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LETTER REGARDING U S NAVY RESPONSE TO REGULATOR COMMENTS ON FINAL DRAFT REMEDIAL INVESTIGATION AT LAKE DRUID AT OPERABLE UNIT 4 (OU 4) NTC ORLANDO FL
10/18/1999
HARDING LAWSON ASSOCIATES

File OU 4

October 18, 1999
Harding Lawson Associates

03.01.04.0008
ID 00112

Commanding Officer
Southern Division
Naval Facilities Engineering Command
ATTN: Barbara Nwokike, Code 1873
2155 Eagle Drive
Charleston, SC 29406

**SUBJECT: Operable Unit (OU) 4 Remedial Investigation**
**Lake Druid PAHs**
**Naval Training Center (NTC), Orlando, Florida**
**CTO 107, Contract No. N62467-89-D-031/107**

Dear Ms. Nwokike:

In September 1998, Harding Lawson Associates (HLA) issued the Final Draft Remedial Investigation (RI) Report for Operable Unit 4 (OU 4) at NTC, Orlando. USEPA Region IV provided review comments in December 1998, and the Florida Department of Environmental Protection (FDEP) provided review comments in February 1999. HLA prepared a detailed response to all regulator comments, which was issued in May 1999. In late June 1999, USEPA provided additional written comments, primarily related to the ecological risk assessment. FDEP also verbally concurred with USEPA's concerns.

The latest regulator comments were related to the formatting of the ecological risk assessment, the adequacy of the site characterization performed in the RI, and a concern that the ecological risk assessment did not adequately address potential risks associated with PAHs, Aroclor-1254, and pesticides detected in Lake Druid sediment.

These issues were discussed with the Navy, USEPA, and FDEP in a conference call on September 2, 1999, and at the Orlando Partnering Team (OPT) meeting in Orlando on September 29, 1999. HLA and the Navy maintain that the presence of PAHs, Aroclor-1254, and pesticides (primarily DDT and chlordane) in Lake Druid is due to the large volume of stormwater discharged to Lake Druid from the surrounding urban environment. No Area C stormwater discharges directly to the lake. It was agreed at the OPT meeting that literature reporting urban stormwater analyses would be researched and compared to data from Lake Druid.

## LAKE DRUID CONDITIONS

Lake Druid is a Class III surface water body, as described in Chapter 62-302, Florida Administrative Code, Surface Water Quality Standards. Lake Druid straddles the western boundary of OU 4 and Area C (Figure 1). The lake captures storm runoff through the storm drainage system of the surrounding neighborhoods and small, intermittent streams. The Lake Druid basin area is approximately 150 acres. Storm water outfalls include an 18 inch and a 48 inch outfall at the northeast corner of the lake, two 12 inch outfalls at the southwest end, and an 18 inch outfall on the northwest shoreline. The 48 inch outfall collects stormwater from up to 1000 feet away, including the Koger Center office park located east of Area C. Lake level is maintained by a weir at a 48 inch

discharge on the northwest shoreline. Lake Druid overflow water is piped from this location to Lake Rowena, located approximately 0.75 mile to the northwest.

Bathymetry data on file with the city of Orlando's Stormwater Utility Bureau indicate that the lake covers over 800,000 square feet (approximately 18 acres). The lake reaches a maximum depth of approximately 15 feet in the south-central part, and has a mean depth of approximately seven feet. In 1996, the average elevation of the lake was 101.1 feet, National Geodetic Vertical Datum. Lake Druid details are shown on Figure 2.

No stormwater runoff from Area C is discharged directly to Lake Druid. No catch basins are present on the property. The primary means of stormwater control is by infiltration. Stormwater does collect in a drainage swale east of Port Hueneme Avenue, and from there is directed through a culvert into the wooded area to the west. Stormwater infiltrates through the wooded area, and during particularly heavy rains flows overland towards Lake Druid, located approximately 200 feet further west.

## SAMPLING STRATEGY

During development of the RI Work Plan, the sampling strategy for Lake Druid was discussed with the OPT. Several pre-RI investigations (including groundwater, surface water, and surface soil sampling) had established that the primary Contaminants of Concern (COCs) were chlorinated VOCs. Recognizing the large volume of non-site related urban runoff discharging to the lake, it was originally proposed to the OPT that any further lake characterization conducted during the RI would focus only on VOCs. This was agreed to by the FDEP representative as a reasonable approach, given the likelihood that urban storm water had introduced organic compounds such as PAHs and pesticides that were clearly unrelated to OU 4 releases. However, USEPA required that at least one full suite sample be collected from Lake Druid sediment and surface water.

