Northeast
Utilities System

107 Selden Street, Berlin CT 06037

Northeast Utilities Service Company
P.O. Box 270
Hartford. CT 06141-0270
(860) 665-5315
Fax (860) 665-6263

June 28, 1996

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AIR RESOURCES DIVISION

Ronald G. Chevalier
Vice President - Fossil/Hydro Engineering
and Operations

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
64 North Main Street
Concord, NH 03302-2033

Dear Mr. Colburn:

Merrimack, Newington, and Schiller Stations
Title V Operating Permit Application

Public Service Company of New Hampshire (PSNH) hereby submits completed Title V Operating Permit application forms, in accordance with Env-A 609, for Merrimack Station, Newington Station, and Schiller Station. We have made every effort to assure that all information required by current regulations is included. We have incorporated existing permits and the most recent NOx RACT amended permit applications in the Title V application and attached that information so that it is easily accessible.

This application for Title V is the product of months of labor, directly involving the State as a part of our team in a joint effort to assure compliance with every aspect of current regulation. This project required a concerted team effort which included the daunting task of physically inventorying hundreds of potential emissions sources at all three stations. The guidance and assistance provided by Tom Hopkins, Air Pollution Control Engineer, and Allan Moulton, Air Pollution Control Engineer, Air Resources Division, were invaluable.

We hope the format we have used to present what is a vast quantity of information facilitates your task of reviewing the material. If we can provide additional information or answer any questions, please contact Robert W. Pickering, PSNH, Fossil Hydro Engineering and Operations, at 634-2390.

Very truly yours,

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

R. G. Chevalier

Attachments

Public Service
of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

June 7, 1996

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
64 North Main Street
Concord, NH 03302-2033

Dear Mr. Colburn:

Public Service Company of New Hampshire (PSNH) requests protection of the confidential commercial information found in those sections of the PSNH Title V permit application entitled "Normal Operating Scenarios," "Alternate Operating Scenarios," and "Future Operating Scenarios" for Merrimack, Newington, and Schiller stations. Env-A 103 requires a claim of confidentiality to be asserted at the time the information is initially submitted to the Air Resources Division. Each page in the Operating Scenarios sections has been stamped "confidential" as the regulation requires.

The Operating Scenarios sections relevant to each station contain competitively sensitive data which falls within the scope of the exceptions to disclosure contained within the New Hampshire Right-to-Know law. See RSA 91-A:5, IV. Disclosure of this proprietary and commercially sensitive information would work to the commercial and competitive disadvantage of PSNH in the now competitive field of power generation; in fact, such disclosure could cause substantial competitive harm.

If you have any further questions after examining the information for which we are requesting protective treatment, please call Robert Pickering, PSNH, Fossil Hydro Engineering and Operations, at 634-2390, or me at 634-2700.

Very truly yours,

Linda T. Landis

Linda T. Landis
Attorney

LTL/cc
cc: Robert Bersak, PSNH Assistant General Counsel

Updated: 6/26/96

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Merrimack Station Introduction

Merrimack Station is a fossil fuel fired electric generating facility. It is made up of two utility boilers, two combustion turbines presently operating as load shaving units, an emergency generator, primary coal crushers, secondary coal crushers and all the necessary support equipment to generate electricity. The primary function of Merrimack Station is to convert the available energy in fossil fuels to electrical power.

Merrimack Station imports fossil fuel, handles it, prepares it for combustion, burns it and discharges the products of combustion. The larger fuel burning devices have air pollution control equipment to reduce the emissions from the products of combustion prior to discharge.

Merrimack Station imports water, treats it, converts it to steam, uses the steam to drive a turbine, and condenses the steam back into water for reuse. The turbine drives a generator and makes electricity.

Merrimack Station is presently performing a compliance demonstration for ambient sulfur dioxide for the NHARD and EPA. Once the ambient sulfur dioxide compliance demonstration is complete, the results will determine if a compliance plan is necessary. It is the intent of Merrimack Station to work with the NHARD and EPA to demonstrate compliance with the National Ambient Air Quality Standard for sulfur dioxide.

Merrimack Station is presently working with the NHARD and EPA on the implementation of a NOx bubble plan to comply with the NHARD NOx RACT rule. The NOx bubble plan will allow least cost compliance with the NOx RACT rule by limiting total facility emissions instead of unit specific emissions. It is the intent of Merrimack Station to comply with the NHARD NOx RACT rule.

PSNH is the owner and operator of Merrimack Station.

COMPLIANCE

After extensive review and inquiry, Public Service Company of New Hampshire (PSNH) has determined that Merrimack Station is in compliance with all applicable air pollution control rules and regulations.

It is the intent of PSNH to continue to operate Merrimack Station in compliance with all current applicable air pollution control requirements, and to bring Merrimack Station into compliance, in a timely manner, with all applicable air pollution control requirements that become effective during the permit term.

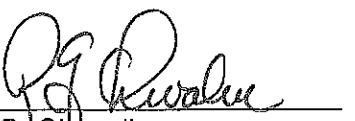
Furthermore, it is the intent of PSNH to bring Merrimack Station into compliance, working with the State, with the forthcoming Compliance Assurance Monitoring (CAM) program.

CERTIFIED STATEMENT OF COMPLIANCE (Env-A 1709.01(h)(7); 40 CFR Part 70.5(d).

The undersigned certifies that, based on information and belief formed after a reasonable inquiry, I certify that the source is in compliance with all applicable regulations. To the best of my knowledge, the statements and information in this document are true, accurate, and complete.

PUBLIC SERVICE COMPANY OF
NEW HAMPSHIRE

Date: June 28, 1996

By: 

R. G. Chevalier
Vice President -- Fossil/Hydro
Engineering and Operations

GENERAL INFORMATION ALL PERMIT APPLICATIONS

Form
ARD - 1

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

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NEW HAMPSHIRE DEPARTMENT OF
Environmental Services
Air Resources Division

I. GENERAL STATIONARY SOURCE INFORMATION

A. Type of Application: ___ New X Renewal ___ Modification

B. Facility Name: Merrimack Station
Street Address: 97 River Road
Mailing Address 97 River Road
Town/City: Bow County: Merrimack
Zip Code: 03304-3314 Telephone Number: 603-669-4000
USGS Map Coordinates: Geodetic Longitude: 71:28:09 Lattitude: 43:08:28
Air Quality Control Region (AQCR): 121

If source is a subsidiary operation, complete the following:

Parent Company: Northeast Utilities
Mailing Address: P.O. Box 270
Town/City: Hartford State: Connecticut
Zipcode: 06141-0270 Telephone Number: 860-665-5000

C. Contact Personnel:

Technical:		Invoicing:	
Name:	Roger F. Deshaies	Name:	Robert Pickering
Title:	Engineering Specialist	Title:	Environmental Coordinator
Company	PSNH	Company	PSNH
Address	97 River Road	Address	1000 Elm Street
City:	Bow	City:	Manchester
State	NH Zip Code: 03304-3314	State	NH Zip Code: 03105-0330
Tele. No.	603-634-4173	Tele. No.	603-634-2390

Legal:		Application Preparation:	
Name:	Linda Landis	Name:	Leo W. Quinn Jr
Title:	Attorney	Title:	Senior Engineer
Company	PSNH	Company	PSNH
Address	1000 Elm Street	Address	1000 Elm Street
City:	Manchester	City:	Manchester
State	NH Zip Code: 03105-0330	State	NH Zip Code: 03105-0330
Tele. No.	603-634-2700	Tele. No.	603-634-2821

D. Major activity or product descriptions (list all activities performed at this location):

Process or Product:	SIC code:
Energy conversion facility producing electricity:	4911

E. Other Equipment:

Are there other ARD Permitted Devices at this Facility?
PO-B-0426, PO-B-0427, PO-B-34, PO-B-35, PO-BP-2416, PO-BP-2417, PO-B-1788
ARD-2 forms are attached for all devices subject to Env-A 607.01
See "Existing State Operating Permits"

II. TOTAL FACILITY EMISSIONS DATA

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	179,867	435,194	32,826	79,423
Oxides of Nitrogen	108,016	111,917	19,713	20,425
Carbon Monoxide	1,478	2,935	270	536
Particulates	11,195	32,148	2,043	5,867
Volatile Organic Compounds	327	1,012	60	185

Note: For regulated pollutants list type and for Toxic Air Pollutants list name and CAS

III. SUPPORT DATA SUBMITTALS

The following data must be submitted with this application:

___ Copies of all calculations for emissions data
___ A site plan of the facility showing the location of all emission points
___ A photocopy of a USGC map section with the site location clearly noted
___ For process applications, a written description of the process
___ Copies of MSDS for all coatings, adhesives, solvents, etc. utilized in the process that result in the creation of air emissions

IV. ADDITIONAL INFORMATION

See Attached

V. CERTIFICATION

I am authorized to make this submission on behalf of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Signed: _____ Title: Vice President Date: 6/28/96

Print or type name: Ronald G. Chevalier

FUEL BURNING EQUIPMENT REGISTRATION

June 28, 1996

Form ARD - 2

Device No.: 93

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

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AIR RESOURCES DIVISION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

I. EQUIPMENT INFORMATION

Facility: Merrimack Station (2 D MW)

A. & B. Device Type: Steam Boiler

Use,Purpose, Process: Electric Generator

Installation ID # & Description: 93 Steam Boiler Unit 1 Stack

DateDesigned: 1957 Date Installed: 1960

Manufacturer: Babcock&Wilcox Boiler Model No: RB-337

Serial No: NA Nameplate Rating mmBtu/hr (input): 1072

Nameplate Rating mmBtu/hr (output): 1,205

HP Output Rating: 150862.5

Burner Manufacturer: NA Burner Model No: NA

Burner Serial No: NA Fuel Flow Rate(gal,mmcf,ton/hr): NA

Type of Burner:

	Fuel Type	Burner Type	Fuel Flow Rate	Combustion Type
Primary Fuel :	Bituminous Coal	Cyclone	NA	One End Only Firing
Secondary Fuel	#2 Oil	NA	NA	One End Only Firing

C. Fuel Supplier

Name and address: Varies

D. Fuel Additives

Manufacturers name and address: NA

Specific identification of additive: NA

Consumption rate: NA gallons per 1000 gallons of fuel

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Solid/Liquid/Gaseous Fuels:

SCC	Fuel Type	Sulfur %	HHV btu/lb	Ash %	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (ton,gal,mmcf)
10100203	Bituminous Coal	2.6	13078	6.45	6.8	1238	307870
10100501	#2 Oil	0.34	19557	NA	NA	NA	12491

Based on 1995 data

*Mst. = moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) 8.6 ft. Discharge height above ground level: 225 ft.

Exhaust Temp: 300 (F). Exhaust Flow (Acfm) 480,000

ExhaustVelocity: NA feet per second. Stack Material: Concrete

Identify other units on this stack None

Is unit equipped with multiple stacks? No (if "yes" provide above data for each)

Is stack monitoring used? YES Describe: Continuous Emissions Monitor

Is Section 123 of CAA applicable? No SOx,NOx,CO2,Flow,Opacity

Stack Base Elevation: (feet above mean sea level): 207 ft.

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760

Seasonal Usage: Winter : 25% Summer : 25% Fall : 25% Spring : 25%

(Seasonal usage must add up to 100%)

Device No.: 93

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	53529	112232	9769	20482
Oxides of Nitrogen	24825	27335	4531	4989
Carbon Monoxide	422	568	77	104
Particulates	684	8052	125	1469
Volatile Organic Compounds	93	125	17	23

Actuals based on 1995 data, future Nox rates will be lower

Device No.: 93

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment:

(Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: Electrostatic Precipitator For Particulates

PC Equipment 2: Selective Non-Catalytic Reduction for NOx Reduction

B. Operation:

(Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Electrostatic Precipitator For Particulates				
Particulates	NA	NA	NA	NA
Selective Non-Catalytic Reduction for NOx Reduction				
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

	PC Equipment 1	PC Equipment 2
Entering Emissions Test Method:	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Electrostatic Precipitator For Particulates				
Particulates	684	8052	125	1469
Selective Non-Catalytic Reduction for NOx Reduction				
Oxides of Nitrogen	24825	27335	4531	4989

Outlet Stack Temp 300

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	Stack Test	CEM
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

FUEL BURNING EQUIPMENT REGISTRATION

June 28, 1996

Form ARD - 2

Device No.: 94

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

I. EQUIPMENT INFORMATION

Facility: Merrimack Station

A. & B. Device Type: Steam Boiler

Use,Purpose, Process: Electric Generator

Installation ID # & Description: 94 Steam Boiler Unit 2 Stack 333 MW

DateDesigned: 1966 Date Installed: 1968

Manufacturer: Babcock&Wilcox Boiler Model No: UP-42

Serial No: NA Nameplate Rating mmBtu/hr (input): 3015

Nameplate Rating mmBtu/hr (output): 3,390

HP Output Rating: 429120

Burner Manufacturer: NA Burner Model No: NA

Burner Serial No: NA Fuel Flow Rate(gal,mmcf,ton/hr): NA

Type of Burner:

	Fuel Type	Burner Type	Fuel Flow Rate	Combustion Type
Primary Fuel :	Bituminous Coal	Cyclone	NA	Opposite End Firing, Flue Gas Recirc.
Secondary Fuel	#2 Oil	NA	NA	pposite End Firing, Flue Gas Reci

C. Fuel Supplier

Name and address: Varies

D. Fuel Additives

Manufacturers name and address: NA

Specific identification of additive: NA

Consumption rate: NA gallons per 1000 gallons of fuel

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Solid/Liquid/Gaseous Fuels:

SCC	Fuel Type	Sulfur %	HHV btu/lb	Ash %	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (ton,gal,mmcf)
10100203	Bituminous Coal	2.6	13006	6.43	8.47	3473	767864
10100501	#2 Oil	0.34	19557	NA	NA	NA	13131

Based on 1995 data

*Mst. = moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) 14.5 ft. Discharge height above ground level: 317 ft.

Exhaust Temp: 335 (F). Exhaust Flow (Acfm) 1,200,000

ExhaustVelocity: NA feet per second. Stack Material: Concrete

Identify other units on this stack None

Is unit equipped with multiple stacks? No (if "yes" provide above data for each)

Is stack monitoring used? YES Describe: Continuous Emissions Monitor

Is Section 123 of CAA applicable? No SOx,NOx,CO2,Flow,Opacity

Stack Base Elevation: (feet above mean sea level): 207 ft.

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760

Seasonal Usage: Winter : 25% Summer : 25% Fall : 25% Spring : 25%

(Seasonal usage must add up to 100%)

Device No.: 94

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	126310	316591	23052	57778
Oxides of Nitrogen	83131	70800	15171	12921
Carbon Monoxide	1052	1602	192	292
Particulates	10508	18921	1918	3453
Volatile Organic Compounds	231	352	42	64

Actuals based on 1995 data, future Nox rates will be lower

Device No.: 94

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment:

(Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: Electrostatic Precipitator For Particulates

PC Equipment 2: Selective Catalytic Reduction for NOx Reduction

B. Operation:

(Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Electrostatic Precipitator For Particulates				
Particulates	NA	NA	NA	NA
Selective Catalytic Reduction for NOx Reduction				
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

	PC Equipment 1	PC Equipment 2
Entering Emissions Test Method:	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Electrostatic Precipitator For Particulates				
Particulates	10508	18921	1918	3453
Selective Catalytic Reduction for NOx Reduction				
Oxides of Nitrogen	83131	70800	15171	12921

Outlet Stack Temp 335

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	Stack Test	CEM
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

FUEL BURNING EQUIPMENT REGISTRATION

June 28, 1996

Form ARD - 2

Device No.: 71

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

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NEW HAMPSHIRE
JUL 0 1 1996
AIR RESOURCES DIVISION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

I. EQUIPMENT INFORMATION

Facility: Merrimack Station

A. & B. Device Type: Gas Turbine

Use,Purpose, Process: Electric Generator

Installation ID # & Description: 71 Combustion Turbine Unit 1 Stack

DateDesigned: 1967 Date Installed: 1968

Manufacturer: Pratt&Whitney Boiler Model No: FT4A-8LF

Serial No: NA Nameplate Rating mmBtu/hr (input): NA

Nameplate Rating mmBtu/hr (output): NA

HP Output Rating: 30172.5

Burner Manufacturer: NA Burner Model No: 697195

Burner Serial No: NA Fuel Flow Rate(gal,mmcf,ton/hr): NA

Type of Burner:

	Fuel Type	Burner Type	Fuel Flow Rate	Combustion Type
Primary Fuel :	#1 oil (JP-4)	Burner Cans	NA	One End Only Firing
Secondary Fuel	NA	NA	NA	

C. Fuel Supplier

Name and address: Varies

D. Fuel Additives

Manufacturers name and address: NA

Specific identification of additive: NA

Consumption rate: NA gallons per 1000 gallons of fuel

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Solid/Liquid/Gaseous Fuels:

SCC	Fuel Type	Sulfur %	HHV btu/lb	Ash %	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (ton,gal,mmcf)
20100901	#1 oil (JP-4)	0.4	19750	NA	NA	319	102859
NA	NA	NA	NA	NA	NA	NA	NA

Based on 1995 data

*Mst. = moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) 10.5 ft. X 14 ft. Discharge height above ground level: 20 ft.

Exhaust Temp: 840 (F). Exhaust Flow (Acfm) NA ~~821 000~~

ExhaustVelocity: NA feet per second. Stack Material: Steel

Identify other units on this stack None

Is unit equipped with multiple stacks? No (if "yes" provide above data for each)

Is stack monitoring used? NO Describe:

Is Section 123 of CAA applicable? No NA

Stack Base Elevation: (feet above mean sea level): 207 ft.

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760

Seasonal Usage: Winter : 25% Summer : 25% Fall : 25% Spring : 25%

(Seasonal usage must add up to 100%)

Device No.: 71

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	13	3185	2.3	581
Oxides of Nitrogen	26	6890	4.8	1257
Carbon Monoxide	1.9	382	0.35	70
Particulates	1.4	2588	0.26	472
Volatile Organic Compounds	1.3	267	0.24	49

Actuals based on 1995 data, future Nox rates will be lower

Device No.: 71

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment: (Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: NA

PC Equipment 2: NA

B. Operation: (Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Particulates	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

Entering Emissions Test Method:	PC Equipment 1	PC Equipment 2
	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
NA				
Particulates	1.4	2588	0.26	472
NA				
Oxides of Nitrogen	26	6890	4.8	1257

Outlet Stack Temp 840

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	NA	NA
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

FUEL BURNING EQUIPMENT REGISTRATION

June 28, 1996

Form ARD - 2

Device No.: 72

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

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I. EQUIPMENT INFORMATION

Facility: Merrimack Station
A. & B. Device Type: Gas Turbine
Use,Purpose, Process: Electric Generator

Installation ID # & Description: 72 Combustion Turbine Unit 2 Stack
DateDesigned: 1968 Date Installed: 1969

Manufacturer: Pratt&Whitney Boiler Model No: FT4A-9LF
Serial No: NA Nameplate Rating mmBtu/hr (input): NA
Nameplate Rating mmBtu/hr (output): NA

HP Output Rating: 29636.1

Burner Manufacturer: NA Burner Model No: 697195
Burner Serial No: NA Fuel Flow Rate(gal,mmcf,ton/hr): NA
Type of Burner:

	Fuel Type	Burner Type	Fuel Flow Rate	Combustion Type
Primary Fuel :	#1 oil (JP-4)	Burner Cans	NA	One End Only Firing
Secondary Fuel	NA	NA	NA	

C. Fuel Supplier

Name and address: Varies

D. Fuel Additives

Manufacturers name and address: NA

Specific identification of additive: NA

Consumption rate: NA gallons per 1000 gallons of fuel

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Solid/Liquid/Gaseous Fuels:

SCC	Fuel Type	Sulfur %	HHV btu/lb	Ash %	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (ton,gal,mmcf)
20100901	#1 oil (JP-4)	0.4	19750	NA	NA	319	124656
NA	NA	NA	NA	NA	NA	NA	NA

Based on 1995 data

*Mst. = moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) 10.5 ft. X 14 ft. Discharge height above ground level: 20 ft.

Exhaust Temp: 840 (F). Exhaust Flow (Acfm) NA 821,000

ExhaustVelocity: NA feet per second. Stack Material: Steel

Identify other units on this stack None

Is unit equipped with multiple stacks? No (if "yes" provide above data for each)

Is stack monitoring used? NO Describe:

Is Section 123 of CAA applicable? No NA

Stack Base Elevation: (feet above mean sea level): 207 ft.

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760

Seasonal Usage: Winter : 25% Summer : 25% Fall : 25% Spring : 25%

(Seasonal usage must add up to 100%)

Device No.: 72

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	15	3185	2.8	581
Oxides of Nitrogen	34	6890	6.2	1257
Carbon Monoxide	2.3	382	0.42	70
Particulates	1.7	2588	0.32	472
Volatile Organic Compounds	1.6	267	0.29	49

Actuals based on 1995 data, future Nox rates will be lower

Device No.: 72

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment:

(Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: NA

PC Equipment 2: NA

B. Operation:

(Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Particulates	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

Entering Emissions Test Method:	PC Equipment 1	PC Equipment 2
	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
NA				
Particulates	1.7	2588	0.32	472
NA				
Oxides of Nitrogen	34	6890	6.2	1257

Outlet Stack Temp 840

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	NA	NA
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

FUEL BURNING EQUIPMENT REGISTRATION

June 28, 1996

Form ARD - 2

Device No.: 75

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

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NEW HAMPSHIRE
JUL 0 1 1996
AIR RESOURCES DIVISION

I. EQUIPMENT INFORMATION

Facility: Merrimack Station

A. & B. Device Type: Diesel ICE

Use,Purpose, Process: Electric Generator Emergency

Installation ID # & Description: 75 Emergency Generator

DateDesigned: 1988 Date Installed: 1988

Manufacturer: Caterpillar Boiler Model No: B406BD1

Serial No: NA Nameplate Rating mmBtu/hr (input): NA

Nameplate Rating mmBtu/hr (output): NA

HP Output Rating: 534

Burner Manufacturer: NA Burner Model No: NA

Burner Serial No: NA Fuel Flow Rate(gal,mmcf,ton/hr): NA

Type of Burner:

	Fuel Type	Burner Type	Fuel Flow Rate	Combustion Type
Primary Fuel :	#2 oil	Fuel Injection	NA	Compression Ignition Internal
Secondary Fuel	NA	NA	NA	

C. Fuel Supplier

Name and address: Varies

D. Fuel Additives

Manufacturers name and address: NA

Specific identification of additive: NA

Consumption rate: NA gallons per 1000 gallons of fuel

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Solid/Liquid/Gaseous Fuels:

SCC	Fuel Type	Sulfur %	HHV btu/lb	Ash %	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (ton,gal,mmcf)
20100102	#2 oil	0.4	19540	NA	NA	28.7 gal/hr	24
NA	NA	NA	NA	NA	NA	NA	NA

Based on 1995 data

*Mst. = moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) .5 ft. Discharge height above ground level: 12 ft.

Exhaust Temp: 1000 (F). Exhaust Flow (Acfm) 2,700

ExhaustVelocity: NA feet per second. Stack Material: Steel

Identify other units on this stack None

Is unit equipped with multiple stacks? No (if "yes" provide above data for each)

Is stack monitoring used? NO Describe:

Is Section 123 of CAA applicable? No NA

Stack Base Elevation: (feet above mean sea level): 207 ft.

