COMMERCIAL-SCALE DEMONSTRATION OF THE LIQUID PHASE METHANOL PROCESS

ENVIRONMENTAL MONITORING PLAN (FINAL)

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AND

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FOR

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UNITED STATES DEPARTMENT OF ENERGY
PITTSBURGH ENERGY TECHNOLOGY CENTER
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ENVIRONMENTAL MONITORING PLAN
LPMEOH™ Process Demonstration Facility

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1. Introduction and Demonstration Plan Goals

The Clean Coal Technology Program is a nearly $7 billion technology demonstration program that was legislated by Congress to be funded jointly be the federal government and industrial sector participants. The goal of the Clean Coal Technology Program is to make available to the United States marketplace a number of advanced, more efficient, reliable, and environmentally responsive coal utilization and environmental control technologies.

Air Products Liquid Phase Conversion Company, L.P. (the Partnership), a joint venture between Air Products and Chemicals, Inc. (Air Products) and Eastman Chemical Company (Eastman), will design, construct, own and operate a 260 ton-per-day Liquid Phase Methanol (LPMEOH™) demonstration unit at the Eastman facility in Kingsport, Tennessee. The demonstration unit will be located on property currently owned by Eastman. It will take synthesis gas from Eastman's coal gasifier and will supply an existing downstream chemical plant with methanol. Some of the methanol produced will be used in stationary and mobile demonstrations to test the fuel characteristics of the methanol produced.

1.1 Environmental Monitoring Plan Purpose

As specified in the Cooperative Agreement, the Partnership is required to develop an Environmental Monitoring Plan (EMP) which describes in detail the environmental monitoring activities to be performed during the operation of the LPMEOH™ demonstration unit. The purpose of the EMP is to: 1) document the extent of compliance monitoring activities, i.e. those monitoring activities required to meet permit requirements, 2) confirm the specific environmental impacts predicted in the National Environmental Policy Act documentation, and 3) establish an information base for the assessment of the environmental performance of the technology for future commercialization.

1.2 Environmental Monitoring Plan Scope

This plan describes the LPMEOH™ demonstration unit that will be constructed on Eastman's site in Kingsport, Tennessee; it describes the compliance monitoring and supplemental monitoring that is associated with the new demonstration unit and the production of methanol. It further provides information from Eastman's existing facilities to provide an overall assessment of the LPMEOH™ technology.

Phase 3, Task 4 of this demonstration project is off-site fuel testing of the product methanol. This testing will take place in 1998 and 1999, two years after start up. An EMP supplement for this task will be provided at a later date; but at least 60 days prior to the start of Phase 2, Task 4 Off-site Testing Construction.

If the decisions from the Design Verification Testing (DVT Phase 1, Task 5) are to demonstrate the production of dimethyl ether (DME) as a mixed co-product with methanol; then an additional supplement to this EMP will be written. The production of DME is not considered in this EMP.

2. Project Description

2.1 Background and History of the Project

The purpose of this proposed project is to demonstrate the commercial viability of the Liquid Phase Methanol (LPMEOH™) Process using coal-derived synthesis gas. This project is planned to be conducted pursuant to the U. S. Department of Energy (DOE) Clean Coal Technology Program.

The United States needs future sources of alternative liquid fuels. With domestic oil production declining and imports increasing, the potential of producing affordable liquid fuels from non-petroleum sources could one day prove both strategically and economically important. The LPMEOH™ Process offers an extremely attractive route to supplementing our liquid fuel supplies with methanol made from the abundant coal reserves of the United States.

Methanol also has a broad range of commercial applications. It can be substituted for or blended with gasoline to power vehicles. It is an excellent fuel for the rapid-start combustion turbines used by utilities to meet peak electricity demands. It contains no sulfur and has exceptionally low nitrogen oxide characteristics when burned. It can also be used as a chemical feedstock.

Air Products and Eastman have entered into a joint venture known as Air Products Liquid Phase Conversion Company, L.P. (The Partnership). The Partnership will participate with the DOE in the Clean Coal Technology demonstration of Liquid Phase Methanol technology. The Partnership will design, build, own, and operate a nominal 260 ton-per-day LPMEOH™ process unit at Eastman's integrated coal gasification facility site in Kingsport, Tennessee. The program objectives are to demonstrate the LPMEOH™ process scale-up and operability (up to four years) under various coal-based synthesis gas feed compositions and to gain operating experience for future synthesis gas conversion projects. The LPMEOH™ technology offers significant potential, over existing foreign Lurgi and Imperial Chemical Industries methanol production technologies to reduce electric power generation costs with the co-production of chemical feedstocks and alternative liquid fuels. The domestically developed LPMEOH™ technology uses United States coal to produce clean, storable, liquid fuels and chemical feedstocks. Eventual commercialization of the LPMEOH™ process would provide chemical feedstock and electric power cost savings, lower sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions, and reduce the use of imported liquid fuels.

The LPMEOH™ technology to be demonstrated at the Eastman facility could someday be used as an adjunct to an integrated gasification combined cycle (IGCC) power plant —one of the cleanest and most efficient of the 21st century power generating options. When the IGCC power plant is not generating at its full capacity, excess coal gas could be used to make methanol. The methanol could be stored onsite and used in peaking turbines or sold as a commercial fuel or a chemical feedstock. In this configuration, the cost of making methanol from coal is likely to be competitive with stand alone natural gas-to-methanol facilities.

The LPMEOH™ demonstration unit will be integrated with Eastman's facility, accepting synthesis gas and converting it to methanol, for use as a chemical feedstock within the Eastman facility. A portion of the methanol production would be used as a fuel, for use as a low-NO_X combustion fuel for testing in stationary power applications and mobile transportation use.

These end-use tests would provide a basis for the comparison of the product methanol with conventionally accepted fuels including emission levels and economic viability. The program goal of demonstrating methanol as a fuel would lead to the potential for greater use of oxygenated fuels, which burn cleaner than conventional fuels, thereby reducing air emissions from mobile (e.g., buses and vanpools) and stationary (e.g., engines, turbines, and boilers) sources.

The U. S. Department of Energy, under the Clean Coal Technology Program, will provide cost-shared financial assistance for the construction of the commercial-scale LPMEOH™ demonstration unit by The Partnership. Air Products will design and construct the LPMEOH™ demonstration unit and Eastman will operate it. The demonstration unit will be a nominal 260 ton-per-day-unit situated on a 0.6 acre plot within the existing Eastman facility in Kingsport, Tennessee.

The Eastman coal gasification facility has operated commercially since 1983. Eastman currently both produces and purchases methanol for use at the site. The net affect of adding the LPMEOH™ demonstration unit is to require the purchase of a nominal 30 tons per day of additional methanol for the site. This net amount also includes the methanol which will be used in tests of combustion turbines and vehicles. At this site, it will be possible to ramp up and down to demonstrate the unique load following flexibility of the LPMEOH™ demonstration unit for application to coal-based electric power generation facilities.

The operation at Eastman may also include the production of dimethyl ether (DME) as a mixed coproduct with methanol for demonstration as a potentially storable fuel pending preliminary laboratory and market Design Verification Test (DVT Phase 1, Task 5) results.

2.2 Project Schedule

The project is divided into the following three phases:

Design
Construction
Operation

The design phase includes of all of the engineering needed to construct the demonstration unit. This activity started in October of 1993 and was completed in early 1996. The Construction Phase started in October of 1995 and includes the fabrication of the equipment and the field construction tasks (foundations, steel erection, etc.). The demonstration unit is expected to be commissioned by the end of 1996. The off-site product-use testing is included in the operation phase and is expected to start in early 1998 and finish in late 1999. The demonstration unit will operate (Phase 3) for four years. During this period it will be operated to prove the commercial viability of the process. This Methanol Operation task is described in Task 2.1 of Phase 3 of the "Statement of Work". The latest "Milestone Schedule Status Report" and the "Work Breakdown Summary" (from the "Statement of Work") are included in Appendixes C and D.

2.3 Site and Facility Description

The 0.6 acre site proposed for the LPMEOH™ demonstration unit is located in Kingsport, Tennessee, at the Eastman facility. The Eastman facility is on the western edge of Sullivan County and includes a small portion of Hawkins County. The world headquarters of Eastman Chemical Company are also located in Kingsport. The Eastman facility also includes the eastern half of Long Island, where the demonstration unit is being built adjacent to existing process facilities.

The Kingsport area is shown in Figure 2.2-1. The location of the proposed plant on Long Island is shown on Figure 2.2-2. A photograph of the Eastman facility as it currently exists is also shown on Plate 2.1. The current site is a gravel covered area bounded to the north by an elevated pipe rack, to the west by an interplant road that runs between the future process area and a chemical manufacturing plant, to the east by an existing methyl acetate plant, and to the south by an interplant road and control and change house. The demonstration unit will resemble the existing facility surroundings.

The proposed project includes four major process areas. The reaction area includes the reactor and its associated equipment. The purification area includes two distillation columns and their heat exchangers. The storage/utility area comprises oil and product methanol storage. The catalyst preparation/reduction area is under roof with several large vessels, slurry handling equipment, and a utility oil skid. An equipment arrangement plan and isometric view are included in Appendixes E and F.

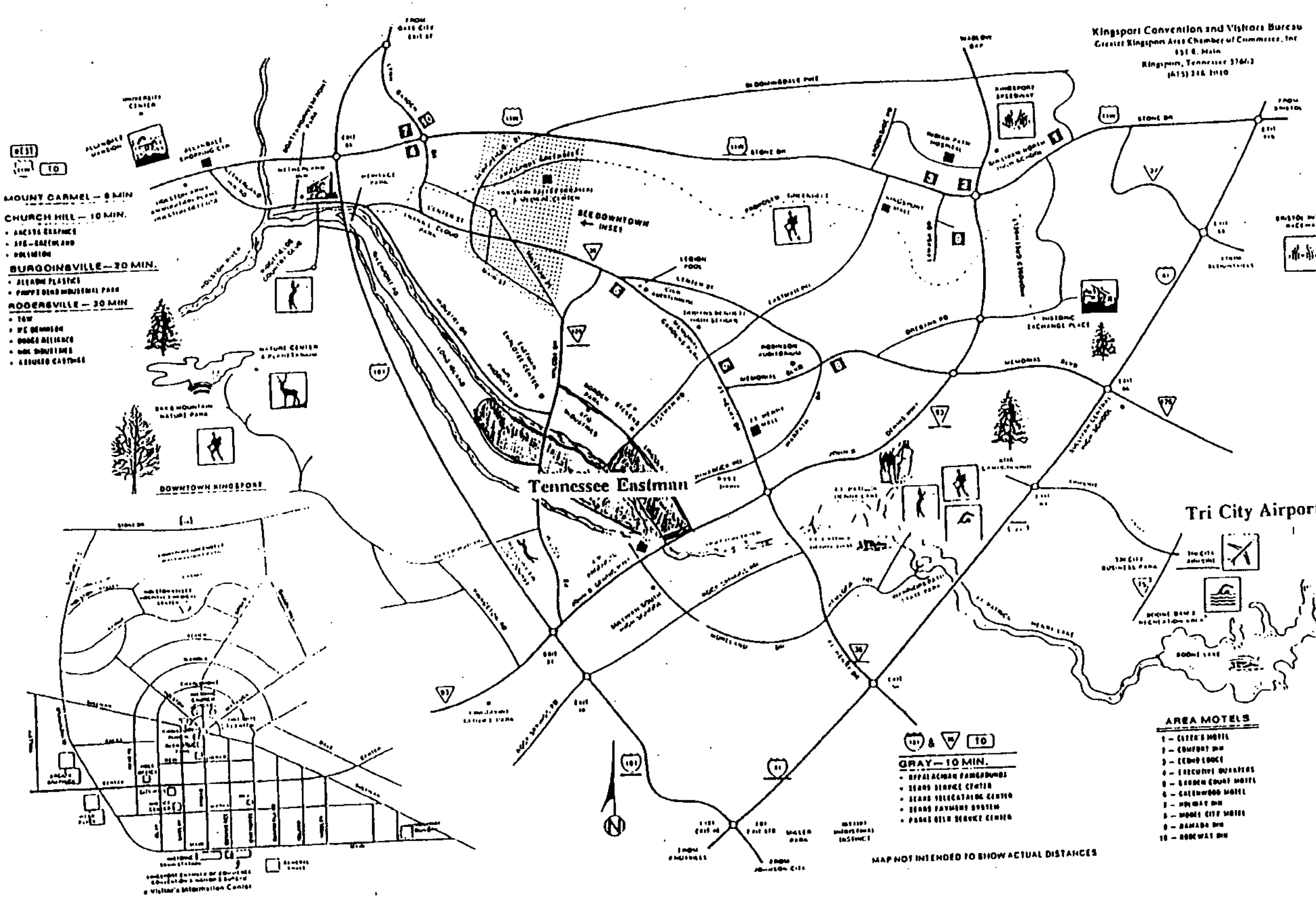


FIGURE 2.2-1 KINGSPORT AREA

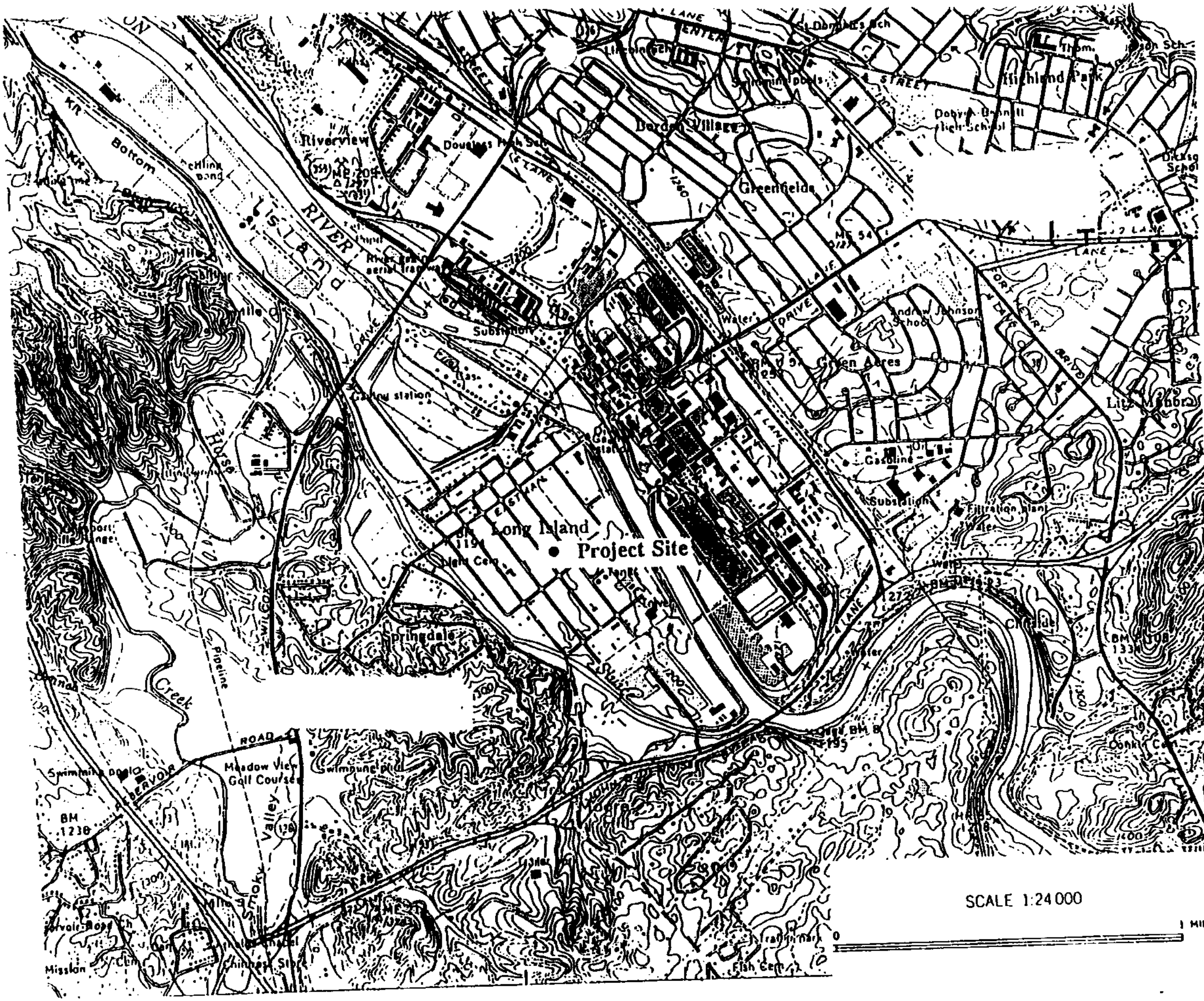
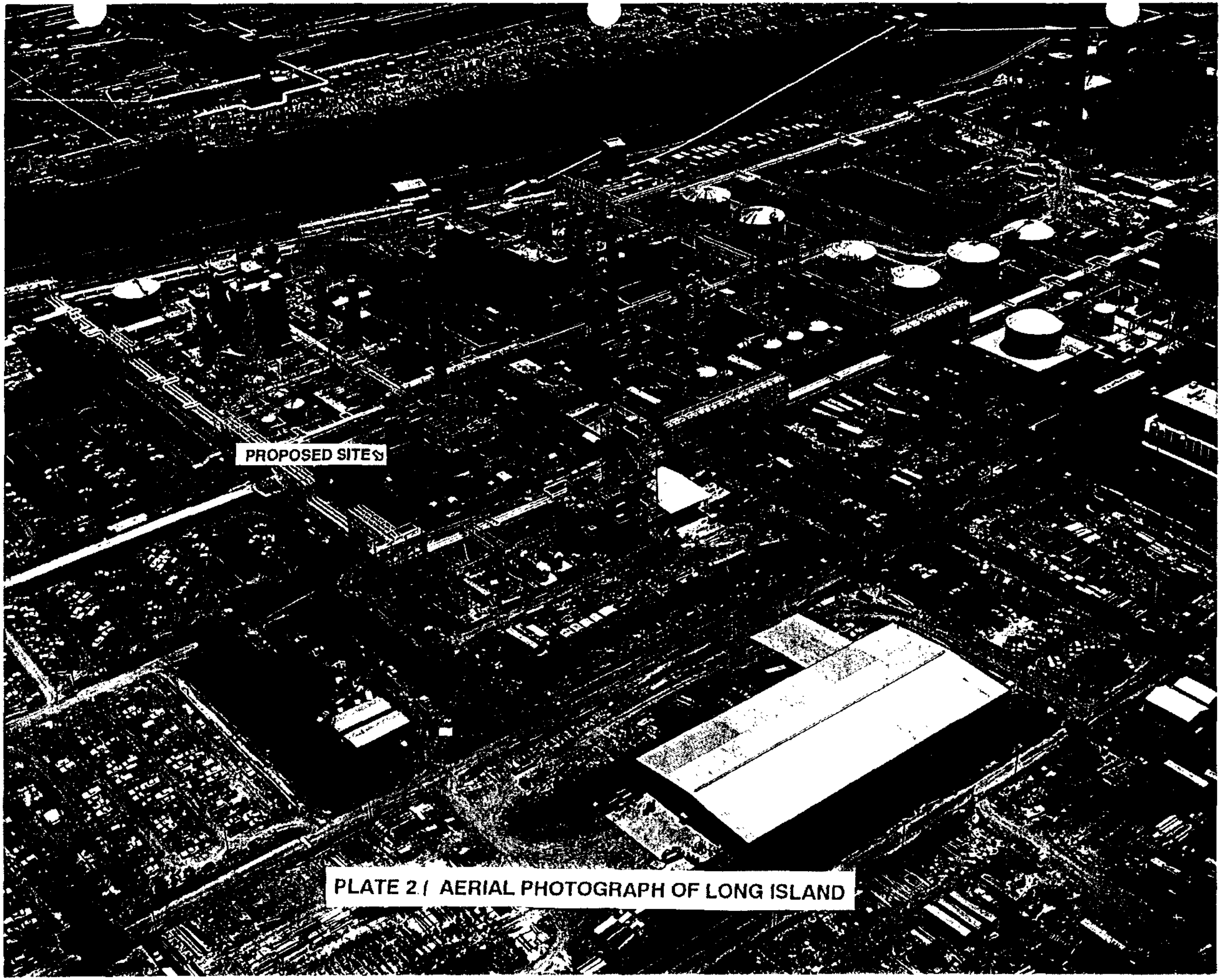


FIGURE 2.2-2 LOCATION OF PROPOSED PROJECT SITE


PROPOSED SITE
PLATE 2.1 AERIAL PHOTOGRAPH OF LONG ISLAND

3. Process Description

3.1 General Description

The reactor used in the LPMEOH™ process is unlike the conventional gas phase reactors that use fixed beds of catalyst pellets and largely depend upon recycle diluent gas to both dilute the carbon monoxide concentration and control the temperature rise caused by the heat of reaction. The LPMEOH™ reactor is a slurry reactor with small, powder-size catalyst particles suspended in inert mineral oil. The synthesis gas bubbles up through the slurry where the hydrogen and carbon monoxide dissolve in the oil and diffuse to the catalyst surface where the methanol reaction occurs. The product methanol diffuses out of the slurry and exits as a vapor with the unreacted synthesis gas. The inert oil acts as a heat sink and permits isothermal operation. The net heat of reaction is removed via an internal heat exchanger which produces steam. Unlike the gas phase reactors, that limit the per-pass conversion of synthesis gas to methanol to accommodate the reaction exotherm, the LPMEOH™ reactor maintains isothermal operation. The methanol vapor leaves the reactor and is condensed to a liquid, sent to the distillation columns for removal of higher alcohols, water, and other impurities, and is then stored in the day tanks for sampling prior to being sent to Eastman's methanol storage. A portion of the unreacted synthesis gas is sent back to the reactor with the synthesis gas recycle compressor, improving cycle efficiency. The methanol will be used for downstream feedstocks and for off-site fuel testing.

Unlike the gas phase reactors, the LPMEOH™ reactor is tolerant to CO-rich gas. Shift and carbon dioxide removal are not required. Low hydrogen-to-carbon monoxide ratios are acceptable as is any carbon dioxide content. Finally, in contrast to the gas phase reactor in which the catalyst is sensitive to flow variations and changes from steady-state, the LPMEOH™ reactor is eminently suited for load-following and for on-off operation.

The LPMEOH™ demonstration unit will be integrated with Eastman's coal gasification facility and inserted in parallel with an existing Lurgi technology methanol unit.

3.2 Detailed Description

The LPMEOH™ demonstration unit consists of three main process sections: methanol synthesis, product purification, and catalyst slurry preparation and handling. The process flow diagrams for the various sections are shown in Appendix A (Sheets 1 through 7); and an equipment list is provided in Appendix B. (Block diagrams for the Kingsport complex and the LPMEOH™ Facility are also provided in Figures 7-1 and 7-2). A glossary of synthesis gas terminology is provided in Table 3-1. A discussion of each major plant section, with reference to the specific process flow diagram sheets in Appendix A, follows.

Table 3-1

Glossary of Syngas Terms - Process Description

LPMEOH™ Demonstration Unit

A. Syngas Terms:

	Term:	Definition:
a	Syngas	Abbreviation for Synthesis Gas
b	Synthesis Gas	A gas containing primarily* hydrogen (H_2), carbon monoxide (CO), or mixtures of H_2 and CO; intended for "synthesis" in a reactor to form methanol and/or other hydrocarbon products.
c	Feed Gas (Feed)	Syngas "fed" to a reactor for synthesis.
d	Reduction Gas	A nitrogen/carbon monoxide mixture used to reduce fresh catalyst.

The four feed gas streams for the LPMEOH™ slurry reactor are:

e	Balanced Gas	A syngas with a composition of hydrogen (H_2), carbon monoxide (CO) and carbon dioxide (CO_2) in stoichiometric balance for the production of methanol (approximately 2:1).
f	CO Gas	A syngas containing primarily CO.
g	H_2 Gas	A syngas with a H_2 to CO ratio greater than 2.
h	Recycle Gas	The portion of unreacted syngas effluent from the reactor, "recycled" as a feed gas.
i	Reactor Feed	The sum of the above four gases, as combined and fed to the LPMEOH™ reactor.

*(Syngas may also contain carbon dioxide (CO_2), water (H_2O), and other gases).

Methanol Synthesis (Sheets 1, 2, 3)

Three sources of synthesis gas from the Kingsport facility will be capable of combining to form the LPMEOH™ reactor feed stream. Approximately half of the Balanced Gas fresh feed to the Lurgi methanol unit will be diverted to the LPMEOH™ demonstration unit (Stream 30). A high purity carbon monoxide (CO) gas stream will also be available from the Kingsport cold boxes (Stream 10). The third feed stream will be the hydrogen (H_2 Gas) exiting the Lurgi unit (Stream 20). Since the H_2 Gas stream is at a lower pressure than the other two feed streams, it will be combined with the Recycle Gas stream (Stream 149), made up of unconverted synthesis gas from the LPMEOH™ reactor, and compressed in the (29K-01 feed gas) compressor.

The CO Gas and Balanced Gas streams will be combined and passed through the (29C-40 Carbonyl) Guard Bed. This bed, packed with activated carbon, will protect the methanol catalyst against possible upsets of iron and nickel carbonyl contaminants.

The combined Reactor Feed gas composition is typically 60.9% H_2, 25.1% CO, 4.1% N_2 and 9.0% CO_2 (stream 109). This high pressure Reactor Feed gas stream is heated to approximately 402°F in the 29E-02 feed/product heat exchanger against the reactor effluent. The feed is then sparged into the 29C-01 LPMEOH™ reactor, mixes with the catalyst slurry and is partially converted to methanol vapor, releasing the heat of reaction to be absorbed by the slurry. The slurry temperature is controlled by varying the steam temperature within the heat exchanger tubes, which is accomplished by adjusting the steam pressure.

Disengagement of the product gas (methanol vapor and unreacted synthesis gas) from the catalyst/oil slurry occurs in the freeboard region of the LPMEOH™ reactor. Any entrained slurry droplets leaving the top of the reactor will be collected in the 29C-06 cyclone separator. An oil flush is maintained to this vessel to assist in the knockout of slurry. The product gas passes through the tubeside of the 29E-02 exchanger, where it is cooled to 250°F by heat exchanging the effluent gas stream against the reactor inlet gas stream. The condensed liquid oil droplets are collected in the 29C-05 High Pressure Oil Separator and then pumped back with the entrained slurry from the 29C-06 separator to the LPMEOH™ reactor by the 29G-01A/B oil circulation pumps. To make up for oil losses into the product recovery train, fresh oil is added into the 29C-05 separator via the 29G-03 A/B pumps. Bypasses have been installed to allow both the 29C-06 and 29C-05 separators to free drain back to the reactor without the use of the 29G-01 pumps. In this mode, the fresh makeup oil would be added as a flush to the 29C-06 separator.

The product gas (stream 120) is further cooled to 105°F in an air-cooled exchanger (29E-03) and a cooling water exchanger (29E-04). The liquid methanol which is condensed is collected in the 29C-03 product separator. The overhead stream from the 29C-03 product separator contains unreacted syngas, 0.9% uncondensed methanol, and 2 ppmw uncondensed oil. Approximately 91% of this unreacted syngas stream is recycled back to the LPMEOH™ reactor after undergoing compression in the 29K-01 compressor. The balance of the unreacted gas returns to the Kingsport facility at 100°F and is sent to the boilers.

Product Purification (Sheet 3, 7)

The condensed methanol *(stream 204)* contains 6 volume % dissolved gases, methyl formate, water, and some higher alcohols. These impurities are removed in a two column distillation train which will produce a methyl acetate feed-grade methanol product. The liquid *(stream 204)* from the 29C-03 product separator is flashed into the 29C-12 Methanol Stabilizer Feed Drum at approximately 70 psig. This vessel has one hour of holdup time to allow for some lag time due to rate and composition changes between the reactor train and the distillation system. Flashed gas from this separator is combined with the overheads of the two columns and sent to the Eastman boilers.

The first distillation column (29C-10) removes the dissolved gases and lighter boiling impurities, such as methyl formate, in the overhead *(stream 211)*. The bottoms from this column are fed to the second train (29C-20) where the purified methanol product is removed as a top stage distillate product. Any non-condensable are combined with the overhead stream from the 29C-10 and 29C-12. The bottom draw from the 29C-20 is a crude methanol stream heavy in higher alcohols, water and any of the oil which was carried over from the reactor. This stream will be sent to the Lurgi distillation system for recovery of 25% (by weight) of the raw methanol and disposal of the oil, higher alcohols and water.

The methanol product produced from the 29C-20 distillation column is pumped by the 29G-21 methanol rectifier reflux pump to either the 29D-20 or 29D-21 lot tanks. After the appropriate purity checks are completed, the contents of the lot tanks will be transferred via the 29G-23 methanol transfer pump to Eastman bulk storage. In some off-design cases where impurities are greater than normal, the lot tanks will be rejected to Eastman's existing methanol Plant 19 for recovery. Product methanol for off-site fuel testing will be produced at limited times during the demonstration period by using only the first distillation column. The bottoms product will be cooled in the 29E-23 heat exchanger before transferring to the lot tanks.

Catalyst Preparation and Slurry Handling (Sheets 4, 5, 6)

The catalyst slurry is activated in the 29C-30 reduction vessel which is an agitated, 304 stainless steel vessel equipped with a heating/cooling jacket. This vessel has three purposes:

1. Fresh Slurry Mix Tank
2. Catalyst Reduction Vessel
3. Spent Slurry Receiver.

Any reclaimed oil stored in the 29C-31 accumulator is first gravity drained into the top oil fill nozzle of the reduction vessel. The balance of 740 gallons of mineral oil is added using the 29G-34 pump. The oil is heated to approximately 200°F using the jacketed utility oil skid. Once the oil is at temperature, 2250 lb. of catalyst oxide is added to form a 30 wt% catalyst slurry mixture. The agitator is used during this time to ensure adequate suspension and more uniform concentration of the slurry.

Reduction gas, consisting of a blend of 96 volume % nitrogen and 4 volume % carbon monoxide (CO), is introduced into the reduction vessel via a gas sparger. The agitator is not required once the reduction gas is introduced. Over the course of the reduction, the slurry temperature is carefully increased while the consumption of CO is monitored to determine when the catalyst is completely reduced. The loss of oil to the vapor phase results in an increase to the catalyst concentration in the slurry from 30 wt % to approximately 40 wt %. The gas stream exiting the reduction vessel is cooled in the 29E-31 condenser, to condense any oil vapors leaving the reduction vessel against the reduction feed. The condensed oil is collected in the 29C-31 separator over the course of the reduction. This oil is reclaimed at the beginning of the next catalyst reduction batch. The temperature in the 29C-31 separator condensate accumulator is controlled by bypassing the reduction feed to minimize the amount of water condensed and collected with the oil.

The catalyst reduction procedure is completed in approximately 20 hours. At the end of reduction, the catalyst is fully active and can be transferred directly to the LPMEOH™ reactor via the 29G-30 transfer pump.

As new catalyst slurry is added to the LPMEOH™ reactor, the catalyst inventory is maintained by withdrawing an equivalent amount of partially deactivated or spent slurry from the reactor. Prior to transferring the slurry from the reactor, the 29C-30 catalyst reduction vessel is pre-warmed using the utility oil skid. The spent slurry is pressure transferred back to the 29C-30 catalyst reduction vessel via the recycle control valve around the 29G-30 Slurry Transfer Pump. Once there, the slurry is purged of the dissolved gases and cooled to a safe handling level at a rate of 60°F/hour using the utility oil system. After cooling, the spent slurry is transferred to the drums or tote bins. The containers will either be shipped off-site to a processor for metals recovery or will be hauled to the on-site incinerator.

4. Emissions and Discharges

4.1 General Description

Figure 4-1 "LPMEOH™ Plant Process and Waste Streams" is a diagram that shows the processing blocks, the emissions from these areas and the disposal points. The disposal points for the gas streams leaving the process are 1) existing Eastman boilers, 2) an existing Eastman scrubber, 3) the atmosphere, and 4) a new vent scrubber (item 29C-120). The great majority of the material is unconverted synthesis gas which goes to the boilers and is burned. These streams will be detailed in subsequent sections.

The solid waste streams will go to either 1) an offsite metals reclaimer, or 2) an existing Eastman incinerator.

The liquid wastes including storm water run-off from process areas will be treated in Eastman's existing Wastewater Treatment Facility.

4.2 Atmospheric Emissions and Control Systems

Four types of streams comprise the emission to the atmosphere:

1) Those that are treated in an existing vent scrubber in Plant 31 (31C-30)
2) Those that are sent to an existing boiler and burned
3) Those that are vented through the new 29C-120 Vent Scrubber to the atmosphere
4) Those that are vented directly to the atmosphere through local vents.

These streams are listed in Table 4-1. No new control devices are added except for the 29C-120 Vent Scrubber. This device is designed to handle plant emergency situations. The great majority of the plant safety valves are either vented to the 29D-02 Slurry Tank (if they contain oil) or the 29D-01 Safety Relief Knock-Out Drum. These vessels would contain liquids for identification and disposal. The vapors from these tanks go to the 29C-120 vent scrubber. Since this stream might contain methanol vapor, it is contacted with a water spray before it is vented through the tall stack to the atmosphere. The water spray is activated by a flow vane which detects any flow to the 29C-120. The scrub water from this vessel goes to the sewer and on to the wastewater treatment facility. Appendix A, Sheet 5 shows the relationship of the 29D-01 and 29C-120 described previously.

4.3 Aqueous Discharges and Control Systems

The aqueous discharges of the facility are directed to three discharge points.

- The existing Eastman wastewater treatment plant
- Directly to the Holston River
- To the existing Eastman Plant 19 (Lurgi Methanol Plant)

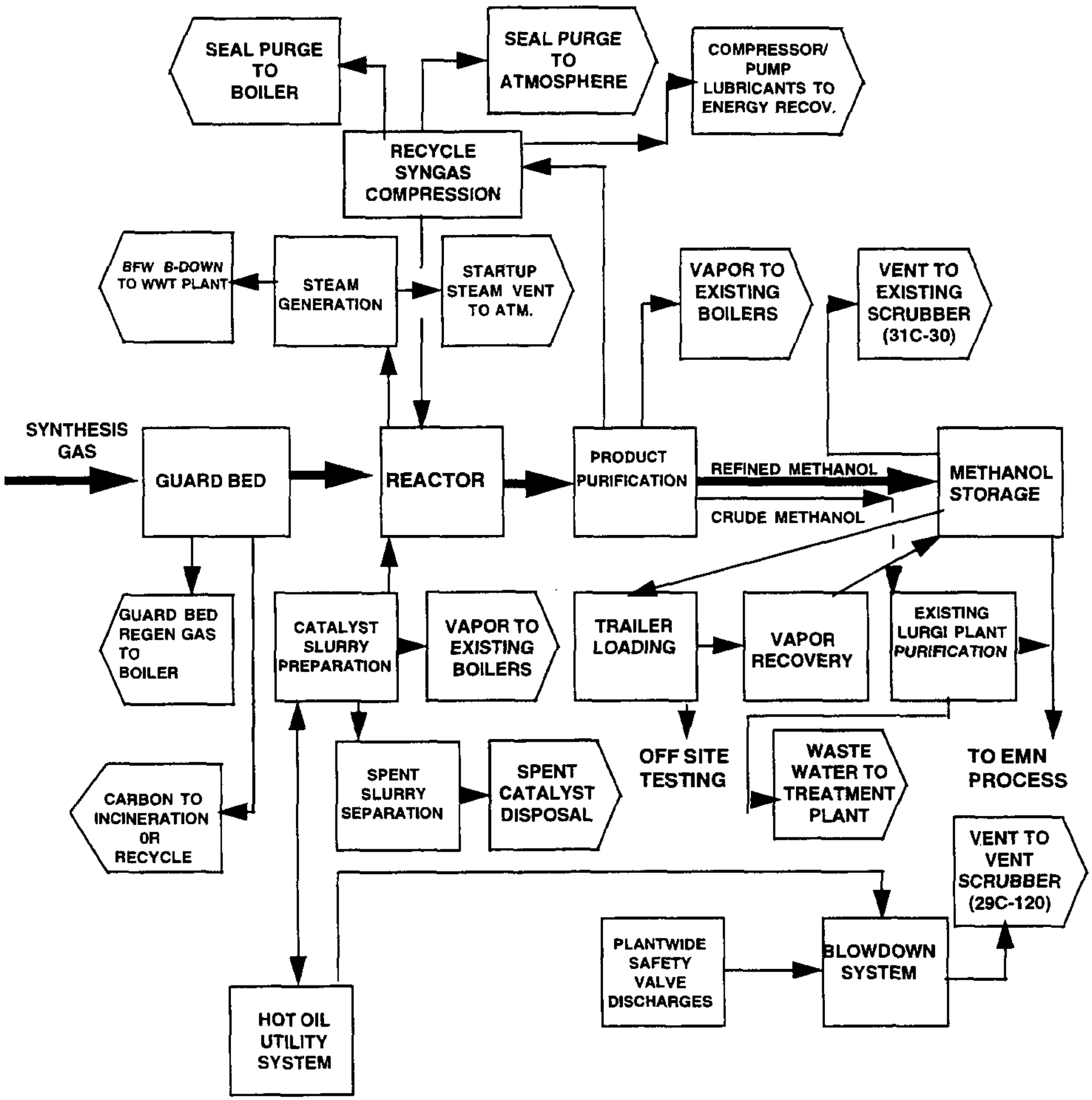


FIGURE 4-1 LPMEOH™ DEMONSTRATION UNIT PROCESS AND WASTE STREAMS

FIG4-1.PPT FSF 4/10/96

TABLE 4-1 ATMOSPHERIC EMISSIONS
Environmental Monitoring Plan
LISTING OF WASTE STREAMS THAT END UP BEING VENTED TO THE ATMOSPHERE

(a) Point	Stream description	Source	Valve	(d) MB point	(b) Flow	(c) Analysis
	To Existing Vent Scrubber in Eastman's in Plant 31					
21	MeOH Storage Vent	D-20 & D-21	PSV 1680		N	N
22	MeOH Drain Tank Vent	D-25	PSV 1648		N	N
	To Tail Gas Header- To Existing Eastman Boilers					
24	Compressor (process side) Seal Gas	K-01			N	N
29	Reduction Gas Vent	C-31			N	GC #10
25	Guard Bed Regeneration				N	N
23	Plant Feed Gas Bypass		V 1041		N	N
19	Distillation Fuel Gas	C-11,C12&C-21		19	FI-810	GC #8
37	Analytical Sample Streams				N	N
148	Main Purge Gas Stream	C-03	PV 150	148	FI 157	GC #7
27	Total of all the above streams to the Existing Boilers				N	N
	Vented Directly to the Atmosphere					
35	Compressor(gear box side)Seal Gas	K-01			N	N
35	*Oil Storage Tank(D-30) Vent*	*D-30*	*PCV1421*		N	N
35	Oil Water separator(C-50)Vent	C-50			N	N
35	Start up steam	C-02	V1608		N	N
34	Equipment Leak Emissions				N	Y
35	Compressor(K-01)lube Oil Vent	K-70			N	N
	Vented Through 29C-120 Vent Scrubber					
36	Safety Relief KO Drum(D-01)	D-01,D-02	FT801	765	N	N

Notes:

(a) Point refers to points shown on Figures 7-1, 7-2, and 7-3
(b) N= not measured; Y= measured
(c) N= not analyzed; Y= analyzed; GC# = analyzed at continuous gas chromatograph point #
(d) MB Point = Material Balance Point shown on Process Flowsheet (Appendix A)

4.3.1 Aqueous Flows to the Wastewater Treatment Plant

4.3.1.1 Process Flows

The following process waste streams are directed to the sewer system which flows to the Eastman wastewater treatment plant

- Boiler Feedwater Blowdown
- Scrub Water from 29C-120 (intermittent flow)

4.3.1.2 Non Process Flows

All of the process areas are curbed and contain catch basins leading to the sewer system. Process areas which might have an oil or catalyst slurry spill are directed to an oil water separator installed below grade. The function of this device is to first of all collect the solids in a head works area (the velocity through the separation is less than 3 ft/min). Any oil is separated by uniquely designed plates that attract the oil to their surface, the oil flows up along the surface and is skimmed away to a storage compartment. As required, this oil will be removed by a licensed contractor for disposal. The solids will also be removed and disposed of in the same manner. The process areas that do not have the oil spill potential will bypass the oil/water separator and go directly to the interceptor sewer. These flows are shown in Figure 4-2.

4.3.2 Aqueous Flows Directly to the Holston River

- Cooling Tower Blowdown - The LPMEOH™ facility receives cooling water from an existing cooling tower. To the extent that it contributes additional heat load to the tower it will induce an incremental blowdown requirement. The tower blowdown goes directly to the river without treatment.

- Stormwater runoff from non process areas will flow through the storm-water drains, ditches, and/or swales and will be directed to the river.

4.3.3 Aqueous Flow to Eastman Lurgi Methanol Plant (Plant 19)

The bottoms from the 29C-20 methanol rectifier column contain methanol, water and higher alcohols. This stream goes to a distillation tower in the existing Lurgi plant for recovery of additional methanol. It contributes to a waste stream that is generated at the bottom of a subsequent distillation tower. Currently, the alcohol/water stream is treated in the wastewater treatment facility. However, due to the increased flow from the Liquid Phase Methanol plant and the limitations of Plant 19 distillation, it may become necessary to install additional controls in order to comply with HON[1] requirements. Eastman is evaluating the current capabilities of Plant 19's distillation section.

[1]Hazardous Organics Portion of National Emission Standards for Hazardous Air Pollutants

STORMWATER FLOWS LPMEOH

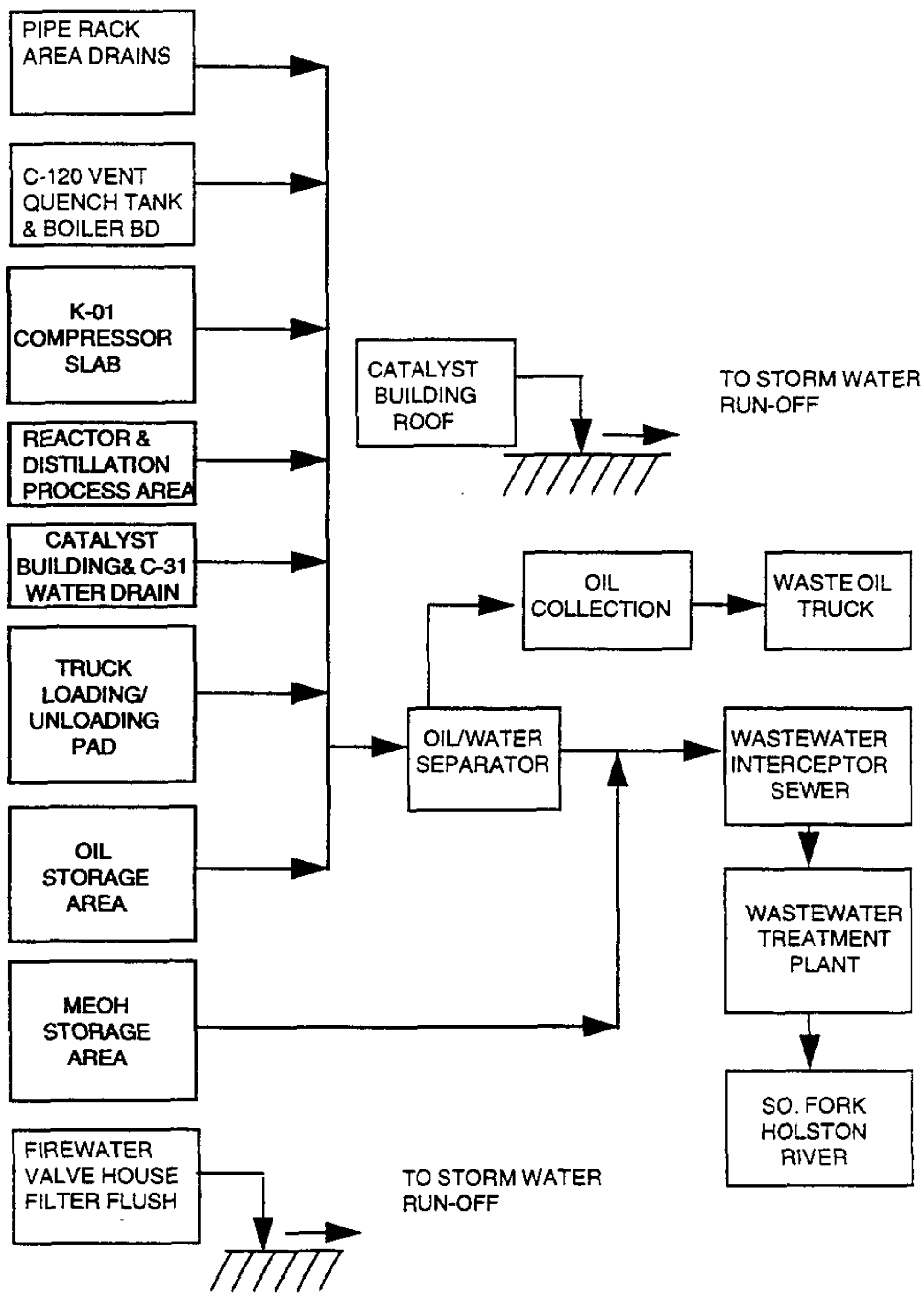


FIGURE 4-2 LPMEOH STORM WATER RUN OFF

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STORMDR1.PPT

4.4 Solid Waste Discharges and Management Systems

The plant has only two solid waste streams:

- Spent Catalyst - a slurry
- Guard Bed Adsorbent

4.4.1 Spent Catalyst Slurry

A portion (about 5%) of the catalyst slurry is removed from the reactor every 12-14 days. This slurry is approximately 40 weight % reduced catalyst and 60 weight % mineral oil. It is cooled and stripped with nitrogen to remove any alcohols or other light materials (this stripping gas goes to the boilers). The slurry is put into drums and sent to a metals reclaimer where the copper and zinc values are recovered.

4.4.2 Guard Bed Adsorbent

It is anticipated that a single charge of activated carbon will last for the four-year demonstration. Provisions are made for regenerating the adsorbent by heating with nitrogen gas (this waste gas also goes to the existing Eastman boilers). When the carbon loses its ability to adsorb nickel or iron carbonyl it will be removed, packaged in fiber drums and sent to the existing Eastman incinerator. An alternative might be to send it back to the manufacturer for recycling.

5. Compliance Monitoring

5.1 Existing System

Eastman's Kingsport facility has approximately 600 process emission sources. These permits account for over 2600 process vents. The State of Tennessee has granted an air construction permit for the LPMEOH™ addition. The LPMEOH™ Process emission source contains five process vents, three from oil storage equipment, one from the relief system, and the last vent accounting for equipment leaks. These vents and the permit will be described later in this section.

The LPMEOH™ demonstration unit will impact the air permits for two other process emission sources, the B-325 boilers and the plant 31 scrubber. In addition, because of the large capacity of Eastman's waste water treatment facility, the affect on the existing permit for the outfall to the river is negligible. All of these issues will be addressed in more detail later in this section.

5.1.1 Gaseous Streams

5.1.1.1 Boilers

NSPS and the HON require Eastman to monitor whether flow from the waste gas header is being vented to the boiler, to another control device such as the flare, or to the atmosphere. Normally, flow is directed to the boiler. A semi annual report is filed with the state indicating when the stream is diverted to the flare. No other monitoring is required.

Another regulation that covers one of the boilers is the Boiler and Industrial Furnace regulations that are part of RCRA. Since a vent is being added to the header, a waste characterization will be needed. This would involve initial sampling and analysis of the header gas after the LPMEOH™ demonstration unit is operational. The current law also requires additional sampling after three years. These samples will be analyzed for metals, chlorine, heating value, and ash.

