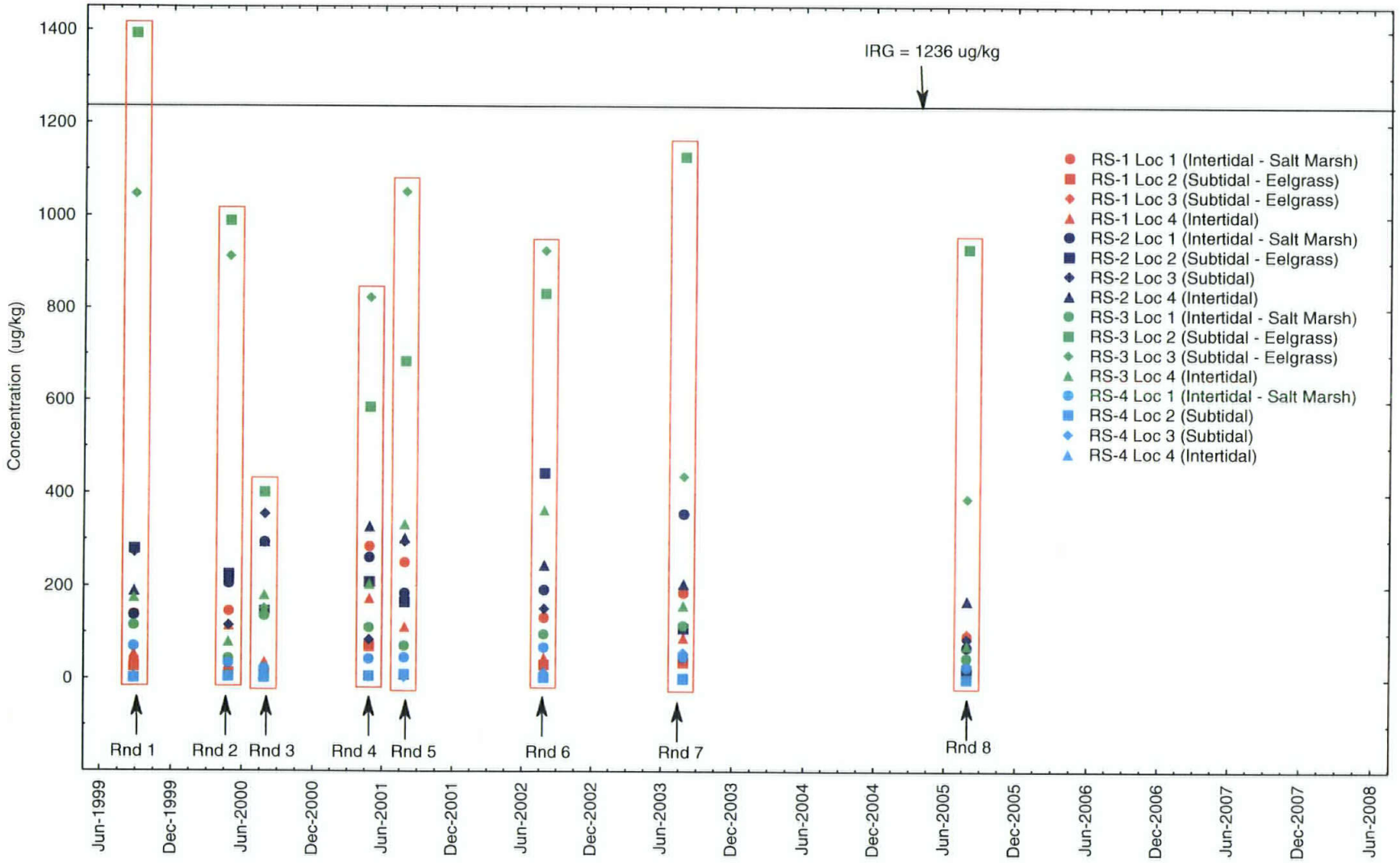
CONCENTRATION PLOTS AT REFERENCE STATIONS

All Reference Station Samples - Sediment
Acenaphthylene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



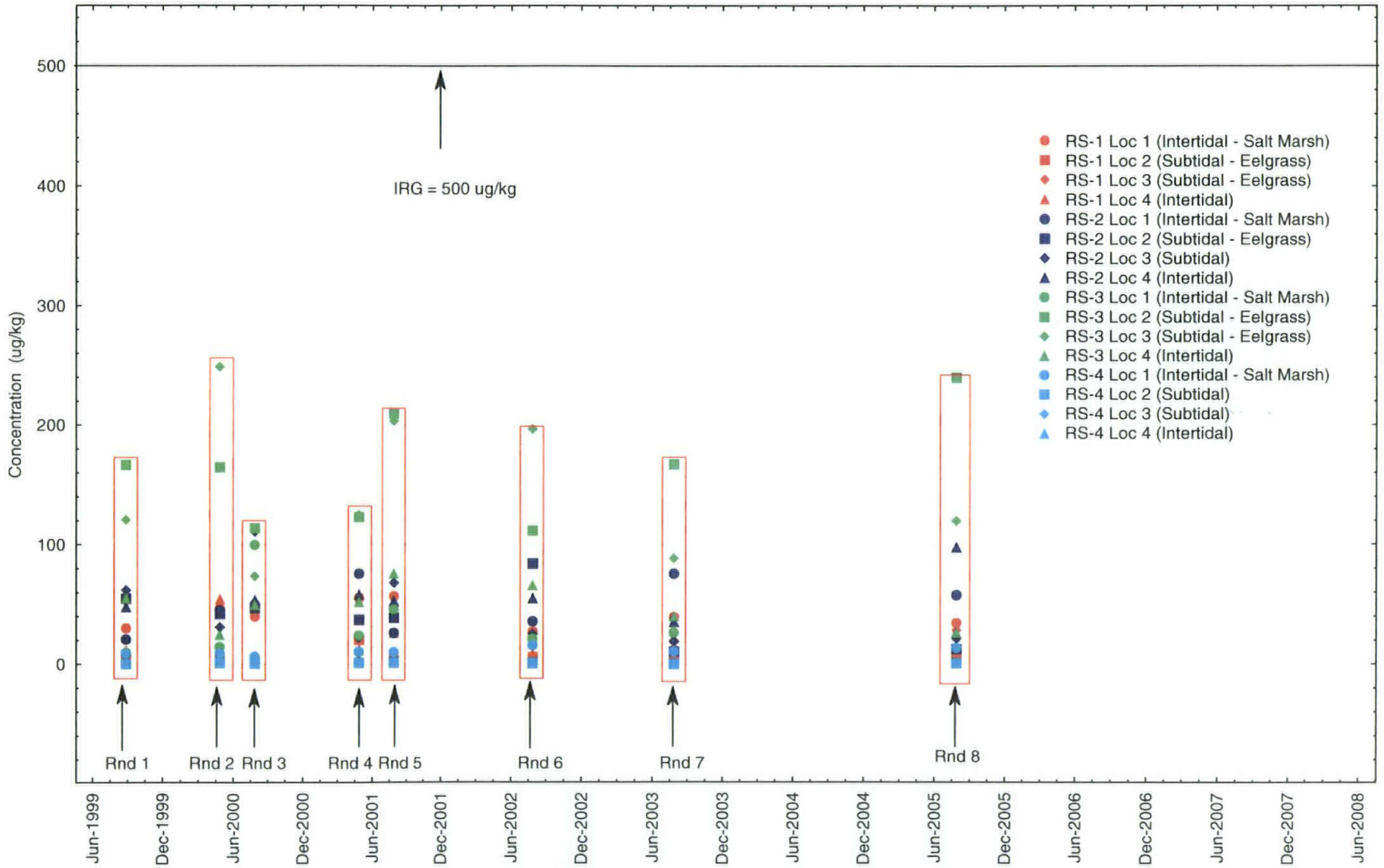
July 15, 2008

All Reference Station Samples - Sediment
Anthracene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



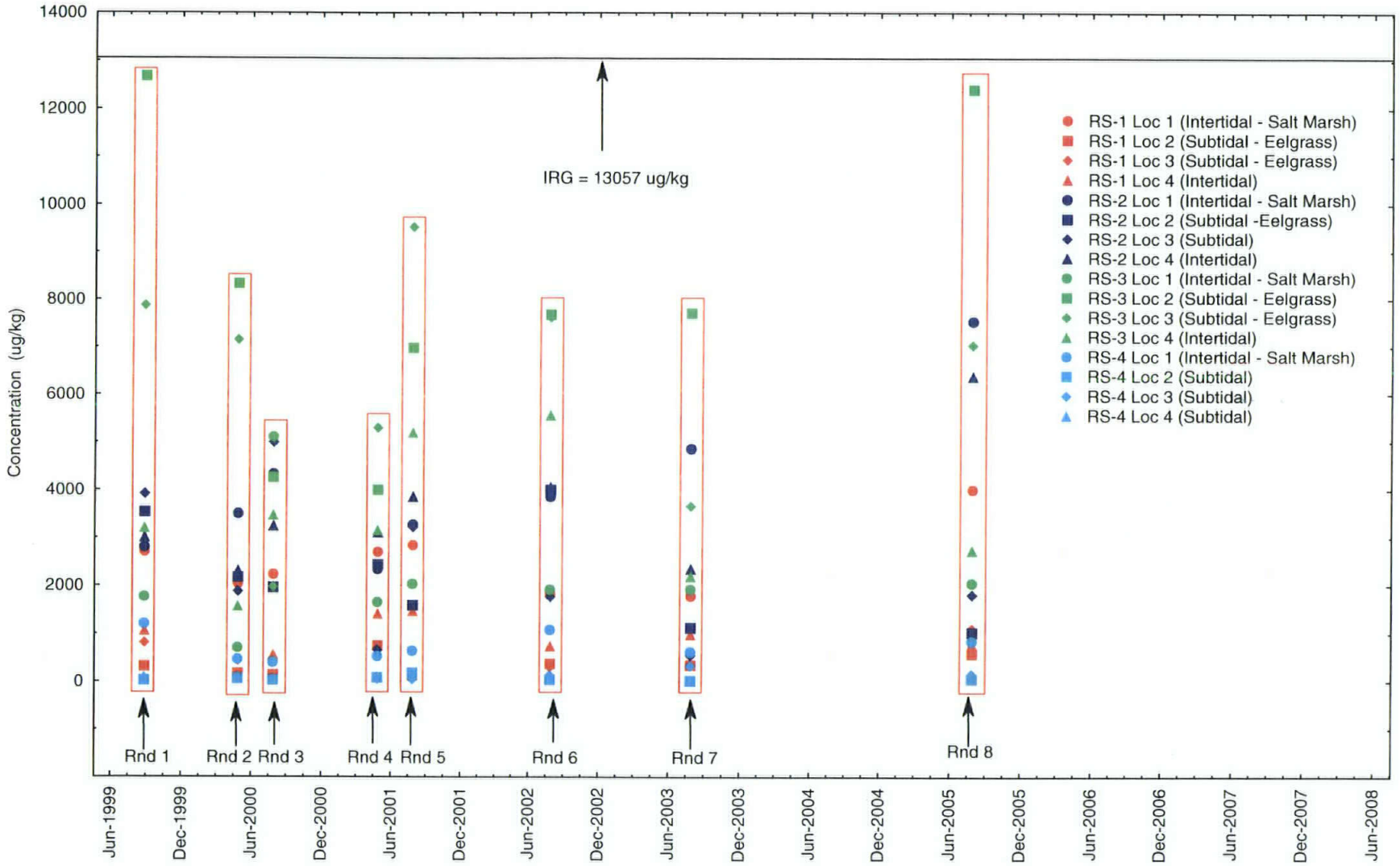
July 15, 2008

All Reference Station Samples - Sediment
Fluorene Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



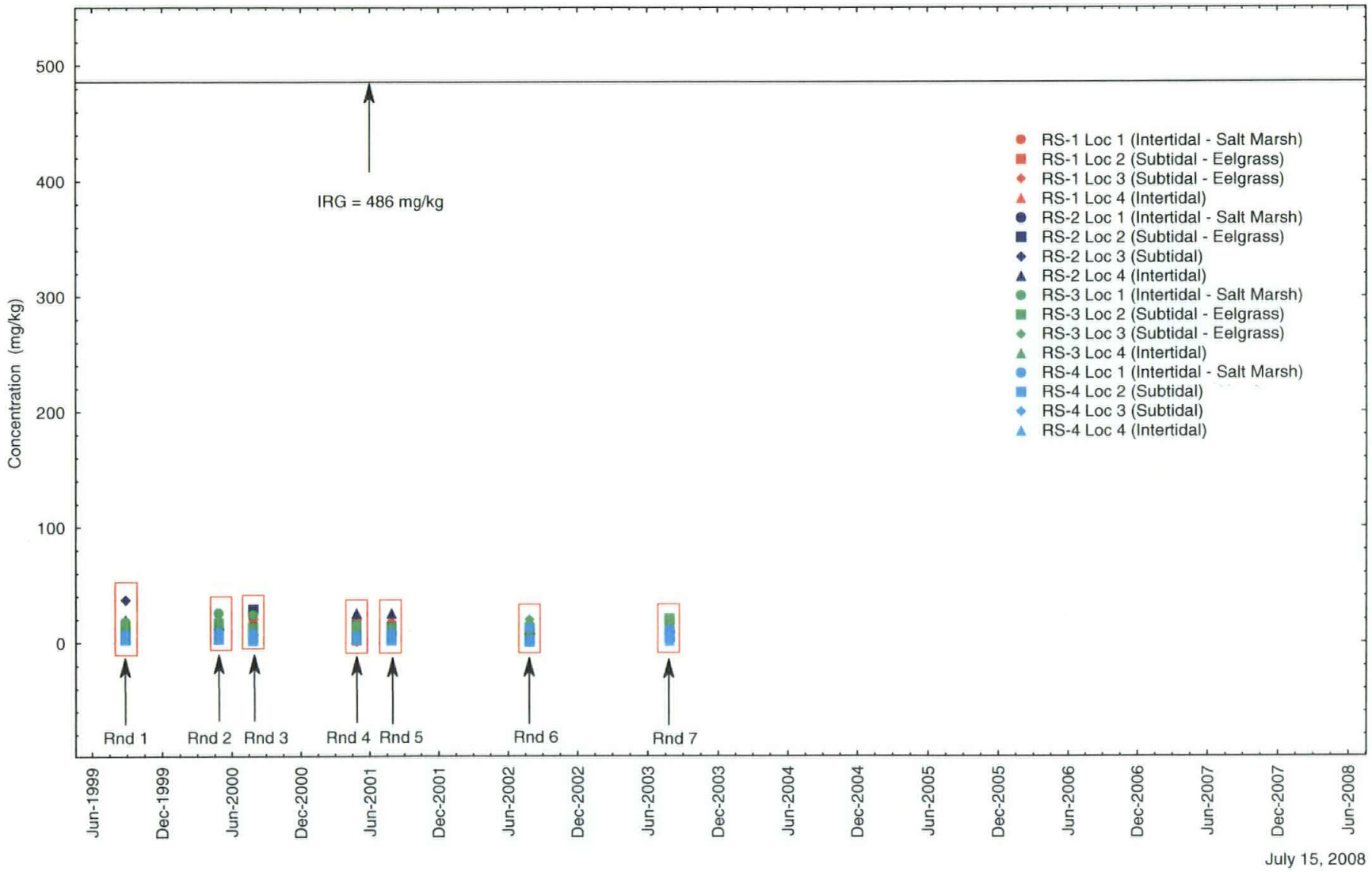
July 15, 2008

All Reference Station Samples - Sediment
High Molecular Weight PAH Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



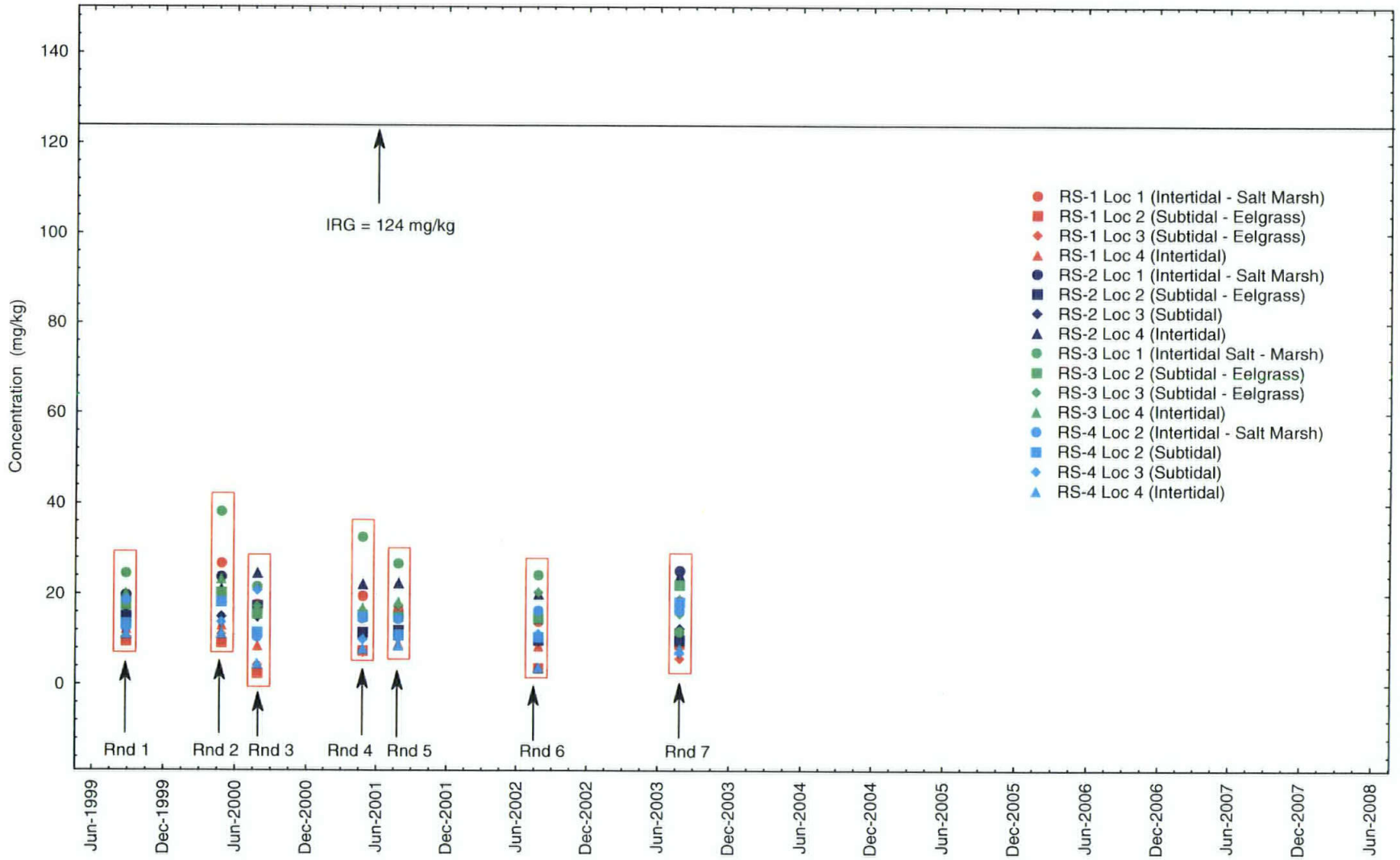
July 15, 2008

All Reference Station Samples - Sediment
Copper Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