## SAMPLING RESULTS

Sampling locations are shown on Figure 2. Two full suite sediment samples and a duplicate were collected from the lake. Samples U4D01003 and U4D01003D were collected from the portion of the lake where high concentrations of VOCs had been detected. This location was approximately 80 feet south of the 48 inch outfall. Sample U4D05001 was collected along the shoreline further south, away from VOCs but still on Navy property. This sample was intended to serve as a Control.

Sample results are shown on Table 1. Flouranthene and pyrene were detected in sample U4D01003 at 6,200 ug/kg and 6,600 ug/kg, respectively. Only pyrene at 200 ug/kg was detected in the field sample itself. No PAHs were detected in the Control. Several pesticides and Aroclor-1254 were also detected at location U4D01003, although most were also present at higher concentrations in the Control.

Pyrene and flouranthene are pyrogenic PAHs, produced primarily by the combustion of organic matter. These compounds would be expected to be present in urban runoff. Lake Druid receives substantial volumes of stormwater during rain events. Lake residents report that from the western shore, a wave of water can be observed moving across the lake from the 48 inch outfall near OU 4 during major rain events.

## LITERATURE SEARCH

Several reports were researched for PAH and pesticide data collected at other sites in Florida. The U.S. Geological Survey has published reports evaluating the water quality of stormwater runoff, as has the St. John's Water Management District and Florida DEP. A reference list is provided at the end of this memo.

Unfortunately, several of the reports do not include comprehensive laboratory results, either because organic compounds were not the focus of the study, or because results were presented in a qualitative rather than quantitative manner. The St. John's report provides a large PAH database, but presented mostly as total PAHs, without a breakout of individual compounds.

The most useful report was prepared by Florida DEP, and is titled *"Final Report, Characterization of Stormwater Contaminated Sediment and Debris for Determining Proper Disposal Methods"*. This report evaluated sediment quality associated with stormwater management devices, in order to determine if hazardous constituents were present that might pose a concern when disposing of sediment removed during maintenance. Although many of the samples were collected from catch basins, manholes, and street sweepings, the study also evaluated sediment quality in detention and retention basins, canals, and lakes.

## DATA COMPARISON

PAH data from the FDEP report was tabulated and plotted on a bar graph against data from Lake Druid sample U4D00103D (Figure 3). Samples that were obviously from catch basins and street sweepings were omitted, as these data are not readily comparable to Lake Druid. Sample descriptions in the report were not always clear, so some of the graphed data may still represent locations with different environments than Lake Druid. However, the majority of the data came from canals, basins, and lakes. Note also that the graph does not include every data point presented in the report. Occasionally low concentrations of PAHs were detected in some sediment samples, but the overwhelming majority of the data is represented by that shown on the graph.

The graph plots concentrations of total PAHs, pyrene, and flouranthene from each sample location. From these results, it is clear that the PAH concentrations detected in Lake Druid are generally much lower than concentrations found in stormwater sediments in Florida. Also note the pyrene/flouranthene ratio. In Lake Druid, pyrene and flouranthene are present in (approximately) a 1:1 ratio. This is also true of the majority of the sediments evaluated in the FDEP report.

It is possible that the lower concentrations detected in Lake Druid may in part be due to dilution. Lake Druid, although small, is still larger than typical drainage basins and canals. Nevertheless, the data provide compelling evidence that PAHs detected in Lake Druid are clearly the results of runoff from the surrounding urban environment.

Although not illustrated graphically, comparison of pesticide results between Lake Druid and the FDEP report yielded similar results. DDT and its breakdown products were detected in sample

U4D00103D at a total concentration 6.6 ug/kg, and in the Control at 33.3 ug/kg. These compounds were also present in 17 out of the 20 data points shown in Figure 3, at concentrations up to 39.7 ug/kg. The highest concentration of chlordane (total) in Lake Druid was 7.3 ug/kg. Chlordane was present in 17 of the 20 data points shown on Figure 3, frequently at concentrations above 100 ug/kg.