5.1.1.2 Plant 31 (Methyl Acetate Plant)

Documentation produced by the permitting personnel at Eastman in agreement with state regulators do not indicate that controlled storage tanks will need to be monitored to meet NSPS and HON regulations, but that the device that is controlling the emissions will need to be monitored. Measuring water flow and acetic acid flow to the absorber is adequate proof of the removal efficiency and will be all that is required. Regardless, because Plant 31 is a covered HON process, this monitoring will have to be done and no additional monitoring equipment will be required.

5.1.2 Aqueous Streams

5.1.2.1 Discharges to the Sewer

Wastewater from the demonstration unit is combined with wastewater from all the plants in the coal gasification complex in Eastman's interceptor sewer (ITS). This combined wastewater stream will be monitored for total flow, Total Organic Carbon (TOC), and pH before the Waste Water Treatment (WWT) Plant and at the outfall as specified in the NPDES permit. All process areas are curbed and drain to the ITS to contain any potential spills.

5.1.3 Solid Wastes

The solid process wastes generated by the demonstration unit will not be co-mingled. A discussion of their monitoring is included in Section 5.2.3.

5.2 Demonstration Project

5.2.1 Air Permit

The Air Permit for the LPMEOH™ demonstration unit is included in the Appendix. It identifies five new sources from this demonstration (see Fig. 5-2):

A. Conservation Vent from 29D-30 Fresh Oil Storage Tank
B. Conservation Vent from Tank 29D-31 Reclaimed Oil Storage Tank
C. Conservation Vent from Tank 29C-36 Slurry Centrifuge Surge Pot
D. Relief System; Vent from Water scrubber 29C-120
E. Equipment leaks (Fugitive Emissions)

Table 5-2 shows the type and quantity of emissions from each of these sources. Note that process changes have resulted in the deletion of 29D-31 and 29C-36 tank vents. These sources had negligible emissions so there is no impact on the permitted quantities.

Point A above does not require monitoring as determined by the State because the vapor pressure of the mineral oil it contains is extremely low. As mentioned above, points B and C no longer exist.

The permit for point D shows a very small flow of carbon monoxide (0.88 tons/yr.). The design of the system producing this material (Conservation vent on 29D-02) has changed from 2% vol. CO to 2% vol H_2. The flow has been reduced to .02 lb./hr of H_2 which would produce approximately 0.09 tons/yr. of H_2 emission in this stack. Any other flows to this source would happen only under upset conditions. The demonstration unit has been designed to minimize the scenarios where the safety valves will be lifted. This stream does not require monitoring as determined by the EPA; there is no applicable standard for hydrogen.

ow Diagram

r Item 7 of APC-21 (& 24)

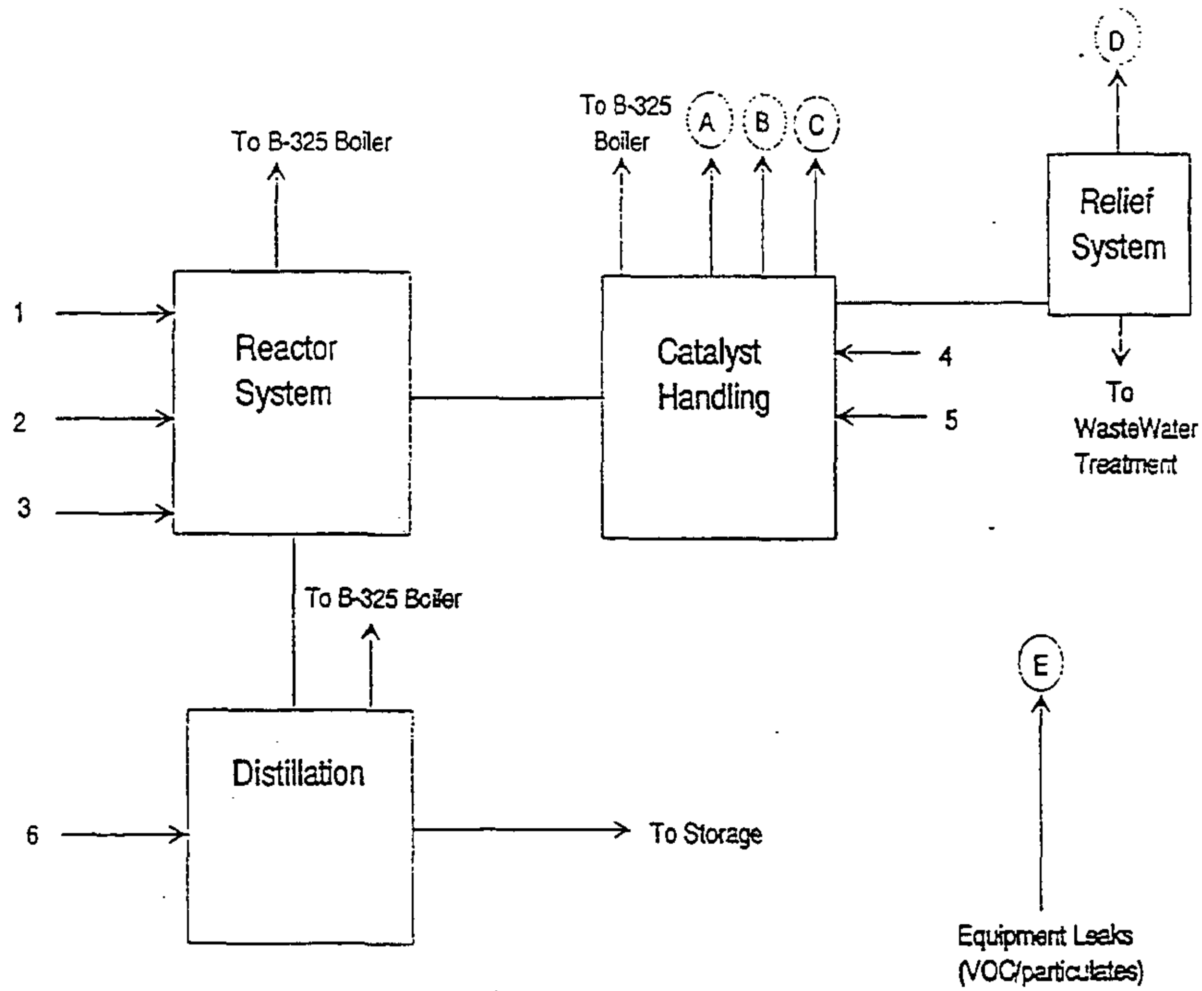


FIGURE 5-2

Process Emission Source
Number B-486-1
Date DEC 0 2 1984
Page 15d of 15

Emission Chances for New/Modified Sources

Vent Code	Type of Emission	* ________ Application Max. Lb/Hr	This Application Max. Lb/Hr	Net Change Max. Lb/Hr	Hrs./Yr.	Net Change Max. TYP
A	VOC	Not Applicable	Negligible	-	8760	Negligible
B	VOC	Not Applicable	Negligible	-	8760	Negligible
C	VOC	Not Applicable	Negligible	-	8760	Negligible
D	CO	Not Applicable	0.20	+0.20	8760	+0.88
Fugitives E	VOC	Not Applicable	4.56 TPY	-	8760	+4.56
	CO	Not Applicable	1.72 TPY	-	8760	+1.72
	TSP	Not Applicable	0.10 TPY	-	8760	+0.10
	Others	Not Applicable	1.68 TPY	-	8760	+1.68

Total Emission Change:	max. lbs./hr.	max. TPY
VOC	-	+4.56
TSP	-	+0.10
SO_2	-	-
NO_x	-	-
CO	-	+2.60
Other	-	+1.68

* Previous Application Submittal Date
(New Source)

TABLE 5-2

5.2.1.1 Fugitive Emissions

Under requirements covered in the HON, Eastman is required to establish a Leak Detection and Repair (LDAR) program for the LPMEOH™ demonstration unit. This program will use EPA method 21 to test all potential leak points for fugitive VOC emissions on a regular basis. Leak and repairs will be documented as specified in the HON.

The LDAR program requires monitoring on a quarterly basis. The monitoring involves using a flame ionization detector to sniff the air around potential leak points such as valve packing and piping flanges. The detector checks ppm levels of Volatile Organic Compounds (VOC). At this time, the Fugitive Emission Management (FEMS) database for the demonstration unit has not been built. However, Table 5-3 shows an example of a FEMS database report for the existing methanol unit. A "leaker" is defined as a potential leakpoint with emission greater than 500 ppm VOC. Leakers must be repaired within a specified timeframe. If the percent of leakers drops below 2% of the total number of potential leakpoints, the reporting frequency drops to once every six months.

In addition to the LDAR requirements, the Industrial Hygiene Department will conduct a workplace exposure study to determine the normal CO background concentration. This will be done by placing a portable CO analyzer and recorder on a LPMEOH™ operations person during the course of a full day. The analyzer will record the concentration of CO that is encountered in a normal day of plant operation. This study will be conducted once within six months after the start of operations. Experience has shown that unless procedures change this one time study will be adequate for the four year program.

5.2.1.2 Particulate Emissions

Particulate emissions from the catalyst handling process will be monitored by the Industrial Hygiene Department in periodic workplace exposure studies. Similar to the CO monitor, a device to monitor particulates will be worn by a LPMEOH™ operator during the catalyst charging process. The device will record the normal exposure level to particulate emissions that personnel will encounter during this process. This study will be conducted once during the first year of operation. Experience has shown that unless procedures change this one time study will be adequate for the four year program.

5.2.2 Aqueous Streams

The aqueous discharges from the demonstration unit are described in section 4.3. None of the sources end up as new discharge points to the environment, each represents a small addition to an existing discharge point. As described in section 5.1.2 these streams do not effect the existing Eastman permits and therefore are not required to be monitored separately. As required by the NPDES permit, the combined stream is monitored at the outfall of the wastewater treatment facility. These results are reported quarterly to the State and will be included in the quarterly Environmental Monitoring Report (EMR).

5.2.3 Solid Wastes

There are two solid waste streams from the demonstration unit. The first is the spent catalyst slurry which will be sent offsite to a metals reclaimer. The second stream is spent guard bed adsorbent (note that there are two guard beds in the process, the existing one which contains a catalytic material and the new bed which contains an adsorbent material) which will be incinerated on site. The Eastman incinerator is classified as a hazardous waste incinerator. Both hazardous and non-hazardous waste can be burned in this incinerator. The state only requires that input rate of hazardous waste be monitored. Because the guard bed adsorbent for the demonstration unit is similar to the guard bed adsorbent used in the existing Methanol unit which is considered non-hazardous based on testing required by RCRA, compliance monitoring should not be required. It will be necessary to confirm the non-hazardous classification when the new guard bed is in operation.

TABLE 5- 3
PAGE 1 OF 2

Leak Sum..ary Report
Acid Division

Reporting Period Start Date :07/01/95
Reporting Period Ending Date :02/01/96

Area ACID-AA

Sub Area MEOH

Equipment Type	Chemical State / Monitor Type	Initial Number Scheduled	Points Remaining	Number Leakers	Percent Leakers	Number of Repair Attempts	Number Repaired	Number Still Leaking	Percent Repaired	Number Repair Delays
CON	Light Liquid / Monitor	785	0	8	1.02	11	8	0	100	0
CON	Light Liquid / Visual	234	0	0	N/A	0	0	0	N/A	0
CON	Vapor / Monitor	219	0	3	1.37	4	3	0	100	0
CON	Vapor / Visual	128	0	0	N/A	0	0	0	N/A	0
Summary for CON		**1366**	**0**	**11**	**N/A**	**15**	**11**	**0**	**N/A**	**0**
CVS	Vapor / Monitor	31	0	0	.000	0	0	0	****	0
CVS	Vapor / Visual	6	0	0	N/A	0	0	0	N/A	0
Summary for CVS		**37**	**0**	**0**	**N/A**	**0**	**0**	**0**	**N/A**	**0**
INS	Light Liquid / Visual	77	0	0	N/A	0	0	0	N/A	0
INS	Vapor / Visual	18	0	0	N/A	0	0	0	N/A	0
Summary for INS		**95**	**0**	**0**	**N/A**	**0**	**0**	**0**	**N/A**	**0**
PMP	Light Liquid / Monitor	152	0	8	5.26	10	7	1	87.5	0

Note 1: "Initial Number Scheduled" includes first monitoring attempts only.
Note 2: "Number of Repair Attempts" includes multiple attempts on the same point.
Note 3: "Percent Leakers" is based on the total number of points monitored.
Note 4: For CON & SCR, Light Liquid or Vapor points with Visual compliance method are Exempt points.

TABLE 5-3
PAGE 2 OF 2

Leak Summary Report
Acid Division

Reporting Period Start Date :07/01/95
Reporting Period Ending Date :02/01/96

Area ACID-AA

Sub Area MEOH

Equipment Type	Chemical State / Monitor Type	Initial Number Scheduled	Points Remaining	Number Leakers	Percent Leakers	Number of Repair Attempts	Number Repaired	Number Still Leaking	Percent Repaired	Number Repair Delays
PMP	Light Liquid / Visual	589	0	1	N/A	1	1	0	N/A	0
Summary for PMP		741	0	9	N/A	11	8	1	N/A	0
PRV	Vapor / Visual	120	0	0	N/A	0	0	0	N/A	0
Summary for PRV		120	0	0	N/A	0	0	0	N/A	0
VLV	Light Liquid / Monitor	1045	274	12	1.15	12	11	1	91.7	1
VLV	Light Liquid / Visual	1	0	1	N/A	1	1	0	N/A	0
VLV	Vapor / Monitor	313	91	4	1.28	4	2	2	50.0	2
Summary for VLV		1359	365	17	N/A	17	14	3	N/A	3
Summary for MEOH		3718	365	37	N/A	43	33	4	N/A	3

Note 1: "Initial Number Scheduled" includes first monitoring attempts only.
Note 2: "Number of Repair Attempts" includes multiple attempts on the same point.
Note 3: "Percent Leakers" is based on the total number of points monitored.
Note 4: For CON & SCR, Light Liquid or Vapor points with Visual compliance method are Exempt points.

6. Supplemental Monitoring

6.1 General

The attached Figure 6-1 is from the Cooperative Agreement. It describes in simple terms how the Liquid Phase Methanol Demonstration Unit integrates with existing Eastman Facilities. The Cooperative Agreement states that even though the data from the existing subsystems (non-shaded blocks) are not considered contract data, Eastman will provide certain types of "Publicly Available Technical Data" for these units. An outline of this data is contained in section 6.2.

A description of the data that will be collected on the Liquid Phase Methanol Demonstration Unit is given in 6.3.

6.2 Existing Subsystem Data

6.2.1 Catalyst Guard Bed

The existing catalyst guard bed (shown in Figure 7-1) at Eastman's gasification facility is designed to remove all sulfur containing compounds from the feed synthesis gas. It has been in service since 1991. The guard bed catalyst has been replaced only one time, in 1995. It is not expected to be replaced again until 1999. Figure 6-2 shows a configuration of the guard bed with relevant dimensions. The synthesis gas streams before and after the guard bed are analyzed periodically for hydrogen sulfide. From this analysis, a sulfur removal efficiency can be determined (typically the efficiency is 45-50% removal).

6.2.2 Methanol Distillation

Refined methanol from the LPMEOH™ demonstration unit would be combined with refined methanol product from the Distillation unit in Eastman's existing Plant 19 (Lurgi Methanol Plant). In addition, a crude methanol stream from the LPMEOH™ demonstration unit would be fed to the Distillation unit in Plant 19 for further refining. All of the refined methanol will be used in Eastman's existing methyl acetate production facility. Table 6-1 lists the specification that Eastman uses as the basis for their internal acceptance criteria.

6.2.3 Coal Gasification

In order to corroborate coal gasification data from other Clean Coal Technology projects, Eastman will provide publicly available data from the existing gasification complex. Figure 6-1 shows a schematic of the Eastman Coal Gasification and Gas Cleanup facility with the major streams entering the facility and the major effluent streams. Table 6-2 lists the streams and the parameters that will be monitored and reported from publicly available data.

6.3 Liquid Phase Methanol Data

6.3.1 1994 Catalyst Poisons Study

A comprehensive study of all three of the future feed streams to the Kingsport LPMEOH™ facility was conducted by APCI's and Eastman's analytical teams. The study was completed over a one year period and analyzed the following streams and solids for trace compounds which might poison the LPMEOH™ catalyst:

- spent catalyst from Eastman's existing Lurgi unit
- spent guard bed adsorbents from the Lurgi unit
- gas cylinders of the three feed streams collected at two different points in time and analyzed by APCI's analytical team in Allentown
- on-line sampling conducted by both Eastman and APCI analytical experts at Kingsport

The study included the elements and inorganic compounds that are recognized as Hazardous Air Pollutants (HAPS). A summary of our findings, as well as individual reports on different analytical tests are included in the appendix.

6.3.2 1996 LPMEOH™ Reactor Study

An additional study is planned to assure that the Kingsport feed gases do not contain any, as of yet, unquantified trace compounds that could poison the catalyst. This study will be conducted in mid-1996 and will involve running a portable lab-scale slurry autoclave using two of the feed gases at the Eastman site. The portable unit will be equipped with different size guard beds to allow testing of various adsorbents, should a catalyst poison be found. It will also be equipped with appropriate gas chromatograph equipment to allow quantification of known catalyst poisons, as well as the bulk gas analysis. The tests are expected to last approximately 4 weeks. The schedule for construction and startup of the portable laboratory, the details of the analytical equipment being installed, as well as, a P&ID for the test unit are attached in the appendix.

6.3.3 Air Monitoring

No supplemental air monitoring is expected.

6.3.4 Noise

The plant is designed to meet OSHA noise regulations. The K-01 feed gas compressor is expected to be near the 85 dBA limit during operation. This unit will be tested during startup.

BLOCK FLOW DIAGRAM

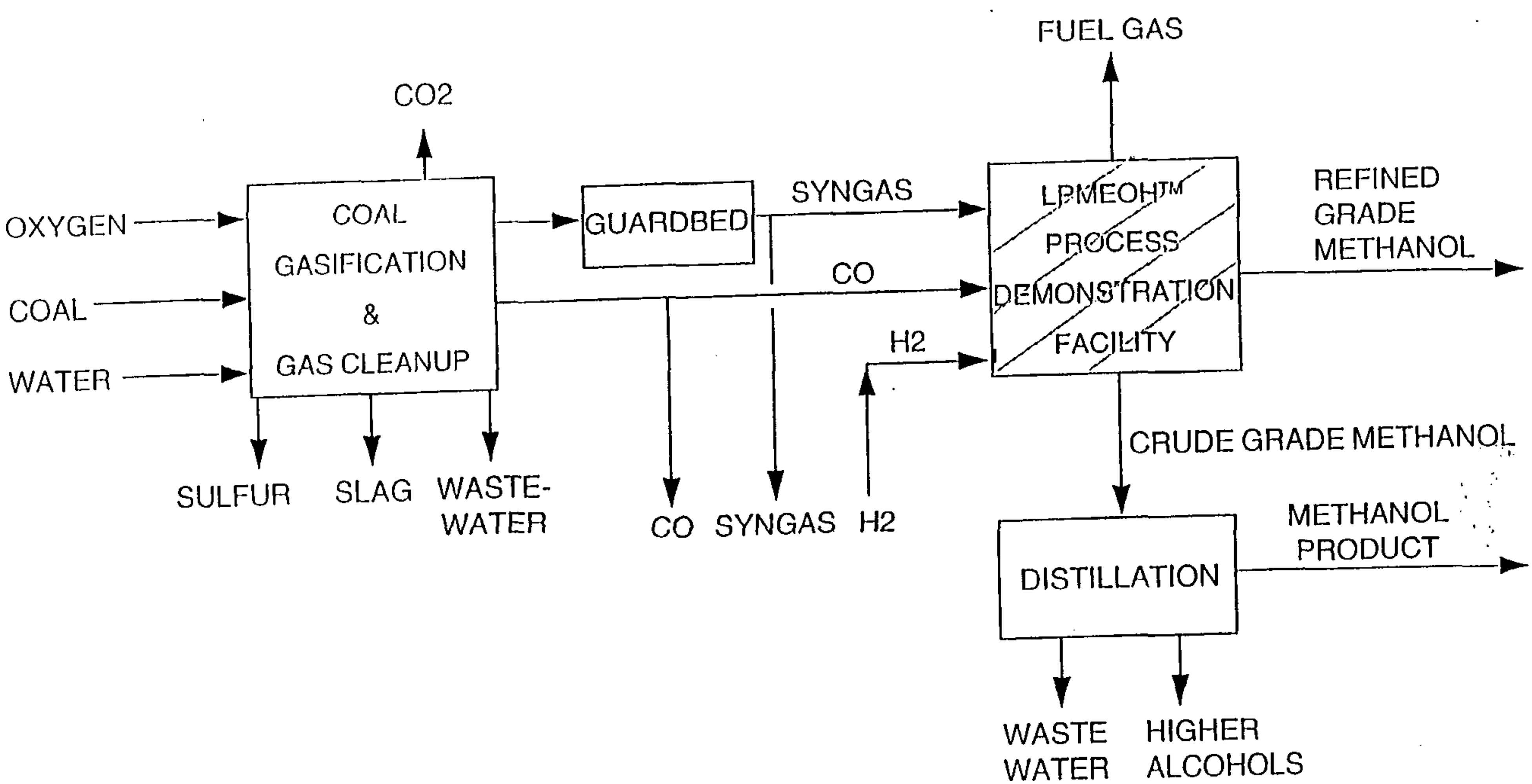


FIGURE 6-1

P14N1 Rev. 9/28/94/jjs

10C-30 CATALYST GUARD BED

SUPPORT/CATALYST LOADING

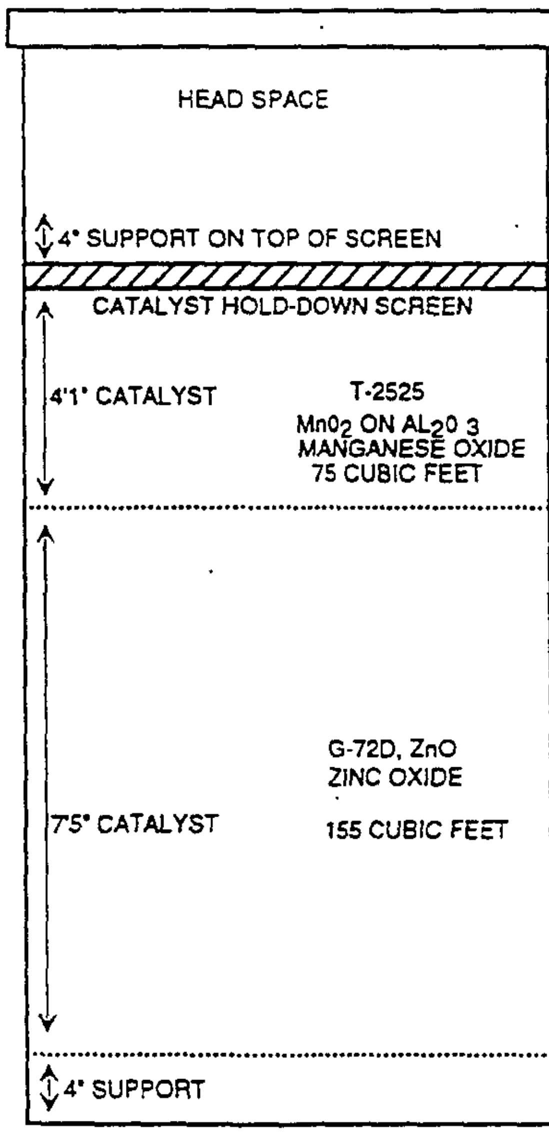


FIGURE 6-2

TABLE 6-1

Refined Methanol Internal Acceptance Criteria

Component	Upper Internal Manufacturing Limit (WT. %)
Acetic Acid	0.0030 %
Water	0.0300 %
Decane	12 ppm
Methyl Alcohol	99.9 % (lower limit)
Acetone	125 ppm
Ethyl Alcohol	500 ppm

TABLE 6-1

List of Streams Entering and Leaving Eastman's Coal Gasification Facility

	Stream	Description	Parameters*
1	Coal	Fresh coal to gasifier	F,C,H
2	O2	Oxygen fed to gasifier	F
3	H2O	Water fed to gasifier	F
4	WW	Waste water from Gasifier	F,C
5	SG	Clean Syngas from gasification facility	F,C,T,P
6	S	Sulfur recovered from gasification facility	F,A
7	CO2	Carbon dioxide produced from gasifier	F,A
8	Slag	Slag generated from gasifier	F

* A = Assay or Purity
C = Composition
F = Flow
H = Heat Value
P = Pressure
T = Temperature

TABLE 6-2

6.3.5 Liquid Waste Monitoring

6.3.5.1 Non-Process Flows

The oil water separator will be inspected monthly. The volume of materials (oil and solids) that are removed will be recorded. The amount of any waste oils that are generated by the facility will be recorded. (Function of the oil water separator and waste disposal are described in 4.3.1.2.)

6.3.6 Solid Waste

6.3.6.1 Spent Catalyst Slurry

Each batch of spent catalyst will be analyzed for percent solids.

The total weight of the material will also be reported. This will be compared to the Environmental Assessment (EA) data. (Disposal of this non-hazardous material is described in 4.4.1.)

6.3.6.2 Spent Guard Bed (29C-40) Adsorbent

This material will either go to the Eastman incinerator or will be returned to the supplier. The weight and volume will be recorded. (Disposal of this material is described in 4.4.2.)

6.3.7 Confirmation of EMP from Task 5 Topical Reports

The Phase 3, Task 5 - Data Collection and Monitoring task in the Statement of Work will provide confirmation of the environmental acceptability of the LPMEOH™ technology for replication in future projects. Air Products will prepare Topical Reports as further outlined in the Demonstration Test Plan and Technical Progress Reports containing the analysis of the operation of the LPMEOH™ Process Demonstration Unit. These Reports will include compositions, temperatures, pressures and flowrates of materials and energy entering and leaving the LPMEOH™ Process Demonstration Facility. This will include any potential HAPS (Hazardous Air Pollutants) determined to be of significance.

If the Task 5 analysis of the operation of the LPMEOH™ Process Demonstration Unit show any discrepancies which might impact the environmental acceptability of the LPMEOH™ technology, then this Environmental Monitoring Plan will be appropriately modified to address the discrepancy.

Section 7 - Data Management and Reporting

7.0 General - Background and Overview

The LPMEOH™ process will be commercialized in conjunction with integrated gasification combined cycle (IGCC) electric power generation facilities. The LPMEOH™ process is aimed at directly converting synthesis gas, as produced by modern coal gasifiers, to produce liquid fuels and chemical feedstocks as a coproduct with electricity. The demonstration at Kingsport has some of the features of this commercial application, such as the coal gasification and gas cleanup facility, which operates steadily at full load, both at Kingsport and for commercial applications. However, other needs of the demonstration are not available at Kingsport, such as : a) synthesis gas compositions rich in carbon monoxide "as-produced" directly from the coal gasifier, and b) a combined cycle power plant with electricity demand load-following. Other CCT Projects (e.g. - Tampa, Wabash River) are demonstrating IGCC, so commercial and environmental data will be available from these CCT Programs, to fill in the gaps that cannot done directly in the demonstration at Kingsport. The LPMEOH™ process demonstration at Kingsport must therefore depend in part, on a carefully developed test plan, with specific tests which simulate operation of future IGCC/LPMEOH™ commercial plant designs in which methanol is coproduced with power in a combined cycle coal gasification plant.

The carefully developed operation test plan is to be carried out during the four-year methanol operation phase (Task 2.1 of Phase 3). Task 2.1 is broken into three sequential tasks, in each of which appropriate test runs will be conducted to simulate and demonstrate the commercial IGCC design integration. The actual test runs will depend on the results of previous operations. A "run authorization" document containing the run goals, feed gas availability, safety concerns, details of the operating conditions, non-typical samples to be taken and expected results for each specific case, will be issued and will be available for DOE review prior to the start of the run. Results of each run will be reported in the Quarterly Technical Progress Reports, including compositions, temperatures, pressures and flow rates of materials and energy entering and leaving the LPMEOH™ process demonstration facility, in addition to recycle streams, run lengths, and other data indicative of process reliability and operability.

EMP Data Management and Reporting.

The EMP data management and reporting will take into account:

- the differences between the Kingsport demonstration and future IGCC/LPMEOH™ commercial plant designs; and
- the environmental data which other CCT IGCC projects will provide; and
- the timing of the different operational test stages and specific tests to be done at Kingsport during Task 2.1 Methanol Operation.

Two EMP objectives must also be satisfied:

- the need to have environmental data which characterizes the special attributes of the LPMEOH™ process technology; e.g. - to support engineering data requirements on environmental impacts of future projects, (In general, this data will be gathered and included in the Quarterly Technical Progress Reports for the specific commercial Task 2.1 tests).

- the need to identify and confirm environmental impacts and the performance predicted in the NEPA documentation for this project. (In general, this data will be gathered and included in the EMR quarterly and annual reports, under the Compliance Monitoring (5.0), and the Supplemental Monitoring (6.0) Sections, and summarized later in this Section 7.).

Overall data management and reporting, to meet these two EMP objectives, is discussed in Sections 7.1 through 7.5 of this EMP. Figure 7-1 shows how Eastman's Coal Gasification and Lurgi Methanol Units integrate with the LPMEOH™ demonstration unit. Figure 7-2 shows the main flows to and from the LPMEOH™ demonstration unit and details which flows are continuous and which are intermittent. Figure 7-3 shows the miscellaneous streams that leave the LPMEOH™ demonstration unit. A description of each of these streams is provided in Table 7-1, which also describes details of the data to be reported, the frequency of data collection and of the sampling and analytic methods.

7.1 Eastman Reporting of "Publicly Available Technical Data".

Refer to Figure 7-1 and Table 7-1. Eastman reporting of "Publicly Available Technical Data.", relating to the three LPMEOH™ process related areas (described in the Statement of Work), will be done as follows:

(a) The gasifier facility at Kingsport. Material balance point #'s; 1, 2, 3, 4, 5, 6, 7, and 8 will be provided in the first year of operation of the LPMEOH™ demonstration unit. If a significant change in gasifier facility operation (e.g., feed stock change, equipment modifications or additions, etc.) occurs, then an update will be provided.

(b) Catalyst Guard Bed on Balanced Gas. Material balance point #'s 5 and 9, including quantities of trace impurities entering and leaving the Catalyst Guard Bed, will be provided in the first year of operation of the LPMEOH™ demonstration unit. If a significant change occurs (e.g. new or additional catalyst, process change, upsets, etc.), then an update on these material balance points will be provided.

Information that has a significant impact on the cost of the guard bed unit, including frequency of replacement of guard bed materials, overall sizes or dimensions of equipment, information on run lengths indicative of process reliability or operability and information relating to operating costs anticipated for a commercial facility, will

INTEGRATION OF EXISTING FACILITIES WITH LPMEOH™ FACILITY

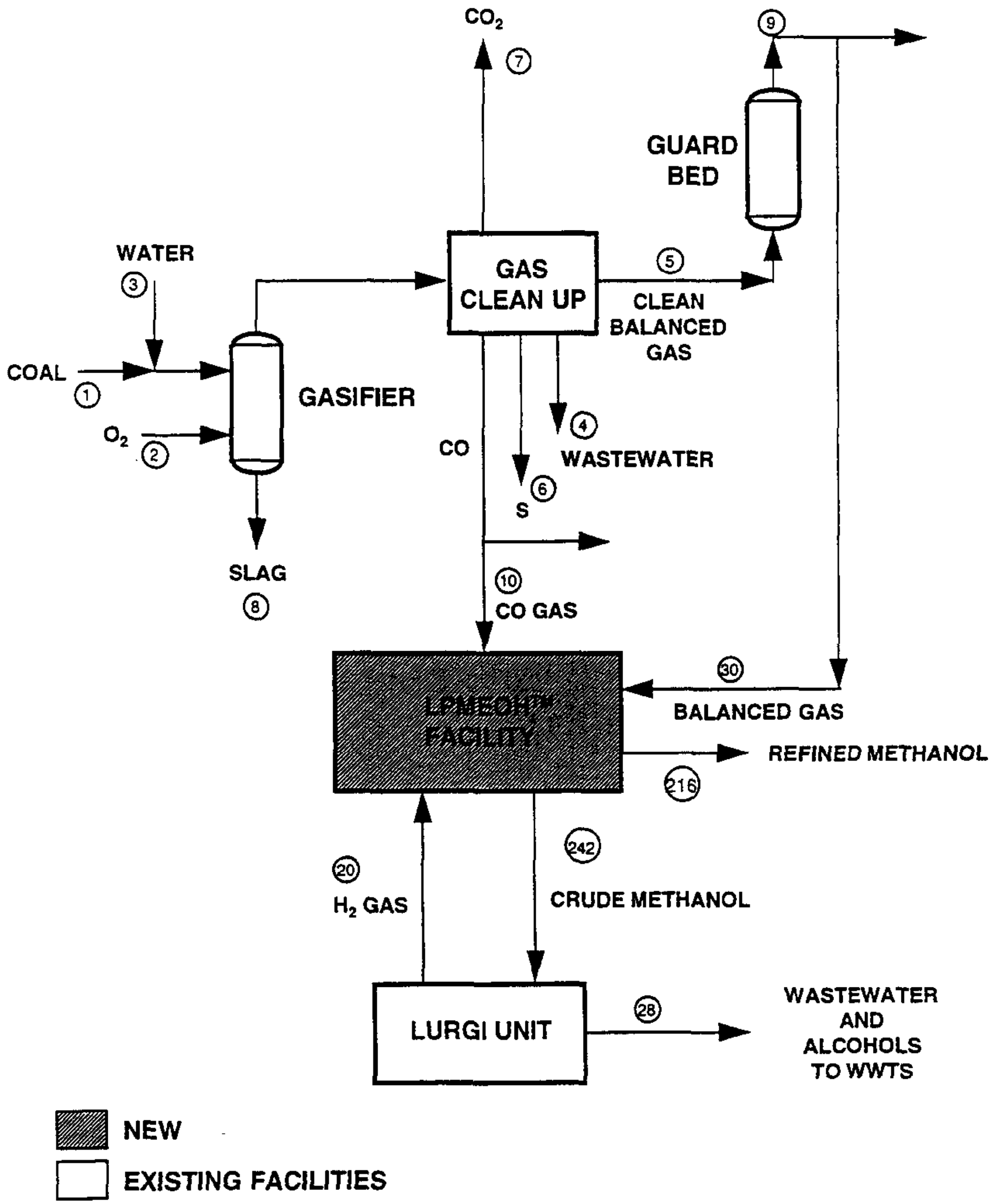


FIGURE 7-1

FSF 5/6/96

LPMeOH1

"LPMEOH™ FACILITY"
SIMPLIFIED ENVIRONMENTAL MONITORING DIAGRAM

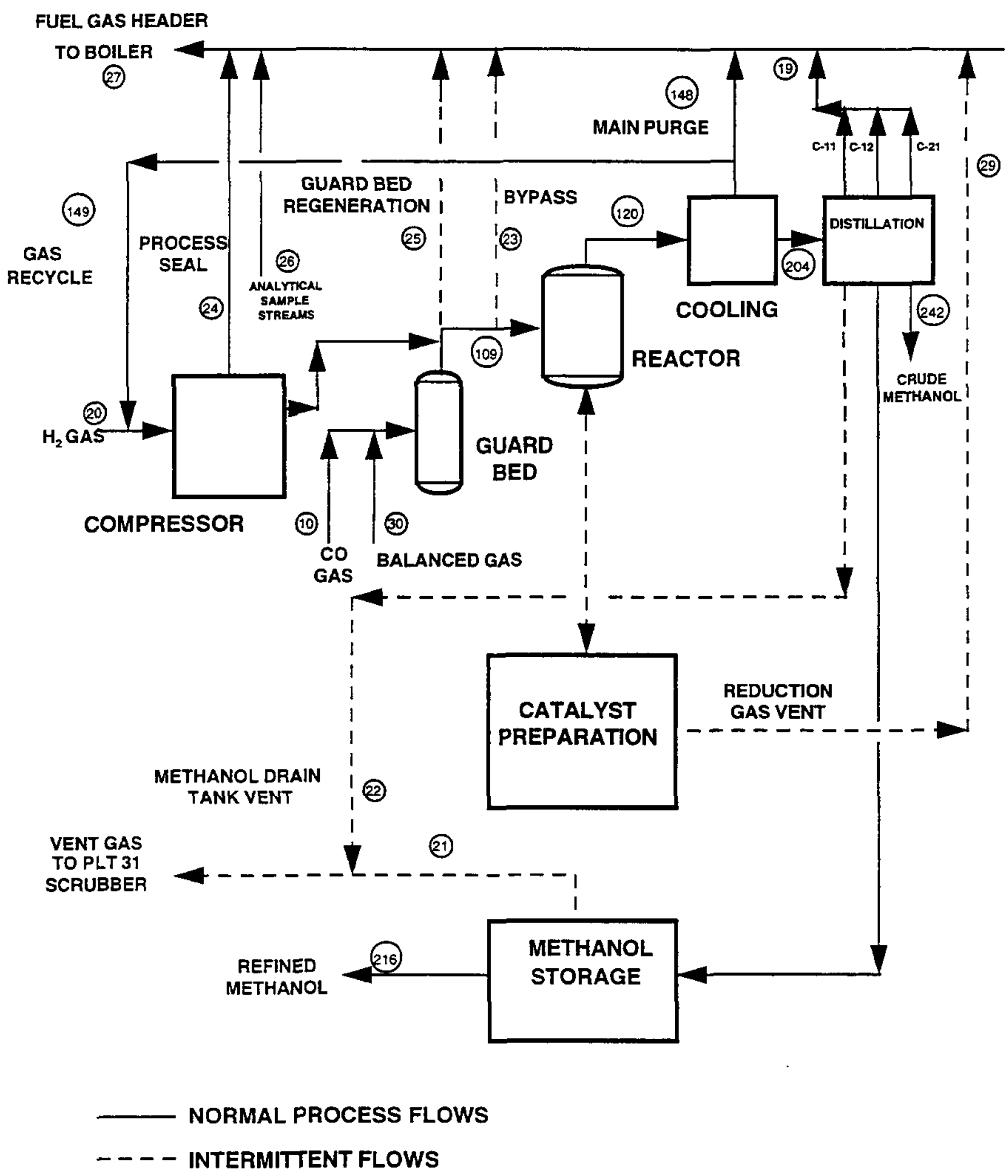


FIGURE 7-2

FSF 5/9/96

MISCELLANEOUS STREAMS LEAVING THE LPMEOH™ FACILITY

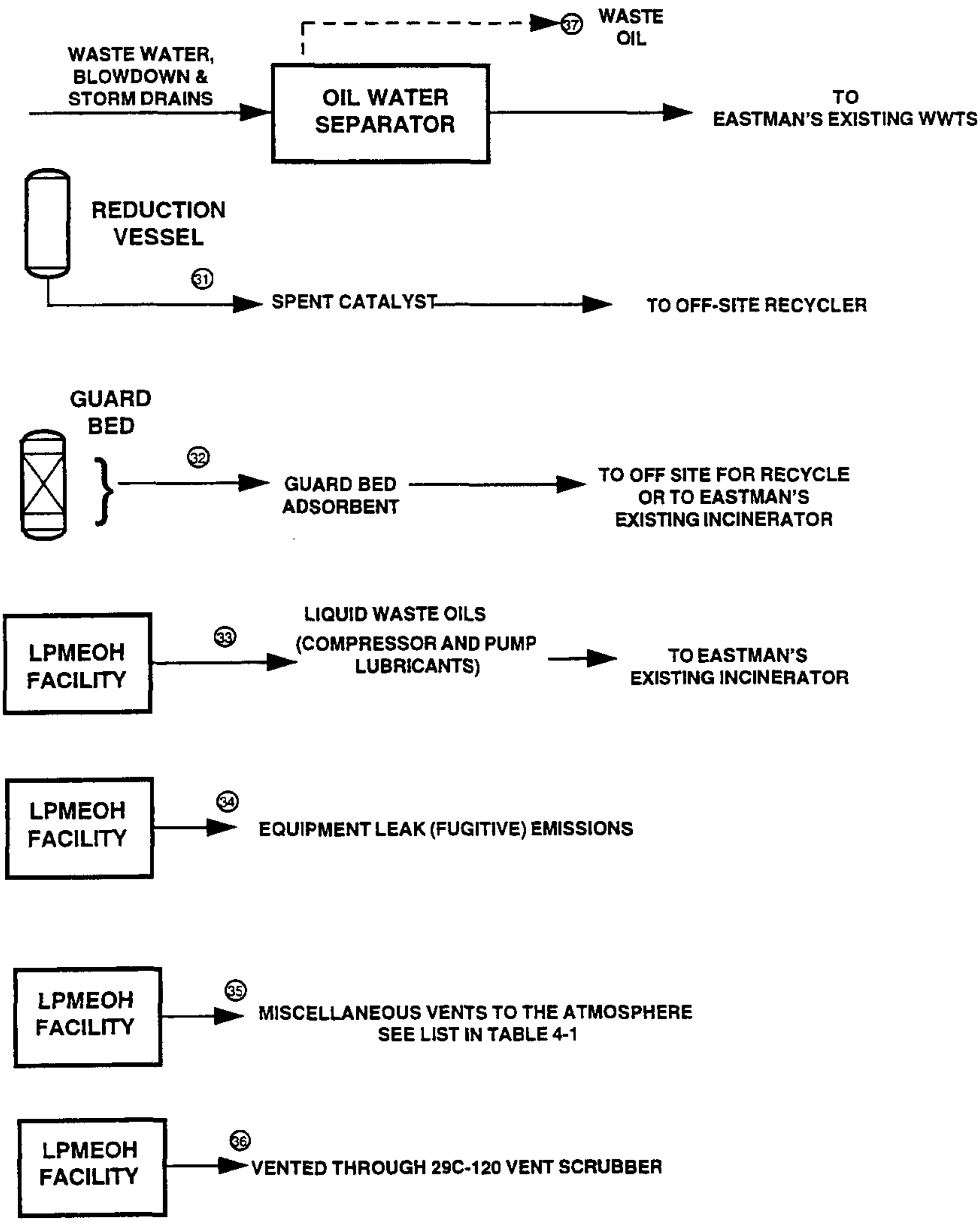


FIGURE 7-3

FSF 5/9/96

be provided in the first year of operation of the LPMEOH™ demonstration unit. An update will be provided if a significant change (as defined above) occurs.

(c) Crude Grade Methanol Distillation. A typical analysis of the crude grade methanol (Material Balance Point # 242) for the first year of operation of the LPMEOH™ demonstration unit will be used for engineering calculations, which will be made to determine the ultimate disposition of the Contained Components. The impact on Material Balance Point # 28 will be calculated and reported, as part of this engineering calculation. During subsequent Process Operational Tests, the composition of the crude methanol is expected to change, and additional engineering calculations of the impact, covering the range of typical compositions, will be done.

The above three areas will be included in separate, Special Topical Reports to be issued in Year 1, and will be summarized in the Year 1 Annual EMR report. Table 7-1 summarizes the streams, and the tests and reporting that will be provided. Updates, if any, will be included in subsequent Quarterly EMRs.

7.2 Reporting of Information in Technical Progress Reports

Refer to Figure 7-2 and Table 7-1. Material balance point #'s 10, 20, 30 (synthesis gas in), 216, 242, (methanol product out), and 148 (unreacted synthesis gas out; e.g. - the fuel gas which would go to the combined cycle power plant in the commercial embodiment) are the essential key flow streams for commercial operations. These balance point #'s and the internal *streams Recycle* Gas (149), Reactor Feed Gas (109), Reactor Section Effluent Gas (120) and Methanol to Distillation (204) will be summarized in the Quarterly Technical Progress Reports for the various operational test runs during the four-year methanol operation phase (Task 2.1 of Phase 3).

Material balance point 19 is specific to product purity requirements, but at least one of the three streams that comprise stream 19 will be present on all future commercial projects. All such streams would go to a tail gas fuel header similar to what is being demonstrated at Kingsport. Tail gas fuel header design data for point 19 will be reported in the Quarterly Technical Progress Reports.

Reporting of information on these material balance points will also be included in separate Topical Reports prepared throughout the demonstration period. Table 7-1 summarizes these streams, and the tests and reporting that will be provided.

7.3 Reporting of EMP Compliance Monitoring Information

Refer to Figures 7-2, 7-3 and Table 7-1. Material balance point #'s 27 and 34 will be reported in the Quarterly Environmental Monitoring Report (EMR), as part of the Compliance Monitoring Information described in Section 5 of this EMP.

If there are changes to the Clean Air laws that would require additional reporting, then these data will be included in the Quarterly EMRs. Table 7-1 summarizes these compliance monitoring points, and the tests and reporting that will be provided in the EMRs.

7.4 Reporting of EMP Supplemental Monitoring Information

Refer to Figures 7-2, 7-3 and Table 7-1. The remaining material balance point #'s shown in these Figures are as follows: balance point #'s 29, 21, 22, 23, 24, 25 and 26 in Figure 7-2; and balance points #'s 37, 31, 32, 33, and 36 in Figure 7-3. These balance point #'s will be reported in the Quarterly EMR, as part of the Supplemental Monitoring Information described in Section 6 of this EMP. Data for points not monitored will be calculated or estimated. Summary of points defined in Stream 35 contain normally N_2 or steam under normal process conditions; the EMR will report any deviations. Table 7-1 summarizes these streams, and the tests and reporting that will be provided in the EMR.

A table which summarizes the total synthesis gas use and Methanol Production for the reporting period will also be provided in the Quarterly EMRs. The table will list the following:

- Total synthesis gas consumption (units of thousands of standard cubic feet) for Stream #10, #20, and #30.
- Total methanol production (units of tons) for Stream #216 and #242
- Total plant purge (units of thousands of standard cubic feet) for Stream #148.

7.5 Environmental Monitoring Reports (EMR's)

Environmental monitoring shall be conducted under the EMP and shall be reported in quarterly and annual Environmental Monitoring Reports (EMRs). The EMR's will be prepared on a quarterly basis, for the anticipated four-year operating period. The reports will contain the following:

- a description of project status including a summary of Methanol Production and synthesis gas use.
- details of the sampling and analytical procedures.
- summaries of the environmental and health monitoring data collected, including Compliance and Supplemental Monitoring information per Section 7.3 and 7.4 above.
- the project's permit compliance status.
- copies of compliance reports and analyses sent by Participants to regulatory agencies.
- identification of problem areas encountered, with an action plan and status report of resolution.
- recommendations of modification or deletion of supplemental monitoring tasks not yielding useful data.
- appendices with sampling and analytical data sheets.

The Annual EMR shall contain the fourth quarterly report, and will summarize and analyze information from prior reports.

7.6 Reporting Requirements Check List

A Reporting Requirements Check List is provided (Table 7-2) for the reports that are described in the EMP and the DTP.

