53746

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION

TRENTON, NEW JERSEY

SHARKEY FARMS LANDFILL REMEDIAL INVESTIGATION/FEASIBILITY STUDY

QUALITY ASSURANCE PROJECT MANAGEMENT PLAN

OCTOBER 19, 1984

SUBMITTED BY:

Alfred Crew Consulting Engineers, Inc.
and
Hazen and Sawyer, P.C.
75 North Maple Avenue
Ridgewood, New Jersey 07450

Barry J Berdahl
Barry J. Berdahl, Ph.D
Project Manager

George J Kehrberger
George J. Kehrberger, P.E.
Ass't Project Manager

In Association With:

HydroQual, Inc.
1 Lethbridge Plaza
Mahwah, New Jersey 07430

Richard Scheible
Richard Scheible
Quality Assurance Officer

and

R.E. Wright Associates, Inc.
3240 Schoolhouse Road
Middletown, Penna 17051

Carl G Boyer
Carol G. Boyer
Technical Project Manager

Approved by:

Chris Altomari
Site Manager
NJDEP - HSMA

Floyd Genicola
Quality Assurance Officer
NJDEP - HSMA

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3.0 PROJECT DESCRIPTION

The Sharkey Farms Landfill is located in the Townships of Parsippany-Troy Hills, and East Hanover, Morris County. The site consists of four separate fill areas, the North Fill area is a 39 acre island bordered on all sides by the Rockaway River. The South Fill area is approxiamtely 64 acres in size and includes the Parsippany-Troy Hills Sewage Treatment Plant, which was constructed in a portion of the former fill area. The Northwest Fill area is approximately 36 acres in size. The Southwest Fill area includes 15 acres south of the Whippany River. Plate 1 shows the location of the various fill sites.

The Sharkey Farms Landfill site has been used in the past for disposal of hazardous wastes, primarily solvents including: benzene, toluene, chloroform, methylene chloride, and dichloroethylene. Other chemical wastes may also be present. The nature of the landfill operation involved waste from many industrial sources and from alleged "midnight dumping." These conditions are perceived to present a threat to the surrounding residents and downstream populations because hazardous substance discharges to air, groundwater, and surface water may impact the environment. Therefore, the NJDEP, in cooperation with the USEPA, has established the Sharkey Farms Landfill as a high priority site for performing a Remedial Investigation/Feasibility Study (RI/FS) to fully characterize the environmental risks posed by the site and to formulate appropriate remedial actions to be undertaken tc cure unacceptable off-site impacts.

The overall project objective is to select the most technically responsive, cost-effective, and implementable remedial action to decrease environmental hazards to acceptable levels. To accomplish this purpose, the environmental conditions at the site must be established through various site investigations, which include sampling and analyzing soil, groundwater, surface waters, potable wells, and waste materials.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Implementation of the Quality Assurance Project Management Plan requires that the project team members are cognizant of the project's procedures, goals, and objectives. Overall responsibility for the Quality Assurance/Quality Control (QA/QC) lies principally with the Project Manager, the Quality Assurance Officer, the Health and Safety Officer, and the individual Task Leaders.

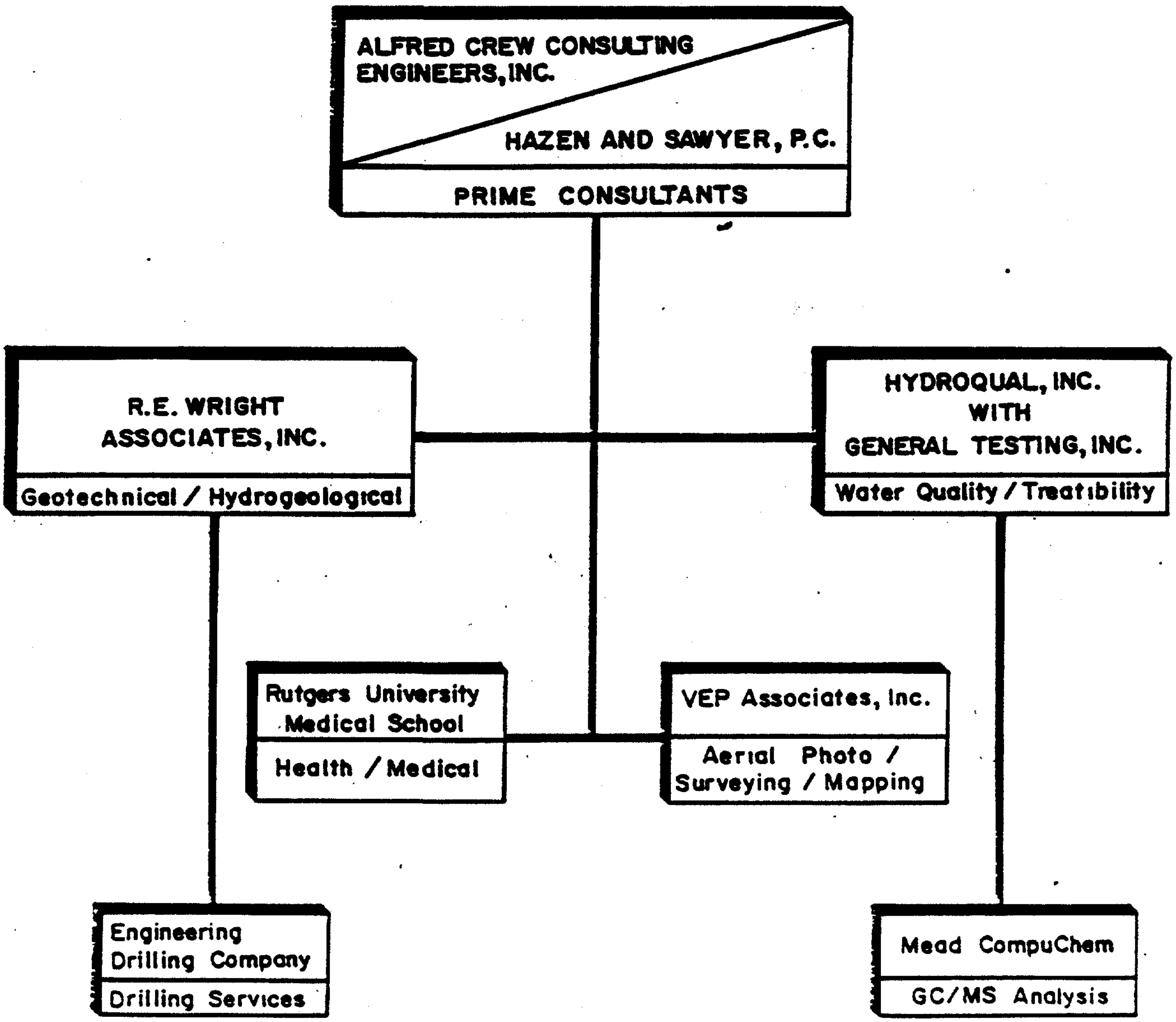
The overall project organization is shown on Figure 4-1. The primary responsibility of each firm will be as follows:

- Alfred Crew Consulting Engineers, Inc./Hazen and Sawyer Engineers, Inc. (ACCE/H&S), as the prime consultant, will be responsible for overall engineering management and administration of the project, the development of remedial objectives and alternatives, the evaluation of those alternatives, the preparation of the conceptual design and final report elements, and the coordination and community relations task.

- R.E. Wright Associates, Inc. (REWAI) will have responsibility for direction of subsurface investigations. Engineering Drilling Company will support REWAI and will perform drilling and other support activities for subsurface investigations. REWAI, under direction of ACCE/H&S, will have the responsibility of coordinating and implementing the site investigations to be performed under Task 3.

FIGURE 4.0-1

SHARKEY FARMS LANDFILL (X-373)
JOINT VENTURE ORGANIZATION



- HydroQual, Inc. (HQI), and its laboratory service group, General Testing Corporation (GTC), will be responsible for the surface water investigations, air sampling, laboratory analysis, and the development of laboratory/bench scale treatability study programs, if appropriate. A GC/MS analytical laboratory will support HQI/GTC in the area of GC/MS laboratory services, as required.

- VEP Associates, Inc., West Caldwell, New Jersey, will be utilized for aerial photography, surveys, and topographic mapping.

- Rutgers University Medical School (RUMS), Piscataway, New Jersey will provide services related to health and medical surveillance.

