DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

5439

September 7, 2007

Formerly Utilized Sites Remedial Action Program

SUBJECT: Iowa Army Ammunition Plant Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G and L, Warehouse 3-01, and the West Burn Pads Area South of the Road, Final

Mr. Scott Marquess
U.S. Environmental Protection Agency, Region VII
901 North 5th Street
Kansas City, KS 66101

Dear Mr. Marquess:

On February 27, 2007, USACE submitted the draft final version of the subject document for review in accordance with the Federal Facility Agreement (FFA) Administrative Docket Number CERCLA-07-2005-0378 executed between the U.S. Environmental Protection Agency (EPA), the State of Iowa, the Department of Energy, and the U.S. Army Corps of Engineers for the Iowa Army Ammunition Plant (IAAAP). Pursuant to FFA Article IX, Consultation with EPA and the State of Iowa, Paragraph B.1, the draft final document is final.

Enclosed please find a package of updated pages to the subject document. The package includes instructions for removing specified pages from the draft final document and replacing with the update pages. Please follow the instructions and update the draft final document accordingly. The revised pages change the designation of the document from "draft final" to "final" and include minor changes to the text in response to comments and requests received during and following the review period. The resulting document will be the final version of the document, dated June 19, 2007.

Copies of this letter and the update package are also being provided to Mr. Dan McGhee (Iowa Department of Public Health), Mr. Dan Cook (Iowa Department of Natural Resources) and Mr. Steve Bellrichard (IAAAP).

If you have any questions regarding this letter or the update package, please contact me at 314-260-3915.

Sincerely,

Sharon Cotner

Sharon Cotner
FUSRAP Program Manager

Enclosure

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

September 7, 2007

Formerly Utilized Sites Remedial Action Program

SUBJECT: Iowa Army Ammunition Plant Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G and L, Warehouse 3-01, and the West Burn Pads Area South of the Road, Final

Mr. Dan McGhee
Iowa Department of Health
Lucas State Office Building
321 East 12th Street
Des Moins, IA 50319-0075

Dear Mr. McGhee:

Enclosed please find a letter and an update package sent to Mr. Scott Marquess (U.S. EPA, Region VII). The letter acknowledges that the subject document is final in accordance with the Federal Facility Agreement (FFA) Administrative Docket Number CERCLA-07-2005-0378 executed between the U.S. Environmental Protection Agency (EPA), the State of Iowa, the Department of Energy, and the U.S. Army Corps of Engineers (USACE) for the Iowa Army Ammunition Plant (IAAAP).

Enclosed please also find a package of updated pages to the subject document. The package includes instructions for removing specified pages from the draft final document and replacing with the update pages. Please follow the instructions and update the draft final document accordingly. The revised pages change the designation of the document from "draft final" to "final" and include minor changes to the text in response to comments and requests received during and following the review period. The resulting document will be the final version of the document, dated June 19, 2007.

Copies of this letter and the update package are also being provided to Mr. Steve Bellrichard (IAAAP) and Mr. Dan Cook (Iowa Department of Natural Resources).

If you have any questions regarding this letter or the update package, please contact me at 314-260-3915.

Sincerely,

Sharon Cotner
FUSRAP Program Manager

Enclosure

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

September 7, 2007

Formerly Utilized Sites Remedial Action Program

SUBJECT: Iowa Army Ammunition Plant Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G and L, Warehouse 3-01, and the West Burn Pads Area South of the Road, Final

Mr. Steve Bellrichard
Iowa Army Ammunition Plant
17571 State Hwy 79
Middletown, IA 52638

Dear Mr. Bellrichard:

Enclosed please find a letter and an update package sent to Mr. Scott Marquess (U.S. EPA, Region VII). The letter acknowledges that the subject document is final in accordance with the Federal Facility Agreement (FFA) Administrative Docket Number CERCLA-07-2005-0378 executed between the U.S. Environmental Protection Agency (EPA), the State of Iowa, the Department of Energy, and the U.S. Army Corps of Engineers (USACE) for the Iowa Army Ammunition Plant (IAAAP).

Enclosed please also find a package of updated pages to the subject document. The package includes instructions for removing specified pages from the draft final document and replacing with the update pages. Please follow the instructions and update the draft final document accordingly. The revised pages change the designation of the document from "draft final" to "final" and include minor changes to the text in response to comments and requests received during and following the review period. The resulting document will be the final version of the document, dated June 19, 2007.

Copies of this letter and the update package are also being provided to Mr. Dan McGhee (Iowa Department of Public Health) and Mr. Dan Cook (Iowa Department of Natural Resources).

If you have any questions regarding this letter or the update package, please contact me at 314-260-3915.

Sincerely,

Sharon Cotner

Sharon Cotner
FUSRAP Program Manager

Enclosure

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

September 7, 2007

Formerly Utilized Sites Remedial Action Program

SUBJECT: Iowa Army Ammunition Plant Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G and L, Warehouse 3-01, and the West Burn Pads Area South of the Road, Final

Mr. Dan Cook
Wallace State Office Building
900 East Grand Ave
Des Moines, IA 50319

Dear Mr. Cook:

Enclosed please find a letter and an update package sent to Mr. Scott Marquess (U.S. EPA, Region VII). The letter acknowledges that the subject document is final in accordance with the Federal Facility Agreement (FFA) Administrative Docket Number CERCLA-07-2005-0378 executed between the U.S. Environmental Protection Agency (EPA), the State of Iowa, the Department of Energy, and the U.S. Army Corps of Engineers (USACE) for the Iowa Army Ammunition Plant (IAAAP).

Enclosed please also find a package of updated pages to the subject document. The package includes instructions for removing specified pages from the draft final document and replacing with the update pages. Please follow the instructions and update the draft final document accordingly. The revised pages change the designation of the document from "draft final" to "final" and include minor changes to the text in response to comments and requests received during and following the review period. The resulting document will be the final version of the document, dated June 19, 2007.

Copies of this letter and the update package are also being provided to Mr. Dan McGhee (Iowa Department of Public Health) and Mr. Steve Bellrichard (IAAAP).

If you have any questions regarding this letter or the update package, please contact me at 314-260-3915.

Sincerely,

Sharon Cotner

Sharon Cotner
FUSRAP Program Manager

Enclosure

Instructions for Updating the *Draft Final Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G, and L, Warehouse 3-01 and the West Burn Pads Area South of the Road*

1. Remove the existing (green) title page and spine sheet and replace with the new (red) title page and spine sheet.
2. Insert the Update Package explanation page titled "ATTENTION"
3. Remove the existing first page of the document (the cover page dated February 26, 2007) and replace with the new cover page (dated June 19, 2007).
4. Remove existing pages 93 through 98 and replace with the new pages 93 through 98.
5. Remove existing Figures 48 and 49 and replace with new Figures 48 and 49.
6. Immediately following Appendix F, add the following in this order:
    - The card-stock page that contains the Appendix G tab,
    - Appendix G cover page (which describes the contents of Appendix G),
    - The draft "Sampling and Analysis Report", and
    - The nine (9) historical aerial photographs for the West Burn Pads Area South of the Road.

FINAL

REMEDIAL INVESTIGATION WORK PLAN FOR LINE 1, FIRING SITES AREA, YARDS C, G, AND L, WAREHOUSE 3-01 AND THE WEST BURN PADS AREA SOUTH OF THE ROAD

MIDDLETOWN, IOWA

June 19, 2007

U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program

ATTENTION

The Final version of this *Remedial Investigation Work Plan for Line 1, Firing Sites Area, Yards C, G, and L, Warehouse 3-01, and the West Burn Pads Area South of the Road* was created by incorporation of an "Update Package" on June 19, 2007. After incorporation of the "Update Package" most text pages still retain the "Draft Final" footer. It should be noted that after incorporation of the "Update Package" this document represents the Final revision, irrespective of the footer on individual text pages. To verify that the "Update Package" has been incorporated into this copy, pages 93 through 98 should display "Final" in the footer

FINAL

REMEDIAL INVESTIGATION WORK PLAN FOR LINE 1, FIRING SITES AREA, YARDS C, G, AND L, WAREHOUSE 3-01 AND THE WEST BURN PADS AREA SOUTH OF THE ROAD

MIDDLETOWN, IOWA

June 19, 2007

prepared by
U.S. Army Corps of Engineers, St. Louis District Office, Formerly Utilized Sites Remedial Action Program

with assistance from
Science Applications International Corporation
under Contract FA4890-04-D-0004 Delivery Order Number DJ01

were found include trenches 1, 2, and 21 in the area east of the access road to a monitoring well, hereafter referred to as the "access road," and trenches 9, 11, 12, 13, and 24 in the area west of the access road. In general, soil samples will be collected along drainage ways that are down gradient of the previously identified contamination. In addition, two proposed sampling locations are in an area just west of the access road where ECC also explored the subsurface soil conditions, however, no soil samples had been collected for analysis. Also, surface and subsurface soil samples will be collected from one location within and at four locations surrounding the distressed area found by ECC to be contaminated by explosives. Initial proposed sampling locations are shown in Figures 48 and 49. These locations are subject to relocation depending upon the conditions encountered in the field; sampling locations are to be in drainage ways down gradient from the formerly identified contaminated areas.

With the exception of soil present in the vicinity of the distressed area, soil samples collected are to be analyzed for metals, explosives, and depleted uranium (subsurface soil only). In addition, the soil will be analyzed for Semi-Volatile Organic Compounds (SVOCs), including [4, 4'-Methylene bis(2-chloroaniline)], because SVOCs were identified previously as potential constituents of concern (PCOC) at the West Burn Pad area and previous investigations of the area south of the road have not included the SVOC analysis of soil. However, the number of surface soil samples to be analyzed for SVOCs will be limited to those locations that are down gradient of previously identified contaminated areas (an estimated eight locations). A minimum of eight samples are required to satisfy the requirements for use of statistical methods. Conversely, all subsurface soil samples collected will be analyzed for SVOCs. Soil samples collected in association with the distressed area will be analyzed for explosives only. Information pertaining to individual sampling locations established in the West Burn Pads Area South of the Road is presented in Table 4-7.

Unexploded ordnance (UXO) support is needed for this area during soil sampling activities. See the Heath and Safety Plan (Appendix F) for safety protocols concerning UXO.

4.7.1.1 Sediment Sampling

To determine if Spring Creek has been impacted by activities at the West Burn Pad Area South of the Road, three sediment samples will be collected at the investigative area. One sediment sample will be collected from Spring Creek on the northeastern corner of the investigation site boundary to determine if the area to the north is contributing contaminants to the creek. One sediment sample will be collected from Spring Creek on the southeastern corner of the investigation site boundary to determine if any sediment contamination may be exiting the area. An additional sediment sample will be collected from a central drainage ditch at the point where it discharges to Spring Creek to determine if the investigative area is contributing contaminants to the creek. The sediment sampling locations (523, 524, and 525) are shown in Figure 48. These sediment samples will be collected for analysis of metals, SVOCs, and explosives.

Additional upstream sediment samples may be collected if contamination is observed in the sediment of the creek. If necessary, additional sediment samples will be collected in 100 ft increments along the creek for delineation purposes.