TABLE 7-1

Stream No.	1	2
Description	Fresh Coal to Gasifier	Oxygen Feed to Gasifier
PFD Material Balance Point No.	N/A	N/A
Gas Chromatograph Point No.	N/A	N/A
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Topical Report	X	X
Temperature	X	X
Pressure	X	X
Flow Rate		
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)	X	
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
% O_2		X
Analysis Frequency	N/A	N/A
Sampling Technique	Grab	Piped to Analyzer
Analytical Method	Infrared, ICP	Paramagnetic

Stream No.	3	4
Description	Water Feed to Gasifier	Waste Water from Gasifier
PFD Material Balance Point No.	N/A	N/A
Gas Chromatograph Point No.	N/A	N/A
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)	X	X
Temperature	X	X
Pressure	X	X
Flow Rate		
Composition	Treated Water No Analysis	
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
PPM Total Organic Carbon		X
Analysis Frequency	N/A	N/A
Sampling Technique	N/A	Grab
Analytical Method	N/A	IC, IR, ICP, Potentiometer

Stream No.	5	6
Description	Clean Synthesis Gas from Gasification	Sulfur Recovered from Gasification
PFD Material Balance Point No.	N/A	N/A
Gas Chromatograph Point No.	N/A	N/A
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)	X	X
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Raw Synthesis Analysis (Vol %)	X	
Hydrogen		
Carbon Monoxide		
Carbon Dioxide		
Hydrogen Sulfide		
Oxygen (Argon)		
Nitrogen		
Nitrogen Oxide (NOx)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
% Sulfur		X
Analysis Frequency	N/A	N/A
Sampling Technique	Grab	Grab
Analytical Method	GC	

Stream No.	7	8
Description	Carbon Dioxide Produced from Gasifier	Slag Generated from Gasifier
PFD Material Balance Point No.	N/A	N/A
Gas Chromatograph Point No.	N/A	N/A
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)	X	X
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		Not Analyzed
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
% CO_2	X	
Analysis Frequency	N/A	
Sampling Technique	Grab	
Analytical Method	GC	

Stream No.	9	10
Description	Balanced (Synthesis) Gas from Existing Guard Bed	CO Gas to LPMEOH Facility
PFD Material Balance Point No.	N/A	10
Gas Chromatograph Point No.	N/A	2
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		X (Summary Data)
Technical Progress Reports		X
Test Series Report (one time)	X	
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		X
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Raw Syngas (Vol %)	X	
Hydrogen		
Carbon Monoxide		
Carbon Dioxide		
Hydrogen Sulfide		
Oxygen (Argon)		
Nitrogen		
Nitrogen Oxides (NOx)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	N/A	Continuous
Sampling Technique	Grab	Piped to GC
Analytical Method	GC	GC

Stream No.	19	20
Description	Distillation Fuel Gas	H2 Gas to LPMEOH Facility
PFD Material Balance Point No.	--	20
Gas Chromatograph Point No.	8	3
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		X (Summary Data)
Technical Progress Reports	X	X
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X	X
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	Continuous	Continuous
Sampling Technique	Piped to GC	Piped to GC
Analytical Method	GC	GC

Stream No.	21	22
Description	Methanol Storage Tank (D-20 and D-21) Vent (Intermittent Flow)	Methanol Drain Tank (D-25) Vent (Intermittent Flow)
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:	Not Monitored (see section 5.1.1.2 of this report)	Not Monitored (see section 5.1.1.2 of this report)
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)		
Temperature		
Pressure		
Flow Rate		
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency		
Sampling Technique		
Analytical Method		

Stream No.	23	24
Description	Bypass (intermittent flow)	Compressor (process side) seal gas
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:	Not monitored; bypass is mainly used during startup	Not monitored
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)		
Temperature		
Pressure		
Flow Rate		
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency		
Sampling Technique		
Analytical Method		

Stream No.	25	26
Description	Guard Bed Regeneration (intermittent flow)	Analytical Sample Vents
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:	*Not monitored*	*Not monitored*
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)		
Temperature		
Pressure		
Flow Rate		
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency		
Sampling Technique		
Analytical Method		

Stream No.	27	28
Description	Total flow to boilers	Wastewater and alcohols to WWTS
PFD Material Balance Point No.	-	
Gas Chromatograph Point No.	-	
Reported in:		
EMRs (Compliance)	X	
EMRs (Supplemental)		X
Technical Progress Reports		
Test Series Report (one time)		
Temperature		Eastman will supply data comparing flow, composition and BOD loads before and after the addition of LPMEOH. Information will be reported annually during the demonstration.
Pressure		
Flow Rate		
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X	
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		X
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	See Section 5.1.1.1 of this report	Annual
Sampling Technique	Grab	Grab
Analytical Method	GC	GC/IR/TC

Stream No.	29
Description	Reduction Gas (intermittent flow)
PFD Material Balance Point No.	
Gas Chromatograph Point No.	
Reported in:	
EMRs (Compliance)	
EMRs (Supplemental)	
Technical Progress Reports	X
Test Series Report (one time)	
Temperature	X
Pressure	X
Flow Rate	- (approximated from inlet gas flow)
Composition	
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X
Hydrogen	
Carbon Monoxide	
Nitrogen	
Carbon Dioxide	
Methanol	
Dimethyl Ether	
Methane	
Oxygen (Argon)	
"Other" (by difference)	
Coal Analysis (Wt %)	
Hydrogen	
Argon	
Sulfur	
Oxygen	
Nitrogen	
Moisture	
Fixed Carbon	
Ash	
Chlorine	
Heating Value (BTU/#)	
Methanol Analysis (Wt %)	
Acetic Acid	
Water	
Decane	
Methanol	
Acetone	
Ethanol	
Analysis Frequency	Continuous
Sampling Technique	Piped to GC
Analytical Method	GC

Stream No.	30	31
Description	Balanced Gas to LPMEOH Facility	Spent Catalyst
PFD Material Balance Point No.	30	-
Gas Chromatograph Point No.	1	-
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)	X (Summary Data)	X
Technical Progress Reports	X	
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		Total weight of slurry and % solids will be reported. See section 6.3.6.1 of this report
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X	
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	Continuous	Approx. Biweekly
Sampling Technique	Piped to GC	Grab
Analytical Method	GC	Filtration

Stream No.	32	33
Description	Guard Bed Adsorbent to Incinerator	Compressor & Pump Lubricants to Energy Recovery
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)	X	X
Technical Progress Reports		
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition	Weight of Adsorbent removal will be reported. See section 6.3.6.2 of this report	Weight/Volume of materials will be reported. See section 6.3.5.1 of this report
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	At Bed Change	As Required
Sampling Technique	N/A	N/A
Analytical Method	N/A	N/A

Stream No.	34	35
Description	Equipment leak (fugitive emissions)	Miscellaneous Vent to the Atmosphere
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:		Not Monitored
EMRs (Compliance)	X	
EMRs (Supplemental)		
Technical Progress Reports		
Test Series Report (one time)		
Temperature	N/A	
Pressure	N/A	
Flow Rate	X	
Composition	See section 5.2.1.1 of this report	
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
ppm VOC	X	
Analysis Frequency	Quarterly	
Sampling Technique	EPA Method 21	
Analytical Method	Ion Flame Detection	

Stream No.	36	37
Description	Vents through 29C-120 vent scrubber	Waste Oil
PFD Material Balance Point No.	-	-
Gas Chromatograph Point No.	-	-
Reported in:	Not monitored	
EMRs (Compliance)		
EMRs (Supplemental)		X
Technical Progress Reports		
Test Series Report (one time)		
Temperature		X
Pressure		X
Flow Rate		X
Composition		Waste oil will be removed from the oil/water separator and volume will be reported. See section 6.3.5.1 of this report
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Analysis Frequency		As required
Sampling Technique		N/A
Analytical Method		N/A

Stream No.	109	120
Description	Reactor Feed Gas	Reactor Section Effluent Gas (syngas/methanol)
PFD Material Balance Point No.	109	120
Gas Chromatograph Point No.	5	6
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		
Technical Progress Reports	X	X
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X	X
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	Continuous	Continuous
Sampling Technique	Piped to GC	Piped to GC
Analytical Method	GC	GC

Stream No.	148	149
Description	Main (Plant) Purge	Recycle Gas
PFD Material Balance Point No.	148	149
Gas Chromatograph Point No.	7	7
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)	X (Summary Data)	
Technical Progress Reports	X	X
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	X	X
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)		
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	Continuous	Continuous
Sampling Technique	Piped to GC	Piped to GC
Analytical Method	GC	GC

Stream No.	204	216
Description	Methanol to Distillation	Refined (Grade) Methanol
PFD Material Balance Point No.	204	216
Gas Chromatograph Point No.	N/A	N/A
Reported in:		
EMRs (Compliance)		
EMRs (Supplemental)		X (Summary Data)
Technical Progress Reports	X	X
Test Series Report (one time)		
Temperature	X	X
Pressure	X	X
Flow Rate	X	X
Composition		
GC Analysis of Gases in LPMEOH™ Plant (Vol %)		
Hydrogen		
Carbon Monoxide		
Nitrogen		
Carbon Dioxide		
Methanol		
Dimethyl Ether		
Methane		
Oxygen (Argon)		
"Other" (by difference)		
Coal Analysis (Wt %)		
Hydrogen		
Argon		
Sulfur		
Oxygen		
Nitrogen		
Moisture		
Fixed Carbon		
Ash		
Chlorine		
Heating Value (BTU/#)		
Methanol Analysis (Wt %)	X	X
Acetic Acid		
Water		
Decane		
Methanol		
Acetone		
Ethanol		
Analysis Frequency	Weekly	Daily
Sampling Technique	Grab	Grab
Analytical Method	GC/IR/TC	GC/IR/TC

Stream No.	242
Description	Crude (Grade) Methanol to Lurgi (Methanol) Unit
PFD Material Balance Point No.	242
Gas Chromatograph Point No.	N/A
Reported in:	
EMRs (Compliance)	
EMRs (Supplemental)	X (Summary Data)
Technical Progress Reports	X
Test Series Report (one time)	
Temperature	X
Pressure	X
Flow Rate	X
Composition	
GC Analysis of Gases in LPMEOH™ Plant (Vol %)	
Hydrogen	
Carbon Monoxide	
Nitrogen	
Carbon Dioxide	
Methanol	
Dimethyl Ether	
Methane	
Oxygen (Argon)	
"Other" (by difference)	
Coal Analysis (Wt %)	
Hydrogen	
Argon	
Sulfur	
Oxygen	
Nitrogen	
Moisture	
Fixed Carbon	
Ash	
Chlorine	
Heating Value (BTU/#)	
Methanol Analysis (Wt %)	X
Acetic Acid	
Water	
Decane	
Methanol	
Acetone	
Ethanol	
Analysis Frequency	Weekly
Sampling Technique	Grab
Analytical Method	GC/IR/TC

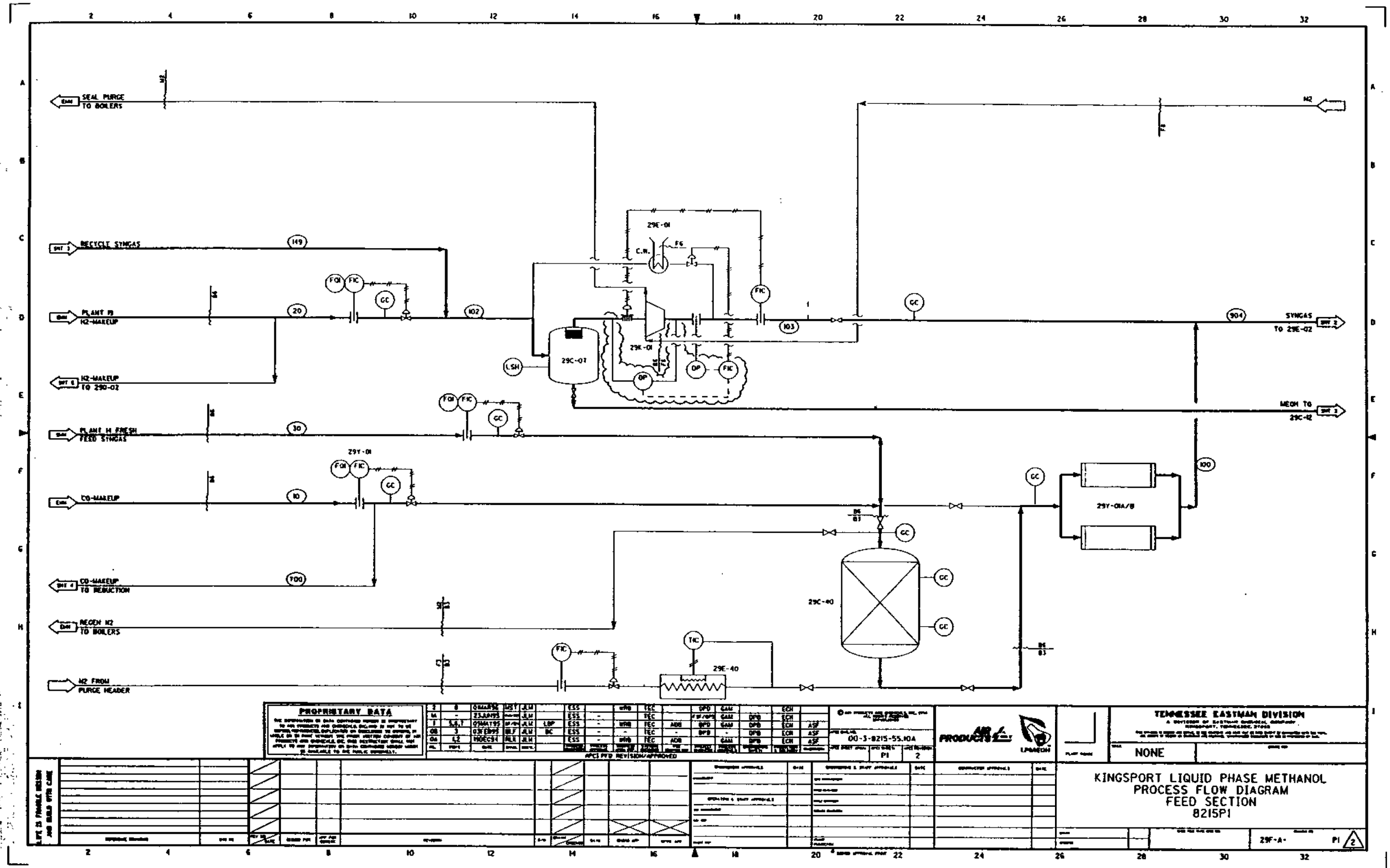
TABLE 7-2

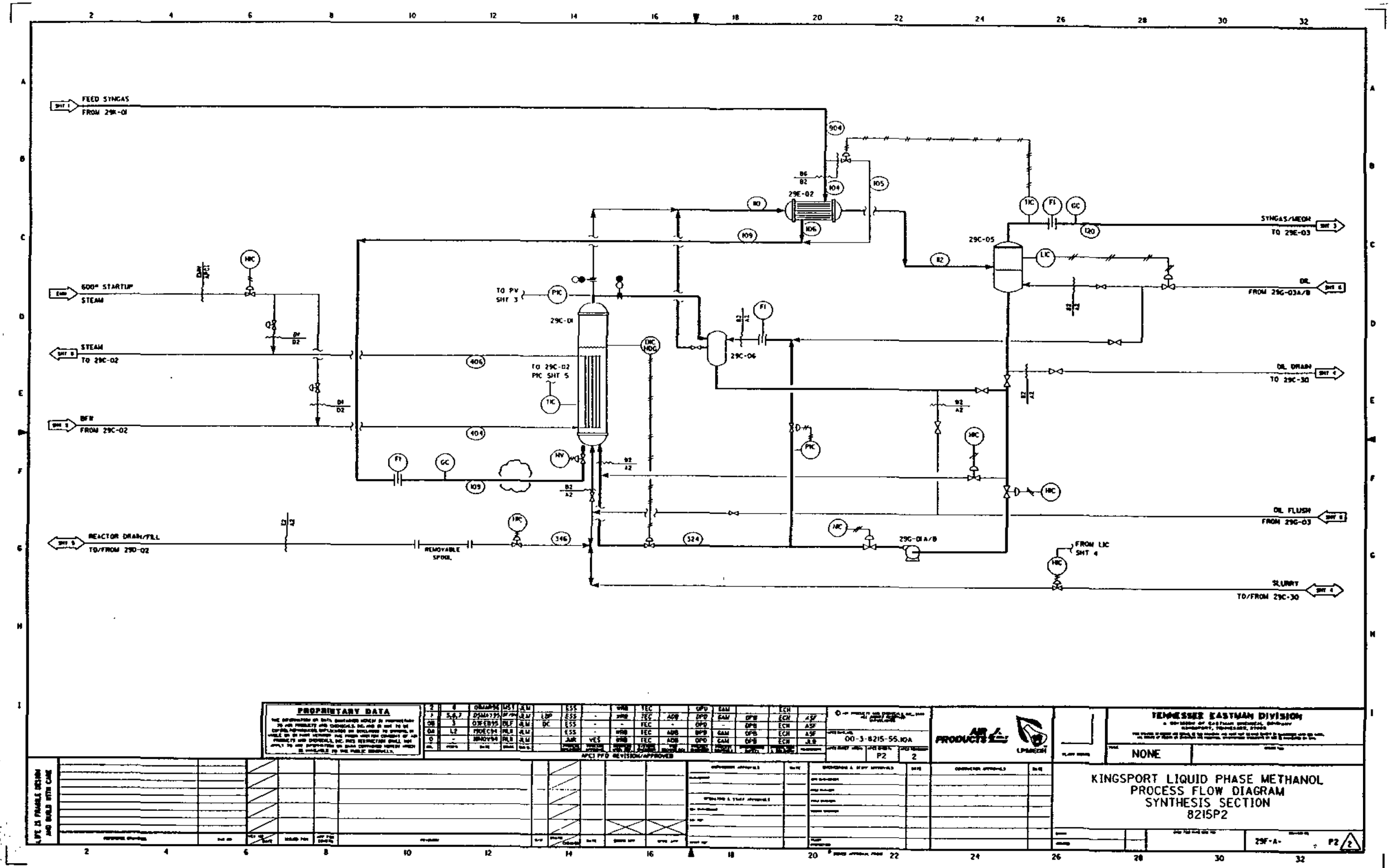
REPORTING REQUIREMENTS
CHECK LIST

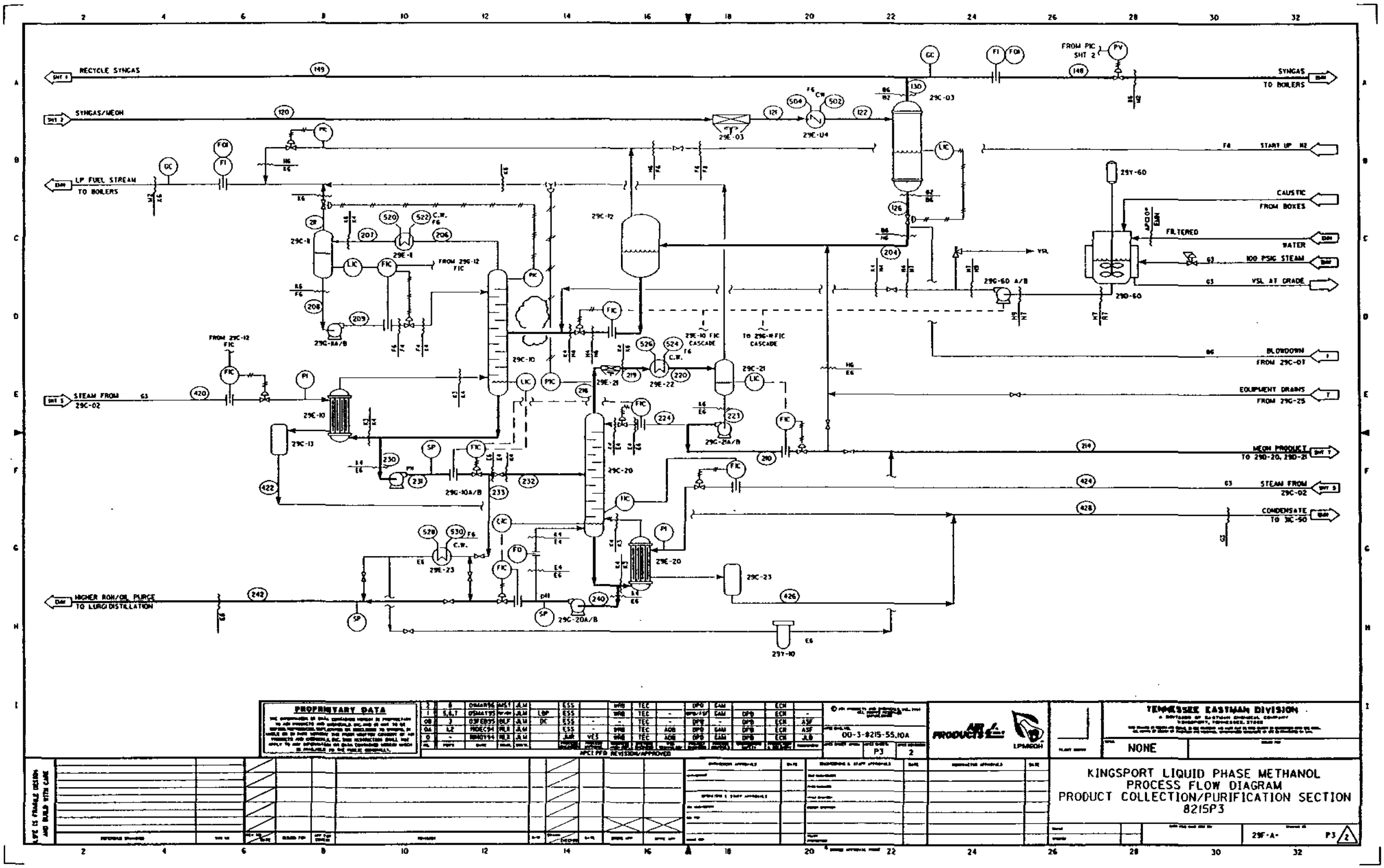
REPORT	DEFINED IN	FREQUENCY
1. Topical Reports - Reports on specific classes of operation (e.g., Texaco-type syngas operation; load following and turndown operation; etc.)	DTP	As required - 60 days after completion of last run in class.
2. Special (Topical) Report - Provides information on Eastman Gasification and Gas Clean-up systems.	EMP	One time - during the first year of operation.
3. Technical Progress Reports - Provide information on plant operations on a quarterly basis.	DTP	Quarterly during operating years - 60 days after end of quarter.
4. Environmental Monitoring Reports - Provide Compliance and a supplemental monitoring information on a quarterly basis.	EMP	Quarterly during the operating years. The 4th quarter report will also include an annual summary - 60 days after end of quarter.
5. Special (Topical) Report - Provide Data collected in two programs to characterize the Eastman Feed gases (includes analysis of HAPS)	EMP	One time - by December 1996

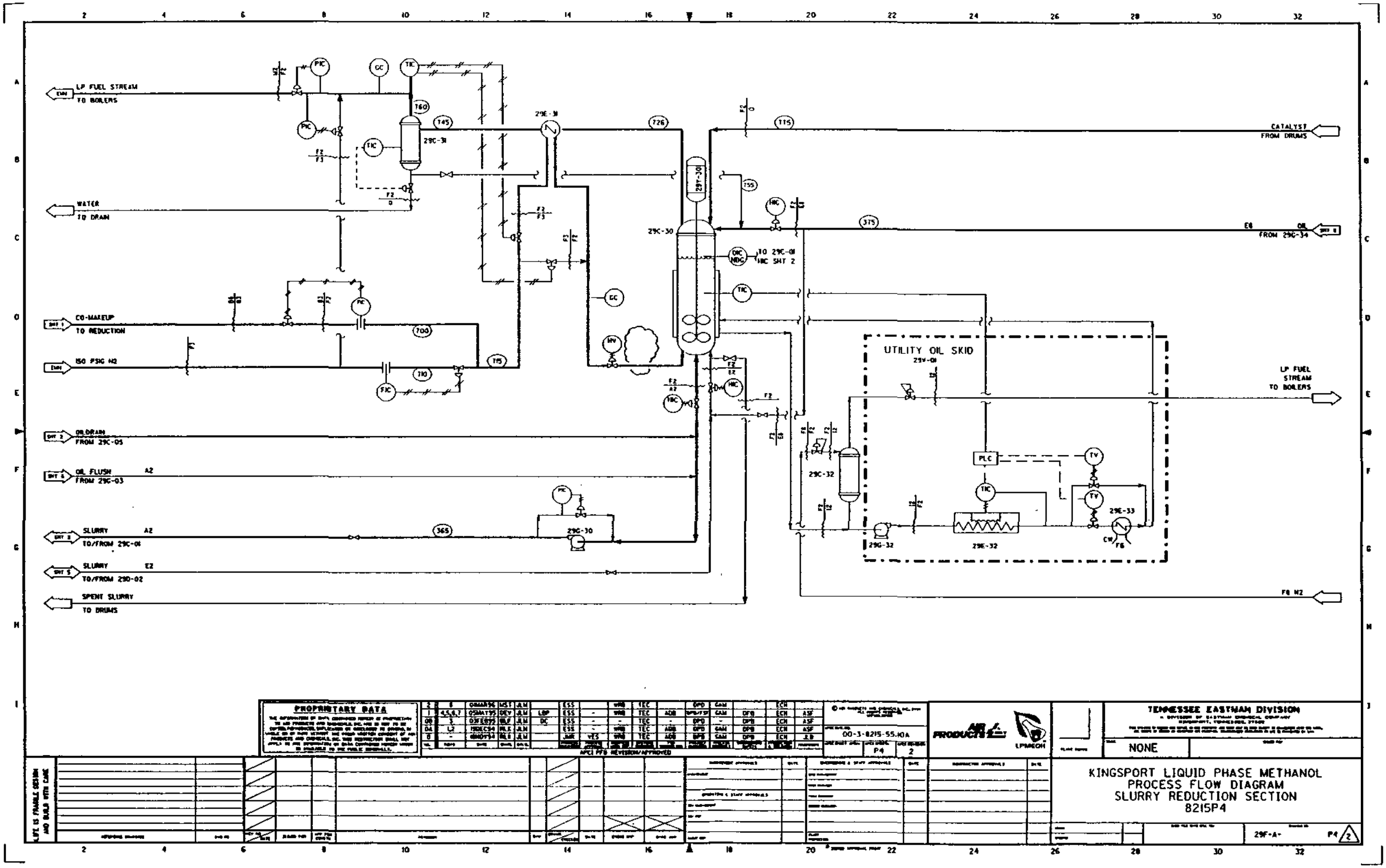
APPENDIX A

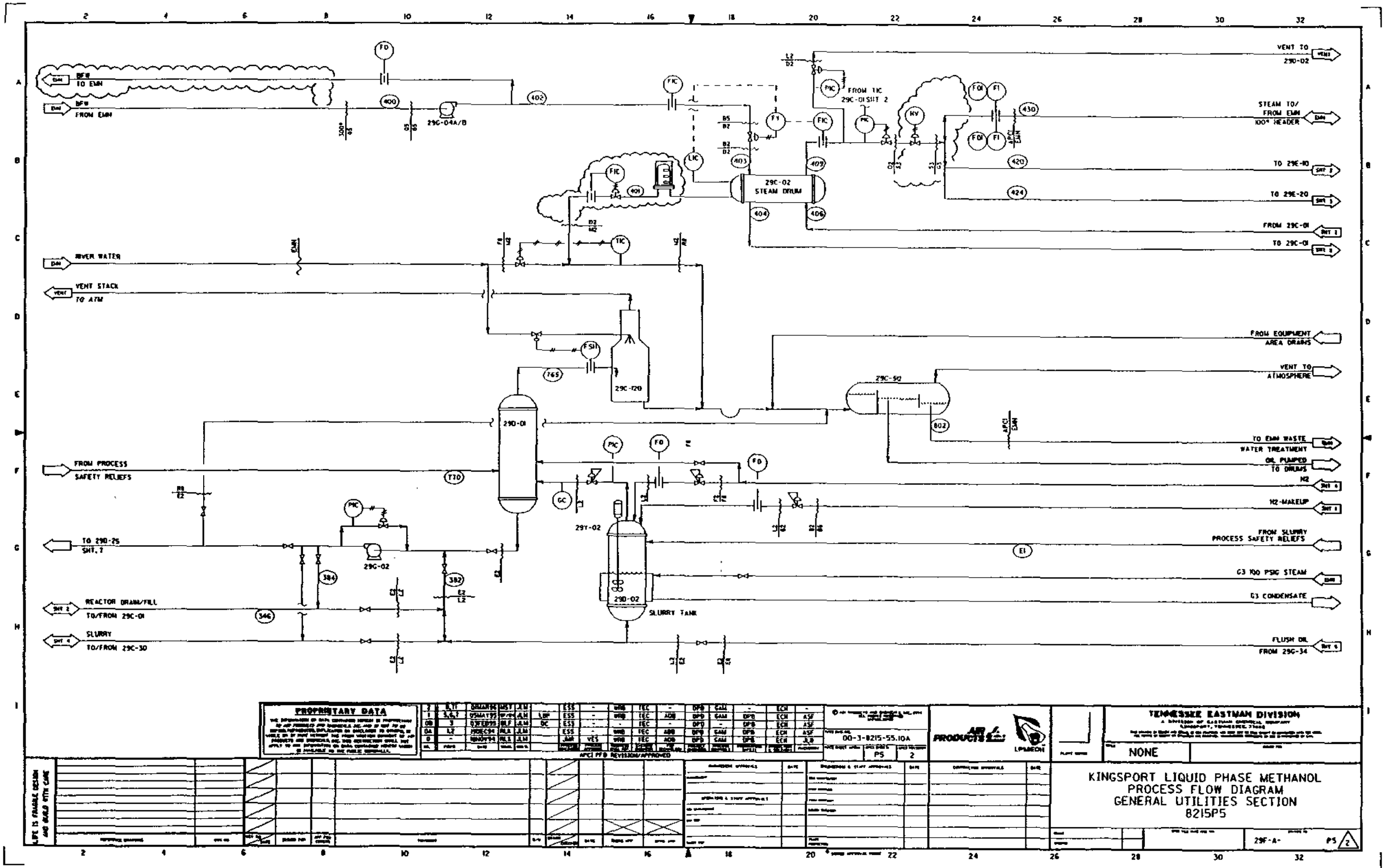
PROCESS FLOW DIAGRAMS

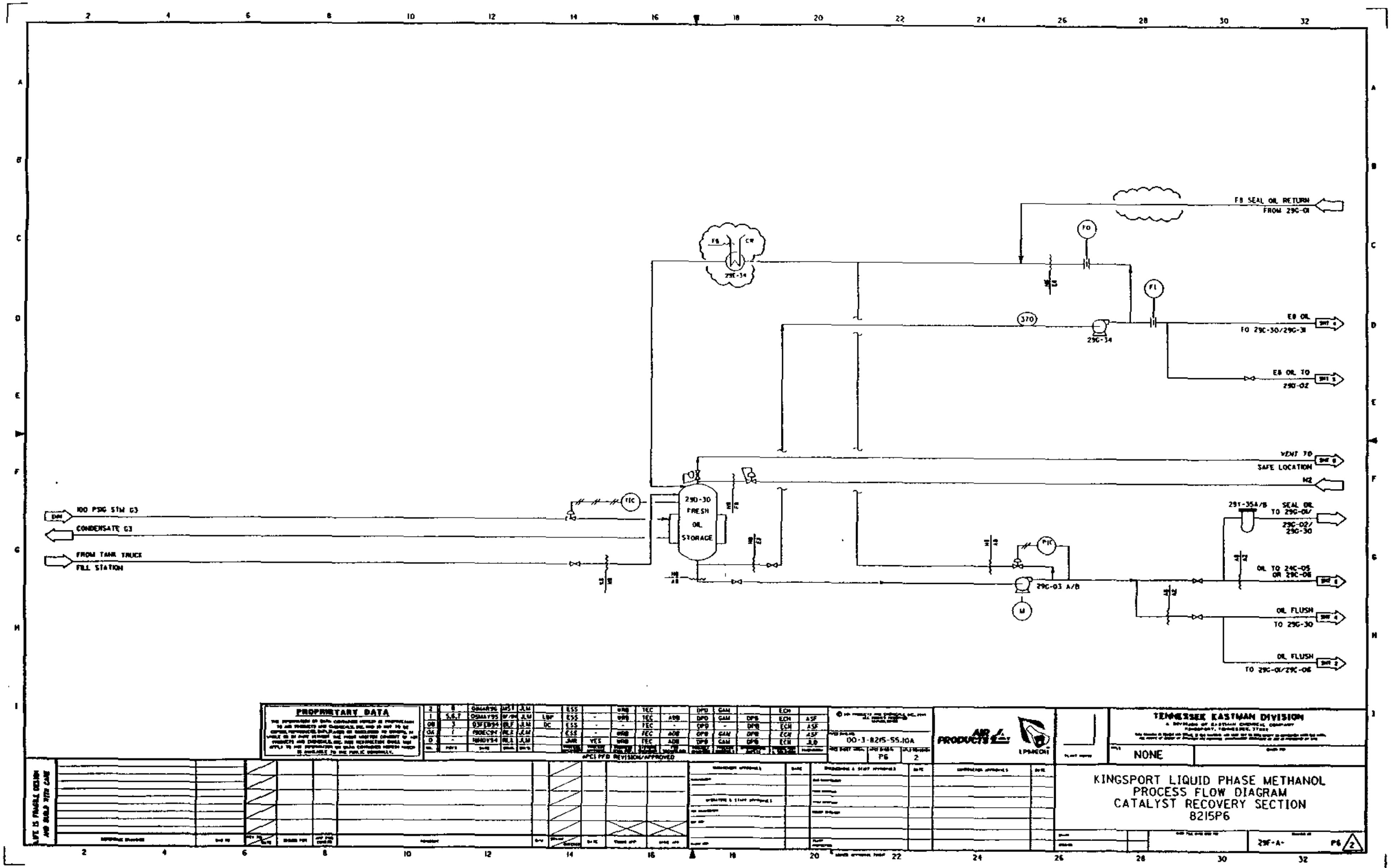

SEAL PURGE TO BOILERS
RECYCLE SYNGAS
PLANT 19 H2-MAKEUP
H2-MAKEUP TO 29D-02
PLANT 14 FRESH FEED SYNGAS
CO-MAKEUP
CO-MAKEUP TO REDUCTION
REGEN N2 TO BOILERS
N2 FROM PURGE HEADER
N2
SYNGAS TO 29E-02
MEOH TO 29C-12
29E-01
29K-01
29C-07
29Y-01
29Y-01A/B
29C-40
29E-40
PROPRIETARY DATA
TENNESSEE EASTMAN DIVISION
NONE
00-3-8215-55.10A
AIR PRODUCTS
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
FEED SECTION
8215P1
29F-A-
P1

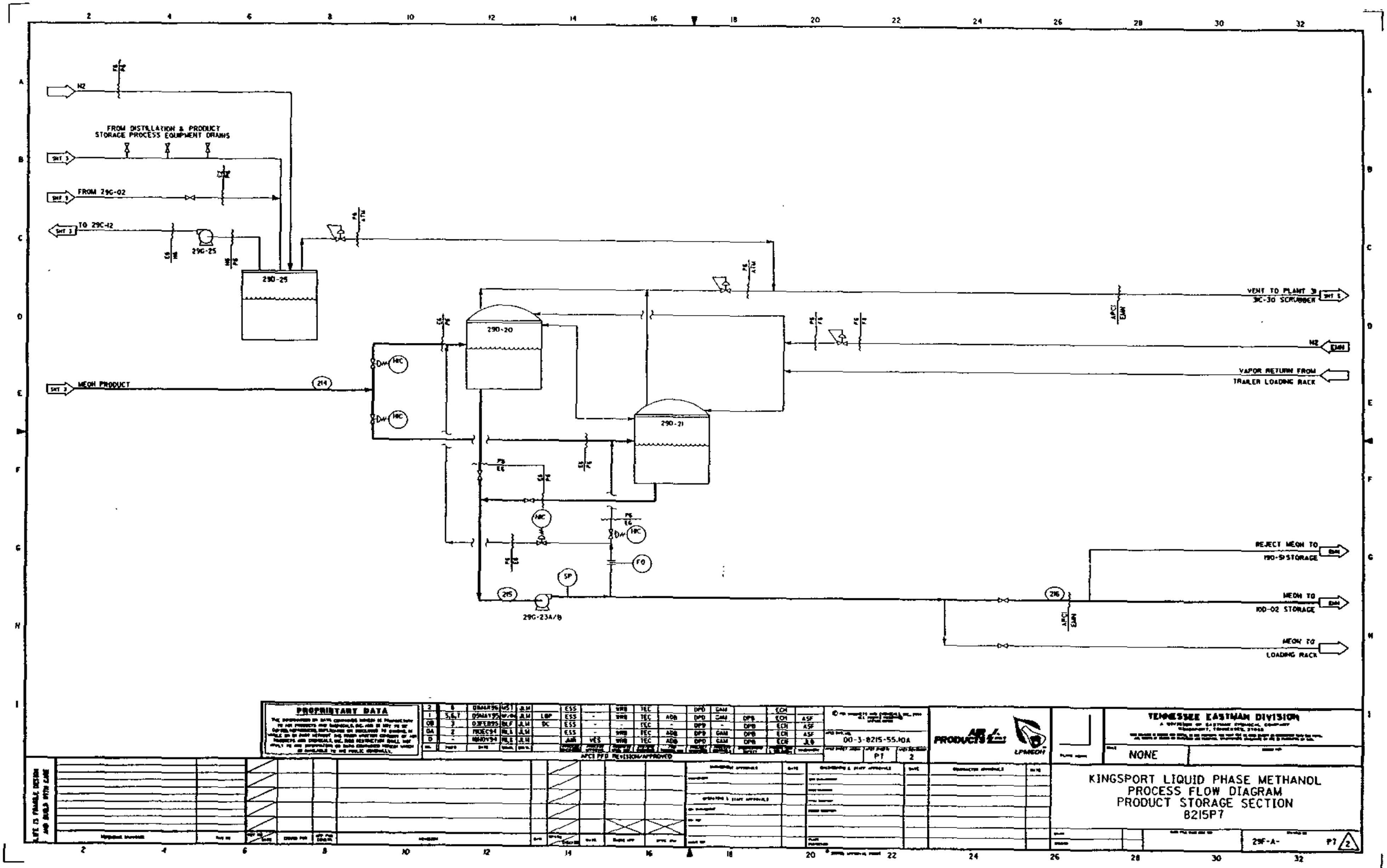

FEED SYNGAS
FROM 29K-01
600# STARTUP
STEAM
STEAM
TO 29C-02
BFW
FROM 29C-02
REACTOR DRAIN/FILL
TO/FROM 29D-02
REMOVABLE
SPOOL
TO PV
SHT 3
29C-01
TO 29C-02
PIC SHT 5
29E-02
29C-05
29C-06
29C-01A/B
SYNGAS/MEOH
TO 29E-03
OIL
FROM 29G-03A/B
OIL DRAIN
TO 29C-30
OIL FLUSH
FROM 29G-03
FROM LIC
SHT 4
SLURRY
TO/FROM 29C-30
PROPRIETARY DATA
APCI PFD REVISION/APPROVED
00-3-8215-55.10A
AIR PRODUCTS
TENNESSEE EASTMAN DIVISION
NONE
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
SYNTHESIS SECTION
8215P2
29F-A-
P2


RECYCLE SYNGAS
SYNGAS/MEOH
LP FUEL STREAM TO BOILERS
STEAM FROM 29C-02
HIGHER ROH/OIL PURGE TO LURGI DISTILLATION
SYNGAS TO BOILERS
FROM PIC SHT 2
START UP H2
CAUSTIC FROM BOXES
FILTERED
WATER
100 PSIG STEAM
VSL AT GRADE
BLOWDOWN FROM 29C-07
EQUIPMENT DRAINS FROM 29C-25
MEOH PRODUCT TO 29D-20, 29D-21
STEAM FROM 29C-02
CONDENSATE TO 3C-50
FROM 29C-12 FIC
29E-10 FIC CASCADE
TO 29G-11 FIC CASCADE
29C-03
29E-03
29E-04
29C-11
29E-11
29C-12
29C-10
29C-21
29C-20
29E-20
29E-21
29E-22
29E-23
29E-10
29C-13
29C-23
29G-11A/B
29G-10A/B
29G-20A/B
29G-21A/B
29G-60 A/B
29D-60
29Y-60
29Y-10
PROPRIETARY DATA
APCI PFD REVISION/APPROVED
00-3-8215-55.10A
TENNESSEE EASTMAN DIVISION
NONE
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
PRODUCT COLLECTION/PURIFICATION SECTION
8215P3
29F-A-
P3
LIFE IS FRAGILE DESIGN AND BUILD WITH CARE
LPMEOH


LP FUEL STREAM
TO BOILERS
WATER
TO DRAIN
CO-MAKEUP
TO REDUCTION
150 PSIG H2
OIL DRAIN
FROM 29C-05
OIL FLUSH
FROM 29C-03
SLURRY
TO/FROM 29C-01
SLURRY
TO/FROM 29D-02
SPENT SLURRY
TO DRUMS
CATALYST
FROM DRUMS
OIL
FROM 29C-34
LP FUEL
STREAM
TO BOILERS
FR N2
UTILITY OIL SKID
29V-01
29C-30
29C-31
29E-31
29T-30
29C-32
29E-32
29G-32
29G-30
29E-33
TO 29C-01
HIC SHT 2
PROPRIETARY DATA
00-3-8215-55.10A
NONE
TENNESSEE EASTMAN DIVISION
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
SLURRY REDUCTION SECTION
8215P4
29F-A-
P4
LPMEOH


BFW TO EMN
BFW FROM EMN
29C-04A/B
RIVER WATER
VENT STACK TO ATM
FROM PROCESS SAFETY RELIEFS
TO 29D-25 SHT. 7
REACTOR DRAIN/FILL TO/FROM 29C-01
SLURRY TO/FROM 29C-30
29C-02 STEAM DRUM
29C-120
29D-01
29G-02
29Y-02
29D-02
SLURRY TANK
29C-50
VENT TO 29D-02
STEAM TO/ FROM EMN 100# HEADER
TO 29E-10
TO 29E-20
FROM 29C-01
TO 29C-01
FROM EQUIPMENT AREA DRAINS
VENT TO ATMOSPHERE
TO EMN WASTE WATER TREATMENT
OIL PUMPED TO DRUMS
N2
N2-MAKEUP
FROM SLURRY PROCESS SAFETY RELIEFS
G3 100 PSIG STEAM
G3 CONDENSATE
FLUSH OIL FROM 29C-34
FROM TIC 29C-01SHT 2
PROPRIETARY DATA
APCI PFD REVISION/APPROVED
00-3-8215-55.10A
P5
2
AIR PRODUCTS
LPMEOH
TENNESSEE EASTMAN DIVISION
NONE
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
GENERAL UTILITIES SECTION
8215P5
29F-A-
LIFE IS FRAGILE DESIGN AND BUILD WITH CARE


FB SEAL OIL RETURN
FROM 29C-01
EB OIL
TO 29C-30/29C-31
EB OIL TO
29D-02
VENT TO
SAFE LOCATION
N2
SEAL OIL
TO 29C-01/
29C-02/
29C-30
291-35A/B
OIL TO 24C-05
OR 29C-06
OIL FLUSH
TO 29C-30
OIL FLUSH
TO 29C-01/29C-06
29D-30
FRESH
OIL
STORAGE
29C-34
29C-03 A/B
370
100 PSIG STM G3
CONDENSATE G3
FROM TANK TRUCK
FILL STATION
PROPRIETARY DATA
APCI PFD REVISION/APPROVED
00-3-8215-55.10A
P6
2
TENNESSEE EASTMAN DIVISION
NONE
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
CATALYST RECOVERY SECTION
8215P6
29F-A-
P6
LIFE IS FRAGILE DESIGN
AND BUILD WITH CARE


N2
FROM DISTILLATION & PRODUCT
STORAGE PROCESS EQUIPMENT DRAINS
FROM 29G-02
TO 29C-12
29G-25
29D-25
MEOH PRODUCT
214
29D-20
29D-21
HIC
SP
FO
215
29G-23A/B
216
VENT TO PLANT 31
3C-30 SCRUBBER
N2
VAPOR RETURN FROM
TRAILER LOADING RACK
REJECT MEOH TO
19D-51 STORAGE
MEOH TO
10D-02 STORAGE
MEOH TO
LOADING RACK
PROPRIETARY DATA
APCI PFD REVISION/APPROVED
00-3-8215-55.10A
P7
2
TENNESSEE EASTMAN DIVISION
NONE
KINGSPORT LIQUID PHASE METHANOL
PROCESS FLOW DIAGRAM
PRODUCT STORAGE SECTION
8215P7
29F-A-
P7
2

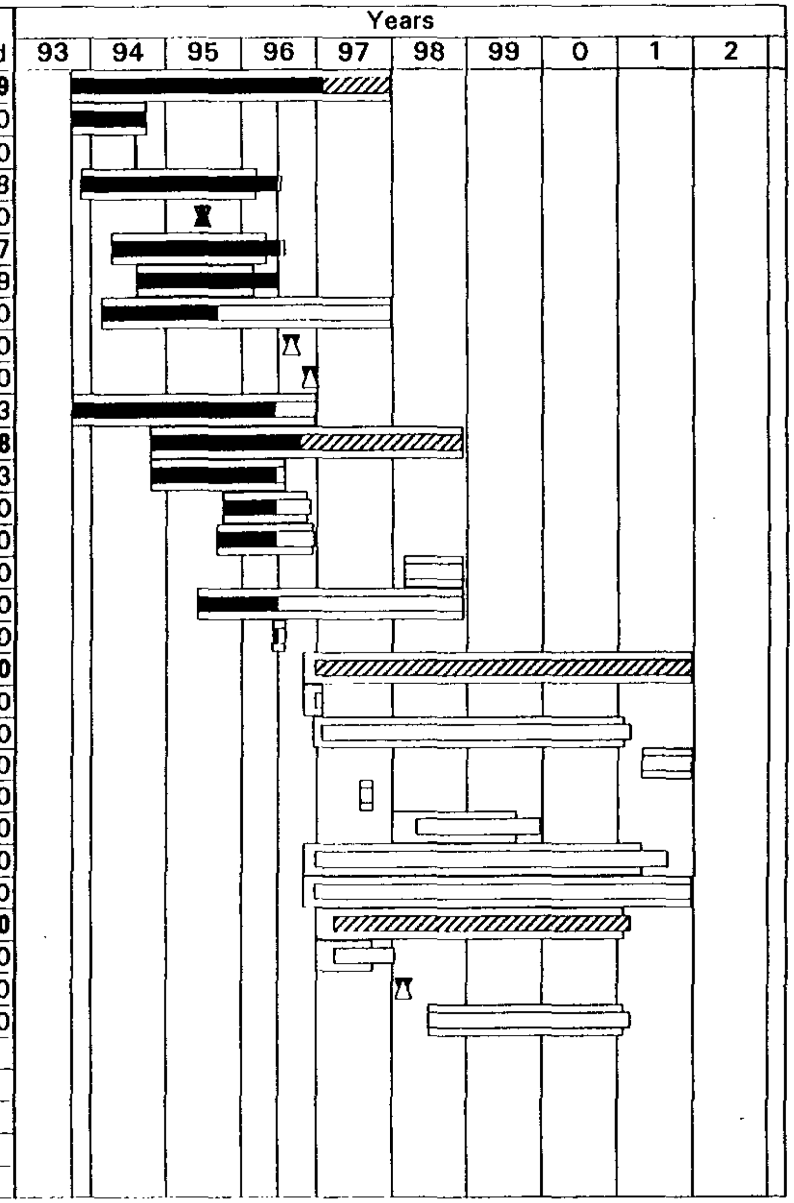
Appendix B - Equipment List

Equipment No.	Description	Process Flow Diagram No.	Equipment No.	Description	Process Flow Diagram No.
29C-01	LPMEOH Reactor	2	29E-11	Methanol Stabilizer Condenser	3
29C-02	Steam Drum	5	29E-20	Methanol Rectifier Reboiler	3
29C-03	High Pressure Methanol Separator	3	29E-21	Methanol Rectifier Air Cooler Condenser	3
29C-05	Secondary Oil K.O. Vessel	2	29E-22	Methanol Rectifier Cooling Water Subcool	3
29C-06	Cyclone	2	29E-23	Crude Methanol Cooler	3
29C-07	Compressor K.O. Separator	1	29E-31	Reduction Vessel Overhead Condenser	4
29C-10	Methanol Stabilizer Tray Column	3	29E-32	Utility Oil Heater	4
29C-11	Methanol Stabilizer Reflux Drum	3	29E-33	Utility Oil Cooler	4
29C-12	Methanol Stabilizer Feed Drum	3	29E-40	Regeneration Heater	1
29C-13	Stabilizer Condensate Pot	3	29G-01A/B	Condensed Oil Circulation Pump	2
29C-20	Methanol Rectifier Tray Column	3	29G-02	Slurry Return Pump	5
29C-21	Methanol Rectifier Reflux Drum	3	29G-03A/B	Oil Make-up Pump	6
29C-23	Rectifier Condensate Pot	3	29G-04A/B	Boiler Feed Water Pump	5
29C-30	Catalyst Reduction Vessel	4	29G-10A/B	Methanol Stabilizer Underflow Pump	4
29C-31	Reduction Condensate Accumulator	4	29G-11A/B	Methanol Stabilizer Reflux Pump	4
29C-32	Utility Oil Surge Tank	4	29G-20A/B	Methanol Rectifier Underflow Pump	4
29C-40	Carbonyl Guard Bed	1	29G-21A/B	Methanol Rectifier Reflux Pump	4
29C-50	Oil/Water Separator	5	29G-23A/B	Methanol Transfer Pump	7
29C-120	Vent Scrubber	5	29G-25	Methanol Drain Tank Lift Pump	7
29D-01	Safety Relief K.O. Drum	5	29G-30	Slurry Transfer Pump	4
29D-02	Slurry Tank	5	29G-32	Utility Oil Circulating Pump	4
29D-20	Methanol Lot Tank	7	29G-34	Oil Feed Pump	6
29D-21	Methanol Lot Tank	7	29G-60A/B	Caustic Metering Pump	3
29D-25	Methanol Area Drain Tank	7	29K-01	Syngas Recycle Compressor	1
29D-30	Fresh Oil Storage Tank	6	29SP-001	Steam Drum Blowdown Cooler	5
29D-60	Caustic Mix Tank	3	29Y-01A/B	Fresh Feed Syngas Filter	1
29E-01	Syngas Compressor Recycle Cooler	1	29Y-02	Slurry Tank Agitator	5
29E-02	Syngas Feed/Product Economizer	2	29Y-10	Methanol Product Filter	3
29E-03	Methanol Product Air Cooler Condenser	3	29Y-30	Catalyst Reduction Agitator	4
29E-04	Methanol Product Cooling Water Condenser	3	29Y-35A/B	Seal Oil Filter	6
29E-10	Methanol Stabilizer Reboiler	3	29Y-60	Caustic Tank Agitator	3