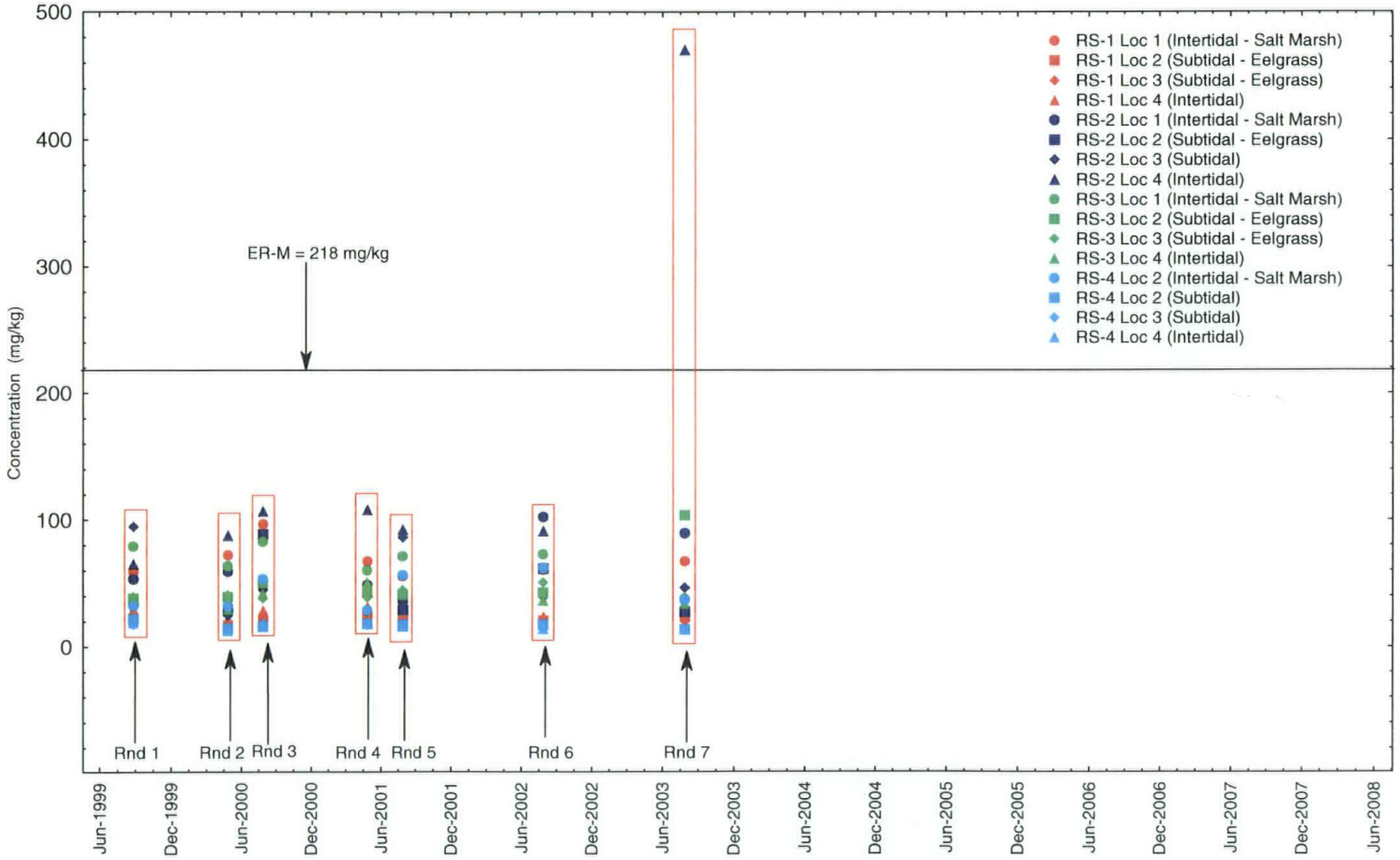
July 15, 2008

All Reference Station Samples - Sediment
Nickel Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



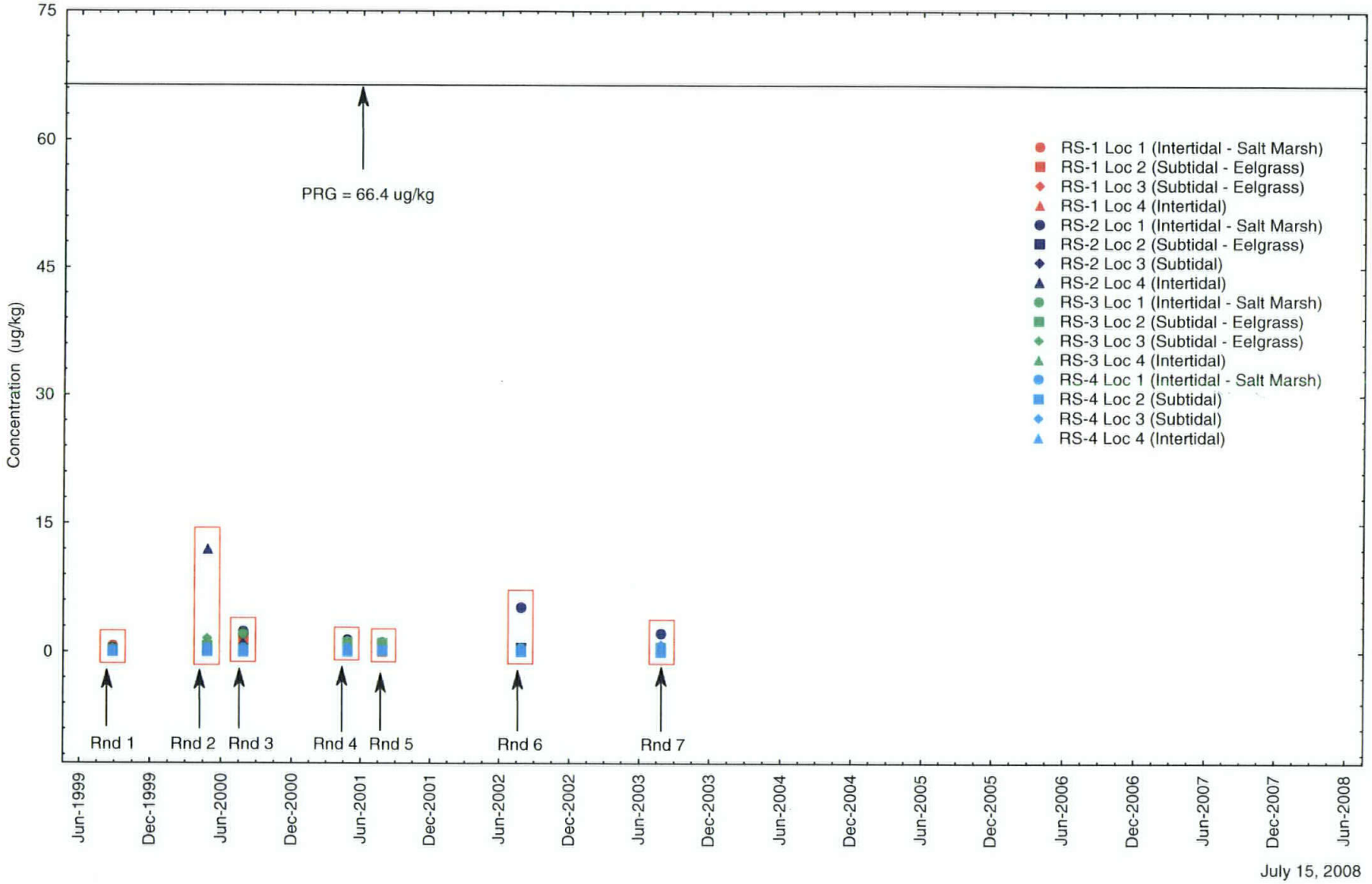
July 15, 2008

All Reference Station Samples - Sediment
Lead Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



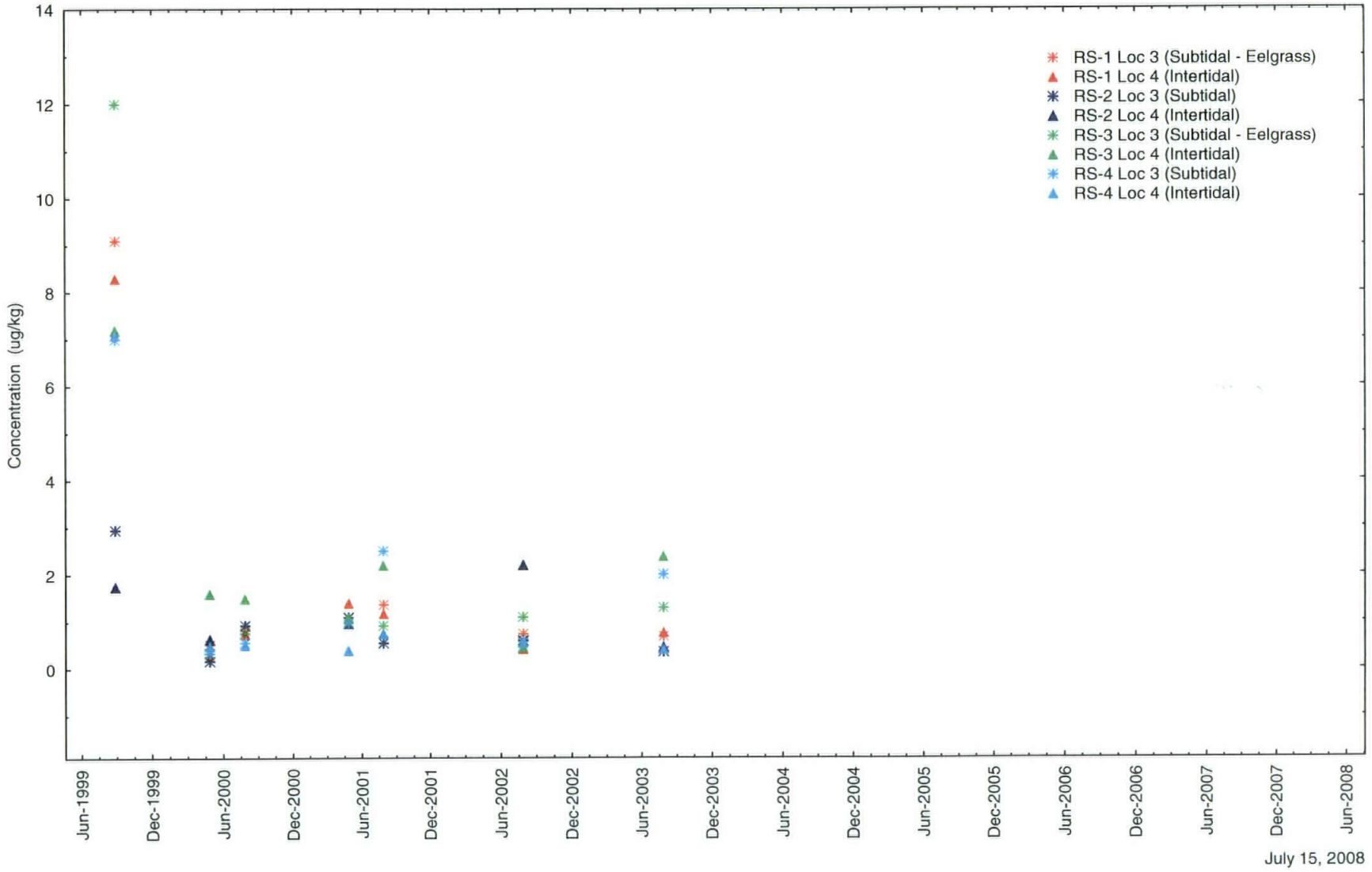
July 15, 2008

All Reference Station Samples - Sediment
4,4'-DDT Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

All Reference Station Samples - Mussel
4,4'-DDT Results by Round
Portsmouth Naval Shipyard, Kittery, Maine



July 15, 2008

ATTACHMENT B

TECHNICAL MEMORANDUM
COMPARISON OF ANALYTICAL METHODS FOR THE INTERIM OFFSHORE MONITORING PROGRAM

Technical Memorandum

Comparison of Analytical Methods for the Interim Offshore Monitoring Program for Operable Unit 4

Portsmouth Naval Shipyard, Kittery, Maine

INTRODUCTION

For the first seven rounds of the Interim Offshore Monitoring Program at Portsmouth Naval Shipyard (PNS), Kittery Maine, sediment and tissue samples were analyzed for metals and organic chemicals [i.e., dioxins, polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs)] using analytical methods developed for the National Oceanic and Atmospheric Administration (NOAA) Status and Trends program. These methods were selected to be consistent with methods used to analyze samples during previous investigations in the offshore area (TtNUS, 1999). In addition, these methods yield lower detection limits for some chemicals compared to standard U.S. Environmental Protection Agency (USEPA) analytical methods. However, NOAA methods are typically more expensive than standard USEPA methods and can be conducted by only a few laboratories in the United States; therefore, the analysis time is typically twice as long as it is for commercial laboratories. For these reasons, as was discussed during the January 8, 2004 technical meeting for the Round 1 through 7 Interim Offshore Monitoring Program report, and as described in the action item letter from the Navy dated March 16, 2004, the Navy has evaluated the need to continue using NOAA methods for future rounds of interim offshore monitoring.

The following two questions must be answered to determine whether the analytical methods can be changed for future rounds of monitoring:

- Will changing analytical methods yield different results, and if so, are those changes important enough to warrant not changing the methods?
- Will changing analytical methods raise the analytical detection limits so that the project objectives cannot be met?

The remainder of this memorandum answers the two questions first for analysis of metals and second for analysis of organic chemicals.

EVALUATION OF METALS ANALYTICAL METHODS

Background

Based on the analytical methods for metals, differences in the concentrations of some metals are expected by changing the analytical methods. The NOAA analytical method utilizes a complete digestion of the sediment particle using hydrofluoric acid so metals that are incorporated into the sediment matrix are included in the sample results. These typically include metals such as aluminum, iron, and other metals that may be specific to the geologic material in the area where samples were collected. The USEPA analytical method, on the other hand, utilizes a total recoverable digestion, which digests the material bound to the outer portion of the sediment particle. This is done to determine the concentration of chemicals that will be more bioavailable to human and ecological receptors. Therefore, the change in methods will yield different results for metals that are incorporated into the sediment matrix, which are not likely related to site activities.

The more critical issue, however, is whether the concentrations of the primary chemicals of concern in the offshore area [i.e., chemicals for which Interim Remediation Goals (IRGs) were developed such as copper and nickel] or other metals that may be important at some sites (such as lead) change significantly by using USEPA methods. This is an important issue because if much lower or higher concentrations were obtained for these metals using the USEPA methods, it would appear as if there was a decline or increase in the chemical concentrations over time, when the changes may be solely because of the differences in analytical methods.

Approach

To address the concerns raised above and to evaluate the differences in chemical concentrations obtained by the different analytical methods, Texas A&M University (TAMU), the laboratory that analyzed the Round 7 Interim Offshore Monitoring Program samples using the NOAA methods, shipped the Round 7 sediment samples to Katahdin Analytical Services (Katahdin) in January 2004. The samples were collected from August 9 through 13, 2003. Katahdin analyzed the split samples between February 16 and 25, 2004 which is within a few days of the end of the standard six-month holding time. Metals in the sediment are expected to be stable, chemical analysis a few days past the holding time is not expected to affect the sample results for the purpose of this evaluation. Fifteen samples (plus two duplicates) were then selected for analysis by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) using USEPA Method 6020.

Mercury was not analyzed by Katahdin because the NOAA method does not utilize a complete digestion of the sediment so the mercury results obtained using the USEPA 7471A method are expected to be similar to the results obtained using the NOAA method. Also, the tissue samples were not analyzed using the USEPA method because tissue is completely dissolved using both NOAA and USEPA methods so the results obtained using the USEPA method are also expected to be similar to the results obtained using NOAA methods. TAMU analyzed aluminum, cadmium, chromium, copper, iron, manganese, nickel, and zinc using ICP-MS methodology, arsenic, lead and silver using Graphite Furnace Atomic Absorption (GFAA) methodologies. Katahdin analyzed these metals using ICP-MS.

