Ref. 56. (5)

MEDPS-PE (22 Oct 68) 1st Ind
SUBJECT: Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

DA, OTSG, Washington, D. C. 20315 24 October 1968

THRU: Chief of Engineers, Department of the Army, ATTN: ENCMC-FU, Washington, D. C. 20315

TO: Commanding General, U. S. Army Material Command, ATTN: AMCPT-H, Washington, D. C. 20315

1. Concur in conclusions and recommendations contained in inclosed report.

2. Reference 2a, inclosed report, was forwarded to you by 1st Ind dated 1 May 1967.

3. Data included in Appendix A of report were obtained from results of analysis of fuel samples submitted by the installation.

FOR THE SURGEON GENERAL:

1 Incl
nc (Cy 11 wd)

HERSCHEL E. GRIFFIN
Colonel, M. C.
Chief, Preventive Medicine Division

CF:
CO, Third USAML (Cy 10)
ATTN: EHES

CO, USAMRA, ATTN: USAMRA-EA

Mr. Joseph E. Flanagan, OCE (Blind Cy)

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
EDGEWOOD ARSENAL, MARYLAND 21010

USAEHA-EA

22 OCT 1968

SUBJECT: Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

The Surgeon General
ATTN: MEDPS-P
Department of the Army
Washington, D.C. 20315

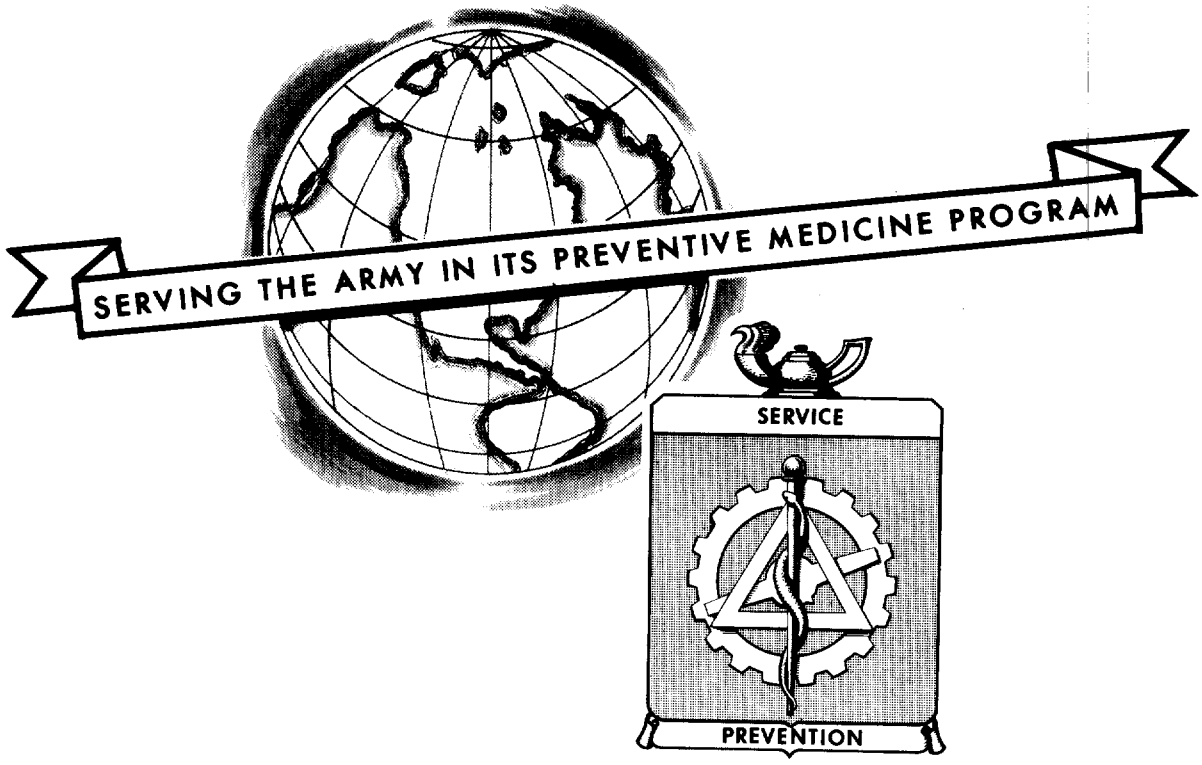
Inclosed are 11 copies of the Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967. This report was written by CPT Roy C. Burke III, Sanitary Engineer, Air Pollution Engineering Division, this Agency.

