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Chemical Division - U. S.
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Incinerate Waste Treatment Unit Vent (P-148)

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INCINERATE WASTE TREATMENT UNIT VENT (P-148)

ABSTRACT

The Waste Treatment Unit (WTU) vent was sampled as part of the effort to identify sources of vinylidene chloride (VDC) within Plant B and sample analysis showed significant emissions from the open top scrubber. Because of its proximity to work area, these emissions were identified as a personnel exposure hazard, and a stack was placed atop the scrubber. This allowed normal atmospheric dispersion to reduce the work area concentration of organics to safe levels. Stack sampling was used to quantify the emission and indicated an emission rate of 150-450 lb/D of chlorinated hydrocarbons with a vinyl chloride (VC) content greater than 2000 ppm. Although this VC emission is not specifically covered by NESHAP regulations, emissions of this magnitude are likely to fall within the purview of the Clean Air Act. Thus, incineration of the WTU vent was evaluated.

Two methods of increasing the vent pressure for incineration were considered. The first method was to operate the WTU system at about 5 psig to force the vent to the incinerator which operates at a maximum pressure range of between 3.0-3.5 psig. The second method was to compress the vent from the WTU stack to a pressure high enough to conduct it to the incinerator. The second method poses safety problems due to possibility of air-leakage into the system upstream of the compressor suction. Additionally, the compression system would be more expensive; thus, the first method was considered best for WTU vent incineration.

The process design for a system to incinerate the WTU vent has been completed, and it is recommended that it be installed as soon as practicable.

Not Correct
452 #10
SEE: 974000000000
4/24/79
2.5-2.6 lbm/dm³
VC - 3.6%
VDC - 14.6%
EDC - 137.6%
150.9
452-151-301

INTRODUCTION

In February 1977, a VDC emission control Project (P-746) was initiated to identify sources of VDC emissions in Plant "B" and develop means for controlling them. This broad project covered several emissions work items, one of which was the waste water stripper (WTU) vent. Prior to the initiation of P-746, the WTU scrubber was operating without a vent stack thus causing a high ground-level concentration of chlorinated hydrocarbons. To reduce personnel exposure to organic emissions in the work area, and provide a better means to quantify the VDC content of the emissions, a stack was installed on the scrubber. Following this, samples were collected and their analysis indicated organic emission of 150 to 450 lb/day with a vinyl chloride content greater than 2000 ppm. Consequently, it was decided to incinerate the WTU vent and completely eliminate the organic emissions. This work item was deleted from the VDC emission control project (P-746) to be treated under a separate project entitled - Incinerate Waste Treatment Unit Vent (P-148).

DISCUSSION

Two methods of increasing the vent pressure so that it can be incinerated were considered. The first method was to operate the WTU system at a pressure of about 5 psig to force the vent to the incinerator which operates within a pressure range of 0.5-1.0 psig. (The designed maximum pressure is 3.0-3.5 psig). The second method was to compress the vent from the WTU stack to a pressure high enough to conduct it to the incinerator. This method poses some safety problems by introducing the possibility of air leakage into the system upstream of the compressor suction. Because of this safety problem and because the compressor system would be more expensive; the first method was considered best to incinerate the vent.

Prior to the design of the incineration system, two process considerations were examined.

1. The effect of increasing the system operating pressure on WTU operations (particularly on seal loops).
2. Sizing the incinerator header so that minimal pressure drop would occur at design vent flows.

Presently, the WTU is operating at atmospheric pressure and the seal loops (about 6 ft. in height) are capable of holding a backpressure up to 2.5 psi. Additionally, the loops allow for an emergency overflow of aqueous organics back to the API separator should vessels be overfilled (see Figure 1). To increase the stripper operating pressure to 5 psig, and still maintain the 500 gpm aqueous feed rate, all the seal loops should be extended by 7 feet to hold a backpressure of up to 6 psi; otherwise aqueous organics would overflow from the vessels to the separator. At this increased pressure, steam requirement to the stripper would increase by about 17% over the original steam flow and the stripper bottom temperature would increase to 227°F.

The incinerator header was sized at 3 inches to provide a pressure drop of only 0.1 psig with 25 ACFM vent flow. This should allow the WTU to operate at 5 psi without adverse effects caused by swings in incinerator operating pressure.

At this point, a preliminary incineration system was designed. The table in Figure 1 shows the design data while the dotted-lines illustrates the new incineration piping. A 3-inch line would run from the existing vent stack to the incinerator header and the seal loops would be extended by 7 feet. A pressure control valve would be installed on the vent header to maintain the stripper operating conditions at 5 psig and 227°F.

