Report of Flood, Oil Sheen, and Fish Kill Incidents on East Fork Poplar Creek at the Oak Ridge Y-12 Plant

Prepared by the Water Compliance Department of the Environmental Compliance Organization

September 1997

Prepared for the Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 3831
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400
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1.0 INTRODUCTION

The Oak Ridge Y-12 Plant was originally constructed in 1943 by the U.S. Army Corps of Engineers as part of the classified Manhattan Project. The original mission of the Y-12 Plant was to separate fissionable isotopes of uranium by the electromagnetic process. Since 1984, it has been managed by Lockheed Martin Energy Systems, Inc., under contract with the U.S. Department of Energy (DOE).

The current mission of the Oak Ridge Y-12 Plant is to meet the needs of the DOE, other government agencies, and private industry through a commitment to excellence in the utilization of a technology-based manufacturing center. The mission includes production of complex components and assemblies; safe and secure storage of nuclear materials; dismantlement, disposition, evaluation, and assessment of weapons components; transitioning the plant size to meet DOE needs; transfer technology to private industry; maintenance of DOE capabilities; and support of other national priorities.

The Y-12 Plant, Oak Ridge National Laboratory (ORNL), and the K-25 Site are situated on portions of a 34,545-acre federal reservation in the Clinch River drainage basin (Fig. 1-1). Located 3 miles from the population center of the city of Oak Ridge, the main Y-12 Plant site occupies an area of 811 acres in the eastern end of Bear Creek Valley and at the headwaters of the East Fork Poplar Creek (EFPC).

The headwaters of EFPC consist of springs on the northwestern slopes of Chestnut Ridge. The stream originates inside the Y-12 Plant at Outfall 200 at East Fork Kilometer (EFK) 25.1 (Fig. 1-2). The stream reach inside the plant, is confined by 2.6-m-high, vegetated, riprap banks of limestone rock and is approximately 2.4 m wide. The Y-12 Plant is equipped with a 1-ha, synthetically lined, impoundment called Lake Reality at EFK 23.8. Flow from EFPC can be diverted into Lake Reality for spill containment purposes. From Lake Reality, EFPC flows a distance of 23.4 km to its confluence with Poplar Creek, a tributary of the Clinch River. Most of the plant’s 60 outfalls discharge to EFPC between Outfall 200 and Lake Reality. These discharges include once-through cooling water, storm water, steam condensate, groundwater, cooling tower blowdown, sump water, treated groundwater, and treated process wastewater. Outfall 200, is approximately 1.2 km upstream of Lake Reality and is fed by the Y-12 Plant storm sewer system that extends west for approximately 2 km above Outfall 200. Since July 1996, stream flow has been controlled by the addition of approximately four million gallons per day of raw water from the Clinch River. Raw water is added to EFPC at a point approximately 15 m below Outfall 200. The average flow at Station 17 (an in-stream monitoring point at EFK 23.4 and the Y-12 Plant boundary) is maintained at a minimum of 7 MGD.

2.0 CHRONOLOGY OF EVENTS

Wednesday, July 23, 1997

Between 10:30 p.m., July 22, 1997, and 12:50 a.m., July 23, 1997, a localized storm released approximately 6 in. of rain on the Y-12 Plant. Readings from local rain gauges, which are part of the National Oceanic and Atmospheric Administration, Atmospheric Turbulence and Diffusion Division, Regional Atmospheric Measurement and Analytical Network, varied from 1.55 in. at Walker Branch to 4.98 in. at the Oak Ridge Water Treatment Plant on Pine Ridge. A 5-in. rain gauge at Building 9706-2 was checked at approximately 12:50 a.m., and found to be full (approximately 6.25 in.) and running over. Extensive flooding, property damage, and power outages resulted from this storm event. Due to increased flow in EFPC from the storm, raw water addition was stopped. U.S. Geologic Survey (USGS) personnel estimate the peak flow in EFPC, approximately 200 ft downstream of Station 17, to be...
Fig. 1-1. Map of the U.S. Department of Energy Oak Ridge Reservation showing locations of the Y-12 Plant, Oak Ridge National Laboratory (ORNL), and the K-25 Site.
Fig. 1-2. Map of Oak Ridge Y-12 Plant showing selected buildings, East Fork Poplar Creek outfalls and monitoring locations.
967-1,290 MGD. USGS personnel estimate the average daily flow on July 23, 1997, in EFPC at Station 17 to be 80.8 MGD.

At 9:06 a.m., flood conditions were discussed with Tennessee Department of Environment and Conservation (TDEC), DOE Oversight Division personnel; guidance was requested for the discharge of water that had accumulated in building basements. TDEC, DOE Oversight Division personnel visited the Y-12 Plant at approximately 2:00 p.m., to inspect Lake Reality and the upper reach of EFPC to determine the status of flood recovery activities.

Thursday, July 24, 1997

At approximately 10:09 a.m., a sheen was visible on EFPC within the boundary of the Y-12 Plant. A sheen approximately 1 m wide and 15 m long was observed in the distribution channel and on Lake Reality. Twenty geese were present on the island of Lake Reality and were observed with oil coating their feathers. The Tennessee Wildlife Resources Agency (TWRA) was notified, and a wildlife officer was dispatched. A temporary boom and absorbent pads were placed on the creek downstream of Lake Reality. The National Response Center was notified of the oil sheen at 11:00 a.m., Mr. James Francis of the Tennessee Emergency Management Agency (TEMA) was notified at 11:00 a.m., and Mr. Ken Fritts of the Local Emergency Planning Committee (LEPC) was notified at 11:28 a.m. At approximately 11:00 a.m., TDEC, DOE Oversight Division, personnel made a visual inspection of the Y-12 Plant. Oil booms were placed on EFPC at the Lake Reality outlet box, downstream of Outfall 109, and downstream of Outfall 200. Discharge from the diversion channel was closed and the entire flow of EFPC was diverted into Lake Reality to capture the sheen. Mr. Jim Evans of the TWRA observed the geese for signs of sickness; he said that the geese would remove the oil from their feathers by preening. Removal of the oil sheen and debris from Lake Reality and the diversion channel using absorbent pads continued through Saturday, August 2, 1997. The origin and quantity of oil released during this incident are uncertain. No oil sheens were observed off site due to this incident. As of August 15, 1997, no adverse effects to the geese were observed.

At approximately 1:30 p.m., raw water addition to EFPC resumed. At 1:48 p.m., Utilities Department personnel received an alarm indicating dissolved oxygen (DO) levels of 3.07 mg/L in EFPC at Monitoring Station 8 (Building 9422-3), south of Building 9201-2. At 1:55 p.m., Utilities Department personnel arrived at Station 8 and observed dead fish and increased the raw water flow to increase oxygen levels in the creek. At 2:11 p.m., the Y-12 Plant Shift Superintendent (PSS) notified the Y-12 Plant Spill Response Coordinator of a potential fish kill incident. At 2:19 p.m., the alarm from Station 8 cleared and DO levels were measured at 5.15 mg/L. At approximately 2:20 p.m., ORNL aquatic biologists were notified of the fish kill incident, and a fish survey was requested. ORNL aquatic biologists arrived at approximately 2:45 p.m. and began conducting surveys along EFPC to determine the extent of the fish kill. At 2:37 p.m., workers reported to the PSS observing dead fish in EFPC behind Building 9201-1. At 2:45 p.m., Y-12 Plant personnel notified DOE Y-12 Site Office personnel of the fish kill and requested a conference call notification to TDEC, DOE Oversight Division personnel. At 3:00 p.m., Y-12 Plant personnel notified Ms. Renee Parker, of the TDEC, DOE Oversight Division, of the fish kill.

Notification of the fish kill was made by the PSS to Mr. Danny Anderson of TEMA at 3:25 p.m.; Mr. Ken Fritts of the LEPC at 3:38 p.m.; and Ms. Renee Parker of the TDEC, DOE Oversight Division, at 3:40 p.m. At 3:45 p.m., TDEC, DOE Oversight Division personnel, arrived at the Y-12 Plant to begin an investigation of the fish kill. At 4:00 p.m., Lake Reality discharge was isolated, and the flow of raw water into EFPC was stopped. At 6:00 p.m., plant management and ORNL aquatic biologists met to
discuss the event and review the data obtained from sampling. Utilities personnel reported a malfunction in the feed system that supplies sodium bisulfite to dechlorinate raw water. ORNL scientists estimated that 30 kg of sodium bisulfite was released to EFPC when the raw water addition was restarted. The information analyzed indicated that DO levels in upper EFPC had returned to normal by 3:00 p.m. The malfunctioning feed system was administratively controlled until repaired on September 8, 1997. Approximately 24,000 fish were killed in this incident in upper EFPC. No impacts were observed off site due to this incident.

3.0 ENVIRONMENTAL MONITORING RESULTS

3.1 Building and Secondary Containment Structures

Twelve buildings experienced flooding in basements and low areas. One facility flooded was Building 9418-1, which contains a 14,000-gal Z-Oil tank. Now inactive, this tank was once part of the Y-12 Plant Z-Oil system, a massive heat-transfer system that once connected several buildings and used mineral oil as a coolant. Components of the inactive system were drained; however, some residual oil remains. Flooding of the building caused the tank to float in its dike, pushing the building off the foundation. Water in this dike was collected and treated at an on-site wastewater treatment facility.

Flood water from three buildings was discharged under a Best Management Practices Plan: Buildings 9201-1, 9201-3, and 9404-7. Water from Buildings 9204-1, 9720-12, 9733-3, and 9733-4 was not discharged. Water from Buildings 9215 and 9815 was collected and treated at on-site wastewater treatment facilities.

Water in the basement of Building 9201-2 was discharged through a filter via Outfall 055 to EFPC, bypassing the East End Mercury Treatment Facility (EEMTF), Outfall 550, as allowed by the National Pollutant Discharge Elimination System (NPDES) Permit. The discharge resumed through Outfall 550 at 12:00 p.m., Wednesday, July 30, 1997.

Some water in the basement of Building 9204-3 was discharged to EFPC via Outfall 200 before environmental monitoring took place. However, the discharge was stopped; after environmental monitoring was conducted, the remaining water was collected and treated at an on-site wastewater treatment facility.

Due to the storm, 28 secondary containment dikes were sampled July 23–29, 1997. Of the 28 dikes sampled, 27 were sampled and released under normal procedures. One secondary containment dike was collected and treated at an on-site wastewater treatment facility.

3.2 East Fork Poplar Creek Monitoring

Wednesday, July 23, 1997

At 6:20 a.m., samples were taken at Lake Reality inlet and Lake Reality outlet and analyzed for polychlorinated biphenyls (PCBs). PCBs at these locations were less than the detection limit of 0.5 µg/L. Analytical data and field readings are presented in Appendix A.

At 9:00 a.m., a routine, 24-h composite sample was collected at Station 17 (Building 9422-1). This sample represented the 24-h period including the 6-in. storm. This sample was analyzed for mercury, ammonia as nitrogen, total suspended solids, and inductively coupled plasma (ICP) metals, which
include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, phosphorus, potassium, selenium, silver, sodium, strontium, thallium, thorium, titanium, vanadium, zinc, and zirconium. The mercury result was 0.0028 mg/L. This result is elevated as compared with 0.00042 mg/L, the mercury result measured at Station 17 on July 21, 1997, prior to the storm. Aluminum, copper, iron, manganese, and suspended solids were slightly elevated as compared with dry weather, but were typical for storm events. All other parameters were within normal ranges.

A grab sample for mercury was collected at 9:00 a.m., at Station 17. The result was 0.0034 mg/L. See Fig. 3-1 for a graphical representation of mercury concentrations at Station 17 before and after the flood event.

At 9:00 a.m., a 7-day composite sample was collected at Station 17. Uranium and radiochemical analysis were performed to determine activities of the following radionuclides: americium-241, curium-243/244, neptunium-237, plutonium-238, plutonium-239/240, thorium-228, thorium-230, thorium-232, thorium-234, uranium-234, uranium-235, uranium-238, cesium-137, cobalt-60, potassium-40, radium-228, technetium-99, strontium-89/90, and tritium. Alpha activity, beta activity, gamma activity, and total radium alpha activity were also determined. All activities for this sample were either below the minimum detectable activity, less than 3 percent of the DOE derived concentration guidelines, or within normal ranges.

At 9:50 a.m., a 7-day composite sample was collected at Station 8 (Building 9422-3). Uranium and radiochemical analysis were conducted. All activities for this sample were either below the minimum detectable activity, less than 3 percent of the DOE derived concentration guidelines, or within normal ranges.

**Thursday, July 24, 1997**

At 9:50 a.m., a 24-h composite sample was collected at Station 17. The sample was analyzed for mercury, ammonia as nitrogen, total suspended solids, and ICP metals. The mercury result was 0.0019 mg/L. Copper, iron, lithium, manganese, ammonia as nitrogen, and total suspended solids were slightly elevated as compared with dry weather, but they were probably elevated due to the storm event. A grab sample for mercury was also collected at Station 17 at 9:50 a.m., and the result was 0.00090 mg/L. This result is elevated, but it is believed to be a result of the storm event.

At 2:10 p.m., a 24-h composite sample was collected at Station 8. The sample was analyzed for mercury, ammonia as nitrogen, total suspended solids, and ICP metals. The mercury result was 0.0030 mg/L. Aluminum, copper, lithium, manganese, zinc, and total suspended solids were slightly elevated compared with dry weather values; however, this is believed to be a result of the storm event.

At approximately 2:15 p.m., field measurements for chlorine and DO were taken at various points along the creek to make a profile. Samples were also collected for sulfite analysis. Data were collected at the following locations: Outfall 200, Station 8, in-stream at Outfall 054, in-stream at Outfall 055, in-stream at Outfall 021, Station 17, and in-stream below Station 17. According to this profile, DO had returned to normal levels at all locations except Station 8, in-stream at Outfall 055, and in-stream at Outfall 021. The DO values at Station 8, in-stream at Outfall 055, and in-stream at Outfall 021 were 3.9 mg/L, 5.8 mg/L, and 5.5 mg/L, respectively. Sulfate data were elevated at Station 8 and Outfall 021 also. Chlorine data were normal. These data are consistent with a release of excess sodium bisulfite.
Fig. 3-1. Mercury concentrations from grab samples taken at Station 17 from July 1 to August 8, 1997.
ORNL aquatic biologists arrived at approximately 2:45 p.m. to conduct surveys along EFPC to determine the extent of the fish kill. Surveys continued until 6:00 p.m., when it was determined that the relative extent of the kill had been determined and the actual toxic episode had passed and fish were no longer dying. A complete survey was conducted the following day. See Appendix B for detailed information regarding these surveys. The large number of dead fish precluded an actual count of dead fish retrieved from surveys. The survey activities produced more than ten, 5-gal buckets of dead fish. To determine how these volumes of fish translated into fish numbers, a subsample from the first day’s surveys was counted. Approximately 2.5 gal of fish were identified to species and counted. This count was then applied to subsequent collections of fish to provide a number estimate. Although every effort was applied to randomly subsample the 10-gal source, the possibility exists that these numbers are skewed and should be used with caution. However, given the sheer numbers of dead fish collected, no other alternative appeared reasonable. This subsample approach has been recommended by the American Fisheries Society (AFS) in a publication on investigations of fish kills (AFS Publication 24, 1992). Table 3-1 contains an estimate, by species, of the fish killed by the July 24, 1997, incident.

