# Background Report Reference

**AP-42 Section Number:** 8.13

**Background Chapter:** 4

**Reference Number:** 13

**Title:** Compliance Test Report: Hunt Refining Company-Number Two Sulfur Recovery Unit

TTL, Inc.

August 1991

rescan
damaged file

8.13 BR #13 4.5

**TTL, Inc.** PRACTICING IN THE GEOSCIENCES

3516 Greensboro Avenue • P.O. Drawer 1128 • Tuscaloosa, Alabama 35403 • Telephone 205-345-0816 • FAX 205-345-0992

September 6, 1991

Mr. Charles Markin
Hunt Refining Company
P.O. Drawer 1850
Tuscaloosa, Alabama 35403

RE: Sulfur Recovery Study
Hunt Refining Company
Tuscaloosa, Alabama

Dear Mr. Markin:

Please find enclosed three copies of the Sulfur Recovery Study on the Number Two Sulfur Recovery Unit performed at the Hunt Refining Company Plant on August 20 and 21, 1991 in Tuscaloosa, Alabama.

If you or any of your associates have any questions or comments, please do not hesitate to call.

Sincerely yours,

TTL, Inc.

Jack E. Davis, CIH
Vice President

Garry C. Pearson
Project Manager

JED/GCP/joi

Enclosures

# SULFUR RECOVERY STUDY

# ON THE

# NUMBER TWO SULFUR RECOVERY UNIT

FOR

HUNT REFINING COMPANY

TUSCALOOSA, ALABAMA

AUGUST 20 & 21, 1991

## TABLE OF CONTENTS

## INTRODUCTION

This report documents the sulfur dioxide emission tests performed on the Number Two Sulfur Recovery Unit of the Petroleum Refinery operated by Hunt Refining Company in Tuscaloosa, Alabama, on August 20 and 21, 1991. The purpose of these tests was to measure the sulfur dioxide emission of this process unit and to evaluate its performance under the Alabama Department of Environmental Management's Air Pollution Control Rules and Regulations.

Mr. Charles Markin was present during the tests and was responsible for the operation of this equipment. Messrs. Garry Pearson, Lee Lindley, Robert Slee and Stanley McCarter performed the tests for TTL, Inc. in Tuscaloosa, Alabama. The State of Alabama was represented by Gaynor Drablos.

## DESCRIPTION OF INSTALLATION & PROCESS OPERATION

The tests described in this report were conducted on the new sulfur gas incinerator in the number two sulfur plant of Hunt Refining Company's Tuscaloosa Refinery.

The operation consisted of mixing two gas streams together to produce a raw, high-sulfur gas stream to feed a Claus Sulfur Recovery Unit. The two gas streams are called acid gas and sour gas. After mixing, the gas streams are forced through a Claus Sulfur Recovery Unit followed by a Shell Claus Off-Gas Treating Unit (SCOT Unit). From the SCOT Unit, the gas stream is fed into an incinerator for conversion of the remaining hydrogen sulfide to sulfur dioxide that is allowed to discharge into the air.

A flow sheet of the sour gas, acid gas and effluent gas from the incinerator is shown in Figure 1. The production rate was monitored on the sulfur recovery unit by gauging the sulfur pit.