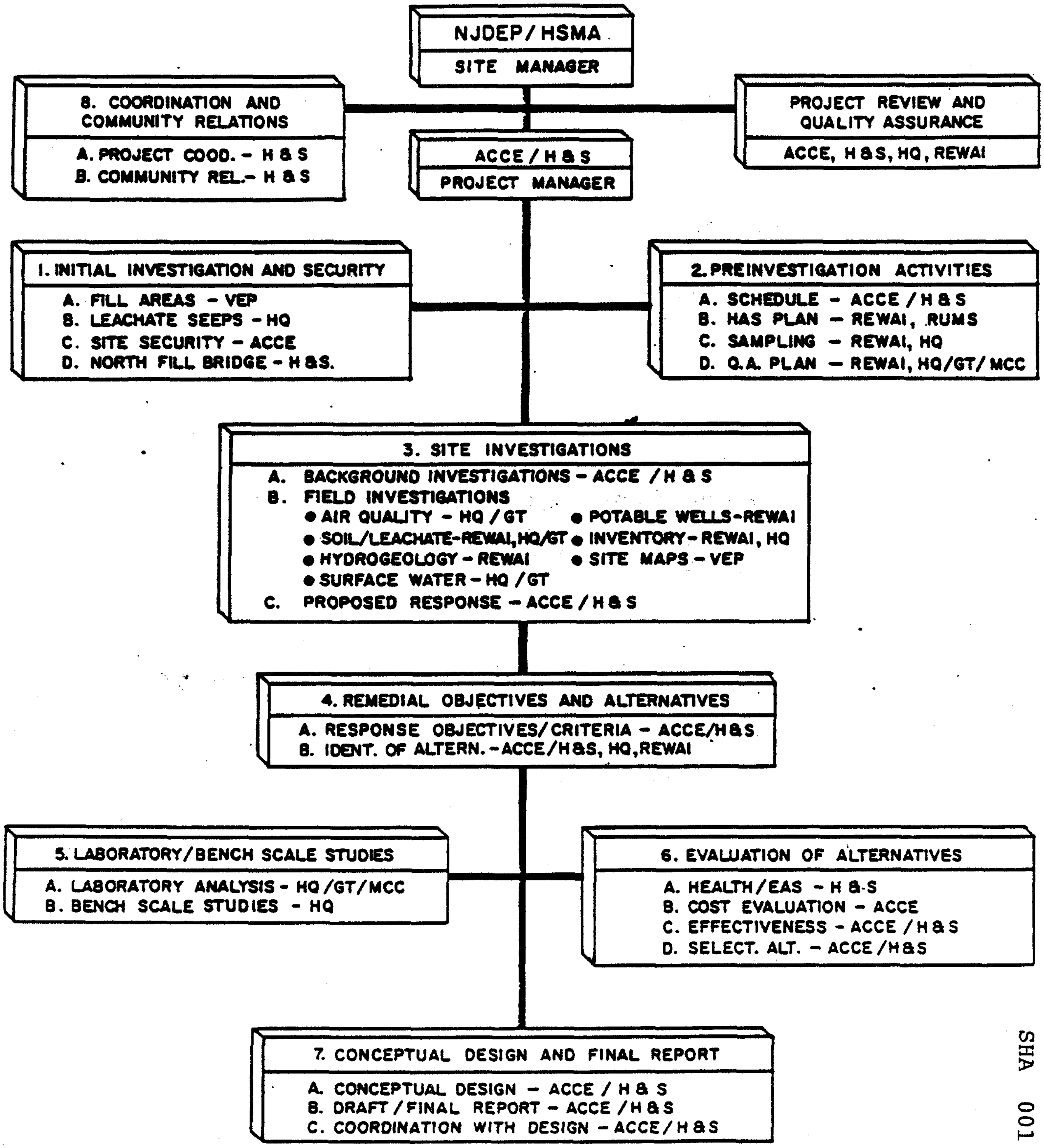
A more detailed Project Organization Chart is shown on Figure 4-2. These charts (Figures 4-1 and 4-2) illustrate the interrelationship of ACCE/H&S with their principal subconsultants, REWAI and HQI, and with the organizations that have lesser roles in the project. In addition, these charts show the line of contact with the NJDEP Site Manager and the project responsibilities of each firm by project task.

Table 4-1 indicates the key personnel assigned to this project. The following is a brief description of the responsibilities of the various key people involved.

FIGURE 4.0-2

SHARKEY FARMS LANDFILL SITE (X-373)

PROJECT ORGANIZATION



NJDEP/HSMA
SITE MANAGER

8. COORDINATION AND COMMUNITY RELATIONS
A. PROJECT COOD. - H & S
B. COMMUNITY REL. - H & S

PROJECT REVIEW AND QUALITY ASSURANCE
ACCE, H & S, HQ, REWAI

ACCE/H & S
PROJECT MANAGER

1. INITIAL INVESTIGATION AND SECURITY
A. FILL AREAS - VEP
B. LEACHATE SEEPS - HQ
C. SITE SECURITY - ACCE
D. NORTH FILL BRIDGE - H & S.

2. PREINVESTIGATION ACTIVITIES
A. SCHEDULE - ACCE / H & S
B. HAS PLAN - REWAI, RUMS
C. SAMPLING - REWAI, HQ
D. Q.A. PLAN - REWAI, HQ/GT/MCC

3. SITE INVESTIGATIONS
A. BACKGROUND INVESTIGATIONS - ACCE / H & S
B. FIELD INVESTIGATIONS
- AIR QUALITY - HQ / GT
- SOIL/LEACHATE-REWAI, HQ/GT
- HYDROGEOLOGY - REWAI
- SURFACE WATER - HQ / GT
- POTABLE WELLS-REWAI
- INVENTORY - REWAI, HQ
- SITE MAPS - VEP

C. PROPOSED RESPONSE - ACCE / H & S

4. REMEDIAL OBJECTIVES AND ALTERNATIVES
A. RESPONSE OBJECTIVES/CRITERIA - ACCE/H & S
B. IDENT. OF ALTERN. - ACCE/H & S, HQ, REWAI

5. LABORATORY/BENCH SCALE STUDIES
A. LABORATORY ANALYSIS - HQ / GT / MCC
B. BENCH SCALE STUDIES - HQ

6. EVALUATION OF ALTERNATIVES
A. HEALTH/EAS - H & S
B. COST EVALUATION - ACCE
C. EFFECTIVENESS - ACCE / H & S
D. SELECT. ALT. - ACCE / H & S

7. CONCEPTUAL DESIGN AND FINAL REPORT
A. CONCEPTUAL DESIGN - ACCE / H & S
B. DRAFT / FINAL REPORT - ACCE / H & S
C. COORDINATION WITH DESIGN - ACCE / H & S

JOINT VENTURE FIRMS:

ACCE / H & S = ALFRED CREW CONSULTING ENGINEERS / HAZEN AND SAWYER, P.C.
HQ = HYDROQUAL, INC. / GT = GENERAL TESTING CORP. / MCC = MEAD COMPUCHEM
REWAI = R.E. WRIGHT ASSOCIATES, INC. / EDC = ENGINEERING DRILLING CO.
VEP = VEP ASSOCIATES, INC.
RUMS = RUTGERS MEDICAL SCHOOL

TABLE 4-1. KEY PROJECT PERSONNEL

Title	Personnel	Firm
Project Manager	Dr. Barry Berdahl	H&S
Assistant Project Manager	Dr. George Kehrberger	ACCE
Quality Assurance Officer	Mr. Richard Scheible	HQI/GTC
Health and Safety Officer	Mr. Kent Littlefield	REWAI
Task Leaders		
Site Investigations	Mr. Carl Boyer	REWAI
Site Investigations	Mr. Joseph Cleary	HQI
Aerial Photography and Mapping	Mr. Larry Hoyt	VEP
Site Security	Mr. John Samulka	ACCE

The Project Manager, Dr. Barry Berdahl of H&S, is the overall manager of technical and administrative activities, and is responsible for coordinating and scheduling of all project activities.

The Assistant Project Manager, Dr. George Kehrberger of ACCE, will provide assistance to the Project Manager.

The Quality Assurance Officer, Mr. Richard Scheible of GTC, is responsible for the implementation of the Quality Assurance Project Management Plan relative to the laboratory activities from sample custody through data reporting.

The Health and Safety Officer, Mr. Kent Littlefield of REWAI, is responsible for advising the project staff on health and safety issues, and monitoring the effectiveness of the health and safety program conducted in the field.

The various Task Leaders from the subcontractors are responsible for performance of their task(s) in conformance with the proposal team. They will also ensure the soundness of the technical approach used by field personnel for collecting water, soil, and waste samples, and for reviewing the results of field activities to evaluate the integrity of the samples collected.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY AND COMPLETENESS

A. Precision: The laboratory objective for precision is to equal or exceed the precision demonstrated for these analytical methods on similar samples. A copy of the laboratory's recent experience for the analysis of organic priority pollutants is attached. These are within the established control limits for the methods, as published by the USEPA.

B. Accuracy: The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for these analytical methods on similar samples. A copy of the laboratory's recent experience for the analysis of organic priority pollutants is attached. These are within the established control limits for the methods as published by the USEPA.