Table 4-7. Sampling & Analysis Plan for West Burn Pads Area South of the Road

Sample Location	Easting	Northing	Depth	Analytes(s)[1]	Description/Rationale
500	693908.02	91846.70	0-0.5'	E, M	West of trench 1/Evaluate horizontal and vertical extent of soil contamination to the west.
			3.0-4.0'	E, M, S, DU	
501	693926.56	91828.50	0-0.5.'	E, M, S	South of trench 1 and distressed area. Evaluate horizontal and vertical extent of soil contamination in a southerly direction
			3.0-4.0'	E, M, S, DU	
502	693931.81	91836.55	0-0.5'	E, M , S	Between trenches 1 and 2. Confirm the presence of soil contamination and evaluate the horizontal and vertical extent of soil contamination
			3.0-4.0'	E, M, S, DU	
503	693955.26	91829.20	0-0.5'	E, M , S	Southwest of trench 2. Evaluate horizontal and vertical extent of soil contamination in a southerly direction.
			3.0-4.0'	E, M, S, DU	
504	693961.55	91839.35	0-0.5'	E, M	East of trench 2 and west of trench 21. Evaluate if the contamination found at trenches 2 and 21 are connected by waste or migration.
			3.0-4.0'	E, M, S, DU	
505	693987.80	91848.45	0-0.5'	E, M	North-northeast of trench 21 and south of trench 6. Evaluate the horizontal and vertical extent of soil contamination in a northeasterly direction.
			3.0-4.0'	E, M, S, DU	
506	693992.00	91830.95	0-0.5'	E, M, S	Southeast of trench 21. Evaluate horizontal and vertical extent of soil contamination in an east-southeast direction.
			3.0-4.0'	E, M, S, DU	
507	693746.70	91838.65	0-0.5'	E, M	Northwest of trench 24. Evaluate horizontal and vertical extent of soil contamination in a northwesterly direction.
			4.0-5.0'	E, M, S, DU	
508	693744.60	91817.31	0-0.5'	E, M	West-northwest of trench 9. Evaluate horizontal and vertical extent of soil contamination in a westerly direction.
			3.0-4.0'	E, M, S, DU	
509	693749.85	91804.71	0-0.5'	E, M , S	Southwest of trench 9. Evaluate horizontal and vertical extent of soil contamination in a southwestern direction.
			3.0-4.0'	E, M, S, DU	
510	693763.15	91839.35	0-0.5'	E, M	West of trench 7 and north of trench 8. Evaluate horizontal and vertical extent of soil contamination in a northerly direction.
			4.0-5.0'	E, M, S, DU	
511	693783.79	91811.01	0-0.5'	E, M , S	South-southeast of trench 11. Evaluate horizontal and vertical extent of soil contamination in a southerly direction.
			4.0-5.0'	E, M, S, DU	
512	693791.14	91840.40	0-0.5'	E, M	Northeast of trench 12. Evaluate horizontal and vertical extent of soil contamination in a northerly direction.
			4.0-5.0'	E, M, S, DU	
513	693803.39	91834.80	0-0.5'	E, M	North of trench 13. Evaluate horizontal and vertical extent of soil contamination in a northeasterly direction.
			4.0-5.0'	E, M, S, DU	

Table 4-7. Sampling & Analysis Plan for West Burn Pads Area South of the Road (Cont'd)

Sample Location	Easting	Northing	Depth	Analytes(s)[1]	Description/Rationale
514	693808.99	91818.36	0-0.5'	E, M, S	East of trench 14 and south of trench 22. Evaluate horizontal and vertical extent of soil contamination in an easterly direction.
			4.0-5.0'	E, M, S, DU	
515	693802.34	91811.36	0-0.5'	E, M, S	South of trench 13. Evaluate horizontal and vertical extent of soil contamination in southerly direction.
			4.0-5.0'	E, M, S, DU	
516	693848.53	91834.80	0-0.5'	E, M	Confirm that there is no contamination in the soil and to complete the characterization of the general area
			3.0-4.0'	E, M, S, DU	
517	693868.83	91815.91	0-0.5'	E, M	Confirm that there is no contamination in the soil and to complete the characterization of the general area
			3.0-4.0'	E, M, S, DU	
518	Field Determined	Field Determined	0-0.5'	E	In distressed area. Evaluate the vertical extent of soil contamination.
			2.0-3.0'	E	
519	Field Determined	Field Determined	0-0.5'	E	North of distressed area. Evaluate horizontal and vertical extent of soil contamination in a northern direction.
			2.0-3.0'	E	
520	Field Determined	Field Determined	0-0.5'	E	East of distressed area. Evaluate horizontal and vertical extent of soil contamination in an eastern direction.
			2.0-3.0'	E	
521	Field Determined	Field Determined	0-0.5'	E	South of distressed area. Evaluate horizontal and vertical extent of soil contamination in a southerly direction.
			2.0-3.0'	E	
522	Field Determined	Field Determined	0-0.5'	E	West of distressed area. Evaluate horizontal and vertical extent of soil contamination in a western direction.
			2.0-3.0'	E	
526	693875.32	91851.58	0-0.5'	E, M	Location added to improve sample coverage in the middle portion of the study area.
			2.0-3.0'	E, M	
527	693841.74	91807.88	0-0.5'	E, M	Location added to improve sample coverage in the middle portion of the study area.
			2.0-3.0'	E, M	
528	693821.51	91779.37	0-0.5'	E, M	Location added to improve sample coverage in the southern portion of the study area.
			2.0-3.0'	E, M	
529	693782.87	91772.01	0-0.5'	E, M	Location added to improve sample coverage in the southern portion of the study area.
			2.0-3.0'	E, M	
530	693753.89	91786.27	0-0.5'	E, M	Location added to improve sample coverage in the southern portion of the study area.
			2.0-3.0'	E, M	
531	693729.97	91755.91	0-0.5'	E, M	Location added to improve sample coverage in the southern portion of the study area.
			2.0-3.0'	E, M	

[1]E= explosives; M= metals; S= semi volatile organic compounds; DU=depleated Uranium

4.8 FIELD SAMPLING SUMMARY

A summary of sampling to be conducted at each of the investigative areas during the RI is presented in Table 4-8. The summary table presents the investigative area boundary, media of concern, PCOCs, and the sampling and analysis plan for each investigative area.

Table 4-8. Remedial Investigation Sample Summary

Investigative Unit and Site Boundary	Media of Concern	Potential Constituents of Concern (PCOCs)	Sampling and Analysis Plan
Line 1 (within the fence line with special interest in how migration to impoundment southwest of line may have occurred)	Soil Sediment	PCOCs for EUs may include the following (See Table 4.3.1 for an extensive list of PCOCs for each EU.): • Explosives • SVOCs (including MOCA) • PCBs • Metals • DU	• Approximately 42 buildings are planned to be surveyed for evidence of residual radioactive materials (A list of buildings to be surveyed is provided in Section 3.3.1.4.) • Approximately 85 samples are to be collected at 12 EUs at Line 1. (See Table 5 for an extensive list of the number of samples, sample depth, and analyses at each EU.) • No sediment areas (i.e., drainages inundated >50% of the year) have been identified at Line 1; therefore, no sediment samples will be collected at Line 1 during this RI. However, soil samples will be taken in low-lying areas and ditches to ensure drainage areas are investigated sufficiently. • Conduct buildings surveys for delineation of contamination or clearance using a MARSSIM Final Status Survey approach.
Firing Sites Area (within the fence line, boundaries around each firing site will follow topography, or other rationale as described in Section 3.2)	Soil Sediment (FS-12 only) Structures (FS-3, FS-4, FS-5, and FS-12)	• DU • Explosives • Metals	<u>FS-1 and 2</u> • Collect a surface soil sample and a composited soil sample from a depth interval of 18"-2' from 8 locations to be analyzed for explosives (7 locations will be pre-determined locations near back doors or areas of obvious staining, one location will be sited in the leach field by the field crew). • Collect 2 additional surface soil samples for metals from topographic low points. <u>FS-3, 4, and 5</u> • Collect 7 surface soil samples for explosives and metals, and collect one (1) surface soil sample for explosives. Pre-determined locations are near drainages, firing site pads, and structures. • Conduct a gamma walkover survey and collect surface and subsurface soil samples according to the methodology presented in Section 4. <u>FS-6, FS-7, FS-8 and FS-15</u> • Conduct a gamma walkover survey and collect surface and subsurface soil samples according to the methodology presented in Section 4. • No further sampling is necessary. <u>FS-9, FS-10, FS-11, and FS-12</u> • Collect soil samples from 4 locations in obvious depressions to be analyzed for explosives and metals. Samples will be collected at depths of 2, 4-5, and 10 ft. UXO considerations exist at this site. • Conduct a gamma walkover survey and collect surface and subsurface soil samples according to the methodology presented in Section 4. • Perform a radiological survey of the FS 12 structure. • UXO considerations exist at this site. <u>FS-14</u> • Collect one surface soil sample for metals and four additional surface samples for explosives. • Conduct a gamma walkover survey and collect surface and subsurface samples according to the methodology presented in Section 4.

Table 4.8. Remedial Investigation Sample Summary (Cont'd)

Investigative Unit and Site Boundary	Media of Concern	Potential Constituents of Concern (PCOCs)	Sampling and Analysis Plan
Storage Yard C (within the fence line)	Soil Sediment (only if soil is found to be contaminated)	• Explosives • Metals	Collect approximately 20 biased surface soil samples for analysis of explosives and metals. Preferentially sample in areas surrounding the loading docks, drainage ditches along the rail lines, and ephemeral stream beds. Locations may be altered slightly in the field at the discretion of the sampling manager based on site topography (with preferences toward low lying areas) and near areas of obvious staining. Sediment samples will be collected only if soil is found to be contaminated above action levels. Sediment samples will only be analyzed for COPCs found to be above action levels in soil. Sediment sampling locations will be collected in the closest downstream drainage ditch, as appropriate.
Storage Yard G (within the fence line)	Soil Sediment (only if soil is found to be contaminated)	• Explosives • Metals	Collect a total of 12 surface soil samples for analysis of explosives and metals. Sampling will focus on the soil cleared areas near the igloos. Sampling locations were placed at the lowest point to the right or left of the loading dock in front of every other igloo (approximately). Locations may be altered slightly in the field at the discretion of the sampling manager based on site topography (with preferences toward low lying areas) and near areas of obvious staining. Sediment samples will be collected only if soil is found to be contaminated above action levels. Sediment samples will only be analyzed for COPCs found to be above action levels in soil. A drainage ditch exists on the uphill side of the site access road that runs in front of the igloos. Sediment sampling locations will be determined in the field by following the drainage pattern from the igloo to Long Creek. Samples would then be collected in Long Creek on the downstream side of the drainage discharge point into Long Creek.
Storage Yard L (grounds between 7-37-1, 7-37-2, 7-37-3 warehouses and the road)	Soil	No chemical PCOCs have been identified for sampling during this RI.	No further chemical sampling is necessary at Yard L.
Warehouse 3-01 (building structure)	Structure	No chemical PCOCs have been identified for sampling during this RI.	No further chemical sampling is necessary at Warehouse 3-01.
West Burn Pads Area South of the Road (EDA road to N/S road to bunker access road to creek)	Soil Sediment	• Metals • SVOCs • Explosives • Depleted Uranium	• Collect 23 surface soil samples for analysis of metals and explosives, but the surface soil at only 8 of these locations will be analyzed for SVOCs. • Collect 18 subsurface soil samples for analysis of metals, explosives, SVOCs, and depleted Uranium. • Collect 5 surface and 5 subsurface soil samples relative to the distressed area for analysis of explosives. • Collect 3 sediment samples from Spring Creek for analysis of metals, explosives, and SVOCs. Additional upstream sediment samples may be collected if contamination is observed in the sediment of the creek. If necessary, delineation sediment samples will be collected in 100 ft increments. UXO support for this area is needed.

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX G

SUPPLEMENTAL INFORMATION RELATED TO THE WEST BURN PADS AREA SOUTH OF THE ROAD

The following supplemental information regarding the West Burn Pads Area South of the Road was received during the course of planning this RI. This information was evaluated by the project team and was used, as applicable, as inputs to the planning process for investigation of soils in this area. Information includes:

- *A draft report entitled: Sampling and Analysis Report, Focused FS Soils Removal, West Burn Pads Landfill—South Extension, Fire Training Pit, Iowa Army Ammunition Plant, Middletown, Iowa, January 4, 2003.*
- *Historical aerial photographs from available years ranging from the 1937 through 1998.*

THIS PAGE INTENTIONALLY LEFT BLANK

Sampling and Analysis Report

Focused FS Soils Removal
West Burn Pads Landfill-South Extension
Fire Training Pit
Iowa Army Ammunition Plant
Middletown, Iowa

Prepared for

US Army Corps of Engineers
Omaha District
106 South 15th Street
Omaha, Nebraska 68102

Contract No. DACA45-95-D-0026
Delivery Order No. 005 &008

January 04, 2003

Environmental Chemical Corporation
1240 Bayshore Highway
Burlingame, California 94010

Table Of Contents

List of Tables

List of Figures

1.0 Objective

The objective of this project was to sample the area south of the West Burn Pads Landfill (known as the West Burn Pads Landfill-South extension) and an area in the Fire Training Area previously identified by the USACE. Upon receipt of the analytical data, a determination will be made as to the disposition of the soil in these areas and any possible Land Disposal Restrictions.

2.0 Background

2.1 West Burn Pads Landfill-South Extension

During the initial phase of the Removal Actions Phase at the West Burn Pads Landfill, six groundwater-monitoring wells were installed to monitor groundwater quality around the West Burn Pads Landfill. Upon completion of the removal actions, well WBP-99-3 (which is located in the WBPL-south extension area) still showed abnormally high RDX concentrations. In fall 99 the RDX concentration was 530 ppb. The spring sampling event of 2000 indicated an increased RDX concentration of 640 ppb. This concentration continually increased up to the last sampling event in Spring 2002 to 1400 ppb.