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 500

Seasonal Usage: Winter : 25% Summer : 25% Fall : 25% Spring : 25%

(Seasonal usage must add up to 100%)

Device No.: 75

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	0.001	0.017	0.000124	0.003
Oxides of Nitrogen	0.04	0.84	0.007	0.15
Carbon Monoxide	0.007	0.14	0.001	0.025
Particulates	0.003	0.059	0.001	0.011
Volatile Organic Compounds	0.002	0.044	0.000385	0.008

Actuals based on 1995 data, future Nox rates will be lower

Device No.: 75

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment:

(Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: NA

PC Equipment 2: NA

B. Operation:

(Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Particulates	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

Entering Emissions Test Method:	PC Equipment 1	PC Equipment 2
	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
NA				
Particulates	0.003	0.059	0.001	0.011
NA				
Oxides of Nitrogen	0.04	0.84	0.007	0.15

Outlet Stack Temp 1000

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	NA	NA
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

RECEIVED
NEW HAMPSHIRE
JUL 0 1 1996
AIR RESOURCES DIVISION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

I. EQUIPMENT INFORMATION

Facility: Merrimack Station
A. & B. Device Type: Crusher
Use,Purpose, Process: Coal Crusher

Installation ID # & Description: 99 Primary Coal Crushers
Date Designed: NA Date Installed: 1960

Manufacturer: Pennsylvania Crusher Model No: NA
Serial No: NA

B. Raw Materials Entering Process

Description	Normal (lb/day)	Amount Used Max. (lb/day)	Actual (tons/yr)
Bituminous Coal	600 ton/hour	885 tons/hr	1359412

C. Coatings and Solvents Entering Process

Description	Normal (lb/day)	Amount Used Max. (lb/day)	Actual (tons/yr)
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA

D. Amount of Liquid Waste Discarded

Gallons per year: NA Tons per year: NA

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Liquid/Gaseous Fuels:

Comp.	Fuel Type	Sulfur %	Ash %	Max Firing Rate (mmBtu/hr)	Annual Usage
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Solid Fuels:

Comp.	Fuel Type	BTU/ Ton	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (tons)
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

* moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) NA ft. Discharge height above ground level: NA ft.
Exhaust Temp: NA (F). Exhaust Flow (Acfm) NA
ExhaustVelocity: NA feet per second. Stack Material: N/A
Identify other units on this stack None
Is unit equipped with multiple stacks? No (if "yes" provide above data for each)
Is stack monitoring used? NO Describe: NA
Is Section 123 of CAA applicable? No
Stack Base Elevation: (feet above mean sea level): 207

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760
Seasonal Usage Winter %: 25% Summer % 25% Fall % 25% Spring %: 25%
(Seasonal usage must add up to 100%)

Device No.: 99

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA
Carbon Monoxide	NA	NA	NA	NA
Particulates	NA	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA

No.: 99

Device)

nt)

ons/yr)

: 2

ons/yr)

t 2

State of New Hampshire
Department of Environmental Services
Air Resources Division
P.O. Box 2033
Concord, NH 03302-2033
Telephone: 603-271-1370

RECEIVED
NEW HAMPSHIRE
JUL 0 1 1996
AIR RESOURCES DIVISION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services
Air Resources Division

I. EQUIPMENT INFORMATION

Facility: Merrimack Station
A. & B. Device Type: Crusher
Use,Purpose, Process: Coal Crusher

Installation ID # & Description: 100 Secondary Coal Crushers (4)
Date Designed: NA Date Installed: 1960

Manufacturer: Pennsylvania Crusher Model No: NA
Serial No: NA

B. Raw Materials Entering Process

Description	Normal (lb/day)	Amount Used Max. (lb/day)	Actual (tons/yr)
Bituminous Coal	300 ton/hour	690 tons/hr	1359412

C. Coatings and Solvents Entering Process

Description	Normal (lb/day)	Amount Used Max. (lb/day)	Actual (tons/yr)
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA

D. Amount of Liquid Waste Discarded

Gallons per year: NA Tons per year: NA

II. OPERATIONAL INFORMATION

A. Fuel Usage (list each fuel utilized by each component for this device)

Liquid/Gaseous Fuels:

Comp.	Fuel Type	Sulfur %	Ash %	Max Firing Rate (mmBtu/hr)	Annual Usage
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Solid Fuels:

Comp.	Fuel Type	BTU/ Ton	% Mst.	Max Firing Rate (mmBtu/hr)	Annual Usage (tons)
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

* moisture percentage

B. Stack Information: (provide information requested for each stack)

Inside Diameter (top) NA ft. Discharge height above ground level: NA ft.
Exhaust Temp: NA (F). Exhaust Flow (Acfm) NA
ExhaustVelocity: NA feet per second. Stack Material: N/A
Identify other units on this stack None
Is unit equipped with multiple stacks? No (if "yes" provide above data for each)
Is stack monitoring used? NO Describe: NA
Is Section 123 of CAA applicable? No
Stack Base Elevation: (feet above mean sea level): 207

C. Hours of Operation:

Hours/Day 24 Days/Week: 7 Weeks/Year: 52 Hours/Year: 8760
Seasonal Usage Winter %: 25% Summer % 25% Fall % 25% Spring %: 25%
(Seasonal usage must add up to 100%)

Device No.: 100

III. DEVICE EMISSIONS DATA:

POLLUTANT	Actual (lb/day)	Potential (lb/day)	Actual (tons/yr)	Potential (tons/yr)
Sulfur Dioxide	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA
Carbon Monoxide	NA	NA	NA	NA
Particulates	NA	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA

Device No.: 100

IV. POLLUTION CONTROL EQUIPMENT:

A. Type of Equipment:

(Note: If Process utilizes more than one control device, provide data for each Device)

PC Equipment 1: NA

PC Equipment 2: NA

B. Operation:

(Note: If Process emits more than one pollutant, provide data for each pollutant)

Pollutant Input Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
NA				
Particulates	NA	NA	NA	NA
Oxides of Nitrogen	NA	NA	NA	NA

Inlet Duct Temp: NA

	PC Equipment 1	PC Equipment 2
Entering Emissions Test Method:	NA	NA

Pollutant Output Information

POLLUTANT	Normal (lb/day)	Max. (lb/day)	Actual (tons/yr)	Potential (tons/yr)
NA				
Particulates	NA	NA	NA	NA
NA				
Oxides of Nitrogen	NA	NA	NA	NA

Outlet Stack Temp _____

	PC Equipment 1	PC Equipment 2
Exiting Emissions Test Method:	NA	NA
Control Efficiency Percent (%):	NA	NA
Capture Efficiency Percent (%):	NA	NA
Final Disposal of Collected Pollutants:	NA	NA
Voltage:	NA	
Spark Rate:	NA	
Milliamps:	NA	
Particulate Size:	NA	

Note: For Particulate emissions, provide a particle size analysis (if available).

Cost Data:

Capital cost: NA Installation cost: NA

Operating cost: NA (per year)

Attached, please find the applicable rules and regulations for the Title V facilities of PSNH. PSNH considered all Federal and State regulations in its Title V review. PSNH has cited applicable State regulations which are as stringent or more stringent than the parallel Federal regulations. New Hampshire Env-A 611 adopts and incorporates the Federal Title IV Acid Rain Program. The review of the State of New Hampshire Rules Governing the Control of Air Pollution was performed using a copy of the rules effective December 13, 1995 obtained from the NHARD on May 6, 1996. Following is the legend to be used for the Title V applicable rules table that is attached:

MK	The Merrimack Station Facility
NT	The Newington Station Facility
SCH	The Schiller Station Facility
MK1	The Merrimack Station Unit No. 1 Steam Boiler
MK2	The Merrimack Station Unit No. 2 Steam Boiler
MKCT1	The Merrimack Station Combustion Turbine No. 1
MKCT2	The Merrimack Station Combustion Turbine No. 2
MKEG	The Merrimack Station Emergency Generator
NT1	The Newington Station Unit No. 1 Steam Boiler
NTAB1	The Newington Station Auxiliary Boiler No. 1
NTAB2	The Newington Station Auxiliary Boiler No. 2
NTEG	The Newington Station Emergency Generator
SR4	The Schiller Station Unit No. 4 Steam Boiler
SR5	The Schiller Station Unit No. 5 Steam Boiler
SR6	The Schiller Station Unit No. 6 Steam Boiler
SRCT1	The Schiller Station Combustion Turbine No. 1
SREG	The Schiller Station Emergency Generator

Title V Applicable Rules and Regulations

State of NH Rules	Pertains To	Affected Devices
303.01	ambient particulate	MK,NT,SCH
304.01	ambient SO2	MK,NT,SCH
305.01	ambient CO	MK,NT,SCH
306.01	ambient NO2	MK,NT,SCH
307.01	ambient ozone	MK,NT,SCH
308.01	ambient lead	MK,NT,SCH
402.02	sulfur in liquid fuel oil	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1
402.03	sulfur in gaseous fuel	NT1,SR4,SR5,SR6,SRCT1,SREG
402.04	sulfur in coal	MK1,MK2,SR4,SR5,SR6
406.03,06	acid deposition	MK,NT,SCH
502.01	abatement strategy	MK,NT,SCH
611	Title IV Acid Rain	MK1,MK2,NT1,SR4,SR5,SR6
612.02	operational flexibility	MK,NT,SCH
704.04	emission based fees	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
803.11	solvent metal cold cleaners	MK,NT,SCH
805.02	CEM applicability	MK1,MK2,NT1,SR4,SR5,SR6
805.07	CEM data availability	MK1,MK2,NT1,SR4,SR5,SR6,
1202.01,02,03,04	opacity	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
1202.05,06,07	particulate emissions	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
1205.04,05,06,07	gasoline tanks (Phase I)	MK
1211.02	NOx RACT applicability	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
1211.03	NOx for utility boilers	MK1,MK2,NT1,SR4,SR5,SR6
1211.11	NOx for emergency gens	MKEG,NTEG,SREG
1211.12	NOx for aux boilers	NTAB1,NTAB2
1211.13	NOx for load shaving	MKCT1,MKCT2,SRCT1
1211.18	NOx bubble	MK1,MK2,MKCT1,MKCT2,NT1, NTAB1,NTAB2,SR4,SR5,SR6,SRCT1
1211.21	NOx testing	MK1,MK2,MKCT1,MKCT2,NT1, NTAB1,NTAB2,SR4,SR5,SR6,SRCT1
1211.22	NOx monitoring	MK1,MK2,NT1,SR4,SR5,SR6
1702.01	Application Forms	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
1703.01	Form ARD-1	MK, NT, SCH
1704.01	Form ARD-2	MK1,MK2,MKCT1,MKCT2,MKEG,NT1, NTAB1,NTAB2,NTEG,SR4,SR5,SR6, SRCT1,SREG
1706.01	Form ARD-4	3 Oil Tanks at NT
1709.01	Info for Title V sources	MK,NT,SCH

Attached, please find the recordkeeping and reporting requirements for the Title V facilities of PSNH. PSNH considered all Federal and State regulations in its Title V review. PSNH has cited applicable State regulations which are as stringent or more stringent than the parallel Federal regulations. New Hampshire Env-A 611 adopts and incorporates the Federal Title IV Acid Rain Program. The recordkeeping and reporting requirements review of the State of New Hampshire Rules Governing the Control of Air Pollution was performed using a copy of the rules effective December 13, 1995 obtained from the NHARD on May 6, 1996. Following is the legend to be used for the recordkeeping and reporting requirements table that is attached:

MK	The Merrimack Station Facility
NT	The Newington Station Facility
SCH	The Schiller Station Facility
MK1	The Merrimack Station Unit No. 1 Steam Boiler
MK2	The Merrimack Station Unit No. 2 Steam Boiler
MKCT1	The Merrimack Station Combustion Turbine No. 1
MKCT2	The Merrimack Station Combustion Turbine No. 2
MKEG	The Merrimack Station Emergency Generator
NT1	The Newington Station Unit No. 1 Steam Boiler
NTAB1	The Newington Station Auxiliary Boiler No. 1
NTAB2	The Newington Station Auxiliary Boiler No. 2
NTEG	The Newington Station Emergency Generator
SR4	The Schiller Station Unit No. 4 Steam Boiler
SR5	The Schiller Station Unit No. 5 Steam Boiler
SR6	The Schiller Station Unit No. 6 Steam Boiler
SRCT1	The Schiller Station Combustion Turbine No. 1
SREG	The Schiller Station Emergency Generator

Recordkeeping and Reporting Requirements

State of NH Rules	Pertains To	Affected Devices
406.08	fuel use, sulfur content	MK,NT,SCH
609.05(c)	send application to EPA	MK,NT,SCH
611	Title IV Acid Rain	MK1,MK2,NT1,SR4,SR5,SR6
805.02	CEM operating hours	MK1,MK2,NT1,SR4,SR5,SR6
805.04	CEM data recording	MK1,MK2,NT1,SR4,SR5,SR6
805.06	CEM quality assurance	MK1,MK2,NT1,SR4,SR5,SR6
	opacity CEM audits	MK1,MK2,NT1,SR4,SR5,SR6
	CEM audit reporting	MK1,MK2,NT1,SR4,SR5,SR6
805.08	excess emissions reports	MK1,MK2,NT1,SR4,SR5,SR6
805.11	CEM recordkeeping	MK1,MK2,NT1,SR4,SR5,SR6
901.03	general recordkeeping	MK,NT,SCH
901.05	VOC reporting	MK,NT,SCH
901.06	NOx recordkeeping	MK,NT,SCH
901.07	NOx reporting	MK,NT,SCH
902	malfunctions of air pollution control equipment	MK1,MK2,NT1,SR4,SR5,SR6
1205.08,09,10	gasoline tanks (Phase I)	MK
1211.11	NOx for emergency gens	MKEG,NTEG,SREG
1211.18	NOx bubble	MK1,MK2,MKCT1,MKCT2,NT1, NTAB1,NTAB2,SR4,SR5,SR6,SRCT1
1211.21	NOx testing	MK1,MK2,MKCT1,MKCT2,NT1, NTAB1,NTAB2,SR4,SR5,SR6,SRCT1

Attached, please find the compliance test method references for the Title V facilities of PSNH. This section includes a table for quick reference followed by a more thorough description of some of the test methods. Following is the legend to be used for the compliance test method references table that is attached:

MK1	The Merrimack Station Unit No. 1 Steam Boiler
MK2	The Merrimack Station Unit No. 2 Steam Boiler
MKCT1	The Merrimack Station Combustion Turbine No. 1
MKCT2	The Merrimack Station Combustion Turbine No. 2
MKEG	The Merrimack Station Emergency Generator
NT1	The Newington Station Unit No. 1 Steam Boiler
NTAB1	The Newington Station Auxiliary Boiler No. 1
NTAB2	The Newington Station Auxiliary Boiler No. 2
NTEG	The Newington Station Emergency Generator
SR4	The Schiller Station Unit No. 4 Steam Boiler
SR5	The Schiller Station Unit No. 5 Steam Boiler
SR6	The Schiller Station Unit No. 6 Steam Boiler
SRCT1	The Schiller Station Combustion Turbine No. 1
SREG	The Schiller Station Emergency Generator

Compliance Test Method References

	NOx	SOx	Particulate	CO	VOC
MK1	CEM	CEM	Stack Test	AP-42	AP-42
MK2	CEM	CEM	Stack Test	AP-42	AP-42
MKCT1	Stack Test	AP-42	AP-42	AP-42	AP-42
MKCT2	Stack Test	AP-42	AP-42	AP-42	AP-42
MKEG	AP-42	AP-42	AP-42	AP-42	AP-42
NT1	CEM	CEM	Stack Test	CEM	AP-42
NTAB1	Stack Test	AP-42	AP-42	AP-42	AP-42
NTAB2	Stack Test	AP-42	AP-42	AP-42	AP-42
NTEG	AP-42	AP-42	AP-42	AP-42	AP-42
SR4	CEM	CEM	Stack Test	AP-42	AP-42
SR5	CEM	CEM	Stack Test	AP-42	AP-42
SR6	CEM	CEM	Stack Test	AP-42	AP-42
SRCT1	Stack Test	AP-42	AP-42	AP-42	AP-42
SREG	AP-42	AP-42	AP-42	AP-42	AP-42

EMISSION SAMPLING REQUIREMENTS

The Unit 2 boiler flue gas was tested for SO_2, NO_X and CO_2 emissions along with volumetric flow rate to satisfy the conditions of the EPA Acid Rain Program of the Clean Air Act. Each pollutant parameter was tested in strict accordance with official EPA procedures at the stack sampling location described in Sections 1, 2 and 3. In this section, the test procedures, including sampling and analysis, are discussed.

All sampling procedures were conducted in strict accordance with the Methods prescribed in the Code of Federal Regulations as found in 40 CFR Part 60 as amended, where applicable.

Sulfur Dioxide

Sulfur Dioxide will be measured in accordance with EPA Method 6C. This method is applicable to the determination of sulfur dioxide (SO_2) concentrations in emissions from stationary sources using an instrumental analyzer procedure. POSL uses a ultraviolet Western Research 721AT analyzer. The instrument meets all the performance specifications of the Method. The instrument will be calibrated before and after each test cycle using EPA Protocol Gases.

Oxides of Nitrogen

Oxides of nitrogen will be measured in accordance with EPA Method 7E. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources using an instrumental analyzer procedure. POSL uses a Thermo Electron Model 42H Chemiluminescent NO_x Analyzer with 9 ranges from 0-5000 ppm. The instrument meets all of the performance specifications of the method. The instrument will be calibrated before and after each test cycle using EPA Protocol Gases.

Carbon Dioxide

Carbon Dioxide will be measured in accordance with EPA Method 3A. This method is applicable to the determination of Carbon dioxide (CO_2) concentrations in emissions from stationary sources using an instrumental analyzer procedure. POSL uses a Milton Roy Model 3300 non-dispersive infrared analyzer with a range of 0-20%. The instrument meets all of the performance specifications of the method. The instrument will be calibrated before and after each test cycle using EPA Protocol Gases.

Volumetric Flow/Moisture

Volumetric flow rates and moisture contents will be measured using EPA Methods 1 through 4, including the determination of the number of sampling points and their locations in the stack (RM1), stack velocity and volumetric flow rate (RM2), stack gas molecular weight (RM3) and stack gas moisture content (RM4).

EMISSION SAMPLING EQUIPMENT

Volumetric Flow and Moisture Sampling Train

The sampling train will consist of a modified EPA Method 5 sampling train, including a stainless steel probe, Type S pitot tube and a condenser consisting of four impingers connected in series. Sampling will be conducted for a period of time such that the minimum total gas volume of 21 standard cubic feet (scf) will be collected at a rate no greater than 0.75 cfm.

The sampling train used during this test program for volumetric flow and moisture content determination was manufactured by Graseby / Andersen company and is a model 90-900 Universal Stack Sampler. The design specifications of this train meet all the requirements of the EPA's Reference Method 1 through 4 as found in the Federal Regulations under Section 40 CFR Part 60, Appendix A, and 40 CFR Part 75, Appendix A as amended. The following is a brief description of the individual pieces of equipment that make up the train.

Probe - The sampling probe is constructed of stainless steel with a stainless steel liner, sufficiently heated to prevent water condensation and is equipped with a glass wool filter installed at the end inserted into the stack.

Condenser - The probe is connected to the condensing system made up of four impingers connected in series with ground glass, leak free fittings. The second impinger is a Greenburg-Smith design. The first, third, and fourth impingers are the Greenburg-Smith design modified by replacing the tip with a 1/2" diameter glass tube extending to about 1/2" from the bottom of the flask.

Metering System - Leaving the fourth impinger, the sample stream flows through flexible tubing, a vacuum gauge, needle valve, a leakless vacuum pump in parallel with a by-pass valve and a dry gas meter.

CEM Gas Sampling System

The Transportable CEM sampling system used to quantify the oxygen, carbon dioxide, oxides of nitrogen and sulfur dioxide from the facility meets all the specifications of the reference Methods 3A (O_2 and (CO_2), 7E (NO_x), and 6C (SO_2). The following is a brief description of the individual components that make up the system.

Probe - The sampling probe is constructed of stainless steel with a stainless steel liner, sufficiently heated to prevent water condensation and is equipped with a glass wool filter installed at the end inserted into the stack.

Sample Gas Manifold - A sample gas manifold, to divert a portion of the sample gas stream to the analyzers and the remainder to the by-pass discharge vent.

Sample Transport Lines - Teflon tubing, to transport the sample from the moisture removal system to the gas conditioner.

Moisture Removal System - A Universal Analyzers Inc., model 1090 Peltier Effect sample cooler was used to remove moisture from the sample without removing gas components.

Calibration Valve - A Three way ball valve, located at the base of the probe, allows an operator to select either the sample emissions gas stream or a calibration gas stream.

Gas Analyzers - All analyzers are capable of a continuous determination of O_2 , CO_2, SO_2 and NO_x concentrations in a sample stream. They each meet or exceed the following specifications:

Calibration Error - Less than ± 2 % of span for zero, mid and high range calibration gasses.

System Bias - Less than ± 5 % of span for zero, mid and high range calibration gasses

Zero Drift - Less than ± 3 % of span over the period of each test run.

Calibration Drift - Less than ± 3 % of span over the period of each test run.

Data Acquisition System - A Eurotherm Chessell Model 4200 strip chart recorder with a math package is used to record analyzer response to the sample and calibration gas streams. The chart recorder is operated continuously while the internal math package is used to calculate the average channel value for the test run duration. The recorder samples each analyzer channel once every second.

CEM RELATIVE ACCURACY TEST AUDIT

Data Reduction - An average pollutant/diluent concentration for each test run was determined from the data acquisition system. This data was reduced to determine relative pollutant concentrations.

Procedures detailed in Performance Specifications 2 and 3 were used to generate emissions data for comparison to the facility's CEM. The data was generated according to procedures delineated in 40CFR75 Appendix A - Reference Methods.

Relative accuracy tests were conducted in a manner that ensures that results are representative of source emissions at the time of sampling. Reference Method testing was coordinated with the facility's CEM log interval to allow direct correlation of data.

As defined in the Performance Specifications, the comparison of nine to twelve average Reference Method data points to the corresponding average CEM data points allows calculation of instrument and system relative accuracy.

QUALITY CONTROL PROCEDURES

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling.

All sampling and analysis was conducted in strict accordance with EPA test procedures. The quality control (QC) procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems was adhered to as well.

POSL's entire equipment inventory is on a schedule of routine maintenance and calibration. This includes meter boxes, thermocouples, barometers, and pitot tubes.

Meter boxes are calibrated over a full range of flow rates against a calibrated laboratory standard test meter every six months. After each field use, the meter box is given a calibration check against the standard test meter at the average flow rates and highest vacuums experienced in the field. Thermocouples are calibrated as specified in the EPA Handbook against a NBS traceable Dry-Well Calibrator. Pitot tubes are visually inspected for conformance to the dimensional specifications in EPA Method 2. All pitot tubes used by POSL meet this criteria and are assigned a pitot coefficient of 0.84. Pitot tubes which do not meet the criteria are either repaired or discarded.

All calculations were conducted in strict accordance with the equations found in the individual Methods. Emission rate calculations were conducted on a computer and the input data was checked by a person other than the original to ensure correctness.

FACILITY DESCRIPTION

Public Service of New Hampshire's Merrimack Generating Station is located in Bow, New Hampshire. Unit # 2 is a Babcock and Wilcox Cyclone Furnace. The boiler uses bituminous coal as the primary fuel. The unit produces 335 megawatts.

Method 1 - Sample and Velocity Traverses for Stationary Sources

1. PRINCIPLE AND APPLICABILITY

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m^2 (113 $in.^2$) in cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. PROCEDURE

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2\,L\,W}{L + W} \qquad \text{Eq. 1-1}$$

where L = length and W = width.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure,

determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12 and 24 in.); and (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12 and 24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that used for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-Sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to the approval of the Administrator.

In addition, for stacks having diameters greater than 0.61 m (24 in.), no traverse points shall be within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of

2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

2.3.1.2 Stacks With Diameters Equal To or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4 x 3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9 x 4 or 12 x 3, and would not necessarily have to be 6 x 6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique

has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable, and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above.

2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent or duct diameters downstream or less than one-half duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (**NOTE:** Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-purging" with pressurized air is required.

2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, Section 2.2.

NOTE: If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, Section 2.2.

2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow Section 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable

according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.

2.5.3 Measurement Procedure.

2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H_2O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.

2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.

2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point.

A post-test check as described in Section 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.

2.5.4.1 Calculate the resultant angle at each traverse point:

$$R_i = \text{arc cosine } [(\text{cosine } Y_i)(\text{cosine } P_i)] \qquad \text{Eq. 1-2}$$

where:

R_i = resultant angle at traverse point i, degree.

Y_i = yaw angle at traverse point i, degree.

P_i = pitch angle at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

$$R_{avg} = \Sigma R_i/n \qquad \text{Eq. 1-3}$$

where:

R_{avg} = average resultant angle, degree.

n = total number of traverse points.

2.5.4.3 Calculate the standard deviations:

$$S_d = \left[\frac{\sum_{i=1}^{n} (R_i - R_{avg})^2}{(n-1)} \right]^{1/2} \qquad \text{Eq. 1-4}$$

where:

S_d = standard deviation, degree.

2.5.5 The measurement location is acceptable if $R_{avg} \leq 20°$ and $S_d \leq 10°$.

2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3600 ft/min).

2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the centroid of the test section.

2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be ±2° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

2.5.6.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data

values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows: Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.

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Table 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

1. PRINCIPLE AND APPLICABILITY

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites that fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. APPARATUS

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. Pitot tube made of metal tubing (e.g., stainless steel) as shown in Figure 2-1. It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 cm (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (±5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in the Bibliography describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T = \frac{\sum_{i=1}^{n} \sqrt{\Delta p_i + K}}{\sum_{i=1}^{n} \sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm (in.) H_2O.

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in. H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used, subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternative positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg. See **NOTE** in Method 5, Section 2.1.9.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube for a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 70 S, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in Sections 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in the Bibliography)

may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01.

2.7.1 Hemispherical (shown in Figure 2-4) ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90-degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety-degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm (0.005 in.) H_2O. For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm (0.005 in.) H_2O for Δp values between 1.3 and 25 mm (0.05 and 1.0 in.) H_2O, and to the nearest 1.3 mm (0.05 in.) H_2O for Δp values above 25 mm (1.0 in.) H_2O. A special, more sensitive gauge will be required to read Δp values below 1.3 mm (0.05 in.) H_2O (see Citation 18 in the Bibliography).

3. PROCEDURE

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator, may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. CALIBRATION

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.), and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in Sections 4.1.2 through 4.1.5 below.

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in the Bibliography); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external

tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6B).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D_e = \frac{2\,L\,W}{(L + W)} \qquad \text{Eq. 2-1}$$

where:

D_e = Equivalent diameter.

L = Length.

W = Width.

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to ±5 to 6 percent for the measurement of velocities

between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in the Bibliography for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

4.1.3.2 Level and zero the manometer. Turn on the fan, and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std}, and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct, and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s, and enter its value in the data table. Remove the Type S pitot tube from the duct, and disconnect it from the manometer.

4.1.3.7 Repeat Steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat Steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

$$C_{p(s)} = C_{p(std)} \frac{\sqrt{\Delta p_{std}}}{\sqrt{\Delta p}} \qquad \text{Eq. 2-2}$$

where:

$C_{p(s)}$ = Type S pitot tube coefficient.

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube, cm (in.) H_2O.

Δp_s = Velocity head measured by the Type S pitot tube, cm (in.) H_2O.

4.1.4.2 CalculateC_p (side A), the mean A-side coefficient, andC_p (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $_p$ (side A), and the deviation of each B-side values of $C_{p(s)}$ from $_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - {}_p \text{ (A or B)} \qquad \text{Eq. 2-3}$$

4.1.4.4 Calculate σ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma \text{ (side A or B)} = \frac{\sum_{1}^{3} \left| C_{p(s)} - {}_p \text{ (A or B)} \right|}{3} \qquad \text{Eq. 2-4}$$

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $_p$ (A) and $_p$ (B) is 0.01 or less.

4.1.5 Special Considerations.

4.1.5.1 Selection of Calibration Point.

4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $_{p}$ (side A) and $_{p}$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in the Bibliography). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6A), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or 1/4 in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in the Bibliography).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4.)

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (isolated or in an assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct, 30.5 to 91.4 cm (12 to 36 in.) in diameter, the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_{p(s)}$. Consult Citation 9 in the Bibliography for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 30.5 cm (12 in.) (see Citation 16 in the Bibliography).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of the Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings, or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figure 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings, or recalibrate the assembly.

4.2 Standard Pitot Tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either

a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternative reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperature measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97 \ \frac{\text{m}}{\text{sec}} \left[\frac{\text{(g/g-mole)(mm Hg)}}{\text{(°K)(mm } H_2O\text{)}}\right]^{1/2}$$ for the metric system and

$$85.49 \ \frac{\text{ft}}{\text{sec}} \left[\frac{\text{(lb/lb-mole)(in. Hg)}}{\text{(°R)(in. } H_2O\text{)}}\right]^{1/2}$$ for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6), g/g mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d (1 - B_{ws}) + 18.0 B_{ws} \qquad \text{Eq. 2-5}$$

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack pressure, mm Hg (in. Hg),

$= P_{bar} + P_g$ Eq. 2-6

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dsm^3/hr (dscf/hr).