C. Representativeness: The representativeness of the data from the sampling sites depends on the sampling procedures. The representativeness of the analytical data is a function of the procedures used in processing the samples. The objective for representativeness is to provide data of the same high quality as other analyses of similar samples using the same methods during the same time period within the laboratory. Representativeness can be determined for this objective by a comparison of the quality control data for these samples against other data for similar samples analyzed at the same times. Differences within 10 percent are acceptable.

D. Comparability: The results of these analyses can be compared with other analyses by other laboratories, because the objectives of the laboratory for comparability are: to demonstrate traceability of standards to NBS or USEPA sources; to use standard methodology; to apply appropriate levels of quality control within the context of the laboratory Q/A Program; and to participate in interlaboratory studies to document laboratory performance. By using traceable standards and standard methods, the analytical results can be compared to others operating similarly. The QA Program documents internal performance, and the interlaboratory studies document performance compared to other analysts at other locations.

E. Completeness: The completeness of an analysis is documented by including in the report, sufficient information to allow the data user to assess the quality of the results. The information delivered includes such items as: chromatograms, spectra, QC data, and summaries of results. Additional information, such as the laboratory worksheets, notes, etc., are stored with the sample results in the laboratory.

6.0 SAMPLING PROCEDURES

The purpose of the sampling program is to determine the presence of identifiable pollutants and their migration route to the surrounding environments. This study will focus on determining the pollutant characteristics in the soil, ground and surface waters, leachates, and air. The sampling locations have been determined to determine the extent of contamination and the directions of flow. water. Specific sampling procedures for each matrix are further identified in the Field Sampling Program (FSP). The sampling procedure in the FSP includes the following:

- reasons for selecting sampling locations,
- description and location of sampling location,
- number of samples,
- sample identification,
- sample breakdown and preservation procedures,
- sample tracking and shipping procedures,
- definition of travel/trip blanks, field blanks, replicates, and spikes.

To control the sampling program for the most accurate and complete data, specific quality control procedures have been established.

6.1 CONTAINERS

To ensure that the sample containers themselves do not contain contaminants and to ensure the integrity of the samples through the analysis phase, the following containers will be utilized:

A. Amber bottles, semivolatile organics, one liter, amber bottles will be:
- washed with hot detergent water,
- rinsed with tap and deionized water,
- rinsed with nanograde hexanes,
- air dried,
- baked at 400°C,
- cooled,
- capped with clean, teflon lined lids.

B. Plastic bottles, one liter for metals will be:
- washed with hot detergent water,
- rinsed with hot tap water,
- rinsed with deionized water,
- rinsed with five percent HNO_3,
- drained and air dried,
- capped with acid rinsed polyethylene lined caps.

C. Forty ml vials, for VOA analysis, will be:
- washed with hot detergent water,
- rinsed with hot tap water,
- rinsed with deionized water,
- rinsed with methanol, nanograde,
- drain dried,
- baked for 8 hours at 180°C,
- cooled,
- capped with teflon lined septum caps. (SEPTA are new and have been detergent washed and baked at 180°C).

6.2 PRESERVATION

To maintain the integrity of the samples, the sample bottles will be filled and immediately chemically preserved (see Table 6-1), using information given in Technical Additions to Methods for Chemical Analysis of Water and Wastes, EPA-600/4-82-005, DEC, 1982. The samples will all be immediately chilled in ice chests using wet ice and transported to GTC in Hackensack, New Jersey. The laboratory will be set to receive the samples any time, day or evening. Samples will be immediately checked for integrity and chain of custody documents for completeness.

The following morning, samples will be delivered by courier to the analytical laboratory:

All samples will be kept at 4°C during transport to the laboratory using ice packs. They will be shipped in locked and sealed ice chests. The receiving laboratory will be notified to expect the samples for immediate initiation of log-ins and sample preparation. All maximum holding times will be met.

6.3 CHAIN OF CUSTODY PROCEDURES

Chain of Custody Forms will be prepared at the start of sampling. These forms will accompany samples during all shipments and will demonstrate a clear history of the samples through the final analysis stage. This chain of custody procedure is completely described in a later section, as are the forms, notebooks and procedures to be used to document all sample history, sampling conditions, and analyses to be performed.

TABLE 6-1. SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT

Measurement	Volume Required	Container	Number of Containers (Waters)	Preservative	Holding Time
pH, temp.	100 ml	p	1	None	analyze immediately
Conductance	100 ml	p	1	None	analyze immediately
GC/MS, 624	40 ml	g	4	Cool 4°C	14 days
GC/MS, 625	1 liter	g	3	cool 4°C	7 days
PCB, 608	1 liter	g	2	cool 4°C	7 days
Metals, Total	1 liter	p	1	HNO_3, pH <2	28 days
Cyanides	1 liter	p	1	cool 4°C NaOH to pH >12	14 days
Phenols	1 liter	g	1	cool 4°C H_2SO_4 to pH <2	28 days
Chlorides, TDS	500 ml	p	1	cool 4°C	7 days

Note: Leachates and water samples will be preserved as listed above. For soil and/or sludge samples, one pint glass bottles with teflon lined lids will be used, together with completely filled 40 ml septum vials.

7.0 SAMPLE CUSTODY

The history of each sample, from the time it was taken, through receipt by the analytical laboratory, must be documented by a Chain of Custody Form for each transfer involved. Internal laboratory records then document the custody the sample through its final report stage.

7.1 SAMPLE IDENTIFICATION

At the time of sampling, a numbered, bound log book will be used to record all pertinent information for each sample taken. This information will include:

- Project Number
- Project Name
- Sample Location (exact description e.g., depth, composite, grab, etc.)
- Time (military)
- Sampling Technician (print)
- Sample Media (soil, water, leachate, etc.)
- Sample Number (taken from sample bottle labels)

After log-in of the sample, a permanent label will be prepared for each sample container. This label will detail:

Project Name: ____________ Project No.: ____________
Sample Site (code from FSP) ____________
Date: ____________ Time: (military) ____________
Laboratory No.: ____________
Collected by: (print) ____________ (signature) ____________
Log Book No.: ____________
Remarks: ____________

These labels will be permanently affixed to the sample bottles in the laboratory. After completion of the label by the sample collector, he will then overwrap the label with clear plastic tape to prevent any label loss during shipping and/or handling. This is especially important during shipment with wet ice.

As an added precaution, each set of 40 ml vials will be bagged in plastic zip loc bags. These are leak proof to prevent contamination from the ice water.

After completion of all labels, the collector then completes the individual Chain of Custody Forms (see attached) for each sample. At the end of the day, all sampling records are transferred to the command trailers on-site Master Log. Only the Task Manager may complete these daily activities logs.

In summary, sample numbers with complete identification will then be recorded on:

1. Field collector's log book
2. Sample bottle labels
3. Chain of Custody Forms
4. Master sample log to be completed at the end of each day. The Master Log will be kept in the site command trailer.

710 Exchange Street
Rochester, NY 14608

85 Trinity Place
Hackensack, NJ 07601

GENERAL TESTING CORP.

CHAIN OF CUSTODY RECORD

Sampling Place: ______________________________

____
Street City State

Sample Source: ________ Producer ________ Hauler ________ Disposal Site ________

________ Other ______________________________

Shipper Name: ______________________________

Shipper Address: ______________________________
Street City State Zip

Shippers Telephone # (   ) ______________________________

Collector's Name: ______________________________ ; ______________________________
Print Signature

Field Information: ______________________________

____

Relinquished by:	Received by:	Date/Time
1. sign.	1. sign.	/
for	for	/
2. sign.	sign.	/
for	for	/
3. sign.	sign.	/
for	for	/

Received for Laboratory by: ______________________________

Method of Shipment: ______________________________

Sample	Sample Location	Date	Time	Sample Type	Number of Containers

The Task Leaders for the various site activities, must approve all sampling records before samples are delivered to the laboratory.

Samples are delivered to GTC's Hackensack laboratory where they are immediately checked for integrity and completeness. The sample bottles are then transferred to courier packs for delivery to the analytical laboratory. Chain of Custody forms are completed for all transfers.

7.2 LABORATORY CHAIN OF CUSTODY

Will be completed after final selection of laboratory.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 CALIBRATION PROCEDURES FOR LABORATORY EQUIPMENT

To be completed after final laboratory selection.

8.2 CALIBRATION PROCEDURES FOR FIELD EQUIPMENT

8.2.1 Surface Geophysics

8.2.1.1 Terrain Conductivity.

Electromagnetic Induction Meter

Geonics Model No. EM-31

- Calibrated at factory;
- Daily conduct an internal check to confirm meter is working properly.

