AS-4010

REMEDIAL WORK PLAN FOR
AL TECH SPECIALTY STEEL CORPORATION
WILLOWBROOK COOLING POND
DUNKIRK, NEW YORK

October 1988

Prepared for:

AL TECH SPECIALTY STEEL CORPORATION
Willowbrook Avenue
Dunkirk, New York 14048

ecology and environment, inc.
BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

recycled paper

ADVANCE NOTIFICATION

Mobile Incinerator PCB Disposal

The following notice is provided to comply with pertinent notice requirements set forth in 6NYCRR Part 373, 40 CFR Part 761, and applicable federal and state agency guidelines:

1. Company Identification:

Al Tech Specialty Steel Corporation
Dunkirk Plant
Willowbrook Avenue
Dunkirk, NY 14048

Company Officials Responsible:

Frank J. Boinski
Director, Environmental Affairs
Al Tech Specialty Steel Corporation
Telephone: 716-366-1000

Contractor Officials Responsible for Disposal Operations:

George R. Butler
Senior Project Manager
OH Materials Corporation
P.O. Box 551
Findlay, Ohio 45839
Telephone: 419-423-3526

Government Officials Responsible for Oversight:

Daniel Kraft
PCB Coordinator
USEPA Region II
TSCA Task Force
Edison, NJ
Telephone: 201-321-6669

Paul R. Counterman
Director, Bureau of Hazardous Waste
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York
Telephone: 518-457-9696

2. Nature of PCB Disposal Activity:

   Thermal Destruction of approximately 2,100 cubic yards of PCB contaminated soils ranging from 0-2100 parts per million (ppm).

3. Location of Facility:

   Al Tech Specialty Steel Corporation
   Dunkirk Plant
   Willowbrook Avenue
   Dunkirk, NY 14048
   Telephone: 716-366-1000

4. The project will commence on or about November 1, 1988, and will be completed prior to December 31, 1988; operations will be scheduled twenty-four hours per day, seven days per week.

5. No telephone facsimile notices will be necessary since the project will be restricted to the single site referenced above.

6. Telephone messages regarding changes in the project location will not be necessary since the project will be restricted to the single site referenced above.

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1. INTRODUCTION

AL Tech Specialty Steel Corporation (AL Tech) of Dunkirk, New York contracted with Ecology and Environment, Inc. (E & E) for the development of this work plan detailing the cleanup procedures for remediation of the Willowbrook Avenue cooling pond. The remediation of the cooling pond will be performed by O.H. Materials Corporation (OHM) of Princeton, New Jersey utilizing a duly permitted mobile infrared incinerator.

This plan describes the steps that will occur for the removal and treatment of polychlorinated biphenyls (PCB)-contaminated sludges and sediments from the cooling pond and hexavalent Chromium (Cr VI) from the incinerator ash. AL Tech and Special Metals Corporation (Special Metals) both utilize the pond as a part of their cooling water systems. Discharges to the cooling pond have varied with time and operating conditions, and have included small particles of scale, oil, and greases. PCB contamination likely occurred as a result of equipment failures, line breaks, or spills and observed Cr levels can be traced to the carry over of mill scale.

This cleanup plan was prepared in accordance with United States Environmental Protection Agency (EPA) regulations, under the authority of the Toxic Substances Control Act (TSCA) (40 CFR, Part 761), and New York State regulations (NYCRR, Title 6, Part 373). However, for the primary purpose of removing PCB contaminants the EPA Region II office and the New York State Department of Environmental Conservation (NYSDEC) Region 9 office will be kept apprised.

During cleanup to the level of 25 ppm of PCBs by weight, as required by 40 CFR Part 761, Polychlorinated Biphenyls Spill Cleanup Policy; verification sampling and analysis will be conducted to determine the level of residual PCB contamination; pond bottom and shoreline samples will also be analyzed for Cr VI concentrations. The sampling and analysis for PCBs will be performed in accordance with EPA Guidelines for Verification of PCB Spill Cleanup (EPA 1985) and the analysis for Cr VI will be performed in accordance with SW846 EPA Method 7195.

Cleanup of the cooling pond will be followed by a post cleanup monitoring program. This program is further described in Section 7.0. Upon completion of the cleanup, a New York State-registered professional engineer will verify the level of cleanup as required by regulations.

2. SITE DESCRIPTION AND HISTORY

2.1 LOCATION

AL Tech is located in the City of Dunkirk, Chautaugua County, New York. The facility is located approximately 0.7 miles north of the Interstate 90 thruway, and is bordered to the north by a railroad, to the east by a residential area, to the south by Willowbrook Avenue, a residential street, and to the west by Brigham Road. The cooling pond is located in the southwest corner of the facility site. The surface dimensions of the cooling pond are approximately 225 feet (N-S) and 320 feet (E-W), or approximately 72,000 square feet (1.6 acres).

2.2 WASTE HANDLING OPERATIONS

In 1905, Atlas Steel built portions of the existing facilities on the site in Dunkirk, New York, for the purpose of steel production. Alleghany Ludlum Steel Corporation purchased the property in the 1930s. AL Tech purchased a portion of the Alleghany Ludlum complex in 1976; the remainder of the complex was purchased by Special Metals in 1981. Also in 1981, GATX purchased the AL Tech portion of the facility and later sold this property to Rio Algom, USA in 1986. Rio Algom, Ltd., of Toronto is the present grandparent company of AL Tech. The Willowbrook cooling pond was constructed in the early 1950s by Niagara Mohawk Power Corporation (NMPC) under an agreement with Alleghany Ludlum Steel Corporation. NMPC excavated the pond to bedrock (approximate elevation 610 feet above mean sea level) in exchange for the excavated material for use as fill at NMPC's Dunkirk Steam Generating Station. There is nothing to indicate that NMPC deposited any waste in the excavated pond and no designs or plans and specifications relating to the pond construction could be located.

When the pond was excavated, it was used as a portion of Alleghany Ludlum's cooling water circuit (contact and noncontact cooling water). A provision of the 1976 agreement of sale between AL Tech and Alleghany Ludlum resulted in the continued joint use of the pond by both firms; this arrangement was perpetuated when Alleghany Ludlum sold the remainder of the complex to Special Metals. This joint use of the pond continues today. In 1978 an oil accumulation system with an oil skimmer was installed to prevent tramp oil from overflowing to the Dunkirk city sewer system.

Discharges to the cooling pond by all previous owners and operators have varied with time and operating conditions, and have included small particles of scale, oil, and greases. However, due to common purchasing practices of Alleghany Ludlum and in light of the fact that the entire complex has historically handled the same types of steel, it is reasonable to assume that the various discharges to the pond have contained similar contaminants.

Special Metals discharges to the cooling pond along its east bank through a 24-inch concrete pipe. This discharge is reportedly noncontact heat exchanger water and water from a basement sump observed to be contaminated with oil. The results of a recently completed study of all discharges to the pond confirmed that this discharge contained PCBs at some time(s) during its history.

In an August 1988 study performed by Hazard Evaluations, Inc., the overall process water system was reviewed and each discharge to the cooling pond analyzed. Based upon this study it was recommended to optimize the discharges to the cooling pond by rerouting Sewer No. 4 to the City of Dunkirk sewage system and recirculating Sewer No. 5 within the Bar Finishing and Storage Building. AL Tech will be instituting these recommendations in the near future.

As a result of these revisions to the existing system the peak process water flow during normal operations will measure 1600 gallons per minute (gpm); however, all processes seldom operate simultaneously. AL Tech plans to install a new rolling mill with an estimated peak flow of 520 gpm to be added to the 1600 gpm for a total maximum flow of 2120 gpm. See Appendix A for the August 1988 study report. The total process water flow will be composed of the following major inflows:

- Olson Furnace Pump House -- 650 gpm;
- Shark Pit Pump House -- 150 gpm;
- South End Pump House -- 800 gpm; and
- Future Rolling Mill Pump House -- 520 gpm.

2.3 SITE HYDROGEOLOGY

Based on a 1988 study performed by URS Company, Inc., on the investigation of the equalization pond (a separate system located about 600 feet downgradient of the cooling pond), the hydrogeologic setting is as follows:

- Groundwater: Flow is generally south to north; depth is shallow (<10 feet).
- Fissile shale bedrock: At shallow (about 10 ft.) depth.
- Overlying glacial sediments: Consist of sand, silt, and clay.
- Background well: Located approximately 2,500 feet south of the cooling pond and west of the County Fairgrounds.
- Monitoring wells: Located around the equalization pond, about 600 feet downgradient from the cooling pond.
- Local flow around the equalization pond: Radial to the underdrain sump, it does not reflect regional flow.

As a result of these data, E & E has concluded that, although the direction of groundwater flow in the vicinity of the cooling pond is northerly, it is very likely that a large groundwater mound has formed around the large unlined pond and that, if pollutants occur in the water, they will migrate radially out from the cooling pond in any direction.

To monitor these potential migration paths and to confirm or deny the existence of a groundwater mound, in August, 1988 E & E installed and sampled the following system of eight shallow stainless steel monitoring wells (see Figure 2-1):

- Two wells close to the north side of the pond;
- Two wells on the south side of and in close proximity to the pond;
- Four more wells, each placed in line with the first four, two directly south and two directly north.

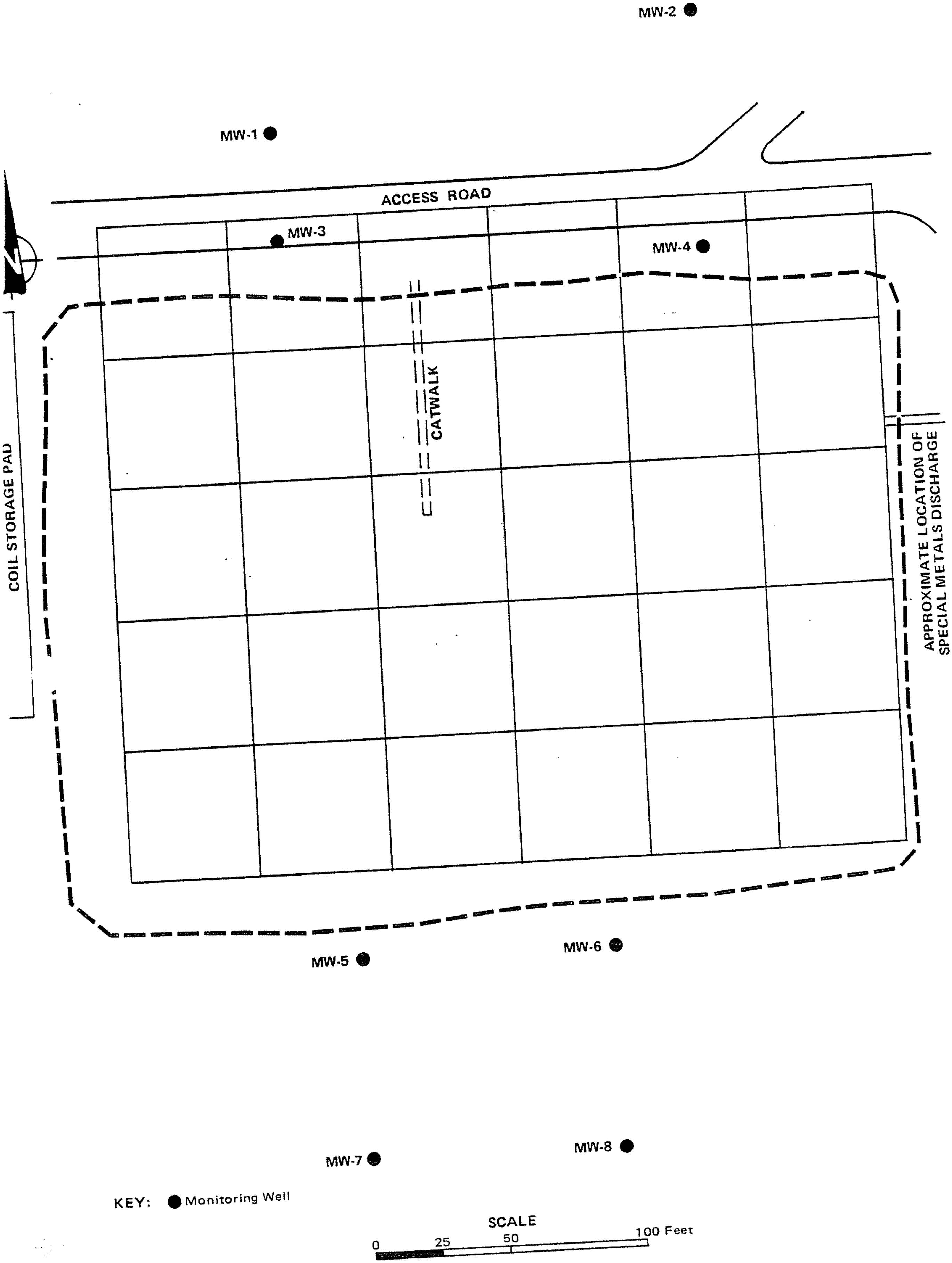

Figure 2—1 LOCATION OF MONITORING WELLS

Appendix B presents the monitoring well logs; while Appendix C has a Trip Report summarizing the field operations.

2.4 SUMMARY OF SIGNIFICANT ANALYTICAL RESULTS

On June 4, 1987, AL Tech collected five sediment samples in the southwest corner of the cooling pond in the area of the oil skimmer. (See Figure 2-2 for sampling locations.) These samples were later analyzed by Free-Col Laboratories for PCB contamination. The analytical results showed Aroclor-1248 contamination above 50 ppm in one sample. See Table 2-1 for analytical results.

On June 25, 1987, URS Company, Inc., of Buffalo, New York, performed subsequent sampling at the cooling pond. This program entailed the collection of nine bottom sediment grab samples and one shoreline composite sample. (See Figure 2-2 for sampling locations.) These samples were analyzed by Free-Col Laboratories, for PCB contamination. The analytical results showed contamination above the allowed 50 ppm by weight in some of the bottom sediment and the shoreline composite samples (see Table 2-2 for analytical results.)

As defined by 6 NYCRR Part 372.4(e)(1), these samples showed that the soil and sludges would qualify as hazardous waste(s) (NYSDEC Hazardous Waste Number B007) and a TSCA regulated substance upon their removal and disposal and require further evaluation with respect to their possible migration.

On May 3, 1988, OHM sampled the sludge in the cooling pond. Seven samples were taken and composited with a total volume of approximately 2.5 gallons (see Figure 2-2 for sample locations). Samples were shipped in a sealed plastic container to OHM's facility in Baton Rouge, Louisiana, for dewatering testing.

Two types of sediment/sludge were observed while sampling. A heavy metal fines and sand and more oily grease-like sludge with fines. Dark oil-like staining was observed around the pond and an oil sheen was visible on parts of the pond.

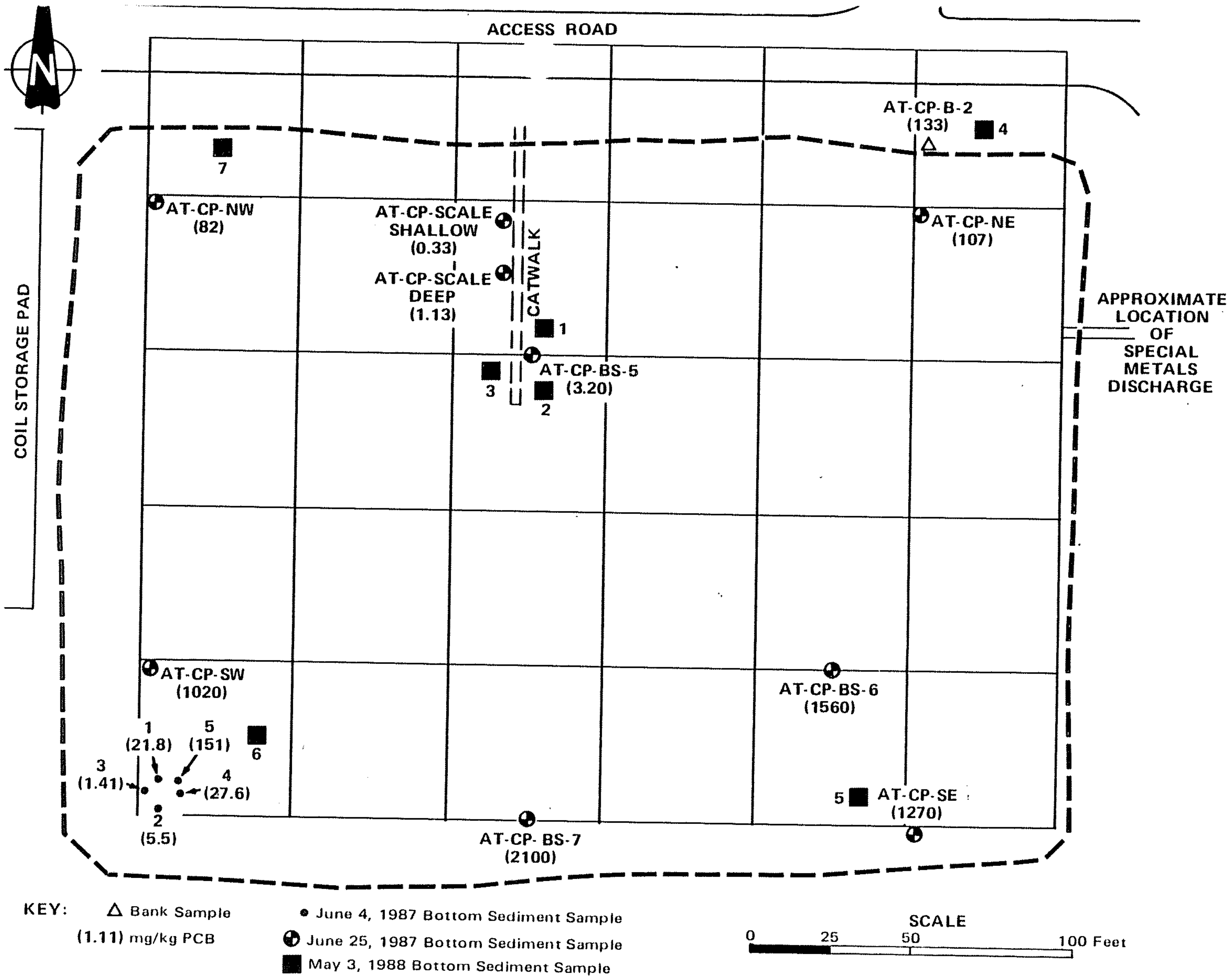

Figure 2– 2 WILLOWBROOK AVENUE COOLING POND SAMPLING LOCATIONS

Table 2-1

ANALYTICAL RESULTS OF JUNE 4, 1987 BOTTOM SEDIMENT SAMPLING

Sample	Aroclor-1248* (mg/kg)
1	21.8
2	5.5
3	1.41
4	27.6
5	151.0

Source: Free-Col Laboratories, 1987

* Testing for Aroclor 1016, 1221, 1232, 1242, 1254, 1260, and 1262 yielded results of <0.1 mg/kg.

Table 2-2

ANALYTICAL RESULTS OF
JUNE 25, 1987 BOTTOM SEDIMENT SAMPLING

Sample	Aroclor-1232* (mg/kg)
AT-CP-B-2	133.0
AT-CP-Scale S	0.33
AT-CP-Scale D	1.13
AT-CP-BS-5	3.20
AT-CP-BS-6	1,560.0
AT-CP-BS-7	2,100.0
AT-CP-NW	82.0
AT-CP-NE	107.0
AT-CP-SE	1,270.0
AT-CP-SW	1,020.0

Source: Free-Col Laboratories, 1987

The dewatering test results of the samples are as follows:

- Basis:
  - 2,650 cubic yards of sludge *in situ*
  - 51 percent solids in *in situ* sludge
- Yields:
  - 84 percent dry weight solids in filter cake
  - 2,000 tons of filter cake to be produced (estimate)
  - 28 days needed to complete the project

The filter cake from the dewatering test was analyzed at ETC's Findlay, Ohio, laboratory for the following parameters:

- Physical characteristics
- Phenols
- Cyanide
- Volatile organics
- Semi-volatile organics
- Base neutral compounds
- Acid extractables
- Pesticides
- PCBs
- EP Toxicity
- Total metals

Table 2-3 presents results for the detected compounds. The complete analytical report and associated detection limits are provided in Appendix D.

Vinyl chloride was detected just above the 100 ppm detection limit and is believed to be a contaminant from the polyvinyl chloride sampling equipment.

The combustion parameters determined by Calib Brett Laboratories are provided in Table 2-4.

To evaluate ash characteristics, a sample was reduced to ashes in a muffle furnace programmed to reach a temperature of 1,380 degrees Fahrenheit for 30 minutes. This process corresponds closely to the reaction within the primary chamber of the mobile infrared incinerator. The sample was then analyzed for EP Toxicity. The results appear in Table 2-5.

Table 2-3

ANALYTICAL RESULTS OF DEWATERING TEST

Item	Result
Flash point, SF, CC	>95 degrees C
Density	1.43 g/cm
pH test	6.4 pH units
Total solids	82.2%
Vinyl chloride	215 (mg/kg)
PCBs (Aroclor 1242)	247 ppm
Total Cadmium	<1.0 ppm
Total Chromium	1,680 ppm
Total Iron	110,000 ppm
Total Lead	36.2 ppm
Total Nickel	10,200 ppm
Total Zinc	124 ppm
EP Toxicity-Barium	0.112 ppm

Source: ETC Laboratories, 1988

Table 2-4

COMBUSTION PARAMETERS

Item	Parameter
Carbon	3.82%
Hydrogen	1.16%
Nitrogen	0.042%
Sulfur	0.027%
Oxygen	1.67%
Ash	77.06%
Moisture	16.34%
Heat content	803 Btu/lb.

Source: Calib Brett Laboratories, 1988

Table 2-5

ANALYTICAL RESULTS OF EP TOXICITY ON ASH

Item	Concentration (ppm)	Limit (ppm)
Arsenic	0.188	5.0
Barium	0.205	100.0
Cadmium	BDL	1.0
Chromium	12.7	5.0
Lead	BDL	5.0
Mercury	BDL	0.7
Selenium	BDL	1.0
Silver	BDL	5.0

Note: BDL - Below Detection Limit

Source: ETC Laboratories, 1988

Based on the benchscale analyses, the ash appears to be hazardous due to its Cr VI concentration. Daily representative samples of the ash will be analyzed for Cr VI and PCB concentrations prior to their release for metals recovery.

In August 1988, eight new 2 inch diameter stainless steel monitoring wells were installed to monitor the existing groundwater in the vicinity of the cooling pond (see Figure 2-1). These eight wells and an existing background well were sampled and the analytical results are presented in Table 2-6.

Table 2-6

ANALYTICAL RESULTS OF AUGUST 1988 GROUNDWATER SAMPLING

Sample	PCB Aroclors (ug/l)							TSS (mg/l)	Ni (mg/l)	Cr (Total) (mg/l)
	1016	1221	1232	1242	1248	1254	1260			
MW-1	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	820	0.027	<0.010
MW-2	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	12,000	<0.015	<0.010
MW-3	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	11,000	<0.015	<0.010
MW-4	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	5,100	<0.015	<0.010
MW-5	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	16,000	<0.015	<0.010
MW-6	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	15,000	<0.015	<0.010
MW-7	<1.0	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	2,500	<0.015	<0.010
MW-8	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	14,000	<0.015	<0.010
Background	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	340	0.016	0.013
Duplicate	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	9,700	<0.015	<0.010
Trip Blank	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<1.0	5	<0.015	<0.010

Source: Ecology and Environment, 1988

3. SITE PREPARATION

Site preparation will begin approximately 45 days before mobilization of the dewatering equipment and will involve installing utility interconnects, pouring concrete pads, and constructing a temporary water cooling system. The majority of the site preparation will be performed by local contractors under the direct supervision of the assigned OHM supervisor.

3.1 UTILITY INTERCONNECTS

Installing the utility interconnects will be coordinated by the OHM site supervisor; this includes installing meters at the utilities to identify actual utility consumption. The following utility connections will be made:

- Water 20 gallons per minute (gpm) -- will be intercepted at the fire hydrant located approximately 86 feet south of the billet storage area.
- Electric 480 volt 3-phase 2,000 amps -- will be received from the power substation transformers provided by AL Tech and directed to the billet storage building.
- Natural gas 6,000 cubic feet per hour -- will be hooked to the network at the north side of the power substation.

3.2 CONCRETE PAD CONSTRUCTION

A storage area will be constructed in the billet storage building to contain dewatered sludge from the lagoon. The concrete area will be curbed with a 6-inch high easement. The floor will be gently sloped in two directions to collection sumps. The sumps will collect the possible leachate from the staged filter cake. An equipment decontamination area will be constructed over one sump to collect washwater generated from equipment cleaning. The collected water will be tested for debris and discharged to the treatment system.

3.3 TEMPORARY WATER COOLING SYSTEM

OHM will supply and construct a 750,000-gallon above-ground temporary water cooling pool to be used as a reservoir for both the direct and indirect cooling water used at the plant. The pool will be set up north of the existing pond.

4. DEWATERING APPROACH

This project involves removing and dewatering approximately 2,650 cubic yards of sludge from the recirculating water impoundment. The approximate dimensions of this impoundment are 225 feet by 320 feet. The impoundment is constructed of soil. The sludge present is a result of the accumulation of metal fines, sand, and oily waste from the water cooling system.

Because the sludge is regulated under TSCA, OHM will remove this sludge from the impoundment and dewater it so it can be incinerated. After a visual inspection confirming all sludge has been removed from the pond, verification sampling and analysis will be conducted.

4.1 SLUDGE REMOVAL

OHM will use a Mud Cat pumping system to remove the sludge from the impoundment. This system is powered by either a diesel engine or an electric motor with the principal controls being hydraulically operated. A hydraulic boom raises or lowers a horizontal auger cutter which drives material to a pump suction intake. Depending on material density, the Mud Cat is capable of pumping sludge at a rate of 500 to 1,000 gallons per minute (gpm). The system is propelled by a winch system anchored on the impoundment shore. Sludge from the system is then pumped to the processing area for blending and conditioning in two 8,000-gallon tanks.

4.2 SLUDGE DEWATERING

OHM will use a 3.0 cubic-yard capacity recessed chamber filter press for dewatering the sludge. Based on the sample provided by AL Tech, OHM estimates that the press system will yield a 57 percent volume reduction and produce a cake which is 84 percent solids by weight. The estimated total weight of dry cake to be produced is 2,000 tons. The filtrate from the press will be pumped back to the impoundment or to the temporary cooling pool.

5. INCINERATOR OPERATION

The OHM mobile infrared incinerator, utilized at Florida Steel Corporation (located in Indiantown, Florida) for its site remediation work on similar PCB-contaminated soils, will be used to decontaminate the Willowbrook cooling pond soils. In June 1988, this infrared incinerator was subjected to a very extensive TSCA national permit trial burn and met or surpassed all applicable air emission standards and meets all requirements of 40 CFR Part 761 governing the disposal of PCB-contaminated materials (see Appendix D for the conditions and results of this trial burn). This incinerator will decontaminate the residue generated from the sludge dewatering system (see Section 4.1).

The method of decontamination employed by this state-of-the-art incinerator is thermal oxidation. The complete operating and maintenance procedures are contained in the EPA mobile incinerator permit and will be furnished upon request. A general summary of the technology employed by this mobile incinerator is described in Sections 5.1 and 5.2.

5.1 WASTE PRETREATMENT AND HANDLING

The sludge excavated from the cooling pond will be dewatered as described in Section 4.1. The filter cake (dewatered sludge) will be properly stored on a curbed concrete pad inside the billet storage area (see Section 3.1).

The filter cake will be moved to the incinerator location via a front end loader, where it will be fed into the waste-feed hopper. The waste-feed hopper is designed with an open top and sloping walls to facilitate loading and discharge of the filter cake into the enclosed conveyor system. The enclosed conveyor system is designed to prevent spills and air leakage while facilitating easy decontamination.

The feed-rate measurement system consists of a weighbridge, located on the inlet to the conveyor, and a belt speed sensor. These two controlling devices, which utilize an integrator to receive the signals and convert them to a weight, adequately serve to produce a uniform feed control to the infrared primary chamber. The weight of material being fed to the incinerator is shown via digital controls in the control room. This allows the operators to know the current status of all operating units simultaneously.

The incinerator ash will be stored in Building 293. After PCB decontamination is verified, OHM will analyze the ash to determine proper disposal. The preliminary analysis of the ash (see Table 2-5) shows that the ash does not classify as RCRA hazardous. Subsequent to the verification of the destruction of PCBs to an approved level, the ash will be moved off-site for reclamation of its heavy metal components.

5.2 THERMAL DESTRUCTION TRANE

The thermal destruction trane consists of: an infrared heated, continuous-conveyor belt primary combustion chamber; a natural-gas fired secondary combustion chamber (four burner); a hot gas quench unit; a Venturi gas scrubbing unit; a packed column chemical scrubber; an induced-draft fan; and a stack.

The filter cake conveyed to the primary chamber will be of uniform consistency (see Table 2-4 for filter cake combustion parameters), which will ensure adequate feeding to the furnace belt. The filter cake will be placed into the furnace live-bottom feed hopper and moved to the effective width of the furnace belt. The feed hopper discharge drive is manually synchronized with the furnace belt to control the furnace feed rate. The correct amount of the filter cake will then enter the furnace through a vertical drop chute. As for the Florida Steel remediation, this system will be a very reliable method for obtaining the proper amounts of feed to the thermal destruction system.

The OHM thermal destruction trane operating parameters will reflect those of the TSCA permit trial burn. These successful operating parameters are summarized in Table 5-1.

5.2.1 Primary Infrared Combustion Chamber (PICC)

The Primary Infrared Combustion Chamber (PICC) allows for the proper time, temperature, and mixing (through the use of cake-breakers) of the filter cake feed to volatilize all the organic contaminants contained in the filter cake. The PICC is composed of a feed, processing, and discharge module all constructed of mild carbon steel. These modules are assembled on a modified "goose neck" trailer for easy transportation, set up, and tear down.

The filter cake enters the PICC through the top of the feed module for processing. The filter cake drops onto the high-temperature-resistant metal alloy conveyor belt, which transports

Table 5-1

OHM PROPOSED INCINERATOR OPERATING PARAMETERS

Item	Result
Primary chamber temperature	1,600 degrees F
Primary chamber residence time	15 min.
Secondary chamber temperature	2,000 degrees F
Secondary chamber residence time (minimum)	4 sec.
Excess oxygen (minimum)	5.0%
Feed rate (maximum hourly)	8,000 lbs.
PCB concentration (maximum)	6966 ppm
DRE for PCB (minimum)	99.9999%
Combustion efficiency (minimum)	99.9%
Electricity required (average) 44OV, 3 phase	1,200 KVA
(maximum)	2,000 KVA
Natural gas consumption	5,500 cubic ft./hr.

the filter cake through the PICC. The conveyor belt is pulled through the chamber by a chain-driven roller system mounted in the feed module. As the filter cake moves through the PICC, it is exposed to infrared radiation (heat) in multiple temperature control zones. The temperatures in these zones are controlled automatically via the silicon carbide heating elements. Varying the input power maintains the preset temperature conditions of each specific zone. As the filter cake moves through the PICC, it is exposed to the thermal conditions necessary for volatilization of the organic contaminants. In order to ensure the proper volatilization of all organics, the filter cake must be stirred with the cake-breakers as it moves through the PICC. As the filter cake moves through the PICC, it is exposed to combustion air provided by a forced draft fan. The hot gas flow is counter-current to the filter cake flow which allows uniform heat transfer to the filter cake, avoiding over heating of the filter cake. This results in a very efficient volatilization process of the organics contained in the filter cake.

Upon completion of the PICC process, the filter cake (now considered an ash) is discharged and spray cooled in a lateral screw conveyor to ensure proper ash temperature and adequate compaction (density) of the ash for safety and transportation requirements. The ash is then discharged through a bucket elevator and transported from the furnace location.

The volatilized gases from the filter cake together with the combustion gases are removed from the PICC by an induced-draft (ID) fan located at the scrubber exhaust. The ID fan maintains a sufficient negative pressure in the PICC, ensuring that gas flows out of the PICC into the secondary combustion chamber, while preventing excess or unmetered air in-leakage. This also ensures the safety of all personnel as any air leakage which occurs flows into -- not out of -- the thermal destruction unit.

5.2.2 Secondary Combustion Chamber (SCC)

The secondary combustion chamber (SCC) is the location where a sufficient temperature and residence time are obtained for the complete destruction of the organics volatilized in the PICC. The SCC is constructed of mild steel and assembled on two trailers for easy transportation, set up, and tear down. The SCC is designed to allow the hot gases sufficient time and turbulence at temperature (see Table 5-1) to meet or surpass all federal and New York State emissions requirements contained in NYCRR, Title 6, Part 212. This SCC is fired by four natural-gas, 1.5 million BTU per hour burners. These burners are mounted on the inlet portion of the SCC in order to sustain the desired temperature for proper thermal destruction efficiencies.

The exhaust gases then flow out of the SCC into the downstream gas cleaning equipment.

5.2.3 Exhaust Gas Cleaning Equipment (EGCE)

The exhaust gas cleaning equipment (EGCE) removes the gas contaminants prior to the discharge of the gases up the stack. The first unit in the EGCE trane is an adiabatic quench, where the hot gases (approximately 1,900 degrees F) are quenched to the adiabatic saturation temperature of 180 degrees F or lower. The gases exit the quench chamber and enter a Venturi gas scrubber, which forces a water spray to wet any particulate in the gas stream. This wetting effect causes a mixing of gases and particulate, and an agglomeration (massing with an increase in particle size) of any contaminants in the gas stream. The last unit in the EGCE trane is a packed column chemical scrubber which removes the agglomerated particulate and acid gases to meet all New York State emissions requirements prior to the discharge of the clean gases to the stock.

The blowdown water (water removed from this system) will be approximately 12,000 gallons per day and will be treated at the wastewater treatment facility prior to discharge.

6. RELEVANT REGULATORY STANDARDS

Testing has shown the sludge in the Willowbrook pond to be PCB contaminated; however, no other RCRA-regulated parameters were found in concentrations which would subject them to regulations. Therefore, the incineration of this waste falls under the jurisdiction of the Toxic Substances Control Act (TSCA) as administered by USEPA Office of Toxic Substances.

For the purposes of the cooling pond remediation, incinerator and air permits have been investigated in accordance with NYCRR, Title 6, Parts 373 and 212, respectively.

6.1 INCINERATOR REGULATORY CONCERNS

OHM completed a TSCA test burn of its infrared unit on June 30, 1988, at a site in the State of Florida. The successful completion of this test has resulted in USEPA verbally approving a national TSCA permit. The permit allows OHM to burn PCB-contaminated solids anywhere in the United States with no additional federal approvals. To follow is a brief summary of information by subsection required in NYCRR, Title 6, Subpart 373-1.5(f):

373-1.5(f)(3)

(i)

(a) 803 BTU/lb. of filter cake (see Table 2-4).

(b) The waste feed is a pre-processed filter cake (see Table 2-4 and Appendix D, Table 1).

(c) See Appendix D, pages 5 through 14 for compounds that were analyzed. See Appendix D, Section 2, Analytical Methodology, pages 1 through 3 for the tests and procedures used for the compounds.

(d) See Appendix D, pages 5 through 14 for the quantification of the compounds that were analyzed.

(e) See Appendix D, pages 5 through 14 for the identification of the Principal Organic Hazardous Constituents (POHC's) for the Willowbrook Cooling Pond waste feed. See the national TSCA permit trial burn waste feed POHC's in Tables 5-1 and 5-2 in the accompanying trial burn activity report for the June 1988 trial burn (Appendix E).

(ii)

(a) Shirco of Dallas, Texas manufacturer - identified as a Mobile Infrared Hazardous Waste Incineration System.

(b) Type incinerator - Primary Infrared Combustion Chamber (PICC). Natural Gas-Fired Secondary Combustion Chamber (SCC).

(c) PICC 52 feet long x 94 inches wide x 34 inches high. SCC 40 feet long x 7 feet wide x 8 feet high.

(d) PICC - Silicon Carbide (SiC) electrical resistant heating elements (440 Volts, 3 Phase)
1200 KVA average to 2,000 KVA maximum
SCC-Four 1.5 million BTU/hr. natural gas fired burners
5,500 ft.^{3}/hr.

(e) 14,000 lbs. per hour of filter cake maximum.

(f) See Appendix F.

(g) See Appendix G and the national TSCA permit trial burn Section 4.6.1, 4.6.2, 4.6.3 (Appendix E).

(h) The nozzle and burner design are not applicable because wastes are not injected into the burners. The only burners are Maxon gas burners model #28930 incorporated in the SCC.

(i) Construction Materials--mild steel and appropriate refractory linings. The waste gas cleaning equipment are primarily fiberglass vessels, downstream of the refractory-lined quench chamber.

(j) Appendix E, pages 3-3 through 3-6 and 3-8;
Appendix F for system control setpoints, pages 4-52 through 4-77; and
Appendix G in its entirety.

(iii) Please reference 3(i) a, b, c, and e for this information.

(iv) The design data is identical as no major modifications have been made to the Mobile Infrared Hazardous Waste Incinerator System Operating Conditions (see Table 6-1).

(v)

(a) See Appendix E, Sections 3 and 4 for national TSCA trial burn permit. Same methods used for Florida Steel site remediation.

(b) See Appendix E, Section 5 for national TSCA trail burn permit. Same methods used for Florida Steel site remediation.

(vi)

(a) CO level Max. 3 ppm

(b) Waste feed rate 14,000 lbs./hr.

(c) Combustion temp. 1) PICC 1,600 degrees F
2) SCC 2,000 degrees F

(d) Gas Velocity 7 ft./sec.

(e) 24,000 CFM flow rate of stack gases;
Max. 180 degrees F stack gas temperature.

(f) 6 seconds waste gas residence time in SCC.

(g) 99.8% HCl removal efficiency.

(h) No fugitive emissions as the induced draft fan creates a negative pressure inside all operating units. Any air leakage goes into the incineration trane NOT OUT.

(i) See Appendix F.

(viii) See Appendices D and E.

Table 6-1

Operating Conditions

	Proposed for Willowbrook	National TSCA Permit Trial Burn	Florida Steel
Primary Chamber Temp.	1,600 degrees F	1,600 degrees F	1,600 degrees F
Primary Chamber Residence Time	15 min.	15 min.	15 min.
Secondary Chamber Temp.	2,000 degrees F	2,000 degrees F	2,000 degrees F
Waste Gas Secondary Chamber Residence Temp. (minimum)	4 sec.	6 sec.	4 sec.
Excess Oxygen (min.)	5%	5%	5%
Feed Rate (max.) to 14,000 lbs./hr.	14,000 lbs./hr.	14,000 lbs./hr.	14,000 lbs./hr.
PCB Concentration	2,100 ppm max.	7,000 ppm ave.	1 to 300 ppm range
DRE for PCB (min.) [POHC]	99.9999%	99.9999%	99.9999%
Combustion Efficiency	99.9%	99.9%	99.9%
HCl Removal Efficiency	99.8%	99.8%	99.8%
HCl Emissions (lb./hr.)	0.115 lb./hr. max.	0.093 lb./hr.	Not Available
<u>Particulate Emissions</u>			
Grains/dscf	Not Available	0.03 ave.	Not Available
Grains/dscf at 7% Oxygen	0.08	0.06 ave.	0.0255 ave.
PCB Concentration in Ash (max.)	2 ppm	2 ppm	2 ppm

6.2 AIR EMISSION REGULATORY CONCERNS

6 NYCRR 212.3(e) specifically states that compliance with Federal regulations set forth in 40 CFR 761 satisfies applicable New York State air emission requirements. Therefore, in lieu of submitting an air pollution source permit application as required by 6 NYCRR 212, AL Tech has provided in Appendix G a completed facsimile of the application form (for information purposes only) to aid NYSDEC in an expeditious review of air emission concerns. Additionally, in this section results of air dispersion modeling with regard to New York State Air Quality Standards are presented. Review of this information leads to the conclusion that the proposed operations at Willowbrook Pond will be in full compliance with the intent of New York State air pollution permit standards.

To follow is additional information on stack parameters and emissions modeled for the AL Tech cooling pond based upon OHM's previous emissions at Indiantown, Florida.

6.2.1 Stack Parameters and Emissions

The air dispersion model used to estimate air concentrations from normal operation of the OHM incinerator is the PTPLU2 (Point Source Plume Version 2.0) model for short-term (1-hour) average concentrations. This is in the USEPA family of air dispersion models called UNAMAP, for User's Network for Applied Modeling of Air Pollution (USEPA 1986), Version 6.0. The PTPLU2 model is often recommended for detailed regulatory modeling involving both criteria and non-criteria pollutants (e.g. air toxics or carcinogens) (USEPA 1987; Budney, 1977). The user guide which documents this model (Pierce, et. al, 1982; Pierce, 1986) describes it as intended as a screening level model most useful for finding the point of maximum ground level concentration. The model calculates ground level concentrations over a wide range of wind speeds and atmospheric stability -- 49 cases in all.

Two cases are developed, a worst case and a base case. For the worst case, Table 6-2 summarizes the physical parameters required by the PTPLU2 model. The expected emission rates are based on measured values from the test burn reported in Appendix E. This is justified since the feed rate to be used in the Willowbrook Pond cleanup is the same as that used in the test burn. However, the feed used in the test burn contained nearly 7,000 ppm PCBs, which is more than three times

Table 6-2

AL Tech Specialty Steel Willowbrook Pond Cleanup OHM Mobile Incinerator Stack Physical Parameters Used for Dispersion Modeling with Worst Case Scenario Based on Test Burn Emissions

Parameter	Value	Reference
Height of stack	37 feet above grade	
Stack diameter	32 inches	
Stack gas exit temperature	177.1 degrees F	
Stack gas exit velocity	37.76 ft./sec.	
Stack gas volume flow rate	6,180 dscfm (12,669 ACFM)	
Operating Conditions	24 hr./d, 5d/week, 4-5 weeks total	
<u>Emissions Based on Test Burn</u>		
Total suspended particulates	1.587 lb./hr.	Appendix E, Tables 5-7, 5-8
Hydrogen chloride	0.115 lb./hr.	Appendix E, Table 5-8
Residual PCB's	6.3 E-6 lb./hr.	Appendix E, Table 5-11
PCDF, total (average of 3)	18.53 ng/m^3, 4.29 E-7 lb./hr.	Appendix E, Table 5-12
PCDD, total	<2.76 ng/m^3, <6.39 E-8 lb./hr.	Appendix E, Tables 5-12
<u>Test Burn Conditions</u>		
Charge rate	13,837 lb./hr.	
Stack gas volume flow rate	6170 dry SCFM	
Chloride in feed	0.43%	
PCB's in feed	6966 ppm	
<u>Proposed NY State Guidelines</u>		
PCDD at 7% O_2 and 20 degrees C (2,3,7,8-TCDD equivalents by Eadon method)	2 ng/dscm	

higher than that in the Willowbrook Pond material. Rather than pro-rate emission rates downward, our calculations are based on the test burn emissions; which is why they are likely to be conservative (high), worst-case results.

For a less conservative, more likely emission rate, we used as a base case the results from a test burn recently conducted by the USEPA as summarized in Table 6-3. This test burn reported emission rates only for total suspended particulates (TSP); and these rates are well below the 0.08 grains/dscf standard set by New York State (NYCRR, Title 6, Part 219).

The PTPLU2 predictions for the OHM incinerator, using the stack parameters in Tables 6-2 and 6-3, are summarized in Tables 6-4 and 6-5, respectively. Considering first the worst-case results from Table 6-4, these show that the highest 1-hour average concentrations of each pollutant would occur with "C" stability (slightly unstable) and a wind speed of 5.06 m/s (11.5 mph), measured at a height of 10 meters. The highest concentrations under these conditions would occur 230 meters (755 feet) from the stack.

For comparison, Table 6-4 lists the National Ambient Air Quality Standard (NAAQS) for total suspended particulates (TSP) as 260 ug/m^3 on a 24 hr. average basis. The maximum 1 hour average TSP value found is 10.28 ug/m^3, occurring very near the incinerator. To convert this 1 hour average value to a 24 hour average, various formulas are suggested of the form:

$$24 \text{ hr. average} = 1 \text{ hr. average} \times (1/24)^p$$

where, the power p has been suggested between 0.17 (Wippermann, 1961) and 0.5 (Hino, 1986), but is usually taken as 0.5. With this conversion, the maximum TSP becomes 2.11 ug/m^3 as a 24 hour average, which is only 0.8% of the NAAQS.

For hydrogen chloride, no standard has been established. The New York State Guideline document for toxic materials (NYDEC, 1986) lists a tentative value obtained by multiplying the Threshold Limit Value for HCl by 300. The maximum ground level concentration of 0.745 ug/m^3, is far below the guideline value of 140 ug/m^3, not even considering the averaging time adjustment.

For polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) New York State has suggested a stack emission guideline of 2 ng/dscm as 2,4,7,8-TCDD, as listed in Table 6-2. This is a weighted average of all 4-8 chlorinated isomers using weighting factors or Toxic Equivalence Factors (TEF)

TABLE 6-3

O.H. MATERIALS
INDIANTOWN, FLORIDA

SUMMARY OF PARTICULATE TEST DATA AND TEST RESULTS

TEST DATA:			
Test run number	1	2	3
Test location	Stack	Stack	Stack
Test date	1-20-88	1-20-88	1-21-88
Test time period	1111-1254	1503-1633	0903-1032
SAMPLING DATA:			
Sampling duration, min.	80.0	80.0	80.0
Nozzle diameter, in.	0.368	0.368	0.368
Cross sectional nozzle area, sq.ft.	0.000739	0.000739	0.000739
Barometric pressure, in. Hg	29.90	29.88	29.77
Avg. orifice press. diff., in H2O	1.55	1.61	1.83
Avg. dry gas meter temp., deg F	86	86	81
Avg. abs. dry gas meter temp., deg. R	546	546	541
Total liquid collected by train, ml	665.0	622.0	712.0
Std. vol. of H2O vapor coll., cu.ft.	31.30	29.28	33.52
Dry gas meter calibration factor	0.993	0.993	0.993
Sample vol. at meter cond., dcf	54.2	56.2	59.1
Sample vol. at std. cond., dscf (1)	52.2	54.1	57.2
Percent of isokinetic sampling	98.3	96.8	99.3
GAS STREAM COMPOSITION DATA:			
CO2, % by volume, dry basis	4.2	4.2	4.4
O2, % by volume, dry basis	14.2	14.0	13.4
CO, % by volume, dry basis	0.0	0.0	0.0
N2, % by volume, dry basis	81.6	81.8	82.2
Molecular wt. of dry gas, lb/lb mole	29.245	29.236	29.240
H2O vapor in gas stream, prop. by vol.	0.375	0.351	0.369
Mole fraction of dry gas	0.625	0.649	0.631
Molecular wt. of wet gas, lb/lb mole	25.03	25.29	25.09
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H2O	-0.14	-0.12	-0.13
Static pressure, in. Hg	-0.010	-0.009	-0.009
Absolute pressure, in. Hg	29.89	29.87	29.76
Avg. temperature, deg. F	168	169	169
Avg. absolute temperature, deg.R	628	629	629
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	16	16	16
Avg. gas stream velocity, ft./sec.	28.54	29.00	30.83
Stack/duct cross sectional area, sq.ft.	5.59	5.59	5.59
Avg. gas stream volumetric flow, wacf/min.	9600	9700	10300
Avg. gas stream volumetric flow, dscf/min.	5000	5300	5500
LABORATORY PARTICULATE REPORT:			
Front half acetone rinse, g	0.0041	0.0037	0.0027
Filter catch fraction, g	0.0420	0.0404	0.0444
EPA METHOD 5 CATCH, g	0.0461	0.0441	0.0471
PARTICULATE EMISSIONS:			
Concentration, gr/dscf	0.0136	0.0126	0.0127
Mass rate, lbs/hr	0.59	0.57	0.59
Concentration, gr/dscf @ 7% O2	0.0281	0.0250	0.0234
Allowable concentration, gr/dscf at 7% O2	0.08	0.08	0.08

(1) Standard Conditions = 68 deg. F. (20 deg. C.) and 29.92 inches (760 mm) mercury, dry basis

Table 6-4

Comparison of Maximum Predicted Ground Level Concentrations from OHM Incinerator with Regulatory Standards by PTPLU2 Source Plume Model (Worst Case)

Atmospheric Stability Pasquill Class	Wind Speed m/s	Distance to Max. Conc. Meters	Maximum Ground Level Concentrations, ug/m^3				
			TSP	HCl	PCB	PCDF	PCDD
A (unstable morning)	3.03	156	8.95	0.649	3.55E-5	2.42E-6	<3.6E-7
B	5.04	157	9.64	0.699	3.83E-5	2.60E-6	<3.9E-7
C	5.06	230	10.28	0.745	4.08E-5	2.77E-6	<4.1E-7
D	5.09	403	8.97	0.650	3.56E-5	2.42E-6	<3.6E-7
E	2.09	1468	3.85	0.279	1.53E-5	1.04E-6	<1.5E-7
F (very stable night)	2.14	2195	4.18	0.303	1.66E-5	1.13E-6	<1.7E-7

Pollutant	Criteria NAAQS ug/m^3	Averaging Time
TSP	260	24 hours
HCl	140(a)	-

Dioxins as 2,3,7,8-TCDD Equivalents

(a) New York State Department of Environmental Conservation Acceptable Ambient Level, derived as TLV/50

Table 6-5

Comparison of Maximum Predicted Ground Level Concentrations from OHM Incinerator with Regulatory Standards by PTPLU2 Source Plume Model (Base Case)

Atmospheric Stability Pasquill Class	Wind Speed m/s	Distance to Max. Conc. Meters	Maximum Ground Level Concentrations of TSP (ug/m^3)
A (unstable morning)	3.03	137	4.22
B	4.03	157	<u>4.42</u>
C	4.05	230	4.05
D	7.13	300	4.15
E	2.09	1316	1.69
F (very stable night)	2.14	2000	1.84

Pollutant	Criteria NAAQS ug/m^3	Averaging Time
TSP	260	24 hours

developed to represent the relative toxicity of the various congeners relative to 2,3,7,8-tetra chlorinated dibenzo-p-dioxin (TCDD). The analysis values reported by OHM's test burn give detectable values only for tetra chlorinated dibenzofurans. These components are given a zero value for the TEF used in calculating the 2,3,7,8-TCDD equivalency by the New York State method. By the USEPA method (Bellim and Barnes, 1986), a value of 0.001 is recommended for the TEF applied to tetra-chlorinated dibenzofurans.

With this factor, the 2,3,7,8-TCDD equivalence emission rate in the worst case is 0.01853 ng/m^3 which is less than 1% of the New York State emissions guideline. Using the Eadon method preferred by New York State, the 2,3,7,8-TCDD equivalence emission of detectable PCDDs and PCDFs are zero.

7. CLEANUP PERFORMANCE STANDARDS

This cleanup plan is designed to ensure that contaminated sediments from the cooling pond will be excavated, incinerated on site, and the residual ash will be transported and reclaimed in accordance with all applicable and relevant state and federal regulations. The cleanup performance standards discussed below are based on applicable guidelines and regulations, field sampling, and analytical data. A post-cleanup monitoring program will be instituted to evaluate residual groundwater quality.

7.1 COOLING POND EXCAVATION

The waste sediments in the cooling pond will be completely excavated. The initial determination of the completeness of contaminant removal will be based on visual inspection of the lagoon during excavation. Post excavation sampling will be performed to ensure complete removal.

7.2 POST-EXCAVATION SAMPLING AND ANALYSIS

The efficacy of contaminated sludge and sediment removal will be determined by sampling the cooling pond bottoms and side walls, and analyzing the soils for PCBs and Cr VI. This sampling and analysis for PCBs will be performed in accordance with the guidelines outlined in the EPA document, Verification of PCB Spill Cleanup by Sampling and Analysis (EPA 1985) and the analysis for Cr VI will be performed in accordance with SW846 EPA Method 7195. Soils will be collected from 0 to 6 inches in depth using precleaned stainless steel spoons. A sampling grid has been designed to allow a statistically significant number of sampling nodes to be identified and a composite sample from the nodes collected to adequately characterize the extent of contaminant removal. Based on EPA guidelines, soil samples will be collected from a total of 37 discrete sampling locations. These will be pooled together into three composite samples. Analyses will be performed by a New York State-certified analytical laboratory on an accelerated turnaround basis.

Based on the laboratory data, the adequacy of the remedial activity will be determined. In the event that a sample exhibits concentrations of constituents in excess of the action levels, further excavation, sampling, and analysis will occur until a level of 25 ppm for PCBs in the sediment and 5 ppm in the ash for Cr VI is reached.

During the excavation of the cooling pond, an impermeable membrane will cover the excavation staging area to prevent accumulation of water and minimize recharge to the surficial aquifer. In addition, a small pump will be placed in the excavated impoundment to collect any residual rainwater and/or groundwater recharge. Water which has been in contact with cooling pond sediment will be treated in the onsite pretreatment facility.

7.3 DISPOSAL

All excavated materials and sludges from the dewatering process will be incinerated on site, and the resultant ash will be containerized and transported in accordance with applicable state and federal regulations and reclaimed at an approved facility. All wastewater generated during the cleanup will be treated on site.

7.4 EQUIPMENT DECONTAMINATION

All vehicles entering the excavation area during excavation will be required to be decontaminated prior to exiting the site. Decontamination will occur in the tank cleaning area. Wash water will be discharged a local temporary facility. Vehicles operating on access paths will be rinsed with high pressure water to remove any soil and prevent transport to offsite areas.

The hydraulic excavator or other equipment operating in the impoundment area or contacting impoundment sludges will be washed with acetic acid and rinsed with high pressure water. Wastewater will be collected and treated on site.

7.5 POST-CLEANUP MONITORING

Post-cleanup monitoring of the newly installed groundwater monitoring system will conform to the requirements set forth in NYCRR 6, subpart 373(2.6).

8. SAFETY PRECAUTIONS

A site-specific health and safety plan will be developed which will describe all safety precautions. It will also contain procedures to follow in the event of an accidental fire or injury to personnel.

In general, procedures will be taken to ensure against contamination during all phases of the cleanup. These procedures include wearing protective clothing, and safe use of the proper equipment. Prior to leaving the work area, personnel will remove the protective clothing, and exposed skin surfaces will be thoroughly washed and rinsed.

Tyvek (or equivalent) coveralls, head protection, rubber gloves, and boots will be required. Wrists and ankles will be taped to prevent dust from entering the inside the protective clothing. Appropriate respiratory protection will be used, based on evaluation by the onsite consultant.

All site activity will comply with the safety requirements applicable to hazardous waste site activities set forth at 29 CFR Part 1910.

9. WASTE DISPOSAL

During the cleanup of the cooling pond the following wastes are expected to be generated:

- Contaminated wastewater from the cooling pond;
- Contaminated soil and debris;
- Wash water; and
- Protective clothing.

All liquids will be treated in the on site treatment plant.

All noncontaminated, nonhazardous waste will be shipped to a local sanitary landfill, with leachate collection systems for final disposal.