APPENDIX C

MILESTONE SCHEDULE STATUS REPORT
LIQUID PHASE METHANOL DEMONSTRATION
DE-FC22-92PC90543

Task Name	Duration	Start	End	% Comp	% Sched
PHASE 1: DESIGN	**51.20 m**	**Oct/01/93**	**Dec/30/97**	**97**	**79**
PROJECT DEFINITION(TASK1)	12.04 m	Oct/01/93	Sep/30/94	100	100
CONTINUATION APPLICATION(B.P.#2)	9.00 d	Aug/02/94	Aug/10/94	100	100
PERMITTING(TASK 2)	32.07 m	Nov/17/93	Jul/15/96	98	98
NEPA FONSI APPROVAL	0.00 d	Jun/30/95	Jun/30/95	100	100
DESIGN ENGINEERING(TASK 3)	27.71 m	Apr/15/94	Aug/01/96	98	97
VENDOR ENGINEERING	22.83 m	Aug/10/94	Jul/01/96	99	99
OFF-SITE TESTING(TASK 4)	46.35 m	Feb/25/94	Dec/30/97	10	40
UPDATED FUEL TEST PLAN APPROVAL	0.00 d	Aug/31/96	Aug/31/96	0	0
DECISION TO CONTINUE DME TESTING	0.00 d	Dec/01/96	Dec/01/96	0	0
PLANNING, ADMIN & DME DVT(TASK 5)	39.16 m	Oct/01/93	Dec/30/96	95	83
PHASE 2: CONSTRUCTION	**50.18 m**	**Oct/17/94**	**Dec/15/98**	**60**	**48**
PROCUREMENT(TASK1)	21.61 m	Oct/17/94	Aug/01/96	98	93
CONSTRUCTION(TASK 2)	14.12 m	Oct/02/95	Dec/02/96	41	60
TRAINING & COMMISSIONING(TASK 3)	15.70 m	Sep/05/95	Dec/23/96	25	60
OFF-SITE TESTING(TASK 4)	9.57 m	Mar/01/98	Dec/15/98	0	0
PLANNING & ADMINISTRATION(TASK 5)	42.69 m	Jun/01/95	Dec/15/98	30	30
CONTINUATION APPLICATION(B.P.#3)	2.08 m	May/31/96	Aug/01/96	40	40
PHASE 3: OPERATION	**60.31 m**	**Dec/27/96**	**Dec/28/01**	**0**	**0**
START-UP(TASK 1)	1.22 m	Dec/27/96	Feb/01/97	0	0
METHANOL OPERATION(TASK 2.1)	49.52 m	Jan/26/97	Mar/06/01	0	0
DISMANTLE PLANT(TASK 2.3)	7.98 m	May/01/01	Dec/28/01	0	0
ON-SITE PRODUCT USE DEMO(TASK 3)	2.08 m	Aug/01/97	Oct/02/97	0	0
OFF-SITE PRODUCT USE DEMO(TASK 4)	20.02 m	May/01/98	Dec/28/99	0	0
DATA ANALYSIS/REPORTS(TASK 5)	56.35 m	Dec/27/96	Aug/30/01	0	0
PLANNING & ADMINISTRATIVE(TASK 6)	60.31 m	Dec/27/96	Dec/28/01	0	0
PROVISIONAL DME IMPLEMENTATION	**47.41 m**	**Apr/01/97**	**Mar/07/01**	**0**	**0**
DME DVT(PDU TESTS)(TASK 3.6)	9.57 m	Apr/01/97	Jan/15/98	0	0
DECISION TO IMPLEMENT	0.00 d	Mar/01/98	Mar/01/98	0	0
DESIGN, MODIFY & OPERATE(TASK 3.2.2)	32.36 m	Jul/01/98	Mar/07/01	0	0



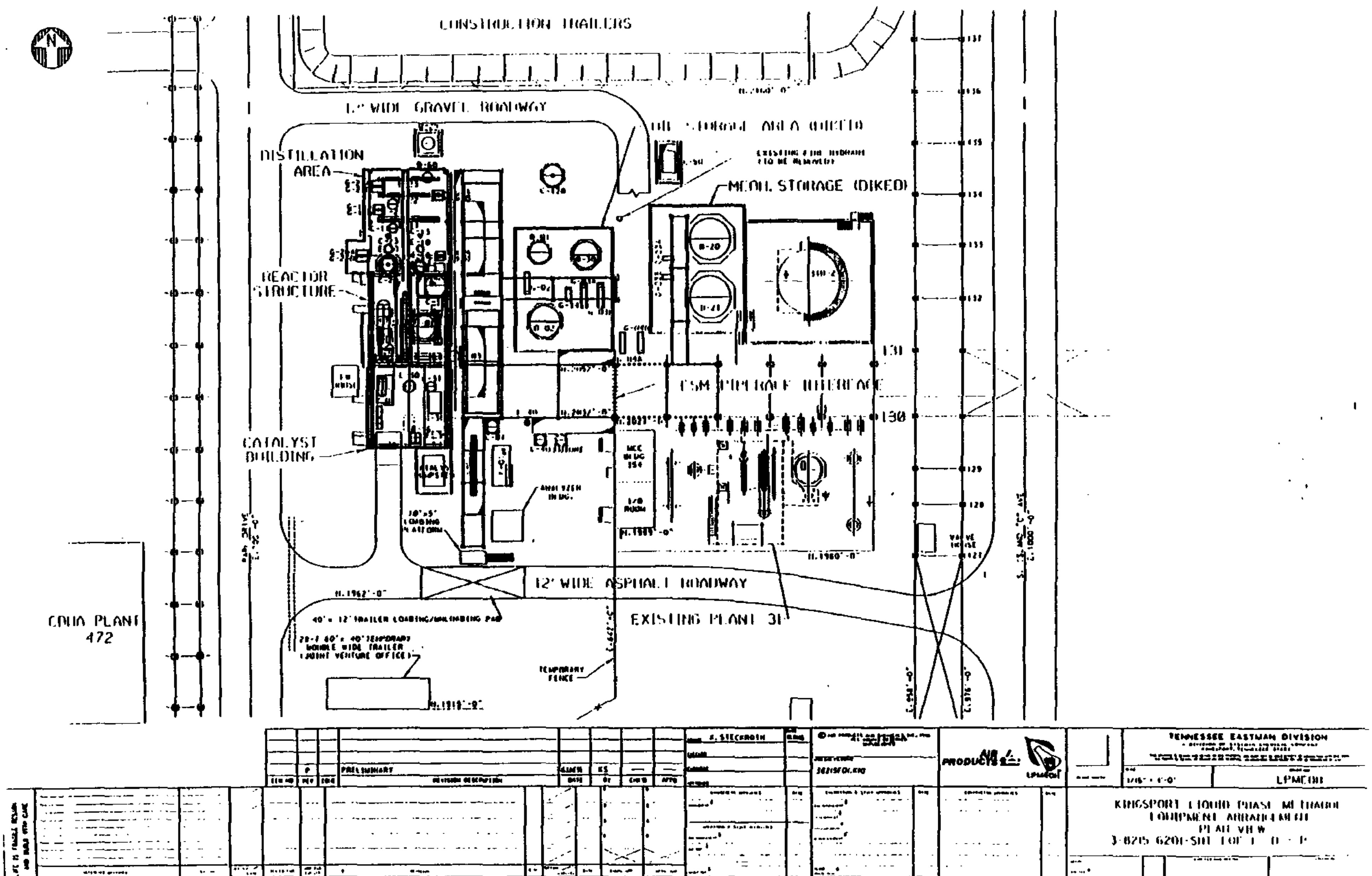
Printed: Jun/27/96
Page 1

Milestone △ Summary

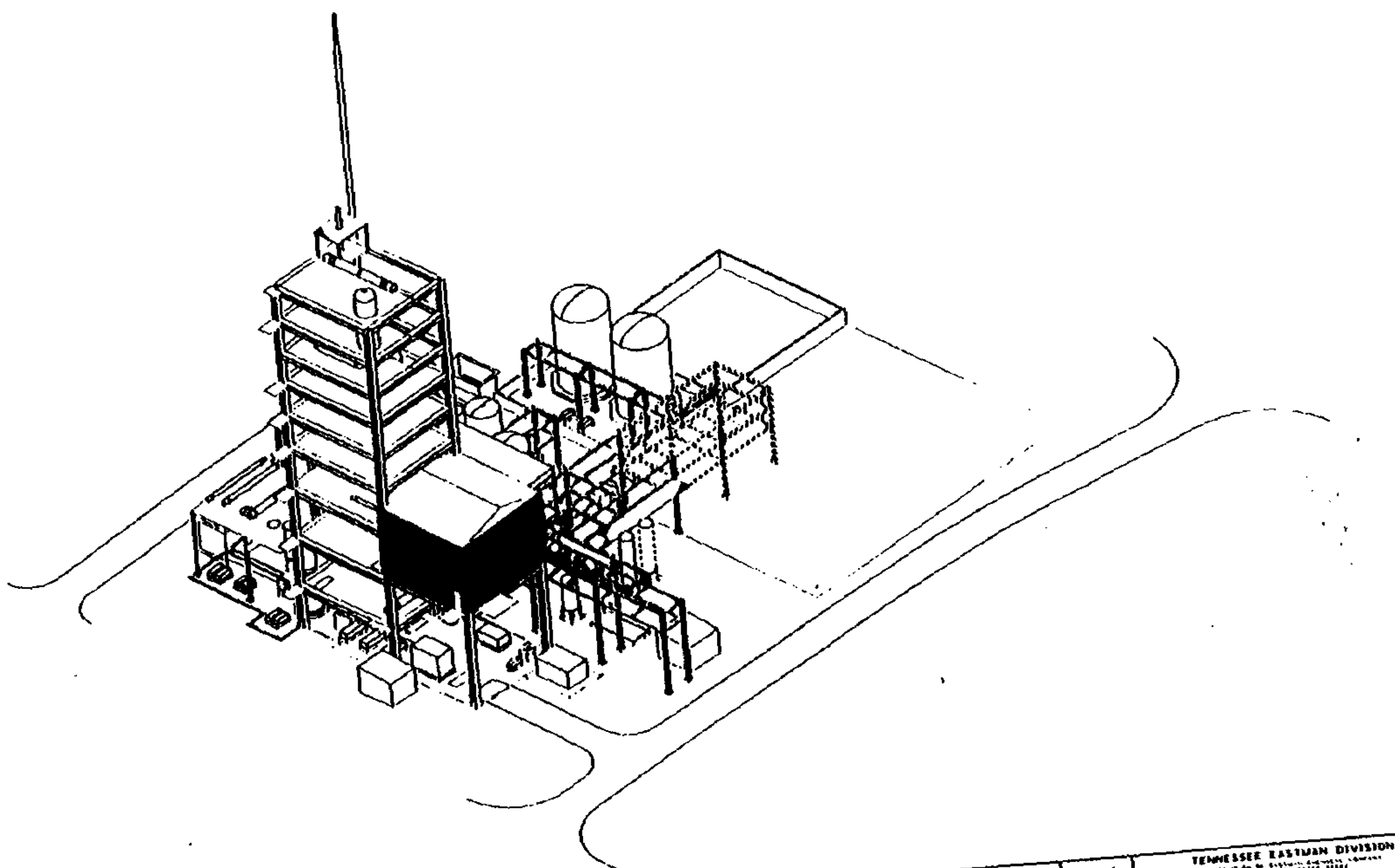
APPENDIX D

Table 1.1.1 Work Breakdown Summary			
Phase I	Task 1	1.1	Project Definition
	Task 2	1.2	Permitting
	Task 3	1.3	Design Engineering
	Task 4	1.3	Off-site Testing (Definition and Design)
	Task 5	1.5	Planning, Administration and DME Verification Testing
Phase II	Task 1	2.1	Procurement
	Task 2	2.2	Construction
	Task 3	2.3	Training and Commissioning
	Task 4	2.4	Off-site Testing (Procurement and Construction)
	Task 5	2.5	Planning and Administration
Phase III	Task 1	3.1	Startup
	Task 2	3.2	LPMEOH™ Process Demonstration Facility Operation
	Task 2.1	3.2.1	Methanol Operation
	Task 2.2	3.2.2	DME Design, Modification and Operation
	Task 2.3	3.2.2	LPMEOH™ Process Demonstration Facility Dismantlement
	Task 3	3.3	On-site Testing (Product Use Demonstration)
	Task 4	3.4	Off-site Testing (Fuel Use Demonstration)
	Task 5	3.5	Data Collection and Monitoring
	Task 6	3.6	Planning and Administration

APPENDIX E


CONSTRUCTION TRAILERS
12' WIDE GRAVEL ROADWAY
OIL STORAGE AREA (DIKED)
EXISTING FIRE HYDRANT (TO BE REMOVED)
MEOH STORAGE (DIKED)
DISTILLATION AREA
REACTOR STRUCTURE
CATALYST BUILDING
CSM PIPERACK INTERFACE
131
130
MCC BLDG 154
ANALYZER BLDG.
12' WIDE ASPHALT ROADWAY
EXISTING PLANT 31
40' x 12' TRAILER LOADING/UNLOADING PAD
20'-0" 60' x 40' TEMPORARY DOUBLE WIDE TRAILER (JOINT VENTURE OFFICE)
TEMPORARY FENCE
VALVE HOUSE
COAL PLANT 472
N
TENNESSEE EASTMAN DIVISION
KINGSPORT LIQUID PHASE METHANOL
EQUIPMENT ARRANGEMENT
PLAN VIEW
3-8215 6201-SHT 1 OF 1
LPMEOH
PRELIMINARY
F. STECKROTH
AIR PRODUCTS

APPENDIX F



TENNESSEE EASTMAN DIVISION

LPMEOH

KINGSPORT LIQUID PHASE METHANOL
EQUIPMENT ARRANGEMENT ISOMETRIC VIEW
LOOKING NORTHEAST

AIR PRODUCTS

PRELIMINARY

REVISION DESCRIPTION

APPENDIX G

AIR PERMIT APPLICATION

State of Tennessee
Department of Environment and Conservation
Division of Air Pollution Control

Process Emission Source
Number B-486-1
Page 1 of 15
Date DEC 0 2 1994

APC-20
PERMIT APPLICATION

PLEASE TYPE OR PRINT AND SUBMIT IN DUPLICATE FOR EACH EMISSION SOURCE, ATTACH APPROPRIATE SOURCE DESCRIPTION FORMS.

1. Organization's Legal Name Eastman Chemical Company			/// For /// APC	APC Company-Point No.
2. Mailing Address (St/Rd/P.O. Box) P. O. Box 1993				APC Log/Permit No.
City Kingsport	State TN	Zip Code 37662		Phone With Area Code (615)229-2000
3. Principal Technical Contact J. H. Albrecht				Phone With Area Code (615)229-5877
4. Site Address (St/Rd/Hwy) South Eastman Road				County Name Sullivan
City of Distance to Nearest Town Kingsport		Zip Code 37662		Phone With Area Code (615)229-2000
5. Emission Source No. B-486-1		Permit Renewal Yes ( ) No (X)		SIC No. 2869

6. Brief Description of Emission Source

Production of Methanol and Dimethyl Ether

7. Type of Permit Request (Complete One Line Only)

Construction (X)	Starting Date 3/1/95	Completion Date 12/31/96		
Operating ( )	Date Construction Started	Date Completed	Last Permit No. New Source	Emission Source Reference Number New Source
Location Transfer ( )	Transfer Date		Last Permit No.	Emission Source Reference Number

Address of Last Location

8. Describe Changes That Have Been Made to This Equipment or Operation Since the Last Construction or Operating Permit Application.

New Source.

9. Signature (Application Must Be Signed Before It Will Be Processed)

Barry M. Mitchell

10. Signer's name (Type or Print) B. M. Mitchell

Title Authorized Signatory

APC-21 & 24
PROCESS OR FUEL BURNING SOURCE DESCRIPTION

1. Organization Name	Eastman Chemical Company	/// For	APC Company-Point No.
2. Emission Source No.	B-486-1	/// APC	APC Log/Permit No.

3. Description of Process or Fuel Burning Unit
Production of Methanol and Dimethyl Ether

4. Normal Operation:	Hours/Day	Days/Week	Weeks/Year	Days/Year	Hours/Year
	24	7	52	365	8760

5. Type of Permit Application	(Check Below One Only)
Process Source: Apply for a separate permit for each source, (check at right, and complete lines 6, 7 and 8)	X
Process Source with in-process fuel: Products of combustion contact materials heated. Apply for a Separate permit for each source. (Check a right, and complete line 6, 7, 8, 10 to 14)	
Non-Process Fuel Burning Source: Products of combustion do not contact materials heated. Complete this form for each boiler or fuel burner and complete and emission point description form (APC-22) for each stack. (Check at right and complete lines 8 to 14)	

6. Type of Operation	Normal Batch Time	Normal Batches/Day
Continuous (X) Batch ( )		

7. Process Material Inputs and In-Process Solid Fuels	Diagram Reference*	Input Rates (Pounds/Hour) Design	Actual	(For APC Use Only) SCC Code
1. Synthesis Gas	1	35,500	35,500	
2. Sodium Hydroxide	6	1	1	
3. Carbon Monoxide	2	4,600	4,600	
4. Hydrogen Purge	3	5,500	5,500	
5. Oil	5	6,200	6,200	
6. Catalyst	4	1,600	1,600	
7.				
Totals**			54,000	

* A Flow Diagram Must be Attached
**Total Rounded to 2 Significant Figures

8. Total Emissions for This PES (Tons/Year):

	Average	Maximum
Particulates	0.10	0.10
SO_2	0	0
NO_x	0	0
CO	2.60	2.60
VOC	4.56	4.56

Other (Specify)	Average	Maximum
CO_2	1.38	1.38
H_2	0.30	0.30

9. Boiler or Burner Data. (Complete Lines 9 to 14 using a separate form for each boiler.)

Boiler Number	Stack Number **	Type of Firing***	Rated Boiler Horsepower	Rated Input Capacity (10^6 Btu/Hr)	Fuel Type	
					Primary	Secondary
Not Applicable						

Boiler Serial No.	Date Constructed	Last Modification Date

** Boilers with same stack will have same stack number.
*** Cyclone spreader (with or without reinjection), pulverized (wet or dry bottom, with or without reinjection), other stoker (specify type), hand fired, automatic, or other type (describe below in comments.)

10. Fuel Data. (Complete for a process source with in-process fuel or a nonprocess fuel burning source.) Not Applicable

Fuels Used	Annual Usage	Hourly Usage		Percent Sulfur	Percent Ash	Btu Value of Fuel	(For APC Only) SCC Code
		Design	Average				
Natural Gas:	10^6 CUFT	CUFT	CUFT	///	///	1,000	
#2 Fuel Oil:	10^3 GAL	GAL	GAL		///		
#5 Fuel Oil:	10^3 GAL	GAL	GAL		///		
#6 Fuel Oil:	10^3 GAL	GAL	GAL		///		
Coal:	TONS	LBS	LBS				
Wood:	TONS	LBS	LBS	///	///		
Liquid Propane	10^3 GAL	GAL	GAL	///	///	85,000	
Other: (Specify Type & Units)							

11. If Wood is Used as a Fuel, Specify Types and Estimate Percent by Weight of Bark. Not Applicab

12. If Wood is Used With Other Fuels, Specify Percent by Weight of Wood Charged to the Burner. Not Applicable

13. Comments:

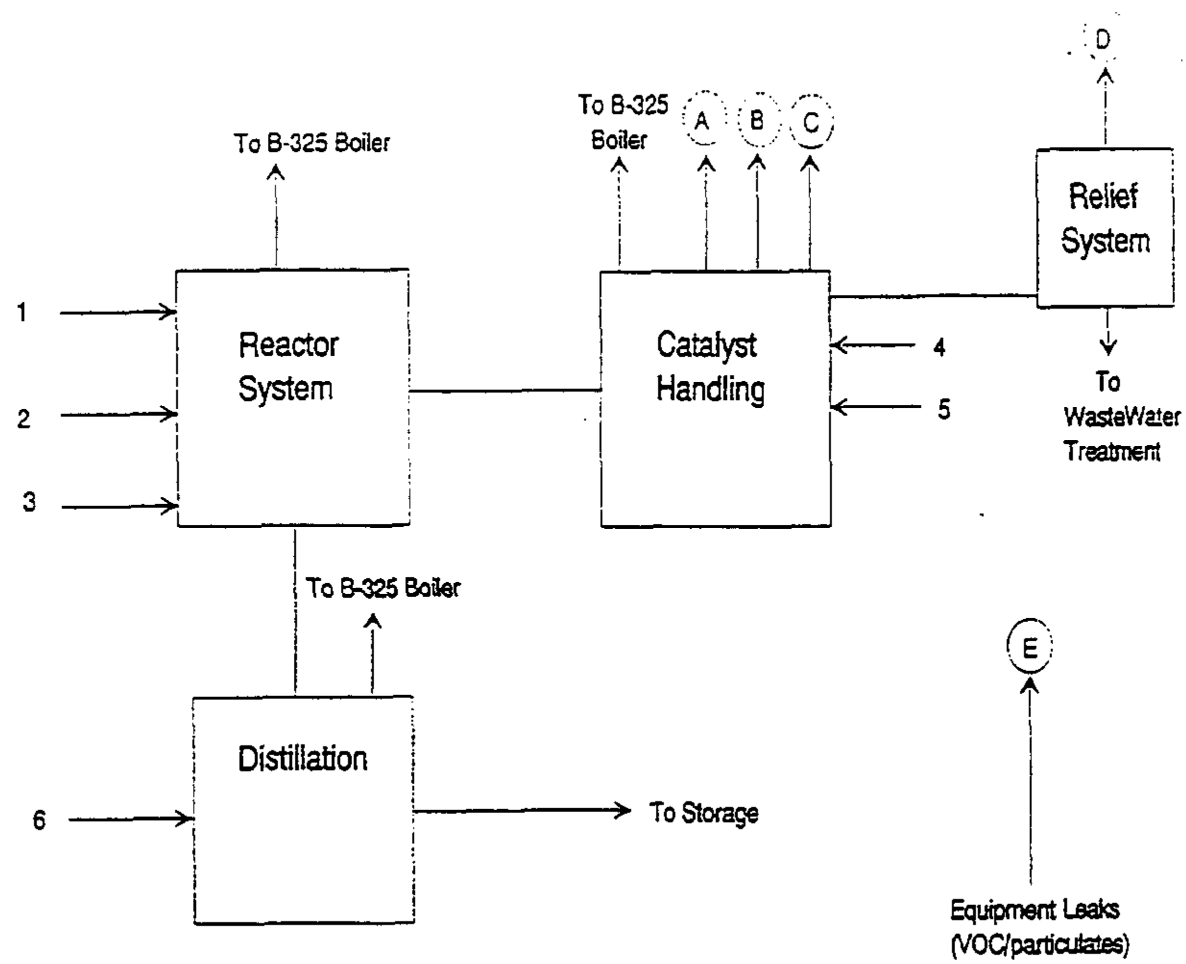
14. If a Standby or Interruptible Fuel is Used, Give Type of Fuel, Annual Quantity Used, and the Schedule or Program for Use Not Applicable

Sulfur Content of Standby Fuel %	If Coal, Show Ash Content %

Btu Value ______________

Flow Diagram

for Item 7 of APC-21 (& 24)



PROCESS EMISSION SOURCE NUMBER B-486-1
PAGE 5 OF 15
DATE DEC 0 2 1994
TANK ID NUMBER 29D-30
VENT ID NUMBER A

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

PROCESS TANK
STORAGE TANK

1. ORGANIZATION NAME - EASTMAN CHEMICAL COMPANY		FOR	APC COMPANY-POINT NO
2. PROCESS EMISSION SOURCE NO. B-486-1		APC	APC SEQUENCE NO.
3. TANK LATITUDE 36 DEG 31' 7" N	TANK LONGITUDE 82 DEG 32' 48" W	UTM VERTICAL 4042400 N	UTM HORIZONTAL 361500 E
4. TANK ID NUMBER 29D-30	VENT ID NUMBER A	CONSTRUCTION DATE 3/1/95	
5. DIAMETER (FT) 9.0	HEIGHT (FT) 22.1	CAPACITY (GAL) 10500.	
6. CYLINDER (VERT) X	CYLINDER (HORZ)	SPHERE	OTHER (DESCRIBE)

7. TANK COLOR	WHITE	ALUMINUM SPECULAR	ALUMINUM DIFFUSE	GRAY LIGHT	GRAY MEDIUM	GRAY DARK	OTHER (DESCRIBE)
A. ROOF:	X						
B. SHELL:					X		

8. PAINT CONDITION	GOOD X	POOR	NO PAINT

9. TANK TYPE	FIXED ROOF	FLOATING ROOF	OPEN TOP	UNDERGROUND	OTHER (DESCRIBE)
	X				

10. INSULATED NONE	TEMPERATURE 77. DEGREES F	PRESSURE 14. PSIA	

11. FOR FLOATING ROOF TANKS COMPLETE: NOT APPLICABLE

A. ROOF TYPE	DOUBLE DECK	PONTOON	PAN	OTHER (DESCRIBE)
B. SEAL TYPE	SINGLE	DOUBLE		OTHER (DESCRIBE)
C. SHELL CONSTRUCTION	RIVETED	WELDED		OTHER (DESCRIBE)

12. LIST ALL LIQUIDS, VAPORS, GASES, OR MIXTURES TO BE STORED IN THIS TANK. GIVE THE PERCENT BY WEIGHT OF EACH COMPONENT. SEE APC - 27 SHEET 3.

13. OUTAGE: AVERAGE DISTANCE FROM TOP OF TANK TO LIQUID SURFACE (FEET) 11.0	AVG. THROUGHPUT (GALLONS / DAY) 99.	MAXIMUM NO. OF TANK TURNOVERS PER YEAR 3.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

PROCESS EMISSION SOURCE
NUMBER B-486-1

DATE DEC 0 2 1994
TANK ID NUMBER 29D-30
VENT ID NUMBER A

APC - 27
STORAGE TANK DESCRIPTION

14. LOADING TYPE:	BOTTOM	SUBMERGED	VAPOR BALANCED	OTHER (DESCRIBE)
		X		

15. OPERATING HOURS/YEAR 8760. OPERATING DAYS/YEAR 365.

16. SPECIAL VAPOR CONTROL DEVICES:

CONSERVATION VENT

17. OPERATIONAL DATA:

CONTINUOUS FILLING AND DISCHARGING
AVERAGE DAILY LEVEL FLUCTUATION N/A
AVERAGE DAILY VOLUME FLUCTUATION N/A

BATCH FILLING
AVERAGE NUMBER OF GALLONS PER FILLING 6000.
AVERAGE NUMBER OF FILLS PER YEAR 6.

18. INERT GAS OR NITROGEN FLOW:
GAS FLOW 0.08300 SCFM
SATURATION OF GAS 100.0 %

19. TOTAL VOC EMISSIONS: Negligible TONS/YEAR

20. TOTAL PARTICULATE EMISSIONS: 0.00 TONS/YEAR

21. EMISSIONS ESTIMATION METHOD AP - 42

PROCESS EMISSION SOURCE
NUMBER B-486-1
PAGE 7 OF 15
DATE DEC 0 2 1994
TANK ID NUMBER 29D-30
VENT ID NUMBER A

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

12. (CONTINUED)

COMPONENT	WEIGHT PERCENT	MOL. WEIGHT	VAPOR PRESSURE (PSIA) AT 77. DEG F
White Mineral Oil	100.0	450.0	0.0000

PROCESS EMISSION SOURCE
NUMBER B-486-1

DATE DEC 0 2 1994
TANK ID NUMBER 29D-31
VENT ID NUMBER B

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

PROCESS TANK
STORAGE TANK

1. ORGANIZATION NAME - EASTMAN CHEMICAL COMPANY						FOR	APC COMPANY-POINT NO
2. PROCESS EMISSION SOURCE NO. B-486-1						APC	APC SEQUENCE NO.
3. TANK LATITUDE 36 DEG 31' 7" N	TANK LONGITUDE 82 DEG 32' 48" W		UTM VERTICAL 4042400 N				UTM HORIZONTAL 361500 E
4. TANK ID NUMBER 29D-31	VENT ID NUMBER B		CONSTRUCTION DATE 3/1/95				
5. DIAMETER (FT) 4.0	HEIGHT (FT) 11.6		CAPACITY (GAL) 1000.				
6. CYLINDER (VERT) X	CYLINDER (HORZ)		SPHERE				OTHER (DESCRIBE)
7. TANK COLOR	WHITE	ALUMINUM		GRAY			OTHER (DESCRIBE)
		SPECULAR	DIFFUSE	LIGHT	MEDIUM	DARK	
A. ROOF:	X						
B. SHELL:					X		
8. PAINT CONDITION	GOOD X		POOR				NO PAINT
9. TANK TYPE	FIXED ROOF X	FLOATING ROOF	OPEN TOP	UNDERGROUND			OTHER (DESCRIBE)
10. INSULATED NONE	TEMPERATURE 122. DEGREES F		PRESSURE 15. PSIA				

11. FOR FLOATING ROOF TANKS COMPLETE: NOT APPLICABLE

A. ROOF TYPE	DOUBLE DECK	PONTOON	PAN	OTHER (DESCRIBE)
B. SEAL TYPE	SINGLE	DOUBLE		OTHER (DESCRIBE)
C. SHELL CONSTRUCTION	RIVETED	WELDED		OTHER (DESCRIBE)

12. LIST ALL LIQUIDS, VAPORS, GASES, OR MIXTURES TO BE STORED IN THIS TANK. GIVE THE PERCENT BY WEIGHT OF EACH COMPONENT. SEE APC - 27 SHEET 3.

13. OUTAGE: AVERAGE DISTANCE FROM TOP OF TANK TO LIQUID SURFACE (FEET) 5.8	AVG. THROUGHPUT (GALLONS / DAY) 51.	MAXIMUM NO. OF TANK TURNOVERS PER YEAR 19.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

PROCESS EMISSION SOURCE
NUMBER B-486-1

DATE DEC 0 2 1994
TANK ID NUMBER 29D-31
VENT ID NUMBER B

APC - 27
STORAGE TANK DESCRIPTION

14. LOADING TYPE:	BOTTOM	SUBMERGED	VAPOR BALANCED	OTHER (DESCRIBE)
	X			

15. OPERATING HOURS/YEAR 8760.   OPERATING DAYS/YEAR 365.

16. SPECIAL VAPOR CONTROL DEVICES:

CONSERVATION VENT

17. OPERATIONAL DATA:

CONTINUOUS FILLING AND DISCHARGING
AVERAGE DAILY LEVEL FLUCTUATION N/A
AVERAGE DAILY VOLUME FLUCTUATION N/A

BATCH FILLING
AVERAGE NUMBER OF GALLONS PER FILLING 500.
AVERAGE NUMBER OF FILLS PER YEAR 37.

18. INERT GAS OR NITROGEN FLOW:
GAS FLOW 0.08300 SCFM
SATURATION OF GAS 100.0 %

19. TOTAL VOC EMISSIONS: Negligible TONS/YEAR

20. TOTAL PARTICULATE EMISSIONS: 0.00 TONS/YEAR

21. EMISSIONS ESTIMATION METHOD AP - 42

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

12. (CONTINUED)

COMPONENT	WEIGHT PERCENT	MOL. WEIGHT	VAPOR PRESSURE (PSIA) AT 122. DEG F
White Mineral Oil	100.0	450.0	0.0000

PROCESS EMISSION SOURCE
NUMBER B-486-1

DATE DEC 0 2 1994
TANK ID NUMBER 29C-36
VENT ID NUMBER C

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

PROCESS TANK
STORAGE TANK

1. ORGANIZATION NAME - EASTMAN CHEMICAL COMPANY		FOR	APC COMPANY-POINT NO
2. PROCESS EMISSION SOURCE NO. B-486-1		APC	APC SEQUENCE NO.
3. TANK LATITUDE 36 DEG 31' 7" N	TANK LONGITUDE 82 DEG 32' 48" W	UTM VERTICAL 4042400 N	UTM HORIZONTAL 361500 E
4. TANK ID NUMBER 29C-36	VENT ID NUMBER C	CONSTRUCTION DATE 3/1/95	
5. DIAMETER (FT) 2.0	HEIGHT (FT) 4.7	CAPACITY (GAL) 110.	
6. CYLINDER (VERT) X	CYLINDER (HORZ)	SPHERE	OTHER (DESCRIBE)

7. TANK COLOR	WHITE	ALUMINUM SPECULAR	ALUMINUM DIFFUSE	GRAY LIGHT	GRAY MEDIUM	GRAY DARK	OTHER (DESCRIBE)
A. ROOF:	X						
B. SHELL:					X		

8. PAINT CONDITION	GOOD X	POOR	NO PAINT

9. TANK TYPE	FIXED ROOF	FLOATING ROOF	OPEN TOP	UNDERGROUND	OTHER (DESCRIBE)
	X				

10. INSULATED NONE	TEMPERATURE 122. DEGREES F	PRESSURE 15. PSIA

11. FOR FLOATING ROOF TANKS COMPLETE: NOT APPLICABLE

A. ROOF TYPE	DOUBLE DECK	PONTOON	PAN	OTHER (DESCRIBE)
B. SEAL TYPE	SINGLE	DOUBLE		OTHER (DESCRIBE)
C. SHELL CONSTRUCTION	RIVETED	WELDED		OTHER (DESCRIBE)

12. LIST ALL LIQUIDS, VAPORS, GASES, OR MIXTURES TO BE STORED IN THIS TANK. GIVE THE PERCENT BY WEIGHT OF EACH COMPONENT. SEE APC - 27 SHEET 3.

13. OUTAGE: AVERAGE DISTANCE FROM TOP OF TANK TO LIQUID SURFACE (FEET) 2.3	AVG. THROUGHPUT (GALLONS / DAY) 50.	MAXIMUM NO. OF TANK TURNOVERS PER YEAR 166.

PROCESS EMISSION SOURCE
NUMBER B-486-1
PAGE 12 OF 15
DATE DEC 0 2 1994
TANK ID NUMBER 29C-36
VENT ID NUMBER C

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

APC - 27
STORAGE TANK DESCRIPTION

14. LOADING TYPE:	BOTTOM	SUBMERGED	VAPOR BALANCED	OTHER (DESCRIBE)
		X		

15. OPERATING HOURS/YEAR 8760. OPERATING DAYS/YEAR 365.

16. SPECIAL VAPOR CONTROL DEVICES:

CONSERVATION VENT

17. OPERATIONAL DATA:

CONTINUOUS FILLING AND DISCHARGING
AVERAGE DAILY LEVEL FLUCTUATION N/A
AVERAGE DAILY VOLUME FLUCTUATION N/A

BATCH FILLING
AVERAGE NUMBER OF GALLONS PER FILLING 88.
AVERAGE NUMBER OF FILLS PER YEAR 208.

18. INERT GAS OR NITROGEN FLOW:
GAS FLOW 0.08300 SCFM
SATURATION OF GAS 100.0 %

19. TOTAL VOC EMISSIONS: Negligible TONS/YEAR

20. TOTAL PARTICULATE EMISSIONS: 0.00 TONS/YEAR

21. EMISSIONS ESTIMATION METHOD AP - 42

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL

PROCESS EMISSION SOURCE
NUMBER B-486-1

DATE DEC 0 2 1994
TANK ID NUMBER 29C-36
VENT ID NUMBER C

APC - 27
STORAGE TANK DESCRIPTION

12. (CONTINUED)

COMPONENT	WEIGHT PERCENT	MOL. WEIGHT	VAPOR PRESSURE (PSIA) AT 122. DEG F
White Mineral Oil	100.0	450.0	0.0000

State of Tennessee
Department of Environment and Conservation
Division of Air Pollution Control

Process Emission Sourc
Number B-486-1
Page 14 of 15
Date DEC 0 2 199

APC-22
EMISSION POINT DESCRIPTION

1. Organization Name Eastman Chemical Company		/// For /// APC	APC Company-Point No.
2. Emission Source No. B-486-1	Flow Diagram Point No. D		APC Sequence No.

3. Location:	Latitude	Longitude	UTM Vertical	UTM Horizontal
	36° 31' 7" N	82° 32' 48" W	4042400 N	361500 E

4. Brief Emission Point Description
Vent from scrubber

5. Normal Operation:	Hours/Days	Days/Week	Weeks/Year	Days/Year	Hours/Year
	24	7	52	365	8760

6. Stack or Emission Point Data:	Height Above Grade (FT)	Diameter (FT)	Temperature (°F)	% of Time Over 125°F	Direction of Exi (Up, Down, Horizontal)
	60	0.3	100	0	Up
Data at Exit Conditions:	Flow (Actual Ft^3/Min.) 0.13	Velocity (Ft/Sec) 0.03	Moisture (Volume %) 2		
Data at Standard Conditions: (70°F and 29.92 In. Hg.	Flow (Dry Std. Ft^3/Min.) 0.10	Velocity (Ft/Sec) 0.02			

7. Air Contaminants

	Emissions (Lbs/Hr)		Concentration		Emissions (TPY)		Emissions*	Control*	Control
	Average	Maximum	Average	Max.	Average	Maximum	Est. Method	Device	Eff. %
Particulates	-		**	**					
Sulfur Dioxide	-		***	***					
Nitrogen Oxides	-		PPM	PPM					
Organic Compounds	-		PPM	PPM					
Carbon Monoxide	0.2	0.2	PPM 400,000	PPM 400,000	0.88	0.88	2	000	-
Fluorides	-								
Other (Specify)	-								

8. Check Types of Monitoring and Recording Instruments That are Attached:
Opacity Monitor ( ). SO_2 Monitor ( ). NO_x Monitor ( ). Other (Specify in Comments) ( )
None (X)

9. Comments: (Continue on Back if Needed)

* Refer to the back of the permit application form for estimation method and control device codes.
** Exit gas particulate concentration units: process - grains/dry standard ft^3 (70°F); wood fired boilers - grains/dry standard ft^3 (70°F); all other boilers - lbs/million Btu heat input.
*** Exit gas sulfur dioxide concentrations units: process - ppm by volume, dry bases; boile: lbs/million Btu heat input.

APC-22
EMISSION POINT DESCRIPTION

1. Organization Name	Eastman Chemical Company	/// For /// APC	APC Company-Point No.
2. Emission Source No. B-486-1	Flow Diagram Point No. E		APC Sequence No.

3. Location:	Latitude	Longitude	UTM Vertical	UTM Horizontal
	36° 31' 7" N	82° 32' 48" W	4042400 N	361500 E

4. Brief Emission Point Description

Equipment Leaks

5. Normal Operation:	Hours/Days	Days/Week	Weeks/Year	Days/Year	Hours/Year
	24	7	52	365	8760

6. Stack or Emission Point Data:	Height Above Grade (FT)	Diameter (FT)	Temperature (°F)	% of Time Over 125°F	Direction of Exi (Up, Down, Horizontal)
	-	-	-	-	
Data at Exit Conditions:	Flow (Actual Ft^3/Min.)	Velocity (Ft/Sec)	Moisture (Volume %)		
	-	-	-		
Data at Standard Conditions: (70°F and 29.92 In. Hg.	Flow (Dry Std. Ft^3/Min.)	Velocity (Ft/Sec)			
	-	-			

7. Air Contaminants

	Emissions (Lbs/Hr) Average	Emissions (Lbs/Hr) Maximum	Concentration Average	Concentration Max.	Emissions (TPY) Average	Emissions (TPY) Maximum	Emissions* Est. Method	Control* Device	Control Eff. %
Particulates	-	-	** -	** -	-	0.10	3	000	-
Sulfur Dioxide	-		***	***					
Nitrogen Oxides	-		PPM	PPM					
Organic Compounds	-	-	PPM -	PPM -	-	4.56	5	000	-
Carbon Monoxide	-	-	PPM -	PPM -	-	1.72	5	000	-
Fluorides	-								
Other (Specify) Hydrogen	-	-	-	-	-	0.30	5	000	-

8. Check Types of Monitoring and Recording Instruments That are Attached:
Opacity Monitor ( ). SO_2 Monitor ( ). NO_x Monitor ( ). Other (Specify in Comments) (X)
None ( )

9. Comments: (Continue on Back if Needed)

Leak detection and repair as required by Title III.

* Refer to the back of the permit application form for estimation method and control device codes.

** Exit gas particulate concentration units: process - grains/dry standard ft^3 (70°F); wood fired boilers - grains/dry standard ft^3 (70°F); all other boilers - lbs/million Btu heat input.

*** Exit gas sulfur dioxide concentrations units: process - ppm by volume, dry bases; boilers lbs/million Btu heat input.

BACT/LAER Discussion

Flow Diagram Reference Point A, B, C

1. Description of Reference Point

Conservation vents for Tanks 29D-30, 29D-31, and 29C-36.

2. Description of Emissions

Inert gas with a potential for a small quantity of VOC as a result of tank filling operations, breathing losses, and inert gas purges on level devices.

3. Alternatives Considered

Because low VOC emissions are produced due to the low vapor pressure of the stored chemical, no emission abatement was considered for these sources.

4. Relative Cost of Alternative Systems

Not applicable.

5. Relative Efficiencies of Alternative Systems

Not applicable.

6. Process Steps Which Inherently Reduce Emission Levels

None.

7. Reasons for Selection of the System Chosen

The low vapor pressure of the stored chemical results in low VOC emissions without the installation of emission control equipment. Emissions are negligible.

BACT/LAER Discussion

Flow Diagram Reference Point D

1. Description of Reference Point

Vent from a water scrubber.

2. Description of Emissions

Emissions consist of carbon monoxide.

3. Alternatives Considered

Due to the low potential for emissions as a result of process constraints, no alternatives were considered.

4. Relative Cost of Alternative Systems

Not applicable.

5. Relative Efficiencies of Alternative Systems

Not applicable.

6. Process Steps Which Inherently Reduce Emission Levels

None.

7. Reasons for Selection of the System Chosen

Process constraints do not allow CO emissions to reach a significant level.

BACT/LAER Discussion

Flow Diagram Reference Point E

1. Description of Reference Point

   Fugitive emissions from valves, flanges, and open equipment. Leak detection and repair will be employed per Title III.

2. Description of Emissions

   These emissions consist of VOCs (including Methanol), CO, particulates, and other (H_2 and CO_2).

3. Alternatives Considered

   Because of the applicability of the HON, no other alternatives were considered.

4. Relative Cost of Alternative Systems

   Not applicable.

5. Relative Efficiencies of Alternative Systems

   Not applicable.

6. Process Steps Which Inherently Reduce Emission Levels

   None.

7. Reasons for Selection of the System Chosen

   Leak detection and repair, as required by Title III, represent the best management practices available.

Emission Changes for New/Modified Sources

Vent Code	Type of Emission	* ______ Application Max. Lb/Hr	This Application Max. Lb/Hr	Net Change Max. Lb/Hr	Hrs./Yr.	Net Change Max. TYP
A	VOC	Not Applicable	Negligible	-	8760	Negligible
B	VOC	Not Applicable	Negligible	-	8760	Negligible
C	VOC	Not Applicable	Negligible	-	8760	Negligible
D	CO	Not Applicable	0.20	+0.20	8760	+0.88
Fugitives E	VOC	Not Applicable	4.56 TPY	-	8760	+4.56
	CO	Not Applicable	1.72 TPY	-	8760	+1.72
	TSP	Not Applicable	0.10 TPY	-	8760	+0.10
	Others	Not Applicable	1.68 TPY	-	8760	+1.68

Total Emission Change:	max. lbs./hr.	max. TPY
VOC	-	+4.56
TSP	-	+0.10
SO_2	-	-
NO_x	-	-
CO	-	+2.60
Other	-	+1.68

* Previous Application Submittal Date

(New Source)

APPENDIX H

APPROVED AIR PERMIT

(BEST COPY AVAILABLE AT THIS TIME- WILL PROVIDE BETTER COPIES AT MEETING 4/25/96 FSF)

TENNESSEE ...
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-1531

Permit to Construct or Modify an Air Contaminant Source Issued Pursuant to Tennessee Air Quality Act

Date Issued: MAR 16 1995

Permit Number: 941010P

Date Expires: February 1, 1997

Issued To:

Eastman Chemical Company

Installation Address:

South Eastman Road
Kingsport

Installation Description:
B-486-1
Production of Methanol and Dimethyl Ether:
Three (3) Tanks; Vents: A, B, C, D, and E

Emission Source Reference No.:
82-1010-88

The holder of this permit shall comply with the conditions contained in this permit as well as all applicable provisions of the Tennessee Air Pollution Control Regulations.

CONDITIONS:

1. The application that was utilized in the preparation of this permit is dated December 2, 1994 and signed by Mr. B.M. Mitchell of the permitted facility. If this person terminates his/her employment or is reassigned different duties such that he/she is no longer the responsible person to represent and bind the facility in environmental permitting affairs, the owner or operator of this air contaminant source shall notify the Technical Secretary of the change. Said notification shall be in writing and submitted within thirty (30) days of the change. The notification shall include the name and title of the new person assigned by the source owner or operator to represent and bind the facility in environmental permitting affairs. All representations, agreement to terms and conditions and covenants made by the former responsible person that were used in the establishment of limiting permit conditions on this permit will continue to be binding on the facility until such time that a revision to this permit is obtained that would change said representations, agreements and covenants.