Table 3-1. Estimate of species killed in upper East Fork Poplar Creek on July 24, 1997

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central stoneroller (<em>Campostoma ancmatum</em>)</td>
<td>12,650</td>
</tr>
<tr>
<td>Striped shiner (<em>Luxilus chrysocephalus</em>)</td>
<td>1,663</td>
</tr>
<tr>
<td>Blacknose dace (<em>Rhinichthys atratulus</em>)</td>
<td>9,751</td>
</tr>
<tr>
<td>Redbreast sunfish (<em>Lepomis auritus</em>)</td>
<td>68</td>
</tr>
<tr>
<td>Estimated Total</td>
<td>24,132</td>
</tr>
</tbody>
</table>

At 3:00 p.m., field measurements for pH, conductivity, temperature and DO were taken at the following locations along EFPC to make a second profile: In-stream at Outfall 021, in-stream at Outfall 055, Station 17, in-stream at Station 17, and in-stream below Station 17. Values for conductivity were elevated; however, all other parameters measured were within an acceptable range.

At 3:10 p.m., a routine sample was collected at Outfall 055 while the EEMTF was in bypass operation. The value for mercury was measured at 0.0047 mg/L. This value exceeded the NPDES permit limit for mercury at Outfall 055 (0.004 mg/L).

At approximately 4:30 p.m., a third profile was conducted for DO at the following locations along EFPC: Outfall 200, raw water addition, Station 8, in-stream at Station 8, in-stream at Outfall 054, in-stream at Outfall 021, Lake Reality inlet, Lake Reality outlet, and Station 17. DO had returned to normal at all locations.

Friday, July 25, 1997

At 8:50 a.m., a 24-h composite sample was collected at Station 17. The sample was analyzed for mercury, ammonia as nitrogen, total suspended solids, and ICP metals. The mercury result was 0.0019 mg/L. Lithium and manganese were slightly elevated as compared with dry weather; however,
this is probably due to the storm event. All other parameters were within normal ranges. A grab sample for mercury was also collected at Station 17 at 8:50 a.m. The result was 0.0013 mg/L.

At approximately 9:15 a.m., samples were collected at Lake Reality inlet, Lake Reality outlet, and Outfall 201 for acute toxicity testing using *Ceriodaphnia dubia* and fathead minnow (*Pimephales promelas*) larvae. The tests were conducted by ORNL, Aquatic Toxicology Laboratory personnel. Water from these three locations was not toxic to *Ceriodaphnia* or fathead minnows. The 48-h LC₉₀'s for each species were greater than 100 percent. TDEC, DOE Oversight Division personnel also collected samples at these locations for independent toxicity testing.

A 9:30-a.m. a grab sample collected at Lake Reality outlet was analyzed for uranium, alpha activity, and beta activity. The results were within normal ranges.

At 10:25 a.m., a fourth profile was conducted for pH, temperature and DO at the following locations on EFPC: raw water addition, Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were within normal ranges during this profile.

An 11:00-a.m. sample collected at Outfall 201 was analyzed for uranium, alpha activity, and beta activity. The results were within normal ranges.

At approximately 1:00 p.m., Y-12 Public Affairs personnel released a media advisory regarding the fish kill. The advisory indicated that 8,200 dead fish had been collected as of July 24, 1997, and that a significantly higher total fish count was possible once all the fish had been collected.

At 1:05 p.m., a fifth profile was conducted for pH, temperature and DO at the following locations on EFPC: raw water addition, Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were within normal ranges during this profile.

At 1:35 p.m., a 24-h composite sample was collected at Station 8. The sample was analyzed for mercury, ammonia as nitrogen, total suspended solids, and ICP metals. The mercury result was 0.0021 mg/L. All other parameters were within normal ranges.

TDEC, DOE Oversight Division personnel returned to Lake Reality at approximately 2:30 p.m. to collect a sample for oil and grease analysis. Y-12 Plant personnel also collected a sample and analyzed it for oil and grease and PCBs. The sample was collected near the raft at Lake Reality. The sample was collected by skimming the water surface to collect as much of the sheen as possible. The result for oil and grease was 32.3 mg/L, and PCBs were measured at 1.4 μg/L in this sample.

A 2:55-p.m. sample collected at the Lake Reality inlet was analyzed for uranium, alpha activity, and beta activity. The results were within normal ranges.

**Saturday, July 26, 1997**

At approximately 8:00 a.m., a routine sample from Station 17, was collected and analyzed for mercury, ammonia, suspended solids, and ICP metals. The mercury concentration was measured at 0.00098 mg/L. This value is probably related to the flood event. All other parameters were within normal ranges.
At 8:00 a.m., a sixth profile was conducted for pH, conductivity, DO, and chlorine at the following locations on EFPC: raw water addition in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were normal during this profile.

At approximately 8:45 a.m., a routine sample was collected from Station 8 and analyzed for mercury, ammonia, suspended solids, and ICP metals. The sample was a 19-h composite sample. The mercury concentration was measured at 0.0011 mg/L. This value is elevated from what is typically measured at Station 17; however, this is probably related to the flood event. All other parameters were within normal ranges.

At 10:10 a.m., a seventh profile was conducted for pH, conductivity, DO, and chlorine at the following locations on EFPC: raw water addition, in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were normal.

At 3:00 p.m., an eighth profile was conducted for temperature, pH, conductivity, DO, and chlorine at the following locations on EFPC: raw water addition, in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were normal.

Sunday, July 27, 1997

At 7:55 a.m., a ninth profile was conducted for temperature, pH, conductivity, DO, and chlorine at the following locations on EFPC: raw water addition, in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were normal.

A routine sample at Station 17 was collected at 7:55 a.m. from Station 17 and analyzed for mercury, ammonia, suspended solids, and ICP metals. The sample was a 24-h composite sample. The mercury concentration was measured at 0.00089 mg/L. This value is elevated from what is typically measured at Station 17; however, this is probably related to the flood event. All other parameters were within normal ranges.

A 24-h composite sample was collected at Station 8 at approximately 8:49 a.m. and analyzed for mercury, ammonia, suspended solids, and ICP metals. The mercury concentration was measured at 0.00081 mg/L. This value is elevated from what is typically measured at Station 17; however, this is probably related to the flood event. All other parameters were within normal ranges.

At 10:05 a.m., a tenth profile was conducted for temperature, pH, conductivity, DO, and chlorine at the following locations on EFPC: raw water addition, in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, and Station 17. All parameters were normal.

Monday, July 28, 1997

A 24-h composite sample was collected at 8:50 a.m. at Station 17, and analyzed for mercury, ammonia, suspended solids, and ICP metals. The mercury concentration was measured at 0.00071 mg/L. This value is elevated from what is typically measured at Station 17; however, this is probably related to the flood event. All other parameters were within normal ranges.

A 24-h composite sample was collected at 9:30 a.m. at Station 8, and analyzed for mercury, ammonia, suspended solids, and ICP metals. The mercury concentration was measured at
0.00076 mg/L. This value is elevated from what is typically measured at Station 17; however, this is probably related to the flood event. All other parameters were within normal ranges.

**Tuesday, July 29, 1997**

At approximately 10:45 a.m., the last profile was conducted for DO at the following locations on EFPC: raw water addition, in-stream at Station 8, Lake Reality diversion channel, in-stream below Lake Reality, Station 17, and in-stream below Station 17. DO levels measured were normal during this profile.

**4.0 OTHER TESTING**

To evaluate the effects of sodium bisulfite (and resulting low DO) on aquatic life in EFPC, a laboratory simulation was conducted on fathead minnows by ORNL aquatic biologists. The bisulfite concentrations in EFPC at the time of the fish kill were estimated by using a feed rate of 0.7 gal/h, a solution of 30 percent sodium bisulfite released for 37 h into a 2,800-gal energy dissipation chamber, then released at once to EFPC. Using the results of the laboratory simulation, it is believed that fish near the discharge point would have been exposed to a concentration of approximately 1.55 g/L sodium bisulfite at pH values of 5.5 to 6 for 1 to 5 min in water totally devoid of DO. The concentration of DO in the laboratory tests was 0 mg/L within 1 min. Laboratory tests of fathead minnows revealed that low DO and reduced pH potentiated the toxicity of the sodium bisulfite. According to aquatic biologists at ORNL, the amount of sodium bisulfite added to EFPC on July 24, 1997, appears capable of causing rapid fish mortality. For more information regarding the sodium bisulfite toxicity tests, see Appendix C.
APPENDIX A

MONITORING DATA
Table A-1. Field readings for East Fork Poplar Creek on July 24, 1997 from 2:10-3:50 p.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>Chlorine (mg/L)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 200</td>
<td>&lt;0.05</td>
<td>6.8</td>
<td>15:00</td>
</tr>
<tr>
<td>Station 8</td>
<td></td>
<td>3.9</td>
<td>14:10</td>
</tr>
<tr>
<td>In-stream at Outfall 054</td>
<td>&lt;0.05</td>
<td>7.5</td>
<td>15:15</td>
</tr>
<tr>
<td>In-stream at Outfall 055</td>
<td></td>
<td>5.8</td>
<td>14:50</td>
</tr>
<tr>
<td>In-stream at Outfall 021</td>
<td>&lt;0.05</td>
<td>5.5</td>
<td>15:05</td>
</tr>
<tr>
<td>Station 17</td>
<td></td>
<td>7.0</td>
<td>15:35</td>
</tr>
<tr>
<td>In-stream below Station 17</td>
<td></td>
<td>6.8</td>
<td>15:50</td>
</tr>
</tbody>
</table>

Table A-2. Field readings for East Fork Poplar Creek on July 24, 1997 from 3:00-3:50 p.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Temp. (°C)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-stream at Outfall 021</td>
<td>7.4</td>
<td>450</td>
<td>26.8</td>
<td>5.5</td>
<td>15:00</td>
</tr>
<tr>
<td>In-stream at Outfall 055</td>
<td></td>
<td></td>
<td></td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>Station 17</td>
<td>7.0</td>
<td>400</td>
<td></td>
<td>7.5</td>
<td>15:25</td>
</tr>
<tr>
<td>In-stream at Station 17</td>
<td>7.6</td>
<td>400</td>
<td>27.6</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>In-stream below Station 17</td>
<td></td>
<td></td>
<td></td>
<td>6.8</td>
<td>15:50</td>
</tr>
</tbody>
</table>
Table A-3. Field readings for East Fork Poplar Creek on July 24, 1997 from 4:44-5:32 p.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 200</td>
<td>6.6</td>
<td>16:44</td>
</tr>
<tr>
<td>Raw water addition</td>
<td>6.2</td>
<td>16:48</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>6.9</td>
<td>16:54</td>
</tr>
<tr>
<td>Station 8</td>
<td>7.2</td>
<td>16:54</td>
</tr>
<tr>
<td>In-stream at Outfall 054</td>
<td>6.9</td>
<td>17:00</td>
</tr>
<tr>
<td>In-stream at Outfall 021</td>
<td>6.9</td>
<td>17:06</td>
</tr>
<tr>
<td>Lake Reality inlet</td>
<td>7.3</td>
<td>17:14</td>
</tr>
<tr>
<td>Lake Reality outlet</td>
<td>6.5</td>
<td>17:23</td>
</tr>
<tr>
<td>Station 17</td>
<td>6.1</td>
<td>17:32</td>
</tr>
</tbody>
</table>

Table A-4. Field readings for East Fork Poplar Creek on July 25, 1997 from 10:25-11:30 a.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Temp. (°C)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.0</td>
<td>18.3</td>
<td>6.5</td>
<td>10:25</td>
</tr>
<tr>
<td>Raw water addition</td>
<td>7.0</td>
<td>18.1</td>
<td>7.0</td>
<td>10:40</td>
</tr>
<tr>
<td>Raw water addition</td>
<td>7.1</td>
<td>18.1</td>
<td>7.0</td>
<td>10:45</td>
</tr>
<tr>
<td>Station 8</td>
<td>7.4</td>
<td>25.4</td>
<td>7.2</td>
<td>11:00</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.5</td>
<td>26.0</td>
<td>8.5</td>
<td>11:10</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.3</td>
<td>25.6</td>
<td>6.9</td>
<td>11:20</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.3</td>
<td>25.6</td>
<td>6.8</td>
<td>11:30</td>
</tr>
</tbody>
</table>
Table A-5. Field readings for East Fork Poplar Creek on July 25, 1997 from 1:05-1:45 p.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Temp. (°C)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.4</td>
<td>17.5</td>
<td>7.7</td>
<td>13:05</td>
</tr>
<tr>
<td>Station 8</td>
<td>7.4</td>
<td>22.0</td>
<td>7.8</td>
<td>13:15</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.7</td>
<td>25.5</td>
<td>8.3</td>
<td>13:25</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.6</td>
<td>26.0</td>
<td>7.7</td>
<td>13:30</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.7</td>
<td>26.0</td>
<td>7.8</td>
<td>13:45</td>
</tr>
</tbody>
</table>

Table A-6. Field readings for East Fork Poplar Creek on July 26, 1997 from 8:00-9:00 a.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Chlorine (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.2</td>
<td>210</td>
<td>7.7</td>
<td>&lt;0.05</td>
<td>09:00</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>7.4</td>
<td>290</td>
<td>7.7</td>
<td>&lt;0.05</td>
<td>08:45</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.4</td>
<td>310</td>
<td>7.7</td>
<td>&lt;0.05</td>
<td>08:25</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.4</td>
<td>320</td>
<td>7.4</td>
<td>&lt;0.05</td>
<td>08:10</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.4</td>
<td>320</td>
<td>7.1</td>
<td>&lt;0.05</td>
<td>08:00</td>
</tr>
</tbody>
</table>
Table A-7. Field readings for East Fork Poplar Creek on July 26, 1997 from 10:10-10:49 a.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Chlorine (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.2</td>
<td>215</td>
<td>6.6</td>
<td>0.01</td>
<td>10:49</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>7.2</td>
<td>290</td>
<td>6.9</td>
<td>0.04</td>
<td>10:42</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.3</td>
<td>325</td>
<td>7.6</td>
<td>0.01</td>
<td>10:31</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.7</td>
<td>325</td>
<td>7.0</td>
<td>0.01</td>
<td>10:25</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.4</td>
<td>330</td>
<td>6.9</td>
<td>0.06</td>
<td>10:10</td>
</tr>
</tbody>
</table>

Table A-8. Field readings for East Fork Poplar Creek on July 26, 1997 from 3:00-4:30 p.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Chlorine (mg/L)</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.4</td>
<td>220</td>
<td>7.3</td>
<td>&lt;0.05</td>
<td>18.5</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>7.7</td>
<td>310</td>
<td>8.8</td>
<td>&lt;0.05</td>
<td>22.6</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.9</td>
<td>325</td>
<td>9.0</td>
<td>&lt;0.05</td>
<td>26.1</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>8.0</td>
<td>355</td>
<td>8.4</td>
<td>&lt;0.05</td>
<td>26.2</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.9</td>
<td>350</td>
<td>7.5</td>
<td>&lt;0.05</td>
<td>26.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Chlorine (mg/L)</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.1</td>
<td>210</td>
<td>7.6</td>
<td>0.04</td>
<td>16.0</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>7.2</td>
<td>280</td>
<td>7.2</td>
<td>0.03</td>
<td>20.7</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.3</td>
<td>310</td>
<td>7.0</td>
<td>0.02</td>
<td>21.1</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.4</td>
<td>310</td>
<td>7.6</td>
<td>0.02</td>
<td>20.5</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.4</td>
<td>320</td>
<td>6.9</td>
<td>0.06</td>
<td>22.1</td>
</tr>
</tbody>
</table>

Table A-10. Field readings for East Fork Poplar Creek on July 27, 1997 from 10:05-10:50 a.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>Conductivity (umhos)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Chlorine (mg/L)</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.2</td>
<td>205</td>
<td>8.0</td>
<td>0.01</td>
<td>16.2</td>
</tr>
<tr>
<td>Station 8</td>
<td>7.3</td>
<td>290</td>
<td>7.8</td>
<td>0.05</td>
<td>21.5</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.4</td>
<td>310</td>
<td>7.4</td>
<td>0.02</td>
<td>22.4</td>
</tr>
<tr>
<td>In-stream below Lake Reality</td>
<td>7.5</td>
<td>285</td>
<td>8.5</td>
<td>0.02</td>
<td>21.1</td>
</tr>
<tr>
<td>Station 17</td>
<td>7.5</td>
<td>320</td>
<td>7.6</td>
<td>0.06</td>
<td>22.3</td>
</tr>
</tbody>
</table>
Table A-11. Field readings for East Fork Poplar Creek on July 29, 1997 from 10:45-11:09 a.m.