Results

Table 1 presents the results of the samples analyzed by both the NOAA and USEPA methods. In addition to the sample results, a ratio was calculated by dividing the results from the NOAA method analysis by the results from the USEPA method analysis. Table 2 is a summary of the maximum, minimum, average, and median ratio for each chemical. A ratio of 1.0 indicates that the sample results from both methods were essentially the same. A ratio of 2.0 indicates that the NOAA method result was approximately two times higher than the result obtained using the USEPA method, and so on. Ratios were not calculated for samples where a non-detected value was found for samples analyzed by either the NOAA or USEPA method. As can be seen in Table 1, most ratios ranged from 1.0 to 2.0 indicating that the samples analyzed using the NOAA methods produce detected results approximately one to two times greater than that detected results with the USEPA method.

Figures 1 through 12 present graphically the positive results of the samples that were analyzed by both NOAA and USEPA methods; non-detected data were not included in the figures. NOAA concentrations are plotted on the X-axis and the corresponding USEPA concentration for each sample analyzed is plotted on the Y-axis. The best fit line and equation of the best fit line (including the correlation coefficient, R^2) are also shown. The correlation coefficient ranged from 0 to 1.0 with an R^2 value of 1.0 indicating the best correlation and a value of 0 indicating no correlation.

IRGs have been developed for two metals, copper and nickel. Also, lead has been identified as a metal of concern at several on-shore sites. Therefore, these three metals are the primary focus of this memorandum, although the results for other metals are discussed as well. Figures 1 through 3 present the correlation plots for copper, lead, and nickel, respectively. All three metals have very good correlations, with R^2 values of 0.95, 0.91, and 0.75, for copper, lead, and nickel, respectively. The slightly poorer correlation of nickel is caused by more variability in the sample results with the two greatest nickel concentrations, which may be more indicative of the heterogeneous nature of the samples. Overall, most samples for these three metals fall close to the best fit line, especially for the concentrations close to

the IRGs or Effects-Range Median, which are footnoted on the figures. The ratios of the results using NOAA to USEPA methods for these three metals ranged from 0.5 to 2.6 for copper, 0.4 to 2.6 for lead, and 0.5 to 3.1 for nickel, with average ratios of 1.4, 1.4, and 1.3, respectively. A review of the ratios in Table 1 for the individual samples indicates that most of the ratios for copper and nickel ranged from 1.0 and 1.3, which indicates that very little of these metals are incorporated into the sediment matrix. For lead, the ratios were slightly higher with most of them ranging from 1.2 to 1.4, so slightly more lead may be incorporated into the sediment matrix. Also, in the samples with the greater chemical concentrations, some of the variability may be caused by the heterogeneous nature of the sediment as evident when evaluating the duplicate samples. For example, as seen in Table 1, the copper results at M04-1 using the NOAA methods ranged from 6,421 mg/kg in the original sample and 7,725 mg/kg in the duplicate sample. Using the USEPA methods the concentrations ranged from 6,070 mg/kg in the original sample and 6,490 mg/kg in the duplicate sample, which are similar to the results in the original sample.

Figures 4 through 12 present the correlation plots for the remainder of the metals. These plots were evaluated to understand the differences in the analytical results using these two methods.

The correlation coefficients for aluminum (Figure 4), cadmium, (Figure 6), and manganese (Figure 10) are low (especially aluminum) compared to the R^2 values for the other metals (the low R^2 value for chromium will be discussed in the next paragraph). The NOAA/USEPA ratios are also the greatest for these metals, with average ratios of 4.5 for aluminum, 5.1 for cadmium, and 2.6 for manganese. As discussed above, metals with higher NOAA/USEPA ratios have a larger percentage of these metals are incorporated into the sediment matrix because the NOAA method extracts that portion of the metal from the sediment particle.

For chromium, two correlation plots were generated; one with all the data and one with the data from monitoring station M03-2 removed. The chromium concentration for M03-2 using NOAA methods was 925 mg/kg, which was much higher than the chromium concentrations at that location during the previous six rounds. During previous rounds, chromium concentrations ranged from 94 mg/kg (Round 4) to 137 mg/kg (Round 2). Therefore, there may have been a small piece of metal in the sample aliquot that was analyzed using the NOAA methods but was not present in the aliquot that was analyzed using the USEPA methods which had a chromium concentration of 58.1 mg/kg. If a value of between 94 and 137 mg/kg was used instead of the 925, the NOAA/USEPA ratio for that sample would be 1.6 to 2.4, which is in-line with the NOAA/USEPA ratio for the other samples. After removing that data point, the R^2 values increased to 0.72, which shows relatively good correlation. The average NOAA/USEPA ratio for chromium after removing that sample was 1.8, indicating that a larger amount of chromium is incorporated into the sediment matrix compared to some of the other metals such as copper, lead, and nickel.

Finally, arsenic, iron, silver, and zinc had relatively high R^2 values of 0.88, 0.70, 0.80, and 0.92, respectively. The average NOAA/USEPA ratios for these metals were 1.3, 1.3, 1.4, and 1.2.

Summary

As indicated from Table 1, there were very few non-detections in this data set, but a review of the non-detect values for the USEPA method indicates that any slight difference in the detection limits between the two methods should not impact the project objectives because the detection limits are below the IRGs.

For the primary metals of concern for OU4, copper, nickel, and to a lesser extent lead, the results of this evaluation show that there is a good correlation of sample results between the NOAA and USEPA analytical methods. NOAA results were consistently greater than USEPA results, suggesting, some percentage of these metals are bound up in the sediment matrix, which is extracted in the complete digestion using NOAA method that is not extracted in the recoverable digestion used in the USEPA method.

Although the Navy could realize some cost savings by switching to the USEPA analytical methods for the Interim Offshore Monitoring Program, the cost savings are not significant to warrant changing methods at this time based on the uncertainties in the data as follows:

- If the Navy decided to switch analytical methods for the sampling program, a slight adjustment to the chemical concentrations obtained using the USEPA method would need to be made when conducting a trend analysis, which would slightly increase the chemical concentration in the sediment samples. This adjustment would be done to account for the portion of chemical that is bound to the sediment matrix and not digested using the USEPA method. There would be uncertainty in the adjustment factor because it would only be based on a limited number of samples.

- As presented in the draft Rounds 1 through 7 Interim Offshore Monitoring Program report, metals are only proposed for analysis at three monitoring stations during the next two rounds (Rounds 8 and 9), and at all of the monitoring stations for Round 10. Therefore, compared to the costs for the overall monitoring program, the cost savings involved in switching analytical methods for metals are low, because of the small numbers of samples involved and the lower cost for metals analysis compared to the analysis for the organic chemicals.

Therefore, because of the uncertainty in the adjustment factors that would be needed, and the relatively low cost savings at this time, the Navy is not recommending changing analytical methods for analysis of metals in sediment as part of the Interim Offshore Monitoring Program. The continued use of the NOAA analytical methods for sediment as part of the Interim Offshore Monitoring Program is being recommended primarily because the data are being plotted on trend plots and the first seven rounds were analyzed using NOAA methods. However, the Navy believes that it is appropriate to use USEPA analytical methods for samples that will not be used for trending because of the similarity in the results between the two analytical methods. Also, the Navy is recommending using USEPA analytical methods for the analysis of mussels in future rounds because as discussed above, similar analytical results are expected using the NOAA and USEPA methods.

EVALUATION OF ORGANIC CHEMICAL ANALYTICAL METHODS

Background/Approach

Both NOAA and USEPA methods for analysis of organic chemicals in tissue and sediment samples are similar in instrumentation, technique, and quantification. Therefore, the results obtained using the two methods are expected to yield similar results so chemical analysis for the organic chemicals using the USEPA methods was not conducted for the Round 7 samples. However, an evaluation of the differences in the methods is included herein. The following bullets list the items that were included in this evaluation:

- Method detection limits (MDLs)
- Parameter lists included in analytical methods
- Analytical methods

Results

The following sections present the results of the evaluation of each of the items listed above.

Method Detection Limits

MDLs were obtained from Columbia Analytical Services, Inc. (CAS), Severn Trent Laboratories, Inc. (STL), and TAMU. These MDLs are presented in Tables 3 through 9 for PAHs (Tables 3 and 4), PCBs (Tables 5 and 6), pesticides (Tables 7 and 8), and dioxins in sediment and tissue (Table 9). The target MDLs from the Interim Offshore Monitoring Plan (TtNUS, October 1999) are also presented on the tables. CAS and STL do not have current MDLs for some of the chemical groups that are included in the standard analyte list. The MDLs for sediment and dioxin tissue results are presented on a dry weight

basis; other tissue results are presented on a wet weight basis. The MDLs for the tissue samples from CAS (with the exceptions of dioxins) are presented on a wet weight basis. The MDLs listed in the tables are similar for the three laboratories, indicating the low detections limits that meet the project objectives can be obtained using standard USEPA methods.

Parameter Lists

There are some differences in the compound lists between the laboratories and the analytical methods. The following bullets present a summary of these differences:

- **PAHs:** All of the PAHs and alkylated PAHs can be obtained using the SW-846 8270 SIM analytical method; however, CAS and STL do not have established MDLs for all the parameters as presented in Tables 3 and 4. The MDLs would need to be calculated by the laboratory selected for the chemical analysis before sampling. Also, the Navy is considering eliminating alkylated PAHs from the Interim Offshore Monitoring Program, so MDLs for those parameters may not be needed.

- **PCBs:** All of the 28 PCB congeners being analyzed for as part of the Interim Offshore Monitoring program can be analyzed for using USEPA method SW-846 method 8082.

- **Pesticides:** The majority of the pesticides being analyzed for as part of the Interim Offshore Monitoring program can be analyzed for using USEPA method SW-846 method 8081. STL would analyze chloropyrifos by SW-846 Method 8141 and CAS would analyze pentachloroanisole by SW-846 Method 8151. STL would analyze pentachloroanisole, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, and 1,2,4,5- tetrachlorobenzene by SW-846 Method 8270, the same method they would use for the PAHs. Therefore, at least two different analytical methods would be needed to obtain results for all of the pesticides, if NOAA methods were not used. However, the five pesticides listed above that are included in "typical" analytical lists were not identified as chemicals of concern (COCs) in the Interim Record of Decision (ROD) for OU4 (Navy, 1999), do not have IRGs established for them, and are not currently being used to make any decisions for OU4. Therefore, the Navy proposes removing those pesticides from the list of analytical procedures for future sampling events if USEPA methods are used.

- **Dioxins/Furans:** All of the dioxins/furans being analyzed for as part of the Interim Offshore Monitoring program can be analyzed for using USEPA Method 1613 with similar detection limits as the NOAA methods.

Analytical Methods

In general, the extraction and analytical methods are similar between the NOAA and USEPA methods. The methods used by TAMU are presented as Standard Operating Procedures (SOPs) adapted from the technical memorandum on the sampling and analytical methods of the Mussel Watch Project (NOAA, 1998). The methods used by STL and CAS are based on Test Methods for Evaluating Solid Waste; Physical/Chemical Methods (SW-846), 3rd edition, up to and including Update III, Office of Solid Waste and Emergency Response, Washington, DC., and Chemical Analyses of Water and Wastewater. The following bullets summarize the USEPA analytical methods and the SOPs for each group of parameters:

- PAHs: TAMU SOP 9733; CAS and STL SW-846 8270 SIM.
- PCBs: TAMU SOP 9810; CAS and STL SW-846 8082.
- Pesticides: TAMU SOP 9810; CAS and STL SW-846 8081.
- Dioxins: TAMU SOP 9722; CAS and STL USEPA 1613.

Summary

The proposed USEPA analytical methods can obtain similar MDLs as the NOAA methods and any differences in the MDLs will not impact the project objectives. Therefore, the impact of MDLs should have no bearing on whether USEPA analytical methods can be used in future sampling rounds.

All of the parameters being analyzed as part of the Interim Offshore Monitoring Program can be analyzed using USEPA methods; however, additional analytical methods will need to be utilized to obtain the current list of pesticides. The Navy proposes removing five pesticides from the parameter list (chloropyrifos, pentachloroanisole, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, and 1,2,4,5-tetrachlorobenzene) for future rounds because the pesticides are not typically included in the standard SW-846 Method 8081 list, are not listed as COCs in the Interim ROD for OU4, and no decisions for OU4 are being made based on these chemicals:

All of the other parameters can be measured using standard USEPA analytical methods, although laboratory specific MDLs would need to be obtained for some of the parameters before selecting the laboratory for analysis. Also, the Navy is considering eliminating alkylated PAHs from the Interim Offshore Monitoring Program.

The USEPA analytical methods proposed by CAS and STL are similar to the SOPs provided by TAMU. The analytical methods should not impact the quality of data produced and the project objectives will be achieved using USEPA methodology.

OVERALL RECOMMENDATIONS

The following bullets summarize the overall recommendations for this memorandum:

- Use NOAA analytical methods for metals analysis of sediment samples at the monitoring and reference stations as part of the Interim Offshore Monitoring Program stations for data that will be used for chemical trend plots; consider using USEPA analytical methods for sediment samples that will not be included in the trend plots (i.e., extent samples).
- Use USEPA analytical methods for metals analysis of mussel samples at the monitoring and reference stations as part of the Interim Offshore Monitoring Program stations.
- Use USEPA analytical methods for organic chemical analysis of sediment and mussel samples at the monitoring and reference stations as part of the Interim Offshore Monitoring Program stations provided that the detection limits are low enough to meet project objectives.
- Remove chloropyrifos, pentachloroanisole, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, and 1,2,4,5-tetrachlorobenzene from the parameter list for future Interim Offshore Monitoring Program sampling rounds.

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NCCOSC (Naval Command, Control, and Ocean Surveillance Center), 2000. Estuarine Ecological Risk Assessment for Portsmouth Naval Shipyard, Kittery, Maine, Narragansett, Rhode Island, May.

NOAA, 1998. Technical Memorandum NOS ORCA 130, Sampling and Analytical Methods of the National Status and Trends Program Mussel Watch Project, 1993-1996 Update, National Oceanic and Atmospheric Administration, March.

TtNUS (Tetra Tech NUS, Inc.), 1999. Interim Offshore Monitoring Plan for Operable Unit 4 for Portsmouth Naval Shipyard. TtNUS, King of Prussia, PA, October.

TtNUS (Tetra Tech NUS, Inc.), 2004. Rounds 1 through 7 Interim Offshore Monitoring Program Report for Operable Unit 4 for Portsmouth Naval Shipyard. TtNUS, King of Prussia, PA, April.

USEPA (U.S. Environmental Protection Agency), 1986. Test Methods for Evaluating Solid Waste; Physical/Chemical Methods (SW-846), 3rd edition, up to and including Update III. Office of Solid Waste and Emergency Response, Washington, DC. 1986

USEPA (U.S. Environmental Protection Agency), 1983, Chemical Analyses of Water and Wastewater.

Figure 1
Copper Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

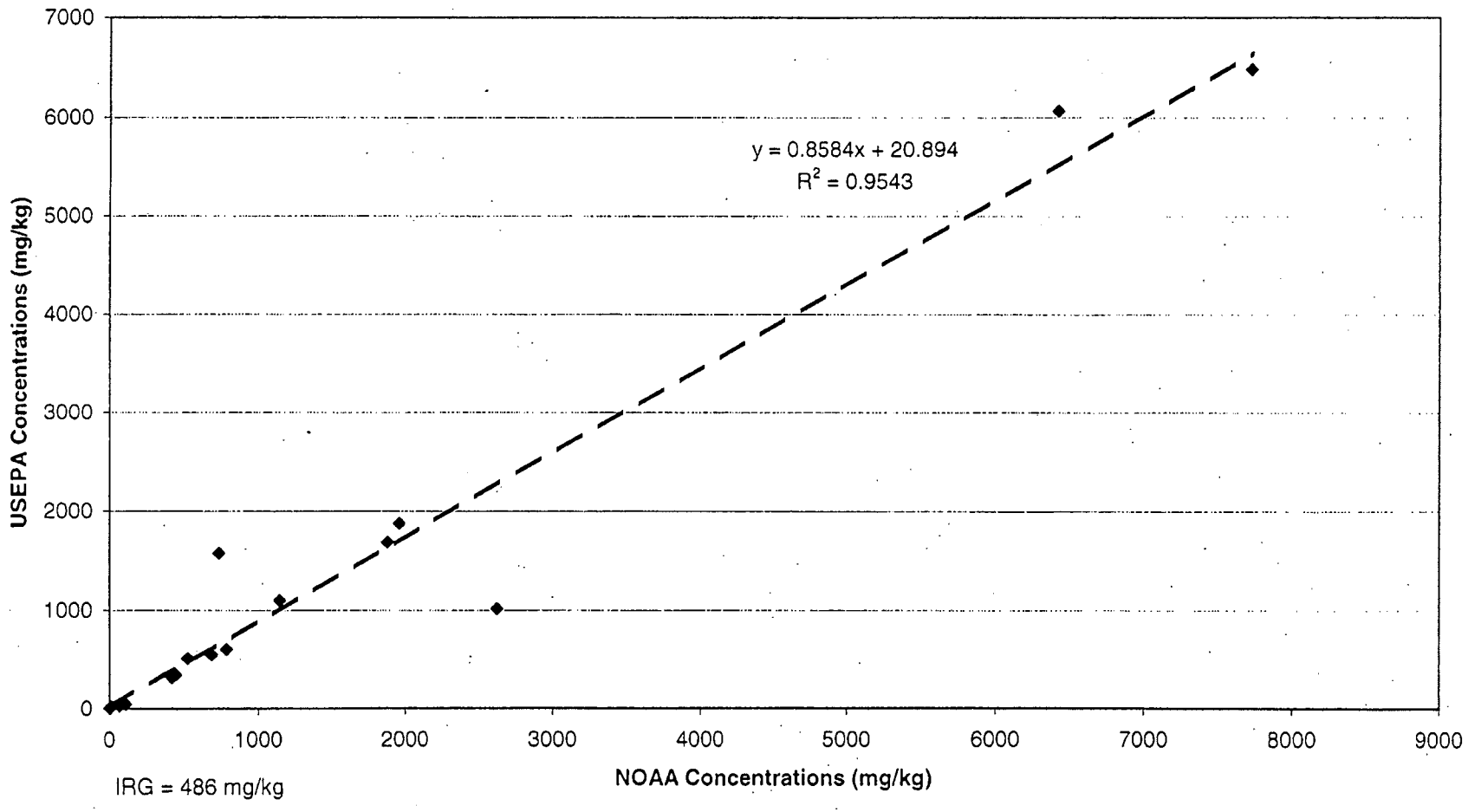

Figure 2
Lead Concentrations for Sample Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

