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ENGINEERING AND DEVELOPMENT SUPPORT OF GENERAL DECON TECHNOLOGY FOR THE DARCOM INSTALLATION RESTORATION PROGRAM

Task 9. Lagoon Sediment Analysis

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OBJECTIVE

The purpose of this task is to analytically determine the trinitrotoluene, dinitrotoleune and cyclotrimethylene trinitramine content of lagoon sediment from four Installations.

INTRODUCTION

To assess any safety problems in the treatment of explosive contaminated sediment, lagoon sediment samples were collected from four Army installations. Atlantic Research Corporation analyzed the sediments for percent moisture, TNT, RDX, 2,4-DNT and 2,6-DNT. The sediment samples were then sent to the Large Caliber Weapon Systems Laaboratory for sensitivity analysis. USATHAMA will then correlate the sediment sensitivity vs. explosive levels in the sediment.

METHODS

Five to six samples of wet contaminated lagoon sediment were received from four installations: Alabama Army Ammunition Plant (AAAP), Louisiana Army Ammunitions Plant (LAAP), Umatilla Army Depot (UAD), and Savannah Army Depot (SAD) at various times during the month of July.

As instructed by USATHAMA, each individual sample was well mixed and a 4 - 6 gram sample was taken to determine the percent moisture. The percent moisture samples were put in an oven at 110°C for 24 hours. The samples were then cooled in a desiccator and reweighed to a constant weight. A twenty gram sample was also taken from each sediment sample to determine explosive content. These samples were air dried overnight on the dull side of a sheet of aluminum foil.

Because of the extreme variation in explosive levels of the sediment, two extraction methods were used. The sediment samples with relatively low explosive levels were analyzed by weighing out duplicate 2 gram samples from each site. The samples were then extracted with 2 five ml washes of benzene. The washes were combined to give one complete extraction.

These samples were analyzed on a Hewlett-Packard 5880A GC with an electron capture detector. The operating conditions were:

Column:	1.5% OV-17 & 1.95% OV-210 on Anakrom Q 80/100 packed in a 2 mm I.D. by 6 ft. glass column
Temperature:	Injection port - 210°C
	Oven - 140°C - 210°C
	Program rate - 12°C per minute
	Dectector - 300°C

The detection limits for this method were:

TNT	0.3 µg/g
2,4-DNT	0.3 µg/g
2,6-DNT	0.2 µg/g
RDX	1 µg/g

The sediment samples which were highly contaminated were analyzed by the extracting duplicate 0.5 gram samples from each site with 2 ten ml washes of acetone. The washes were combined for analysis. The samples were analyzed on a Hewlett-Packard 5880A GC with a Flame Ionization detector. The operating conditions were:

Column:	2% Dexsil 300 GC on Anakrom Q packed in a 2mm I.D., 0.25 in. O.D. by 2 ft. column
Temperature:	Injection port - 210°C
	Oven - 140 - 230°C
	Program rate - 8°C/min.
	Detector - 250°C

The detection limits of this method were:

TNT	178 µg/g
2,4-DNT	~100 µg/g
2,6-DNT	~100 µg/g
RDX	490 µg/g

RESULTS

The sampling locations at Alabama AAP are presented in Figure 1. The explosive levels and percent moisture data for the sediment samples are presented in Table 1. RDX, 2,4-DNT and 2,6-DNT levels in the sediment were below the analytical detection limits. TNT levels in the sediment were highest at site 1 with concentrations of 67 µg/g. The other five sites had TNT levels at or below 1 µg/g. Moisture levels in the Alabama AAP sediments ranged from 21 to 37%.

The sampling pattern which was to be used for the lagoons at the other three sites are presented in Figure 2. Louisiana AAP sampled lagoon 9. The specific lagoons sampled at Umatilla AD and Savannah AD were not supplied.

The explosive levels and percent moisture data for Umatilla AD sediment are presented in Table 2. Site 1 had the highest TNT levels at 10,500 µg/g. The TNT levels for site 5 were also high at 3400 µg/g. The 2,4-DNT levels were 12 µg/g at site 1, 1.5 µg/g at site 5 and .3 µg/g or less at the other sites. The 2,6-DNT levels were .5 µg/g or less for all the sites sampled at Umatilla AD. The sediment moisture levels ranged from 7 to 15 percent. RDX levels in the sediment could not be determined because of interfering peaks from UAD sediment. The levels presented are the maximum which could be present in the sediment.

The explosive levels and percent moisture data for the Louisiana AAP sediment samples were presented in Table 3. TNT and RDX levels were highest at site 1 with concentration of 30,000 µg/g and 18,000 µg/g, respectively. The 2,4-DNT and 2,6-DNT concentrations in the sediment were below the analytical detection limits for all sites. The DNT could not be run on the more sensitive electron capture due to the highest TNT and RDX concentration. The sediment moisture levels ranged form 25 to 54 percent.