<table>
<thead>
<tr>
<th>Location</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw water addition</td>
<td>7.4</td>
<td>10:45</td>
</tr>
<tr>
<td>In-stream at Station 8</td>
<td>7.6</td>
<td>10:50</td>
</tr>
<tr>
<td>Lake Reality diversion channel</td>
<td>7.9</td>
<td>10:55</td>
</tr>
<tr>
<td>Lake Reality outlet</td>
<td>6.4</td>
<td>11:00</td>
</tr>
<tr>
<td>Station 17</td>
<td>6.6</td>
<td>11:05</td>
</tr>
<tr>
<td>In-stream below Station 17</td>
<td>6.4</td>
<td>11:09</td>
</tr>
</tbody>
</table>
Customer: K G HANZELKA

Customer: UNCLASSIFIED

Matrix: WATER

Sample Description: 94221

Chain of Custody No: 199705300056

Protocol: NORE

Charge Number: S2211001

Sampler(s):

Date/Time Sampled: 07/21/97 08:20:00

Date/Time Received: 07/21/97 09:59:55

Date/Time Needed: 08/04/97 23:59:59

Date/Time Completed: 07/30/97 16:39:42

Date/Time Approved: 07/30/97 16:39:42

Sample Status: APPROVED

Sample Approver:

<><< Inorganic >>>>

Test: HG2451

Rpt Basis: As-Received

Test Req Cnt: 01

Analysis Meth: EPA -245.1 Mar90

Approver: D E HASTE

QC Batch/File: QC97211061/97209J

Analyte Id  Analyte Name
7439976  Mercury

HT  Lim  Fr  Dil Factor  Result  Dual  Conf  Unit
  1  0.00042

***** END OF REPORT *****

UNCLASSIFIED
### Official Report

**Customer:**

- **Smpl Id:** 199705300057
- **Location:** 942:1
- **Chain of Custody No.:** NONE
- **Charge Number:** S2211001

**Sample Description:**
- **Charge Nunber:** S2211001
- **Sample Status:** APPROVED

**Sample Approver:**

**Customer Comments:**

**Lab Comments:**

---

### Inorganic

- **Test:** HG2451
- **Test Basis:** As-Received
- **Test Req Cnt:** 01
- **Analysis Meth:** EPA -245.1 War90
- **Prep Method/Date:**
- **Test Status:** APPROVED
- **HT Deadline:** 08/19/97 08:20:00
- **Date/Time Analyzed:** 07/30/97 12:29:02
- **Lab Group:** IKAA-1

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<th>Analyte Name</th>
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<th>Lim</th>
<th>Dilu Factor</th>
<th>Result</th>
<th>EPA Qual</th>
<th>Confidence Unit</th>
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</thead>
<tbody>
<tr>
<td>7439976</td>
<td>Mercury</td>
<td>T1</td>
<td></td>
<td></td>
<td>0.00045</td>
<td></td>
<td>mg/L</td>
</tr>
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</table>

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***** END OF REPORT *****

UNCLASSIFIED
<table>
<thead>
<tr>
<th>SUBMITTER</th>
<th>ADDRESS</th>
<th>CUSTOMER ID</th>
<th>REQ NO</th>
<th>SAMPLE NO</th>
<th>MTC</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shedden, R M</td>
<td>Building 9116</td>
<td>M.S.8098</td>
<td></td>
<td>E97204000</td>
<td>8601</td>
<td>APPROVED</td>
</tr>
</tbody>
</table>

**DATE SAMPLED:** 07/23/97 05:00:00  
**DATE NEEDED:** 07/23/97  
**DATE RECEIVED:** 07/23/97  
**DATE COMPLETED:** 07/23/97  
**LOCATION:** 9422-7 Flooding  
**CHARGE #:** S2211401  
**CASE:**  
**SAMPLE DESCRIPTION:** grab  
**FINAL APPROVAL:**  

**COMMENTS:** RUSH. CALL MARK SHEDDEN WITH RESULTS 241-2585

**TEST:** MS-U  
**PREP MTH:** Total U and Pu235 by Mass Spec  
**PROC MTH:** Y/P65-71/6  
**PHASE:**  
**RESULT**  
**CONFIDENCE**  
**UNIT**  

<table>
<thead>
<tr>
<th>CAS NUMBER</th>
<th>DETERMINATION</th>
<th>DT</th>
<th>RESULT</th>
<th>CONFIDENCE</th>
<th>UNIT</th>
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</thead>
<tbody>
<tr>
<td>7440611</td>
<td>Uranium</td>
<td>0.005</td>
<td>mg/L</td>
<td>+/-0.05</td>
<td></td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
<td>0.54</td>
<td>mg/L</td>
<td>+/-0.05</td>
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</tr>
</tbody>
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**TEST:** PCBx20  
**PREP MTH:** Gas Chromatography, PCBs in Water  
**PROC MTH:** EPA 608  
**PHASE:**  
**RESULT**  
**CONFIDENCE**  
**UNIT**  

<table>
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<tr>
<th>CAS NUMBER</th>
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<th>DT</th>
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<th>CONFIDENCE</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>1336363</td>
<td>PCB -</td>
<td>28.2</td>
<td>ug/L</td>
<td>Y</td>
<td></td>
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<tr>
<td>12674112</td>
<td>PCB1016</td>
<td>28.2</td>
<td>ug/L</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>11104282</td>
<td>PCB1221</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11141165</td>
<td>PCB1232</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53469219</td>
<td>PCB1242</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>12672296</td>
<td>PCB1248</td>
<td>N</td>
<td></td>
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<tr>
<td>11097691</td>
<td>PCB1254</td>
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<tr>
<td>11096825</td>
<td>PCB1260</td>
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<td></td>
<td></td>
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Customer Sample ID: INLET
Customer: B J BROWN

Matrix: WATER
Sample Description: WATER
Location: LAKE REALITY / INLET
Chain of Custody No: 12406
Protocol: NJ3E
Charge Number: S22111401
Sampler(s):

Date/Time Sampled: 07/23/97 06:20:00
Date/Time Received: 07/25/97 13:41:05
Date/Time Needed: 07/28/97 25:59:59
Date/Time Completed: 07/28/97 08:12:43
Date/Time Approved: 07/28/97 08:12:43
Sample Status: APPROVED

Customer Comments: 4 HOUR TURN AROUND !

Lab Comments:

----- Organic -------

Test: PCB608
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -608 Jul82
Approver: T T ADAMS
QC Batch/File:

<table>
<thead>
<tr>
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<th>Analyte Name</th>
<th>Cust</th>
<th>HT</th>
<th>Lin</th>
<th>Fn</th>
<th>Dil Factor</th>
<th>Result</th>
<th>Qual</th>
<th>Confidence</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>12674112</td>
<td>Aroclor-1016</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11104282</td>
<td>Aroclor-1221</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
<td></td>
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<td>11141165</td>
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<td>1</td>
<td>1</td>
<td>0.5</td>
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<td>ug/L</td>
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<td>53469219</td>
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<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12672296</td>
<td>Aroclor-1248</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
<td></td>
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<tr>
<td>11097691</td>
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<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
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<td>11096625</td>
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<td>ug/L</td>
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Test Name: Polychlorinated Biphenyls by GC
Prep Method/Date: EPA -608 Jul82 07/25/97 14:00:00
Test Status: APPROVED
HT Deadline: 09/03/97 14:00:00
Date/Time Analyzed: 07/25/97 17:00:00
Lab Group: NYSTI

----- END OF REPORT -----
**Customer Comments:** 4 HOUR TURN AROUND!

<table>
<thead>
<tr>
<th>Analyte Id</th>
<th>Analyte Name</th>
<th>MT Lim</th>
<th>Dilu Factor</th>
<th>Result</th>
<th>EPA</th>
<th>Confidence Unit</th>
</tr>
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<tbody>
<tr>
<td>12674112</td>
<td>Aroclor-1016</td>
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<td>&lt; 0.5</td>
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<td>&lt; 0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
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<td>Aroclor-1232</td>
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<td>&lt; 0.5</td>
<td>&lt; 0.5</td>
<td>ug/L</td>
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<td>11097601</td>
<td>Aroclor-1254</td>
<td>01</td>
<td>&lt; 0.5</td>
<td>&lt; 0.5</td>
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<td>11096625</td>
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***** END OF REPORT *****

UNCLASSIFIED
Patient: Y-EC-HSEA SERV
8601
BLDG 9116, MS 8098 (423)574-1599

Sample ID: 199705300017
K G HANZELKA
Customer: smpl
Location: 94221
Chain of Custody No: .
Date/Time Received: 07/23/97 09:00:00
Date/Time Approved: 08/08/97 15:01:21

Matrix: WATER
Sample Description: Mercury in Water/Waste by CVAAS

Analyte Id Analyte Name
7439976 Mercury

Cust HT Lim Fn Dilu Factor Result EPA Qual Confidence Unit
1 0.0028 mg/L

Test Name: Mercury in Water/Waste by CVAAS
Prep Method/Date: APPROVED
HT Deadline: 08/20/97 09:00:00
Date/Time Analyzed: 07/30/97 13:08:35
Lab Group: IYICPZ

Analyte Id Analyte Name
7440360 Antimony
7440382 Arsenic
7440393 Barium
7440417 Beryllium
7440428 Boron
7440439 Cadmium
7440702 Calcium
7440473 Chromium
7440484 Cobalt
7440508 Copper
7459896 Iron
7439921 Lead
7439932 Lithium
7439954 Magnesium
7439965 Manganese
7439987 Molybdenum
7440020 Nickel
7440031 Niobium
7723160 Phosphorus
7440097 Potassium
7782492 Selenium
7440224 Silver
7440235 Sodium
7440246 Strontium
7440280 Thallium
7440291 Thorium
7440326 Titanium
7440622 Vanadium
7440666 Zinc
7440677 Zirconium

Cust HT Lim Fn Dilu Factor Result EPA Qual Confidence Unit
0.2 1.60 mg/L
0.2 < 0.4 mg/L
0.2 < 0.4 mg/L
0.2 0.0637 mg/L
0.2 < 0.0004 mg/L
0.2 < 0.006 mg/L
0.2 < 0.002 mg/L
0.2 0.012 mg/L
0.2 2.17 mg/L
0.2 < 0.02 mg/L
0.2 0.04 mg/L
0.2 8.90 mg/L
0.2 0.303 mg/L
0.2 < 0.006 mg/L
0.2 < 0.008 mg/L
0.2 < 0.01 mg/L
0.2 0.25 mg/L
0.2 2.7 mg/L
0.2 < 0.1 mg/L
0.2 < 0.006 mg/L
0.2 6.81 mg/L
0.2 0.100 mg/L
0.2 < 0.03 mg/L
0.2 < 0.01 mg/L
0.2 < 0.02 mg/L
0.2 < 0.004 mg/L
0.2 < 0.10 mg/L
0.2 < 0.004 mg/L

Test Name: Elements by EPA 200.7 ICP-AES
Prep Method/Date: APPROVED
HT Deadline: 01/19/98 09:00:00
Date/Time Analyzed: 08/05/97 07:30:00
Lab Group: IYICPZ

Comments: TOTAL RECOVERABLE METALS
Test: NITROGEN - NH3  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -350.3 1974  
Approver: P M LONG  
QC Batch/File: QC97210013  

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<tr>
<td>N3350</td>
<td>Ammonia as Nitrogen</td>
<td>&lt; 0.2</td>
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Test: SOLIDS-TOT-S  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -160.2 1971  
Approver: P M LONG  
QC Batch/File: QC97205019  

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<td>N873</td>
<td>Suspended Solids</td>
<td>65.0</td>
<td>EPA</td>
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Test Name: Nitrogen, Ammonia  
Prep Method/Date: APPROVED  
HT Deadline: 08/20/97 09:00:00  
Date/Time Analyzed: 07/26/97 15:45:00  
Lab Group: IANETC  

Test Name: Total Suspended Solids, EPA 160.2  
Prep Method/Date: APPROVED  
HT Deadline: 07/30/97 09:00:00  
Date/Time Analyzed: 07/24/97 05:17:00  
Lab Group: IANETC  

***** END OF REPORT *****
UNCLASSIFIED
UNCLASSIFIED
ASO Operating ESLIMS
Official Report

Customer Smpl Id: 199705300058
Project: Y-EC-HSEA
K S HANZELKA
B DG 9116, MS 8098 (425)574-1599

Customer: MATRIX: WATER
Sample Description: Location: 9421
Chain of Custody No: Protocol: NONE
Charge Number: S211001
Sampler(s): Sample Status: APPROVED

Date/Time Sampled: 07/23/97 09:00:00
Date/Time Received: 07/23/97 10:57:25
Date/Time Needed: 08/06/97 23:59:59
Date/Time Completed: 07/30/97 16:40:05
Date/Time Approved: 07/30/97 16:40:05

Customer Comments:

Lab Comments:

<<<< Inorganic >>>>>
Test: HG2451
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -245.1 Mar90
Approver: D E HASTE
GC Batch/File: QC97211061/97209J

Test Name: Mercury in Water/Waste by CVAAS
Prep Method/Date:
HT Deadline: 08/20/97 09:00:00
Date/Time Analyzed: 07/30/97 13:11:46
Lab Group: IKAA-1