Because of this abnormality, aerial photographs south of the West Burn Pads Landfill were examined to look for signs of past construction activities. It was determined that this area could have been an extension of the WBPL and used to dispose of explosive contaminated residue. To further investigate this possibility, a visit was made to the IAAAP by Ben Letak and Don Moses of the USACE.

During an inspection of the suspected area, several anomalies were observed.

- An igniter box was identified, which indicates the possibility of a former burn pad in the area.

- An underground viewing bunker with periscope was observed behind American Ordnance's break room. This viewing bunker was aimed directly at the suspected burn Pad area.

- An area of disturbed ground with no vegetation and a red discoloration was observed. From previous investigations at Line 5A and 5B, soil with a red discoloration indicated high concentrations of either TNT or Tetryl.

- A man made dam was constructed along side Brush Creek extending approximately 200 to 300 yards. This coincides with the natural terrain to the west to create an area for a sedimentation dam.

Due to these abnormalities, ECC was directed by the USACE to investigate these areas and determine if further sampling and characterization was warranted.

On 9/28/01 ECC personnel obtained samples, using a hand auger, down to a depth of 3 feet, within the suspected areas at four different locations and analyzed for explosives using field test kit analysis.

The sample taken at the surface of the area with no vegetation and a red discoloration indicated a 2,4,6-TNT concentration of 1,148 ppm. The 3-ft sample had a 2,4,6 TNT concentration of 116 ppm.

Another area that exhibited explosive contamination was within the suspected sedimentation dam. A sample was taken at 1-ft, where bedrock was encountered. This sample contained a 2,4,6 TNT concentration of 0.8 ppm.

None of the other samples taken in the South Burn Pad Area showed any signs of explosive contamination.

2.2 Fire Training Area

During examination of aerial photographs of the area south of the West Burn Pads Landfill, a disturbed area was noticed in the Fire Training Area. The area in question was located just North of the past remedial action.

On 5/24/01 three exploratory trenches were dug between the fire training area and the adjacent smoke training vault. These exploratory trenches indicated the presence of a small "landfill trench" or "secondary burn pit". Analytical results from samples taken during this operation indicated the presence of high levels of metals (Barium and Silver) and low-level explosive contamination. The exploratory trenching uncovered the western, southern and eastern boundaries of the secondary burn pit area, but failed to find the northern boundary. The results from this sampling event is included below:

Soil samples were obtained from pits dug in an area north of the Fire Training Area situated south of the West Burn Pads Area. Three trenches were dug in this area Trench 1 (FTA-TR1), Trench 2 (FTA-TR2) and Trench 3 (this trench was closest to the Fire Training Area and had the appearance of clean native soil so no sample was obtained).

Sample Identification	**Explosives mg/kg**	**Metals mg/kg**							
		As	Ba	Cd	Cr	Pb	Se	Ag	Hg
FTA-TR1-01	RDX 2mg/kg	ND	3600	3.4	120	280	ND	3700	0.52
FTA-TR1-02	ND	ND	330	0.34	24	26	ND	78	0.051
FTA-TR2-01	RDX 1.9 mg/kg	ND	6300	12	390	730	ND	22000	0.087

3.0 Characterization Sampling

3.1 West Burn Pads Landfill-South Extension

On 11/8/01 and 11/9/01 a total of twenty-four (24) trenches were dug in the West Burn Pads Landfill-South Extension area. Samples were taken in each of the trenches except for six (6). Three additional locations were sampled in the area identified as the old sedimentation dam and a surface sample was taken from chunks of material identified by the UXO personnel as possible explosive residue on the southern edge of sample location #1.

Kevin Howe and Ben Letak (USACE) and Morris Ridenour (ECC's project chemist) selected all sample locations. All trenches were dug using a backhoe, under the operation of Dean Johnson, except for samples taken in the sedimentation dam area, which were dug using a hand auger. Samples were collected in a stainless steel bowl, homogenized with a stainless steel spoon and placed into a glass jar with Teflon lined lid. All samples were surveyed using a GPS system operated by USACE representative Ben Letak. A list of coordinated for sample locations can be found in Table 6.

Because of the consistency of the material in the trenches, samples consisted mostly of composites from the surface down to final depth. In some cases however, discrete grab samples of unusual material were collected from pockets from within these trenches. For more information on sample contents please see below.

A total of twenty-four (24) samples were taken and analyzed for explosives using SW-846 Method 8330 and RCRA Metals using SW-846 Method 6010B. Samples were sent to Data Chem Laboratory for analysis. A description of what was found in each of the trenches follows:

3.1.1 Chunks

Chunks of material located in an area of red discoloration and devoid of vegetation were obtained from the surface at the southern end of Trench 1. Burnt gravel and shards of metal were also observed.

3.1.2 Trench 1

52 ft trench running north and south
Found burnt slag, burnt wood, a hinge and nails and small pieces of metal scraps, small amounts of white chunks and burnt rocks. Average depth of trench 8 ft. Hit bedrock at southern end at 4.0 ft. Two samples taken

3.1.3 Trench 2

69 ft trench running north and south
A few burnt gravel pieces found on south end. Soil consisted of fill down to clay then bedrock. Hit bedrock on south end at 4.0 ft. Bedrock depth on north end at 7.0 ft. Two samples taken

3.1.4 Trench 3

10 ft trench running north and south
The first 1.5 ft consisted of black topsoil then brown/orange clay down to bedrock at 8.5 ft. Hit electrical wire 3 ft. One sample taken

3.1.5 Trench 4

10 ft trench running north and south
1.5 ft topsoil, brown clay to 5.0 ft then from 5 ft to 6.0 ft a yellow clay until bedrock at 6.0 ft. One sample taken

3.1.6 Trench 5

21 ft trench running north and south
1.0 ft topsoil then brown clay to 5.0 ft. light gray clay from 5.0ft to 5.5 ft. where bedrock was encountered. One sample taken

3.1.7 Trench 6

9 ft trench running east and west
First 1.0 ft consisted of topsoil, then brown clay to 5 ft, light gray clay from 5 ft to 5.5 ft where bedrock was encountered. One sample taken.

3.1.8 Trench 7

9 ft trench running east and West
Construction debris starting just below ground level and extending to 4.0 ft. Debris consisted of stone, bricks and a gray ash material. Trench dug down to 8 ft. Water gathered in hole. One sample taken.

3.1.9 Trench 8

13 ft trench running north and south.

15 inches of fill material then black ash material until resistance was met at 7 ft. May be hard concrete floor. Other debris included some clay brick and concrete. One sample taken.

3.1.10 Trench 9

17 ft trench running north and south.
14 inches of fill material then black ash material 1 ft thick on northern wall and tapering to nothing on southern wall. Below the ash material was wet brown clay. One sample taken.

3.1.11 Trench 10

8 ft trench running east and west.
The first 6 inches consisted of topsoil, then 3 ft of gray clay, then orange clay down to 5.5 ft. Water in hole. One sample taken

3.1.12 Trench 11

9 ft trench running north and south
Top 15 inches brown clay fill, then 3 ft of black ash, and then orange undisturbed clay to a final depth of 6.5 ft. Water in hole. One sample taken.

3.1.13 Trench 12

13 ft trench running north and south.
6-inch fill, then 2 inched of black ash, then construction debris down to 6.5 ft. Debris consisted of stone and concrete. One sample taken.

3.1.14 Trench 13

8 ft trench running north and south
Black fill material with pieces of brick down to 30 inches, the orange clay down to 3.5 ft. Water in hole. One sample taken.

3.1.15 Trench 14

9 ft trench running north and south
6-inch topsoil, then orange clay down to 2 ft. No sample taken.

3.1.16 Trench 15

9 ft trench running north and south.
8 inches of topsoil then orange lusk clay down to 6 ft. No sample taken.

3.1.17 Trench 16

9 ft long trench running north and south
16 inches topsoil then orange lusk clay down to 7 ft. No sample taken.

3.1.18 Trench 17

12 ft trench running east and west.
Black topsoil first 18 inches. Orange lusk clay down to 6 ft where it turns into orange/gray till. One sample taken

3.1.19 Trench 18

12 ft trench running east and west.
Black topsoil first 16 inches. Orange lusk clay to 4 ft then hit bedrock. No sample taken.

3.1.20 Trench 19

29 ft trench running east and west.
Black topsoil first 7 inches. Orange/brown lusk next 25 inches, then 4-inch layer of gray clay atop bedrock. Total depth 3.0 ft. One sample taken.

3.1.21 Trench 20

20 ft trench running north and south.
Orange/brown lusk from surface to six feet where it changed to orange/gray till. Total depth 6.0 ft. Some white sticky material was encountered. One sample taken.

3.1.22 Trench 21

13 ft trench running east and west.
Black silt and clay with some blotches of brown clay starting at surface down to 8 ft. Some pieces of bedrock started at 1 ft and went down to 3 ft. Grey clay started at 8 ft. Total depth of hole 8 ft. One sample taken.

3.1.23 Trench 22

19 ft trench running north and south.
Orange/brown unconsolidated lusk from surface to 4.5 ft then changed to till. Total depth of hole 5.0 ft. No sample taken.

3.1.24 Trench 23

20 ft trench running north and south.
Orange/ brown unconsolidated lusk from surface to 4.5 ft then changed to till. Total depth of hole 5.0 ft. No sample taken.

3.1.25 Trench 24

25 ft trench running east and west.
Construction debris starting at western edge just below the surface, black ash on the eastern end of trench started 2 ft below the surface. Total depth on western side 7.0 ft. Depth on eastern side 3 ft. One sample taken.

3.2 Sedimentation Dam

3.2.1 Sample point # 25

Black topsoil was encountered from the surface to 1 ft. below ground surface where bedrock was encountered. Sample was a composite from the surface to 1 ft.

3.2.2 Sample point # 26

Sample was taken from the bank of the creek from the surface to 1 ft. into the embankment. Soil was grayish black in color.

3.2.3 Sample Point # 27

Black topsoil was encountered from the surface until bedrock was encountered at 7 inches bgs. One composite sample was taken.

3.3 Fire Training Area

On 11/8/01 five (5) trenches were excavated at the Fire Training area. Each of the trenches was sampled except for trench # 3. Trench #1 and Trench #2 were sampled and analyzed for VOCs, SVOCs, explosives and RCRA metals using SW-846 Methods 8260B, 8270C, 8330 and 6010B. Trench #4 was analyzed for explosives and TCLP metals using SW-846 Methods 8330 and 1311/6010B. Trench # 5 was sampled and analyzed for explosives, RCRA metals and TCLP metals us SW-846 methods 8330, 6010B and 1311/6010B.

Kevin Howe and Ben Letak from the USACE and ECC's project chemist Morris Ridenour selected all sample locations. All trenches were dug using a backhoe, under the operation of Dean Johnson. Samples were collected in a stainless steel bowl, homogenized with a stainless steel spoon and place into a glass jar with Teflon Lined lid. All sample locations were surveyed using a GPS system operated by USACE personnel Ben Letak. Sample locations can be found in Table 6.

Samples mainly consisted of composites from the contaminated material in the trenches. In some cases however, discrete grab samples were obtained of unusual material contained in pockets within these trenches. For more information on sample content please see below.

A total of five (5) samples were taken and analyzed from the fire training Area. Samples were sent to data Chem Laboratory for analysis. A description of what was found in each of the trenches follows:

3.3.1 Trench 1

43 ft. trench running north and south.
The first 19 inches was topsoil, then brown clay down to 4.0 ft. A pocket of green diesel fuel smelling material was encountered at 4.0 ft. down to 13.5 ft. This material was the same as at the fire-training pit. A PID reading of 41 ppm was observed. A composite sample of the green material was sampled.

3.3.2 Trench 2

41 ft. trench running north and south, 22.5 ft. east of Trench #1.
The first 19 inches was topsoil, then brown clay down to 7.0 ft. A pocket of the same green, diesel fuel smelling material was encountered approximately 10 ft from the southern end of the trench approximately 7 ft. down. Total depth of hole was 12 ft. A composite sample was taken of the green material.

3.3.3 Trench 3

29 ft. trench running north and south, 23 ft to the west of Trench 1.
ECC encountered 19 inches of topsoil, then brown clay to 11 ft deep. No sample taken.

3.3.4 Trench 4

20 ft. trench running north and south.
Trash from surface to 2.5 ft deep extending north 10 ft. and tapering to nothing. One sample was taken in trash area.