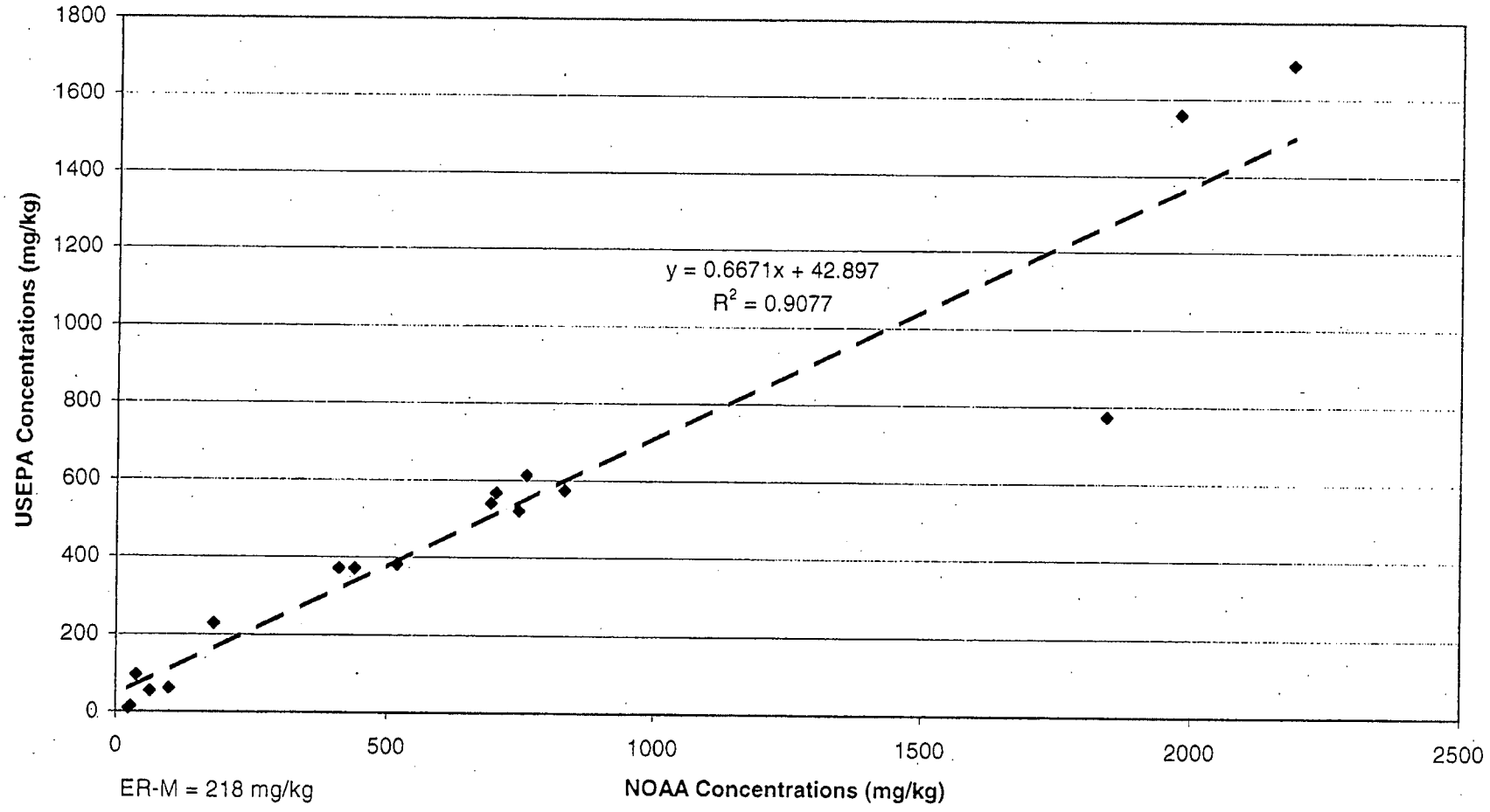

Figure 3
Nickel Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

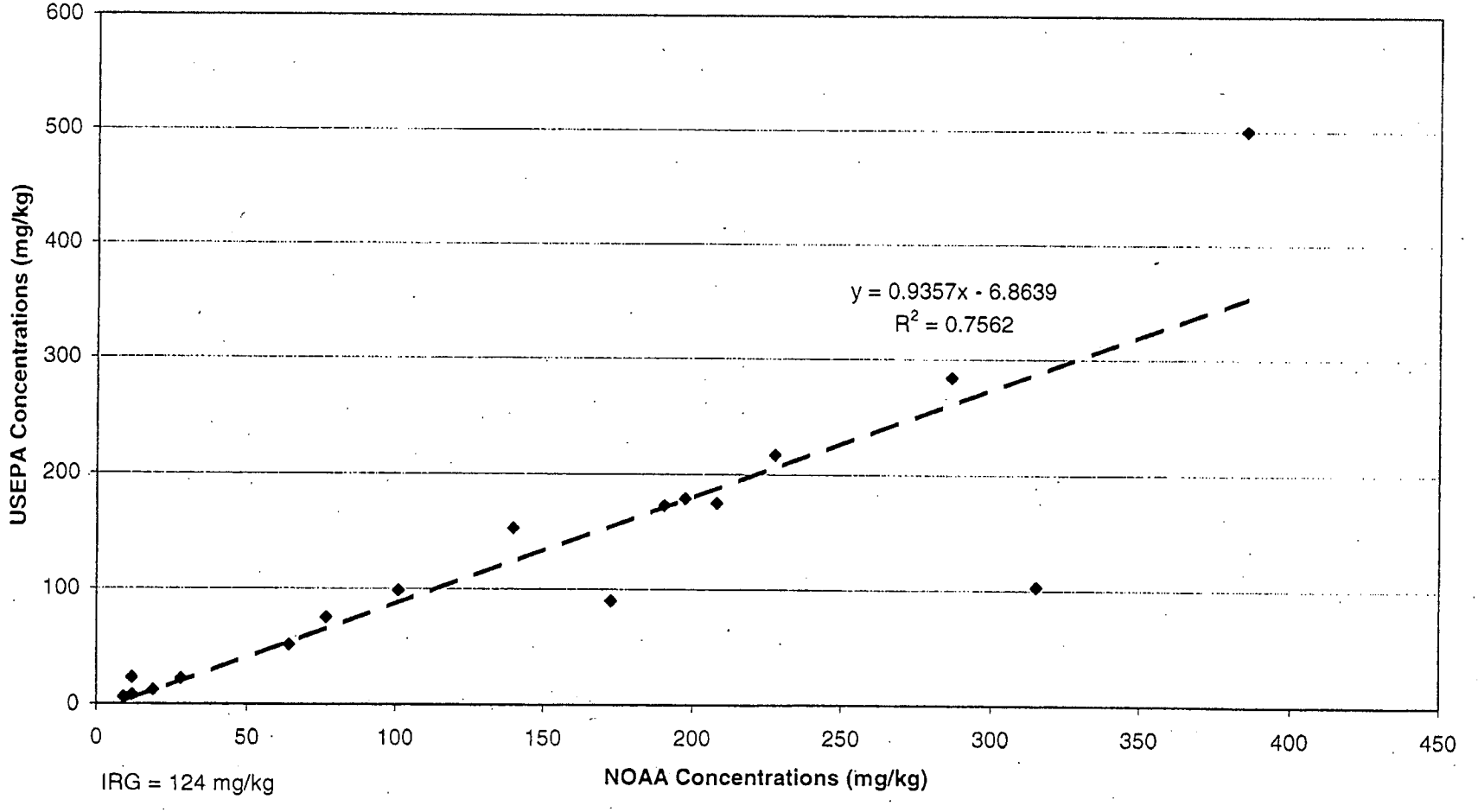

Figure 4
Aluminum Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

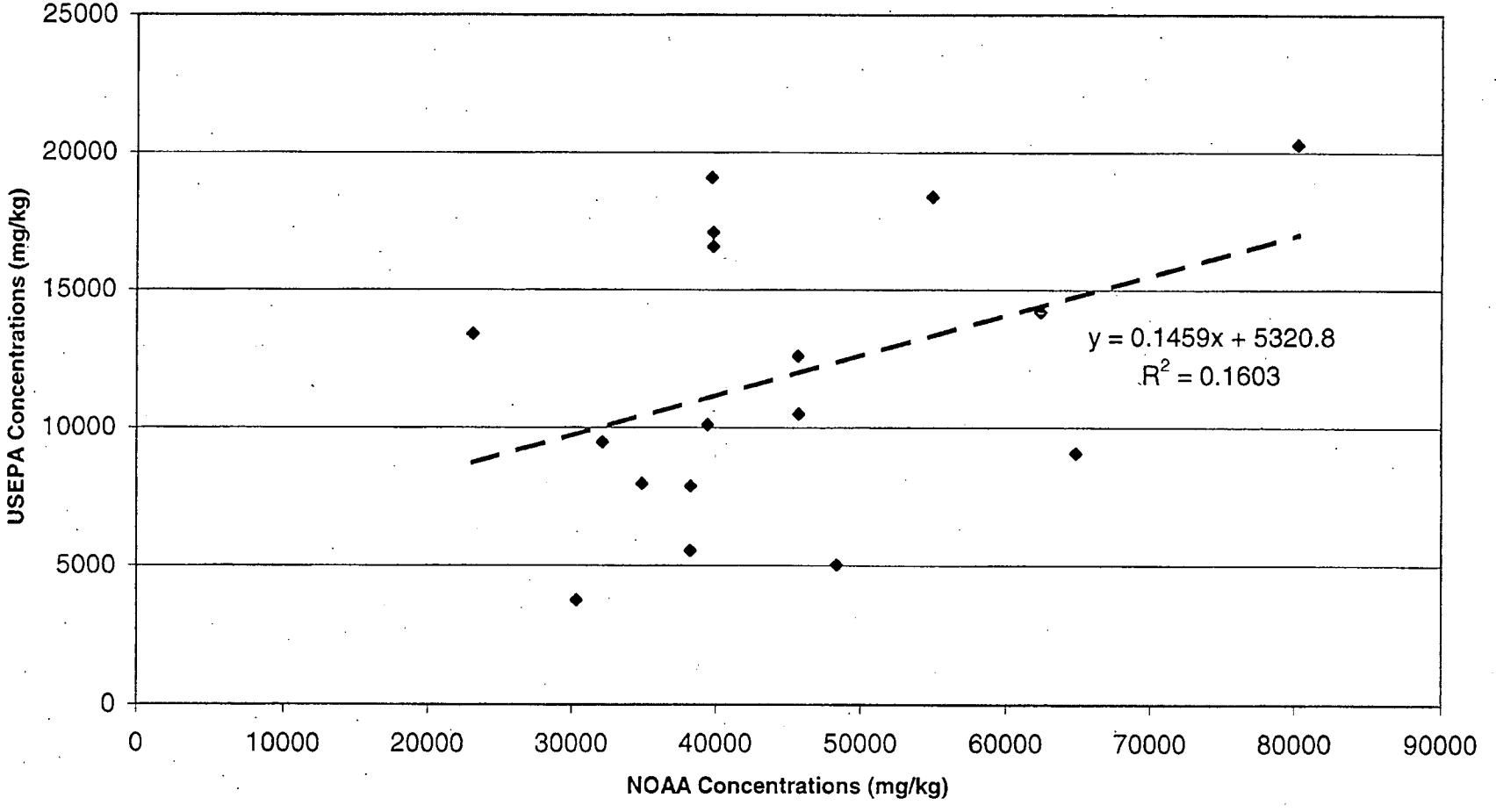

Figure 5
Arsenic Concetrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

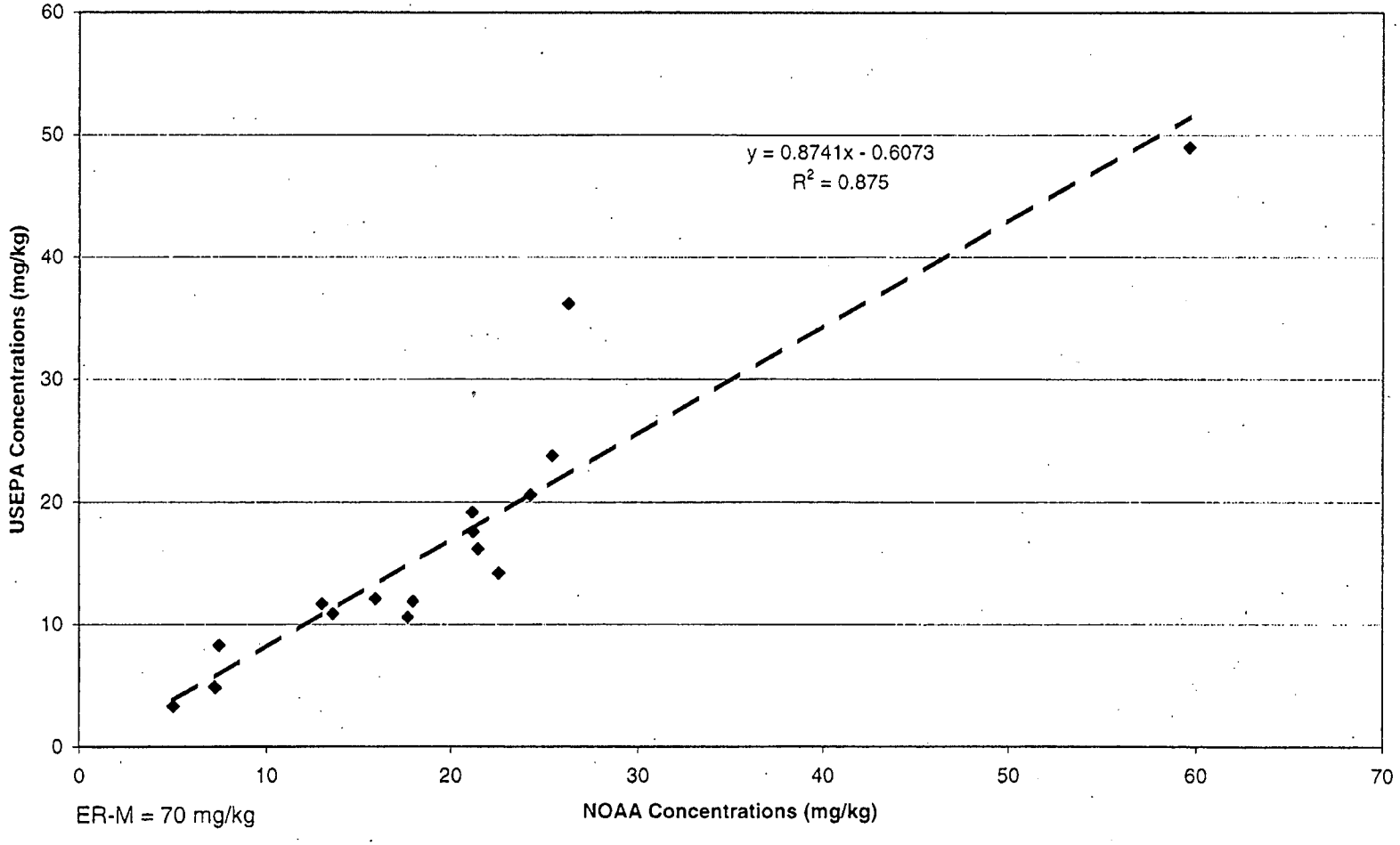

Figure 6
Cadmium Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

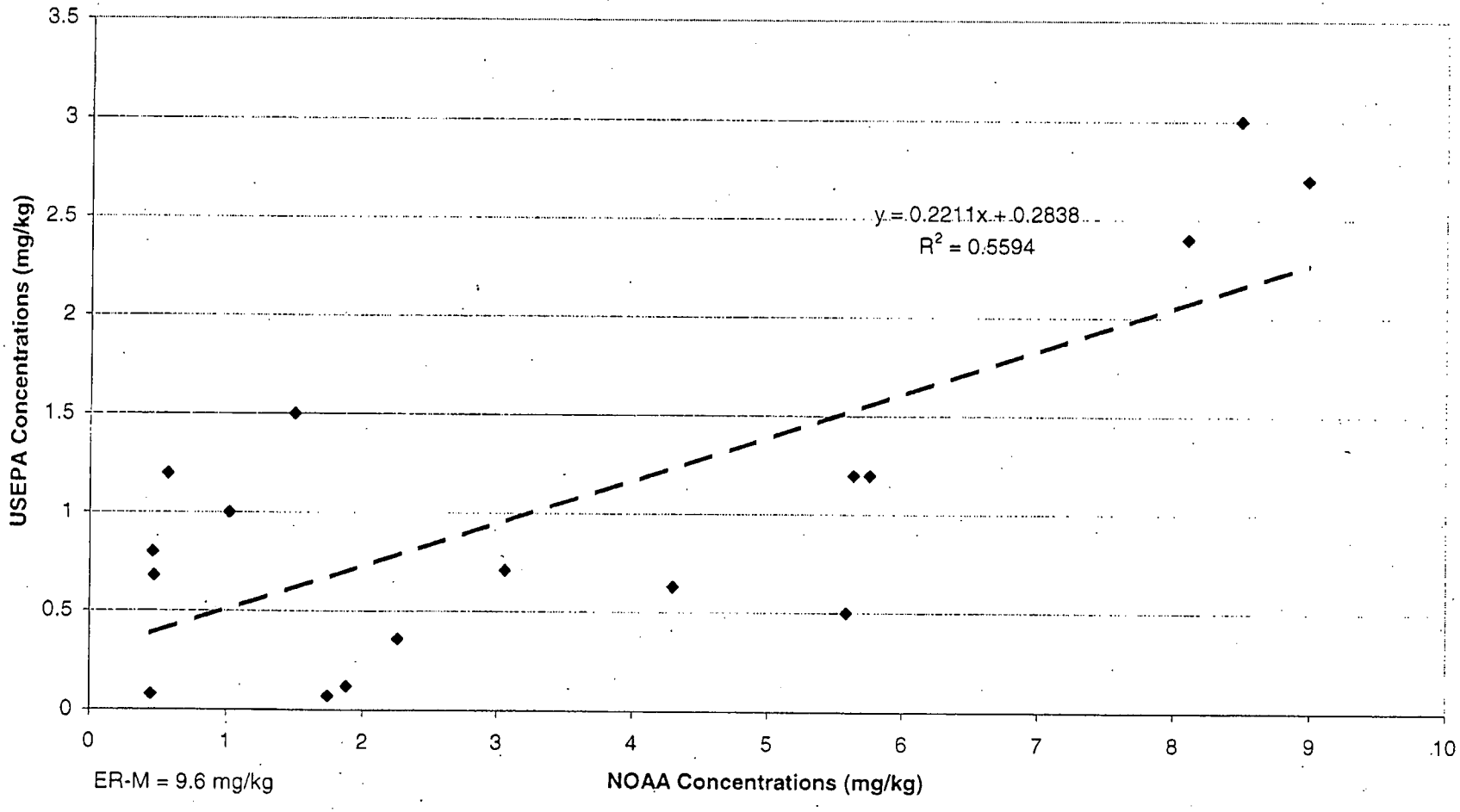

Figure 7
Chromium Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

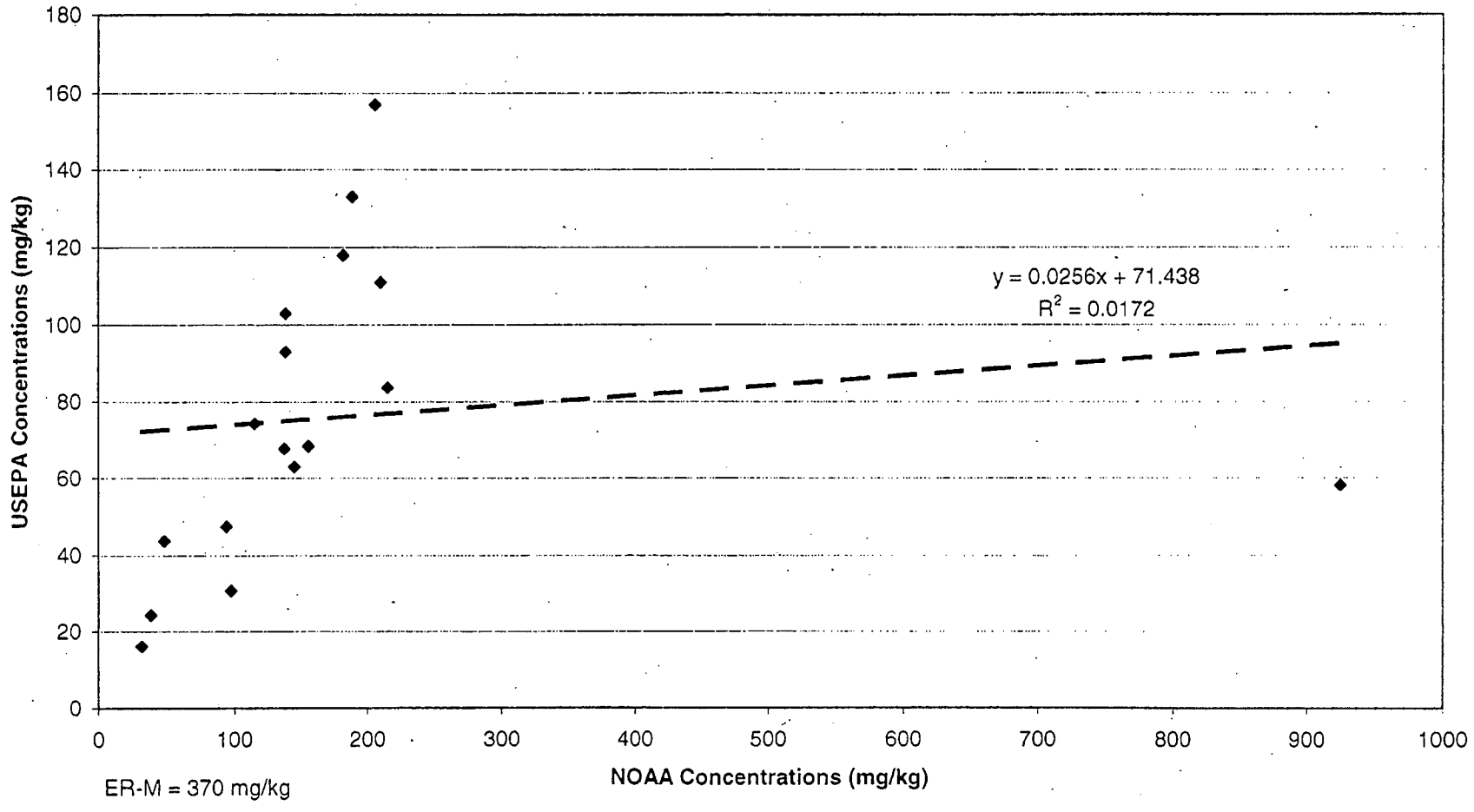

Figure 8
Chromium Concentrations for Samples Analyzed Using USEPA and NOAA Methods
(excluding sample OU4-SD-M03-203A)
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