Cust
Analyte Id
Analyte Name
7439976
Mercury

HT
Lin
En
Dilu Factor
Result
EPA
Conf
Unit
1
0.0034
mg/L

***** END OF REPORT *****
UNCLASSIFIED
### Inorganic

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<th>Test Name:</th>
<th>Total Uranium and % U-235 by TIMS - 9769</th>
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<td>AS0 - AC-MM-2-22012 07/31/97 08:00:00</td>
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<td>Date/Time Analyzed:</td>
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<th>Confidence Unit</th>
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<tr>
<td>7442611</td>
<td>Uranium</td>
<td>1</td>
<td>0.018</td>
<td>1</td>
<td>0.33</td>
<td>0.002</td>
<td>mg/L</td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
<td>1</td>
<td>0.018</td>
<td>1</td>
<td>0.33</td>
<td>0.05</td>
<td>wt %</td>
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### Radiochemical

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<th>Test Name:</th>
<th>Am-241 and Cm-244 By Alpha Spec (Env samples)</th>
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<td>Prep Method/Date:</td>
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<td>Date/Time Analyzed:</td>
<td>08/05/97 17:00:00</td>
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<th>Fn</th>
<th>MDA</th>
<th>Result</th>
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<th>Confidence Unit</th>
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<tr>
<td>13804201</td>
<td>Americium-241</td>
<td>0.36</td>
<td>0.032</td>
<td>0.32</td>
<td>0.015</td>
<td>0.17 pCi/L</td>
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<td>14496102</td>
<td>Americium-241</td>
<td>0.32</td>
<td>0.015</td>
<td>0.32</td>
<td>0.015</td>
<td>0.14 pCi/L</td>
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<tr>
<td>1191</td>
<td>Cm-243/244</td>
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### Isotopic Neptunium by Alpha Spec (Env Samples)

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<th>Confidence Unit</th>
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<tr>
<td>13994202</td>
<td>Neptunium-237</td>
<td>0.29</td>
<td>0.15</td>
<td>0.29</td>
<td>0.15</td>
<td>0.19 pCi/L</td>
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### Isotopic Plutonium by Alpha Spec (Env samples)

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<th>MDA</th>
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<th>Confidence Unit</th>
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<tbody>
<tr>
<td>13981103</td>
<td>Plutonium-238</td>
<td>0.17</td>
<td>0.059</td>
<td>0.17</td>
<td>0.059</td>
<td>0.096 pCi/L</td>
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<tr>
<td>5460</td>
<td>Plutonium-239/240</td>
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<td>7.1</td>
<td>3.2</td>
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<tr>
<td>12587672</td>
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<td>3.7</td>
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<td>10045973</td>
<td>Cesium-137</td>
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<td>10198400</td>
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<td>Uranium-234</td>
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<td>15165108</td>
<td>Thorium-234</td>
<td>0.28</td>
<td>0.067</td>
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<td>24678828</td>
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<td>14274589</td>
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<td>14269467</td>
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<td>15505108</td>
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Test Name: Gross Alpha/Beta Activity (Env samples)
Prep Method/Date: EPA -900.0
Test Status: APPROVED
HT Deadline: HT Deadline:
Date/Time Analyzed: 07/30/97 11:00:00
Lab Group: RURAD1

Test Name: Cs-137 eq. gross gamma activity (Env Samples)
Prep Method/Date: EPA -901.1
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 08/04/97 07:00:00
Lab Group: RURAD1

Test Name: Isotopic Uranium by Alpha Spec (Env samples)
Prep Method/Date: ASO -AC-MM-2-22012 07/29/97 00:00:00
Test Status: APPROVED
HT Deadline: HT Deadline:
Date/Time Analyzed: 08/04/97 00:00:00
Lab Group: RURAD1

Test Name: GAMSPEC-ENV
Prep Method/Date: EPA -901.1 07/29/97 08:00:00
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 07/29/97 13:00:00
Lab Group: RURAD1

Test Name: Gamma Spectroscopy (Env samples)
Prep Method/Date: EPA -900.0 07/25/97 12:00:00
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 07/30/97 11:00:00
Lab Group: RURAD1

Test Name: Gross Alpha/Beta Activity (Env samples)
Prep Method/Date: EPA -900.0 07/25/97 12:00:00
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 07/30/97 11:00:00
Lab Group: RURAD1

Test Name: Cs-137 eq. gross gamma activity (Env Samples)
Prep Method/Date: EPA -901.1 07/31/98 08:00:00
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 08/04/97 07:00:00
Lab Group: RURAD1

Test Name: Isotopic Thorium by Alpha Spec (Env Samples)
Prep Method/Date: ASO -Y/P65-7206 08/04/97 08:00:00
Test Status: APPROVED
HT Deadline:
Date/Time Analyzed: 08/06/97 00:00:00
Lab Group: RURAD1
### TCPPLS-ENV

**Rpt Basis:** As-Received  
**Analysis Meth:** ASO - Y/P65-7154  
**Approver:** C L WATSON  
**QC Batch/File:** QC97219039

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### TOTALRA-ENV

**Rpt Basis:** As-Received  
**Analysis Meth:** EPA - 903.0-904.0  
**Approver:** C L WATSON  
**QC Batch/File:** QC97213031

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### TOTALSR-ENV

**Rpt Basis:** As-Received  
**Analysis Meth:** EPA - 905.0  
**Approver:** C L WATSON  
**QC Batch/File:** QC97205002

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### TRITIUM-ENV

**Rpt Basis:** As-Received  
**Analysis Meth:** EPA - 906.0  
**Approver:** C L WATSON  
**QC Batch/File:**

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**Test Name:** TC-99 BY LIQUID SCINTILLATION  
**Prep Method/Date:** ASO - Y/P65-7154, 07/31/97 08:00:00  
**Test Status:** APPROVED  
**HT Deadline:** 01/27/98 08:00:00  
**Date/Time Analyzed:** 08/06/97 14:00:00  
**Lab Group:** RURAD1

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**Test Name:** Total Radium Alpha/Beta Activity (Env Samples)  
**Prep Method/Date:** EPA - 903.0-904.0, 07/31/97 07:00:00  
**Test Status:** APPROVED  
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**Date/Time Analyzed:** 08/01/97 11:00:00  
**Lab Group:** RURAD1

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**Test Name:** Total Strontium Activity (Env Samples)  
**Prep Method/Date:** EPA - 905.0, 07/30/97 00:00:00  
**Test Status:** APPROVED  
**HT Deadline:** 07/30/97 00:00:00  
**Date/Time Analyzed:** 07/30/97 00:00:00  
**Lab Group:** RURAD1

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**Test Name:** Tritium Activity (Env samples)  
**Prep Method/Date:** EPA - 906.0, 07/29/97 12:00:00  
**Test Status:** APPROVED  
**HT Deadline:** 01/25/98 12:00:00  
**Date/Time Analyzed:** 08/07/97 07:00:00  
**Lab Group:** RURAD1

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---

UNCLASSIFIED
## Official Report

**Customer Smpl Id:** 199706180041  
**Project:** Y-EC-HSEA  
**NPDES:** 8601  
**Block:** 9116  
**MS:** 8098  
**(423)574-1599**

**Date/Time Sampled:** 07/23/97 09:50:00  
**Date/Time Received:** 07/23/97 10:57:25  
**Date/Time Needed:** 08/06/97 25:59:59  
**Date/Time Completed:** 08/07/97 14:29:44  
**Date/Time Approved:** 08/07/97 14:29:44

### Inorganic

**Test:** TOTAL-U-9769  
**Rpt Basis:** As-Received  
**Test Req Cnt:** 01  
**Analysis Meth:** ASO -Y/P65-8044  
**Approver:** C A CHAMBERS  
**QC Batch/Flle:** QC97216010

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### Radiochemical

**Test:** ASPECAM-ENV  
**Rpt Basis:** As-Received  
**Test Req Cnt:** 01  
**Analysis Meth:** ASO -AC-MM-2-22012  
**Approver:** C C GRANGER  
**QC Batch/Flle:** QC97216010

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**Test:** ASPECNP-ENV  
**Rpt Basis:** As-Received  
**Test Req Cnt:** 01  
**Analysis Meth:** ASO -Y/P65-7206  
**Approver:** C L WATSON  
**QC Batch/Flle:** QC97218050

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**Test:** ASPECPU-ENV  
**Rpt Basis:** As-Received  
**Test Req Cnt:** 01  
**Analysis Meth:** ASO -AC-MM-2-22012  
**Approver:** C L WATSON  
**QC Batch/Flle:** QC97216008

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Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: AS0 -Y/P65-7206
Approver: C L WATSON
QC Batch/File: QC97218043

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<td>1526808</td>
<td>Thorium-232</td>
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<td>15065108</td>
<td>Thorium-234</td>
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### Test: ASPEU-ENV
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: AS0 -AC-M-2-22012
Approver: C C GRANGER
QC Batch/File: QC97217060

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<td>24678928</td>
<td>Uranium-238</td>
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### Test: GAMSPEC-ENV
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -901.1
Approver: C L WATSON
QC Batch/File: QC97211014

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<td>15117961</td>
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### Test: GROSSAB-ENV
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -900.0
Approver: C L WATSON
QC Batch/File: QC97211054

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### Test: GROSSGAM-ENV
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -901.1
Approver: C C GRANGER
QC Batch/File: QC97216065

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**Official Report**

**Test Name:** Isotopic Thorium by Alpha Spec (Env Samples)
**Prep Method/Date:** AS0 -Y/P65-7206 08/04/97 08:00:00
**Test Status:** APPROVED
**HT Deadline:** 01/31/98 08:00:00
**Date/Time Analyzed:** 08/06/97 00:00:00
**Lab Group:** RURAD1

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**Test Name:** Isotopic Uranium by Alpha Spec (Env Samples)
**Prep Method/Date:** AS0 -AC-M-2-22012 07/29/97 00:00:00
**Test Status:** APPROVED
**HT Deadline:** 01/31/98 08:00:00
**Date/Time Analyzed:** 08/04/97 00:00:00
**Lab Group:** RURAD1

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**Test Name:** Gamma Spectroscopy (Env samples)
**Prep Method/Date:** EPA -901.1 07/29/97 08:00:00
**Test Status:** APPROVED
**HT Deadline:** 01/31/98 08:00:00
**Date/Time Analyzed:** 07/29/97 13:00:00
**Lab Group:** RURAD1

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**Test Name:** Gross Alpha/Beta Activity (Env samples)
**Prep Method/Date:** EPA -900.0 07/25/97 12:00:00
**Test Status:** APPROVED
**HT Deadline:** 01/31/98 08:00:00
**Date/Time Analyzed:** 07/30/97 11:00:00
**Lab Group:** RURAD1

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**Test Name:** Cs-137 eq. gross gamma activity (Env Samples)
**Prep Method/Date:** EPA -901.1 07/31/97 08:00:00
**Test Status:** APPROVED
**HT Deadline:** 01/31/98 08:00:00
**Date/Time Analyzed:** 08/04/97 07:00:00
**Lab Group:** RURAD1

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***** END OF REPORT *****

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OFFICIAL REPORT

YEAR-12 ANALYTICAL SERVICES ORGANIZATION

PAGE 1 OF 3

SUBMITTER: Russell H Harden
ADDRESS: Building 916, Room 0114 MS.8098
DATE SAMPLED: 07/23/97 10:40:00
DATE RECEIVED: 07/23/97
DATE COMPLETED: 07/24/97
DATE APPROVED: 07/24/97

SAMPLE DESCRIPTION: Grab

TEST: 8HR-U 8 Hour EMERGENCY-Uranium
REPLICATE: 1
STATUS: APPROVED
TIME ANALYZED: 07/23/97 19:23:10
APPROVER: E017231

COMMENTS: DUPLICATE ANALYSIS: 5.5 ug/g TOTILL U
0.27 WT % 239U

RESULT CONFIDENCE UNIT
5.5 *0.27 +/- .05 Weight %

TEST: CT-U Analysis of Uranium Isotopes
REPLICATE: 1
STATUS: APPROVED
TIME ANALYZED: 07/24/97 00:00:00
APPROVER: E019888


MDA:
U-234 4.64 PCI/L
U-235 9.18
U-236 4.64
U-238 6.58

DUPLICATE RESULTS:
U-234 573 +/- 215 MDA: 5.64 PCI/L
U-235 37.5 +/- 23.0 MDA: 7.03
U-236 15.0 +/- 12.2 MDA: 5.64
U-238 1820 +/- 658 MDA: 5.65

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RECEIVED JUL 2 997
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#### OFFICIAL REPORT

**SAMPLE E972040002**

**Y-12 ANALYTICAL SERVICES ORGANIZATION**

**PAGE 2 OF 3**

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**TEST: CT_U_P Analysis of Uranium Isotopes Prep**

**PREP MTH:** N/P65-7611  **PROC MTH:** N/P65-7611  **PHASE:** ALL

**THIS TEST WAS CANCELLED BY DDD**

**TEST: ICP_LCH Metals in Waste samples - Customer must specify**

**PREP MTH:** Y/P65-0020  **PROC MTH:** 6010mod  **PHASE:** ALL

**TIME ANALYZED:** 07/23/97 14:14:00  **APPROVER:** E029191

**COMMENTS:** Dissolved Metals Analysis. Sample filtered and analyzed without digestion.

Analysis may not meet all QC requirements of SW-846 6010.