## CONCLUSION

Lake Druid is a small lake, located in a highly urbanized environment. Major stormwater outfalls are located around the perimeter of the lake, discharging stormwater collected from the surrounding residential neighborhood and the nearby Koger Center office park. No stormwater collected from Area C is discharged directly to the lake.

Comparison of data collected from Lake Druid to available data collected within Florida demonstrates that PAHs and pesticides are present in sediments associated with urban runoff throughout the state. The concentrations detected in Lake Druid are generally much lower than most of the data presented in a recent FDEP report on stormwater sediments.

The concentrations of PAHs and pesticides detected in Lake Druid are consistent with what has been shown to be present in urban stormwater sediments in Florida, and are therefore unrelated to activities conducted by the Navy at Area C and OU 4.

If you should have any questions, or if you wish to discuss this topic further, please do not hesitate to call me at (781) 245-6606.

Very Truly Yours,

**HARDING LAWSON ASSOCIATES**

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## REFERENCES


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Florida Department of Environmental Protection (FDEP), 1998. *Final Report, Characterization of Stormwater Contaminated Sediment and Debris for Determining Proper Disposal Methods*. August 13, 1998.

U.S. Geological Survey (USGS), 1983. Effects of Recharge from Drainage Wells on Quality of Water in the Floridan Aquifer in the Orlando Area, Central Florida. Water-Resources Investigations Report 82-4094. Prepared in cooperation with the Florida Department of Environmental Regulation, Tallahassee, Florida, 1983.

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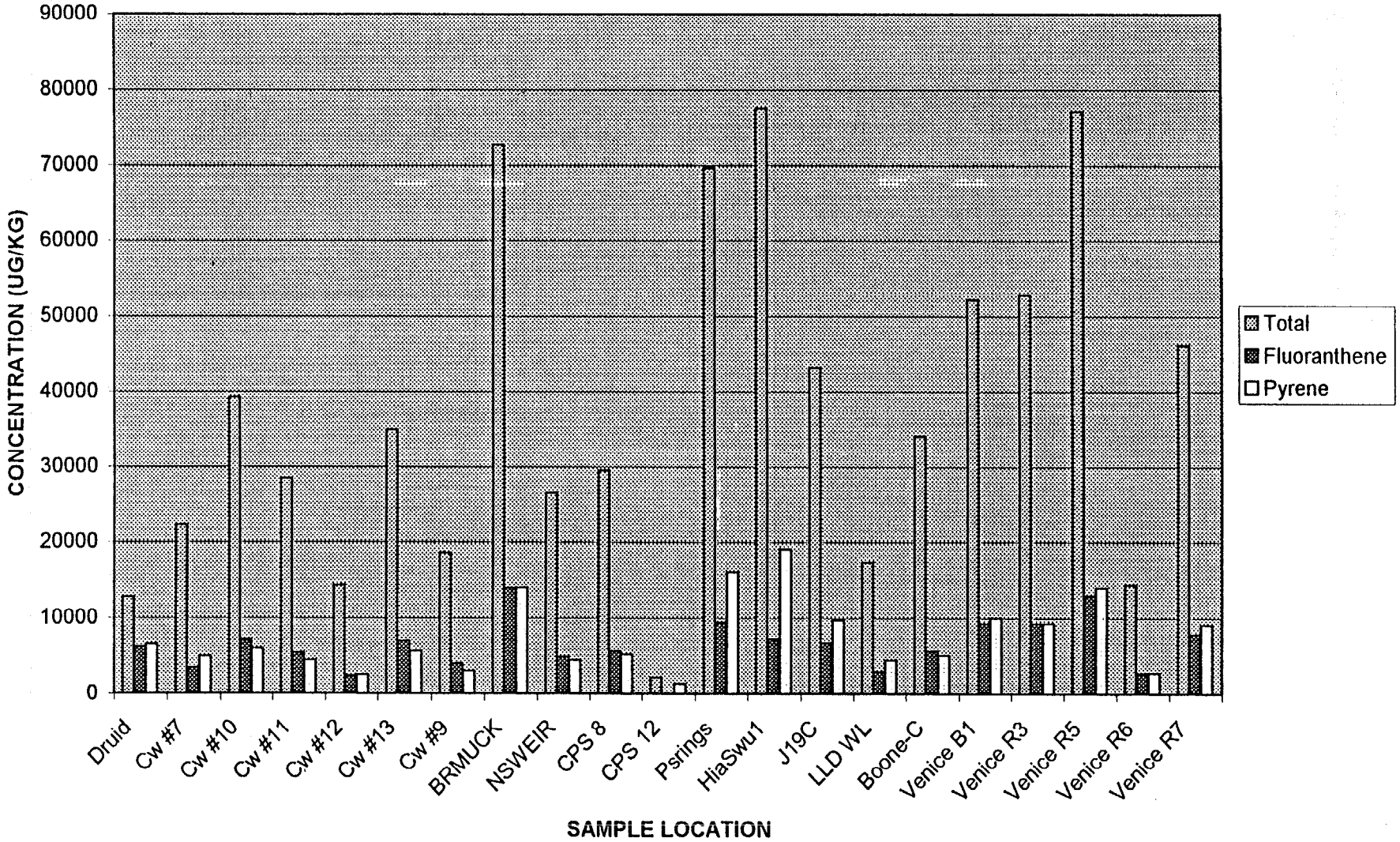
**Figure 3**
**COMPARISON OF PAH DATA**