At the end of the cleanup operations, no waste generated during cleanup will be left on site.

All contaminated, hazardous waste will be incinerated onsite for PCB removal. The residual ash will be dealt with in accordance with all federal and state laws.

10. CLEANUP SCHEDULE

Assuming all permit approvals are received AL Tech will initiate cleanup of the cooling pond on October 3, 1988. All cleanup activities will be completed by December 31, 1988 barring unforseen circumstances.

11. CLEANUP CERTIFICATION

Following cleanup of the cooling pond, AL Tech will submit to EPA and NYSDEC a certification of cleanup signed by a professional engineer registered in New York State. This certification will state that the cooling pond has been cleaned up in accordance with the specifications set forth in this plan.

12. REFERENCES

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APPENDIX A

HAZARD EVALUATIONS, INC., RECIRCULATION RESERVOIR INFLUENT WASTEWATER CHARACTERIZATION AND SEGREGATION REPORT

RECIRCULATION RESERVOIR INFLUENT WASTEWATER CHARACTERIZATION AND SEGREGATION REPORT

AL TECH SPECIALTY STEEL CORPORATION
DUNKIRK, NEW YORK

Prepared By:
Hazard Evaluations, Inc.
Buffalo, New York

September 1988

1.0 INTRODUCTION

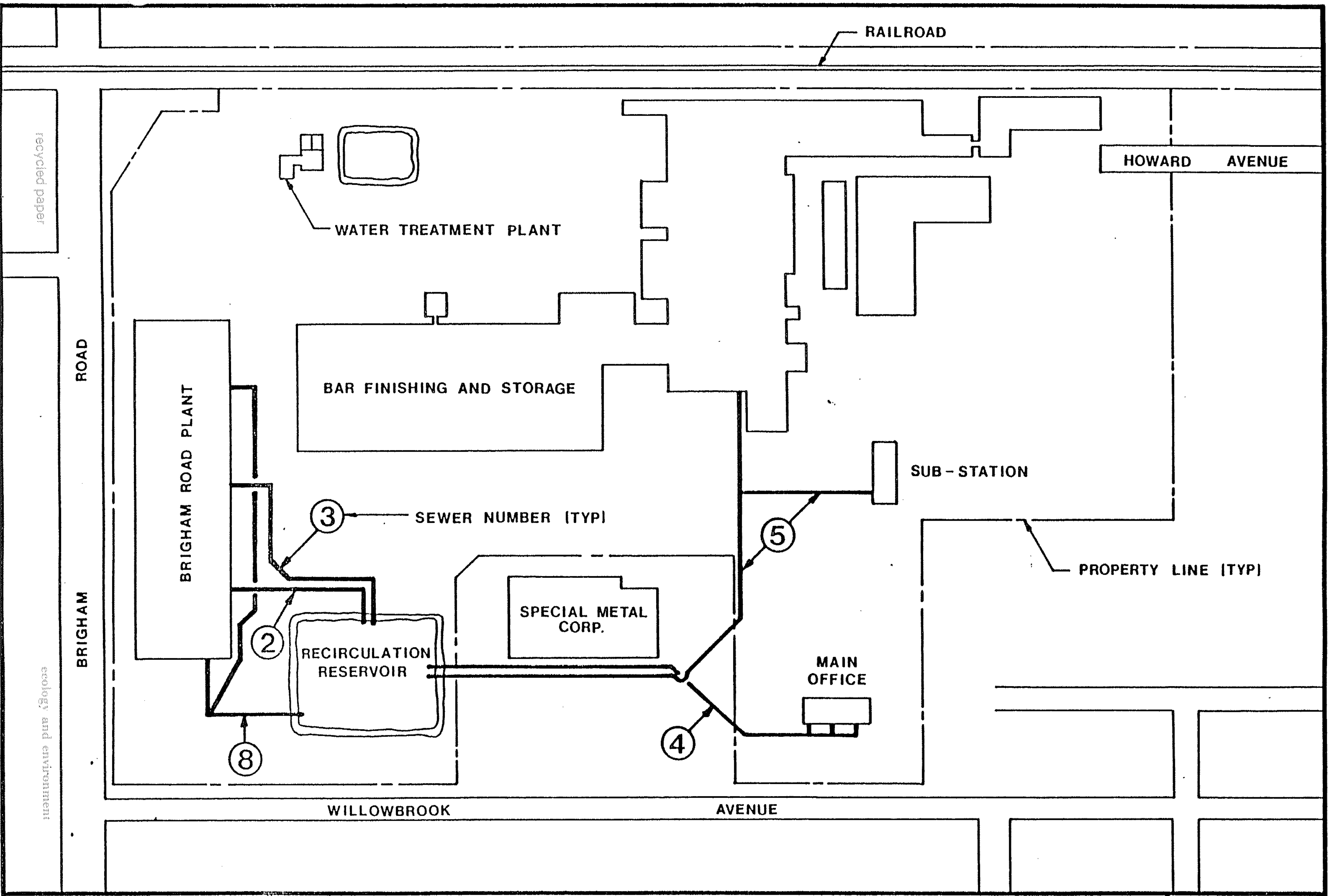
The AL Tech Specialty Steel facility located in Dunkirk, New York utilizes an on-site surface impoundment as a source of cooling water for various steel manufacturing operations. The sources of water contained in this impoundment, identified as the Recirculation Reservoir (Figure 1), include process wastewaters, non-contact cooling waters and condensates, storm runoff from within the plant and probably some contribution of groundwater. Hazard Evaluations, Inc. conducted a limited sampling/analysis and flow monitoring program during August, 1988 to characterize the wastewater discharges which enter this reservoir. The results of this characterization program are summarized in this report, and will serve as the basis for both the segregation of wastewaters discharged to the reservoir and the design of treatment equipment to be installed at the inlet to the reservoir.

2.0 IDENTIFICATION OF WASTEWATER DISCHARGES

The identification of the separate wastewater discharges to this reservoir was based on existing sewer plans for the Dunkirk plant as supplied by AL Tech, discussions with AL Tech personnel, and an inspection of the manufacturing areas suspected of contributing to these discharges. From the information collected, it was determined that five (5) separate wastewater sewer mains convey flow ultimately discharged to the reservoir (Figure 1). These sewers and their discharges are identified as follows:

Sewer No. 2 - Olson Furnace Pump House Discharge - The majority of this water originates from the quench tanks which are utilized to cool steel coils exiting the Olson Furnace. A floor drain located at the inspection point for this operation also contributes a small volume of Dunkirk city water. Contaminants detected in this discharge would be derived from scale washed from the coils.

Sewer No. 3 - Shark Pit Pump House Discharge - The majority of the water which enters the Shark Pit Pump House originates from



HAZARD EVALUATIONS

AL TECH SPECIALTY STEEL CORP.
RECIRCULATION SEWERS

FIGURE I

the "shark pit" located inside the Brigham Road plant. This in-floor chamber is used as a recirculation reservoir for the Bar and Rod Mill. All discharges to the "shark pit" are comprised of contact cooling water from the steel forming operations. Contaminants in these cooling waters should reflect the characteristics of the mill scale, grease and hydraulic oils which are flushed to collection flumes in the process areas by constant flows of water. As city water also serves as a source of cooling water for these operations, excess water routinely occurs in this recirculation system. The excess water exits the "shark pit" through an overflow pipe and is conveyed via a gravity sewer to the Shark Pit Pump House.

<u>Sewer No. 4 - Press Building Discharge</u> - This sewer originates in AL Tech's Main Office building, from which it conveys a small volume of air conditioner condenser cooling water and stormwater runoff. The sewer then passes beside the former AL Tech Press Plant, currently owned by Special Metals Corporation. Discharges from the Special Metals plant are suspected to include stormwater runoff, non-contact cooling water and plant floor drain discharges.

<u>Sewer No. 5 - Bar Finishing and Storage Building Discharge</u> - The largest contribution of wastewater to this sewer originates from several areas within the Bar Finishing building. The principal source is a process sewer which drains the round, shape and mini mill areas of this plant, and discharges to a scale pit located to the south of the Bar Finishing building. Contaminants in the overflow from this scale pit should reflect the characteristics of the mill scale, as the pit incorporates an oil/water separator. The wet well into which the overflow is discharged also receives limited discharges from two other sewers from the Bar Finishing building. One sewer enters the wet well from the east, and conveys the overflow from the charger boom cooling bosh in the shape mill area. The other sewer which enters the wet well from the west conveys non-

contact cooling water from hydraulic cooling units and overhead door heater condensate, both from the bar finishing area. This sewer also receives condensate from the compressors in the facility's sub-station. From the wet well, Sewer No. 5 passes the Special Metals building to the east and south prior to its discharge to the Recirculation Reservoir. A floor drain connection to this sewer from Special Metals was observed.

Sewer No. 8 - Brigham Road Plant Storm Sewer - The main storm sewer for the Brigham Road Plant runs along the east side of the building to the South End Pump House located just west of the Recirculation Reservoir. This sewer collects the majority of the storm runoff from this side of the plant (most roof drains are disconnected), and Rust Furnace Cooling Tower overflows. Other contributions to this sewer may include overflows from either the Shark Pit Pump House sump and the Olson Furnace hot well in the event that the pumps in either of these sumps fail. A roof drain collector from the pickling room of the Brigham Road Plant combines with this storm sewer just south of the plant before discharge to the South End Pump House sump. Contaminant loading from these sources will be minimal if the actual discharges are limited to the non-contact and storm contributions.

3.0 SAMPLING/ANALYSIS AND FLOW MONITORING

A variety of grab and 24-hour composite samples of wastewater were collected over a two day period during which operations at the AL Tech facility were at normal production levels. Five composite samples were collected to represent end-of-pipe conditions for the discharges to the Recirculation Reservoir. Grab samples were collected at seven locations within the facility to characterize specific waste streams to aid in the differentiation of potential sources of the contaminants of concern. At most sampling locations, instantaneous flow measurements were also taken to allow contaminant loadings from each waste stream to be determined. In addition to the wastewater samples, a sediment sample was obtained from the 24" diameter storm sewer discharging from the Special Metals building at its connection with Sewer No. 4 (Sample No. AT4-B). All samples were shipped under chain-of-custody procedures to the analytical laboratories. A sampling report which provides details concerning the field activities completed as part of this wastewater characterization program is presented in Appendix A.

All wastewater samples were analyzed for the parameters Total PCBs, Oil & Grease, Total Suspended Solids, Total Nickel, Total Chromium and Hexavalent Chromium. The pH and temperature of the wastewater samples were recorded in the field immediately following sample acquisition. The sediment sample was analyzed for the parameters Total PCBs, Oil & Grease, Total Nickel, Total Chromium and Hexavalent Chromium. The analytical results for these samples plus the flow monitoring results obtained at each sampling location are presented in Table 1.

4.0 WASTEWATER CHARACTERIZATION AND SEGREGATION

A review of the data generated by this characterization program indicates that all of the wastewater samples exhibited very low contaminant concentrations. Of great significance to this project is the near absence of PCBs in the AL Tech discharges to the reservoir. It is possible that the low levels of PCBs which were detected in the discharges from the Olson Furnace and Shark Pit Pump Houses represent miniscule remnants of PCB contamination left after AL Tech's purging of PCB-containing oils from this facility. These low PCB levels, combined with the proposed installation of treatment equipment at the influent to the Recirculation Reservoir, should minimize AL Tech's liabilities related to continued contamination of the reservoir. The PCB level in the sediment sample obtained from the sewer which conveys wastewater discharges from the Special Metals Plant was below the USEPA's TSCA Task Force action level of 25 ppm.

The remaining parameters were selected due to their requirement as design and/or segregation criteria. The City of Dunkirk has placed limits on AL Tech's discharges of Total Nickel, Hexavalent

TABLE 1

ANALYTICAL RESULTS - WASTEWATER CHARACTERIZATION PROGRAM
AL TECH SPECIALTY STEEL CORPORATION
DUNKIRK, NEW YORK

Sample No.	Sample Medium	Sample Type	PCBs	Oil and Grease	Total Nickel	Total Chromium	Hex. Chromium	TSS	pH	Temp.	Flow
AT2-A	WW	C	1	LT 1.0	0.17	0.08	0.028	5.4	2.95	30.5	340
AT2-B	WW	G	2	1.1	0.92	0.09	0.031	61.1	7.93	32.4	-
AT3-A	WW	C	LT 1	4.8	0.40	0.04	LT 0.001	12.1	7.75	30.0	115
AT3-B	WW	G	1	1.6	1.29	0.26	LT 0.001	103.0	7.61	34.0	-
AT4-A	WW	C	LT 1	LT 1.0	0.13	0.05	0.009	4.5	7.46	29.3	830
AT4-B	SED	G	8000	-	2760.	477.	LT 0.01	-	-	-	-
AT5-A	WW	C	LT 1	3.8	0.14	0.02	0.007	4.3	7.08	32.5	820
AT5-B	WW	G	LT 1	5.3	0.22	0.04	0.012	18.8	6.72	29.6	580
AT5-C	WW	G	LT 1	2.0	LT 0.1	LT 0.01	LT 0.001	LT 1.0	7.91	29.3	7
AT5-D	WW	G	LT 1	2.9	0.21	0.06	0.015	6.1	6.75	28.3	20
AT5-E	WW	G	LT 1	4.5	0.24	0.03	0.015	12.6	7.78	28.2	135
AT8-A	WW	C	LT 1	LT 1.0	LT 0.1	0.58	0.50	LT 1.0	7.63	28.6	15
AT8-B	WW	G	LT 1	LT 1.0	0.13	0.47	0.44	53.0	6.57	26.9	-

Notes:

1. Sample Medium: WW - wastewater; SED - Sewer sediment
2. Sample Type: C - 24-hour composite; G - Grab
3. LT - Less Than
4. PCBs reported in parts per billion
5. Oil & Grease, Nickel, Chromium, Hexavalent Chromium and TSS reported in parts per million
6. pH reported in Standard Units
7. Temperature reported in degrees Celsius
8. Flow reported in gallons per minute

Samples collected during August 10-11, 1988

Chromium and Total Chromium (8 ppm, 2 ppm and 8 ppm, respectively). However, none of the wastewater samples analyzed exhibited levels of these contaminants in excess of the discharge permit limits. This situation presents AL Tech with the option of segregating some of the current Recirculation Reservoir discharges and discharging them to the City of Dunkirk's sewerage system for treatment at the POTW.

As Sewers No. 2 and 3 contain small amounts of PCBs, and therefore, could present AL Tech with an increased environmental liability if they discharged from the facility, it is recommended that the wastewaters in these sewers continue to be conveyed to the Recirculation Reservoir. In addition, because Sewer No. 8 serves as the receiver of overflows from the Olson Furnace and Shark Pit Pump Houses in cases of pump failure, it is also recommended that this sewer discharge remain to the reservoir. In addition, all of these sewers are associated with the Brigham Road Plant and have existing pumping systems, which will optimize the selection of the location for the treatment equipment.

The remaining Sewers No. 4 and 5 should be considered for segregation from the Recirculation Reservoir, which will involve either the implementation of separate recirculation systems or discharge to the municipal sewerage system for off-site treatment. As the City of Dunkirk utilizes combined sewers, the air conditioner cooling water and stormwater runoff from the Main Office building currently entering Sewer No. 4 can be discharged together with the building's sanitary discharges. The flow in Sewer No. 4 from the Main Office has been monitored at less than 5 gpm during a period of cool weather. However, the maximum capacity of cooling water discharged to this sewer by the air conditioning system has been estimated at approximately 100 gpm. As a result, it is likely that the 8" diameter sanitary sewer from the Main Office may not have the remaining capacity in summer to handle the volume of runoff from large storms. Therefore, the re-routing of the storm sewers in the area of the Main Office may be required, possibly discharging stormwater directly to the drainage ditch along Willowbrook Avenue.

The effluent from the scale pit located south of the Bar Finishing and Storage Building which currently enters Sewer No. 5 has been monitored at between 400 and 550 gpm. The maximum discharge capacity from this source is estimated at approximately 800 gpm. This volume of flow may exceed the existing capacity of the sanitary sewers in the area of the scale pit, precluding the discharge of these wastewaters directly to the City sewer system without the installation of a new sewer main within the plant. In addition, another source for cooling water for the bar finishing operations would be required to replace the Reservoir water. As a result, the development of a separate recirculation system to replace the existing system between the Recirculation Reservoir and the Bar Finishing and Storage Building should be considered as a possible solution. This approach would utilize the existing scale pit as the recirculation reservoir, with a cooling tower being installed over the pit to cool the process discharges for re-use within the plant. Discharges from this system would be limited to the blowdown from the cooling tower, which would not be likely to hydraulically overload the plant sewer system near the BFS Building. Discharges from the plant's substation could be connected to the sanitary sewer serving that building.

5.0 ADDITIONAL CONSIDERATIONS

Several aspects of the results of this program warrant additional consideration by AL Tech, including:

- The wastewater samples from Sewers Nos. 2 and 3 exhibited higher concentrations of PCBs at the reservoir than from the pump house sumps. This may indicate either that there is residual PCB contamination in the sewers between the pump houses and the reservoir, or that the data reflect differences between composite and grab samples. AL Tech should consider flushing these sewers prior to the remediation of the reservoir to allow the proper disposal of any contaminated sewer sediments with the materials excavated from the reservoir.

- The low pH (2.95) of sample number AT2-A compared to the grab sample from that sewer may indicate that either a permanent or temporary sewer connection exists between the pickling tanks in the Brigham Road Plant and the Olson Furnace hot well. However, discussions with plant personnel have indicated that this should not be the case. Evidence cited to support the contention that no connection exists is the longevity of brass pump impellers and sprayer nozzles used within this system.

6.0 SUMMARY

The results of this wastewater characterization program indicate that the wastewaters currently being discharged to the Recirculation Reservoir contain low concentrations of the contaminants monitored. To optimize the modification of the five sewers discharging to the reservoir to accommodate the proposed wastewater treatment equipment, it is recommended that Sewer Nos. 4 and 5 be segregated from the reservoir inlet for discharge to the City of Dunkirk sewerage system and recirculation within the BFS Building, respectively. This approach will result in the following:

- Location of the treatment equipment in the immediate vicinity of the Brigham Road Plant, thereby utilizing existing wastewater pumping systems to convey wastewaters to the treatment equipment and minimizing new sewer construction;

- Down-scaling of the treatment equipment from the original estimated capacities to handle the reduced wastewater flow volume to the Recirculation Reservoir;

- Elimination of both wastewater/recirculation water conveyance across property now owned by the Special Metals Corporation and the need for the recirculation pumping system currently located in the basement of the Special Metals building; and

- Increased wastewater flow volumes being discharged to the City of Dunkirk sewerage system as a result of the connection of Sewer No. 4 discharges.

APPENDIX A

FIELD SAMPLING REPORT

SAMPLING REPORT

Recirculation Reservoir Remediation Project

Task 1: Wastewater Characterization

AL TECH SPECIALTY STEEL CORP.

DUNKIRK, NEW YORK

Prepared For:

HAZARD EVALUATIONS, INC.
57 Littlefield Avenue
Buffalo, NY 14211

AUGUST 1988

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

N/SPDES SAMPLING
ENVIRONMENTAL AUDITS
GROUND WATER MONITORING
HAZARDOUS WASTE EVALUATIONS

SAMPLING, FLOW MEASUREMENT, AND ANALYSIS REPORT

This report was prepared as part of the Recirculation Reservoir Remediation Project, Task 1: Wastewater Characterization, for the Al Tech Specialty Steel Corporation in Dunkirk, New York.

Description

Wastewater samples were collected from 12 points along five (5) sewer lines which discharge water into the Recirculation Reservoir. The sewer lines are identified as 2, 3, 4, 5, and 8 and are located on the Sampling Point Locations Map included in this report. One (1) sediment sample was obtained from sample point 4B because there was no water flow detected.

A 24-hour composite sample was collected from each of the five (5) sewer lines. Automatic samplers were installed downstream of all tributary connections. The composite samples are representative of normal wastewater discharge over a 24-hour period.

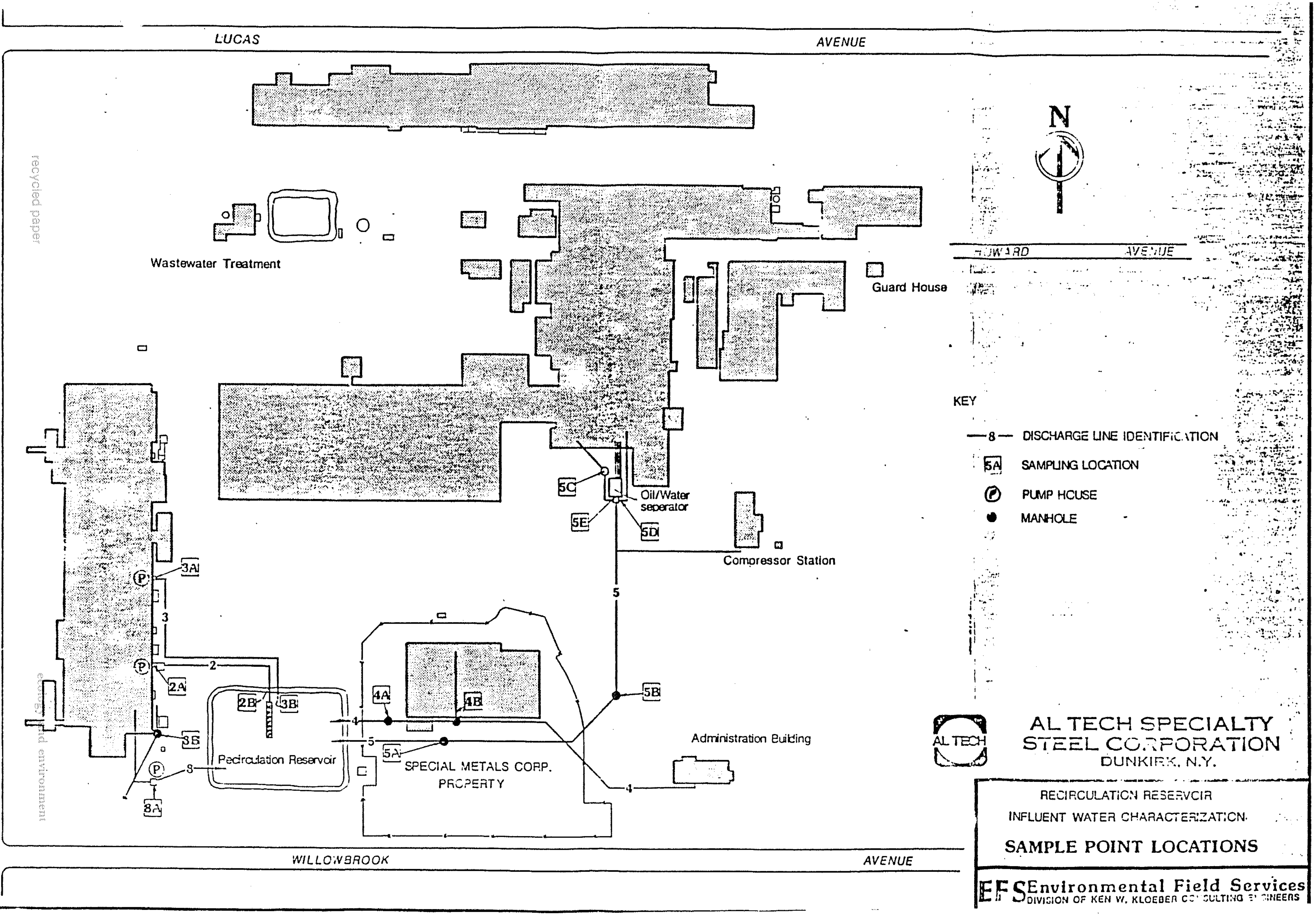
Grab samples were obtained from points tributary to the main sewer lines in order to identify possible sources of pollutant contribution. Instantaneous flow rate measurements were taken at each applicable sampling point to determine the volume of wastewater being discharged to the reservoir. All grab samples and flow rate measurements were taken during normal production periods.

Sampling and Flow Measurement

Composite samples were obtained with ISCO automatic samplers equipped with vinyl tubing and a stainless steel strainer. A measured volume of sample was collected and composited every 30 minutes over a 24-hour period. Grab samples were collected directly into the sample container. All samples were collected, preserved, and immediately transported to ACTS Testing Labs in Buffalo, New York for analysis of Oil and Grease, Suspended Solids, Nickel, Chromium, and Hexavalent Chromium. Field measurements for pH and temperature were performed by EFS technicians at the sampling site. Refer to Appendix A for the laboratory report, chain of custody records, and field sheets.

Sampling procedures and the transfer of samples were in accordance with 40 CFR, Part 136, and the "NPDES Compliance Sampling Manual", approved for publication by the Office of Water Enforcement, U.S. Environmental Protection Agency.

Instantaneous flow rates were determined at each applicable sampling point using either volumetric or velocity-area methods. Velocity measurements were taken with the Marsh-McBirney Model 201 Electromagnetic Velocity Meter.



AL TECH SPECIALTY
STEEL CORPORATION
DUNKIRK, N.Y.

RECIRCULATION RESERVOIR
INFLUENT WATER CHARACTERIZATION

SAMPLE POINT LOCATIONS

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

Sample Point Characteristics

2A

An automatic sampler was installed in the wet well of the Olson Furnace Pump House. This sampling location is designated as 2A. The inlet line of the sampler was positioned approximately one (1) foot below the water surface, directly beneath the 10 inch pipe discharging water into the well. Flow measurements of depth and velocity were taken directly from the 10 inch pipe. No other waters were observed entering the wet well. The processes contributing water to the pump house operate seven (7) days per week, 24 hours per day. The pumps discharging water from the wet well to the reservoir were observed operating continuously.

2B

Waters from the Olson Furnace Pump House are discharged directly into the Recirculation Reservoir through a series of heat dissipating sprayers. A grab sample was collected from a relief line connected directly to the sprayers. This point is identified as 2B. No flow measurement was taken.

3A

The sampling line of an automatic sampler was installed directly into the 10 inch pipe discharging water to the wet well of the Shark Pit Pump House. This sample point is identified as 3A. Flow measurements for depth and velocity were obtained from the 10 inch pipe. No other waters were observed entering the wet well. Processes discharging water to this location operate 7 days per week, 24 hours per day at varying rates of production. The pumps cycle approximately every four (4) minutes for three (3) minute intervals. During a pumping interval, the surface of water in the wet well is lowered 0.72 feet.

3B

The Shark Pit Pump House discharges waters directly into the Recirculation Reservoir. A grab sample was taken from the discharge pipe at the reservoir. This point is identified as 3B. No flow measurement was taken.

4A

Sample location 4A is a manhole located on the west side of the Special Metals building. An automatic sampler was installed with the inlet line positioned in the 24 inch discharge pipe. This manhole is the first accessible point upstream from the reservoir on sewer line 4. Flow measurements of depth and velocity were recorded.

4B

The next manhole upstream of 4A is identified as sampling point 4B. A 24 inch tributary line runs under the Special Metals building and connects with the 24 inch main line at this point. There was no water flow observed in the 24 inch tributary line, therefore a sediment sample was obtained at the intersection with the main sewer. Approximately two (2) inches of sediment was measured in the pipe. No other manholes could be located on sewer line 4.

5A

An automatic sampler was installed in the first manhole upstream of the reservoir on sewer line 5. The sample point is identified as 5A. This manhole is located in an open area south of sample point 4B on Special Metals property. Three (3) other lines enter the manhole at various elevations, however no water flow was observed in any line except the 15 inch main sewer. The sampler inlet line and flow measurements for depth and velocity were taken in the 15 inch sewer.

5B, 5C, 5D, 5E

Grab samples were collected from four tributary points upstream of 5A. Flow measurements for depth and velocity were taken at 5B, 5C, and 5D. Sample point 5E is the weir discharge from the Oil/Water separator. A depth measurement was taken to determine the flow rate. All waters discharging through sewer line 5 are from a variety of operations in the BFS Mill. These operations are running between 7 A.M. and 4 P.M. daily.

8A

An automatic sampler was installed to collect samples from the 12 inch sewer line discharging water into the wet well at the pump house south of the Brigham Road Plant (BRP). This sampling point is identified as 8A. The flow rate of water entering the wet well was determined by measuring the discharge from the 12 inch pipe using a volumetric method. There was no other inflow observed. The pump operates for approximately 8½ minutes, lowering the surface of water in the wet well by two (2) feet.

8B

A grab sample was collected from the manhole, identified as 8B, located at the southeast corner of the BRP. Depth and velocity measurements were taken, to determine flow rates, from the 24 inch storm sewer.

Refer to Table 1 for descriptions of sample types and locations.

TABLE 1

Sample Point Locations

Sample Point	Type of Sample	Location
2A	Composite	Wet well to Olson Furnace Pump House
2B	Grab	Discharge line at Reservoir
3A	Composite	10 inch pipe entering wet well to Shark Pit Pump House
3B	Grab	Discharge line at Reservoir
4A	Composite	Manhole on west side of Special Metals building
4B	Grab (Sediment)	Manhole on south side of Special Metals building inside 24 inch pipe that connects to main sewer line
5A	Composite	Manhole south of Special Metals facility
5B	Grab	Manhole in grassy area at north west corner of Administration parking lot
5C	Grab	Concrete chamber at north west corner of oil/water separater
5D	Grab	8 inch pipe entering east side of effluent chamber of the oil/water separater
5E	Grab	Effluent weir of oil/water separater
8A	Composite	12 inch pipe entering the wet well of the pump house, south of the Brigham Road Plant (BRP)
8B	Grab	Manhole at southeast corner of BRP on 24-inch storm sewer

TABLE 2A

Summary of Analytical Testing

Client: Hazard Evaluations/Al Tech Specialty Steel
Project No: 50-37
Laboratory: ACTS Testing Labs

Sample Location:	2A	2B	3A	3B
Date Sampled :	8/10-11/88	8/10/88	8/10-11/88	8/10/88
Time :	24-hour	3:30 PM	24-hour	3:25 PM
Sample I.D. :	AT2-A	AT2-B	AT3-A	AT3-B
Type of Sample :	Composite	Grab	Composite	Grab
parameter (mg/l)				
pH units	2.95	7.93	7.75	7.61
Temperature (°C)	30.5	32.4	30.0	34.0
TSS	5.4	61.1	12.1	103
Oil and Grease(T)	<1.0	1.1	4.8	1.6
Nickel	0.17	0.92	0.40	1.29
Chromium	0.08	0.09	0.04	0.26
Hex-Chromium	0.028	0.031	<0.001	<0.001
Flow (gpm)	340	----	115	----

< = less than

TABLE 2B

Summary of Analytical Testing

Client: Hazard Evaluations/Al Tech Specialty Steel
Project No: 50-37
Laboratory: ACTS Testing Labs

Sample Location:	4A	4B	8A	8B
Date Sampled :	8/10-11/88	8/10/88	8/10-11/88	8/11/88
Time :	24-hour	2:55 PM	24-hour	11:55 AM
Sample I.D. :	AT4-A	AT4-B	AT8-A	AT8-B
Type of Sample :	Composite	Grab	Composite	Grab
parameter (mg/l)				
pH units	7.46	----	7.63	6.57
Temperature (°C)	29.3	----	28.6	26.9
TSS	4.5	----	<1.0	53.0
Oil and Grease(T)	<1.0	----	<1.0	<1.0
Nickel	0.13	2760	<0.1	0.13
Chromium	0.05	477	0.58	0.47
Hex-Chromium	0.009	< 0.01	0.50	0.44
Flow (gpm)	830	----	15	----

< = less than

TABLE 2C

Summary of Analytical Testing

Client:	Hazard Evaluations/Al Tech Specialty Steel
Project No:	50-37
Laboratory:	ACTS Testing Labs

Sample Location:	5A	5B	5C	5D	5E
Date Sampled :	8/10-11/88	8/11/88	8/11/88	8/11/88	8/11/88
Time :	24-hour	10:07 AM	10:20 AM	8:45 AM	8:30 AM
Sample I.D. :	AT5-A	AT5-B	AT5-C	AT5-D	AT5-E
Type of Sample :	Composite	Grab	Grab	Grab	Grab
parameter (mg/l)					
pH units	7.08	6.72	7.91	6.75	7.78
Temperature (°C)	32.5	29.6	29.3	28.3	28.2
TSS	4.3	18.8	< 1.0	6.1	12.6
Oil and Grease(T)	3.8	5.3	2.0	2.9	4.5
Nickel	0.14	0.22	< 0.1	0.21	0.24
Chromium	0.02	0.04	< 0.01	0.06	0.03
Hex-Chromium	0.007	0.012	< 0.001	0.015	0.015
Flow (gpm)	820	580	7	20	135

< = less than

APPENDIX

LABORATORY REPORT

CHAIN OF CUSTODY RECORDS

FIELD SHEETS

ACTS TESTING LABS, INC.

25 Anderson Road • Buffalo, N.Y. 14225-4906 • Tel: (716) 897-3300 • Fax: (716) 897-0876

TECHNICAL REPORT 8-2175E
JOB # 50-37

August 18, 1987

Mr. Marc Smith
ENVIRONMENTAL FIELD SERVICES

SUBJECT:

Analyses of thirteen (13) samples for various parameters. The samples were received on August 11, 1988.

RESULTS:

	Total Suspended Solids	Nickel	Chromium	Hexavalent Chromium	Oil & Grease
AT2-B	61.1	0.92	0.09	0.031	1.1
AT3-B	103	1.29	0.26	LT 0.001	1.6
AT4-B**	-	2,760	477	LT 0.01	-
AT5-A	4.3	0.14	0.02	0.007	3.8
AT5-B	18.8	0.22	0.04	0.012	5.3
AT5-C	LT 1.0	LT 0.1	LT 0.01	LT 0.001	2.0
AT5-D	6.1	0.21	0.06	0.015	2.9
AT5-E	12.6	0.24	0.03	0.015	4.5
AT4-A	4.5	0.13(0.15)*	0.05(0.06)*	0.009(0.009)*	LT 1.0
AT3-A	12.1(11.7)*	0.40	0.04	LT 0.001	4.8
AT2-A	5.4	0.17	0.08	0.028	LT 1.0
AT8-A	LT 1.0	LT 0.1	0.58	0.50	LT 1.0
AT8-B	53.0	0.13	0.47	0.44	LT 1.0

LT = Less Than
* = Duplicate Result
** = Sample was a Soil. Results are reported as micrograms per gram (ug/g).
Results are reported as milligrams per liter (mg/l).

EXPERIMENTAL:

The analyses were conducted according to procedures listed in "Standard Methods for the Examination of Water and Wastewater", 16th Edition, 1985.

ACTS TESTING LABS, INC.

Elmer K. Gerbracht

Elmer K. Gerbracht
Technical Director

ACTS TESTING LABS, INC.

Charles E. Hartke

Charles E. Hartke
Chemistry Laboratory Manager

/sms

CHAIN OF CUSTODY RECORD

Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

PROJECT NO. 50-37

SAMPLERS(SIGNATURE): Mac W. Smith

SAMPLE I.D.	DATE	TIME	SAMPLE TYPE	PRESERVATION	SAMPLE LOCATION	NO. OF CONTAINERS	Oil and Grease (T)	Ni, Cr	TSS	Hex-Cr			REMARKS
AT2-B	8/10/88	3:15 p	Grab	H_2SO_4 HNO_3 4°C	Line 2 at reservoir	3	✓	✓	✓	✓			Water
AT3-B	↓	3:15 p	↓	↓	Line 3 at reservoir	3	✓	✓	✓	✓			Water
AT4-B	↓	2:55 p	↓	4°C	Line 4 Manhole	1 ~~2~~		✓		✓			Grit

RELINQUISHED BY(SIGNATURE): Mac W. Smith	DATE/TIME 8/11/88 7:00A	RECEIVED BY(SIGNATURE):	
RELINQUISHED BY(SIGNATURE):	DATE/TIME 8.11.88 8:40A	RECEIVED BY(SIGNATURE):	
RELINQUISHED BY(SIGNATURE):	DATE/TIME	RECEIVED BY(SIGNATURE):	
RELINQUISHED BY(SIGNATURE):	DATE/TIME	RECEIVED BY(SIGNATURE):	
RECEIVED FOR LABORATORY BY(SIGNATURE): Sue Schwab	DATE/TIME 8/11/88 8:40am	NAME & ADDRESS OF LABORATORY: ACTS Testing Labs, Inc. 3916 Broadway Buffalo, New York 1422	

CHAIN OF CUSTODY RECORD

Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

PROJECT NO. 50-37

SAMPLERS(SIGNATURE): Marc W. Smith

SAMPLE I.D.	DATE	TIME	SAMPLE TYPE	PRESERVATION	SAMPLE LOCATION	NO. OF CONTAINERS	O+G (T)	Ni, Cr	TSS, Hex-Cr				REMARKS
AT5-A	8/11/88	1:15P	Comp.	H_2SO_4 HNO_3 4°C	Line 5 Manhole A	3	✓	✓	✓				
AT5-B		10:07A	Grab		Line 5 Manhole B	3	✓	✓	✓				
AT5-C		10:20A	Grab		Line 5 Concrete Chamber	3	✓	✓	✓				
AT5-D		8:45A	Grab		Line 5 Oil Separator effluent Chamber	3	✓	✓	✓				
AT5-E		8:30A	Grab		Line 5 Oil Separator effluent wier	3	✓	✓	✓				
AT4-A		1:45P	Comp.		Line 4 Manhole A	3	✓	✓	✓				
AT3-A		10:45A	Comp.		Line 3 Shark Pit Pump House	3	✓	✓	✓				
AT2-A		11:15A	Comp.		Line 2 ~~Shark Pit~~ Olson Furnace	3	✓	✓	✓				
AT8-A		11:45A	Comp.		Line 8 Pump House BRP South	3	✓	✓	✓				
~~8~~													
AT8-B	↓	11:55A	Grab	↓	Line 8 Manhole B	3	✓	✓	✓				

RELINQUISHED BY(SIGNATURE): Marc W. Smith — DATE/TIME: 8/11/88 3:30pm — RECEIVED BY(SIGNATURE): Douglas M. Ruszczyk

RELINQUISHED BY(SIGNATURE): Douglas M. Ruszczyk — DATE/TIME: 8/11/88 4:04pm — RECEIVED BY(SIGNATURE):

RELINQUISHED BY(SIGNATURE): — DATE/TIME: — RECEIVED BY(SIGNATURE):

RELINQUISHED BY(SIGNATURE): — DATE/TIME: — RECEIVED BY(SIGNATURE):

RECEIVED FOR LABORATORY BY(SIGNATURE): — DATE/TIME: 8/11/88 4:06pm

NAME & ADDRESS OF LABORATORY:
ACTS Testing Labs, Inc.
3916 Broadway
Buffalo, New York 14227

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL

Address: DUNKIRK, N.Y.

Contact: Phone:

INSTALLATION

Sample Point: SP-2

Sample Location: OLSON PUMP HOUSE ; WET WELL OFF OF LINE 2

Date: 8 / 10 / 88 Crew: DR / MS

Weather: HAZY, 80°F

Sampling Device: ISCO 1680 #2, VINYL TUBING & STAINLESS STEEL STRAINER

Time at Installation: 10:00 AM Type of Sample: 24 HOUR COMPOSITE

Sample Interval: 30 MIN. Sample Volume: 145 ml

Comments and Observations: SAMPLE LINE AND STRAINER PULLING SAMPLING OUT OF ELSON SUMP PIT (IE. WET WELL)

COLLECTION

Date: 8 / 11 / 88 Crew: DR / MS

Weather: SUNNY 85°F

Time at Collection: 11:15 AM

Field Measurements:

7:35AM DR pH Calibration: Buffer 7- 7.01 ; Buffer 4- ; Buffer 10- 10.01
(time/initial)

pH Measurement: 2.95 Temperature: 30.5°C

Identification: AT2-A

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W Smith Date: 8 / 11 / 88
(Supervisor)

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP.

Address: DUNKIRK, N.Y

Contact: Phone:

INSTALLATION

Sample Point: AT2-B

Sample Location: OLSON PUMP HOUSE DISCHARGE (LINE 2) INTO RECIRCULATING RESEVOIR

Date: / / Crew:

Weather:

Sampling Device:

Time at Installation: Type of Sample:

Sample Interval: Sample Volume:

Comments and Observations:

COLLECTION

Date: 8 / 10 / 88 Crew: DR/MS

Weather: HAZY, 88°F

Time at Collection: 3:10 PM

Field Measurements:

3:15 MS pH Calibration: Buffer 7- 6.99 ; Buffer 4- 4.02 ; Buffer 10-
(time/initial)

pH Measurement: 7.93 Temperature: 32.4°C

Identification: AT2-B

Physical Observations: CLEAR WITH SOME SETTLING SOLIDS AND AN OIL SHEEN OBSERVED.

Laboratory: ACTS

Comments: GRAB SAMPLES TAKEN FOR PCB's, Cr & Ni, TSS & (Cr HEX) [illegible] AND pH & TEMPERATURE

Reviewed By: Marc W. Smith
(Supervisor)

Date: 8 / 11 / 88

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL
Address: DUNKIRK, N.Y
Contact: Phone:

INSTALLATION

Sample Point: SP-3
Sample Location: SUMP PIT FROM SHARK PIT, WET WELL OFF OF LINE 3
Date: 8 / 10 / 88 Crew: DR/MS
Weather: HAZY 80°F
Sampling Device: ISCO 2700 ; VINYL TUBING & STAINLESS STEEL STRAINER
Time at Installation: 9:15AM Type of Sample: 24 HOUR COMPOSITE
Sample Interval: 30min Sample Volume: 196 mL
Comments and Observations: STAINLESS STEEL STRAINER PULLING SAMPLE FROM INCOMING 10" ∅ PIPE

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS
Weather: SUNNY 85°F
Time at Collection: 10:45 AM
Field Measurements:
7:30AM DR pH Calibration: Buffer 7- 7.01 ; Buffer 4- ; Buffer 10- 10.01
(time/initial)
pH Measurement: 7.75 Temperature: 30.0°C
Identification: AT3-A
Physical Observations: CLOUDY WITH AN OILY, SILT DEPOSIT ON BOTTOM OF POT.
Laboratory: ACTS
Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith Date: 8 / 11 / 88
(Supervisor)

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP.

Address: DUNKIRK, N.Y

Contact: ______ Phone: ______

INSTALLATION

Sample Point: AT3-B

Sample Location: SHARK PIT DISCHARGE (LINE 3) INTO RECIRCULATING RESEVOIR

Date: / / Crew: ______

Weather: ______

Sampling Device: ______

Time at Installation: ______ Type of Sample: ______

Sample Interval: ______ Sample Volume: ______

Comments and Observations: ______

COLLECTION

Date: 8 / 10 / 88 Crew: DR/MS

Weather: SUNNY, 88°F

Time at Collection: 3:15 PM

Field Measurements:

3:15 MS (time/initial) pH Calibration: Buffer 7- 6.99 ; Buffer 4- 4.02 ; Buffer 10- ______

pH Measurement: 7.61 Temperature: 34.0

Identification: AT3-B

Physical Observations: CLOUDY WITH SOLIDS PRESENT AND OIL SHEEN OBSERVED

Laboratory: ACTS

Comments: GRAB SAMPLES TAKEN FOR PCB'S, Cr & Ni, TSS & Cr (HEX), O&G AND pH & TEMPERATURE

Reviewed By: Marc W Smith (Supervisor) Date: 8 / 11 / 88

Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL

Address: DUNKIRK, N.Y.

Contact: ______ Phone: ______

INSTALLATION

Sample Point: SP-4

Sample Location: LINE 4, MANHOLE A AT SPECIAL METALS PLANT

Date: 8 / 10 / 88 Crew: DR/MS

Weather: HAZY 85°F

Sampling Device: QUALITY CONTROL SAMPLER WITH 3/8" ID VINYL TUBING & STAINLESS STEEL STRAINER

Time at Installation: 2:30 PM Type of Sample: 24 HOUR COMPOSITE

Sample Interval: 30 MIN Sample Volume: 240 ML

Comments and Observations: STRAINER SAMPLING IN DOWNSTREAM SECTION OF 24" Φ PIPE

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 88°F

Time at Collection: 1:45 PM

Field Measurements:

7:35AM DR (time/initial) pH Calibration: Buffer 7- 7.01 ; Buffer 4- ______ ; Buffer 10- 10.01

pH Measurement: 7.46 Temperature: 29.3°C

Identification: AT4-A

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith (Supervisor) Date: 8 / 11 / 88

Environmental Field Services

DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP

Address: DUNKIRK, N.Y

Contact: ____________ Phone: ____________

INSTALLATION

Sample Point: SP4-B

Sample Location: LINE 4, 24" Φ LINE FROM SPECIALS METALS INTO LINE 4

Date: __/__/__ Crew: ____________

Weather: ____________

Sampling Device: ____________

Time at Installation: ____________ Type of Sample: ____________

Sample Interval: ____________ Sample Volume: ____________

Comments and Observations: GRAB SAMPLES TAKEN FOR PCB, Ni & Cr

COLLECTION

Date: 8 / 10 / 88 Crew: DR/MS

Weather: HAZY 88°F

Time at Collection: 2:55 PM

Field Measurements:

____________ pH Calibration: Buffer 7- ______; Buffer 4- ______; Buffer 10- ______
(time/initial)

pH Measurement: ____________ Temperature: ____________

Identification: ATH-B

Physical Observations: GRIT & SLUDGE CONTAINING SAND, SILT & COARSER PEBBLES

Laboratory: ACTS

Comments: GRAB SAMPLE TAKEN OF SLUDGE LAYER, 2" THICK, AT ENTRANCE OF 24" Φ SPECIAL METALS LINE TO LINE 4. THERE WAS NO FLOW PRESENT IN SPECIAL METALS LINE.

Reviewed By: Marc W. Smith Date: 8 / 11 / 88
(Supervisor)

EFS **Environmental Field Services**
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP

Address: DUNKIRK, N.Y

Contact: Phone:

INSTALLATION

Sample Point: SP5

Sample Location: LINE 5, MANHOLE A IN SPECIAL METALS PLANT

Date: 8 / 10 / 88 Crew: DR/MS

Weather: HAZY 85°F

Sampling Device: ISCO 1680 #3 WITH VINYL TUBING (3/8" ID) & STAINLESS STEEL STRAINER

Time at Installation: 1:50 PM Type of Sample: 24 HOUR COMPOSITE

Sample Interval: 30 MIN Sample Volume: 155 mL

Comments and Observations: STRAINER SAMPLING IN 15"ø PIPE IN DOWNSTREAM SECTION

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 88°F

Time at Collection: 1:15 PM

Field Measurements:

7:35AM DR (time/initial) pH Calibration: Buffer 7- 7.01 ; Buffer 4- ; Buffer 10- 10.01

pH Measurement: 7.08 Temperature: 32.5°C

Identification: AT5-A

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith (Supervisor) Date: 8/11/88

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: ALTECH SPECIALTY STEEL CORP

Address: DUNKIRK, N.Y

Contact: Phone:

INSTALLATION

Sample Point: SP-5B

Sample Location: MANHOLE ON LINE 5 DOWNSTREAM FROM OIL & WATER SEPARATOR

Date: / / Crew:

Weather:

Sampling Device:

Time at Installation: Type of Sample:

Sample Interval: Sample Volume:

Comments and Observations: GRAB SAMPLES COLLECTED FOR pH, TSS, Cr(HEX), Cr, Ni, AND O&G(T) AND PCB

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 88°F

Time at Collection: 10:07AM

Field Measurements:

7:35AM DR pH Calibration: Buffer 7- 7.01 ; Buffer 4- ; Buffer 10- 10.01
(time/initial)

pH Measurement: 6.72 Temperature: 29.6 °C

Identification: AT5-B

Physical Observations: SLIGHTLY CLOUDY WITH SOME SOLIDS SETTLING

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith Date: 8/ 11 / 88
(Supervisor)

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP.

Address: DUNKIRK, N.Y.

Contact: ______ Phone: ______

INSTALLATION

Sample Point: SP-5C

Sample Location: INCOMING LINE WEST OF OIL ; WATER SEPERATOR AT NORTH END OF SEPERATOR

Date: / / Crew: ______

Weather: ______

Sampling Device: ______

Time at Installation: ______ Type of Sample: ______

Sample Interval: ______ Sample Volume: ______

Comments and Observations: GRAB SAMPLES COLLECTED FOR pH, TSS; Cr (HEX) Cr, Ni AND O&G(T) AND PCB

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 88°F

Time at Collection: 10:20AM

Field Measurements:

7:35AM DR pH Calibration: Buffer 7- 7.01 ; Buffer 4- ______ ; Buffer 10- 10.01
(time/initial)

pH Measurement: 7.91 Temperature: 29.3°C

Identification: AT5-C

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith Date: 8 / 11 / 88
(Supervisor)

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL. TECH SPECIALTY STEEL CORP.

Address: DUNKIRK, N.Y.

Contact: ______ Phone: ______

INSTALLATION

Sample Point: SP5-D

Sample Location: INCOMING LINE TO EAST SIDE OF OIL: WATER SEPARATOR

Date: / / Crew: ______

Weather: ______

Sampling Device: ______

Time at Installation: ______ Type of Sample: ______

Sample Interval: ______ Sample Volume: ______

Comments and Observations: GRAB SAMPLES TAKEN FOR pH, TSS, Cr(HEX) Cr, Ni AND O&G(T) AND PCB

COLLECTION

Date: 8 / 11 / 88 Crew: DE/NS

Weather: SUNNY 88°F

Time at Collection: 8:45AM

Field Measurements:

7:35AM DR pH Calibration: Buffer 7 - 7.0 ; Buffer 4 - ______ ; Buffer 10 - 10.01
(time/initial)

pH Measurement: 6.75 Temperature: 28.3°C

Identification: AT5-D

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Max W. Smith Date: 8 / 11 / 88
(Supervisor)

Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP.

Address: DUNKIRK, N.Y.

Contact:

Phone:

INSTALLATION

Sample Point: SP 5E

Sample Location: OIL & WATER SEPARATOR AT RECTANGULAR WEIR END CONTRACTION

Date: / /

Crew:

Weather:

Sampling Device:

Time at Installation:

Type of Sample:

Sample Interval:

Sample Volume:

Comments and Observations: GRAB SAMPLES COLLECTED FOR pH, TSS, Cr (HEX) Cr, Ni, and O&G(T) AND PCB

COLLECTION

Date: 8 / 11 / 88

Crew: DR/MS

Weather: SUNNY 85°F

Time at Collection: 8:30am

Field Measurements:

7:35am DR (time/initial) pH Calibration: Buffer 7- 7.01; Buffer 4- ; Buffer 10- 10.01

pH Measurement: 7.78

Temperature: 28.2°C

Identification: AT5-E

Physical Observations: SLIGHTLY CLOUDY

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith (Supervisor)

Date: 8/11/88

EFS Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

6397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL

Address: DUNKIRK, N.Y.

Contact: ______ Phone: ______

INSTALLATION

Sample Point: SP-8

Sample Location: LINE 8 PUMP HOUSE AT SW CORNER OF PLANT (BZP SOUTH)

Date: 8 / 10 / 88 Crew: DR/MS

Weather: HAZY, 82°F

Sampling Device: ISCO 1680 #4 WITH VINYL TUBING & STAINLESS STEEL STRAINER

Time at Installation: 11:40 AM Type of Sample: 24 HOUR COMPOSITE

Sample Interval: 30 MIN. Sample Volume: 110 ml

Comments and Observations: SAMPLE BEING DRAWN FROM SUMP PIT (IE WET WELL)

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 85°F

Time at Collection: 11.45 AM

Field Measurements:

7.35 DR. pH Calibration: Buffer 7- 7.01 ; Buffer 4- ______ ; Buffer 10- 10.01
(time/initial)

pH Measurement: 7.63 Temperature: 28.6°C

Identification: AT8-A

Physical Observations: CLEAR

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith Date: 8 / 11 / 88
(Supervisor)

Environmental Field Services
DIVISION OF KEN W. KLOEBER CONSULTING ENGINEERS

8397 Boston State Road
Boston, NY 14025
716 941-5544

SAMPLING FIELD SHEET

Client Name: AL TECH SPECIALTY STEEL CORP.

Address: DUNKIRK., N.Y.

Contact: Phone:

INSTALLATION

Sample Point: SP8-B

Sample Location: MANHOLE B ON LINE 8 AT SE. CORNER OF BRP

Date: / / Crew:

Weather:

Sampling Device:

Time at Installation: Type of Sample:

Sample Interval: Sample Volume:

Comments and Observations: GRAB SAMPLE COLLECTED FOR pH, PCB, TSS, Cr (HEX), Cr, Ni, AND O&G (TOTAL)

COLLECTION

Date: 8 / 11 / 88 Crew: DR/MS

Weather: SUNNY 85°F

Time at Collection: 11:55AM

Field Measurements:

7:35AM DR pH Calibration: Buffer 7- 7.01 ; Buffer 4- ; Buffer 10- 10.01
(time/initial)

pH Measurement: 6.57 Temperature: 26.9°C

Identification: AT8-B

Physical Observations: CLEAR WITH SOLIDS SETTLING ON BOTTOM OF JAR. OIL SHEEN OBSERVED ON SURFACE.

Laboratory: ACTS

Comments: ICED DOWN SAMPLES

Reviewed By: Marc W. Smith (Supervisor) Date: 8 / 11 / 88

APPENDIX B

PCB ANALYTICAL RESULTS

ENVIRONMETRICS
10679 Midwest Industrial Blvd.
St. Louis, MO 63132
(314) 427-0550

HAZARD EVALUATIONS, INC.
57 LITTLEFIELD AVENUE
BUFFALO, NY 14211

PROJECT #00204-30

ANALYSIS REPORT

PCBs IN WATER

ASTM D-3534

SAMPLE NO.	IDENTIFICATION	TOTAL ppb	TYPE
AT8A		<1	----
AT2A		1	1242/1260
AT3A		<1	----
AT4A		<1	----
AT5A		<1	----
AT5B		<1	----
AT5C		<1	----
AT5D		<1	----
AT5E		<1	----
AT8B		<1	----
AT2-B		2	1242/1260
AT3-B		1	1242/1260

RECEIVED
AUG 22 1988
Hazard Evaluations, Inc.