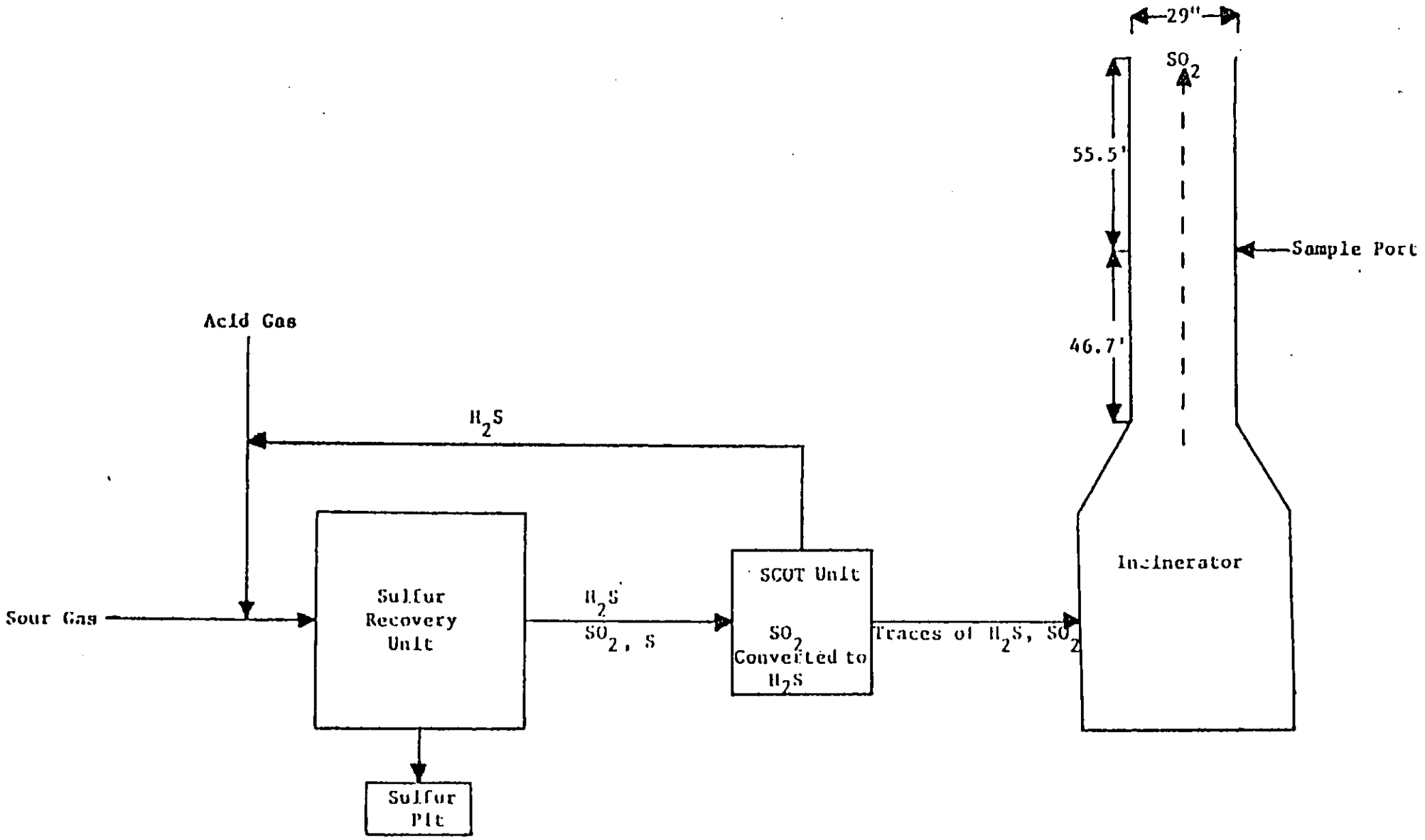


Figure 1. Gas Process Flow Sheet

## SUMMARY OF PARAMETERS AND EMISSION RATES

Table I is a summary of the results of the tests performed on Hunt Refining Company's Number Two Sulfur Recovery Unit and incinerator on August 20 and 21, 1991. The percent concentrations of sulfur dioxide in the discharge gas were 0.0063, 0.0044 and 0.0057 for an average of 0.0055. The percent by volume of sulfur dioxide in the stack gas was calculated to a zero percent oxygen basis.

During the tests, the average discharge characteristics of the discharge stack were as follows:

| | |
|---|---|
| Temperature | 1124 °F |
| Moisture | 6.28 % |
| Velocity | 33.23 fps |
| Flow | 9,148 ACFM |

TTL, INC.

Jack E. Davis, CIH

James C. Bambarger, P.E.

**TABLE I**
**TEST RESULTS**

| RUN NO. | #1 | #2 | #3 | Average |
|---|---|---|---|---|
| Stack Gas Temperature (F) | 1127 | 1103 | 1143 | 1124 |
| Moisture Content (% By Volume) | 7.03 | 7.14 | 4.66 | 6.28 |
| Stack Gas Velocity (actual ft/sec) | 32.197 | 34.825 | 32.694 | 33.23 |
| Volumetric Flow Rate (actual cfm) | 8861 | 9584 | 8998 | 9148 |
| Volumetric Flow Rate (dscfm) | 2753 | 3004 | 2824 | 2860 |
| Concentration of $SO_2$ (mg/dscf) | 2.40 | 1.71 | 2.24 | 2.12 |
| Concentration of $SO_2$ (% by volume, 0% Oxygen basis) | 0.0063 | 0.0044 | 0.0057 | 0.0055 |
| Sulfur Production Rate (lb/hr) | 2704 | 1637 | 2247 | 2196 |

Hunt Oil Co.