To avoid running condensed organics to the incinerator, the design provides for the installation of a knock-out pot very close to the incinerator header. An anti-backflow system will conduct vent to the incinerator start-up scrubber in the event of an incinerator shutdown or backward vent flow. Additionally, the design provides for the incineration of vent from the VC II Plant WTU (with the same modifications to the new WTU).

On January 29, 1980, the proposed incineration system was presented to the Operations Review Committee for comments and contributions. The Committee agreed to the concepts of the proposal but asked for the following refinements.

1. Install a panel board mounted pressure indicator with high and low pressure alarms for the vent system of the WTU. The system should be engineered to help indicate impending problems in the WTU system or the incinerator system.
2. Install a selector switch at the panel board to permit routing of the vent from the incinerator to the start-up scrubber manually.
3. Establish the level of air that might be introduced into the system and apply it to flammability data to determine if there is any need for additional safe-guards.

Based on the third point, a study was made on the potential for vent flammability if the oxygen concentration is within the explosibility region. Two possibilities of getting air into the system were identified:

1. Air leakage through a worn seal on the stripper feed pumps.
2. Air dissolved in the stripper feed water (API separator and WTU pond).

For the case of a leaking pump seal, a shaft-to-seal clearance of 0.002 inches was considered with the pump operating at minimum NPSH. Under these worst case conditions, the maximum amount of oxygen leakage into the pump is 0.125 ACFM, and if all of this oxygen ultimately leaves the WTU system in the stripper vent, it would constitute less than 1.0% of the vent flow. Oxygen of this concentration is insufficient to cause vent flammability. In considering air dissolved in the stripper feed water, it was assumed that the water would be saturated with oxygen. This should be a worst case assumption since both the API separator and the WTU pond are essentially unagitated and the opportunity for oxygen to dissolve in the water is minimal. The solution of oxygen in water is temperature dependent and thus, the ambient temperature of the stripper feed water is very important. The water temperature in the API separator was measured at 100°F and under maximum flow conditions, the amount of oxygen dissolved in the water at this temperature would constitute 2.5% of the vent (see Table I). This should pose no flammability problems. If the API temperature dropped to 79°F, the oxygen concentration could rise as high as 8%. This still would pose no vent hazard. However, the water from API separator is not fed directly to the stripper, but passes through the surge pond where it has the opportunity to cool further. Under these conditions, the water could contain enough oxygen to cause flammability problems in the vent if it were fully saturated (though this is very unlikely).

Figure 2 illustrates the detailed instrumentation for the incineration scheme. Leaving the stripper, the vent would pass through the PCV (designed to fail in an open position). The PCV would also be equipped with a pressure recorder mounted in

the control room as well as low and high pressure alarm signals. The manual valves would be installed as shown for the use of the operators to initiate the stripper start-up by directing the vent to the scrubbers. For safety purposes, the incineration line has been equipped with an anti-backflow valve having a controlled pressure drop of 0.5 psig at full flow conditions. The associated pressure differential transmitter and switch are to sense a reverse vent flow and will automatically close this valve. Simultaneously, the PCV on the scrubber line would be opened to allow vent flow through the scrubber. A hand switch would be placed on the control board for the shutdown system. Although this creates a duality in instrumentation, it is much more convenient to employ when both waste treatment units are to be started up at the same time.

CONCLUSION

The proposed modification of the WTU would provide for a safe incineration of the organics vents and completely eliminate the vinyl chloride emission.

RECOMMENDATIONS

1. The WTU vent should not be incinerated until the stripper feed has been rerouted to come directly from the API separator.
2. The API separator should be covered to further preclude the solution of hazardous amounts of oxygen in the waste water. However, this is not necessary prior to installation of the WTU vent incineration system.
3. After the vent incineration system is installed, the WTU vents should always be cleared of oxygen to safe levels prior to switching them to the incinerator after WTU start-up.
4. The incineration line should be of corrosion resistant pipe (furan or chemtite).
5. Equipment should be designed and installed as soon as possible to eliminate the organic emissions.