### UNCLASSIFIED

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<td>Manganese</td>
<td>UDL</td>
<td>&lt;0.04</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>7439987</td>
<td>Molybdenum</td>
<td>UDL</td>
<td>&lt; 0.4</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>7440235</td>
<td>Sodium</td>
<td>UDL</td>
<td>&lt; 10</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>7440020</td>
<td>Nickel</td>
<td>UDL</td>
<td>&lt; 0.2</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>7723140</td>
<td>Phosphorus</td>
<td>UDL</td>
<td>&lt; 3</td>
<td>mg/L</td>
<td></td>
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<tr>
<td>7439921</td>
<td>Lead</td>
<td>UDL</td>
<td>&lt; 1</td>
<td>mg/L</td>
<td></td>
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<td>7440246</td>
<td>Strontium</td>
<td>0.07</td>
<td></td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>7440326</td>
<td>Titanium</td>
<td>UDL</td>
<td>&lt;0.05</td>
<td>mg/L</td>
<td></td>
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### PCB in Aqueous Waste Samples

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<tr>
<td>12674112</td>
<td>PCB1016</td>
<td>11096825</td>
<td>PCB1248</td>
</tr>
<tr>
<td>11104282</td>
<td>PCB1221</td>
<td>12672296</td>
<td>PCB1248</td>
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<td>11141165</td>
<td>PCB1232</td>
<td>11097691</td>
<td>PCB1254</td>
</tr>
<tr>
<td>53469219</td>
<td>PCB1242</td>
<td>1336363</td>
<td>PCB</td>
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</tbody>
</table>

**DT RESULT CONFIDENCE UNIT**

| <0.5         | <0.5         | 3           | <0.5         |
| <0.5         | <0.5         | <0.5        | <0.5         |
| <0.5         | <0.5         | <0.5        | NA           |

**TEST: PCB**

Gas Chromatography, PCBs in Water

**PREP MTH: PROC MTH: EPA 608**

**PHASE: TIME ANALYZED: 07/23/97 15:00:00**

**APPROVER:**

---

**DETERMINATION**

- PCB 1016
- PCB 1221
- PCB 1232
- PCB 1242
- PCB 1248
- PCB 1254
- PCB 1260
- PCB

**CONFIDENCE UNIT**

- ug/L
- ug/L
- ug/L
- ug/L
- ug/L
- ug/L

**TEST: TOC**

Total Organic Carbon, EPA 415.1

**PREP MTH: PROC MTH: SW846 9010**

**PHASE: TIME ANALYZED: 07/23/97 00:00:00**

**APPROVER:**

---

**DT RESULT CONFIDENCE UNIT**

| 37          | +/-1         | mg/L        |

**TEST: TOC_95**

Total Organic Carbon

**PREP MTH: PROC MTH: SW846 9010**

**PHASE: TIME ANALYZED: 07/23/97 00:00:00**

**APPROVER:**

---

* Duplicate results for this determination are included in this report

---
### Test Results

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<td>7440611</td>
<td>Uranium</td>
<td></td>
<td>0.063</td>
<td>+/- .1</td>
<td>mg/L</td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
<td></td>
<td>0.97</td>
<td></td>
<td>Weight %</td>
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**Comments:** RUSH, Attn: Carey Chambers

**Test:** 8 Hour EMERGENCY-Uranium

**Prep Mth:** Y/P65-7105

**PROC MTH:**

**Date Analyzed:** 07/23/97 20:22:38

**Approver:** E017231

**Status:** APPROVED

**Duplicate Analysis:** 0.063 ug/g TOTAL U 0.97 WT % 235U
### UNCLASSIFIED

#### OFFICIAL REPORT

Y-12 ANALYTICAL SERVICES ORGANIZATION

**Date:** 07/28/97 10:20:57

**UNCLASSIFIED**

**07/28/97 10:20:57**  
**Y-12 ANALYTICAL SERVICES ORGANIZATION**  
**PAGE 1 OF 1**

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<th>MTC</th>
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<tr>
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<td>Building 9116</td>
<td>Room 0114 M.S.8098</td>
<td>Bldg 9204-3</td>
<td>E972040006</td>
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**DATE SAMPLIED:** 07/23/97 00:00:00  
**DATE NEEDED:** 07/23/97  
**DATE RECEIVED:** 07/23/97  
**DATE COMPLETED:** 07/26/97  
**LOCATION:** Basement H20  
**PROJECT CODE:**  
**SAMPLE DESCRIPTION:** Grab  
**FINAL APPROVAL:**  

**COMMENTS:** RUSH, Attn: Carey Chambers (BHR II); Tanya Carver (FCOLI)

**TEST:** BHR U 8 Hour EMERGENCY-Uranium  
**PREP MTH:**  
**PROC MTH:** Y/P65-7.65  
**PHASE:**  
**COMMENTS:** DUPLICATE ANALYSIS: 0.010 mg/L  
4.2 WT % 235U  

**DT** | **RESULT** | **CONFIDENCE** | **UNIT** |
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**CAS NUMBER** | **DETERMINATION** | **DT** | **RESULT** | **CONFIDENCE** | **UNIT** |
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<tbody>
<tr>
<td>7440611</td>
<td>Uranium</td>
<td></td>
<td>0.010</td>
<td>+/- .2</td>
<td>mg/L</td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
<td></td>
<td>4.1</td>
<td>+/- .2</td>
<td>Weight %</td>
</tr>
</tbody>
</table>

**TEST:** FCOLI Coliform, Fecal  
**PREP MTH:**  
**PROC MTH:** MMES-EC 119  
**PHASE:**  
**COMMENTS:** Holding Time was exceeded before the sample was received by the lab  

**DT** | **RESULT** | **CONFIDENCE** | **UNIT** |
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<tr>
<td></td>
<td>3000</td>
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<td>C/100mL</td>
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**RECEIVED**  
**AUG 3 2 1997**

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***LAST PAGE***
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<td>HG-AA</td>
<td>SU846</td>
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<tr>
<td>7439976</td>
<td>Mercury</td>
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<td></td>
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<td>0.0003</td>
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<td>mg/L</td>
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**OFFICIAL REPORT**

**09/11/97 13:03:50**

**Y-12 ANALYTICAL SERVICES ORGANIZATION**

**PAGE 1 OF 1**

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<td>E972040008</td>
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**DATE SAMPLED:** 07/23/97 00:00:00  
**DATE NEEDED:** 07/23/97  
**LOCATION:** Basement H20  
**DATE RECEIVED:** 07/23/97  
**DATE COMPLETED:** 07/23/97  
**PROJECT CODE:**  
**FINAL APPROVAL:**  

**COMMENTS:** RUSH, Attn: Carey Chambers (8HR-U): Kaye Sedman (HG-AA)

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<tr>
<td>7440611</td>
<td>Uranium</td>
<td></td>
<td>&lt;0.005</td>
<td>+/- 10%</td>
<td>mg/L</td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
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<td>NA/LOW U</td>
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<tr>
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<th>MERCURY BY COLD VAPOR AA</th>
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<tr>
<td>7439976</td>
<td>Mercury</td>
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<td>0.0045</td>
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<td>mg/L</td>
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***LAST PAGE***
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OFFICIAL REPORT

Y-12 ANALYTICAL SERVICES ORGANIZATION

07/23/97 19:28:04

SUBMITTER
Harden, Russell H II

ADDRESS
Building 9116, room 0114 M.S. 809B

CUSTOMER ID
Bldg 9201-1

REQ NO
- E972040009

SAMPLE NO
- E972040009

MTC
- 8601

STATUS
- APPROVED

CHARGE #: 52211401

CASE:

DATE SAMPLED: 07/23/97

DATE NEEDED: 07/23/97

DATE RECEIVED: 07/23/97

DATE COMPLETED: 07/23/97

LOCATION: Basement H20

PROJECT CODE:

SAMPLE DESCRIPTION: Basement H20

SAMPLER:

DATE RECEIVED:

DATE COMPLETED:

PROJECT CODE:

FINAL APPROVAL:

COMMENTS: RUSH, Attn: Carey Chambers

TEST: BHR_U

PROC MTH: Y/P65-7165

PREP MTH:

PHASE:

REPLICATE: 1

STATUS: APPROVED

TIME ANALYZED: 07/23/97 19:24:49

APPROVER: E017231

CAS NUMBER

DETERMINATION

DT

RESULT

CONFIDENCE

UNIT

7440561

Uranium

0.091

--

mg/L

15117961

Uranium-235

0.21

+/-.05

Weight %

PAGE 1 OF 1

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*** LAST PAGE ***
<table>
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<td>Uranium</td>
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<td>0.005</td>
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<td>mg/L</td>
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<tr>
<td>15117961</td>
<td>Uranium-235</td>
<td>15</td>
<td>+/- .5</td>
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**Comments:** rush carey chambers

**Received:** JUL 2 9 1997
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<td>FCOLI</td>
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<td>Fecal Coliform Bacteria</td>
<td></td>
<td>88000</td>
<td></td>
<td>C/100mL</td>
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**Comments:** RUSH, Attn: Tanya Carver
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Y-12 ANALYTICAL SERVICES ORGANIZATION

PAGE 1 OF 1

SUBMITTER: Harden, Russell H
ADDRESS: Building 9116 Room 0114 M.S.8098

CUSTOMER ID: Reg No: Sample No: MT: Status

H: 97/33-4 E972040012 8601 APPROVED

DATE SAMPLED: 07/23/97 14:35:00
DATE NEEDED: 07/23/97
LOCATION: H2O Bldg

DATE RECEIVED: 07/23/97
DATE COMPLETED: 07/26/97
PROJECT CODE: CHARGE #: CASE:

SAMPLER: SAMPLE DESCRIPTION: Grab

COMMENTS: RUSH, Attn: Stony VanHook

TEST: FCOL1 Coliform, Fecal
PREP MTH: PROC MTH: MMES-EC 119 PHASE:

CASE NUMBER DETERMINATION RESULT CONFIDENCE UNIT

N362 Fecal Coliform Bacteria 63000

REPLICATE: 1 STATUS: APPROVED

TIME ANALYZED: 07/23/97 16:50:00 APPROVER: E017940

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*** LAST PAGE ***
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OFFICIAL REPORT

Y-12 ANALYTICAL SERVICES ORGANIZATION

07/25/97 10:03:36

SUBMITTER
Harden, Russell H

ADDRESS
Building 9116 Room 0114 M.S.8098

CUSTOMER ID
Bldg 9815

REQ NO
E972040013

SAMPLE NO
8501

MTC
APPROVED

STATUS

DATE SAMPLED: 07/23/97 15:15:00

DATE NEEDED: 07/24/97

DATE RECEIVED: 07/23/97

DATE COMPLETED: 07/24/97

PROJECT CODE:

SAMPLE DESCRIPTION: Crane

LOCATION: Basement

COMMENTS: RUSH, Attn: Rose Wilkes (ICP_LCH); Tanya Carver (ICNP0)

TEST: ICNP0

Anions by IC (EPA 300.0, SW-846 9056) as N and P

REPLICATE: 1

TIME ANALYZED: 07/24/97

STATUE: CANCELLED

PREP MTH: Y/P65-0020

PROC MTH: 6010mod

PHASE: ALL

APPROVER: E029191

TEST: ICP_LCH

Metals in Waste samples - Customer must specify

REPLICATE: 1

TIME ANALYZED: 07/23/97 15:45:00

STATUS: APPROVED

PREP MTH: Y/P65-0020

PROC MTH: 6010mod

PHASE: ALL

APPROVER: E029191

COMMENTS: Dissolved Metals Analysis. Sample filtered and analyzed without digestion.

Analysis may not meet all QC requirements of SW-846 6010.

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<td>Barium</td>
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<td>mg/L</td>
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<td>7440326</td>
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UNCLASSIFIED

RECEIVED JUL 2 9 1997
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<tr>
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<th>CONFIDENCE</th>
<th>UNIT</th>
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<tbody>
<tr>
<td>N2788</td>
<td>Nitrate/Nitrite as Nitrogen</td>
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<td>4.3</td>
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<td>mg/L</td>
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Sample received preserved analyzed by 353.2 (N-NO3) instead of by 300.0 (ICNPD). Russ Hardin notified. TiC
Customer: K. G. HANZELKA

Matrix: WATER

Sample Description: 94221

Date/Time Sampled: 07/24/97 09:50:00

Date/Time Received: 07/24/97 11:48:09

Date/Time Needed: 08/23/97 23:59:59

Date/Time Completed: 08/21/97 13:22:48

Sample Status: APPROVED

Sample Approver: D. E. HASTE

Test Name: Mercury in Water/Waste by CVAAS

Prep Method/Date:

Test Status: APPROVED

HT Deadline: 08/21/97 09:50:00

Date/Time Analyzed: 07/30/97 13:21:02

Lab Group: IKAA-1

Test Name: Elements by EPA 200.7 ICP-AES

Prep Method/Date:

Test Status: APPROVED

HT Deadline: 08/12/97 12:00:00

Date/Time Analyzed: 08/12/97 12:00:00

Lab Group: IYICP2

Comments: TOTAL RECOVERABLE METALS

Digested spike recovery for aluminum was 228%; QC limits are 75 to 125%
<table>
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<tr>
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<th>Test Name</th>
<th>Prep Method/Date</th>
<th>Test Status</th>
<th>HT Deadline</th>
<th>Date/Time Analyzed</th>
<th>Lab Group</th>
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<tr>
<td>NITROGEN-NH3</td>
<td>Ammonia as Nitrogen</td>
<td>Nitrogen, Ammonia</td>
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<tr>
<td>SOLIDS-TOT-S</td>
<td>Suspended Solids</td>
<td>Total Suspended Solids, EPA 160.2</td>
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**Test Status:** APPROVED

**HT Deadline:** 08/21/97 09:50:00

**Date/Time Analyzed:** 07/28/97 15:45:00

**Lab Group:** IAUETC

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<th>Cust</th>
<th>HT Limit (mg/L)</th>
<th>Dilution Factor</th>
<th>Result (mg/L)</th>
<th>Qual Confidence</th>
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<tr>
<td>1</td>
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***** END OF REPORT *****
UNCLASSIFIED

Customer: K G HANZELKA

Sample Description: Location: 94221

Chain of Custody No: .

Protocol: N3NE

Charge Number: S2211001

Sampler(s):

Customer Comments:

Lab Comments:

<<<< Inorganic >>>>

Test Name: Mercury in Water/Waste by CVAAS

Test Name: Mercury in Water/Waste by CVAAS

Prep Method/Date:

Test Status: APPROVED

HT Deadline: 08/21/97 09:50:00

Date/Time Analyzed: 07/30/97 13:18:06

Lab Group: IKAA-1

Analyte Id  Analyte Name
7439976  Mercury

Cust  MT  Lim  En  DIL Factor  Result  Qual  Confidence Unit

0.000390  mg/L

***** END OF REPORT *****

UNCLASSIFIED
## Inorganic

### Test: HG2451
- **Rpt Basis:** As-Received
- **Test Req Cnt:** 01
- **Analysis Meth:** EPA -245.1 Mar90
- **Appraiser:** D E HASTE
- **QC Batch/File:** GC97210601/GC9720909

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<th>Dilu Factor</th>
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### Test: ICP2007
- **Rpt Basis:** As-Received
- **Test Req Cnt:** 01
- **Analysis Meth:** EPA -200.7 R3.3
- **Appraiser:** R W WILKES
- **QC Batch/File:** GC972103020/EPA01V1

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Comments: TOTAL RECOVERABLE METALS
### Nitrogen-NH3

**Rpt Basis:** As-Received  
**Analysis Meth:** EPA -350.1 1974  
**Approver:** P M LONG  
**QC Batch/File:** QC97210013

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<th>Test Name</th>
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<th>QC Batch/File</th>
<th>Test Req Cnt</th>
<th>Test Status</th>
<th>Prep Method/Date</th>
<th>Date/Time Analyzed</th>
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<tbody>
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<td>N3350</td>
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### Total Suspended Solids

**Rpt Basis:** As-Received  
**Analysis Meth:** EPA -160.2 1971  
**Approver:** P M LONG  
**QC Batch/File:** QC97210030

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Lab Smpl Id: A972050201

Customer Smpl Id: STA. 8
Project: Y-EC-HSEA SPILLS SULFATE

A W SHERDEN
BLD 9116, MS 8098 (423)241-2585

Customer:

Matrix: WATER
Sample Description: HSEA COC19501 line2
Location: STA. 8
Chain of Custody No: HSEA 19501
Protocol: NONE
Charge Number: S2211401
Sampler(s):

Date/Time Sampled: 07/24/97 14:10:00
Date/Time Received: 07/24/97 19:18:44
Date/Time Needed: 07/31/97 23:59:59
Date/Time Completed: 07/25/97 15:47:21
Date/Time Approved: 07/25/97 15:47:21
Sample Status: APPROVED
Sample Approver:

Test Name: Anions by IC (EPA 300.0)
Prep Method/Date:
Test Status: APPROVED
HT Deadline: 08/21/97 14:10:00
Date/Time Analyzed: 07/24/97 20:47:00
Lab Group: IAWETC

Analyte Id Analyte Name
14808798 Sulfate

Test:
ANIONS
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -300 Dec89
Approver: S J VAN HOOK III
QC Batch/File: QC97206044