AUGUST 16, 1988

WAYNE L. COOPER
LABORATORY DIRECTOR

American Council of Independent Laboratories • American Society for Testing and Materials • American Chemical Society • American Industrial Hygiene Association

ENVIRONMETRICS
10679 Midwest Industrial Blvd.
St. Louis, MO 63132
(314) 427-0550

HAZARD EVALUATIONS, INC.
57 LITTLEFIELD AVENUE
BUFFALO, NY 14211

PROJECT #00204-30

ANALYSIS REPORT

PCBs IN SOLID

SAMPLE NO.	IDENTIFICATION	TOTAL ppm	TYPE
AT4-B		8	1242/1254

AUGUST 16, 1988

WAYNE L. COOPER
LABORATORY DIRECTOR

APPENDIX B

DRILL LOGS

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/15/88
WELL/BORING MW-1
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickerson
DRILL METHOD Rotary Auger
PAGE 1 OF 2
WATER LEVEL FIRST ENCOUNTERED 13'
FINAL 11.5'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
-		6				
1 -	0	10	Dry	Brown silty clay loam compacted	Fill	67%
-		7				
2 -		11		Brown silty clay loam		
-		35		Topsoil		
3 -	0	15	Dry	Brown silty clay		58%
-		12				
4 -		9				
-		9				
5 -	0	7	Dry	Brown silty clay	Stone blocking sampler aperture	8%
-		12				
6 -		17				
-		57				
7 -		38	Dry	Brown silty clay	Hit cobble	38%
-	0	70				
8 -		100/5"				
-		50				
9 -		70				
-		100/3"	Dry	Brown sandy silty loam	Moderately compacted	63%
10 -	0					
-		39		Black weathered compact shale		
11 -		63		Shale with limonite		92%
-		77	Dry	Staining; inclusions 1-5 mm		
12 -		100/5½"		< 5%		

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/15/88
WELL/BORING MW-1
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickerson
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 13'
FINAL 11.5'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
	6	--				
		61		Tight black uncontaminated		
13		50	Damp	Weathered Black Shale		
		55		No limonite staining		
14		54		Inclusions 1-5 mm 5%		
		14			Water in hole	75%
15	0	39		Weathered balck silty shale		
		51				
16		100/4"		15.8' fissle shale		
17				B.O.H.	17.3'	

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/12/88
WELL/BORING MW-2
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 1 OF 2
WATER LEVEL FIRST ENCOUNTERED 13'
FINAL 13'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		5		Tan crumbly silty loam		100%
1	0	15				
		24	Dry			
2		25				
		29				
3		25	Dry	Crumbly tan silt with limonite staining on inclusions 1-2 mm; <5%		75%
	0	24				
4		26				
		9		Tan silt with pebbles 1-20 mm 15% slight compaction		100%
5		14				
	0	23	Dry			
6		30				
		19				
7	0	24	Dry	Brown silty loam, semi consolidated; pebble inclusions 1-10 mm (shale fragments)		75%
		100/5"				
8		-				
		18		Brown pebbly silt with limonite staining		100%
9		27				
	0	50	Dry			
10		80				
		12				
11		30		Black weathered shale with limonite staining; pebbles 5-10 mm 15%; moderate compaction		100%
	0	40	Dry			
12		51				

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/12/88
WELL/BORING MW-2
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 13'
FINAL 13'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		8		At 12.5" clay; weathered black shale with shale inclusions 1-10 mm 15%; mild plasticity	Pyrite nydules 1-2mm <5%	100%
		15				
13	0	28	Damp			
		19				
14		9				
		10		Black silty clay/weathered shale; inclusions 1-5 mm 10%; moderate cohesion	Very plastic	100%
15	0	11				
		15				
16		8	Moist	Black cohesive silty clay to 17.7'; fissle laminated black shale to tip		88%
		8				
17	0	14				
		18			Water in hole	
18		100/4"		Fissle black shale thinly laminated		20%
19						
20				B.O.H.	19.7%	

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/12/88
WELL/BORING MW-3
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickerso
DRILL METHOD Rotary Auger
PAGE 1 OF 2
WATER LEVEL FIRST ENCOUNTERED 10'
FINAL 7.3'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		12				
1	0	19		Brown/black gravelly silt loam with pebbles 1-3 cm 20%	Cobble blocked tip	25%
		11				
2		10				
		5				
3	0	6	Dry	Brown/black sandy clay silt loam moderate cohesion		54%
		7				
4		10				
		5				
5	0	16	Damp	Brown clay silt with inclusions 1-5 mm < 5% moderate cohesions		88%
		18				
6		21				
		21				
7	0	30	Dry	Brown silty clay; pebbles 1-5 mm <10%; moderately high cohesion		100%
		53				
8		73				
		14				
9	0	17	Damp	Black-gray weathered shale; black rounded shale inclusions 1-10 mm <10%; moderately high cohesion		75%
		23				
10		28				
		21				
11	0	23	Damp	Black weathered silt; slightly laminated		
		31				
12		23				

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/12/88
WELL/BORING MW-3
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 10'
FINAL 7.3'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		42				
13		27		Thin, finely laminated fissle black shale	1 ft. water in hole	100%
	0.2	46				
14		26				
15				B.O.H.	15'	

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/11/88
WELL/BORING MW-4
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 1 OF 2
WATER LEVEL FIRST ENCOUNTERED 14'
FINAL 12.6'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
-		10				
1 -	0	10	Dry	0-6" gravel, asphalt 6"-19" tan brown clay silt		79%
-		21				
2 -		20				
—	2	6	Dry	Brown clay silt, moderate compaction; black pebble inclusions 1-5 mm < 5%	HnU possibly hexane	41%
3 -		12				
-		22				
4 -		35				
-		11				
5—	2	36	Dry	Compact tan silty clay; pebble inclusions 1-5 mm < 5% moderately cohesive		100%
-		46				
6 -		60				
-		21				
7 -	0	34	Dry	Brown - tan silty clay; limonite staining	Poor cohesion	83%
—		100/5"				
8 -		-				
-		19				
9 -	0	30	Dry	Crumbly weathered black shale/ compacted silty clay; shale inclusions 1-10 mm		92%
-		35				
10—		51				
-		18				
11 -		27	Damp	Gray - black silty clay with shale fragments; moderately cohesive; black shale inclusions 1-10 mm		
-		33				
12 -		34				

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/11/88
WELL/BORING MW-4
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 14
FINAL 12.6'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		11				
13	0.8	17	Damp	Gray - black silty clay; weathered black shale; moderately plastic and cohesive black pebble inclusive 1-5 mm < 5%		100%
		21				
14		22				
		8				
15	0	16	Moist	Black silty clay with pebble inclusion		71%
		43				
16		35		Weathered, laminated, fissle shale		
17						
18				B.O.H.	18.3'	

recycled paper

ecology and environment

DRILL LOG

PROJECT AS-4010 ELEVATION DATE 8/11/88

WELL/BORING MW-5 LOCATION Altech Specialty Steel LOGGER J. Nickers

DRILL METHOD Rotary Auger Corp, Dunkirk, New York PAGE 1 OF 2

WATER LEVEL FIRST ENCOUNTERED 11' FINAL 9.9'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		6		Brown, crumbly silty loam		100%
1	0	12	Dry	Tan silty clay loam		
		6				
2		12				
		6				
3	0	10	Dry	Tan silty clay, moderate cohesion	Moderately plastic	80%
		18				
4		19				
		13				
5	0	20		Tan slightly sandy silty clay; pebbles 1-5 mm 5%	Probably hit a cobble	83%
		35				
6		50/2"				
		45				
7	0	35		Very compacted brown/tan silty clay; pebble inclusions 5%; Black 1-5 mm	Cohesion very high near tip	100%
		53				
8		59				
		19				
9	0	22		Tan silty clay with pebble inclusion grading to grey weathered possilbe shale		80%
		37				
10		23				
		5				
11	0	9	Moist	Gray - black weathered shale, medium high cohesion; black pebble inclusions 1-5 mm 5%	Slightly plastic	83%
		11				
12		11				

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/11/88
WELL/BORING MW-5
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 2 OF 2
ATER LEVEL FIRST ENCOUNTERED 11'
FINAL 9.9'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		7				
13	2	8	Moist	Gray - black shale, moderately cohesive; pebble inclusions 10 mm 5%	Downhole HnU; 9 ppm; possibly steam	
		11				
14		16				
		35				
15		35		Thinly laminated fissle weathered black shale		87%
		13				
16		100/6"		B.O.H.		87%

DRILL LOG

ROJECT AS-4010
ELEVATION
DATE 8/10/88
LL/BORING MW-6
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
ILL METHOD Rotary Auger
PAGE 1 OF 2
TER LEVEL FIRST ENCOUNTERED 12'
FINAL 9.55'

EPTH IN EET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		4				
1	0	7	Dry	Tan sandy sily loam		100%
		7				
2		7				
		12				
3	0	20	Dry	Tan clay silt with pebbles 1-5 mm 5%		100%
		20				
4		34				
		10				
5	0	25	Dry	Tan clay silt grading to whitish sandy clay silt		80%
		35				
6		38				
		10				
7	0	25	Dry	Tan sandy silt		100%
		38				
8		58	Dry	White - yellow weathered shale; crumbly Brown - gray sand silt Pebbly clay silt, pebbles 1-10 mm black, 5-10%	Compacted HnU 0.4 down hole	
		25				
9	0	48				
		52				88%
10		52				
		12				
11		24	Dry	Grey - black weathered shale with pebbles incusions 1-10 mm; black		88%
		20				
12		30				

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/10/88
WELL/BORING MW-6
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Hicker
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 12'
FINAL 9.55'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
-	20					
13 -	37			Light gray weathered shale, crumbly, fissle		88%
-	46					
14 -	35	1.0				
—	45					
15 -	63			Weathered black fissle shale grading to more competent shale		
-	72					
16 -	100/3"	0		B.O.H.	16.1'	

DRILL LOG

ROJECT AS-4010 ELEVATION DATE 8/10/88

LL/BORING MW-7 LOCATION Altech Specialty Steel LOGGER J. Nickersc

ILL METHOD Rotary Auger Corp, Dunkirk, New York PAGE 1 OF 2

TER LEVEL FIRST ENCOUNTERED 10' FINAL 12.9'

PTH IN ET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
-	4			0"-5" Topsoil		80%
1 -	7	0	Dry	Tan silty clay loam; semi-compacted		
-	8					
2 -	10					
—	7					
3 -	8	0	Dry	Tan - light gray silty clay; black pebble inclusions 1-5 mm	Moderate cohesion	70%
-	8					
4 -	9					
-	2					
5—	3	0	Moist	Tan silty clay; pebbles 1-5 mm 5%		75%
-	6					
6 -	10					
-	9					
7 -	10	0	Moist	Tan clay silt; black shale tan cla loam with medium grained sandstone gray; well cemented	Probably isolated cobble, not part of lithology	75%
—	45					
8 -	38					
-	21					
9 -	43					
-	55					
10—	50	0.2	Moist	Tan clay; compacted grey tan clay with pebble inclusions 1-5 mm 5%	Water in hole HnU reading possibly from steam	100%
-	8					
1 -	12	0	Dry	Black clay mud; compacted; pebbles 1-10 mm 5%		100%
-	12					
2 -	14					

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/10/88
WELL/BORING MW-7
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickerso
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 10'
FINAL 12.9'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
	6			Wet gray clay	Plastic	100%
13	20	0.2	Wet	Gray, fissle, crumbly shale		
	35					
14	85					
15						
16						
17						
18				B.O.H.	18'	

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/9/88
WELL/BORING MW-8
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Hicker
RILL METHOD Rotary Auger
PAGE 1 OF 2
ATER LEVEL FIRST ENCOUNTERED 15'
FINAL 12.7'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		5		Brown silty loam topsoil		100%
1	0	4	Dry	Tan - brown sitly clay; limonite staining		
		5				
2		8				
		9				
3	0	9	Dry	Tan - brown silty clay		67%
		13				
4		8				
		11				
5	0	13	Dry	Brown silty clay to 4.5'; weathere gray-black silty clay; thinly laminated weathered shale	Incompetent	80%
		16				
6		9				
		11				
7	0	35	Dry	Tan - brown very fine silt with pebble inclusions 1-5 mm		75%
		35				
8		17	Dry	Black dense pebbly silty clay; limonite staining on rims of pebbles 1-5 mm	Slightly plastic	100%
		18				
9	0	16				
		14				
10		11	Damp	Black dense pebbly silty clay; pebbles 1-5 mm	Slightly plastic	100%
		11				
11	0	16				
		16				
12						

DRILL LOG

PROJECT AS-4010
ELEVATION
DATE 8/9/88
WELL/BORING MW-8
LOCATION Altech Specialty Steel Corp, Dunkirk, New York
LOGGER J. Nickers
DRILL METHOD Rotary Auger
PAGE 2 OF 2
WATER LEVEL FIRST ENCOUNTERED 15'
FINAL 12.7'

DEPTH IN FEET	HnU (ppm)	Blow Count	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	Notes	Recovery
		16				
13	0	19	Slightly Moist	Pebbly dark gray silty clay; pebbles 1-10 mm		100%
		27				
14		22		Gray silty clay; pebbles 1-10 mm		
		16				
15	0	42	Wet	15': weathered black shale; crumbly		
		50				
16		43				
17				B.O.H.	17.25'	

APPENDIX C

TRIP REPORT

TRIP REPORT
AL Tech Specialty Steel Corporation
August 8-16, 1988

Ecology and Environment, Inc., (E & E) was contracted by AL Tech Specialty Steel Corporation to install eight groundwater monitoring wells in the vicinity of the on-site cooling water pond as part of a groundwater monitoring plan for the site.

The E & E crew consisted of Jon Nickerson (field team leader) and Jim Mays (site safety officer) for August 8 through August 16. Bill Murray (E & E) provided additional field support on the 16th.

Original monitoring well positions selected included two points ten feet north of the northern pond edge; two, 100 feet north of the northern pond edge; two, ten feet south of the southern pond edge, and two 100 feet south of the southern pond edge. Rough terrain prohibited access to the northernmost locations. A roadway and an underground waterline were obstacles to the positions 10 feet from the northern pond edge. A chain link fence made the southernmost positions inaccessible. All points were positioned as close as possible to their originally planned location. Figure 1 displays the approximate locations of wells MW-1 through MW-8.

Buffalo Drilling Company, Inc. of Buffalo, New York was contracted to perform the monitoring well installation. Drillers, Charles Nicometi and Ken Kreiger operated a Diedrich D-50 rig for installation of monitoring wells MW-5, MW-6, and MW-8, and the upper portions of MW-4 and MW-7. Mr. Daryl Altrogger, a Buffalo Drilling supervisor, arranged for a CME-55 rig to complete the work. It arrived on site the evening of 8/11 and was used to complete wells MW-4 and MW-7, and to drill wells MW-1, MW-2, and MW-3.

Health and safety monitoring was performed continuously during drilling activities. Both an HNu and an O_2/Explosimeter were operated in the breathing zone at all times. Each time auger sections were disconnected, the instrument probes were inserted down the hole to monitor gases potentially escaping to the breathing zone. The O_2 meter continuously read 20.9% oxygen, and the explosimeter never gave readings above 0.0% L.E.L. The HNu gave down hole readings of up to 2 ppm, which are believed to have resulted from steam emitted from the hole due to a hot bit scraping the bedrock. The breathing zone never yielded HNu readings above 0.0. ppm.

Split spoon samples were taken continuously to bedrock using a 24-inch split spoon and a 140 pound hammer. Characteristic sediments of the area included a sequence commencing with a black silty loam top soil grading into a tan clay silt. At approximately 8' to 10', a dense black clay silt was encountered. This unit was underlain by fissile fractured gray shale, the bedrock of the area. The depth to shale ranged from 12' to 16' below grade. Relief between the northernmost and southernmost wells is approximately three feet. Water was encountered at depths ranging from 12' to 16'. Static water levels ranged between 8 and 14 feet below top of steel casing.

Well construction consisted of 2" ID stainless steel screening and riser with flush-joint threaded couplings. A 3"-6" sand toe was placed at the bottom of each hole on which the screening rested. A 12 foot sand pack was installed around the screen and coupling, followed by a 2' bentonite seal. The remaining area was grouted to the surface using a 10% bentonite grout mixture. A locking steel protective casing was mounted in grout over each well.

Decontamination procedures for split spoons between samples consisted of the following sequence: TSP and water with scrubbing/tap water wash with scrubbing/distilled water rinse/10% nitric acid solution rinse/ distilled water rinse/hexane rinse/distilled water triple rinse. Rinses were performed using garden sprayers. All liquids produced from the decontamination procedure were disposed in a manner approved by Mr. Gene Porter, supervisor of AL Tech's wastewater treatment facility. Mr. Porter also designated a concrete bermed area beneath an oil skimmer tank as a steam cleaning area. All augers and rods were steam cleaned between holes. In addition, all screens and risers were steam cleaned prior to installation. Fluids generated during steam cleaning were disposed of in the cooling water pond.

Each well was developed for one half hour. Development waters were also placed in the cooling pond, as directed by Mr. Porter.

Monitoring well sampling was performed on all 8 new wells. In addition, an existing on-site background monitoring well was sampled and designated as MW-9. A duplicate sample of MW-4 was labeled MW-10, and MW-11 is actually a trip blank of distilled water. Prior to sampling the wells, an HNu reading was taken from the headspace of each well. MW-6 and MW-8 were the only wells to yield readings, 0.4 ppm and 0.6 ppm, respectively. During sampling, readings of pH, temperature, and conductivity were obtained for each well. However, the quality of these results is questionable due to a lack of consistency in the readings.

All samples were brought to E & E's Analytical Services Center for PCB and TSS analysis. In addition, possible select metals analysis may be requested of the samples in the future. MW-9 was sampled in advance of the others and its analysis were requested on a quick turnaround basis. This was to determine as soon as possible if the water is contaminated and if an additional background monitoring well must be installed. Photocopies of all chain-of-custody forms are attached. Photodocumentation of site activities is forthcoming. Laboratory results are expected to be ready by September 1, 1988.

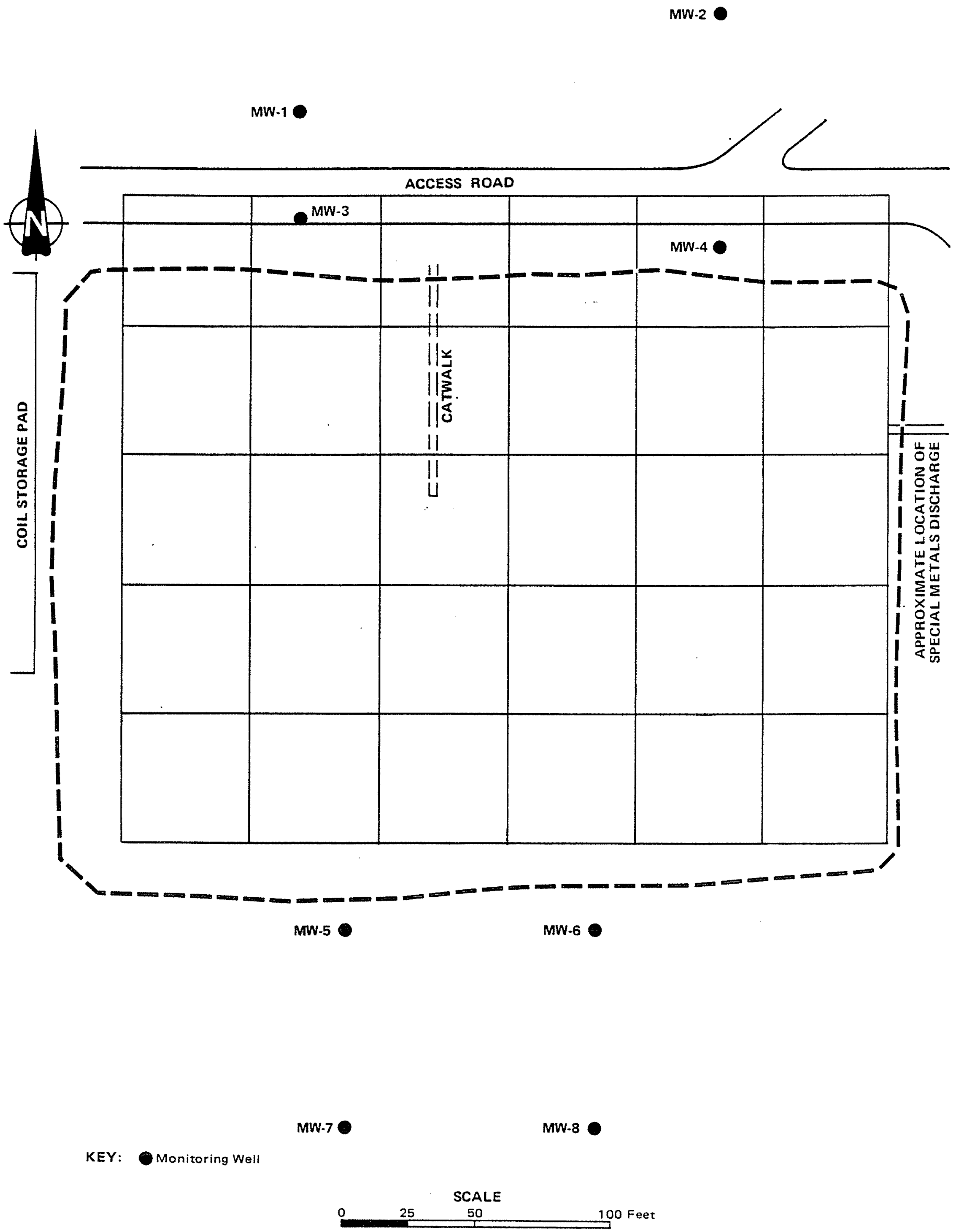


Figure 1 LOCATION OF MONITORING WELLS

APPENDIX D

OHM'S ANALYTICAL RESULTS

ANALYTICAL REPORT

Findlay Laboratory, A Division of
Environmental Testing and Certification Corp.
16406 U.S. Route 224 East
P.O. Box 1404
Findlay, Ohio 45839-1404

ETC · FINDLAY LABORATORY

CLIENT: O.H. Materials Corp. (Al Tech)
Findlay, OH

ATTN: G. McCartney

PROJECT NUMBER: 290.9061

SAMPLE TYPE: Soil

ANALYSIS PERFORMED:

Landfill Disposal

(Sample: AT-001)

DATE COMPLETED: 6/06/88

DATE RECEIVED: 5/27/88

This report is "PROPRIETARY AND CONFIDENTIAL" and delivered to, and intended for the exclusive use of the above named client only. Environmental Testing and Certification Corp. assumes no responsibility or liability for the reliance hereon or use hereof by anyone other than the above named client.

The analyses and data interpretation that form the basis of this report was prepared under the direct supervision and control of the undersigned who is solely responsible for the contents and conclusions therein.

Reviewed and Approved by: TE [illegible] for 6/8/88
R. J. Schock, Mgr.-ETC Findlay Laboratory Date

PROJECT 290.9061

SUMMARY REPORT OF ANALYTICAL SERVICES

1. INTRODUCTION

Environmental Testing & Certification Corp. (ETC)-Findlay Laboratory received samples from O.H. Materials Corp. These samples were acquired by their technical personnel and transferred to the laboratory complete with a chain-of-custody record, a copy of which is attached for reference. These samples were composited and analyzed for Landfill Disposal parameters.

2. ANALYTICAL METHODOLOGY

Total Phenols

Samples were mixed for one hour and prepared and analyzed according to EPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, July 1982; Method 9065, Phenolics (Spectrophotometric, Manual 4-AAP with Distillation).

GC/MS Volatile Organic Analyses and Screens

Volatile analysis of the samples was performed using methods based on EPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, July 1982; Method 8240, GC/MS Methods for Volatile Organics.

GC/MS Semi-Volatile Organic Analyses and Screens

Acid and base neutral extractables were prepared and analyzed using methods based on USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, July 1982, Method 8270, GC/MS Methods for Semi-Volatile Organics. Extractions were performed by either Method 3540, Soxhlet Extraction or Method 3550, Sonication Extraction.

Density

Densities of the samples were determined according to Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985; Method 213E, Specific Gravity.

Total Solids

Samples were analyzed according to Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985; Method 209F, Total, Fixed and Volatile Solids in Solid and Semi-solid Samples.

PROJECT 290.9061

SUMMARY REPORT OF ANALYTICAL SERVICES

Polychlorinated Biphenyls and Organochlorine Pesticides

Solid samples were analyzed and prepared according to USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd edition, 1982; Method 3550, Sonication Extraction or Method 3540, Soxhlet Extraction and Method 8080, Organochlorine Pesticides and PCBs.

Total and Amenable Cyanide

The samples were prepared and analyzed according to USEPA Test Methods for Evaluating Solid Wastes, SW-846, 2nd edition, July 1982 (Revised April 1984); Method 9010, Total and Amenable Cyanide.

pH

All samples that were water soluble were tested with pH strips to determine if they were corrosive as per EPA-600/4-84-038 (May 1984); Characterization of Hazardous Waste Sites, Vol. III.

Sulfides

Sulfide analyses were performed according to EPA 600/4-84-038, Characterization of Hazardous Waste Sites-A Methods Manual, May 1984; Section 17, G.1.2. Determination of Sulfide in Solid Phase Hazardous Waste Disposal Site Samples.

Paint Filter Test

This test was performed on the samples in accordance with Method 9095, Paint Filter Liquids Test; USEPA SW-846, 2nd edition, July 1982, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods.

Flash Point

Flash points were performed at 60°C according to the procedure specified in USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd edition, July 1982; Method 1020, Seta-flash Closed-cup Method.

PROJECT 290.9061

SUMMARY REPORT OF ANALYTICAL SERVICES

RCRA Parameters

Metals - Samples were prepared and analyzed according to USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd edition, July 1982. Samples were prepared by either Method 3010, 3030, 3050, or 1310 as appropriate for the following metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Sample analyses for these metals were performed according to method 6010, Inductively Coupled Plasma Method (SW-846 Proposed Sampling and Analytical Methodologies, 1984).

Pesticides - Solid sample leachates were analyzed for pesticides according to Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985; Method 509A.

Herbicides - Solid sample leachates were analyzed for herbicides according to Standard Methods for the Examination of Water and Wastewater, 16th edition, 1985; Method 509B.

Total Organic Carbons

Samples were prepared and analyzed according to EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition, 1984, Method 9060, Total Organic Carbon (TOC).

Metals

Samples were prepared and analyzed according to USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd edition, July 1982. Samples were prepared by Method 3010, 3030, 3050, or 1310 as appropriate for the following metals: cadmium, chromium, iron, lead, nickel, and zinc. Sample analyses for these metals were performed according to Method 6010, Inductively Coupled Plasma Method (SW-846 Proposed Sampling and Analytical Methodologies, 1984).

3. ANALYTICAL RESULTS

The following tables detail the results of the various analyses performed on Sample #290.9061-AT-001.

PROJECT 290.9061

TABLE 1 - LANDFILL DISPOSAL ANALYSIS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Parameter	Result
Color	Black
Odor	Mild, Sweet
Flash Point, SF, CC	> 95°C
Density	1.43 g/cm^3
pH Test	6.4 pH units
Total Sulfide	26.6 mg/Kg
Total Cyanide	< 1.0 mg/Kg
Amenable Cyanide	< 1.0 mg/Kg
Total Phenols	32.0 mg/Kg
Paint Filter Test	Pass
Total Solids	82.2% by weight
Total Organic Carbons	17,500 mg/Kg

PROJECT 290.9061

TABLE 2 - VOLATILE ORGANICS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)
Acrolein	BDL*
Acrylonitrile	BDL*
Benzene	BDL
Bromomethane	BDL
Bromodichloromethane	BDL
Bromoform	BDL
Carbon Tetrachloride	BDL
Chlorobenzene	BDL
Chloroethane	BDL
2-Chloroethylvinyl ether	BDL
Chloroform	BDL
Chloromethane	BDL
Dibromochloromethane	BDL
1,3-Dichlorobenzene	BDL
1,2-Dichlorobenzene	BDL
1,4-Dichlorobenzene	BDL
1,1-Dichloroethane	BDL
1,2-Dichloroethane	BDL
1,1-Dichloroethene	BDL
Trans-1,2-Dichloroethene	BDL
1,2-Dichloropropane	BDL
Total Dichloropropenes	BDL
Ethylbenzene	BDL
Methylene Chloride	BDL
1,1,2,2-Tetrachloroethane	BDL
Tetrachloroethene	BDL
1,1,1-Trichloroethane	BDL
1,1,2-Trichloroethane	BDL
Trichloroethene	BDL
Toluene	BDL
Vinyl Chloride	215

*Limit of Detection = 1,000 mg/Kg ppm (parts-per-million)
Limit of Detection = 100 mg/Kg ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 3 - ADDITIONAL VOLATILE HSL COMPOUNDS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)	Detection Limit (mg/Kg)
Acetone	BDL	500
2-Butanone	BDL	100
Carbon Disulfide	BDL	100
Ethyl ether	BDL	100
Ethylene Dibromide	BDL	100
2-Hexanone	BDL	100
4-Methyl-2-Pentanone (MIBK)	BDL	100
Styrene	BDL	100
Tetrahydrofuran	BDL	100
1,1,2-Trichloro-1,2,2-trifluoroethane	BDL	100
Vinyl Acetate	BDL	500

mg/Kg = ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 4 - VOLATILE SCREEN

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)

No chromatographic peaks present with an area greater than 25% of the internal standards

mg/Kg = ppm (parts-per-million)

PROJECT 290.9061

TABLE 5 - BASE/NEUTRAL COMPOUNDS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)	Compound	Concentration (mg/Kg)
Acenaphthene	BDL	3,3'-Dichlorobenzidine	BDL
Acenaphthylene	BDL	Diethylphthalate	BDL
Anthracene	BDL	Dimethylphthalate	BDL
Benzidine	BDL	2,4'-Dinitrotoluene	BDL
Benzo(a)anthracene	BDL	2,6'-Dinitrotoluene	BDL
Benzo(b)fluoranthene	BDL	Dioctylphthalate	BDL
Benzo(k)fluoranthene	BDL	1,2-Diphenyl hydrazine	BDL
Benzo(a)pyrene	BDL	Fluoranthene	BDL
Benzo(g,h,i)perylene	BDL	Fluorene	BDL
Bis(2-chloroethyl)ether	BDL	Hexachlorobenzene	BDL
Bis(2-chloroethoxy)methane	BDL	Hexachlorobutadiene	BDL
Bis(2-ethylhexyl)phthalate	BDL	Hexachloroethane	BDL
Bis(2-chloroisopropyl)ether	BDL	Hexachlorocyclopentadiene	BDL
4-Bromophenyl phenylether	BDL	Indeno-(1,2,3-cd)pyrene	BDL
Butyl benzylphthalate	BDL	Isophorone	BDL
2-Chloronaphthalene	BDL	Naphthalene	BDL
4-Chlorophenyl phenylether	BDL	Nitrobenzene	BDL
Chrysene	BDL	N-Nitrosodi-n-propylamine	BDL
Dibenzo(a,h)anthracene	BDL	N-Nitrosodiphenylamine	BDL
Di-n-butylphthalate	BDL	Phenanthrene	BDL
1,3-Dichlorobenzene	BDL	Pyrene	BDL
1,4-Dichlorobenzene	BDL	1,2,4-Trichlorobenzene	BDL
1,2-Dichlorobenzene	BDL		

Limit of Detection = 100 mg/Kg ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 6 - ACID EXTRACTABLE

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)	Detection Limit (mg/Kg)
4-Chloro-3-Methylphenol	BDL	100
2-Chlorophenol	BDL	100
2,4-Dichlorophenol	BDL	100
2,4-Dimethylphenol	BDL	100
2,4-Dinitrophenol	BDL	1,000
2-Methyl-4,6-Dinitrophenol	BDL	1,000
2-Nitrophenol	BDL	100
4-Nitrophenol	BDL	100
Pentachlorophenol	BDL	100
Phenol	BDL	100
2,4,6-Trichlorophenol	BDL	100

mg/Kg = ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 7 - ADDITIONAL SEMI-VOLATILE HSL COMPOUNDS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)
Aniline	BDL
Benzyl Alcohol	BDL
4-Chloroaniline	BDL
Dibenzofuran	BDL
2-Methylnaphthalene	BDL
2-Methylphenol	BDL
4-Methylphenol	BDL
2-Nitroaniline	BDL
3-Nitroaniline	BDL
4-Nitroaniline	BDL
2,4,5-Trichlorophenol	BDL

Limit of Detection = 100 mg/Kg ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 8 - SEMI-VOLATILE SCREEN RESULTS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)

No chromatographic peaks present with an area greater than 25% of the internal standards

mg/Kg = ppm (parts-per-million)

PROJECT 290.9061

TABLE 9 - PESTICIDES AND PCBS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)	Detection Limit (mg/Kg)
Aldrin	BDL	2.0
BHC-alpha	BDL	2.0
BHC-beta	BDL	2.0
BHC-gamma	BDL	2.0
BHC-delta	BDL	2.0
Chlordane	BDL	20.0
4,4'-DDD	BDL	2.0
4,4'-DDE	BDL	2.0
4,4'-DDT	BDL	2.0
Dieldrin	BDL	2.0
Endosulfan-alpha	BDL	2.0
Endosulfan-beta	BDL	2.0
Endosulfan Sulfate	BDL	2.0
Endrin	BDL	2.0
Endrin Aldehyde	BDL	2.0
Heptachlor	BDL	2.0
Heptachlor Epoxide	BDL	2.0
Toxaphene	BDL	20.0
POLYCHLORINATED BIPHENYLS		
Aroclor 1016	BDL	1.0
Aroclor 1221	BDL	1.0
Aroclor 1232	BDL	1.0
Aroclor 1242	247	1.0
Aroclor 1248	BDL	1.0
Aroclor 1254	BDL	1.0
Aroclor 1260	BDL	1.0

mg/Kg = ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 10 - RCRA PARAMETERS

SAMPLE IDENTIFIER: EP Toxicity Leachate; Soil Composite
OHM SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/L)	Detection Limit (mg/L)
RCRA Metals		
Arsenic	BDL	0.1
Barium	0.112	0.1
Cadmium	BDL	0.1
Chromium	BDL	0.1
Lead	BDL	0.1
Mercury	BDL	0.05
Selenium	BDL	0.1
Silver	BDL	0.1
Pesticides		
Lindane	BDL	0.001
Endrin	BDL	0.001
Methoxychlor	BDL	0.01
Toxaphene	BDL	0.01
Herbicides		
2,4-D	BDL	0.01
2,4,5-TP	BDL	0.01

mg/L = ppm (parts-per-million)
BDL = Below Detection Limit

PROJECT 290.9061

TABLE 11 - METALS

SAMPLE IDENTIFIER: Soil Composite
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/Kg)	Detection Limit (mg/Kg)
Cadmium	BDL	1.0
Chromium	1,680	1.0
Iron	110,000	1.0
Lead	36.2	1.0
Nickel	10,200	1.0
Zinc	124	1.0

mg/Kg = ppm (parts-per-million)
BDL = Below Detection Limit

OHM

CHAIN-OF-CUSTODY RECORD

Form 0019
Field Technical Services
Rev. 03/88

No. 40750

.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

JECT NAME: AL Tech
PROJECT LOCATION: Dunkirk NY
J. NO.:
PROJECT CONTACT: Greg McCartney
PROJECT TELEPHONE NO.:
ENT'S REPRESENTATIVE: Frank Boinski
PROJECT MANAGER/SUPERVISOR: Greg McCartney

SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	NUMBER OF CONTAINERS	ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS): Landfill	Metals/Total Pb,Cd,Ni,Fe,Cr,Zn							REMARKS
AT-001	5-26	1300	X		Filter cake from IFAD Bench Scale	1, 8oz	X	X							High metals & PCB's

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME
1	1	Greg McCartney		5-27	10:00
2					
3					
4					

REMARKS: Sample recieved from IFAD on 5-27-88

SAMPLER'S SIGNATURE: Greg McCartney

A Subsidiary of Environmental Treatment and Technologies Corp.
The Environmental Services Company

ANALYTICAL REPORT

Findlay Laboratory, A Division of
Environmental Testing and Certification Corp.
16406 U.S. Route 224 East
P.O. Box 1404
Findlay, Ohio 45839-1404

ETC · FINDLAY LABORATORY

CLIENT: O.H. Materials Corp.
Findlay, OH

ATTN: G. McGartney

PROJECT NUMBER: 290.9061

SAMPLE TYPE: Soil

ANALYSIS PERFORMED:

RCRA Metals

(Sample: AT-001)

DATE COMPLETED: 6/13/88

DATE RECEIVED: 6/03/88

This report is "PROPRIETARY AND CONFIDENTIAL" and delivered to, and intended for the exclusive use of the above named client only. Environmental Testing and Certification Corp. assumes no responsibility or liability for the reliance hereon or use hereof by anyone other than the above named client.

The analyses and data interpretation that form the basis of this report was prepared under the direct supervision and control of the undersigned who is solely responsible for the contents and conclusions therein.

Reviewed and
Approved by:

R. J. Schock, Mgr.-ETC Findlay Laboratory

6/14/88
Date

A Subsidiary of Environmental Treatment and Technologies Corp.
The Environmental Services Company

PROJECT 290.9061

SUMMARY REPORT OF ANALYTICAL SERVICES

1. INTRODUCTION

Environmental Testing & Certification Corp. (ETC)-Findlay Laboratory received 1 sample from O.H. Materials Corp., Findlay, Ohio. This sample was acquired by their technical personnel and transferred to the laboratory complete with a chain-of-custody record, a copy of which is attached for reference. This sample was analyzed for the following:

RCRA Metals

Samples were prepared and analyzed according to USEPA Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd edition, July 1982. Samples were prepared by Method 3010, 3030, 3050, or 1310 as appropriate for the following metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Sample analyses for these metals were performed according to Method 6010, Inductively Coupled Plasma Method (SW-846 Proposed Sampling and Analytical Methodologies, 1984).

TCLP Leachate Preparation

TCLP leachates were prepared according to Federal Register, Vol. 51 No. 216, Friday, November 7, 1986, Appendix I to Part 268-Toxicity Characteristic Leaching Procedures.

2. ANALYTICAL RESULTS

The following table details the analytical results for sample #290.9061-AT-001.

PROJECT 290.9061

TABLE 1 - RCRA METALS

SAMPLE IDENTIFIER: EP Toxicity Leachate; Soil Ash
ETC SAMPLE NUMBER: 290.9061-AT-001

Compound	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	0.188	0.1
Barium	0.205	0.1
Cadmium	BDL	0.1
Chromium	12.7	0.1
Lead	BDL	0.1
Mercury	BDL	0.02
Selenium	BDL	0.1
Silver	BDL	0.1

mg/L = ppm (parts-per-million)
BDL = Below Detection Limit

OHM

CHAIN-OF-CUST ƆY RECORD

Form 0019
Fie echnical Services
Rev. 03/88

No. 40753

.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

JECT NAME	PROJECT LOCATION Findky, OH
J. NO. 0.9061	PROJECT CONTACT ~~Findlay, OH~~ Jake Pekarek
	PROJECT TELEPHONE NO. 419-423-3526
NT'S REPRESENTATIVE	PROJECT MANAGER/SUPERVISOR

ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS): TOC

SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	NUMBER OF CONTAINERS	TOC	REMARKS
290.9061- AT-001	5-31-[illegible]	1000		X	Solid	1-40ml Vial	X	

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME
1	1	Jack Pekarek	Fed X		
2					
3					
4					

REMARKS
P.O. # 20718
To Wastex
Results Mon A.M.
6-6 ??

SAMPLER'S SIGNATURE

A Subsidiary of Environmental Treatment and Technologies Corp.

APPENDIX E

DEMONSTRATION REPORT OF OHM'S INFRARED INCINERATOR

O.H. Materials Corp.
16406 U.S. Route 224 East
P.O. Box 551
Findlay, Ohio 45839-0551
419-423-3526
Telex 298248 OHMI UR (RCA)

OHM

September 20, 1988

Mr. Frank Boinski
Director, Environmental Affairs
AL Tech Specialty Steel Corporation
Spring Street Road
Watervliet, NY 12189

Dear Mr. Boinski:

RE: Demonstration Report of OHM's Infrared Incinerator

Please find enclosed the Demonstration Test Report of OHM's infrared incinerator. The trial burn was conducted on June 29 and 30, 1988. The data indicates that the incinerator meets the requirements of 40 CFR 761.

This information has been forwarded to AL Tech to assist in the preparation of a State of New York Air Pollution Permit. The report is quite lengthy and any information required for the state permit should be contained in the summary section. I do have a New York permit application form in my files if additional information is required.

Another question that has arised is whether a modification needs to be made to your NPDES permit in order to accept the 12,000 gallons per day of scrubber water. A copy of this permit will be needed for OHM's records as will be required by our National TSCA Incinerator Operating Permit.

Sincerely,

Gregory J McCartney

Gregory J. McCartney
Project Engineer

GJM:dmc

Enclosures

pc: George Butler (with enclosures)
Jim Burford
Jan Power

recycled paper A Subsidiary of Environmental Treatment and Technologies Corp. ecology and environment

1.0 SUMMARY OF RESULTS

The trial burn conducted in June 1988 with O.H. Materials Corp.'s (OHM) mobile infrared incinerator at Florida Steel's (FLORIDA STEEL) Indiantown, Florida, Mill Site was designed to demonstrate OHM's ability to comply with the standards for polychlorinated biphenyls (PCB) incinerators as set forth in 40 CFR 761.70(b). All process streams were analyzed for PCB content. Each of the effluent streams were also analyzed for polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDDs and PCDFs). In addition, the flue gas stream was monitored for the following constituents: fixed gases (oxygen, carbon dioxide, and carbon monoxide); total particulates; hydrochloric acid (HCl); and oxides of nitrogen (NO_x). The results contained herein demonstrate compliance with all applicable performance requirements of 40 CFR Part 761.

Remediation Technologies Incorporated (RETEC) of Concord, Massachusetts, was retained as an independent consultant to coordinate the demonstration test stack sampling. Keystone Environmental Resources, Inc. (KEYSTONE) of Monroeville, Pennsylvania, was contracted to do the sampling and fixed-gas monitoring. The gravimetric analysis of the particulate filter was also performed by KEYSTONE. Analysis of the Modified Method 5 (MM5) components was completed by Environmental Testing and Certification Corp's (ETC), Edison, New Jersey, Laboratory. The Edison Laboratory also completed all PCB, furan, and dioxin analyses. The remaining waste feed physical analyses were completed by ETC's Findlay, Ohio, Laboratory.

A summary of results for all three demonstration tests appears in Table 1.1. Sample calculations are contained in Appendix A.

The feed rate to the incinerator ranged from 13,728 to 13,921 pounds per hour (lbs/hr) for the test program, with an average feed rate of 13,837. The heat and moisture content of the waste material for the five test runs averaged 1,053 British thermal units per pound (Btu/lb) and 6.6 percent, respectively. The total chloride analysis data for the waste feed samples averaged 0.43 percent. The waste feed PCB concentration averaged 6,966 ppm.

The ash from Test Runs 1 and 3 contained less than 2.0 parts per million (ppm) total PCBs, although ash from Test Run 2 had a total PCB concentration of 33.6 ppm. The ash collected during this test run was reprocessed in order to meet the site performance requirement of 2.0 ppm. The suspected reasons for the ash outlier are discussed in Section 5.2.

The scrubber water samples from each test contained less than 1 part per billion (ppb) PCB.

TABLE 1.1

DEMONSTRATION TEST RESULTS SUMMARY

Test	1	2	3
Date	6-29-88	6-29-88	6-30-88
Time test began	0945	1626	0955
Time test ended	1510	2044	1434
Primary Chamber Operating Parameters			
Waste feed rate (lb/hr)	13,921	13,856	13,728
PCB concentration (mg/kg)	Three test average--6,966		
PCB feed rate (lb/hr)	96.97	96.52	95.63
Heat content (Btu/lb)	872	1500	786
Furnace Draft (inches water)	-0.02	-0.01	-0.02
Secondary Chamber Operating Parameters			
Chamber temperature (degrees Fahrenheit)	1,987	1,996	1,995
Average oxygen (percent)	13.5	13.6	13.4
Average carbon dioxide (percent)	4.8	4.8	5.0
Calculated retention time (seconds)	6.11	6.04	6.31

TABLE 1.1 (CONTINUED)

DEMONSTRATION TEST RESULTS SUMMARY

Test	1	2	3
Average carbon monoxide (ppm)	1.2	4.3	1.1
Combustion efficiency (percent)	99.99	99.99	99.99
Particulate/HCl Emissions			
Total sample time (minutes)	120	120	120
Total sample volume (dscf)	51.73	52.28	51.31
Stack gas flow rate (dscfm)	6,332	6,001	6,209
Average oxygen (percent)	13.8	13.5	13.3
Particulate concentration (gr/dscf)[a]	0.053	0.061	0.056
Chlorine emission (lb/hr)	0.088	0.076	0.115
PCB Emissions			
Total sample time (minutes)	240	238	240
Total sample volume (dscf)	76.65	77.45	82.34
Stack gas flow rate (dscfm)	6,105	6,196	5,874
PCBs (ug/sample)	<.782	<.532	<.542
PCB feed rate (lb/hr)	96.97	96.52	95.63
PCB output rate (lb/hr)x10^6	<8.24	<5.63	<5.11
PCB DRE (percent)	>99.999992	>99.999994	>99.999995

---

[a] Corrected to 7 percent oxygen

TABLE 1.1 (CONTINUED)

DEMONSTRATION TEST RESULTS SUMMARY

Test	1	2	3
Scrubber Parameters			
Average scrubber pH	6.75	7.06	7.14
Average venturi pressure drop (inches water)	26.7	26.1	26.4

Detected quantities of PCBs in the flue gas for Test Runs 1 and 2 were 0.66 and 0.33 micrograms (ug) per sample. No detectable levels of PCBs were present in Test Run 3. The Destruction and Removal Efficiency (DRE) values for all runs were determined to be in excess of 99.9999 percent and well within the performance requirements of the Toxic Substances Control Act (TSCA).

The particulate concentrations for all three runs averaged 0.057 grains per dry standard cubic feet (gr/dscf) when corrected to 7 percent oxygen, and were within the performance standard of 0.08 gr/dscf.

HCl emissions from the system were determined to be less than 0.115 lb/hr and in compliance with the performance standards for hazardous-waste incinerators.

The average flue gas concentrations of NO_x was determined to be 16.2 ppm.

Dioxin and dibenzofuran analyses were conducted on samples from each of three effluent process streams. The results of these analyses are summarized in Section 5.0.

A set of permit conditions, capable of achieving total compliance during normal operations, is contained in Table 1.2.

TABLE 1.2

SUGGESTED PERMIT OPERATING PARAMETERS

Feed Parameters:

Feed rate	14,000 lbs/hrs
PCB concentration	6,966 ppm
Matrix	Solid (must pass paint filter test)

Secondary Parameters:

Secondary temperature	1,850 degrees Fahrenheit
Oxygen level (minimum)	3 percent
Combustion efficiency	99.9 percent

Pollution Control Equipment Parameters:

Scrubber pH (minimum)	6.5 percent
Venturi pressure drop (minimum)	20 inches

Primary Chamber Parameters:

A 24-hour composite sample of incinerator ash will be required each day in order to continuously verify the performance of the primary chamber.

Stop waste feed when electrical input to primary chamber has phase variations greater than 15 percent or peak electrical input is less than 600 amps per phase.

Viscosity of supplemental oil added to waste feed must be less then 190 csu.

2.0 PROCESS OPERATION

The OHM mobile incinerator operates on the infrared technology. The waste is fed to the incinerator using a weigh belt feeder, which accurately regulates and records the amount of waste incinerated. After the waste enters the incinerator it is heated by passing electrical current through silicon carbide heating elements. The energy is transferred to the waste through infrared-radiant heat as it is conveyed under the heating elements on a high-temperature, stainless-steel belt. The ash obtains temperatures in excess of 1,200 degrees Fahrenheit.

The volatilized waste is then pulled into the secondary chamber by the induced draft (ID) fan which creates a negative draft on the entire system. The secondary chamber can be heated with natural gas to a temperature of 2,200 degrees Fahrenheit. Final oxidation of the waste is completed with a minimum residence time of 4.0 seconds.

The flue gases are then scrubbed of acid and particulates in the pollution-control equipment which consists of a quench section, venturi scrubber, and packed-column chemical scrubber. The exhaust gases are then sent to the Fiberglass-reinforced, plastic exhaust stack.

A complete engineering description of all elements, including detailed engineering drawings, can be reviewed in the permit application submitted on May 8, 1987.

2.1 OPERATION DURING TRIAL BURN

During the trial burn the incinerator was operated under normal operating conditions and standard operating procedures. The waste was first blended with a mixture of 30 percent diesel fuel and 70 percent Bunker C oil in order to increase the heating value to approximately 700 Btu/lb. The oil mixture was thoroughly mixed with the sand in a pug mill located in the feed storage area.

The waste was metered to the incinerator on a weight belt feeder. The feed rate was measured continuously and was determined by averaging the rate over each demonstration test.

The operating parameters of the system during each of the three tests is contained in Table 2.1. The parameters were determined by averaging at 15-minute intervals over the entire stack sampling period.

TABLE 2.1

OPERATING PARAMETERS (AVERAGED OVER TEST PERIOD) AT 15-MINUTE INTERVALS

Test Data	Test 1	Test 2	Test 3
Primary chamber pressure (inches of water)	-0.02	-0.01	-0.02
Retention time (min)	15	15	15
Zone A_1 Temp. (°F)	1,497	1,462	1,496
Zone A_2 Temp. (°F)	1,450	1,434	1,455
Zone A_3 Temp. (°F)	1,556	1,553	1,578
Zone B_1 Temp. (°F)	1,642	1,666	1,655
Zone B_2 Temp. (°F)	1,555	1,605	1,579
Zone B_3 Temp. (°F)	1,570	1,595	1,581
Primary exhaust (°F)	1,584	1,566	1,601
Power Zone A kW	208	181	184
Power Zone B kW	299	309	301
Secondary Temp. (°F)	1,988	1,996	1,996
Secondary exhaust Temp. (°F)	1,914	1,924	1,921
Venturi Pressure Drop (inches of water)	26.7	26.05	26.44
Scrubber pH	6.75	7.06	7.14

2.2 OPERATIONAL EVENTS DURING TRIAL BURN

The following subsections present a chronology of events which occurred before and during the demonstration test. No major upsets or problems occurred during any of the demonstration tests.

2.2.1 Pretesting and Diagnostic Testing Events

The FLORIDA STEEL Indiantown Superfund removal action was essentially completed on May 23, 1988, with the exception of 45 tons of decontamination waste and some additional soils. On May 23, 1988, the unit was shut down and underwent a maintenance program which included the following:

- Realignment of all rollers
- Partial reinsulation of primary chamber
- Installation of bucket elevator
- Installation of new ash sieve through collection system

The maintenance was completed on June 24, 1988, at which time the maintenance items were checked under static conditions.

On May 12, 1988, nine drums of transformer oil arrived on site and were sampled. Because the analysis revealed the oil to contain less then 65 percent PCBs, this material was used for diagnostic testing only.

On June 23, 1988, nine additional drums of transformer oil were ordered for delivery on the morning of June 29, 1988. The supplier analyzed the drums before shipment, and determined an average concentration of 65 percent. The oil was therefore appropriate for use in the actual demonstration runs.

Diagnostic testing was conducted on June 27 and 28, 1988, in order to verify the proper operation of the incinerator on a highly contaminated feed material. An initial test was conducted on clean sand in order to determine background conditions. Then two tests were conducted using a spike waste feed on each day of the testing. The sampling duration of each test was 30 minutes. The diagnostic test was essential in determining the operating parameters of the test. A report containing the results of the diagnostic testing has been submitted under separate cover. The diagnostic testing was completed at 1400 hours on June 28, 1988.

2.2.2 Test No. 1

On June 29, 1988, waste feed to the incinerator began at 0610 hours using the initial shipment of PCB transformer oil for spiking the waste. The second shipment of oil was received at 0730 hours. The operators then took the new drums and blended them together into four empty drums. The contents of the mixed drums containing the 65 percent PCB oil were then used to spike the waste. The waste was spiked by mixing 1.5 gallons per minute (gpm) of the blended transformer oil into the pug mill which has a capacity of 1.0 tons of sand per minute.

The newly mixed waste was then fed to the incinerator at 0900 hours. The stack sampling began at 0945 hours.

During the first test, a short interruption of waste feeding was experienced. The waste was shut off by the operator because the rotary airlock motor on the ash discharge system burnt out. The motor was changed and waste feed was started after 27 minutes. The stack sampling was temporarily stopped until the waste feed was reestablished.

The first test was completed at 1510 hours and the waste feed was stopped temporarily before the start of the second test.

2.2.3 Test No. 2

The stack sampling started at 1626 hours, and sampling was completed at 2044 hours. Sampling was stopped by Mr. Jim Surman of Midwest Research Institute (MRI) 2 minutes early due to hazardous-weather conditions.

2.2.4 Test No. 3

OHM started feeding the waste to the primary chamber at 0715 hours using the same waste pile as the two previous tests. Stack sampling began at 0955 hours, and was completed at 1430 hours. No sampling interruptions were experienced.

3.0 SAMPLING AND MONITORING PLAN

This section presents the sampling and monitoring plan used during the demonstration test of the OHM mobile incinerator. Pursuant to the TSCA regulations contained in 40 CFR Part 761, stack emissions monitoring was conducted for the following parameters. These parameters are mandatory when an incinerator is first used for the disposal of PCBs:

- Oxygen
- Carbon monoxide
- Carbon dioxide
- NO_x
- HCl
- PCBs
- Total particulate matter

In addition, the incinerator operators monitored and recorded specific process parameters, including PCB feed rate and combustion temperature of the incinerator process. The flue gas was also monitored for sulfur dioxide and total hydrocarbons.

Samples of the ash and scrubber water were also collected during the demonstration test. They were analyzed for PCBs, PCDD, and PCDF to determine the overall system's environmental impact.

The test program was designed to evaluate the overall system performance. The trial burn program consisted of three tests conducted during a 2-day program. Samples were collected from five process streams: waste feed, ash, scrubber effluent, treated blowdown water, and flue gas. Monitoring and recording of key incinerator operating parameters were also conducted during each test. The specific sampling and monitoring approaches are presented in the following subsections. Figure 3.1 shows a schematic of sampling locations and Figure 3.2 shows a schematic of monitoring locations. A summary of the demonstration test sampling and monitoring plan appears in Table 3.1. Table 3.2 contains a summary of the monitoring plan that is used during normal operation of the incinerator.

3.1 PROCESS STREAM SAMPLING

A summary of the sampling procedures used during the demonstration test follows. All sampling and monitoring was conducted according to the Demonstration Test Plan dated April 15, 1988, Submission No. 6. Representative aliquots of all collected samples were made available to United States Environmental Protection Agency (USEPA) representatives on site.