Author: Kamren A. Jimoh Date: 5-6-80

Approved: R. A. L. L. Date: 5-6-80

Approved: J. Boyd Alleman Date: 5-12-'80

A P P E N D I X

SEE SAC 60-1700

NO T-118

SIZE 2' ϕ x 4' T/T

DESIGN PRESS. 15PSIG

AT 180°F

	T	(PSIG)	(ACFM)	N	lighter than EDC	heavier than EDC
①	100	5	5.2-25	89.07	8.66	2.27
②	100	0.5-3.5	5.2-25	89.07	8.66	2.27

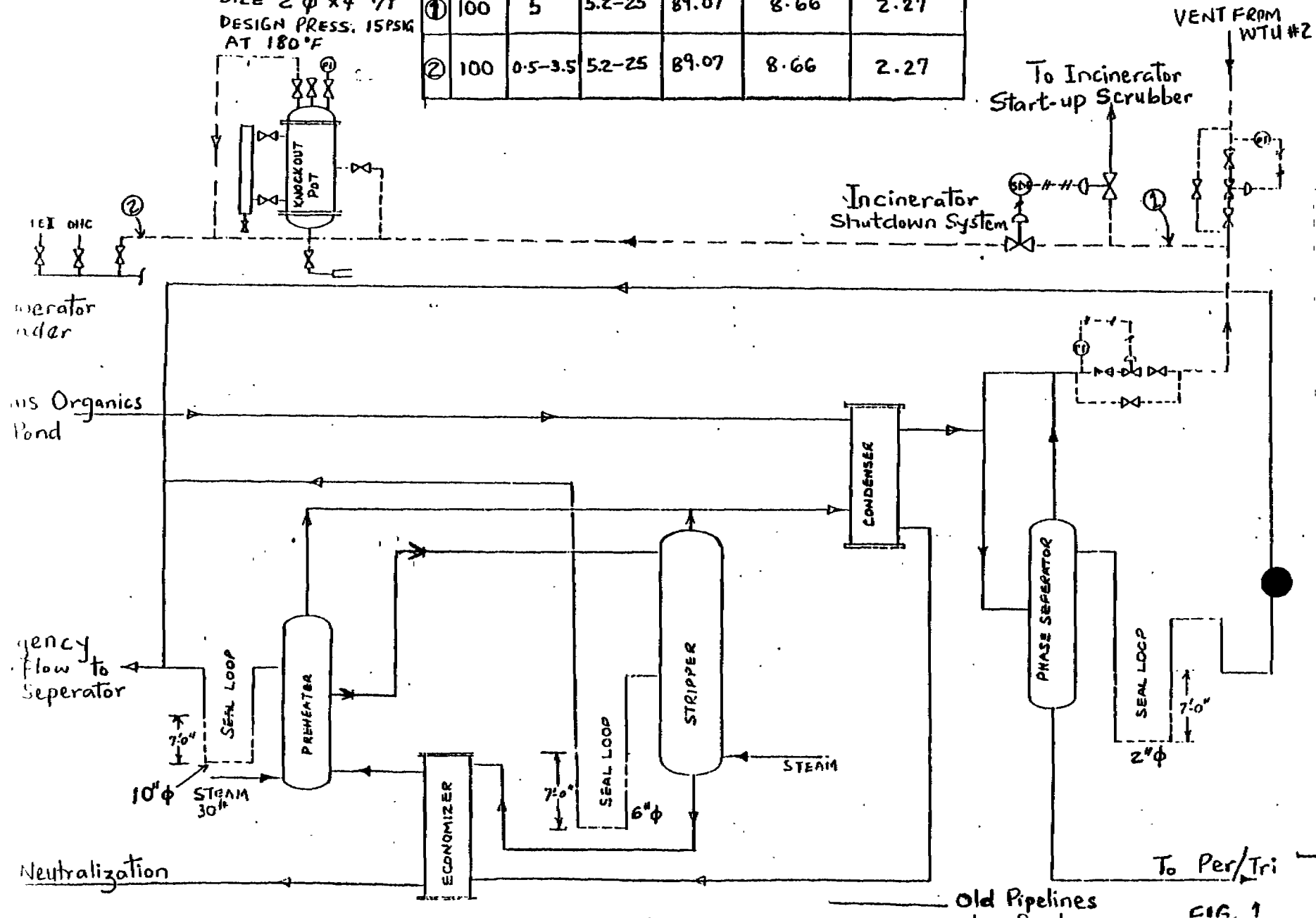


FIG. 1

TABLE I

CALCULATED WTU VENT COMPOSITION

API Waste Water at 100°F

<u>Sample Date</u>	<u>10-03-79</u>	<u>10-10-79</u>	<u>10-12-79</u>
Vent flow ACFM	5.9	4.9	4.9
Total Organics % vol.	14.41	7.10	11.29
Oxygen % vol. (1)	2.13	2.5	2.5
CO ₂ , N ₂ , etc. % vol. (2)	83.46	90.4	86.21

API Waste Water 79°F

<u>Sample Date</u>	<u>10-03-79</u>	<u>10-10-79</u>	<u>10-12-79</u>
Vent flow ACFM	5.9	4.9	4.9
Total Organics % vol.	14.41	7.10	11.29
Oxygen % vol. (1)	6.64	8.0	8.0
CO ₂ , N ₂ , etc. % vol. (2)	78.95	84.9	80.7

(1) Calculated based on O₂ solubility in waste water and 500 gpm feed to stripper.