1 Incl
as (11 cy)

I. H. Simmons

I. H. SIMMONS
Colonel, MC
Commanding

SUMMARY REPORT OF AIR POLLUTION EVALUATIONS SUPPLEMENT VOLUNTEER ARMY AMMUNITION PLANT TYNER, TENNESSEE PROJECT NO. 21-25-67/69 19 JUNE - 12 JULY 1967



US ARMY
ENVIRONMENTAL HYGIENE AGENCY
EDGEWOOD ARSENAL, MD. 21010

USAEHA-EA Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

22 OCT 1968

ABSTRACT

The Air Pollution Engineering Division, this Agency, conducted a source sampling survey at Volunteer Army Ammunition Plant for the period 19 June - 12 July 1967. The units sampled included the main boiler plant, East Acid sulfuric acid concentrator, acid and fume recovery systems, red water incinerator, and oleum-sellite plant. A fuel conversion at the main boiler plant eliminated this facility as a major source of particulate matter and sulfur dioxide. Oxides of nitrogen and acid mists from the AOP (North and East Acid) and the acid-fume recovery systems were found to be the major problem. Sulfur dioxide emissions do not constitute a major problem at this time. It was recommended that particulate emissions from the red water incinerator be reduced.

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
EDGEWOOD ARSENAL, MARYLAND 21010

IN REPLY REFER TO:
USAEHA-EA

SUMMARY REPORT OF AIR POLLUTION EVALUATIONS
SUPPLEMENT
VOLUNTEER ARMY AMMUNITION PLANT
TYNER, TENNESSEE
PROJECT NO. 21-25-67/69
19 JUNE - 12 JULY 1967

1. AUTHORITY.

a. AR 40-4, Army Medical Service Facilities, 14 July 1967.

b. Letter, AMCPT-H, HQ, USAMC, 18 October 1965, subject: Environmental Pollution Surveys, and indorsements thereto.

2. REFERENCES.

a. Summary of Air Pollution Evaluations, Volunteer Army Ammunition Plant, December 1965 - February 1967, US Army Environmental Hygiene Agency, Edgewood Arsenal, Maryland.

b. Devorking, H., R. L. Chass, A. P. Fudurick, and C. V. Kanter, Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles County, California, November 1965.

c. American Society of Mechanical Engineers, Power Test Code 27, "Determining Dust Concentration in Gas Stream," 1957.

d. US Department of Health, Education, and Welfare, Public Health Service, Atmospheric Emissions from Sulfuric Acid Manufacturing Processes, Public Health Service Publication Number 999-AP-13, Cincinnati, Ohio, 1965.

e. US Department of Health, Education, and Welfare, Public Health Service, Atmospheric Emissions from Nitric Acid Manufacturing Processes, Public Health Service Publication Number 999-AP-27, Cincinnati, Ohio, 1966.

f. Unpublished Report, Sulfuric Acid Emission Survey, Farmers Chemical Association, Inc., Tyner, Tennessee, Resources Research, Inc., Lakeland, Florida, 6 June 67.

g. Technical Section Standing Operating Procedure for Air Pollution Alarm System, Atlas Chemical Industries, Inc., Volunteer Army Ammunition Plant, June 1967.

USAEHA-EA Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

3. OBJECTIVE.

Based on recommendations cited in Summary Report, reference paragraph 2a, the objective of this survey was to perform source sampling at the main boiler plant, East Acid sulfuric acid concentrator, acid and fume recovery systems, red water incinerator, and oleum-sellite plant. The sampling results were used to characterize the different source emissions and to support recommendations concerning necessary abatement measures.

4. BACKGROUND.

A complete description of plant history, climatology, topography, processes, unit operations, previous source sampling results, and other information appeared in the Summary Report, reference paragraph 2a.

