UMTRA-DOE/AL

United States Department of Energy

Report of Final Audit
Remedial Action Construction
UMTRA Project
Riverton, Wyoming

Preparation Date - December 1990

U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico

Uranium Mill Tailings Remedial Action Project UMTRAP

FINAL AUDIT REPORT

RIVERTON, WYOMING

DECEMBER 1990

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1.0 SUMMARY

This final audit report summarizes the results of all Quality Assurance audits, in-process surveillances, and radiological surveillances conducted at the Riverton, Wyoming, Uranium Mill Tailings Remedial Action (UMTRA) Project Site.

All issues documented as audit or surveillance Findings or Recommendations have been resolved to the satisfaction of the UMTRA Project Office.

It is recommended in this report that the U.S. Department of Energy (DOE) certify the site.

2.0 INTRODUCTION

This final audit report consists of a summary of the Quality Assurance audit, radiological surveillance, and in-process surveillance reports prepared by the Technical Assistance Contractor (TAC). This report provides an independent assessment by the TAC of the compliance of the remedial action with plans, specifications, and standards. A recommendation to the DOE for certification of the site is included.

2.1 QUALITY ASSURANCE AUDITS

Quality Assurance audits are conducted periodically by the DOE, with assistance from the TAC, to verify that the procedures and systems required by the respective Quality Assurance programs are being implemented during remedial action. The Quality Assurance audits are performed on the frequency of approximately one per year for each organization and subcontractor conducting UMTRA Project work. The results of the audits and follow-up actions for the Riverton site are documented in Section 5.0; a summary is given in Table 2.1.

Table 2.1 Summary of audits and surveillances

Type/date	Number of findings	Number of observations	Date closed
TAC radiological surveillances			
August 15-18, 1988	0	12	1-03-89
July 11-14, 1989	0	11	3-08-90
TAC in-processs surveillances			
June 21, 1989	1	4	2-14-90
November 29, 1989	5	9	4-09-90
October 10, 1990	0	5	12-07-90
TAC Quality Assurance audits			
MK-Environmental Systems November 16, 1989	1	10	1-05-90
MK-Ferguson (Albuquerque) November 14, 1989	0	10	1-04-90

2.2 RADIOLOGICAL AND IN-PROCESS SURVEILLANCE REPORTS

Radiological and in-process surveillances are conducted by the TAC for the DOE to provide an independent assessment that the quality of remedial action work is sufficient to ensure that the EPA standards and other site-specific requirements are met. These performance surveillances complement the Quality Assurance programs and audits, and provide a high degree of assurance that the remedial action tasks are accomplished in compliance with relevant specifications and standards. Performance surveillances are conducted at processing sites a minimum of once per construction season, or twice per remedial action. The results of the surveillances and follow-up actions for the Riverton site are documented in Sections 3.0 and 4.0; a summary appears in Table 2.1.

2.3 OTHER QUALITY ASSURANCE AUDITS/SURVEILLANCES

Summaries of Quality Assurance audits and surveillances conducted by the DOE and the TAC are included in Sections 4.0 and 5.0 and summarized in Table 2.1. Included in the summaries are DOE and contractor resolutions to Observations presented in the audit report.

2.4 AUDIT PROCEDURES

Criteria and procedures for conducting UMTRA Project audits and surveillances are provided in the UMTRA Project Audit/Surveillance Program Plan (DOE, 1988).

2.5 GENERAL STANDARDS

In 1978, the U.S. Congress passed Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), declaring uranium mill tailings a potential health hazard to the public, and requiring that certain sites be designated for remedial action. The Riverton site was included as one of these. The EPA was directed to promulgate radiological and nonradiological standards for decontamination of the sites, the DOE was authorized to initiate and manage the remedial actions, and the NRC was charged with concurring in the remedial actions and licensing the disposal sites. The standards that apply to all UMTRA Project sites, as promulgated by the EPA, are given in Subparts A and B of 40 CFR Part 192 as follows:

- The standards in Subpart A are directed at controlling the stabilization of radioactive materials at the disposal sites, and are addressed by the engineering design specifications developed by the DOE UMTRA Project Office for the disposal sites. Compliance with the Subpart A standards at the Riverton site was accomplished by disposing of the Residual Radioactive Material (RRM) from the Riverton processing site at a licensed Title II site.

- Subpart B standards define the conditions under which a site has been adequately decontaminated. In-situ measurements and analyses of soil samples from excavated areas were conducted by the Remedial Action Contractor (RAC), and the results compared to the cleanup standards for verification that contaminated materials had been removed. The TAC conducted radiological surveillances at the Riverton site to provide an independent evaluation of the RAC's verification efforts.

In addition, the processing site will be evaluated to determine if groundwater restoration in accordance with Subpart B of the proposed groundwater protection standards (52 FR 3600; Sept. 24, 1987) is required.

3.0 RADIOLOGICAL SURVEILLANCES

Two radiological surveillances were performed at the Riverton, Wyoming, site to provide an independent assessment that the quality of remedial action work was sufficient to ensure that the EPA standards were met. While quality assurance programs and audits provided a high degree of assurance that procedures were followed, radiological surveillances addressed whether the work actually would result in a site that meets EPA standards. Specific attention was given to the contractor's radiological survey plans and procedures, measurement techniques, and data management capabilities. The TAC used laboratory and field instruments for contractor cross-calibration purposes and for analyzing soil samples taken from the sites.

3.1 SURVEILLANCE OBJECTIVES

Radiological surveillances have three distinct objectives. The first objective is verification that remedial actions are meeting the EPA cleanup standards or other cleanup standards specified in the remedial action planning documents. The second objective is evaluation of excavation control methods used by the RAC to ensure that contaminated areas are not overexcavated, thereby preventing increased quantities of material for disposal, and potential escalated costs. The final objective of a surveillance is to review the general data management methods and procedures of the RAC, and provide a pathway for the exchange of ideas for technological improvements in the program.

The results of the radiological surveillances were documented as either Findings or Observations, with the former related to non-compliance items, and the latter relating to items of proficiency, non-critical deficiency, or developmental activities. Findings presented in a radiological surveillance are based on one of the following criteria:

- Noncompliance with requirements of the site Remedial Action Plan (RAP), engineering design, or UMTRA Project Office directives applicable to the site.

- Evidence that the existing radiological measurement techniques may result in residual contamination levels in excess of established limits (underexcavation).

- Evidence that the existing radiological measurement techniques may result in otherwise avoidable excavation of soils <u>not</u> contaminated in excess of the limits (overexcavation). The soil contamination limits are those specified by EPA standards, including site-specific modifications agreed to by the NRC or mandated by UMTRA Project Office directives.

- Evidence that some aspect of the contractor's radiological survey plans and procedures, measurement techniques, or data management capabilities are insufficient to allow eventual certification of the site.

3.2 SURVEILLANCE RESULTS

During the radiological surveillance of the Riverton processing site conducted on August 15-18, 1988, the auditors documented twelve Observations and no Findings. Eight Observations documented positive aspects of the radium (Ra-226) sampling and analysis, verification sampling, alpha counting system, and general data management. The remaining minor Observations included the need to update calibration and performance indicators, and the need for additional training for the field staff.

During the radiological surveillance conducted on July 11-14, 1989, the auditors documented eleven Observations and no Findings. Seven Observations documented positive aspects of the Ra-226 sampling and analysis, verification sampling, instrumentation calibration, site access control, and data management. The remaining Observations included the need for analysis of duplicate samples, an incorrectly calculated site emanation fraction factor, and use of an unofficial site verification map.

3.3 SUMMARY AND CONCLUSIONS

The overall conclusion from the two radiological surveillances was that the health physics aspects of the Riverton remedial action program were effectively performed according to written procedures and documentation requirements. All issues of the August 1988 surveillance were satisfactorily closed out on January 3, 1989; the July 1989 surveillance was satisfactorily closed out on March 8, 1990.

4.0 QUALITY ASSURANCE IN-PROCESS SURVEILLANCES

In order to ensure that the approved construction plans and specifications were being properly followed and that the preplanned inspection points established by the NRC and DOE were being observed, the DOE/TAC team performed one in-process surveillance at the Riverton site during remedial action activities, and two final close-out inspections upon completion of remedial action. The surveillance was independent of the contractor performing the work and did not relieve the contractor from any inspection or checking responsibilities that were required. The Quality Assurance surveillance was conducted at the Riverton site in June 1989. The close-out inspections were conducted in November 1989 and October 1990.

The surveillance conducted by the TAC involved a one-day site visit by a team headed by the TAC Quality Assurance Department and supported by other TAC disciplines as necessary. During the TAC surveillance, materials, records, and construction activities were verified using the approved Remedial Action Inspection Plan (RAIP), RAP, and plans and specifications for the site. The following sections provide additional information regarding the surveillance activities and summarize the surveillance Findings and resolutions.

4.1 SURVEILLANCE OBJECTIVES AND CHECKLIST

The Quality Assurance surveillance had three distinct objectives. The first objective was to verify compliance by the RAC with the approved RAP for the Riverton site. To accomplish this, the approved RAP with any modifications was reviewed by the TAC Quality Assurance Department surveillance team leader and members, and a checklist was established made up of key construction activities and the methods used to perform them.

The second objective was to verify that the RAC was in compliance with the approved plans and specifications. The surveillance team accomplished this objective by review of documentation, and by observing construction activities as they were being performed.

The final objective of the surveillance was to verify that the approved RAIP for the Riverton site was being implemented. This was accomplished by qualified TAC personnel witnessing the performance of inspection activities by staff in the field.

4.2 SURVEILLANCE RESULTS

In-process surveillance results are documented as either Findings/Recommendations or Observations, with the former relating to non-compliance items and the latter relating to items observed during the site visit. The results of the surveillance and close-out inspections performed at the Riverton site included six Findings/Recommendations and 18 Observations. All of the Findings/Recommendations were corrected to the satisfaction of the UMTRA Project Office. The six Findings/Recommendations noted during the surveillance and the close-out inspections required the following:

- Affixing equipment calibration labels to measuring and test equipment requiring regularly scheduled calibration.
- Adjusting monitor well risers to bring the surface casing to the required height above ground level.
- Adjusting the fence to ensure that the bottom of the fence touched the ground and to repair small breaks in the fence.
- Additional fine grading of the irrigation ditch on the northeast corner of the site.
- Performing a monitor well inventory to account for all wells to remain and all wells to be abandoned.
- Disposing of four-inch PVC well casing projecting from the ground at two locations not documented on drawings.

4.3 SUMMARY AND CONCLUSIONS

One in-process surveillance and two remedial action close-out inspections were conducted at the Riverton. A total of six Findings/Recommendations and 18 Observations were noted. Follow-up of Findings/Recommendations confirmed that all required actions were taken by the RAC and all Findings/Recommendations were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office.

5.0 QUALITY ASSURANCE AUDITS

During the performance of remedial action activities at the Riverton site, there was one audit of MK-Environmental Services activities in San Francisco and one audit of the MK-Ferguson Albuquerque Operations Office activities. These audits were performed by the TAC with support from the DOE UMTRA Project Office.

5.1 AUDIT OBJECTIVES

Quality assurance audits have two objectives. The first objective is to verify compliance by MK-Environmental Services and MK-Ferguson Albuquerque with their approved Quality Assurance Program Plans (QAPPs) and supporting procedures. The second objective is to provide objective evidence of the effectiveness of the implementation of the approved QAPPs and supporting procedures.

5.2 AUDIT RESULTS

Audit results are documented as either Findings/Recommendations or Observations, with the former relating to non-compliance items and the latter relating to items observed during the audit. The results of the audits included one Finding/Recommendation and 20 Observations. The one Finding noted during the audits required the following:

- The performance of Quality Control checks by hand-held calculators on a regular basis for each in-house computer program utilized for calculations in support of the UMTRA Project.