(Continued on the next page)

SG GAH John W. Walton
TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

NON-TRANSFERABLE POST AT INSTALLATION ADDRESS

CN-0754 (Rev 9-92) RDA 1298

2. Maximum process material input rate shall not exceed 54,000 pounds per hour (lb/hr).

3. This permit is only valid for the tanks listed below:

Tank ID	Capacity (Gallons)
29D-30	10,500
29D-31	1,000
29C-36	8110

4. Carbon monoxide (CO) emitted from Vent D shall not exceed 0.2 lb/hr.

5. Fugitive CO emitted from this source (pumps, valves, flanges, etc.) shall not exceed 1.72 tons per year (ton/yr).

6. Fugitive particulate matter emitted from this source (pumps, valves, flanges, etc.) shall not exceed 0.1 ton/yr.

This emission limitation is established pursuant to Rule 1200-3-7-.01(5) of Tennessee Air Pollution Control Regulations and the information contained in the agreement letter dated April 25, 1986 from the permittee.

7. Fugitive volatile organic compounds emitted from this source (pumps, valves, flanges, etc.) shall not exceed 4.56 ton/yr.

8. The permittee shall certify the start-up date of the air contaminant source regulated by this permit by submitting a copy of this permit, with the information required in A) and B) of this condition completed, to the Technical Secretary's representatives listed below:

A) DATE OF START-UP: ________ / ________ / ________
(month) (day) (year)

B) Anticipated operating rate: ________ percent of maximum rated capacity.

For the purpose of complying with this condition, "start-up" of the air contaminant source shall be the date of the setting in operation of the source for the production of product for sale or use as raw materials or steam or heat production.

The undersigned represents that he/she has the full authority to represent and bind the permittee in environmental permitting affairs. The undersigned further represents that the above provided information is true to the best of his/her knowledge and belief.

Signature		Date
Signer's name (type or print)	Title	Phone with area code

Note: This certification is not an application for an operating permit. At a minimum, the appropriate application form, usually an APC 20, must be submitted requesting an operating permit. The application must be submitted in accordance with the [illegible] requirements of this permit.

The completed certification shall be delivered to Compliance Validation Program and the Field Office at the addresses listed below no later than 30 days after the air contaminant source is started-up.

Compliance Validation Program
Division of Air Pollution Control
9th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1531

Johnson City Field Office
Division of Air Pollution Control
2305 Silverdale Road
Johnson City, TN 37601-2162

(Continued on the next page)

MAR 1 6 1995

9. Visible emissions from this source shall not exceed 20 percent or greater opacity as determined by EPA Method 9, as published in the Federal Register, Volume 39, Number 219 on November 12, 1974. (6 minute average)

10. This permit shall serve as a temporary operating permit from initial start-up to the receipt of a standard operating permit, (regardless of the expiration date), provided the operating permit is applied for within thirty (30) days of initial start-up and the conditions of this permit and any applicable emission standards are met.

(End of conditions)

APPENDIX I

CATALYST POISONS STUDY

Memorandum

AIR PRODUCTS

To: Distribution | Dept./Loc.:

From: C. M. Chen | Dept./Ext.: PSE Process Eng./1-3315

Date: 9 May 1995

Subject: Updated summary of Kingsport LPMEOH feed stream analysis results

---

Distribution:

Air Products:
D. M. Brown *
W. R. Brown *
D. A. Chin-Fatt *
P. A. Clark *
P. J. Clark *
D. P. Drown/F. S. Frenduto *
S. A. Gardner *
F. A. Lucrezi *
E. S. Schaub/V. E. Stein/B. L. Bhatt/M. S. Mazdai/S. P. DiMartino *
B. A. Toseland/X-D Peng *

Eastman Chemical:
M. S. Baggett
T. T. Golob
W. C. Jones
J. L. Phillips
K. M. Pittman
J. K. Sanders

* sent via MS Mail

The attached table is an *updated* summary of Kingsport gas feed stream analytical results. Results of gas scrubbing followed by ICP-AES (10 January 1995 report) and gas chromatographic analysis (23 February 1995 analysis report) have been incorporated into the table.

Please call me (610-481-3315) if you have any questions or comments.

Christopher M. Chen

FORM 1020 (REV. 6/89)

✓ HAPS

Methanol Feed Contaminants: Summary of Analytical Results (rev. 4/28/95)

Component	Catalyst Limit (ppmv)	Analytical Method Used	Sampling Technique	Sample Date	ppmv in Syngas Feed, pre-G.Bed	ppmv in CO Makeup	ppmv in H_2 Makeup	Comments
Acetylene	5	GC-FID	Offline gas	8/5/94	< 0.5 (*Note* 2)	< 0.5 (*Note* 2)	< 0.5 (*Note* 2)	
		GC-FID	Offline gas	2/94	< 1 (*Note* 2)	< 1 (*Note* 2)	< 1 (*Note* 2)	
/ Arsenic as AsH_3	0.01 ?	HGA-AAS	Charcoal tube	8/5/94	0.027	< 0.001	< 0.001	Eastman syngas guard bed
		ICP-AES	Acid scrub	4/94	< 0.04	N/A	< 0.04	
		TOF-SIMS	Spent catalyst	1993	Significant amount of AsO_2^- detected on spent catalyst surface vs. fresh catalyst.			
✓ Halogens (Cl & F)	0.01	TOF-SIMS	Spent catalyst	1993	*No additional amount detected on spent catalyst* surface vs. fresh catalyst. No further analysis performed.			
✓ HCl		FT-IR	Offline gas	2/94	< 1	< 1	< 1	
Iron as $Fe(CO)_5$	0.01	ICP-AES	Acid scrub	12/94	< 0.01	< 0.01	< 0.01	APCI guard bed for upset
		F-AAS	Offline gas	8/5/94	< 0.01	< 0.01	< 0.01	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
		F-AAS	Charcoal tube	8/5/94	< 0.05	< 0.04	< 0.07	
		TOF-SIMS	Spent catalyst	1993	Slightly more Fe^+ detected on spent catalyst surface vs. fresh catalyst.			
/ Nickel as $Ni(CO)_4$	0.01	ICP-AES	Charcoal tube	8/5/94	≤ 0.001	< 0.001	< 0.002	APCI guard bed for upset
		ICP-AES	Acid scrub	12/94	< 0.01	< 0.01	< 0.01	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
		TOF-SIMS	Spent catalyst	1993	No additional amount of Ni^+ detected on spent catalyst surface vs. fresh catalyst.			
Nitrogen compounds								
Ammonia	10	ion chromatography	Acid scrub	3/94	< 0.23	N/A	< 0.23	
		FT-IR	Offline gas	2/94	< 1	< 1	< 1	
HCN	0.01	FT-IR	Offline gas	2/94	< 1	< 1	< 1	Need more sensitive analysis and/or portable test trailer.
		ion chromatography	Caustic scrub	3/94	< 5	< 2.5	< 7.5	
		TOF-SIMS	Spent catalyst	1993	No additional amount of CN^- detected on spent catalyst surface vs. fresh catalyst.			

conditions used for this analysis are listed in Table 3. The argon and oxygen content was obtained on the same instrument using a calcium chabazite column to separate argon from oxygen. The chromatographic conditions used for this analysis are listed in Table 4.

All three samples were screened for amines on a Hewlett-Packard 5890A gas chromatograph using a SPB-5 FSOT capillary column interfaced to a nitrogen-phosphorus detector (NPD). None of the samples contained any detectable levels of amines. The lower limit of detection for amine compounds is approximately 0.5 mole ppm. The chromatographic conditions are listed in Table 5. The samples were also screened for carbonyl sulfide (COS) on a Hewlett-Packard 5890 Series II gas chromatograph using a Chromosil 330 packed teflon column interfaced to a flame photometric detector (FPD). None of the samples contained any detectable levels of COS. The lower limit of detection for COS is approximately 4 mole ppm. The chromatographic conditions are listed in Table 6.

The sample was also analyzed on a DB-WAX FSOT capillary column interfaced to a flame ionization detector (FID) for determination of any additional organic compounds. Quantitation was obtained using an external standardization procedure with a detector response factor determined for methanol. The chromatographic conditions are listed in Table 7.

RESULTS AND DISCUSSION

The concentration values reported for each sample in Table 1 have been normalized to 100% accountability. The total accountabilities for the "CO Feed" and "Syngas" samples were very close to 100% prior to normalization. However, the total accountability for the "Purge Gas" sample had a total accountability higher than 100%. This is mostly due to the high hydrogen content in the sample. The Eastman Syngas standard used to quantitate the hydrogen content only had 50 mole % hydrogen.

"Kingsport"-type syngas
Headed to Allentown

Table 1

Sample Composition (Mole %)

Components	CO Feed	Syn Gas	Purge Gas
Hydrogen	1.76 (0.30)	68.06 (0.23)	73.07 (0.85)
Argon	0.16 (0.30)	0.06 (2.78)	0.94 (0.20)
Oxygen	0.08 (1.43)	0.40 (0.41)	7.14 (0.04)
Nitrogen	0.91 (0.99)	0.40 (2.43)	7.80 (0.41)
Carbon Monoxide	97.03 (0.17)	27.96 (0.93)	5.92 (0.21)
Carbon Dioxide	N.D. (<0.001)	3.00 (0.94)	2.88 (0.32)
Methane	0.05 (0.99)	0.12 (2.76)	1.28 (0.05)
Ethane	N.D. (<0.00005)	0.0006 (3.44)	0.03 (0.18)
Ethylene	N.D. (<0.00005)	N.D. (<0.00005)	N.D. (<0.00005)
Acetylene	N.D. (<0.00005)	N.D. (<0.00005)	N.D. (<0.00005)
Propane	N.D. (<0.00005)	N.D. (<0.00005)	0.01 (1.05)
Propylene	N.D. (<0.00005)	N.D. (<0.00005)	N.D. (<0.00005)
Iso-butane	N.D. (<0.00005)	N.D. (<0.00005)	0.0006 (0.10)
n-Butane	N.D. (<0.00005)	N.D. (<0.00005)	0.004 (0.48)
Iso-pentane	N.D. (<0.00005)	N.D. (<0.00005)	0.0003 (0.77)
n-Pentane	N.D. (<0.00005)	N.D. (<0.00005)	0.0009 (0.37)
Hexanes	N.D. (<0.00005)	N.D. (<0.00005)	0.0002 (1.38)
Amines	N.D. (<0.00005)	N.D. (<0.00005)	N.D. (<0.00005)
COS	N.D. (~~<0.0004~~) (<0.00005)	N.D. (~~<0.0004~~) (<0.00005)	N.D. (~~<0.0004~~) (<0.00005)
Acetonitrile	N.D. (<0.05)	N.D. (<0.05)	N.D. (<0.05)
Methanol	N.D. (<0.05)	N.D. (<0.05)	0.34 (0.38)

Dean forgot to update

Note: The data above is presented in the format X(S) where X is the average of two determinations and S is the relative percent standard deviation of the analysis.
N.D. = Not Detected.

Table 2

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890 Series II Refinery Gas Analyzer

Columns:

Analysis of Inerts - Chrompack 25 meter x 0.53 mm ID Molsieve 5A PLOT fused silica capillary column; Chrompack 27.5 meter x 0.53 mm ID PoraPLOT Q PLOT fused silica capillary column.

Analysis of Hydrocarbons - Chrompack 50 meter x 0.53 mm ID AL203/KCL PLOT fused silica capillary column.

Oven Temperature Program:

Initial Temperature	40 °C
Initial Time	6 min
Program Rate	12 °C/min
Final Temperature	180 °C
Final Time	18 min

Carrier Gas: Helium

Flow Rate (Molsieve/PoraPLOT Q)	7.5 ml/min
Column Headpressure	22 psig
Flow Rate (AL203/KCL)	6 ml/min
Column Headpressure	8 psig
Splitter Flow Rate	40 ml/min

Detector Type: Thermal Conductivity/Flame Ionization

Detector Temperature	200 °C / 200 °C
TCD Reference Flow	22.5 ml/min
FID Hydrogen	30 ml/min
FID Air	360 ml/min
Valve / Injector Temperature	120 °C

Injection Volume: 25 microliters at atmospheric pressure

Injection Mode: Valco gas sampling valves

Data System: Hewlett-Packard 3396 integrator (Stored HP Methods RGA01 and RGA02)

Quantitation Method: External Standard (Calib. Std. # 2, 3, 4 and 8; Scotty Std. # 100 and 101)

Table 3

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890A Gas Chromatogarph

Columns: Activated Charcoal 80/100 mesh packed nickel column, 10' x 1/8"

Oven Temperature Program:

Initial Temperature	40	°C
Initial Time	4	min
Program Rate	10	°C/min
Final Temperature	120	°C
Final Time	1	min

Carrier Gas: Nitrogen

Flow Rate	30	ml/min
Column Headpressure	22	psig

Detector Type: TCD

Detector Temperature	200	°C
Amplifier/Range Setting	0	
Reference	20	ml/min

Injector Temperature: 0 °C

Injection Volume: 1 cc @ 1 atm.

Injection Mode: Valco gas sampling valve

Data System: HP-3396 Integrator

Quantitation Method: External Standard

Calibration Standard: Calib. Std. # 16, Eastman Syn Gas Standard

Sample Preparation: None

Table 4

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890A Gas Chromatogarph

Columns: Calcium Chabazite 80/100 mesh packed SS column, 6' x 1/8"

Oven Temperature Program:

Initial Temperature	40	°C
Initial Time	5	min
Program Rate	15	°C/min
Final Temperature	210	°C
Final Time	1	min

Carrier Gas: Helium

Flow Rate	22	ml/min
Column Headpressure	25	psig

Detector Type: TCD

Detector Temperature	200	°C
Amplifier/Range Setting	0	
Reference	33	ml/min

Injector Temperature: Room Temperature

Injection Volume: 5 cc @ 1 atm.

Injection Mode: Valco gas sampling valve

Data System: HP-3396 Integrator

Quantitation Method: External Standard

Calibration Standard: Calib. Std. # 2, 3

Sample Preparation: None

Table 5

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890A Gas Chromatograph

Columns: SPB-5 FSOT capillary column, 30 meter x 0.32 mm I.D., 1.0 micron film. Col. # 224

Oven Temperature Program:

Initial Temperature	45	°C
Initial Time	5	min
Program Rate	8	°C/min
Final Temperature	220	°C
Final Time	10	min

Carrier Gas: Helium

Flow Rate	2.1	ml/min
Column Headpressure	9.5	psig
Splitter Flow Rate	20	ml/min

Detector Type: NPD

Detector Temperature	280	°C
Amplifier/Range Setting	0	
Hydrogen	3.5	ml/min
Air	110	ml/min
NPD Make-up	28	ml/min

Injector Temperature: 150 °C

Injection Volume: 0.5 cc @ 1 atm.

Injection Mode: Manual injection

Data System: HP-3396 Integrator

Quantitation Method:

Calibration Standard:

Sample Preparation: None

Table 6

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890 Series II Gas Chromatograph

Columns: Chromosil 330 packed teflon column, 8' x 1/8"

Oven Temperature Program:

Initial Temperature	45	°C
Initial Time	2	min
Program Rate	10	°C/min
Final Temperature	70	°C
Final Time	2	min

Carrier Gas: Helium

Flow Rate	10	ml/min
Column Headpressure	15	psig

Detector Type: FPD

Detector Temperature	150	°C
Amplifier/Range Setting	0	
Hydrogen	100	ml/min
Air	110	ml/min
FPD Make-up	24	ml/min

Injector Temperature: 80 °C

Injection Volume: 2.5 cc @ 1 atm.

Injection Mode: Valco gas sampling valve

Data System: HP-3396 Integrator

Quantitation Method:

Calibration Standard:

Sample Preparation: None

Table 7

Gas Chromatographic Conditions

Instrument: Hewlett-Packard 5890 Series II Gas Chromatograph

Columns: DB-Wax FSOT capillary column, 30 meter x 0.25 mm I.D., 0.5 micron film. Col. # 92

Oven Temperature Program:

Initial Temperature	40	°C
Initial Time	10	min
Program Rate	8	°C/min
Final Temperature	160	°C
Final Time	2	min

Carrier Gas: Helium

Flow Rate	1.8	ml/min
Column Headpressure	9.1	psig
Splitter Flow Rate	20	ml/min

Detector Type: FID

Detector Temperature	270	°C
Amplifier/Range Setting	2	
Hydrogen	30	ml/min
Air	310	ml/min
FID Make-up	28	ml/min

Injector Temperature: 150 °C

Injection Volume: 1 cc @ 1 atm.

Injection Mode: Valco gas sampling valve

Data System: PE Nelson 2700 Turbochrome

Quantitation Method: External Standard

Calibration Standard: 11664-10-3 (3.43 mole % methanol in Argon)

Sample Preparation: None

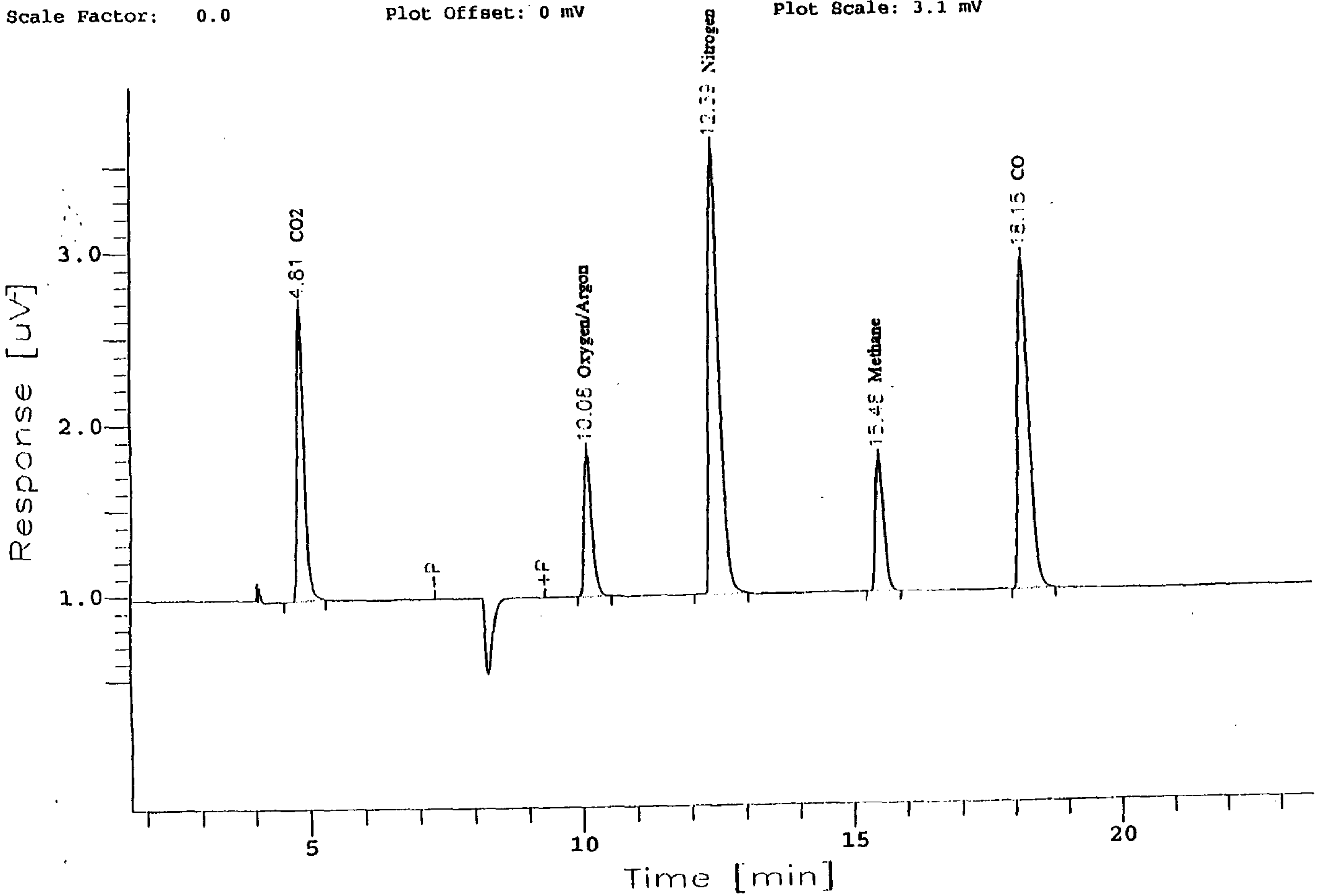
PURGE GAS
RGA Analysis - TCD

Sample Name : PURGE GAS
FileName : A:\N21A006.RAW
Method : default
Start Time : 1.71 min
Scale Factor: 0.0

End Time : 23.61 min
Plot Offset: 0 mV

Sample #: 2
Date : 1/6/95 10:24 AM
Time of Injection: 11/21/94 03:32 PM
Low Point : 0.47 mV
Plot Scale: 3.1 mV

High Point : 3.5

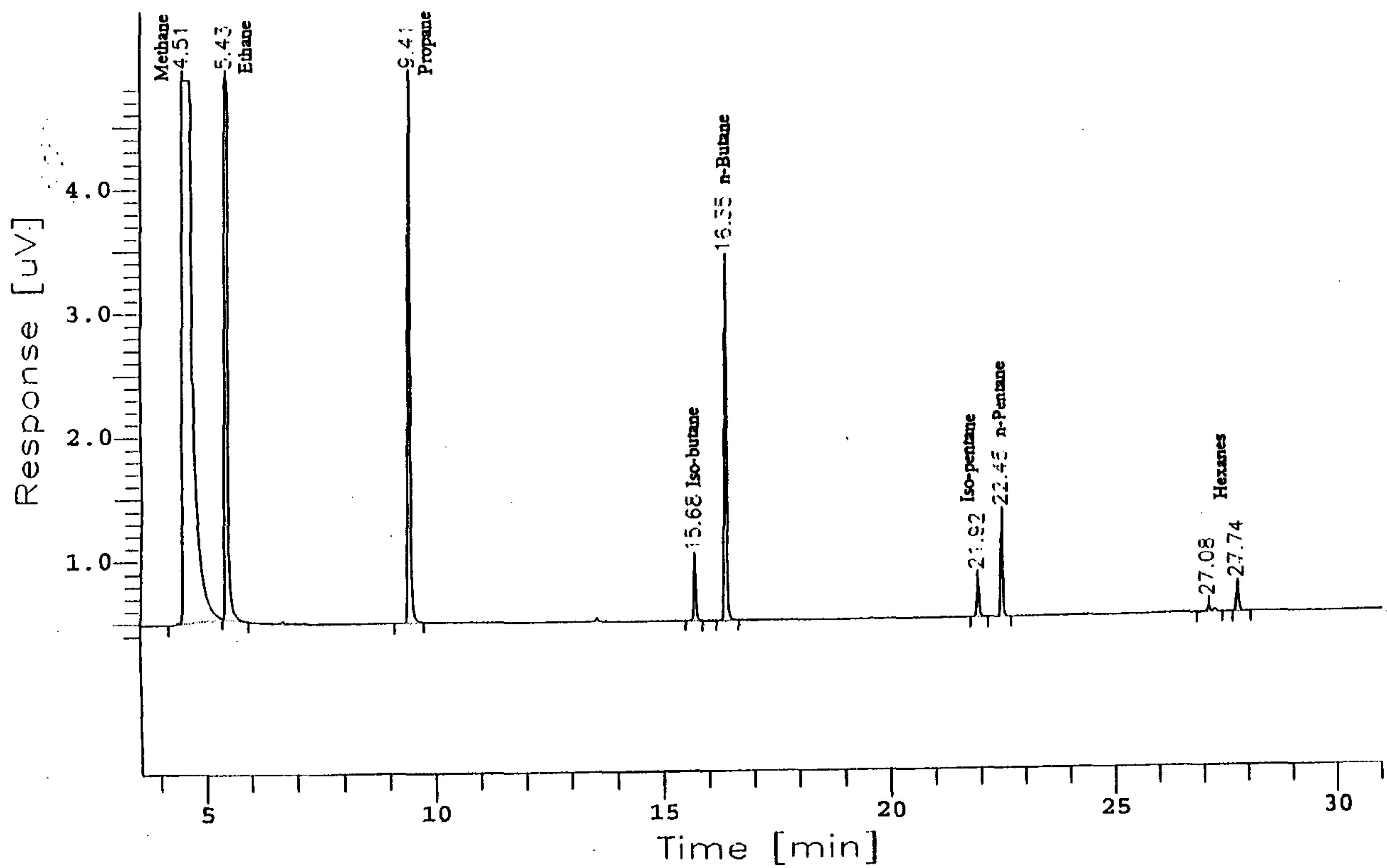


PURGE GAS
RGA Analysis - FID

Sample Name : PURGE GAS
FileName : A:\N21B006.RAW
Method : default
Start Time : 3.58 min
Scale Factor: 0.0

End Time : 31.00 min
Plot Offset: 0 mV

Sample #: 2
Date : 1/6/95 10:27 AM
Time of Injection: 11/21/94 03:32 PM
Low Point : 0.38 mV
High Point : 4.8
Plot Scale: 4.5 mV



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JUN - 1 1994

PROCESS ENGINEERING

Analysis Report

AIR PRODUCTS

To:	Elizabeth S. Schaub	Dept./Loc.:	PSG Proc Eng / A12A3
From:	Patrick J. Clark	Dept./Ext.:	CRSD-ATC / 6504
Date:	31 May 1994	Lab Name:	Separations And Mass Spectrometry
Subject:	Gas Chromatographic Analysis of Process Gas Streams from Eastman Chemical (Kingsport, TN)		
Sample No.:	See Below		

c: CS File No. 1432, LB File, SAMS Circ., A. J. Di Gioia, C. M. Chen

lower D.L. ≅ 0.5 ppm

6/6/94 voice mail
· No aromatics (benzene or higher)
· No acetonitrile
· will perform analysis for O_2/Ar split this week

SUMMARY:

Three samples of feed gas to the proposed Liquid Phase Methanol facility at the Eastman Chemical complex at Kingsport, TN were analyzed for composition by gas chromatography. The samples were designated as follows: "CO Feed to AC2O Plant" described as a pure CO stream from a HYCO cold box, "Inlet Feed to MeOH Plant" described as the main syngas supply from the Lurgi plant feed, and "Purge Gas from MeOH Plant" described as the purge gas from the Lurgi methanol plant. The mole percent compositions of these process streams are tabulated in Table 1. The expected compositions, provided by Eastman Chemical, are also included in Table 1.

All of the samples contained hydrogen, oxygen/argon, nitrogen, carbon monoxide and methane. The sample identified as "Inlet Feed to MeOH Plant" also contained carbon dioxide, ethane and methanol. The sample identified as "Purge Gas from MeOH Plant" also contained carbon dioxide, ethane, ethylene, propane, propylene, iso-butane, n-butane, iso-pentane, n-pentane and n-hexane as well as methanol. The samples did not contain any detectable hydrocarbons heavier than C6.

Although two of the samples contained methanol, no other oxygenated organic compounds or amine compounds were detected in any of the samples. The estimated lower limit of detection for these types of compounds is approximately 0.5 mole ppm.

PROBLEM DEFINITION:

Air Products will be constructing a 250 ton per day Liquid Phase Methanol facility at the Eastman Chemical complex in Kingsport (TN). Currently, a Texaco gasifier is used to convert coal into syngas which is used to produce a variety of chemicals, including methanol (using conventional Lurgi fixed bed technology), acetic acid and acetic anhydride. The LPMEOH plant will have three different sources of feed gas as described above. It is essential to know the composition of these feed streams, especially the presence of any components which may cause deactivation of the catalyst.

Request No.:	022225		
Charge No.:	00-3-8215.51.10.11	Analyst:	PJC
Notebook No.:	10975-99		
M[illegible]d No.:			
Ph[illegible]e Date:	31 May 1994		
Sample Receipt Date:	01 March 1994	Doc. Name:	s:\reports\1400\1432scha.doc

ANALYTICAL PROCEDURES:

A Hewlett-Packard 5890 Series II Refinery Gas Analyzer (RGA) was used for the quantitative analysis of oxygen/argon, nitrogen, carbon monoxide, carbon dioxide and the C1 to C6 hydrocarbons. An external standardization procedure was used for quantitation. The standards and samples were introduced into the gas chromatograph at atmospheric pressure using a gas sampling manifold interfaced to a vacuum system and a ballast cylinder system. The chromatographic conditions used for this analysis are listed in Table 2. Representative chromatograms are shown in Figures 1 and 2.

The quantitative analysis for hydrogen was performed on a Hewlett-Packard 5890A gas chromatograph using nitrogen carrier gas. An external standardization procedure was used for quantitation. The chromatographic conditions used for this analysis are listed in Table 3.

The sample was also analyzed on a DB-WAX FSOT capillary column interfaced to a flame ionization detector for determination of any additional organic compounds. Quantitation was obtained using an external standardization procedure with a detector response factor determined for methanol. The chromatographic conditions are listed in Table 4. The chromatogram shown in Figure 3 illustrates the elution order and retention times for a number of potential components of interest. A representative chromatogram of the "Purge Gas from the MeOH Plant" is shown in Figure 4.

RESULTS AND DISCUSSION:

The concentration values reported for each sample in Table 1 have been normalized to 100% accountability. The total accountabilities for the samples identified as "Inlet Feed to MeOH Plant" and "Purge Gas from MeOH Plant" were very close to 100% prior to normalization. However, the total accountability for the sample identified as "CO Feed to AC2O Plant" was quite low due to residual helium being present in the sample cylinder. The sample cylinders were initially filled with helium ~~and vented to atmospheric pressure prior to shipment to Eastman Chemical for filling~~. During sampling, Eastman pressurized the cylinder with the process stream, vented the cylinder to atmospheric pressure and then refilled with the process stream. Apparently the process pressure for the latter sample was inadequate to completely purge all residual helium from the sample cylinder.

Table 1

Sample Composition (mole percent)

Component	Retention Time (min.)	CO Feed to AC2O Plant	Inlet Feed to MeOH Plant	Purge Gas from MeOH Plant
hydrogen		1.8 (0.02) [2%]	68.36 (0.014) [67.8%]	82.26 (0.45) [74%]
oxygen/argon	7.76	0.35 (0.001)	0.14 (0.0009)	1.36 (0.001)
nitrogen	10.08	0.83 (0.004) [1%]	0.35 (0.0018) [0.5%]	3.63 (0.006) [12%]
carbon monoxide	16.02	97.0 (0.08) [97%]	26.56 (0.025) [27.7%]	7.94 (0.041) [11%]
carbon dioxide	3.95	N.D. (< 0.0010)	4.50 (0.029) [4.0%]	3.96 (0.015) [3%]
methane	4.45	0.044 (0.001)	0.062 (0.0004)	0.73 (0.004)
ethane	5.34	N.D. (< 0.00005)	0.00035 (0.00004)	0.0082 (0.0001)
ethylene	6.58	N.D. (< 0.00005)	N.D. (< 0.00005)	0.00008 (0.00001)
propane	9.34	N.D. (< 0.00005)	N.D. (< 0.00005)	0.0034 (0.00005)
propylene	13.47	N.D. (< 0.00005)	N.D. (< 0.00005)	< 0.0001
iso-butane	15.64	N.D. (< 0.00005)	N.D. (< 0.00005)	0.00014
n-butane	16.31	N.D. (< 0.00005)	N.D. (< 0.00005)	0.0011 (0.00004)
iso-pentane	21.90	N.D. (< 0.00005)	N.D. (< 0.00005)	0.00012 (0.00001)
n-pentane	22.43	N.D. (< 0.00005)	N.D. (< 0.00005)	0.00034
n-hexane	28.1	N.D. (< 0.00005)	N.D. (< 0.00005)	0.00014 (0.00001)
acetylene		N.D.	N.D.	N.D. (phone conversation).
methanol		N.D. (< 0.00005)	0.032 (0.004)	0.10 (0.006)

How much O_2 ? → Mostly all Argon.

NOTE: The results above are reported in the format X (S) where X is the average of two determinations and S is the standard deviation of the analysis.

The expected compositions for the primary components, as provided by Eastman Chemical, are included in brackets [ ] below each reported concentration.

Table 2

Gas Chromatographic Conditions for Instrument: Hewlett-Packard 5890 Series II Refinery Gas Analyzer

Columns:

Analysis of Inerts - Chrompack 25 meter x 0.53 mm ID Molsieve 5A PLOT fused silica capillary column; Chrompack 27.5 meter x 0.53 mm ID PoraPLOT Q PLOT fused silica capillary column.

Analysis of Hydrocarbons - Chrompack 50 meter x 0.32 mm ID AL203/KCL PLOT fused silica capillary column.

Oven Temperature Program:

Initial Temperature	40	°C	Final Temperature	180	°C
Initial Time	6	min	Final Time	16.5	min
Program Rate	8	°C/min	Total Analysis Time	40.0	min

Carrier Gas: Helium

Flow Rate (Molsieve/PoraPLOT Q)	5.5	mL/min	Flow Rate (AL203/KCL)	1.3	mL/min
Column Headpressure	16	psig	Column Headpressure	12	psig
Splitter Flow Rate	30	mL/min			

Detector Type: Thermal Conductivity/Flame Ionization

Detector Temperature	200	°C / 200 °C
TCD Reference Flow	15.7	mL/min
FID Hydrogen	30	mL/min
FID Air	360	mL/min
Valve / Injector Temperature	120	°C

Injection Mode \ Volume: Valco gas sampling valves / 1 mL at atmospheric pressure

Data System: Hewlett-Packard 3396 integrator (Stored HP Method RGA)
PE-Nelson Turbochrom Data System (Stored Methods RGA_TCD and RGA_FID)

Calibration Standards: External Standardization

Standard No. 2 - 0.1970 mole % oxygen/argon, 0.1080 mole % nitrogen, 0.1031 mole % carbon monoxide, 0.0963 mole % methane

Standard No. 8 - 74.3 mole % carbon monoxide, 25.7 mole % methane

Standard No. 33 - 37.0 mole % hydrogen, 0.50 mole % oxygen, 0.50 mole % nitrogen, 0.50 mole % carbon monoxide, 0.50 mole % carbon dioxide, 46.0 mole % methane, 10.0 mole % ethane, 1.0 mole % ethylene, 2.0 mole % propane, 0.15 mole % propylene, 0.7 mole % isobutane, 0.7 mole % n-butane, 0.5 mole % isopentane

Scotty Standard No. 100 - 16.3 mole ppm methane, 15.3 mole ppm ethane, 16.7 mole ppm ethylene, 21.2 mole ppm propane, 12.3 mole ppm propylene, 16.6 mole ppm n-butane

Table 3

Gas Chromatographic Conditions
(hydrogen)

Instrument: Hewlett-Packard 5890A Gas Chromatograph

Columns: 10 ft. x 1/8-inch OD nickel column packed with 60/80 mesh Activated Charcoal

Oven Temperature Program:

Initial Temperature	40	°C
Initial Time	4	min
Program Rate	10	°C/min
Final Temperature	120	°C
Final Time	1	min
Total Analysis Time	13.0	min

Carrier Gas: Nitrogen

Flow Rate	22 mL/min
Column Headpressure	22 psig

Detector Type: Thermal Conductivity

Detector Temperature	200 °C
TCD Reference Flow	33 mL/min
Valve / Injector Temperature	ambient

Injection Volume: 1 mL at atmospheric pressure

Injection Mode: Valco gas sampling valve

Data System: Hewlett-Packard 3396 integrator / PE-Nelson Turbochrom Date System

Quantitation Method: External Standardization

Calibration Standard: Standard No. 16 - 5.01 mole % hydrogen
Standard No. 17 - 39.5 mole % hydrogen
Standard No. 18 - 60.0 mole % hydrogen

Table 4

Gas Chromatographic Conditions for Instr ment: Hewlett-Packard 5890A

Column: J&W Scientific DB-WAX FSOT capillary, 30 m x 0.32 mm ID, 0.5 micron film thickness
Column No. 196

Oven Temperature Program

Initial Temperature	40 °C
Initial Time	10 min
Program Rate	8 °C/min
Final Temperature	160 °C
Final Time	5 min
Total Time	30.0 min

Carrier Gas Helium

Flow Rate	1.8 mL/min
Carrier Gas Velocity	27.3 cm/sec
Column Headpressure	9.2 psig
Splitter Flow Rate	20 mL/min

Injector Temperature 150 °C

jection Mode / Volume gas-tight syringe / 1.0 cc at atmospheric pressure

Detector Type Flame Ionization

Detector Temperature	200 deg C
Amplifier / Range Setting	0
Hydrogen	30 mL/min
Air	300 mL/min
FID Make-up	28 mL/min

Quantitation Method External Standardization

Figure 1 PURGE GAS FROM MEOH PLANT

RGA Analysis - TCD

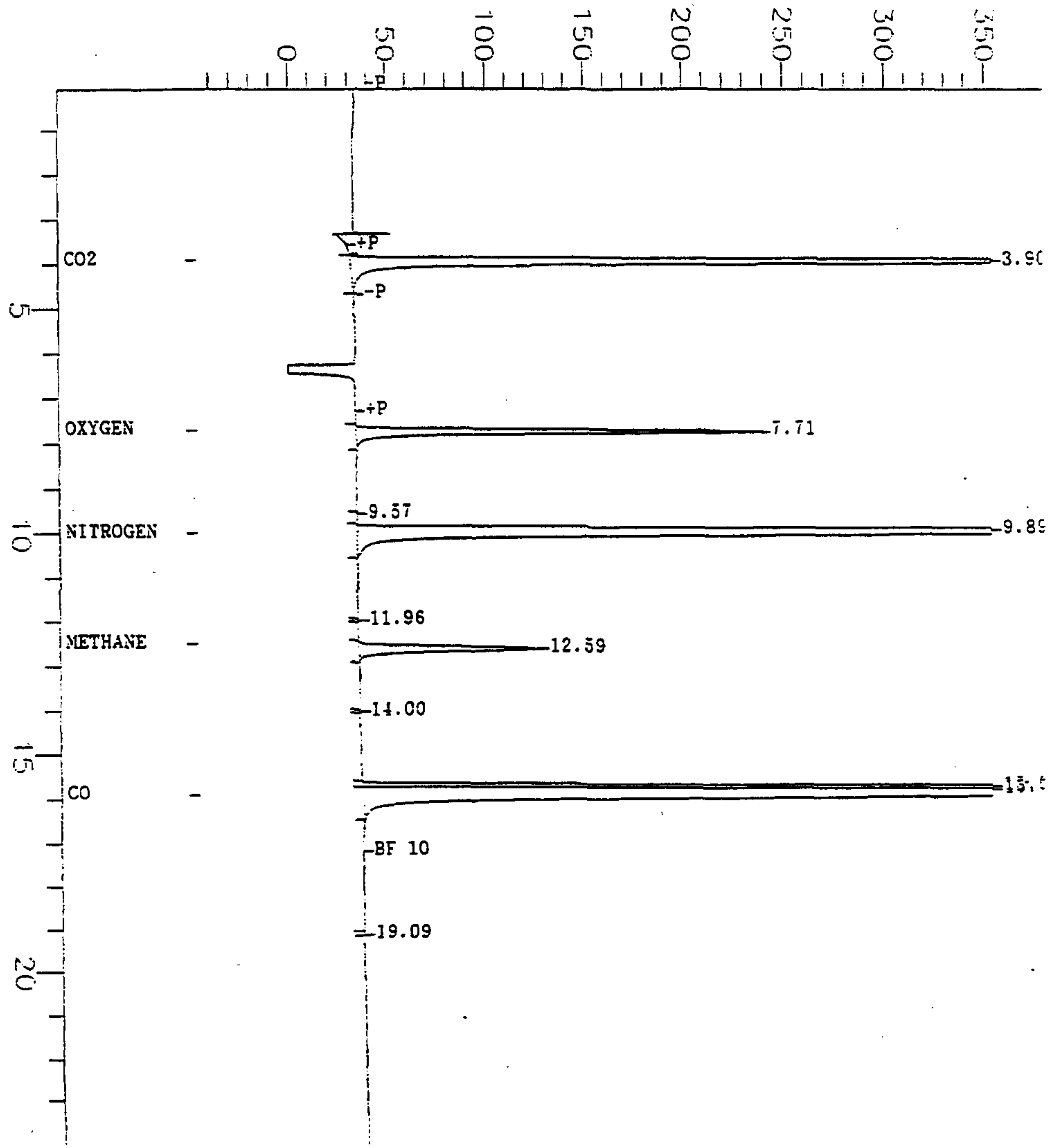
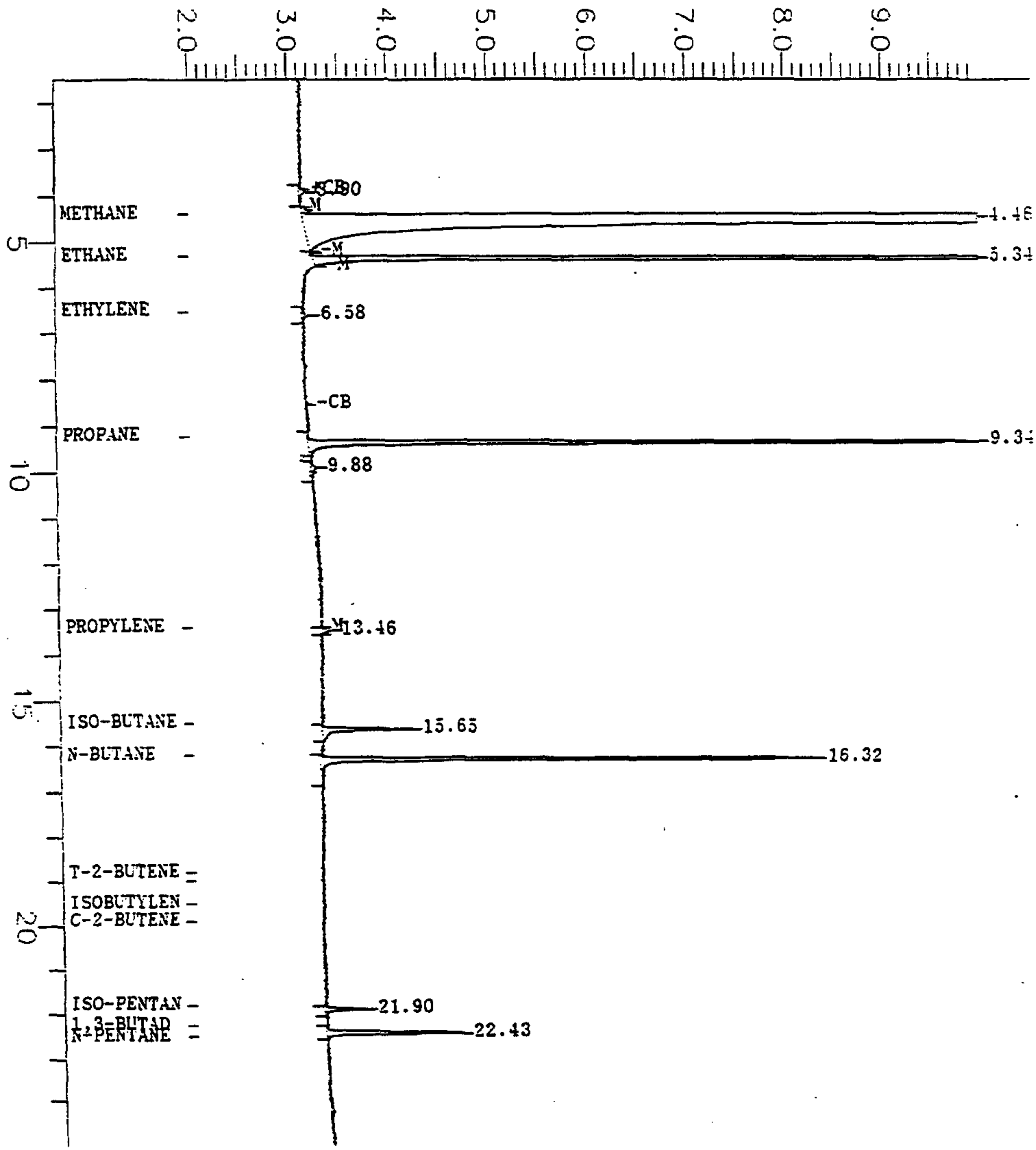


Figure 2 PURGE GAS FROM MEOH PLANT

RGA Analysis - FID



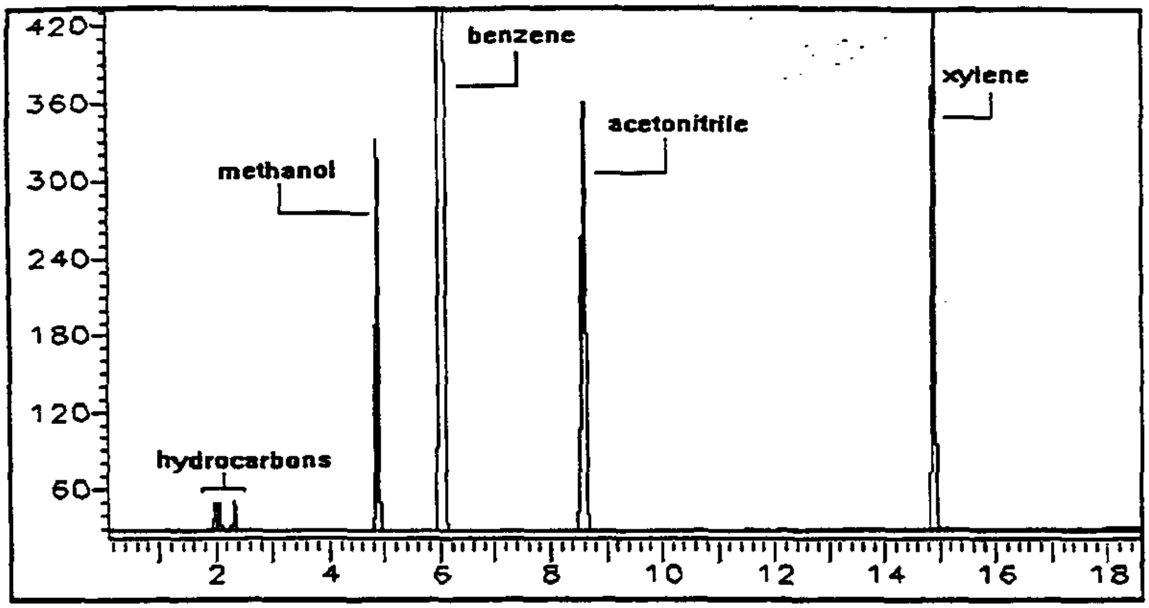


FIGURE 3. Elution Order of Organic Compounds on DB-WAX Capillary Column

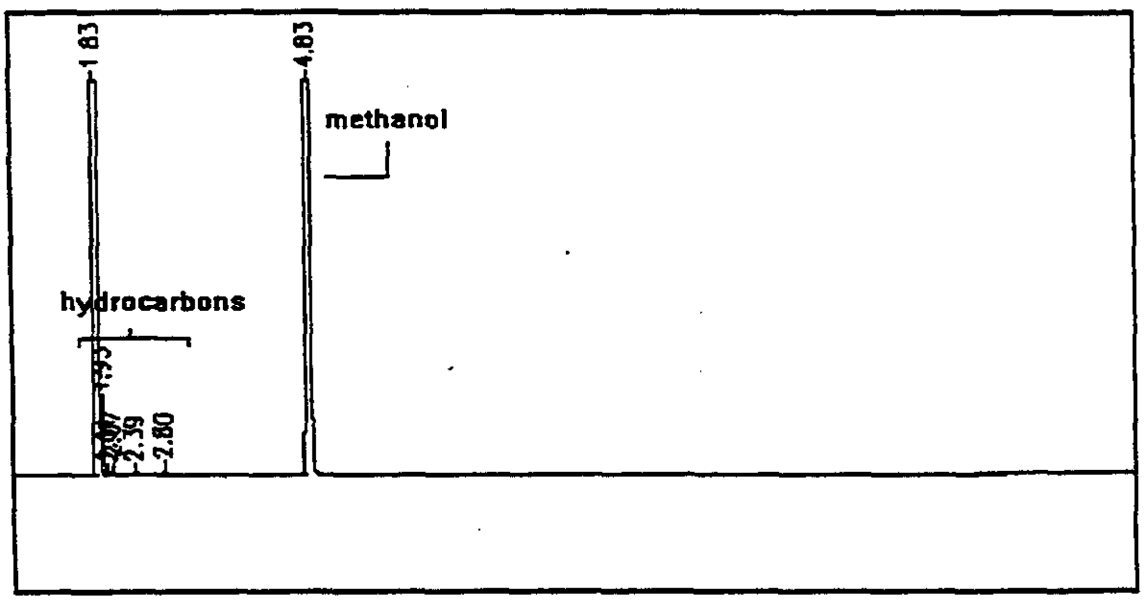


FIGURE 4. "Purge Gas from MeOH Plant" on DB-WAX Capillary Column

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MAY 05 1994

Analysis Report

AIR PRODUCTS

To	E. S. Schaub /cmc PROCESS ENGINEERING	Dept./Loc.:	PSG Eng. / A12A3
From:	S. A. Gardner SAG	Dept./Ext.:	CRSD / 4637
Date:	2 May 1994	Lab Name:	Spectroscopy
Subject:	Infrared Analysis of Gas Cylinders from Eastman Chemical		
Sample No.:	Inlet Feed to MeOH Plant; CO Feed to AC20 Plant; Purge Gas from MeOH Plant		

c: P. J. Clark; E. J. Karwacki; F. A. Lucrezi; D. R. Latshaw/IR Lab

SUMMARY:

Three cylinders of gas sampled at Eastman Chemical's Kingsport, TN facility were submitted for infrared analysis to determine their composition. The Inlet Feed to MeOH Plant sample contained percent levels of CO and CO_2, as well as a significant amount of CH_4. A small amount of C_2H_6 was also present. The CO Feed to AC20 Plant sample contained percent levels of CO and a significant amount of CH_4. The Purge Gas from MeOH Plant sample was found to contain percent levels of CO and CO_2, as well as a significant amount of CH_4. The spectra were specifically examined for the presence of HCN, SO_2, HCl, NO, NO_2, N_2O and NH_4. No indications for the presence of these compounds were observed. Ammonia is a very strong absorber in the infrared. Its lower detection limit (LDL) was estimated to be in the ppb range. The LDLs for the remaining compounds were estimated to be 1 ppm. However, CO and CH_4 present in the samples would interfere with SO_2, HCl and N_2O bands, thus significantly raising the LDLs for these compounds in the samples. Copies of spectra are attached for your reference.