5. SAMPLING PROCEDURES.

a. Particulate samples were taken according to accepted procedures described in references 2b and 2c. The sampling train consisted of probe tip, heated probe, cyclone, glass fiber filter, Greenberg-Smith impingers (in ice bath), water-cooled condenser, dry gas meter, rotameter, and vacuum pump.

b. Sulfuric acid mist samples were taken from the SAC and sellite stack utilizing the procedure described for particulate sampling. At the conclusion of a sampling run the probe tip, probe, cyclone, filter housing, and glass connections, were thoroughly rinsed with deionized water. Total acidity of these rinsings (with filter paper added) was titrated with NaOH and expressed as 100% sulfuric acid (H_2SO_4) mist. The grab sampling technique was used for nitric acid mist determination at the acid and fume recovery. A glass wool trap placed near the sampling port intercepted acid as the evacuated flask was filled. Total acid collected in the glass wool trap was related to the sampling flask volume and expressed as 100% nitric acid (HNO_3).

c. Sulfur dioxide and sulfur trioxide were sampled using the Shell Development Company Method without modification, reference paragraph 2d.

d. Oxides of nitrogen were sampled using the Hydrogen Peroxide Method and the Phenoldisulfonic Acid (PDA) Method, both without modification, as described in reference paragraph 2e. The PDA method was substituted for hydrogen peroxide whenever interference by SO_2, SO_3, NH_3 was expected. Evacuated flasks (grab sampling techniques) were used for sample collection in both cases.

6. DISCUSSION.

a. Main Boiler Plant Building 401-1.

(1) Table 1 summarizes particulate emission rates and compares these results to existing federal standards. Since natural gas is the primary fuel, with No. 2 oil as standby, particulate emissions are not a problem. If coal burning is resumed particulate emissions would then exceed standards. Additional source sampling would be required to determine accurately the quantity of emissions.

(2) Photoelectric or other type smoke detectors would have to be installed if coal burning (or usage of No. 3 oil or heavier) is resumed.

b. Other Unit/Process Emissions.

(1) Averaged emissions expressed as pounds per day are summarized in Table 2. It was assumed that each operational stack (within a single process) was used continuously and discharged amounts equivalent to the stack sampled. Because of shutdowns and other operational difficulties daily averages may be considerably different from those shown. However, they do reflect the total air pollution potential when averaged over a period of time.

(2) The red water incinerator contributed approximately 90% of the particulate emitted from plant operations. At this time, no specific standards exist for a process of this type.

(3) The major sources of SO_2 are the SAC (North and East Acid) and the sellite exhaust. The air monitoring system has not recorded ambient concentrations equal to or in excess of 0.1 ppm (lower action level).

(4) Significant quantities of oxides of nitrogen are emitted from operations shown in Table 2. Numerous shut down levels (3.0 ppm measured by the air monitoring network) have occurred resulting in a cutback of offending processes until ambient levels of NO_2 drop. Combined output of AOP units (North and East Acid Areas) contribute approximately 50% of the total nitrogen oxides. (This excluded the 500 ton/day nitric acid plant, North Acid). Acid and fume recovery systems discharge nearly 35%, and the remaining 15% originates from the SAC, fuel combustion, and miscellaneous leaks from the entire plant. The visible yellow to red plumes from the acid and fume recoveries present an additional esthetic problem.

USAEHA-EA Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

TABLE 1

PARTICULATE EMISSION RATES
MAIN BOILER PLANT

Unit (1)	Average Steam Output lb/hr	(2) Measured Emission Rate		Allowable (5) Emission lb/million Btu Input
		lb/hr (3)	lb/million (4) Btu Input	
Boiler 3, Coal	71,500	70	0.705	0.36
	71,500	217	2.220	0.36
	71,500	575	5.870	0.36
Boiler 3, Gas	71,500	3.4	0.035	0.36
	71,500	4.5	0.046	0.36
	71,500	2.3	0.023	0.36
Boiler 4, Gas	74,500	0	0	0.36
	80,500	3.6	0.033	0.36
	80,500	3.0	0.027	0.36

(1) Building 401-1 contained four water tube boilers @ 150,000 lb steam/hr. (400 psig, 448°F, saturated).

(2) Taken from daily steam records assuming each boiler operated under stable load conditions.