5.3 SUMMARY AND CONCLUSIONS

One quality assurance audit was conducted of the MK-Environmental Systems activities in San Francisco and one audit of the MK-Ferguson Albuquerque Operations Office activities. A total of one Finding and 20 Observations were noted. Follow-up of Findings/Recommendations confirmed that all required actions were taken by either MK-Environmental Systems or MK-Ferguson Albuquerque and all Findings/Recommendations were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office.

6.0 SUMMARY AND CONCLUSIONS

Two radiological surveillances, two Quality Assurance audits, one Quality Assurance in-process surveillance, and two final remedial action close-out inspections were conducted at the Riverton UMTRA Project site. A total of seven Findings/Recommendations and 61 Observations were noted during TAC activities. Follow-up of Findings/Recommendations and Observations confirmed that all required actions were taken by the RAC, and all Findings/Recommendations were satisfactorily resolved. The TAC concludes that the remedial action was conducted in accordance with the approved Remedial Action Plan, that the site conforms to the applicable EPA standards or to the agreed-upon deviations from those standards, and recommends the site for certification by the DOE.

REFERENCES

DOE (U.S. Department of Energy), 1988. "UMTRA Project Audit/Surveillance Program Plan", UMTRA-DOE/AL-400326.0000, prepared by Jacobs Engineering Group Inc., for the DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

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SECTION I

EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

The purpose of this completion report is to provide evidence that the final Riverton, Wyoming, Processing Site property condition is in accordance with the approved design, and that all Environmental Protection Agency (EPA) standards have been satisfied. Included as appendices, in order to support the stated conclusions, are the design calculations, as-built drawings and specifications, a description of the methodology utilized to obtain the radiological measurements which were used to verify the remedial actions, and the pre-remedial action and post-remedial action radiological measurements.

The final Remedial Action Plan (RAP) which has been approved by the Department of Energy, and concurred upon by the Nuclear Regulatory Commission (NRC) and the State of Wyoming, contains the conceptual design, which was used to develop the final approved design. During remedial action construction operations, there were no conditions encountered which required design features which were not in the conceptual design.

All remedial action activities were completed in conformance with the specifications and drawings, and the as-built drawings in our opinion, reflect an accurate depiction of the existing Processing Site property condition.

MK-Ferguson Company

J.G. Oldham
Project Director

SECTION II

DESIGN ASSESSMENT

II. DESIGN ASSESSMENT

This section defines the requirements established for the inactive uranium Processing Site located near Riverton, Wyoming and provides an assessment of the completed design wi' respect to the design requirements. The design criteria, which were formally approved by the U.S. Department of Energy and conditionally concurred upon by the Nuclear Regulatory Commission and the State of Wyoming, are given in Section II-A. Section II-B gives the design bases established by Morrison-Knudsen Engineers (MKE) to guide the design efforts. A Design Basis Summary to assess how specific design basis are satisfied by the design is given in Section II-C.

A. Design Criteria

"Remedial Action Plan (RAP) and Final Design for Stabilization of the Inactive Uranium Mill Tailings Site at Riverton, Wyoming UMTRA-DOE/AL 050507.0000 was provided to MK-Ferguson Company and Morrison-Knudsen Engineers, Incorporated, as guidance for design activities."

1. Purpose/Objectives:

The design objectives are to isolate the uranium mill tailings for the purpose of preventing their misuse by man and dispersal by natural forces, and to protect the groundwater by removing all contamination from the Processing Site to eliminate any infiltration. The following major design objectives were established:

- Reduce contaminant levels of radium-226 (Ra-226) in areas released for unrestricted use to 5 picocuries per gram (pCi/g) averaged in the first 15 centimeters (cm) of soil below the surface, and 15 pCi/g averaged in 15-cm-thick layers of soil below more than 15 cm below the surface.

- Make a reasonable effort to achieve, in any occupied or habitable building, an annual average (or equivalent) radon

decay product concentration (including background) not to exceed 0.02 working level (WL). In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and the level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour (microR/hr).

- Protect against releases of contaminants from the Riverton Site during construction.

- Minimize the areas disturbed at the Riverton Site during construction.

- Minimize human exposure to contaminated materials during construction.

- Ensure, to the extent practicable, that existing or anticipated beneficial uses of surface and ground waters at the Riverton Site are not adversely affected.

2. Configuration and Essential Features

The principal construction features of the Riverton, Wyoming, UMTRA Site are:

- Erection of a temporary security fence, and construction of a staging area and on-site access roads.

- Demolition of the mill building and wash house at the Riverton Site.

- Construction of a waste-water retention pond according to applicable regulations to protect against the release of contaminants from the site during construction.

- Construction of drainage control measures according to applicable regulations, to direct all generated waste-water and storm-water runoff to the retention pond during construction.

- Installation of measures to control erosion from all disturbed areas during remedial action.

- Consolidation of contaminated materials from the windblown areas and vicinity properties onto the tailings site.

- Excavation of all tailings and contaminated materials from the tailings site and relocation of all of the materials (including demolition debris) by truck to the Gas Hills Disposal Site.

- Backfilling, recontouring to promote surface drainage, and revegetation (as necessary) of all areas disturbed at the Riverton Site during remedial action.

3. Environmental Requirements:

- The design shall be based on reducing the average radon flux from the site to levels not exceeding 20 picocuries per square meter per second.

- The contaminant levels around the Riverton Site shall be reduced to levels which do not exceed 5 picocuries per gram of Ra-226 above background in the top 15 centimeters (cm) of soil, and do not exceed 15 picocuries per gram Ra-226 above background in any 15 cm layer below that depth.

4. Structural Requirements:

- The Riverton Site shall be backfilled with uncontaminated soil to a level compatible with the surrounding terrain, recontoured to promote surface drainage, revegetated as necessary, and released for any use consistent with existing local use controls.

5. Quality Assurance Requirements:

- Quality assurance for design and construction shall comply with the UMTRA Project Quality Assurance Plan (DOE/AL-185) and the MK-Ferguson Company Quality Assurance Program Plan which complies with ANSI/ASME NQA-1-1979 with 1981 Addendum and 10 CFR 50, Appendix B, as applied to the UMTRA Project.

6. Codes and Standards

- Local and Federal codes and standards shall be followed during design and construction. These shall include, but are not limited to the following:

AASHTO:	American Association of State Highways and Transportation Officials
ANSI:	American National Standards Institute
ASTM:	American Society for Testing Materials
AWWA:	American Water Works Association

CFR:	Code of Federal Regulations, as applicable (such as 10 CFR, 29 CFR, etc.)
CISPI:	Cast Iron Standard Pipe Institute
DOL/OSHA:	Department of Labor - Occupational Safety and Health Administration
NEC:	National Electric Code
NEMA:	National Electric Manufacturers Association
PFI:	Pipe Fabricators Institute - Handbook of PVC Pipe Design and Construction
UBC:	Uniform Building Code
UL:	Underwriters Laboratory
UPC:	Uniform Plumbing Code (DOE 6430)

B. Design Bases Established by MKE to Meet the Approved Criteria

The means by which MKE assures that all elements of the design criteria are met is through Design Basis Memoranda (DBM). The Design Basis Memoranda are developed by Lead Task Engineers under the direction of the Site Design Engineer. The Design Basis Memoranda address the given design criteria and produce site specific design requirements which then govern the final design requirements which must be addressed in order to assure that all elements of the design criteria are met.

The design bases established by MKE, for the Riverton, Wyoming, UMTRA Site are:

07-401-01	General Design Criteria
07-415-00	Construction Facilities
07-419-00	Vehicle Monitoring and Decontamination
07-426-00	Contaminated Materials Excavation, Final Site Grading and Revegetation
07-430-00	Retention Basin
07-432-00	Demolition, Decontamination and Utilities Protection

C. Design Basis Summary

07-401-01 General Design Criteria

The first DBM defines the purpose and objectives of the remedial action. It identifies the codes and standards which are to be used. It presents the general criteria for structural design, hydrology and hydraulics, geotechnical, wastewater handling and construction phase requirements.

07-415-00 Construction Facilities

This memorandum presents the basic information and guidelines for the preparation of specifications and designs for the construction facilities, including: access control and radiological monitoring facilities, staging areas, field offices, and temporary fencing at the Riverton Site.

07-419-00 Vehicle Monitoring and Decontamination

This memorandum presents the basis for design of a decontamination pad and wash system to be utilized for the decontamination of all construction equipment and vehicles used during construction, to

protect against release of contaminated materials from the Riverton Site.

07-426-00 Contaminated Materials Excavation, Final Site Grading and Revegetation

This Design Basis Memorandum presents the basis for design of the tailings materials excavation and the final grading and revegetation at the Riverton, Wyoming Site. The excavation shall be designed for the transportation of all contaminated materials to an off-site disposal area. Contaminated materials will be excavated from existing tailings pile, mill yard and windblown contaminated areas.

07-430-00 Retention Basin

This memorandum presents the basis for design of a wastewater retention basin for use during construction to protect against release of contaminants from the site and to provide runoff and sediment control.

07-432-00 Demolition, Decontamination and Utilities Protection

The purpose of this memorandum is to establish the criteria for decontaminating and demolishing the existing buildings and foundations, and protection and restoration of specific utilities at the Riverton, Wyoming Site.

It also describes measures required to protect the currently operating Acid Plant, and to assure protection of personnel around these facilities.

SECTION III

REMEDIAL ACTION ASSESSMENT

III. REMEDIAL ACTION ASSESSMENT

A brief description of the pre-remedial action site conditions, and the remedial action and cleanup verification performed at the Riverton, Wyoming UMTRA Site is provided in the following paragraphs. Also stated is the radiological verification methods applied to insure radiological cleanup to the EPA limits for the UMTRA project.

A. Pre-Remedial Action Site Conditions

The Riverton inactive Uranium Mill Site is located in Fremont County, Wyoming, approximately 2 miles southwest of the city of Riverton, on the north side of State Highway 138 (formerly State Highway 789.) The total site, which covers about 173 acres, is generally bounded by BIA Route 28 (goes In Lodge Road) on the north, a vacant field (owned by Lome Drilling and Well Service) on the west, State Highway 138 to the south, and irrigated farmland on the east. The designated site is surrounded by the Wind River Indian Reservation. The neighboring properties are owned by members of the Arapahoe and Shoshone Indian Tribes and others.

The 173 acre designated site consists of a rectangular tailings pile (70 acres), part of the original mill structures and equipment, a portable water well with a pumphouse and metal water tower, and an active Sulfuric Acid Plant. The site is bordered by drainage ditches and irrigation canals.