8.2.2 Analytical Equipment

8.2.2.1 Radiation Counter

- SEI Monitor 4
- Calibrated by Manufacturer to a cesium 137 gamma source

8.2.2.2 Photoionization Detector

Portable Photoionizer

HNU Model 101

- Factory Calibrated to benzene.
- Frequency - minimum of once every other day:

1. Attach probe; set meter to standby position and zero the meter, check battery indicator also.
2. Attach regulator and hose to calibration gas tanks (isobutylene).
3. Attach end of hose to probe and turn meter switch to 0-200 scale.
4. Open regulator, check tank pressure, and read tank calibration gas concentration supplied with tank.
5. With span dial set to 9.8, read and record meter reading.
6. Adjust meter by changing span setting to read the same as concentration provided on tank label.
7. Record span setting and remove calibration apparatus.

8.2.2.3 Explosimeter

MSA Model 2A

- Factory calibrated to pentane;
- Field calibrated to methane (2% in air);
  - Calibration tests (daily) in accordance with manufacturer's calibration kit procedures (Appendix A).

8.2.2.4 Oxygen Meter

Portable Oxygen Indicator

MSA Model E

- Field Calibrated (daily) in a pollution-free atmosphere at 20.8 percent.

8.2.2.5 pH

VMR Scientific Inc. Phase IV Model 1000 pH/mV/Temperature meter. Calibration procedure includes setting temperature dial to the temperature of the sample, and routine calibration with two buffer standards, 4.01 pH and 7.00 pH.

8.2.2.6 Specific Conductance/Temperature

YSI Model 33 SCT Meter

Calibration Procedure

1. Prepare standard KCl solution (0.01 mg/l) by diluting 0.745 g of pure dry KCl in distilled water until the solution is 1 kg.

2. The meter is calibrated to this standard to an absolute accuracy of ±1.5% based on standard deviation.

3. The solution should have a conductance of 1413 umhos/cm at 25°C.

4. The actual conductance of the sample is determined by the meter.

5. The ratio of the expected value to the observed value of conductance is calculated and should be within +1.5%.

8.2.3 <u>Borehole Geophysics</u>

8.2.3.1 <u>Logging System</u>

Well Reconnaissance Systems, Inc.

Geo-Logger Type 9616

8.2.3.2 <u>Recorder</u>

Texas Instruments, Inc.

Model FSO, A/N, BCA - 2 PEN

8.2.3.3 Gamma Ray Probe

Mineral Logging Systems, Inc.

1 1/4-inch 3-way gamma Ray probe

Model ATI

- Factory calibrated
- Field tested (Appendix A)

8.2.3.4 Caliper Probe

Well Reconnaissance, Inc.

1 1/4-inch Bridge-type caliper probe

Model ATW

- frequency - as needed
- procedure - Appendix A

8.2.3.5 Temperature Probe

Well Reconnaissance, Inc.

Pulse Temperature Tool

- frequency - as needed

- procedure - Appendix A

8.2.4 Miscellaneous

8.2.4.1 Flow Meters

A variety of flow meters are available for use. Selection of size and type will be dependent upon well conditions anticipated (turbidity, yield, etc.). Flowmeters are calibrated by the manufacturer prior to use. Accuracy is checked in the field by filling containers of known volume, recording the time required, and comparing these observations to the meter indication. This procedure will be folllowed at least twice during tests.

8.2.4.2 Stevens Water Level Recorders

Stevens recorders are mechanical recording devices that require essentially no calibration in the field other than operation and maintenance checks which are conducted at the time of installation and periodically during use (at least once every seven days).

8.2.4.3 Bristol Recorders

Bristol recorders are initially calibrated by the manufacturer and periodically recalibrated by REWAI. These latter calibrations should only be performed in the shop following procedures outlined by the manufacturer. Attempted field calibration is not recommended. Field calibration checks are necessary, however, and should be conducted frequently during use. (See Appendix A).

8.2.4.4 Electric Water Level Indicator

A soil test model electric water level indicator will be used for all water level measurements. It will be calibrated in the field by selectively confirming readings with those obtained with a steel measuring tape and water-sensitive paste.

9.0 ANALYTICAL PROCEDURES

All air, water, soil, and waste samples will be analyzed by the GC/MS laboratory to be selected to perform this work. Analytical procedures, test methods, detection limits, and instrument calibrations, will be provided by the GC/MS laboratory and incorporated into this QA Project Management Plan.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

10.1.2 Field Data

Data collected in the process of Geologic and Hydrogeologic field investigations is recorded in a variety of formats. The reduction of raw data associated with drilling/soil sampling logs and aquifer testing, consists essentially of categorization of data followed by integration of categorized data into a unit or series of data summaries (illustration, graphs, equations, cross sections, etc.) from which quantatative or qualitative assessments can be derived by further integration and evaluation.

Many references concerning the reduction and use of hydrologic data are available depending on the type of analysis being performed. Included in these references are:

Freeze, R. A. and Cherry, J. A. (1979). Groundwater, Prentice Hall, Inc., New Jersey 604 pp.

Fetter, C. W. (1980). Applied Hydrogeology, Merrill Publishing Company, Ohio 488 pp.

Field data obtained during sampling of groundwater monitoring wells, surface waters, potable wells, and sediment will also be summarized on appropriate field forms, examples of which are shown in the FSP Appendix. This information will be used in assessing field conditions at the time of sampling and will be summarized and analyzed along with the chemistry data in the final report. Before the potable wells are actually pumped, a potable well questionnaire, to be filled out via telephone interviews, will also be summarized and used in the interpretation of the hydrogeological and chemistry data of the wells.

Temperature and pH data collected in the field will be reported as measured in the field. Conductance values measured by the YSI 33 are corrected to 25°C according to the following equation:

$$\text{Conductance at } 25^{\circ}\text{C} = \frac{\text{Conductance (at T) (umhos/cm)}}{[1 + 0.0191\,(T^{\circ}\text{C} - 25^{\circ}\text{C})]}$$

10.2 DATA VALIDATION

Data collected and/or reduced in the field will be validated for correctness of format, calculation, and completeness.

- Checking to see that inventory and station numbers are correct
- Checking to see that specified sampling and preservation methods were followed
- Noting any anomalies or unusual circumstances in the data sampling and collection
- Verifying that calibration procedures were followed
- Verifying that data are reported in correct units
- Checking ~~10%~~ of all field calculations

- Verifying that samples were properly shipped
- Verifying that quality assurance blanks were prepared and taken

This verification will be done by the REWAI sub-task leader who will perform the initial data categorization step of data reduction. Further validation of these parameters will be performed by the REWAI Project Manager prior to data integration and evaluation. All assigned data reduction or analytical procedures will be verified for accuracy and content by at least two professionals qualified and experienced in performing this function, including the generator.

11.0 INTERNAL QUALITY CONTROL CHECKS

11.2 FIELD

On each day of field sampling, approximately 5% of all temperature, conductance, and pH field measurements will be checked by duplicate measurement. Duplicate measurements of specific conductance may be made by either a second meter reading in the field or by wet chemistry analysis in the laboratory. The pH standards used in the field will be checked against each other, and distilled water used in the field to clean the pH and other meter probes will be checked for conductance.

Instrument conditions and calibration procedures will be checked by the on-site coordinator or sampling crew chief. Instrument voltage and calibration adjustments will be checked daily. Calibrations will also be checked to assure that they were made both prior to and following the day's surveys.

12.0 PERFORMANCE AND SYSTEM AUDITS

The purpose of performance and system audits is to ensure that all established measurement systems proceed in a consistent, orderly, and complete manner for the duration of the project. Audits are conducted as periodic inspections for each task system.

12.1 SYSTEM AUDITS

All systems will be audited by the Project Manager at the beginning of the project, and after the first and third month of the program schedule.

The initial audit program calls for a thorough evaluation of all systems before the project begins so as to thoroughly familiarize all personnel of their specific tasks and performance specifications, as detailed in the QA/QC program. Follow up audits by the Project Manager after the first month and third month will ensure that project goals are being met, specifically with regard to the following:

- Organizational procedures are firmly established as originally proposed, including documentation control by the Task Managers.
- QC check samples are being taken as scheduled.
- All field measurement systems are being calibrated and maintained as specified.

- Corrective action procedures are firmly established. These include immediate notification to the Site Manager of all maintenance problems.

- The Health and Safety Plan protocols are being followed, including Level C protection for those personnel directly exposed to possible contaminants, e.g., drilling personnel.

12.2 PERFORMANCE AUDITS

12.2.1 Site Work Performance Audits

Performance audits are accomplished by daily surveillance by the various Task managers. The managers must submit daily activity reports while on-site. All of these activity reports are written in the on-site command trailer daily log book. The Managers must also approve all daily sampling logs.