3.3.5 Trench 5

15 ft trench running east and west.
Ash and debris from surface to 3 ft. Took sample at 2-3 ft depth and one sample and the bottom of the excavation one foot below trash (4ft.).

4.0 Results, Dispositions and LDRs

Upon receipt of the analytical data From Data Chem Laboratory, the following determinations have been made on the disposition of the soils from each location. The three locations include the South Burn Pad Area, Trench # 1 and # 2 in the Fire Training Area and Trench # 4 and # 5 in the Fire Training Area. Please refer to the tables corresponding to each parameter for a complete listing of explosive, RCRA Metals, VOCs, SVOCs and TCLP Metals concentrations, RBC concentrations and indexes and disposition.

A RBC index number for explosives under 1.0 will give the sample a disposition as Random Fill if any of the explosive compounds are over excavation criteria. A RBC index between 1.0 and 10.0 will give the samples a disposition as Trench 6. A RBC index over 10.0 will give the sample a disposition in the CAMU for treatment at a further date.

4.1 West Burn Pads Landfill-South Extension

The sample known as Chunks, taken of the surface material in the area void of vegetation had a TNT concentration of 750,000 ppm. Extreme caution should be taken in the handling of this material. The area should be cordoned off until a determination can be made about its final disposal. This sample had a RBC index value of 3948.388

Both locations sampled at Trench #1 had explosive concentrations exceeding excavation criteria and high enough for disposition as Trench 6. The southern edge of Trench #1 was located in the area identified as Chunks. The 4 ft. samples also had a Barium concentration of 32,000 ppm, which fails the 20X rule for metals.

Explosive contamination over the excavation criteria was also found in both samples in Trench #2. The 4ft sample had a RBC index of 0.54, which gives it a disposition as Random Fill. It has a RDX concentration of 12 ppm and a TNT concentration of 59 ppm. The sample taken at 7 ft. had a RBC index of 3.97, which gives it a disposition as Trench 6 material. It had a TNT concentration of 630 ppm and a RDX concentration of 3.97.

Trench #3 had a Barium concentration of 4500 ppm, which exceeds the 20X rule for Metals.

The composite sample taken at Trench #9 had a RDX concentration of 5.4 ppm, which puts it over the excavation criteria and gives it a disposition as Random Fill.

The sample taken at Trench #11 had a RDX concentration of 7.3 ppm, which exceed excavation criteria and gives it a disposition as Random Fill.

Trench #12 had a lead concentration of 1300 ppm, which exceeds the excavation criteria and also fails the 20X rule.

The sample taken at Trench # 13 has a TNT concentration of 530 ppm and a RBC index of 2.79, which gives it a disposition as Trench 6. Trench # 13 also had a lead concentration of 110 ppm, which exceeds the 20X rule.

Trench # 20 had a Barium concentration of 55,000 ppm, which exceeds the 20X rule for metals.

Trench # 21 had a RDX concentration of 14 ppm, which exceed excavation criteria and gives it a disposition as Random Fill. A TNT concentration of 72 was also identified. Trench # 21 also had a Barium concentration of 35,000 ppm, which exceeds the 20X rule for Metals.

Trench # 24 had a RDX concentration of 6.8 ppm, which exceed excavation criteria and gives it a disposition as Random Fill.

4.2 Fire Training Area Trenches #1 and #2

These trenches were excavated and sampled due to several disturbed areas located on old aerial photographs obtained by the USACE. The contaminated soil had the same appearance and smell as the soils from the fire-training pit. Samples obtained from these trenches were analyzed for VOCs and SVOCs using SW-846 methods 8260B and 8270C. Note: Trench # 3 was also part of this exploratory trenching, but no visible contamination was observed and no sample was taken.

The analytical results indicated low concentrations of both VOCs and SVOCs. None of the concentrations exceeded the limits set forth in the 2001 EPA Region III RBC table and therefore need not be removed. Please see spreadsheet for sample concentrations and RBC limits.

4.3 Fire Training Area Trenches #4 and #5

The trenches in this area were excavated and sampled due to high levels of metals contamination found during a previous sampling event performed by the USACE. The object was to determine if any of the soils exceeded Land Disposal Restrictions and find the limits of the contamination.

Trench # 4, which was on the Northern end of the affected area, was sampled for explosives and TCLP Metals. This was the area that had a high Silver concentration during the previous sampling event and concerned were raised about possible LDRs.

The analytical results showed a RDX concentration of 6.8 ppm. This concentration exceeds the excavation criteria and warrants a disposition as random fill. The TCLP Metals results show no compounds exceeding any Land Disposal Restrictions.

Trench # 5 was located on the Southern edge of the affected area and had two samples taken at different depths. One sample was taken in the contaminated looking soil and

debris. The depth of this sample was 3.0 ft. This sample was analyzed for explosives and TCLP Metals. The other sample was taken a foot below the contaminated soil at 4.0 ft. and was analyzed for explosives and Total RCRA Metals. This sample was taken to find the bottom of the contamination.

The 3.0 ft. sample contained a TCLP Barium, concentration of 200 mg/L, which exceed the Land Disposal Restriction concentration of 100 mg/L. No explosive concentrations over the excavation criteria were observed.
The 4.0 ft sample showed low concentrations of explosives and Total RCRA Metals, but nothing over excavation criteria.

Please see spreadsheets for entire listing of concentrations and exceedances.

Environmental Chemical Corporation

Iowa Army Ammunition Plant

Table 1 - Explosives Data (ppm)

Sample Identification	1,3,5 TNB	1,3 DNB	2,4,6 TNT	2,4 DNT	2,6 DNT	2Amino-4,6 DNT	2-NT	3-NT	4Amino-2,6 DNT	4-NT	HMX	NB	RDX	Tetryl	RBC index	Disposition
SBP-T1-Chunk	29	ND	750000*	ND	ND	ND	ND	ND	ND	ND	1.8	ND	53*	ND	3948.388	Trench 7
SBP-T1-03	0.14	ND	440*	ND	ND	ND	ND	ND	ND	ND	2.8	ND	2*	ND	2.357	Trench 6
SBP-T1-04	0.15	ND	73*	0.087	ND	0.59	ND	ND	0.6	ND	28	ND	310*	ND	6.356	Trench 6
SBP-T2-04	ND	ND	59*	ND	ND	ND	ND	ND	ND	ND	3.3	ND	12*	ND	0.541	RF
SBP-T2-07	0.14	ND	630*	ND	ND	ND	ND	ND	ND	ND	4.8	ND	34*	ND	3.97	Trench 6
SBP-T3-08	ND	ND	6.3	ND	ND	ND	ND	ND	ND	ND	0.49	ND	0.59	ND	0.045	NER
SBP-T4-06	ND	ND	25	ND	ND	ND	ND	ND	ND	ND	1.0	ND	0.65	ND	0.144	NER
SBP-T5-05	ND	ND	21	ND	ND	ND	ND	ND	ND	ND	0.37	ND	ND	ND	0.111	NER
SBP-T6-04	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	0.47	ND	ND	ND	0.008	NER
SBP-T7-04	ND	ND	0.86	ND	ND	ND	ND	ND	ND	ND	0.16	ND	ND	ND	0.005	NER
SBP-T8-07	0.18	ND	3.3	ND	ND	ND	ND	ND	ND	ND	0.71	ND	0.96	ND	0.036	NER
SBP-T9-02	0.51	ND	8.2	ND	ND	ND	ND	ND	ND	ND	2.9	ND	5.4*	ND	0.147	RF
SBP-T10-05	ND	ND	3.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	NER
SBP-T11-03	0.15	ND	1.2	ND	ND	ND	ND	ND	ND	ND	0.59	ND	7.3*	ND	0.147	RF
SBP-T12-07	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	0.67	ND	0.6	ND	0.096	NER
SBP-T13-04	0.3	ND	530*	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.79	Trench 6
SBP-T17-06	ND	ND	0.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	NER
SBP-T19-03	ND	ND	0.89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	NER
SBP-T20-06	ND	ND	2.3	ND	ND	ND	ND	ND	ND	ND	0.71	ND	0.83	ND	0.028	NER
SBP-T21-08	0.22	ND	72	0.082	ND	2.8	ND	ND	1.3	ND	2.1	ND	14*	ND	0.682	RF
SBP-T24-07	0.11	ND	0.43	ND	ND	ND	ND	ND	ND	ND	3.4	ND	2.1*	ND	0.043	RF
SBP-T25-01	ND	ND	0.099	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	NER
SBP-T26-00	ND	ND	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	NER
SBP-T27-01	ND	ND	0.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	NER
FTA-T1-13	ND	ND	4.4	ND	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND	0.023	NER
FTA-T2-07	ND	ND	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	NER
FTA-T4-03	0.22	ND	1.0	ND	ND	ND	ND	ND	0.29	ND	2.4	ND	6.8*	ND	0.138	RF
FTA-T5-03	0.21	ND	0.5	ND	ND	ND	ND	ND	0.74	ND	0.49	ND	1.0	ND	0.028	NER
FTA-T5-04	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	NER

* = Excavation Criteria, **NER** = No excavation Required, **RF** = Rando

Cape Environmental Management
Iowa Army Ammunition Plant
Table 2 - Final Explosive Concentrations and RBC Calculations
1996 RBC Numbers

SBP-T1-CHUNK

RDX	53.0 / 52	=	1.019
HMX	1.8 / 100000	=	0.000
2,4,6 TNT	750000.0 / 190	=	3947.368
1,3,5 TNB	29.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	3948.388

SBP-T1-03

RDX	2.0 / 52	=	0.038
HMX	2.8 / 100000	=	0.000
2,4,6 TNT	440.00 / 190	=	2.316
1,3,5 TNB	0.14 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.54 / 200	=	0.003
4-Amino-2,6-DNT	0.00 / 120	=	0.000
2-Amino-4,6-DNT	0.00 / 120	=	0.000
		Total	2.357

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T1-04

RDX	310.0 / 52	=	5.962
HMX	28.0 / 100000	=	0.000
2,4,6 TNT	73.0 / 190	=	0.384
1,3,5 TNB	0.2 / 61000	=	0.000
2,4 DNT	0.087 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.6 / 120	=	0.005
2-Amino-4,6-DNT	0.59 / 120	=	0.005
		Total	6.356

SBP-T2-04

RDX	12.0 / 52	=	0.231
HMX	3.3 / 100000	=	0.000
2,4,6 TNT	59.0 / 190	=	0.311
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.541

* ir es total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T2-07

RDX	34.0 / 52	=	0.654
HMX	4.8 / 100000	=	0.000
2,4,6 TNT	630.0 / 190	=	3.316
1,3,5 TNB	0.14 / 61000	=	0.000
2,4 DNT	0.21 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	3.970

SBP-T3-08

RDX	0.59 / 52	=	0.011
HMX	0.49 / 100000	=	0.000
2,4,6 TNT	6.3 / 190	=	0.033
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.00 / 120	=	0.000
		Total	0.045

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T4-06

RDX	0.65 / 52	=	0.013
HMX	1.0 / 100000	=	0.000
2,4,6 TNT	25.0 / 190	=	0.132
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.144

SBP-T5-05

RDX	0.0 / 52	=	0.000
HMX	0.4 / 100000	=	0.000
2,4,6 TNT	21.0 / 190	=	0.111
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.111

* in[illegible]es total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T6-04

RDX	0.0 / 52	=	0.000
HMX	0.47 / 100000	=	0.000
2,4,6 TNT	1.5 / 190	=	0.008
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.00 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.008

SBP-T7-04

RDX	0.0 / 52	=	0.000
HMX	0.2 / 100000	=	0.000
2,4,6 TNT	0.86 / 190	=	0.005
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.00 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.005

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T8-07

RDX	0.96 / 52	=	0.018
HMX	0.71 / 100000	=	0.000
2,4,6 TNT	3.3 / 190	=	0.017
1,3,5 TNB	0.18 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.036

SBP-T9-02

RDX	5.4 / 52	=	0.104
HMX	2.9 / 100000	=	0.000
2,4,6 TNT	8.2 / 190	=	0.043
1,3,5 TNB	0.51 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
*Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.147

* inc .es total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T10-05

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	3.3 / 190	=	0.017
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.00 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.017

SBP-T11-03

RDX	7.3 / 52	=	0.140
HMX	0.6 / 100000	=	0.000
2,4,6 TNT	1.2 / 190	=	0.006
1,3,5 TNB	0.2 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.147