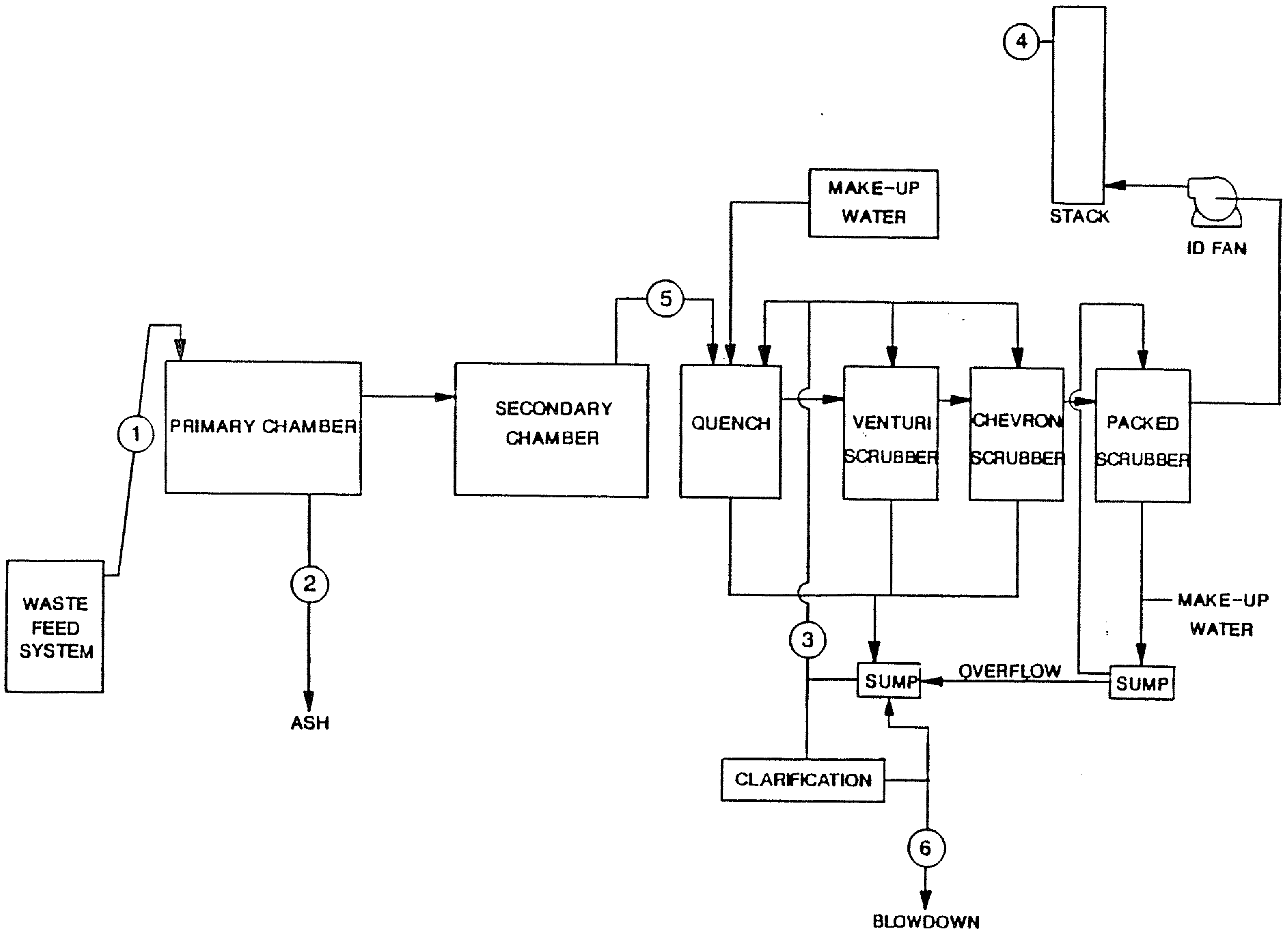


FIGURE 3.1
SCHEMATIC OF
SAMPLING LOCATIONS

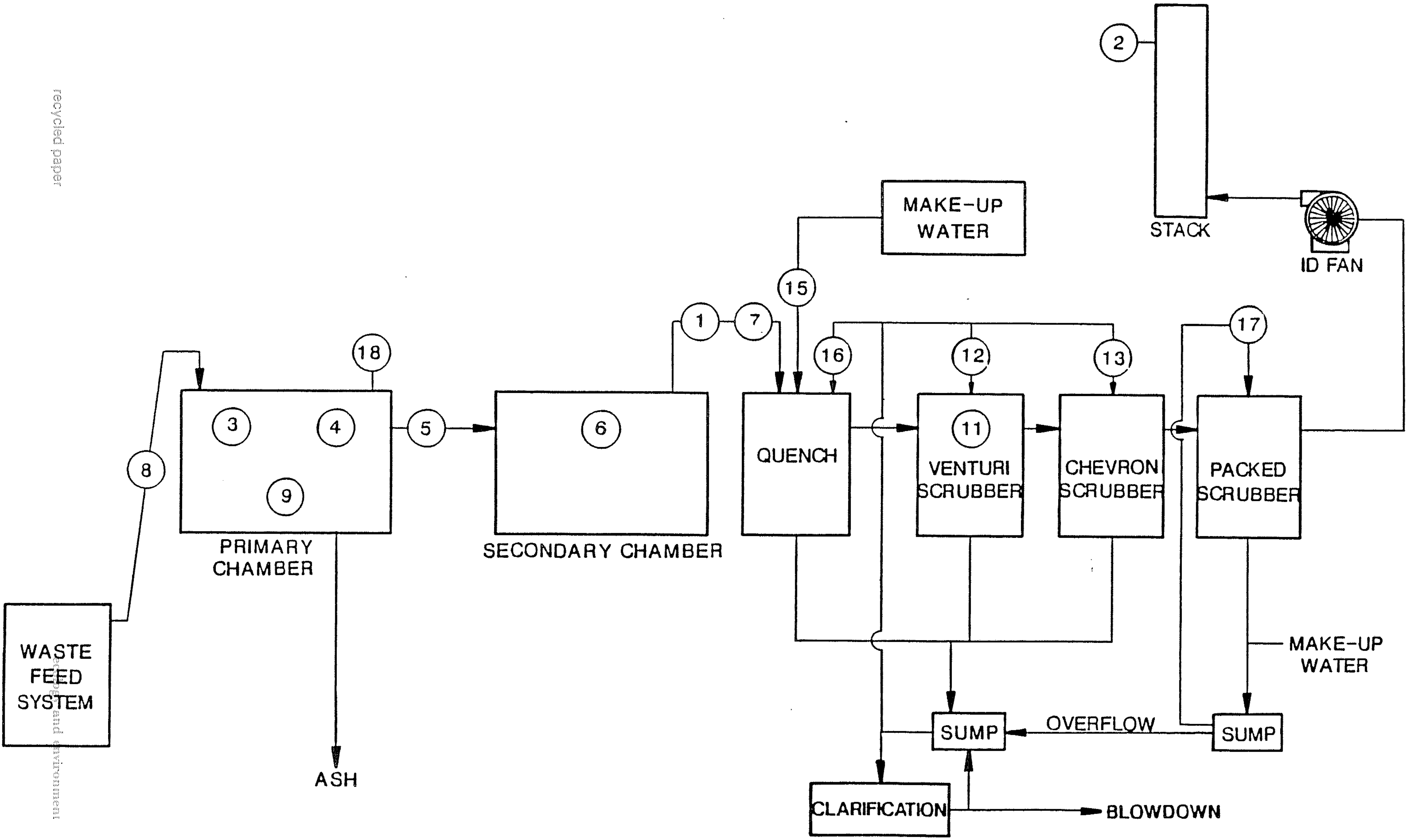


FIGURE 3.2

SCHEMATIC OF MONITORING LOCATIONS

TABLE 3.1

DEMONSTRATION TEST SAMPLING AND MONITORING PLAN

Parameter	Stream	Method	Frequency	Location*	Number of Samples	Replicates	Field Blanks
PCB, Cl^-, Btu/lb, Moisture	Waste feed	Composite	15 minutes	1	3	2	--
PCB, PCDD, PCDF	Ash	Composite	15 minutes	2	3	2	--
PCB, PCDD, PCDF	Scrubber water	Grab	End of run	3	3	2	2
PCB	Treated scrubber water	Grab	End of run	6	3	--	--
PCB, PCDF, PCDD	Stack gas	MM5	Continuous	4	3	--	1
Particulate, HCl	Stack gas	M5	Continuous	4	3	--	1
NO_x	Stack gas	Monitor	Continuous	4	--	--	--
Carbon monoxide, carbon dioxide	Stack gas	NDIR monitor	Continuous	4	--	--	--
Oxygen	Stack gas	KEYSTONE CEM	Continuous	4	--	--	--
Oxygen	Stack gas	Electro-chemical cell monitor	Continuous	5	--	--	--

*Refers to Figure 3.1

TABLE 3.2

SUMMARY OF MONITORING PLAN

Parameter	Method	Frequency	Location[a]	Contingency
Oxygen	Extractive CEM	Continuously	AE 461, 1	Stop Operations/Repair System (SORS)
Carbon Monoxide	Extractive CEM	Continuously	AE 570, 2	SORS
Carbon Dioxide	Extractive CEM	Continuously	AE 570, 2	SORS
Combustion Temperature Primary Furnace	Double Element Shielded Thermocouples	Continuously	TE 112, 3 Zone A TE 112, 4 Zone B	Second System Second System
Primary Exhaust Duct	Double Element Shielded Thermocouples	Continuously	TE 300, 5	Second System
Combustion Temperature Secondary Combustor	Double Element Shielded Thermocouples	Continuously	TE 450, 6	Second System
Secondary Exhaust Duct	Double Element Shielded Thermocouples	Continuously	TE 460, 7	Second System
Waste Feed Rate	Weigh Belt Feeder	Continuously	WTI, 8	SORS
Residence Time Primary Furnace	Belt Speed Element	Continuously	SE 31, 9	Manual Calculation
Exhaust Gas Velocity	Velocity Probe	Continuously	AE 571, 2	Repair
Combustion Efficiency	Manual Calculation			Manual Calculation

[a] Number refers to Figure 3.2.

TABLE 3.2 (CONTINUED)

SUMMARY OF MONITORING PLAN

Parameter	Method	Frequency	Location[a]	Contingency
Venturi Pressure Drop	Differential Pressure Transmitter	Continuously	11	Manual Adjustment
Venturi Scrubber Liquid Flow	Flow Element	Continuously	12	SORS
Chevron Flow	Flow Element	Continuously	13	Second System
Scrubber Quench Flow	Flow Element	Continuously	15	Second System
Scrubber Quench Recycle Flow	Flow Element	Continuously	16	Second System
Packed Scrubber Liquid Flow	Flow Element	Continuously	17	SORS
Incinerator Draft	Pressure Transmitter	Continuously	18	SORS

[a] Number refers to Figure 3.2.

3.1.1 Waste Feed

The waste feed consisted of PCB-contaminated soils. A grab-sampling procedure was used to obtain a representative, time-averaged sample of the waste feed. The waste feed was sampled at the incinerator feed hopper. Grab samples, approximately 3 ounces in volume, were obtained at 15-minute intervals throughout each test. These samples were composited in an amber-glass jar with a Teflon-lined cap.

3.1.2 Incinerator Ash

A grab-sampling procedure was used to obtain a representative, time-averaged sample of the incinerator ash. Grab samples, approximately 1 ounce in volume, were obtained from the ash discharge at 15-minute intervals. The samples were composited and homogenized (in an amber-glass jar) prior to submittal to the laboratory.

The first point composite was taken 10 minutes after stack sampling had begun. The last composite was taken when the stack sampling had been completed.

3.1.3 Scrubber Effluent Sampling

As a measure of system effectiveness, the scrubber effluent was analyzed for PCB content. Because of the volume and homogeneity of the liquid in the scrubber recirculation tank, short-term variations in PCB concentration were not expected; therefore, frequent grab sampling was not required.

Five 1-liter samples were taken from the scrubber sump at the end of each test run. One-liter amber-glass sample bottles with Teflon-lined lids were used. Prior to use, the bottles were rinsed with deionized water, acetone, and pesticide-grade hexane. Sample collection was consistent with USEPA Methods 3510 and 8080.

3.1.4 Flue Gas Sampling

During each test, various flue gas emissions and parameters were sampled and monitored by the stack-sampling contractor. Complete details of the sampling, analysis, and monitoring systems and procedures are given in Section 4.0. A summary of the sampling and monitoring methods used during the trial burn is presented below.

A single USEPA MM5 sampling train was used during the testing for PCB, dioxin, and furans. A separate Method 5 sampling train was set up for particulate and HCl.

Monitoring for NO_x was conducted on a continuous basis using a Thermal Environmental Chemiluminescent Model 10 NO/NO_x Gas Analyzer.

Continuous monitoring of the flue gas was conducted for oxygen, carbon monoxide, carbon dioxide, sulfur dioxide, and hydrocarbons. The sampling location for the continuous monitoring system was on the exhaust stack, approximately 2 feet below the sampling ports. The stack gas was conditioned by a Thermo Environmental Model 600 condensing conditioner. (All monitors were calibrated prior to and during use as required.)

3.2 PROCESS MONITORING

System monitoring was conducted as outlined in the permit application and Table 3.2; this included the following parameters:

- Primary chamber temperature
- Secondary chamber temperature
- Waste feed rate
- Primary chamber residence time
- Venturi pressure drop
- Venturi liquid flow rate
- Chevron liquid flow rate
- Scrubber liquid quench flow
- Scrubber liquid recycle flow
- Packed scrubber liquid flow
- Incinerator draft
- Oxygen concentration
- Carbon monoxide concentration
- Carbon dioxide concentration

4.0 SAMPLING AND ANALYSIS PROCEDURES

This section documents the sampling, analytical, data-reduction and quality-assurance (QA) procedures conducted during the demonstration test of the OHM mobile incinerator.

As previously indicated, three test runs were conducted to demonstrate the effectiveness of the infrared technology in processing soils contaminated with PCBs. During the course of the field program, samples were collected from six process streams: waste feed, incinerator ash, makeup water, scrubber water, treated scrubber water, and flue gas. The specific sampling approaches for each of these streams are presented below. A description of the analytical methods used for each process stream is given in Section 4.9. A summary chart of the sampling and analytical program is presented in Table 4.1.

4.1 WASTE-FEED SAMPLING

Samples of "as fired" waste feed (contaminated soil) were collected from the incinerator feed hopper at 15-minute intervals throughout each test run. The hopper was sampled by the waste feed operator. The sample was collected in a new 6-quart "aluminum roasting pan." These samples were then composited into precleaned amber-glass bottles to form a single sample for PCB and chloride analyses. Duplicate samples were also collected as outlined in the demonstration test plan. One additional amber-glass bottle was collected during each test and archived at the ETC Edison Laboratory.

4.2 INCINERATOR ASH SAMPLING

Samples of the treated soil were collected from the ash discharge chute at 15-minute intervals throughout the test run. The samples were collected by Mr. Mark McCabe of RETEC. The composite was collected in a stainless-steel pan freshly lined with clean aluminum foil at each 15-minute interval. The sample was allowed to cool for 10 minutes before being equally divided into the sample bottles. At the completion of the run, the sample bottles were shaken for approximately 1 minute in order to obtain a homogeneous sample. These samples were then analyzed for PCB and PCDD/PCDF. Duplicate samples were collected as required by the QA plan. One additional duplicate sample was collected for each test and archived at the ETC Edison Laboratory.

4.3 MAKEUP WATER SAMPLING

One sample of makeup water (scrubber influent water) was collected on the first day of the sampling program. The sample was collected at the point where the on-site well water enters the 12,000-gallon fresh water reservoir. The sample was analyzed for PCBs.

TABLE 4.1

SAMPLE AND ANALYTICAL CHART
PCB TRIAL BURN JUNE 29 AND 30, 1988

Matrix	Sample Method	Parameter	Analytical Method	By	Detection Limit	Sample Volume	Number of Samples Per Analysis			
							Test 1	Test 2	Test 3	Total
Soil	Composite 15 Minute	PCB	680	ETC	2 ppm	10 g	1	2^a	2^a	5
		Cl	ASTM,D608-81	ETC	0.1%	1 g	1	2	2	5
		Btu	ASTM,E711	ETC	200 Btu/lb	1 g	1	2	2	5
		Moisture	ASTM,D2216	ETC	1.0%	10 g	1	2	2	5
Ash	Composite 15 Minute	PCB	680	ETC	10 ppb	100 g	1	2^a	2^a	5
		PCDD/PCDF	M 8280	ETC	0.2 ppb	100 g	1	1	1	3
Scrubber Water	Grab	PCB	680	ETC	0.2 ppb	1.0L	1	2^a	2^a	5
		PCDD/PCDF	M 8280	ETC	1 ppb	1.0L	├------	------	------┤ b	1
Flue Gas	MM5	PCB	680	ETC	1.0 ug	$4m^3$	1	2^c	1	4
		PCDD/PCDF	M 8280	ETC	10 ng	$4m^3$	1	1	1	3
Flue Gas	M5	Particulate		SSC	0.01gr/ dscf	30 ft^3	1	1	1	3
		HCl		SSC			1	2^c	2^c	5
Treat Scrubber Water	Grab	PCB	680	ETC	1 ppb	1.0L	1	1	1	3
Makeup Water	Grab	PCB	680	ETC	1 ppb	1.0L	1			1

a - Duplicate Samples
b - 3-Day Composite Sample
C - Field Blank Samples

4.4 SCRUBBER WATER SAMPLING

Samples of the scrubber water were collected at the conclusion of each sampling run. These samples were collected into precleaned amber-glass containers for PCB analysis. An additional sample of scrubber water was collected from each of the tests and equally composited into a single sample for PCDD/PCDF analysis. Duplicate samples were also collected and a sample from each run was archived at the ETC Edison Laboratory. The sample was collected from a sample tap at the discharge of the quench recycle pump. Approximately 1 liter of liquid was purged from the sample tap before collection of the sample.

4.5 TREATED SCRUBBER WATER

A sample of treated scrubber water was collected at the end of each run. The water was sampled at a tap in the discharge pipe after the flow meter. The sample was collected in a 1-liter amber-glass bottle.

4.6 FLUE GAS SAMPLING

The characterization of the flue gas stream required the most comprehensive sampling program, entailing organic sampling as well as specific sampling for particulate matter, HCl, and continuous measurements for fixed gases and NO_x. A discussion of the specific procedures and instrumentation used for the accurate characterization of this stream is provided below.

4.6.1 Particulate Matter and HCl

Particulate and HCl species were simultaneously sampled using a Method 5 sampling train (see Figure 4.1).

Samples were collected from 12 sampling points in the 32-inch-diameter stack. The number and location of these points was determined in accordance with USEPA Reference Method 1. Sampling times were 120 minutes in duration, providing for a collected sample volume of greater than 50 dscf. All sampling and leak check procedures were conducted in accordance with the requirements of the Reference Method.

Particulate matter was recovered from the front half of the sampling train (nozzle, probe, and filter housing), using distilled in glass (DIG) acetone, into a precleaned linear polyethylene (LPE) sampling container. The associated particulate filter (Gelman Sciences - Type A/E) was recovered into its original petri dish for transport and subsequent analysis.

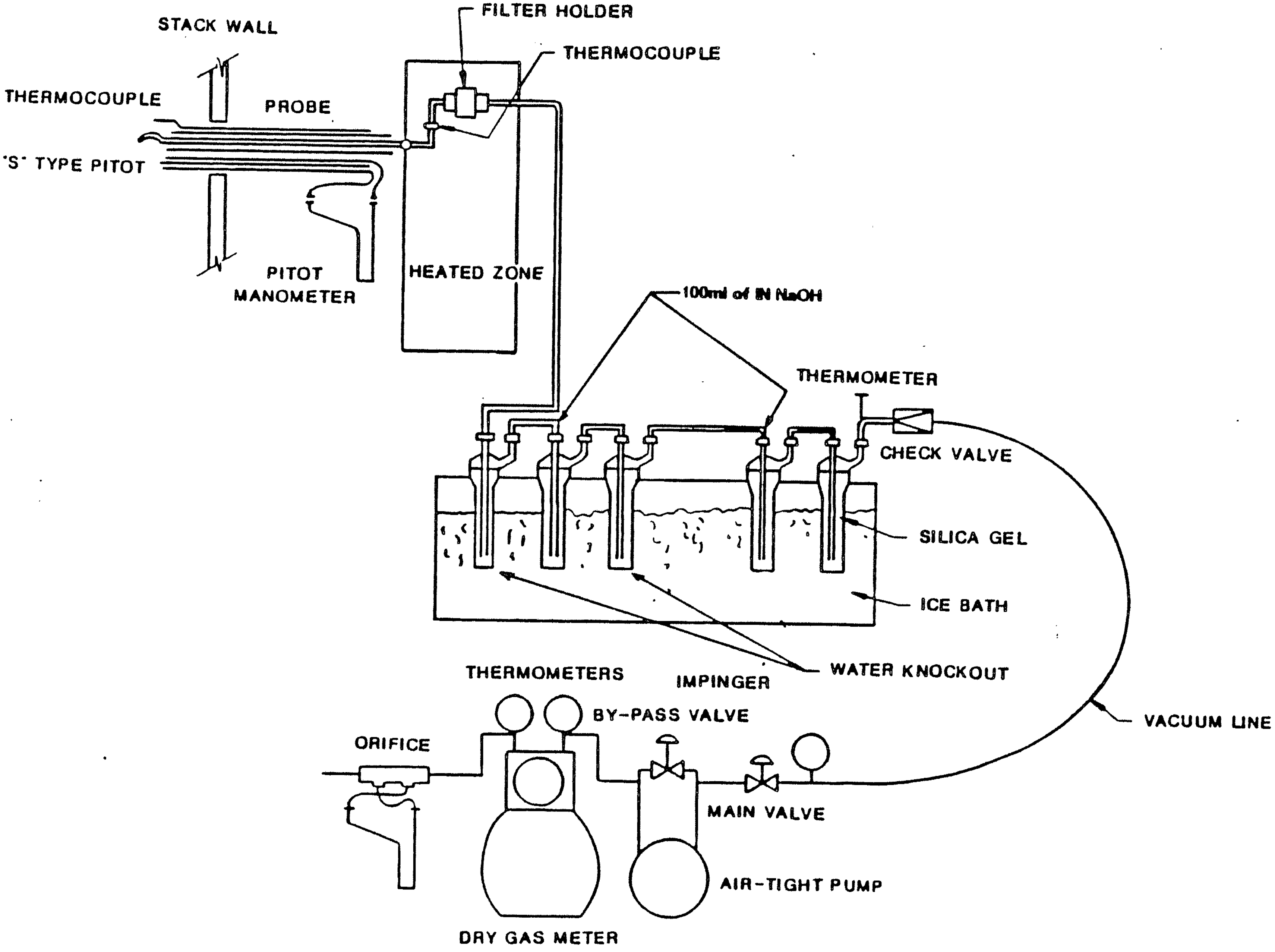


FIGURE 4.1
METHOD 5 SAMPLING TRAIN

The impinger arrangement consisted of a dry impinger, an impinger with 100 milliliters (ml) of 1.0 normal sodium hydroxide, a dry impinger, an impinger with 100 ml of 1.0 normal sodium hydroxide, and an impinger loaded with silica gel for final moisture removal. The use of the dry impingers was to provide an additional reservoir for the moisture from the saturated stack gas which was determined to be approximately 40 percent moisture. The material collected in the first three impingers was subjected to analysis by ion chromatic technique. The fourth impinger was analyzed for the purpose of determining capture efficiency of the sample train. This data was then converted using the stoichiometric relationship between the chloride ion and hydrogen chloride and used to determine actual HCl emissions.

The impinger solutions were measured gravimetrically and recovered into precleaned LPE containers for transport to the laboratory. The Method 5 samples remained in the custody of KEYSTONE personnel through analysis.

Calibration and field data sheets for the particulate sampling train are included in Appendix C.

4.6.2 Organic Sampling--PCBs, PCDDs, and PCDFs

The concentration and mass flow rate of the organic species of interest for the program were quantified using the MM5 train illustrated in Figure 4.2. A diagram of the XAD-2 cartridge is contained in Figure 4.3.

The sampling train consisted of a glass-lined, heat-traced probe with a stainless-steel, button-hook nozzle and attached thermocouple and pilot tube assembly. The filter holder contained a Whatman QA-A Quartz fiber filter heated to 248 (plus or minus 25) degrees Fahrenheit, which was followed by a water-cooled condenser and a sorbent module containing precleaned XAD-2 resin. The module was maintained at less than 68 degrees Fahrenheit. The control unit was a Model 31-200TC manufactured by NAPP Inc. The sorbent module was followed by a series of impingers to collect and remove entrained moisture from the gas stream.

The first impinger acts as a condensate reservoir and is modified to prevent organic material from being purged from the collected liquid. The last impinger contains desiccant for determination of the moisture content of the flue gas. The impinger system is followed by a pump, dry gas meter, and calibrated orifice.

All components of the sampling train that had the potential to come into contact with samples for organic analysis were subjected to rigorous cleaning procedures, prior to their use in the field. The presampling activities included:

- o Soap and water wash

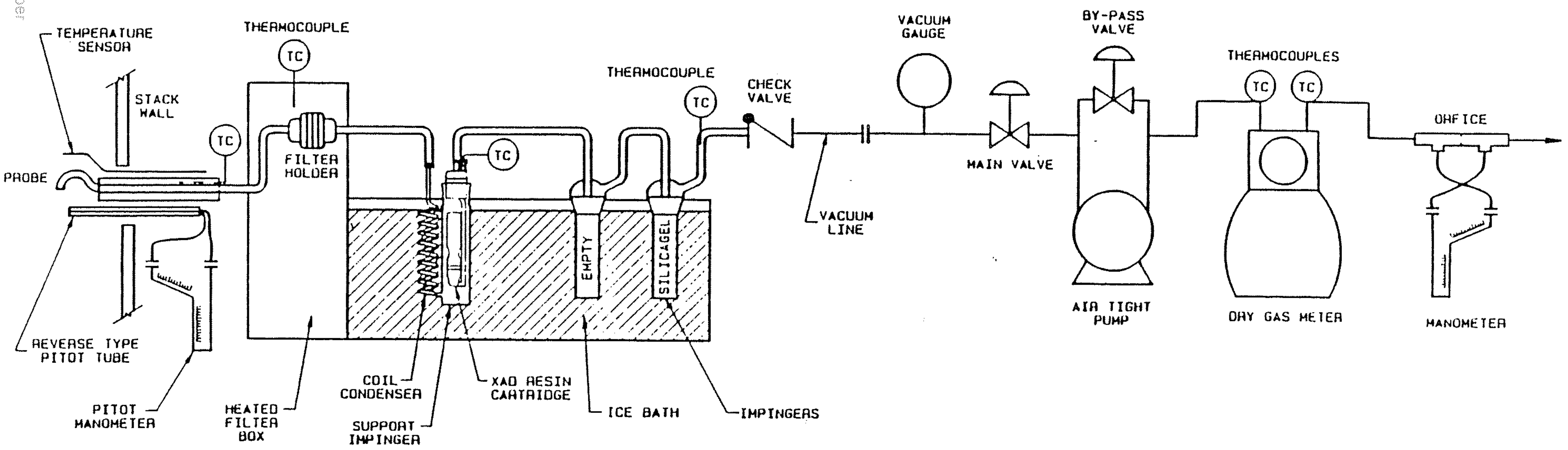


FIGURE 4.2

MODIFIED METHOD 5 SAMPLING TRAIN

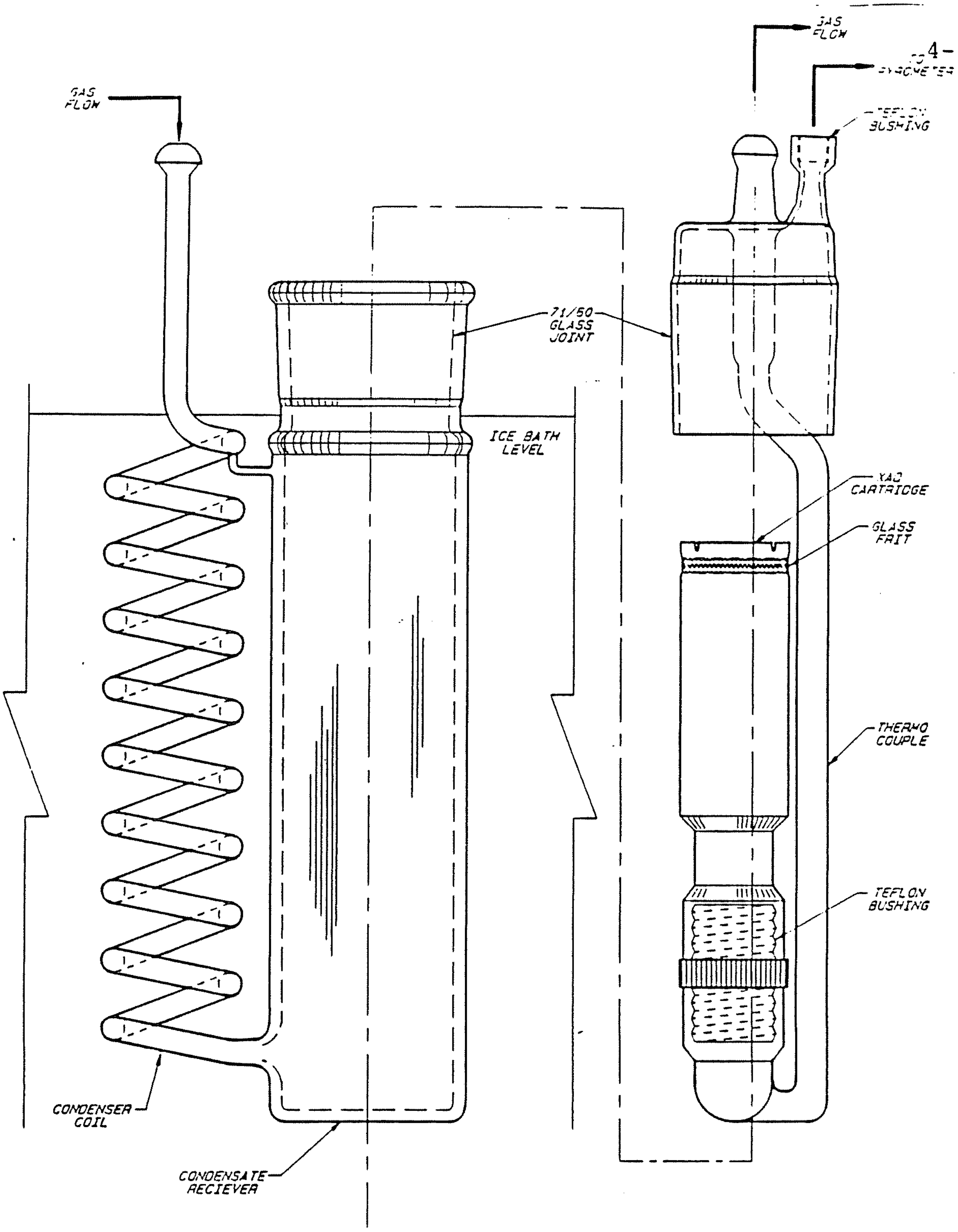


FIGURE 4.3

MM5 CONDENSER AND XAD RESIN CARTRIDGE

- Fifteen-percent, nitric-acid rinse
- Deionized-water rinse and an organic-water rinse with acetone and methylene chloride

All glassware was capped with solvent-rinsed aluminum foil for transport.

The organic sorbent and field solvents were subjected to quality assurance/quality control (QA/QC) evaluations in accordance with USEPA Level I procedures, prior to their use in the field.

A field-biased blank train was assembled and recovered in the field in conjunction with the first day of sampling to quantify any biases introduced through the handling and transporting of the samples. The field-biased blank train for the second day was not analyzed due to breakage of XAD-2 enroute.

Samples of flue gas were collected from 12 traverse points in the exhaust stack, as determined by USEPA Reference Method 1. All sampling and leak-check procedures were conducted in accordance with the requirements of Reference Method 5. Sampling times were 4 hours in duration, based upon the requirements of TSCA.

Upon completion of the sampling run, the train was sealed and removed to a designated, clean area for recovery. The front half of the train was brushed and rinsed with 1:1 methylene chloride and acetone (v:v). The front half rinse was recovered into a precleaned amber-glass bottle with a Teflon-lined cap.

The particulate filter was recovered into its original petri dish and sealed with Teflon tape for transport. The sorbent module was sealed in its original glass container.

The volume of the condensate was measured in a precleaned graduated cylinder and transferred to an amber-glass container. The back half of the train (back half of the filter housing, condenser, and first impinger) were rinsed with DIG methylene chloride into the recovered condensate sample. The container was then vented and sealed.

The net water gain of the remaining impingers was determined and recorded for calculation of moisture content.

4.6.3 Continuous Monitoring

Monitoring for fixed gases, carbon monoxide, and NO$_x$ was conducted on a continuous basis throughout the entire sampling program. NO$_x$ concentrations were monitored in accordance with USEPA Method 7E adapted for this source. Carbon monoxide concentrations were monitored in accordance with USEPA Method 10. Oxygen and carbon dioxide concentrations were monitored in accordance with USEPA Method 3A.

Samples were extracted from an existing, threaded fitting located 2 feet below the stack sampling ports. The stack gas was extracted through a Teflon line for continuous analysis by instrumentation housed in the continuous emission monitor (CEM) station. A list of equipment used is summarized in Table 4.2. The stack gas was conditioned by a Thermo Environmental Model 600 condensing conditioner. The dry stack gas was analyzed for carbon dioxide, oxygen, carbon monoxide, NO_x, and sulfur dioxide. A sample from the stack gas was extracted through a heated line for analysis by a Beckman Model 402 total hydrocarbon analyzer.

The instrumentation was calibrated daily and was audited by Mr. Jim Surman before the first PCB run. The audit calibration gases were high and low concentrations of carbon dioxide, oxygen, and carbon monoxide which were provided by MRI and added directly into the sample line. The instruments responded accurately with a response time of less than 1 minute. The signal output from the instrumentation was recorded by strip chart recorders and a data-logging system.

All CEM data was recorded on a Model 150 data logger. A summary of the field data from the program is presented in Appendix C.

4.6.4 Sampling Containers

A complete list of samples collected from each of the sampling runs is presented in Table 4.3.

4.7 QA/QC PROCEDURES

The QA program entailed the calibration of all sampling and analytical apparatus where applicable and the use of control samples and replicate analyses where feasible.

4.7.1 Sampling Apparatus

The sampling equipment was calibrated according to USEPA procedures specified in APTD 0576; 40 CFR 60, Appendix B; and manufacturers specifications.

- Dry Gas Meter and Orifice Meter--The dry gas meters for all sampling trains were calibrated against a standard wet test, which had been calibrated by procedures outlined in the Quality Assurance Handbook for Air Pollution Measurement System Volume 1, Section 2.1.2 USEPA-600/4-77-027A.

- Thermocouples--The Type K thermocouples in the meter control box, a heated sample box impinger umbilical connector, and attached to the probe were calibrated against ASTM mercury-in-glass thermometers at two points: in an ice bath and at the boiling point of water.

TABLE 4.2

CONTINUOUS EMISSIONS MONITORS

Manufacturer	Parameter	Model	Principal of Operation	Range of Operation
Infrared Industries	Carbon dioxide	702	NDIR	(0 to 20 percent)
Inrared Industries	Carbon monoxide	730	NDIR	(0 to 500 ppm_v)
Thermal Environmental	NO_x	10	Chemiluminescent	(0 to 250 ppm_v)
Thermal Environmental	Sulfur dioxide	40	Pulsed fluorescence	(0 to 25 ppm_v)
Combustion Engineering	Oxygen	305A	Polaragraphic	(0 to 25 percent)
Beckman Industries	THC	402	Flame ionization detector	(0 to 100 ppm_v)

TABLE 4.3

FIELD SAMPLING--NUMBER AND TYPE OF SAMPLES

Sample Description	Sample Code	Analysis	Number Collected	Container Type	Comments
Modified Method 5					
Particulate filter	-MM5/PF	Organic	4	Petri	b
Front half	-MM5/FH	Organic	4	500-ml amber	b
Condensate	-MM5/CD	Organic	4	500-ml amber	a,b
XAD-2 resin and rinse	-MM5/XR	Organic	4	Glass trap	b
Method 5					
Particulate filter	-M5/PF	Gravimetric	1	Petri	
Front half	-M5/FH	Gravimetric	1	500-ml LPE	
Impinger catch	-M5/IMP	HCl	2	500-ml LPE	b
Solid/Liquid Samples					
Waste feed	SFeed-	Organic	8	1,000-ml amber	
Incinerator ash	XAsh-	Organic	11	1,000-ml amber	
Scrubber makeup	XScrub-Blk	PCB	1	1,000-ml amber	
Scrubber water	XScrub-	Organic	11	1,000-ml amber	
Treated water	TRTScrub-	PCB	3	1,000-ml amber	

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a - Extract with methylene chloride
b - Store at 4 degrees Celsius

- Pitot Tube--The "S" type pitot tubes were designed to meet geometric configurations as defined in USEPA Method 2.

4.7.2 Quality-Control Samples

Following are descriptions of the QC samples used in the program:

- Blank Samples--Blanks were collected for all samples in the field (i.e., solvent rinses, sorbent traps, and a glass fiber filter). Each blank was subjected to the same treatment and analysis as the corresponding sample.

- Field-Biased Blanks--Field-biased blanks, or blank samples which had been exposed to field and sampling conditions to assess possible contamination from the field.

- Duplicate Samples--Duplicate samples were collected for all solid and liquid process streams.

4.7.3 Sorbent Media Quality

The XAD-2 sorbents used in the flue-gas sample collection system were subjected to rigorous pretreatment in the laboratory, prior to release for field sampling purposes. The pretreatment procedures included sequential extraction, with a series of organic solvents so native organic contamination was reduced to acceptable levels. The requisite resin pretreatment procedures and guidelines for evaluating resin quality are contained in EPA IERL-RTP Procedures Manual: Level I Environmental Assessment (Second Edition), EPA-600/7-78-201.

4.8 SAMPLE TRANSPORT AND CUSTODY

All samples were placed in the sample preparation room as soon as possible after recovery.

Samples were shipped to the analytical laboratory by a designated person responsible for sample security. Upon receipt at the laboratory, the samples were logged into the laboratory logbook, given an identification number, and put into the custody of one person responsible for their analysis. All samples were inspected for damage, integrity of chain of custody, and leakage from liquid sample bottles. Field and laboratory custody procedures are detailed below.

4.8.1 Field Custody Procedures

In addition to identification labels or tags, chain-of-custody seals were used on samples collected by test personnel. These self-locking seals were placed across the shipping containers in such a way that the container could not be opened without breaking the seal. The condition of the seal was noted in the Sample Bank Master Log to document whether any tampering had occurred after the sample was collected.

The chain of custody of a sample was initiated and maintained as follows:

- A sample was collected and labeled.
- The sample was recorded on the sample chain-of-custody record.
- All samples were accounted for, packed, and shipped to the laboratory.

4.8.2 Laboratory Custody Procedures

Upon receipt at the laboratory, the samples and the sample packing sheet were turned over to the sample manager who:

- Logged the sample into the large bound master log
- Noted the condition and the container type
- Assigned and affixed a control number to the sample container
- After necessary preservation and/or subdivision, stored the samples in the refrigerated or non-refrigerated section of the sample bank as appropriate

4.9 ANALYTICAL PROCEDURES

Analytical activities for the program were conducted by ETC's Edison laboratory. All analyses were carried out in accordance with USEPA-approved methods. QA/QC procedures specified in the USEPA methods were used as guidelines for the analyses of the samples. This included the addition of method blanks and duplicate analyses where applicable (e.g., adequate sample size). Surrogate compounds were also added to monitor the efficiency of sample extraction and recovery in the gas chromatograph/mass spectrometry (GC/MS) analyses.

The specific analytical methods used in the program are summarized in the following paragraphs.

4.9.1 Presampling Activities

The first phase of the program involved the preparation of sorbent material and evaluation of high purity reagents to be used as sampling-train rinses and impinger solutions. Procedures used to obtain and/or prepare these materials are as follows:

- Organic-Free Water--Three gallons of high-purity water were prepared by distilling tap water, and passing the distillate through an activated charcoal column.
- Acetone--"Resi-analyzed"-grade was obtained from J. T. Baker Chemicals and used without further purification.
- Methylene Chloride--"Resi-analyzed"-grade methylene chloride was obtained from J. T. Baker Chemicals and used without further purification.
- Sodium Hydroxide--1.0 normal sodium hydroxide was prepared by dissolving 40 grams of the sodium hydroxide in 1 liter of deionized water.
- XAD-2--Precleaned XAD-2 was obtained (Supelpack-2, USEPA Level 1 contamination-free). It was further purified by Soxhlet extraction in methylene chloride. At the end of 16 hours of extraction, the solvent was discarded, and fresh aliquots of methylene chloride were added. The XAD-2 was then extracted for another 16-hour period. When the resulting extract exhibited no extraneous peaks in the GC screen, the XAD-2 was air-dried and immediately packed into precleaned containers for use in the field.

4.9.2 Sample Preparation

Upon receipt of the collected samples, the laboratory initiated preparations for specific constituent analyses. Analyses for particulate matter, total chloride, and organic constituents in the incinerator ash and waste-feed materials were initiated on the samples as submitted; however, flue-gas and scrubber-effluent samples required special handling prior to analysis.

Procedures for sample preparation and the methods used for the resulting analyses were as follows:

- Waste Feed--A 10-gram aliquot of the waste-feed sample was taken for extraction. It was spiked with 4,4'-Dibromobiphenyl and extracted for

16 hours in a Soxhlet extractor using toluene. The resulting extract was dried over anhydrous sodium sulfate adjusted to 5,000 ml using a Kuderna-Danish evaporator.

- Incinerator Ash--A 10-gram aliquot of each ash sample was spiked with 4,4'-dibromobiphenyl. The sample was extracted for 16 hours with toluene. The resulting extract was dried over anhydrous sodium sulfate and concentrated to approximately 1 ml, using Kuderna-Danish evaporators to facilitate lower sample detection limits.
- Scrubber Effluent--Approximately 1-liter aliquots of each of the effluent samples were spiked with 4,4'-dibromobiphenyl and extracted with methylene chloride in a separator funnel. The resulting extract was dried over anhydrous sodium sulfate and concentrated to about 1 ml, using Kuderna-Danish evaporators. Internal standards were then added prior to GC/MS analyses.
- Flue Gas--The flue-gas sampling train MM5 contains various components that need to be individually prepared and composited into one integrated sample prior to organic analysis. The components include the XAD-2 sorbent trap (XR-), probe rinses (FH-), condensate water (CD-), and particulate filter trap (PF-). The sample preparation procedures are delineated in Figure 4.4.

4.10 ANALYTICAL METHODS

Methods for analyses for PCBs, total chloride, particulate matter, PCDD/PCDF, and NO_x are described below.

4.10.1 PCBs in Waters, Oil, and Solids by GC/MS (SIM)

Samples were prepared using USEPA-approved methods and analyzed for PCB concentrations by GC/MS on a Hewlett-Packard 5890/5970 GC/MSD operated in the Select Ion Monitoring (SIM) Acquisition mode. The column used was a 60-meter by 0.25-millimeter fused silica capillary, coated with a 0.25-micrometer film of DB-5 stationary liquid phase (J&W Scientific; Rancho Cordova, California).

4.10.1.1 Qualitative PCB Determination (SIM)

For each level of chlorination, the two most intense ions in the M plus cluster-region were monitored at plus or

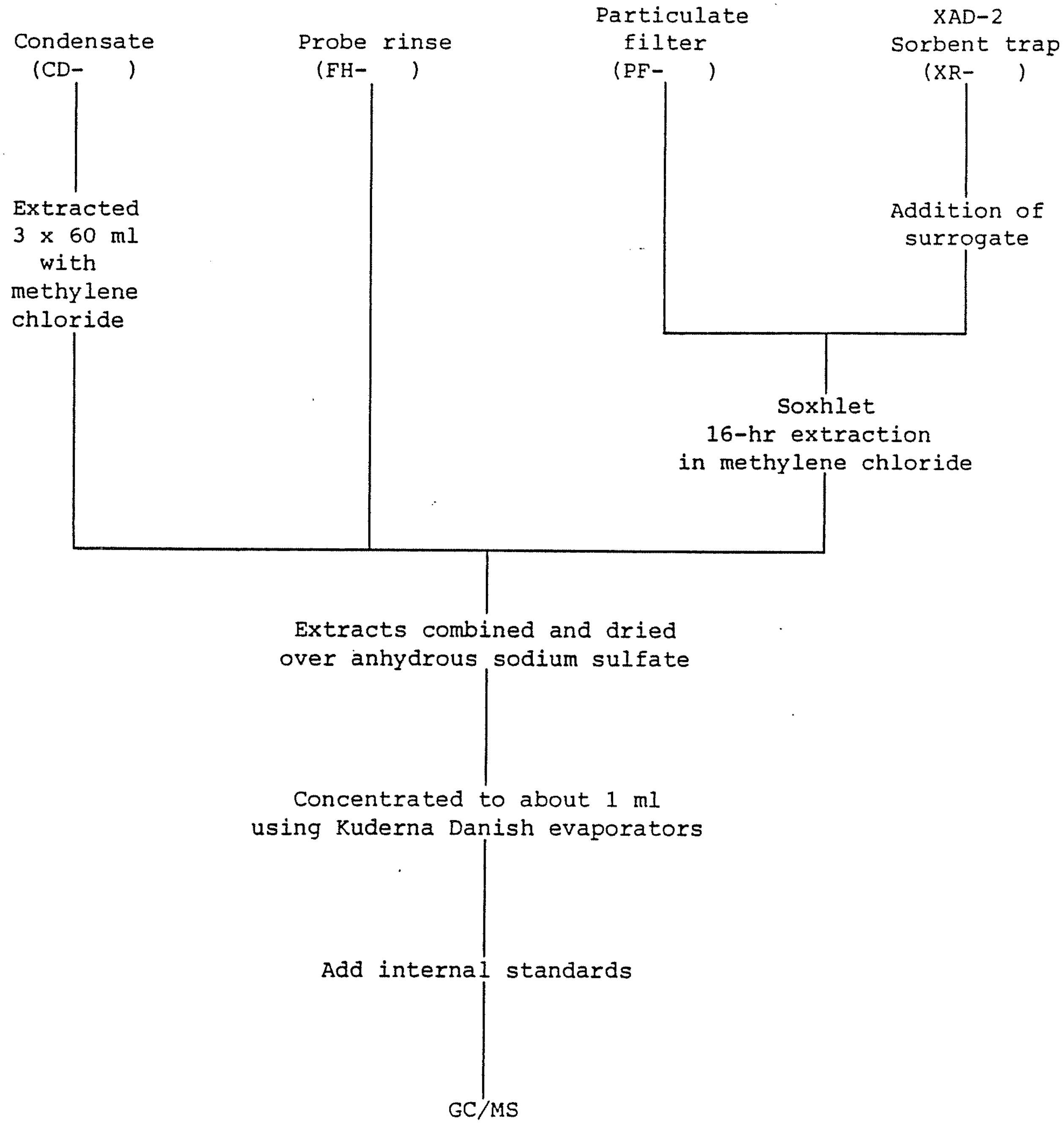


FIGURE 4.4

MODIFIED METHOD 5
SAMPLE PREPARATION PROCEDURES

minus 0.05 amu with a dwell time of 30 milliseconds. Qualitative PCB determination was based upon comparison of these abundance ratios to those in the literature for each chlorination level. Positive PCB cluster identification was made if the ion ratio fell within 10 percent of the theoretical level for that particular level of chlorination.

For each detected homolog, a level of chlorination was determined based upon the absence of ions at M plus 35 and M plus 70 amu in the individual spectrum.

4.10.1.2 Quantitation

PCB-congener calibration standards, containing a single PCB isomer to represent each level of chlorination, were used to generate response curves versus phenanthrene-d_{12} ISTD for each chlorination level. These response curves were used to determine sample concentrations at each level of chlorination from which the total PCB concentration was determined. For qualitative purposes, the weight-percent of each chlorination level was calculated and compared to published data for the various commercial Aroclor mixtures. Method extraction efficiencies were monitored with Aroclor spikes and a surrogate (4,4'-Dibromobiphenyl) to determine possible matrix interferences. GC/MS conditions for the analyses are listed in Table 4.4.

4.10.2 Total Chloride by Ion Chromatography

The total chloride content of the Method 5 impinger samples was determined using ASTM Method D-4327. The material collected in the first three impingers and the fourth impinger were subjected to separate analysis by an ion chromatic technique, for the purpose of determining chlorine capture efficiency of the sample train. The analytical data was then converted using the stoichiometric relationship between the chloride ion and hydrogen chloride and used to determine actual HCl emissions.

4.10.3 Gravimetric Determinations--Particulate Matter

Particulate matter in the probe-rinse and filter samples is determined according to the method discussed in the Federal Register 40 CFR 60, Appendix B, Reference Method 5.

4.10.4 PCDD/PCDF by GC/MS

A modified Method 8280 was used for the GC/MS characterization of PCDD/PCDF in the waste-feed, incinerator fly-ash, flue-gas, and scrubber-water samples. Analyses were conducted on a single, weighted-composite sample from the

TABLE 4.4

GC/MS PCB-SIM PARAMETERS

<u>GC Parameters</u>:	
Injector Temperature	300 Degrees Celsius
Column Coating	60M DB-5
Film Thickness	0.25 um
Column Dimensions	60m x 0.25 mm I.D.
Carrier Gas	Helium
Linear Velocity of Carrier Gas	24 Centimeters per Second
Temperature program	100 to 300 Degrees Celsius at 8 Degrees Celsius per Minute Held at 300 Degrees Celsius for 12.5 Minutes
Interface Temperature	310 Degrees Celsius
<u>MS Parameters</u>:	
Ion Source Temperature	265 Degrees Celsius
Multiplier Voltage	2800 Volts
Emission Current	300 Microamps

ash and scrubber water process streams. If there was a positive identification of PCDD/PCDF species from the composite sample, the remaining or individual run samples were analyzed.

The method uses a matrix-specific extraction, analyte-specific cleanup, and capillary-GC/low resolution-MS technique. Both the PCDD and PCDF were identified and measured as isomer groups (i.e., by level of chlorination). A concentration was measured for each PCDD/PCDF isomer group.

The total PCDD/PCDF concentration in each sample extract was obtained by summing group concentrations. The ten selected PCDD/PCDF congeners listed in Table 4.5 were used as calibration standards, and the field samples were analyzed according to GC/MS conditions listed in Table 4.6.

TABLE 4.5

PCDD/PCDF CONGENERS USED AS CONCENTRATION CALIBRATION STANDARDS

2,3,7,8--TCDD

2,3,7,8--TCDF

1,2,3,7,8--Penta CDD

1,2,3,7,8--Penta CDF

1,2,3,4,7,8--Hexa CDD

1,2,3,4,7,8--Hexa CDF

1,2,3,4,6,7,8--Hepta CDD

1,2,3,4,6,7,8--Hepta CDF

1,2,3,4,5,6,7,8--Octa CDD

1,2,3,4,5,6,7,8--Octa CDF

TABLE 4.6

GC/MS CONDITIONS FOR PCDD/PCDF ANALYSIS

Instrument: Hewlett-Packard 5890/5970 GC/MSD

<u>GC Conditions</u>	
Column	60 m DB-5 fused silica capillary column
Injection	
- Mode	Splitless
- Temperature	300 degrees Celsius
Temperature program	220 degrees Celsius for 17 minutes then 10 degrees Celsius per minute to 280 degrees Celsius then 30 degrees per minute to 320 degrees Celsius; hold for 12.7 minutes
<u>MS Conditions</u>	
Mode	70ev electron impact ionization
Mass range	Select ion monitoring for the ions in the molecular clusters and the loss of the COCl (M-63)

5.0 PRESENTATION AND DISCUSSION OF RESULTS

Three test runs were conducted to demonstrate that the OHM mobile infrared incinerator complied with Title 40 Code of Federal Regulations Part 701.70(b). The following subsections discuss the results of all sampling and analysis conducted during the June 1988 TSCA trial burn. The emissions of total chlorinated organics were determined when the incinerator was first used for the destruction of PCBs. The analytical results of this testing are hereby resubmitted in Appendix B. The stack sampling report from KEYSTONE is contained in Appendix C and the summary analytical reports from ETC are contained in Appendix F.

5.1 WASTE FEED RESULTS

A summary of the waste feed characteristics are contained in Table 5.1. The feed rate to the incinerator ranged from 13,728 to 13,921 lbs/hr with an average feed rate of 13,835 lbs/hr. The heat and moisture content of the waste material for the three test runs averaged 1,053 Btu/lb and 6.6 percent, respectively. The total chloride analysis data for the waste feed samples averaged 0.43 percent.

The waste was also analyzed for total petroleum hydrocarbons by GC. The waste from Test Run 2 showed a distinctly higher concentration of the heavier hydrocarbon products. This indicates the oil mixture used during Test Run 2 had a higher concentration of the Bunker C oil than either the first or third test runs.

The results of individual congener group analyses (Cl_1 through Cl_{10}) are presented in Table 5.2. Total PCB concentrations for the three test runs were determined to be 7,255; 8,277; and 5,366 ppm. The distribution of the congeners was primarily in the trichloro- through octachloro- biphenyls. The average PCB concentration for these samples was 6,966 ppm.

5.2 INCINERATOR ASH

Table 5.3 presents the results of PCB analysis for the treated soil samples. Test Runs 1 and 3 had PCB levels less then 2.0 ppm which falls within the guidelines of the Office of Toxic Substances (OTS). Test Run 2 had a PCB concentration of 33.6 ppm. The potential cause of this outlier has been thoroughly investigated over the past 2 months. The results of this investigation are discussed in Sections 5.2.1 and 5.2.2.

The operating permit application addresses the ash QA which will be used during operation. The QA program consist of taking a sample every 2 hours and compositing this sample into a 24-hour composite. . The ash collected during this time is stored in accordance with 40 CFR 761 standards, i.e., curbed impervious concrete pad that is protected from rain. It is held in this manner until a certified laboratory confirms the

TABLE 5.1

WASTE FEED CHARACTERISTICS

	Test Run		
	1	2	3
Feed Rate (lb/hr)	13,921	13,856	13,728
Heat Content (Btu/lb)	872	1,500	786
Moisture (percent)	6.6	6.6	6.5
Total Chloride (percent)	.54	.36	.38
Oil and Grease (percent)	3.56	3.62	3.65
Total Petroleum Hydrocarbons by GC			
Gasoline (ppm)	4,100	3,800	3,800
Diesel Fuel (ppm)	3,300	3,500	3,300
Lubrication Oil (ppm)	17,000	20,000	16,000

TABLE 5.2

PCB DETERMINATION IN WASTE FEED SAMPLES GC/MS METHOD 680 (mg/kg [ppm] DRY WEIGHT)

	Test Run		
Isomer Group	1	2*	3*
Cl_1-PCB	ND	ND	ND
Cl_2-PCB	5.00	5	2.5
Cl_3-PCB	25.0	30.0	15
Cl_4-PCB	25.0	94.7	19.9
Cl_5-PCB	580	952	470
Cl_6-PCB	3,385	3,739	2,479
Cl_7-PCB	2,650	2,820	1,902
Cl_8-PCB	445	491	303
Cl_9-PCB	140	145	175
Cl_{10}-PCB	ND	ND	ND
Total PCB	7,255	8,277	5,366

Three test average--6,966

ND - Not Detected

*Mean Concentration

TABLE 5.3

PCB DETERMINATION IN INCINERATOR ASH SAMPLES GC/MS METHOD 680 (mg/kg [ppm] DRY WEIGHT)

	Test Run		
Isomer Group	1	2*	3*
Cl_1-PCB	ND	ND	ND
Cl_2-PCB	ND	ND	ND
Cl_3-PCB	ND	ND	ND
Cl_4-PCB	.003	0.02	0.002
Cl_5-PCB	.043	1.24	0.087
Cl_6-PCB	.301	12.2	0.511
Cl_7-PCB	.417	15.2	0.763
Cl_8-PCB	.124	3.67	0.182
Cl_9-PCB	.058	1.28	0.062
Cl_{10}-PCB	ND	ND	ND
Total PCB	0.946	33.61	1.607

ND - Not Detected

*Mean Concentration

2.0 ppm cleanup criterion. If the ash contains greater than 2.0 ppm PCB, it is reprocessed through the incinerator. Any ash containing greater than 2.0 ppm is never released from the "incinerator system boundaries", and thus does not present a potential threat to human health or the environment.