12.2.2 Laboratory Performance Audits

One visit to the analytical laboratory by the Q/A Officer is planned. All laboratory systems will be reviewed to ensure compliance with the QA/QC manual. We will attempt to provide sampling schedules so the laboratory can anticipate receipts of samples and plan work schedules. After this first visit, the laboratory must apply its own internal audit system for proper validation of data. All laboratory reports are reviewed by the Project QA/QC Officer before being submitted to the Project Manager. A copy of the QA/QC Report for Analytical Measurements are attached in a separate section.

Other phases of the project, including geophysical surveys, engineering designs, construction plans, etc., will be audited for performance through internal audit procedures established by the respective engineering firms. All audit reports will be submitted to the Project Manager for review.

13.0 PREVENTIVE MAINTENANCE

13.1 INTRODUCTION AND OBJECTIVES

A preventive maintenance program will be followed on all the field equipment to be used during the various site investigations. The objective of the preventive maintenance program for sampling and analytical equipment is to minimize downtime and to ensure reliable field measurements and laboratory analytical results.

13.2 SAMPLING AND ANALYTICAL EQUIPMENT

Equipment used in soil sampling will include a mud rotary rig and hand-augering equipment. The rig is routinely inspected for worn or damaged moveable parts or other mechanical elements. Samplng tools such as a split-barrel sampler and hand augering devices will be frequently cleaned. A supply of extra split-barrel sampler basket inserts will be kept available.

Equipment used for water sampling includes generators and submersible pumps. Maintenance of generators includes routine cleaning and oil changes. If the submersible pumps become clogged, they will be dismantled and cleaned; this can be done in the field. The battery in the static water level meter is checked frequently and replaced when needed. A spare battery is available inthe meter box at all times. Field analytical equipment, including the pH meter and YSI SCT Model 33 meter, is maintained in accordance with the manufacturer's specifications.

13.3 SUPPORT EQUIPMENT

Support equipment is defined as all equipment not previously discussed that will at some point be required for completing an environmental monitoring or measurement task. This equipment may include safety devices, storage and transportation containers, wind indicators, cameras, and communications gear. For preventive maintenance purposes, support equipment should be peridically inspected to maintain the performance standards necessary for proper and efficient execution of all tasks and reponsibilities. Appropriate and sufficient replacement parts or equipment should be available for all of these categories of equipment so that sampling and monitoring tasks are not substantially impeded or delayed.

13.4 LABORATORY ANALYTICAL EQUIPMENT

Preventive maintenance procedures for laboratory equipment will be provided by the GC/MS laboratory.

13.5 FIELD ANALYTICAL EQUIPMENT

Field analytical equipment will be used to measure pH, conductivity, and air quality. Preventive maintenance procedures for the various equipment is shown in Table 13-1.

TABLE 13-1. FIELD ANALYTICAL EQUIPMENT PREVENTIVE MAINTENANCE PROCEDURES

Equipment	Preventive Maintenance
pH Meter	Routine battery checks and calibrations with buffer solutions on a daily basis. Probe replacement. Check KCl solution.
Conductivity Meter	Battery check and replacement when necessary. Clean instruments after use.
Photoionization Detector	Battery check and change after use.
Combustible Gas Meter	Battery check and change after use.
Air Supply Pumps	Replace after eight hours with new battery operated unit.
Terrain Conductivity Meter	Daily internal check.

14.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

14.1 FIELD WORK

The assessment of field sampling for accuracy and precision will be determined from the travel/trip blanks and field blanks which will be provided and analyzed as additional samples during each day of sampling. These blanks have been described in Section 6.0.

In addition, field replicate samples will be collected during the site investigations. One replicate will be collected for approximately each 20 samples collected during the site investigation. The replicate will determine the accuracy of sample identification and sample collection procedures utilized.

14.2 LABORATORY ANALYSIS

This section to be provided by the GC/MS laboratory.

15.0 CORRECTIVE ACTION

A corrective action request form (see attached) will be utilized to notify the Project Manager of any nonconformance with the QA Project Management Plan. This report could be written by the QA Project Officer or the Task Leader. The report would fully describe the nature of the problem, person responsible, date, the apparent cause of nonconformance, and the corrective action taken or recommended.

CORRECTIVE ACTION REQUEST FORM

Problem Identification

Date:

A. Nature of Problem

B. Apparent Cause

C. Corrective Action Taken or Proposed

Originator:

Copies to:

Title:

Signature:

FIGURE 15-1. CORRECTIVE ACTION FORM

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

A QA/QC report will be submitted to the Project Manager and Task Leader subsequent to each of the site investigation sampling activities. A summary of the QA/QC effort will be included in the Task 3 Site Investigations report, along with the laboratory reports.

The QA/QC report will summarize the results of the field surveys and sample analyses. The report will be constructed in the following format.

I. Introduction
II. Summary of Field Program
    A. Documentation
    B. Field Data Sheets
       Custody Records
       Reasons
       Corrective Action
    C. Schedule Compliance in Sampling and Sample Handling
    D. Discussion of Compliance with QA Plan
III. Summary of Analytical program
    A. Schedule Compliance
    B. Summary of Precision, Accuracy, Completeness for each Parameter
    C. Summary of System/Performance Audits
    D. Deviations from Plan
    E. Discussion of Compliance with Plan
IV. Conclusions/Recommendations

Note: Section III of report will be developed by the GC/MS analytical laboratory selected to perform the work.

APPENDIX A

CALIBRATION PROCEDURES FOR FIELD EQUIPMENT

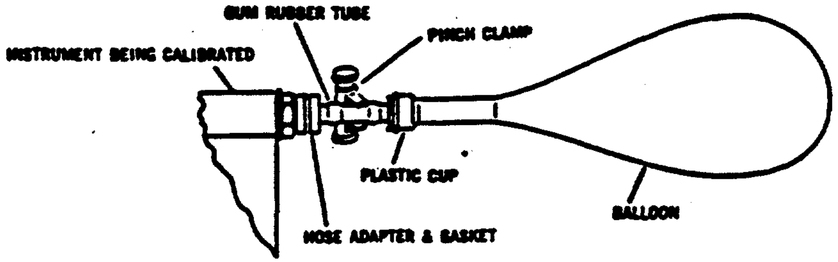
MSA Calibration Test Kit Part Number 454380

For use only with:

MSA EXPLOSIMETER® Combustible Gas Indicator Models 2-2A-2B-3-4-5-6
MSA GASCOPE® Combustible Gas Indicator Calibrated for Natural Gas, 0-100% L.E.L. Scale
MSA Model 40, & 40S Combustible Gas Indicator, 0-100% L.E.L. Scale

INSTRUCTIONS:

1. Adjust instrument meter to zero as described in its instruction manual.
2. Screw the hose adapter onto the sample inlet fitting of the instrument being calibrated.
3. Remove cover from calibrating gas can.
4. Assemble the rubber tube and balloon to the plastic cup as shown.
5. Eliminate the air from the balloon by rolling it up towards the cup.
6. While keeping the balloon rolled up, slip the open end of the rubber tube over the outlet spout on the calibrating gas can.
7. Press center of top on gas can and let balloon inflate until it takes full shape. It is not necessary to pressurize the balloon.
8. Close off the rubber tube near the plastic cup with the pinch clamp. Remove the rubber tube from the outlet spout.
9. Slide the rubber tube onto the hose adapter and remove the pinch clamp.
10. Draw gas sample from balloon thru instrument by operating the aspirator bulb. Note the maximum meter reading.
11. Refer to calibration curve on back of this sheet for instrument being tested.
12. Starting with METHANE-IN-AIR-MIXTURE at bottom of graph look up graph to equivalent maximum and minimum points between the curves. Directly to the left of these points is the range of meter readings for the instrument being calibrated. Example is shown on the first graph.
13. If the indicator fails to read within the range shown on the graph, check test kit for leaks, and for sample dilution caused by failure to completely exhaust the balloon. Check the instrument flow system for leaks (Refer to the instrument instruction manual for maintenance and testing procedures). If proper response cannot be obtained, replace detector unit. If installation of new detector units fail to give proper indication, the indicator should be returned for repair.
14. Remove the calibration test components and store them in the Kit.