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K (°R).

$= 273 + t_s$ for metric. Eq. 2-7

$= 460 + t_s$ for English. Eq. 2-8

T_{std} = Standard absolute temperature, 293°K (528°R).

v_s = Average stack gas velocity, m/sec (ft/sec).

Δp = Velocity head of stack gas, mm H_2O (in. H_2O).

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average Stack Gas Velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}} \quad \text{Eq. 2-9}$$

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q = 3600 (1-B_{ws}) v_s A \left[\frac{T_{std} P_s}{T_{s(avg)} P_{std}}\right] \quad \text{Eq. 2-10}$$

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Method 3 - Gas Analysis for the Determination of Dry Molecular Weight

1. APPLICABILITY AND PRINCIPLE

1.1 Applicability.

1.1.1 This method is applicable for determining carbon dioxide (CO_2) and oxygen (O_2) concentrations and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO_2, O_2, carbon monoxide (CO), and nitrogen (N_2) are not present in concentrations sufficient to affect the results.

1.1.2 Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO_2 or O_2 and stoichiometric calculations to determine dry molecular weight; and (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator, U.S. Environmental Protection Agency (EPA).

1.1.3 Note. Mention of trade names or specific products does not constitute endorsement by EPA.

1.2 Principle. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2, percent O_2, and if necessary, for percent CO. For dry molecular weight determination, either an Orsat or a Fyrite analyzer may be used for the analysis.

2. APPARATUS

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used, provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are, otherwise, capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. Stainless steel or borosilicate glass tubing equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other materials, inert to O_2, CO_2, CO, and N_2 and resistant to temperature at sampling conditions, may be used for the probe. Examples of such materials are aluminum, copper, quartz glass, and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. Same as in Section 2.1.1.

2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser no greater than 250 ml that will not remove O_2, CO_2, CO, and N_2, to remove excess moisture which would interfere with the operation of the pump and flowmeter.

2.2.3 Valve. A needle valve, to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. A rotameter, or equivalent rate meter, capable of measuring flow rate to within 2 percent of the selected flow rate. A flow rate range of 500 to 1000 cc/min is suggested.

2.2.6 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time length of the test run. A capacity in the range of 55 to 90 liters is suggested. To leak check the bag, connect it to a water manometer, and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm (2 to 4 in.) H_2O and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled U-tube manometer, or equivalent, of about 30 cm (12 in.), for the flexible bag leak check.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm (30 in.) Hg, for the sampling train leak check.

2.3 Analysis. An Orsat or Fyrite type combustion gas analyzer. For Orsat and Fyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

3. SINGLE-POINT, GRAB SAMPLING AND ANALYTICAL PROCEDURE

3.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight. If an Orsat analyzer is used, it is recommended that the analyzer be leak checked by following the procedure in Section 6; however, the leak check is optional.

3.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line long enough to allow at least five exchanges. Draw a sample into the analyzer, and immediately analyze it for percent CO_2 and percent O_2. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 7.2.

3.4 Repeat the sampling, analysis, and calculation procedures until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

4. SINGLE-POINT, INTEGRATED SAMPLING AND ANALYTICAL PROCEDURE

4.1 The sampling point in the duct shall be located as specified in Section 3.1.

4.2 Leak check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just before sampling, leak check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe, and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag, and make sure that all connections are tight.

4.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft^3) of sample gas is recommended; however, smaller volumes may be collected, if desired.

4.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO_2 and percent O_2 using either an Orsat analyzer or a Fyrite type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that Orsat leak check described in Section 6, be performed before this determination; however, the check is optional. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 7.2.

4.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

5. MULTI-POINT, INTEGRATED SAMPLING AND ANALYTICAL PROCEDURE

5.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of 12 traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

5.2 Follow the procedures outlined in Sections 4.2 through 4.5, except for the following: Traverse all sampling points, and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

6. LEAK-CHECK PROCEDURE FOR ORSAT ANALYZER

Moving an Orsat analyzer frequently causes it to leak. Therefore, an Orsat analyzer should be thoroughly leak checked on site before the flue gas sample is introduced into it. The procedure for leak checking an Orsat analyzer is as follows:

6.1 Bring the liquid level in each pipette up to the reference mark on the capillary tubing, and then close the pipette stopcock.

6.2 Raise the leveling bulb sufficiently to bring the confining liquid meniscus onto the graduated portion of the burette, and then close the manifold stopcock.

6.3 Record the meniscus position.

6.4 Observe the meniscus in the burette and the liquid level in the pipette for movement over the next 4 minutes.

6.5 For the Orsat analyzer to pass the leak check, two conditions must be met:

6.5.1 The liquid level in each pipette must not fall below the bottom of the capillary tubing during this 4-minute interval.

6.5.2 The meniscus in the burette must not change by more than 0.2 ml during this 4-minute interval.

6.6 If the analyzer fails the leak-check procedure, check all rubber connections and stopcocks to determine whether they might be the cause of the leak. Disassemble, clean, and regrease leaking stopcocks. Replace leaking rubber connections. After the analyzer is reassembled, repeat the leak-check procedure.

7. CALCULATIONS

7.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (lb/lb-mole).

$\%CO_2$ = Percent CO_2 by volume, dry basis.

$\%O_2$ = Percent O_2 by volume, dry basis.

%CO = Percent CO by volume, dry basis.

$\%N_2$ = Percent N_2 by volume, dry basis.

0.280 = Molecular weight of N_2 or CO, divided by 100.

0.320 = Molecular weight of O_2 divided by 100.

0.440 = Molecular weight of CO_2 divided by 100.

7.2 Dry Molecular Weight. Use Equation 3-1 to calculate the dry molecular weight of the stack gas.

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO) \qquad \text{Eq. 3-1}$$

Note: The above equation does not consider argon in air (about 0.9 percent, molecular weight of 39.9). A negative error of about 0.4 percent is introduced. The tester may choose to include argon in the analysis using procedures subject to approval of the Administrator.

8. BIBLIOGRAPHY

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Method 4 - Determination of Moisture Content in Stack Gases

1. PRINCIPLE AND APPLICABILITY

1.1 Principle. A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

1.2.1 Two procedures are given. The first is a reference method, for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., drying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

1.2.2 The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator, U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H_2O of the reference method.

1.2.3 Note: The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the gas stream is saturated. Attach a temperature sensor [capable of measuring to within 1°C (2°F)] to the reference method probe. Measure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the moisture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables.

In cases where the psychrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternative methods, subject to the approval of the Administrator, shall be used.

2. REFERENCE METHOD

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedures in Method 5.

2.1.1 Probe. Stainless steel or glass tubing, sufficiently heated to prevent water condensation, and equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particulate matter. When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Administrator.

2.1.2 Condenser. See Method 5, Section 2.1.7, for a description of an acceptable type of condenser and for alternative measurement systems.

2.1.3 Cooling System. An ice bath container and crushed ice (or equivalent), to aid in condensing moisture.

2.1.4 Metering System. Same as in Method 5, Section 2.1.8, except do not use sampling systems designed for flow rates higher than 0.0283 m^3/min (1.0 cfm). Other metering systems, capable of maintaining a constant sampling rate to within 10 percent and determining sample gas volume to within 2 percent, may be used, subject to the approval of the Administrator.

2.1.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg. See **NOTE** in Method 5, Section 2.1.9.

2.1.6 Graduated Cylinder and/or Balance. To measure condensed water and moisture caught in the silica gel to within 1 ml or 0.5 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. These balances are suitable for use here.

2.2 Procedure. The following procedure is written for a condenser system (such as the impinger system described in Section 2.1.7 of Method 5) incorporating volumetric analysis to measure the condensed moisture, and silica gel and gravimetric analysis to measure the moisture leaving the condenser.

2.2.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine points shall be used for rectangular stacks

having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used in all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to the approval of the Administrator. Select a suitable probe and probe length such that all traverse points can be sampled. Consider sampling from opposite sides
of the stack (four total sampling ports) for large stacks, to permit use of shorter probe lengths. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Place known volumes of water in the first two impingers. Weigh and record the weight of the silica gel to the nearest 0.5 g, and transfer the silica gel to the fourth impinger; alternatively, the silica gel may first be transferred to the impinger, and the weight of the silica gel plus impinger recorded.

2.2.2 Select a total sampling time such that a minimum total gas volume of 0.60 scm (21 scf) will be collected, at a rate no greater than 0.021 m^3/min (0.75 cfm). When both moisture content and pollutant emission rate are to be determined, the moisture determination shall be simultaneous with, and for the same total length of time as, the pollutant emission rate run, unless otherwise specified in an applicable subpart of the standards.

2.2.3 Set up the sampling train as shown in Figure 4-1. Turn on the probe heater and (if applicable) the filter heating system to temperatures of about 120°C (248°F), to prevent water condensation ahead of the condenser; allow time for the temperatures to stabilize. Place crushed ice in the ice bath container. It is recommended, but not required, that a leak check be done, as follows: Disconnect the probe from the first impinger or (if applicable) from the filter holder. Plug the inlet to the first impinger (or filter holder), and pull a 380 mm (15 in.) Hg vacuum; a lower vacuum may be used, provided that it is not exceeded during the test. A leakage rate in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, is unacceptable. Following the leak check, reconnect the probe to the sampling train.

2.2.4 During the sampling run, maintain a sampling rate within 10 percent of constant rate, or as specified by the Administrator. For each run, record the data required on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump, and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if necessary, salt to maintain a temperature of less than 20°C (68°F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impinger), and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of

the moisture condensed to the nearest ml. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet, Figure 4-3), and calculate the moisture percentage, as described in 2.3 below.

2.2.7 A quality control check of the volume metering system at the field site is suggested before collecting the sample following the procedure in Method 5, Section 4.4.

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

2.3.1 Nomenclature.

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg)(m^3)/(g-mole)(°K) for metric units and 21.85 (in. Hg)(ft^3)/(lb-mole)(°R) for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

ΔV_m = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).

$V_{m(std)}$ =Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed, corrected to standard conditions, scm (scf).

$V_{wsg(std)}$ = Volume of water vapor collected in silica gel, corrected to standard conditions, scm (scf).

V_f = Final volume of condenser water, ml.

V_i = Initial volume, if any, of condenser water, ml.

W_f = Final weight of silica gel or silica gel plus impinger, g.

W_i = Initial weight of silica gel or silica gel plus impinger, g.

Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of Water Vapor Condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\ \rho_w\ R\ T_{std}}{P_{std}\ M_w}$$

$$= K_1\ (V_f - V_i) \qquad \text{Eq. 4-1}$$

where:

K_1 = 0.001333 m^3/ml for metric units,

= 0/04707 ft^3/ml for English units.

2.3.3 Volume of Water Collected in Silica Gel.

$$V_{wsg(std)} = \frac{(W_f - W_i)\ R\ T_{std}}{P_{std}\ M_w}$$

$$= K_2\ (W_f - W_i) \qquad \text{Eq. 4-2}$$

where:

K_2 = 0.001335 m^3/g for metric units,

= 0.04715 ft^3/g for English units.

2.3.4 Sample Gas Volume.

$$V_{m(std)} = V_m\ Y\ \frac{P_m\ T_{std}}{P_{std}\ T_m}$$

$$= K_3\ Y\ \frac{V_m\ P_m}{T_m} \qquad \text{Eq. 4-3}$$

where:

K_3 = 0.3858 °K/mm Hg for metric units,

= 17.64 °R/in. Hg for English units.

NOTE: If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$\overline{B_{ws}} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}} \qquad \text{Eq. 4-4}$$

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

2.3.6 Verification of Constant Sampling Rate. For each time increment, determine the ΔV_m. Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results, and repeat the run.

3. APPROXIMATION METHOD

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus. See Figure 4-4.

3.1.1 Probe. Stainless steel or glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either in-stack or heated out-stack) to remove particulate matter. A plug of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers, each with 30-ml capacity, or equivalent.

3.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicating-type silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve. Needle valve, to regulate the sample gas flow rate.

3.1.6 Pump. Leak-free, diaphragm type, or equivalent, to pull the gas sample through the train.

3.1.7 Volume Meter. Dry gas meter, sufficiently accurate to measure the sample volume to within 2 percent, and calibrated over the range of flow rates and conditions actually encountered during sampling.

3.1.8 Rate Meter. Rotameter, to measure the flow range from 0 to 3 liters/min (0 to 0.11 cfm).

3.1.9 Graduated Cylinder. 25-ml.

3.1.10 Barometer. Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

3.1.11 Vacuum Gauge. At least 760-mm (30-in.) Hg gauge, to be used for the sampling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml water in each impinger. Leak check the sampling train as follows: Temporarily insert a vacuum gauge at or near the probe inlet; then, plug the probe inlet, and pull a vacuum of at least 250 mm (10 in.) Hg. Note the time rate of change of the dry gas meter dial; alternatively, a rotameter (0 to 40 cc/min) may be temporarily attached to the dry gas meter outlet to determine the leakage rate. A leak rate not in excess of 2 percent of the average sampling rate is acceptable. **NOTE:** Carefully release the probe inlet plug before turning off the pump.

3.2.2 Connect the probe, insert it into the stack, and sample at a constant rate of 2 liters/min (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft^3) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-5.

3.2.3 After collecting the sample, combine the contents of the two impingers, and measure the volume to the nearest 0.5 ml.

3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas; therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenclature.

B_{wm} = Approximate proportion by volume of water vapor in the gas stream leaving the second impinger, 0.025.

B_{ws} = Water vapor in the gas stream, proportion by volume.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 [(mm Hg)(m^3)]/[(g-mole)(°K)] for metric units and 21.85 [(in. Hg)(ft^3)]/[(lb-mole)(°R)] for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293°R (528°R).

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents, ml.

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, sm^3 (scf).

Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.09982 g/ml (0.002201 lb/ml).

3.3.2 Volume of Water Vapor Collected.

$$V_{wc(std)} = \frac{(V_f - V_i)\ \rho_w\ R\ T_{std}}{P_{std}\ M_w}$$

$$= K_1\ (V_f - V_i) \qquad \text{Eq. 4-5}$$

where:

K_1 = 0.001333 m^3/ml for metric units,

= 0.04707 ft^3/ml for English units.

3.3.3 Gas Volume.

$$V_{m(std)} = V_m\ Y\ \frac{P_m\ T_{std}}{P_{std}\ T_m}$$

$$= K_2\ Y\ \frac{V_m\ P_m}{T_m} \qquad \text{Eq. 4-6}$$

where:

K_2 = 0.03858 °K/mm Hg for metric units,

= 17.64 °R/in. Hg for English units.

3.3.4 Approximate Moisture Content.

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}} + B_{wm}$$

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}} + (0.025) \qquad \text{Eq. 4-7}$$

4. CALIBRATION

4.1 For the reference method, calibrate the metering system, temperature gauges, and barometer according to Sections 5.3, 5.5, and 5.7, respectively, of Method 5. The recommended leak check of the metering system (Section 5.6 of Method 5) also applies to the reference method. For the approximation method, use the procedures outlined in Section 5.1.1 of Method 6 to calibrate the metering system, and the procedure of Method 5, Section 5.7, to calibrate the barometer.

Figure 4-3. Analytical data - reference method.

	Impinger volume, ml	Silica gel weight, g
Final		
Initial		
Difference		

5. BIBLIOGRAPHY

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Method 5 - Determination of Particulate Emissions from Stationary Sources

1. PRINCIPLE AND APPLICABILITY

1.1 Principle. Particulate matter (PM) is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator, U.S. Environmental Protection Agency, for a particular application. The PM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of PM emissions from stationary sources.

2. APPARATUS

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in the Bibliography); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in the Bibliography). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be ≤30°, and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm (1/8 to 1/2 in.)--or larger if higher volume sampling trains are used--inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

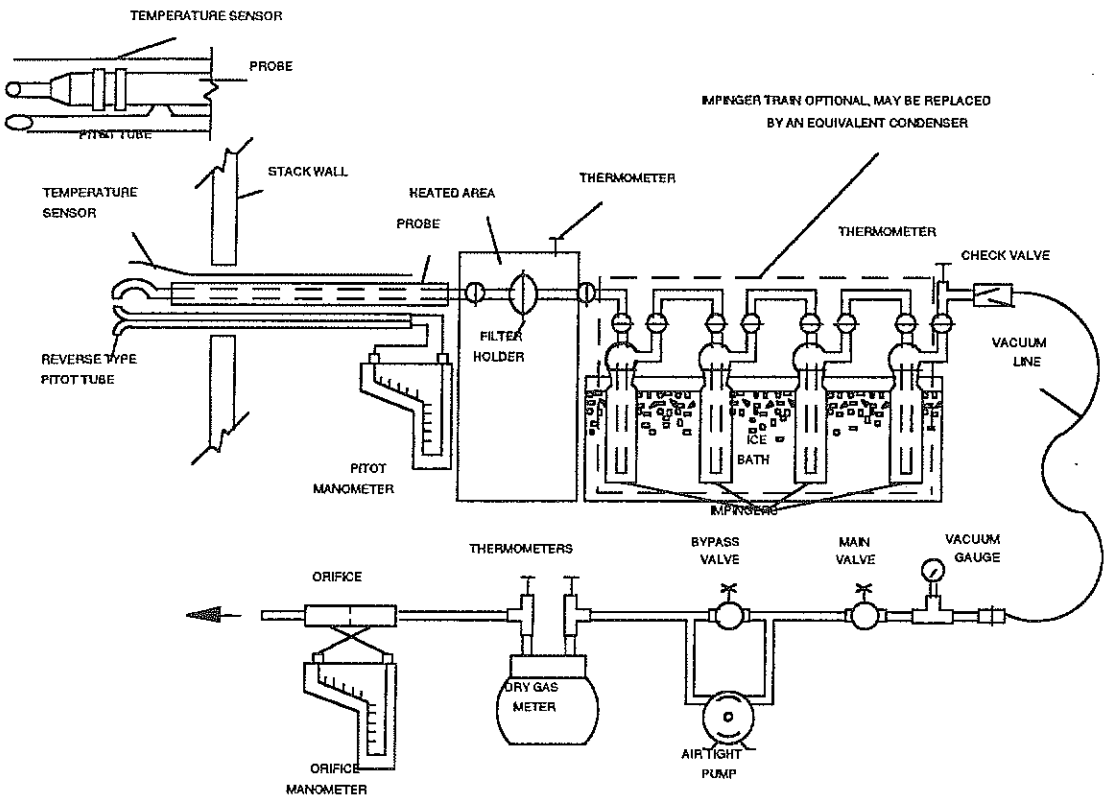

Figure 5-1. Particulate Sampling Train

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of 120 ± 14°C (248 ± 25°F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480°C (900°F); quartz liners shall be used for temperatures between 480 and 900°C (900 and 1,650°F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820°C (1,508°F), and for quartz it is 1,500°C (2,732°F).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825 or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

NOTE: Mention of trade names or specific products does not constitute endorsement of the Environmental Protection Agency.

2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

2.1.4 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (Δp) readings, and the other, for orifice differential pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to the approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during the sampling of 120 ± 14°C (248 ± 25°F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free noncontaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 cm (1/2 in.) ID glass tube extending to about 1.3 cm (1/2 in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using a flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator. The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperature to within 1°C (2°F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20°C (68°F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE: If a determination of the PM collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.8 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry gas meter (DGM) capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg.

NOTE: In many cases, the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is

the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Section 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles. Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500-ml or 1000-ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable for use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.3 Analysis. For analysis, the following equipment is needed:

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.

2.3.5 Beakers. 250-ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. REAGENTS

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM Method D 2986-71 (Reapproved 1978)(incorporated by reference--see §60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3, the filter material must be of a type that is unreactive to SO_2 or SO_3. Citation 10 in the Bibliography may be used to select the appropriate filter.

3.1.2 Silica Gel. Indicating type, 6- to 16-mesh. If previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, deionized distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.2 Sample Recovery. Acetone--reagent grade, ≤0.001 percent residue, in glass bottles--is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (≤0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis:

3.3.1 Acetone. Same as in Section 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. PROCEDURE

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. It is suggested that sampling equipment be maintained according to the procedures described in APTD-0576.

Weigh several 200- to 300-g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in its impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes), and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20 ± 5.6°C (68 ± 10°F) and ambient pressure for at least 24 hours, and weigh at intervals of at least 6 hours to a constant weight, i.e., ≤0.5-mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105°C (220°F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 minutes (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

The sampling time at each point shall be the same. It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260°C (500°F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm (15 in.) Hg vacuum.

NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm (15 in.) Hg vacuum
(see **NOTE** immediately above). Then connect the probe to the train, and leak-check at about 25 mm (1 in.) Hg vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm (15 in.) Hg vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve, and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass valve; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below, and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable), and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leakcheck shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sample run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-Test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the

procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120 ± 14°C (248 ± 25°F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter (DGM) reading. Record the DGM readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump, and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85 ± 0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29 ± 4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross-section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20°C (68°F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of the sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak-check (see Section 4.1.4.2). The total PM weight shall include the summation of the filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or, in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

Note that when two or more trains are used, separate analyses of the fronthalf and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the fronthalf catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final DGM meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates because of source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external PM near the tip of the probe nozzle, and place a cap over it to prevent losing or gaining PM. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened, and cap it. Remove the umbilical cord from the last impinger, and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder, and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used, and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly, and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder, and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the PM cake is inside the fold. Carefully transfer to the petri dish any PM and/or filter fibers that adhere to the filter holder gasket, by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover PM or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Deionized distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank, and follow the Administrator's directions on analysis. Perform the acetone rinse as follows:

Carefully remove the probe nozzle, and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter that is brushed from the probe. Run the brush through the probe three times or more until no visible PM is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and
quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurred during transport. Label the container to identify clearly its contents.

Container No. 3. Note the color of the indicating silica gel to determine whether it has been completely spent, and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container, and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for Container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid that is in the first three impingers to within 1 ml by using a graduated cylinder or by weighing it to within 0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see **NOTE**, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose PM from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight, and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105°C (220°F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105°C (220°F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container, and confirm on the analysis sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker, and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours, and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure the acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker, and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours, and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are optional for the tester.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 5.3, determine the $\Delta H_@$ for the metering system orifice. The $\Delta H_@$ is the orifice pressure differential in units of in. H_2O that correlates to 0.75 cfm of air at 528°R and 29.92 in. Hg. The
$\Delta H_@$ is calculated as follows:

$$\Delta H_@ = 0.0319\ \Delta H \frac{T_m\ \theta^2}{P_{bar}\ Y^2\ V_m^2}$$

where:

ΔH = Average pressure differential across the orifice meter, in. H_2O.

T_m = Absolute average DGM temperature, °R.

P_{bar} = Barometric pressure, in. Hg.

θ = Total sampling time, min.

Y = DGM calibration factor, dimensionless.

V_m = Volume of gas sample as measured by DGM, dcf.

$$0.0319 = (0.0567 \text{ in. Hg/°R})(0.75 \text{ cfm})^2$$

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the ΔH_e pressure differential for 10 minutes. Record the volume collected, the DGM temperature, and the barometric pressure. Calculate a DGM calibration check value, Y_c, as follows:

$$Y_c = \frac{10 - 0.0319 T_m}{V_m \left(\frac{P_{bar}}{} \right)}^{\frac{1}{2}}$$

where:

Y_c = DGM calibration check value, dimensionless.

10 = Run time, min.

Compare the Y_c value with the dry gas meter calibration factor Y to determine that: $0.97Y < Y_c < 1.03Y$. If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibrated Critical Orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box, may be used as a quality control check by following the procedure of Section 7.2.

5. CALIBRATION

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System.

5.3.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 ft^3/rev). A spirometer of 400 liters (14 ft^3) or more capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice manometer

indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter, and note the gas volume indicated by the DGM. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the DGM, and the outlet of the DGM. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m^3 (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5.6, and calculate Y, the DGM calibration factor, and $\Delta H_@$, the orifice calibration factor, at each orifice setting as shown on Figure 5.6. Allowable tolerances for individual Y and $\Delta H_@$ values are given in Figure 5.6. Use the average of the Y values in the calculations in Section 6.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m^3/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and DGM volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

5.3.2 Calibration After Use. After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the DGM calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously detailed.

Alternative procedures, e.g., rechecking the the orifice meter coefficient, may be used, subject to the approval of the Administrator.

5.3.3 Acceptable Variation in Calibration. If the DGM coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical sample flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD-0576 can also be used. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used. Also, probes with outlet temperatures monitoring capabilities do not require calibration.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the DGM and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing, and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenclature.

A_n =Cross-sectional area of nozzle, m^2 (ft^2).

B_{ws} =Water vapor in the gas stream, proportion by volume.

C_a =Acetone blank residue concentration, mg/g.

c_s =Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I =Percent of isokinetic sampling.

L_a =Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i =Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i = 1, 2, 3...n), m^3/min (cfm).

L_p =Leakage rate observed during the post-test leak check, m^3/min (cfm).

m_a =Mass of residue of acetone after evaporation, mg.

m_n =Total amount of particulate matter collected, mg.

M_w =Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_{bar} =Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s =Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} =Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R =Ideal gas constant, 0.06236 [(mm Hg)(m^3)]/[(°K)(g-mole)] {21.85 [(in. Hg)(ft^3)]/[(°R)(lb-mole)]}.

T_m =Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_s =Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} =Standard absolute temperature, 293°K (528°R).

V_a =Volume of acetone blank, ml.

V_{aw} =Volume of acetone used in wash, ml.

V_{lc} =Total volume liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m =Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ =Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s =Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a =Weight of residue in acetone wash, mg.

Y =Dry gas meter calibration factor.

ΔH =Average pressure differential across the orifice meter (see Figure 5-2), mm H_2O (in. H_2O).

ρ_a =Density of acetone, mg/ml (see label on bottle).

ρ_w =Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ =Total sampling time, min.

θ_1 =Sampling time interval, from the beginning of a run until the first component change, min.

θ_i =Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p =Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 =Specific gravity of mercury.

60 =Sec/min.

100 =Conversion to percent.

6.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20°C, 760 mm Hg or 68°F, 29.92 in. Hg) by using Equation 5-1.

$$V = V_m Y \frac{T_{std} (P_{bar} + \Delta H/13.6)}{T_m P_{std}}$$

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m} \qquad \text{Eq. 5-1}$$

where:

K_1 = 0.3858 °K/mm Hg for metric units,

= 17.64 °R/in. Hg for English units.