(3) Emission Rate, lb/hr =

$$\frac{(\text{Concentration, gr/ft}^3)(\text{Stack Flow, ft}^3/\text{min})(60\ \text{min/hr})}{7000\ \text{gr/lb}}$$

(4) Emission Rate, lb/million Btu =

$$\frac{\text{Emission Rate, lb/hr}}{(\text{Steam Output, lb/hr})(0.00137\ \text{million Btu Input/lb steam})}$$

(5) See Appendixes

USAEHA-EA Summary Report of Air Pollution Evaluations, Supplement, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-25-67/69, 19 June - 12 July 1967

TABLE 2

AVERAGE PLANT AREA EMISSIONS IN POUNDS PER DAY

Unit or Process	Particulate	Sulfur Dioxide	Total Oxides of Nitrogen as NO_2	Acid Mist As 100% HNO_3	Acid Mist As 100% H_2SO_4
EAST ACID AREA					
Acid and Fume Recovery System	- - -	- - -	32,400	38,200	- - -
Sulfuric Acid Concentrator	- - -	2,160	290	- - -	6,260
AOP	- - -	- - -	24,900*	- - -	- - -
Nitric Acid Concentrator	- - -	- - -	526*	- - -	916
Sellite Exhaust	- - -	48	- - -	- - -	750
Red Water Incinerator	2,880(1)	- - -	8,650	- - -	- - -
NORTH ACID AREA					
Boiler Plant (Gas)	288	0	4,420	- - -	- - -
AOP	- - -	- - -	20,000*	- - -	- - -
Nitric Acid Concentrator	- - -	- - -	460*	- - -	803*
500 T/day, HNO_3 Plant	- - -	- - -	(2)	(2)	- - -
Sulfuric Acid Concentrator (3)	- - -	690	- - -	- - -	288

* Data selected from Summary Report, reference 2a.
(1) The unit sampled was operating at 40% capacity. The cumulative emission, 2880 lbs/day, was calculated assuming 40% operation for all 12 units.
(2) Not sampled.
(3) Data taken from reference paragraph 2f.

(5) Nitric acid mist (Table 2) from the acid and fume recovery systems contributed nearly 80% of the total plant emission. SAC units discharged approximately 15%. The Brinks Mist Eliminator installed on the sellite exhaust should substantially reduce sulfuric acid mist from the process.

7. CONCLUSION.

a. Particulate emissions from the main boiler plant are no longer a major problem.

b. The red water incinerator is the major source of particulate emissions.

c. SO_2 emissions do not appear to constitute a major problem at this time.

d. Oxides of nitrogen and acid mists generated by processes shown in Table 2 are, at the date of this survey, the major air pollution problem.

8. RECOMMENDATIONS.

a. A high priority be given to reduction and control of oxides of nitrogen.

b. Particulate emissions be reduced from the red water incinerator.

c. Acid mist discharges be reduced from sellite exhaust, sulfuric acid concentrator, acid and fume recovery system, and nitric acid concentrator.

d. Surveillance of potential air pollution sources and ambient air monitoring be continued.

ROY C. BURKE III
CPT, MSC
Sanitary Engineer

APPROVED BY:

FOR MSC FOR
RALPH J. WALSH
COL, MSC
Director, Engineering Services

APPENDIX A

ANALYSIS OF COAL AND NO. 2 FUEL OIL

Item	Coal	Oil
Heating Value	13,125 Btu/lb (as received)	141,000 Btu/gal
Sulfur, %	0.79	0.4-0.7
Ash	10.4	Trace

APPENDIX B

AVERAGE ANALYSIS OF NATURAL GAS BURNED POWER PLANT - BUILDING 401-1

Nitrogen	1.12%
Carbon Dioxide	1.18%
Methane	93.80%
Propane	0.64%
Butane	0.29%
Pentane	0.10%
Hexane	0.07%
Ethane	2.80%
Sulfur	150 ppm (Max)
Heating Value Btu/cu. ft.	1040

APPENDIX C

DETERMINATION MAXIMUM ALLOWABLE PARTICULATE EMISSION

GIVEN:

Manufacturer Rated Steam Output	=	150,000 lb/hr per unit
Steam Pressure	=	400 psig
Steam Temperature	=	448°F
Feedwater Temperature	=	210°F
Heat Content Saturated Vapor	=	1,205.0 Btu/lb
Heat Content Feedwater = 210-32	=	178.0 Btu/lb
Net Heat Content Output Steam	=	1,027.0 Btu/lb
Assume Boiler Efficiency	=	75%
Heat Input = 1027/0.75	=	1,370 Btu Input/lb steam

Heat Input = (150,000 lb steam/hr)(1,370 Btu/lb steam)

Input Capacity	=	205 million Btu/hr

Using Figure 1, AR 11-21

Maximum Allowable Particulate Emissions	=	0.36 lb/million Btu Heat Input

APPENDIX D

SUMMARY OF SAMPLING RESULTS

Unit	Particulate gr/scf[1]	Acid Mist mg/m^3 (2)	Sulfur Dioxide as 100% SO_2 ppm^3	Sulfur Trioxide as 100% H_2SO_4 ppm^3	Oxides of Nitrogen as 100% NO_2 ppm^3
Boiler Plant					
Boiler No. 3 (Coal)	Avg 1.244 Range 0.304-2.485		Avg 240 Range 220-260	Avg 1 Range 0-1	Avg 140 Range 120-160
Boiler No. 3 (Gas)	Avg 0.014 Range 0.010-0.019		Avg 0 Range None		Avg 280 Range 100-480
Boiler No. 4 (Gas)	Avg 0.007 Range 0.000-0.012		Avg 0 Range None		Avg 200 Range 140-300
Acid & Fume Recovery No. 3					
Acid Side		Avg 177,300 Range 7,800, 434,400			Avg 42,000 Range 4,641-83,660
Fume Side		Avg 3,300 Range 560-8,170			Avg 27,300 Range 7,676-45,306
Sulfuric Acid Concentrator					
Before Mahon C		Avg 1,610 Range 1,200-1,940	Avg 140 Range 130-160	Avg 400 Range 20-640	Avg 20 Range None
After Mahon C		Avg 560 Range 400-750	Avg 90 Range 60-100	Avg 30 Range 10-40	Avg 15 Range 10-20
Sellite Exhaust		Avg 410 Range 150-630	Avg 20 Range 10-20	Avg 40 Range 20-60	
SO_2 Bypass Line			Avg 160,000 Range 138,000-200,000		
Red H_2O Incinerator No. 8	Avg 0.291 Range 0.216-0.364				Avg 880 Range 400-1,100

(1) Grains per standard cubic foot @ 60°F, 29.92" Hg.
(2) Milligrams per cubic meter @ 60°F, 29.92" Hg.
(3) Parts per million by volume