## SUMMARY OF PARAMETERS AND EMISSION RATES

Table I is a summary of the results of the tests performed on Hunt Refining Company's Number Two Sulfur Recovery Unit and incinerator on August 20 and 21, 1991. The percent concentrations of sulfur dioxide in the discharge gas were 0.0063, 0.0044 and 0.0057 for an average of 0.0055. The percent by volume of sulfur dioxide in the stack gas was calculated to a zero percent oxygen basis.

During the tests, the average discharge characteristics of the discharge stack were as follows:

| | |
|---|---|
| Temperature | 1124 °F |
| Moisture | 6.28 % |
| Velocity | 33.23 fps |
| Flow | 9,148 ACFM |

TTL, INC.

Jack E. Davis, CIH

James C. Bambarger, P.E.

**TABLE I**
**TEST RESULTS**

| RUN NO. | #1 | #2 | #3 | Average |
|---|---|---|---|---|
| Stack Gas Temperature (F) | 1127 | 1103 | 1143 | 1124 |
| Moisture Content (% By Volume) | 7.03 | 7.14 | 4.66 | 6.28 |
| Stack Gas Velocity (actual ft/sec) | 32.197 | 34.825 | 32.694 | 33.23 |
| Volumetric Flow Rate (actual cfm) | 8861 | 9584 | 8998 | 9148 |
| Volumetric Flow Rate (dscfm) | 2753 | 3004 | 2824 | 2860 |
| Concentration of $SO_2$ (mg/dscf) | 2.40 | 1.71 | 2.24 | 2.12 |
| Concentration of $SO_2$ (% by volume, 0% Oxygen basis) | 0.0063 | 0.0044 | 0.0057 | 0.0055 |
| Sulfur Production Rate (lb/hr) | 2704 | 1637 | 2247 | 2196 |

| PARAMETER | | | |
|---|---|---|---|
| RUN NO. | SO2 #1 | SO2 #2 | SO2 #3 |
| DATE | 8-20-91 | 8-20-91 | 8-21-91 |
| Dp | 0.107 | 0.127 | 0.110 |
| SQR(Dp) | 0.327 | 0.356 | 0.332 |
| Dh | 0.010 | 0.010 | 0.010 |
| tm | 92.8 | 109.7 | 91.4 |
| ts | 1127.0 | 1102.6 | 1142.8 |
| As | 4.5869434404 | 4.5869434404 | 4.5869434404 |
| An | 0.0001873 | 0.0001873 | 0.0001873 |
| Vm | 8.265 | 8.414 | 8.569 |
| Vmc | 8.265 | 8.414 | 8.569 |
| Y | 1.0215 | 1.0215 | 1.0215 |
| Th | 240 | 240 | 240 |
| Lp | 0 | 0 | 0 |
| La | 0.00017 | 0.00017 | 0.00017 |
| Vlc | 13 | 13 | 8.7 |
| CO2 | 3.18 | 3.17 | 3.65 |
| O2 | 10.43 | 10.17 | 10.00 |
| N2 | 86.14 | 86.43 | 86.19 |
| CO | 0.25 | 0.23 | 0.17 |
| Kp | 85.49 | 85.49 | 85.49 |
| Cp | 0.84 | 0.84 | 0.84 |
| Pbar | 30.05 | 29.89 | 29.9 |
| Pg | 0.005 | 0.005 | 0.005 |
| Ps | 30.050 | 29.890 | 29.900 |
| Pm | 30.051 | 29.891 | 29.901 |
| Vw(std) | 0.612 | 0.612 | 0.410 |
| Vm(std) | 8.095 | 7.955 | 8.373 |
| Bws | 0.0703 | 0.0714 | 0.0466 |
| Md | 28.927 | 28.914 | 28.983 |
| Ms | 28.159 | 28.134 | 28.471 |
| vs | 32.197 | 34.825 | 32.694 |
| EA | 82.9 | 78.7 | 77.2 |
| Qa | 8861.1 | 9584.5 | 8998.0 |
| Qstd | 2752.9 | 3004.3 | 2824.1 |
| Vn | 26.07 | 25.39 | 26.69 |
| I | 30.012 | 27.024 | 30.258 |
| mSO2 | 19.5 | 13.6 | 18.8 |
| cSO2 | 2.404 | 1.710 | 2.242 |
| SPR | 2703.68 | 1637.44 | 2246.72 |
| VPf | 754.654 | 754.654 | 754.654 |
| %SO2(stk) | 0.003185 | 0.002266 | 0.002971 |
| %SO2 | 0.006330 | 0.004393 | 0.005670 |
| % Allowable Emission | 0.025 | 0.025 | 0.025 |