NOTE: Equation 5-1 can be used as written unless leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression:

$$[V_m - (L_p - L_a) \theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$[V_m - (L_1 - L_a) \theta_1 - \sum_{i=2}^{n} (L_i - L_a) \theta_i - (L_p - L_a) \theta_p]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of Water Vapor.

$$V_{w(std)} = V_{lc} \frac{\rho_w R T_{std}}{M_w P_{std}} = K_2 V_{lc} \qquad \text{Eq. 5-2}$$

where:

K_2 =0.001333 m^3/ml for metric units,

= 0.04707 ft^3/ml for English units.

6.5 Moisture Content.

$$\frac{V_{w(std)}}{}$$

$$B_{ws} = \frac{}{V_{m(std)} + V_{w(std)}} \qquad \text{Eq. 5-3}$$

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_{ws} shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the **NOTE** of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1°C (2°F).

6.6 Acetone Blank Concentration.

$$C_a = \frac{m_a}{V_a \rho_a} \qquad \text{Eq. 5-4}$$

6.7 Acetone Wash Blank.

$$W_a = C_a V_{aw} \rho_a \qquad \text{Eq. 5-5}$$

6.8 Total Particulate Weight. Determine the total particulate matter catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank (see Figure 5-3).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$C_s = 0.001\ m_n / V_{m(std)} \qquad \text{Eq. 5-6}$$

6.10 Conversion Factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft^3	gr/ft^3	15.43
g/ft^3	lb/ft^3	2.205×10^{-3}
g/ft^3	g/m^3	35.31

6.11 Isokinetic Variation.

6.11.1 Calculation from Raw Data.

$$I = \frac{100\ T_s\ [K_3\ V_{lc} + (V_m\ Y / T_m)(P_{bar} + \Delta H/13.6)]}{60\ \theta\ v_s\ P_s\ A_n} \qquad \text{Eq. 5-7}$$

where:

K_3 = 0.003454 [(mm Hg)(m^3)]/[(ml)(°K)] for metric units,

= 0.002669 [(in. Hg)(ft^3)]/[(ml)(°R)] for English units.

6.11.2 Calculation from Intermediate Values.

$$I = \frac{T_s \, V_{m(std)} \, P_{std} \, 100}{T_{std} \, v_s \, \theta \, A_n \, P_s \, 60 \, (1-B_{ws})}$$

$$= K_4 \frac{T_s \, V_{m(std)}}{P_s \, v_s \, A_n \, \theta \, (1-B_{ws})} \qquad \text{Eq. 5-8}$$

where:

K_4 = 4.320 for metric units,

= 0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the PM results are low in comparison to the standard, and "I" is over 110 percent or less than 90 percent, the Administrator may opt to accept the results. Citation 4 in the Bibliography may be used to make acceptability judgments. If "I" is judged to unacceptable, reject the results, and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. ALTERNATIVE PROCEDURES

7.1 Dry Gas Meter as a Calibration Standard. A DGM may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated periodically as follows:

7.1.1 Standard Dry Gas Meter Calibration.

7.1.1.1. The DGM to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft^3/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft^3/rev) and capable of measuring volume to within 1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the DGM should be minimized [no greater than 100 mm H_2O (4 in. H_2O) at a flow rate of 30 liters/min (1 cfm)]. This can be accomplished by using large diameter tubing connections and straight pipe fittings.

7.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The range of flow rates should be between 10 and 34 liters/min (0.35 and 1.2 cfm) or over the expected operating range.

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter volume, V_w, and the run time, θ. Calculate the DGM coefficient, Y_{ds}, for each run. These calculations are as follows:

$$Q = K_1 \frac{P_{bar}\ V_w}{(t_w + t_{std})\ \theta}$$

$$Y_{ds} = \frac{V_w\ (t_{ds} + t_{std})\ P_{bar}}{V_{ds}\ (t_w + t_{std})\ (P_{bar} + \Delta p/13.6)}$$

where:

K_1 = 0.3858 for international system of units (SI); 17.64 for English units.

V_w = Wet test meter volume, liter (ft^3).

V_{ds} = Dry gas meter volume, liter (ft^3).

t_{ds} = Average dry gas meter temperature, °C (°F).

t_{std} = 273°C for SI units; 460°F for English units.

t_w = Average wet test meter temperature, °C (°F)

P_{bar} = Barometric pressure, mm Hg (in. Hg).

Δp = Dry gas meter inlet differential pressure, mm H_2O (in. H_2O).

θ = Run time, min.

7.1.1.5 Compare the three Y_{ds} values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_{ds} values at each flow rate resulting in five average meter coefficients, Y_{ds}.

7.1.1.6 Prepare a curve of meter coefficient, Y_{ds}, versus flow rate, Q, for the DGM. This curve shall be used as a reference when the meter is used to calibrate other DGM's and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibration.

7.1.2.1 Recalibrate the standard DGM against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard DGM is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

7.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates [suggested rates are 14 and 28 liters/min (0.5 and 1.0 cfm)]. Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within 1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

7.2 Critical Orifices As Calibration Standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Selection of Critical Orifices.

7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in Section 7.2.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and
34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range.

A minimum of three critical orifices will be needed to calibrate a Method 5 DGM; the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Gauge/cm	Flow rate, liters/min	Gauge/cm	Flow rate, liters/min
12/7.6	32.56	14/2.5	19.54
12/10.2	30.02	14/5.1	17.27
13/2.5	25.77	14/7.6	16.14
13/5.1	23.50	15/3.2	14.16
13/7.6	22.37	15/7.6	11.61
13/10.2	20.67	15/10.2	10.48

7.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13- by 20-mm sleeve type, into a 1/2

inch Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5-9.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifices. Other schemes may be used, subject to the approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used; i.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Before calibrating the meter box, leak check the system as follows: Fully open the coarse adjust valve, and completely close the by-pass valve. Plug the inlet. Then turn on the pump, and determine whether there is any leakage. The leakage rate shall be zero; i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

7.2.2.1.2 Check also for leakages in that portion of the sampling train between the pump and the orifice meter. See Section 5.6 for the procedure; make any corrections, if necessary. If leakage is detected, check for cracked gaskets, loose fittings, worn O-rings, etc., and make the necessary repairs.

7.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in Section 5.3. Make sure that the wet test meter meets the requirements stated in Section 7.1.1.1. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

7.2.2.2 Calibration of Critical Orifices. Set up the apparatus as shown in Figure 5-10.

7.2.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

7.2.2.2.2 Leak check the system as in Section 7.2.2.1.1. The leakage rate shall be zero.

7.2.2.2.3 Before calibrating the critical orifice, determine its suitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box orifice manometer reading, ΔH. Slowly increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer. Record the critical vacuum for each orifice. Orifices that do not reach a critical value shall not be used.

7.2.2.2.4 Obtain the barometric pressure using a barometer as described in Section 2.1.9. Record the barometric pressure, P_{bar}, in mm Hg (in. Hg).

7.2.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ±0.5 percent in K'. Record the information listed in Figure 5-11.

7.2.2.2.6 Calculate K' using Equation 5-9.

$$K' = \frac{K_1 V_m Y (P_{bar} + \Delta H/13.6) T_{amb}^{1/2}}{P_{bar} T_m \theta} \quad \text{Eq. 5-9}$$

where:

K' = Critical orifice coefficient, $[m^3)(°K)^{1/2}]/[(mm\ Hg)(min)]$ $\{[(ft^3)(°R)^{1/2})]/[(in.\ Hg)(min)]\}$.

T_{amb} = Absolute ambient temperature, °K (°R).

Average the K' values. The individual K' values should not differ by more than ±0.5 percent from the average.

7.2.3 Using the Critical Orifices as Calibration Standards.

7.2.3.1 Record the barometric pressure.

7.2.3.2 Calibrate the metering system according to the procedure outlined in Sections 7.2.2.2.1 to 7.2.2.2.5. Record the information listed in Figure 512.

7.2.3.3 Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations below:

$$V_{m(std)} = K_1 V_m [P_{bar} + (\Delta H/13.6)]/T_m \quad \text{Eq. 5-10}$$

$$V_{cr(std)} = K' (P_{bar} \theta)/T_{amb}^{1/2} \quad \text{Eq. 5-11}$$

$$Y = V_{cr(std)}/V_{m(std)} \quad \text{Eq. 5-12}$$

where:

$V_{cr(std)}$ =Volume of gas sample passed through the critical orifice, corrected to standard conditions, dscm (dscf).

K' = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ±2 percent from the average.

7.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking orifice 13/2.5, use orifices 12/10.2 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to Section 7.2.2.2.

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Method 3A - Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

1. APPLICABILITY AND PRINCIPLE

1.1 Applicability. This method is applicable to the determination of oxygen (O_2) and carbon dioxide (CO_2) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream: a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. RANGE AND SENSITIVITY

Same as in Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O_2 or CO_2 concentration is not less than 20 percent of the span.

3. DEFINITIONS

3.1 Measurement System. The total equipment required for the determination of the O_2 or CO_2 concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve. Same as in Method 6C, Sections 3.2 through 3.8, and 3.10.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

Same as in Method 6C, Sections 4.1 through 4.4.

5. APPARATUS AND REAGENTS

5.1 Measurement System. Any measurement system for O_2 or CO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe. A leak-free probe of sufficient length to traverse the sample points.

5.1.2 Sample Line. Tubing to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O_2 or CO_2 concentration on a dry basis, or transport dry gases.

5.1.3 Sample Transport Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as in Method 6C, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 Gas Analyzer. An analyzer to determine continuously the O_2 or CO_2 concentration in the sample gas stream. The analyzer must meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 Calibration Gases. The calibration gases for CO_2 analyzers shall be CO_2 in N_2 or CO_2 in air. Alternatively, CO_2/SO_2, O_2/SO_2, or $O_2/CO_2/SO_2$ gas mixtures in N_2 may be used. Three calibration gases, as specified in Sections 5.3.1 through 5.3.4 of Method 6C, shall be used. For O_2 monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. MEASUREMENT SYSTEM PERFORMANCE TEST PROCEDURES

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 5 percent (or 0.2 percent by volume, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter

the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, Response Time, and Sampling System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

7. EMISSION TEST PROCEDURE

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as that used during the response time test. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the average system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. QUALITY CONTROL PROCEDURES

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O_2 and CO_2 are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O_2 and CO_2 measurement results.

8.2 If only O_2 is measured using Method 3A, measurements of the sample stream CO_2 concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrent with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO_2 values for comparison with the O_2 measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO_2 is measured using Method 3A, concurrent measurements of the sample stream CO_2 concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. EMISSION CALCULATION

9.1 For all CO_2 analyzers, and for O_2 analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

9.2 For O_2 analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{gas} = \frac{C_{ma} - C_{oa}}{C_m - C_o} (- C_m) + C_{ma} \qquad \text{Eq. 3A-1}$$

Where:

C_{gas} = Effluent gas concentration, dry basis, percent.

C_{ma} = Actual concentration of the upscale calibration gas, percent.

C_{oa} = Actual concentration of the low-level calibration gas, percent.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.

C_o = Average of initial and final system calibration bias check responses for the low level gas, percent.

= Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. BIBLIOGRAPHY

Same as in Bibliography of Method 6C.

Method 6C - Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

1. APPLICABILITY AND PRINCIPLE

1.1 Applicability. This method is applicable to the determination of sulfur dioxide (SO_2) concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas sample is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental analyzer for determination of SO_2 gas concentration using an ultraviolet (UV), nondispersive infrared (NDIR), or fluorescence analyzer. Performance specifications and test procedures are provided to ensure reliable data.

2. RANGE AND SENSITIVITY

2.1 Analytical Range. The analytical range is determined by the instrumental design. For this method, a portion of the analytical range is selected by choosing the span of the monitoring system. The span of the monitoring system shall be selected such that the pollutant gas concentration equivalent to the emission standard is not less than 30 percent of the span. If at any time during a run the measured gas concentration exceeds the span, the run shall be considered invalid.

2.2 Sensitivity. The minimum detectable limit depends on the analytical range, span, and signal-to-noise ratio of the measurement system. For a well designed system, the minimum detectable limit should be less than 2 percent of the span.

3. DEFINITIONS

3.1 Measurement System. The total equipment required for the determination of gas concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface. That portion of a system used for one or more of the following: sample acquisition, sample transport, sample conditioning, or protection of the analyzers from the effects of the stack effluent.

3.1.2 Gas Analyzer. That portion of the system that senses the gas to be measured and generates an output proportional to its concentration.

3.1.3 **Data Recorder.** A strip chart recorder, analog computer, or digital recorder for recording measurement data from the analyzer output.

3.2 **Span.** The upper limit of the gas concentration measurement range displayed on the data recorder.

3.3 **Calibration Gas.** A known concentration of a gas in an appropriate diluent gas.

3.4 **Analyzer Calibration Error.** The difference between the gas concentration exhibited by the gas analyzer and the known concentration of the calibration gas when the calibration gas is introduced directly to the analyzer.

3.5 **Sampling System Bias.** The difference between the gas concentrations exhibited by the measurement system when a known concentration gas is introduced at the outlet of the sampling probe and when the same gas is introduced directly to the analyzer.

3.6 **Zero Drift.** The difference in the measurement system output reading from the initial calibration response at the zero concentration level after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.7 **Calibration Drift.** The difference in the measurement system output reading from the initial calibration response at a mid-range calibration value after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.8 **Response Time.** The amount of time required for the measurement system to display 95 percent of a step change in gas concentration on the data recorder.

3.9 **Interference Check.** A method for detecting analytical interferences and excessive biases through direct comparison of gas concentrations provided by the measurement system and by a modified Method 6 procedure. For this check, the modified Method 6 samples are acquired at the sample by-pass discharge vent.

3.10 **Calibration Curve.** A graph or other systematic method of establishing the relationship between the analyzer response and the actual gas concentration introduced to the analyzer.

4. MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

4.1 **Analyzer Calibration Error.** Less than ±2 percent of the span for the zero, mid-range, and high-range calibration gases.

4.2 **Sampling System Bias.** Less than ±5 percent of the span for the zero and mid-range calibration gases.

4.3 **Zero Drift.** Less than ±3 percent of the span over the period of each run.

4.4 Calibration Drift. Less than ±3 percent of the span over the period of each run.

4.5 Interference Check. Less than ±7 percent of the modified Method 6 result for each run.

5. APPARATUS AND REAGENTS

5.1 Measurement System. Use any measurement system for SO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1. The essential components of the measurement system are described below:

5.1.1 Sample Probe. Glass, stainless steel, or equivalent, of sufficient length to traverse the sample points. The sampling probe shall be heated to prevent condensation.

5.1.2 Sample Line. Heated (sufficient to prevent condensation) stainless steel or Teflon tubing, to transport the sample gas to the moisture removal system.

5.1.3 Sample Transport Lines. Stainless steel or Teflon tubing, to transport the sample from the moisture removal system to the sample pump, sample flow rate control, and sample gas manifold.

5.1.4 Calibration Valve Assembly. A three-way valve assembly, or equivalent, for blocking the sample gas flow and introducing calibration gases to the measurement system at the outlet of the sampling probe when in the calibration mode.

5.1.5 Moisture Removal System. A refrigerator-type condenser or similar device (e.g., permeation dryer), to remove condensate continuously from the sample gas while maintaining minimal contact between the condensate and the sample gas. The moisture removal system is not necessary for analyzers that can measure gas concentrations on a wet basis; for these analyzers, (1) heat the sample line and all interface components up to the inlet of the analyzer sufficiently to prevent condensation, and (2) determine the moisture content and correct the measured gas concentrations to a dry basis using appropriate methods, subject to the approval of the Administrator. The determination of sample moisture content is not necessary for pollutant analyzers that measure concentrations on a wet basis when (1) a wet basis CO_2 analyzer operated according to Method 3A is used to obtain simultaneous measurements, and (2) the pollutant/CO_2 measurements are used to determine emissions in units of the standard.

5.1.6 Particulate Filter. An in-stack or heated (sufficient to prevent water condensation) out-of-stack filter. The filter shall be borosilicate or quartz glass wool, or glass fiber mat. Additional filters at the inlet or outlet of the moisture removal system and inlet of the analyzer may be used to prevent accumulation of particulate material in the measurement system and extend the useful life of the components. All filters shall be fabricated of materials that are nonreactive to the gas being sampled.

5.1.7 Sample Pump. A leak-free pump, to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The pump may be constructed of any material that is nonreactive to the gas being sampled.

5.1.8 Sample Flow Rate Control. A sample flow rate control valve and rotameter, or equivalent, to maintain a constant sampling rate within 10 percent. (Note: The tester may elect to install a back-pressure regulator to maintain the sample gas manifold at a constant pressure in order to protect the analyzer(s) from overpressurization, and to minimize the need for flow rate adjustments.)

5.1.9 Sample Gas Manifold. A sample gas manifold, to divert a portion of the sample gas stream to the analyzer and the remainder to the by-pass discharge vent. The sample gas manifold should also include provisions for introducing calibration gases directly to the analyzer. The manifold may be constructed of any material that is nonreactive to the gas being sampled.

5.1.10 Gas Analyzer. A UV or NDIR absorption or fluorescence analyzer, to determine continuously the SO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. (Note: Housing the analyzer(s) in a clean, thermally-stable, vibration-free environment will minimize drift in the analyzer calibration.)

5.1.11 Data Recorder. A strip chart recorder, analog computer, or digital recorder, for recording measurement data. The data recorder resolution (i.e., readability) shall be 0.5 percent of span. Alternatively, a digital or analog meter having a resolution of 0.5 percent of span may be used to obtain the analyzer responses and the readings may be recorded manually. If this alternative is used, the readings shall be obtained at equally spaced intervals over the duration of the sampling run. For sampling run durations of less than 1 hour, measurements at 1-minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be obtained. For sampling run durations greater than 1 hour, measurements at 2-minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be obtained.

5.2 Method 6 Apparatus and Reagents. The apparatus and reagents described in Method 6 and shown by the schematic of the sampling train in Figure 6C-2 are used to conduct the interference check.

5.3 SO_2 Calibration Gases. The calibration gases for the gas analyzer shall be SO_2 in N_2 or SO_2 in air. Alternatively, SO_2/CO_2, SO_2/O_2, or $SO_2/CO_2/O_2$ gas mixtures in N_2 may be used. For fluorescence-based analyzers, the O_2 and CO_2 concentrations of the calibration gases as introduced to the analyzer shall be within 1 percent (absolute) O_2 and 1 percent (absolute) CO_2 of the O_2 and CO_2 concentrations of the effluent samples introduced to the analyzer. Alternatively, for fluorescence-based analyzers, use calibration blends of SO_2 in air and the nomographs provided by the vendor to determine the quenching

correction factor (the effluent O_2 and CO_2 concentrations must be known). Use three calibration gases as specified below:

5.3.1 High-Range Gas. Concentration equivalent to 80 to 100 percent of the span.

5.3.2 Mid-Range Gas. Concentration equivalent to 40 to 60 percent of the span.

5.3.3 Zero Gas. Concentration of less than 0.25 percent of the span. Purified ambient air may be used for the zero gas by passing air through a charcoal filter or through one or more impingers containing a solution of 3 percent H_2O_2.

6. MEASUREMENT SYSTEM PERFORMANCE TEST PROCEDURES

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. There are two alternatives for establishing the concentrations of calibration gases. Alternative No. 1 is preferred.

6.1.1 Alternative No. 1--Use of calibration gases that are analyzed following the Environmental Protection Agency Traceability Protocol No. 1 (see Citation 1 in Bibliography). Obtain a certification from the gas manufacturer that Protocol No. 1 was followed.

6.1.2 Alternative No. 2--Use of calibration gases not prepared according to Protocol No. 1. If this alternative is chosen, obtain gas mixtures with a manufacturer's tolerance not to exceed ±2 percent of the tag value. Within 6 months before the emission test, analyze each of the calibration gases in triplicate using Method 6. Citation 2 in the Bibliography describes procedures and techniques that may be used for this analysis. Record the results on a data sheet (example is shown in Figure 6C-3). Each of the individual SO_2 analytical results for each calibration gas shall be within 5 percent (or 5 ppm, whichever is greater) of the triplicate set average; otherwise, discard the entire set and repeat the triplicate analyses. If the average of the triplicate analyses is within 5 percent of the calibration gas manufacturer's cylinder tag value, use the tag value; otherwise, conduct at least three additional analyses until the results of six consecutive runs agree within 5 percent (or 5 ppm, whichever is greater) of the average. Then use this average for the cylinder value.

6.2 Measurement System Preparation. Assemble the measurement system by following the manufacturer's written instructions for preparing and preconditioning the gas analyzer and, as applicable, the other system components. Introduce the calibration gases in any sequence, and make all necessary adjustments to calibrate the analyzer and the data recorder. Adjust system components to achieve correct sampling rates.

6.3 Analyzer Calibration Error. Conduct the analyzer calibration error check by introducing calibration gases to the measurement system at any point upstream of the gas analyzer as follows:

6.3.1 After the measurement system has been prepared for use, introduce the zero, mid-range, and high-range gases to the analyzer. During this check, make no adjustments to the system except those necessary to achieve the correct calibration gas flow rate at the analyzer. Record the analyzer responses to each calibration gas on a form similar to Figure 6C-4. Note: A calibration curve established prior to the analyzer calibration error check may be used to convert the analyzer response to the equivalent gas concentration introduced to the analyzer. However, the same correction procedure shall be used for all effluent and calibration measurements obtained during the test.

6.3.2 The analyzer calibration error check shall be considered invalid if the gas concentration displayed by the analyzer exceeds ±2 percent of the span for any of the calibration gases. If an invalid calibration is exhibited, take corrective action and repeat the analyzer calibration error check until acceptable performance is achieved.

6.4 **Sampling System Bias Check.** Perform the sampling system bias check by introducing calibration gases at the calibration valve installed at the outlet of the sampling probe. A zero gas and either the mid-range or high-range gas, whichever most closely approximates the effluent concentrations, shall be used for this check as follows:

6.4.1 Introduce the upscale calibration gas, and record the gas concentration displayed by the analyzer on a form similar to Figure 6C-5. Then introduce zero gas, and record the gas concentration displayed by the analyzer. During the sampling system bias check, operate the system at the normal sampling rate, and make no adjustments to the measurement system other than those necessary to achieve proper calibration gas flow rates at the analyzer. Alternately introduce the zero and upscale gases until a stable response is achieved. The tester shall determine the measurement system response time by observing the times required to achieve a stable response for both the zero and upscale gases. Note the longer of the two times as the response time.

6.4.2 The sampling system bias check shall be considered invalid if the difference between the gas concentrations displayed by the measurement system for the analyzer calibration error check and for the sampling system bias check exceeds ±5 percent of the span for either the zero or upscale calibration gases. If an invalid calibration is exhibited, take corrective action, and repeat the sampling system bias check until acceptable performance is achieved. If adjustment to the analyzer is required, first repeat the analyzer calibration error check, then repeat the sampling system bias check.

7. EMISSION TEST PROCEDURE

7.1 **Selection of Sampling Site and Sampling Points.** Select a measurement site and sampling points using the same criteria that are applicable to Method 6.

7.2 **Interference Check Preparation.** For each individual analyzer, conduct an interference check for at least three runs per during the initial field test on a particular source category. Retain the results, and report them with each test performed on that source category. If an interference check is being performed,

assemble the modified Method 6 train (flow control valve, two midget impingers containing 3 percent H_2O_2, and dry gas meter) as shown in Figure 6C2. Install the sampling train to obtain a sample at the measurement system sample by-pass discharge vent. Record the initial dry gas meter reading.

7.3 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for Method 6 plus twice the average system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration. If an interference check is being performed, open the flow control valve on the modified Method 6 train concurrent with the initiation of the sampling period, and adjust the flow to 1 liter per minute (±10 percent). (Note: If a pump is not used in the modified Method 6 train, caution should be exercised in adjusting the flow rate since over-pressurization of the impingers may cause leakage in the impinger train, resulting in positively biased results).

7.4 Zero and Calibration Drift Tests. Immediately preceding and following each run, or if adjustments are necessary for the measurement system during the run, repeat the sampling system bias check procedure described in Section 6.4. (Make no adjustments to the measurement system until after the drift checks are completed.) Record the analyzer's responses on a form similar to Figure 6C5.

7.4.1 If either the zero or upscale calibration value exceeds the sampling system bias specification, then the run is considered invalid. Repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before repeating the run.

7.4.2 If both the zero and upscale calibration values are within the sampling system bias specification, then use the average of the initial and final bias check values to calculate the gas concentration for the run. If the zero or upscale calibration drift value exceeds the drift limits, based on the difference between the sampling system bias check responses immediately before and after the run, repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before conducting additional runs.

7.5 Interference Check (if performed). After completing the run, record the final dry gas meter reading, meter temperature, and barometric pressure. Recover and analyze the contents of the midget impingers, and determine the SO_2 gas concentration using the procedures of Method 6. (It is not necessary to analyze EPA performance audit samples for Method 6.) Determine the average gas concentration exhibited by the analyzer for the run. If the gas concentrations provided by the analyzer and the modified Method 6 differ by more than 7 percent of the modified Method 6 result, the run is invalidated.

8. EMISSION CALCULATION

The average gas effluent concentration is determined from the average gas concentration displayed by the gas analyzer and is adjusted for the zero and upscale sampling system bias checks, as determined in accordance with Section 7.4. The average gas concentration displayed by the analyzer may be determined by integration of the area under the curve for chart recorders, or by averaging all of the effluent measurements. Alternatively, the average may be calculated from measurements recorded at equally spaced intervals over the entire duration of the run. For sampling run durations of less than 1 hour, measurements at 1-minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be used. For sampling run durations greater than 1 hour, measurements at 2-minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be used. Calculate the effluent gas concentration using Equation 6C-1.

$$\overline{C_{gas}} = (C_{avg} - C_o)\frac{C_{ma}}{(C_m - C_o)} \qquad \text{Eq. 6C-1}$$

where:

C_{gas} = Effluent gas concentration, dry basis, ppm.

C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, ppm.

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.

C_{ma} = Actual concentration of the upscale calibration gas, ppm.

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2. Westlin, Peter R. and John W. Brown. Methods for Collecting and Analyzing Gas Cylinder Samples. Source Evaluation Society Newsletter. 3(3):5-15. September 1978.