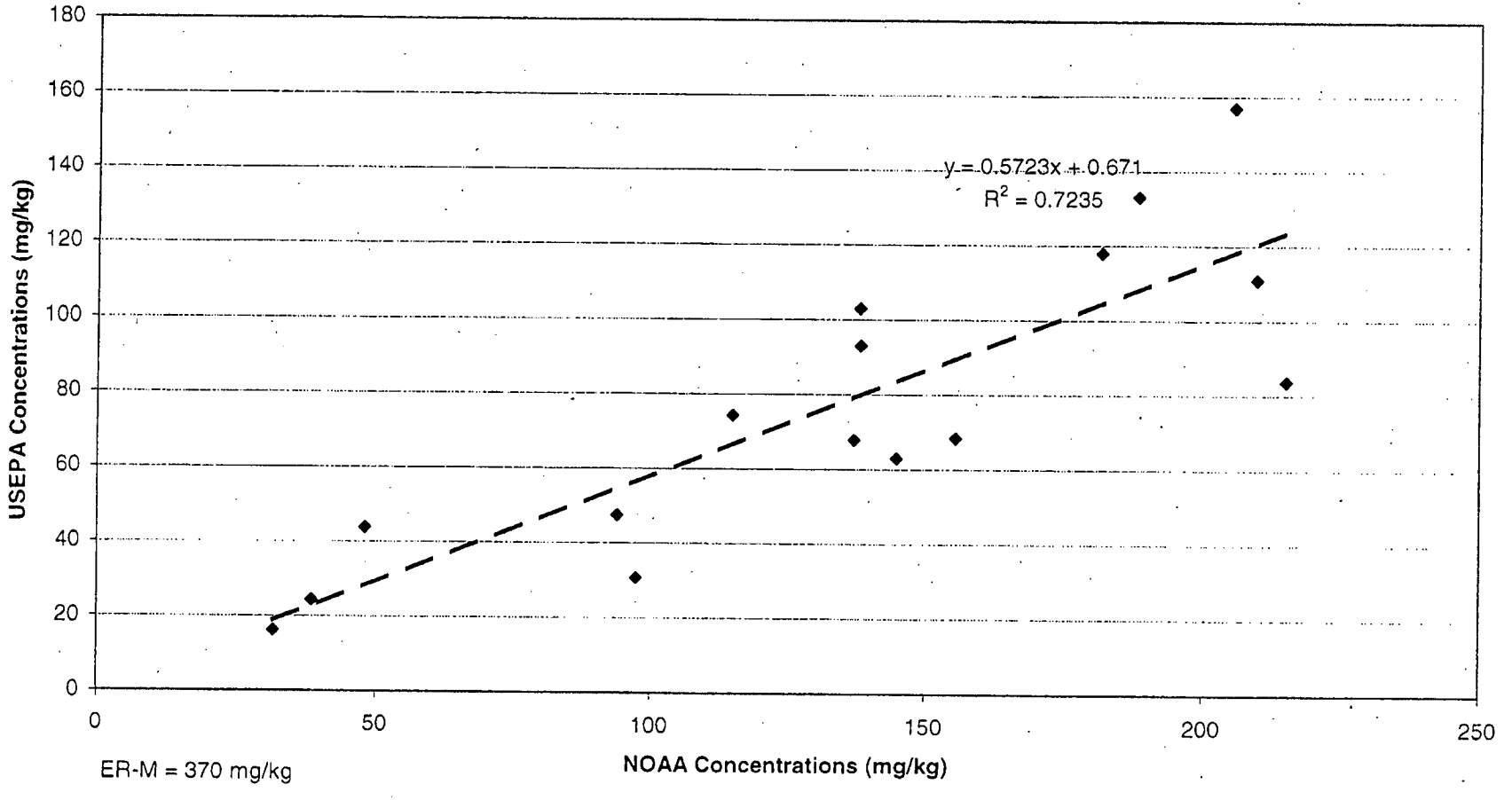

Figure 9
Iron Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

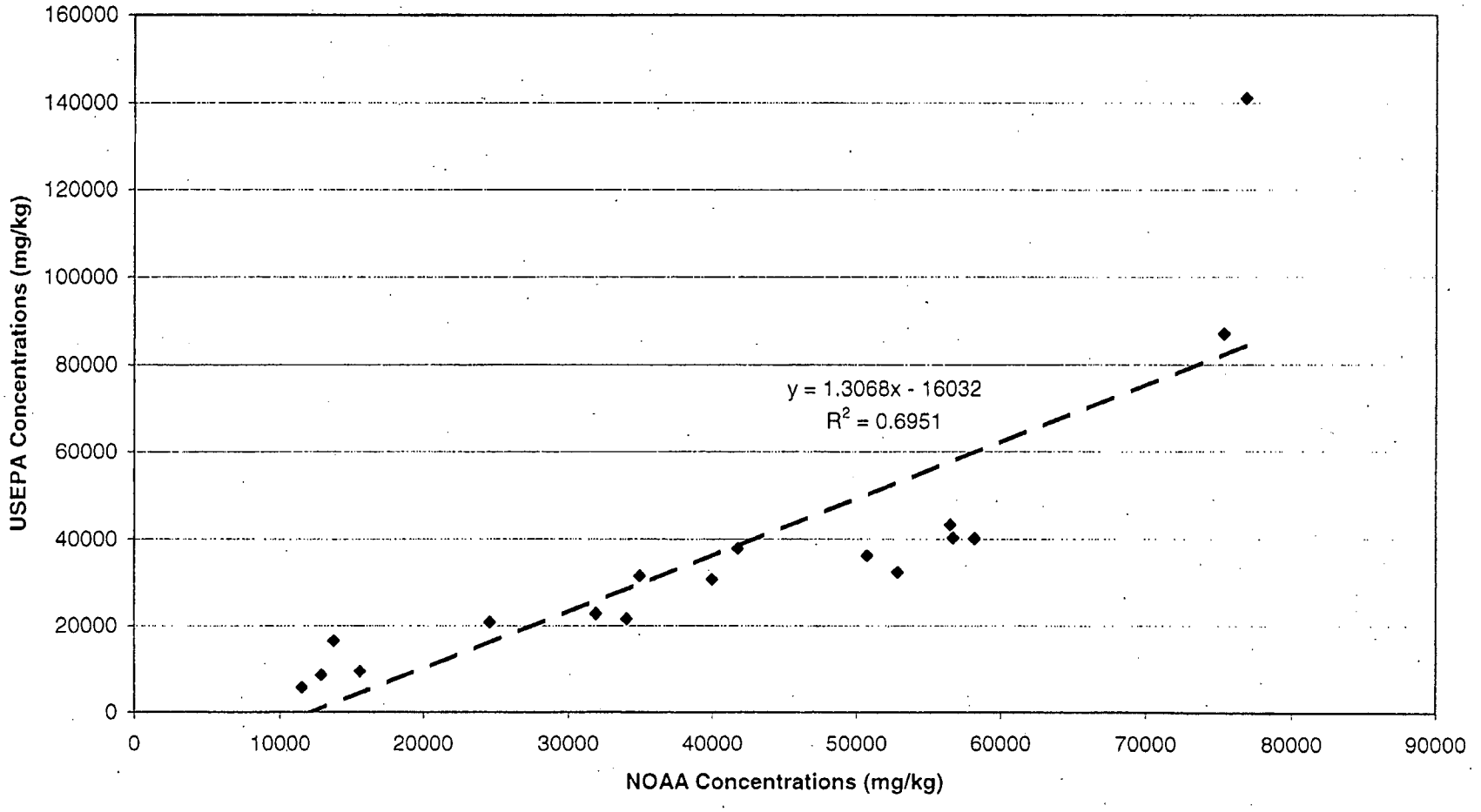

Figure 10
Manganese Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

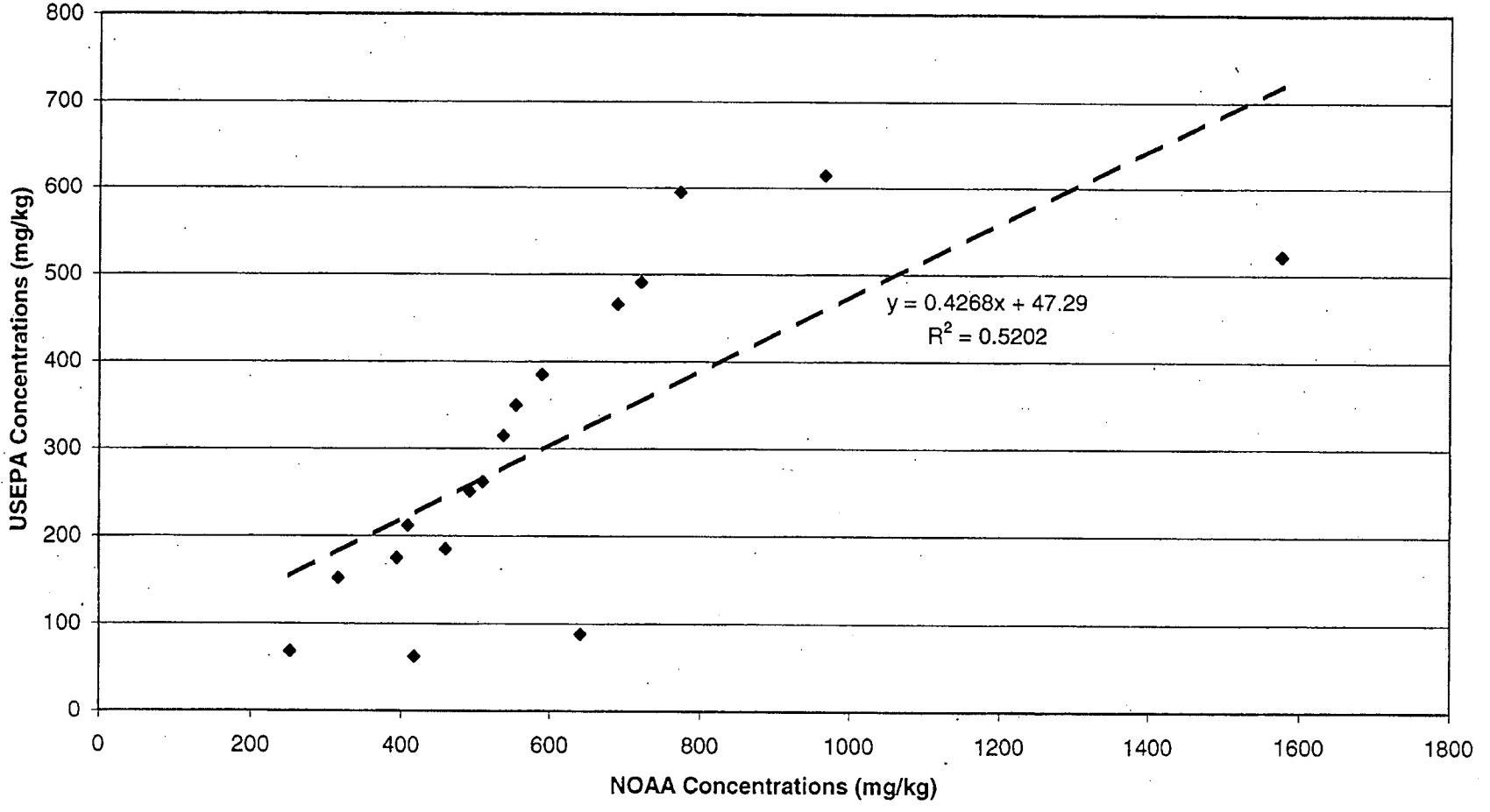

Figure 11
Silver Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

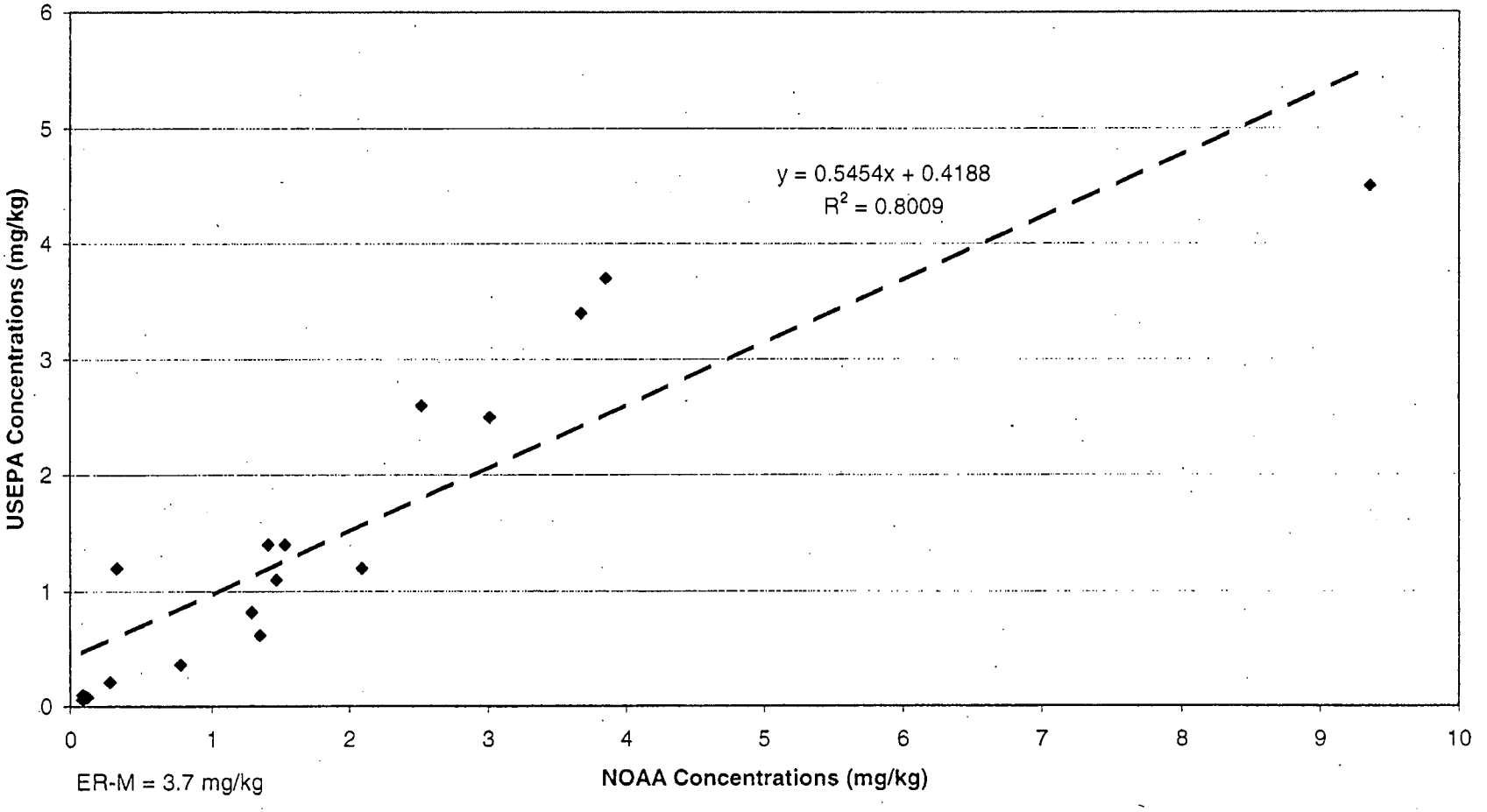

Figure 12
Zinc Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