ANALYTICAL PROCEDURES:

A portion of each sample was drawn into an evacuated 9.3 meter pathlength gas cell in a Nicolet 8220 FT-IR gas analyzer. The Inlet Feed to MeOH Plant and Purge Gas from MeOH Plant samples were also analyzed in a one inch pathlength cell to bring the CO, CO_2 and CH_4 bands onto scale. All spectra were obtained by co-adding 150 scans at 2.0 cm^{-1} resolution and were referenced against a background of the evacuated cells.

Request No.:	022225
Charge No.:	00-3-8215.51.10.11
Notebook No.:	14094-10
Method No.:	none
Done Date:	5/2/94
Sample Receipt Date:	4/28/94
Spectra No:	17253-17262; 17264; 17266-17270

Figure 1

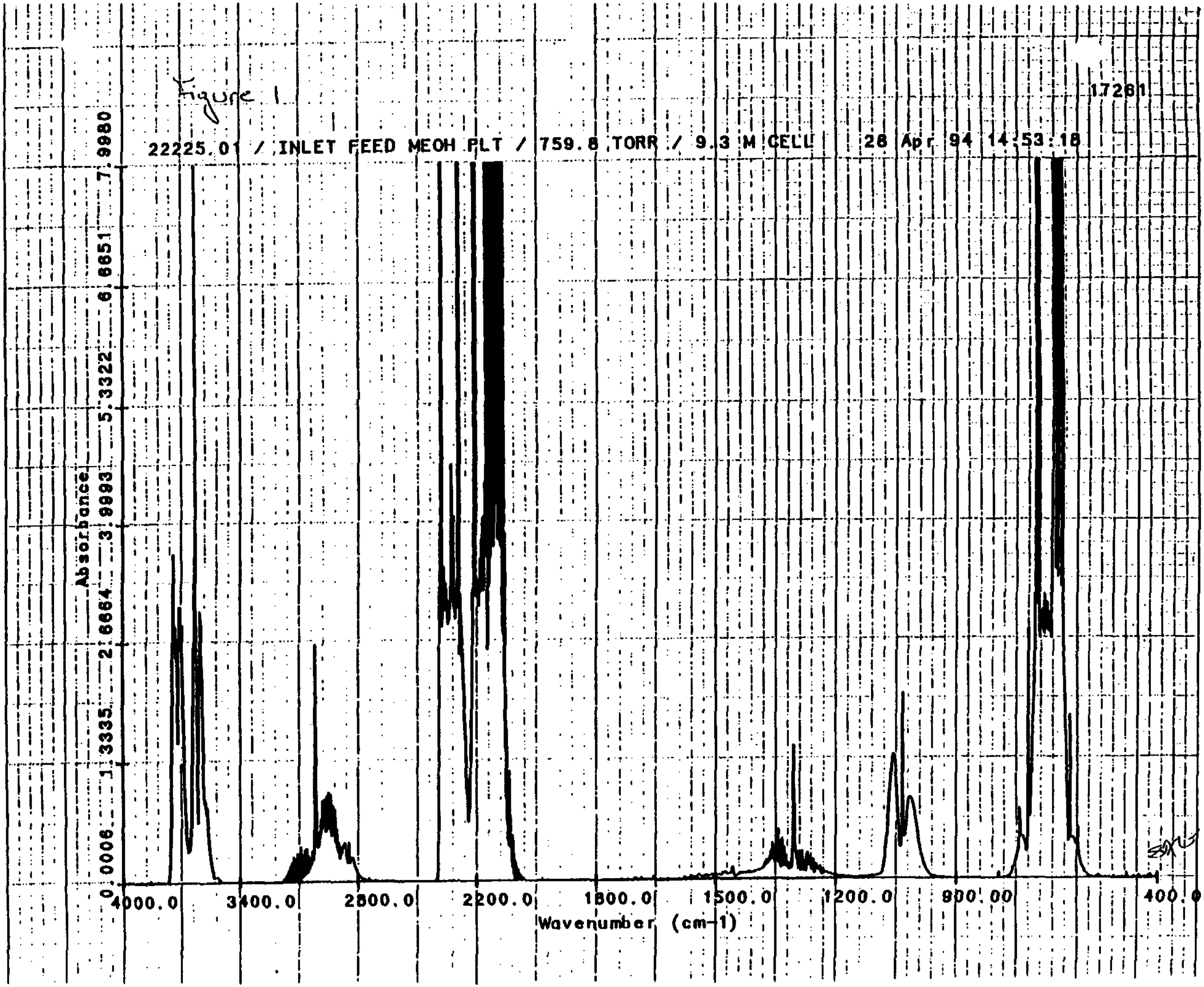
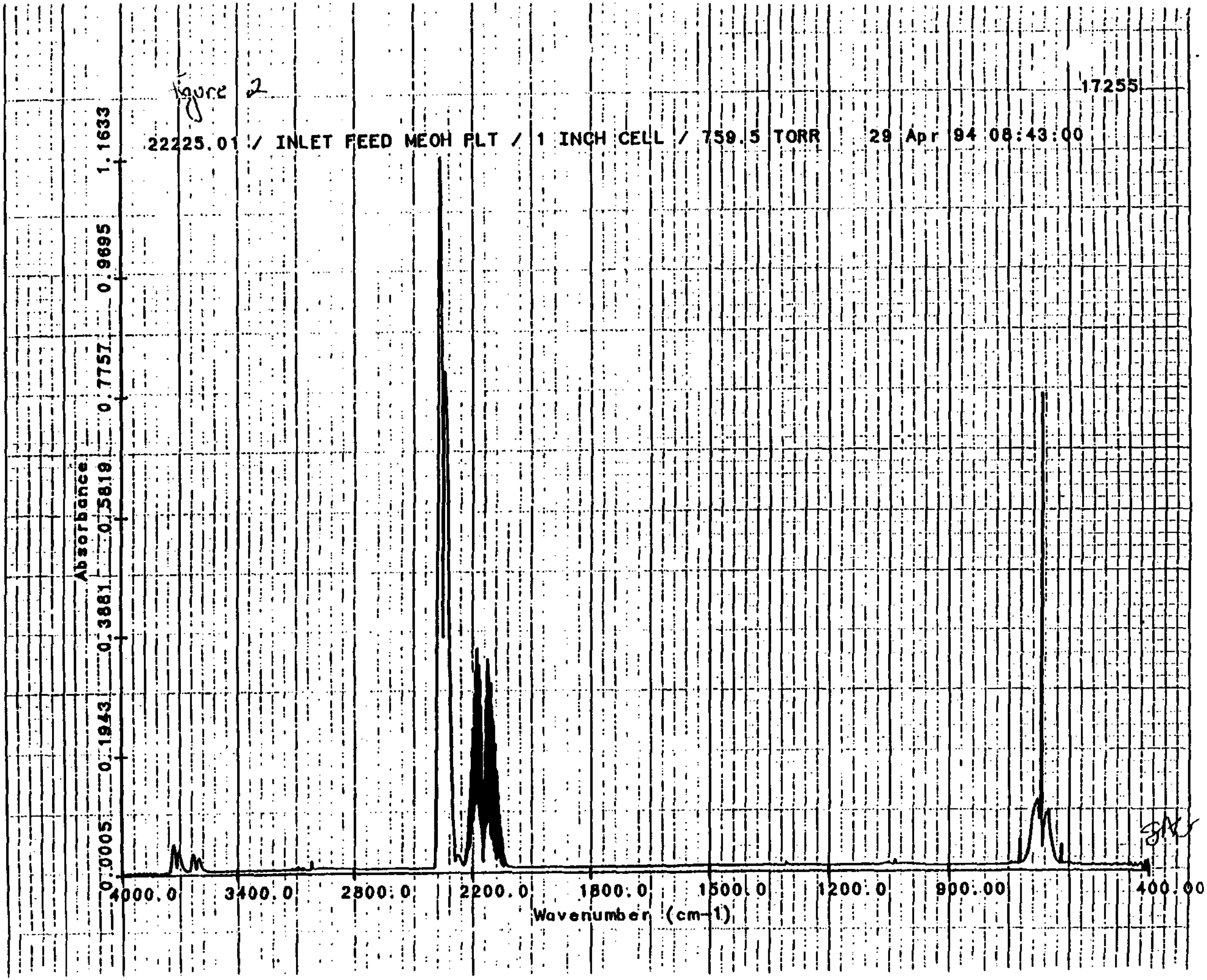
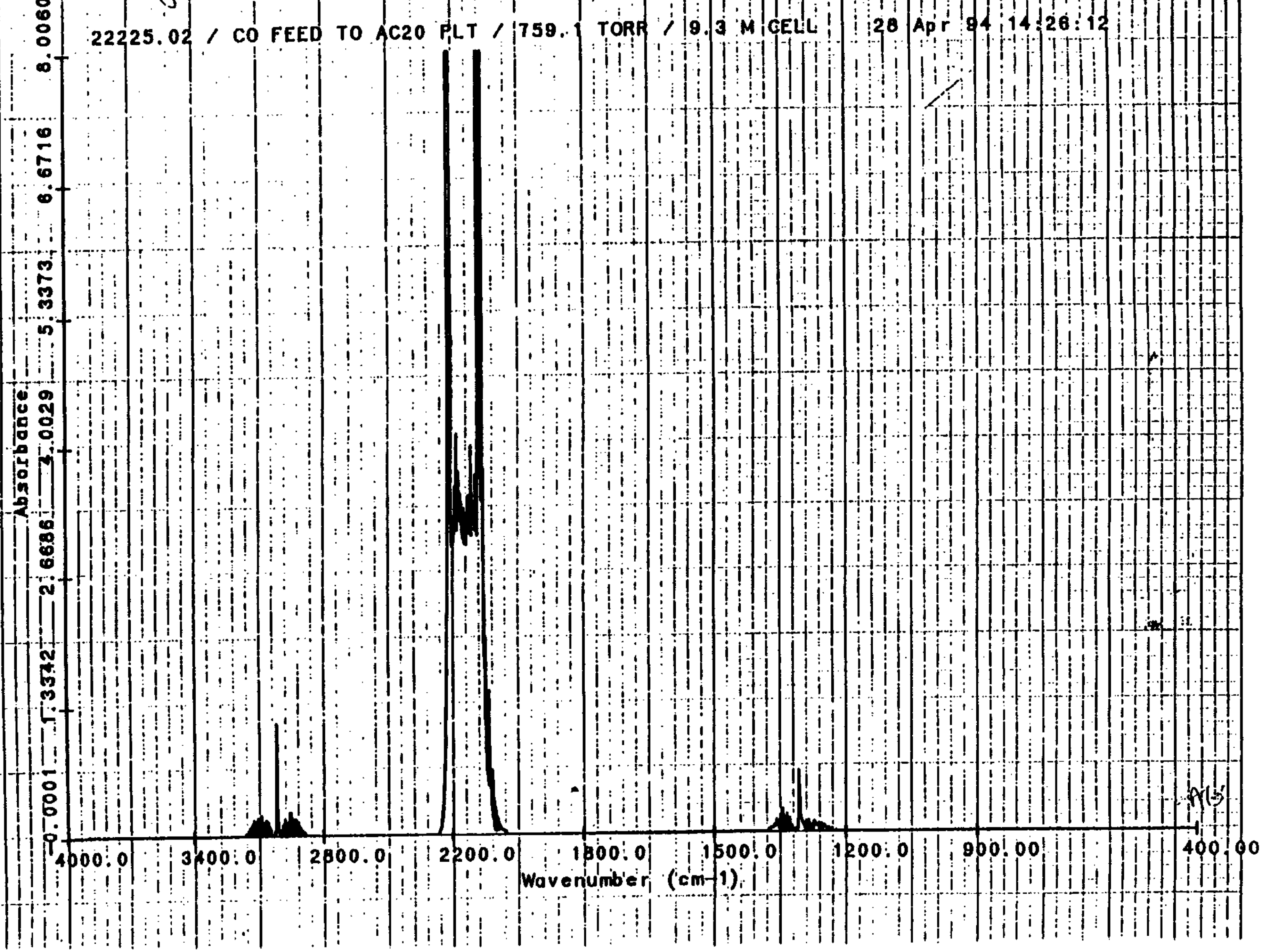

17261
22225.01 / INLET FEED MEOH PLT / 759.8 TORR / 9.3 M CELL 28 Apr 94 14:53:18
Absorbance
0.0006
1.3335
2.6664
3.9993
5.3322
6.6651
7.9980
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 2



17255
22225.01 / INLET FEED MEOH PLT / 1 INCH CELL / 759.5 TORR
29 Apr 94 08:43:00
Absorbance
1.1633
0.9695
0.7757
0.5819
0.3881
0.1943
0.0005
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 3



22225.02 / CO FEED TO AC20 PLT / 759.1 TORR / 9.3 M CELL
28 Apr 94 14:26:12
Absorbance
8.0060
6.6716
5.3373
4.0029
2.6686
1.3342
0.0001
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

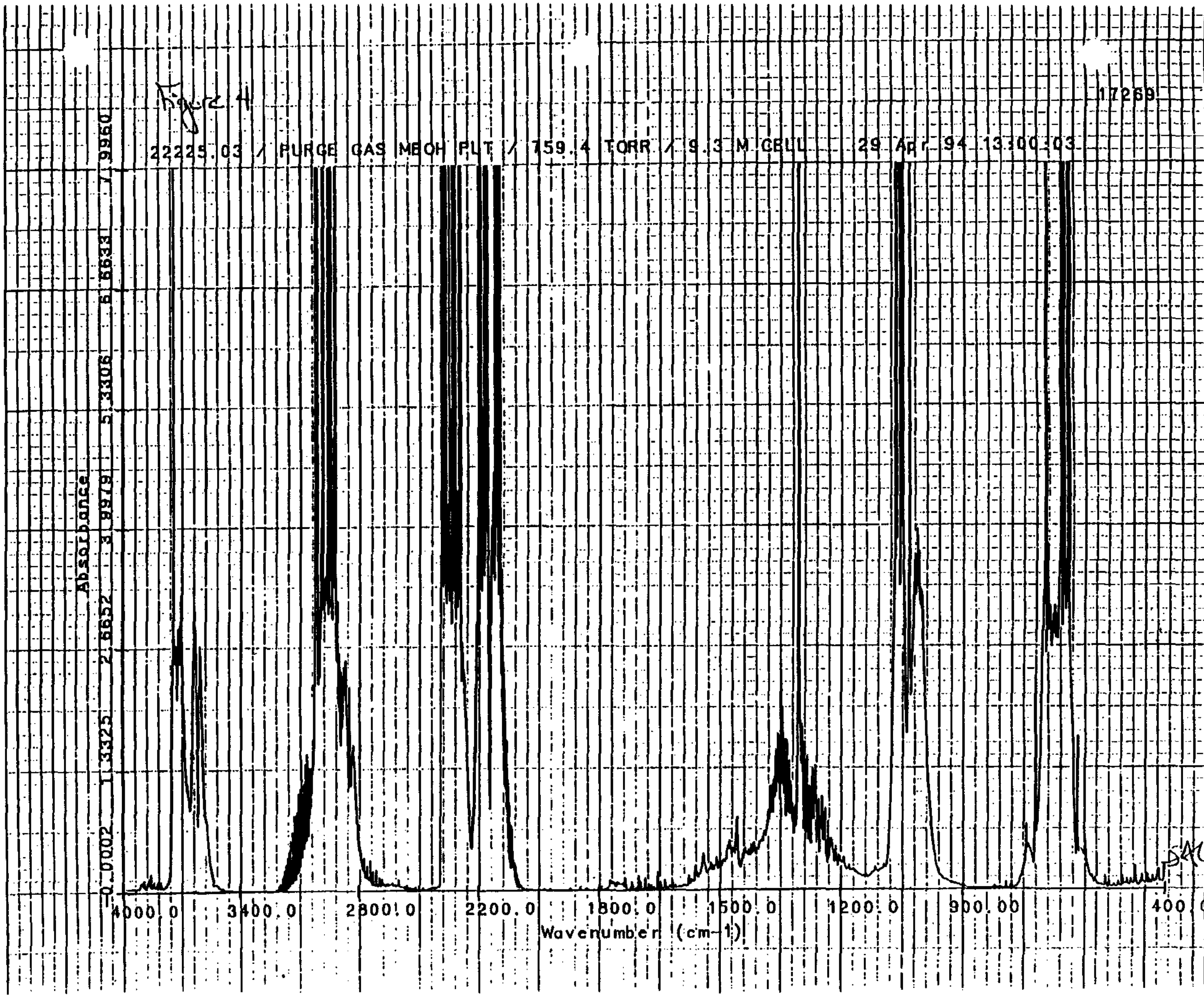

17269
22225.03 / PURGE GAS MEOH PLT / 759.4 TORR / 9.3 M CELL 29 Apr 94 13:00:03
Absorbance
7.9960
6.6633
5.3306
3.9979
2.6652
1.3325
0.0002
0.0
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 4

Figure 5

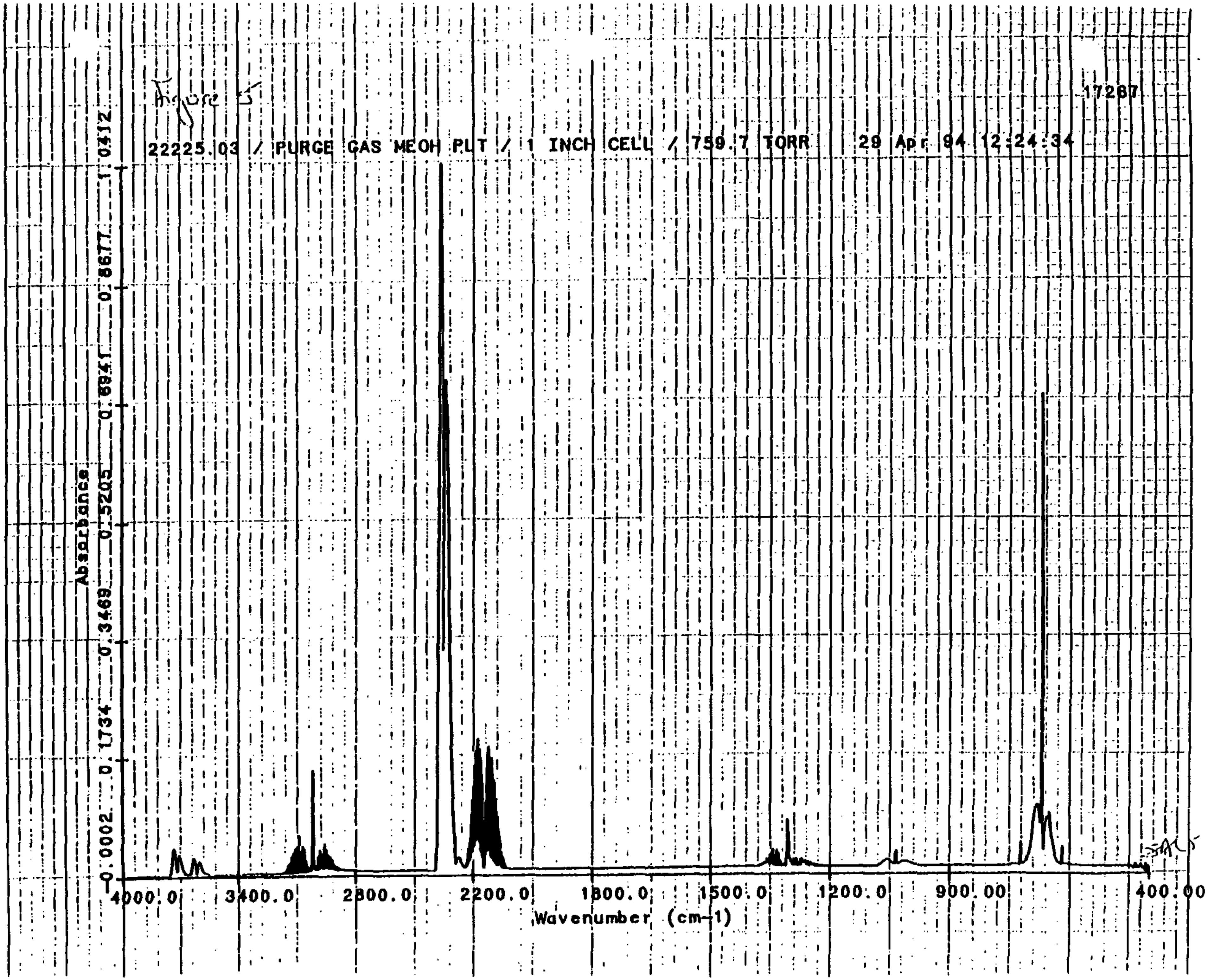

17287
22225.03 / PURGE GAS MEOH PLT / 1 INCH CELL / 759.7 TORR   29 Apr 94 12:24:34
Absorbance
1.0412
0.8677
0.6941
0.5205
0.3469
0.1734
0.0002
0
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 6

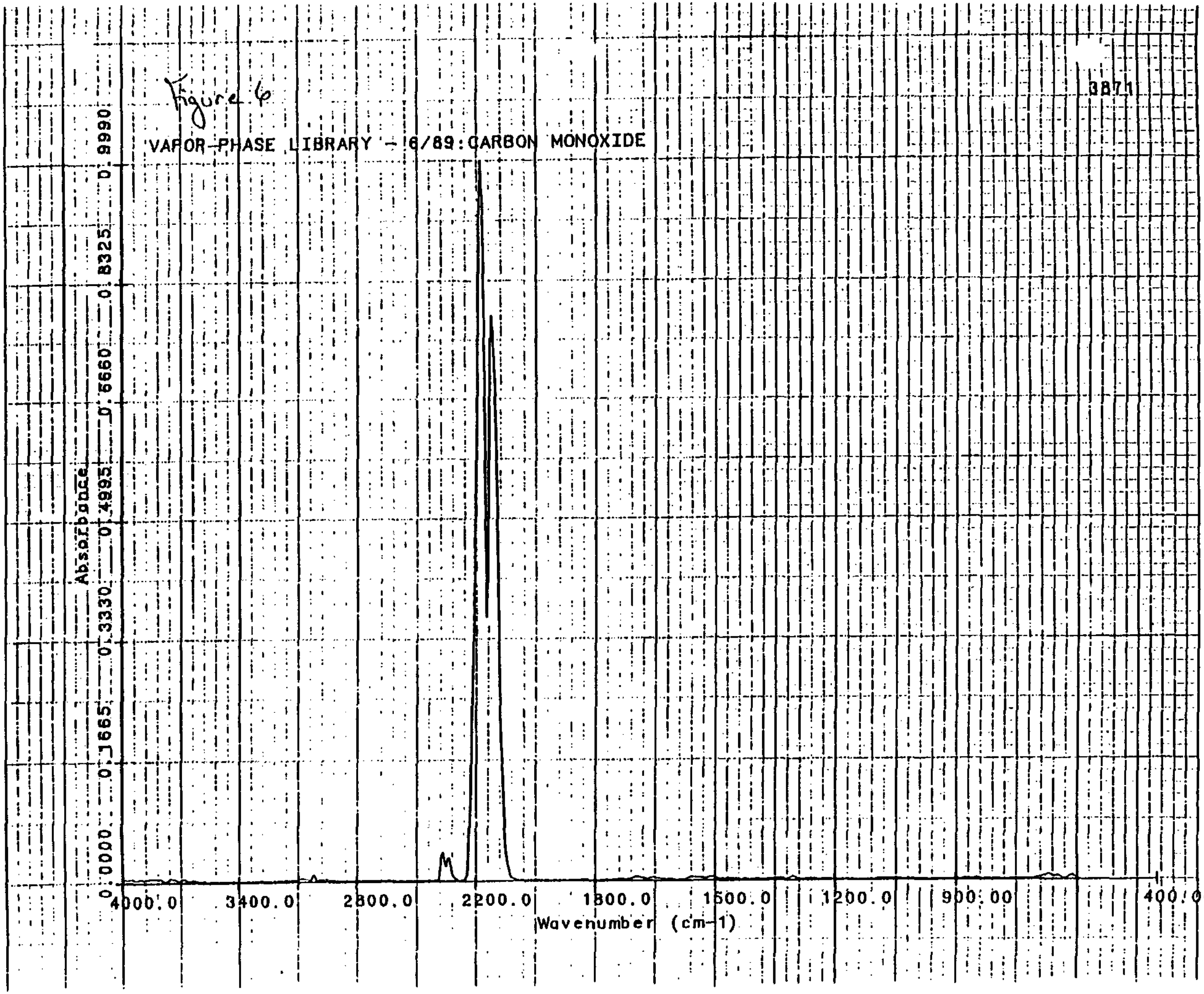

VAPOR-PHASE LIBRARY - 6/89:CARBON MONOXIDE
3871
Absorbance
0.9990
0.8325
0.6660
0.4995
0.3330
0.1665
0.0000
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 7

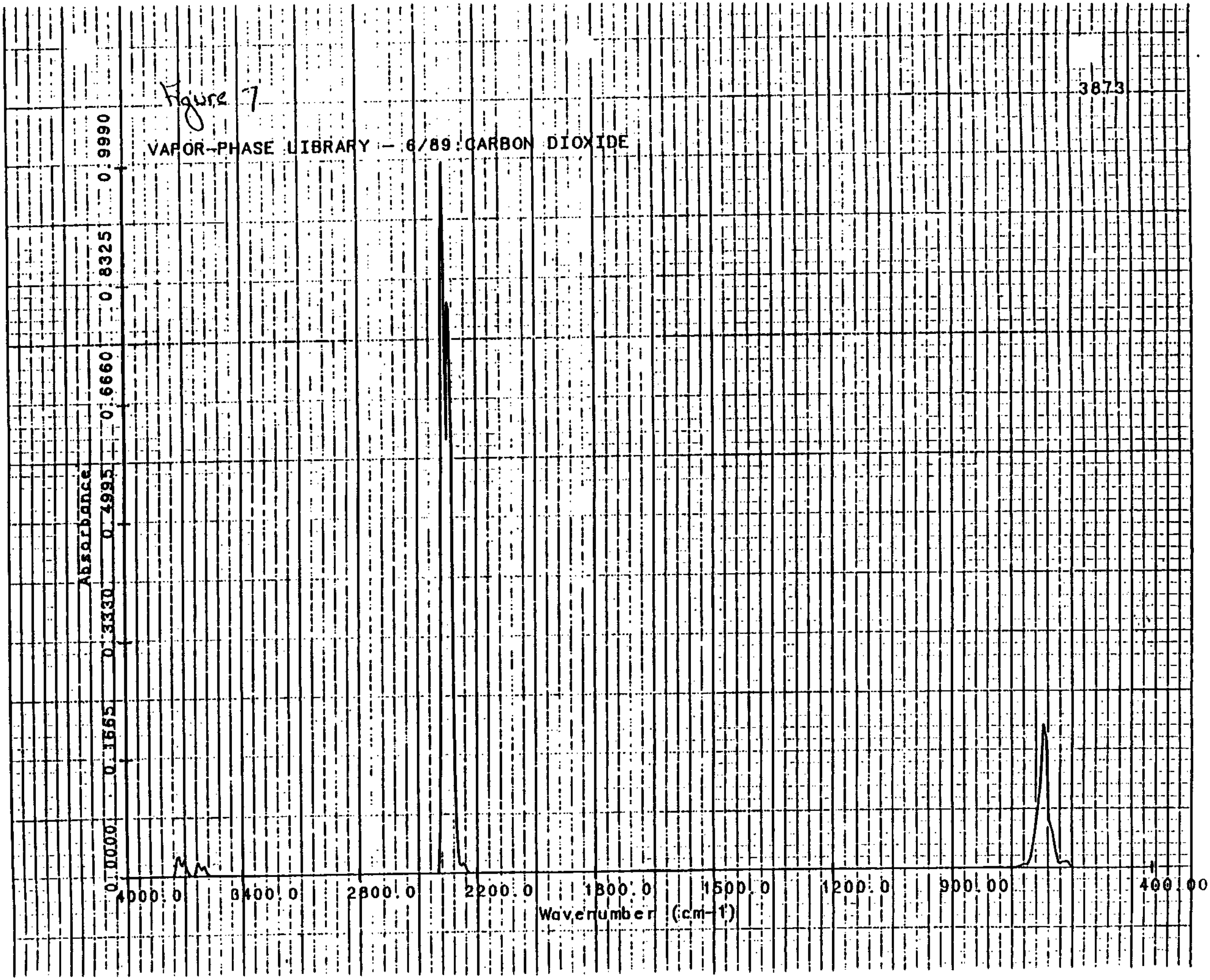

VAPOR-PHASE LIBRARY - 6/89 CARBON DIOXIDE
3873
Absorbance
0.9990
0.8325
0.6660
0.4995
0.3330
0.1665
0.0000
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 8

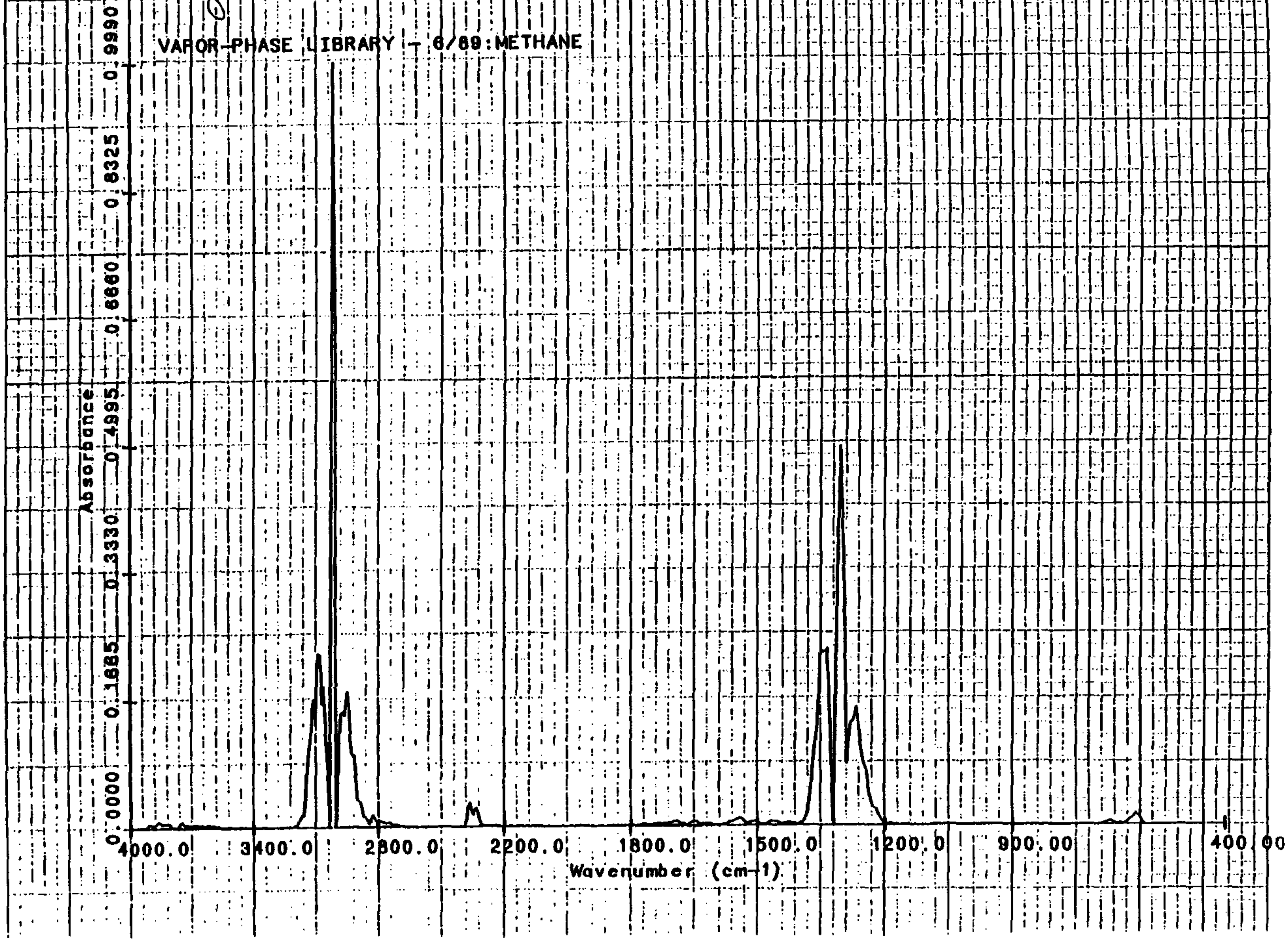
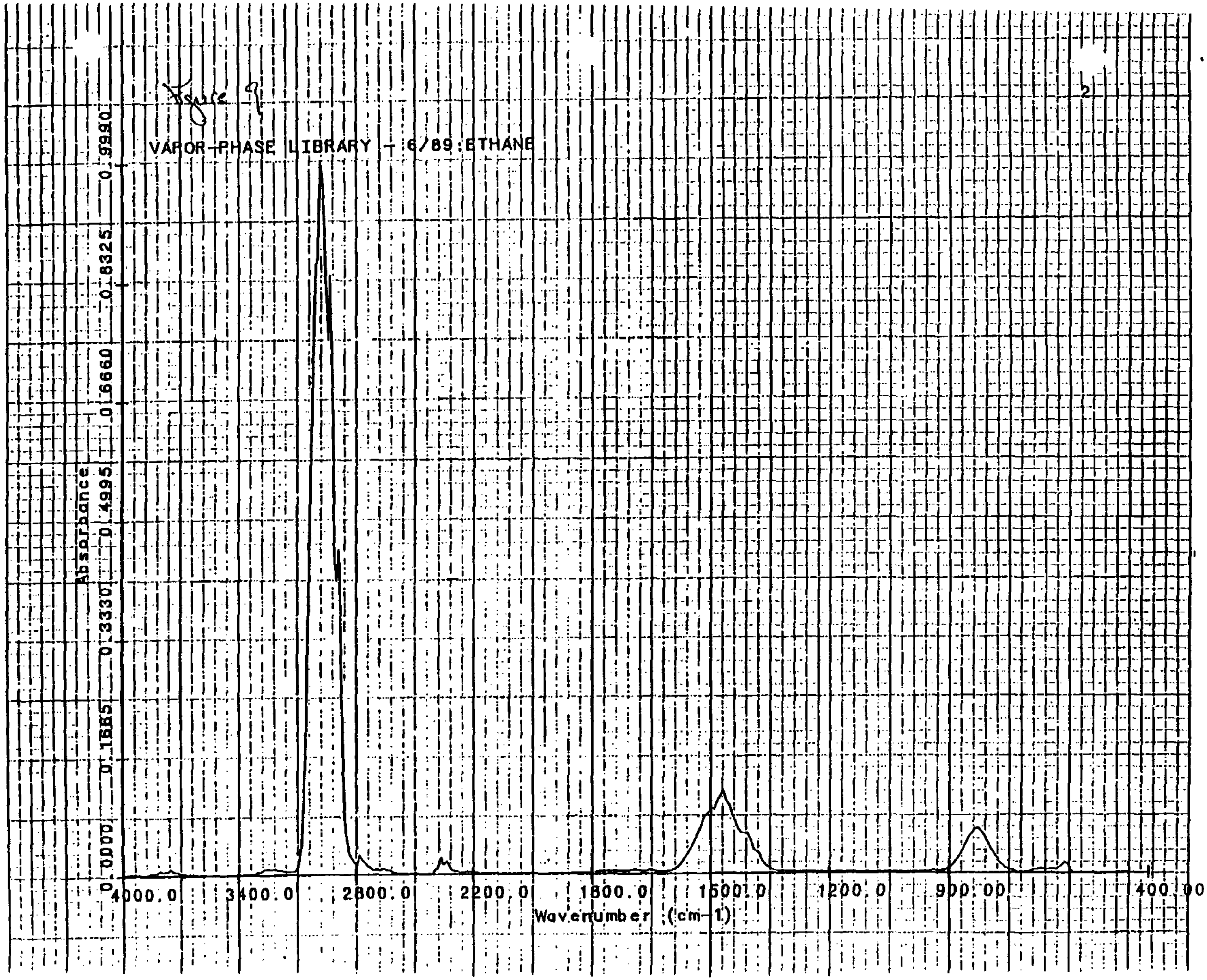

VAPOR-PHASE LIBRARY - 6/89:METHANE
Absorbance
0.9990
0.8325
0.6660
0.4995
0.3330
0.1665
0.0000
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

Figure 9



2
VAPOR-PHASE LIBRARY - 6/89:ETHANE
Absorbance
0.9990
0.8325
0.6660
0.4995
0.3330
0.1665
0.0000
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (cm-1)

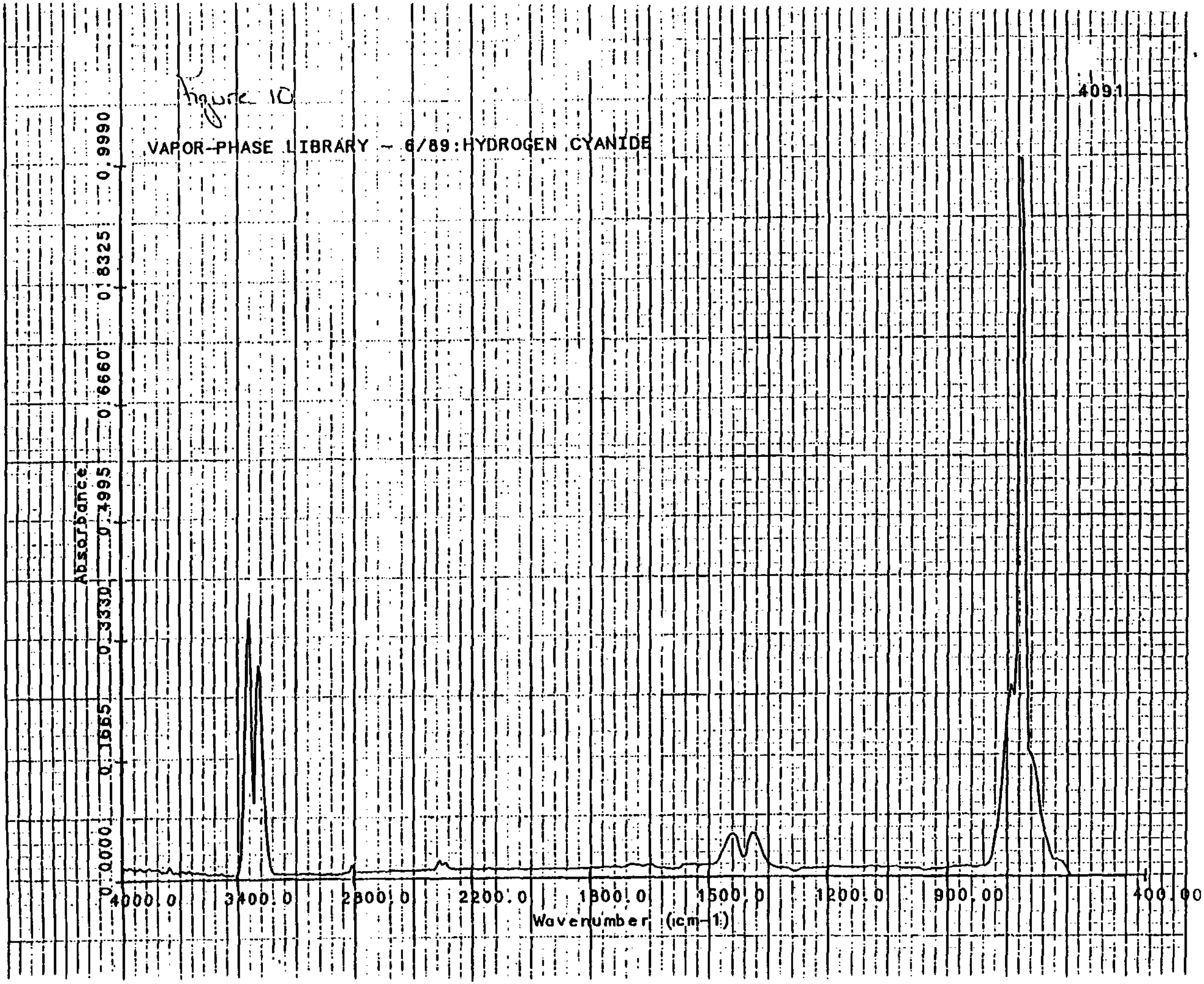


Figure 10
VAPOR-PHASE LIBRARY - 6/89:HYDROGEN CYANIDE
4091
Absorbance
0.9990
0.8325
0.6660
0.4995
0.3330
0.1665
0.0000
4000.0
3400.0
2800.0
2200.0
1800.0
1500.0
1200.0
900.00
400.00
Wavenumber (icm-1)

Bus/cc/File
JMB
WRB-mem. only

Analysis Report

RECEIVED

MAR 11 1994

PROCESS ENGINEERING

AIR PRODUCTS

T	E. S. Schaub	Dept/Loc.:	Proc. Eng.
From:	P. A. Clark	Dept/Ext.:	CRSD/R3111 4870
Date:	8 March 1994	Lab Name:	Surface Science
Subject	TOF-SIMS of Methanol Catalyst Materials		
Sample No.:	X20602-130-A (fresh), X20602-130-B (spent 1989), X20602-130-C (spent 1993)		

cc: P. J. Clark, F. A. Lucrezi, ~~J. T. Cheng~~ C.M. Chen

SUMMARY:

Time-of-Flight Secondary Ion Mass Spectrometry has been used to characterize the surface composition of three samples of a liquid phase methanol catalyst. This catalyst is currently being evaluated by Tennessee Eastman. We have examined the fresh catalyst, a sample of spent catalyst from 1989, and a sample of spent catalyst from 1993. The TOF-SIMS analyses were conducted to confirm the presence of impurity species previously observed in XPS analyses (conducted by Tennessee Eastman's analytical group).

PROBLEM DEFINITION:

Analysis of surface impurities present on a spent liquid phase methanol catalyst.

4/18/94 Call from Paula Clark

Fluorine: Not detected on fresh cat. / 1993 spent cat.
(ref Fig. 10)
Detected on 1989 spent cat. (weak signal → small amt.) @ 19

Request No.:	021469	Lab File Name:	Clark, P. A.
Charge No.:	00-3-8215.51.10.11	Analyst:	PAC
Notebook No.:	13927-46	Data Analyzed:	2/24/94
Method No.:	NONE	Data Captured:	2/94
Done Date:	2/24/94	Data Reported:	2/25/94
Sample Receipt Date:		Doc. Name:	21469.doc
Spectra No:	CE&A Tape 2-94 (2)		

ANALYTICAL PROCEDURES:

T. TOF-SIMS experiments were conducted by F. Radicati di Brozolo of Charles Evans and Associates, Redwood City, CA. The analyses were conducted on a Charles Evans & Associates TFS TOF-SIMS unit. The TOF-SIMS experiment is explained in Attachment 1.

RESULTS AND DISCUSSION:

Table 1 provides a summary of the elements detected by TOF-SIMS. In addition, the chemical form of the species is also included in Table 1. The TOF-SIMS analysis detected As, S, N, Fe, Cl, Na, Cr, K, and Ca.

Table 1
Elements Detected in TOF-SIMS Analysis

Element	Fresh Catalyst	Spent Catalyst ('89)	Spent Catalyst ('93)	Species Detected
As	YES	YES	YES	AsO+, AsO-, AsO2-, AsO3-
S	YES	YES	YES	SO2-, SO3-, SO4-, HSO4-
N	YES	YES	YES	CN-, NO3-, C3H8N+
Fe	ND	YES	YES	Fe+
Ni	ND	yes (trace ?)	ND	
Ba	ND	ND	ND	
Cl	YES	YES	YES	Cl-
Co	ND	ND	ND	
Na	YES	YES	YES	Na+
interesting → Se	ND	ND	ND	
Cr	YES	ND	ND	Cr+
B	ND	ND	ND	
Be	ND	ND	ND	
K	ND	YES	YES	
Ag	ND	ND	ND	
Tl	ND	ND	ND	
Ca	YES	YES	YES	Ca+

ND, Not Detected

The relative distributions of certain species are summarized in Table 2.

While TOF-SIMS is not quantitative, we can make relative comparisons among the samples (i.e., normalize the positive ion signal intensities to Al+ and the negative ion signal intensities to ^{63}Cu-).

We can use relative comparisons to ascertain if a particular species is increasing in intensity (relative to the fresh catalyst) during activation.

Table 2
Distributions of Fe+, Ni+, Ca+, K+, and Na+ Normalized in Al+
and Distributions of CN-, NO_3-, SO_3-, and AsO_2- Normalized to Cu-
For Fresh Catalyst, Spent Catalyst From 1989, and
Spent Catalyst From 1993

Can only make qualitative comparison for a particular species (eg fresh vs. spent cat.)

	Fresh Catalyst	Spent Catalyst ('89)	Spent Catalyst ('93)
Fe/Al	ND	0.33	0.016
Ni/Al	ND	0.015	ND
Ca/Al	0.0088	0.63	0.016
K/Al	ND	0.10	0.011
Na/Al	0.22	0.71	0.29
Cr/Al	0.16	ND	ND
C3H8N *	ND	ND	0.0054
CN/Cu	8.2	7.7	3.3
NO3/Cu	3.5	0.91	0.13
SO3/Cu	1.7	7.2	1.0
AsO2/Cu	0.12	1.9	8.9
Cl/Cu	14	23	15

much loss

sig.?

interesting

SIMS analysis may fragment amines & CN- means ik CN- was orig present. Dennis Brown also questioned if HCN polymerizing to give amines.