As indicated in Table 5.4, no detectable levels of PCDD species were present in any of the ash samples. PCDFs were detected at low levels in the ash from the test program.

A procedure to evaluate the toxicity of a mixture of chlorinated dioxins and furans by estimating 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) equivalents based upon carcinogenic, reproductive, and biochemical effects has been developed by the USEPA's Chlorinated Dioxins Work Group. 2,3,7,8-TCDD equivalents are calculated by applying a toxic equivalence factor (TEF) to each congener chlorinated dibenzo-dioxin (CDD) and chlorinated dibenzofuran (CDF) group. The sum of the respective equivalents for each congener group equals the 2,3,7,8-TCDD equivalent for the mixture. The toxic equivalent factors for the individual PCDD and PCDF isomer groups are presented below.

Congener Group	TEF
PCDF	
Tetra	0.1
Penta	0.1
Hexa	0.01
Hepta	0.001
Octa	0
PCDD	
Tetra	1
Penta	0.2
Hexa	0.04
Hepta	0.001
Octa	0

The procedure was used to evaluate the significance of the dioxin and furan concentrations in the ash samples. The 2,3,7,8-TCDD equivalents for Test Runs 1 and 3 are 0.179 and 0.165 ppb. These values are well below the action levels (1 ppb) that have been established for the cleanup of dioxin-contaminated sites such as Times Beach, Missouri. The 2,3,7,8-TCDD equivalent for Test Run 2 was 1.09 ppb. It should be noted that this ash is reprocessed during normal operation.

5.2.1 Electrical Heat Input Effects on Ash Quality

This section describes how the electrical heating components operated and how they have a major influence on the operation of the primary chamber. The infrared incineration

TABLE 5.4

PCDD/PCDF DETERMINATION IN INCINERATOR ASH SAMPLES GC/MS METHOD 8280 (ug/kg [ppb] DRY WEIGHT)

	Test Run		
Isomer Group	1	2*	3*
PCDD:			
2,3,7,8-TCDD	ND	ND	ND
Tetra	ND	ND	ND
Penta	ND	ND	ND
Hexa	ND	ND	ND
Hepta	ND	ND	ND
Octa	ND	ND	ND
PCDF:			
2,3,7,8-TCDF	0.17	0.825	0.13
Tetra	0.41	3.10	0.25
Penta	0.46	6.36	0.87
Hexa	1.46	5.89	1.02
Hepta	0.46	1.74	0.27
Octa	0.36	1.44	ND
Total 2,3,7,8-TCDD Equivalents	<0.179	<1.09	<0.165

---

*Mean Concentration

technologies are quite different from the older technology which has been used for hazardous-waste incineration.

The major difference is the manner in which the primary chamber is designed. The infrared technology uses a state-of-the-art electrical system. The system consists of two Heating Element Power Centers (HEPCs), distribution network, and glowbar heating elements. The input power is 480-volt three-phase, which is supplied from an external source to the HEPCs. The power control section contains a Silicon Controlled Rectifier (SCR) which regulates the amount of power that is sent to the transformer and thus to the glowbars. Each phase of the three-phase power input controls nine glowbars and each HEPC controls 27 glowbars (one zone). The power distribution system is illustrated in Figure 5.1.

The transformer section is composed of three transformers, one for each phase. The transformer takes the 0 to 480 volt power passed by the SCRs and steps the voltage down to a low voltage-high current power output, which then goes to the heating elements.

The electrically heated glowbars are manufactured from high-purity, high-density silicon carbide crystals. The glowbars are heated with electricity and give off radiant heat in the infrared spectrum.

Infrared heating problems can be caused by a large number of broken glowbars, malfunctioning control system, improper cure of new glowbars, or moisture absorption during long periods of downtime.

Based on our operating experience to date, new operation and maintenance procedures will be implemented to maximize waste destruction in the infrared heating system.

5.2.1.1 Maintenance Program

The following maintenance program will be established.

- Voltage and amperage for each zone will be recorded each hour.
- When amperage reading on each phase differs by 15 percent, operator will initiate waste feed shutoff and investigate cause.
- The first step is to check and determine if broken glowbars are causing the problem.
- If glowbars are broken, they will be replaced. Bars will be replaced with bars having the same resistance as existing bars.

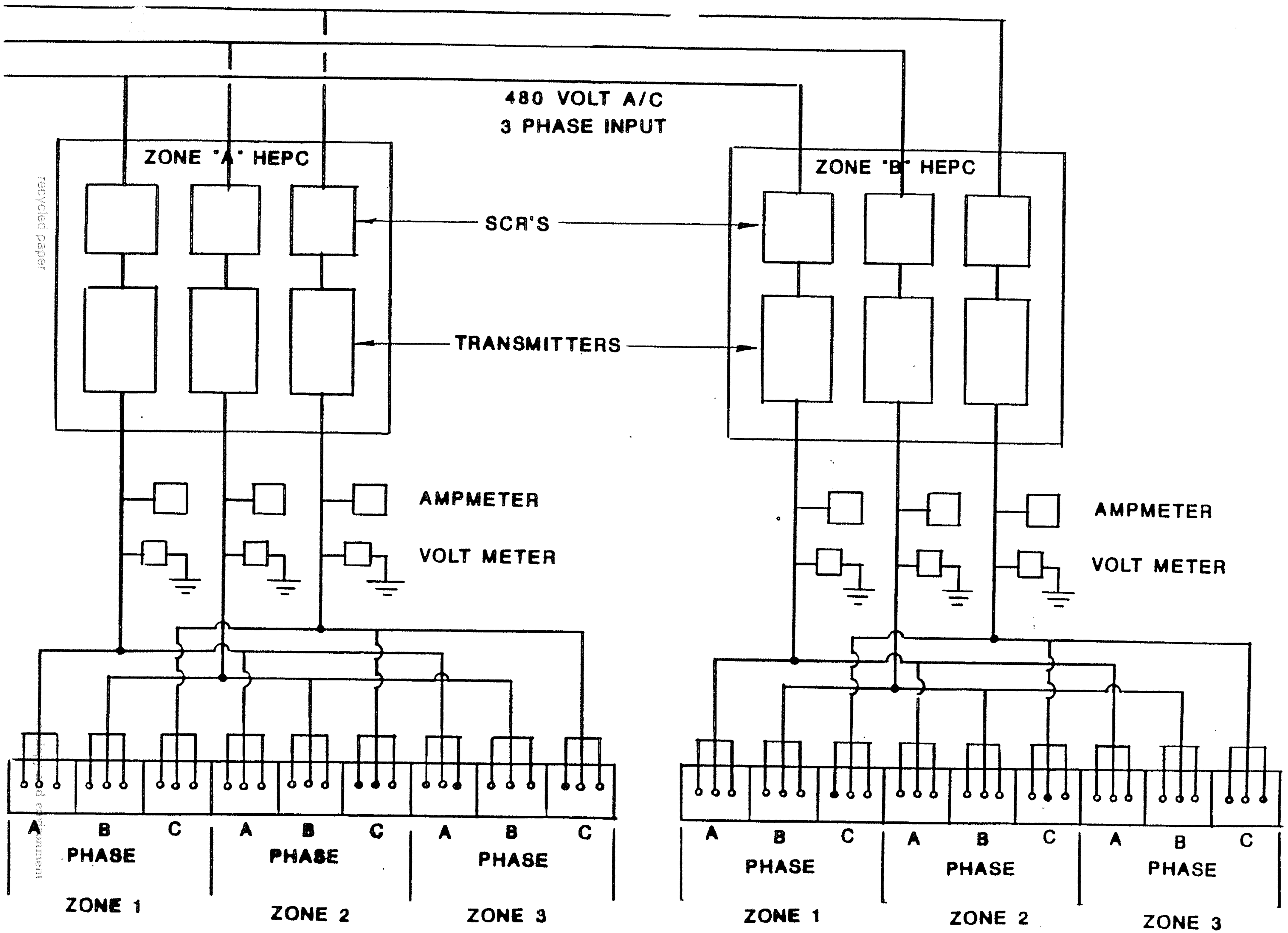


FIGURE 5.1
POWER DISTRIBUTION

- After changing bars, unit will be heated up and checked by reading volts and amps on each phase. If phases are balanced, unit should be slowly brought to operating temperatures.

- If phases are still not balanced after checking all glowbars, problem is in the control system. Maintenance will check the control system for failed SCRs or control circuit failures.

Glowbar Cure

If a large number of glowbars are replaced or the unit has been idle for a long period of time, glowbars need to be cured to remove moisture and stabilize their resistence.

New Bars

New bars will be cured for 24 hours. The cure procedures are as follows:

- 6 hours at 600 degrees Fahrenheit
- 12 hours at 1,200 degrees Fahrenheit
- 6 hours at 1,600 degrees Fahrenheit

If the unit has been idle for a long period, glowbars will be cured for 24 hours at 1,000 degrees Fahrenheit.

5.2.2 Supplemental Oil Addition

When contaminated soils are encountered with less then 400 Btu/lb, it is a standard procedure to add supplemental oil in order to increase the heat content to approximately 800 Btu/lb. A mixture of Bunker C oil and diesel fuel is used to enhance the heat content. The Bunker C oil is used for several reasons as follows:

- Holds the fine sand together so that it does not sift through the wire-woven belt

- Prevents the oil mixture from draining out of the waste

- To obtain optimum ash burnout

The oil is premixed from the distributor and then this mixture is mixed with the waste in a pug mill. The mill processes 1 ton per minute and the oil mixture is measured through a flow meter.

Problems that can occur with the oil addition system are that the oil mixture can separate, resulting in an uneven mixture. If the mixture is rich in Bunker C oil, the ash burnout characteristics can change. The stratification of the Bunker C oil mixture has been identified as a major factor in the ash burnout problem encountered during Test Run 2. The oil mixture problem will be solved by implementing the following systems:

- Maintain constant recirculation of the oil tank
- Measure viscosity prior to mixing to assure a viscosity of less then 190 csu
- Add a heating coil to the oil tank

With these improvements, maintenance of a proper blend is assured. The proposed system is illustrated in Figure 5.2.

5.3 SCRUBBER WATER

As indicated in Table 5.5 a small amount of trichlorobiphenyl (0.02 to 0.21 ppb) was present in all three scrubber samples. The same range of trichlorobiphenyl was also present in the fresh water make-up sample from the on-site well.

The 50,000-gallon scrubber reservoir was also sampled before the start of the first run. Trichlorobiphenyl was also present at a concentration of 0.31 ppb. All water samples met the TSCA requirement of less than 1.0 ppb PCBs.

No detectable levels of PCDD/PCDFs were present in the three-run composite scrubber water sample collected during the program, as illustrated in Table 5.6.

5.4 FLUE GAS

The results of the gravimetric analysis of the particulate samples collected using the USEPA Method 5 train are presented in Table 5.7. The average for the test runs was determined to be 0.057 gr/dscf which is well within the standard of 0.08 gr/dscf.

The impinger samples from the Method 5 sampling train were subjected to total chloride analysis in order to quantify the HCl emissions from the incinerator. The results of these analyses are presented in Table 5.8 and indicate that the HCl emissions from the system were less than 0.115 lb/hr in all cases.

The results of the continuous emissions sampling are summarized in Table 5.9.

The results of PCB analysis of the collected flue gas samples are presented in Table 5.10. No detectable levels of PCBs were present in the samples from Test Run 3. PCBs were present in the samples from Test Runs 1 and 2 at levels of

TABLE 5.5

PCB DETERMINATION IN SCRUBBER WATER SAMPLES GC/MS METHOD 680 (ug/L [ppb])

	Test Run				
Isomer Group	1	2*	3*	Makeup Water	50,000-Gallon Scrubber Reservoir
Cl_1-PCB	ND	ND	ND	ND	ND
Cl_2-PCB	ND	ND	ND	ND	ND
Cl_3-PCB	0.21	0.02	0.146	0.11	0.31
Cl_4-PCB	ND	ND	ND	ND	ND
Cl_5-PCB	ND	ND	ND	ND	ND
Cl_6-PCB	ND	ND	ND	ND	ND
Cl_7-PCB	ND	ND	ND	ND	ND
Cl_8-PCB	ND	ND	ND	ND	ND
Cl_9-PCB	ND	ND	ND	ND	ND
Cl_{10}-PCB	ND	ND	ND	ND	ND
Average Reporting Limit	.03	.03	.03	.03	.03

ND - Not Detected

*Mean Concentration

TABLE 5.6

PCDD/PCDF DETERMINATION IN SCRUBBER WATER SAMPLES GC/MS METHOD 8280 (ug/L) (ppb)

Isomer Group	Composite Sample of All Three Runs
PCDF:	
2,3,7,8-TCDF	<0.17
Tetra	<0.17
Penta	<0.52
Hexa	<0.34
Hepta	<0.34
Octa	<1.17
PCDD:	
2,3,7,8-TCDD	<0.21
Tetra	<0.21
Penta	<0.99
Hexa	<0.56
Hepta	<0.33
Octa	<0.80

TABLE 5.7

PARTICULATE EMISSIONS

Test Run	1	2	3
Front half rinse (mg)	6.6	10.9	10.3
Particulate filter (mg)	84.7	99.3	93.2
Total (mg)	91.3	110.2	103.5
Sample volume (dscf)	51.73	52.28	51.31
Oxygen concentration (percentage)	13.8	13.5	13.3
Isokinetic ratio (percentage)	99.27	96.32	100.4
Particulate emissions			
gr/dscf	0.027	0.032	0.031
gr/dscf at 7 percent water	0.053	0.061	0.056

TABLE 5.8

HCl EMISSIONS

Test Run	1	2	3
Total chloride (mg)	5.45	5.04	7.2
Sample volume (dscf)	51.73	52.28	51.31
Volumetric flow rate (dscfm)	6,332	6,002	6,209
HCl emissions (lb/hr)	0.088	0.076	0.115
Removal efficiency (percentage)	99.88	99.85	99.78

TABLE 5.9

SUMMARY OF CEM DATA TEST AVERAGES

Test Interval	NO_x (0-250) (ppm)	SO_2 (0-50) (ppm)	THC (0-100) (ppm)	CO_2 (0-20) (%)	O_2 (0-25) (%)	CO (0-500) (ppm)
M5 Test-1	16.1	1.1	6.2	4.7	13.8	1.0
M5 Test-2	16.6	0.5	2.3	4.7	13.5	4.6
M5 Test-3	16.1	0.7	5.4	5.1	13.3	1.1
Average	16.3	0.8	4.6	4.8	13.5	2.2
MM5 Test-1	16.1	1.2	8.0	4.8	13.5	1.2
MM5 Test-2	16.1	0.5	2.8	4.8	13.6	4.3
MM5 Test-3	16.3	0.6	5.6	5.0	13.4	1.1
Average	16.2	0.8	5.5	4.9	13.4	2.5

TABLE 5.10

PCB DETERMINATION IN FLUE GAS SAMPLES GC/MS METHOD 680 (ng/SAMPLE)

	Test Run		
Isomer Group	1	2	3
Cl_1-PCB	50	<45	< 35
Cl_2-PCB	< 36	<24	<101
Cl_3-PCB	300	240	< 60
Cl_4-PCB	200	90	< 16
Cl_5-PCB	110	<20	< 18
Cl_6-PCB	<4.3	<14	< 34
Cl_7-PCB	< 19	<16	< 60
Cl_8-PCB	<5.9	<7.9	< 23
Cl_9-PCB	< 57	<75	<195
Cl_{10}-PCB	< 25	<33	<124
Total PCBs*	<782	<532	<542

*Total calculated by adding up detection for all congeners except decachlorobiphenyl.

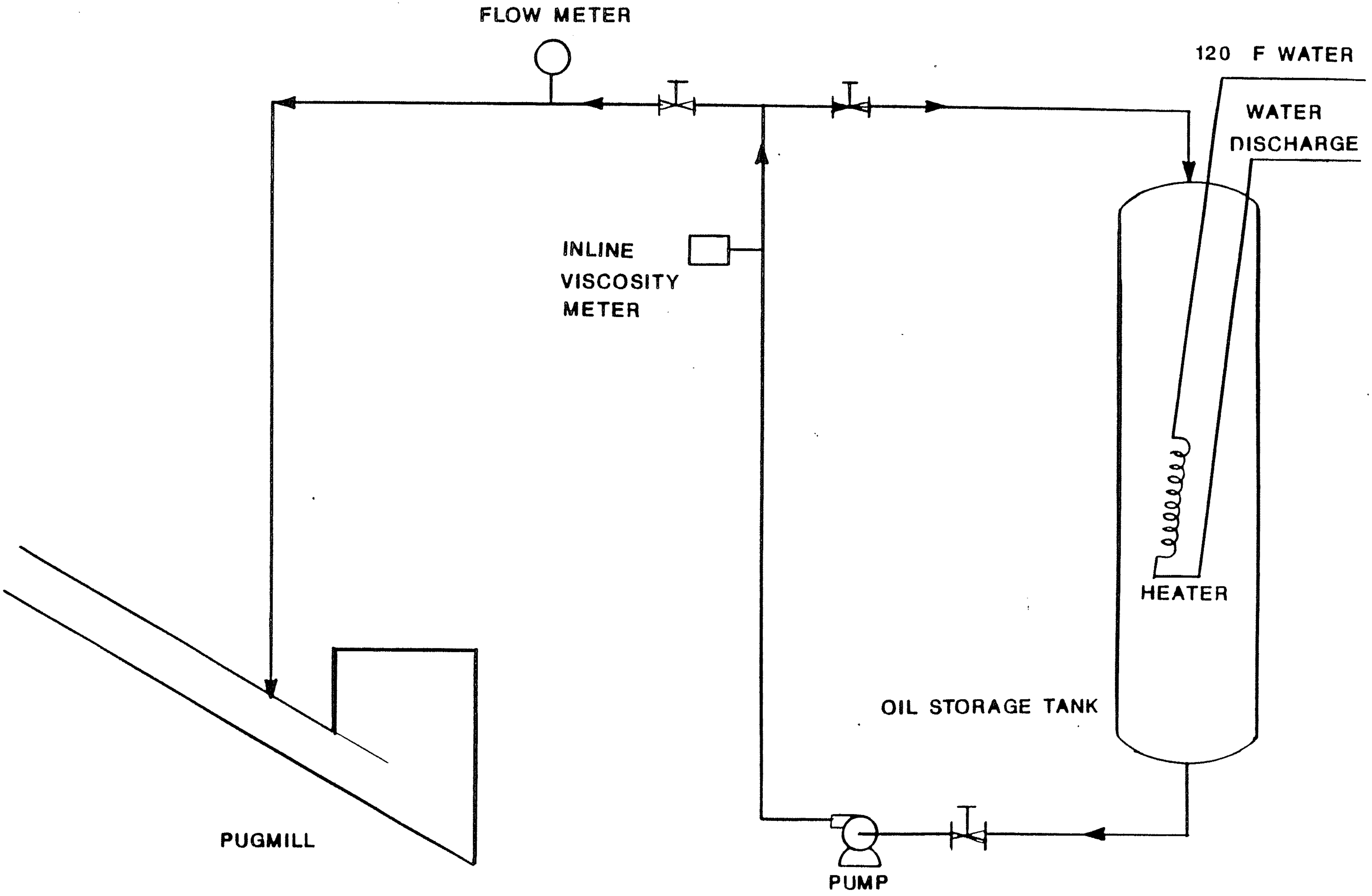


FIGURE 5.2
OIL MIXING SYSTEM

330 to 660 nanograms per sample (ngs). Table 5.11 contains the stack sampling data obtained from the MM5 sampling train. All of the DRE values were determined to be in excess of 99.9999 percent in all cases and met the performance requirements of TSCA.

The result of PCDD/PCDF analyses of the collected flue gas samples are presented in Table 5.12. As indicated, detectable levels of TCDF species were present in the samples at concentrations ranging from 13.8 to 18.4 ng/m3.

When the 2,3,7,8-TCDD toxicity equivalents are applied to the flue gas samples from Test Runs 1, 2, and 3, the toxicity equivalents have been determined to be less than 2.19, 1.36, and 2.76 ng/m^3, respectively. The concentrations of the 2,3,7,8-TCDD equivalents are all less than the 10 ng/m3 guidelines established in TSCA guidelines for demonstration test plans.

5.5 PERFORMANCE EVALUATION SAMPLES

On August 8, 1988, Mrs. Joan Blake of the OTS traveled to ETC's Edison laboratory to perform an audit. A total of five samples were submitted to the laboratory as follows:

Description	USEPA No.	ETC No.
XAD-2 Resin spiked	12501	BG-2763
XAD-2 Resin spiked	12502	BG-2764
XAD-2 Resin blank	12503	BG-2765
Ampule IsoOctane-spiked	12504	BG-2766
Ampule IsoOctane-blank	12505	BG-2767

Mrs. Blake witnessed the complete analytical procedure from sample preparation to data reporting. The results of the PCB analysis are contained in Table 5.13 and the PCDD/PCDF results are contained in Table 5.14. The complete analytical report can be found in Appendix G.

TABLE 5.11

DESTRUCTION AND REMOVAL EFFICIENCIES OF PCBS

	Test Run		
Parameter	1	2	3
Total PCB from MM5(ug)	< .782	< .532	< .542
Sample Volume (dscf)	76.65	77.45	82.34
Stack Gas Flow (dscfm)	6,105	6,196	5,874
PCB Feed Rate (lbs/hour)	96.97	96.52	95.63
PCB Output (lbs/hour)	8.24E-6	5.63E-6	5.11E-6
PCB DRE (percent)	99.999992	99.999994	99.999995

TABLE 5.12

PCDD/PCDF DETERMINATION IN FLUE GAS SAMPLES
GC/MS METHOD 8280 (ng/m3)

	Test Run		
Isomer Group	1	2	3
PCDF:			
2,3,7,8-TCDF	< 5.0	< 5.0	< 5.0
Tetra	13.8	10.0	18.4
Penta	< 5.0	< 5.0	6.4
Hexa	< 5.0	< 5.0	< 5.0
Hepta	< 5.0	< 5.0	< 5.0
Octa	< 5.0	< 5.0	< 5.0
PCDF Total	17.2	12.5	25.9
PCDD:			
2,3,7,8-TCDD	< 5.0	< 5.0	< 5.0
Tetra	< 5.0	< 5.0	< 5.0
Penta	< 5.0	< 5.0	< 5.0
Hexa	< 5.0	< 5.0	< 5.0
Hepta	< 5.0	< 5.0	< 5.0
Octa	< 5.0	< 5.0	< 5.0
PCDD Total	< 5.0	< 5.0	< 5.0
2,3,7,8-TCDD Equivalents Total	< 2.19	< 1.36	< 2.76

TABLE 5.13

PCB DETERMINATION IN TSCA PERFORMANCE SAMPLES GC/MS METHOD 680 (ng/sample)

Isomer Group	USEPA Sample No. 12501	12502	12503	12504	12505
Cl_1-PCB	78.0	79.5	< 8.9	207	< 29
Cl_2-PCB	116	117	< 6.8	160	< 13
Cl_3-PCB	94.5	96	< 17	118	< 17
Cl_4-PCB	70.5	63	< 11	73.8	< 15
Cl_5-PCB	140	137	< 6.1	148	< 39
Cl_6-PCB	159	152	< 12	163	< 36
Cl_7-PCB	132	128	< 14	115	< 30
Cl_8-PCB	135	129	< 11	120	< 38
Cl_9-PCB	437	407	< 87	357	< 236
Cl_{10}-PCB	506	608	< 63	381	< 237
TOTAL PCBs	1,868	1,916.5	ND	1,842.8	ND

ND - Not Detected

TABLE 5.14

PCDD/PCDF DETERMINATION IN TSCA PERFORMANCE STANDARDS GC/MS METHOD 8280 (ng/sample)

	USEPA Sample No.				
	12501	12502	12503	12504	12505
PCDD:					
2,3,7,8-TCDD	48.7	50.8	< .33	45.1	< 0.23
Tetra	48.7	50.8	< .33	45.1	< 0.23
Penta	47.8	48.3	< .79	44.3	< 0.26
Hexa	97.2	95.9	< .35	92	< 0.43
Hepta	79.8	79.6	< .24	72.5	< 0.27
Octa	89.8	88.9	< .57	83.5	< 0.30

	USEPA Sample No.				
	12501	12502	12503	12504	12505
PCDF:					
2,3,7,8-TCDD	39.6	40.3	< .17	38.7	< 0.13
Tetra	40.2	40.9	< .17	39.2	< 0.13
Penta	39.7	40.0	< .27	38.3	< 0.24
Hexa	252	257	< .19	252	< 0.20
Hepta	141	145	< .33	135	< 0.22
Octa	132	130	< .33	127	< 0.43

6.0 SUMMARY OF QA

All sampling, monitoring, and analytical protocols were followed without significant variance. As a result, the completeness goals have been substantially met. The data generated in the test is valid for the purpose of evaluating incinerator performance. The overall quality of the data generated in this study is good.

A performance audit was conducted jointly during the tests by personnel from the USEPA OTS and MRI.

A more complete discussion of data quality is found in the Quality Assurance Report, included as Appendix D.

7.0 VISITS AND AUDITS

Table 7.1 contains a list of all visitors and OHM personnel who were on site during the course of the trial burn. No audit reports or engineering certifications were issued by any visitor as an outcome of their visit during the trial burn.

Table 7.2 contains the addresses and phone numbers of all visitors. The home addresses and phone numbers for all OHM employees can be obtained from the corporate personnel office.

TABLE 7.1

SUMMARY OF VISITORS DURING TRIAL BURN

Name	Title	Affiliation	Date On Site Day 1 6-29-88	Day 2 6-30-88
Jim Burford	Manager	OHM	X	X
Greg McCartney	Project Engineer	OHM	X	X
Mike Risser	Site Supervisor	OHM	X	X
Wayne Crutcher	Site Engineer	OHM	X	X
Matt Witte	Engineer	OHM	X	X
Rob Wright	PCT	OHM	X	X
Bill Whiteman	PCT	OHM	X	X
Norwood Wilson	Lead Operator	OHM	X	X
Dave Buchanan	Lead Operator	OHM	X	X
Paul Sanders	Lead Operator	OHM	X	X
Leroy Harmon	Operator	OHM	X	X
Rodney Cameron	Operator	OHM	X	X
Tony Melfi	Operator	OHM	X	X
Don Pickett	Operator	OHM	X	X
Jerry McClendon	Operator	OHM	X	X
Jim Hawkins	Chemist	OHM	X	X
Bill Hiser	Operator	OHM	X	X
Bill Jacobs	Operator	OHM	X	X
Dick Long	Operator	OHM	X	X
Kevin Miller	Operator	OHM	X	X
Alvin Peaden	Recovery Technician	OHM		X
S.G. Broussard	Equipment Operator	OHM	X	X
Tim Lutz	Recovery Technician	OHM	X	X
Hiroshi Dodohara	Chemical Engineer	USEPA	X	X
Brian O'Palico	Chemical Engineer	USEPA	X	X
Jim Surman	Senior Chemical Engineer	MRI	X	X
Mark Grunebach	Sampler	KEYSTONE	X	X
Robert Frey	Lead Sampler	KEYSTONE	X	X
Frank Paolo	Sampler	KEYSTONE	X	X
Mark McCabe	Sampling Coordinator	RETEC	X	X
S.N. Prakash	Engineer	Holcroft/ Loftus	X	X

TABLE 7.2

VISITOR ADDRESSES AND TELEPHONE NUMBERS

USEPA Washington OTS

Mr. Hiroshi Dodohara
Chemical Engineer
PCB Disposal Section
USEPA
401 M Street, S.W.
(TS-798) Room 118
Washington, DC 20460
(202) 382-3959

Mr. Brian O'Palico
Chemical Engineer
PCB Disposal Section
USEPA
401 M Street, S.W.
(TS-798) Room 118
Washington, DC 20460
(202) 382-3959

OTS Consultant:
Mr. Jim Surman
Senior Chemical Engineer
Midwest Research Institute
425 Volker Blvd.
Kansas City, MO 64110
(816) 753-7600

Stack Sampling

Mr. Mark McCabe
Sampling Project Manager
Retec
9 Damomill Square
Concord, MA 01742
(617) 371-1422

Mr. Robert N. Frey, Jr.
Lead Sampler
Keystone Environmental
Resources Inc.
440 College Park Dr.
Monroeville, PA 15146
(412) 733-9500

Mr. Mark Grunebach
Sampler
Keystone Environmental
Resources Inc.
440 College Park Dr.
Monroeville, PA 15146
(412) 733-9500

Mr. Frank Paolo
Sampler
Keystone Environmental
Resources Inc.
440 College Park Dr.
Monroeville, PA 15146
(412) 733-9500

8.0 CLOSURE

At the completion of the trial burn, approximately 10 tons of spiked waste remained. This waste was destroyed immediately. In addition, 45 tons of the decontamination waste from the Indiantown project was destroyed. The incinerator was then shut down and decontaminated. Additional residues were collected during the decontamination phase and these residues were destroyed on August 18, 1988. The ash collected from Test Run 2 was also reprocessed at this time.

The liquid PCBs which were used during the demonstration test were obtained from:

AmerEco Environmental Services, Inc.
Route 1, Box 159
Kingsville, MO 64061

Eighteen drums of PCB liquids were shipped to the Indiantown site. Seven drums of material were mixed with the on-site waste and burned during the trial burn. The remaining eleven drums were shipped back to AmerEco Environmental Services, Inc. for final destruction.

The seven empty drums were decontaminated with the triple rinse method as required by 40 CFR 761.79(a). The shipping and location of the drums were monitored using the Missouri Department of Natural Resources (Missouri DNR) Hazardous Waste Manifests.

APPENDIX F

AUTOMATIC WASTE FEED CUTOFF SYSTEM

FIGURE 4.10 (CONTINUED)

SYSTEM CONTROL SETPOINTS

Parameter	Setpoint
Air-Pollution-Control Equipment	
Scrubber Inlet Gas	10,000 to 36,000 acfm for each parallel side. 36,000 to 62,000 acfm for both parallel sides
Quench Water Flow Rate	10 gpm minimum per side
Quench Water Pressure	60 psig minimum
Scrubber Quench Liquor Recycle Flowrate	28 gpm per side
Scrubber Venturi Liquor Recycle Flowrate	140 gpm per side
Scrubber Chevron Washdown Recycle Flowrate	28 gpm per side
Chevron Sump Pump Discharge Pressure	45 psig minimum
Scrubber Chemical Packing Recycle Flowrate	200 gpm per side
Chemical Pump Discharge Pressure	13 psig minimum
Chemical Mix Tank Recycle Pump Discharge Pressure	15 psig minimum
Scrubber Venturi Gas Side Differential Pressure	7- to 20-inch water column per site coordinator
Scrubber Low Temperature	110 degrees Fahrenheit

4.6.1 Alarms

System alarms are very important to any process control system since they aid the operator in supervising the overall operation of the process variables and equipment. An alert is initially indicated by a horn mounted in the control cabinet followed by the lighting of a module in the annunciator panel which indicates the particular area of the furnace that is having trouble. The horn can be silenced by pressing the Alarm Acknowledge pushbutton. The illuminated module on the annunciator will stay lit however, until the trouble is resolved.

The annunciator panel also incorporates a "Test" button. This can be pushed to test for burned out light bulbs behind the panels. This does not test each device, only the alarm panel. It is recommended the push to test be exercised monthly.

In the case of any control panel alarm the operator should first confirm that the alarm is based on an actual occurrence and is not a malfunction of a sensing element. In all cases a visual inspection of an indicated failed device should be performed. Also, process conditions upstream and downstream of an alarm location should determine the validity of the alarm. In the case of a false alarm a process upset can be avoided by emergency manual operation of the system or the directly affected device. SHIRCO operating experience and testing has proven that manual operation of the control loops produces less upset, pollution, and incomplete decontamination than immediate interlock shutdown. Thus the operators should be encouraged to "take over" in the specified situations.

4.6.2 General Description

Presented in the following sections are descriptions of each system alarm. Section 4.6.3 covers the alarms which incorporate "interlocking" with other equipment, resulting in automatically controlled component shutdowns. These shutdowns are designed into the control system for component protection. A brief description of each alarm listed below, its cause, and corrective action is included in this section.

- Primary Exhaust Temperature High
- Primary Belt Stopped
- Zone A Temperature High
- Zone B Temperature High
- Feed Hopper Stopped
- Cakebreaker Stopped
- Primary Pressure High
- Wireway Cover Open
- Ash Discharge Conveyor Stopped
- Ash Cooling Screw Stopped
- Induced Draft Blower Off
- Stack Temperature High
- Secondary Velocity High

- Stack CO High
- Secondary Temperature Low
- Scrubber Quench Temperature High
- Emergency Backup System On
- Scrubber Vacuum High

Presented in Section 4.6.4 are the alarms which annunciate only. A brief description of each alarm, its cause, and corrective action is included in this section.

- Zone A HEPC Off
- Zone B HEPC Off
- Primary Combustion Air Blower Off
- Belt Mistracking
- Ash Discharge Temperature High
- Air Pressure Low
- Air Compressor Off
- Secondary Combustion Air Off
- Secondary Burner Off
- Secondary Temperature High
- Secondary Exhaust Temperature High
- Secondary O_2 Low
- Venturi Pressure Drop Low
- Chevron Recycle Flow Low
- Chemical Recycle Flow Low
- Scrubber Level High
- Scrubber Level Low
- pH Low
- pH High
- Chevron Recycle Pump Off
- Chemical Recycle Pump Off
- Scrubber Quench Water Flow Low
- Feed Conveyor Off
- Emergency Quench Water On
- Emergency Backup Lockout
- Venturi Recycle Flow Low
- Mixing Tank Pump Off
- Emergency Quench Water Pressure Low
- Chemical Tank Mixer Off
- Scrubber Quench Recycle Flow Low
- Scrubber Temperature Low

4.6.3 Alarms - Interlocking

4.6.3.1 Primary Exhaust Temperature High

A thermocouple (TE 300) monitors temperature in the primary exhaust duct and the alarm is initiated by the temperature recorder when the exhaust temperature exceed a preset value (2,050 degrees Fahrenheit).

Deactivates HEPCs (A and B) until the temperature alarm point is no longer exceeded.

Corrective Action

A. Check recorder reading against the temperature indicator, disagreement indicates possible thermocouple or temperature loop failure.

B. If the high temperature is correct, and the difference between the exhaust temperature and the furnace temperature is not significantly high:

   1. Check all zone temperatures, and if the HEPCs have not all ready been shutdown automatically, turn them off by hand.

   2. If the exhaust temperature is increasing rapidly, manually close the combustion damper using the controller or the damper lever until the high temperature returns to normal. The combustion air damper may be opened gradually to reestablish process. The high temperature can be caused by a fluctuation in Btu value of the waste. Adjust combustion air flow first, then evaluate whether a change in feed rate is needed.

   3. Ensure furnace draft is not excessive (0.1 in water)

4.6.3.2 Primary Belt Stopped

A magnetic sensing element (SE 31) monitors movement of the discharge end terminal pulley and the alarm is initiated when the element detects that the belt has stopped moving, or the speed has reduced to below the minimum.

Feed conveyor shuts down immediately. HEPCs are deactivated in 25 minutes if no motion is detected.

Corrective Action

A. Verify that the belt is not moving by observing the belt through the sight glass, or observing rotation of the discharge terminal drum.

   1. If the belt is moving, the speed sensor has failed. Switch HOA to hand and continue to operate. The HEPC should be switched to Hand as well. Caution: The interlock protection will be disabled in the Hand mode. The belt must be observed energy 10 minutes to ensure movement. Replace the sensing element as soon as possible.

2. If the belt is not moving, check the following immediately:

   a. The feed system should have shut down.

   b. Check to ensure that the local disconnect for the belt drive is on.

   c. Check the belt drive motor breaker in the MCC.

   d. Check all chains and power transmission equipment for breakage, jamming, etc.

   e. Check belt pinch for proper operation.

B. If the repair cannot be made immediately or if the circuit breaker continues to trip, the system should be shut down as directed in "Emergency Shutdown Procedures - Furnace Belt."

4.6.3.3 Zone A Temperature High

Thermocouples monitor the temperature in Zone A, and the alarm is initiated by the temperature recorder when the temperature in the module exceeds a preset valve (1,800 degrees Fahrenheit). The alarm is initiated by any one of the three thermocouples in Zone A.

Deactivates A Zone HEPC if the automatic mode has been selected.

Corrective Action

A. Identify which thermocouple(s) is causing the alarm by comparing the reading on the recorder with the reading on TI 100 or TIC 110 or TJR 100. If the reading indicated by the recorder is excessively high compared to it's counterpart, the thermocouple circuit has failed. Switch to Hand operation and monitor the temperature closely. Caution: The interlock protection will be disabled in the Hand mode. At the first cool down of the system repair the circuit.

B. If in Auto, ensure that the heating element power center for Zone A is shut down, if not do so manually. If in Auto, the heating element power center should come back once the temperature has dropped below 1,800 degrees Fahrenheit. If in Hand, switch to Auto when the temperature falls below 1,800 degrees Fahrenheit and the HEPC should return to service.

C. Ensure that the furnace draft is not excessive. If the draft is found to be excessive, close the damper to return to normal draft.

D. Reduce combustion air supply by closing the combustion air blower damper. Leave the damper closed until the high temperature has reduced to normal process temperature, then gradually increase the damper opening to regain the process.

4.6.3.4 Zone B Temperature High

Thermocouples monitor the temperature in Zone B, and the alarm is initiated by the temperature recorder when the temperature in the module exceeds a preset value (1,800 degrees Fahrenheit). The alarm is initiated by any one of the three thermocouples in Zone B.

Deactivates B Zone HEPC if the automatic mode has been selected.

Corrective Action

A. Identify which thermocouple(s) is causing the alarm by comparing the reading on the recorder with the reading on TI 100 or TIC 120 or TJR 100. If the reading indicated by the recorder is excessively high compared to it's counterpart, the thermocouple circuit has failed. Switch to Hand operation and monitor the temperature closely. Caution: The interlock protection will be disabled in the Hand mode. At the first cool down of the system repair the circuit.

B. If in Auto, ensure that the heating element power center for Zone B is shut down, if no, do so manually. If in Auto, the heating element power center should come back once the temperature has returned below 1,800 degrees Fahrenheit. If in Hand, switch to Auto when the temperature falls below 1,800 degrees Fahrenheit and the HEPC should return to service.

C. Ensure that the furnace draft is not excessive. If the draft is found to be excessive, close the damper to return to normal draft.

D. Reduce combustion air supply by closing the combustion air blower damper. Leave the damper closed until the high temperature has reduced to normal process temperature, then gradually increase the damper opening to regain the process.

4.6.3.5 Feed Hopper Stopped

A set of contacts in the motor starter monitors the operation of the feed hopper motor. In the event of motor failure, the alarm will be initiated causing the feed system to shut down.

Corrective Action

A. Visibly verify the alarm by observing the feed hopper motors.

B. If a motor has stopped, and a prolonged inspection or maintenance appears necessary begin normal shutdown procedures.

4.6.3.6 Cakebreaker Stopped

Individual speed sensors monitor the movement of each cakebreaker shaft.

In the event of no movement of a cakebreaker shaft, an alarm is initiated which shuts down the feed system immediately and the HEPCs after 15 minutes.

Corrective Action

A. Ensure the HOA switch and the local disconnect are in the proper position.

B. Check the cakebreaker drive and shaft for loosening, jamming, or bearing failure.

    1. If one or more cakebreakers have stopped such that feed is backing up behind them, clear the backup by turning the shaft manually. After clearing, attempt to rotate the shaft so that the breaking fingers are at a 45 degree angle to the belt and not causing a feed backup.

C. Check the cakebreaker drive motor in the MCC for tripped breaker.

D. Check for failed motor.

E. If prolonged inspection or maintenance appears necessary, begin normal shutdown procedures outlined in Section 4.4, as soon as all material has been discharged from furnace. Extended operation at temperature with the cakebreaker out of service will cause the shaft to warp.

4.6.3.7 Primary Pressure High

A pressure transmitter in the discharge module monitors draft in the furnace and the alarm is activated when the transmitter senses a decrease in draft to the point of furnace pressurization. Deactivates feed after 5 minutes.

Corrective Action

A. Verify that the unit is pressurized. Look for smoke and heat being emitted from the feed and wireways. Temporarily put the furnace draft control on manual and increase the induced draft blower damper opening to prevent smoke emissions.

B. Check the primary pressure controller setpoint to verify that it is not set above the alarm point.

C. Verify that the induced draft blower is operating, "Induced Draft Blower Off" light and "Emergency Backup System On" light should not be illuminated. If they are illuminated proceed to Section 4.6.3.11.

   1. Check induced draft fan drive system for malfunction.

   2. Inspect system for blown gaskets, open ports or access covers, or other damage that may be allowing air to enter the system.

D. Check induced draft blower damper and damper actuator for correct operation.

E. Check primary chamber combustion air blower and damper for proper operation (i.e., damper open more than controller signal calling for).

F. If the exhaust system seems to be operating correctly, check the transmitter and sensing lines for plugging.

G. If pressurization cannot be corrected, or if an extended inspection and maintenance appears necessary, the system should be shut down.

4.6.3.8 Wireway Cover Open

A position switch mounted under the wireway cover provides a signal to the control cabinet of the status of the wireway cover (open or closed). An alarm is initiated when the cover switch is not made, signifying an open cover.

Deactivates the HEPC in the zone affected by the open cover. The appropriate HEPC off light should be illuminated.

Corrective Action

Check for open covers in the affected zone to ensure the position switch has made contact with the cover. If the problem is not readily apparent, switch the HOA to Hand and continue to operate. Have the wireway cover circuit checked during the first cool down.

4.6.3.9 Ash Discharge Conveyor Stopped

A magnetic sensing element (SE 270) monitors the movement of the inclined ash conveyor screw, and the alarm is initiated when the element detects that the conveyor system has stopped moving. Deactivates the feed system immediately.

Corrective Action

A. Verify that the screw is not moving.

   1. If it is operating, a failure in the speed sensing circuit is indicated. If prolonged inspection or maintenance appears necessary, the system should be shut down following the normal shutdown procedures.

   2. If the screw is not moving, check the following:

      a. Inspect screw for foreign objects, possibly causing a jam.

      b. Check the motor and drive train for possible damage.

B. Check the MCC for a tripped breaker. Check HOA switch and local disconnect for proper position.

C. If prolonged inspection or maintenance appears necessary, the system should be shut down following the normal shutdown procedures.

4.6.3.10 Ash Cooling Screw Stopped

A magnetic speed sensing element (SE 250) monitors the movement of the transverse ash cooling screw, and the alarm is initiated when the element detects that the conveyor system has stopped moving. Deactivates the feed system immediately.

Corrective Action

A. Ensure that the feed system has shut down.

B. Check the light over the HOA switch

   1. If the light is on, switch to off and investigate the feed conveyor for jamming, or drive system for malfunction.

   2. If the light is off, check motor or thermal overload. Check conveyor system for mechanical malfunction.

C. If it becomes apparent that a prolonged investigation or extended maintenance is necessary, shut down the unit per the procedure outlined.

4.6.3.11 Induced Draft Blower Off

See Section 4.3.12

4.6.3.12 Stack Temperature High

A thermocouple (TE 570) located in the exhaust stack monitors the temperature of the exhaust gas in the stack. The alarm is initiated when the temperature recorder receives a signal indicating high temperature (200 degrees Fahrenheit). At a temperature of 250 degrees Fahrenheit, the emergency quench is activated and the feed is stopped.

Corrective Action

A. Compare the reading on the temperature recorder with the reading on the temperature indicator. If they are significantly different, a failed thermocouple or thermocouple loop failure is indicated.

B. If the temperature readings are correct, the entire scrubbing water and venturi quench recycle water-flow rates must be checked. Adjustment of flow rates to design should reduce the temperature to normal operating levels.

C. If flow is at design and operation is normal, reduction in feed or secondary operation may be required to lower the temperature.

D. Once the second level alarm is sounded, ensure that emergency quench water-flow rate is adjusted to adequately, but not excessively, cool the gases.

E. Determine cause of high temperature before resuming feed.

4.6.3.13 Secondary Velocity High

A velocity probe mounted in the exhaust stack continuously monitors the stack gas velocity. A first level alarm is initiated when the velocity exceeds a preset value. When the velocity exceeds the second preset value, the feed is stopped if the velocity cannot be brought within limits within 30 seconds.

Corrective Action

If the condition is sudden after having been at the feed rate for some time, the velocity increase should be verified by reviewing changes in the operating parameters. Primarily inspect the feed to determine if the feed rate has increased or a higher volatile content is being experienced. A reduction in feed rate and increasing residence time should reduce the velocity after a few minutes.

4.6.3.14 Stack Co High

A gas sensor mounted on the exhaust stack continuously monitors the CO concentration in the exhaust stream. The alarm is initiated when the level of the CO exceeds a preset value. The feed is stopped if the CO concentration cannot be brought within limits in 5 minutes.

Corrective Action

A. Determine whether the occurrence was proceeded by or it accompanied by a low secondary chamber temperature. If so, take steps to regain temperature.

B. If the secondary temperature is within operating range (2,200 to 2,250 degrees Fahrenheit) then the supply air flow should be checked.

   1. Ensure that the O_2 controller set point is at or above 4 percent.

   2. Change the secondary chamber supply air control to manual and gradually increase the supply air flow.

   3. As the supply air is increased, observe the changes in secondary chamber temperature and exhaust O_2 along with stack CO. When an air flow value is reached that produces adequate CO and peak secondary chamber exhaust temperature, the adjustment is complete.

4.6.3.15 Secondary Temperature Low

A temperature sensing element (TE 450) located in the secondary measures the temperature in the chamber. When the temperature falls below 1,800 degrees Fahrenheit, the alarm is illuminated and the feed system is deactivated.

Corrective Action

A. Check the temperature on the recorder against the temperature on indicators. If the temperature is significantly different then a failure in the temperature loop is indicated.

B. Check the HEPC's for malfunction.

C. Determine if the feed has ceased and the secondary chamber burner should be restarted.

D. Determine if supply air flow is inadequate or excessive (primary or secondary).

E. Determine if cooling sprays have inadvertently turned on.

F. Determine if the feed has an excessive moisture content.

4.6.3.16 Scrubber Quench Temperature High

Two thermocouples (TE 500 and TE 501) located in the discharge of the quench, just before the venturi measures the temperature of the gas in this area and transmits this temperature to recorder in the control cabinet. An alarm is initiated, the feed is shut down, and the emergency quench water is turned on when the temperature recorder reaches a value above 250 degrees Fahrenheit.

Corrective Action

A. Determine the reason for the high downstream quench temperature.

B. If it appears that the problem is plugged water lines or nozzles, these may be cleaned while the system is operating; however, the waste feed should be stopped.

C. If the problem is a full or partial loss of fresh or recycle water, proceed to Sections 4.6.3.12 and 4.6.4.17.

D. If it appears a prolonged investigation or maintenance inspection is necessary, and as long as the emergency water is available, then proceed with a normal shutdown. If emergency water is not available, proceed to Section 17.1.

4.6.3.17 Emergency Backup System On

A contact mounted on the emergency backup system diesel engine monitors system status. An alarm is initiated when the backup system is activated.

Corrective Action

A. Check the ID blower to ensure it is still operational, if not, proceed to Section 17.1.

B. Check the backup fan and quench system to verify that it is operational.

C. Check the power supply to the auto start breaker. A loss of power will simulate a total power outage which activates the emergency backup system.

D. Check the secondary draft controller set point to verify that it is not set above the alarm point.

E. If it becomes apparent that an extended investigation or maintenance inspection is necessary, then proceed with a normal shutdown, after the feed material has been shut off and the material has been discharged.

4.6.3.18 Scrubber Vacuum High

A pressure switch (PS 501) located in the scrubber exhaust senses the vacuum in the scrubber and transmits a signal to the control panel. On an increase in vacuum to 31 inches of water, the alarm is initiated. The induced draft fan is immediately shut down on activation of the alarm. The stoppage of the induced draft fan will subsequently shut down the feed system and activate the emergency backup system.

Corrective Action

A. Upon sounding of the alarm, the operator should check the vacuum break damper for correct operation.

B. If the vacuum continues to be high and the exhaust blower damper and vacuum break are operating correctly, check the sensor since such pressure should not occur with these operational.

4.6.4 Alarms - Annunciate Only

4.6.4.1 Zone A HEPC Off

A contact in the HEPC provides a status signal to the control cabinet. When the HEPC is shut down, an alarm is initiated.

Corrective Action

A. If the alarm occurs during a shutdown of the furnace system, the alarm is normal and to be expected.

B. If the alarm occurs during operation, the following checks should be made:

1. Can the process continue at the current rate or should it be reduced. Appropriate feed rate adjustment or shutdown procedures are then initiated.

2. Check the following alarms to see if they are activated, if they are initiated, proceed to the appropriate section for responses.

   a. "Wireway Cover Open"
   b. "Zone A Temperature High"
   c. "Primary Belt Stopped"
   d. "C/A Stopped"
   e. "Primary Exhaust Temperature High"

3. Check the lights on the front of the HEPC. If the red light is on, power is being delivered through the breaker to the HEPC.

4. If the red light is not on, reset the breaker on the front of the power center. If the red light does not come on but the voltage meters on the front of the power center indicate power to the heating elements, the bulb is burned out and the problem is not in the HEPC.

5. If the power center does not operate when the breaker is reset, refer to the manufacturer's operation instructions, Section 9, for troubleshooting and corrective maintenance.

6. If the yellow light on the front of the power panel is not on and the bulb has not burned out, refer to the power center instruction manual for troubleshooting and corrective maintenance instructions.

7. If the malfunction cannot be repaired immediately, implement emergency shutdown procedures for failed power centers.

4.6.4.2 Zone B HEPC Off

See Section 4.6.4.1.

4.6.4.3 Primary Combustion Air Blower Off

A set of contacts in the motor starter circuit provides a signal to the control cabinet signifying the status of the motor. The alarm is initiated when the motor is not running.

Corrective Action

A. Determine whether the primary chamber process absolutely requires the combustion air blower to satisfactorily decontaminate the waste.

B. The chamber may be operated in a pyrolysis mode. However, the blower damper should be opened and the draft set point increased to allow as much or all the air needed to enter. As long as the remainder of the system operates satisfactorily, this operation may be continued while the troubleshooting and repairs are done.

C. The ash produced must be analyzed to assure process completion.

D. If the remaining air flow is inadequate, the feed rate may be totally stopped or decreased until the air supply is adequate.

E. While adjusting the process, have the blower inspected.

   1. Inspect the blower for jamming or the bearings for failure.

   2. Inspect the MCC for tripped breaker.

   3. Check for thermal overload.

   4. Check gear reducer or gear box for malfunction.

F. The feed will be automatically stopped when efficient destruction of the waste can no longer be assured. For instance, if the combustion air to the furnace is indeed inadequate, O_2 levels will drop, and CO levels will rise to their respective setpoint conditions, automatically shutting off the feed to the incinerator.

4.6.4.4 Primary Belt Mistracking

A belt position sensor, located in the discharge end of the incinerator, provides a signal to the control cabinet indicating the position of the primary belt in relation to the furnace wall insulation. When the belt moves within an inch of the insulation, the belt position sensor detects this movement and initiates a time delay relay. When the relay times out and has not been reset again by the belt position sensor, an alarm is initiated in the control panel. The time delay is to ensure that the belt is indeed in an alarm condition and the belt position sensor has not sensed a small bulge in the belt.

<u>Corrective Action</u>

A. Visually ensure that the belt is within 1 inch of the insulation by observing through the discharge end sight glass.

B. Determine, by observing the entire length of the belt, if the condition is temporary or if the belt is indeed moving towards the insulation.

C. Inspect all drive components to determine possible cause of mistracking.

D. Refer to the O and Manual for belt tracking adjustments, if required.

E. If the cause cannot be remedied while operating, and it is possible that excessive mistracking will occur soon, a normal system shutdown should be initiated.

4.6.4.5 Ash Discharge Temperature High

A thermocouple (TE 250) located in the transverse ash cooling screw monitors the temperature in the ash discharge. When the temperature exceeds 350 degrees Fahrenheit, the temperature recorder initiated an alarm which illuminates the appropriate window and turns on the water to the ash cooling sprays.

Corrective Action

The operator should verify that the cooling water flow is adequate. If the temperature cannot be reduced below the limit value within 30 minutes, a feed stoppage should be initiated to allow inspection.

4.6.4.6 Air Pressure Low

A pressure switch (PS 54) mounted in the supply line to the belt guidance system will initiate an alarm when the compressed air supply pressure falls below 100 psi. Without air pressure to the belt position sensor, the sensor will not trip the appropriate time delays and an alarm "Belt Mistracking" will be initiated. Additionally the O_2 analyzer will cease to function and the "Secondary O_2 Low" alarm will be initiated. The following automatic systems will either be inoperative or out of automatic control:

1. Emergency Quench Water
2. Chemical Recycle Supply
3. Chemical Pump Supply and Discharge
4. Chemical Recycle Pump Supply and Discharge
5. Chevron Recycle Pump Supply and Discharge
6. Belt Guidance System
7. Belt Pinch
8. Hopper Vibrators

Corrective Action

A. Determine cause of low compressed air supply.

B. Begin emergency shutdown procedure for furnace belt after the feed material has been discharged from the ash conveyor. The systems above must be monitored for proper operation and adjustments made manually during this period.

4.6.4.7 Air Compressor Off

A contact in the air compressor motor starter initiates a signal to the control panel when the motor stops.

Corrective Action

Visually inspect the air compressor to determine the possible cause. Within a short period of time process control will become difficult without air pressure. "Air Pressure Low" alarm should be illuminated soon after the air compressor shuts down. If the problem cannot be corrected or a prolonged maintenance inspection is expected, the unit should be shut down.

4.6.4.8 Secondary Combustion Air Off

A set of motor contacts in the starter circuit monitors the status of the motor and sends the proper signal to the control cabinet. When the motor is non-operational, the alarm is initiated.

Corrective Action

A. If the primary chamber blower, plus induced drafting, is not adequate to maintain process, then the feed must be ceased until the problem can be corrected.

4.6.4.9 Secondary Burner Off

A sensor in the burner gas control system produces a signal which is transmitted to the control cabinet. When the burner goes off, an alarm is initiated and the burner restart cycle is started.