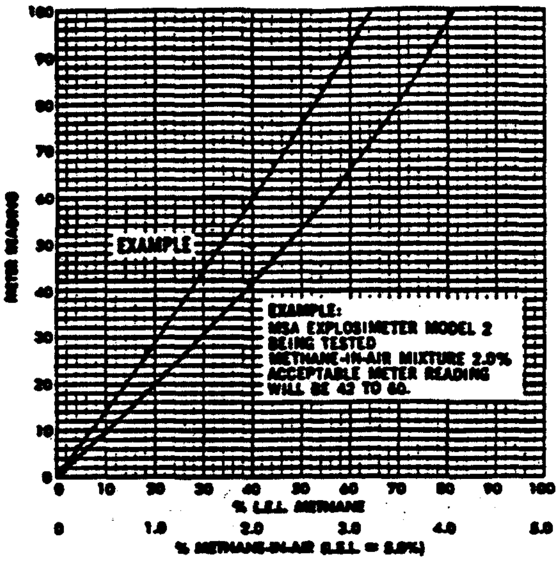
REPLACEMENT PARTS

81696 — Balloons, package of three
96329 — Can, Calibration Gas, percent Methane in air as labeled
454314 — Adapter, Hose

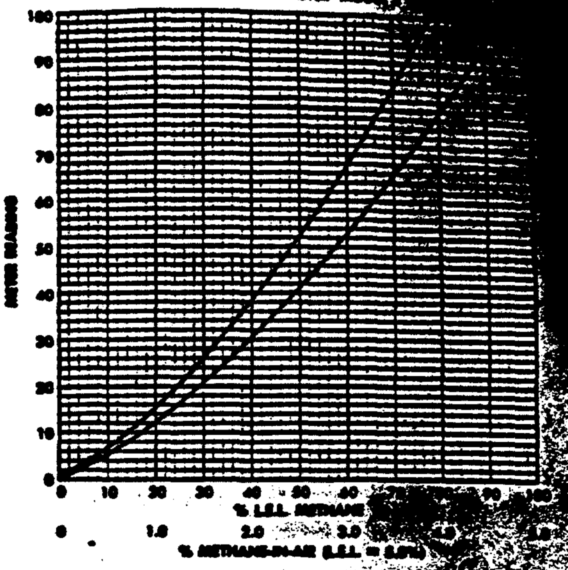
454315 — Gasket
454379 — Tube, Gum Rubber
58238 — Pinch Clamp
81748 — Cup, Plastic

Manufactured by
MINE SAFETY APPLIANCES COMPANY
PITTSBURGH, PENNSYLVANIA, U.S.A., 15208

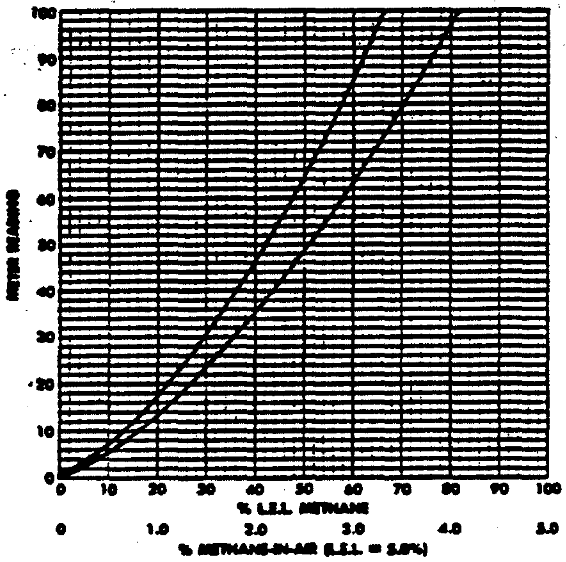
MSA EXPLOSIMETER* MODELS 2, 2A, 2B AND 6
MSA COMBUSTIBLE GAS INDICATOR MODEL 40



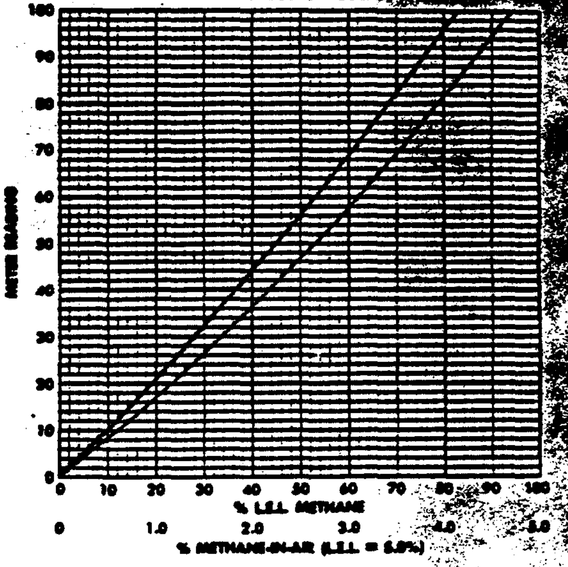
MSA EXPLOSIMETER* MODEL 3



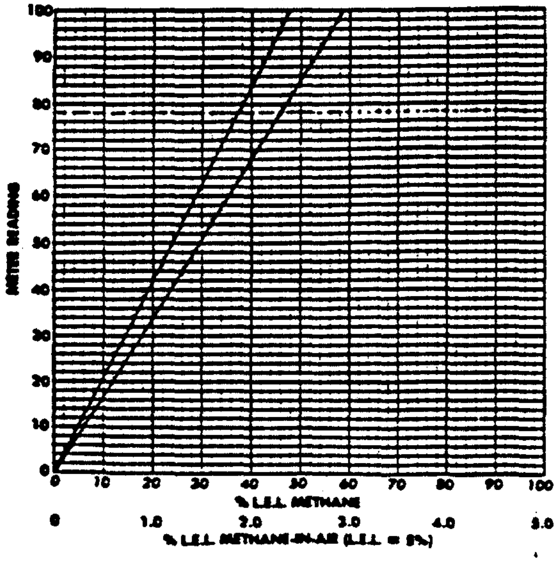
MSA EXPLOSIMETER* MODEL 4



MSA GASCOPE* MODEL [illegible]



MSA EXPLOSIMETER* MODEL 5



NOTE, Special Calibrations: Model 40S 0-100% L.E.L. mixture: 40.5% UDMH, 50.5% Deta, 9% Acetonitrile. Methane 2% should read between 50-70 2.5% Methane should read between 65-95.

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CALIBRATION PROCEDURES FOR THE PULSE TEMPERATURE TOOL

The use of a temperature calibration pulse oscillator attachment facilitates a convenient method of calibrating a wide range of temperature spans displayed on the strip chart recorder.

The temperature calibration oscillator is calibrated for use with the temperature tool supplied. Other pulse producing devices should not be substituted.

Geothermal gradient calibration of the gamma module from temperatures 50° F. to 120° F. over a 5" span.

1. Test/Operate switch on the master module should be placed in the test position.
2. Connect the red clip lead from the temperature calibration decade to the red binding post engraved ~~control.~~ #4
3. The black clip lead to the black binding post ~~ground.~~ #1
4. Place the rate switch on the gamma module to 1K, time constant (T.C.) switch to one.
5. Set the temperature switch on the calibration decade box to 50°.
6. Use the position control on the right hand side of the gamma module to position the #1 pen on the zero line, first major division on the left of the chart paper.
7. Switch the temperature switch on the calibration decade box to 120°.
8. Rotate the variable span knob adjacent to the rate switch to position the pen 5" to the right of the zero reference line.
9. Rotate the temperature switch on the calibration box back to 50°.

10. Some slight re-adjustment of the position control may be necessary to bring the pen exactly on the zero line of the chart paper.
11. Rotate the temperature switch on the calibration decade box to 120° again.
12. The pen should travel up scale to the 5" point if not a slight re-adjustment is required to the variable span control.
13. It may be necessary to repeat the above procedures several times to familiarize the operator with the steps in calibration. Once the pen is correctly positioned on thg zero and 5" line, representing 50° to 120° span, the knobs can be locked with the knob lock located to the right of the center line on the top of the position and variable span controls.
14. The calibration decade box can be removed from the circuit and the test operate switch flipped back to the operate position.
15. Attach the temperature tool to the cable connector and proceed with the log.
16. At this point it is advisable to make note of the rate switch setting, variable span and position control settings, with respect to the temperature span desired. This will make the calibration quicker the next time these settings are required.

Once the geothermal gradient log is obtained, the expanded anomaly log is usually desired.

1. For expample: If the temperature range of 90° to 100° is the zone of interest, attach the calibration decade box to the master module as described earlier for the geothermal gradient.

calibration, essentially the technique is the same with the exception of the rate switch settings.

All expanded temperature ranges will use the 100 count setting of the rate switch.

1. Rate Switch 100.
2. Time Constant 1.
3. Decade Box set at 90°.
4. Position Control to zero pen on chart.
5. Decade Box 100°.
6. Variable Span to 5" line on chart.
7. Double check previous settings on the position and variable span controls.
8. Any 10°, 20°, 30° or any expansion of temperature ranges will follow the above procedures.
9. If working with higher temperature ranges, for example, the 110° to 120° range, the rate switch should be placed on the 500 count position. It should be pointed out that the variable span knob settings below 200 become somewhat unlinear.there for the next higher count rate position of the rate switch should be used.

The temperature tool has a pulse repetition rate of 700 pulses/second for the 40° F. temperatures to over 3,600 pulses/second for the 120° F. temperature.

Ideally the rate switch should be positioned to count the anticipated pulse rate proportional to the temperatures encountered.

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A unique feature of this pulse temperature system is the capability of calibration of the tool for another range while the temperature tool is in the hole.