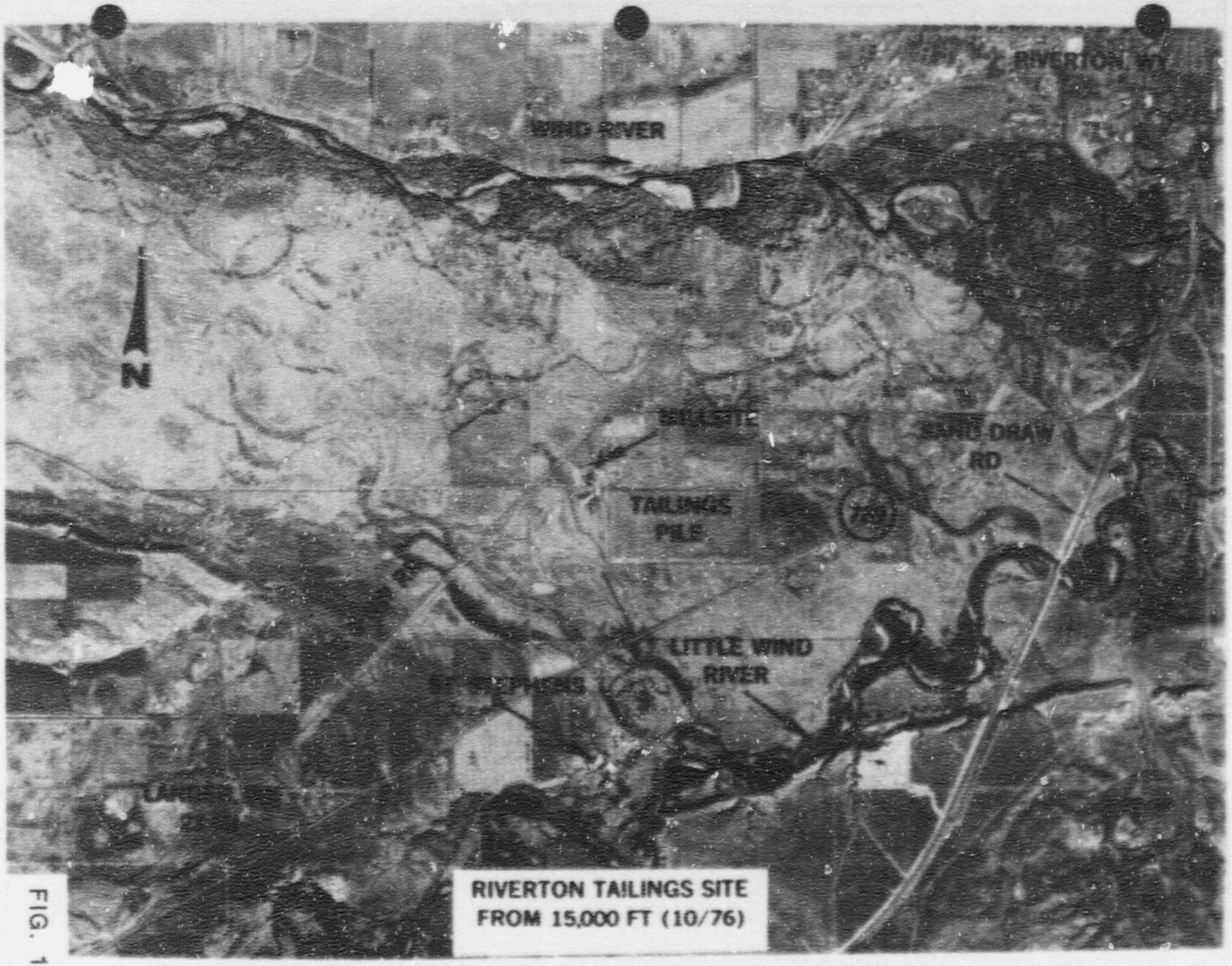
Dispersion of tailings by wind and water erosion has contaminated approximately 84 acres. The total volume of contaminated materials, including the tailings, underlying soils, windblown contaminated soils, and vicinity property materials were originally estimated to be approximately 1,500,000 cubic yards (cy). During construction, a total of 2,200,000 cubic yards of

tailings and contaminated materials were excavated and transported to the Gas Hills Disposal Site.

The rectangular tailings pile in the southern half of the designated site is higher on the west side and slopes to the east. The pile was contoured and covered with 18 inches of material from the surrounding edges of the pile. The excavation for the cover created a swale around the pile which collects runoff from the pile. The cover was seeded with crested wheatgrass which controls wind and water erosion to some degree.

In order to stabilize the tailings and meet the EPA standards, the tailings and other contaminated materials were consolidated and transported to the Gas Hills Disposal Site, located in the Gas Hills Mining District approximately 55 miles east of Riverton. The Gas Hills Uranium Mining District is an area where extensive uranium mining and milling have occurred, and the land is also used for low-density livestock grazing. The district is sparsely populated with the closest urban center being Jeffrey City approximately 30 miles to the south.

The following photos represent the Pre-Remedial Action Site Conditions:

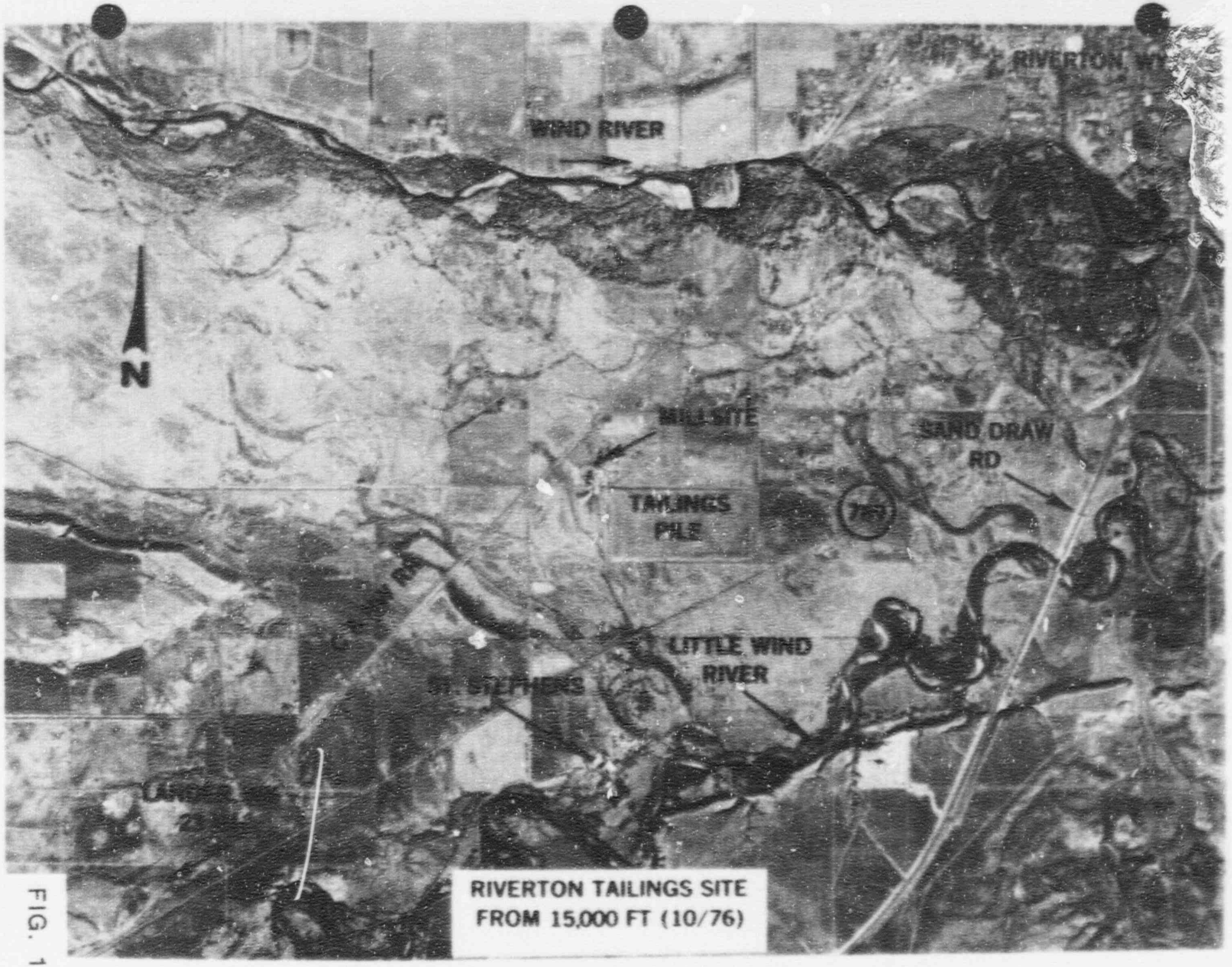


RIVERTON TAILINGS SITE
FROM 15,000 FT (10/76)

FIG. 1

RIVERTON TAILINGS SITE
JAN. 1980 — VIEW NE

FIG. 2



RIVERTON TAILINGS SITE
FROM 15,000 FT (10/76)

FIG. 1

RIVERTON TAILINGS SITE
JAN. 1980 — VIEW NE

FIG. 2

B. Remedial Action and Cleanup Verification

Remedial Action at the Riverton, Wyoming Site consisted of:

- Mobilization of equipment and personnel to perform all construction activities.
- Perform dust control measures for dust generated by all construction activities.
- Construction of temporary facilities, including parking area, office trailers, installation of all utilities, and the relocation of existing irrigation ditches.
- Sealing of monitor wells.
- Construction of a Waste Water Petention Basin including a stilling basin and outflow structure.
- Construction of a decontamination pad and wash system.
- Construction of a paved turnout, and accelerating and decelerating lanes on State Highway 138 at the project site entrance.
- Improve the intersection of State Highway 789 and 138 complete with signs, lighting, directional light signals and controls.
- Improve the private road between State Highway 789 and 138 by widening, furnishing and placing aggregate surfacing, and constructing drainage ditches.
- Installation of traffic signs required on all state highways.

- Construction of a site access road from State Highway 138.

- Construction of site fencing and maintenance of existing fences.

- Removal of asbestos and asbestos containing materials.

- Demolition and transportation of the following items to the Gas Hills Disposal Site: mill building, ore storage bins, concrete foundations and footings, and miscellaneous debris.

- Excavation and transportation of mill tailings, windblown contaminates, and vicinity property contaminates.

- Demolition and disposal of decontamination pad and retention basin.

- Removal of temporary fencing (except parking area).

- Removal of all State Highway improvements and return to original condition.

- Final site grading restoration and seeding of all disturbed areas.

The following photographs provide a pictorial history of the sequence of events during Remedial Action activities. Post Remedial Action photos are included in Appendix '

- Figure 1, 06/03/87, looking east - prior to Remedial Action.

- Figure 2, 06/24/88, looking east - waste water retention basin and mill site demolition complete.

- Figure 3, 08/15/88, looking west - primary excavation on eastern half of tailings pile. Secondary excavation and dewatering just starting.

- Figure 4, 10/14/88, looking north - excavation of windblown areas. Continuing primary and secondary excavation.

- Figure 5, 04/17/89, overhead view - stockpiling of vicinity property material, placement of general fill, and continuing excavation of tailings material.

- Figure 6, 06/15/89, looking south - stockpiling of vicinity property material, placement of general fill, and continuing excavation of tailings material.

- Figure 7, 08/15/89, overhead view - reduced waste water retention basin on the northern portion, tailings excavation complete, continuing general fill placement, continuing vicinity property load-out, and start of seed bed preparation.

- Figure 8, 11/16/89, looking east - continuing site revegetation.

- Figure 9, 03/19/90, overhead view - site revegetation complete. Parking and staging area remaining per Chemical Marketing Service request.