# TABLE 1
## Summary of Sediment Analytical Results
### Lake Druid

| Sample ID | U4D01003 | U4D01003D | U4D05001 |
|---|---|---|---|
| Lake | Druid | Druid | Druid Control |
| Sampling Date | 10/29/97 | 10/29/97 | 10/29/97 |
| **Volatile Organics, ug/kg** | | | |
| 1,2-Dichloroethene (total) | 480 | 100 | 140 U |
| Tetrachloroethene | 53 U | 59 U | 140 U |
| Toluene | 6 J | 59 U | 140 U |
| Vinyl chloride | 27 J | 59 U | 140 U |
| **Semivolatile Organics, ug/kg** | | | |
| 4-Methylphenol | 1700 U | 59000 U | 4700 U |
| Benzo(a)anthracene | 1700 U | 59000 U | 4700 U |
| Benzo(a)pyrene | 1700 U | 59000 U | 4700 U |
| Benzo(b)fluoranthene | 1700 U | 59000 U | 4700 U |
| Benzo(g,h,i)perylene | 1700 U | 59000 U | 4700 U |
| Benzo(k)fluoranthene | 1700 U | 59000 U | 4700 U |
| bis(2-Ethylhexyl)phthalate | 170 J | 11000 J | 4700 U |
| Butylbenzylphthalate | 1700 U | 59000 U | 4700 U |
| Chrysene | 1700 U | 59000 U | 4700 U |
| Dibenz(a,h)anthracene | 1700 U | 59000 U | 4700 U |
| Di-n-butylphthalate | 1700 U | 59000 U | 4700 U |
| Di-n-octylphthalate | 1700 U | 59000 U | 4700 U |
| Fluoranthene | 1700 U | 6200 J | 4700 U |
| Indeno(1,2,3-cd)pyrene | 1700 U | 59000 U | 4700 U |
| Phenanthrene | 1700 U | 59000 U | 4700 U |
| Pyrene | 200 J | 6600 J | 4700 U |
| **TOTAL PAHs** | **200** | **12800** | **ND** |
| **Pesticides/PCBs, ug/kg** | | | |
| 4,4'-DDD | 17 U | 19 U | 8.1 J |
| 4,4'-DDE | 17 U | 6.6 J | 18 J |
| 4,4'-DDT | 17 U | 19 U | 7.2 J |
| alpha-Chlordane | 2.1 J | 1.9 J | 7.3 J |
| Aroclor-1254 | 70 J | 65 J | 470 U |
| Aroclor-1260 | 170 U | 190 U | 470 U |
| delta-BHC | 5.4 J | 6.7 J | 12 J |
| Dieldrin | 17 U | 19 U | 1.4 J |
| Endosulfan I | 4.2 J | 10 U | 24 U |
| gamma-BHC (Lindane) | 0.54 J | 10 U | 24 U |
| gamma-Chlordane | 8.9 U | 10 U | 24 U |
| Heptachlor | 3.9 J | 1.2 J | 8 J |
| **General Chemistry, mg/kg** | | | |
| Total Organic Carbon | 16000 > | 16000 > | 16000 > |
| Total Petroleum Hydrocarbons | NA | NA | NA |