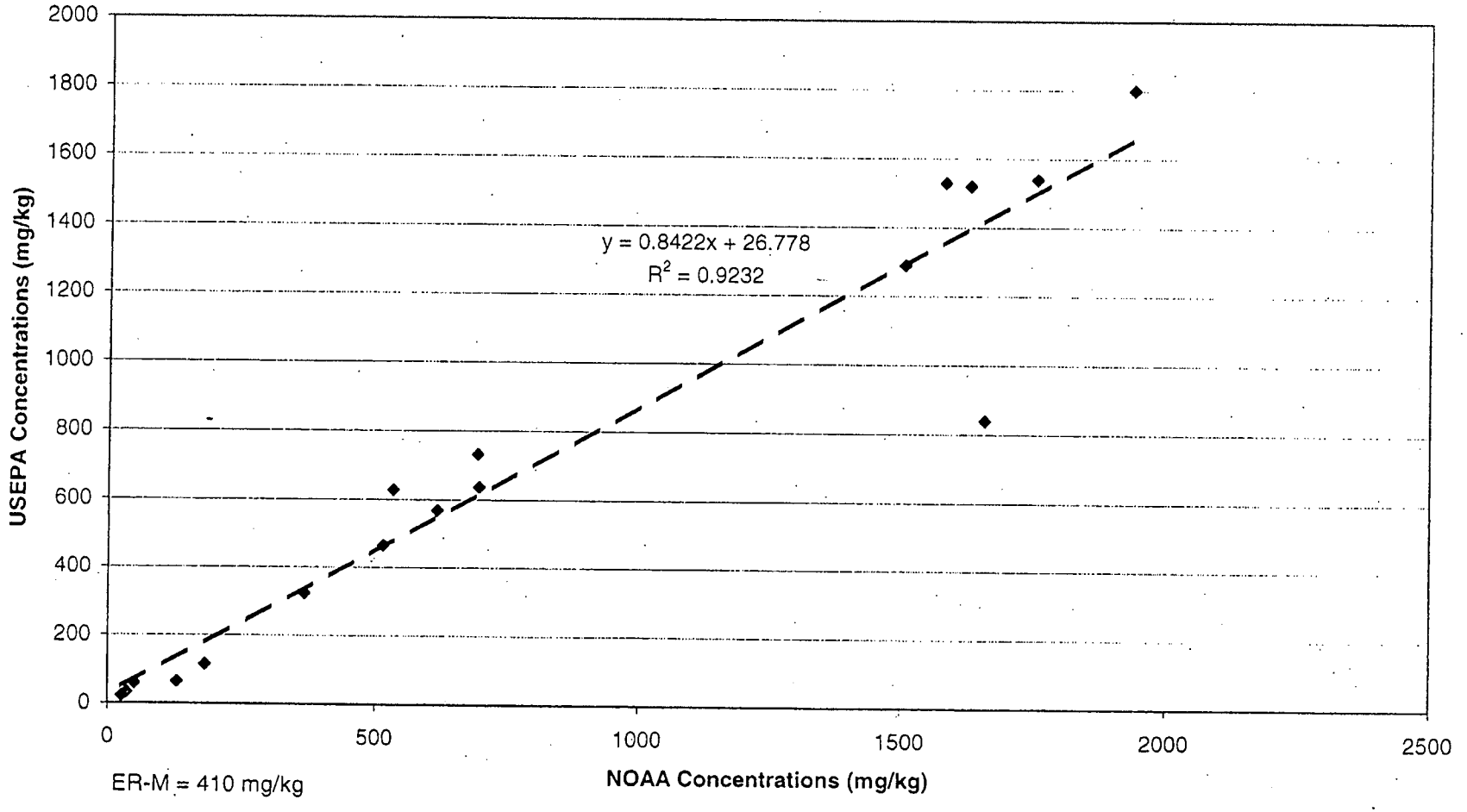

Figure 13
Copper Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

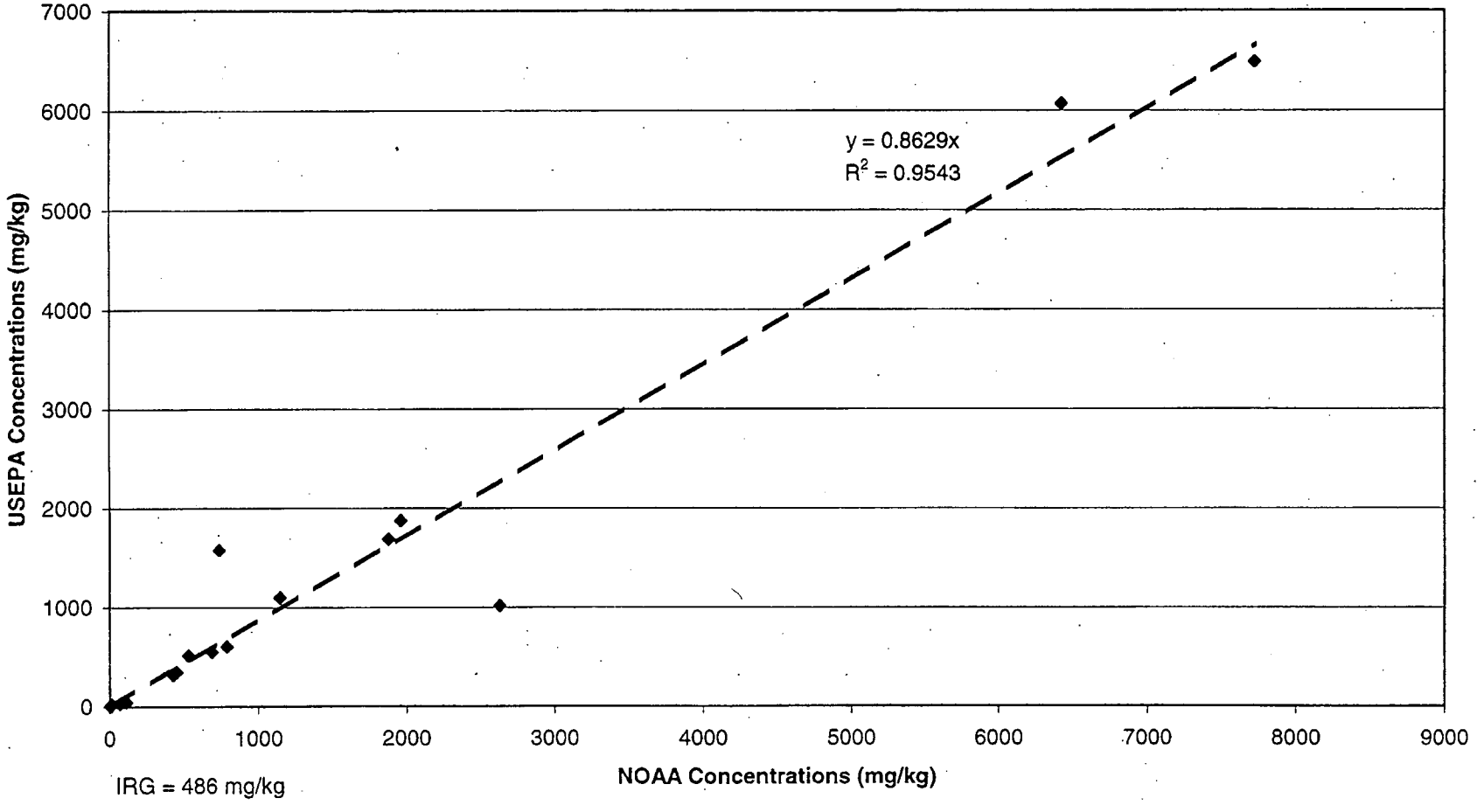

Figure 14
Lead Concentrations for Sample Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

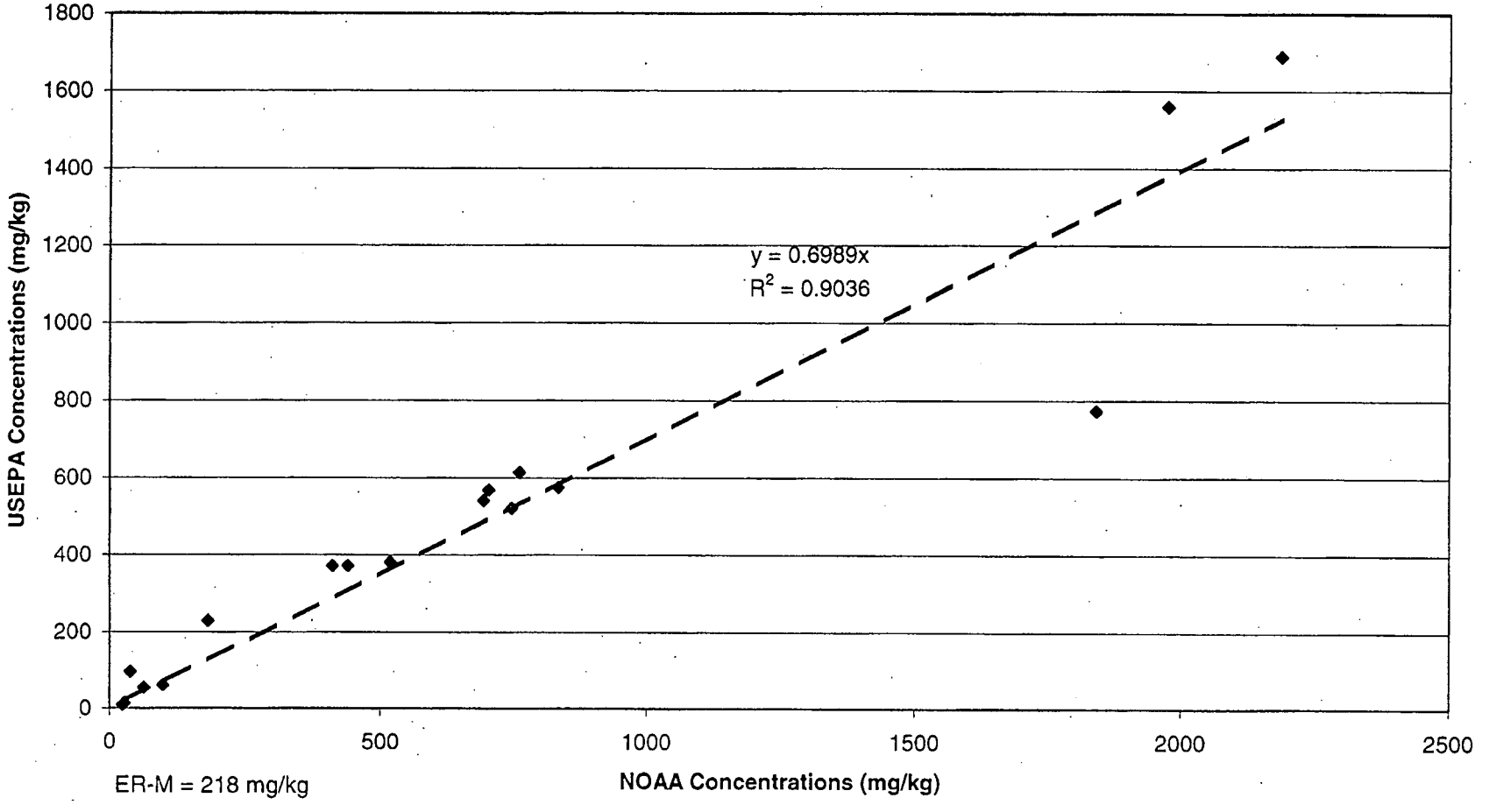

Figure 15
Nickel Concentrations for Samples Analyzed Using USEPA and NOAA Methods
Evaluation of Analytical Methods Memorandum
Portsmouth Naval Shipyard, Kittery, Maine