Cust MT Lim Ft Dily Factor Result EPA Dual Confidence Unit
40 71 - - HT mg/L

***** END OF REPORT *****
UNCLASSIFIED
Customer Smpl Id: N/S Pipe-1

Pipe-1

Project: Y-EC-HSEA SPILLS SULFATE
BLDG 9116, MS 8098 (423)241-2585

Matrix: WATER
Sample Description: HSEA COC19501 line1
Location: N/S Pipe
Chain of Custody No: HSEA 19501
Protocol: NONE
Charge Number: S2211401
Sampler(s):

Date/Time Sampled: 07/24/97 15:00:00
Date/Time Received: 07/24/97 19:05:56
Date/Time Needed: 07/31/97 23:59:59
Date/Time Completed: 07/25/97 15:47:21
Sample Status: APPROVED

Test Name: Anions by IC (EPA 300.0)
Prep Method/Date: None
Test Status: APPROVED
HT Deadline: 08/21/97 15:00:00
Date/Time Analyzed: 07/24/97 20:35:00
Lab Group: IAWETC

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([^])

***** END OF REPORT *****
UNCLASSIFIED
Lab Smpl Id: A972050203  
LIMS 05.01.023  
08/22/97 09:02  

Customer Smpl Id: Outfall 20  
Customer: R M SHEDDEN  
Project: Y-EC-HSEA  
SPILLS  
SULFATE  

Date/Time Sampled: 07/24/97 15:05:00  
Date/Time Received: 07/24/97 17:35:44  
Date/Time Needed: 07/31/97 23:59:59  
Date/Time Completed: 07/25/97 15:47:37  
Date/Time Approved: 07/25/97 15:47:37  

Matrix: WATER  
Sample Description: HSEA C0019501 line4  
Location: STA. 8  
Chain of Custody No: HSEA 19501  
Protocol: NONE  
Charge Number: 52211401  
Sampler(s):  

Customer Comments:  
Lab Comments:  

<<<< Inorganic >>>>  
Test: ANIONS  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -300 Dec89  
Approver: S J VAN HOOK III  
QC Batch/File: QC97206044  

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Test Name: Anions by IC (EPA 300.0)  
Prep Method/Date:  
Test Status: APPROVED  
MT Deadline: 08/21/97 15:05:00  
Date/Time Analyzed: 07/24/97 21:11:00  
Lab Group: IAWETC  

***** END OF REPORT *****

UNCLASSIFIED
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**** END OF REPORT *****

UNCLASSIFIED
## UNCLASSIFIED

### OFFICIAL REPORT

Y-12 ANALYTICAL SERVICES ORGANIZATION

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<thead>
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<th>ADDRESS</th>
<th>CUSTOMER ID</th>
<th>REQ NO</th>
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**DATE SAMPLED:** 07/24/97 16:40:00
**DATE RECEIVED:** 07/24/97
**DATE COMPLETED:** 07/25/97
**LOCATION:** Basement H20
**CHARGE #:** S2211401
**SAMPLE DESCRIPTION:** Grab

**COMMENTS:** RUSH, Attn: Tom Adams

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**RECEIVED JUL 2 9 1997**

*** LAST PAGE ***
Customer Sample Id: W/S Pipe-2
Project: Y-EC-HSEA SPILLS SULFATE
Customer: R M SHEDDEN

Matrix: WATER
Sample Description: HSEA COC19501 line6
Location: STA. 8
Chain of Custody No: HSEA 19501
Protocol: NONE
Charge Number: S2211501
Sampler(s):

Date/Time Sampled: 07/24/97 16:45:00
Date/Time Received: 07/24/97 17:35:44
Date/Time Needed: 07/31/97 23:59:59
Date/Time Completed: 07/25/97 15:48:16
Date/Time Approved: 07/25/97 15:48:16
Sample Status: APPROVED
Sample Approver:

Customer Comments:
Lab Comments:

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Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -300 Dec89
Approver: S J VAN HOOK III
QC Batch/File: QC97206044

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Prep Method/Date:
Test Status: APPROVED
HT Deadline: 08/21/97 16:45:00
Date/Time Analyzed: 07/24/97 21:36:00
Lab Group: IAWTC

***** END OF REPORT *****
UNCLASSIFIED
UNCLASSIFIED
ASO Operating ESLIMS
Official Report

Customer Smpl Id: STA 17
Customer: R M SHEDDEN
Project: Y-EC-HSEA
BLDG 9116, MS 8098 (423)241-2505

Matrix: WATER
Sample Description: HSEA COC19501 line5
Location: STA. 8
Chain of Custody No: HSEA 19501
Protocol: NONE
Charge Number: S2211401
Sampler(s):

Date/Time Sampled: 07/24/97 17:05:00
Date/Time Received: 07/24/97 17:35:44
Date/Time Needed: 07/31/97 23:59:59
Date/Time Completed: 07/25/97 15:48:16
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Sample Status: APPROVED
Sample Approver:

Customer Comments:
Lab Comments:

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Test: ANIONS
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA-300 Dec89
Approver: S J VAN HOOK III
QC Batch/File: QC97206044

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**Comments:** Element are not approved for EPA 200.7 and may not meet the Q.C. requirements.
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UNCLASSIFIED

OFFICIAL REPORT

Y-12 ANALYTICAL SERVICES ORGANIZATION

UNCLASSIFIED

07/25/97 15:36:05

SAMPLE NO: E972060005

SUBMITTER: Harden, Russell H II

ADDRESS: Building 9116 Rcom 0114 M.S.8098

DATE SAMPLED: 07/25/97 00:00:00

DATE RECEIVED: 07/25/97

DATE COMPLETED: 07/25/97

PROJECT CODE:

SAMPLER: 30096

SAMPLE DESCRIPTION: Grab

DATE NEEDED: 07/25/97

DATE RECEIVED: 07/25/97

DATE COMPLETED: 07/25/97

PROJECT CODE:

SUBMITTER ADDRESS CUSTOMER ID REP NO

LOCATION: Sample # 2

FINAL APPROVAL:

CAS NUMBER DETERMINATION RESULT CONFIDENCE UNIT

7440611 Uranium <0.02 +/- 10% mg/L

15117961 Uranium-235 NA/LOW U -- Weight %

COMMENTS: RUSH, Attn: Wilma Sanders

TEST: 4HR_U 4 Hour EMERGENCY-Uranium

PREP MTH: PROC MTH: Y/P65-71/6 PHASE:

REPLICATE: 1 STATUS: APPROVED

TIME ANALYZED: 07/25/97 15:24:58 APPROVER: E017231

UNCLASSIFIED

*** LAST PAGE ***
Test Name: Mercury in Water/Waste by CVAAS

Test Name: Elems by EPA 200.7 ICP-AES

Comments: TOTAL RECOVERABLE METALS
Test: NITROGEN-NH3  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -350.3 1974  
Approver: P M LONG  
QC Batch/File: GC97210013

Analyte Id Analyte Name  
K3350 Ammonia as Nitrogen

Test: SOLIDS-TOT-S  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -160.2 1971  
Approver: P M LONG  
QC Batch/File: GC97210030

Analyte Id Analyte Name  
K873 Suspended Solids

---  

Test Name: Nitrogen, Ammonia  
Prep Method/Date:  
Test Status: APPROVED  
HT Deadline: 08/22/97 08:50:00  
Date/Time Analyzed: 07/28/97 15:45:00  
Lab Group: IAWETC

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Prep Method/Date:  
Test Status: APPROVED  
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Date/Time Analyzed: 07/29/97 05:24:00  
Lab Group: IAWETC

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UNCLASSIFIED
Customer Smpl Id: 199705300060
Customer: K G HANZELKA
Pro. ect: Y-EC-HSEA NPDES 8601
K G HANZELKA BLDG 9116, MS 8098 (423)574-1599
Customer Comments: 
Lab Comments: 

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Test Name: Mercury in Water/Waste by CVAAS
Prep Method/Date: 
Test Status: APPROVED
HT Deadline: 08/22/97 08:50:00
Date/Time Analyzed: 08/05/97 10:43:29
Lab Group: IKAA-1

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***** END OF REPORT *****
UNCLASSIFIED
LIMS 05.01.023
08/08/97 10:54

Customer Smpl Id: LAKE REALITY

Customer:
Matrix: WATR
Sample Description: WATR GRAB
Location: LAKE REALITY OUTLET
Chain of Custody No: 19502
Protocol: NONE
Charge Number: 12211401
Sampler(s): A.R.GARLAND

Test: TOTAL-U-9769
Rpt Basis: As-Received
Analysis Meth: ASO - Y/P65-8044
Approver: W J SANDERS
QC Batch/File: 

---

Test Name: Total Uranium and % U-235 by TIMS - 9769
Prep Method/Date: 
HT Deadline: 01/21/98 09:30:00
Date/Time Analyzed: 07/30/97 00:00:00
Lab Group: MYI802

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Test Name: Cross Alpha/Beta Activity (Env samples)
Prep Method/Date: EPA -900.0 07/29/97 11:00:00
Test Status: APPROVED
HT Deadline: 07/30/97 15:00:00
Date/Time Analyzed: 07/30/97 15:00:00
Lab Group: RURAD1

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UNCLASSIFIED
Official Report

Customer Smpl Id: OUTFALL 201

Project: Y-EC-HSEA

SPILLS

FISHKIL

BLD: 9116, MS 8098

(423)241-2585

Customer: M. SHEDDEN

Matrix: WATER

Sample Description: WATER GRAB

Location: OUTFALL 201

Chain of Custody No: 195112

Protocol: NONE

Charge Number: S221401

Sampler(s): A.R. GARLAND

Date/Time Sampled: 07/25/97 11:00:00

Date/Time Received: 07/29/97 07:59:27

Date/Time Needed: 08/05/97 23:59:59

Date/Time Completed: 08/01/97 10:34:59

Date/Time Approved: 08/01/97 10:34:59

Sample Status: APPROVED

Sample Approver: 

Customer Comments:

Lab Comments:

<<<<< Inorganic >>>>>

Test: TOTAL-U-9769

Rpt Basis: As-Received

Analysis Meth: ASO -Y/65-8044

Approver: W J SANDERS

QC Batch/File: 

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Test: GROSSAB-ENV

Rpt Basis: As-Received

Analysis Meth: EPA -900.0

Approver: C L WATSON

QC Batch/File: QC97211059

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Test Name: Total Uranium and % U-235 by TIMS - 9769

Prep Method/Date:

HT Deadline: 01/21/98 11:00:00

Date/Time Analyzed: 07/30/97 00:00:00

Lab Group: MYISOZ

Cust EPA Result - HT

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Test Name: Gross Alpha/Beta Activity (Env samples)

Prep Method/Date: EPA -900.0

HT Deadline: 07/30/97 15:00:00

Lab Group: RURAD1

Cust EPA Result - Qual Confidence

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***** END OF REPORT *****
Customer: Snpl

Subject: Snpl Id: 199707240009

Project: Y-EC-HSEA NPDES 8601

Location: 94123

Protocol: NCG:

Charge Number: S15 10016

Matrix: WATIR

Sample Description:

Chain of Custody No:

Protocols:

Charge Number:

Sample Status: APPROVED

Sample Approver:

Customer Comments:

Lab Comments:

INORGANIC

Test: HG2451

Rpt Basis: As-Received

Prep Method/Date:

Test Status: APPROVED

Lab Group: IKM-1

Analyte Id Analyte Name
7439976 Mercury

Test: ICP2007

Rpt Basis: As-Received

Prep Method/Date:

Test Status: APPROVED

Lab Group: IYICP2

Analyte Id Analyte Name
7429905 Aluminum
7440350 Antimony
7440382 Arsenic
7440393 Barium
7440417 Beryllium
7440428 Boron
7440439 Cadmium
7440702 Calcium
7440473 Chromium
7440484 Cobalt
7440508 Copper
7439986 Iron
7439921 Lead
7439932 Lithium
7439954 Magnesium
7439965 Manganese
7439987 Molybdenum
7440020 Nickel
7440031 Nickel
7723140 Phosphorus
7440097 Potassium
7782692 Selenium
7440224 Silver
7440235 Sodium
7440246 Strontium
7440280 Thallium
7440291 Thorium
7440326 Titanium
7440622 Vanadium
7440666 Zinc
7440677 Zirconium

Comments: TOTAL RECOVERABLE METALS
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<th>Unit</th>
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<tr>
<td>N3350</td>
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**Test Name:** Nitrogen, Ammonia  
**Prep Method/Date:**  
**Test Status:** APPROVED  
**HT Deadline:** 08/22/97 13:35:00  
**Date/Time Analyzed:** 07/28/97 15:45:00  
**Lab Group:** IAMETC

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**Test Name:** Total Suspended Solids, EPA 160.2  
**Prep Method/Date:**  
**Test Status:** APPROVED  
**HT Deadline:** 08/01/97 13:35:00  
**Date/Time Analyzed:** 07/29/97 05:24:00  
**Lab Group:** IAMETC

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**Customer Snpl Id:** LAKE REALITY  
**R M SHEEDEN**

**Location:** LAKE REALITY (RAFT)

**Protocol:** None

**Chain of Custody No:** 11/705

**Charge Number:** 52114141

**Sampler(s):** J.B. BLANTON

---

**Test Name:** Oil and Grease, Total Recoverable, Gravimetric

**Test Name:** Polychlorinated Biphenyls by GC

**Test Name:** Organic

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<th>Result</th>
<th>EPA</th>
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<th>Confidence</th>
<th>Unit</th>
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**EPA Qualifiers:**
- U - Analyte analyted for but undetected. Analyte result was below the contract required quantitation limit (CRQL).