By simply connecting the calibration decade box to the binding posts directly under the engraved control and switching the test/operate switch to the test position. This opens up the signal normally sent up the tool allowing any changes in calibration required to meet unknown anomalies.

After the new range has been calibrated, change the test/operate switch back to the operate position and remove the calibration decade box from the red and black binding posts.

CALIPER TOOL (Continued)

OPERATION:

A. Calibration of the Control Module:

1. Attach the caliper tool to the cable connector.
2. Turn the function switch to MOTOR.
3. Press the red button marked motor ON.
4. The caliper motor will run until it completes its cycle, then the red lamp will shut off and the green lamp will light, The caliper feelers should now be open.
5. Turn the function switch to RECORD. The RECORD indicator will light (yellow lamp).
6. Slip the calibration paddle over the end of the Caliper Tool and place one of the caliper arms into the hole corresponding to the minimum diameter to be measured. Always approach the hole from the same direction with feeler arm.
7. Using the Position control, place the pen onto the far left (zero) line to indicate the minimum diameter to be measured. NOTE: Sensitivity Control should be Maximum when making first positioning adjustment.
8. Remove the feeler from the hole in the calibration board and place it into the hole corresponding to the largest diameter desired for this scale.
9. Observe the pen. If the pen did not deflect as far as desired, turn the sensitivity control clockwise until the pen is slightly past the paper line.

OPERATION: (Continued)

A. Calibration of the Control Module: (Continued)

10. Repeat steps No. 6, No. 7, and No. 8 until proper deflections are achieved. This operation may have to be repeated two or three times to achieve the desired results.
11. Repeat the above procedures for each scale.
12. Intermediate diameters can be checked by placing the arm into the proper holes in the calibration paddle and observing the position of the recorder pen.
13. CLOSE TOOL.

CAUTION: Never attempt to connect the logging tool to the cable while the control unit is set for MOTOR OPERATION. A potential of 175 volts DC is applied to the cable when the OPEN-CLOSE lever switch is in either direction. Never leave the function switch in the MOTOR position when using other types of logging tools.

B. Logging Operation:

1. With the function switch turned to the OFF position and the Caliper feelers completely closed, lower the caliper tool downhole.
2. When the bottom is reached, open the caliper feelers by turning the function switch to MOTOR, moving the OPEN-CLOSE switch to OPEN, then pressing the red motor ON button. When the feelers open and the cycle is complete, indicated by the green lamp automatically turning on, turn the function switch to RECORD.
3. Set the log paper for the correct depth. Bring the caliper tool uphole at a logging speed of approximately 50 feet or less per minute.

GAMMA-RAY LOGGING

The theory of gamma-ray logging is fairly simple. All formations contain radioactive material, but the amount is highly variable.

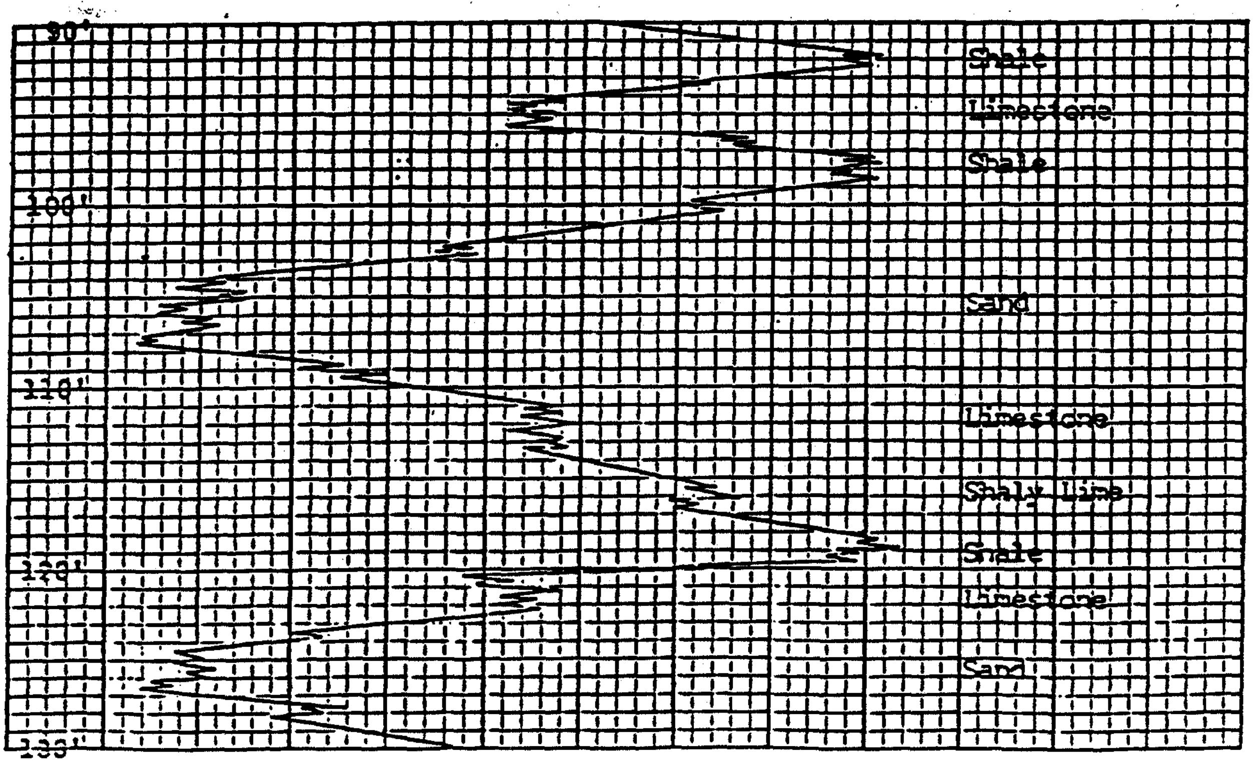
The gamma-ray log is primarily used as a qualitative log. Usually formations of high counting rate designate shale or volcanic ash. Formations of low counting rates are usually anhydrite, salt, coal, lime, dolomite, or sand. It is possible for sands to be radioactive or contain radioactive waters.

The radioactive substances are undergoing constant disintegration, in the course of which rays are emitted. Radioactive radiation is spasmodic. Gamma rays emanate from a radioactive source at a constant rate only if that rate is measured over a long period of time. This variation of the radiation is called statistical variation and it follows the laws of probability. At very low rates of radiation, the statistical variation may be quite high. This will give what looks like poor repeatability of two different logs from the same well or from wells in the same general area.

When the gamma tool is suspended in the well (tool not moving) you will notice that the gamma trace is not steady, but is constantly fluctuating. This fluctuation is the statistical variation; the smaller the time constant used, the greater will be this fluctuation.

To reduce the statistical variation, the WRI tool is run at a normal speed of 10 feet to 20 feet (3 to 6 meters) per minute. Usually this will be a time constant of 2 or 4 seconds. In an area of high radiation a time constant of one second is normally used.

When starting off in a new area, the best practice is to run two or three logs of the same well using different time constants.



THE GAMMA RAY PROBE

The Gamma Ray Probe is of the scintillation type, i.e. gamma radiation is transformed into light traces by a sodium iodide crystal. A photomultiplier tube detects the light traces and emits an electrical pulse for each gamma emission or light trace. The pulses from the photomultiplier tube are fed into a preamplifier, one-shot multivibrator, and amplified; and from there are passed up the cable to the module on the surface.

All components within the probe are mounted in such a way as to offer resistance to the effects of vibration and rough usage. All electrical power necessary for operation is supplied from the module and fed down the cable. The open circuit voltage measured at the banana plug on the cable connector and the outer sheath of cable is approximately 40 volts D.C.

Solid state integrated circuits and silicon transistors are used for the amplifier and counter circuits.

The Geo-Logger Gamma Probe is sturdy and has been found to give consistent results and long, trouble-free service when protected from mechanical shock. Dropping and severe thermal shock can damage the sodium iodide crystal or photomultiplier tube.

Should the probe show to be inoperative, it should be checked by an electronics technician experienced in pulse circuitry, or should be returned to Well Reconnaissance, Inc., in Addison (Dallas), Texas, for repair.

DISASSEMBLING OF THE PROBE BY UNTRAINED PERSONNEL IS DEFINITELY NOT RECOMMENDED

OPERATION OF GAMMA RAY PROBE

GAMMA RAY LOGGING:

1. Rotate the Module Selector Switch on the Master Module before attaching the cable connector to the probe. Then turn the Selector Switch to the Gamma position.
2. Connect probe to the cable connector.
3. Set the Rate Switch to 100 counts/second.
4. Rotate the T. C. (Time Constant) Switch to Position 2.
5. Turn the variable span and position controls full clockwise and lock in this position.
6. Place tool in well.
7. Let the tool down at approximately 10 feet (3 meters) per minute.