Corrective Action

If the restart cycle does not relight the burner, the operator must determine whether or not the shut off is due to an interlock or it can be repaired quickly. If the burner is being used for process power, then the feed should be stopped if the temperature interlock has not already shut down the system.

4.6.4.10 Secondary Temperature High

A thermocouple (TE 450) located near the discharge of the secondary chamber initiates a signal to the recorder which illuminates the window for the alarm at a preset temperature (250 degrees Fahrenheit).

Corrective Action

A. High temperature could be caused by insufficient combustion air supply. Increase the supply air flow by increasing the O_2 setpoint. Failure of this requires reduction of the feed rate to the primary.

B. Check the cooling water spray. If inoperative or out of adjustment stop or decrease feed until the problem can be corrected.

C. Excessive combustion of pyrolyzed organics in the primary chamber could be causing the problem. Decrease combustion air flow to the primary chamber to determine the effect on the secondary temperature.

D. A sudden increase in primary feed rate or combustion content could cause the secondary temperature to rise. Decrease the feed rate to the primary.

4.6.4.11 Secondary Exhaust Temperature High

A thermocouple (TE 460) located in the secondary exhaust duct initiates a signal to the recorder which illuminates the window for the alarm at a preset value (2,500 degrees Fahrenheit).

Corrective Action

See response for 4.6.4.10 above.

4.6.4.12 Secondary O_2 Low

An O_2 analyzer probe mounted in the secondary exhaust duct monitors the O_2 level in the duct and sends the appropriate signal to the control cabinet. If the O_2 level falls below 4 percent, an alarm is initiated and the appropriate window is illuminated. If the oxygen level falls below 3.0 percent, the feed will automatically shut off.

Corrective Action

If the low O_2 reading is accompanied by high CO measured in the exhaust stack or low secondary chamber temperature, the operator should check the O_2 control setpoint and the operation of the combustion air blower damper. If the control loop appears to be malfunctioning, the operator should switch to manual. The manual control should be based upon secondary chamber temperature and stack CO concentration.

If the O_2 concentration if below 4 percent, and the analyzer is working correctly, and the stack gas is within specification, then the process may continue without further adjustment.

4.6.4.13 Venturi Pressure Drop Low

A differential pressure transmitter installed across the scrubber venturi measures the pressure drop across the venturi and transmits this signal to the control cabinet. A signal below a preset value (6 inches of water) will initiate an alarm and illuminate the appropriate window.

Corrective Action

Operator should readjust the venturi damper in a low exhaust flow condition to produce the needed pressure drop.

In the event of a low-pressure drop during an obvious high-flow condition, the operator should inspect the venturi damper for damage or loss of adjustment. A corresponding loss of venturi recycle water may have occurred at the same time.

Check the transmitter for plugged or broken tubing.

4.6.4.14 Chevron Recycle Flow Low

A flow sensing element (FE 592) measures the flow in the feed line to the Chevron sprays. The alarm is initiated by the flow falling below 30 gpm. The backup pump will immediately come on.

Corrective Action

If the backup pump does not increase the flow, then plugging of the line is the probable cause. If the problem cannot be corrected in 30 minutes then a normal shutdown per Section 17.1 should be initiated.

4.6.4.15 Chemical Recycle Flow Low

A flow sensing element (FE 610) measures the flow from the chemical recycle pump. The alarm is the initiated when the flow falls below 300 gpm. The backup pump will immediately come on.

Corrective Action

If the backup pump does not increase the flow, then plugging of the line is the probable cause. If the problem cannot be corrected in 30 minutes then a normal shutdown should be initiated.

4.6.4.16 Scrubber Level High

A level switch located in the scrubber sump monitors the level of the liquid in the sump and transmits this signal to the control cabinet. When the level raises 20 inches above the bottom of the sump, an alarm is initiated and the appropriate window is illuminated.

Corrective Action

A. Check the blowdown control to ensure it is in operating order.

B. Check the chemical recycle and the Chevron recycle systems to ensure they are operating correctly.

C. If level continues to rise, open the drain valve on the bottom of the scrubber to bring the level of the sump to acceptable limits. Determine the cause of the high level.

4.6.4.17 Scrubber Level Low

A level switch, located in the scrubber sump monitors the level of the liquid in the sump and transmits a signal to the control cabinet. When the level falls below 12 inches from the bottom of the sump, an alarm is initiated and the appropriate window is illuminated. The fresh water valve is immediately opened which supplies water to the sump until the level is back to acceptable limits.

Corrective Action

A. Inspect the sump level to ensure the alarm is not dead to a failed sensing element, or a leak in the sump.

B. Check the Chevron recycle and the chemical recycle systems for proper operation.

C. Check the fresh water valve for correct operation.

4.6.4.18 pH Low

A pH sensor located in the chemical recycle line upstream of the chemical addition point provides a signal via a transmitter to the control cabinet. A low signal initiates the alarm when the pH is below 5.

Corrective Action

A low scrubber pH could be followed by excessive HCl or SO_2 emissions. While continuing to operate, the operator should inspect the entire pH control system. While this inspection is underway, grab stack gas samples should be analyzed for HCl and SO_2. If out of specification HCl or SO_2 emissions are found, and the pH cannot be raised, a normal system shutdown should be initiated.

4.6.4.19 pH High

A pH sensor mounted in the recycle flow line upstream of the chemical addition point provides a signal via a transmitter to the control cabinet. An alarm is initiated when the pH rises above 10.

Corrective Action

Inspect the pH control components.

4.6.4.20 Chevron Recycle Pump Off

A control in each pump motor starter provides a signal to the control cabinet indicating motor status. Since there are two motors, both motors will have to be off in order for the alarm to be initiated.

Corrective Action

If the alarm is initiated by an automatic switching of the pumps, an investigation should be made as to the cause of the first pump shutdown.

Check for low flow or a build-up of solids in the sump, causing an overload. The operator should quickly investigate this possibility to prevent the backup pump from also overheating. A solids build-up may be reduced by opening the bottom drain while adding makeup water with the manual valve.

If both pumps are off, a high quench exhaust temperature may result. This high temperature will activate the emergency quench system and stop the flow of feed to the primary chamber.

The "Chevron Recycle Flow Low" light may be illuminated during the pump switching however, it should go out once the second pump is operating.

4.6.4.21 Chemical Recycle Pump Off

A contract in each pump motor starter provides a signal to the control cabinet indicating motor status. Since there are two motors, both motors will have to be off for the alarm to be initiated.

Corrective Action

If the alarm is initiated by an automatic switching of the pumps, an investigation should be made as to the cause of the first pump shutdown.

Check for low flow or build-up of solids in the sump, causing a motor overload. The operator should quickly investigate this possibility to prevent the backup pump from also overheating and tripping out. A solids buildup may be reduced by opening the bottom drain while adding makeup water with the manual valve.

If both pumps are off, the "Chemical Recycle Flow Low" light will be illuminated, and a temporary process upset will be experienced. However the process should return to normal once one of the pumps is back in operation.

4.6.4.22 Scrubber Quench Water Flow Low

Flow sensors (FE 501, FE 500) located in the fresh water piping to the quench section spray nozzles provide a signal to the control cabinet indicating status of the flow in the pipe. On the occasion of low flow, 10 gpm, a signal is generated which initiates an alarm.

Corrective Action

If the flow of water is low enough, the temperature of the exhaust will rise, initiating a signal to the emergency quench water system. Operator must ensure that the emergency quench water is on.

If the flow cannot be increased to normal within 30 minutes, then a normal system shutdown must be initiated.

4.6.4.23 Feed Conveyor Off

A set of contacts in the motor starter for the feed conveyor signals the control panel of the status of the motor. A stopped motor will initiate an alarm.

Corrective Action

A. Verify that the feed conveyor has stopped.

B. If the motor has stopped, first try to reset the starter.

C. If the motor will not restart, check fuses, and the thermal overload.

D. If an overheating is suggested, inspect the conveyor for an overload or mechanical jam.

E. If a partial or full jam is suggested, and the conveyor belts are running, an inspection of each conveyor must be made. Note: Correct safety protection must be worn while performing this inspection.

   1. If the location of the jam cannot be seen, remove access ports from the conveyor. Note: Before working on the conveyor, ensure the conveyor motor is off and tagged out.

2. If bridging is found in the furnace feed chute, after removing its access cover, stop the feed hopper drive. Using a probe, break the bridge allowing the feed to enter the furnace through the chute opening.

G. Inspect the conveyor system for mechanical component failures or malfunction which may have stopped or allowed a conveyor belt to slip.

4.6.4.24 Emergency Quench Water On

This alarm is initiated when the stack temperature exceeds 250 degrees Fahrenheit or the scrubber quench temperature exceeds 250 degrees Fahrenheit. The alarm should be accompanied by a shutdown of the feed system (initiated by the high stack temperature).

Corrective Action

The operator should first determine that the emergency quench water is on, and the feed system is shut down. The cause of the quench water activation must be determined before feed is resumed.

4.6.4.25 Venturi Recycle Flow Low

Flow sensing devices (FE 590, FE 591) located in the feed line to the venturi sprays monitor the flow in this line and produce a signal which is transmitted to the control cabinet. An alarm is initiated when the flow falls below 105 gpm.

Corrective Action

If this alarm is accompanied by either a "Chevron Recycle Flow Low" or a "Quench Recycle Flow Low" then the problem lies in the Chevron Recycle pumping skid.

If the alarm is singular, then the problem is most likely a plugging of the feed line or the nozzles. The nozzles can be cleaned while the unit is operational, however the feed should be stopped while this is being done.

4.6.4.26 Mixing Tank Pump Off

A set of contacts in the motor starter circuit monitors the status of the motors. The alarm is initiated when both pumps are off. If either pump is operating, the alarm should not be picked up.

Corrective Action

Open manual bypass to allow gravity flow of chemical into the recycle line. Monitor pH and adjust the valve accordingly. If adequate pH can be maintained manually then operation can continue with careful monitoring, while pump investigation continues. If pH cannot be maintained then a normal shutdown should be initiated.

4.6.4.27 Emergency Quench Water Pressure Low

A pressure sensor mounted in the feed line to the emergency quench water senses to the pressure in this line, and produces a signal which is transmitted to the control cabinet. An alarm is initiated when the pressure falls below 60 pound per square inch (psi).

Corrective Action

The operator should determine the cause of the low pressure. Should the alarm be accompanied by "Emergency Quench Water On" alarm, the condition should be transitory. However, should the alarm annunciate by itself, the system should be checked immediately. Should a temperature excursion occur without this backup system operational, equipment damage could be experienced.

4.6.4.28 Chemical Tank Mixer Off

A contact in the motor starter signals to the control cabinet the status of the mixing motor. An alarm is initiated when the motor is non-operational.

Corrective Action

The operator should inspect the mixer motor to ensure the motor is off.

If the mixing cannot be resumed in 30 minutes and the process in out of specifications, then a normal shutdown per Section 17.1 should be initiated.

4.6.4.29 Scrubber Quench Recycle Flow Low

Flow sensing devices (FE 593 and FE 594) located in the feed line to the quench sprays monitor the flow in the line and produce a signal which is transmitted to the control cabinet. An alarm is initiated when the flow falls below 21 pgm.

Corrective Action

Immediately verify that the backup Chevron recycle pump has started. If it has not, then the flow to the nozzles has plugged, and the remainder of the system is operating normally. If the plugging cannot be corrected in 30 minutes, then a normal system shutdown should be initiated.

4.6.4.30 Scrubber Temperature Low

A temperature switch (TS 502) located in the scrubber sump senses the temperature of the liquid in the sump and transmits this signal to the control cabinet. An alarm is initiated when the temperature falls below 108 degrees Fahrenheit.

APPENDIX G

MONITORING EQUIPMENT SPECIFICATIONS

APPENDIX C

MONITORING EQUIPMENT SPECIFICATIONS

CONTENTS:

- SECTION 7.0 OF DEMONSTRATION TEST PLAN SUBMITTAL NO. 1
- HORIBA BROCHURE
- THERMOX BROCHURES
- CALIBRATION PROCEDURES
- TABLE OF CONTENTS HORIBA MOBEL ENDA-800 SERIES INSTRUCTION MANUAL
- TABLE OF CONTENTS HORIBA VIA-500F INSTRUCTION MANUAL

7.0 CONTINUOUS MONITORING PROCEDURES

A continuous monitoring system will be used to monitor flue gas carbon monoxide, carbon dioxide, and oxygen levels. The continuous monitoring system will consist of a sample gas conditioning system, gas analyzers, and data acquisition/ recording system as shown in Figure 7.1. The Thermox Oxygen Meter does not require sample conditioning.

7.1 SAMPLE ACQUISITION/CONDITIONING

The flue gas will be extracted from the afterburner exhaust duct for the oxygen and from the stack for carbon monoxide and carbon dioxide. The carbon monoxide and carbon dioxide samples will be drawn through a flue gas conditioning system. The conditioning system is designed to deliver a sample stream representative of the flue gas stream to the sample analysis subsystem. Since the stream must be clean and dry for proper analyzer operation, a spun-glass fiber filter followed sequentially by mist filter, secondary filter, and a thermo-electric condenser are used for particulate and moisture removal. A system for the introduction of zero and span gases is also included for analyzer calibration.

7.2 SAMPLE ANALYSIS

The carbon monoxide concentration will be determined using a HORIBA Model ENDA-828 Non-Dispersive Infrared (NDIR) Carbon Monoxide Analyzer with measuring range of 0 to 500 ppm full scale. The analyzer will be calibrated at 0 percent carbon monoxide with ultrapure nitrogen and two other appropriate span gases before and after each test.

A calibration equation will be determined from a linear regression of these known gas concentrations versus instrument response. The equation used to convert instrument signal to concentration units follows:

$$\text{Concentration} = m(\text{response}) + b$$

where

m = slope of calibration curve
response = instrument signal (volts)
b = intercept of calibration curve

Oxygen concentrations will be determined using a Thermox Oxygen Analyzer with a measuring range of 0 to 22 percent oxygen full scale. The analyzer will be calibrated with a zero and two span gases in an analogous fashion to the previously described carbon monoxide monitor.

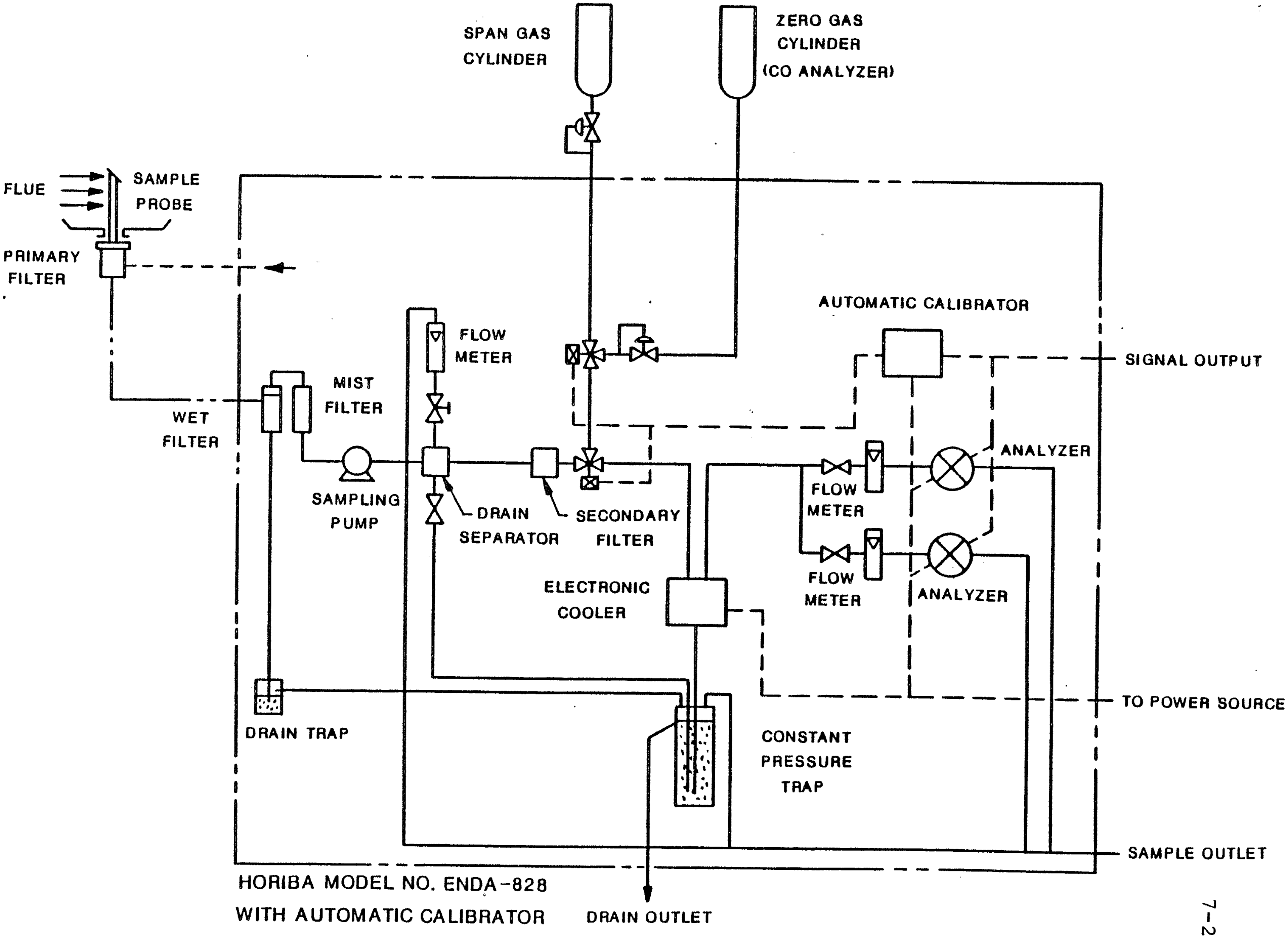


FIGURE 7.1

FLUE GAS CONDITIONING

Carbon dioxide concentrations will be determined using a HORIBA Model ENDA-828 NDIR Carbon Dioxide Analyzer with a measuring range of 0 to 40 percent carbon dioxide. This monitor will be calibrated with a zero and two span gases in an analogous fashion to the previously described carbon monoxide and carbon dioxide monitors.

Table 7.1 lists the analyzer specifications for all the above determinations.

The continuous-emissions monitors will be calibrated once a day from Airco cylinders containing certified (± 1 percent) calibration gases. This gas will be prepared according to USEPA protocol.

TABLE 7.1

ANALYZER SPECIFICATIONS OF CONTINUOUS MONITORS

	HORIBA ENDA-828 CO_2 Analyzer	HORIBA ENDA-828 CO Analyzer	Thermox WDG III O_2 Analyzer
Operating Sensitivity Ranges	0-20% CO_2, full scale 0-40% CO_2, full scale	0-200 ppm CO, full scale 0-500 ppm CO, full scale	0.5-21.9% O_2, full scale
Operating Temperature Ranges	24 to 122 degrees Fahrenheit	24 to 122 degrees Fahrenheit	32 to 122 degrees Fahrenheit
Analysis Method	Nondispersive infrared	Nondispersive infrared	Zirconium oxide electrochemical cell
Linearity	+/-1% of full scale	+/-1% of full scale	
Reproducibility	+/-1% of full scale	+/-1% of full scale	+/-1% of full scale
Drift	+/-2% of full scale per week in both zero and span	+/-2% full scale per week in both zero and span	0.1% of sensor output per month
Noise level	0.5% of full scale in most sensitive range	0.5% of full scale in most sensitive range	

HORIBA

Continuous Stack Gas Analyzer Systems

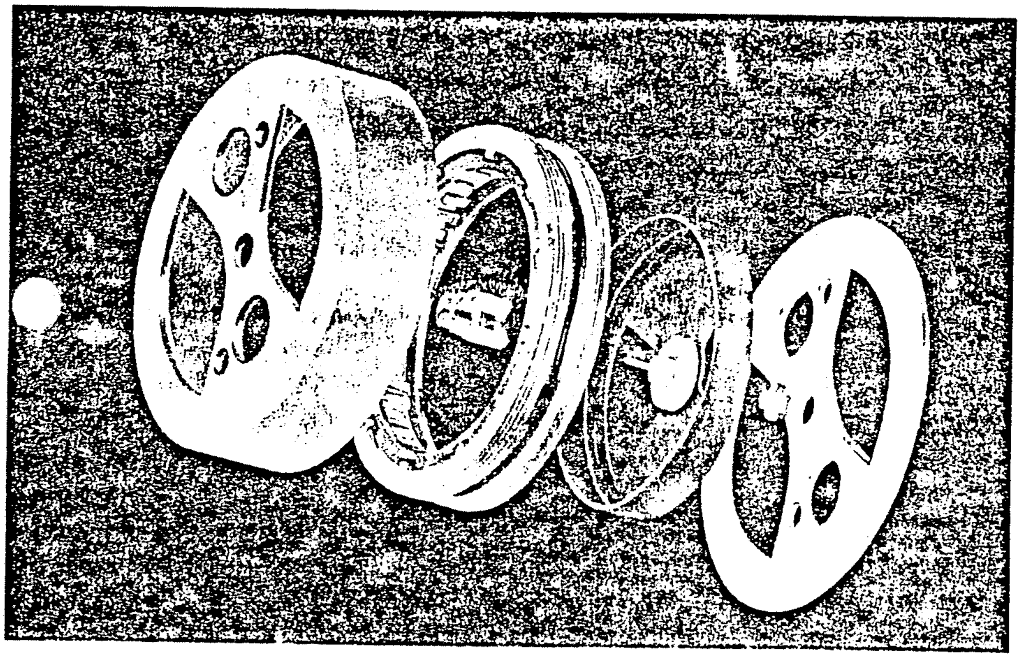
Series 100 Transportable Stack Gas Analyzer Systems
Series 800 Continuous Gas Analyzer Systems

NON-DISPERSIVE INFRARED (NDIR) SYSTEMS FOR NOx, SO_2, CO, CO_2
PARAMAGNETIC SYSTEMS FOR O_2

A World Ahead
in Analyzer Technology.

The HORIBA Stack

Throughout its history, Horiba has been known for its innovative, dependable analyzers and analyzer systems. The needs of industry have caused Horiba to develop a comprehensive line of stack gas analyzer systems ranging from the Transportable Series 100 to the Continuous Series 800—systems designed for continuous monitoring of stack gases in the industrial process industries.



The HORIBA Difference: The Chopper Motor.

To produce its line of state-of-the-art NDIR gas analyzers, Horiba patented its unique chopper motor, an integral part of all Horiba gas analyzers.

No one else has the design, so no one else can achieve its exclusive, trouble-free operation. It's simply the best chopper motor on the market today. And the better the chopper motor, the more accurate and dependable the gas analysis.

Briefly, this is how the chopper works.

In the process of infrared analysis, infrared radiation emitted by the light source is passed through the sample and reference cells and is modulated by the rotating chopper. This motor must work consistently to achieve accurate measurements.

The Horiba chopper motor accomplishes this in two ways. First, the chopper motor is a synchronous motor operating at line frequency. Line voltage frequency is precisely controlled by power utility companies, so the operating frequency of the chopper motor is precisely and accurately controlled. And second, instead of gears and belts, the Horiba chopper motor uses jeweled bearings on moving surfaces that for all practical purposes never wear out.

This combination of synchronous motor design and jeweled bearings create a stable, accurate motor that results in stable, accurate measurements with almost no failure – and no down time.

Over the past several decades, Horiba has designed and manufactured high quality non-dispersive infrared analyzers and analyzer systems. Horiba has designed and sold stack gas monitoring systems since 1964. More than 2000 systems have been sold world wide. The tremendous diversity of application knowledge accumulated over the last 20 years has allowed Horiba standard Series 800 analyzers to be applied with the same dependability and reliability as the basic NDIR analyzer.

The Series 800 can measure any combination of components. The Series 800 standard systems are designed to measure any combination of NOx, SO_2, CO, CO_2 and O_2 in single parameter, dual parameter and triple parameter systems. Horiba's paramagnetic analyzer—is used for O_2 analysis. Both NDIR and paramagnetic methods insure a highly reliable, stable measurement with minimal operating costs and easy maintenance.

A dual-detection NDIR system continuously analyzes trace gas concentrations without interference. The Horiba dual detector technique is used in applications where there is significant interference from a co-existing gas. This technique allows measurement of the sample gas without the need for ultra narrow bandpass

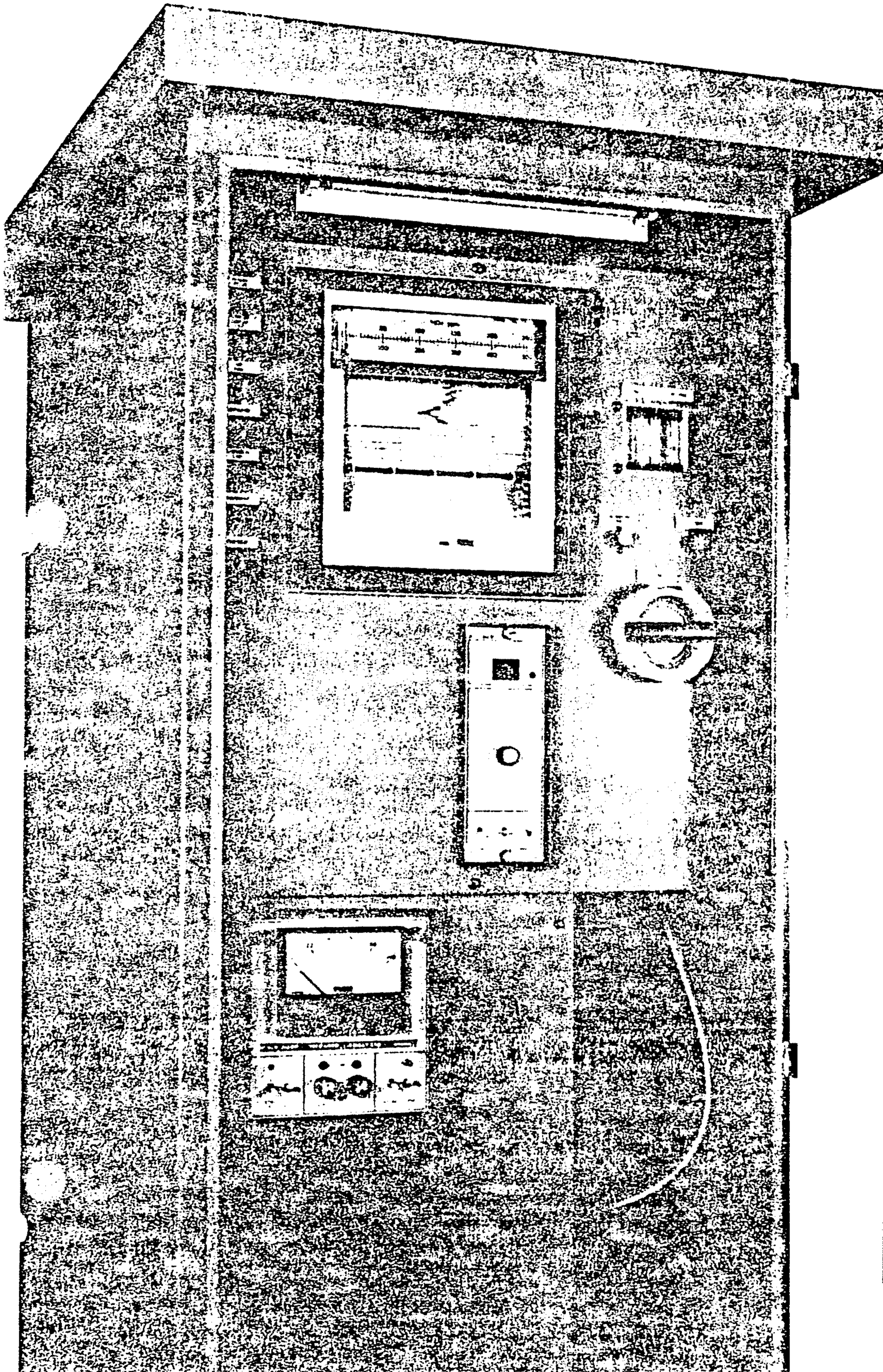
Gas Systems

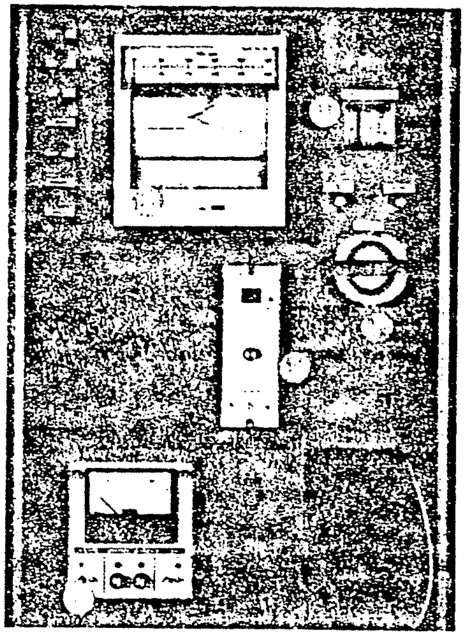
filters, or pressurized gas filter absorbence cells, which are subject to loss of sensitivity and undetected leaks.

Virtually no sampling errors. Both the analyzer units and sample gas preconditioner are housed in the same cabinet. A unique dehumidification mechanism (thermoelectric cooler) as well as other special features make sampling errors almost non-existent. An easily replaced acid mist (SO_3) filter removes corrosive sample gas components. Secondary filters, flow and pressure regulation is provided to supply a clean, dry sample gas to the analyzers.

Using teflon, PVC or stainless steel for the materials exposed to the sample gas, absorption—or loss of sample gas—is minimized, while durability and corrosion resistance are optimized. Special materials may be specified when required.

The Horiba Series 800 uses 304 stainless steel for the sampling probe. A primary heated filter mounted directly onto the probe removes particles without allowing condensation of water vapor. The filter element is a convoluted sandwich composed of quartz wool and stainless steel that can be easily replaced in the field. Again, special materials may be specified when required.





1) VIA NDIR Analyzer
2) Automatic Calibrator
3) Sample Gas Flow Meters
4) Secondary Filter
5) Recorder

HORIBA

For NOx measurement an ultra-low temperature converter insures stability, durability. The NOx converter catalyst operates at a low temperature (190°C), to avoid dissociation reactions. You always know precisely how much NOx is in the sample.

The Series 100 is totally transportable. Specifically designed for transportability, the Series 100 has made easy, short term measurement a reality. Developed from extensive practical experience with the Series 800 stationary stack gas and process analyzers, the Series 100 brings accurate, precise and proven measurement to units that can be easily moved from one facility to another.

Each of the Series 100 systems consists of a sample probe, a sampling system and an analyzer. Continuous measurement of SO_2, CO_2, CO, NOx or O_2 is easily achieved by the proper combination of these components. The Series 100 analyzer system gives you vital data required to optimize boiler efficiency and reduce fuel costs.

FEATURES & BENEFITS

Series 800/100

- Stable, reliable measuring systems: NDIR (SO_2, NOx, CO, CO_2), paramagnetic O_2.
- Analyzer unit and sample conditioning housed in the same fully gasketed steel cabinet suitable for outdoor installation (Series 800)
- Virtually no sampling errors
- No drift caused by acid mist
- Special materials and sample system designs for increased durability, corrosion resistance and reliability
- Continuously supplied clean sample for accurate, continuous measurement

PRINCIPLES OF OPERATION

NDIR METHOD (CO_2, SO_2, NOx, CO)

All Horiba NDIR gas analyzers operate on the principle of infrared absorbance. Certain gases (CO, CO_2, HC, SO_2, NO) absorb infrared energy at specific wavelengths. For example, carbon monoxide absorbs infrared energy at a wavelength of 4.7 microns and carbon dioxide at 4.3 microns. Since the amount of energy absorbed is related to the number of gas molecules in the path of an infrared energy beam, it is possible to measure the concentration of a gas by detecting the amount of infrared energy absorbed.

In its simplest form, a Horiba NDIR analyzer uses a dual beam infrared light source and gas filled capacitive microphone detectors to develop an electronic signal proportional to the gas concentration being measured.

The type of detector and the length of the measuring cell are selected based on the range of measurement desired. The measured concentration of a sample is clearly displayed on a 4.7 inch analog meter face.

STANDARD ACCESSORIES

	Name	Specifications	Q'ty
1.	Probe	Stainless steel 304, 1m	1
2.	Primary filter ass'y	Stainless steel 304, flange 40A, w/heater	1
3.	Primary filter cap	Drip proof cover	1
4.	Teflon tube	8φ/6φ, 10m	1
5.	Funnel	Polyethylene, for water supply to water trap	1
6.	Silicon grease	1g	1
7.	Fuse	1A	3
8	Fuse	2A	1
9.	Anchor bolt	L type, M12 × 160, w/nut and washer	4
10.	Instruction manual		1
11.	Installation manual		1

STANDARD SPARE PARTS

	Name	Specifications	Q'ty
1	Primary filter element	Stainless steel 304, Quartz wool, 2μ	2
2	Mist catcher	#3030	1
3	Secondary filter element	Glass 55φ for NOx,CO,CO_2, O_2 analyzer and Teflon 55φ for SO_2 analyzer	5

OPTIONAL SPARE PARTS

	Name	Specifications	Q'ty
1.	Primary filter element	Stainless steel 304, Quartz wool, 2μ	12 pcs/set
2.	Primary filter O-ring	JIS B2401, P50A, Vitron rubber	2 pcs/set
3.	Primary filter holder cap	Vitron rubber	4 pcs/set
4.	Primary filter element cap	Vitron rubber	4 pcs/set
5.	Wet filter element	Polyester, 40φ	18 pcs/set
6.	Mist catcher	#3030	6 pcs/set
7.	Sampling pump diaphragm	Vitron rubber, w/valve ass'y	2 pcs/set
8.	Air pump diaphragm	Neoprene, w/valve ass'y for HP-55	2 pcs/set
9.	Secondary filter element	Glass 55φ for NOx, CO, CO_2, O_2 analyzer and Teflon 55φ for SO_2 analyzer	20 pcs/set
10.	Air filter		1 pc.

SAMPLE REQUIREMENTS

	ENOA-812 ENDA-822	ESDA-813 ENDA-823	ECDA-814 ENDA-824	ECMA-815 ENDA-825	EOXA-816	ENDA-827 ENDA-837
SO_2	less than 2000 ppm	within measuring range	less than 2000 ppm	–	–	within measuringing range
SO_3	less than 50ppm	–	–	–	–	–
NO	within measuring range	less than 1000ppm	–	–	–	within measuring range
NO_2	less than 1/10 NO	–	–	–	–	–
CO_2	5 ~ 15%	–	within measuring range	5 ~ 15%	–	–
CO	less than 1000 ppm	–	–	within measuring range	less than 1000ppm	–
O_2	0.5 ~ 15%	–	–	–	within measuring range	–
HCℓ	none	–	–	–	–	–
NH_3	less than 50ppm	–	–	–	–	–
HF	none	–	–	–	–	–
$Cℓ_2$	none	–	–	–	–	–
H_2O	4 ~ 20%	–	–	–	–	–
N_2	balance	–	–	–	–	–

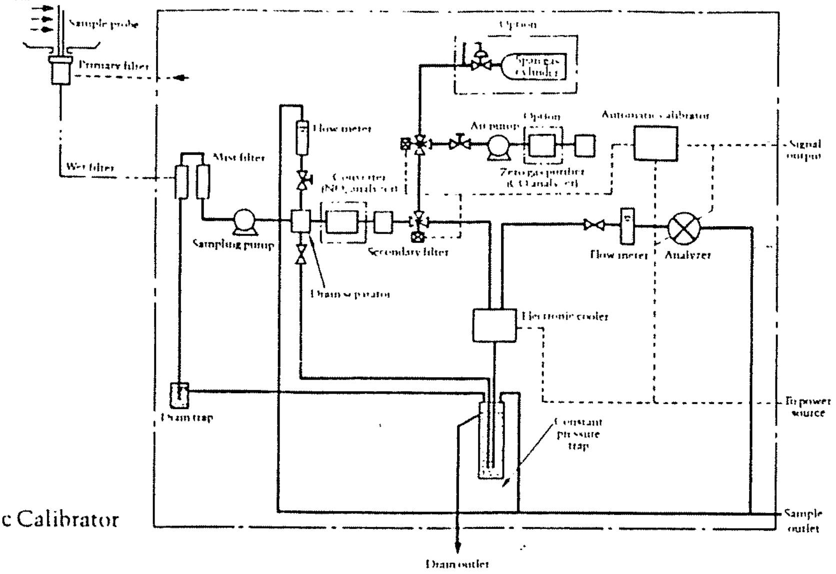
SPECIFICATIONS
Any measurement combination is available up to three components

	1 Component Analyzers					2 Component Analyzers						3 Component Analyzers	
Model	ENOA-812	ESDA-813	ECDA-814	ECMA 815	EOXA 816	ENDA 822	ENDA 823	ENDA 824	ENDA 825	ENDA 827	ENDA 828	ENDA 837	ENDA 838
Component(s) measured	NOx	SO_2	CO_2	CO	O_2	NOx, O_2	SO_2, O_2	CO_2, O_2	NOx, SO_2	CO, O_2	2 components among NOx, SO_2, CO, CO_2	NOx, SO_2, O_2	2 components among NOx, SO_2, CO, CO_2, + O_2
Enclosure	Self balancing, outdoor installation type	–	–	–	–	–	–	–	–	–	–	–	–
Measuring method Principle Sampling	NDIR 2.5°C dry sampling	NDIR –	NDIR –	NDIR –	PM –	NDIR, PM –	NDIR, PM –	NDIR, PM –	NDIR, PM –	NDIR –	NDIR –	NDIR, PM –	NDIR, PM –
Measuring range (Standard) (Option)	0 ~ 200/500ppm 0 ~ 100/200, 0 ~ 100/250, 0 ~ 250/500, 0 ~ 500/1000, 0 ~ 1000/2000 (1)	0 ~ 200/500ppm 0 ~ 100/200, 0 ~ 100/250, 0 ~ 250/500, 0 ~ 500/1000, 0 ~ 1000/2000 (2)	0 ~ 20/40% 0 ~ 10/20% (3)	0 ~ 200/500ppm 0 ~ 100/200, 0 ~ 100/250, 0 ~ 250/500, 0 ~ 500/1000, 0 ~ 1000/2000 (4)	0 ~ 10/25% 0 ~ 5/25% (5)	Refer to (1) & (5)	Refer to (2) & (5)	Refer to (3) & (5)	Refer to (4) & (5)	Refer to (1) & (2)	Refer to (1), (2), (3) & (4)	Refer to (1), (2) & (5)	Refer to (1), (2), (3), (4) & (5)
Repeatability Zero drift Span drift Linearity	±1.0% of F.S. ±2.0% of F.S./week (auto calibration) ±2.0% of F.S./week (auto calibration) ±1.0% of F.S.	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
Response time (90% at system inlet)	1 min.	4 min.	1 min	1 min	1 min	1 min	4 min SO_2, 1 min O_2	1 min	1 min	4 min SO_2, 1 min NOx	–	4 min SO_2, 1 min NOx, O_2	–
Output (Load resistance)	DC 4 ~ 20mA isolated, 0 ~ 1V Simultaneous output (Less than 750 ohms)	–	–	–	–	–	–	–	–	–	–	–	–
Sample flow rate	3 ~ 4ℓ/min	–	–	–	–	–	–	–	–	–	–	–	–
Sample requirement Temperature Particulates Pressure	Less than 250°C Less than 0.1g/Nm³ Atmospheric pressure ±100mm H_2O	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
External output signals make contact	Power off DC 50V, 0.1A In maintenance DC 50V, 0.1A Range indication DC 50V, 0.1A In calibration DC 50V, 0.1A Calibration fault (*) *(Only for auto calibration)	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
Calibration	Manual calibration or Auto calibration (once per day by integrated timer)	–	–	–	–	–	–	–	–	–	–	–	–
Power source	AC line, 900VA	–	–	–	800VA	1KVA	–	–	–	1.2KVA	–	1.4KVA	–
Installation conditions Temperature Vibration	−5°C ~ 40°C (Std.) −15°C ~ 40°C Heated cabinet (option) Less than 0.3G at 100Hz	–	–	–	–	–	–	–	–	–	–	–	–
Weight	240 kg/528 lbs	–	–	–	–	260 kg/572 lbs	–	–	–	300 kg/660 lbs	–	320 kg/704 lbs	–
Dimensions	23.6 in x 70.9 in x 31.5 in	–	–	–	–	–	–	–	–	[illegible]	–	–	–

Models are available for 100, 115, 220, 230 or 240V AC, at 50/60 Hz operation as specified.
NDIR : Non Dispersive Infrared Method
PM : Paramagnetic Method

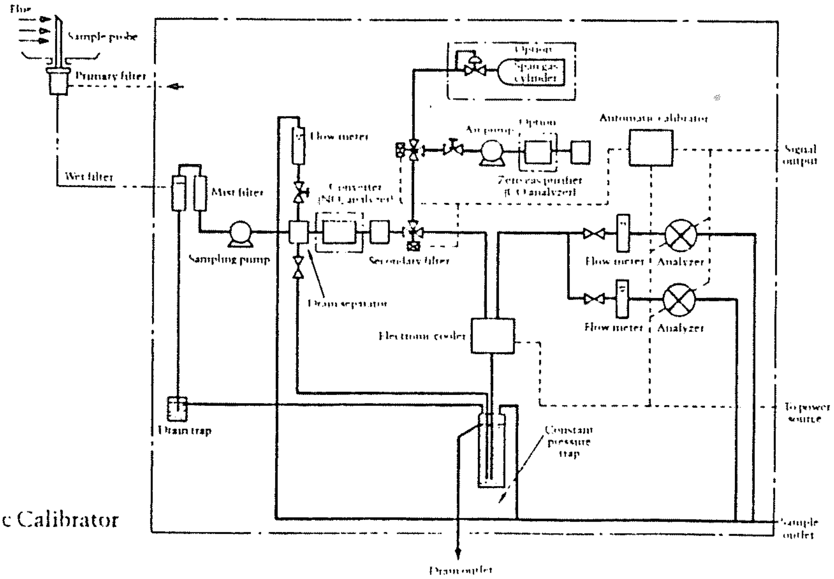
Specifications are subject to change without advanced notice for further improvement.

FLOW SHEET



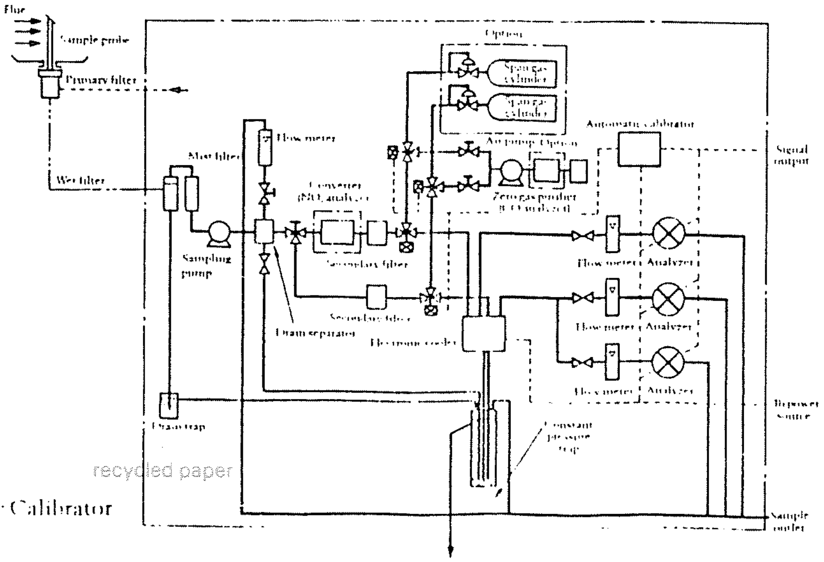
ENOA-812
ESDA-813
ECDA-814
ECMA-815
EOXA-816

With Automatic Calibrator



ENDA-822
ENDA-823
ENDA-824
ENDA-825
ENDA-827
ENDA-828

With Automatic Calibrator



ENDA-838
ENDA-837

With Automatic Calibrator

PARAMAGNETIC (MAGNETIC DUMB BELL) METHOD

The sample gas flow chamber is located within a magnetic field created by a strong permanent magnet. A glass dumb bell, charged with air or CO_2, is horizontally suspended by a platinum wire fitted with a mirror. Because oxygen has an exceptionally high magnetic susceptibility, its paramagnetism moves the dumb bell in the magnetic field in proportion to its concentration. The strength of the magnetic field, the volume of the suspended dumb bell and the magnetic susceptibility of the dumb bell remain constant so that only the force caused by the magnetic susceptibility of the sample gas acts upon the dumb bell and gives a rotating force to the dumb bell. Measuring the rotation angle of the dumb bell provides a measurement of oxygen concentration.

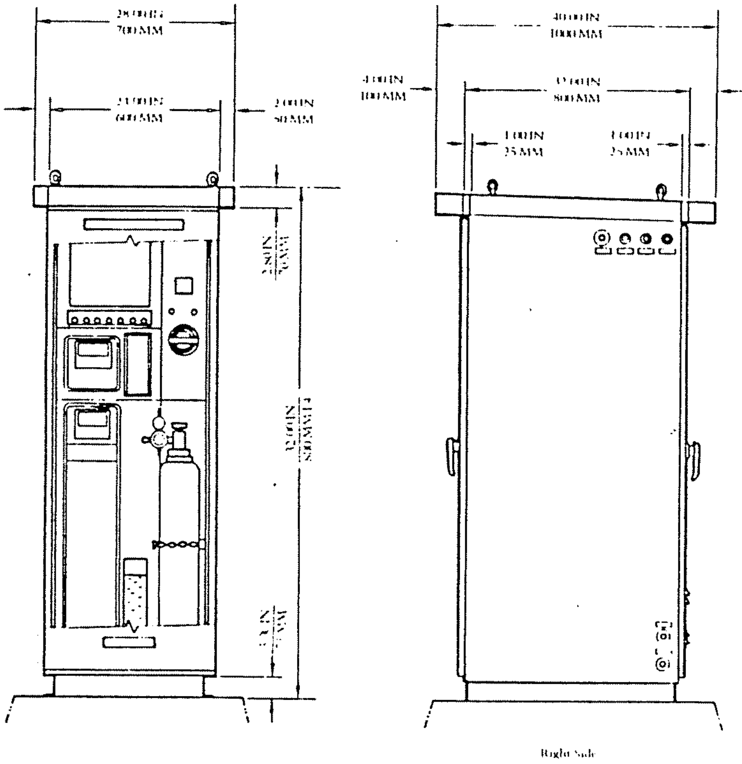
COEXISTING GAS INTERFERENCE (100%)

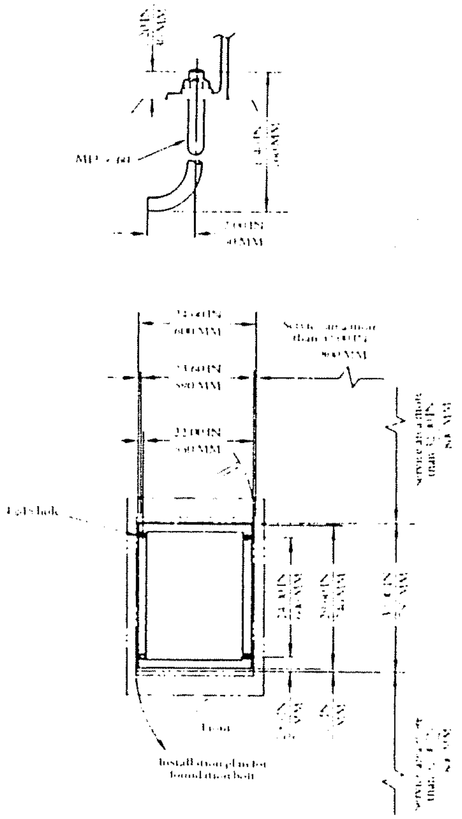
(with interference ratio of Oxygen as 100)

Acetylene C_2H_2	0.24
Ammonia NH_3	−0.26
Argon Ar	−0.22
Carbon dioxide CO_2	−0.27
Carbon monoxide CO	+0.01
Ethylene C_2H_4	−0.26
Normal hexane C_6H_{14}	−1.7
Hydrogen H_2	+0.24
Methane CH_4	0.2
Nitrogen N_2	0.0
Oxygen O_2	100.0
Nitric monoxide NO	+43.0
Nitrogen dioxide NO_2	+28.0

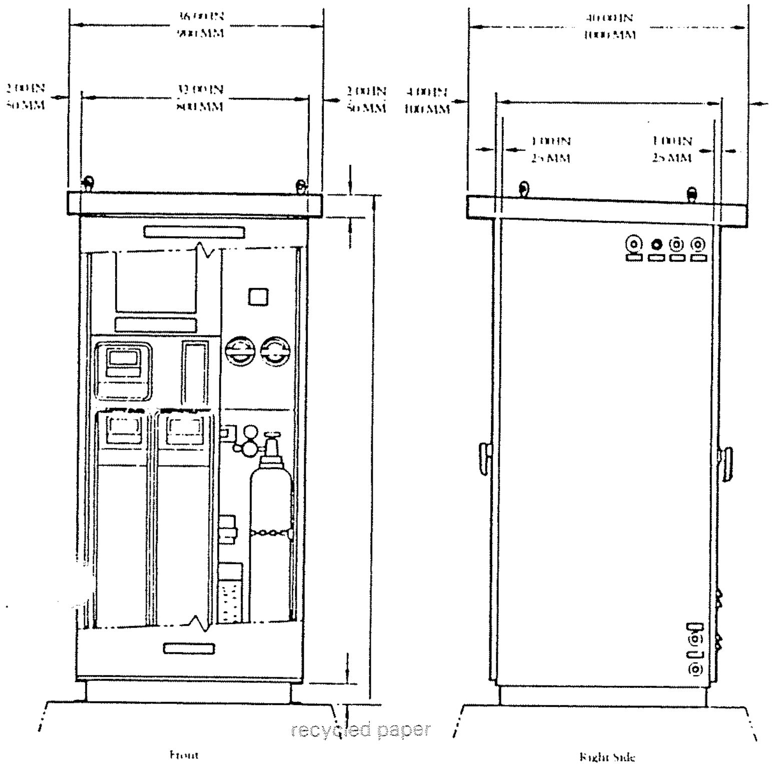
DIM SIONAL OUTLINES

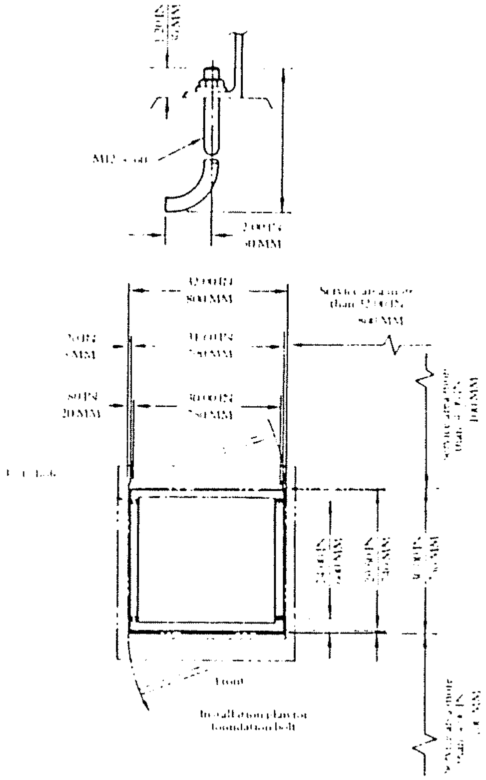
ENOA-812, ESDA-813, ECDA-814, ECMA-815, EXOA-816, ENDA-822, ENDA-823, ENDA-824, ENDA-825





NDA-827, ENDA-837, ENDA-828, ENDA-838

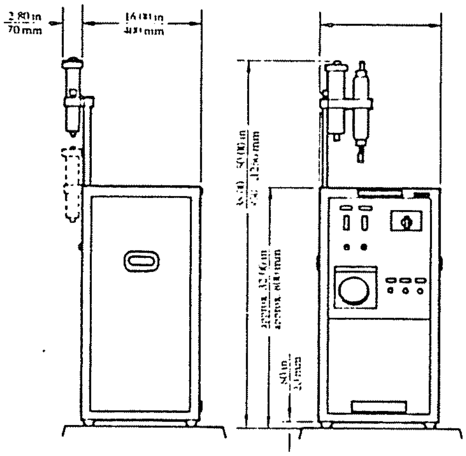


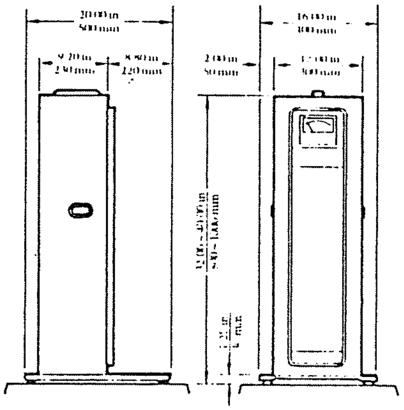


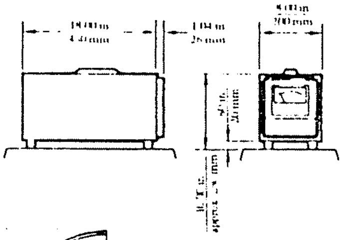
SPECIFICATIONS

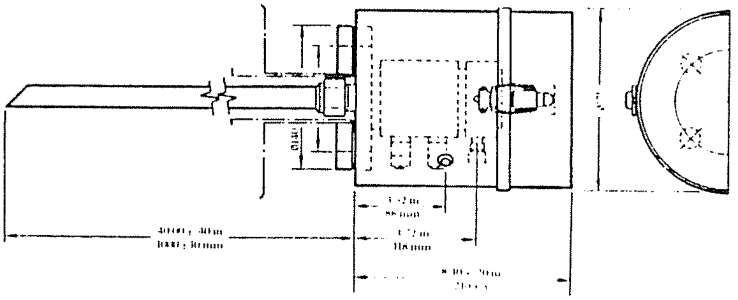
	FNOA-102	ESDA-103	FCDA-104	FCMA-105	FOXA-106
Component measured	NOx	SO_2	CO_2	CO	O_2
Measuring method Principle Sampling	NDIR 2.5°C dry sampling	— —	— —	— —	PM —
Measuring range	0 – 200/500 ppm	0 – 200/500 ppm	0 – 20/40%	0 – 200/500 ppm	0 – 10/25%
Repeatability	± 1% of full scale	—	—	—	—
Response speed (90% at system inlet)	1 min.	4 mins.	1 min	—	—
Output	4 – 20 mA DC Isolated 0 – 1V	—	—	—	—
Sample flow rate	2 – 3ℓ/min	3 – 4ℓ/min	2 – 3ℓ/min	—	—
Ambient temperature	5 – 40°C	—	—	—	—
Power source	AC line, 550 VA	—	—	—	AC line, 500 VA
Weight	approx 70 kg / 154 lbs	—	—	—	approx 60kg/132lb

NOTE: 1. Please consult us for other ranges than above.
2. Models are available for 100, 115, 220, 230 or 240V AC, at 50 or 60Hz operation as specified.
3. As for the sample composition requirement, please refer to those of "800 SERIES" according to component(s) measured.
4. NDIR: Non-dispersive Infrared Absorptimetry, PM: Paramagnetic Method









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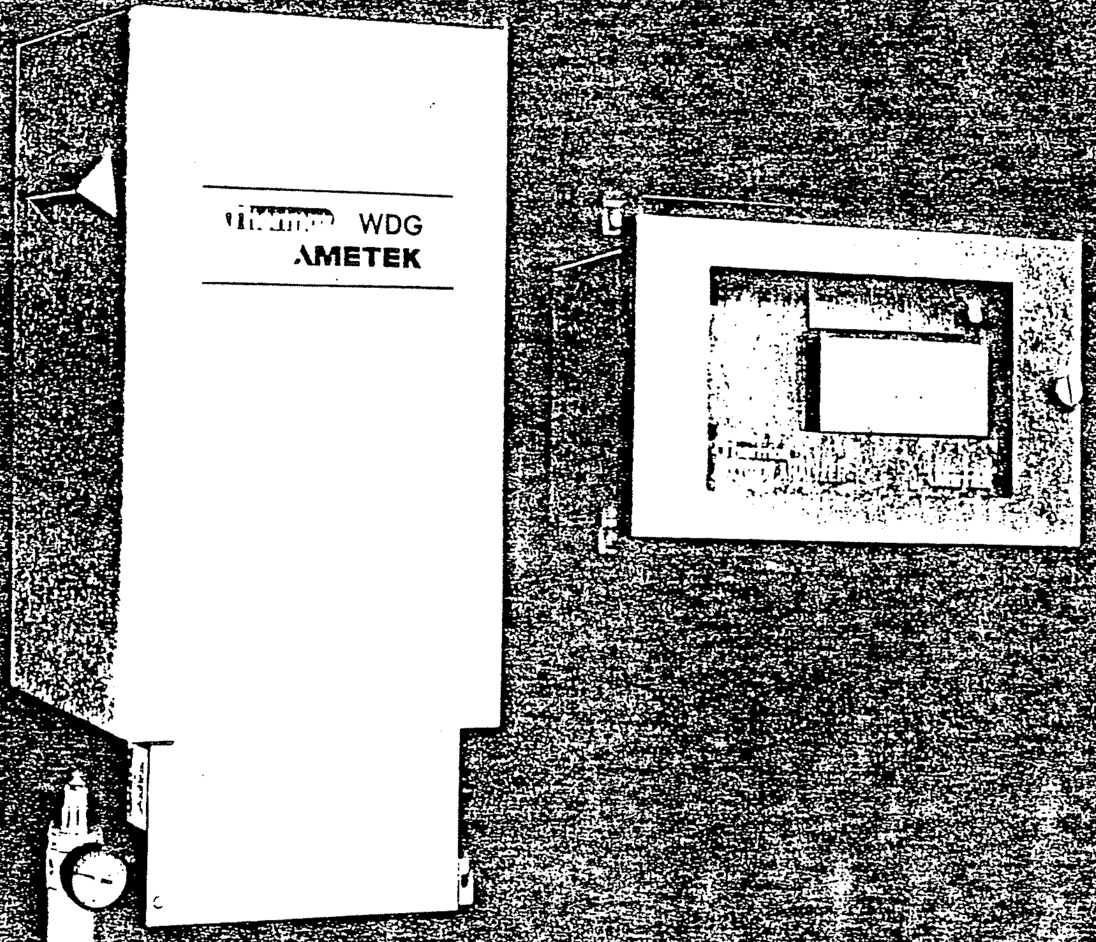
BULLETIN P-25

10200004

WDG-III COMBUSTION OXYGEN ANALYZER



AMETEK
THERMOX INSTRUMENTS DIVISION

Thermox™

WDG-III COMBUSTION OXYGEN ANALYZER

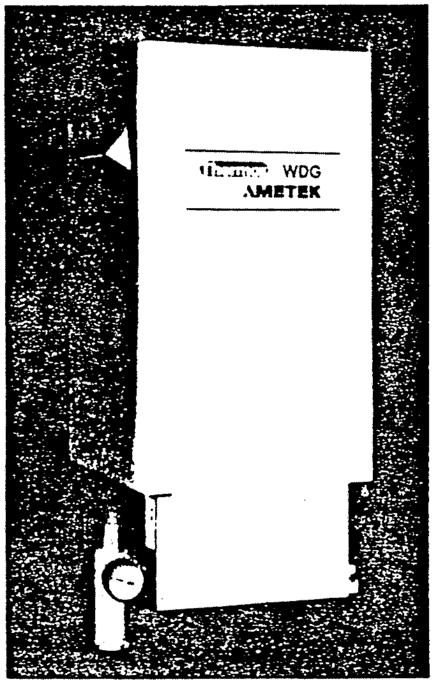


Fig. 1—WDG-III sensor unit

Measuring excess oxygen in flue gas is recognized as the best method of determining excess air in combustion processes.