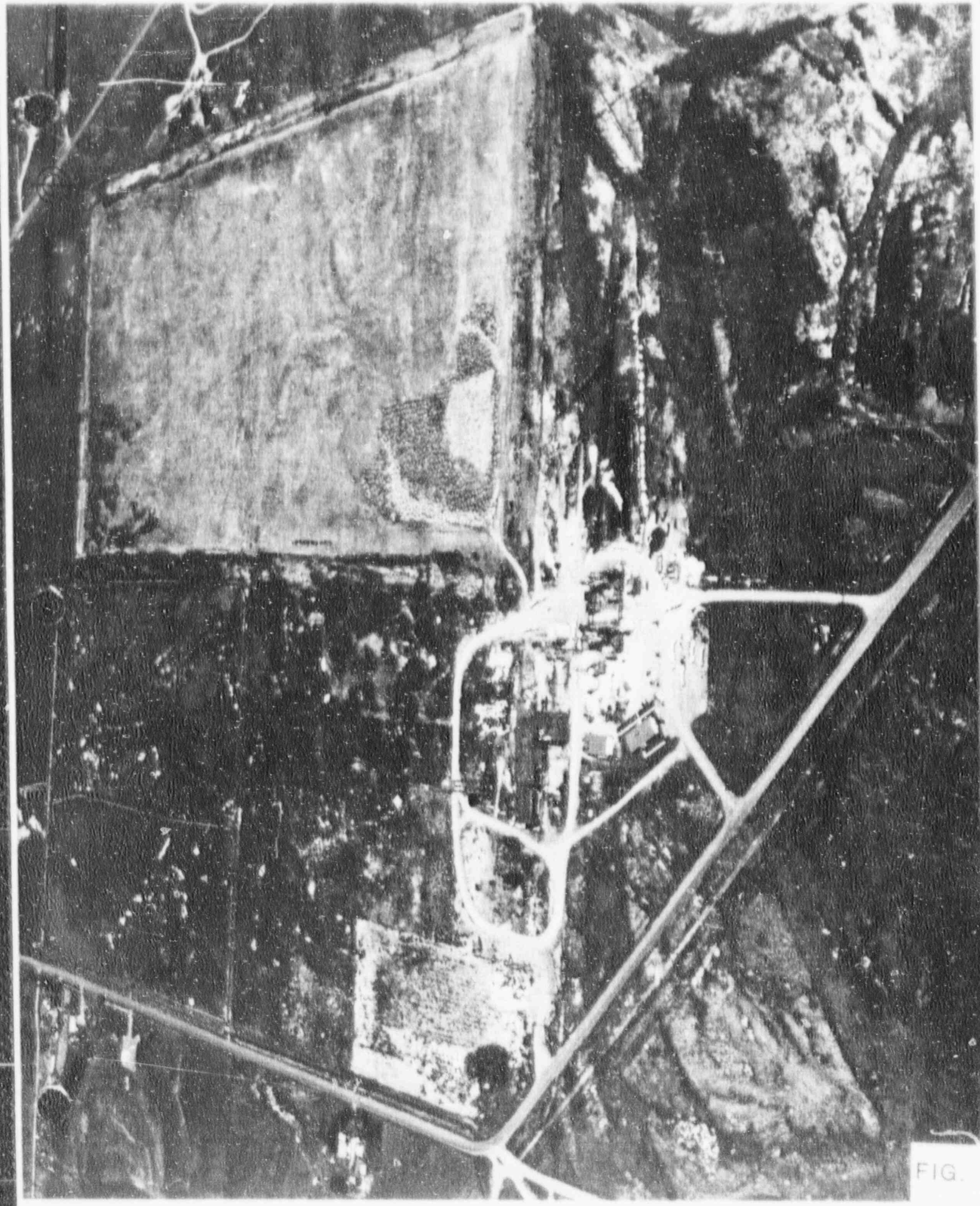


FIG. 1

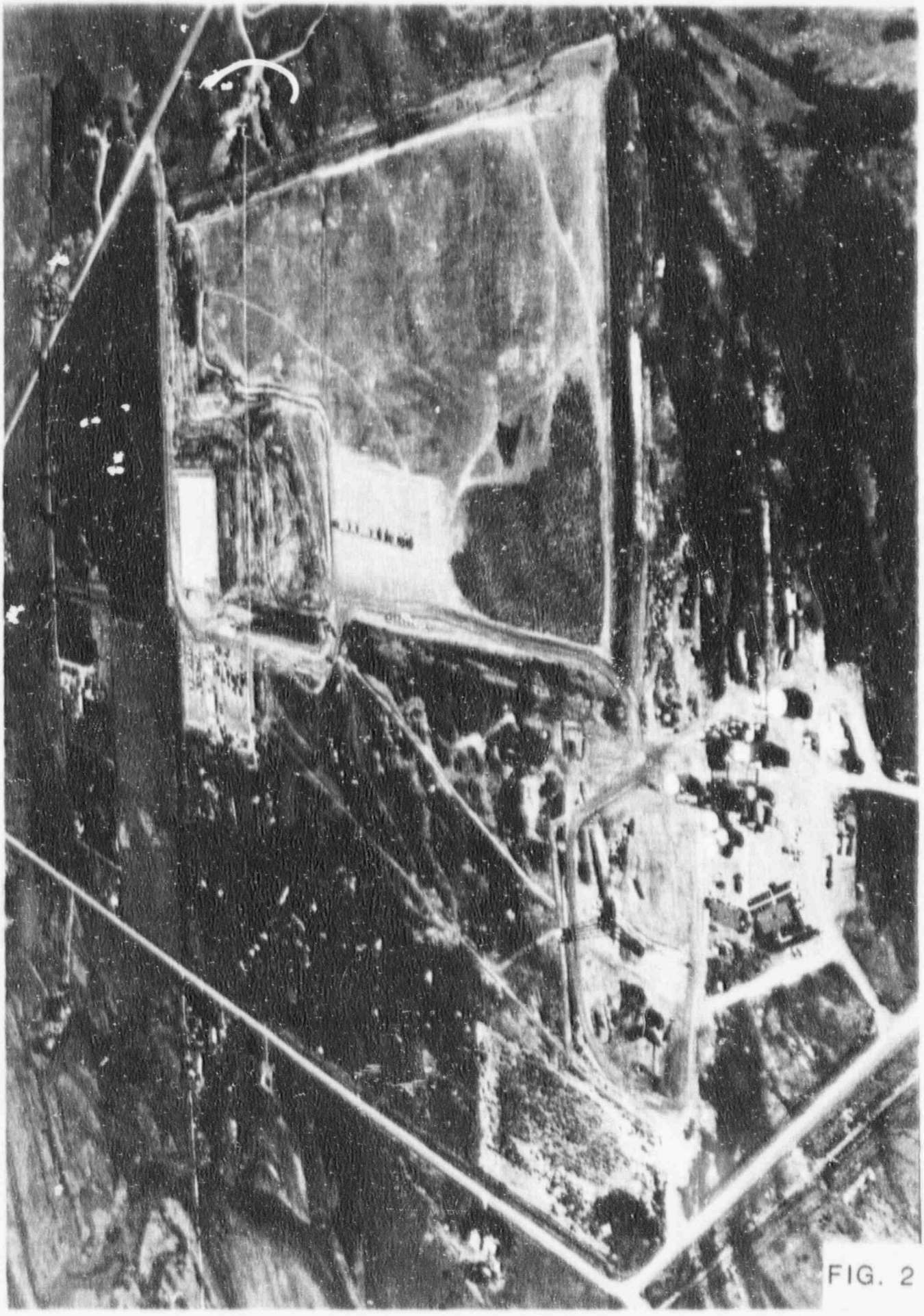


FIG. 2

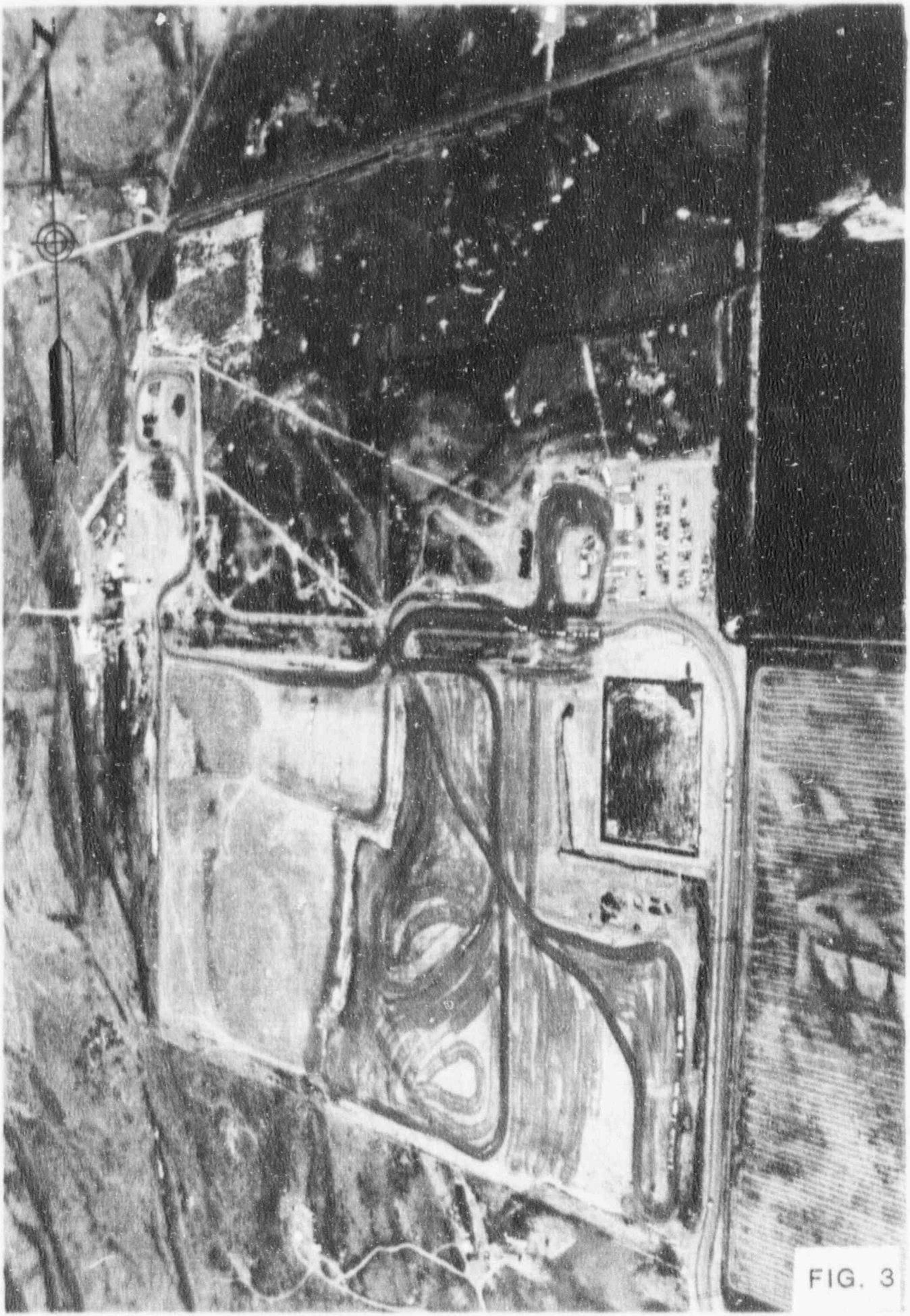


FIG. 3

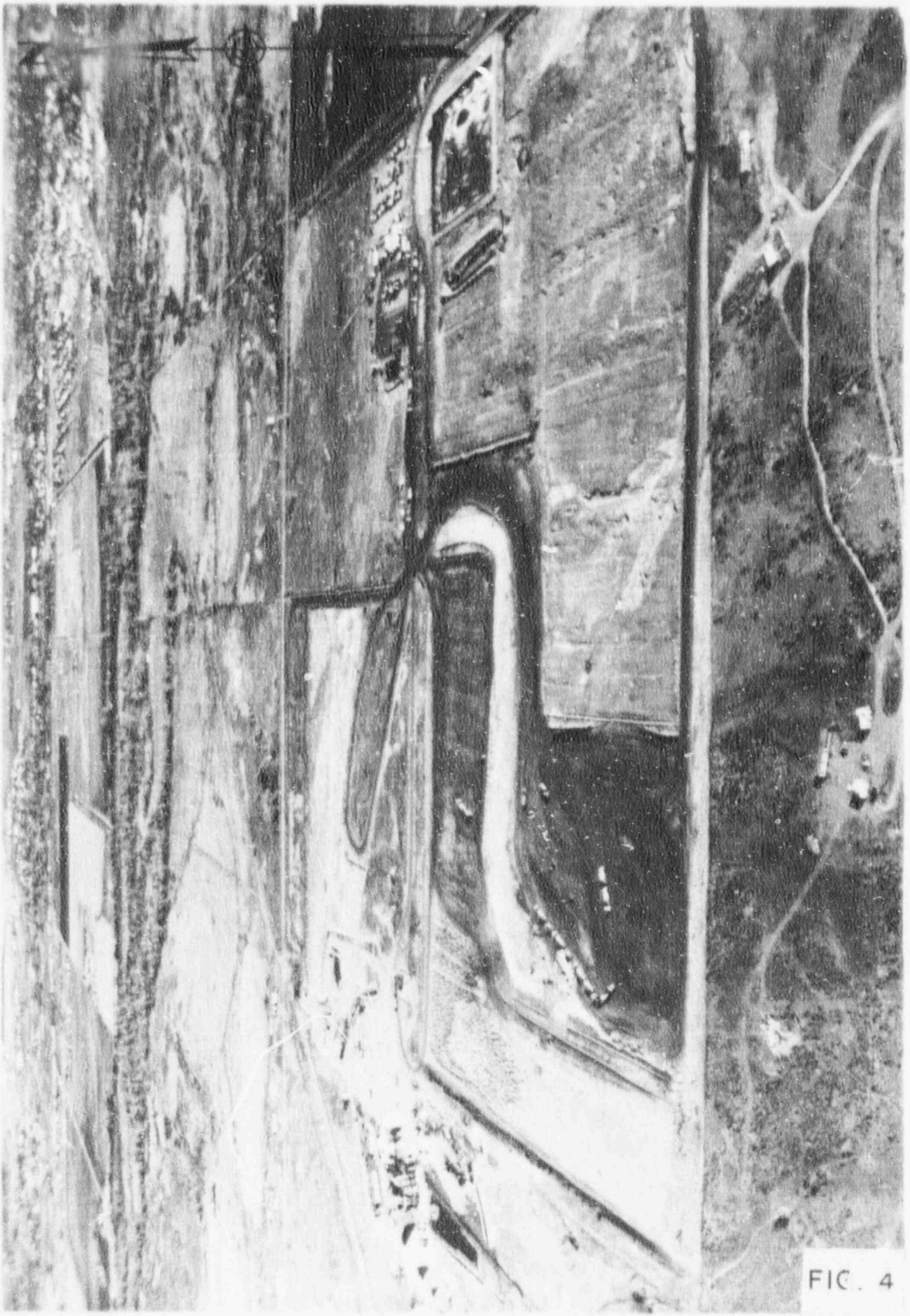


FIG. 4

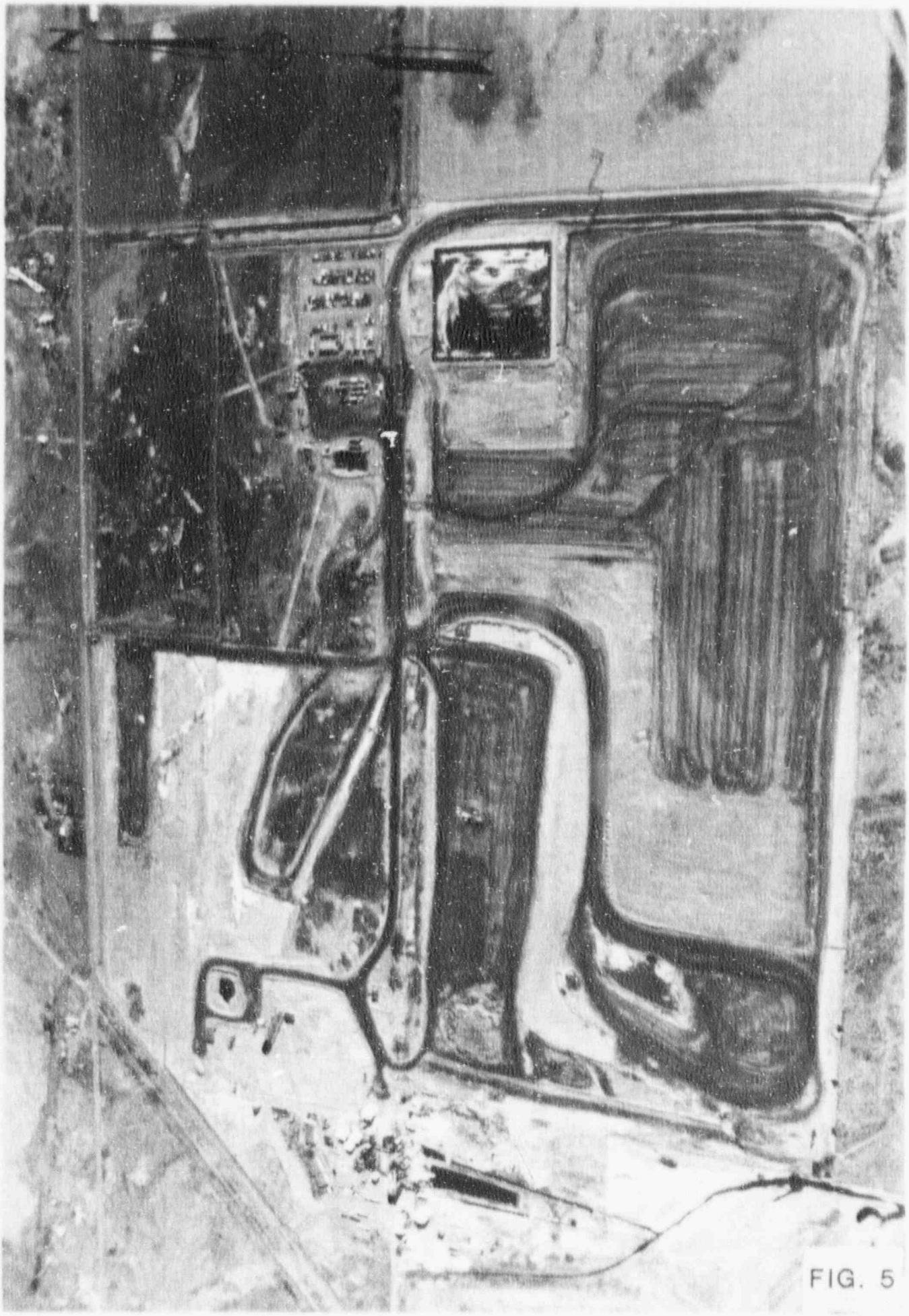


FIG. 5

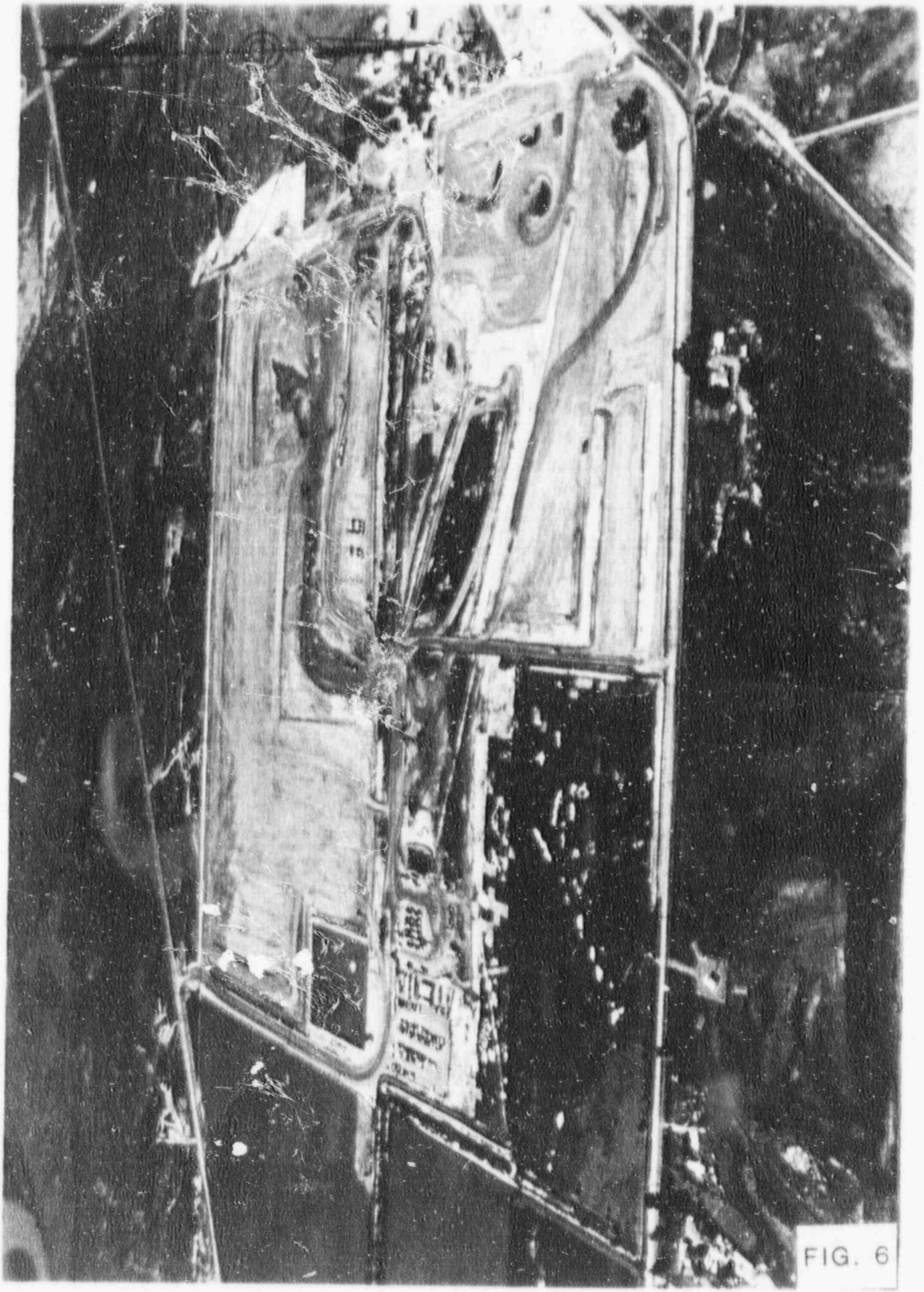


FIG. 6

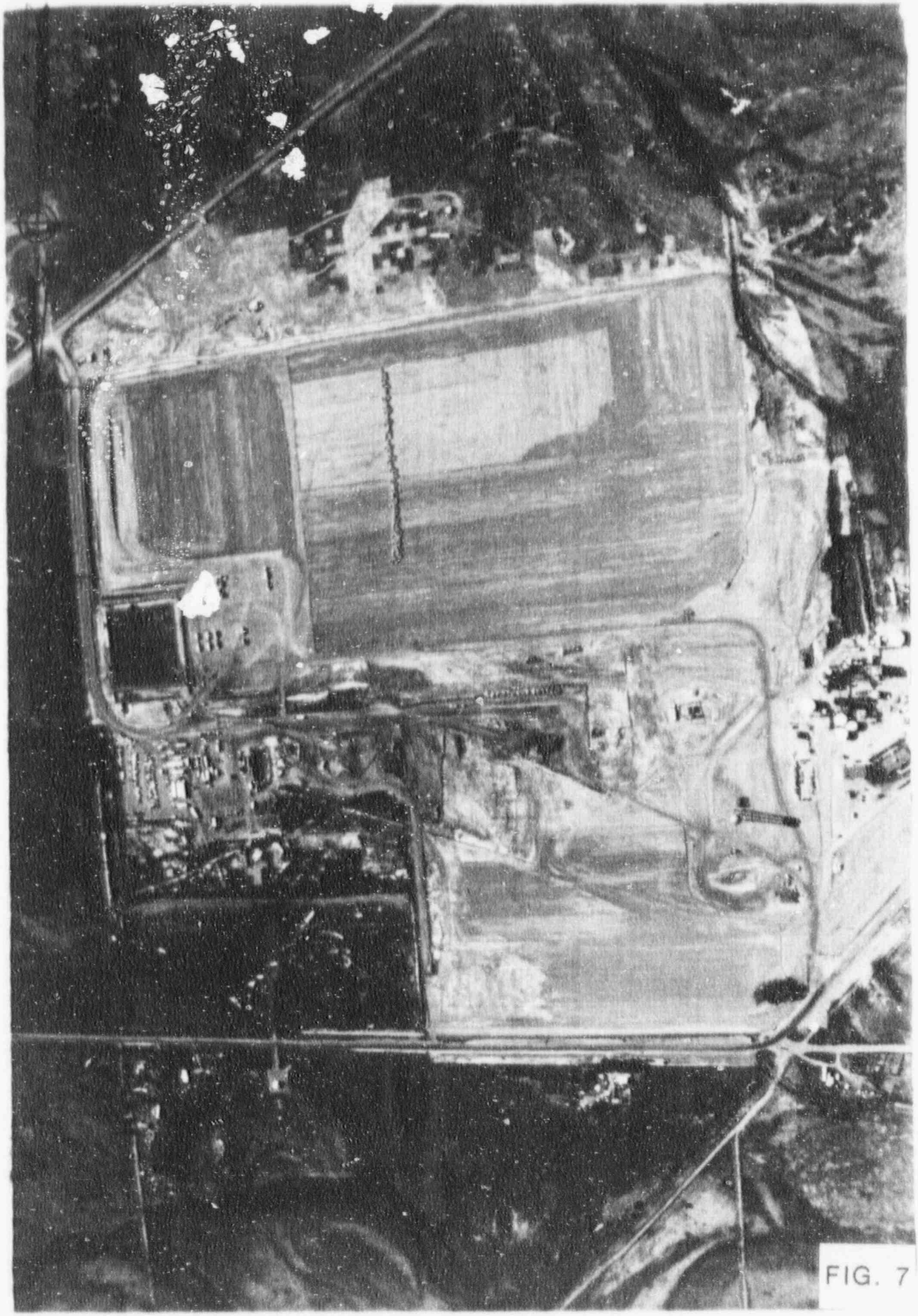


FIG. 7

FIG. 8

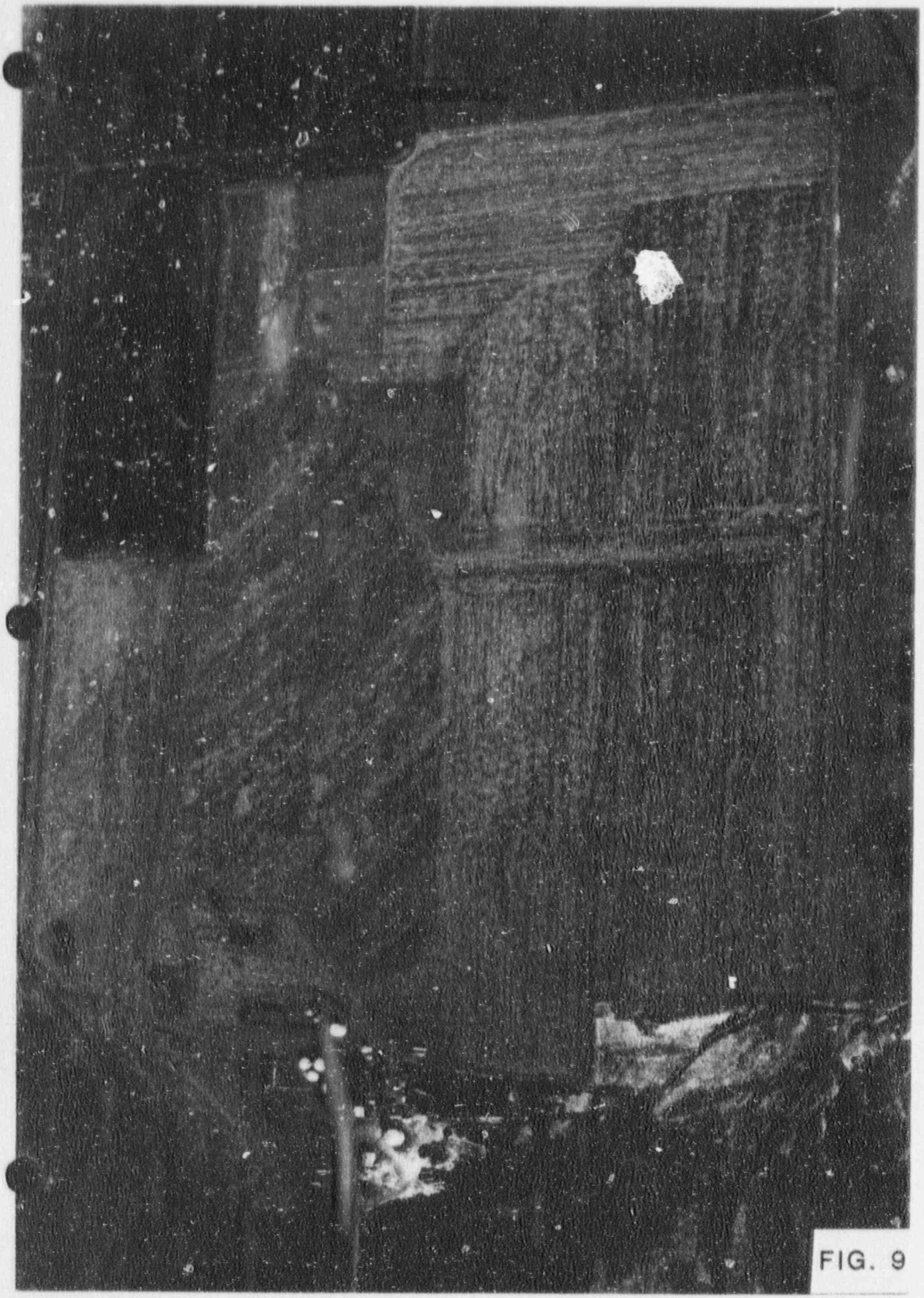


FIG. 9

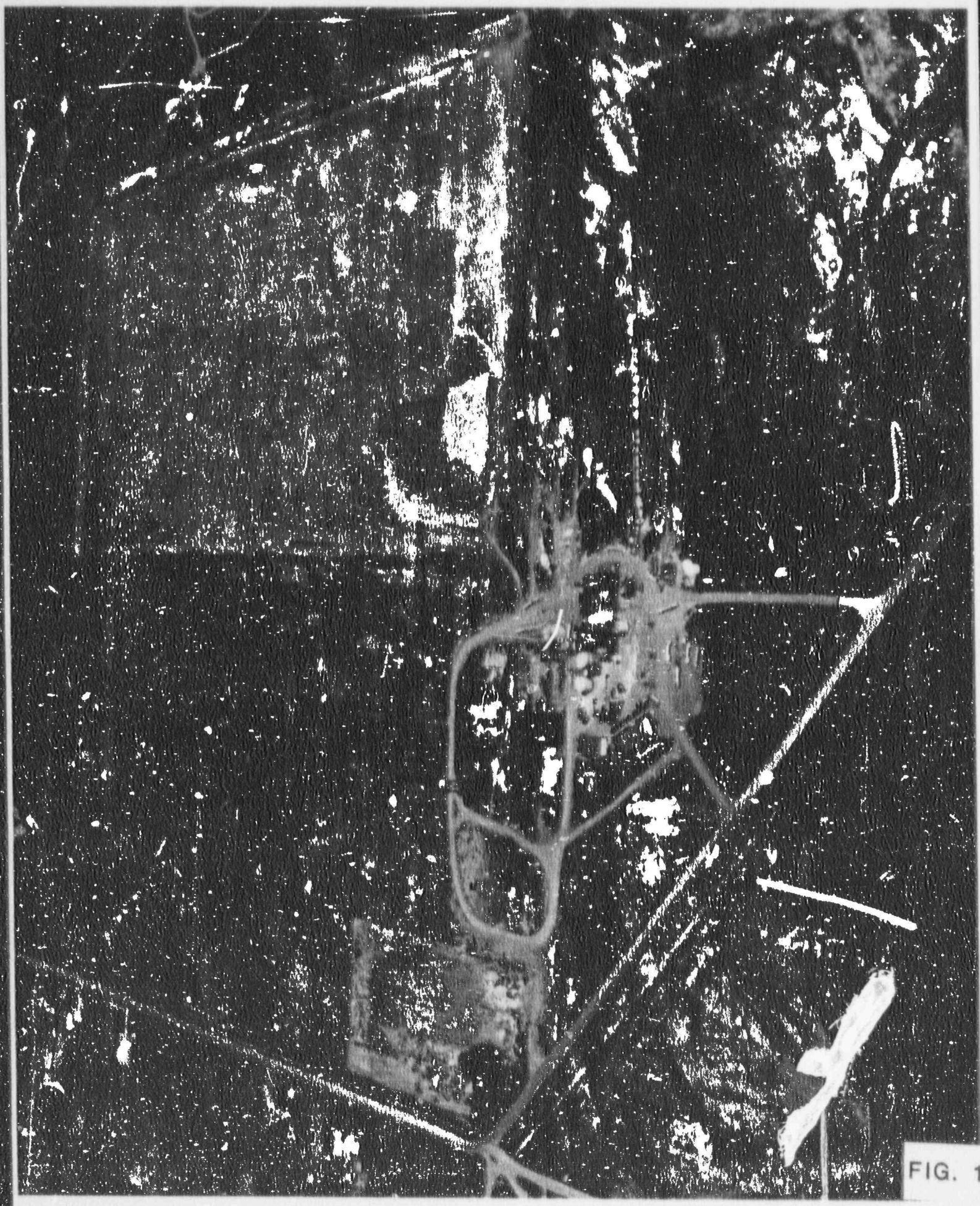


FIG. 1

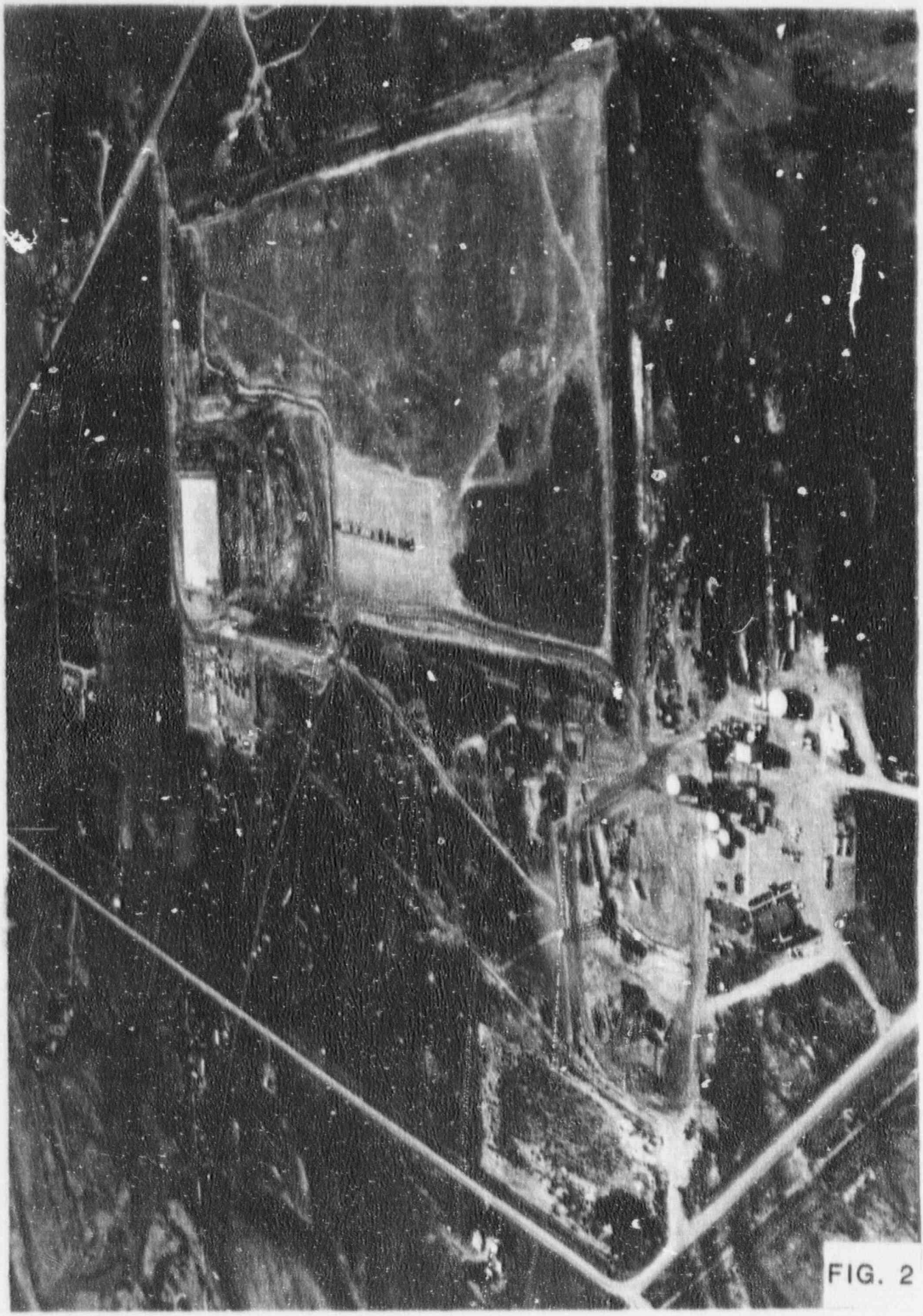


FIG. 2

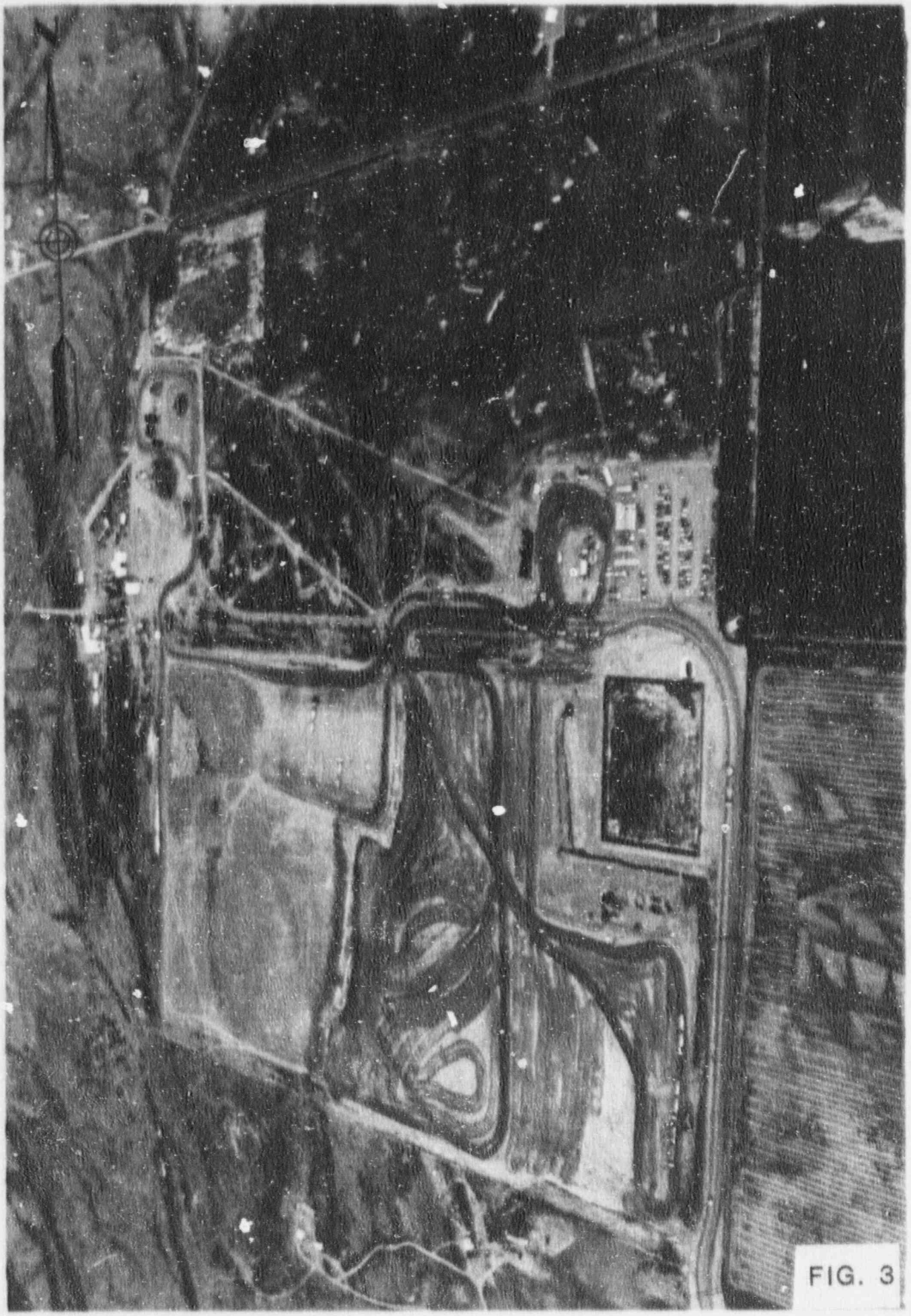


FIG. 3

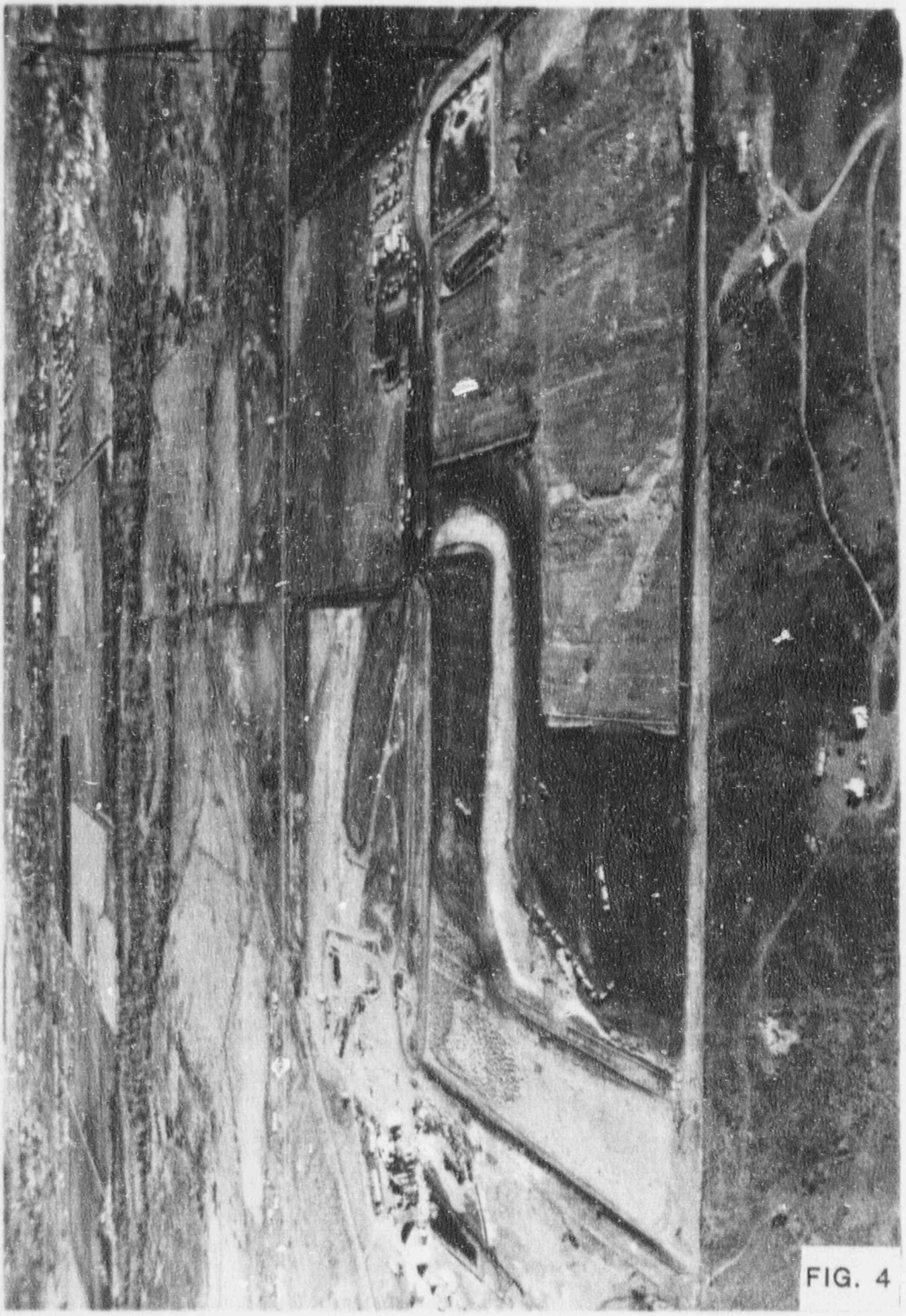


FIG. 4

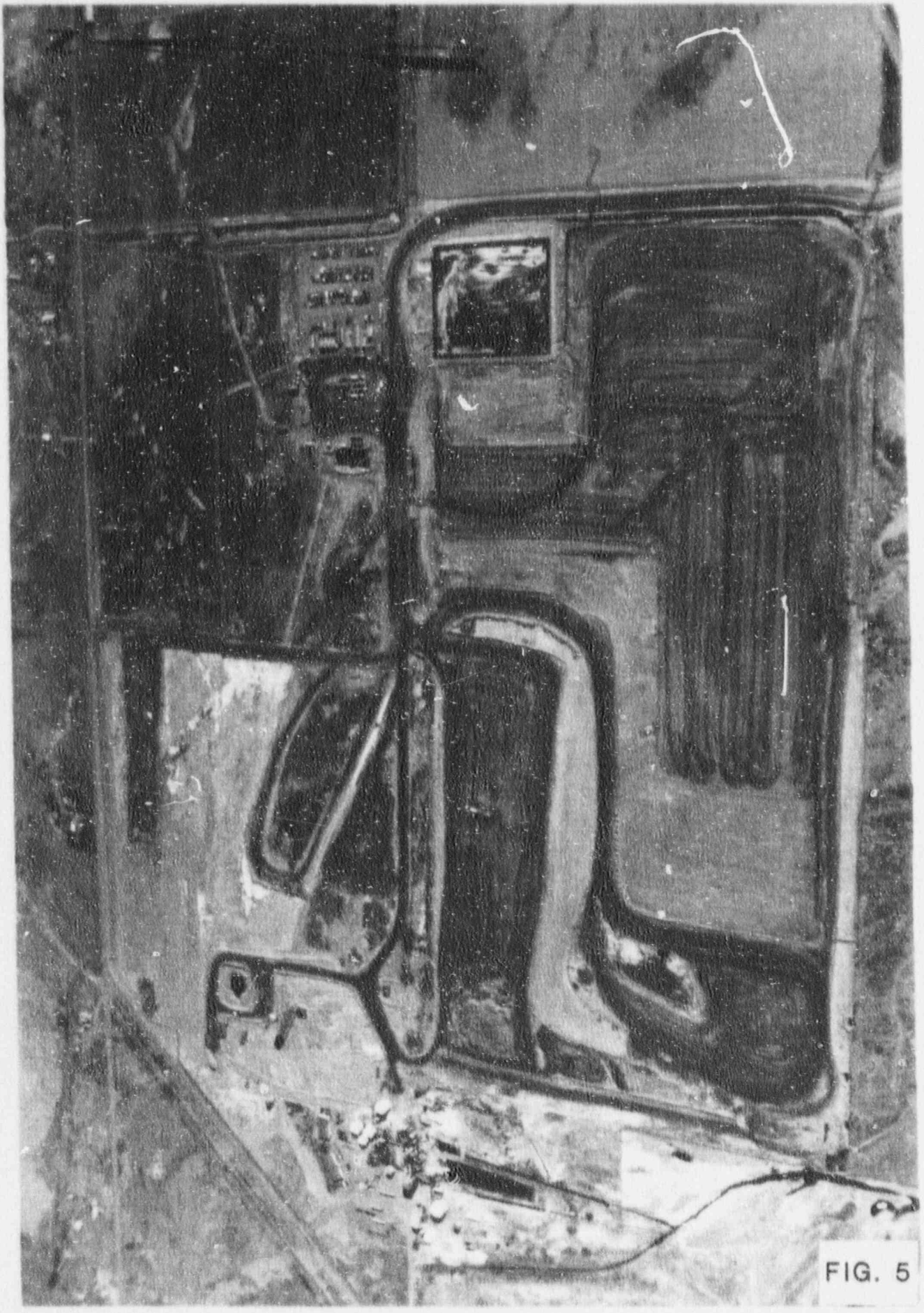


FIG. 5

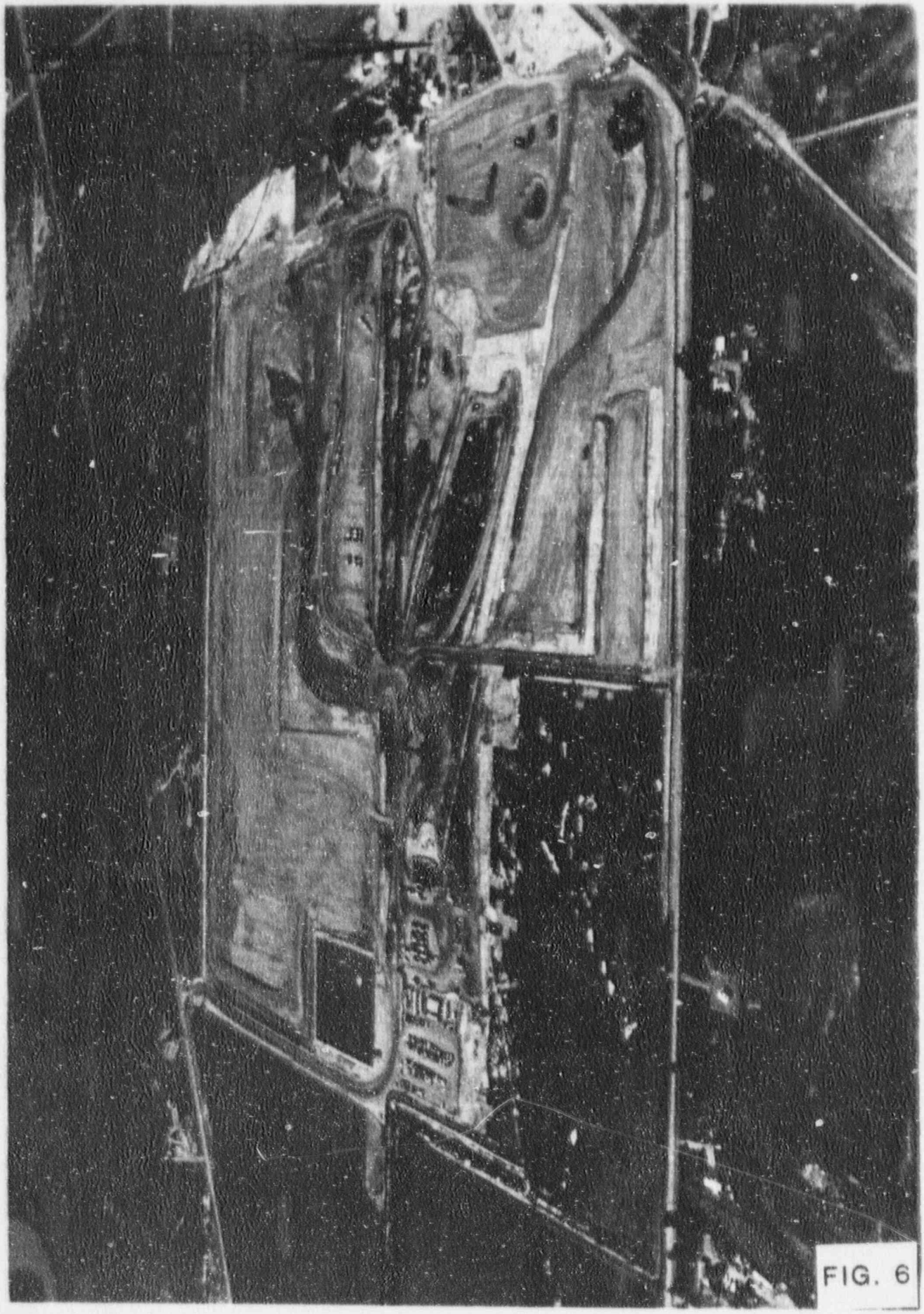


FIG. 6

FIG. 7

FIG. 8

FIG. 9

C. Geotechnical Testing

See Appendix E for the sequence of events which lead to deleting any geotechnical testing requirements for the Riverton Processing Site.

D. Radiological Verification

1. Soil Verification

o Soil Measurement Methods

Radiological verification of remedial action was conducted through the use of on-site radium-226 (Ra-226) analysis of soil. Gamma-ray spectrometry systems employing two opposed 7.6 cm x 7.6 cm NaI (Tl) detectors was used to measure the 1728 and 1764 keV gamma-rays from the Ra-226 daughter, bismuth 214. All soil samples were dried and allowed to equilibrate prior to analysis. The associated error of this system, designated as the Opposed Crystal System (OCS), was empirically