(2) Calculated by difference.

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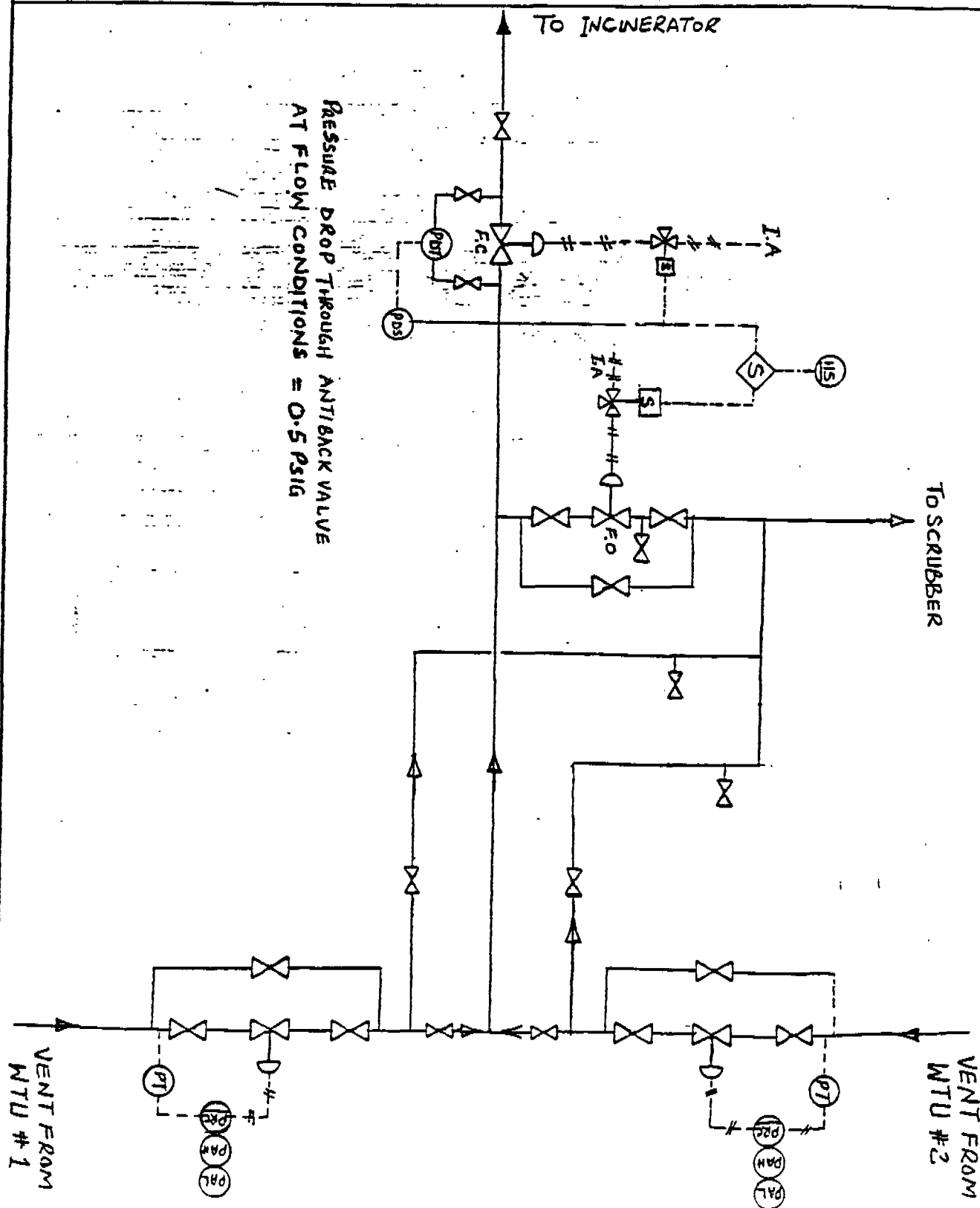


PROCESS CALCULATIONS

Job 48 By K. JimeH Apprvd. _____

Date 2-16-80 Page 2 of 2

SUBJECT DETAIL INSTRUMENTATION OF THE INCINERATION LINE



SL 073164

FIG. 2