The sensitive area of the Gamma Ray Probe (approximately 6" [15 cm] from the bottom of probe) should be used as a reference when zeroing the depth counter. In lowering the probe into the hole, every effort should be made to avoid abruptly hitting the bottom of the hole. Also, spudding with the probe should be avoided. The probe should be lowered into the hole rather slowly in any event, in order that the sensitivity will be correctly set in going down. Unlike electric logging, the sensitivity of gamma logging is very much affected by the speed at which the probe travels.

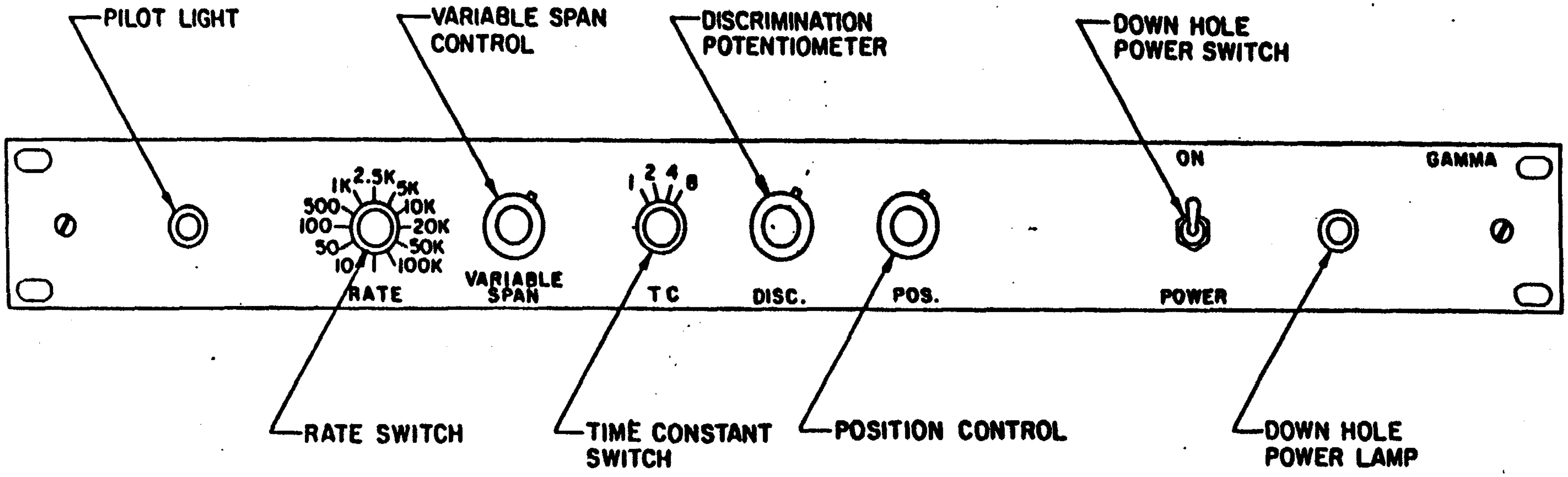
The time constant should always remain the same in using the logger with the Gamma Ray Probe in a given area, except under unusual circumstances. The time constant to be used depends strictly on the speed of logging. The optimum speed of logging will generally be about 10 to 20 feet (3 to 6 meters) per minute.

GAMMA RAY LOGGING: (continued)

8. When the probe has reached bottom, pull the cable up until there is no slack in the cable. Observe the depth counter indicator; make a note of the total depth on the chart or log heading.
9. Start the probe up the well at the desired logging speed.
10. Watch the depth as the probe nears the top of the hole.
11. Stop the tool when the depth indicator reads zero.
12. If the record appears satisfactory, make a note of all pertinent data such as your total depth, hole number, elevation, sensitivity used, etc., on the top of the chart paper or log heading.

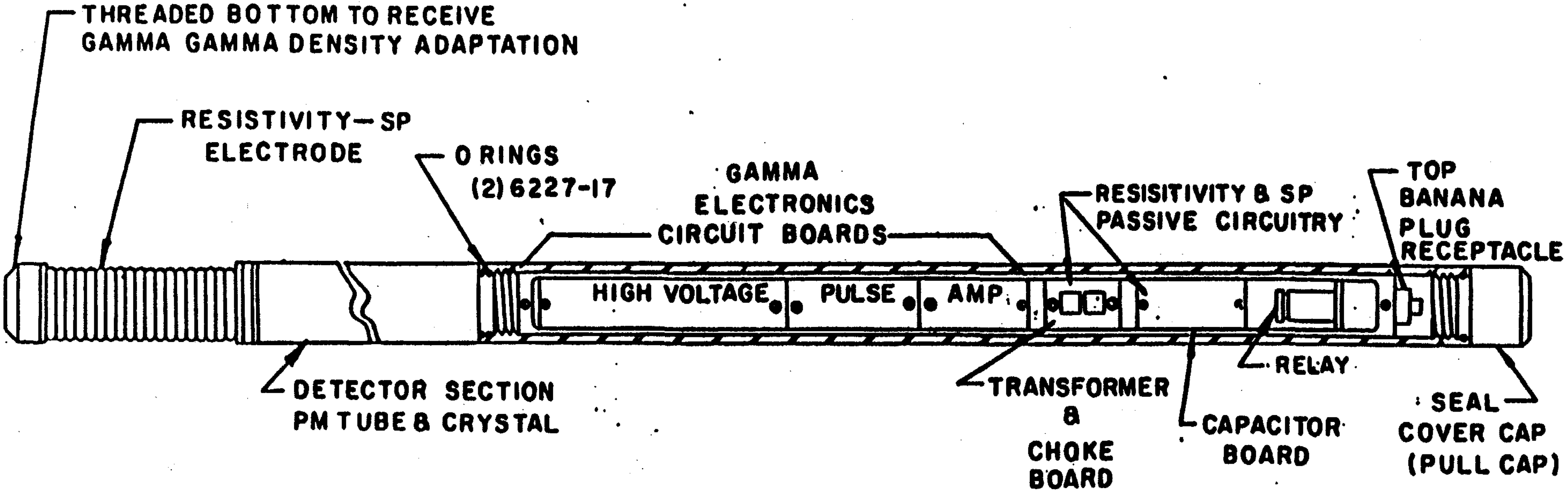
Since gamma radiation is statistical in nature, the pulses from the Gamma Ray Probe must be integrated or averaged over a determined length of time -- the time constant. The time constant switch is located to the right of the rate switch on the control module, where the integration is accomplished, and a time constant scale is provided in seconds. The faster logging speeds require a shorter time constant; and conversely, the slower logging speeds require a longer time constant.

DISASSEMBLING OF THE PROBE BY UNTRAINED PERSONNEL IS DEFINITELY NOT RECOMMENDED.



GAMMA CONTROL PANEL

REVISIONS	DATE					
DISC. SWITCH CHANGE RMC RS	4-9-76	DESCRIPTION GAMMA CONTROL PANEL			WELL RECONNAISSANCE, INC. DALLAS, TEXAS	
		USED ON ASSY. #.			W.O. 9583	DATE
		MATERIAL NOTED			CONTRACT	
		TOLERANCE UNLESS NOTED ± 1/64 ± .005	DRAWN BY LG	DATE 7-3-75	CHKD. BY	DATE
		REMOVE ALL BURRS & SHARP EDGES		SCALE NONE	MODEL NO.	NO. 13600



REVISIONS	DATE	DESCRIPTION 1¼" 3WAY GAMMA RESISTIVITY SP PROBE	WELL RECONNAISSANCE, INC. DALLAS, TEXAS	
		USED ON, ASSY. #	W.O.	DATE
		MATERIAL NOTED	CONTRACT	
		TOLERANCE UNLESS NOTED $\pm\frac{1}{64}$ $\pm$.005 DRAWN BY LM DATE 9/9/75	CHKD. BY	DATE
		REMOVE ALL BURRS & SHARP EDGES SCALE NONE	MODEL NO. ATI	NO. 13663

[redacted]

Bristol Recorder Calibration Check Procedure

In order to check calibration, it is necessary to supply the input with precise signal levels of 0%, 50%, and 100%. The manner in which these signals are generated is left to the discretion of the user. Proceed as follows:

1. Apply 0% test signal to input and note reading on chart.
2. Repeat some procedure using 50% and 100% test input levels, again noting corresponding readings on chart.
3. If readings are within 0.5%, no calibration adjustments are required. If not, proceed to Step 4:
4. Reapply 0% test signal to input. If reading is in error, turn fine zero adjacent screw on pen arm to correct. Recheck readings at 50% and 100% check points. If normal, no further adjustments are required.
5. If readings at upper end of scale are still in error, more detailed calibration will be required. Return unit to shop.