Method 7E - Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)

1. APPLICABILITY AND PRINCIPLE

1.1 Applicability. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream; a portion of the sample stream is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data.

2. RANGE AND SENSITIVITY

Same as in Method 6C, Sections 2.1 and 2.2.

3. DEFINITIONS

3.1 Measurement System. The total equipment required for the determination of NO_x concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface, Gas Analyzer, and Data Recorder. Same as in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.1.2 NO_2 to NO Converter. A device that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO).

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as in Method 6C, Sections 3.2 through 3.8.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

Same as in Method 6C, Sections 4.1 through 4.4.

5. APPARATUS AND REAGENTS

5.1 Measurement System. Use any measurement system for NO_x that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as in Method 6C, Sections 5.1.1 through 5.1.9, and 5.1.11.

5.1.2 NO_2 to NO Converter. That portion of the system that converts NO_2 in the sample gas to NO. A NO_2 to NO converter is not necessary if the NO_2 portion of the exhaust gas is less than 5 percent of the total NO_x concentration.

5.1.3 NO_x Analyzer. An analyzer based on the principles of chemiluminescence to determine continuously the NO_x concentration in the sample gas stream. The analyzer must meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) must be provided at the analyzer.

5.2 NO_x Calibration Gases. The calibration gases for the NO_x analyzer shall be NO in N_2. Use four calibration gases as specified in Method 6C, Sections 5.3.1 through 5.3.3. Ambient air may be used for the zero gas.

6. MEASUREMENT SYSTEM PERFORMANCE TEST PROCEDURES

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. Same as in Method 6C, Section 6.1, except if calibration gas analysis is required, use Method 7, and change all 5 percent performance values to 10 percent (or 10 ppm, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, Response Time, and Sample System Bias Check. Same as in Method 6C, Sections 6.2 through 6.4.

6.4 NO_2 to NO Conversion Efficiency. If the NO_2 concentration within the sample stream is greater than 5 percent of the NO_x concentration, conduct an NO_2 to NO conversion efficiency test in accordance with Section 5.6 of Method 20.

7. EMISSION TEST PROCEDURE

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the response time test. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Method 7 plus twice the average system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Same as in Method 6C, Section 7.4.

8. EMISSION CALCULATION

Same as in Method 6C, Section 8.

BIBLIOGRAPHY

Same as the bibliography of Method 6C.

METHOD 17-DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES (IN-STACK FILTRATION METHOD)

INTRODUCTION

Particulate matter is not an absolute quantity; rather, it is a function of temperature and pressure. Therefore, to prevent variability in particulate matter emission regulations and/or associated test methods, the temperature and pressure at which particulate matter is to be measured must be carefully defined. Of the two variables (i.e., temperature and pressure), temperature has the greater effect upon the amount of particulate matter in an effluent gas stream; in most stationary source categories, the effect of pressure appears to be negligible.

In Method 5, 250° F is established as a nominal reference temperature. Thus, where Method 5 is specified in an applicable subpart of the standards, particulate matter is defined with respect to temperature. In order to maintain a collection temperature of 250° F, Method 5 employs a heated glass sample probe and a heated filter holder. This equipment is somewhat cumbersome and requires care in its operation. Therefore, where particulate matter concentrations (over the normal range of temperature associated with a specified source category) are known to be independent of temperature, it is desirable to eliminate the glass probe and heating systems, and sample at stack temperature.

This method describes an in-stack sampling system and sampling procedures for use in such cases. It is intended to be used only when specified by an applicable subpart of the standards, and only within the applicable temperature limits (if specified), or when otherwise approved by the Administrator.

1. Principle and Applicability

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at stack temperature. The particulate mass is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method applies to the determination of particulate emissions from stationary sources for determining compliance with new source performance standards, only when specifically provided for in an applicable subpart of the standards. This method is not applicable to stacks that contain liquid droplets or are saturated with water vapor. In addition, this method shall not be used as written if the projected cross-sectional area of the probe extension-filter holder assembly covers more than 5 percent of the stack cross-sectional area (see Section 4.1.2).

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 17-1. Construction details for many, but not all, of

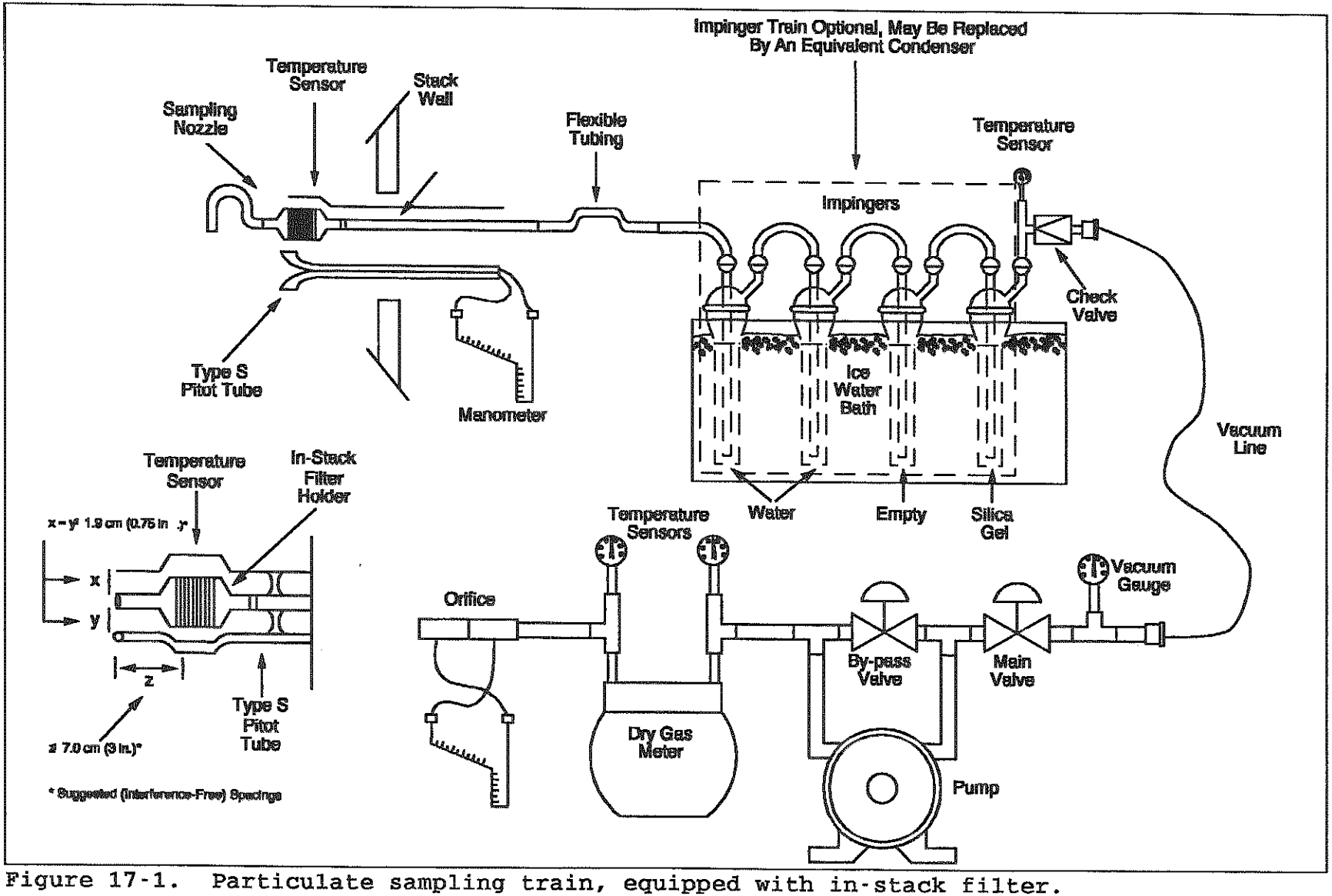

Figure 17-1. Particulate sampling train, equipped with in-stack filter.

the train components are given in APTD-0581 (Citation 2 in Bibliography); for changes from the APTD-0581 document and for allowable modifications to Figure 17-1, consult with the Administrator.

The operating and maintenance procedures for many of the sampling train components are described in APTD-0576 (Citation 3 in Bibliography). Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (316) or glass, with sharp, tapered leading edge. The angle of taper shall be 30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing. Other materials of construction may be used subject to the approval of the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm (1/8 to 1/2 in.)-or larger if higher volume sampling trains are used-inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.1.

2.1.2 Filter Holder. The in-stack filter holder shall be constructed of borosilicate or quartz glass, or stainless steel; if a gasket is used, it shall be made of silicone rubber, Teflon, or stainless steel. Other holder and gasket materials may be used subject to the approval of the Administrator. The filter holder shall be designed to provide a positive seal against leakage from the outside or around the filter.

2.1.3 Probe Extension. Any suitable rigid probe extension may be used after the filter holder.

2.1.4 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator; the pitot tube shall be attached to the probe extension to allow constant monitoring of the stack gas velocity (see Figure 17-1). The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane during sampling (see Method 2, Figure 2-6b). It is recommended: (1) that the pitot tube have a known baseline coefficient, determined as outlined in Section 4 of Method 2; and (2) that this known coefficient be preserved by placing the pitot tube in an interference-free arrangement with respect to the sampling nozzle, filter holder, and temperature sensor (see Figure 17-1). Note that the 1.9 cm (0.75 in.) free-space between the nozzle and pitot tube shown in Figure 17-1, is based on a 1.3 cm (0.5 in.) ID nozzle. If the sampling train is designed for sampling at higher flow rates than that described in APTD-0581, thus necessitating the use of larger sized nozzles, the free-space shall be 1.9 cm (0.75 in.) with the largest sized nozzle in place.

Source-sampling assemblies that do not meet the minimum spacing requirements of Figure 17-1 (or the equivalent of these requirements, e.g., Figure 2-7 of Method 2) may be used; however, the pitot tube coefficients of such assemblies shall be determined by calibration, using methods subject to the approval of the Administrator.

2.1.5 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (^p) readings, and the other, for orifice differential pressure readings.

2.1.6 Condenser. It is recommended that the impinger system described in Method 5 be used to determine the moisture content of the stack gas. Alternatively, any system that allows measurement of both the water condensed and the moisture leaving the condenser, each to within 1 ml or 1 g, may be used. The moisture leaving the condenser can be measured either by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a silica gel trap with exit gases kept below 20° C (68° F) and determining the weight gain.

Flexible tubing may be used between the probe extension and condenser. If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

2.1.7 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 17-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications of this method are met.

2.1.8 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in.
Hg). In many cases, the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.9 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3.

The temperature sensor shall be attached to either the pitot tube or to the probe extension, in a fixed configuration. If the temperature sensor is attached in the field, the sensor shall be placed in an interference-free arrangement with respect to the Type S pitot tube openings (as shown in Figure 17-1 or in Figure 2-7 of Method 2). Alternatively, the temperature sensor need not be attached to either the probe extension or pitot tube during sampling, provided that a difference of not more than 1 percent in the average velocity measurement is introduced. This alternative is subject to the approval of the Administrator.

2.2 Sample Recovery.

2.2.1 Probe Nozzle Brush. Nylon bristle brush with stainless steel wire handle. The brush shall be properly sized and shaped to brush out the probe nozzle.

2.2.2 Wash Bottles-Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples; glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable for use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.3 Analysis.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 mg.

2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. Reagents

3.1 Sampling.

3.1.1 Filters. The in-stack filters shall be glass mats or thimble fiber filters, without organic binders, and shall exhibit at least 99.95 percent efficiency (0.05 percent penetration) on 0.3 micron dioctyl phthalate smoke particles. The filter efficiency tests shall be conducted in accordance with ASTM Standard Method D2986 - 71 (Reapproved 1978) (incorporated by reference-see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose.

3.1.2 Silica Gel. Indicating type, 6- to 16-mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Crushed Ice.

3.1.4 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.1.5 Water. Same as in Method 5, section 3.1.3.

3.2 Sample Recovery. Acetone, reagent grade, 0.001 percent residue, in glass bottles. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers. Thus, acetone blanks shall be run prior to field use and only acetone with low blank values (0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis.

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type.
Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. All components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in its impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper size on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105° C (220° F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Make a projected-area model of the probe extension-filter holder assembly, with the pitot tube face openings positioned along the centerline of the stack, as shown in Figure 17-2. Calculate the estimated cross-section blockage, as

shown in Figure 17-2. If the blockage exceeds 5 percent of the duct cross sectional area, the tester has the following options: (1) a suitable out-of-stack filtration method may be used instead of in-stack filtration; or (2) a special in-stack arrangement, in which the sampling and velocity measurement sites are separate, may be used; for details concerning this approach, consult with the Administrator (see also Citation 10 in Bibliography). Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture

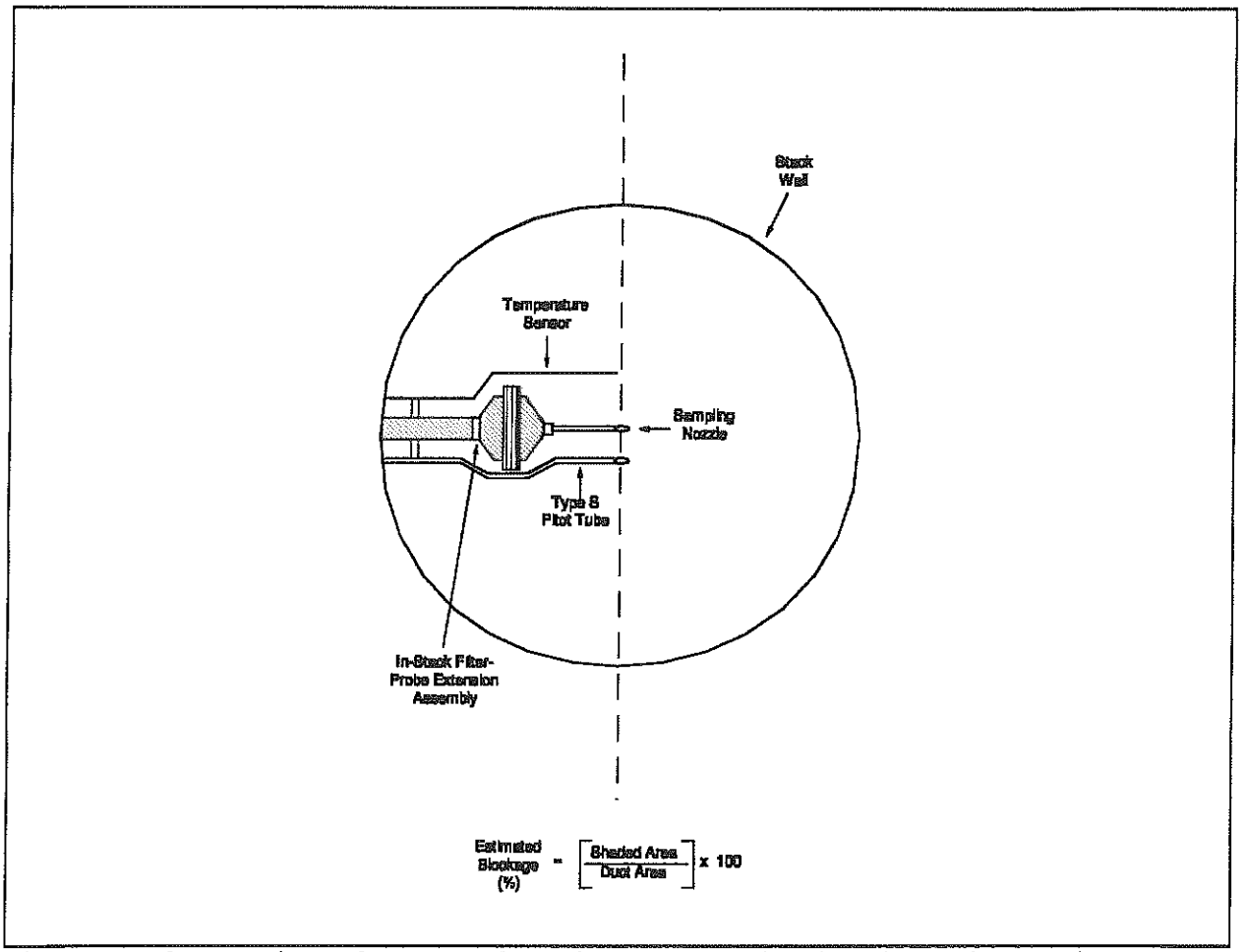

Figure 17-2. Projected-area model of cross-section blockage (approximate average for a sample traverse) caused by an in-stack filter holder-probe extension assembly.

content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a probe extension length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 minutes (or some greater time interval if specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an

integer plus one-half minute, in order to avoid timekeeping errors.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

If impingers are used to condense stack gas moisture, prepare them as follows: place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

If some means other than impingers is used to condense moisture, prepare the condenser (and, if appropriate, silica gel for condenser outlet) for use.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as not to allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed. Mark the probe extension with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Assemble the train as in Figure 17-1, using a very light coat of silicone grease on all ground glass joints and greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Place crushed ice around the impingers.

4.1.4 Leak Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, plug the inlet to the probe nozzle with a material that will be able to withstand the stack temperature. Insert the filter holder into the stack and wait approximately 5 minutes (or longer, if necessary) to allow the system to come to equilibrium with the temperature of the stack gas stream. Turn on the pump and draw a vacuum of at least 380 mm Hg (15 in. Hg); note that a lower vacuum may be used, provided that it is not exceeded during the test. Determine the leakage rate. A leakage rate in excess of 4 percent of the average sampling rate or 0.00057 m3/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until the desired vacuum is reached. Do not reverse direction of by-pass valve. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe nozzle and immediately turn off the vacuum pump. This prevents water from being forced backward and keeps silica gel from being entrained backward.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-Test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain a sampling rate such that sampling is within 10 percent of true isokinetic, unless otherwise specified by the Administrator.

For each run, record the data required on the example data sheet shown in Figure 17-3. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak check, and when sampling is halted. Take other readings required by Figure 17-3 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling the deposited material. To begin sampling, remove the nozzle cap and verify that the pitot tube and probe extension are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid

Plant _____
Location _____
Operator _____
Date _____
Run No. _____
Sample box No. _____
Meter box No. _____
Meter ΔH@ _____
C factor _____
Pitot tube coefficient, Cp _____

SCHEMATIC OF STACK CROSS SECTION

Barometric pressure _____
Assumed moisture, % _____
Probe length, (ft.) _____
Nozzle identification No. _____
Average calibrated nozzle diameter, (in.) _____
Filter No. _____
Leak rate, (cfm) _____
Static pressure, (in. Hg) _____

Traverse point number	Sampling time	Vacuum	Stack temperature	Velocity head	Pressure differential across orifice meter	Gas meter reading	Gas sample temperature at dry gas meter		Filter temperature	Temperature of gas leaving condenser or last impinger
					ΔH	V_m	Inlet	Outlet		
	min.	(in.Hg)	(T_s) (°F)	(ΔP_s) (in. H_2O)	(in. H_2O)	(ft^3)	(°F)	(°F)	(°F)	(°F)
Total							Avg.	Avg.		
Average							(T_m)			

Figure 17-3. Particulate Field Data Sheet.

adjustment to the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29±4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe extension assembly into the stack to prevent water from being forced backward. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe extension through the portholes, to minimize chance of extracting deposited material.

During the test run, take appropriate steps (e.g., adding crushed ice to the impinger ice bath) to maintain a temperature of less than 20° C (68° F) at the condenser outlet; this will prevent excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter holder assembly be used rather than attempting to change the filter itself. Before a new filter holder is installed, conduct a leak check, as outlined in Section 4.1.4.2. The total particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or, in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator. Note that when two or more trains are used, a separate analysis of the collected particulate from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case the particulate catches from the individual trains may be combined and a single analysis performed.

At the end of the sample run, turn off the pump, remove the probe extension assembly from the stack, and record the final dry gas meter reading. Perform a leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Section 3.1 of Method 2; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Section 6.11) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe extension assembly is removed from the stack at the end of the sampling period. Allow the assembly to cool.

When the assembly can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, forcing condenser water backward.

Before moving the sample train to the cleanup site, disconnect the filter holder-probe nozzle assembly from the probe extension; cap the open inlet of the probe extension. Be careful not to lose any condensate, if present. Remove the umbilical cord from the condenser outlet and cap the outlet. If a flexible line is used between the first impinger (or condenser) and the probe extension, disconnect the line at the probe extension and let any condensed water or liquid drain into the impingers or condenser. Disconnect the probe extension from the condenser; cap the probe extension outlet. After wiping off the silicone grease, cap off the condenser inlet. Ground glass stoppers, plastic caps, or serum caps (whichever are appropriate) may be used to close these openings.

Transfer both the filter holder-probe nozzle assembly and the condenser to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank." Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe nozzle or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, fitting, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse with acetone the inside parts of the fitting in a similar way until no visible particles remain. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Rinse the brush with acetone and quantitatively collect these washings in the sample container. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints are wiped clean of silicone grease (if applicable), clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make final rinse of the brush and filter holder. After all acetone washings and particulate matter are collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label the container to clearly identify its contents.

Container No. 3. If silica gel is used in the condenser system for mositure content determination, note the color of the gel to determine if it has been completely spent; make a notation of its condition. Transfer the silica gel back to its original container and seal. A funnel may make it easier to pour the silica gel without spilling, and a rubber policeman may be used as an aid in removing the silica gel. It is not necessary to remove the small amount of dust particles that may adhere to the walls and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for Container No. 3 under "Analysis."

Condenser Water. Treat the condenser or impinger water as follows: make a notation of any color or film in the liquid catch. Measure the liquid volume to within ±1 ml by using a graduated cylinder or, if a balance is available, determine the liquid weight to within ±0.5 g. Record the total volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas. Discard the liquid after measuring and recording the volume or weight.

4.3 Analysis. Record the data required on the example sheet shown in Figure 17-4. Handle each sample container as follows:

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of

no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at the average stack temperature or 105° C (220° F), whichever is less, for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at the average stack temperature or 105° C (220° F), whichever is less, for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container
and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. This step may be conducted in the field. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance.

FIGURE 17-4 - ANALYTICAL DATA

Plant _____
Date _____
Run No. _____
Filter No. _____
Amount liquid lost during transport _____
Acetone blank volume, ml _____
Acetone blank concentration, mg/mg (Equation 17-4)_____
Acetone wash blank, mg (Equation 17-5) _____

Container number	Weight of particulate collected, mg		
	Final weight	Tare weight	Weight gain
1.			
2.			
Total			
Less acetone blank			
Weight of particulate matter			

	Volume of liquid water collected	
	Impinger volume, ml	Silica gel weight, g
Final.....		
Initial.....		
Liquid collected		
Total volume collected....		g* ml

*Convert weight of water to volume by dividing total weight increase by density of water (1 g/ml).

$$\frac{\text{Increase, g}}{(1\text{g/ml})} = \text{Volume water, ml}$$

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Note: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

5. Calibration

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. If the pitot tube is placed in an interference-free arrangement with respect to the other probe assembly components, its baseline (isolated tube) coefficient shall be determined as outlined in Section 4 of Method 2. If the probe assembly is not interference-free, the pitot tube assembly coefficient shall be determined by calibration, using methods subject to the approval of the Administrator.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m3/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m3/min (0.02 cfm).

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

Alternative procedures, e.g., using the orifice meter coefficients, may

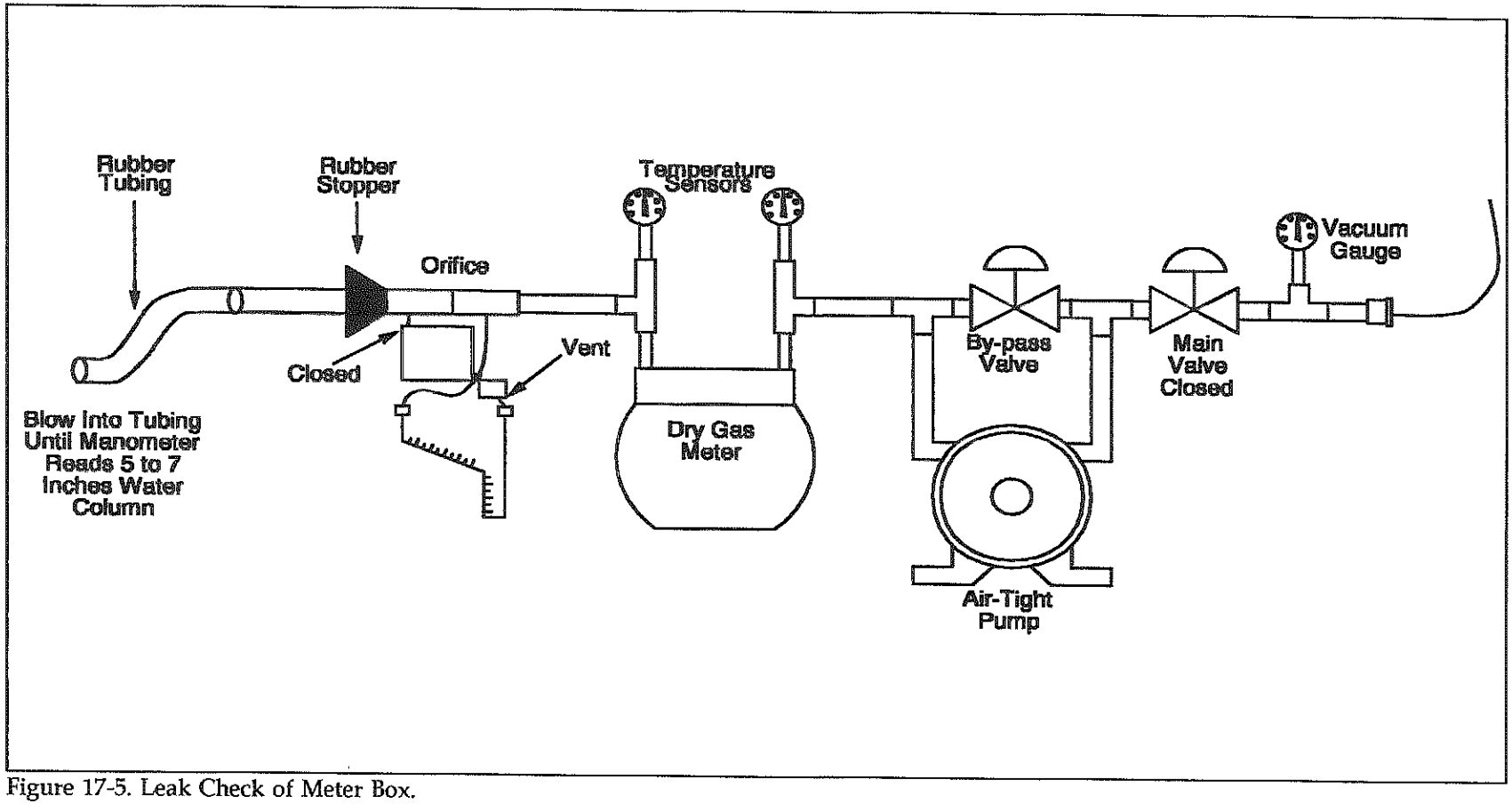

Figure 17-5. Leak Check of Meter Box.

be used, subject to the approval of the Administrator.