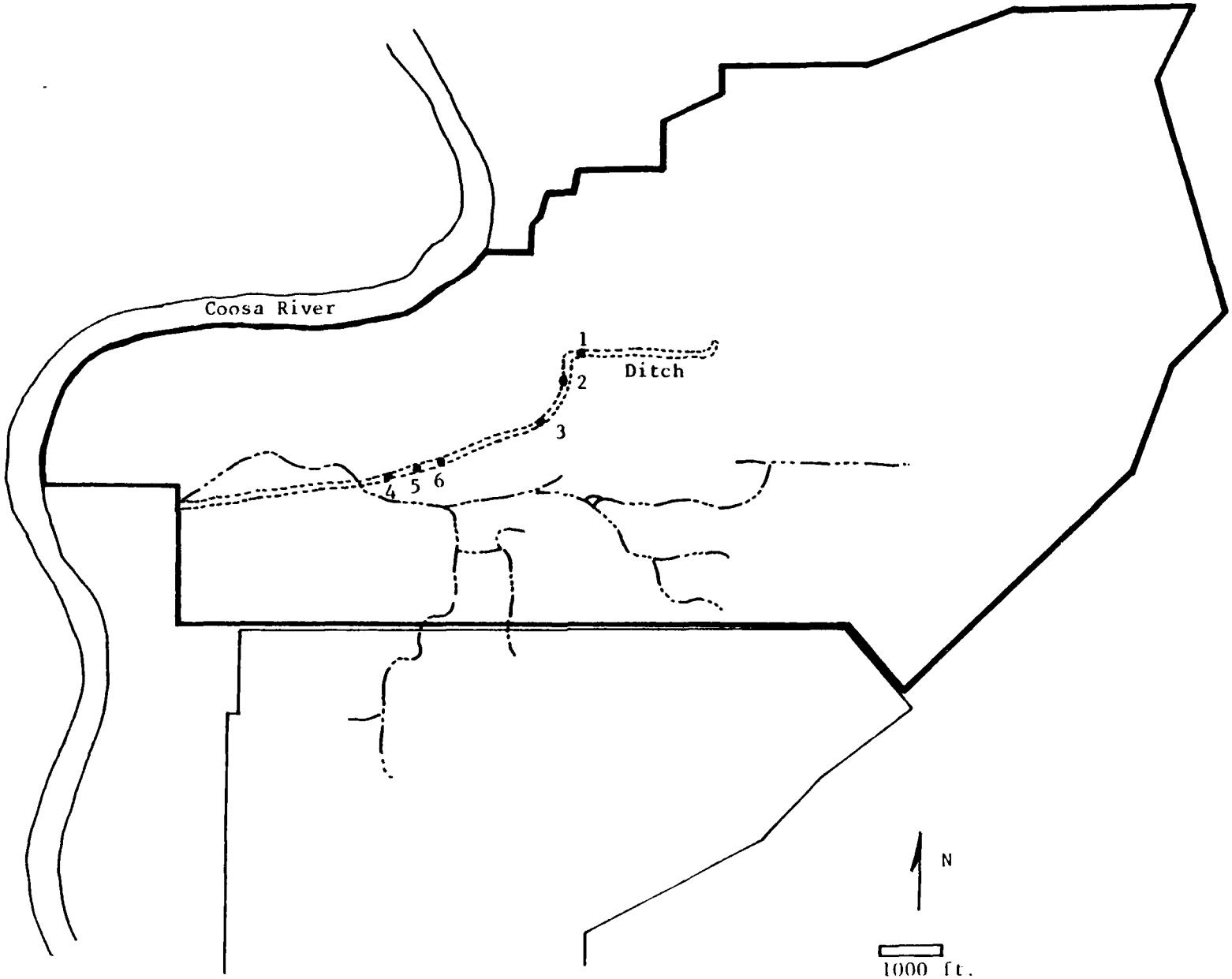

Figure 1. Alabama Ditch Sampling Locations

Table 1. Explosive Levels in Alabama AAP Sediment Samples (µg/g, dry wt)

Sample Number	Station Number	2,4-DNT	2,6-DNT	TNT	RDX	Percent Moisture
1	07-001-2	<.3	<.2	67	<1	23
2	07-002-2	<.3	<.2	0.5	<1	37
3	06-003-2	<.3	<.2	0.8	<1	21
4	21-002-2	<.3	<.2	1.0	<1	27
5	21-004-2	<.3	<.2	< .3	<1	21
6	21-005-2	<.3	<.2	1.0	<1	37