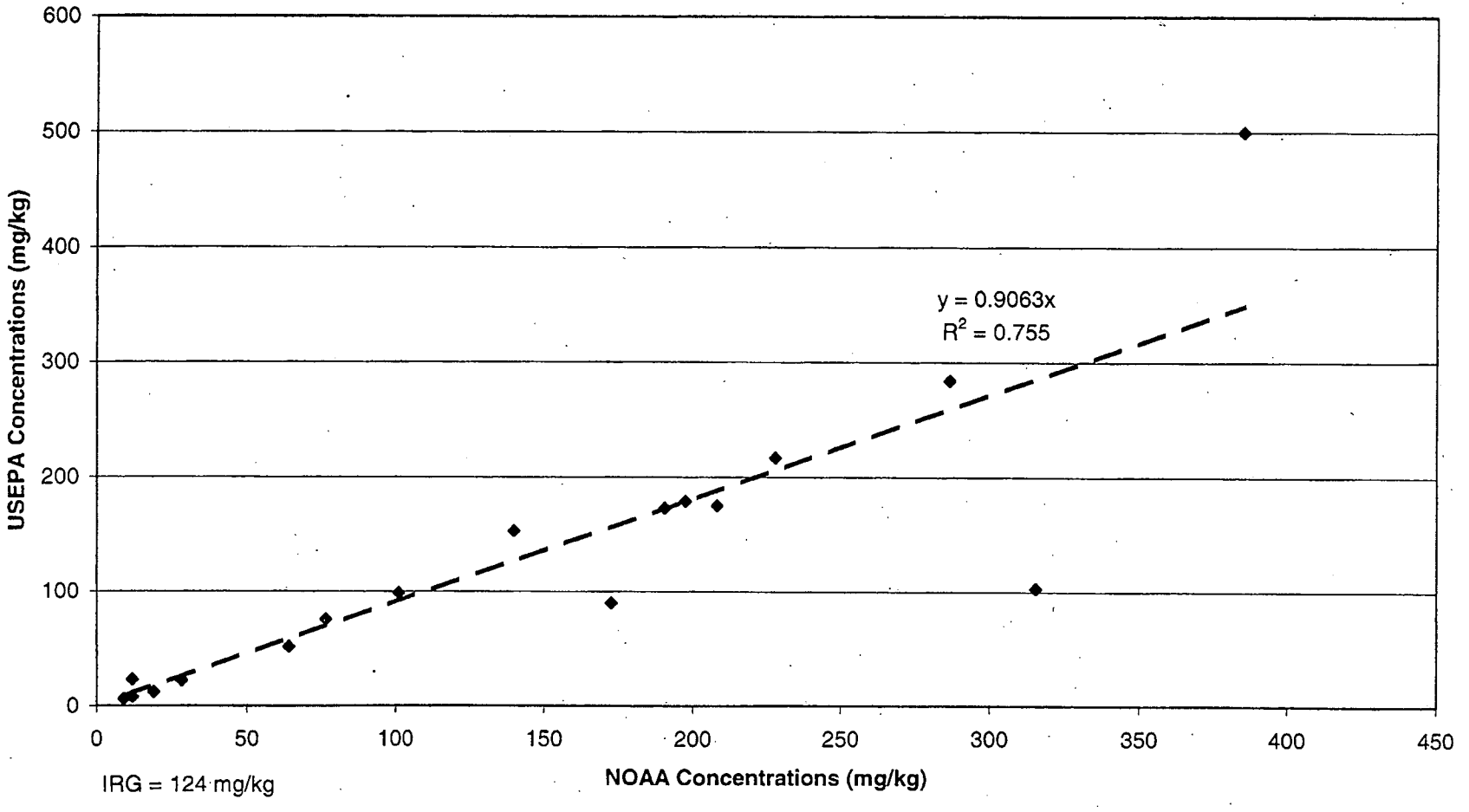

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

	ALUMINUM			ARSENIC			CADMIUM			CHROMIUM		
Station	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio[1]
M01-1	48335	5040	9.6	7.2	4.9	1.5	0.45 U	0.08 B	NA	97.4	30.8	3.2
M03-2	64801	9060	7.2	17.7	10.6	1.7	0.46 U	0.8	NA	925	58.1	15.9
M04-1	38231	7870	4.9	26.3	36.2	0.7	0.57 J	1.2	0.5	206	157	1.3
M04-1D	39400	10100	3.9	25.4	23.8	1.1	1.0	1	1.0	210	111	1.9
M05-1	80242	20300	4.0	59.6	49	1.2	1.5 J	1.5	1.0	155 J	68.4	2.3
M08-1	39664 J	19100	2.1	21.2	17.6	1.2	8.5	3	2.8	188	133	1.4
M08-1D	39768 J	17100	2.3	21.5	16.2	1.3	9.0	2.7	3.3	182	118	1.5
M08-2	45646 J	12600	3.6	13.6	10.9	1.2	3.1	0.71	4.3	115	74.3	1.5
M09-1	54927 J	18400	3.0	24.2	20.6	1.2	5.6	1.2	4.7	138	103	1.3
M09-2	34866 J	7960	4.4	13	11.7	1.1	4.3	0.63	6.8	94	47.5	2.0
M09-3	39764 J	16600	2.4	21.2	19.2	1.1	5.8	1.2	4.8	138	93	1.5
M11-3	32113 J	9460	3.4	22.6	14.2	1.6	8.1	2.4	3.4	215	83.7	2.6
M12-1	45717 J	10500	4.4	18.0	11.9	1.5	5.6	0.5	11.2	145	63	2.3
M13-1	62366	14200	4.4	15.9	12.1	1.3	0.47 U	0.68	NA	137 J	67.8	2.0
R01-2	30335 J	3750	8.1	5.0	3.3	1.5	1.7	0.07 B	NA	31.5	16.2	1.9
R01-4	38200 J	5540	6.9	7.2	4.8	1.5	1.9	0.12	15.7	38.3	24.4	1.6
R03-1	23119 J	13400	1.7	7.4	8.3	0.9	2.3	0.36	6.3	48.0	43.8	1.1
Minimum	23119	3750	1.7	4.99	3.3	0.7	0.45	0.07	0.5	31.5	16.2	1.1
Maximum	80242	20300	9.6	59.6	49	1.7	9.0	3.0	15.7	925	157	15.9
Average	44558	11822	4.5	19.2	16.2	1.3	3.5	1.1	5.1	180	76.1	1.8
Median	39764	10500	4.0	18.0	12.1	1.2	2.3	0.8	4.3	138	68.4	1.7

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Station	COPPER			IRON			LEAD			MANGANESE		
	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio
M01-1	68.3	29.7	2.3	15562	9540	1.6	63	53.9	1.2	641	88.6	7.2
M03-2	732	1580	0.5	34919	31500	1.1	180	229	0.8	460	185	2.5
M04-1	6421	6070	1.1	76871	141000	0.5	747	521	1.4	1576	522	3.0
M04-1D	7725	6490	1.2	75344	87000	0.9	834	575	1.5	966	615	1.6
M05-1	685 J	553	1.2	41758	37900	1.1	694 J	541	1.3	589	385	1.5
M08-1	1958	1880	1.0	56465	43300	1.3	2187	1690	1.3	554	350	1.6
M08-1D	1878	1690	1.1	58158	40200	1.4	1976	1560	1.3	537	315	1.7
M08-2	446	349	1.3	34024	21600	1.6	439	372	1.2	394	175	2.2
M09-1	1145	1100	1.0	50716	36200	1.4	762	614	1.2	771	595	1.3
M09-2	526	517	1.0	31909	22800	1.4	519	382	1.4	720	491	1.5
M09-3	785	608	1.3	39955	30700	1.3	704	568	1.2	689	466	1.5
M11-3	2628	1020	2.6	56674	40300	1.4	1843	774	2.4	509	262	1.9
M12-1	421	322	1.3	52818	32400	1.6	410	372	1.1	492	251	2.0
M13-1	111 J	46.8	2.4	24602	20900	1.2	97.7 J	60.4	1.6	408	212	1.9
R01-2	5.1	5.7 U	NA	11502	5830	2.0	23.6	9	2.6	417	62.8	6.6
R01-4	6.3	8.1 U	NA	12855	8680	1.5	27.2	13.7	2.0	251	68.5	3.7
R03-1	13.1	21.1 U	NA	13731	16500	0.8	37.8	95.4	0.4	316	152	2.1
Minimum	5.1	5.7	0.5	11502	5830	0.5	23.6	9	0.4	251	62.8	1.3
Maximum	7725	6490	2.6	76871	141000	2.0	2187	1690	2.6	1576	615	7.2
Average	1503	1311	1.4	40462	36844	1.3	679	496	1.4	605	306	2.6
Median	685	553	1.2	39955	31500	1.4	519	382	1.3	537	262	1.9

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Station	NICKEL			SILVER			ZINC		
	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio
M01-1	18.8 J	12	1.6	0.28	0.21	1.3	128	64.2	2.0
M03-2	315 J	103	3.1	1.4	1.4	1.0	535	629	0.8
M04-1	385 J	500	0.8	1.4	0.62	2.2	1629	1520	1.1
M04-1D	287 J	284	1.0	1.3	0.82	1.6	1755	1540	1.1
M05-1	76.5	75.3	1.0	1.5	1.4	1.1	698	638	1.1
M08-1	197	179	1.1	3.7	3.4	1.1	1581	1530	1.0
M08-1D	190	173	1.1	3.9	3.7	1.0	1506	1290	1.2
M08-2	64.1	51.4	1.2	1.5	1.1	1.3	365	323	1.1
M09-1	228	217	1.0	2.5	2.6	1.0	695	733	0.9
M09-2	140	153	0.9	2.1	1.2	1.7	515	465	1.1
M09-3	208	175	1.2	3.0	2.5	1.2	618	569	1.1
M11-3	172	89.8	1.9	9.4	4.5	2.1	1659	840	2.0
M12-1	101	98.5	1.0	0.78	0.36	2.2	1937	1800	1.1
M13-1	28.0	22.1	1.3	0.33	1.2	0.3	180	116	1.6
R01-2	9.0	6 U	NA	0.09 U	0.06 B	NA	25.9	22.7	1.1
R01-4	11.8	8	1.5	0.09 U	0.1	NA	35.7	33.2	1.1
R03-1	11.7	22.9	0.5	0.12 J	0.08 B	NA	49.9	59.2	0.8
Minimum	9.0	6.0	0.5	0.1	0.1	0.3	25.9	22.7	0.8
Maximum	385	500	3.1	9.4	4.5	2.2	1937	1800	2.0
Average	144	128	1.3	2.0	1.5	1.4	818	716	1.2
Median	140	98.5	1.1	1.4	1.2	1.3	618	629	1.1

1 - The average and median ratios for chromium do not include the ratio of 15.9.

NOAA - National Oceanic and Atmospheric Administration (Method referenced in NOS ORCA 130)
USEPA - United States Environmental Protection Agency (Analytical Method SW-846, Method 7471A)
Ratio = [NOAA]/[USEPA]

NA - Ratios were not calculated for samples where one value was not detected
U - Nondetected
B - Validated as nondetected
J - Estimated value

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Station	Aluminum			Arsenic			Cadmium			Chromium		
	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio[1]
M01-1	48,335	5,040	9.6	7.2	4.9	1.5	0.45 U	0.08 B	NA	97.4	30.8	3.2
M03-2	64,801	9,060	7.2	17.7	10.6	1.7	0.46 U	0.8	NA	925	58.1	15.9
M04-1	38,231	7,870	4.9	26.3	36.2	0.7	0.57 J	1.2	0.5	206	157	1.3
M04-1D	39,400	10,100	3.9	25.4	23.8	1.1	1.0	1	1.0	210	111	1.9
M05-1	80,242	20,300	4.0	59.6	49	1.2	1.5 J	1.5	1.0	155 J	68.4	2.3
M08-1	39,664 J	19,100	2.1	21.2	17.6	1.2	8.5	3	2.8	188	133	1.4
M08-1D	39,768 J	17,100	2.3	21.5	16.2	1.3	9.0	2.7	3.3	182	118	1.5
M08-2	45,646 J	12,600	3.6	13.6	10.9	1.2	3.1	0.71	4.3	115	74.3	1.5
M09-1	54,927 J	18,400	3.0	24.2	20.6	1.2	5.6	1.2	4.7	138	103	1.3
M09-2	34,866 J	7,960	4.4	13	11.7	1.1	4.3	0.63	6.8	94	47.5	2.0
M09-3	39,764 J	16,600	2.4	21.2	19.2	1.1	5.8	1.2	4.8	138	93	1.5
M11-3	32,113 J	9,460	3.4	22.6	14.2	1.6	8.1	2.4	3.4	215	83.7	2.6
M12-1	45,717 J	10,500	4.4	18.0	11.9	1.5	5.6	0.5	11.2	145	63	2.3
M13-1	62,366	14,200	4.4	15.9	12.1	1.3	0.47 U	0.68	NA	137 J	67.8	2.0
R01-2	30,335 J	3,750	8.1	5.0	3.3	1.5	1.7	0.07 B	NA	31.5	16.2	1.9
R01-4	38,200 J	5,540	6.9	7.2	4.8	1.5	1.9	0.12	15.7	38.3	24.4	1.6
R03-1	23,119 J	13,400	1.7	7.4	8.3	0.9	2.3	0.36	6.3	48.0	43.8	1.1
Minimum	23,119	3,750	1.7	4.99	3.3	0.7	0.45	0.07	0.5	31.5	16.2	1.1
Maximum	80,242	20,300	9.6	59.6	49	1.7	9.0	3.0	15.7	925	157	15.9
Average	44,558	11,822	4.5	19.2	16.2	1.3	3.5	1.1	5.1	180	76.1	1.8
Median	39,764	10,500	4.0	18.0	12.1	1.2	2.3	0.8	4.3	138	68.4	1.7

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

	Copper			Iron			Lead			Manganese		
Station	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio
M01-1	68.3	29.7	2.3	15,562	9,540	1.6	63	53.9	1.2	641	88.6	7.2
M03-2	732	1,580	0.5	34,919	31,500	1.1	180	229	0.8	460	185	2.5
M04-1	6,421	6,070	1.1	76,871	141,000	0.5	747	521	1.4	1,576	522	3.0
M04-1D	7,725	6,490	1.2	75,344	87,000	0.9	834	575	1.5	966	615	1.6
M05-1	685 J	553	1.2	41,758	37,900	1.1	694 J	541	1.3	589	385	1.5
M08-1	1,958	1,880	1.0	56,465	43,300	1.3	2,187	1,690	1.3	554	350	1.6
M08-1D	1,878	1,690	1.1	58,158	40,200	1.4	1,976	1,560	1.3	537	315	1.7
M08-2	446	349	1.3	34,024	21,600	1.6	439	372	1.2	394	175	2.2
M09-1	1,145	1,100	1.0	50,716	36,200	1.4	762	614	1.2	771	595	1.3
M09-2	526	517	1.0	31,909	22,800	1.4	519	382	1.4	720	491	1.5
M09-3	785	608	1.3	39,955	30,700	1.3	704	568	1.2	689	466	1.5
M11-3	2,628	1,020	2.6	56,674	40,300	1.4	1,843	774	2.4	509	262	1.9
M12-1	421	322	1.3	52,818	32,400	1.6	410	372	1.1	492	251	2.0
M13-1	111 J	46.8	2.4	24,602	20,900	1.2	97.7 J	60.4	1.6	408	212	1.9
R01-2	5.1	5.7 U	NA	11,502	5,830	2.0	23.6	9	2.6	417	62.8	6.6
R01-4	6.3	8.1 U	NA	12,855	8,680	1.5	27.2	13.7	2.0	251	68.5	3.7
R03-1	13.1	21.1 U	NA	13,731	16,500	0.8	37.8	95.4	0.4	316	152	2.1
Minimum	5.1	5.7	0.5	11,502	5,830	0.5	23.6	9	0.4	251	62.8	1.3
Maximum	7,725	6,490	2.6	76,871	141,000	2.0	2187	1,690	2.6	1,576	615	7.2
Average	1,503	1,311	1.4	40,462	36,844	1.3	679	496	1.4	605	306	2.6
Median	685	553	1.2	39,955	31,500	1.4	519	382	1.3	537	262	1.9

TABLE 1

METALS RESULTS USING NOAA AND USEPA ANALYTICAL METHODS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

	Nickel			Silver			Zinc		
Station	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio	NOAA (mg/kg)	USEPA (mg/kg)	Ratio
M01-1	18.8 J	12	1.6	0.28	0.21	1.3	128	64.2	2.0
M03-2	315 J	103	3.1	1.4	1.4	1.0	535	629	0.8
M04-1	385 J	500	0.8	1.4	0.62	2.2	1,629	1,520	1.1
M04-1D	287 J	284	1.0	1.3	0.82	1.6	1,755	1,540	1.1
M05-1	76.5	75.3	1.0	1.5	1.4	1.1	698	638	1.1
M08-1	197	179	1.1	3.7	3.4	1.1	1581	1530	1.0
M08-1D	190	173	1.1	3.9	3.7	1.0	1506	1290	1.2
M08-2	64.1	51.4	1.2	1.5	1.1	1.3	365	323	1.1
M09-1	228	217	1.0	2.5	2.6	1.0	695	733	0.9
M09-2	140	153	0.9	2.1	1.2	1.7	515	465	1.1
M09-3	208	175	1.2	3.0	2.5	1.2	618	569	1.1
M11-3	172	89.8	1.9	9.4	4.5	2.1	1,659	840	2.0
M12-1	101	98.5	1.0	0.78	0.36	2.2	1,937	1,800	1.1
M13-1	28.0	22.1	1.3	0.33	1.2	0.3	180	116	1.6
R01-2	9.0	6 U	NA	0.09 U	0.06 B	NA	25.9	22.7	1.1
R01-4	11.8	8	1.5	0.09 U	0.1	NA	35.7	33.2	1.1
R03-1	11.7	22.9	0.5	0.12 J	0.08 B	NA	49.9	59.2	0.8
Minimum	9.0	6.0	0.5	0.1	0.1	0.3	25.9	22.7	0.8
Maximum	385	500	3.1	9.4	4.5	2.2	1,937	1,800	2.0
Average	144	128	1.3	2.0	1.5	1.4	818	716	1.2
Median	140	98.5	1.1	1.4	1.2	1.3	618	629	1.1

1 - The average and median ratios for chromium do not include the ratio of 15.9.

NOAA - National Oceanic and Atmospheric Administration (Method referenced in NOS ORCA 130)
USEPA - United States Environmental Protection Agency (Analytical Method SW-846, Method 7471A)
Ratio = [NOAA]/[USEPA]

NA - Ratios were not calculated for samples where one value was not detected
U - Nondetected
B - Validated as nondetected
J - Estimated value

TABLE 2

SUMMARY OF RATIOS OF NOAA/USEPA ANALYTICAL RESULTS
EVALUATION OF ANALYTICAL METHODS MEMORANDUM
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Metal	*Minimum Ratio*	*Maximum Ratio*	*Average Ratio*	*Median Ratio*
ALUMINUM	1.7	9.6	4.5	4.0
ARSENIC	0.7	1.7	1.3	1.2
CADMIUM	0.5	15.7	5.1	4.3
CHROMIUM(1)	1.1	15.9	1.8	1.7
COPPER	0.5	2.6	1.3	1.1
IRON	0.5	2.0	1.3	1.4
LEAD	0.4	2.6	1.4	1.3
MANGANESE	1.3	7.2	2.6	1.9
NICKEL	0.5	3.1	1.3	1.1
SILVER	0.3	2.2	1.4	1.3
ZINC	0.8	2.0	1.2	1.1

1 - The average and median ratios for chromium do not include the ratio of 15.9.