determined to be less than ± 20% at a concentration of 5.0 pCi/g Ra-226 (95% confidence level). The minimum detectable activity was similarly determined to be 1.3 pCi/g Ra-226, which is essentially the same value as background soil concentrations of Ra-226 in the Riverton area (1.9 pCi/g).

o Soil Measurement Quality Control

The requirement for independent analysis of 5% (later 4%) of all verification soil samples was instituted at the Riverton site. A summary of this data is presented in Appendix J, Part A.

Calibration and routine performance checks utilizing reference material standards (5.12 pCi/g Ra-226) from the Technical Measurements Center in Grand Junction, Colorado were routinely conducted on the

Opposed Crystal Systems at the Riverton site. Results of this quality assurance program for the 5.12 pCi/g standard is also presented in Appendix J, Part A.

The soil verification results presented in Appendix J, Part A were independently checked by the health physics technical staff to ensure accuracy. This completed the final step in the quality assurance program for radiological testing.

o Grid Establishment, Survey, and Soil Sampling

A description of gridding, surveying, and soil sampling requirements is included in the DOE-approved procedure entitled Verification Procedures for Vicinity Properties and Tailings Sites - RAC-015. The procedure (Revisions 4, 5, 6, 7, and 9) is presented in Appendix J, Part A.

o Soil Verification Results