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T12-07

RDX	0.60 / 52	=	0.012
HMX	0.7 / 100000	=	0.000
2,4,6 TNT	16.0 / 190	=	0.084
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.00 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.096

SBP-T13-04

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	530.0 / 190	=	2.789
1,3,5 TNB	0.3 / 61000	=	0.000
2,4 DNT	0.11 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	2.790

* in es total concentration for M,O, and P Nitrotoluene

Cape Environmental Management
Iowa Army Ammunition Plant
Table 2 - Final Explosive Concentrations and RBC Calculations
1996 RBC Numbers

SBP-T17-06

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.94 / 190	=	0.005
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.005

SBP-T19-03

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.89 / 190	=	0.005
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.005

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T20-06

RDX	0.83 / 52	=	0.016
HMX	0.7 / 100000	=	0.000
2,4,6 TNT	2.3 / 190	=	0.012
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.028

SBP-T21-08

RDX	14.0 / 52	=	0.269
HMX	2.1 / 100000	=	0.000
2,4,6 TNT	72.0 / 190	=	0.379
1,3,5 TNB	0.22 / 61000	=	0.000
2,4 DNT	0.082 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	1.3 / 120	=	0.011
2-Amino-4,6-DNT	2.8 / 120	=	0.023
		Total	0.682

* in[illegible]es total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T24-07

RDX	2.1 / 52	=	0.040
HMX	3.4 / 100000	=	0.000
2,4,6 TNT	0.43 / 190	=	0.002
1,3,5 TNB	0.11 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.043

SBP-T25-01

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.099 / 190	=	0.001
1,3,5 TNB	0.00 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.001

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

SBP-T26-00

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.18 / 190	=	0.001
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.001

SBP-T27-01

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.17 / 190	=	0.001
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.001

* inc .s total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

FTA-T1-13

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	4.4 / 190	=	0.023
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.35 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.023

FTA-T2-07

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.19 / 190	=	0.001
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.0 / 120	=	0.000
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.001

* indicates total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

FTA-T4-06

RDX	6.8 / 52	=	0.131
HMX	2.4 / 100000	=	0.000
2,4,6 TNT	1.0 / 190	=	0.005
1,3,5 TNB	0.22 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.35 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.29 / 120	=	0.002
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.138

FTA-T5-03

RDX	1.0 / 52	=	0.019
HMX	0.49 / 100000	=	0.000
2,4,6 TNT	0.50 / 190	=	0.003
1,3,5 TNB	0.21 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.0 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.74 / 120	=	0.006
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.028

* indi total concentration for M,O, and P Nitrotoluene

Cape Environmental Management

Iowa Army Ammunition Plant

Table 2 - Final Explosive Concentrations and RBC Calculations

1996 RBC Numbers

FTA-T5-04

RDX	0.0 / 52	=	0.000
HMX	0.0 / 100000	=	0.000
2,4,6 TNT	0.12 / 190	=	0.001
1,3,5 TNB	0.0 / 61000	=	0.000
2,4 DNT	0.0 / 4100.0	=	0.000
2,6 DNT	0.0 / 2000.0	=	0.000
Tetryl	0.0 / 20000	=	0.000
Nitrobenzene	0.0 / 1000	=	0.000
* Nitrotoluene	0.35 / 20000	=	0.000
1,3 DNB	0.0 / 200	=	0.000
4-Amino-2,6-DNT	0.29 / 120	=	0.002
2-Amino-4,6-DNT	0.0 / 120	=	0.000
		Total	0.003

* indicates total concentration for M,O, and P Nitrotoluene

Environmental Chemical Corporation

Iowa Army Ammunition Plant

Table 3 - Total RCRA Metals Data (ppm)

Sample Identification	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver	Comments
SBP-T1-Chunk	ND	700	0.2	1.4	7.1	ND	ND	ND	
SBP-T1-03	ND	800	0.16	18	12	ND	ND	ND	
SBP-T1-04	ND	32000	0.21	20	23	ND	ND	ND	Failed 20X rule for Barium
SBP-T2-04	ND	1700	ND	18	12	0.14	ND	ND	
SBP-T2-07	ND	480	ND	15	9.9	0.18	ND	ND	
SBP-T3-08	ND	4500	0.24	17	13	0.076	ND	ND	Failed 20X rule for Barium
SBP-T4-06	ND	1000	0.21	15	ND	0.041	ND	ND	
SBP-T5-05	ND	64	ND	9.4	ND	ND	ND	ND	
SBP-T6-04	ND	1200	ND	16	16	0.047	ND	1.5	
SBP-T7-04	ND	180	0.25	11	74	0.044	ND	ND	
SBP-T8-07	ND	89	0.74	13	26	0.12	ND	ND	
SBP-T9-02	ND	70	0.34	12	29	ND	ND	ND	
SBP-T10-05	ND	190	ND	19	11	ND	ND	ND	
SBP-T11-03	ND	72	0.27	13	23	ND	ND	ND	
SBP-T12-07	ND	180	0.25	15	1300	0.14	ND	ND	Over excavation criteria for Lead
SBP-T13-04	ND	200	0.39	16	110	0.055	ND	ND	Failed 20X rule for Lead
SBP-T17-06	ND	120	0.24	17	11	0.04	ND	ND	
SBP-T19-03	ND	170	ND	19	9.8	0.06	ND	ND	
SBP-T20-06	ND	55000	0.66	18	28	0.57	ND	ND	Failed 20X rule for Barium
SBP-T21-08	ND	35000	0.31	17	11	0.042	ND	ND	Failed 20X rule for Barium
SBP-T24-07	ND	300	0.32	22	37	0.16	ND	ND	
SBP-T25-01	ND	240	0.43	22	11	ND	ND	ND	
SBP-T26-00	ND	1300	0.49	24	19	0.081	ND	0.6	
SBP-T27-01	ND	1200	0.61	16	18	0.14	ND	0.69	
FTA-T1-13	ND	180	0.27	20	8.8	ND	ND	ND	
FTA-T2-07	ND	130	0.19	19	9.5	ND	ND	ND	
FTA-T5-04	ND	300	0.71	28	17	ND	ND	ND	

ND = Compound not detected at or below Method Detection Limit

Environmental Chemical Corporation

Iowa Army Ammunition Plant

Table 4 - TCLP Metals Analysis

Sample Identification	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver	Comments
FTA-T4-06	ND	8.1 mg/L	0.026 mg/L	ND	0.18 mg/L	ND	ND	0.051 mg/L	
FTA-T5-03	ND	200 mg/L	0.094 mg/L	ND	0.12 mg/L	ND	ND	0.066 mg/L	Over Land Disposal Restrictions

ND = Compound not detected at or below Method Detection Limit.

Environmental Chemical Corporation
Iowa Army Ammunition Plant
Table 5 - VOC and SVOC Analysis

Volatile Organic Compounds Method 8260B

Compound	Sample Identification FTA-T1-13	FTA-T2-07
Acetone RBC Value	81 ug/kg 200,000 mg/kg	93 ug/kg 200,000 mg/kg
Ethyl Benzene RBC Value	340 ug/kg 200,000 mg/kg	
Toluene RBC Value	3.5 ug/kg 410,000 mg/kg	
o-Xylene RBC Value	42 ug/kg 4,100,000 mg/kg	
m,p-Xylene RBC Value	240 ug/kg 4,100,000 mg/kg	
Methylene Chlorine RBC Value		3.8 ug/kg 760 mg/kg

Semi-Volatile Organic Compounds Method 8270C

Compound	Sample Identification FTA-T1-13	FTA-T2-07
2-Methylnaphthalene RBC Value	1400 ug/kg 41,000 mg/kg	34 ug/kg 41,000 mg/kg
Acenaphthalene RBC Value	110 ug/kg 120,000 mg/kg	37 ug/kg 120,000 mg/kg
Anthracene RBC Value	53 ug/kg 610,000 mg/kg	23 ug/kg 610,000 mg/kg
Dibenzofuran RBC Value	140 ug/kg 8,200 mg/kg	50 ug/kg 8,200 mg/kg
Fluorene RBC Value	240 ug/kg 82,000 mg/kg	64 ug/kg 82,000 mg/kg
N-nitrosodiphenylamine RBC Value	290 ug/kg 1200 mg/kg	140 ug/kg 1200 mg/kg
Naphthalene RBC Value	370 ug/kg 41,000 mg/kg	41,000 mg/kg
Phenanthrene RBC Value	570 m g/kg No Value	170 ug/kg No Value

TABLE 6

Iowa Army Ammunition Plant, Middletown, Iowa
West Burn Pads Area - South Extension and Fire Training Area
Trenching and Sampling Locations
24 May 01, 28 Sep 01 and 6-8 May 01
State Plane Coordinates, NAD83 (metric)

Trench # / Sample Point	Area	Trench/ Sample Date	Northing	Easting	Description	Note
25	WBPA-SE	8-Nov-01	91813.4	693988.4	Hand Auger Location	1
26	WBPA-SE	8-Nov-01	91817.0	693995.9	Hand Auger Location	1
27	WBPA-SE	8-Nov-01	91806.3	693970.0	Hand Auger Location	1
9/28/02 Samp #3	WBPA-SE	28-Sep-01	91800.3	693997.2	Hand Auger Location	1
1	FTA	8-Nov-01	91789.7	693677.6	End of Trench @ CL	1
1	FTA	8-Nov-01	91807.5	693678.8	End of Trench @ CL	1
2	FTA	8-Nov-01	91806.6	693685.6	End of Trench @ CL	1
2	FTA	8-Nov-01	91792.1	693684.3	End of Trench @ CL	1
3	FTA	8-Nov-01	91805.1	693672.1	End of Trench @ CL	1
3	FTA	8-Nov-01	91796.2	693671.5	End of Trench @ CL	1
4	FTA	8-Nov-01	91803.5	693654.4	End of Trench @ CL	1
4	FTA	8-Nov-01	91810.2	693653.4	End of Trench @ CL	1
5	FTA	8-Nov-01	91797.9	693652.9	End of Trench @ CL	1
5	FTA	8-Nov-01	91796.7	693649.5	End of Trench @ CL	1
1	FTA	24-May-01	91802.6	693648.2	End of Trench @ CL	2
1	FTA	24-May-01	91803.8	693660.7	End of Trench @ CL	2
2	FTA	24-May-01	91797.4	693648.2	End of Trench @ CL	2
2	FTA	24-May-01	91798.9	693660.1	End of Trench @ CL	2
3	FTA	24-May-01	91792.5	693648.2	End of Trench @ CL	2
3	FTA	24-May-01	91793.5	693657.9	End of Trench @ CL	2

Notes:

1. Trench & sample locations for 9/28/01 & 11/6-8/01 sampling effort were surveyed using a handheld Garmin GPS unit (Model No. GPSMAP76) by Ben Letak. Estimated accuracy of survey = +/- 1.5 meters based on check of 8 known points in area (ie. hydrants, bldg. corners, fence post, etc.) Horizontal Datum used is NAD83, Iowa South zone, 1402. Horizontal Units used are Meters.
2. Trench locations for 5/24/01 sampling were measured from SE corner of Bldg 200-30 using 100 foot survey tape. See Figure 4. Locations were overlapped onto Dec 1998 Baker surveys and state plane coordinates were estimated. Estimated accuracy of survey = +/- 0.5 meter based on method of survey.