* Other amine type species summarized in Table 3.
N Not Detected

Table 3
Amine Species Detected On Surface of 1993 Spent Catalyst

Nominal Mass	Secondary Ion	Measured Mass	Deviation (mamu)
30m/z	CH_4N+	30.030	4
38	C_2N+	38.013	-11
56	C_3H_6N+	56.052	-3
58	C_3H_8N+	58.063	2

Iron, nickel, and potassium were not detected on the fresh catalyst, but did appear after the catalyst was activated. The level of Fe contamination is higher on the 1989 spent catalyst sample than on the 1993 sample. Nickel also appears as a contaminant on the 1989 spent catalyst, but does not appear on the 1993 sample. Potassium is detected in higher amounts on the spent catalyst for 1989 than the 1993 sample.

The levels of Na+, SO_3-, and Cl- contamination were highest on the spent catalyst from 1989. The Na+, SO_3-, and Cl- levels in the 1993 spent catalyst were nearly equivalent to the levels present on the fresh catalyst. Based upon these observations, the catalyst does not pick up additional amounts of Na+, SO_3-, and Cl- from the gas steam during activation.

The levels of Cr+, CN-, and NO_3- appear to decrease after activation. Only the level of As increases after activation. Moreover, there appears to be more As contamination on the 1993 spent catalyst than on the 1989 catalyst sample.

A series of amine type species are present on the surface of the 1993 spent catalyst (see Figures 1 - 4, attached). We observe CH_4N+ at 30.030m/z, C_2N+ at 38.013m/z, C_3H_6N+ at 56.052m/z, and C_3H_8N+ at 58.063m/z. The corresponding secondary ion structures and mamu deviations are summarized in Table 3.

Higher mass species appearing at 103m/z, 105m/z, 107m/z, and 119m/z in the positive ion SIMS spectra are most likely organic type species: C_8H_7+, C_7H_3O+ (102.96m/z), C_8H_9+, C_7H_5O+ (104.95m/z), C_8H_{11}+, C_7H_7O+ (106.95m/z), and C_9H_{11}+, $C_7H_{13}O$+ (118.99m/z and 57mamu deviation).

All the positive and negative ion TOF-SIMS spectra are attached (Figures 4 - 14).

Please feel free to contact me if you require additional information.

Paula

Paula A. Cornelio Clark

v. mail. from Paula Clark

olefin mat'ls
(unsat'd C=C bonds)
also present on fresh catalyst.
"adventitious carbons" - normally present
on inorganic mat'ls

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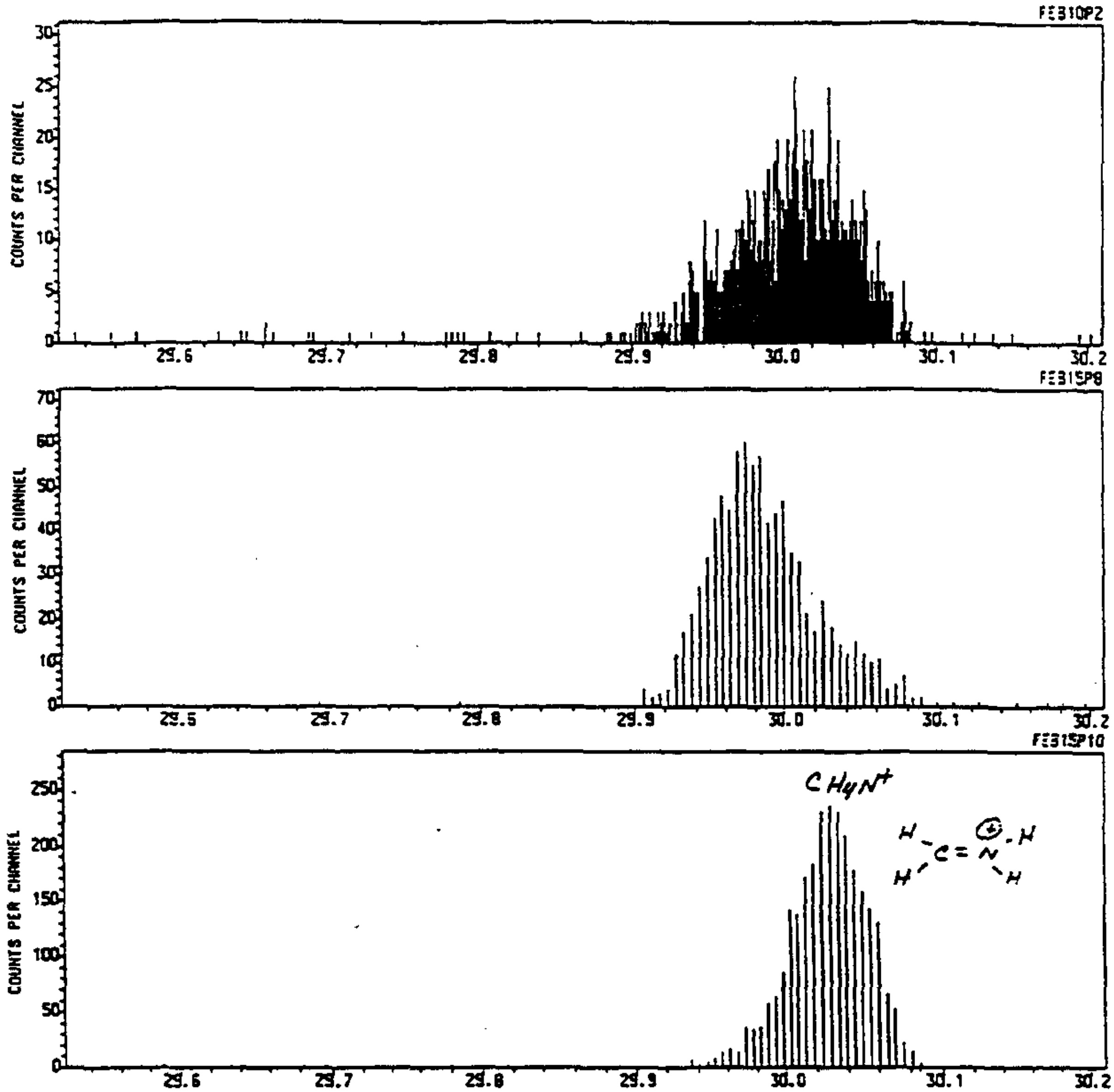

FILE NAME: FEB10P2 DATE : 10 Feb 94 14:25 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1211701
APCI/CLARK; SAMPLE X20602-130-A; FIRST PELLETT; SPOT 1
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 312
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376308
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FIGURE ___

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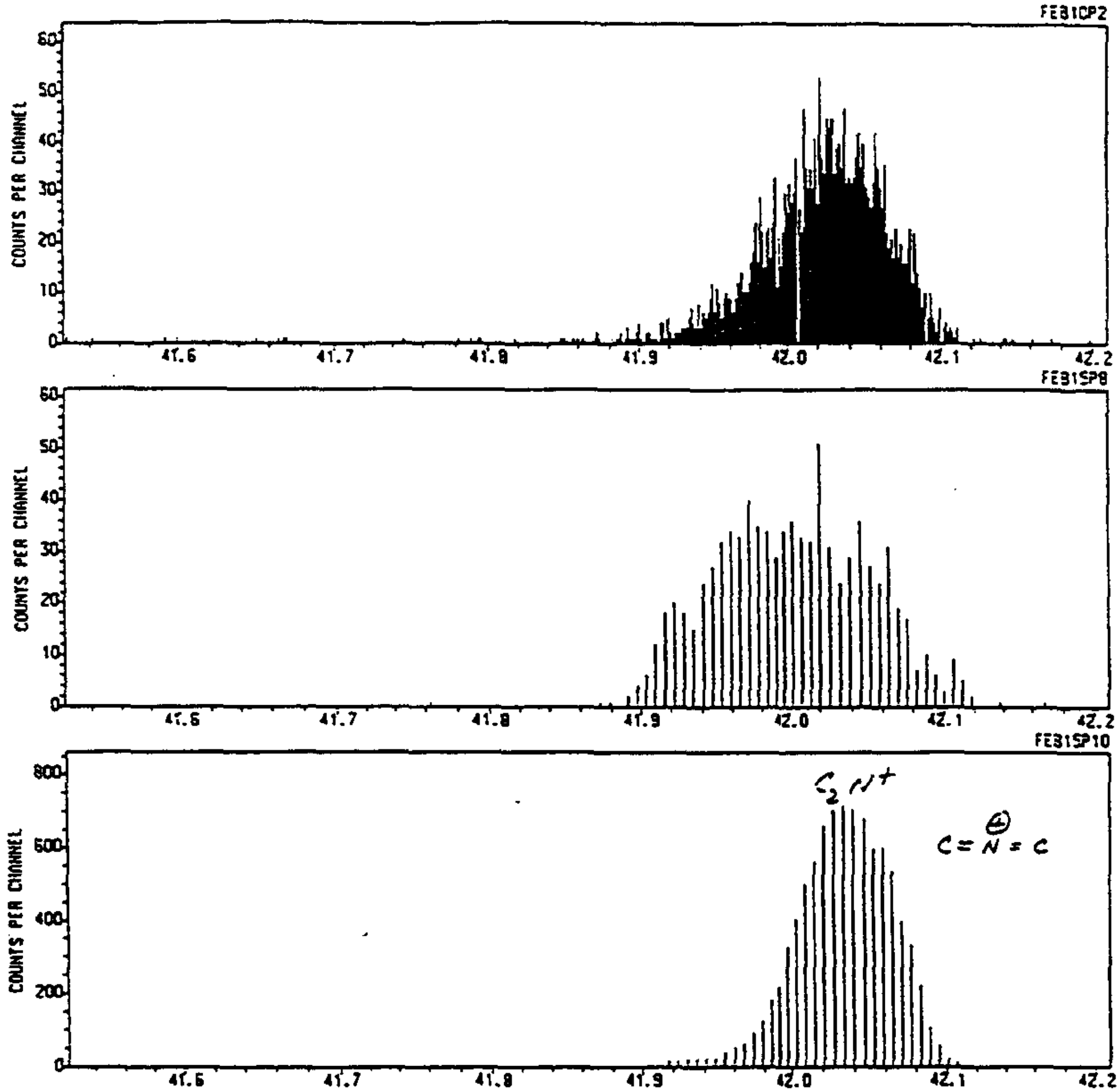
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



FILE NAME: FEB10P2 DATE : 10 Feb 94 14:25 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1211701
APCI/CLARK; SAMPLE X20602-130-A; FIRST PELLETT; SPOT 1
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 312
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376308
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE ____

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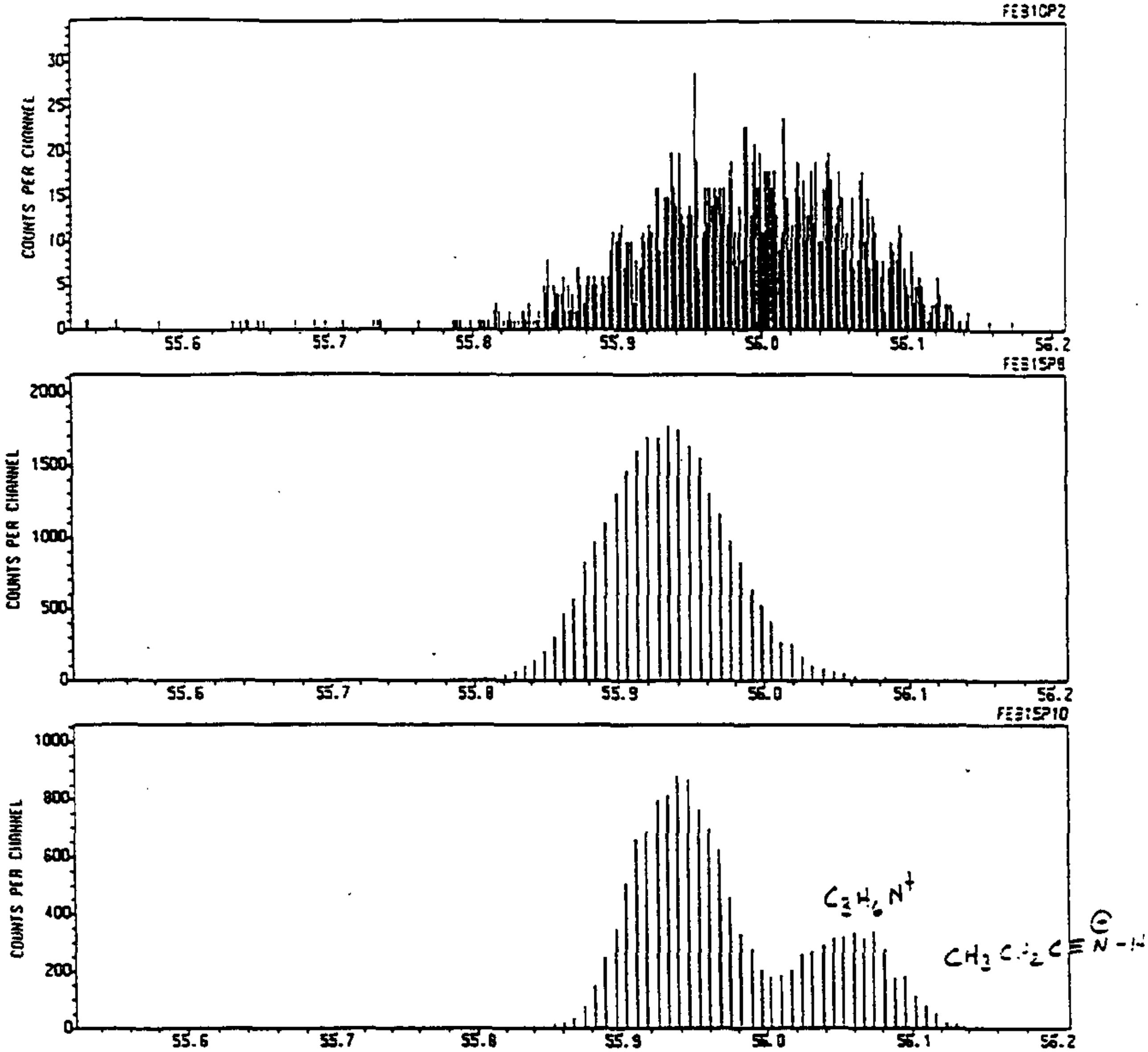

FILE NAME: FEB10P2 DATE : 10 Feb 94 14:25 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1211701
APCI/CLARK; SAMPLE X20602-130-A; FIRST PELLETT; SPOT 1
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 312
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376338
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE ____

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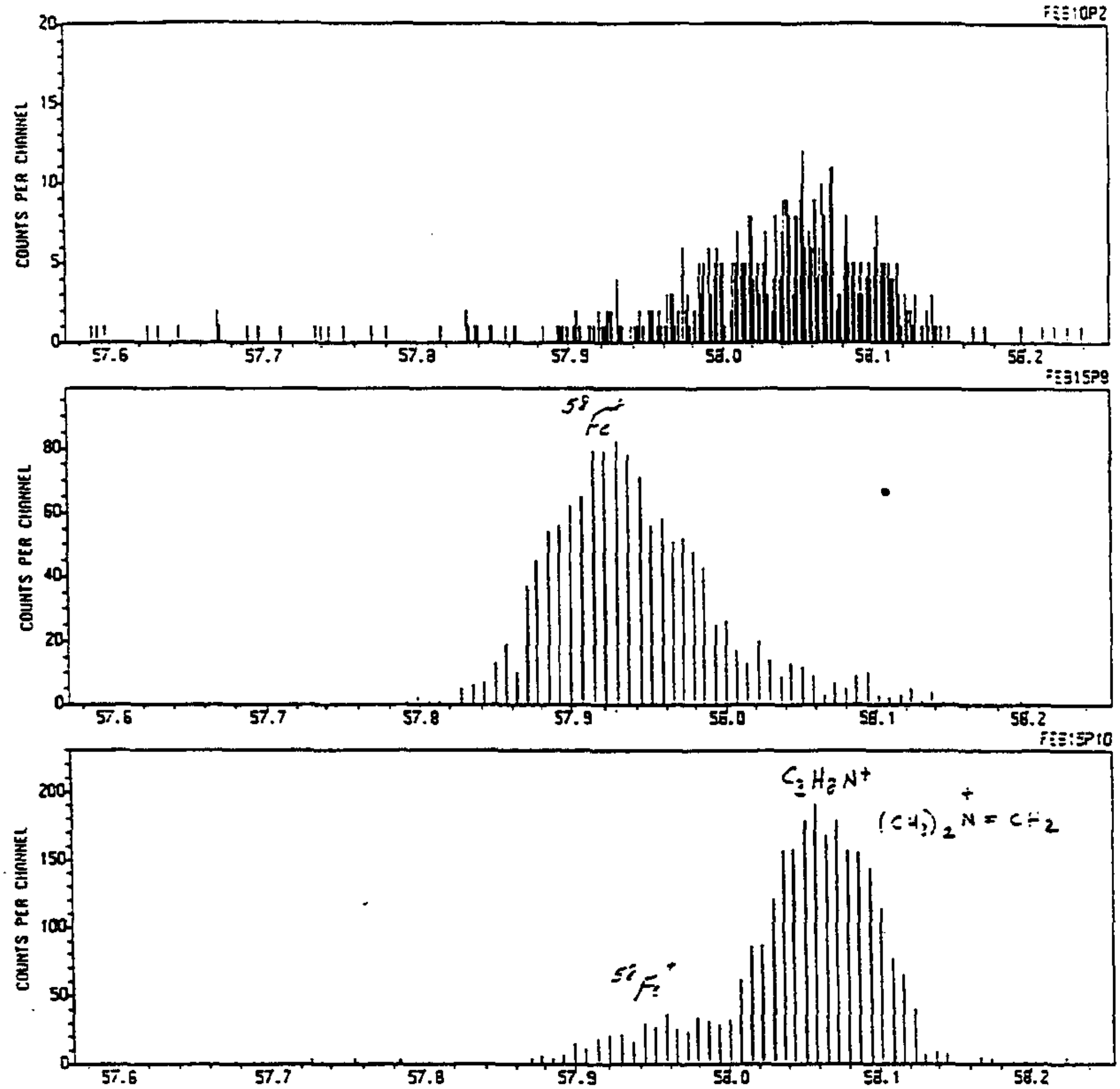

FILE NAME: FEB10P2 DATE : 10 Feb 94 14:25 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1211701
APCI/CLARK; SAMPLE X20602-130-A; FIRST PELLETT; SPOT 1
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 312
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376308
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMNPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE ____

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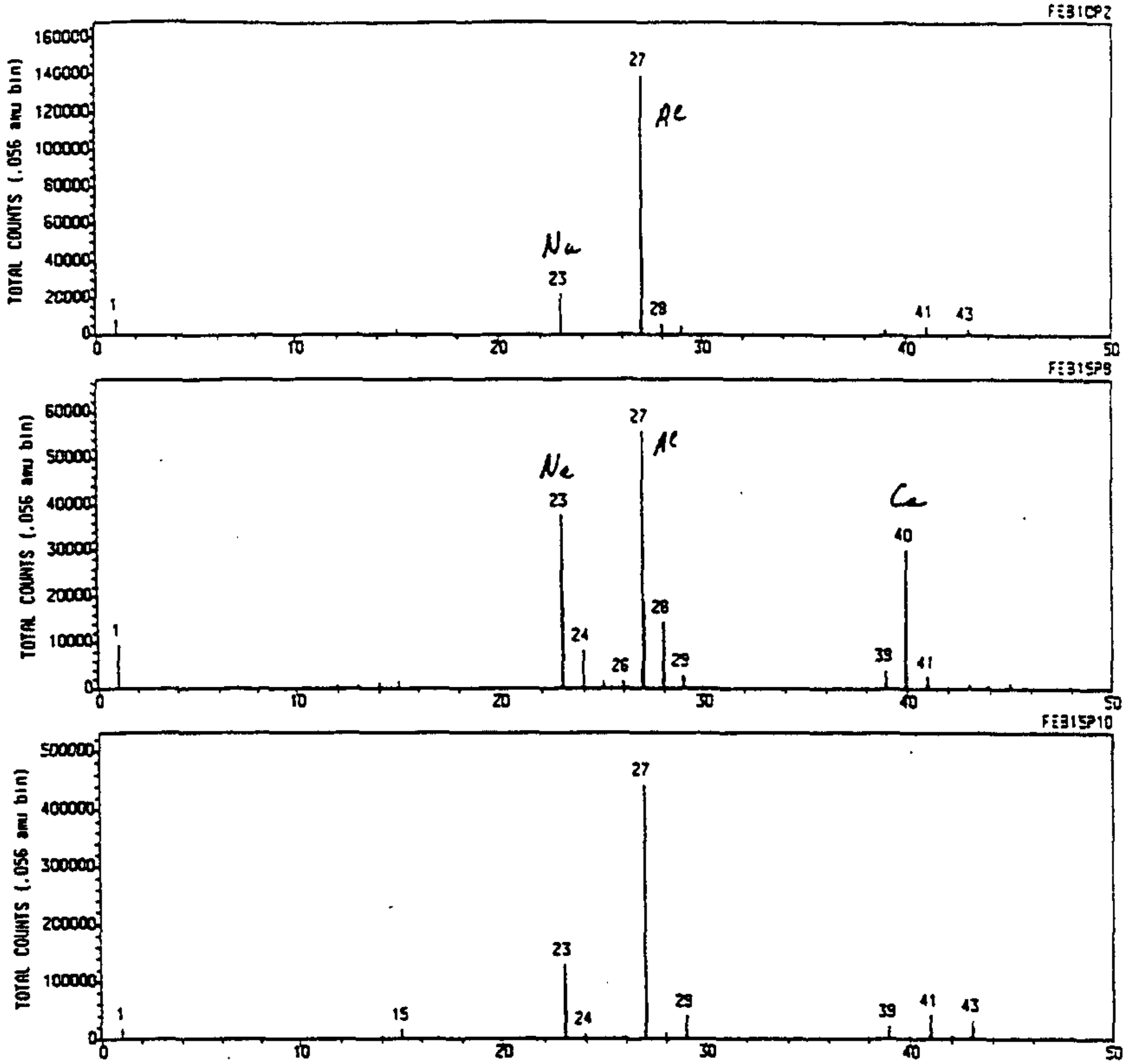

FILE NAME: FEB10P2 DATE : 15 Feb 94 9:24 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 596754
APCI/CLARK; SAMPLE X20602-130-A; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376328
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE ____

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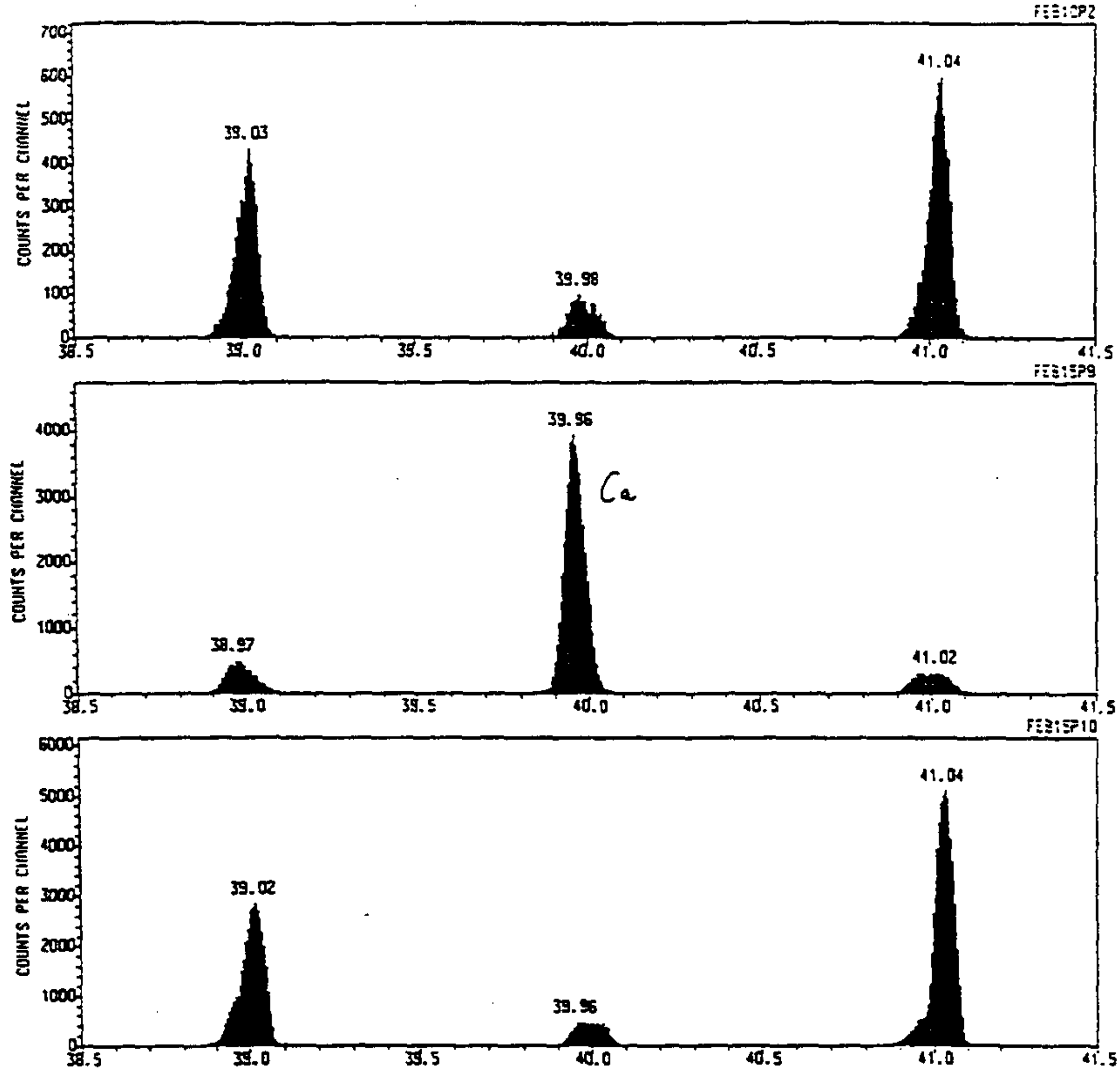

FILE NAME: FEB10P2 DATE : 15 Feb 94 9:24 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 596754
APCI/CLARK; SAMPLE X20602-130-A; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1258
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376308
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE 3

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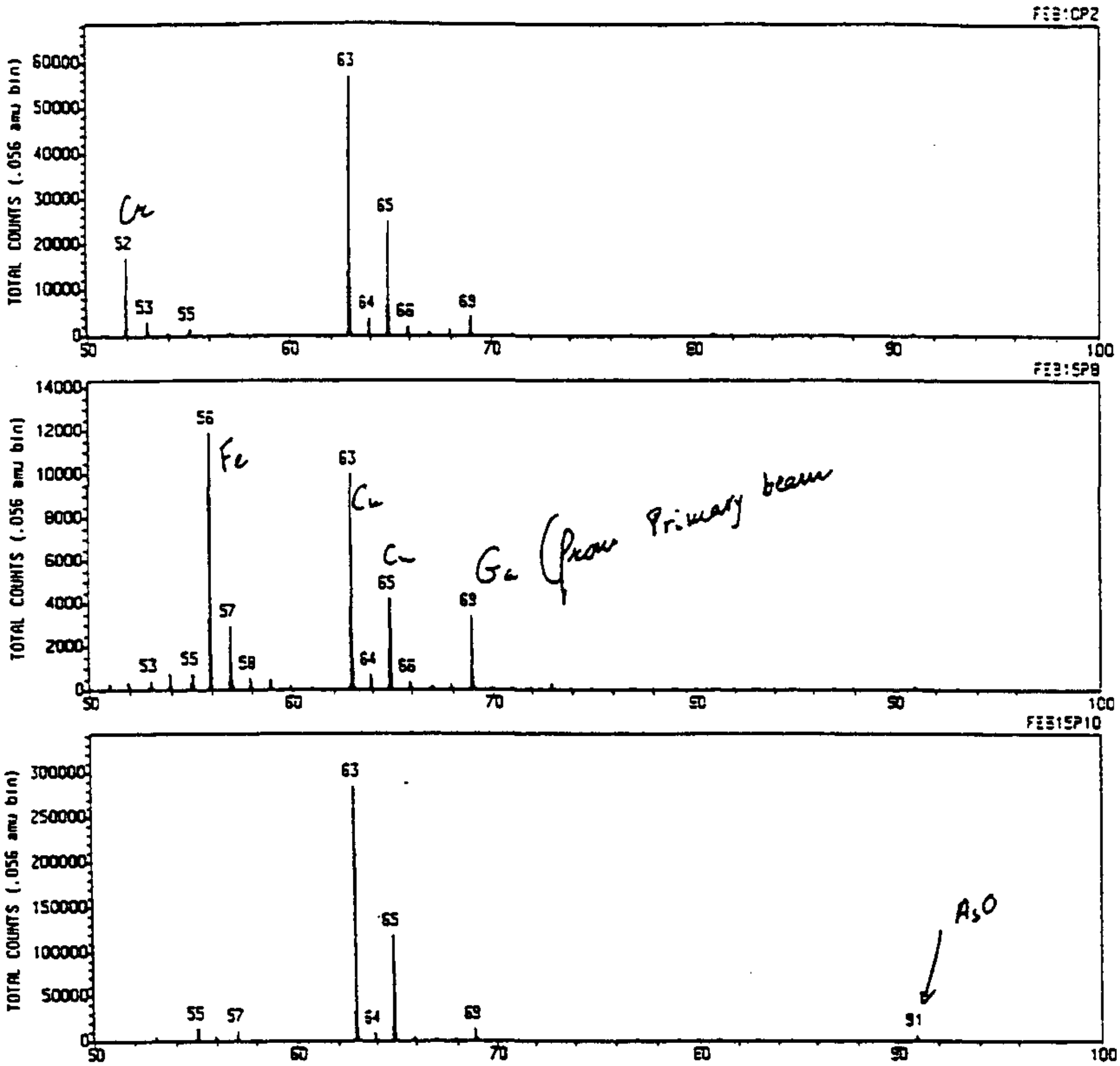

FILE NAME: FEB10P2 DATE : 15 Feb 94 9:24 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 596754
APCI/CLARK; SAMPLE X20602-130-A; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376338
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE 4

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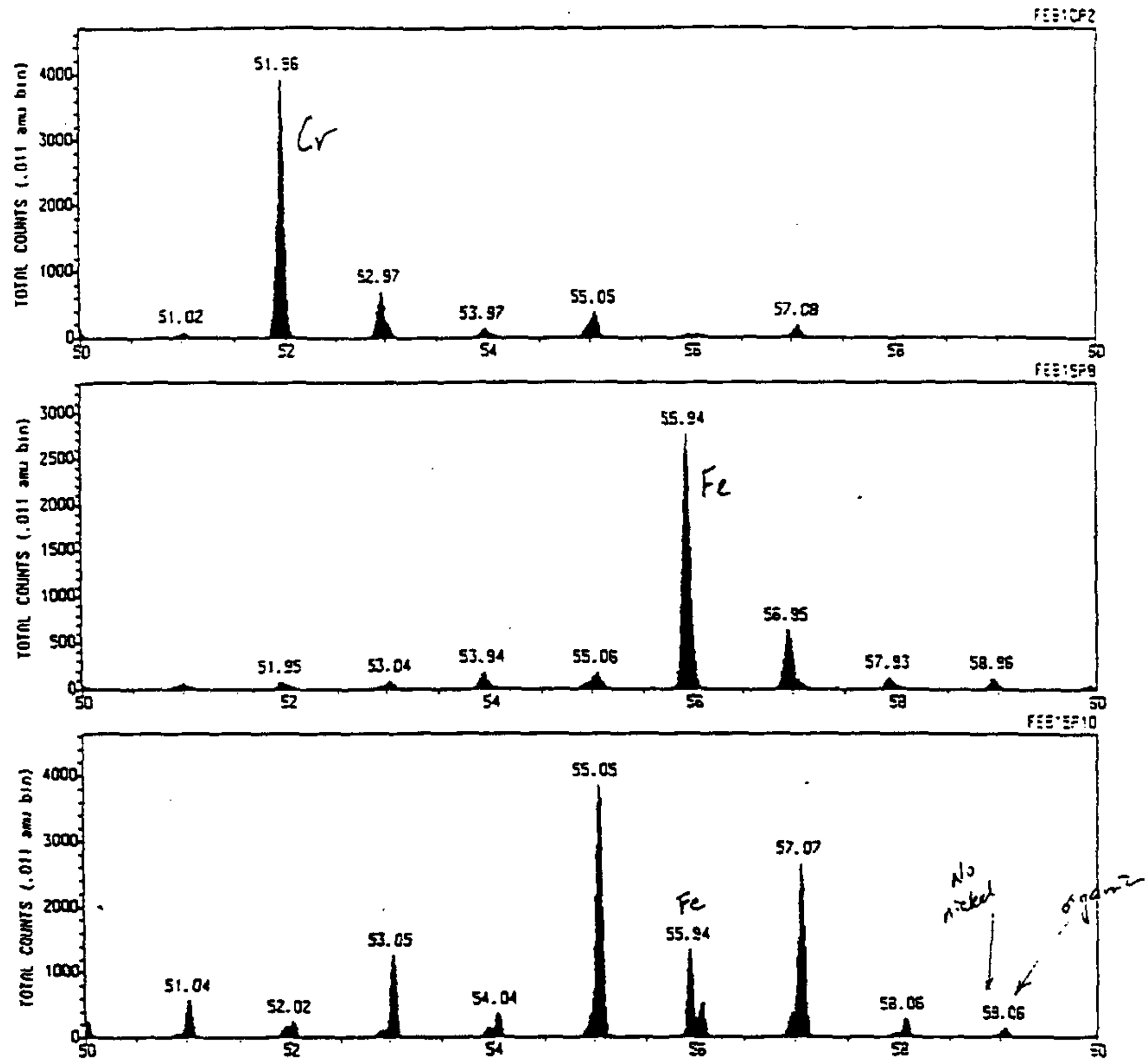
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



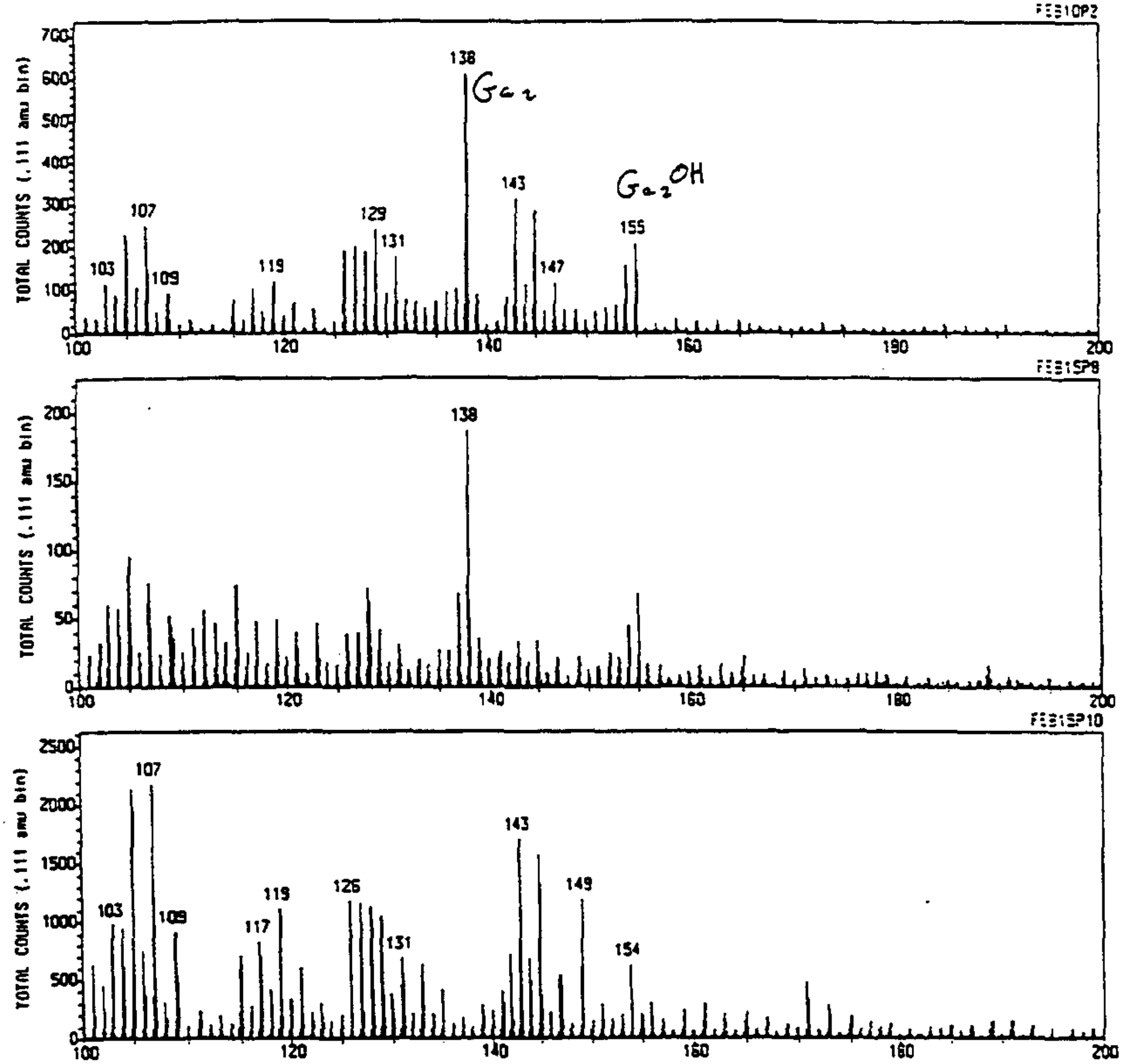
FILE NAME: FEB10P2 DATE : 15 Feb 94 9:24 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 595754
APCI/CLARK; SAMPLE X20602-130-A; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376128
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 3
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMNPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FIGURE

CHARLES EVANS & ASSOCIATES
301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



FILE NAME: FEB10P2 DATE : 15 Feb 94 9:24 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 596754
APCI/CLARK; SAMPLE X20602-130-A; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125:
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P8 DATE : 15 Feb 94 12:55 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 376308
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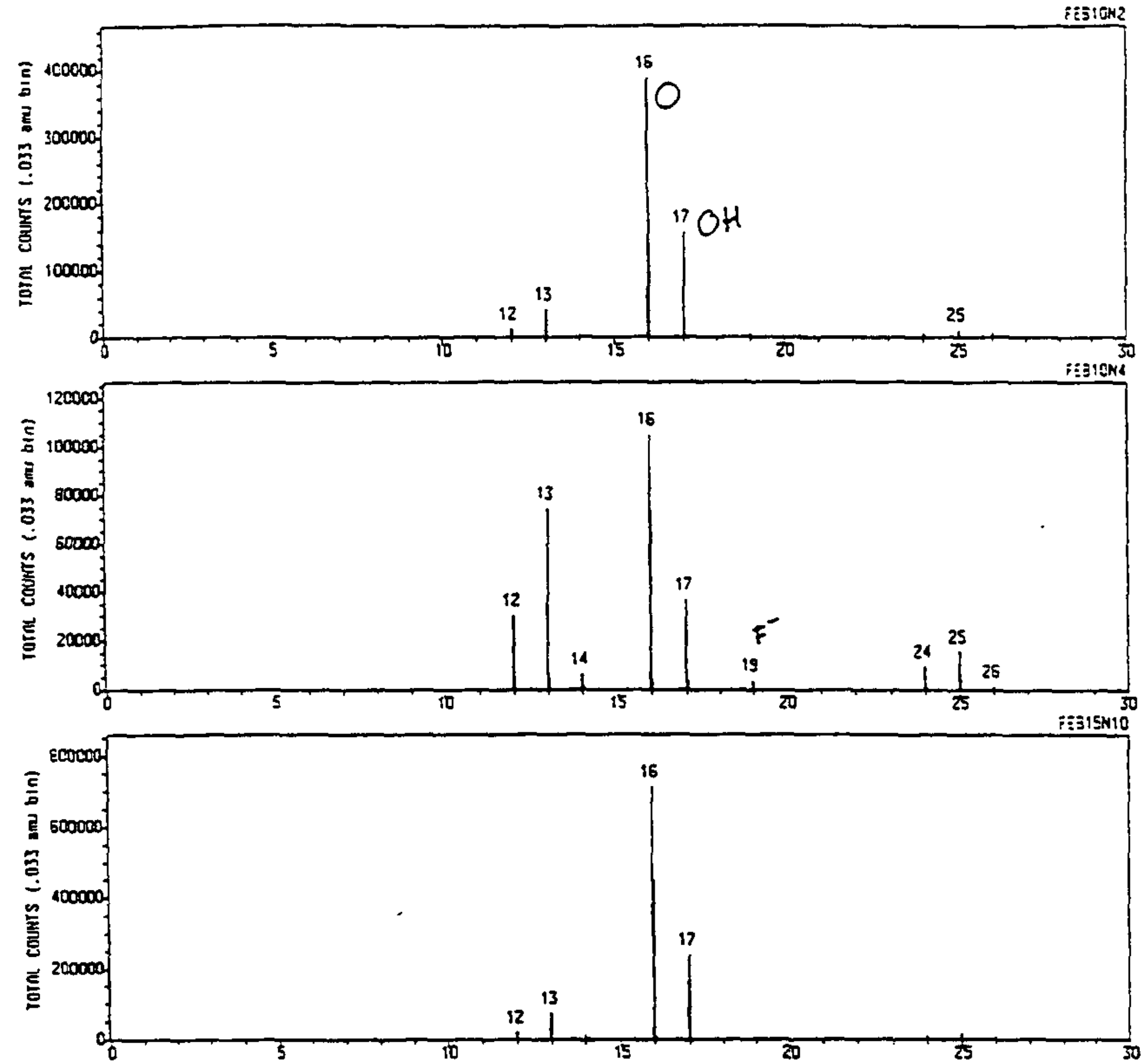
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125:
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15P10 DATE : 15 Feb 94 14:40 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2275670
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
+ IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 125:
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FIGURE 7

CHARLES EVANS & ASSOCIATES
301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 365-7921



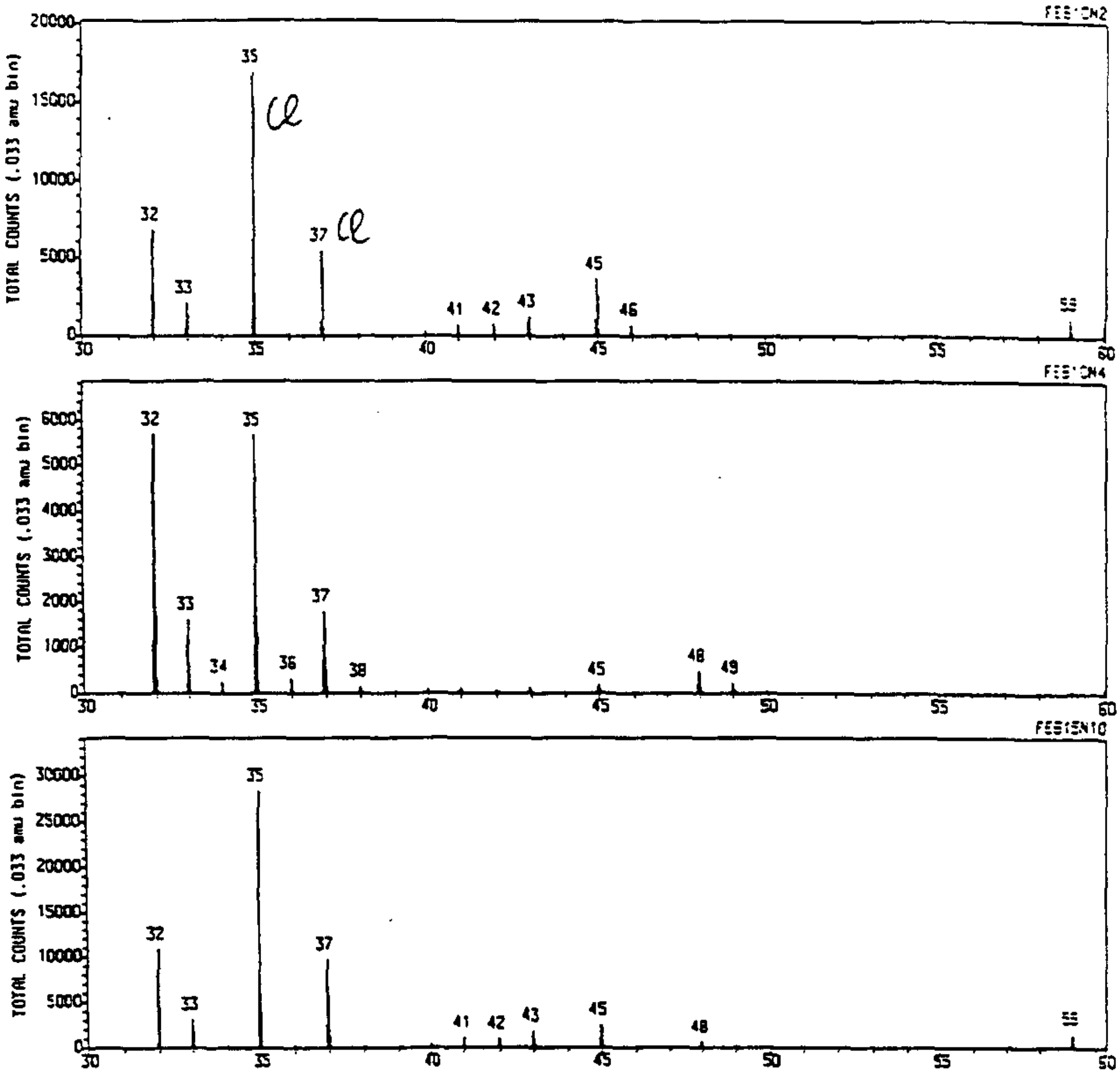
FILE NAME: FEB10N2 DATE : 15 Feb 94 9:46 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1149172
APCI/CLARK; SAMPLE X-20602-130-A; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 3 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB10N4 DATE : 15 Feb 94 10:18 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 574258
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15N10 DATE : 15 Feb 94 15: 3 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2532368
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FIGURE 50

CHARLES EVANS & ASSOCIATES
301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



FILE NAME: FEB10N2 DATE : 15 Feb 94 9:46 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1149172
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- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 3 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