---

***** END OF REPORT *****
Customer Smpl Id: LAKE REALITY
Matrix: WATER
Sample Description: WATER GRAB
Location: LAKE REALITY INLET
Chain of Custody No: 19532
Protocol: NONE
Charge Number: 5221401
Sampler(s): A.R.GARLAND

Customer Comments:
Lab Comments:

<<<<< Inorganic >>>>>
Test: TOTAL-U-9769
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: AS0 -Y/P65-8044
Approver: W J SANDERS
QC Batch/File:

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<<<<< Radiochemical >>>>>
Test: GROSSAB-ENV
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -900.0
Approver: C L WATSON
QC Batch/File: QC97211059

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<td>12587472</td>
<td>Beta activity</td>
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Test Name: Total Uranium and % U-235 by TIMS - 9769
Prep Method/Date:
Test Status: APPROVED
HT Deadline: 01/21/98 14:55:00
Date/Time Analyzed: 07/30/97 00:00:00
Lab Group: NYISO2

Test Name: Gross Alpha/Beta Activity (Env samples)
Prep Method/Date: EPA -900.0
Test Status: APPROVED
HT Deadline: 07/29/97 11:00:00
Date/Time Analyzed: 07/30/97 15:00:00
Lab Group: RURAD1

***** END OF REPORT *****
LIMS 05.01.023 08/22/97 08:21

Customer Smpl Id: 199707250002 K G HANZELKA
Customer: Project: Y-EC-HSEA SURV

ASD Operating ESLIMS
BLIG 9116, MS 8098 (423)574-1599

Official Report

Date/Time Sampled: 07/26/97 08:00:00
Date/Time Received: 07/28/97 16:29:31
Date/Time Needed: 08/27/97 23:59:59
Date/Time Completed: 08/21/97 13:24:30
Date/Time Approved: 08/21/97 13:24:30
Sample Status: APPROVED
Sample Approver:

Lab Smpl Id: A972060232

UNCLASSIFIED AS0 Operating ESLIMS Official Report

Project: Y-EC-HSEA SURV 8601 BLIG 9116, MS 8098 (423)574-1599

Page: 1 of 2

Customer C-nts: Lab C-nts:

Matrix: WATER
Sample Description:
Location: 9-221
Chain of Custody No: 199707250002
Protocol: NONE
Charge Number: S1:000017
Sampler(s):

Customer Comments: Lab Comments:

<<<< Inorganic >>>>

Test: HG2451
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -245.1 Mar90
Approvers: D E HASTE
QC Batch/File: PC97217075/97211A

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Test: ICP2007
Rpt Basis: As-Received
Test Req Cnt: 01
Analysis Meth: EPA -200.7 R3.3
Approvers: D G AILEY
QC Batch/File: PC97226023/EPA0012

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Test Name: Mercury in Water/Waste by CVAAS
Prep Method/Date:
Test Status: APPROVED
HT Deadline: 08/23/97 08:00:00
Date/Time Analyzed: 08/05/97 11:37:06
Lab Group: IXAA-1

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Test Name: Elems by EPA 200.7 ICP-AES
Prep Method/Date:
Test Status: APPROVED
HT Deadline: 01/22/98 08:00:00
Date/Time Analyzed: 08/12/97 12:00:00
Lab Group: IYICP2

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Comments: TOTAL RECOVERABLE METALS
Test Name: Nitrogen, Ammonia
Prep Method/Date: APPROVED
HT Deadline: 08/23/97 08:00:00
Date/Time Analyzed: 07/31/97 10:15:00
Lab Group: IANETC

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Test Name: Total Suspended Solids, EPA 160.2
Prep Method/Date: APPROVED
HT Deadline: 08/02/97 08:00:00
Date/Time Analyzed: 07/30/97 05:22:00
Lab Group: IANETC

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***** END OF REPORT *****
### Inorganic

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#### Test Name: Mercury in Water/Waste by CVAAS
- Prep Method/Date:
- Test Status: APPROVED
- HT Deadline: 08/23/97 08:45:00
- Date/Time Analyzed: 08/05/97 11:31:15
- Lab Group: IKAA-1

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Comments: TOTAL RECOVERABLE METALS
### Test: Nitrogen-NH3
- **Rpt Basis:** As-Received
- **Test Req Cnt:** 01
- **Analysis Meth:** EPA -350.1 1974
- **Approver:** G L Emerson
- **QC Batch/File:** G097212025

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### Test: Solids-Tot-S
- **Rpt Basis:** As-Received
- **Test Req Cnt:** 01
- **Analysis Meth:** EPA -160.2 1971
- **Approver:** P M Long
- **QC Batch/File:** G097211040

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**EPA**

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***** END OF REPORT *****

UNCLASSIFIED
**Customer Comments:**

**Lab Comments:**

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### Inorganic

**Test:** HG2451  
**Rpt Basis:** As-Received  
**Test Req Cnt:** 01  
**Analysis Meth:** EPA -245.1 Mar90  
**Approver:** D E HASTE  
**QC Batch/file:** QC97217075/97211A

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<th>Test Status</th>
<th>HT Deadline</th>
<th>Date/Time Analyzed</th>
<th>Lab Group</th>
<th>EPA Qual</th>
<th>Confidence Unit</th>
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<td>7439976</td>
<td>Mercury</td>
<td>Mercury in Water/Waste by CVAAS</td>
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<td>Prep Method/Date:</td>
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**Comments:** TOTAL RECOVERABLE METALS

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**ELIMS 05.01.023**  
08/22/97 08:22  
**Customer Smpl Id:** 199707250003  
**Project:** Y-EC-HSEA SURV B601  
**Bldg:** 9116, MS 8098  
**(423)574-1599**

| **Matrix:** WATER  
**Sample Description:** | |  
**Location:** 942:1  
**Chain of Custody No:** 199707250003  
**Protocol:** NONE  
**Charge Number:** S150(1017  
**Sampler(s):** | |  

**Date/Time Sampled:** 07/27/97 07:55:00  
**Date/Time Received:** 08/21/97 13:27:19  
**Date/Time Needed:** 08/27/97 23:59:59  
**Date/Time Approved:** 08/21/97 13:27:19

**Sample Status:** APPROVED

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**Comments:** TOTAL RECOVERABLE METALS

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**UNCLASSIFIED**
Test: NITROGEN-NH₃  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -350.1 1974  
Approver: G L EMERSON  
QC Batch/file: QC9721025  

Analyte Id | Analyte Name  
---|---  
N3350 | Ammonia as Nitrogen

Test: SOLIDS-TOT-S  
Rpt Basis: As-Received  
Test Req Cnt: 01  
Analysis Meth: EPA -160.2 1971  
Approver: P M LONG  
QC Batch/file: QC97211040  

Analyte Id | Analyte Name  
---|---  
N873 | Suspended Solids

Test Name: Nitrogen, Ammonia  
Prep Method/Date:  
Test Status: APPROVED  
HT Deadline: 08/24/97 07:55:00  
Date/Time Analyzed: 07/31/97 10:15:00  
Lab Group: IAWETC

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Test Name: Total Suspended Solids, EPA 160.2  
Prep Method/Date:  
Test Status: APPROVED  
HT Deadline: 08/03/97 07:55:00  
Date/Time Analyzed: 07/30/97 05:22:00  
Lab Group: IAWETC

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***** END OF REPORT *****
### Inorganic

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<td>7440622</td>
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Comments: TOTAL RECOVERABLE METALS
**Test: NITROGEN-NH3**
- Rpt Basis: As-Received
- Analysis Meth: EPA -350.1 1974
- Approver: G L EMERSON
- QC Batch/File: QC97212025

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**Test: SOLIDS-TOT-S**
- Rpt Basis: As-Received
- Analysis Meth: EPA -160.2 1971
- Approver: P M LONG
- QC Batch/File: QC97211040

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**Test Name: Nitrogen, Ammonia**
- Prep Method/Date: 
- Test Status: APPROVED
- Date/Time Analyzed: 07/31/97 10:15:00
- Lab Group: IAWETC

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**Test Name: Total Suspended Solids, EPA 160.2**
- Prep Method/Date: 
- Test Status: APPROVED
- Date/Time Analyzed: 07/30/97 05:22:00
- Lab Group: IAWETC

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**Prep Method/Date:**
- Test Status: APPROVED
- HT Deadline: 08/25/97 08:50:00
- Date/Time Analyzed: 08/05/97 11:19:32
- Lab Group: IKAA-1

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### Test Name: Elements by EPA 200.7 ICP-AES

**Prep Method/Date:**
- Test Status: APPROVED
- HT Deadline: 01/24/98 08:50:00
- Date/Time Analyzed: 07/29/97 12:30:00
- Lab Group: IYICP2

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Comments: TOTAL RECOVERABLE METALS

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**Analysis Method:** EPA -350.3 1974

**Prep Method/Date:**

**QC Batch/File:** QC97210013

**Approver:** P W Long

**Report:**

- Test Name: Nitrogen, Ammonia
- Prep Method/Date: APPROVED
- HT Deadline: 08/25/97 08:30:00
- Date/Time Analyzed: 07/28/97 15:45:00
- Lab Group: IAUETC

**EPA Result:**

- **Analyte:** Ammonia as Nitrogen
- **Test Name:** Total Suspended Solids, EPA 160.2
- **Prep Method/Date:** APPROVED
- **HT Deadline:** 07/30/97 05:22:00
- **Lab Group:** IAUETC

**EPA Confidence Unit:** mg/L

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**END OF REPORT**
Customer Smpl Id: 199707240012  
Customer: K G HANZELKA

### Inorganic

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Analysis Meth: EPA -200.7 R3.3  
Approver: R M WILKES  
QC Batch/File: QC97213020/EPA01V1

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Date/Time Analyzed: 08/05/97 11:25:26  
Lab Group: IJAA-1

Test Name: Elements by EPA 200.7 ICP-AES  
Prep Method/Date:  
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HT Deadline: 01/24/98 09:30:00  
Date/Time Analyzed: 07/29/97 12:30:00  
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Comments: TOTAL RECOVERABLE METALS
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Analysis Meth: EPA -350.1 1974  
Approver: P M LONG  
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Approver: P M LONG  
QC Batch/File: QC97211040  

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Prep Method/Date:  
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Date/Time Analyzed: 07/28/97 15:45:00  
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Protocol: NOHE
Charge Number: 52/11401
Sampler(s): H. ELLIOTT

Date/Time Sampled: 07/28/97 13:15:00
Date/Time Received: 07/28/97 16:23:07
Date/Time Needed: 07/31/97 23:59:59
Date/Time Completed: 07/29/97 10:19:29
Date/Time Approved: 07/29/97 10:19:29
Sample Status: APPROVED
Sample Approver:

Customer Comments: RUSH
Lab Comments:

<<<<< Organic >>>>

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Test Req Cnt: 01
Analysis Meth: SU846-8080
Approver: D R ZING

QC Batch/File:

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EPA Qualifiers:
U - Analyte analyted for but undetected. Analyte result was below the contract required quantitation limit (CRL).

***** END OF REPORT *****
UNCLASSIFIED
APPENDIX B

SUMMARY OF FISH KILL SURVEY INFORMATION
Summary of ESD Survey Information for July 24, 1997 Fish Kill

At approximately 13:45 on July 24, 1997, M. G. Ryon of the Environmental Sciences Division (ESD) received a phone call from L. O. Vaughan of Environmental Compliance Division, Y-12 Plant indicating that there was a fish kill occurring in upper East Fork Poplar Creek (EFPC) inside the Y-12 Plant. Mr. Vaughan requested the help of ESD to conduct surveys of EFPC to determine the extent of this kill. Mr. Ryon and E. M. Schilling of ESD arrived and began conducting surveys at approximately 14:45, with one person at the furthest downstream reach of EFPC within the Y-12 Plant perimeter fences and one person at the AS8 sampling weir. Shortly thereafter, additional surveyors, W. K. Roy and L. M. Kszos of ESD also joined the crew. Surveys were made until 18:00 when it was decided that a) the relative extent of the kill had been determined, b) the actual toxic episode had passed and fish were no longer in the process of dying, and c) a larger crew would be needed to completely inventory the dead fish remaining in the stream. A complete survey was conducted the following day, covering EFPC from the lower end of the diversion channel upstream to the North-South Pipes. A crew from Y-12 Plant Utilities also conducted boat surveys of Lake Reality. A final survey of EFPC above Bear Creek Road was conducted on Monday July 28, 1997.

Methods

The fish surveys varied in intensity and coverage between each survey day. On the first day, only 300 m of the stream were surveyed due to the large number of dead fish present. Of the 300 m surveyed, 150 m were covered in the lower Diversion Channel, 75 m in the stream just west of the eastern Y-12 Plant perimeter fence, and 125 m of stream near AS8. The surveyors were unable to make a regular upstream sweep of the entire EFPC, and could only position themselves in the stream and retrieve dead fish as they were swept downstream by the current, making very slow progress upstream. To help gauge the impact of the kill at various locations, collections were made based on a per minute effort at four locations. Although as many fish as possible were collected, the exact number of dead fish retrieved was not determined, except for a volume estimate. Fish collected on the first day were frozen or kept on ice until additional freezer space was located on July 25.

On the second day, July 25, the entire stream above Lake Reality was surveyed; this survey required 7 h, from 0830 to 1530, with a total crew of 5 ESD personnel. All dead fish observed were retrieved, in an attempt to remove all dead fish from the stream. A separate crew from the Y-12 Plant also made boat surveys of Lake Reality, retrieving as many dead fish as possible. The exact number of dead fish collected was not determined, except for a volume
estimate. Collected fish were frozen similar to earlier samples. Because there was no apparent
continuation of mortality since the first hours of the kill on July 24, and a majority of dead fish
had been retrieved during the 2 survey days, it was decided that weekend surveys on July 26-27
were not needed. A final survey was conducted on Monday, July 28. This survey covered the
entire stream above Bear Creek Road, but did not include boat surveys of Lake Reality.

The large number of dead fish precluded an actual count of dead fish retrieved from
surveys. The survey activities produced in excess of 10 full 5 gallon buckets of dead fish. To
determine how these volumes of fish translated into fish numbers, a subsample from the first day’s
surveys was counted. Approximately 2.5 gallons of fish were identified to species and counted.
This count was then applied to subsequent collections of fish to provide a number estimate.
Although every effort was applied to randomly subsample the approximate 10 gallons of source
fish used to determine count numbers, the possibility exists that these numbers are skewed and
should be used with caution. However, given the sheer numbers of dead fish collected, no other
alternative appeared reasonable. This subsample approach has been recommended by the
American Fisheries Society, in a publication on investigations of fishkills (AFS Publication 24,

For comparison basis, the total fish population in upper EFPC, above Lake Reality, was
estimated using regular survey data from the Biological Monitoring and Abatement Program.
Multipass removal estimates of fish populations are routinely made at two sites in this section of
stream. One site (EFK 25.1) is located immediately downstream of the North-South Pipes and
the other site (EFK 24.4) is just downstream of NPDES outfall 21. Estimates of the spring fish
populations at these sites were extrapolated to provide the total fish population size over the 1925
m of stream between the lower end of the Diversion Channel and the North-South Pipes.

Although effective in collecting the majority of dead fish resulting from a kill, dead fish
surveys are not capable of determining the absolute numbers of fish killed by a toxic episode.
Previous tagging studies conducted in upper EFPC in 1992 determined that approximately 60-
80% of the fish killed in an event are retrieved during surveys. To provide an estimate of the total
number potentially killed on July 24, the total number of dead retrieved were multiplied by these
correction factors. Another estimate was generated by using the 3 days of survey data as
multipass removal data. These data were analyzed by the same multipass population estimation
program used to generate estimates of the total fish populations.

As a correlate to the fish surveys, toxicity tests were run on water samples collected on
July 25 from the inlet to Lake Reality, the outlet from Lake Reality, and NPDES outfall 201. This
water was tested using EPA methodology for 48-h static acute tests using fathead minnow larvae
(*Pimephales promelas*) and an invertebrate (*Ceriodaphnia sp.*). The fathead minnow test was
conducted July 26-28 and the invertebrate test was conducted July 28-30.