The drawings presented in Appendix J, identified as drawings RVT-SV-0001 through RVT-SV-0014 show all soil verification grid locations. Each grid is identified by soil sample number. Radium-226 concentrations were determined by OCS counting and Th-230 concentrations were determined by an independent radiological analytical laboratory. Appendix J, Figure J-1 presents OCS Ra-226 soil sample concentrations versus sample number.

Modification No. 1, Change No. 1, Revision 4 to the Riverton Remedial Action Plan (RAP) contains provision to allow verification of Th-230 in some grids using a rocks-to-fines correction factor. This RAP Modification also contains provisions to apply supplemental standards to any remaining Th-230 exceeding the DOE guideline of 35 pCi/g if soil excavation was completed to the existing water level (saturation zone). Separate analytical result tables are provided in Appendix J,

Part A for verification grids where the rocks-to-fines ratio was applied and for verification grids where excavation to the saturated zone was performed (supplemental standards).

- o Radiological Analyses of Backfill Material

Uncontaminated material was used as backfill to bring areas at the Riverton site to final grade. Results of routine OCS analyses of the material indicated near background concentrations of Ra-226. Material with Ra-226 concentrations of less than 5.0 pCi/g was used for surface backfilling. All backfill material analytical data is presented in Appendix J, Part A.