APPENDIX E

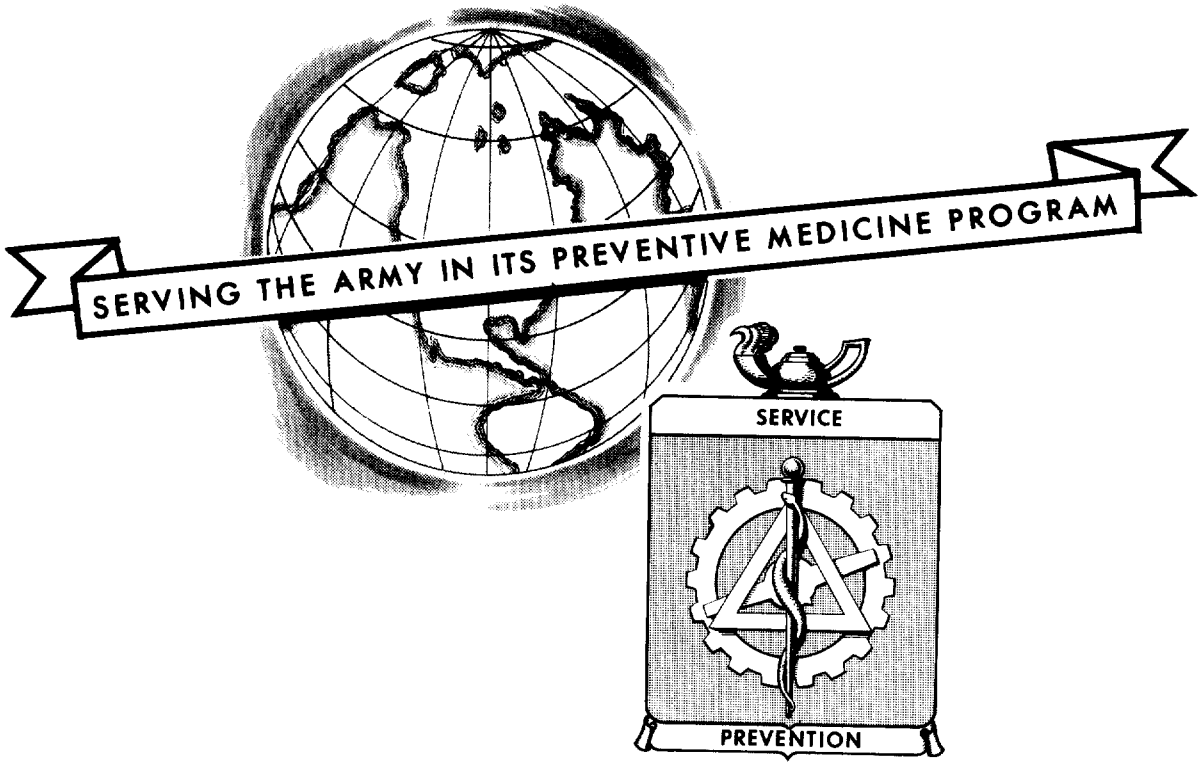
EMISSION RATES

Unit	Particulate		Acid Mist		Sulfur Dioxide		Oxides of Nitrogen	
	No. of Samples	lb/hr	No. of Samples	lb/hr(1)	No. of Samples	lb/hr(2)	No. of Samples	lb/hr(3)
Boiler Plant (Gas)	6	Avg 3 Range 0-5			6	Avg 0 Range None	18	Avg 46 Range 17-70
Boiler Plant (Coal)	3	Avg 287 Range 70-575			3	Avg 69.1 Range 63.2 to 75.6		
Acid and Fume Recovery No. 3								
Acid Side			10	Avg 310 Range 0-870			10	Avg 150 Range 14-330
Fume Side			10	Avg 8 Range 0-20			10	Avg 120 Range 56-200
Sulfuric Acid Concentrator								
Before Mahon C			3	Avg 600 Range 330 to 830	3	Avg 71 Range 62-81	4	Avg 7 Range 6-7
After Mahon C			3	Avg 87 Range 71 to 100	3	Avg 30 Range 21-35	4	Avg 4 Range 4-5
Sellite Exhaust			3	Avg 25 Range 16-36	3	Avg 2 Range 1-3		
SO_2 Bypass Line					6	Avg 2000 Range 1800 to 2600		
Red H_2O Incinerator No. 8	4	Avg 10 Range 7-14					4	Avg 30 Range 12-37

(1) Pounds per hour of 100% HNO_3 or 100% H_2SO_4 depending upon the unit.
(2) Pounds per hour as 100% SO_2.
(3) Pounds per hour as 100% NO_2.

Ref. 5c (5)

AIR POLLUTION ENGINEERING SOURCE SAMPLING SURVEY
RED WATER INCINERATOR
VOLUNTEER ARMY AMMUNITION PLANT
TYNER, TENNESSEE
PROJECT NO. 21-30-68/69
24-31 JULY 1968



US ARMY
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EDGEWOOD ARSENAL, MD. 21010

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1968

15 Oct 1968

ABSTRACT

The Air Pollution Engineering Division, this Agency, conducted a source sampling survey for the period 24 - 31 July 1968, at the red water incinerator, Volunteer Army Ammunition Plant. The installed scrubbers complied with performance criteria outlined in contract specifications. The white plume from each scrubber is comprised of water vapor with minimal particulate.

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
EDGEWOOD ARSENAL, MARYLAND 21010

IN REPLY REFER TO:
USAEHA-EA

15 Oct 1968

AIR POLLUTION ENGINEERING SOURCE SAMPLING SURVEY
RED WATER INCINERATOR
VOLUNTEER ARMY AMMUNITION PLANT
TYNER, TENNESSEE
PROJECT NO. 21-30-68/69
24-31 JULY 1968

1. AUTHORITY.

Letter, SMUVO-A, Volunteer Army Ammunition Plant, 24 May 1968, subject: Request for Incineration Stack Gas Analysis, with indorsements thereto.