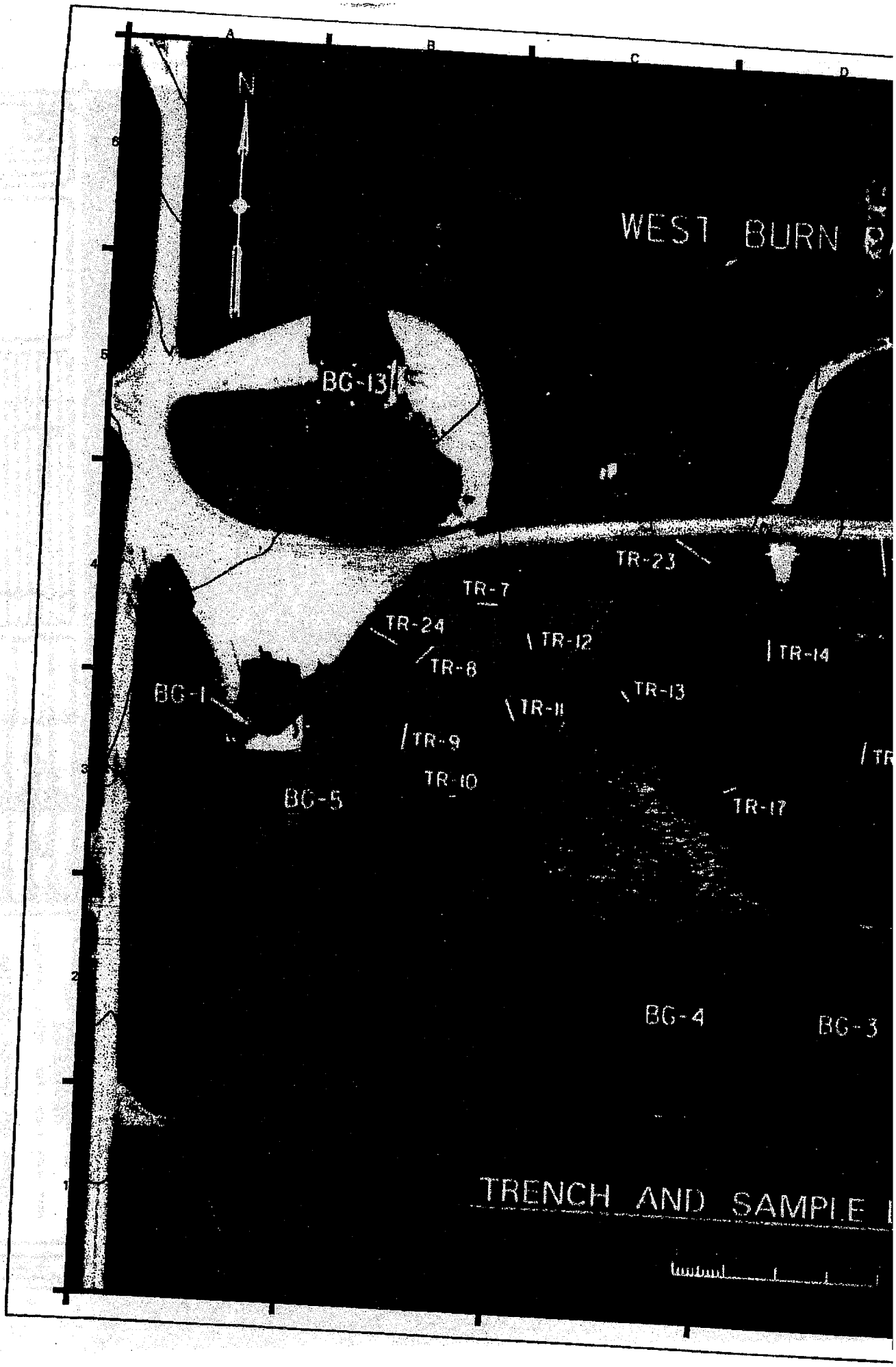
WBPA-SE = West Burn Pads Area - South Extension
FTA = Fire Training Area

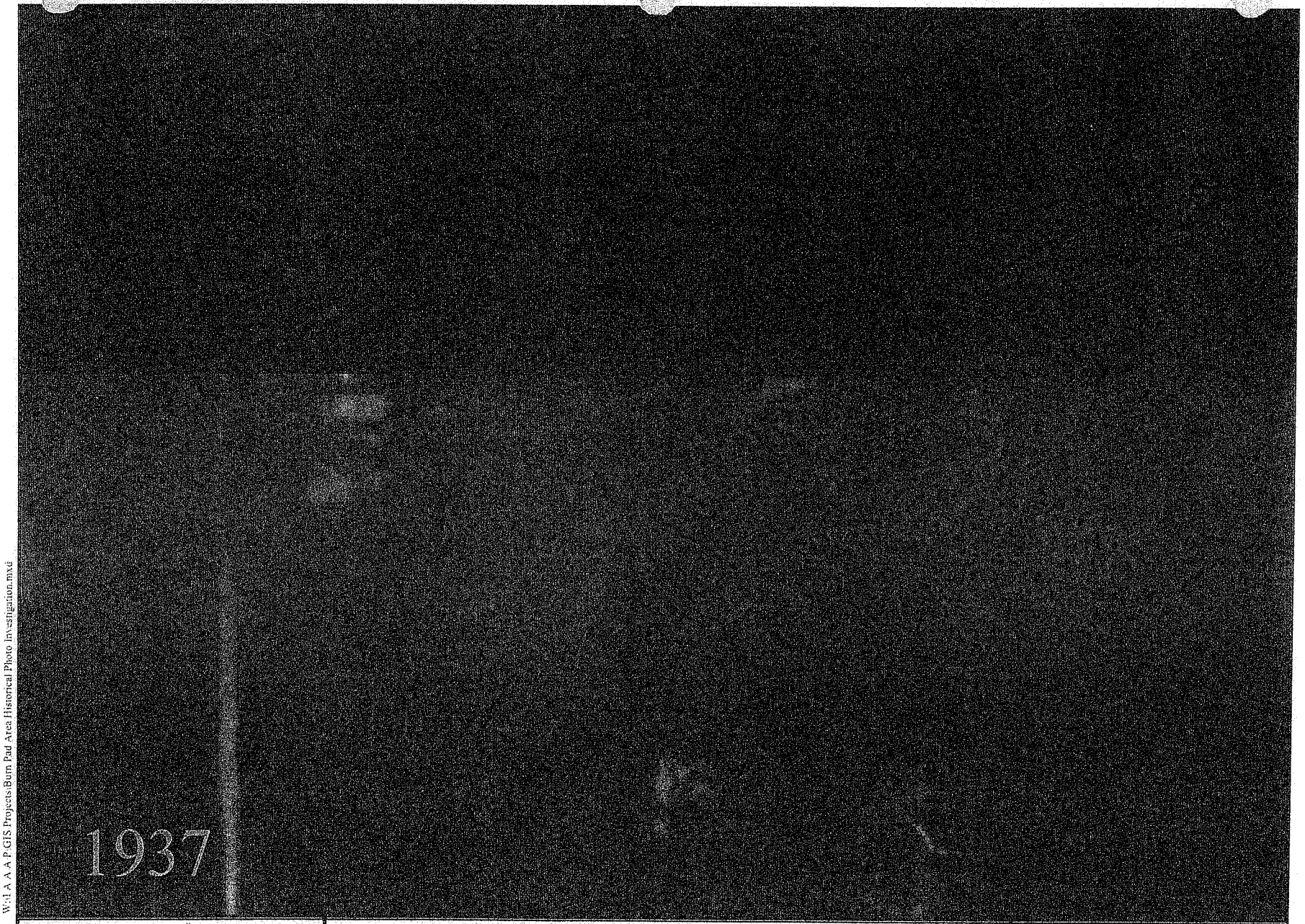
TABLE 6

Iowa Army Ammunition Plant, Middletown, Iowa
West Burn Pads Area - South Extension and Fire Training Area
Trenching and Sampling Locations
24 May 01, 28 Sep 01 and 6-8 May 01
State Plane Coordinates, NAD83 (metric)

Trench # / Sample Point	Area	Trench/ Sample Date	Northing	Easting	Description	Note
1	WBPA-SE	6-Nov-01	91849.3	693917.4	End of Trench @ CL	1
1	WBPA-SE	6-Nov-01	91839.5	693921.9	End of Trench @ CL	1
2	WBPA-SE	6-Nov-01	91850.1	693946.1	End of Trench @ CL	1
2	WBPA-SE	6-Nov-01	91833.4	693946.5	Change of Tr. Direction @ CL	1
2	WBPA-SE	6-Nov-01	91839.0	693948.1	End of Trench @ CL	1
3	WBPA-SE	6-Nov-01	91857.2	693964.5	End of Trench @ CL	1
3	WBPA-SE	6-Nov-01	91856.2	693967.9	End of Trench @ CL	1
4	WBPA-SE	6-Nov-01	91860.9	693975.3	End of Trench @ CL	1
4	WBPA-SE	6-Nov-01	91856.4	693973.8	End of Trench @ CL	1
5	WBPA-SE	6-Nov-01	91867.6	693977.7	End of Trench @ CL	1
5	WBPA-SE	6-Nov-01	91861.0	693980.4	End of Trench @ CL	1
6	WBPA-SE	6-Nov-01	91857.9	693989.8	End of Trench @ CL	1
6	WBPA-SE	6-Nov-01	91860.1	693989.7	End of Trench @ CL	1
7	WBPA-SE	7-Nov-01	91841.0	693771.6	End of Trench @ CL	1
7	WBPA-SE	7-Nov-01	91841.2	693775.8	End of Trench @ CL	1
8	WBPA-SE	7-Nov-01	91831.9	693763.4	End of Trench @ CL	1
8	WBPA-SE	7-Nov-01	91828.5	693760.1	End of Trench @ CL	1
9	WBPA-SE	7-Nov-01	91816.3	693758.7	End of Trench @ CL	1
9	WBPA-SE	7-Nov-01	91810.7	693758.1	End of Trench @ CL	1
10	WBPA-SE	7-Nov-01	91802.1	693767.6	End of Trench @ CL	1
10	WBPA-SE	7-Nov-01	91802.1	693769.3	End of Trench @ CL	1
11	WBPA-SE	7-Nov-01	91817.9	693779.8	End of Trench @ CL	1
11	WBPA-SE	7-Nov-01	91822.3	693778.0	End of Trench @ CL	1
12	WBPA-SE	7-Nov-01	91832.5	693782.8	End of Trench @ CL	1
12	WBPA-SE	7-Nov-01	91835.8	693781.9	End of Trench @ CL	1
13	WBPA-SE	7-Nov-01	91825.1	693800.7	End of Trench @ CL	1
13	WBPA-SE	7-Nov-01	91823.0	693802.5	End of Trench @ CL	1
14	WBPA-SE	7-Nov-01	91832.6	693829.2	End of Trench @ CL	1
14	WBPA-SE	7-Nov-01	91837.0	693829.1	End of Trench @ CL	1
15	WBPA-SE	7-Nov-01	91838.0	693867.9	End of Trench @ CL	1
15	WBPA-SE	7-Nov-01	91835.8	693868.8	End of Trench @ CL	1
16	WBPA-SE	7-Nov-01	91813.1	693848.3	End of Trench @ CL	1
16	WBPA-SE	7-Nov-01	91817.5	693849.0	End of Trench @ CL	1
17	WBPA-SE	7-Nov-01	91805.7	693821.5	End of Trench @ CL	1
17	WBPA-SE	7-Nov-01	91806.9	693824.0	End of Trench @ CL	1
18	WBPA-SE	7-Nov-01	91789.2	693868.4	End of Trench @ CL	1
18	WBPA-SE	7-Nov-01	91793.5	693863.2	End of Trench @ CL	1
19	WBPA-SE	7-Nov-01	91807.6	693894.9	End of Trench @ CL	1
19	WBPA-SE	7-Nov-01	91800.1	693903.5	End of Trench @ CL	1
20	WBPA-SE	7-Nov-01	91860.8	693928.9	End of Trench @ CL	1
20	WBPA-SE	7-Nov-01	91856.3	693929.0	End of Trench @ CL	1
21	WBPA-SE	7-Nov-01	91835.6	693984.5	End of Trench @ CL	1
21	WBPA-SE	7-Nov-01	91836.6	693981.1	End of Trench @ CL	1
22	WBPA-SE	7-Nov-01	91860.9	693850.4	End of Trench @ CL	1
22	WBPA-SE	7-Nov-01	91853.2	693851.5	End of Trench @ CL	1
23	WBPA-SE	7-Nov-01	91857.6	693808.3	End of Trench @ CL	1
23	WBPA-SE	7-Nov-01	91853.3	693815.2	End of Trench @ CL	1
24	WBPA-SE	7-Nov-01	91834.9	693750.7	End of Trench @ CL	1
24	WBPA-SE	7-Nov-01	91831.8	693756.7	End of Trench @ CL	1

E
F
G
H
AREA
SPRING CREEK
TR-20
TR-4
TR-5
TR-6
TR-3
IGNITER BOX
TR-1
TR-2
TR-21
DISTURBED AREA W/RED DISCOLORATION
SAMPLE PT-26
SAMPLE PT-25
SAMPLE PT-27
TR-19
TR-18
SPRING CREEK
BREACHED MAN MADE DAM
CATIONS
U.S. Army Corps of Engineers Rock Island District
IOWA ARMY AMMUNITION PLANT
MIDDLETOWN, IOWA
WEST BURN PADS AREA - SOUTH EXTENSION
TRENCH AND SAMPLE LOCATIONS
SEPT 2001 & NOV 2001 SAMPLING EFFORTS
Sheet reference number:
2
Figure 2 of 5