Note: If the dry gas meter coefficient values obtained before and after atest series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.5 Leak Check of Metering System Shown in Figure 17-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 17-5). Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.6 Barometer. Calibrate against a mercury barometer.

6. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m^2 (ft^2).
B_{ws} = Water vapor in the gas stream, proportion by volume.
C_a = Acetone blank residue concentration, mg/mg.
c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
I = Percent of isokinetic sampling.
L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.
L_i = Individual leakage rate observed during the leak check conducted prior to the "ith" component change (i=1, 2, 3 . . . n), m^3/min (cfm).
L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).
m_a = Mass of residue of acetone after evaporation, mg.
m_n = Total amount of particulate matter collected, mg.
M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 mm Hg-m3/°K-g-mole (21.85 in. Hg-ft^3/°R-lb-mole).
T_m = Absolute average dry gas meter temperature (see Figure 17 3), °K (°R).
T_s = Absolute average stack gas temperature (see Figure 17-3), °K (°R).
T_{std} = Standard absolute temperature, 293°K (528°R).
V_a = Volume of acetone blank, ml.
V_{aw} = Volume of acetone used in wash, ml.
V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 17-4), ml.
V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$ =Volume of gas sample measured by the dry gas meter, corrected to standard conditions,

dscm (dscf).

$V_{w(std)}$ =Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 17, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration coefficient.

ΔH = Average pressure differential across the orifice meter (see Figure 17-3), mm H2O (in. H2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (nth) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 17-3).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20 °C, 760 mm Hg or 68 °F, 29.92 in. Hg) by using Equation 17-1.

$$V_{m(std)} = V_m Y \frac{T_{std} \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m P_{std}}$$

$$= K_1 V_m Y \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m} \qquad \text{Eq. 17-1}$$

where:

K_1 = 0.3858 °K/mm Hg for metric units,

= 17.64 °R/in. Hg for English units.

NOTE: Equation 17-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 17-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 17-1 with the expression:

$$[V_m - (L_p - L_a)\,\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 17-1 by the expression:

n

$$[V_m - (L_1 - L_a)\,\theta_1 - \sum_{i=2} (L_i - L_a)\,\theta_i - (L_p - L_a)\,\theta_p]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of Water Vapor.

$$V_{w(std)} = V_{lc}\,\frac{\rho_w\, R\, T_{std}}{M_w\, P_{std}} = K_2\, V_{lc} \qquad \text{Eq. 17-2}$$

where:

K_2 = 0.001333 m^3/ml for metric units,
= 0.04707 ft^3/ml for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \qquad \text{Eq. 17-3}$$

6.6 Acetone Blank Concentration.

$$C_a = \frac{m_a}{V_a\, \rho_a} \qquad \text{Eq. 17-4}$$

6.7 Acetone Wash Blank.

$$W_a = C_a\, V_{aw}\, \rho_a \qquad \text{Eq. 17-5}$$

6.8 Total Particulate Weight. Determine the total particulate matter catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank (see Figure 17-4).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$c_s = (0.001\ g/mg)(m_n/V_{m(std)}) \qquad \text{Eq. 17-6}$$

6.10 Conversion Factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft^3	gr/ft^3	15.43

g/ft^3	lb/ft^3	2.205×10^{-3}
g/ft^3	g/m^3	35.31

6.11 Isokinetic Variation.

6.11.1 Calculation from Raw Data.

$$I = \frac{100\ T_s \left[K_3\ V_{lc} + \frac{(V_m\ Y)}{T_m}\left(P_{bar} + \frac{\Delta H}{13.6}\right)\right]}{60\ \theta\ v_s\ P_s\ A_n} \qquad \text{Eq. 17-7}$$

where:

K_3 = 0.003454 [(mm Hg)(m^3)]/[(ml)(°K)] for metric units,

= 0.002669 [(in. Hg)(ft^3)]/[(ml)(°R)] for English units.

6.11.2 Calculation from Intermediate Values.

$$I = \frac{T_s\ V_{m(std)}\ P_{std}\ 100}{T_{std}\ v_s\ \theta\ A_n\ P_s\ 60\ (1-B_{ws})}$$

$$= K_4 \frac{T_s\ V_{m(std)}}{P_s\ v_s\ A_n\ \theta\ (1\ -\ B_{ws})} \qquad \text{Eq. 17-8}$$

where:

K_4 = 4.320 for metric units,

= 0.09450 for English units.

6.11.3 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the PM results are low in comparison to the standard, and "I" is over 110 percent or less than 90 percent, the Administrator may opt to accept the results. Use citation 4 in Bibliography to make acceptability judgments. Otherwise, reject the results and repeat the test.

7. Bibliography

1. Addendum to Specifications for Incinerator Testing at Federal Facilities. PHS, NCAPC. December 6, 1967.

2. Martin, Robert M., Construction Details of Isokinetic Source-Sampling Equipment. Environmental Protection Agency. Research Triangle Park, NC, APTD-0581. April, 1971.

3. Rom, Jerome J., Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment. Environmental Protection Agency. Research Triangle Park, NC APTD-0576. March, 1972.

4. Smith, W. S., R. T. Shigehara, and W. F. Todd. A Method of Interpreting Stack Sampling Data. Paper Presented at the 63rd Annual Meeting of the Air Pollution Control Association, St. Louis, MO June 14-19, 1970.

5. Smith, W. S., et al., Stack Gas Sampling Improved and Simplified with New Equipment. APCA Paper No. 67-119. 1967.

6. Specifications for Incinerator Testing at Federal Facilities. PHS, NCAPC. 1967.

Attached, please find the existing Phase I Acid Rain permit for Merrimack Station. Also attached, please find the previously submitted Phase II Acid Rain permit application for Merrimack Station.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

PHASE I ACID RAIN PERMIT

Issued to: Merrimack
Operated by: Northeast Utilities
Effective: January 1, 1995 to December 31, 1999

Summary of Previous Actions

This page will be replaced to document new EPA actions each time a new action is taken by the Agency. The following actions have been taken:

1. Draft Permit, including SO2 Compliance Plan, issued for public comment (see page 1) on July 27, 1993.

Present Action

2. SO2 portion of permit issued as direct final permit which will be final 40 days after notice in the Federal Register, unless significant adverse comment is received within 30 days after publication.

Signature

7/22/94
Date

John P. DeVillars, Regional Administrator
U.S. Environmental Protection Agency,
Region 1
J F Kennedy Federal Building
Boston, MA 02203
Telephone: 617-565-3400
Facsimile: 617-565-3415

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

PHASE I ACID RAIN PERMIT

Issued to: Merrimack Station
Operated by: Northeast Utilites
Effective: January 1, 1995 to December 31, 1999

The Acid Rain Permit comprises the following:

1. The statement of basis prepared by EPA containing:

   Part A, with references to statutory and regulatory authorities, and comments, notes and justifications that apply to the source in general; and

   Part B, for each unit at this source:
   - a table of SO_2 allowances to be allocated under this permit during Phase I, and
   - comments, notes and justifications regarding permit decisions and changes made to the permit application during the review process, and any additional requirements.

2. The permit application dated February 10, 1993 that this source submitted, as corrected on March 2, 1993. The owners and operators of the source must comply with the standard requirements and special provisions set forth in the application.

Draft Permit Approval: Paul Keough 7-27-93
Signature Date

Final Permit Approval: _____
Signature Date

Paul G. Keough
Acting Regional Administrator
U.S. Environmental Protection Agency,
Region 1
JFK Federal Building
Boston, MA 02203
Telephone: 617-565-3400
Facsimile: 617-565-3415

SAVE IT!
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Plant Name: Merrimack
State: New Hampshire
ORIS Code: 2364

Statutory and Regulatory Authorities. In accordance with Title IV of the Clean Air Act Amendments of 1990, the U. S. Environmental Protection Agency issues this permit pursuant to 40 CFR part 72, subparts E and F.

Comments, notes and justifications that apply to the source in general: Due to a typographical error on the Phase I Permit Application form, the reference on the Phase I Permit Application form at Step 2 "Hold allowances in accordance with 40 CFR 72.9(d)(1)" has been changed to "Hold allowances in accordance with 40 CFR 72.9(c)(1)"

IAN O. Cohen		July 18, 1994
Permit Reviewer	Signature	Date

Plant Name: Merrimack
State: NH
ORIS Code: 2364
Boiler ID#: 1

Phase I SO_2 Allowance Allocation

	1995	1996	1997	1998	1999
Table 1 40 CFR 73.10	9922	9922	9922	9922	9922
Phase I Extension 40 CFR 72.42	NA	NA	NA	NA	NA
Substitution 40 CFR 72.41	0	0	0	0	0
Reduced Utilization 40 CFR 72.43	0	0	0	0	0

Comments, notes and justifications regarding permit decisions, and changes made to the permit application forms during the review process:

Consistent with the Partial Settlement Agreement in Environmental Defense Fund v. Carol M. Browner, No. 93-1203 (executed on May 4, 1994):

1. EPA approves 2 conditional substitution plans for this unit for 1995-1999 that designate Newington unit 1 and Mount Tom unit 1 as substitution units. In these plans, Merrimack unit 2, a Phase I unit, also designates the same substitution units. The substitution plans for these units are revised to reflect changes in values used to allocate allowances to the substitution units.

2. EPA's approval of the conditional substitution plans for this unit is subject to the procedures, set forth in Part A of the Statements of Basis of the permits for Newington and Mount Tom, for applying the most stringent federally enforceable or state enforceable emissions limitation for purposes of allocating allowances to substitution units.

EPA approves a reduced utilization plan for this unit for 1995-1999. The plan may result in: (1) a shift of generation from this unit to the following sulfur-free generators: Seabrook unit 1 and Millstone unit 3, and (2) reliance on energy conservation measures. There is no allowance allocation for the use of sulfur-free generation or energy conservation.

On April 15, 1993, EPA received a revised reduced utilization plan designating Seabrook unit 1 and Millstone unit 3 as sulfur-free generators for Merrimack units 1 and 2. This plan superseded a plan which had named Seabrook unit 1 and Hydro-Quebec as sulfur-free generators.

Ian D. Cohen		July 13 1994
Permit Reviewer	Signature	Date

Plant Name: Merrimack
State: NH
ORIS Code: 2364
Boiler ID#: 2

Phase I SO_2 Allowance Allocation

	1995	1996	1997	1998	1999
Table 1 40 CFR 73.10	21421	21421	21421	21421	21421
Phase I Extension 40 CFR 72.42	NA	NA	NA	NA	NA
Substitution 40 CFR 72.41	0	0	0	0	0
Reduced Utilization 40 CFR 72.43	0	0	0	0	0

Comments, notes and justifications regarding permit decisions, and changes made to the permit application forms during the review process:

Consistent with the Partial Settlement Agreement in Environmental Defense Fund v. Carol M. Browner, No. 93-1203 (executed on May 4, 1994):

1. EPA approves 2 conditional substitution plans for this unit for 1995-1999 that designate Newington unit 1 and Mount Tom unit 1 as substitution units. In these plans, Merrimack unit 1, a Phase I unit, also designates the same substitution units. The substitution plans for these units are revised to reflect changes in values used to allocate allowances to the substitution units.

2. EPA's approval of the conditional substitution plans for this unit is subject to the procedures, set forth in Part A of the Statements of Basis of the permits for Newington and Mount Tom, for applying the most stringent federally enforceable or state enforceable emissions limitation for purposes of allocating allowances to substitution units.

EPA approves a reduced utilization plan for this unit for 1995-1999. The plan may result in: (1) a shift of generation from this unit to the following sulfur-free generators: Seabrook unit 1 and Millstone unit 3, and (2) reliance on energy conservation measures. There is no allowance allocation for the use of sulfur-free generation or energy conservation.

On April 15, 1993, EPA received a revised reduced utilization plan designating Seabrook unit 1 and Millstone unit 3 as sulfur-free generators for Merrimack units 1 and 2. This plan superseded a plan which had named Seabrook unit 1 and Hydro-Quebec as sulfur-free generators.

IAN D. Cohen		July 18 1994
Permit Reviewer	Signature	Date

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-95

EPA Phase I Permit Application

FEB 16 1993

For more information, see instructions and refer to 40 CFR 72.30 and 72.31

This submission is: [X] New [ ] Revised

STEP 1
Identify the source by plant name, State, and ORIS code from NADB

Plant Name	State	ORIS Code
Merrimack Station	NH	2364

COMPLIANCE PLAN

STEP 2
Specify a compliance plan for this source by identifying each Table 1 and non-Table 1 unit at this source that is subject to Acid Rain Program emissions limitations during Phase I. Identify each unit by boiler ID# from NADB, and mark one or more boxes if you wish to identify additional methods of compliance for each unit

Table 1 Units

ID# 1

[X] Hold allowances in accordance with 40 CFR 72.9(c)(1) c 2 6/30/94
[X] Substitution plan (include Substitution Plan form)
[X] Reduced utilization plan (include Reduced Utilization Plan form)
[ ] Phase I extension plan (if this unit is a control unit, include Phase I Extension Plan form. If this unit is a transfer unit for a control unit at another source, do not include form but identify the control unit's source by plant name and State below)

Plant Name	State
N/A	

ID# 2

[X] Hold allowances in accordance with 40 CFR 72.9(c)(1) c 2 6/30/94
[X] Substitution plan (include Substitution Plan form)
[X] Reduced utilization plan (include Reduced Utilization Plan form)
[ ] Phase I extension plan (if this unit is a control unit, include Phase I Extension Plan form. If this unit is a transfer unit for a control unit at another source, do not include form but identify the control unit's source by plant name and State below)

Plant Name	State
N/A	

ID# N/A

[X] Hold allowances in accordance with 40 CFR 72.9(c)(1) c 2 6/30/94
[ ] Substitution plan (include Substitution Plan form)
[ ] Reduced utilization plan (include Reduced Utilization Plan form)
[ ] Phase I extension plan (if this unit is a control unit, include Phase I Extension Plan form. If this unit is a transfer unit for a control unit at another source, do not include form but identify the control unit's source by plant name and State below)

Plant Name	State

ID# N/A

[X] Hold allowances in accordance with 40 CFR 72.9(c)(1) c 2 6/30/94
[ ] Substitution plan (include Substitution Plan form)
[ ] Reduced utilization plan (include Reduced Utilization Plan form)
[ ] Phase I extension plan (if this unit is a control unit, include Phase I Extension Plan form. If this unit is a transfer unit for a control unit at another source, do not include form but identify the control unit's source by plant name and State below)

Plant Name	State

Plant Name (from Step 1) Merrimack Station

Non-Table 1 Units

ID# N/A

- [X] Hold allowances in accordance with 40 CFR 72.9(c)(1)
- [ ] Control unit (include Phase I Extension Plan form)
- [ ] Substitution unit (if this is a substitution unit for one or more Table 1 unit(s) at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

- [ ] Reduced utilization plan; unit to be underutilized (include Reduced Utilization Plan form)
- [ ] Compensating unit (if this is a compensating unit for one or more units at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

ID# N/A

- [X] Hold allowances in accordance with 40 CFR 72.9(c)(1)
- [ ] Control unit (include Phase I Extension Plan form)
- [ ] Substitution unit (if this is a substitution unit for one or more Table 1 unit(s) at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

- [ ] Reduced utilization plan; unit to be underutilized (include Reduced Utilization Plan form)
- [ ] Compensating unit (if this is a compensating unit for one or more units at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

ID# N/A

- [X] Hold allowances in accordance with 40 CFR 72.9(c)(1)
- [ ] Control unit (include Phase I Extension Plan form)
- [ ] Substitution unit (if this is a substitution unit for one or more Table 1 unit(s) at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

- [ ] Reduced utilization plan; unit to be underutilized (include Reduced Utilization Plan form)
- [ ] Compensating unit (if this is a compensating unit for one or more units at other source(s), enter plant name and State of other source(s))

Plant Name	State
Plant Name	State

Plant Name (from Step 1) Merrimack Station

STEP 3
Read the standard requirements and certification, enter the name of the designated representative, and sign and date

Standard Requirements

Permit Requirements.

(i) The designated representative of each affected source and each affected unit at the source shall:
(a) Submit a complete Acid Rain permit application (including a compliance plan) under this part in accordance with the deadlines specified in 40 CFR 72.30;
(b) Submit in a timely manner a complete reduced utilization plan if required under 40 CFR 72.43; and
(c) Submit in a timely manner any supplemental information that the permitting authority determines is necessary in order to review an Acid Rain permit application and issue or deny an Acid Rain permit;
(ii) The owners and operators of each affected source and each affected unit at the source shall:
(a) Operate the unit in compliance with a complete Acid Rain permit application or a superseding Acid Rain permit issued by the permitting authority; and
(b) Have an Acid Rain Permit.

Monitoring Requirements.

(i) The owners and operators and, to the extent applicable, designated representative of each affected source and each affected unit at the source shall comply with the monitoring requirements as provided in 40 CFR part 75 and section 407 of the Act and regulations implementing section 407 of the Act.
(ii) The emissions measurements recorded and reported in accordance with 40 CFR part 75 and section 407 of the Act and regulations implementing section 407 of the Act shall be used to determine compliance by the unit with the Acid Rain emissions limitations and emissions reduction requirements for sulfur dioxide and nitrogen oxides under the Acid Rain Program.
(iii) The requirements of 40 CFR part 75 and regulations implementing section 407 of the Act shall not affect the responsibility of the owners and operators to monitor emissions of other pollutants or other emissions characteristics at the unit under other applicable requirements of the Act and other provisions of the operating permit for the source.

Sulfur Dioxide Requirements.

(i) The owners and operators of each source and each affected unit at the source shall:
(a) Hold allowances, as of the allowance transfer deadline, in the unit's compliance subaccount (after deductions under 40 CFR 73.34(c)) not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit; and
(b) Comply with the applicable Acid Rain emissions limitations for sulfur dioxide.
(ii) Each ton of sulfur dioxide emitted in excess of the Acid Rain emissions limitations for sulfur dioxide shall constitute a separate violation of the Act.
(iii) An affected unit shall be subject to the requirements under 40 CFR 72.9(c)(1) as follows:
(a) Starting January 1, 1995, an affected unit under 40 CFR 72.6(a)(1);
(b) Starting on or after January 1, 1995 in accordance with 40 CFR 72.41 and 72.43, an affected unit under 40 CFR 72.6(a)(2) or (3) that is a substitution or compensating unit;
(c) Starting January 1, 2000, an affected unit under 40 CFR 72.6(a)(2) that is not a substitution or compensating unit; or
(d) Starting on the later of January 1, 2000 or the deadline for monitor certification under 40 CFR part 75, an affected unit under 40 CFR 72.6(a)(3) that is not a substitution or compensating unit.
(iv) Allowances shall be held in, deducted from, or transferred among Allowance Tracking System accounts in accordance with the Acid Rain Program.
(v) An allowance shall not be deducted, in order to comply with the requirements under 40 CFR 72.9(c)(1)(i), prior to the calendar year for which the allowance was allocated.
(vi) An allowance allocated by the Administrator under the Acid Rain Program is a limited authorization to emit sulfur dioxide in accordance with the Acid Rain Program. No provision of the Acid Rain Program, the Acid Rain permit application, the Acid Rain permit, or the written exemption under 40 CFR 72.7 and 72.8 and no provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization.
(vii) An allowance allocated by the Administrator under the Acid Rain Program does not constitute a property right.

Nitrogen Oxides Requirements. The owners and operators of the source and each affected unit at the source shall comply with the applicable Acid Rain emissions limitation for nitrogen oxides.

Excess Emissions Requirements.

(i) The designated representative of an affected unit that has excess emissions in any calendar year shall submit a proposed offset plan, as required under 40 CFR part 77.
(ii) The owners and operators of an affected unit that has excess emissions in any calendar year shall:
(a) Pay without demand the penalty required, and pay upon demand the interest on that penalty, as required by 40 CFR part 77; and
(b) Comply with the terms of an approved offset plan, as required by 40 CFR part 77.

Recordkeeping and Reporting Requirements.

(i) Unless otherwise provided, the owners and operators of the source and each affected unit at the source shall keep on site at the source each of the following documents for a period of 5 years from the date the document is created. This period may be extended for cause, at any time prior to the end of 5 years, in writing by the Administrator or permitting authority.
(a) The certificate of representation for the designated representative for the source and each affected unit at the source and all documents that demonstrate the truth of the statements in the certificate of representation, in accordance with 40 CFR 72.24; provided that the certificate and documents shall be retained on site at the source beyond such 5-year period until such documents are superseded because of the submission of a new certificate of representation changing the designated representative.
(b) All emissions monitoring information, in accordance with 40 CFR part 75.
(c) Copies of all reports, compliance certifications, and other submissions and all records made or required under the Acid Rain Program.

Plant Name (from Step 1) Merrimack Station

Recordkeeping and Reporting Requirements (cont.)

(d) Copies of all documents used to complete an Acid Rain permit application and any other submission under the Acid Rain Program or to demonstrate compliance with the requirements of the Acid Rain Program.

(ii) The designated representative of an affected source and each affected unit at the source shall submit the reports and compliance certifications required under the Acid Rain Program, including those under 40 CFR part 72 subpart I and 40 CFR part 75.

Liability.

(i) Any person who knowingly violates any requirement or prohibition of the Acid Rain Program, a complete Acid Rain permit application, an Acid Rain permit, or a written exemption under 40 CFR 72.7 or 72.8, including any requirement for the payment of any penalty owed to the United States, shall be subject to enforcement pursuant to section 113(c) of the Act.
(ii) Any person who knowingly makes a false, material statement in any record, submission, or report under the Acid Rain Program shall be subject to criminal enforcement pursuant to section 113(c) of the Act and 18 U.S.C. 1001.
(iii) No permit revision shall excuse any violation of the requirements of the Acid Rain Program that occurs prior to the date that the revision takes effect.
(iv) Each affected source and each affected unit shall meet the requirements of the Acid Rain Program.
(v) Any provision of the Acid Rain Program that applies to an affected source (including a provision applicable to the designated representative of an affected source) shall also apply to the owners and operators of such source and of the affected units at the source.
(vi) Any provision of the Acid Rain Program that applies to an affected unit (including a provision applicable to the designated representative of an affected unit) shall also apply to the owners and operators of such unit. Except as provided under 40 CFR 72.41 (substitution plans), 40 CFR 72.42 (Phase I extension plans), 40 CFR 72.43 (reduced utilization plans), 40 CFR 72.44 (Phase II repowering extension plans), and section 407 of the Act and regulations implementing section 407 of the Act, and except with regard to the requirements applicable to units with a common stack under part 75 of this chapter (including sections 75.16, 75.17, and 75.18), the owners and operators and the designated representative of one affected unit shall not be liable for any violation by any other affected unit of which they are not owners or operators or the designated representative and that is located at a source of which they are not owners or operators or the designated representative.
(vii) Each violation of a provision of 40 CFR parts 72, 73, 75, 77, and 78, and regulations implementing sections 407 and 410 of the Act by an affected source or affected unit, or by an owner or operator or designated representative of such source or unit, shall be a separate violation of the Act.

Effect on Other Authorities. No provision of the Acid Rain Program, an Acid Rain permit application, an Acid Rain permit, or a written exemption under 40 CFR 72.7 or 72.8 shall be construed as:

(i) Except as expressly provided in title IV of the Act, exempting or excluding the owners and operators and, to the extent applicable, the designated representative of an affected source or affected unit from compliance with any other provision of the Act, including the provisions of title I of the Act relating to applicable National Ambient Air Quality Standards or State Implementation Plans.
(ii) Limiting the number of allowances a unit can hold; *provided*, that the number of allowances held by the unit shall not affect the source's obligation to comply with any other provisions of the Act.
(iii) Requiring a change of any kind in any State law regulating electric utility rates and charges, affecting any State law regarding such State regulation, or limiting such State regulation, including any prudence review requirements under such State law.
(iv) Modifying the Federal Power Act or affecting the authority of the Federal Energy Regulatory Commission under the Federal Power Act.
(v) Interfering with or impairing any program for competitive bidding for power supply in a State in which such program is established.

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name Ronald G. Chevalier	
Signature Ronald G. Chevalier	Date 2/10/93

STEP 4 (optional)
Enter the source AIRS and FINDS identification numbers, if known

AIRS
FINDS

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0227
Expires 6-30-95

Substitution Plan

Page 1

FEB 16 1993

For more information, see instructions and refer to 40 CFR 72.41

This submission is: [X] New [ ] Revised

Page 1 of 1

STEP 1
Identify each unit by plant name, State and boiler ID# from NADB. After the boiler ID# of each substitution unit, enter the letter(s) for the Table 1 unit(s) for which the unit is substituting (see instructions)

Table 1 Units

	Plant Name	State	Boiler ID#
a	Merrimack Station	NH	1
b	Merrimack Station	NH	2
c	N/A		
d	N/A		

Substitution Units

	Plant Name	State	Boiler ID#	Table 1 Units
e	Newington Station	NH	1	a, b
f	N/A			
g	N/A			
h	N/A			
i	N/A			
j	N/A			

STEP 2
Enter baseline (see special instructions)

e	f	g	h	i	j
20177931 mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu

STEP 3
~~Enter the lesser of the 1985 actual or allowable SO2 emissions rate from NADB. Round to~~

e	f	g	h	i	j
~~2.0386~~ 1.9950 lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu

7/13/94

STEP 4
Multiply Step 2 and Step 3 entries, divide by 2000, and round to the nearest ton

e	f	g	h	i	j
~~20557~~ 20127 tons	N/A tons	N/A tons	N/A tons	N/A tons	N/A tons

7/13/94

STEP 5
Mark one of the two options and enter date, if applicable

[ ] The effective date of this plan is January 1, 199[ ]

[X] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 7.