2. REFERENCES.

a. American Society of Mechanical Engineers, Power Test Code 27, "Determining Dust Concentration in Gas Stream," 1957.

b. Devorkin, H., R. L. Chass, A. P., Fudurick, and C. V. Kanter, Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles County, California, November 1965.

c. Methods for Determination of Velocity, Volume Dust and Mist Content of Gases, Bulletin WP 50 (6th Edition), Western Precipitation Group, Joy Manufacturing Company, Los Angeles, California.

d. Test Procedures for Gas Scrubbers, Industrial Gas Cleaning Institute, Wet Collection Division, Publication No. 1, Rye, New York, 28 January 1964.

e. US Department of Health, Education, and Welfare, Public Health Service, Atmospheric Emissions from Sulfur Acid Manufacturing Processes, Public Health Service Publication Number 999-AP-13, Cincinnati, Ohio, 1965.

f. US Department of Health, Education, and Welfare, Public Health Service, Atmospheric Emissions from Nitric Acid Manufacturing Processes, Public Health Service Publication Number 999-AP-27, Cincinnati, Ohio, 1966.

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1968

3. OBJECTIVES.

The objectives of this survey were to measure particulate emissions from the red water incinerator, to determine scrubber efficiency, and to evaluate scrubber compliance with performance criteria in contact specifications.

4. BACKGROUND.

a. The red water incinerator complex utilizes twelve rotary ovens to evaporate liquid waste generated by TNT manufacture. The waste (red water) first enters an evaporation unit and is concentrated from 6% to 35% solids (thick liquor). Thick liquor then is sprayed into rotary ovens and evaporated to dryness.

b. Previous source sampling surveys, by this Agency, indicated that the red water incinerator was a significant particulate emission source. In June 1968, wet scrubbers were installed to reduce these emissions to an acceptable level. The contract specified a particulate reduction to or below 0.5 lb/million Btu heat input. Raw red water serves as the scrubbing media to achieve a cost reduction.

5. PROCEDURES.

a. Particulate samples were collected in accordance with accepted procedures outlined in reference paragraph 2a, b, c, and d. The sampling train consisted of probe tip, probe (heated), cyclone (heated), glass fiber filter (heated), Greenberg-Smith impingers (in ice bath), dry gas meter, and pump.

b. Total oxides of sulfur were measured with the Shell Development Company method, reference paragraph 2e. To simplify sampling and analysis, SO_2 and SO_3 were collected together using hydrogen peroxide as the absorbing media.

c. Total oxides of nitrogen were measured with the phenoldisulfonic acid (PDA) method outlined in reference paragraph 2f. Nitrogen dioxide was absorbed with the Saltzman reagent described in reference paragraph 2f. Both methods employed evacuated flasks (grab sampling technique) for sample collection.

d. Two incinerator units exhaust into one scrubber. For this survey, unit No. 3 was sampled prior to scrubber (No. 4) which serves units No. 3 and 4. The dust loading for the unit (No. 4) was estimated using unit No. 3

sampling results and relative red water inputs to each unit. Therefore, total particulate input to the scrubber (No. 4) equaled unit No. 3 plus unit No. 4. Sampling results obtained after the scrubber were related to the total input to estimate overall particulate removal efficiency.

6. FINDINGS AND DISCUSSION.

a. Particulate.

(1) Sampling results appear in Table 1. Samples taken during periods of abnormal incinerator or scrubber operation were not included in the average values. During normal operation particulate removal efficiency is approximately 92 percent.

(2) Final incinerator discharges (after scrubber) comply with emission criteria outlined in the contract specifications. It is also essential that the emissions comply with federal and/or local air pollution regulations. At this time, no specific standards exist for a process of this type. However, from performance observations during the survey and from comparison to existing standards for similar processes, particulate removal is adequate at the present time.