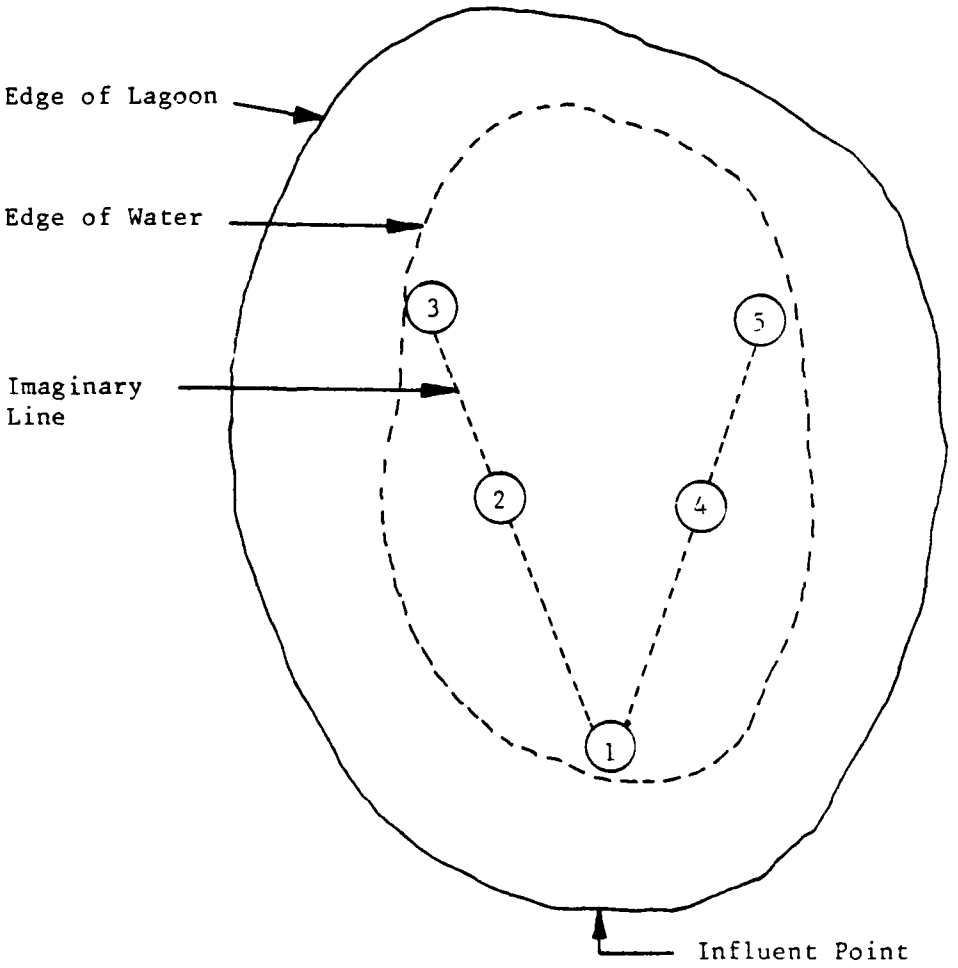

Figure 2. Lagoon Sampling Locations

Table 2. Explosive Levels in Umatilla AAP Sediment Samples (µg/g, dry wt.)

Sample Number	2,4-DNT	2,6-DNT	TNT	RDX	Percent Moisture
1	12	<.2	10,500	<490*	14
2	<.3	<.2	116	<490	7
3	.3	<.2	40	<490	14
4	<.3	<.2	150	<490	14
5	1.5	0.5	3,400	<490	15

*Maximum Amount. Lower levels could not be determined because of intereferences.

Table 3. Explosive Levels in LAAP Sediment Samples (µg/g, dry wt.)

Sample Number	2,4-DNT	2,6-DNT	TNT	RDX	Percent Moisture
1	<100	<100	30,000	18,000	25
2	<100	<100	7,800	6,900	28.1
3	<100	<100	170	420	28.7
4	<100	<100	3,700	3,000	53.7
5	<100	<100	17	<1	30.4

The sediment explosive levels and percent moisture data for the Savannah AD samples are presented in Table 4. Once again, 2,4-DNT and 2,6-DNT levels were below the detection limits for all of the sites. TNT levels ranged from 144,000 to 181,000 µg/g at sites 2 through 5. However, site 1, which should have had the highest levels, had TNT concentrations of 12,000 µg/g. RDX levels ranged from 3,000 to 4,200 µg/g at sites 2 through 5, while the site 1 levels were below the detection limit of 490 µg/g. The RDX levels at site 1 could not be determined with the more sensitive method because of the high TNT levels.

CONCLUSIONS

The sediment samples received for explosives analysis from the four installations were similar to other sediment samples that Atlantic Research has received in that they showed a high degree of variability in both the different samples and within each sample. Because of this variability, caution must be exercised in the interpretation of the correlation of the sensitivity/explosives level results.

Table 4. Explosive Levels in S.A.D. Sediment Samples (μg/g, dry wt.)

Sample Number	2,4-DNT	2,6-DNT	TNT	RDX	Percent Moisture
1	<100	< 100	12,000	<490	26.1
2	<100	< 100	152,000	3,100	32.9
3	<100	< 100	144,000	3,000	46
4	<100	< 100	181,000	4,200	50.7
5	<100	< 100	149,000	3,500	55.7