Thermox Instruments was one of the first companies to offer the modern technology of zirconium oxide sensors in combustion oxygen analyzers. Since the introduction of the WDG Analyzer in 1970, Thermox has specialized in combustion measurement.The WDG-III is the third generation of these instruments—since its introduction in 1976, more than five thousand units have been installed on many demanding applications.

The WDG-III measures oxygen in wet, dirty, corrosive flue gases up to 3200°F, generally without sample filtering, cooling or other conditioning. Its range is from 100 percent oxygen to stoichiometric combustion (with increasing sensitivity as oxygen approaches zero). It offers a quantitative measurement of excess fuel combustion and provides the widest range of application capabilities.

Thermox analyzers have an excellent record of continuous, low maintenance operation. They are entirely field serviceable—no need to return the sensor to the factory for expensive repairs.

By saving fuel through improved combustion efficiency, the WDG-III can often pay for itself in less than a year with fuel bills as low as $5,000 per month. In addition, process upsets which produce smoke, carbon monoxide, hydrocarbon emissions and excessive nitrogen oxides can be avoided.

FEATURES

☐ **Interfaces directly to the combustion process**—maintains in situ sample conditions by direct mounting to the combustion unit, flue gas duct, or process.

☐ **Unrestricted sample path**—most of the sample flows through the analyzer and is returned to process. Only a small portion reaches the cell. "Convection loop" is designed to eliminate plugging from entrained dirt as well as cell damage from moisture.

☐ **Zirconium oxide ceramic sensing element**—no membranes, liquids, fuels or catalysts. Sturdy and shock resistant.

☐ **Highly accurate** — ± 1% of net excess oxygen (O_2 remaining after combustibles, if present, are burned on the hot ceramic sensor)

☐ **Fast response**—over 90% of full scale in less than 5 seconds.

☐ **Usable with sample temperatures as high as 3200°F**

☐ **Available with Combustibles Monitor (WDG-IIIC) option**

☐ **Entirely field serviceable**—all sensor components can be replaced with wrenches and a screwdriver—or a shop-tested replacement assembly can be supplied.

☐ **Functionally arranged electronics**—all electronics consist of engineered "plug-in" card modules.

APPLICATIONS

Users are realizing significant fuel savings and more precise control along with other important benefits in demanding applications such as:

- Gas, oil, pulverized coal, bark and black liquor boilers
- Acid sludge furnaces
- Rotary kilns—cement, lime and phosphate
- Incinerators of all types
- Inert gas generators and systems
- Ceramic kilns
- Soaking pit, reheat and heat-treat furnaces
- Process heaters and furnaces
- Ore roasting furnaces and converters
- Blast furnace stoves
- Coke ovens

EASE OF SERVICE

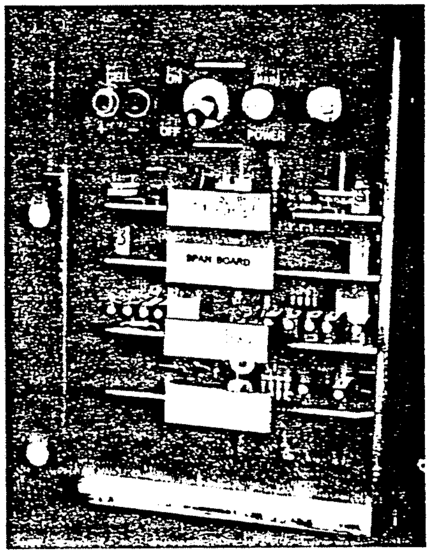


Fig. 2—The WDG-III is designed with user service requirements in mind. Plug-in modules are field replaceable, and some, like the linearizer and O_2 alarm (single or dual), may be retrofitted by installing appropriate electronics card in pre-wired cage assembly. Shown is standard control cabinet with full card cage.

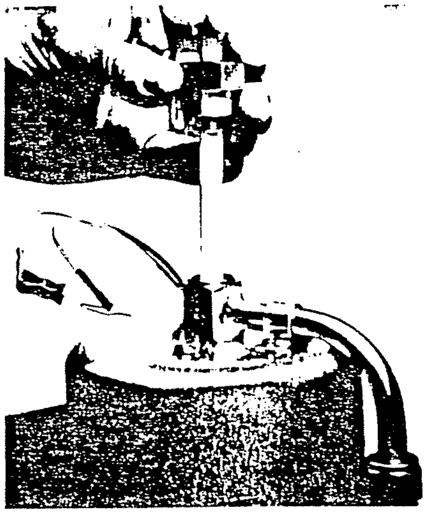


Fig. 3—The zirconium oxide sensing element is easily replaced and requires only two wrenches for removal (electrodes are clip-on type). A calibration port is a standard analyzer feature. Sensor unit maintenance can be conducted from the front without removal of the probe from process or the base plate from its mounting location.

OPERATION-SENSOR

The WDG-III sensor maintains in situ sample conditions by mounting directly to the combustion unit, flue gas duct, or process. The sensor assembly is an extremely simple unit consisting of short heated flow path, controlled temperature furnace, and ceramic electrochemical cell. Its main gas path is a short U-shaped tube through which the sample is drawn by air-operated aspirator, and discharged back to process. The U-shaped section can be readily removed for servicing.

Extending upward from the main sample flow tube is another loop* containing the zirconium oxide sensing element and temperature-controlled, electrical resistance furnace. A small, but constant amount of sample flows up, by thermal convection, past the sensing cell and then back down to the main passageway.

The system has been designed to handle wet, dirty flue gas having a high acid dew point—all surfaces in contact with the gas are maintained at 400°F; even hotter in a special version. This is accomplished by mounting the sensor directly to the process duct in a heated, well-insulated stainless steel cabinet. Heat is supplied to the enclosure and aspirator air by cartridge heaters inserted into a finned aluminum block.

Another heater is supplied which may be installed, at user's option, below the sample tube should application conditions warrant.

The continuous electrical signal generated as the sample passes over the sensing cell is transmitted, without amplification, to the control cabinet and displayed on a meter (see HOW ZIRCONIUM OXIDE CELL WORKS).

For high temperature applications, a ceramic sampling tube replaces the portion of the probe that extends into the process.

*U.S. Patent Re. 29,209. Other Patents Pending

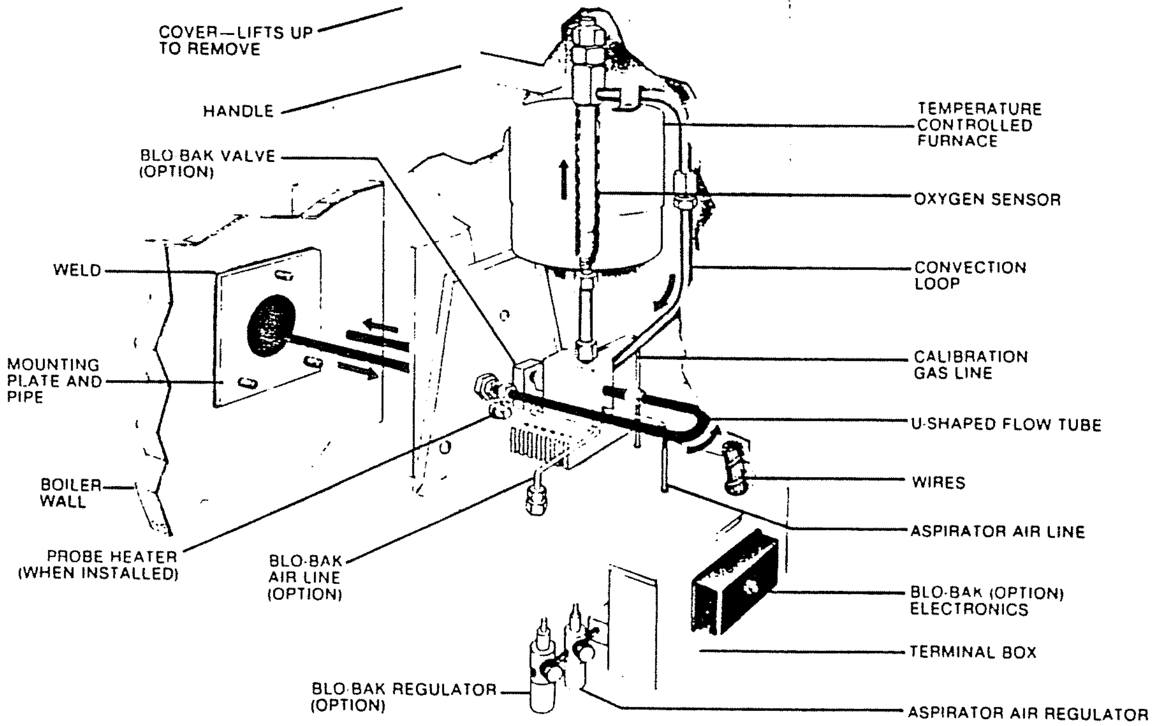


Fig. 4

REMOTE READOUT CONTROL CABINET

Control cabinet is usually installed remote from the sensor—often by as much as several hundred yards.

Cabinet contains the temperature controller for the sensor furnace, a meter for displaying the analysis, plus any specified signal conditioning or alarm modules. A continuous signal for a recorder or controller is provided from a terminal strip. Outputs can be supplied to match any input specification, including a logarithmic or linear signal.

Special units can be supplied containing the required temperature controllers and other modules for any number of remote sensors (multi-sensor system) with the signal from each continuously available to a multi-point or multi-channel recorder.

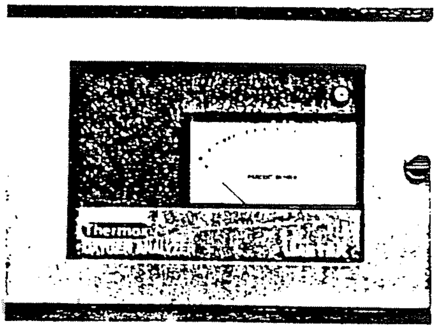


Fig. 5—WDG-III standard control cabinet

HOW ZIRCONIUM OXIDE CELL WORKS

The zirconium oxide ceramic sensing element is a closed-end tube, which when hot (generally above 1200°F) becomes an electrolytic conductor because vacancies in the crystal lattice permit mobility of oxygen ions. Porous platinum coatings on the inside and outside of the tube serve as electrodes. When the two electrodes are in contact with gases having different levels of oxygen partial pressure, a voltage is produced that depends on this ratio (see Fig. 6).

If the oxygen content of one gas (generally air) is known, the EMF produced by the cell indicates the oxygen content of the other gas (see Fig. 7).

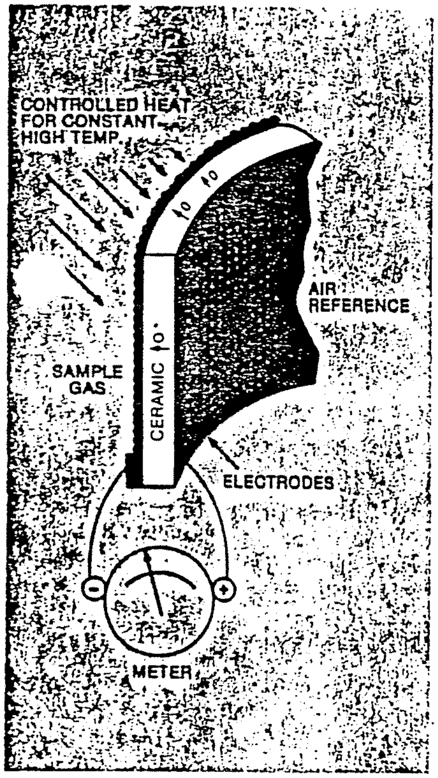


Fig. 6—The zirconium oxide element

Since the voltage of the cell is also temperature dependent, the cell is maintained at a constant temperature. The calibration of the analyzer is obtained from the formula:

$$E = AT \log \frac{0.209}{[O_2]x}$$

where A is a constant, T is absolute temperature and $[O_2]x$ is the oxygen concentration of the sample.

When the flue gas contains excess unburned combustibles (deficiency of oxygen), the electrochemical cell will function as a fuel cell and provide a quantative measurement of this condition. Thus, the ceramic sensing element can measure air/fuel ratio on both sides of stoichiometric combustion (see Fig. 8).

Because of its high operating temperature, the zirconia cell measurement is always "net excess oxygen" or "net excess fuel". When the sample is hotter than 1400°F where oxygen and combustibles cannot coexist, the excess fuel measurement can be displayed as percent unburned combustibles. However, at lower temperatures, oxygen and combustibles can exist together in the sample (the result of poor mixing or leaks at relatively cool locations), and this condition can only be detected with a separate catalytic combustibles sensor. A Thermox Combustibles Monitor is available as an option (see OPTIONS AND ACCESORIES).

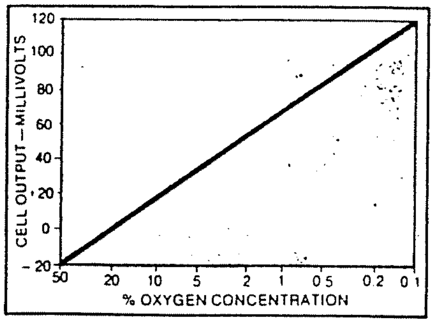


Fig. 7—Oxygen in sample (cell output vs. composition)

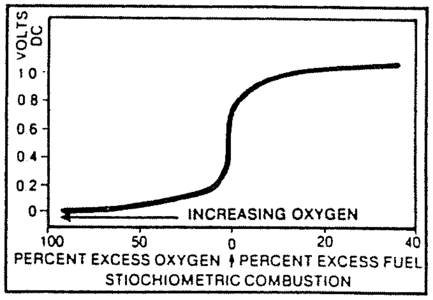


Fig 8—Response of cell to various combustion mixtures

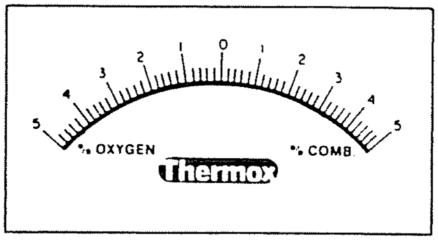


Fig. 9—Display of cell response covering span from 5 percent oxygen to 5 percent combustibles using optional Function Generator Module to linearize curve of Fig. 8.

NOTE: Valid for samples containing either O_2 or combustibles (sample temperature must be above 1400°F)

OTHER THERMOX PRODUCTS

AIR-MIZER Combustion Control System—A combustion optimization system for use on small to medium sized boilers. Accurate, closed loop air-fuel ratio control system that maintains minimum excess air levels for all air-fuel conditions and firing rates; even during rapid load changes.

Portable WDG-P Combustion Oxygen Analyzer—Similar to WDG-III except sensor plumbing is not maintained hot enough to operate indefinitely with high-sulfur fuels.

Portable CMFA-P Combustible Mixture and Flue Gas Analyzer—Incorporates additional function of sampling a premix type combustible mixture, burning it in the analyzer, and then analyzing the combustion products to determine the ratio of air-to-fuel in the original mixture.

Portable Thermox I and Permanent Thermox II and III "Clean Gas" Oxygen Analyzers—Simple, fast response units with range from pure oxygen to below one ppm and then into the reducing range.

SPECIFICATIONS

Sensor Cabinet (Fig. 12)
Weight—55 pounds (25 kg) Materials—Stainless steel case, nickel-plated carbon steel base plate

Readout Control Cabinets (Fig. 13 & 14)
Materials—Aluminum door frame, gasketed, sheet steel enclosure, polyurethane enamel finish inside and out. Control cabinets meet functional requirements of NEMA 4 classification.
Weight (Standard control cabinet) —15 pounds (6.8 kg)
Weight (Extended control cabinet)—26 pounds (11.8 kg)

Span—Any portion of the range from 100% to 0.1% O_2 and 0.1% to 50% excess fuel (combustibles) can be supplied when required

Note: For the zirconium oxide cell to accurately measure unburned combustibles, the sample temperature must be hotter than 1400°F so that combustibles and oxygen cannot coexist.

Accuracy—$\pm 1\%$ of net excess O_2 (O_2 remaining after combustibles are burned on hot ceramic sensor)

Repeatability—$\pm 0.2\%$ of measured value

Response—90% of full scale in less than 5 seconds.

Drift—less than 0.1% of sensor cell output per month.

Ambient temperatures—Sensor: −5° to 175°F (−20.5°C to 79°C)—to 500°F (260°C) on special order. Control Cabinet: 0°F to 120°F (−18°C to 49°C)

Sample temperature—to 1300°F (704°C) with 316 S.S. probe; to 1700°F (927°C) with Alonized 310 S.S.; to 3200°F (1760°C) with ceramic.

Sample flow rate—0.1 to 120 scfh (.047 to 56.64 liters/min.)

Sample pressure—± 2 psig (.1407 kg/cm^2)

Power Supply—115 Volts $\pm 10\%$, 50/60 Hz (220 Volts available)

Normal signal output—0 to 10 mVDC log signal, corresponding to full scale on panel meter. Optional electrically isolated, linear or log outputs available.

Aspirator air requirements—10 to 20 scfh (4.72 to 14.16 liters/min.) at 15 to 100 psi (1.05 to 7.037 kg/cm^2). Aspirator air regulator normally set to 5 psi (.35 kg/cm^2).

Calibration—with analyzed sample oxygen in nitrogen. Calibration port is provided.

OPTIONS AND ACCESSORIES

Specifications shown in this bulletin describe the basic WDG-III. Individual requirements frequently result in the selection of non-basic optional accessories. Particular application conditions sometime *mandate* non-basic sensor configurations and accessories *which are required for proper operation.*

It is important that application information such as fuels used, sample temperature and pressure, unusual corrosive conditions, safety hazards related to ambient atmosphere and possible sample composition, and exceptionally high solids loading be provided with each request for quotation. Systems design, application engineering, and startup services are available.

SENSOR UNIT

Sensor Configurations—available for high ambient temperatures to 500°F. For acid dewpoints to 700°F, a special version of the standard sensor cabinet is available.

Sensors for hazardous areas*—Division 1 (explosion-proof) and Division 2 (Z purge) enclosures can be supplied. However, in many refinery and petrochemical installations, these are not required because of the location of sensor above grade.

Sensors for hazardous samples—sensor can be fitted with flame arrestors (suited for Group B, C, D atmospheres*). This version has Factory Mutual approval.

Special Mounting Kits—for mounting sensor above and below ducts.

Ceramic Probes—for high temperature applications to 3200°F.

Probe Filters—5 micron sintered stainless steel or 20 micron ceramic. Filter threads to probe.

BLO-BAK^{TM} System—supplies reverse air flush to flow tube where sample contains excessive entrained solids. Solenoid controlled operation. Available manual, automatic/manual, and a/m with O_2 memory function (holds last O_2 reading prior to BLO-BAK cycle) for closed loop control applications. *See Bulletin A-123.*

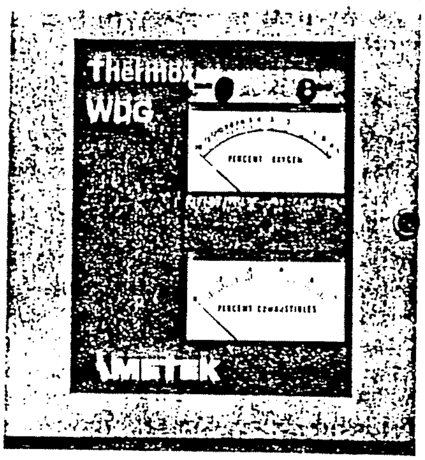


Fig. 10—WDG-IIIC oxygen and combustibles control cabinet

Combustibles Monitor—simplified system using catalytic detector to monitor unburned combustibles in flue gas containing O_2. Mounts inside sensor cabinet and operates independently of the O_2 sensor and its readout. *See Bulletin P-72.*

Sensors for higher and lower pressures—consult factory.

CONTROL CABINET

Control Cabinet configurations—in addition to standard, extended, and larger (junction box-type) wall mount styles, the control cabinet is available with explosion-proof (Div. 1, Group D*) or purge option.

Readouts—most commonly supplied scales are air to 0.5% O_2 (Scale 100) and air to 0.1% O_2 (Scale 101); operating directly on cell output (no electronic conditioning). Both are logarithmic, providing high resolution at low O_2 levels.

Additional logarithmic readouts are in "Thermox Scales" bulletin. These include 100% to 1% O_2 (Scale 103), 0.1% to 10% Excess Fuel (Scale 204), 1% to 15% Excess Fuel (Scale 202), and 5% O_2 to 5% Combustibles (Compound Scale 205).

NOTE: For unburned combustibles measurement limitations; see HOW ZIRCONIUM OXIDE CELL WORKS on page 4

Optional linear readouts available include: 0 to 5, 10, 20 and 25% oxygen. The Function Generator option linearizes compound curves resulting in linear spans; typically 2% O_2 to 2% Combustibles, 5% O_2 to 5% Combustibles, etc. (Fig. 9).

Signal Output(s)—0-10 mVDC logarithmic signal, corresponding to full scale on panel meter is standard. Optional electrically isolated, linear or log outputs available include 0-100 mV, 0-5V, 0-10V, 1-5 mA, 4-20 mA, and 10-50 mA.

Alarm Systems—Cell failure, cell temperature deviation, high combustibles, high O_2 and low O_2 alarms available.

Power Supply—220 V 50/60 Hz & 100 V 50/60 Hz inputs available.

Multisensor System—all electronics and controls mounted in one cabinet for any number of remote sensors. Signal conditioning options include averaging, auctioning, & deviation detection with analog modules or micro-computer.

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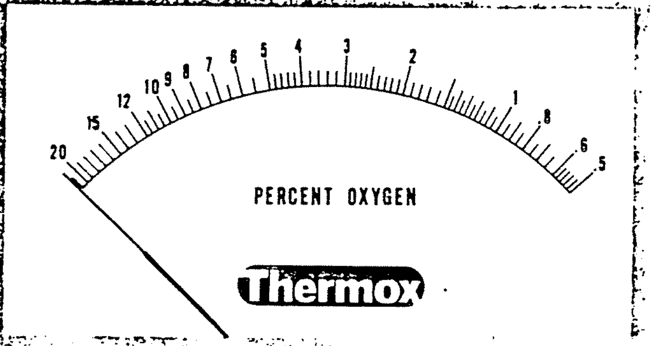
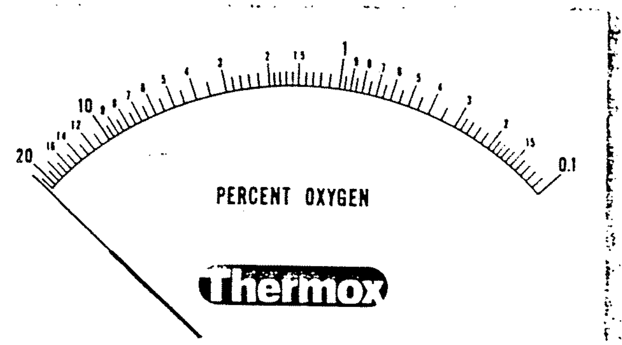
*N.E.C. Article 500

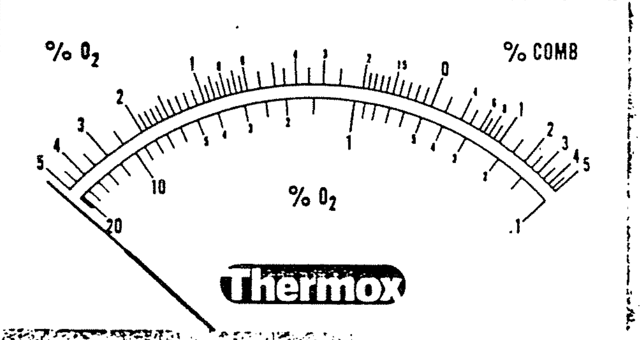
SCALES



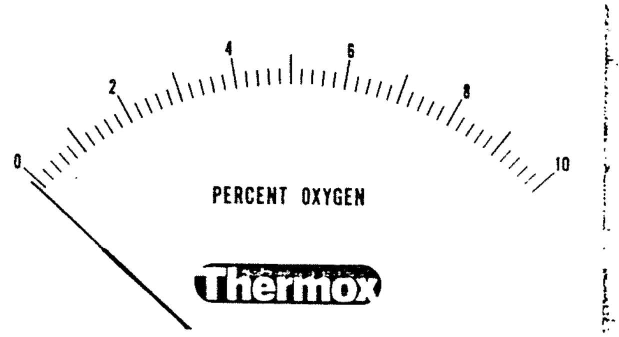
Scale 100—*Standard logarithmic scale suitable for majority of combustion applications.*



Scale 101—*Standard logarithmic scale offering better readability below 1% oxygen.*



Scale 205—*logarithmic scale supplied with optional lean—rich module (deadband card). Spans compound curve of Fig. 8. Scales switch selectable.*



Linear Scales—*linear scale (typical) that can be supplied with linearizer option.*
NOTE: Log scales may also be selected when linearized signal output is used for recording or control.

NOTE: Scales shown approximately ⅔ size.

REQUIRED INTERCONNECTING WIRING

Fig. 11 shows the interconnecting wiring diagram for a basic analyzer. Special types of wire, such as twisted pair or coaxial, are rarely required—the cell output can be handled like the signal from a thermocouple. However, 115V or 220V power for the sensor heaters should not be in the same bundle or conduit as the sensor-control cabinet interconnecting wiring. Likewise, interconnecting wiring for multisensor systems should not use common bundles or conduit routing.

MINIMUM WIRE SIZES BY TERMINAL NO.

DISTANCE (FEET)	1 & 2 (CELL)	3 & 4 (HEATER)	5, 6 & 7 (RTD)
up to 125	22	18	22
125-500	22	16	22
500-750	22	12	20
750-1000	22	12	18

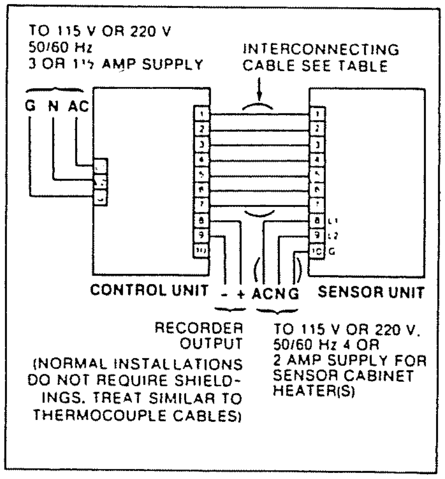
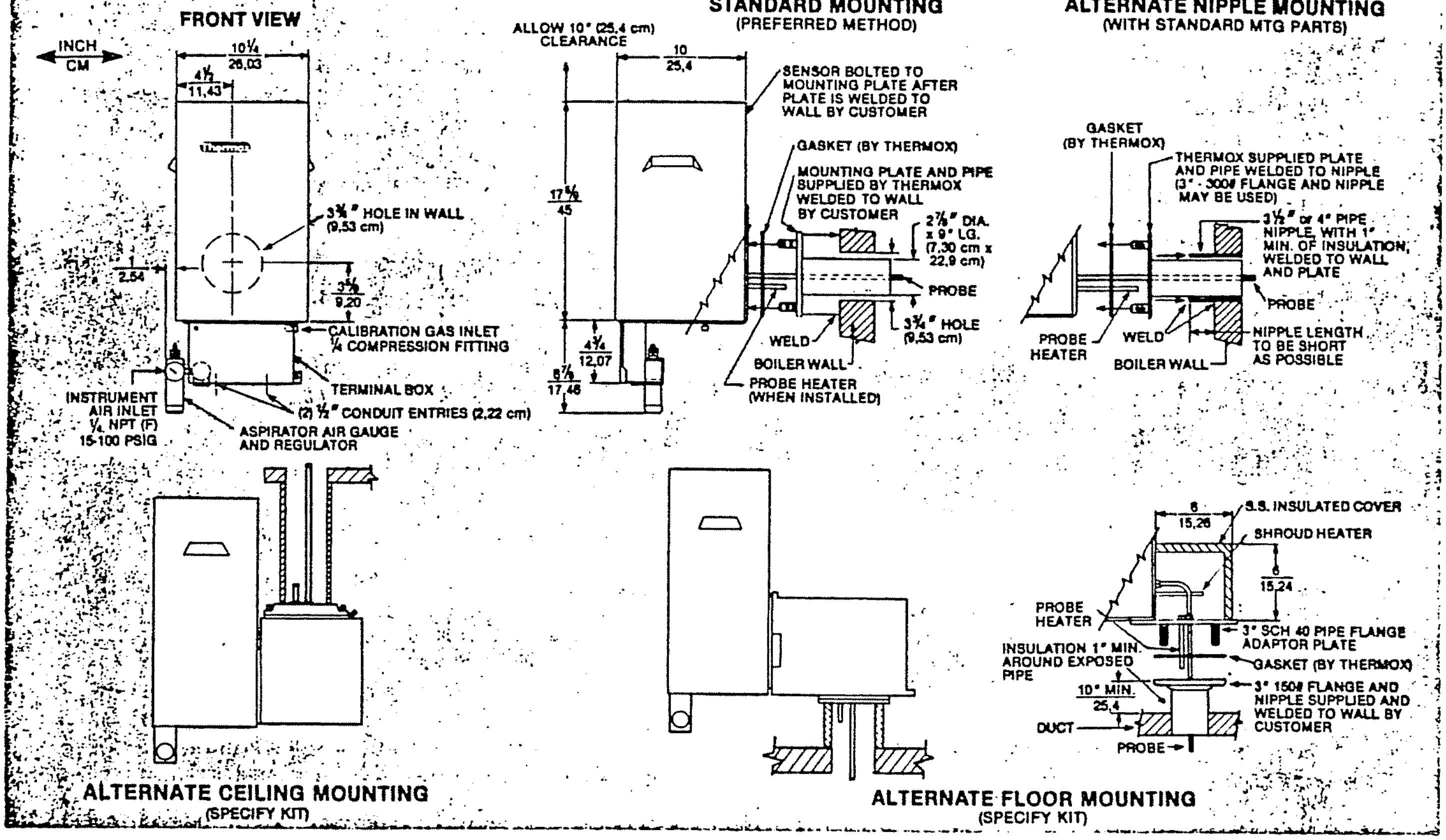
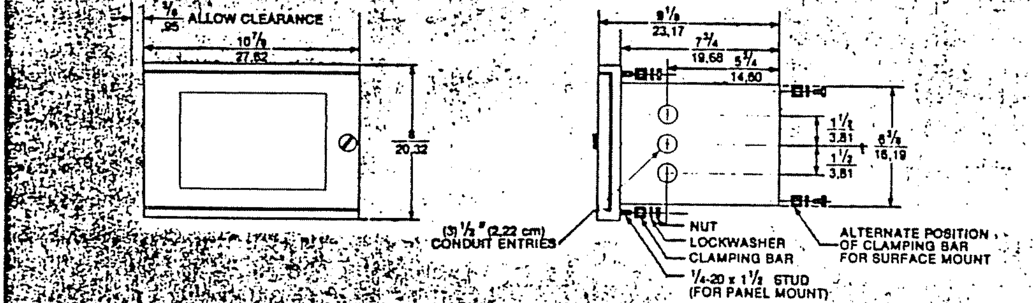


Fig. 11—Basic analyzer wiring diagram

SENSOR UNIT *Fig. 12*



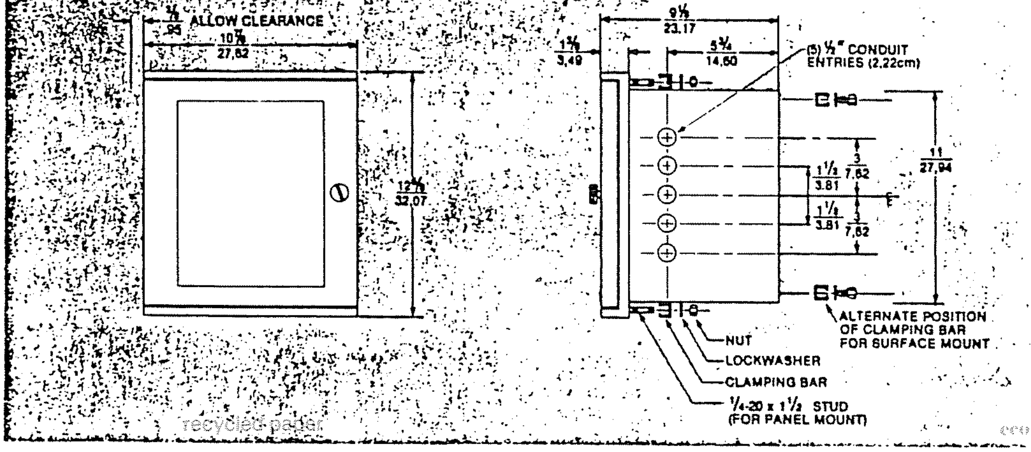
STANDARD CONTROL CABINET *Fig. 13*



NOTES:

1. HARDWARE IS PROVIDED TO PERMIT MOUNTING EITHER ON A PANEL OR ON A SURFACE.
2. PANEL CUT-OUT 7⁹⁄₁₆ x 9¹¹⁄₁₆ (19,21 cm x 24,6 cm)
3. MEETS FUNCTIONAL REQUIREMENTS OF NEMA 4 CLASSIFICATION.

EXTENDED CONTROL CABINET *Fig. 14*



This style supplied (no extra charge) when function card options exceed capacity of standard control cabinet (4 module limit), and with WDG-IIIC Combustibles Monitor. Extended cabinet holds up to 8 modules.

NOTES:

1. HARDWARE IS PROVIDED TO PERMIT MOUNTING EITHER ON A PANEL OR ON A SURFACE.
2. PANEL CUT-OUT 12³⁄₁₆ x 9¹¹⁄₁₆ (30,96 cm x 24,6 cm)
3. MEETS FUNCTIONAL REQUIREMENTS OF NEMA 4 CLASSIFICATION.

HOW TO ORDER

To insure completeness, use the following format when ordering. A WDG-III with desired options and accessories may be ordered by "line item" description or simply by checking appropriate boxes in the tables below.

Basic Model WDG-III Combustion Oxygen Analyzer

☐ 115 VAC 50/60 Hz
☐ 220 VAC 50/60 Hz

A. Number of Sensors (with common control enclosure)

1. ☐ One sensor (standard)
2. ☐ Specify no. of sensors with multisensor systems ____

B. Sensor Enclosure Cabinet Style

1. ☐ Stainless steel weather resistant (standard)
2. ☐ Z purge, Div. 2, hinged, gasketed stainless steel.
3. ☐ "Explosion-proof", Div. 1, Group D
4. ☐ "Explosion-proof", Div. 1, Groups B & C
5. ☐ High Dewpoint (400° to 700°F)

C. Sensor Cabinet Mounting

1. ☐ Wall (std.)
2. ☐ Floor
3. ☐ Ceiling
4. ☐ Special mounting

D. Sensor Accessories

0. ☐ No sensor accessories desired from this table
1. ☐ BLO-BAK (manually actuated)
2. ☐ BLO-BAK (automatic/manual)
3. ☐ BLO-BAK (automatic/manual) with O_2 Memory (sample & hold)
4. ☐ Flame arrestors (set)

E. Probes

1. ☐ 316 S.S. (to 1300°F), 3′ (standard)
2. ☐ 316 S.S. (to 1300°F), 4′
3. ☐ 316 S.S. (to 1300°F), 5′
4. ☐ 316 S.S., special lengths (specify) ________
5. ☐ 310 S.S. Alonized (to 1700°F), 3′
6. ☐ 310 S.S. Alonized (to 1700°F), 4′
7. ☐ 310 S.S. Alonized (to 1700°F), 5′
8. ☐ 310 S.S. Alonized , special lengths (specify) ______
9. ☐ Mullite ceramic (to 2600°F), 2′
10. ☐ Mullite ceramic (to 2600°F), 3½′
11. ☐ Alumina (to 3200°F), 2′
12. ☐ Alumina (to 3200°F), 3½′
13. ☐ Special Probes (specify) ________

F. Probe Accessories

0. ☐ No probe accessories desired from this table
1. ☐ Probe filter (5 micron stainless steel)
2. ☐ Ceramic filter (20 micron alumina)

G. Control Cabinet Style

1. ☐ Standard* WDG-III Cabinet
2. ☐ "Extended" WDG-IIIC Cabinet
3. ☐ Wall-mtd. (general purpose type, NEMA 4) multi-sensor cabinet
4. ☐ "Explosion-proof", Div. 1, Group D

*Supplied with WDG-III unless options dictate additional capacity required.

H. Type of Oxygen Cell Output

1. ☐ Logarithmic (standard) (0-10 mVDC corresponding to log meter span), not isolated
2. ☐ Amplified voltage and current output (using MV/I module), isolated
3. ☐ Linearizer module, voltage and current output, isolated
4. ☐ Compound Scale 205, log voltage output (5V max.), not isolated
5. ☐ Function Generator, linear voltage output, not isolated

I. Oxygen Output Signal (DC)

1. ☐ 0-10mV (std.)
2. ☐ 0-100mV
3. ☐ 0-5V
4. ☐ 0-10V
5. ☐ 1-5mA
6. ☐ 4-20mA
7. ☐ 10-50mA

J. Oxygen System Alarms

0. ☐ No alarm accessories desired from this table
1. ☐ Single O_2 alarm (sealed 4PDT, 3A @ 120VAC)
2. ☐ Dual O_2 alarm (2 ea., sealed 4PDT, 3A @ 120VAC)
3. ☐ Cell failure alarm
4. ☐ Cell temperature (over/under) alarm
5. ☐ Special alarms; consult factory

K. Oxygen Meter Scales (Specify Scale* No.)

1. ☐ Single log scale (std.), specify Scale 100 or 101 ______
2. ☐ Dual log scale and/or suppressed zero (electrical zero does not correspond to air) scale, specify Scale 100A, 101A, 103, 108, 150, 201, 202, 204, etc. ________
3. ☐ Scale 205
4. ☐ Single linear scale, specify 0-5, 10, 20 or 25% O_2 ____
5. ☐ Additional linear range(s), specify ________
6. ☐ Special hand-drawn scale, describe ________
7. ☐ Scales not covered above; consult factory

*For expanded list of log scales; see "Thermox Scales" bulletin.

L. Control Cabinet Accessories

0. ☐ No accessories desired from this table
1. ☐ Purge fitting
2. ☐ Remote meter (GP enclosure)
3. ☐ 60W heater & thermostat

M. Interconnecting Wire

0. ☐ Nothing required from this table
1. ☐ Type VNTC, 16AWG/7 conductor cable (194°F max. temp.)—standard cable for basic WDG-III (see min. wire size table)
2. ☐ Type VNTC, 16 AWG/12 as above—for WDG-III (with optional BLO-BAK plus O_2 Memory) or WDG-IIIC

Other Options/Accessories

Combustibles Monitor (refer to Bulletin P-72)
Recorders; consult factory

Specifications contained herein are subject to change without notice. Since it is impossible to anticipate or control the many different conditions under which this in ation and our products may be used, AMETEK cannot, without complete and accurate information supplied by you about your actual working conditions, gu tee the applicability and accuracy of the information, or the suitability of our products in any given situatio

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20M1280S

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CO, CO$_2$ ANALYZERS

2. SPECIFICATIONS AND CONSTITUTIONS

(The following indicates the standard specifications.)

2-1 Specifications for the Analyzers:

Models	Parameters	Methods	Range
ENOA-812	NOx	NDIR (Non-dispersive Infrared Absorptiometry)	0 ~ 200/500 ppm
ESDA-813	SO$_2$	NDIR	0 ~ 200/500 ppm
ECDA-814	CO$_2$	NDIR	0 ~ 20/40%
ECMA-815	CO	NDIR	0 ~ 200/500 ppm
EOXA-816	O$_2$	MG (Magnetic Dumb-bell Method)	0 ~ 10/25%
ENDA-822	NOx	NDIR	0 ~ 200/500 ppm
	O$_2$	MG	0 ~ 10/25%
ENDA-823	SO$_2$	NDIR	0 ~ 200/500 ppm
	O$_2$	MG	0 ~ 10/25%
ENDA-824	CO$_2$	NDIR	0 ~ 20/40%
	O$_2$	MG	0 ~ 10/25%
ENDA-825	CO	NDIR	0 ~ 200/500 ppm
	O$_2$	MG	0 ~ 10/25%
ENDA-827	NOx	NDIR	0 ~ 200/500 ppm
	SO$_2$	NDIR	0 ~ 200/500 ppm
ENDA-837	NOx	NDIR	0 ~ 200/500 ppm
	SO$_2$	NDIR	0 ~ 200/500 ppm
	O$_2$	MG	0 ~ 10/25%

- Reproducibility : Within ±1% of full scale (with zero and span gases).
- Zero Drift : ±2% of full scale per week (with automatic calibrator).
- Span Drift : ±2% of full scale per week (with automatic calibrator).
- Indications : Indicator (Class 1.5)
  NDIR; 50 equally divided scale.
  O_2 ; 100 equally divided scale.
  (Each indicator is built in the analyzer.)
- Outputs : DC 4 ~ 20 mA and DC 0 ~ 1 V (simultaneously output)
  DC 0 ~ 16 mA and DC 0.2 ~ 1 V (simultaneously output)
  Isolated load resistance;
  Less than 750 Ω (current output)
- Power : AC 100 V ±10 V 50 Hz/60Hz

Note:
1. Two parameters are to be specified for ENDA-828 from NOx, SO_2, CO_2 and CO.
2. ENDA-838 measures 3 parameters consisting of 2 parameters specified for ENDA-828 (parameters measured by means of NDIR) + O_2.
3. The specifications for ENDA-828 and ENDA-838 correspond with those of other modles.
4. NDIR; VIA-300 (without automatic calibrator or VIA-500F (with automatic calibrator)
5. O_2; PMA-200 (without automatic calibrator) or PMA-200F (with automatic calibrator)

2-2 Specifications for the Sampling System:

Sampling Method : 2.5°C Dry Sampling
Sampling Flow Rate : 3 ∿ 4 ℓ/min
Sampling Tube : Teflon Tube (φ8/φ6)
Materials Exposed to Gas : SUS-304, Teflon, Fluoric Rubber, Vinyl Choloride, Polyropyrene, etc.
Calibration : Manual or automatic (once a day by a builtin timer).
Speed of response : 90% response from sample inlet; Within 1 min (within 4 min with SO_2 analyzer only).

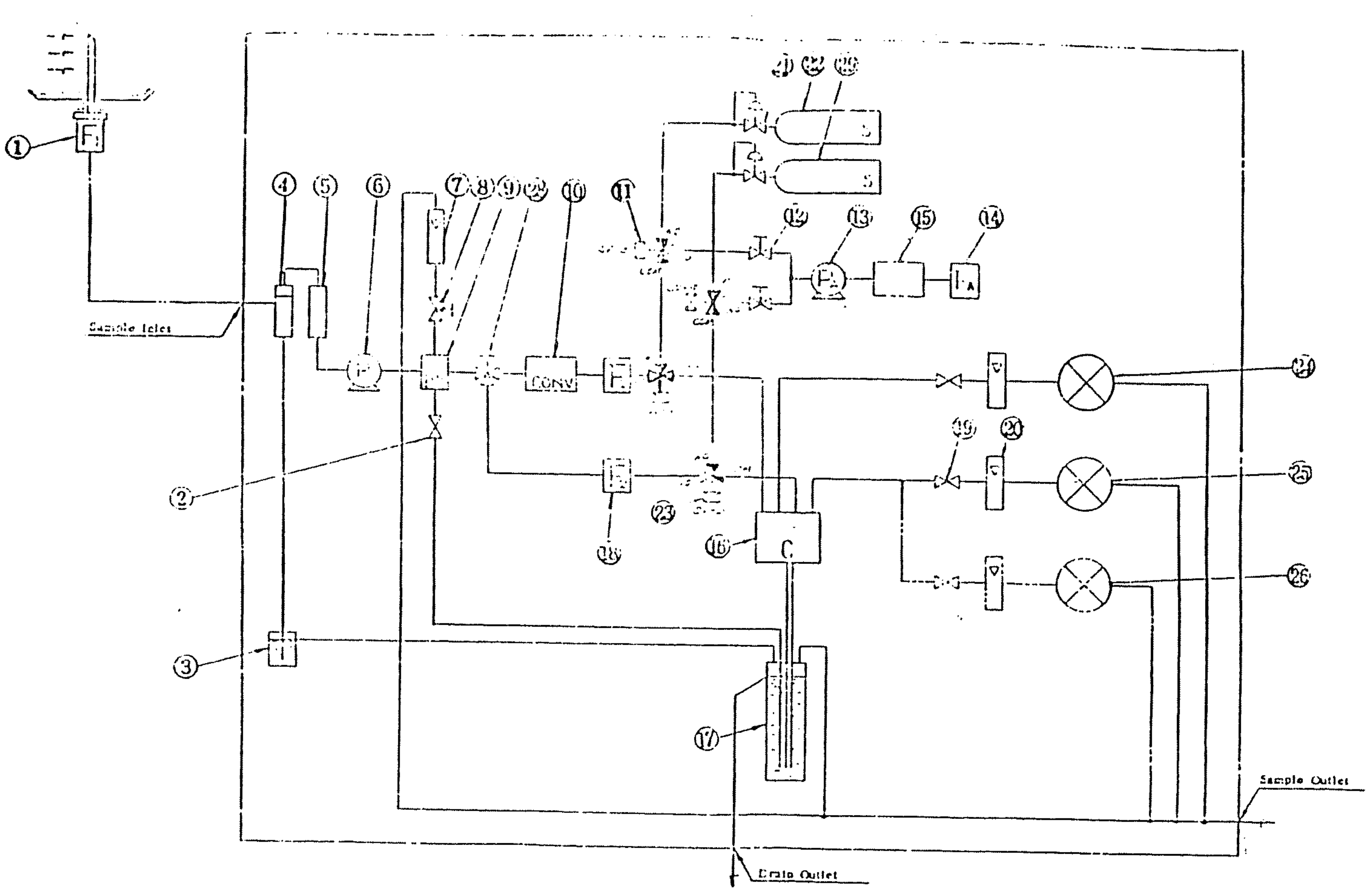
2-3 Specifications for the System:

		1-parameter Analyzer (NDIR)	2-parameter Analyzer (NDIR + O_2)	2-parameter Analyzer (NDIR)	3-parameter Analyzer (NDIR + O_2)
External Dimensions		600(W) × 800(D) × 1800(H)		800(W) × 800(D) × 1800(H)	
Weight		240 kg	260 kg	300 kg	320 kg
Power Consumption	Without Automatic Calibrator	800 VA	900 VA	1.1 kVA	1.2 kVA
	With Automatic Calibrator	900 VA	1 kVA	1.2 kVA	1.4 kVA
Finish		Munsell 7.5 BG 7/1.5 Half-polished (both external and internal surfaces).			
External Input Contacts		CAL. START (only for versions equipped with an automatic calibrator).			
External Output Contacts	Without Automatic Calibrator	Power Disconnected, Maintenance-in-Progress, Calibration-in-Progress, Range Identification			
	With Automatic Calibrator	Power Disconnected, Maintenance-in-Progress, Calibration-in-Progress, Calibration Fault, Range Identification.			
Ambient Temperature		-5 ∿ 40°C (versions for cold climate : -15 ∿ 40°C)			

Note: The power consumption shall be greater with the cold climate versions.

2-4 Constitution:

Outdoor Type Cubicle Rack .... 1 ea.
Analyzer .... 1 ∿ 3 ea.
AIC-302 Automatic Calibrator (for the versions with automatic calibrator only) .... 1 ea.
Sampling Unit .... 1 ea.
Accessories and Supplies .... 1 set



4	Wet Filter	PVC
5	Mist Catcher	Polyethylene
6	Sampling Pump	AP-055
7	By-Pass Flow Meter	
8	Needle Valve	PVC
9	Drain Separator	PVC
10	Converter	CON-11A
11	3-WAY SOLENOID VALVE	SUS 304
12	Needle Valve	PVC
13	Air Pump	HP55
14	Air Filter	
15	Purifier	
16	Electric Cooler	CCU
17	Constant Pressure Trap	PVC
18	Secondary Filter	Polypropylene
19	Needle Valve	PVC
20	Sample Flow Meter	
21	Pressure Regulator	
22	Span Gas Cylinder	10
23	3-WAY SOLENOID VALVE	PVC
24	Analyzer Unit	VIA-500F
25	Analyzer Unit	VIA-500F
26	Analyzer Unit	PHA-200-
27		
1	Balance Valve	PVC
22	Span Gas Cylinder	10 ℓ

Specified	Model No	Measuring object			Note
		(24)	(25)	(26)	
	ENDA-627	NOx	SO2	/	(10) With Converter (15) Without Purifier
	ENDA-628	CO2	CO	/	(10) Without (15) With
	ENDA-626	[illegible]	[illegible]		(10) [illegible] (15) Without
	ENDA-637	NOx	SO2	O2	(10) With (15) Without
	ENDA-638	CO2	CO	O2	(10) Without (15) With
	[illegible]	[illegible]	[illegible]		(10) Without [illegible]

Notes: 1. Measured sample gas should be exhausted to a safety place where back pressure is little.

2. Materials of interior pipings shall be teflon and soft vinyl chloride.

3. [illegible] ⑳ shall be [illegible] [illegible] shall be supplied when requested

01			
No.	Spec	Parts No	Notes
Customer		Name FLOW SCHEMATIC DIAGRAM OF STACK GAS ANALYZER SYSTEM	
Scale	/	Drawing No. V218639	

A			
Revised			
Drawn	Checked	Approved	

2. SPECIFICATIONS

1) Model : HORIBA Model VIA-500F General Purpose Infrared Gas Analyzer

2) Principle : Non-dispersive Infrared Ray Absorptiometry (NDIR)

3) Gas Measured : Stack gas and various other sample gases.

4) Components Measured : CO, CO_2, NO, SO_2, n-C_6H_{14}, C_3H_8, CH_4 etc.

5) Measuring Ranges : Two ranges of either ×2 or ×2.5 (standard)

6) Repeatability : Within ±1.0 % of full scale.

7) Speed of Response : 0.5 ~ 16.0 sec. (electronic system), variable by ADD-3.

8) Calibration : With a builtin zero and span automatic calibrator (calibration is controlled by an external contact signal).