(3) Because of the liquid scrubbing media, the scrubbers produce a heavy white plume which may be esthetically undesirable. The visible plume consists of water vapor (approximately 30%), however, particulate concentration is minimal (Table 1).

b. There are no specific standards for oxides of sulfur or oxides of nitrogen. These results are presented for information.

c. It was observed during the survey (and especially during abnormal incinerator and/or scrubber operation) that operating personnel were unfamiliar with the nature of scrubber performance. Operators should become familiar with proper function of the control devices. In the event of breakdown or malfunction, adjustments should be made with minimal loss of operating time.

7. CONCLUSIONS.

a. The installed scrubbers comply with performance criteria outlined by contract specifications.

b. Operating personnel do not appear to be thoroughly familiar with proper scrubber performance.

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1968

TABLE 1

AVERAGE SAMPLING RESULTS *

	Before Scrubber	After Scrubber
PARTICULATE MATTER		
Concentration, gr/scf[1]	0.16	0.019
Concentration, lb/million Btu	1.58	0.100
Emission, lb/hr	14.10	0.97
OXIDES OF NITROGEN		
NO_x, ppm (NO_x = NO + NO_2)	551	1635
NO_x, lb/hr[2]	2.3	5.9
NO_2, ppm	339	1382
NO_2, lb/hr	1.4	4.7
OXIDES OF SULFUR		
SO_x, ppm (SO_x = SO_2 + SO_3)	82.0	52.9
SO_x, lb/hr[3]	3.3	3.0

1. Standard Conditions: 29.92 in.Hg., 60°F

2. NO_x = NO + NO_2

3. SO_x = SO_2 + SO_3

* See Appendixes A and B for detailed information on particulate and gas sampling results.

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1968

8. RECOMMENDATION.

That red water incinerator personnel become familiar with proper operation and performance of the installed scrubber.

ROY C. BURKE III
CPT, MSC
Sanitary Engineer

APPROVED:

RALPH J. WALSH
COL, MSC
Director, Engineering Services

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1968

APPENDIX A

PARTICULATE SAMPLING DATA

	Before Scrubber, Unit #3						
Stack Temp °F	Gas Flow scfm	Moisture % by Volume	CONCENTRATION gr/scf	CONCENTRATION lb/million Btu Input	Emission lb/hr	Red Water Input % of Maximum #3	Red Water Input % of Maximum #4
518	5145	13.4	0.16	2.0	7.1	40	55
500	5950	10.4	- - -	- -	- -	-	-
580	3270	21.6	- - -	- -	- -	-	-
585	3515	24.7	0.16	1.17	4.82	42	58
After Scrubber, Stack #3							
200	6188	28.3	0.023	0.11	1.19	Not Applicable	
187	7595	29.1	0.034	0.22	1.79		
180	4950	27.0	0.015	0.075	0.64		
175	5910	29.7	0.018	0.11	0.91		
177	5075	29.3	0.007	0.04	0.30		

USAEHA-EA Air Pollution Engineering Source Sampling Survey, Red Water Incinerator, Volunteer Army Ammunition Plant, Tyner, Tennessee, Project No. 21-30-68/69, 24-31 July 1969

APPENDIX B

GAS SAMPLING DATA

Oxides of Nitrogen					
Before Scrubber			After Scrubber		
Gas Flow Scfm	NO_x ppm	NO_2 ppm	Gas Flow Scfm	NO_x ppm	NO_2 ppm
5350	694	526	4936	1622	1714
5350	931	368	4936	1438	1276
6309	414	195	4936	1845	1157
6309	373	289			
6309	344	318			

Oxides of Sulfur

Before Scrubber		After Scrubber	
Gas Flow Scfm	SO_x ppm	Gas Flow Scfm	SO_x ppm
5950	39.5	6188	45.1
3720	83.4	6135	50.9
3515	123.2	4950	59.5
		5910	55.8
		5075	53.1

UNCLASSIFIED

Security Classification

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13. ABSTRACT

The Air Pollution Engineering Division, this Agency, conducted a source sampling survey for the period 24-31 July 1968, at the red water incinerator, Volunteer Army Ammunition Plant. The installed scrubbers complied with performance criteria outlined in contract specifications. The white plume from each scrubber is comprised of water vapor with minimal particulate.

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