STEP 6
Mark one of the two options and enter date, if applicable

[ ] The last date this plan will be in effect is December 31, 199[ ] unless notification to terminate the plan prior to that date is given

[ ] The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

Plant Name (see instructions) Merrimack Station

STEP 7
Complete Step 8, if applicable, read the special provisions and certification, and print the name of the designated representative for each source identified in this plan. Each designated representative must sign and date

Special Provisions

Emissions Limitations.

(i) Each substitution unit governed by an approved substitution plan shall become a Phase I unit from January 1 of the year for which the plan takes effect until January 1 of the year for which the plan is no longer in effect or is terminated.
(ii) Each unit under 40 CFR 72.41(a)(1), and each substitution unit, governed by an approved substitution plan shall be subject to the Acid Rain emissions limitations for nitrogen oxides in accordance with section 407 of the Act and regulations implementing section 407 of the Act.

Liability. The owners and operators of a unit governed by an approved substitution plan shall be liable for any violation of the plan or 40 CFR 72.41 at that unit or any other unit that is the first unit's substitution unit or for which the first unit is a substitution unit under the plan, including liability for fulfilling the obligations specified in 40 CFR part 77 and section 411 of the Act.

Termination.

(i) A substitution plan shall be in effect only in Phase I for the calendar years specified in the plan or until the calendar year for which a termination of the plan takes effect, provided that no substitution plan shall be terminated, and no unit shall be de-designated as a substitution unit, before the end of Phase I if the substitution unit serves as a control unit under a Phase I extension plan.
(ii) To terminate a substitution plan for a given calendar year prior to the last year for which the plan was approved:

(a) A notification to terminate in accordance with 40 CFR 72.40(d) shall be submitted no later than 60 days before the allowance transfer deadline applicable to the given year; and
(b) In the notification to terminate, the designated representative of each unit governed by the plan shall state that he or she surrenders for deduction from the unit's Allowance Tracking System account allowances equal in number to, and with the same or an earlier compliance use date, as those allocated under 40 CFR 72.41(d)(1) for all calendar years for which the plan is to be terminated. The designated representative may identify the serial numbers of the allowances to be deducted. In the absence of such identification, allowances will be deducted on a first-in, first-out basis under 40 CFR 73.35(c)(2).

(iii) If the requirements of 40 CFR 72.41(e)(2)(ii) are met and upon revision of the permit to terminate the substitution plan, the Administrator will deduct the allowances specified in 40 CFR 72.41(e)(2)(ii)(B). No substitution plan shall be terminated, and no unit shall be de-designated as a Phase I unit, unless such deduction is made.
(iv) Change of owner or operator. If there is a change in the owners or operators (which includes for purposes of this section the designated representative) of any unit governed by an approved substitution plan and the requirement under 40 CFR 72.41(b)(1)(i) is no longer met, then the designated representatives of the units governed by the plan shall terminate the plan as of January 1 of the calendar year during which the change was made. If the designated representatives fail to terminate the plan, the Administrator, on his own motion, shall terminate the plan and deduct the allowances required to be surrendered under 40 CFR 72.41(e)(2)(ii).

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name Ronald G. Chevalier	
Signature Ronald G Chevalier	Date 2/10/93
Name	
Signature	Date
Name	
Signature	Date
Name	
Signature	Date

Plant Name (see instructions) Merrimack Station

DISTRIBUTION OF SUBSTITUTION ALLOWANCES

STEP 4 TOTAL

20567 20127 allowances

STEP 8 (Optional)
Add together all entries at Step 4 on page 1, including copies, if any, and enter total in Step 4 Total box.

Identify the column for each unit by entering the letter for that unit from Step 1.

Enter the number of substitution allowances from the Step 4 Total to be allocated to each Table 1 and substitution unit. For Table 1 units, indicate the substitution unit from which these allowances came by entering the letter of the substitution unit in the small corner box. If allowances for a single Table 1 unit come from more than one substitution unit, indicate the amount coming from each substitution unit in a separate box in that column.

Make entries for each year the plan will be in effect. Enter the total for each year, including entries from any copies.

	Table 1 Units		Substitution Units			
						1995 TOTAL
1995	N/A allowances	N/A allowances	allowances	allowances	allowances	N/A allowances
	allowances	allowances				
	allowances	allowances				
						1996 TOTAL
1996	N/A allowances	N/A allowances	allowances	allowances	allowances	N/A allowances
	allowances	allowances				
	allowances	allowances				
						1997 TOTAL
1997	N/A allowances	N/A allowances	allowances	allowances	allowances	N/A allowances
	allowances	allowances				
	allowances	allowances				
						1998 TOTAL
1998	N/A allowances	N/A allowances	allowances	allowances	allowances	N/A allowances
	allowances	allowances				
	allowances	allowances				
						1999 TOTAL
1999	N/A allowances	N/A allowances	allowances	allowances	allowances	N/A allowances
	allowances	allowances				
	allowances	allowances				

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-95

Substitution Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.41

This submission is: [X] New [ ] Revised

Page [1] of [1]

STEP 1
Identify each unit by plant name, State and boiler ID# from NADB. After the boiler ID# of each substitution unit, enter the letter(s) for the Table 1 unit(s) for which the unit is substituting (see instructions)

Table 1 Units

	Plant Name	State	Boiler ID#
a	Merrimack Station	NH	1
b	Merrimack Station	NH	2
c	N/A		
d	N/A		

Substitution Units

	Plant Name	State	Boiler ID#	Table 1 Units
e	Mount Tom	MA	1	a,b
f	N/A			
g	N/A			
h	N/A			
i	N/A			
j	N/A			

STEP 2
Enter baseline (see special instructions)

e	f	g	h	i	j
~~16087035~~ 10687035 mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu	N/A mmBtu

STEP 3
~~Enter the lesser of the 1985 actual or allowable SO2 emissions rate from NADB. Do not round~~

e	f	g	h	i	j
~~2.0039~~ ~~2.1417~~ lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu	N/A lbs/mmBtu

2e 7/18/94

STEP 4
Multiply Step 2 and Step 3 entries, divide by 2000, and round to the nearest ton

e	f	g	h	i	j
~~11444~~ 10705 tons	N/A tons	N/A tons	N/A tons	N/A tons	N/A tons

2e 7/18/94

STEP 5
Mark one of the two options and enter date, if applicable

[ ] The effective date of this plan is January 1, 199[ ]

[X] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 7.

STEP 6
Mark one of the two options and enter date, if applicable

[ ] The last date this plan will be in effect is December 31, 199[ ] unless notification to terminate the plan prior to that date is given

[ ] The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 7
Complete Step 8, if applicable, read the special provisions and certification, and print the name of the designated representative for each source identified in this plan. Each designated representative must sign and date

Special Provisions

Emissions Limitations.

(i) Each substitution unit governed by an approved substitution plan shall become a Phase I unit from January 1 of the year for which the plan takes effect until January 1 of the year for which the plan is no longer in effect or is terminated.
(ii) Each unit under 40 CFR 72.41(a)(1), and each substitution unit, governed by an approved substitution plan shall be subject to the Acid Rain emissions limitations for nitrogen oxides in accordance with section 407 of the Act and regulations implementing section 407 of the Act.

Liability. The owners and operators of a unit governed by an approved substitution plan shall be liable for any violation of the plan or 40 CFR 72.41 at that unit or any other unit that is the first unit's substitution unit or for which the first unit is a substitution unit under the plan, including liability for fulfilling the obligations specified in 40 CFR part 77 and section 411 of the Act.

Termination.

(i) A substitution plan shall be in effect only in Phase I for the calendar years specified in the plan or until the calendar year for which a termination of the plan takes effect, provided that no substitution plan shall be terminated, and no unit shall be de-designated as a substitution unit, before the end of Phase I if the substitution unit serves as a control unit under a Phase I extension plan.
(ii) To terminate a substitution plan for a given calendar year prior to the last year for which the plan was approved:

(a) A notification to terminate in accordance with 40 CFR 72.40(d) shall be submitted no later than 60 days before the allowance transfer deadline applicable to the given year; and
(b) In the notification to terminate, the designated representative of each unit governed by the plan shall state that he or she surrenders for deduction from the unit's Allowance Tracking System account allowances equal in number to, and with the same or an earlier compliance use date, as those allocated under 40 CFR 72.41(d)(1) for all calendar years for which the plan is to be terminated. The designated representative may identify the serial numbers of the allowances to be deducted. In the absence of such identification, allowances will be deducted on a first-in, first-out basis under 40 CFR 73.35(c)(2).

(iii) If the requirements of 40 CFR 72.41(e)(2)(ii) are met and upon revision of the permit to terminate the substitution plan, the Administrator will deduct the allowances specified in 40 CFR 72.41(e)(2)(ii)(B). No substitution plan shall be terminated, and no unit shall be de-designated as a Phase I unit, unless such deduction is made.
(iv) Change of owner or operator. If there is a change in the owners or operators (which includes for purposes of this section the designated representative) of any unit governed by an approved substitution plan and the requirement under 40 CFR 72.41(b)(1)(i) is no longer met, then the designated representatives of the units governed by the plan shall terminate the plan as of January 1 of the calendar year during which the change was made. If the designated representatives fail to terminate the plan, the Administrator, on his own motion, shall terminate the plan and deduct the allowances required to be surrendered under 40 CFR 72.41(e)(2)(ii).

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name Ronald G. Chevalier	
Signature Ronald G Chevalier	Date 2/10/93
Name	
Signature	Date
Name	
Signature	Date
Name	
Signature	Date

Plant Name (see instructions) Merrimack Station

DISTRIBUTION OF SUBSTITUTION ALLOWANCES

STEP 8 (Optional)
Add together all entries at Step 4 on page 1, including copies, if any, and enter total in Step 4 Total box.

Identify the column for each unit by entering the letter for that unit from Step 1.

Enter the number of substitution allowances from the Step 4 Total to be allocated to each Table 1 and substitution unit. For Table 1 units, indicate the substitution unit from which these allowances came by entering the letter of the substitution unit in the small corner box. If allowances for a single Table 1 unit come from more than one substitution unit, indicate the amount coming from each substitution unit in a separate box in that column.

Make entries for each year the plan will be in effect. Enter the total for each year, including entries from any copies.

STEP 4 TOTAL: 10708 11444 allowances

	Table 1 Units		Substitution Units			
1995	N/A allowances	N/A allowances	allowances	allowances	allowances	1995 TOTAL: N/A allowances
	allowances	allowances				
	allowances	allowances				
1996	N/A allowances	N/A allowances	allowances	allowances	allowances	1996 TOTAL: N/A allowances
	allowances	allowances				
	allowances	allowances				
1997	N/A allowances	N/A allowances	allowances	allowances	allowances	1997 TOTAL: N/A allowances
	allowances	allowances				
	allowances	allowances				
1998	N/A allowances	N/A allowances	allowances	allowances	allowances	1998 TOTAL: N/A allowances
	allowances	allowances				
	allowances	allowances				
1999	N/A allowances	N/A allowances	allowances	allowances	allowances	1999 TOTAL: N/A allowances
	allowances	allowances				
	allowances	allowances				

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 8-30-96

Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: ☐ New ☒ Revised

Page 1 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	1

STEP 2
Mark one of the two options and enter date, if applicable

☒ The effective date of this plan is January 1, 199 5

☐ This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

☒ The last date this plan will be in effect is December 31, 199 9 unless notification to terminate the plan prior to that date is given

☐ The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

☒ This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☐ This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☒ This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

☐ Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Merrimack Station	2364	2
	Mount Tom Station	1606	1
	Newington Station	8002	1
b	Merrimack Station	2364	2
	Mount Tom Station	1606	1
	Newington Station	8002	1

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-96

Reduced Utilization Plan

For more information, see instructions and refer to 40 CFR 72.43

This submission is: ☐ New ☒ Revised

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	1

STEP 2
Mark one of the two options and enter date, if applicable

☒ The effective date of this plan is January 1, 1995

☐ This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

☒ The last date this plan will be in effect is December 31, 1999 unless notification to terminate the plan prior to that date is given

☐ The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

☒ This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☐ This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☒ This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

	1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
a	6115	Seabrook Station*	1	N/A	No	Yes
b	566	Millstone Station**	3	N/A	No	Yes
c						
d		*40.04% ownership				
e		**68.02% ownership				
f						

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

☐ Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Brayton Point	1619	1
	Brayton Point	1619	2
	Brayton Point	1619	3
b	Brayton Point	1619	1
	Brayton Point	1619	2
	Brayton Point	1619	3

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-95

EPA Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: ☐ New ☒ Revised

Page 3 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	1

STEP 2
Mark one of the two options and enter date, if applicable

☒ The effective date of this plan is January 1, 199 5

☐ This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

☒ The last date this plan will be in effect is December 31, 199 9 unless notification to terminate the plan prior to that date is given

☐ The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

☒ This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☐ This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☒ This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

☐ Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Salem Harbor	1626	1
	Salem Harbor	1626	2
	Salem Harbor	1626	3
b	Salem Harbor	1626	1
	Salem Harbor	1626	2
	Salem Harbor	1626	3

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-95

EPA Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: ☐ New ☒ Revised

Page 4 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	1

STEP 2
Mark one of the two options and enter date, if applicable

☒ The effective date of this plan is January 1, 199 5

☐ This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

☒ The last date this plan will be in effect is December 31, 199 9 unless notification to terminate the plan prior to that date is given

☐ The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

☒ This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☐ This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

☒ This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station **	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 6

☐ Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Brayton Point	1619	4
b	Brayton Point	1619	4

Plant Name (from Step 1) Merrimack 1

STEP 7
Read the special provisions and certification, and print the name of the designated representative for each source identified in this plan. Each designated representative must sign and date

Special Provisions

Emissions Limitations.

(i) Any compensating unit designated under an approved reduced utilization plan shall become a Phase I unit from January 1 of the calendar year in which the plan takes effect until January 1 of the year for which the plan is no longer in effect or is terminated, except that such unit shall not become subject to the Acid Rain emissions limitations for nitrogen oxides in Phase I under section 407 of the Act and regulations implementing section 407 of the Act.
(ii) The designated representative of any Phase I unit (including a unit governed by a reduced utilization plan relying on energy conservation, improved unit efficiency, sulfur-free generation, or a compensating unit) shall surrender allowances, and the Administrator will deduct or return allowances, in accordance with 40 CFR part 72 subpart I.

Reporting Requirements. The designated representative of any Phase I unit (including a unit governed by a reduced utilization plan relying on energy conservation, improved unit efficiency, sulfur-free generation, or a compensating unit) shall comply with the special reporting requirements for such plans under 40 CFR 72.91 and 72.92.

Liability. The owners and operators of a unit governed by an approved reduced utilization plan shall be liable for any violation of the plan or this section at that or any other unit governed by the plan, including liability for fulfilling the obligations specified in 40 CFR part 77 and section 411 of the Act.

Termination.

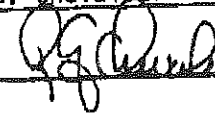
(i) A reduced utilization plan shall be in effect only in Phase I for the calendar years specified in the plan or until the calendar year for which a termination of the plan takes effect; *provided* that no reduced utilization plan that designates a compensating unit that serves as a control unit under a Phase I extension plan shall be terminated, and no such unit shall be de-designated as a compensating unit, before the end of Phase I.
(ii) To terminate a reduced utilization plan for a given calendar year prior to its last year for which the plan was approved:

(a) A notification to terminate in accordance with 40 CFR 72.40(d) shall be submitted no later than 60 days before the allowance transfer deadline applicable to the given year; and
(b) In the notification to terminate, the designated representative of any compensating unit governed by the plan shall state that he or she surrenders for deduction from the unit's Allowance Tracking System account allowances equal in number to, and with the same or an earlier compliance use date as, those allocated under 40 CFR 72.43(d) to each compensating unit for the calendar years for which the plan is to be terminated. The designated representative may identify the serial numbers of the allowances to be deducted. In the absence of such identification, allowances will be deducted on a first-in, first-out basis under 40 CFR 73.35(c)(2).

(iii) If the requirements of 40 CFR 72.43(f)(3)(ii) are met and upon revision of the permit to terminate the reduced utilization plan, the Administrator will deduct the allowances specified in 40 CFR 72.43(f)(3)(ii)(B). No reduced utilization plan shall be terminated, and no unit shall be de-designated as a Phase I unit, unless such deduction is made.

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name R. G. Chevalier	
Signature 	Date 10/20/95
Name	
Signature	Date
Name	
Signature	Date
Name	
Signature	Date

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-95

EPA Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: [X] New [ ] Revised

Page 1 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	2

STEP 2
Mark one of the two options and enter date, if applicable

[X] The effective date of this plan is January 1, 199[5]

[ ] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

[X] The last date this plan will be in effect is December 31, 199[9] unless notification to terminate the plan prior to that date is given

[ ] The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

[X] This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

[ ] This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

[X] This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
		d			
	*40.04% ownership	e			
	**68.02% ownership	f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

[ ] Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Merrimack Station	2364	1
	Mount Tom Station	1606	1
	Newington Station	8002	1
b	Merrimack Station	2364	1
	Mount Tom Station	1606	1
	Newington Station	8002	1

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
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Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: [X] New [ ] Revised

Page 2 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	2

STEP 2
Mark one of the two options and enter date, if applicable

[X] The effective date of this plan is January 1, 199[5]

[ ] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

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[ ] The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

[X] This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

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1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 6

[ ] Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
a	Brayton Point	1619	1
	Brayton Point	1619	2
	Brayton Point	1619	3
b	Brayton Point	1619	1
	Brayton Point	1619	2
	Brayton Point	1619	3

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0221
Expires 6-30-96

Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: [X] New [ ] Revised

Page [3] of [5]

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	2

STEP 2
Mark one of the two options and enter date, if applicable

[X] The effective date of this plan is January 1, 199[5]

[ ] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

[X] The last date this plan will be in effect is December 31, 199[9] unless notification to terminate the plan prior to that date is given

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STEP 4
Mark one or more of the following options and complete the table, if applicable

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1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

[ ] Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
[a]	Salem Harbor	1626	1
	Salem Harbor	1626	2
	Salem Harbor	1626	3
[b]	Salem Harbor	1626	1
	Salem Harbor	1626	2
	Salem Harbor	1626	3

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0121
Expires 6-30-95

EPA

Reduced Utilization Plan

Page 1

For more information, see instructions and refer to 40 CFR 72.43

This submission is: [Y] New [ ] Revised

Page 4 of 5

STEP 1
Identify the Phase I unit for which reduced utilization is planned by plant name, State and boiler ID# from NADB

Plant Name	State	Boiler ID#
Merrimack Station	NH	2

STEP 2
Mark one of the two options and enter date, if applicable

[X] The effective date of this plan is January 1, 199[5]

[ ] This plan is for conditional approval. The designated representative will notify the Agency of activation not later than 60 days before the allowance transfer deadline applicable to the first year for which the plan is to be in effect. Go to Step 4.

STEP 3
Mark one of the two options and enter date, if applicable

[X] The last date this plan will be in effect is December 31, 199[9] unless notification to terminate the plan prior to that date is given

[ ] The last date of the plan is not known. The plan will be effective until December 31, 1999, unless the designated representative notifies the Agency of termination of the plan prior to that date.

STEP 4
Mark one or more of the following options and complete the table, if applicable

[Y] This plan relies on energy conservation measures to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

[ ] This plan relies on improved unit efficiency measure(s) to account for reduced utilization. Full verification will be completed annually according to the requirements of Subpart I of part 72.

[X] This plan designates a compensating unit or relies on sulfur-free generation to account for reduced utilization. (If this option is marked, enter information for each compensating unit or sulfur-free generator in the following table - see instructions.)

1. ORIS Code	2. Plant Name	3. Boiler ID#	4. Allocation for Compensating Units	5. Different System?	6. Another Source?
6115	Seabrook Station*	a 1	N/A	No	Yes
566	Millstone Station**	b 3	N/A	No	Yes
		c			
	*40.04% ownership	d			
	**68.02% ownership	e			
		f			

STEP 5
Mark box if "Yes" is marked in Step 4, column 5

[ ] Additional information is included for each compensating unit or sulfur-free generator not in the dispatch system of the unit reducing utilization under the plan, including copies of system directives or power purchase agreements or other contractual agreements governing the purchase of compensating generation by such unit.

STEP 6
If any sulfur-free generator in Step 4 table will be designated to provide compensating generation for another source ("yes" in column 6), enter the letter for that generator from the table. Identify the Phase I units at other sources for which it will provide compensating generation by entering plant name, ORIS Code, and boiler ID# from NADB

Unit	Plant Name	ORIS Code	Boiler ID#
[a]	Brayton Point	1619	4
[b]	Brayton Point	1619	4

Plant Name (from Step 1) Merrimack 2

STEP 7
Read the special provisions and certification, and print the name of the designated representative for each source identified in this plan. Each designated representative must sign and date

Special Provisions

Emissions Limitations.

(i) Any compensating unit designated under an approved reduced utilization plan shall become a Phase I unit from January 1 of the calendar year in which the plan takes effect until January 1 of the year for which the plan is no longer in effect or is terminated, except that such unit shall not become subject to the Acid Rain emissions limitations for nitrogen oxides in Phase I under section 407 of the Act and regulations implementing section 407 of the Act.
(ii) The designated representative of any Phase I unit (including a unit governed by a reduced utilization plan relying on energy conservation, improved unit efficiency, sulfur-free generation, or a compensating unit) shall surrender allowances, and the Administrator will deduct or return allowances, in accordance with 40 CFR part 72 subpart I.

Reporting Requirements. The designated representative of any Phase I unit (including a unit governed by a reduced utilization plan relying on energy conservation, improved unit efficiency, sulfur-free generation, or a compensating unit) shall comply with the special reporting requirements for such plans under 40 CFR 72.91 and 72.92.

Liability. The owners and operators of a unit governed by an approved reduced utilization plan shall be liable for any violation of the plan or this section at that or any other unit governed by the plan, including liability for fulfilling the obligations specified in 40 CFR part 77 and section 411 of the Act.

Termination.

(i) A reduced utilization plan shall be in effect only in Phase I for the calendar years specified in the plan or until the calendar year for which a termination of the plan takes effect; *provided* that no reduced utilization plan that designates a compensating unit that serves as a control unit under a Phase I extension plan shall be terminated, and no such unit shall be de-designated as a compensating unit, before the end of Phase I.
(ii) To terminate a reduced utilization plan for a given calendar year prior to its last year for which the plan was approved:

(a) A notification to terminate in accordance with 40 CFR 72.40(d) shall be submitted no later than 60 days before the allowance transfer deadline applicable to the given year; and
(b) In the notification to terminate, the designated representative of any compensating unit governed by the plan shall state that he or she surrenders for deduction from the unit's Allowance Tracking System account allowances equal in number to, and with the same or an earlier compliance use date as, those allocated under 40 CFR 72.43(d) to each compensating unit for the calendar years for which the plan is to be terminated. The designated representative may identify the serial numbers of the allowances to be deducted. In the absence of such identification, allowances will be deducted on a first-in, first-out basis under 40 CFR 73.35(a)(2).

(iii) If the requirements of 40 CFR 72.43(f)(3)(ii) are met and upon revision of the permit to terminate the reduced utilization plan, the Administrator will deduct the allowances specified in 40 CFR 72.43(f)(3)(ii)(B). No reduced utilization plan shall be terminated, and no unit shall be de-designated as a Phase I unit, unless such deduction is made.

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name R. G. Chevalier	
Signature R G Chevalier	Date 10/20/95
Name	
Signature	Date
Name	
Signature	Date
Name	
Signature	Date

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Response To Comments Document

PHASE I ACID RAIN PERMIT
MERRIMACK
NEW HAMPSHIRE
ORIS CODE: 2364

During the comment period for the draft Phase I Acid Rain Permit for Merrimack, USEPA received two comments. This document responds to and summarizes the comments and identifies the changes, if any, that have resulted in the permit.

One Year Compliance Plan Approval

Comment: The Natural Resources Defense Council et al.[1] supported the proposed decision to not approve compliance plans for the 1996 - 1999 period until the regulations are revised in a manner that is consistent with the Act. These commenters also objected to EPA granting approval for the one-year period.

New Hampshire Department of Environmental Services objected that EPA should not defer action on compliance plans for the years 1996 through 1999 and should approve the compliance plans for the full five-year period.

Response: Consistent with the Partial Settlement Agreement in Environmental Defense Fund v. Carol M. Browner, No. 93-1203 (D.C. Cir. 1993) (signed May 4 and 20, 1994), EPA is not deferring action for any years on any substitution or reduced utilization plans or portions of plans and is approving (or disapproving) the plans and allocating allowances under certain conditions. See Statement of Basis in the final permit. The settlement reasonably resolves the issue of excess, new allowances. Because EPA is not deferring action on any plans or portions of plans, comments objecting to deferral of action are moot.

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[1] Commenters represented by NRDC's submission include: Wasatch Clean Air Coalition, Southern Environmental Law Center, New Jersey Environmental Lobby, Sierra Club-Utah Chapter, Sierra Club, Kentucky Resources Council, A W Butler Audubon Society, Environmental Defense Fund, Audubon Society of New Hampshire, Appalachian Mountain Club, Wyoming Outdoor Council, Sierra Club-PA Chapter, Ohio Environmental Council, Campaign for a Prosperous Georgia, and American Lung Association of New Jersey.

Exemption of Substitution Units from Title V Fees

Comment: New Hampshire Department of Environmental Services disagreed with EPA's current interpretation that substitution units as well as original units using such substitution units should be exempt from paying title V fees. Only units listed by name in section 404, Table A, should be explicitly exempt. The current policy makes it difficult to implement a title V fee program because the State will not know how much revenue to expect. This is because of conditional substitution plans (since only units subject to active substitution plans are exempt).

Response: The draft permit does not state whether substitution units are subject to fees under Title V, and EPA feels that this comment does not provide sufficient reason to deny the issuing of the Phase I permit or the substitution plan. Although EPA is not acting on this comment in this proceeding, EPA recognizes the commenter's concern about the exemption of substitution units from Title V fees, and will work with New Hampshire separately to attempt to resolve the problem.

Definition of Substitution Unit

Comment: New Hampshire Department of Environmental Services was concerned that EPA's definition of a "substitution unit" is unclear.