9) Outputs : 0 - 100 mV
(non-held, non-isolated)
0 - 1 V
(held and non-isolated)
0 - 1 V, 0 - 16 mA or 4 - 20 mA
(held and isolated)

10) Indicator : A scale with 50 equal divisions (Class 1.5) (standard)

11) Ambient Temperature : 0 - 40°C

12) Power : AC 100 V ± 10 V
(50 Hz or 60 Hz)

13) Power Consumption : Less than approx. 180 VA

14) External Dimensions : Refer to Drawing V316672

15) Weight : With 300 or 500 mm cells;
Approx. 20 kg.
With cells shorter than
200 mm; Approx. 15 kg.

4. OPERATING PROCEDURE AND CAUTION

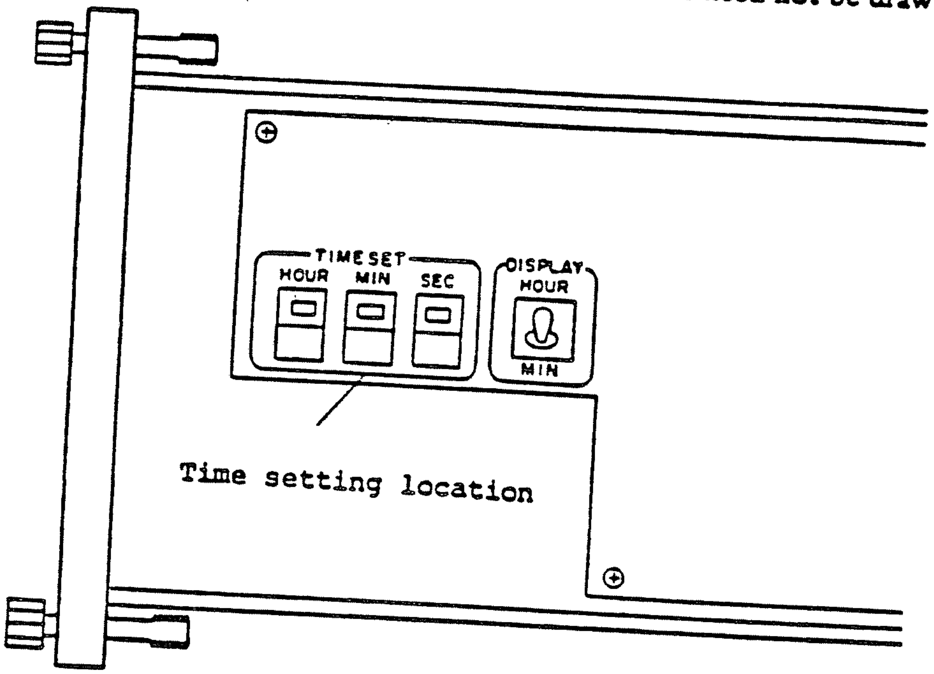
4-1 Caution before Introducing Power:

1) Confirm power specification.
2) Confirm that all connectors are properly connected.
3) Check fuse capacity.

4-2 Introduction of Power and Settings:

1) Set power switch at "ON" position and confirm that the clock indicates.
2) How to set time with the clock:

① Loosen top and bottom screws securing AIC-302 and pull out AIC-302. The time setting section is close to the front so that the chasis need not be drawn out too far.



② HOUR-MIN switch in the DISPLAY section is for selecting hour or minute to be displayed on the panel. The switches in the TIME SET section are for setting the time; the HOUR switch is for adjusting the hour, the MIN switch is for adjusting the minute and the SEC switch is for adjusting the second.

③ Set HOUR-MIN switch at HOUR position and press HOUR manual switch to confirm that the indication on the display advances from 0 to 23. The indication of the second continues to advance while this switch is kept pressed.

④ Next, set HOUR-MIN selection switch to MIN position and press contact switch MIN to confirm that the indication advances from 00 to 59. Depending on the manufacturer of the digital clock, the indication can go beyond 59 only at the initial stage. A prescribed indication will be resumed once the indication returns to 00. Like contact switch HOUR , the contact switch MIN also advances the indication of minute continuously when it is kept as being pressed.

⑤ Digital display for seconds is not indicated, however, if the limit switch of SEC is depressed, both seconds and minutes are reset to 00. In this case, if the digits for minute are 30 or more, the hour is advanced and if the digits are less than 30, the hour is not advanced.

This completes the time setting of the builtin clock. After completing the adjustment, operate the HOUR-MIN switch to confirm that the hour and the minute are correctly adjusted.

3) The analyzer comes to a state of measurement when CENTER-LOCAL selection switch is set at LOCAL position and calibration gas selection switch at MEAS position. Although the signal output from the instrument is "calibration-in-progress" when CENTER-LOCAL switch is switched from CENTER position to LOCAL position, the state of measurement will be reached in about one minute.

4) The instrument will be in a state of "calibration-in-progress" when the calibration gas selection switch is set at positions other than MEAS . If this switch is returned to MEAS position once the instrument is brought into the state of "calibration-in-progress", the state of calibration is maintained for about one minute before reaching the state of measurement.

The states described in 3) and 4) are for the following purposes:

During the calibration, the output of the analyzer is held at the last indication prior to the calibration. The states of 3) and 4) are for the prevention of cancelling this stored memory when the calibration gas selection switch momentarily contacts MEAS position during the manual calibration operation.

5) Take the following steps when manually calibrating the analyzer:

① Set CENTER-LOCAL switch at LOCAL position.

② Set calibration gas selection switch at ZERO GAS position and confirm that the indication on the analyzer indicator stabilizes near zero.
(If the instrument is equipped with an O_2 analyzer, the indication on the O_2 analyzer indicator stabilizes at near the span value.)

③ Next, set the calibration gas selection switch at ZERO CAL position and confirm that the indication on the analyzer indicator indicates near zero.

(If the instrument is equipped with an O_2 analyzer, the indication on the O_2 analyzer indicator stabilizes at near the span value.)

④ Set calibration gas selection switch at $\boxed{\text{SPAN GAS}}$ position and check that the indication on the analyzer indicator stabilizes at near the span value.

(If the instrument is equipped with an O_2 analyzer, the indication on the O_2 analyzer indicator stabilizes at near the span value.)

⑤ Next, switch to $\boxed{\text{SPAN CAL}}$ position and confirm that the analyzer indicator indicates the span value.

(If the instrument is equipped with an O_2 analyzer, the O_2 analyzer indicator indicates zero.)

⑥ If the instrument is equipped with an O_2 analyzer, repeat operations with the calibration gas selection switch at $\boxed{\text{ZERO GAS}}$ and $\boxed{\text{ZERO CAL}}$ positions (to O_2 analyzer, these operations mean the span calibration).

⑦ Although lamp "CAL" (calibration-in-progress) on the panel does not light when the calibration is manually done, a contact signal indicating that the analyzer is being calibrated is output.

6) By flipping CALIBRATION START/RESET switch on the panel toward $\boxed{\text{START}}$ position while setting CENTER-LOCAL switch at $\boxed{\text{LOCAL}}$ position and calibration gas selection switch at $\boxed{\text{MEAS}}$ position, the lamp "CAL" on the panel indicating that the calibration is in progress lights up and the analyzer is calibrated following the sequence programmed in the internal circuit.

When the calibration action is required to be cancelled during the calibration, AIC START/RESET switch on the panel should be flipped toward $\boxed{\text{RESET}}$ direction.

7) When the automatic calibration is required to be done once a day, set CENTER-LOCAL switch at $\boxed{\text{LOCAL}}$ position. The analyzer will be automatically calibrated at every 0 hour 00 minute.

8) When a very long interval or a very short interval is desired between the automatic calibrations, set CENTER-LOCAL switch at $\boxed{\text{CENTER}}$. In such a case, the automatic calibration can be started at any time desired by externally inputting automatic calibration start signal.

9) If a timer circuit is provided in AIC-302 for backing up the automatic calibration at power failure, the automatic calibration is carried out 2 or 3 hours after the restoration of power if the powr supplied into AIC-302 is discontinued for more than 1 minute (the power into the analyzer is also presumed as being discontinued).

AUTOMATIC CALIBRATION TIMER

2. SPECIFICATIONS

Type : AIC-302

Calibrating Cycle : Once every 24 hours (when set at LOCAL)

Calibration Gas Time : 3 min, 9 min or 15 min (to be selected by a jumper).

Sample Displacement Time : 4 min

Input Signal:

Automatic Calibration Start (effective when set at CENTER) : Non-voltage "a" contact pulse signal (50 ~ 1000 m. see)

Applied voltage : DC 24 V

Outflow current : Approx. DC 20 mA

Output Signals:

"Calibration-in-progress" Contact : Non-voltage "a" contact : Approx. 7.5 VA

Maximum Applied Voltage : DC · AC 50 V

Maximum Permissible current : CD · AC 150 mA

Calibration Command (using NPN transistor open collector) : Maximum Applied Voltage : DC +30 V

Maximum Load Current : DC 200 mA

Saturated Voltage : Approx. 1 V

Solenoid Valve Drive Signal : DC 24 V, less than approx. 200 mA (Current required for all solenoid valves is approx. 1 A.)

Air Pump Drive Signal : Load: AC 100 V, 0.1 ~ 1 A

(Optional Features)

With an Integrator Control Circuit:

Integration Time Setting : Selectable for 10 min, 30 min or 60 min.

Integrator Reset Signal Input (effective when set at CENTER) : Non-voltage "a" contact pulse signal (50 ~ 1000 m. sec)

Applied Voltage : DC 24 V

Outflow Current : Approx. DC 20 mA

Integrator Reset Signal Output : Non-voltage "a" contact : Approx. 7.5 VA
Maximum Applied Voltage : DC · AC 50 V
Maximum Permissible Current : DC · AC 150 mA
Power : AC 100 V ± 10V, 50/60 Hz.
Power Consumption : Approx. 50 VA

BECKMAN 960B pH MONITOR

GENERAL SPECIFICATIONS

These specifications apply to electronics apply.

	pH MEASUREMENT	ORP MEASUREMENT
Operating Ranges	Span: 14 pH units. Meter: 0 to 14 pH, with auxiliary 0 to 100% scale.	Span: 1000 mV. Zero mV input set at center scale gives ±50 capability.
Ambient Temperature Coefficient	±0.002 pH per degree Celsius.	±100 V per degree Celsius.
Stability	±0.02 pH units.	±2 mV.
Sample Temperature Compensation	Automatic, 0 °C to 100 °C (RTD).	Not applicable.
Output	Potentiometric Output: 0 to 5 volts d.c.; minimum load impedance, 2000 ohms. Non-Isolated Current Output: 0 to 20 milliamperes, or 4 to 20 milliamperes d.c., maximum load 600 ohms. Isolated Current Output: 0 to 20 milliamperes, or 4 to 20 milliamperes d.c., maximum load 600 ohms.	*Selectable Accessory When Ordered*
Electrical Power Requirements	107 to 127 volts a.c., 50/60 Hz, 0.2 ampere 214 to 254 volts a.c., 50/60 Hz, 0.1 ampere	*Switch Selectable*
Ambient Temperature	−20 °F to 135 °F (−29 °C to 57 °C).	
Ambient Relative Humidity	Up to 99%.	
Alarm Relay	Two independently adjustable relay contact closures, SPST (Form A).	
Output Contact Rating	960BI, 960BN d.c. 10 watts maximum resistive load. 200V max at .05A, 20V at .5A max. 960BI-C2, 960BN-C2 240V AC/28VDC, at 5 Amps maximum, resistive load. 960BI-C2A, 960BN-C2A 80-240VAC only at 3 Amps maximum, resistive load.	
Deadband	Adjustable from less than 1% to 20% of fullscale at any setpoint.	

ELECTRICAL CLASSIFICATION

	MODULE	ELECTRICAL CLASSIFICATION (See Compliances Note Below)	ACTUAL WEIGHT	MOUNTING
Model 960B pH Monitor	Monitor	General Purpose: Accessory Air Purge Kit, Type Z.*	5 lbs (2.3 kg)	Standard panel or optional surfac (pipe stanchion accessory) enclos NEMA-4.
	Remote Preamplifier Electrode Station	Class I, Groups A, B, C, and D. Division 2 (Certification pending).	1.5 lbs (0.7 kg)	Preamplifier located in NEMA-4 case or in pipe.

MAXIMUM SEPARATION OF MODULES

PREAMPLIFIER TYPE	MAXIMUM SEPARATION OF MODULES	
Preamplifier in Separate NEMA-4 Enclosure	Electrodes to Preamplifier:	500 feet (152 m).
	Preamplifier to Monitor:	Pt. No. 837945 Cable has been tested to 1000 feet (305 m). For greater length, consult factory.
Preamplifier in Pipe	Preamplifier to Monitor:	Pt. No. 837945 Cable has been tested to 1000 feet (305 m). For greater length, consult factory.
Integral Preamplifier in Monitor Enclosure	Electrodes to Monitor:	500 feet (152 m).

*The air purge option, when installed along with a user-supplied purge supply pressure or flow indicator, is designed to equip the Model 960 Monitor with a Type Z Air Purge per Instrument Society of America (I.S.A.) Standard S12.4 (1970) and National Fire Protection Assoc Standard NFPA 496-1982, to reduce the classification within an enclosure from Division 2, normally non-hazardous, to non-hazardous. principle is recognized in the National Electrical Code (NEC) of the United States, Chapter 5, Article 500, Section 500-1.

COMPLIANCES

The Model 960B pH Monitor is manufactured to meet the applicable requirements of the United States Occupational Safety Health Act of 1970 (OSHA), if installed in accordance with the requirements of the National Electrical Code (NEC) of United States in non-hazardous locations and operated and maintained in the recommended manner.

The *Remote Preamplifier* and *Electrodes* are constructed to comply with applicable requirements in North Americ non-incendive for installation in Class I Groups A, B, C, and D, Division 2 hazardous locations. Certifications by indepen agencies are pending.

SECTION THREE STARTUP, STANDARDIZATION, OPERATION, AND SHUTDOWN OF pH SYSTEM

NOTE

This section is applicable only to pH systems. For ORP systems, refer to Section Four.

3.1 ALARM SETPOINT ADJUSTMENT FOR pH MONITORING

Before commencing calibration procedure for the alarm setpoints, check TP3 for +2.5 V ±1%, obtainable via ALARM CALIB Reference Voltage Adjustment R15, Figure 2-9, A.

Set DEADBAND Adjustments R19 (HIGH) and R20 (LOW) fully counterclockwise (normal factory setting) to set deadband at the minimum. Both potentiometers must *remain* at this setting throughout calibration of the alarm setpoint adjustments.

Alarm setpoint adjustment is accomplished with HIGH SET PT Adjustment R16 and LOW SET PT Adjustment R18. Factory settings are: LOW, 6 pH (approximately 43% of fullscale); HIGH, 9 pH (approximately 64% of fullscale). If readjustment is desired, proceed as follows:

The 0 to 100 scale on each setpoint potentiometer corresponds to 0 to 14 pH on the upper scale of the front-panel meter and 0% to 100% on the lower scale.

EXAMPLE: Desired LOW Alarm is 5.5 pH.
R18 setting is 5.5/14 X 100 ≅ 39%
Desired HIGH Alarm is 9.5 pH.
R16 setting is 9.5/14 X 100 ≅ 68%

After initial calibration of the setpoint adjustments, the desired deadband may be selected via the appropriate DEADBAND potentiometer; R19 for HIGH Alarm and R20 for LOW Alarm.

The 0 to 100 scale on each DEADBAND potentiometer corresponds to 1% to 20% of fullscale on the front-panel meter.

EXAMPLE: Deadband setting of 50 is equivalent to 10% of meter fullscale (approximately 1.4 pH units). Typically, in on-off control of pH, a deadband setting of 5 (equivalent to 2% of meter fullscale) is sufficent. Deadband should be adjusted only as required to avoid "chatter" of the reagent-addition solenoid valve.

3.2 STANDARDIZATION OF pH SYSTEM

An electrode system is standardized by exposing the electrodes to a U.S. National Bureau of Standards traceable buffer or series of buffers. A normal procedure is to remove the electrodes from the process stream, clean them, bring to temperature equilibrium, expose to buffer(s), etc. During this routine, buffers may become contaminated, resulting in appreciable errors. The recommended practice is to clean the electrodes, then rinse thoroughly with demineralized water followed by rinsing in a small amount of buffer, which is then discarded. The final step before the bias adjustment should be exposure of the electrodes to fresh buffer just taken from the container. Buffers are available both as premixed liquids and as powders to be mixed with distilled water. Refer to Figure 3-1.

A. BUFFER SOLUTIONS

pH (25 °C)	Volume	Part No.
4.01	One Pint (473 mL)	905-003506
7.00	One Pint (473 mL)	905-003501
	One Pint (473 mL) of Concencentrated Solution to be Diluted with Distilled Water. Make 25 Pints (11.8 Liters)	905-003581
10.00	One Pint (473 mL)	905-003505

B. POWDERED BUFFERS TO BE MIXED WITH DISTILLED WATER

pH (25 °C)	Number of Tubes Each Tube Makes One Pint (473 mL)	Part No.
4.01	12 Tubes	905-003005
6.86	12 Tubes	905-003006
7.00	12 Tubes	905-003007
7.413	12 Tubes	905-003008
9.18	12 Tubes	905-003009
12.45	12 Tubes	905-003010
Assorted (Two tubes of each above-listed pH value)	12 Tubes	905-003011

Figure 3-1. Standard pH Buffers

3.2.1 INITIAL STANDARDIZATION AND SETTING OF ELECTRODE SPAN

Newly installed electrodes may show a slight drift initially as the glass surface becomes hydrated. If installed in a process, the electrodes should be removed, cleaned (per Paragraph 5.2), and thoroughly rinsed. In situations where the process stream is hot, the rinsing operation can be used to bring the electrodes into temperature equilibrium.

Procedure

1. For the initial standardization choose two buffers that bracket the pH extremes expected in the process. For example, if the process is expected to vary from pH 5 to pH 9, use buffers of pH 4 and pH 10.
2. Rinse the electrodes with deionized water, followed by a small amount of the *low-pH* buffer, then discard this buffer.
3. Immerse the electrodes in a beaker of fresh *low-pH* buffer. Measure temperature of buffer with a thermometer. From label on buffer container, determine the pH of the buffer at its present temperature. Interpolate as necessary.
4. When meter has stabilized, adjust STD (Standardize) Control R3 so meter or recorder indicates the pH of the buffer at the particular temperature.
5. Rinse the electrodes with deionized water followed by a small amount of the *high-pH* buffer, then discard this buffer.
6. Immerse the electrodes in a beaker of fresh *high-pH* buffer. Measure temperature of buffer with a thermometer. From label on buffer container, determine the pH of the high-pH buffer at its present temperature. Interpolate as necessary.
7. When meter reading stabilizes, adjust Electrode Span Compensation Control R23 to correct for *one-half* the error between the indicated pH and the actual pH of the high-pH buffer. Then adjust STD (Standardize) Control R3 to correct for the remaining half.

EXAMPLE:
High-pH Buffer: 10.00 pH

Upon stabilization, meter indicates pH 9.8. Operator first adjusts Electrode Span Compensation Control for reading of 9.9 pH, and then adjusts STD Control R3 for reading of 10.00 pH.

(Electrode Span Compensation Control R23, Figure 2-9, A, permits accurate monitoring of pH even if the potential change per pH unit is less than the theoretical value of 59.14 mV.)

8. Check the standardization by repeating Steps 2 and 3. If meter indication for the low-pH buffer is correct, standardization is complete; proceed to Step 9.

   If meter reading is incorrect, repeat Steps 4 through 8. If correct reading is *unobtainable*, refer to Troubleshooting, Paragraph 5.1.
9. Place electrode assembly in process stream. The monitor is now ready for routine operation.

3.2.2 SUBSEQUENT STANDARDIZATIONS

After the initial standardization it is not necessary to repeat the entire procedure, with adjustment of Electrode Span Compensation Control R23, during every standardization. Instead, calibration can be checked in either of two ways:

1. *Direct* standardization against a standard buffer solution of accurately known pH, as described in Paragraph 3.2.3.
2. *Indirect* standardization, using a grab sample and an auxiliary laboratory-type pH meter, as described in Paragraph 3.2.4.

3.2.3 DIRECT STANDARDIZATION AGAINST A pH BUFFER SOLUTION

1. Remove electrodes from process and clean them. Rinse with copious amounts of distilled or demineralized water.
2. Choose a buffer with a pH close to that of the process stream.
3. Rinse the electrodes with a small amount of buffer—discard this buffer.
4. Immerse the electrodes in a beaker of the buffer.
5. Measure temperature of buffer with a thermometer. From label on buffer container, determine the pH of the buffer at its present temperature.
6. When meter reading is stable, adjust STD (Standardize) Control R3 so reading is equal to the pH of the buffer at the particular temperature.
7. Restore electrode system to process stream.

3.2.4 INDIRECT STANDARDIZATION, USING GRAB SAMPLE AND AUXILIARY pH METER

Indirect standardization by means of an auxiliary laboratory-type or portable pH meter is used principally in systems where interruption of the process flow is undesirable. Note that this standardization method is *not recommended* in applications where the pH of the grab sample may change appreciably within a comparatively short time interval, because of such effects as temperature change, ongoing chemical reaction, or contamination with atmospheric carbon dioxide. Proceed as follows:

1. Standardize *auxiliary pH meter* with appropriate buffer, as explained in the instruction manual provided with the pH meter. For best accuracy, use a buffer with pH as close as possible to that of the process stream.
2. Draw off a sample of the process stream from a sample point near the electrode station. Simultaneously, note reading on Model 960B. Now proceed *immediately* to Step 3, to minimize the pH change that might be introduced by a change in temperature of the acquired sample.
3. Measure pH of the sample with the *auxiliary pH meter.*

NOTE

Temperature compensation control of auxiliary pH meter must be set to temperature of sample.

4. Determine the required readout correction for the Model 960B by means of the following equation:

Correction = reading obtained in Step 3 –
reading obtained in Step 2

5. Add the correction computed in Step 4 to the *present* pH of the process stream. Adjust STD (Standardize) Control R3 on Model 960B to obtain this reading.

EXAMPLE:

At time of sampling, a Model 960B pH Monitor indicated 4.3 pH. Auxiliary pH meter indicated 4.4 pH for this sample.

Correction = 4.4 – 4.3 = +0.1 pH

Immediately before standardization adjustment, the Model 960B indicates 4.1 pH. *Present* pH of the process stream is 4.1 + 0.1 = 4.2 pH. STD (Standardize) Control R3 of Model 960B is adjusted to obtain this reading.

3.2.5 RECOMMENDED FREQUENCY FOR pH STANDARDIZATION

Initially, check standardization at least two or three times a week, more frequently if the process stream is hot or contains caustic or other chemicals that might coat, etch, or abrade the electrodes. If after several weeks of operation, little or no restandardization has been required, calibration frequency may be reduced as experience dictates, consistent with the accuracy requirements of the particular application.

3.3 SHUTDOWN OF pH SYSTEM

To shut down the system, turn off sample flow to the electrode flow chamber or submersion assembly by appropriate sequential operation of the valves in the sample-handling system. During process shutdown, electrodes must be kept wet by immersion in water, KCl electrolyte, or aqueous process liquid. Prolonged dryout may cause drift in readout when electrodes are again wetted.

SECTION FOUR STARTUP, STANDARDIZATION, OPERATION, AND SHUTDOWN OF ORP SYSTEM

NOTE

This section is applicable only to ORP systems. For pH systems, refer to Section Three.

4.1 SELECTING APPROPRIATE MILLIVOLT RANGE

When used for monitoring oxidation-reduction potential (ORP), the Model 960B operates over a *user-selected* millivolt range appropriate to the particular application. Thus the ORP application differs from pH monitoring, where the Model 960B operates over the *fixed* range of 0 to 14 pH.

The Model 960B has a fixed span of 1000 mV, which may be set anywhere within the overall range of −1000 mV to +1000 mV. Normally, the instrument is set for one of three ranges: 0 to +1000 mV, 0 to −1000 mV, or −500 to +500 mV. Select the desired range as follows:

1. Place signal Input ON/OFF Switch S3 at OFF.
2. Adjust STD (Standardize) Control R3 for meter reading appropriate to the desired range.

DESIRED RANGE	REQUIRED METER READING
−500 to +500 mV	50%
0 to −1000 mV	0%
0 to +1000 mV	0%*

*Exception: If installation uses 763-633104 Preamplifier in Pipe with combination electrode, required meter reading is 100%. In operation, the meter will provide *reverse readout* of the millivolt output as explained in Step 4b.

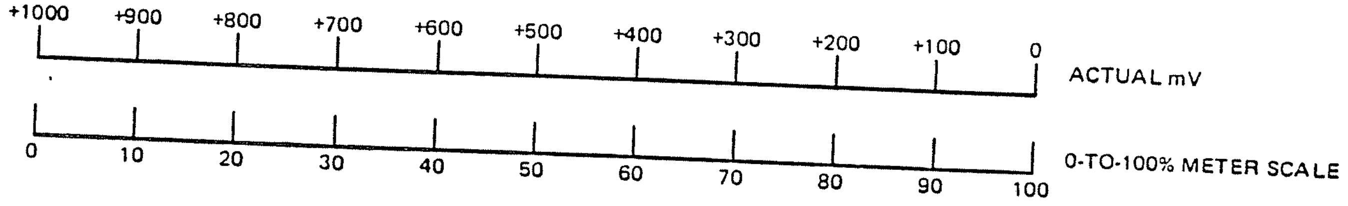
3. Place Signal Input ON/OFF Switch S3 at ON.
4. On the preamplifier, Figure 2-5 or 2-6, connect the electrode leads as required for the desired range:

   a. For range of 0 to −1000 mV or −500 to +500 mV, connect measuring electrode lead (BRN) to terminal marked GLASS; connect reference electrode lead (RED) to terminal marked REF.

   b. For range of 0 to +1000 mV, reverse the signal polarity by interchanging the leads, i.e., connect measuring electrode lead (BRN) to terminal marked REF; connect reference electrode lead (RED) to terminal marked GLASS.

NOTE

If the installation uses a 763-633104 Preamplifier in Pipe with combination electrode, the electrode leads are inaccessible and thus cannot be switched. Instead, in Step 2, with the monitor input signal OFF, STD (Standardize) Control R3 is adjusted for meter reading of 100%. After the monitor input signal is again turned on in Step 3, the meter will provide reverse readout of the millivolt output as diagrammed below.



4.2 ALARM SETPOINT ADJUSTMENT FOR ORP MONITORING

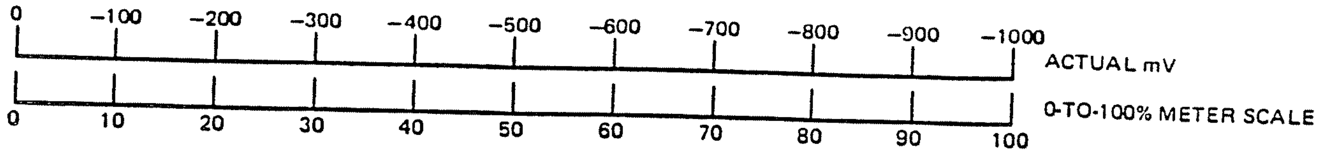
Before commencing calibration procedure for the alarm setpoints, check TP3 for +2.5 V ±1%, obtainable via ALARM CALIB Reference Voltage Adjustment R15, Figure 2-9, A.

Set DEADBAND Adjustments R19 (HIGH) and R20 (LOW) fully counterclockwise (normal factory setting) to set deadband at the minimum. Both potentiometers must *remain* at this setting throughout calibration of the alarm setpoint adjustments.

Alarm setpoint adjustment is accomplished with HIGH SET PT Adjustment R16 and LOW SET PT Adjustment R18. Nominal factory settings for the alarm setpoints are: LOW Alarm, 43%; HIGH Alarm, 64%. If readjustment of alarm setpoints is desired, use the appropriate one of the following procedures.

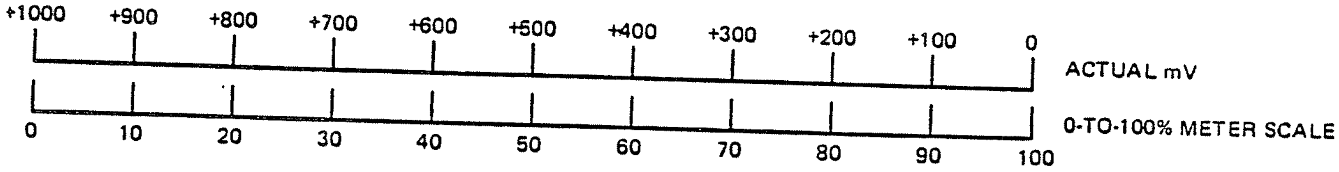
0 to −1000 mV Range
Pick off the alarm settings from the 0 to 100% scale.

EXAMPLE
Desired LOW Alarm is −600 mV. Set LOW Alarm Dial at 60%.
Desired HIGH Alarm is −800 mV. Set HIGH Alarm Dial at 80%.



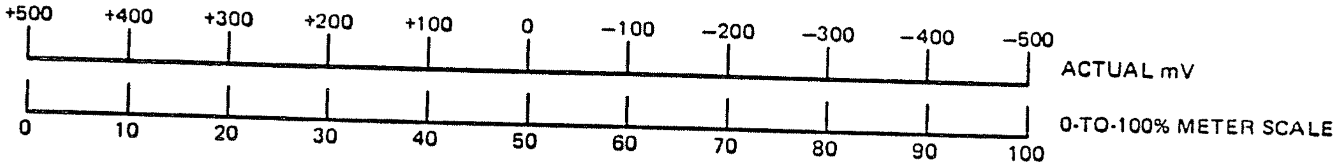
0 to +1000 mV Range
Pick off the alarm settings from the 0 to 100% scale.

EXAMPLE
Desired LOW Alarm is +100 mV. Set LOW Alarm Dial at 90%.
Desired HIGH Alarm is +900 mV. Set HIGH Alarm Dial at 10%.



−500 to +500 mV Range
Pick off alarm settings from the scale below.

EXAMPLE
Desired LOW Alarm is +50 mV. Set LOW Alarm Dial at 45%.
Desired HIGH Alarm is −200 mV. Set HIGH Alarm Dial at 70%.



Deadband Adjustment
After initial calibration of the setpoint adjustments, the desired deadband may be selected via the appropriate DEADBAND potentiometer; R19 for HIGH Alarm and R20 for LOW Alarm.

The 0 to 100 scale on each DEADBAND Potentiometer corresponds to 1% to 20% of fullscale on the front-panel meter. Thus a deadband setting of 50 is equivalent to 10% of fullscale on the meter. Typically, in on-off control ORP a deadband setting of 5 (equivalent to 2% of meter fullscale) is sufficient. Deadband should be adjusted only as required to avoid "chatter" of the reagent-addition solenoid valve.

4.3 "STANDARDIZATION" OF ORP SYSTEM

The potential developed by an oxidation-reduction potential (ORP) instrument, when compared to a standard hydrogen electrode or a silver-silver chloride reference electrode, is essentially "absolute." In general, ORP instruments are modified pH instruments with provisions to shift or expand scale. It becomes possible to add or subtract potential from the electrode signal. Thus the actual indicated potential for electrode exposure to a fixed oxidation-reduction system can be quite arbitrary. The potential change in an ORP system depends on the ratio of oxidants to reductants, for the reactants and products, through a somewhat complex chemical relationship. However, the actual measured potential depends also on the conditions of the sensing electrode.

Unlike the pH system, in which measured potential is biased to fit a pH scale, in ORP we provide "standards" of fixed potential and then physically manipulate and clean the electrodes until the system reads the known potential of the so-called "standards."

The potential change for a given ratio change of oxidants to reductants should be unique for the chemical system under consideration. However, this is not the case if the sensor electrode is coated or poisoned. It is important that potentials be tested *before* the electrode has been in contact with the process stream. Then in subsequent tests, the electrodes, if not reading correctly on the two standards, are known to be coated or otherwise poisoned. They are then cleaned and rechecked until correct readings are obtained.

Equipment Requirements

pH 4.0 Buffer } *For Part Numbers refer*
pH 7.0 Buffer. } *to Figure 3-1.*
Quinhydrone Crystals *(obtain from local supply house)*
Magnetic Stirrer
Beakers

Procedure

At initial startup of instrument:

1. To beaker large enough to hold electrode chamber being used, add sufficient pH 7.0 buffer to cover tips of electrodes. Add stirring bar and place on magnetic stirrer. Stir vigorously. Add crystals of quinhydrone until solution is saturated as evidenced by undissolved crystals.

2. Immerse electrodes in stirred solution prepared in Step 1. Measure solution temperature. Read true potential. Compare this reading with theoretical potential, interpolated millivolts versus temperature, from the following table.

TEMPERATURE (°C)	THEORETICAL POTENTIAL (mV)
20	92
25	86
30	79

If reading is within ±10 mV of value in table, proceed to Step 3. If not, proceed to Step 5. Discard buffer solution.

3. Add pH 4.0 buffer to beaker and saturate with quinhydrone, using procedure of Step 1. Rinse electrodes and immerse in stirred solution. Note actual potential reading on display. Compare with theoretical potential in following table.

TEMPERATURE (°C)	THEORETICAL POTENTIAL (mV)
20	268
25	263
30	258

If reading is within ±10 mV of value in table, proceed to Step 4. If not, proceed to Step 5. Discard this buffer solution.

4. Subtract the reading obtained for the pH 7.0 solution (Step 2), from the reading obtained for the pH 4.0 solution (Step 3). The difference should be 177 mV according to theoretical considerations, but may be a few millivolts lower or higher because of slight deviation of the reference electrode from the theoretical value. If the difference is within acceptable limits, remove electrodes from beaker; rinse with water; and install in process.

5. If electrode system failed to pass the tests of Steps 2 and 3, the sensing electrode is fouled or poisoned and requires cleaning to restore to proper operation. Light mechanical abrasion of the platinum surface with No. 400 emery paper is frequently sufficient to restore the sensing electrode to working condition. If the electrode has absorbed poisoning substances, more drastic treatment is required. The preferred treatment is with aqua regia, a mixture of 25% reagent-grade nitric acid and 75% reagent-grade hydrochloric acid.

WARNING
In handling aqua regia, use EXTREME CAUTION: goggles, gloves, etc.

Physically clean and dry the platinum electrode to remove any obvious coating. Rinse thoroughly with water. With an eyedropper, apply aqua regia to platinum surface, keeping platinum wet for about thirty seconds. Under no circumstances expose platinum to aqua regia for more than one minute. Rinse thoroughly with water.

Repeat tests outlined in Steps 2 and 3. Make up new solutions for each test. The solutions are stable for only a very short time.

At regular intervals, electrode system should be removed from process, flushed with water, and tested by the procedures above. If there is any significant change in the difference between the readings for the two standards, or if the potentials in the two standards shift materially, use the restoration treatment on the noble metal electrode.

If correct results are unobtainable, refer to Troubleshooting, Paragraph 5.1.

4.4 SHUTDOWN OF ORP SYSTEM

To shut down the system, turn off sample flow to the electrode flow chamber or submersion assembly by appropriate sequential operation of valves in the sample-handling system. During process shutdown, the reference electrode must be kept wet by immersion in water, KCl electrolyte, or aqueous process liquid. Prolonged dryout may cause drift in readout when electrode is again wetted.

THERMOX O_2

XIII. SPECIFICATIONS - STANDARD INSTRUMENTS

OXYGEN ANALYZER

Principle of Operation - Zirconium oxide electrochemical cell.

Accuracy - ±1 percent of measured value.

Repeatability - ±0.2 percent of measured value.

Response - 90 percent of full scale in less than 5 seconds.

Drift - Less than 0.1 percent of cell output per month.

Power - 120 VAC or 220 VAC, ±10 percent, 50/60 Hz.

Calibration - Certified mixture O_2 in N_2 (free of combustibles); calibration port provided.

COMBUSTIBLES MONITOR

Principle of Operation - Compensated, constant temperature, catalytic combustion sensor.

Span(s) - 0 to 1 percent combustibles 0 to 2 or 0 to 5 percent spans optional.

Minimum Sensitivity - 0.01 percent (100 ppm) combustibles.

Accuracy - ±5 percent of measured value.

Repeatability - ±2 percent of measured value.

Response - 90 percent of full scale in less than 11 seconds.

Drift - 1 percent of full scale (max.) per month

Filament Failure Alarm - Detects open or short in one or both filaments. Alarm light and SPDT relay provided, rated 3 amps at 120 VAC or 30 VDC.

COMBUSTIBLES MONITOR (CON'T)

Power - Same as Oxygen Analyzer.

*Calibration - Certified span mixture; equal parts CO and H_2, stiochiometric amount of O_2 (minimum) requirement), balance N_2. Zero gas: nitrogen or certified mixture (free of combustibles) used to span Oxygen Analyzer. Calibration port provided.

*The Combustibles Monitor, when calibrated for products of incomplete combustion (CO and H_2) in flue gases, will not be sensitive to natural gas or other hydrocarbons.

Ambient temperatures - Sensor: -5°F to 175°F (-20.5°C to 70°C) -to 500°F (260°C) on special order.
Control-Readout: 0 to 120°F (-18°C to 49°C)

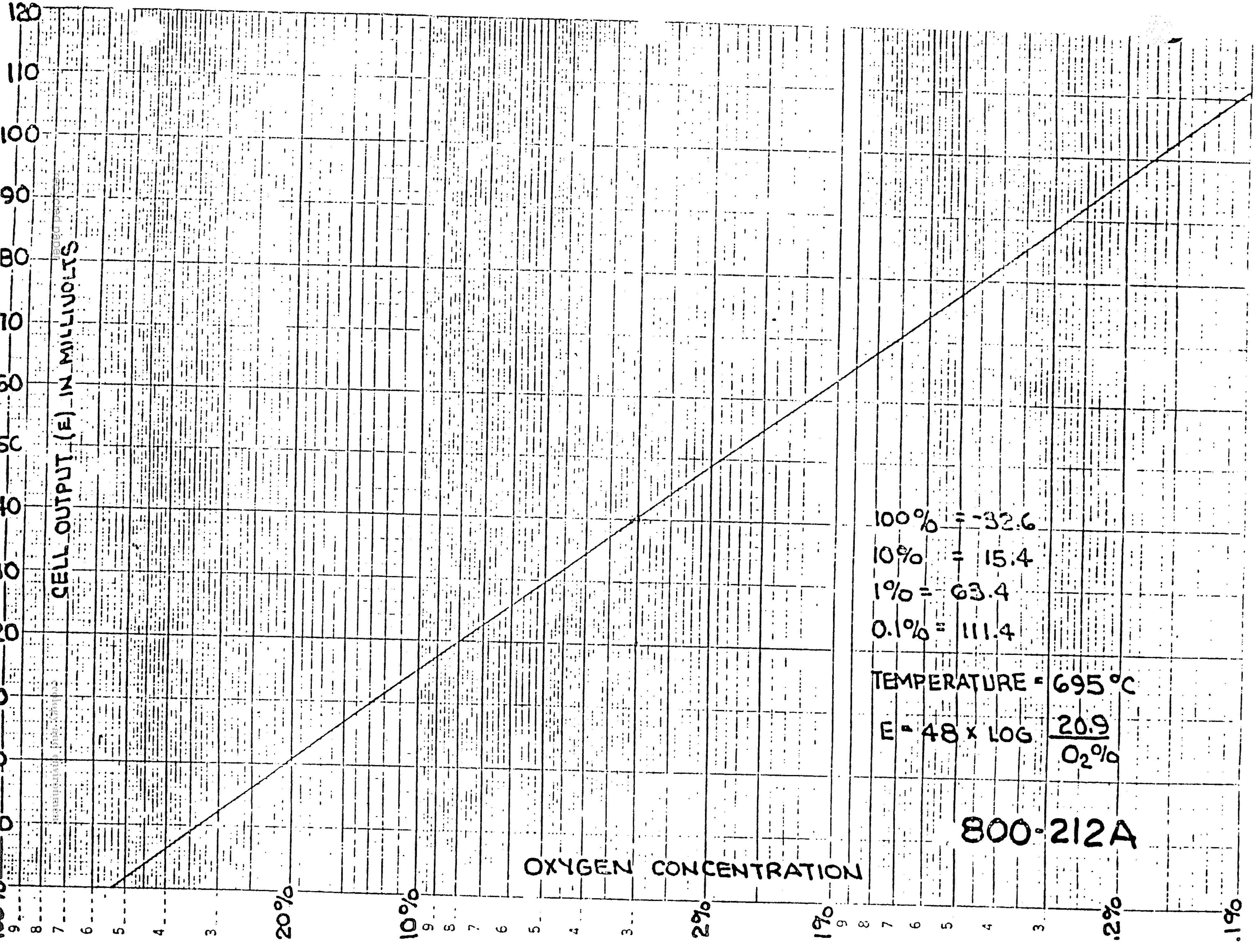
Sample temperature - 0°F to 1500°F (-18°C to 815.5°C) - to 3200°F (1760°C) with ceramic sample tube.

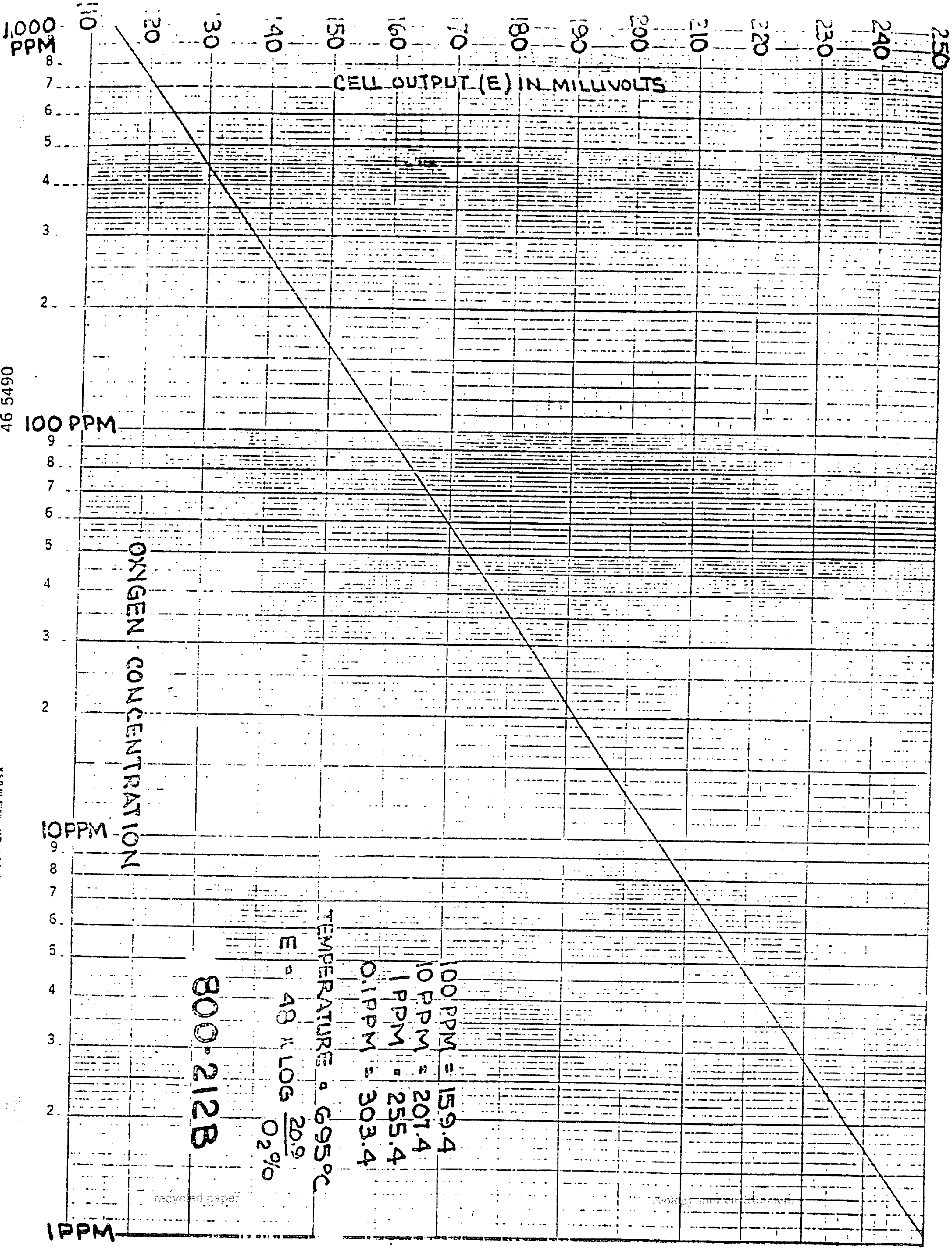
Sample flow rate - 0.1 to 120 scfh (.047 to 56.64 liters/min.)

Sample pressure - 2 psig (.1407 kg/cm^2)

Aspirator air requirement - 10 to 20 scfh (4.72 to 14.16 liters/min.) at 15 to 100 psi (1.05 to 7.037 kg/cm^2)

Specifications contained herein are subject to change without notice. Since it is impossible to anticipate or control the may different conditions under which this information and our products may be used, AMETEK cannot, without complete and accurate information supplied about actual working conditions, guarantee the applicability and accuracy of the information or the suitability of our products in any given situation.


120
110
100
90
80
70
60
50
40
30
20
10
0
CELL OUTPUT (E) IN MILLIVOLTS
100% = -32.6
10% = 15.4
1% = 63.4
0.1% = 111.4
TEMPERATURE = 695 °C
E = 48 × LOG $\frac{20.9}{O_2\%}$
800-212A
OXYGEN CONCENTRATION
9
8
7
6
5
4
3
20%
10%
9
8
7
6
5
4
3
2%
1%
9
8
7
6
5
4
3
.2%
.1%
46 5490


CELL OUTPUT (E) IN MILLIVOLTS
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
OXYGEN CONCENTRATION
1,000 PPM
8
7
6
5
4
3
2
100 PPM
9
8
7
6
5
4
3
2
10PPM
9
8
7
6
5
4
3
2
1PPM
100 PPM = 159.4
10 PPM = 207.4
1 PPM = 255.4
0.1 PPM = 303.4
TEMPERATURE = 695°C
E = 48 x LOG 20.9/O2%
800-212B

VIA - 500F
INSTRUCTION MANUAL
GENERAL PURPOSE INFARED GAS ANALYZER

HORIBA MANUAL NO. 091122

7/86

HORIBA INSTRUMENTS INCORPORATED

recycled paper

HORIBA INSTRUMENTS INC.
1021 DURYEA AVENUE
IRVINE INDUSTRIAL COMPLEX
IRVINE, CALIFORNIA 92714
TELEPHONE 714/540-7874

CONTENTS

INSTRUCTION MANUAL
for
HORIBA MODEL ENDA-800 SERIES
STACK GAS ANALYZERS

ENDA-828

MANUAL NO. 091117 6/86

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IRVINE, CALIFORNIA 92714
TELEPHONE 714/540-7874

CONTENTS

APPENDIX H

AIR PERMIT INFORMATION

OP LOCATIO FACILITY EMISSION POINT R

A ADD
C CHANGE
D DELETE

READ INSTRUCTIONS CONTAINED IN FORM 76-11-7 BEFORE ANSWERING ANY QUESTION

NEW YO[illegible] STATE
DEPARTMENT OF ENVI[illegible]ENTAL CONSERVATION

COPIES
WHITE - ORIGINAL
PINK - DIVISION OF AIR
WHITE - REGIONAL OFFICE
WHITE - FIELD REP
YELLOW - APPLICANT

THIS IS NOT A PERMIT APPLICATION

INCINERATOR INFORMATION

APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

This form is submitted FOR INFORMATION PURPOSES ONLY to expedite NYSDEC substantive review of air emission concerns.

SECTION A

1 NAME OF OWNER/FIRM: Al Tech Specialty Steel
2 NUMBER AND STREET ADDRESS: Willowbrook Avenue
3 CITY - TOWN - VILLAGE: Dunkirk
4 STATE: NY
5 ZIP: 14048-0152
6 OWNER CLASSIFICATION: A ☐ COMMERCIAL B ☒ INDUSTRIAL C ☐ UTILITY D ☐ FEDERAL E ☐ STATE F ☐ MUNICIPAL G ☐ EDUC INST H ☐ HOSPITAL I ☐ RESIDENTIAL J ☐ OTHER
7 NAME & TITLE OF OWNERS REPRESENTATIVE: Frank J. Boinski, Director, Environmental Affairs
8 TELEPHONE: 716-366-1000
9 NAME OF AUTHORIZED AGENT:
10 TELEPHONE:
11 NUMBER AND STREET ADDRESS:
12 CITY-TOWN-VILLAGE:
13. STATE:
14 ZIP:
15 NAME OF PE OR ARCHITECT PREPARING PLANS:
16 N Y S PE OR ARCHITECT LICENSE NO.:
17 TELEPHONE:
18 SIGNATURE OF OWNERS REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT:
19 FACILITY NAME (IF DIFFERENT FROM OWNER/FIRM):
20 FACILITY LOCATION (NUMBER AND STREET ADDRESS):
21 CITY-TOWN-VILLAGE:
23. BUILDING NAME OR NUMBER:
24 FLOOR NAME OR NUMBER:
25. START UP DATE MO / YR.: 11/ 88
26. DRAWING NUMBERS OF PLANS SUBMITTED:
27 PERMIT TO CONSTRUCT: A. ☒ NEW SOURCE B ☐ MODIFICATION
28. CERTIFICATE TO OPERATE: A ☐ NEW SOURCE ☐ EXISTING B ☐ MODIFICATION

SEC. B

29 EMISSION POINT ID	30 GROUND ELEVATION (FT.)	31 HEIGHT ABOVE STRUCTURES (FT)	32 STACK HEIGHT (FT)	33 INSIDE DIMENSION(S) (IN)	34 EXIT TEMPERATURE (°F)	35 EXIT VELOCITY (FT/SEC)	36 EXIT FLOW (ACFM)
	630	-20	37	32	180	18.4	6180

SECTION C

37 REFUSE FEED	38 UNIT TYPE	39 ENCON ID NUMBER	40 UNIT MANUFACTURER'S NAME AND MODEL NUMBER
02	01	None	OHM - Shirco Infrared Incinerator - MOBILE

REFUSE TYPE	% TYPE 5 REFUSE	% TYPE 6 REFUSE	RADIOACTIVE REFUSE	CAPACITY LBS/HR	AMOUNT REFUSE CHARGED LBS/HR	HRS/DAY	DAYS/YR	% OPERATION BY SEASON WINTER	SPRING	SUMMER	FALL
42 PRIMARY 9	43 0.025	44 0	45 YES ☐ NO ☒	46 13,800	47 8000	48 24	49 28				9 9
51 ADD REF	52	53	54 YES ☐ NO ☐	55	56	57	58	59			

SEC D

AUXILIARY EQUIP TYPE	TOTAL NO OF UNITS	AUXILIARY EQUIPMENT MANUFACTURER'S NAME AND MODEL NUMBER	TEMPERATURE ACTUATED	RATED BURNER CAPACITY BTU/HR	FUEL TYPE
60 2	61 1	62 OHM-Shirco Infrared Inc. Secondary Combustion Chamber	63 YES ☐ NO ☒	64 6×10^6	52
66	67	68	69 YES ☐ NO ☐	70.	

SEC E

EMISSION CONT EQUIP. I D	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MO / YR	USEFUL LIFE
72 1	73 13	74 OHM-Shirco Venturi	75 8	76 11/88	77 10
78 2	79 98	80 OHM-Shirco Packed Column Chemical Scrubber	81 8	82 11/88	83 10

SECTION F

CALCULATIONS

Emmission data is provided from results of a test burn of the mobile incinerator conducted at Florida Steel, Indiantown, Florida-6/88. This test burn was conducted on material with a PCB concentration of nearly 7000 ppm. This concentration is almost 30 times greater than the PCB content of sludge to be burned at Al Tech. Results of this test burn and Al Tech waste data are attached.

Results of stack test data concerning dioxin and dibenzofuran are located in Section 5.0 of the test burn data.

TO BE COMPLETED FOR ALL SOURCES USING ITEM 27 AND OTHER SOURCES AS DEFINED IN THE INSTRUCTION FORM 76-11-7

SECTION G

CONTAMINANT NAME	CAS NUMBER	EMISSIONS ACTUAL	UNIT	HOW DET	PERMISS.	% CONTROL EFFICIENCY	HOURLY EMISSIONS (LBS/HR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) ACTUAL		
84 TOTAL PARTICULATES	85 NY075-00-0	86 3	87 1	88 2	89.	90 99.9	91 3	92 2	+3	
95 SULFUR DIOXIDE	96 7446-09-5	97	98	99	100.	101	102	103		
106 PCB	107 11196825	108 6.3	109 3	110 2	111.	112. 99.9	113 6.3×10^{-6}	114 4.2	-3	
117 HCL	118 7647-01-0	119 0.115	120 1	121 2	122.	123	124 0.115	77	0	
128	129	130	131	132	133.	134	135	136		

SEC H

SOLID FUEL TYPE	TONS/YR	%S	OIL TYPE	THOUSANDS OF GALS/YR	%S	GAS TYPE	THOUSANDS OF CU FT / YR	BTU/CF	APPLICABLE RULE
139	140	141	142	143	144	145 52	146 3696	147 1000	148

Upon completion of construction sign the statement listed below and forward to the appropriate field representative

THE INCINERATOR HAS BEEN CONSTRUCTED AND WILL BE OPERATED IN ACCORDANCE WITH STATED SPECIFICATIONS AND IN CONFORMANCE WITH ALL PROVISIONS OF EXISTING REGULATIONS

150 SIGNATURE OF AUTHORIZED REPRESENTATIVE OR AGENT
DATE

AGENCY USE ONLY

151 LOCATION CODE
152. FACILITY ID. NO
153 U T M (E)
154 U T M (N)
155. SIC NUMBER
156 DATE APPL RECEIVED / /
157. DATE APPL. REVIEWED / /
158 REVIEWED BY

PERMIT TO CONSTRUCT

160 DATE ISSUED / /
161 EXPIRATION DATE / /
162 SIGNATURE OF APPROVAL
163 FEE

164
1. DEVIATION FROM APPROVED APPLICATION SHALL VOID THIS PERMIT
2 THIS IS NOT A CERTIFICATE TO OPERATE
3 TESTS AND/OR ADDITIONAL EMISSION CONTROL EQUIPMENT MAY BE REQUIRED FOR THE ISSUANCE OF A CERTIFICATE TO OPERATE

RECOMMENDED ACTION RE: C.O.

165 DATE ISSUED / /
166 EXPIRATION DATE / /
167 SIGNATURE OF APPROVAL
168 FEE

169
1 ☐ INSPECTED BY ________ DATE
2 ☐ INSPECTION DISCLOSED DIFFERENCES AS BUILT VS. PERMIT, CHANGES
3 ☐ ISSUE CERTIFICATE TO OPERATE FOR SOURCE
4 ☐ APPLICATION FOR C O. DENIED ________ DATE ________ INITIALED

170 SPECIAL CONDITIONS
1
2
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5.
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