Ratio = [NOAA]/[USEPA] (see Table 1)
NOAA - National Oceanic and Atmospheric Administration (Method referenced in NOS ORCA 130)
USEPA - United States Environmental Protection Agency (Analytical Method SW-846, Method 7471A)

TABLE 3

MDLs AND LABORATORY REPORTING LIMITS - PAHs IN TISSUE
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target MDL(1) (µg/kg dry weight	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2,3) (µg/kg wet weight)	STL MDL(2,4) (µg/kg dry weight)
Analytical Method		GERG SOP 9733	SW-846 8270 SIM	SW-846 8270 SIM
1-Methylnaphthalene	20	3.15	0.13	--
1-Methylphenanthrene	20	3.16	0.053	--
2-Methylnaphthalene	20	4.05	0.15	--
2,6-Dimethylnaphthalene	20	2.88	0.11	--
1,6,7-Trimethylnaphthalene	20	3.48	0.074	--
Acenaphthene	20	3.85	0.074	--
Acenaphthylene	20	2.84	0.05	--
Anthracene	20	2.77	0.055	--
Biphenyl	20	3.35	0.068	--
Dibenzothiophene	20	1.88	0.14	--
Fluorene	20	3.88	0.054	--
Naphthalene	20	4.73	0.26	--
Phenanthrene	20	3.07	0.066	--
Benz(a)anthracene	20	2.09	0.054	--
Benzo(a)pyrene	20	4.15	0.076	--
Benzo(b)fluoranthene	20	6.80	0.045	--
Benzo(e)pyrene	20	4.66	0.012	--
Benzo(g,h,i)perylene	20	5.70	0.097	--
Benzo(k)fluoranthene	20	3.83	0.081	--
Chrysene	20	2.75	0.08	--
Dibenz(a,h)anthracene	20	5.90	0.079	--
Fluoranthene	20	2.68	0.053	--
Indeno(1,2,3-c,d)pyrene	20	10.7	0.073	--
Perylene	20	9.50	0.10	--
Pyrene	20	2.61	0.070	--
Alkylated PAHs				
C1-Naphthalenes	20	7.20	--	--
C2-Naphthalenes	20	5.76	--	--
C3-Napthalenes	20	6.96	--	--
C4-Naphthalenes	20	6.96	--	--
C1-Fluorenes	20	7.76	--	--
C2-Fluorenes	20	7.76	--	--
C3-Fluorenes	20	7.76	--	--

TABLE 3

MDLs AND LABORATORY REPORTING LIMITS - PAHs IN TISSUE
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target MDL(1) (µg/kg dry weight	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2,3) (µg/kg wet weight)	STL MDL(2,4) (µg/kg dry weight)
C1-Phenanthrenes/Anthracenes	20	5.54	--	--
C2-Phenanthrenes/Anthracenes	20	5.54	--	--
C3-Phenanthrenes/Anthracenes	20	5.54	--	--
C4-Phenanthrenes/Anthracenes	20	5.54	--	--
C1-Dibenzothiophenes	20	3.76	--	--
C2-Dibenzothiophenes	20	3.76	--	--
C3-Dibenzothiophenes	20	3.76	--	--
C1-Fluoranthenes/Pyrenes	20	5.22	--	--
C1-Chrysenes	20	5.50	--	--
C2-Chrysenes	20	5.50	--	--
C3-Chrysenes	20	5.50	--	--
C4-Chrysenes	20	5.50	--	--

1 The Target MDLs are from the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995.
2 All positive results will be reported by the laboratory.
3 CAS does not currently have MDLs for alkylated PAHs by SW-846 Method 8270 SIM.
4 STL does not currently have MDLs for PAHs or alkylated PAHs by SW-846 Method 8270 SIM.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit
PAH = Polycyclic Aromatic Hydrocarbon

TABLE 4

MDLs AND LABORATORY REPORTING LIMITS - PAHs IN SEDIMENT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Sediment MDL(1) (µg/kg dry weight)	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2) (µg/kg dry weight)	STL MDL(2,3) (µg/kg dry weight)
Analytical Method		GERG SOP 9733	SW-846 8270 SIM	SW-846 8270 SIM
1-Methylnaphthalene	20	2.35	0.20	0.0962
1-Methylphenanthrene	20	0.77	0.11	0.120
2-Methylnaphthalene	20	3.21	0.21	0.125
2,6-Dimethylnaphthalene	20	2.09	0.13	0.0822
1,6,7-Trimethylnaphthalene	20	1.30	0.18	0.0941
Acenaphthene	20	0.52	0.21	0.141
Acenaphthylene	20	0.78	0.16	0.0799
Anthracene	20	0.52	0.19	0.132
Biphenyl	20	0.83	0.18	0.0886
Dibenzothiophene	20	0.75	0.19	0.113
Fluorene	20	0.80	0.17	0.157
Naphthalene	20	3.64	0.21	0.111
Phenanthrene	20	2.96	0.15	0.416
Benz(a)anthracene	20	0.94	0.13	0.314
Benzo(a)pyrene	20	2.55	0.14	0.207
Benzo(b)fluoranthene	20	1.31	0.14	0.668
Benzo(e)pyrene	20	1.23	0.12	0.188
Benzo(g,h,i)perylene	20	2.46	0.10	0.680
Benzo(k)fluoranthene	20	0.49	0.15	0.540
Chrysene	20	0.40	0.15	0.634
Dibenz(a,h)anthracene	20	0.99	0.18	1.18
Fluoranthene	20	1.18	0.17	0.558
Indeno(1,2,3-c,d)pyrene	20	1.33	0.15	0.921
Perylene	20	2.46	0.18	0.470
Pyrene	20	1.96	0.11	0.547
Alkylated PAHs				
C1-Naphthalenes	20	5.56	2.5	--
C2-Naphthalenes	20	4.18	2.5	--
C3-Naphthalenes	20	2.60	2.5	--
C4-Naphthalenes	20	2.60	2.5	--
C1-Fluorenes	20	1.60	2.5	--
C2-Fluorenes	20	1.60	2.5	--

TABLE 4

MDLs AND LABORATORY REPORTING LIMITS - PAHs IN SEDIMENT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Sediment MDL(1) (µg/kg dry weight)	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2) (µg/kg dry weight)	STL MDL(2,3) (µg/kg dry weight)
C3-Fluorenes	20	1.60	2.5	--
C1-Phenanthrenes/Anthracenes	20	1.54	2.5	--
C2-Phenanthrenes/Anthracenes	20	1.54	2.5	--
C3-Phenanthrenes/Anthracenes	20	1.54	2.5	--
C4-Phenanthrenes/Anthracenes	20	1.54	2.5	--
C1-Dibenzothiophenes	20	1.50	2.5	--
C2-Dibenzothiophenes	20	1.50	2.5	--
C3-Dibenzothiophenes	20	1.50	2.5	--
C1-Fluoranthenes/Pyrenes	20	3.14	2.5	--
C1-Chrysenes	20	0.80	2.5	--
C2-Chrysenes	20	0.80	2.5	--
C3-Chrysenes	20	0.80	2.5	--
C4-Chrysenes	20	0.80	2.5	--

1 The Target MDLs are from the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluaitons: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995
2 All positive results will be reported by the laboratory.
3 STL does not currently have MDLs for alkylated PAHs by SW-846 Method 8270 SIM.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit
PAH = Polycyclic Aromatic Hydrocarbon

TABLE 5

MDLs AND LABORATORY REPORTING LIMITS - PCBs IN TISSUE
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Tissue MDL(1) (µg/kg dry weight)	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2) (µg/kg wet weight)	STL MDL(2) (µg/kg dry weight)
Analytical Method		GERG SOP 9810	SW-846 Method 8082	SW-846 Method 8082
PCB 8	2	2.02	0.14	0.4952
PCB 18	2	3.27	0.11	0.4380
PCB 28	2	0.99	0.31	0.4394
PCB 44	2	0.73	0.063	0.3760
PCB 52	2	0.85	0.080	0.4903
PCB 66	2	1.20	0.073	0.3237
PCB 77	2	1.0	0.092	0.3032
PCB 81	2	1	0.082	0.2699
PCB 101	2	1.07	0.065	0.3248
PCB 105	2	0.97	0.21	0.1722
PCB 114	2	1	0.32	0.2167
PCB 118	2	1.77	0.10	0.2117
PCB 123	2	1	0.11	0.3423
PCB 126	2	1.0	0.12	0.1929
PCB 128	2	0.96	0.091	0.3247
PCB 138	2	1.80	0.23	0.1426
PCB 153	2	1.27	0.15	0.3941
PCB 156	2	1	0.13	0.1571
PCB 157	2	1	0.082	0.4841
PCB 167	2	1	0.22	0.2519
PCB 169	2	1.0	0.085	0.0611
PCB 170	2	10.4(3)	0.080	0.1943
PCB 180	2	1.33	0.11	0.4585
PCB 187	2	0.88	0.18	0.2407
PCB 189	2	1	0.089	0.0750
PCB 195	2	1.04	0.095	0.1211
PCB 206	2	1.08	0.077	0.5385
PCB 209	2	1.41	0.095	0.1977

1 The Target MDLs are from the QA/QC Guidance for Sampoing and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995.
2 All positive results will be reported by the laboratory.
3 Interference from phthalate.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit
PCB = Polychlorinated biphenyl

TABLE 6

MDLs AND LABORATORY REPORTING LIMITS - PCBs IN SEDIMENT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Sediment MDL(1) (µg/kg dry weight)	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2) (µg/kg dry weight)	STL MDL(2) (µg/kg dry weight)
Analytical Method		GERG SOP9810	SW-846 Method 8082	SW-846 Method 8082
PCB 8	1	0.095	0.087	0.0598
PCB 18	1	0.071	0.029	0.0639
PCB 28	1	0.028	0.25	0.0613
PCB 44	1	0.052	0.18	0.0677
PCB 52	1	0.113	0.047	0.1315
PCB 66	1	0.050	0.037	0.0901
PCB 77	1	0.050	0.065	0.0573
PCB 81	1	0.05	0.030	0.0774
PCB 101	1	0.064	0.030	0.0860
PCB 105	1	0.049	0.040	0.3975
PCB 114	1	0.05	0.075	0.0912
PCB 118	1	0.096	0.039	0.0845
PCB 123	1	0.05	0.034	0.0897
PCB 126	1	0.050	0.039	0.0708
PCB 128	1	0.099	0.25	0.1584
PCB 138	1	0.042	0.030	0.0844
PCB 153	1	0.073	0.039	0.0941
PCB 156	1	0.05	0.043	0.0747
PCB 157	1	0.05	0.035	0.0858
PCB 167	1	0.05	0.033	0.0866
PCB 169	1	0.050	0.032	0.0760
PCB 170	1	0.443(3)	0.033	0.1205
PCB 180	1	0.031	0.031	0.0795
PCB 187	1	0.046	0.036	0.0872
PCB 189	1	0.05	0.030	0.0894
PCB 195	1	0.028	0.041	0.0984
PCB 206	1	0.031	0.055	0.0972
PCB 209	1	0.037	0.050	0.0908

1 The Target MDLs are from the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995.
2 All positive results will be reported by the laboratory.
3 Interference from phthalate.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit
PCB = Polychlorinated biphenyl

TABLE 7

MDLs AND LABORATORY REPORTING LIMITS - PESTICIDES IN TISSUE
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Tissue MDL[1] (µg/kg dry weight)	TAMU MDL[2] (µg/kg dry weight)	CAS MDL[2] (µg/kg wet weight)	STL MDL[2] (µg/kg dry weight)
Analytical Method		GERG SOP 9810	SW-846 Method 8081	SW-846 Method 8081
2,4' DDD	10	0.89	0.18	0.2377
2,4' DDE	10	1.38	0.096	0.2818
2,4' DDT	10	1.01	0.22	0.0861
4,4'-DDD	10	1.01	0.13	0.4649
4,4'-DDE	10	1.71	0.12	0.1817
4,4'-DDT	10	1.26	0.38	0.2522
Aldrin	10	1.05	0.20	0.1252
Alpha Chlordane	10	0.90	0.36	0.1809
Alpha HCH	10	1.29	0.16	0.1874
Beta HCH	10	1.58	0.21	0.2192
Chlorpyrifos	10	4.09	0.17	--[5]
Cis-Nonachlor	10	0.76	0.12	0.1618
Delta HCH	10	0.58	0.34	0.1810
Dieldrin	10	1.24	0.11	0.1795
Endosulfan II	10	2.03	0.35	0.0889
Endrin	10	1.95	0.099	0.1480
Gamma Chlordane	10	0.73	0.14	0.1701
Gamma HCH	10	1.15	0.28	0.2997
Heptachlor	10	1.34	0.45	0.1043
Heptachlor Epoxide	10	0.30	0.15	0.1959
Hexachlorobenzene	10	2.13	0.34	0.5389
Mirex	10	0.70	0.27	0.1340
Oxychlordane	10	0.88	0.077	0.2637
Pentachlorobenzene	10	3.33	--[4]	--[6]
Pentachloroanisole	10	1.50	--[3]	--[6]
Tetrachlorobenzene 1,2,3,4	10	2.47	--[4]	--[6]
Tetrachlorobenzene 1,2,4,5	10	8.38	--[4]	--[6]
Trans-Nonachlor	10	0.97	0.051	0.1409

1 The Target MDLs are from the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995.
2 All positive results will be reported by the laboratory.
3 CAS proposes analyzing pentachloroanisole by SW-846 Method 8151 but does not currently have MDLs.

4 CAS proposes doing these compounds by SW-846 Method 8081 but does not currently have MDLs.
5 STL proposes doing chlorpyrifos by SW-846 Method 8141 but does not currently have MDLs.
6 STL proposes doing these compounds by SW-846 Method 8270 but does not currently have MDLs.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit

TABLE 8

MDLs AND LABORATORY REPORTING LIMITS - PESTICIDES IN SEDIMENT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	Target Sediment MDL(1) (µg/kg dry weight)	TAMU MDL(2) (µg/kg dry weight)	CAS MDL(2) (µg/kg dry weight)	STL MDL(2) (µg/kg dry weight)
Analytical Method		GERG SOP 9810	SW-846 Method 8081	SW-846 Method 8081
2,4' DDD	2	0.032	0.16	0.0307
2,4' DDE	2	0.090	0.069	0.1127
2,4' DDT	2	0.060	0.080	0.0261
4,4'-DDD	2	0.046	0.093	0.0296
4,4'-DDE	2	0.018	0.076	0.0662
4,4'-DDT	2	0.034	0.17	0.0315
Aldrin	2	0.036	0.25	0.0298
Alpha Chlordane	2	0.015	0.062	0.0265
Alpha HCH	2	0.073	0.083	0.1307
Beta HCH	2	0.088	0.22	0.0730
Chlorpyrifos	2	0.127	0.27	--(5)
Cis-Nonachlor	2	0.050	0.13	0.0280
Delta HCH	2	0.036	0.14	0.1026
Dieldrin	2	0.040	0.082	0.0274
Endosulfan II	2	0.101	0.061	0.0499
Endrin	2	0.197	0.24	0.0291
Gamma Chlordane	2	0.062	0.038	0.0297
Gamma HCH	2	0.021	0.099	0.0240
Heptachlor Epoxide	2	0.020	0.14	0.0543
Heptahclor	2	0.077	0.097	0.1134
Hexachlorobenzene	2	0.051	0.16	0.1182
Mirex	2	0.032	0.068	0.0551
Oxychlordane	2	0.019	0.15	0.0175
Pentachloroanisole	2	0.024	50(3)	--(6)
Pentachlorobenzene	2	0.234	--(4)	--(6)
Tetrachlorobenzene 1,2,3,4	2	0.134	--(4)	--(6)
Tetrachlorobenzene 1,2,4,5	2	0.331	--(4)	--(6)
Trans-Nonachlor	2	0.047	0.095	0.0197

1 The Target MDLs are from the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations U.S. EPA, Office of Water, Office of Science and Technology. EPA 823-B-95-001. 1995.
2 All positive results will be reported by the laboratory.
3 CAS proposes analyzing pentachloroanisole by SW-846 Method 8151.

4 CAS proposes doing these compounds by SW-846 Method 8081 but does not currently have MDLs.
5 STL proposes doing chlorpyrifos by SW-846 Method 8141 but does not currently have MDLs.
6 STL proposes doing these compounds by SW-846 Method 8270 but does not currently have MDLs.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services
STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit

TABLE 9

MDLs AND LABORATORY REPORTING LIMITS – DIOXINS IN SEDIMENT/TISSUE
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Compound	TAMU MDL(1) (µg/kg dry weight)	CAS MDL(1) (µg/kg dry weight)	STL MDL(1) (µg/kg dry weight)
Analytical Method	GERG SOP 9722	EPA Method 1613	EPA Method 1613
2,3,7,8-TCDD	1.0	1.0	1.0
Total TCDD	1.0	1.0	1.0
2,3,7,8-TCDF	1.0	1.0	1.0
Total TCDF	1.0	1.0	1.0
1,2,3,7,8-PeCDD	5.0	2.5	5.0
Total PeCDD	5.0	2.5	5.0
1,2,3,7,8-PeCDF	5.0	2.5	5.0
2,3,4,7,8-PeCDF	5.0	2.5	5.0
Total PeCDF	5.0	2.5	5.0
1,2,3,4,7,8-HxCDD	5.0	2.5	5.0
1,2,3,6,7,8-HxCDD	5.0	2.5	5.0
1,2,3,7,8,9-HxCDD	5.0	2.5	5.0
Total HxCDD	5.0	2.5	5.0
1,2,3,4,7,8-HxCDF	5.0	2.5	5.0
1,2,3,6,7,8-HxCDF	5.0	2.5	5.0
1,2,3,7,8,9-HxCDF	5.0	2.5	5.0
2,3,4,6,7,8-HxCDF	5.0	2.5	5.0
Total HxCDF	5.0	2.5	5.0
1,2,3,4,6,7,8-HpCDD	5.0	2.5	5.0
Total HpCDD	5.0	2.5	5.0
1,2,3,4,6,7,8-HpCDF	5.0	2.5	5.0
1,2,3,4,7,8,9-HpCDF	5.0	2.5	5.0
Total HpCDF	5.0	2.5	5.0
OCDD	10.0	5.0	10.0
OCDF	10.0	5.0	10.0

1 All positive results will be reported by the laboratory.

Abbreviations:
TAMU = Texas A&M University
CAS = Columbia Analytical Services

STL = Severn Trent Laboratory
GERG = Geochemical and Environmental Research Group
SOP = Standard Operating Procedure
SIM = Selected Ion Monitoring
MDL = Method Detection Limit