A
B
C
D
N
WEST BURN
BG-13
TR-23
TR-7
TR-24
TR-12
TR-14
TR-8
BG-1
TR-13
TR-11
TR-9
TR-10
BG-5
TR-17
BG-4
BG-3
TRENCH AND SAMPLE



W:\I A A A P\GIS Projects\Burn Pad Area\Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

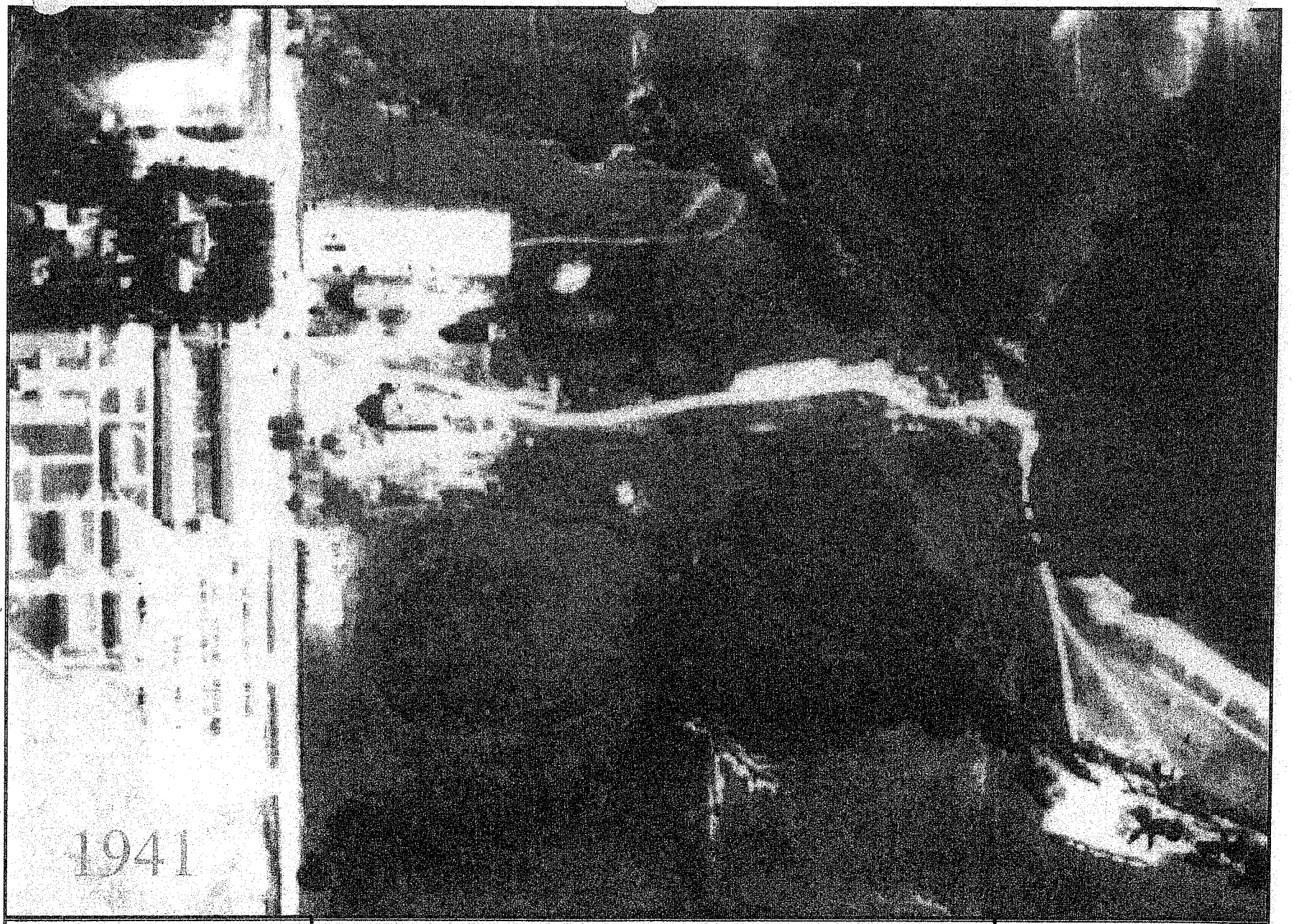
0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY	REV.	DATE
TDC	1	4/10/07



W:\FUSRAP GIS Projects\Burn Pad Area\Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

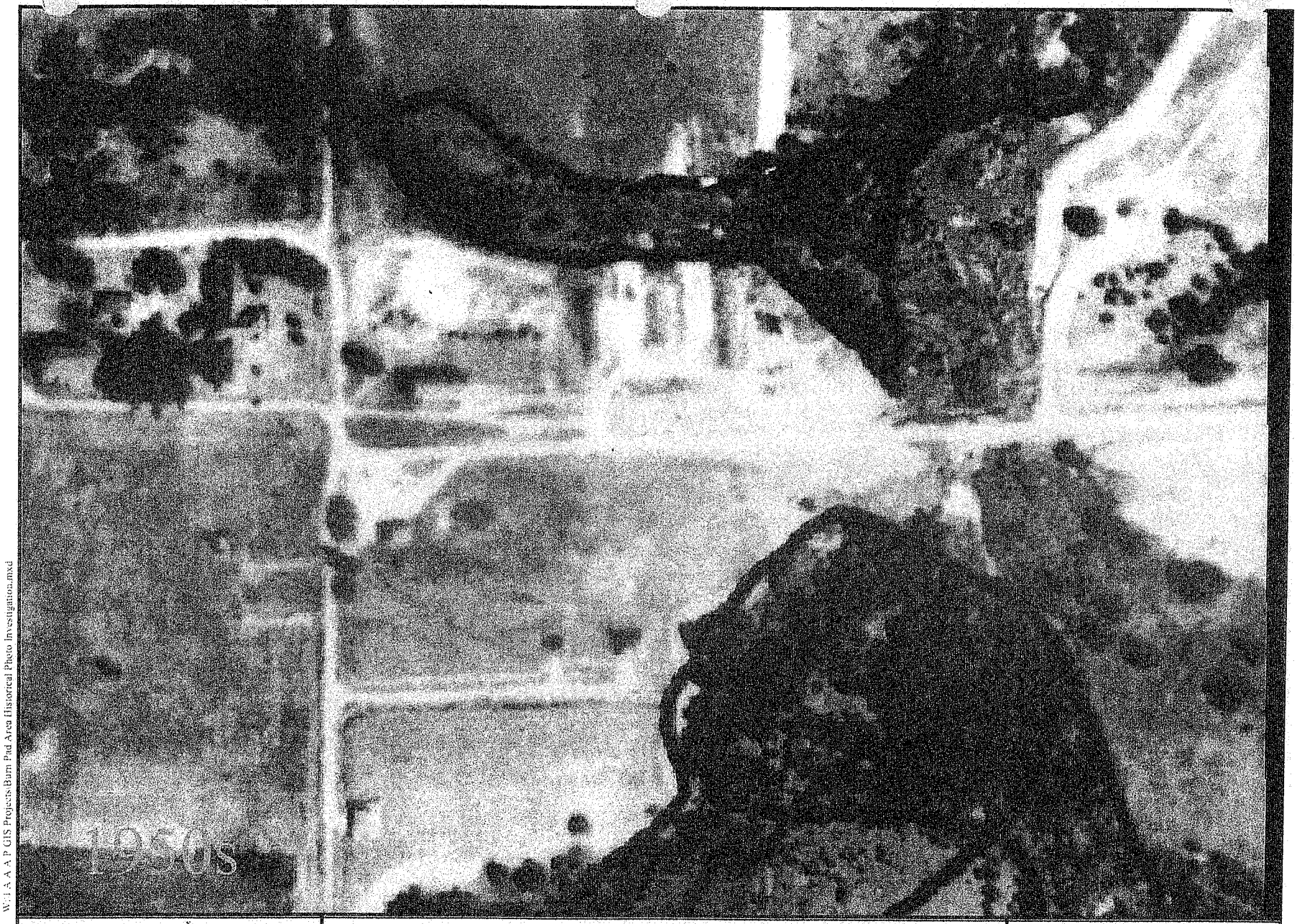
0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY:	REV:	DATE:
TDC	1	4/10/07



W:\LAAP GIS Projects\Burn Pad Area Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

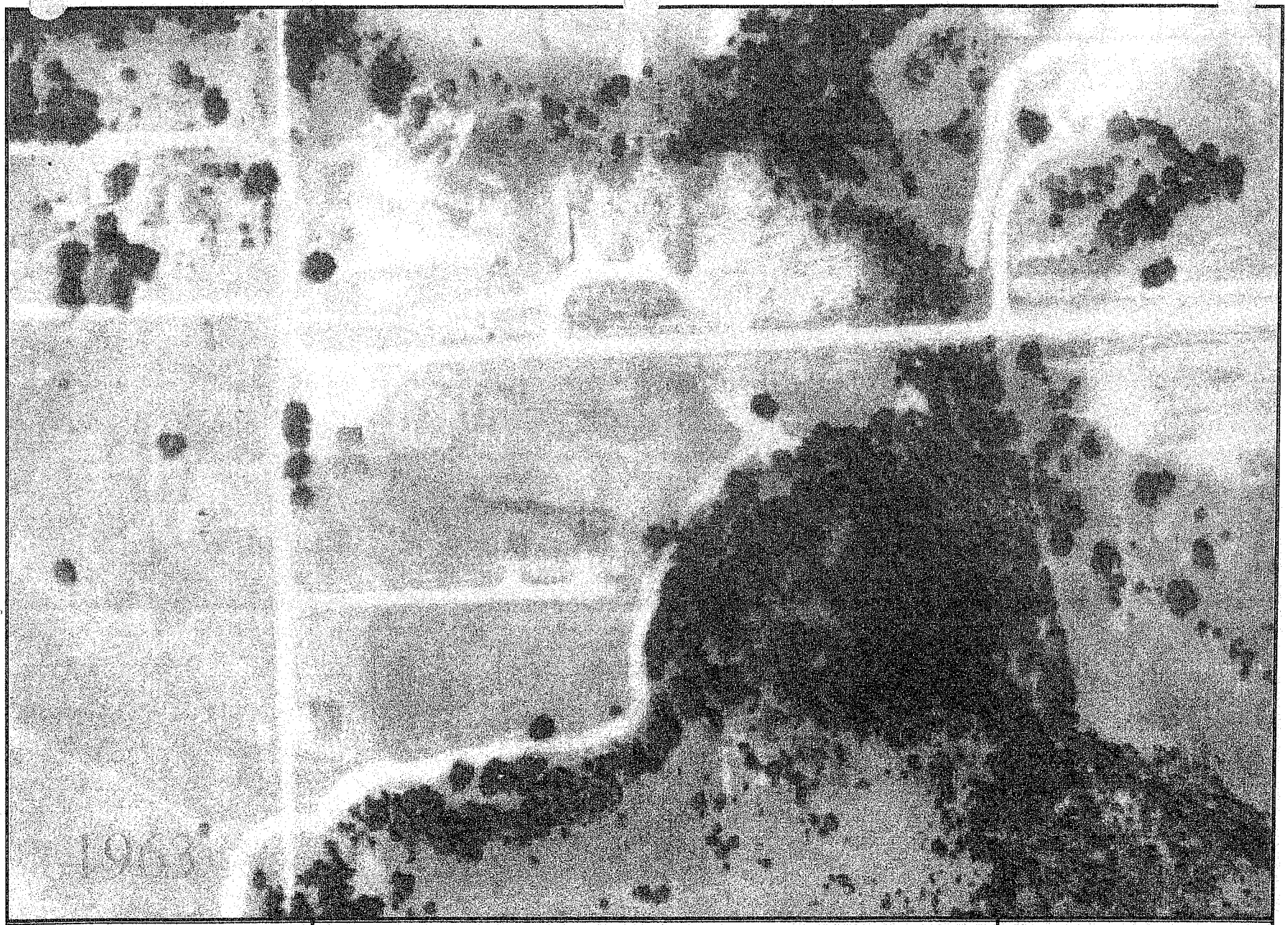
0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY	REV	DATE
TDC	1	4/10/07



W:\IAAAP\GIS Projects\Burn Pad Area Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY:	REV:	DATE:
TDC	1	4/10/07

W:\IAAAP\GIS Projects\Burn Pad Area Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