**Results**

Initial observations made during the survey of July 24, indicated that the kill was
extensive and probably resulted from a short-lived, acutely toxic episode. By the time the survey
teams arrived and began surveys, almost all fish collected had died, with very few struggling,
appearing stressed, or in the process of dying. Few live fish were observed, particularly
downstream of the raw water outlet immediately below the North-South Pipes and above the
diversion channel. Dead fish observed in the stream spanned all size ranges and included all 4
known species found above the lake. The timed estimates of number of dead at each site indicated that most dead fish were located downstream, with few above outfall 109. In the first hours following the kill, 25 dead fish/min were retrieved at the most downstream location of EFPC, immediately west of the perimeter fence. Upstream 450 m, at NPDES Outfall 21, the rate had decreased to 23 fish/min. Upstream another 650 m, at NPDES Outfall 109, the rate dropped to 2 fish/min, and below the raw water outfall, 350 m upstream of Outfall 109 there were no dead fish seen. A large school of striped shiners (*Luxilus chrysocephalus*) was seen in the short section of stream above the raw water outfall and below the North-South Pipes. These fish appeared unharmed and were not exhibiting any signs of stress. The sharp delineation of fish reaction at this point suggested that the toxic agents originated from the raw water outlet, rather than the North-South Pipes. Similarly, observations of fish populations at Station 17 below the lake indicated no dead fish, with many fish behaving normally. Thus, it was inferred that the toxic agent had pulsed down EFPC from the raw water outfall and had been diluted, abated or spent by the time it reached or passed through Lake Reality.

Numerical results from the dead fish surveys indicate that the kill on July 24 totalled 24,132 fish, with more than 8,000 fish retrieved on the afternoon of July 24 and almost 16,000 fish retrieved on July 25 (Table 1). The size of this kill far exceeded any previous kill seen in upper EFPC by 3-fold and represents 51.2% of the fish estimated in the spring population surveys (Table 1). Most of the dead fish were central stonerollers (*Campostoma anomalum*) and blacknose dace (*Rhinichthys atratulus*). More than 60% of the estimated population of these two species was killed. These two species are also the most abundant in spring population surveys. The apparent low numbers of striped shiners killed (<2,000) suggests either a bias in the subsample counts, higher resistance to the toxic agent, or successful avoidance of the toxic pulse. Of the four species occurring above the lake, the striped shiner shows the greatest ability to actively flee from a stressor or stressed section of stream; blacknose dace and central stonerollers are apt to remain in an area and seek cover. The low numbers of dead redbreast sunfish (*Lepomis auritus*) reflect its low abundance in this section of EFPC. Surveys of Lake Reality retrieved basically only these species. None of the larger species known to occur in the lake, such as gizzard shad (*Dorosoma cepedianum*), common carp (*Cyprinus carpio*), or largemouth bass (*Micropterus salmoides*) were noted by crews surveying the lake. This suggests that by the time the toxic agent reached the lake, it was not capable of killing resident fish. Thus it might also be assumed that fish retrieved from the lake, probably died upstream and drifted into it.

The actual numbers retrieved, although larger than any previous kill, may not reflect the total number of fish killed during the July 24 episode. Estimates of the total number of fish killed range from approximately 30,000 to 40,000 (Table 2). This would represent approximately 65-85% of the spring fish population. For individual species, the impact could be even more significant (Table 2). One confounding factor in these comparisons of numbers of fish killed (either actual or estimated) to the total population is the reproduction and recruitment of fish over the summer. Because the spring sample does not include much of this year’s young fish, the total available fish population in upper EFPC prior to the kill on July 24, may have been larger than the 47,000 fish estimated from the spring samples. Comparisons of the number of dead with fall 1996 population estimates indicate that the proportion of the population killed on July 24 ranged from 44-74%. With either comparison, a substantial proportion of the fish population above Lake Reality has been removed.

The toxicity tests indicated no mortality associated with the water samples taken on July
25. There was 100% survival after 48 h in all concentrations, for both species, and at all sample locations. The lack of toxicity of water associated with Lake Reality indicates that whatever agent caused the fish kill on July 24, did not remain active beyond that date and that water

Table 1. Summary of fish kill surveys, total dead, estimated populations, and proportion of fish population killed (based on number of dead fish collected) as a result of toxic episode in upper East Fork Poplar Creek on July 24, 1997.

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<td>8,328</td>
<td>99</td>
<td>12,650</td>
</tr>
<tr>
<td>Striped shiner</td>
<td>555</td>
<td>1,095</td>
<td>13</td>
<td>1,663</td>
</tr>
<tr>
<td>Blacknose dace</td>
<td>3,255</td>
<td>6,450</td>
<td>76</td>
<td>9,751</td>
</tr>
<tr>
<td>Redbreast sunfish</td>
<td>23</td>
<td>45</td>
<td>0</td>
<td>68</td>
</tr>
<tr>
<td>Totals</td>
<td>8,056</td>
<td>15,888</td>
<td>188</td>
<td>24,132</td>
</tr>
</tbody>
</table>

Table 2. Summary of estimated number of fish killed based on several approximations, estimated populations, and proportion of fish populations killed (based on estimates of fish killed) as a result of toxic episode in upper East Fork Poplar Creek on July 24, 1997.

<table>
<thead>
<tr>
<th>Species</th>
<th>Actual dead collected</th>
<th>Estimated dead (based on survey effectiveness of 60 - 80%)</th>
<th>Estimated dead (based on 3-pass estimate)</th>
<th>Estimated population in EFPC above Lake Reality</th>
<th>Range of population killed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central stoneroller</td>
<td>12,650</td>
<td>21,126 - 15,813</td>
<td>16,142</td>
<td>18,361</td>
<td>100 - 86.1</td>
</tr>
<tr>
<td>Striped shiner</td>
<td>1,663</td>
<td>2,777 - 2,079</td>
<td>2,118</td>
<td>13,168</td>
<td>21.1-15.8</td>
</tr>
<tr>
<td>Blacknose dace</td>
<td>9,751</td>
<td>16,284 - 12,189</td>
<td>12,441</td>
<td>15,383</td>
<td>100 - 79.2</td>
</tr>
<tr>
<td>Redbreast sunfish</td>
<td>68</td>
<td>114 - 85</td>
<td>83</td>
<td>187</td>
<td>61.0 - 44.3</td>
</tr>
<tr>
<td>Totals</td>
<td>24,132</td>
<td>40,301 - 30,166</td>
<td>30,784</td>
<td>47,099</td>
<td>85.6 - 64.0</td>
</tr>
</tbody>
</table>

flowing at Outfall 201 was not toxic.
Discussion

Water quality and plant operation information provided by the Y-12 Plant strongly suggest that a dechlorinating agent, applied to the raw water released below the North-South Pipes was responsible for the toxicity resulting in the fish kill of July 24. Dissolved oxygen (DO) measurements in upper EFPC indicate that low oxygen levels (3-5 ppm) occurred for a period of up to 30 min. This slug of low DO water traveling down EFPC to the lake could easily explain the massive fish kill and the resulting observations. Dissolved oxygen levels of 5.2 ppm or lower are documented as causing problems for warmwater fish species (Heath 1995). The presence of other stressors, including a range of petrochemicals, tends to lower resistance to low oxygen conditions. Given the sequence of events in upper EFPC in the few days prior to July 24, where extremely high flows were followed by inputs of a wide range of low concentrations of oils, the sensitivity to low DO conditions might be heightened.

The possible toxic impact of the oils and other contaminants reaching EFPC as a result of the heavy rainfall on July 22 doesn't appear significant enough to be the sole cause of the kill on July 24. Even during the height of the kill, a large school of fish remained immediately downstream of the North-South Pipes. If the toxicity of waters flowing through this outlet were the primary cause of the kill, then it would be expected that this school of fish would not have been present immediately below the pipes. Any impact of waters entering from other sources, such as pumping of basements would have produced a staggered pattern of mortality, with fishing dying in different localities at different times and rates. Further, it would be expected that the mortality observed would have continued over several days at least, as more resistant individuals succumbed slowly to the toxic exposure. This would have provided freshly dead or dying fish for the surveys of July 25 and 28.

In previous fish kills in this stream section, the impact on the fish community has been judged to be short-term only, with no significant long-term ecological effects. In fact, the numerous fish kills over the past 7 years do not appear to have dampened the growth of the stream fish populations. The magnitude of these kills was far less than that of the July 24 kill; maximum mortality of 10-20% of the total population above Lake Reality. Because the current kill has affected a much larger proportion of the resident population, the impacts are expected to extend for a longer period in this situation, perhaps up to a year. Decreased population levels should be evident through the fall 1997 and spring 1998 samples. Depending on the success rate of reproduction during the summer of 1998, the recovery of fish populations should be observed in the fall 1998 population sample. However, complete recovery may take several reproductive seasons to reach the densities seen in 1997. The cyprinid species occurring in upper EFPC have tremendous reproductive capacities and should be able to repopulate this area with little or no long-term ecological impact. Even the redbreast sunfish should, at the worst, only endure a narrowing of its available gene pool, with little if any long-term impacts.

Recommendations

In addition to the operational recommendations that will be prompted by this fish kill, several research efforts will be implemented. Because the exact number of fish killed and the impact on the populations is uncertain, a summer population estimate will be conducted at EFK 24.4. This estimate will be conducted in the same manner as the routine spring/fall samples, and
should provide the best reflection of the extent of the July 24 fish kill. Although, a routine sample at this site is scheduled for September, by conducting a sample as soon as possible after the kill, any migration of additional fish from the stream below Lake Reality into this section will be minimized. As part of an effort to determine fish kill survey effectiveness, a study will be implemented to track and record distributions of tagged dead fish over a 1 or 2 day period. This study will repeat the effort conducted in 1992, where a known number of tagged golden shiners (Notemigonus crysoleucas) are released and then monitored through several surveys of the stream above Lake Reality. Given the new flow conditions, this study should provide information on how far the fish might drift and how effective an individual survey might be in recovering dead fish. As with the 1992 study, each fish will be tagged. Because golden shiners do not occur in upper EFPC and have several unique physical features that separate them from other cyprinids, there is no possibility these fish could be counted as part of a non-study fish kill. Again, this study will conducted within the next several weeks.

References


APPENDIX C

SODIUM BISULFITE TOXICITY TEST RESULTS
Date: August 18, 1997

To: B. E. Skaggs

c: M. G. Ryon

From: L. A. Kszos, 1504, M/S-6351 (574-4784) and G. R. Southworth

Subject: Sodium Bisulfite Toxicity Tests with Fathead Minnows

In order to evaluate the effect of sodium bisulfite (and resulting low dissolved oxygen) on fathead minnows, two initial steps were taken. First, the amount of sodium bisulfite that entered East Fork Poplar Creek (EFPC) was estimated based on the information you provided on flow rates of EFPC and the amount of time that sodium bisulfite was fed into the dissipation chamber. Secondly, the effect of sodium bisulfite on dissolved oxygen and pH was measured using sodium bisulfite obtained from the Y-12 Plant and laboratory dechlorinated tap water.

Estimate of sodium bisulfite concentration in EFPC (G. R. Southworth)

The bisulfite concentrations in EFPC at the time of the fish kill were estimated as follows.

The concentration of sodium bisulfite in the energy dissipation chamber was calculated assuming a feed of 0.7 gph of 30% NaSO₃ for 37 h into a volume of 2800 gal, yielding an initial concentration 2.8 g/L sodium bisulfite (30 kg). The dissolved oxygen in the water and reaeration over 37 h were calculated to convert 2.5 kg of sodium bisulfite to bisulfate, producing an equivalent amount of acidity. Upon the start of raw water flow, it was assumed that the contents of the chamber were added as a slug to EFPC at a rate equal to the raw water flow (3.6 mgd), producing a pulse 1.1 min in duration. This was assumed to mix instantaneously with the 2.4 mgd flow from the N/S pipe, creating an initial concentration in the creek of 1.55 g/L sodium bisulfite. The slug was assumed to travel downstream at 0.5 m/s and spread at a rate causing it to be diluted 20 fold within 1600 m. At the 1600 m point, the slug would be 22 minutes in duration. Bisulfite in the dispersing slug was assumed to react with dissolved oxygen, consuming 22 kg of sodium bisulfite. Reaeration was assumed to provide oxygen to consume an additional 1.4 kg. Thus, at the 1600 m point, 4 kg of the original 30 kg of sodium bisulfite would remain, yielding an estimated concentration of 11 mg/L sodium bisulfite. Excess bisulfite indicates all dissolved oxygen would have been consumed.

Acidity produced by oxidation of bisulfite would have consumed all alkalinity in the dissipation chamber, producing a pH estimated at 3.5, and substantial conversion of bisulfite to sulfur dioxide.
However, mixing with N/S pipe flow would provide adequate buffering capacity to raise the pH, but the combination of high bisulfite and acid produced by oxidation would likely have resulted in a pH of 5.5 to 6 in the initial slug. This would rise to pH 7 or above as the slug dispersed.

Under this scenario, fish near the discharge point would have been exposed to a concentration of approximately 1.55 g/L sodium bisulfite at pH values of 5.5 - 6 for 1 to 5 minutes in water totally devoid of dissolved oxygen. At the downstream site, fish would have been exposed to approximately 11 mg/L sodium bisulfite in deoxygenated water for 20 minutes.

**Effects of sodium bisulfite on dissolved oxygen and pH of dechlorinated tap water**

The attached figure shows the results of adding sodium bisulfite to dechlorinated tap water. A concentration of 1500 mg/L sodium bisulfite (the estimated concentration of the initial slug) decreased the dissolved oxygen from 7.5 to 0 mg/L in 19 sec. The pH dropped from 7.4 to 5.8. A concentration of 600 mg/L sodium bisulfite reduced the dissolved oxygen to 0 mg/L in 1.15 min.

**Toxicity of sodium bisulfite to fathead minnows**

The toxicity of sodium bisulfite to fathead minnows was evaluated using 25 d old minnows and sodium bisulfite obtained from the Y-12 Plant. Ten minnows were placed in each of two replicate beakers containing 500 mL of dechlorinated tap water. Sodium bisulfite was added at the desired concentration and the time to death measured. Two replicate beakers served as controls and contained only dechlorinated tap water. There was no mortality in the control beakers. The results of the test are indicated in the table below.

<table>
<thead>
<tr>
<th>Sodium bisulfite</th>
<th>Time to 100% mortality</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 mg/L</td>
<td>8 min</td>
<td>Fish immediately rose to the surface.</td>
</tr>
<tr>
<td>1200 mg/L</td>
<td>30 min</td>
<td>Fish immediately rose to the surface.</td>
</tr>
<tr>
<td>900 mg/L</td>
<td>9–22 h</td>
<td>Fish died overnight.</td>
</tr>
</tbody>
</table>

The dissolved oxygen in each of the tested concentrations was 0 mg/L within one minute. However, the mortality rates in each concentration are quite different. This indicates that low dissolved oxygen was not the sole cause of mortality, but rather that the low dissolved oxygen and reduced pH potentiated the toxicity of the sodium bisulfate. The amount of bisulfite added to EFPC on July 24, 1997, appears capable of causing rapid fish mortality, especially if the concentration of sodium bisulfite was higher and/or the pH reduction was greater than that estimated.
Sodium bisulfite was added to dechlorinated tap water. Beginning pH was 7.4; beginning D.O. was 7.5.
Distribution

D. E. Bohrman
E. T. Collins
R. E. Fenstermaker
J. M. Gilbert
M. S. Greeley
C. C. Hill
S. H. Howell
C. A. Krull, Jr.
L. A. Kszos
S. D. Morris, DOE-ORO
J. E. Powell
R. M. Shedden
B. E. Skaggs
L. O. Vaughan
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