2. Structures Verification

- o Scalehouse Remedial Action and Radiological Survey

Prior to remedial action at the Riverton site a radiological survey was conducted at the Chemical Marketing Services scalehouse. The interior was found to be contaminated with both total and removable contamination above the established standards for habitable structures. After remedial action was completed on the scalehouse a survey was conducted. The survey results indicate that the established standards for contamination had been met. The survey results are presented in Appendix J, Part B.

E. Summary of Post Remedial Action Site Conditions:

The completed condition of the site is described in Appendix H. As demonstrated in Section III.D and Appendix H, the Riverton Site was cleaned up to meet criteria established in the Remedial Action Plan.

A total of approximately 2,200,000 cubic yards of contaminated material was transported to the Gas Hills Disposal Site. Vicinity property material accounted for approximately 185,000 cubic yards and windblown contaminated material accounted for approximately 155,000 cubic yards.

Prior to placement of clean fill material, all areas of excavation were verified to meet all EPA standards and backfilled to promote positive drainage.

SECTION IV

CERTIFICATION BASIS

IV. CERTIFICATION BASIS:

The MK-Ferguson Company hereby certifies that remedial actions are completed at the Riverton, Wyoming Uranium Mill Tailings Site in accordance with the requirements of:

- UMTRA-DOE/AL 050507.0000 "Remedial Action Plan for Stabilization of the Inactive Uranium Mill Tailings at Riverton, Wyoming, dated October, 1987;

- Contract No. DE-AC04-83AL18796, Remedial Action Contract for the Uranium Mill Tailings Remedial Action Project;

- Approved drawings and specifications for remedial action activities at the Riverton, Wyoming Uranium Mill Tailings Site, prepared for the Department of Energy by MK-Ferguson company and Morrison-Knudsen Engineers, Inc.

Section II of this completion report demonstrates that the design was prepared in accordance with the approved design criteria and Remedial Action Plan for Riverton, Wyoming. Section III demonstrates that work was completed and inspected to verify that it meets the requirements of the design. Based on the consistency and continuity between design requirements, detailed design, and completion of remedial action activities, MK-Ferguson recommends the Department of Energy certify the Riverton, Wyoming, remedial action as being completed in accordance with the established agreements and EPA Standards.

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DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE
CONTRACT NO. DE-AC04-83AL18796

RIVERTON, WYOMING

DRAFT

Completion Report

VOLUME 2
APPENDICES A, B, C & D

Remedial Actions
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

JULY, 1990

MK-FERGUSON COMPANY