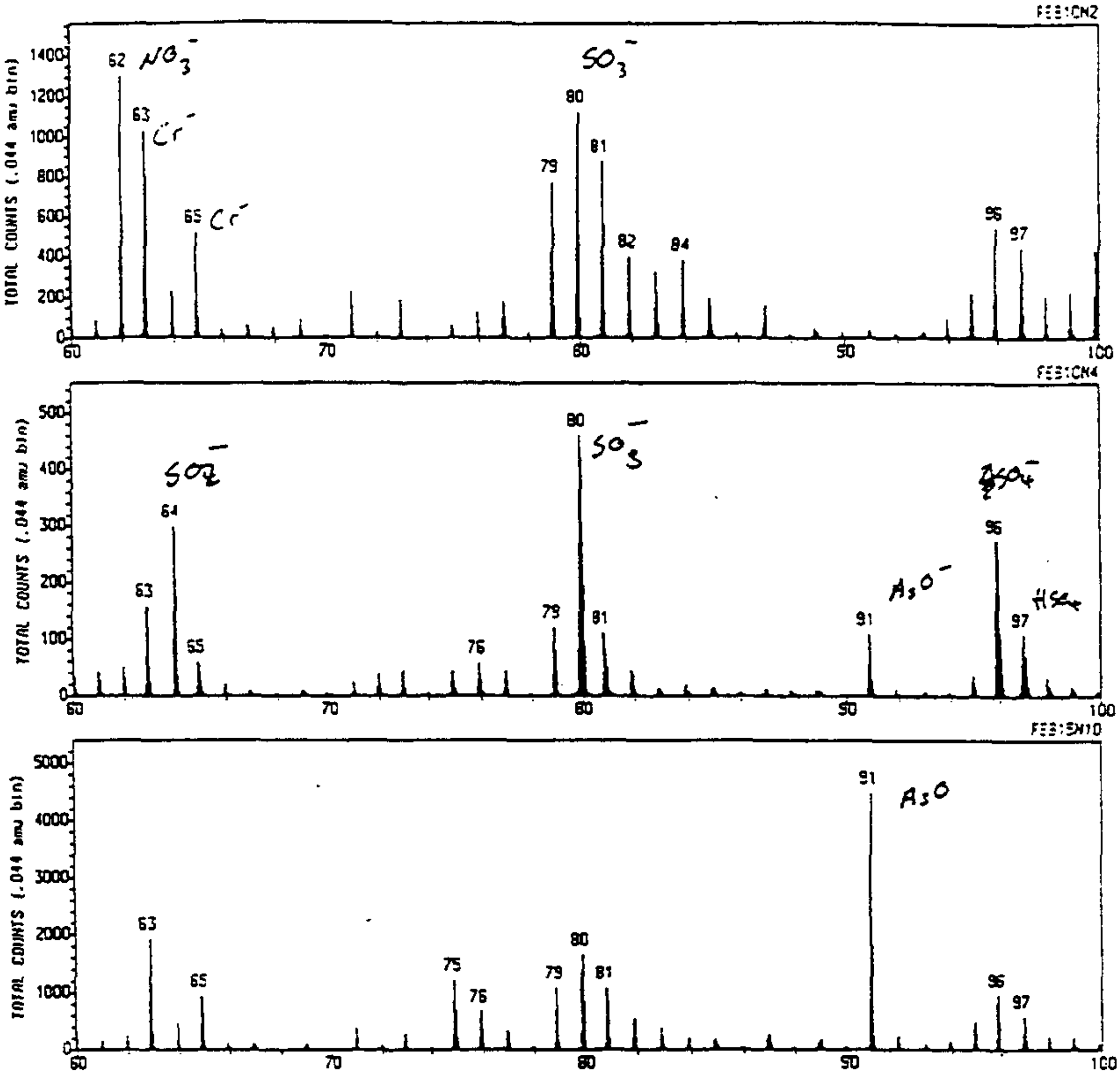
FILE NAME: FEB10N4 DATE : 15 Feb 94 10:18 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 574258
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FILE NAME: FEB15N10 DATE : 15 Feb 94 15: 3 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2532368
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820µm RASTER TYPE: Full NI

FIGURE 1

CHARLES EVANS & ASSOCIATES

301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



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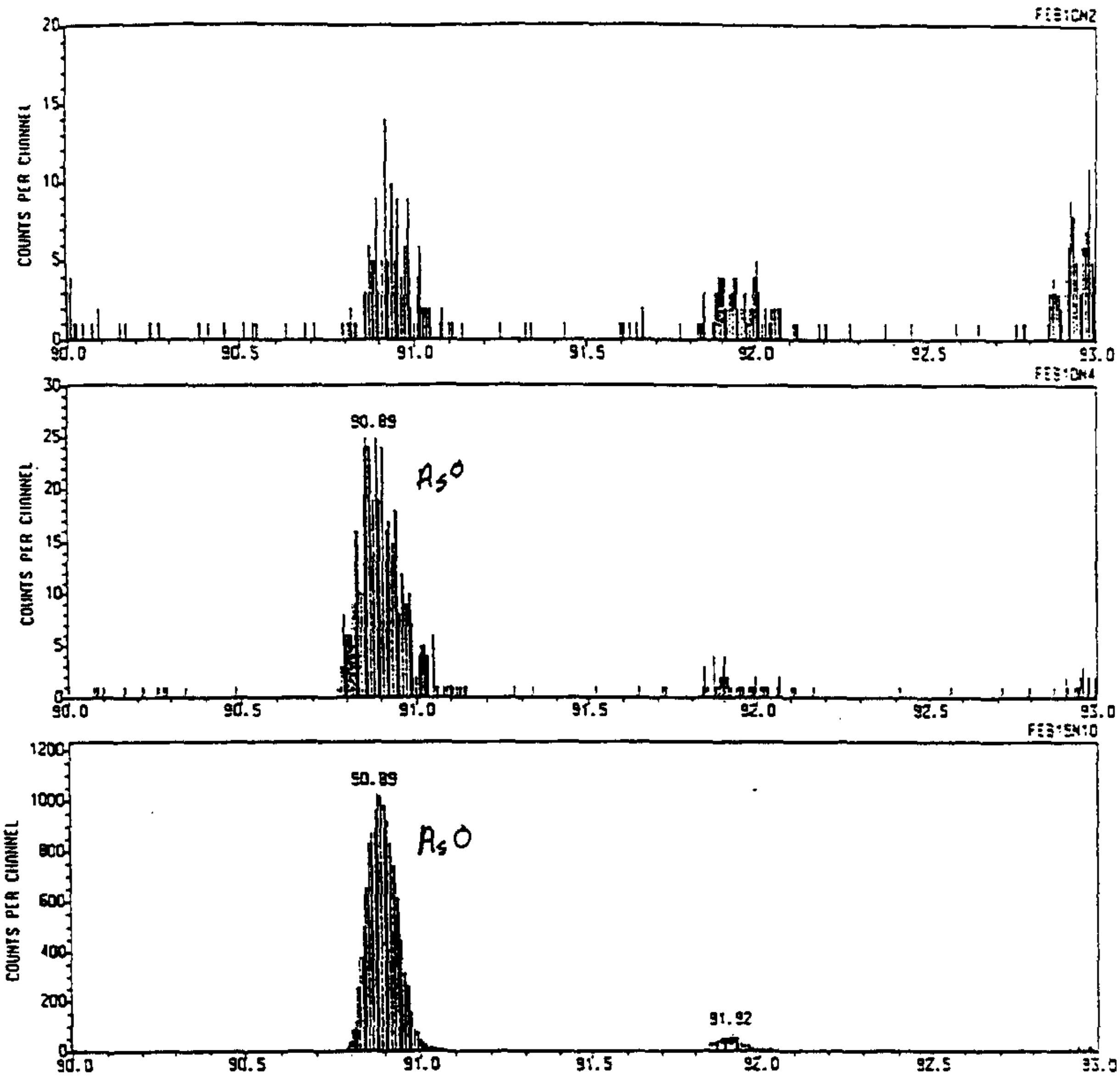
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 3 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB10N4 DATE : 15 Feb 94 10:18 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 574258
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15N10 DATE : 15 Feb 94 15: 3 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2532368
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE 2

CHARLES EVANS & ASSOCIATES
301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



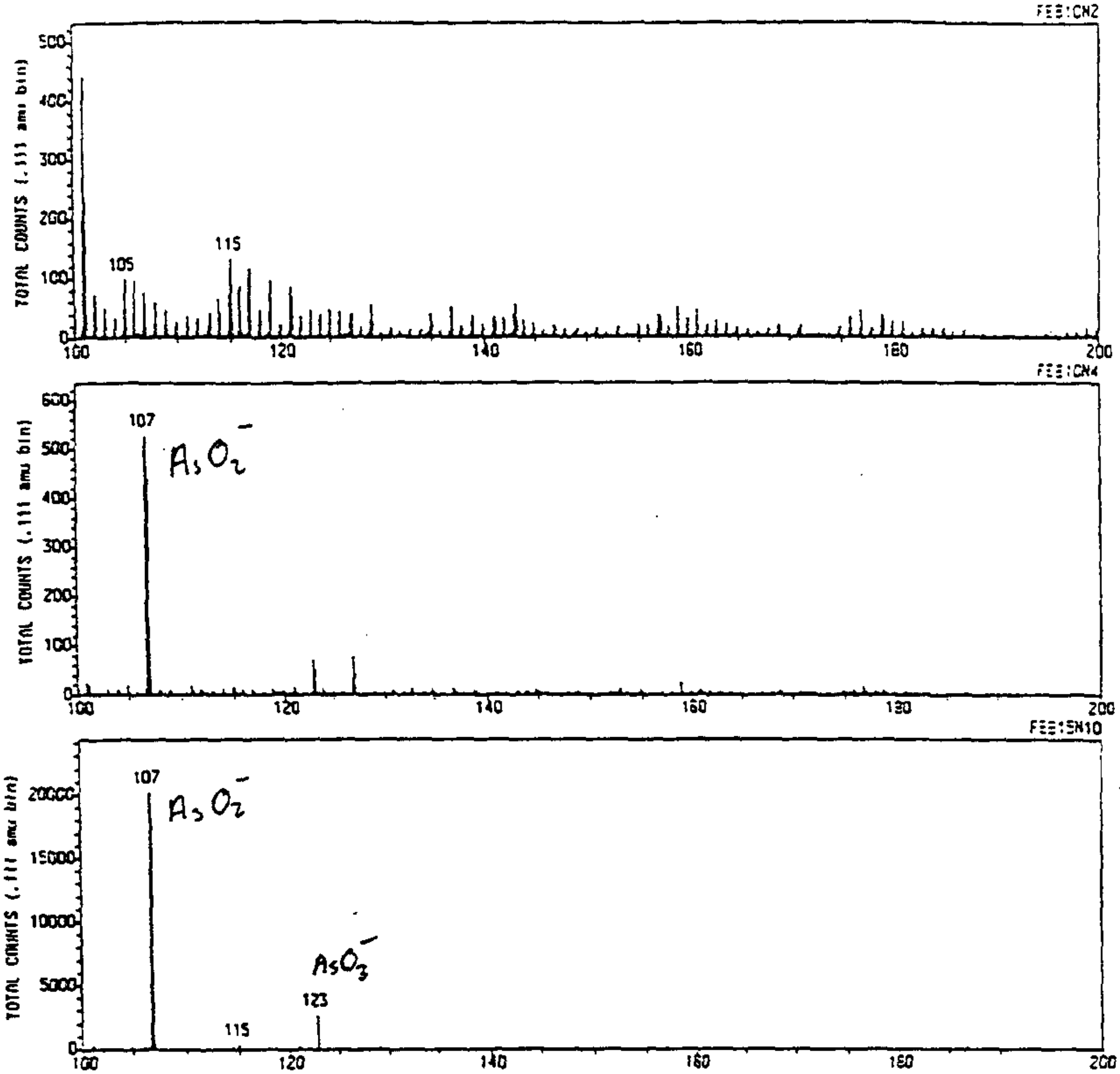
FILE NAME: FEB10N2 DATE : 15 Feb 94 9:46 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 1149172
APCI/CLARK; SAMPLE X-20602-130-A; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 3 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB10N4 DATE : 15 Feb 94 10:18 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 574258
APCI/CLARK; SAMPLE X-20602-130-B; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 5 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FILE NAME: FEB15N10 DATE : 15 Feb 94 15: 3 ACQUISITION TIME: 15.0 MIN. TOTAL INTEGRAL : 2532368
APCI/CLARK; SAMPLE X-20602-130-C; PELLET 2
- IONS PRIMARY GUN: LMIG TIME RECORDER: 1-Stop TDC X-Y SOURCE: Raster TIME PER CHANNEL: 1250
DATA SET: 1 Spectra; 6 Image(s) RASTER SIZE: 820μm RASTER TYPE: Full NI

FIGURE ___

CHARLES EVANS & ASSOCIATES
301 Chesapeake Drive
Redwood City, CA 94063 USA
Phone: (415)-369-4567; FAX: 369-7921



FILE NAME: FEB10N2   DATE : 15 Feb 94 9:46   ACQUISITION TIME: 15.0 MIN.   TOTAL INTEGRAL : 1149172
APCI/CLARK; SAMPLE X-20602-130-A;   PELLET 2
- IONS   PRIMARY GUN: LMIG   TIME RECORDER: 1-Stop TDC   X-Y SOURCE: Raster   TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 3 Image(s)   RASTER SIZE: 820µm   RASTER TYPE: Full NI

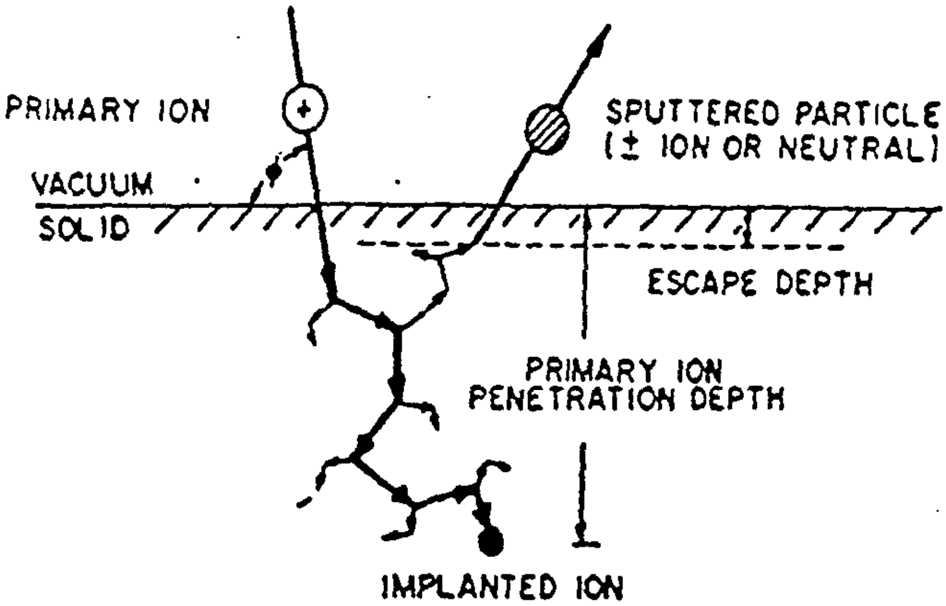
FILE NAME: FEB10N4   DATE : 15 Feb 94 10:18   ACQUISITION TIME: 15.0 MIN.   TOTAL INTEGRAL : 574258
APCI/CLARK; SAMPLE X-20602-130-B;   PELLET 2
- IONS   PRIMARY GUN: LMIG   TIME RECORDER: 1-Stop TDC   X-Y SOURCE: Raster   TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 5 Image(s)   RASTER SIZE: 820µm   RASTER TYPE: Full NI

FILE NAME: FEB15N10   DATE : 15 Feb 94 15: 3   ACQUISITION TIME: 15.0 MIN.   TOTAL INTEGRAL : 2532368
APCI/CLARK; SAMPLE X-20602-130-C;   PELLET 2
- IONS   PRIMARY GUN: LMIG   TIME RECORDER: 1-Stop TDC   X-Y SOURCE: Raster   TIME PER CHANNEL: 125
DATA SET: 1 Spectra; 6 Image(s)   RASTER SIZE: 820µm   RASTER TYPE: Full NI

FIGURE __

Static Secondary Ion Mass Spectrometry (Static SIMS)

A schematic diagram of the Static SIMS experiment is shown below:



In this experiment, a sample (under vacuum) is bombarded by a primary ion beam (Ar, Xe, Ga, or Cs). The ion implants in the solid lattice and generates an area of perturbation known as a collision cascade. This collision cascade results in the desorption of positively and negatively charged secondary ions, neutral species, and electrons. The positive and negative secondary ions are then extracted from the gas phase and mass analyzed in a time-of-flight based mass analyzer.

When the SIMS is experiment is conducted under static conditions, the primary ion beam current density is reduced so as to promote the desorption of intact molecular species. Thus, Static SIMS can provide unambiguous identification of species at the sample surface.

Currently, the Static SIMS data are collected on a Charles Evans & Associates TFS SIMS instrument located at Charles Evans & Associates in Redwood City, CA. Data analysis is conducted in house, using a TFS SIMS computer workstation located in the CRSD-Surface Science Laboratory (R&D3/D155).

ATTACHMENT 1

APPENDIX J

LPMEOH REACTOR STUDY

To:	N. R. Shaub	Dept./Ext.	Facilities Svcs./X6534
From:	T.A. Dahl	Dept./Ext.	GETC/X6361
Date:	May 10, 1995		
Subject:	Field Test Unit (FTU) at Iron Run.		

CC:	D.M. Brown	Dept./Loc.	PSG Tech./A31E2
	B.A. Toseland	Dept./Loc.	GETC/I7066

Unit Summary:

The Field Test Unit (FTU) will be contained in a 48 foot trailer consisting of office and labratory space. The Unit will processes Synthesis Gas, by passing it through several adsorption beds to remove trace impurities from the gas stream. The gas is piped to a Slurry Phase Reactor where a percentage of the Gas is converted to Alcohol's. The reactor effluent is analyzed by G.C., then vented to atmosphere.

The process Gas enters the Lab portion of the trailer at approximately 800psig. It can then be reduced by a regulator or increased by a compressor. When the gas is at the desired pressure, Maximum of 1300psig, it then passes through the adsorber system to remove any impurities in the gas stream. The clean gas is then piped to the reactor system, here again the pressure can be either increased or decreased as necessary. The reactor will operate at pressures to 1300psig and temperatures to 670 F. The product of the reactor is analyzed then vented to an exhaust stack. No product will be produced.

An excess flow valve in the process gas feed line just inside the lab wall, limits the feed gas to a maximum of 15 liters / minute = 0.5298 cubic feet / minute or 31.8 cubic feet / hour. Pressure switches and relief valves are installed in the system to prevent over pressurization.

The exhaust gas flow will be sufficient to dilute the vented product gas to a non hazardous level. Flammable and toxic gas monitors are located in the trailer. These monitors will cause the system to shut down if an unsafe condition should occur.

NFPA Rating of this laboratory:

Fire-4

Health-2

Reactivity-1

Emergency assessment on the above rating, as well as the Unit's hazards review, will be available upon request.

T.A. Dahl

ftudoc

Memorandum

PRODUCTS

To:	T. A. Dahl	Dept/Loc.:	G&E Tech. Center, I7066
From:	Kevin B. Snyder Kevin	Dept/Ext.:	EH&S, TT Area Facilities
Date:	23 August 1995		
Subject:	**Minor Source Determination for Methanol Synthesis Field Test Unit, Microclave System and Autoclave System**		

c: J. A. Berseth (A6121)/File 3.0.3
T. E. Solodar (A33G1)
R. W. Skinner (A6126)

Pennsylvania's Department of Environmental Protection (DEP) has determined that your methanol synthesis sources at Iron Run are exempted from requiring a construction or operating permit because they are all minor sources of contamination. If the quantities of pollutants emitted change because of a change in the process or there is an increase in the hours of operation, please let me or Ron Skinner know.

A copy of the three minor source approvals are attached for your records.

Attachments
lib\c:\Document\Snyderk\KD82395

FORM 1020 (REV. 6/89)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF AIR QUALITY CONTROL

COUNTY:

JUL 27 1995

Request for Determination of Requirement for Plan Approval/Operating Permit Application (Submit In Triplicate)

FACILITY:
UNIT:

Type of Source: Methanol Synthesis

Date of Installation: 1/96

Owner of Source: Air Products & Chemicals, Inc.

Employer I.D. No.: 23-1274455

Mailing Address: P.O. Box 25780, Lehigh Valley, PA 18002-5780 (Iron Run)

Contact Person: Kevin B. Snyder

Telephone: 610-481-6238

Location of Source(s):

Street Address: 7066 Snowdrift Road

Municipality: Upper Macungie Township

Estimated Emissions: Field Test Unit (FTU)

County: Lehigh

Pollutant	CO	H_2	CO_2	N_2	Methanol	Di-Methyl Ether
Quantity lbs/hr	0.33	0.015	0.13	0.0083	0.085	0.068
Quantity s/yr	1900.8	86.4	748.8	47.8	489.6	391.7

1. Averaged 20 days per month, 24 hrs. per day

Thomas A. Dahl
Signature Thomas A. Dahl

Research Specialist
Title

7/19/95
Date

OFFICIAL USE ONLY

Date Received:

Reviewed By: Mark J. Wejkszner

Pursuant to the authority contained in 25 PA Code §127.14(8) the source(s) is exempted from the plan approval and permitting requirements. This determination does not exempt the source(s) from compliance with all other applicable air quality regulations.

[signature]
Signature
"CHIEF - ENGINEERING SERVICES SECTION"
Title
AUG 16 1995
Date

The source(s) does not qualify for exemption from plan approval/permitting requirements under PA Code §127.14(8) and plan approval application(s) must be submitted. The Department is prohibited from acting on an application until 30 days after the municipality and county have received notification by the company. Pertinent forms are attached.

Signature

Title

Date

(Over)

Field Test Description

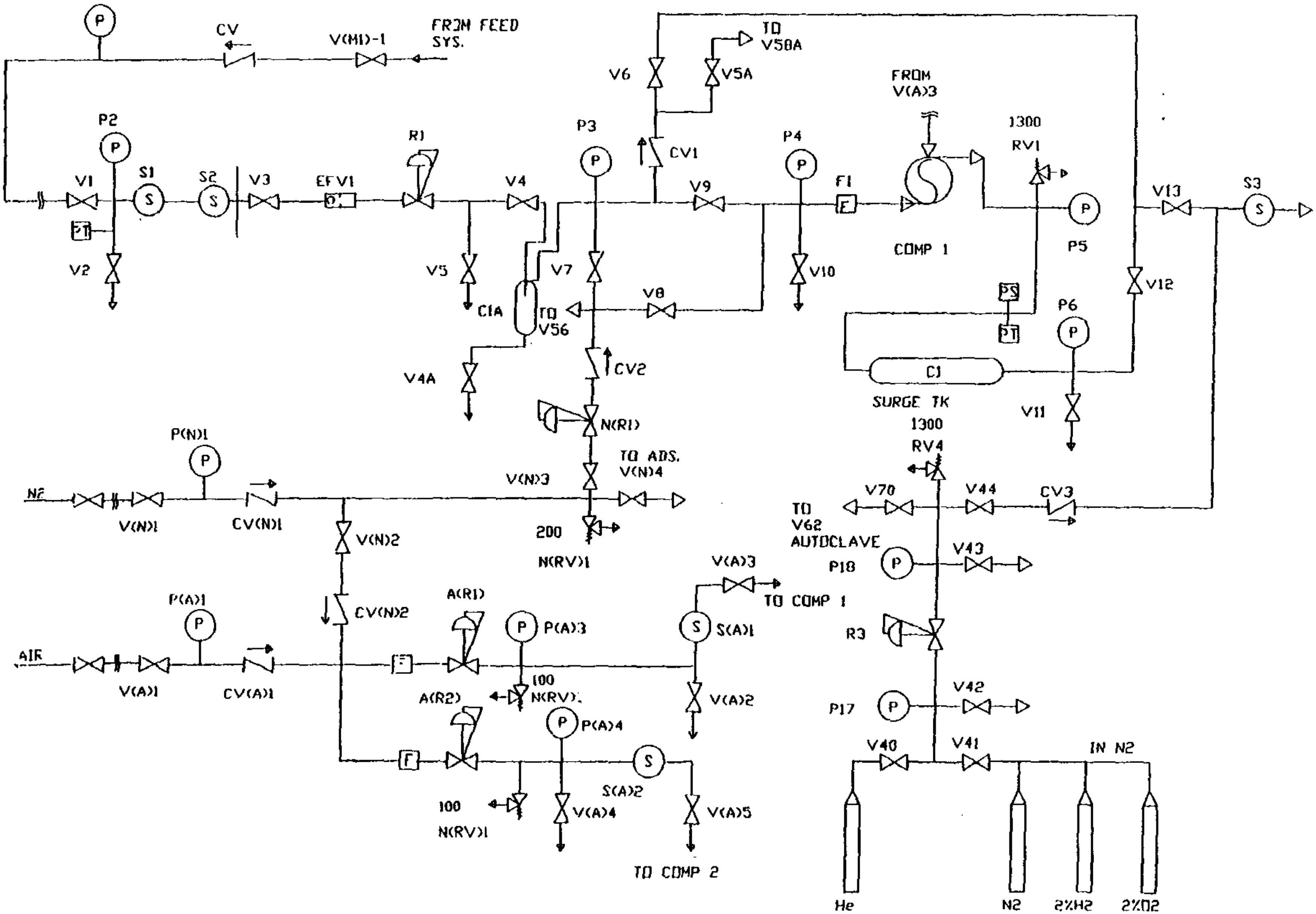
The Field Test Unit (FTU) processes synthesis gas, by passing it first through several adsorption buds to remove trace impurities. The gas is then piped to a 300 cc Autoclave Reactor which converts a percentage of the gas to Methanol and Dimethyl Ether. The Reactor effluent is analyzed by Gas Chromatograph, then vented to atmosphere thru a vent stack. The vent stack is 20 feet high, with 1000 ft^3 per minute air flow. For safety reasons, the process gas is shut off at the source if air flow is lost in the vent stack.

OFFICIAL USE ONLY

Remarks:

Recycled Paper

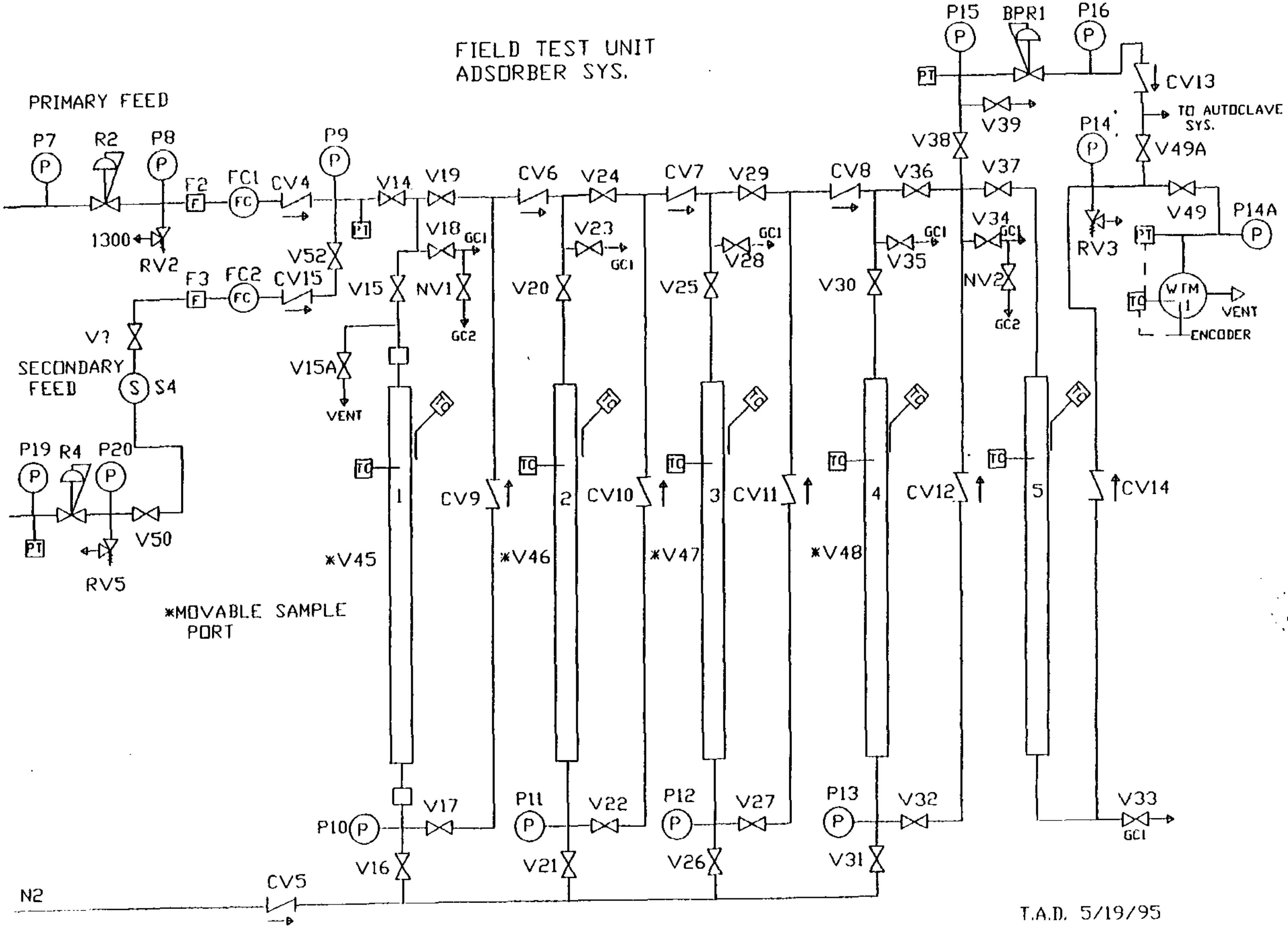
FIELD TEST UNIT
GAS FEED SYSTEM



FIELD TEST UNIT
SHEET 1 OF 6

T.A.D. 5/16/95

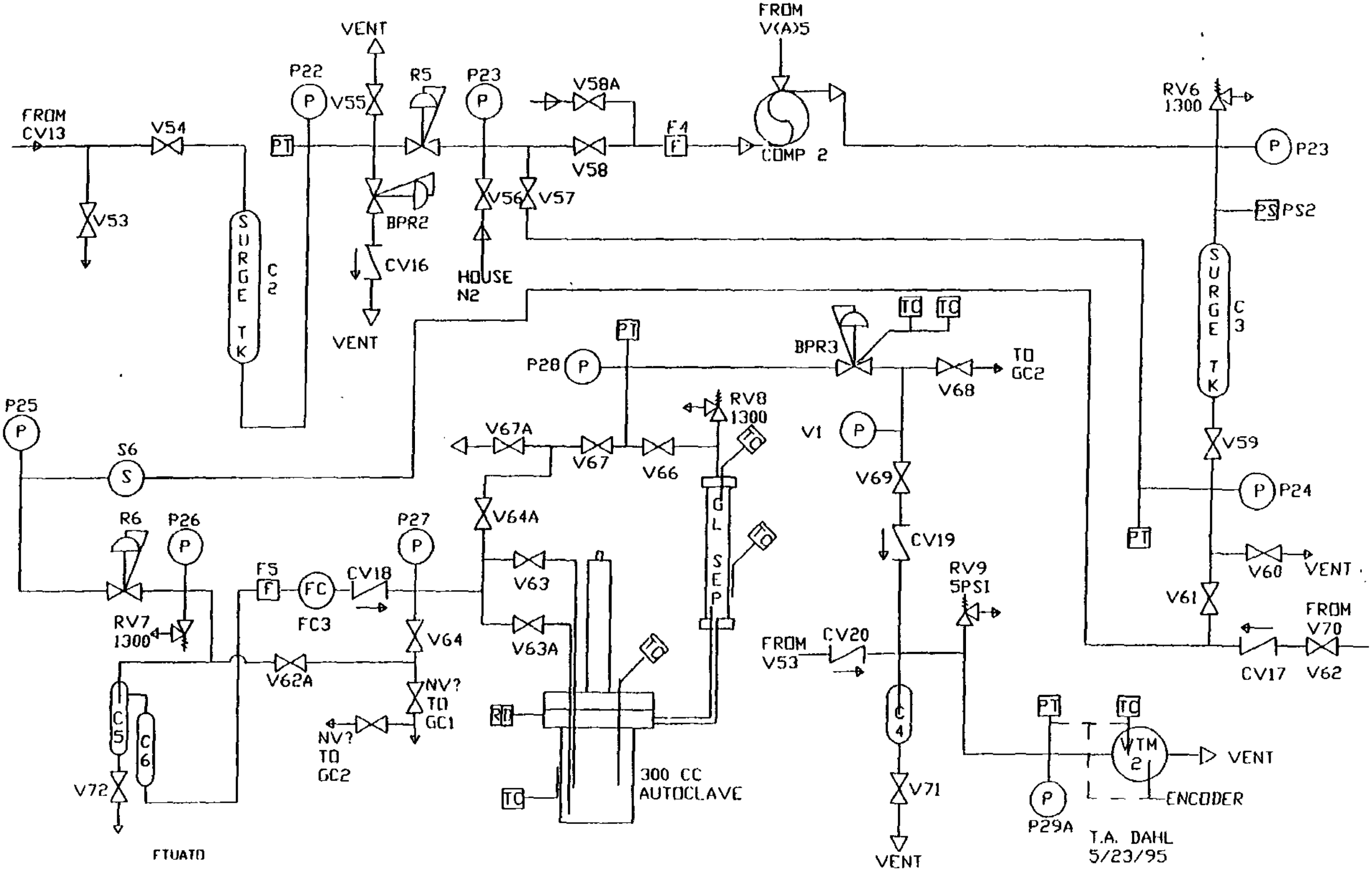
FIELD TEST UNIT
ADSORBER SYS.



T.A.D. 5/19/95

FIELD TEST UNIT
SHEET 2 OF 6

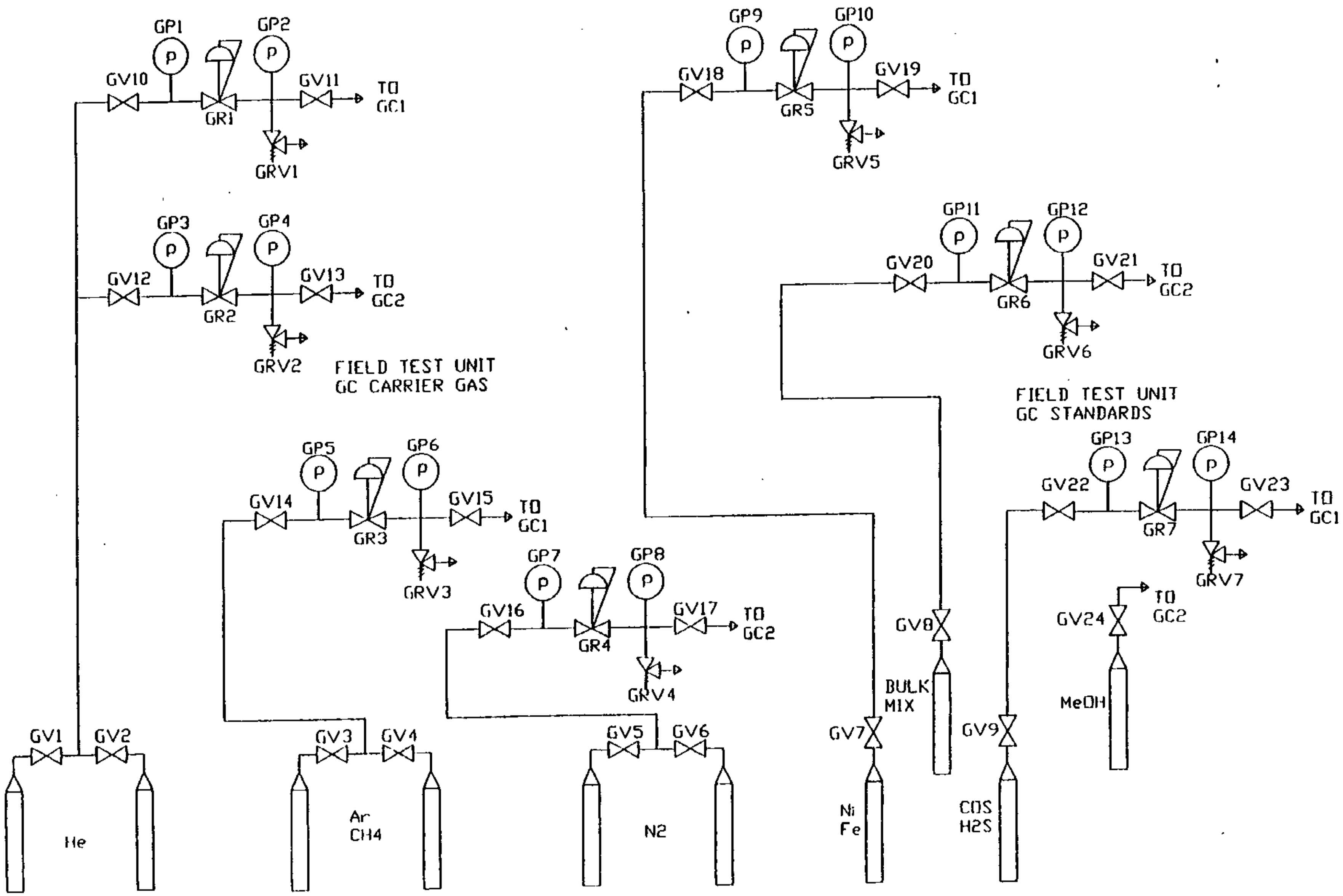
FIELD TEST UNIT
AUTOCLAVE SYS.



FTUATO

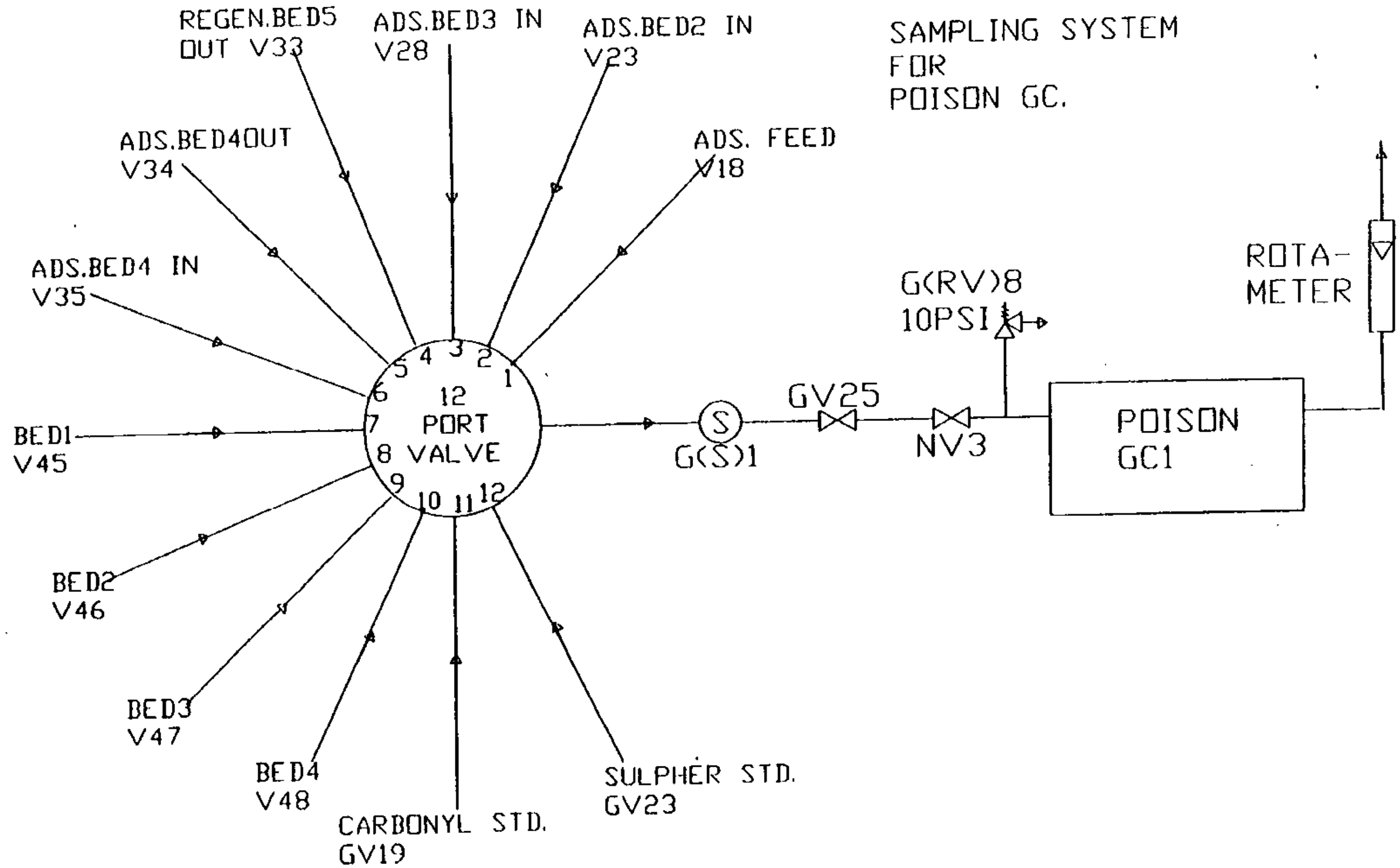
FIELD TEST UNIT
SHEET 3 OF 6

FIELD TES' NIT
GC GAS SYS,EM



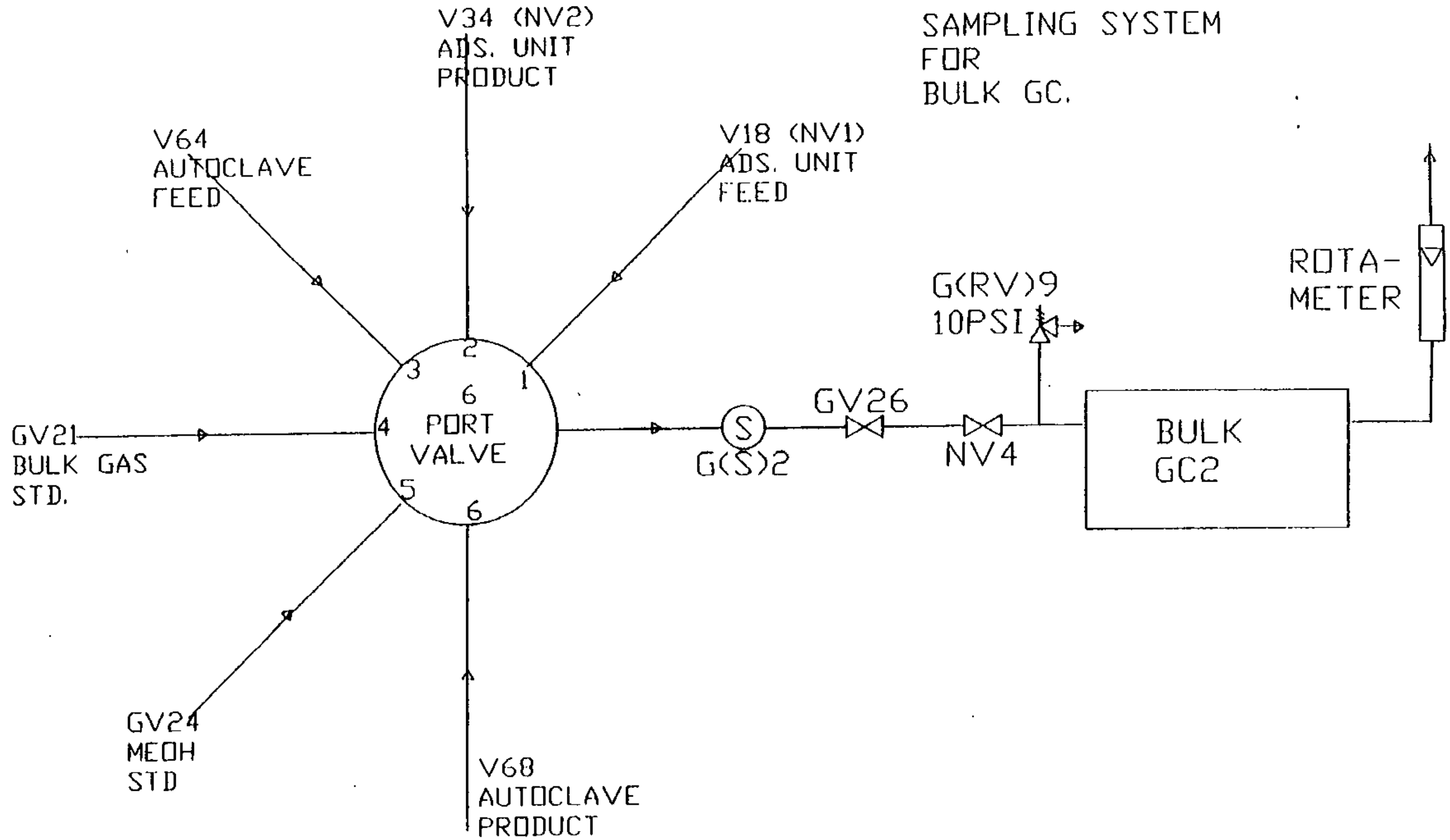
I.A.D. 5/25/95
FIELD TEST UNIT
SHEET 4 OF 6

FTUGAMN



T.A.D. 5/24/95
FIELD TEST UNIT
SHEET 5 OF 6

FTUPOGC



SAMPLING SYSTEM
FOR
BULK GC.

T.A.D. 5/24/95
FIELD TEST UNIT
SHEET 6 OF 6

FTUBUGC

Memorandum

AIR PRODUCTS

):	Tom Dahl	**Dept./Loc.:**	PS&E Res. / I7066
From:	Dean Chin-Fatt	**Dept./Ext.:**	CRSD-ATC RD3 / X3666
Date:	6 April 1994	**Separations Laboratory**	
Subject:	Gas Chromatographic Equipment for Mobile Trailer		

cc: CS File; P.J. Clark; A.J. Di Gioia; LB File

Enclosed is the equipment cost for the gas chromatographs required for the new mobile trailer. From the meeting on 21 March, 1995, it had been decided that the new chromatographs should be configured to do the same gas analyses as done by the GCs in the previous trailer. However, some additional requirements were added. First, the data acquisition is to be done by PE Nelson Turbochrom (similar to the system used in Lab 17). Second, the PID used to do the sulfur analysis in the old system is no longer a viable method to do this analysis, a new detector needed to be found to do low levels of sulfur. Lastly, due to limited space it was desired not to have integrators and to have all data acquisition and valve control through PE Nelson Turbochrom.

The following systems should meet the above requirements. The "Poisons GC" will be an HP-6890 GC with one electronic pressure controlled (EPC) packed injector and the appropriate valving to do simultaneous .jections of the sample onto two columns. One column will be interfaced to an Hewlett-Packard Electron Capture Detector (ECD) to do the nickel and iron carbonyls and the other column to a Sievers Sulfur Chemiluminescence Detector (SCD) to do trace sulfur analysis. The SCD will monitor carbonyl sulfide, hydrogen sulfide and sulfur dioxide to 0.03 mg/L.

The second "Bulk Gas GC" will be another HP-6890 GC with two thermal conductivity detectors (TCD), one flame ionization detector (FID) with full EPC. The FID will be configured to do hydrocarbon analysis or alcohols. The first TCD analyzes for carbon dioxide, oxygen, nitrogen, methane and carbon monoxide. The lower limit for all components is 200 ppm except for carbon monoxide which is 400 ppm. The second TCD detects hydrogen to a lower detection limit of 100 ppm. The TCD signals are electronically summed to provide a single signal output.

These GCs will be configured by Wasson ECE, a certified Hewlett-Packard channel supplier. The base HP-6890 instrument is purchased from Hewlett-Packard and shipped to Wasson along with the Sievers SCD. Wasson will install the Sievers detector, the necessary valves, and columns to perform the analyses stated above. Upon completion of the configuration Wasson will test, install the equipment, train personnel in the use of the equipment and guarantee the performance of the GCs to meet all the detection limits specified above. The Nelson Turbochrom equipment and computer work station will have to be ordered separately and installed in the trailer when the GCs arrive. Turbochrom cannot as yet fully control the new HP-6890 GC so Turbochrom 900 series A/D interfaces will have to be used.

Automation of the stream selection system will be done by Chatham Instruments. Since integrators will not be .sed the Nelson Turbochrom system will have to be able to control the stream select valves. This will require that some external computer code be written for Turbochrom to fully control and read the sample stream number from the stream select valves into the computer. The old stream select valves can be refurbished and used again in the new system to help control cost. As of yet I do not have a quote for the stream select valve automation.

COST ESTIMATE

Mobile Trailer

System 1 "POISONS GC"

	Part No.		Price
Hewlett-Packard	1540A Option 102 Option 230	HP-6890 GC EPC Packed Injector ECD	7642.20 1889.40 3402.80
Sievers	Model 355	SCD	15630.00
Wasson ECE	Configuration		14855.00
		Subtotal	43419.40

System 2 "BULK GC"

	Part No.		Price
Hewlett-Packard	1540A Option 102 Option 112 Option 220 Option 210 Option 301	HP-6890 GC EPC Packed Injector EPC Capillary Injector TCD with EPC FID with EPC 3 Channel EPC	7642.20 1889.40 2603.80 2603.80 2603.80 1518.10
Wasson ECE	Configuration		17125.00
		Subtotal	35986.10
		Grand Total	79405.50