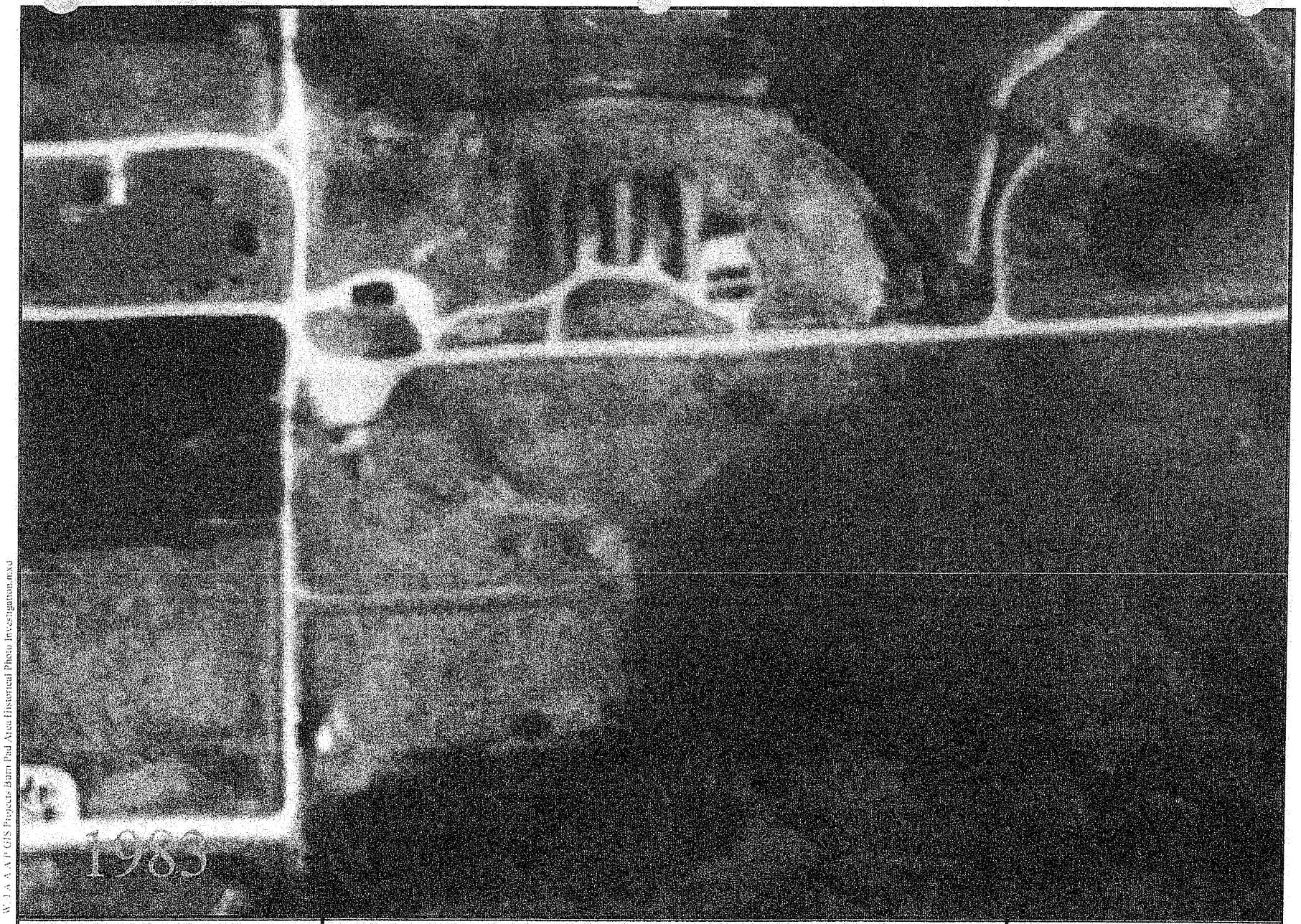
0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY:	REV	DATE
TDC	1	4/10/07



W:\IAAAP\GIS Projects\Burn Pad Area Historical Photo Investigation.mxd

1A-South State Plane
(NAD 83, Meters)

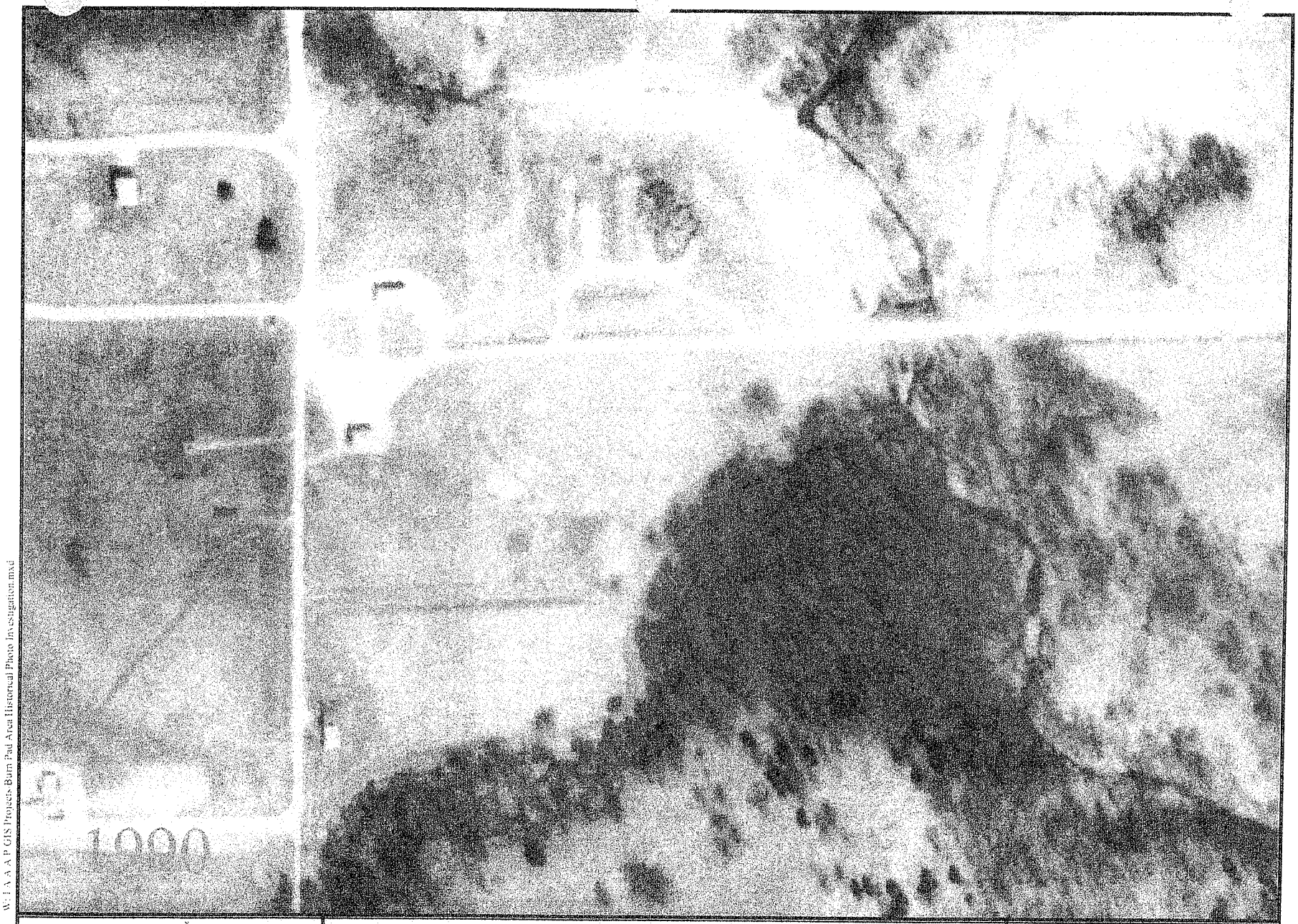
0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY	REV	DATE
TDC	1	4/10/07



W:\IAAAP GIS Projects\Burn Pad Area Historical Photo Investigation.mxd

IA-South State Plane
(NAD 83, Meters)

0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY	REV	DATE
TDC	1	4/10/07

IA-South State Plane
(NAD 83, Meters)

0 25 50 100 Meters

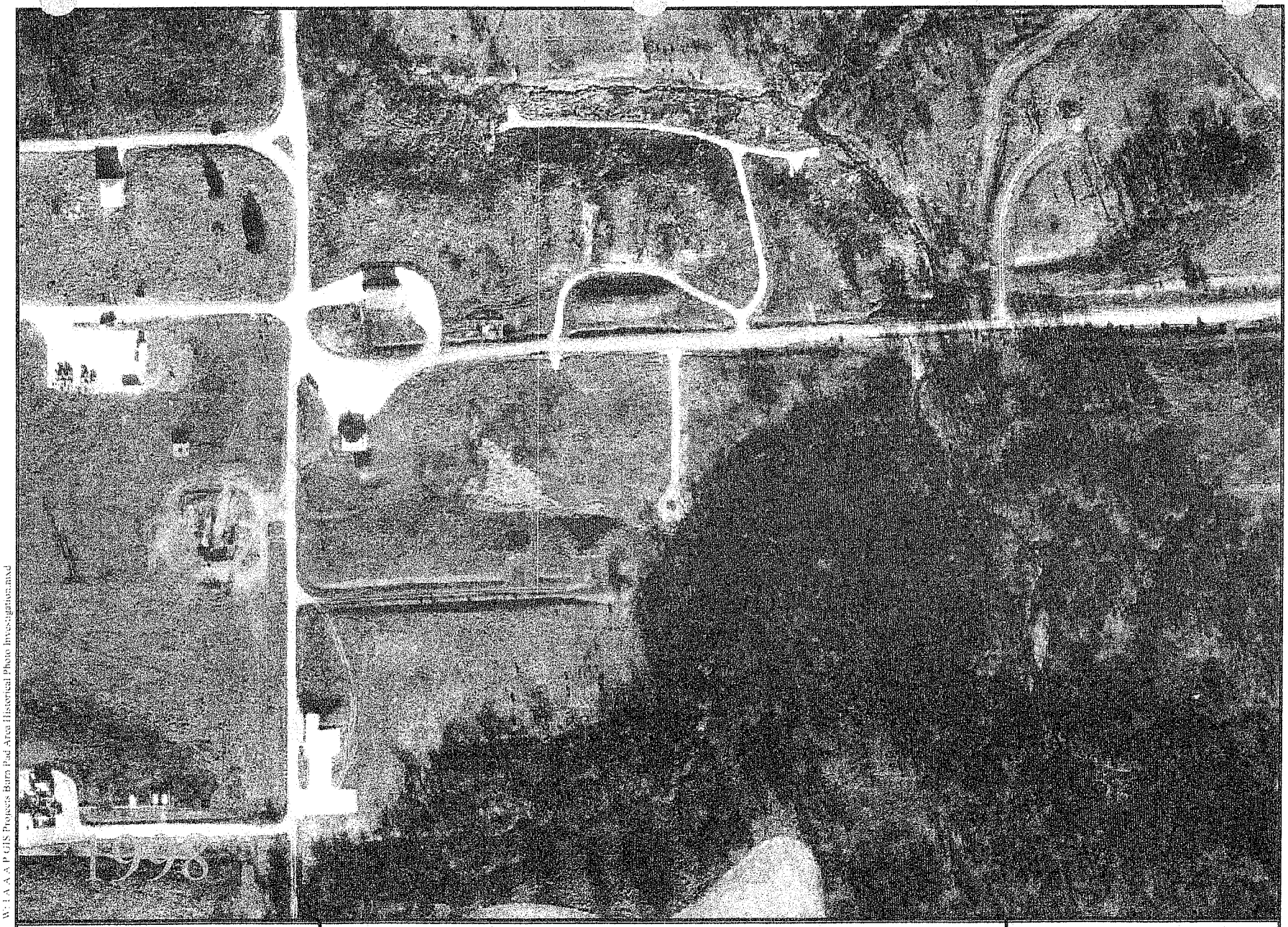
West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY:	REV:	DATE:
TDC	1	4/10/07

W:\IAAAP GIS Projects\Burn Pad Area Historical Photo Investigation.mxd



IA-South State Plane
(NAD 83, Meters)

0 25 50 100 Meters

West Burn Pad (South of Road) Historical Photo

Iowa Army Ammunition Plant
Burlington, Iowa

FUSRAP

DRAWN BY	REV	DATE
TDC	1	4.10.07

W:\AAAP\GIS Projects\Burn Pad Area Historical Photo Investigation.mxd