Response: 40 CFR 72.2 defines a substitution unit as "an affected unit, other than a unit under Section 410 of the Act that is designated as a Phase I unit in a substitution plan under 40 CFR 72.41." Therefore, if a Phase II unit is designated in an approved substitution plan, it is a substitution unit. The commenter questions the status of Newington Unit #1. This Phase II unit is designated in a conditional substitution plan filed by Northeast Utilities for the Merrimack Station and, upon approval and activation of the plan, the unit becomes a substitution unit. Since this unit is a Phase II unit, it is ineligible to be considered an opt-in source. See 42 USC 7651b(a).

United States
Environmental Protection Agency
Acid Rain Program

OMB No. 2060-0258
Expires 1-31-96

Phase II Permit Application

For more information, see instructions and refer to 40 CFR 72.30 and 72.31

This submission is: [X] New [ ] Revised

STEP 1
Identify the source by plant name, State, and ORIS code from NADB

Plant Name	State	ORIS Code
Merrimack	NH	2364

STEP 2
Enter the boiler ID# from NADB for each affected unit, and indicate whether a repowering plan is being submitted for the unit by entering "yes" or "no" at column c. For new units, enter the requested information in columns d and e

a	b	c	d	e
Boiler ID#	Compliance Plan: Unit Will Hold Allowances in Accordance with 40 CFR 72.9(c)(1)	Compliance Plan: Repowering Plan	New Units: Commence Operation Date	New Units: Monitor Certification Deadline
1	(Yes)	No	N/A	N/A
2	(Yes)	No	N/A	N/A
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			
	Yes			

STEP 3
Check the box if the response in column c of Step 2 is "Yes" for any unit

[ ] For each unit that will be repowered, the Repowering Extension Plan form is included and the Repowering Technology Petition form has been submitted or will be submitted by June 1, 1997.

Plant Name (from Step 1) Merrimack

STEP 4
Read the standard requirements and certification, enter the name of the designated representative, and sign and date

Standard Requirements

Permit Requirements.

(1) The designated representative of each affected source and each affected unit at the source shall:
(i) Submit a complete Acid Rain permit application (including a compliance plan) under 40 CFR part 72 in accordance with the deadlines specified in 40 CFR 72.30; and
(ii) Submit in a timely manner any supplemental information that the permitting authority determines is necessary in order to review an Acid Rain permit application and issue or deny an Acid Rain permit;
(2) The owners and operators of each affected source and each affected unit at the source shall:
(i) Operate the unit in compliance with a complete Acid Rain permit application or a superseding Acid Rain permit issued by the permitting authority; and
(ii) Have an Acid Rain Permit.

Monitoring Requirements.

(1) The owners and operators and, to the extent applicable, designated representative of each affected source and each affected unit at the source shall comply with the monitoring requirements as provided in 40 CFR parts 74, 75, and 76.
(2) The emissions measurements recorded and reported in accordance with 40 CFR part 75 shall be used to determine compliance by the unit with the Acid Rain emissions limitations and emissions reduction requirements for sulfur dioxide and nitrogen oxides under the Acid Rain Program.
(3) The requirements of 40 CFR parts 74 and 75 shall not affect the responsibility of the owners and operators to monitor emissions of other pollutants or other emissions characteristics at the unit under other applicable requirements of the Act and other provisions of the operating permit for the source.

Sulfur Dioxide Requirements.

(1) The owners and operators of each source and each affected unit at the source shall:
(i) Hold allowances, as of the allowance transfer deadline, in the unit's compliance subaccount (after deductions under 40 CFR 73.34(c)) not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit; and
(ii) Comply with the applicable Acid Rain emissions limitations for sulfur dioxide.
(2) Each ton of sulfur dioxide emitted in excess of the Acid Rain emissions limitations for sulfur dioxide shall constitute a separate violation of the Act.
(3) An affected unit shall be subject to the requirements under paragraph (1) of the sulfur dioxide requirements as follows:
(i) Starting January 1, 2000, an affected unit under 40 CFR 72.6(a)(2); or
(ii) Starting on the later of January 1, 2000 or the deadline for monitor certification under 40 CFR part 75, an affected unit under 40 CFR 72.6(a)(3).
(4) Allowances shall be held in, deducted from, or transferred among Allowance Tracking System accounts in accordance with the Acid Rain Program.
(5) An allowance shall not be deducted in order to comply with the requirements under paragraph (1)(i) of the sulfur dioxide requirements prior to the calendar year for which the allowance was allocated.
(6) An allowance allocated by the Administrator under the Acid Rain Program is a limited authorization to emit sulfur dioxide in accordance with the Acid Rain Program. No provision of the Acid Rain Program, the Acid Rain permit application, the Acid Rain permit, or the written exemption under 40 CFR 72.7 and 72.8 and no provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization.
(7) An allowance allocated by the Administrator under the Acid Rain Program does not constitute a property right.

Nitrogen Oxides Requirements. The owners and operators of the source and each affected unit at the source shall comply with the applicable Acid Rain emissions limitation for nitrogen oxides.

Excess Emissions Requirements.

(1) The designated representative of an affected unit that has excess emissions in any calendar year shall submit a proposed offset plan, as required under 40 CFR part 77.
(2) The owners and operators of an affected unit that has excess emissions in any calendar year shall:
(i) Pay without demand the penalty required, and pay upon demand the interest on that penalty, as required by 40 CFR part 77; and
(ii) Comply with the terms of an approved offset plan, as required by 40 CFR part 77.

Recordkeeping and Reporting Requirements.

(1) Unless otherwise provided, the owners and operators of the source and each affected unit at the source shall keep on site at the source each of the following documents for a period of 5 years from the date the document is created. This period may be extended for cause, at any time prior to the end of 5 years, in writing by the Administrator or permitting authority:
(i) The certificate of representation for the designated representative for the source and each affected unit at the source and all documents that demonstrate the truth of the statements in the certificate of representation, in accordance with 40 CFR 72.24; provided that the certificate and documents shall be retained on site at the source beyond such 5-year period until such documents are superseded because of the submission of a new certificate of representation changing the designated representative;
(ii) All emissions monitoring information, in accordance with 40 CFR part 75;
(iii) Copies of all reports, compliance certifications, and other submissions and all records made or required under the Acid Rain Program; and,

Plant Name (from Step 1)	Merrimack

Recordkeeping and Reporting Requirements (cont.)

(iv) Copies of all documents used to complete an Acid Rain permit application and any other submission under the Acid Rain Program or to demonstrate compliance with the requirements of the Acid Rain Program.

(2) The designated representative of an affected source and each affected unit at the source shall submit the reports and compliance certifications required under the Acid Rain Program, including those under 40 CFR part 72 subpart I and 40 CFR part 75.

Liability.

(1) Any person who knowingly violates any requirement or prohibition of the Acid Rain Program, a complete Acid Rain permit application, an Acid Rain permit, or a written exemption under 40 CFR 72.7 or 72.8, including any requirement for the payment of any penalty owed to the United States, shall be subject to enforcement pursuant to section 113(c) of the Act.
(2) Any person who knowingly makes a false, material statement in any record, submission, or report under the Acid Rain Program shall be subject to criminal enforcement pursuant to section 113(c) of the Act and 18 U.S.C. 1001.
(3) No permit revision shall excuse any violation of the requirements of the Acid Rain Program that occurs prior to the date that the revision takes effect.
(4) Each affected source and each affected unit shall meet the requirements of the Acid Rain Program.
(5) Any provision of the Acid Rain Program that applies to an affected source (including a provision applicable to the designated representative of an affected source) shall also apply to the owners and operators of such source and of the affected units at the source.
(6) Any provision of the Acid Rain Program that applies to an affected unit (including a provision applicable to the designated representative of an affected unit) shall also apply to the owners and operators of such unit. Except as provided under 40 CFR 72.44 (Phase II repowering extension plans) and 40 CFR 76.11 (NO_x averaging plans), and except with regard to the requirements applicable to units with a common stack under 40 CFR part 75 (including 40 CFR 75.16, 75.17, and 75.18), the owners and operators and the designated representative of one affected unit shall not be liable for any violation by any other affected unit of which they are not owners or operators or the designated representative and that is located at a source of which they are not owners or operators or the designated representative.
(7) Each violation of a provision of 40 CFR parts 72, 73, 74, 75, 76, 77, and 78 by an affected source or affected unit, or by an owner or operator or designated representative of such source or unit, shall be a separate violation of the Act.

Effect on Other Authorities. No provision of the Acid Rain Program, an Acid Rain permit application, an Acid Rain permit, or a written exemption under 40 CFR 72.7 or 72.8 shall be construed as:

(1) Except as expressly provided in title IV of the Act, exempting or excluding the owners and operators and, to the extent applicable, the designated representative of an affected source or affected unit from compliance with any other provision of the Act, including the provisions of title I of the Act relating to applicable National Ambient Air Quality Standards or State Implementation Plans;
(2) Limiting the number of allowances a unit can hold; *provided*, that the number of allowances held by the unit shall not affect the source's obligation to comply with any other provisions of the Act;
(3) Requiring a change of any kind in any State law regulating electric utility rates and charges, affecting any State law regarding such State regulation, or limiting such State regulation, including any prudence review requirements under such State law;
(4) Modifying the Federal Power Act or affecting the authority of the Federal Energy Regulatory Commission under the Federal Power Act; or,
(5) Interfering with or impairing any program for competitive bidding for power supply in a State in which such program is established.

Certification

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name	R. G. Chevalier	
Signature	R G Chevalier	Date 11/13/95

STEP 5 (optional)
Enter the source AIRS and FINDS identification numbers, if known

AIRS	
FINDS	

Actual Fuel Burned 1995

	Coal			#6 Oil				N. Gas	N Gas	N Gas	#2 Oil				JET		
	(ton)	btu/lb	% S	(gal)	btu/gal	% S	lb/gal	(mmcf)	btu/scf	lb S/mmcf	(gal)	btu/gal	% S	lb/gal	(gal)	btu/gal	% S
MK1	307,870	13,078	1.67								12,491	138,499	0.34	7.086			
MK2	767,864	13,006	1.58								13,131	138,575	0.33	7.099			
MKCT1															102,859	134,600	0.32
MKCT2															124,656	134,600	0.32
MKEG*											24	138,575	0.33	7.090			
MK tot	1,075,734										25,646				227,515		
NT1				71,906,659	153,949	1.49	8.487	2,240	1,020	0.15	1,505,855	138,656	0.28	7.159			
NT1A											374,571	138,591	0.28	7.159			
NT1B											328,431	138,595	0.28	7.159			
NTEG*											132	138,423	0.28	7.159			
NT tot				71,906,659				2,240			2,208,989						
SR4	99,450	12,597	0.63	848,156	153,420	1.54	8.489	1.71	1,020	0.15							
SR5	82,736	12,587	0.64	742,981	153,353	1.53	8.490	1.71	1,020	0.15							
SR6	101,969	12,553	0.63	807,622	153,354	1.54	8.487	1.71	1,020	0.15							
SRCT1								0	1,020	0.15					79,955	134,900	0.32
SREG*								0.013	1,020	0.15							
SR tot	284,155			2,398,759				5							79,955		
Totals	1,359,889			74,305,418				2,245			2,234,635				307,470		

* Fuel burn for 3 emergency units estimated based on 24 hours of operation per year

Emissions Factors Actual Emissions

	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
2		Emissions Factors Actual Emissions																
3		AP42 (lb/ton, Kgal, or mmcf)															CEM/stack test/est	
4		SO2 (factor x %s)					CO					VOC					NOx	TSP
5		Coal	#6 Oil*	Gas	#2 Oil*	Jet	Coal	#6 Oil	Gas	#2 oil	Jet	Coal	#6 Oil	Gas	#2 oil	Jet	lb/mmbtu	lb/mmbtu
6	MK1	38			144		0.5			5.0		0.11			0.20		1.125	0.031
7	MK2	38			144		0.5			5.0		0.11			0.20		1.519	0.192
8	MKCT1					140					6.72				0.20	4.7	0.695	0.038
9	MKCT2					140					6.72				0.20	4.7	0.740	0.038
10	MKEG				31.2					102.0					32.1		4.410	0.310
11																		
12	NT1		157	0.6	144			5.0	40	5.0			0.76	1.40	0.20		0.257	0.023
13	NT1A				144					5.0					0.20		0.155	0.014
14	NT1B				144					5.0					0.20		0.140	0.014
15	NTEG				140					6.7					0.20		0.698	0.357
16																		
17	SR4	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.449	0.013
18	SR5	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.420	0.022
19	SR6	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.366	0.012
20	SRCT1			0.6		140			0.11		6.72			12.60		4.7	0.826	0.038
21	SREG			0.29					0.95					82.90			4.410	0.310
22																		
23		* oil factors corrected for fuel density in calculation																
24		*STACK TEST 09/17/91																
25		**STACK TEST 03/22/94																
26		ALL OTHER EMISSION FACTORS ARE AP42 (5th Edition)																
27		TSP for NT1 based on #6 oil only stack test																
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		

	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW
2	PSNH Emissions based on 1995 actual fuel burns												
3		Actual Emissions											
4		CF	Total	SOx		NOx*		CO		TSP*		VOC	
5		%	mmbtu	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr
6	MK1	73%	8,054,378	53,529	9,769	24,825	4,531	422	77	684	125	93	17
7	MK2	74%	19,975,498	126,310	23,052	83,131	15,171	1,052	192	10,508	1,918	231	42
8	MKCT1	0.40%	13,845	13	2.3	26	4.8	1.9	0.35	1.4	0.26	1.3	0.24
9	MKCT2	0.40%	16,779	15	2.8	34	6.2	2.3	0.42	1.7	0.32	1.6	0.29
10	MKEG	0.27%	3.3	0.001	1.24E-04	0.040	0.007	0.007	0.001	0.003	0.001	0.002	3.85E-04
11	MK tot		28,060,503	179,867	32,826	108,016	19,713	1,478	270	11,195	2,043	327	60
12	NT1	34%	13,563,347	49,741	9,078	9,550	1,743	1,251	228	698	127	159	29
13	NT1A	6.0%	51,912	42	7.7	22	4.0	5.1	0.94	2.0	0.36	0.21	0.037
14	NT1B	5.3%	45,519	37	6.7	17	3.2	4.5	0.82	1.7	0.32	0.18	0.033
15	NTEG	0.27%	18	0.014	0.003	0.035	0.006	0.002	4.44E-04	0.018	0.003	7.23E-05	1.32E-05
16	NT tot		13,660,796	49,820	9,092	9,590	1,750	1,261	230	701	128	160	29
17	SR4	51%	2,637,459	7,126	1,301	3,244	592	148	27	94	17	18	3.3
18	SR5	42%	2,198,545	6,040	1,102	2,530	462	124	23	133	24	15	2.8
19	SR6	52%	2,685,575	7,263	1,325	2,693	491	151	28	88	16	18	3.4
20	SRCT1	0.40%	10,786	10	1.8	24	4.5	1.5	0.27	1.1	0.20	1.0	0.19
21	SREG	0.27%	13	1.03E-05	1.89E-06	0.16	0.029	3.38E-05	6.18E-06	0.011	0.002	0.003	5.39E-04
22	SR tot		7,532,378	20,438	3,730	8,492	1,550	424	77	316	58	53	10
23	Total		49,253,676	250,125	45,648	126,098	23,013	3,163	577	12,212	2,229	539	98
24			Grand Total lb/day =>	392,138						Grand Total tons/yr =>			71,565
25			Total mmbtu =((B*2000*C)+(E*F)+(I*1000000*J)+(L*M)+(P*Q))/1000000										
26			SO2 lb/day =AO*2000/365										
27			SO2 tons/yr =((B*D*T)+(E/1000*G*U*H/7.88)+(I*V)+(L/1000*N*W*O/7.05)+(P/1000*R*X))/2000										
28			NOx lb/day =AQ*2000/365										
29			NOx tons/yr =AM*AI/2000										
30			CO lb/day =AS*2000/365										
31			CO tons/yr =((B*Y)+(E/1000*Z)+(I*AA)+(L/1000*AB)+(P/1000*AC))/2000										
32			TSP lb/day =AU*2000/365										
33			*TSP tons/yr=AM*AJ/2000										
34			VOC lb/day =AW*2000/365										
35			VOC tons/yr =((B*AD)+(E/1000*AE)+(I*AF)+(L/1000*AG)+(P/1000*AH))/2000										
36			NOx RACT began 6/1/95										
37			TSP for NT1 based on #6 oil only stack test										

Potential (theoretical) Fuel Burn*

	Coal			#6 Oil				N. Gas	N Gas	N Gas	#2 Oil				JET		
	(ton)	btu/lb	% S	(gal)	btu/gal	% S	lb/gal	(mmcf)	btu/scf	lb S/mmcf	(gal)	btu/gal	% S	lb/gal	(gal)	btu/gal	% S
MK1	414,623	13,078	2.60								-	138,499	0.40	7.086			
MK2	1,169,594	13,006	2.60								-	138,575	0.40	7.099			
MKCT1															20,761,070	134,600	0.40
MKCT2															20,761,070	134,600	0.40
MKEG											500	138,575	0.40	7.090			
MK tot	1,584,217			-				-			500				41,522,140		
NT1				247,523,531	153,949	2.00	8.487	-	1,020	0.15	-	138,656	0.40	7.159			
NT1A											6,219,600	138,591	0.40	7.159			
NT1B											6,219,600	138,595	0.40	7.159			
NTEG											2,750	138,423	0.40	7.159			
NT tot	-			247,523,531				-			12,441,950				-		
SR4	199,533	12,600	1.64	-	153,420	2.00	8.489	-	1,020	0.15							
SR5	199,533	12,600	1.64	-	153,353	2.00	8.490	-	1,020	0.15							
SR6	199,533	12,600	1.64	-	153,354	2.00	8.487	-	1,020	0.15							
SRCT1								-	1,020	0.15					18,873,700	134,900	0.40
SREG								0.27	1,020	0.15							
SR tot	598,600			-				0.27			-				18,873,700		
Totals	2,182,817			247,523,531				0.27			12,442,449				60,395,840		

* Fuel burns reflect current permit limits.
BTU content from 1995 actuals
Fuel %sulfur reflect current permit limits

Emissions Factors/Permit Limits Potential Emissions

AP42 (lb/ton, Kgal, or mmcf)

	SO2 (factor x %s)					CO					VOC					CEM/stack test/est	
	Coal	#6 Oil*	Gas	#2 Oil*	Jet	Coal	#6 OIl	Gas	#2 oil	Jet	Coal	#6 OIl	Gas	#2 oil	Jet	NOx lb/mmbtu	TSP lb/mmbtu
MK1	38			144		0.5			5.0		0.11			0.20		0.920	0.271
MK2	38			144		0.5			5.0		0.11			0.20		0.849	0.227
MKCT1					140					6.720				0.20	4.7	0.900	0.338
MKCT2					140					6.720				0.20	4.7	0.900	0.338
MKEG				31.2					102					32.1		4.410	0.310
NT1		157	0.6	144			5.0	40	5.0			0.76	1.40	0.20		0.350	0.219
NT1A			-	144					5.0					0.20,		0.200	0.410
NT1B			-	144					5.0					0.20		0.200	0.410
NTEG			-	140		0			6.7					0.20		0.698	0.357
			-														
SR4	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.500	0.307
SR5	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.500	0.307
SR6	38	157	0.6			0.5	5.0	40			0.06	0.76	1.40			0.500	0.307
SRCT1			0.6		140			0.11		6.720			12.60		4.7	0.900	0.343
SREG			0.3					0.95					82.90			4.410	0.310

* oil factors corrected for fuel density in calculation

*STACK TEST 09/17/91

**STACK TEST 03/22/94

ALL OTHER EMISSION FACTORS ARE AP42 (5th Edition)

PSNH Emissions based on Potential (theoretical) Fuel Burns

Potential (theoretical) Emissions

	CF	Total	SOx		NOx		CO		TSP		VOC	
	%	mmbtu	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr	lb/day	tons/yr
MK1	100%	10,844,880	112,232	20,482	27,335	4,989	568	104	8,052	1,469	125	23
MK2	100%	30,423,480	316,591	57,778	70,800	12,921	1,602	292	18,921	3,453	352	64
MKCT1	100%	2,794,440	3,185	581	6,890	1,257	382	70	2,588	472	267	49
MKCT2	100%	2,794,440	3,185	581	6,890	1,257	382	70	2,588	472	267	49
MKEG	5.7%	69	0.017	0.003	0.84	0.15	0.14	0.025	0.059	0.011	0.044	0.008
MK tot		46,857,309	435,194	79,423	111,917	20,425	2,935	536	32,148	5,867	1,012	185
NT1	100%	38,105,920	229,341	41,855	36,540	6,669	3,391	619	22,864	4,173	515	94
NT1A	100%	861,981	997	182	472	86	85	16	968	177	3.4	0.62
NT1B	100%	862,007	997	182	472	86	85	16	968	177	3.4	0.62
NTEG	5.7%	381	0.43	0.078	0.73	0.13	0.050	0.009	0.37	0.068	1.51E-03	2.75E-04
NT tot		39,830,289	231,335	42,219	37,485	6,841	3,561	650	24,800	4,526	522	95
SR4	100%	5,028,240	34,027	6,210	6,888	1,257	273	50	4,229	772	33	6
SR5	100%	5,028,240	34,027	6,210	6,888	1,257	273	50	4,229	772	33	6
SR6	100%	5,028,240	34,027	6,210	6,888	1,257	273	50	4,229	772	33	6
SRCT1	100%	2,546,062	2,896	528	6,278	1,146	347	63	2,393	437	243	44
SREG	5.7%	278	2.17E-04	3.96E-05	3.4	0.61	7.10E-04	1.30E-04	0.24	0.043	0.062	0.011
SR tot		17,631,061	104,976	19,158	26,945	4,918	1,167	213	15,081	2,752	341	62
Total		104,318,659	771,505	140,800	176,347	32,183	7,663	1,399	72,029	13,145	1,876	342

1,029,421 <= Grand Total lb/day

Grand Total tons/yr => 187,869

Total mmbtu =((B*2000*C)+(E*F)+(I*1000000*J)+(L*M)+(P*Q))/1000000

SO2 lb/day =AO*2000/365

SO2 tons/yr =((B*D*T)+(E/1000*G*U*H/7.88)+(I*V)+(L/1000*N*W*O/7.05)+(P/1000*R*X))/2000

NOx lb/day =AQ*2000/365

NOx tons/yr =AM*AI/2000

CO lb/day =AS*2000/365

CO tons/yr =((B*Y)+(E/1000*Z)+(I*AA)+(L/1000*AB)+(P/1000*AC))/2000

TSP lb/day =AU*2000/365

*TSP tons/yr=AM*AJ/2000

VOC lb/day =AW*2000/365

VOC tons/yr =((B*AD)+(E/1000*AE)+(I*AF)+(L/1000*AG)+(P/1000*AH))/2000

Merrimack Station
Insignificant Emissions Estimation

As previously discussed with the NHARD, PSNH will estimate for fee calculation purposes the emissions from Insignificant activities that do not have emissions limitations. Though rules and regulations exist for some of these activities, the small amounts of emissions from these activities do not trigger the applicable requirements. As can be seen in the all inclusive emissions inventory included with this application, the insignificant activities without emissions limitations at Merrimack Station are: four small boilers, several sources of fugitive dust, two sources of fugitive emissions, solvent cleaning using specially designed sinks, solvent cleaning in shops, chemical lab vents, a gasoline tank and pump and chemical cleaning of the water side of boilers. The chemical cleaning of the water side of boilers is an infrequent activity, only taking place every several years. The following emissions estimates are made for fee calculation purposes:

	Tons	
Particulates	< 18	from small boilers, fugitive dust, fugitive emissions
CO	< 1	from small boilers, fugitive emissions
NOx	< 7	from small boilers, fugitive emissions
SOx	< 14	from small boilers, fugitive emissions
VOCs	< 2	from small boilers, fugitive emissions, solvent cleaning (shops and sinks), gas tank, chemical lab vents, chemical cleaning of boilers
HAPs	< 2	solvent cleaning (shops and sinks), gas tank, chemical lab vents, chemical cleaning of boilers
Total	< 44	

PSNH agrees to use 44 tons for the estimate of insignificant activity emissions from Merrimack Station for fee calculation purposes. These numbers were arrived at using conservative estimates. Attached, please find an explanation of how these estimates were arrived at.

Basis for estimates:

Particulate:

4 small boilers must be much less than one NT Aux boiler (0.37 tons in 1995)
coal piles, Mt. Tom calculations were 1102 pounds per year (Merrimack pile twice the size)
coal and ash handling are each estimated to be less than the coal pile (1102 pounds per year)
haul roads, West Springfield and Mt. Tom Stations calculations were 12.3 and 28.4 pounds per year respectively.
fugitive emissions are calculated to be less than 14 tons

CO:

4 small boilers must be much less than one NT aux boiler (0.94 tons)
fugitive emissions are calculated to be less than 0.1 tons

NOx:

4 small boilers must be much less than one NT aux boiler (4.02 tons)
fugitive emissions are calculated to be less than 5 tons

SOx:

4 small boilers must be much less than one NT aux boiler (9.84 tons)
fugitive emissions are calculated to be less than 9 tons

VOCs:

4 small boilers must be much less than one NT aux boiler (0.04 tons)
fugitive emissions are calculated to be less than 0.02 tons
solvent cleaning, West Springfield and Mt. Tom Stations calculations were both 163.7 pounds per year
gas tank and pump with Stage 1 vapor recovery is estimated to be <1000 pounds
chemical lab vents, due to the small amounts of chemicals used it is estimated to be < 1000 pounds
chemical cleaning, due to the small amounts of chemicals used it is estimated to be < 1000 pounds

HAPs:

solvent cleaning, West Springfield and Mt. Tom Stations calculations were both 163.7 pounds per year
gas tank and pumps with Phase 1 vapor recovery is estimated to be < 1000 pounds
chemical lab vents, due to the small amounts of chemicals used it is estimated to be < 1000 pounds
chemical cleaning, due to the small amounts of chemicals used it is estimated to be < 1000 pounds

Fugitive Emissions Calculation from the Warm Up Lines

It is not standard operating procedure to use the MK1 warm up line. Because it is used infrequently an estimate of emissions from it will not be made. It is standard operating procedure to use the MK2 warm up line when the Unit is down on load. A very conservative estimate of 2200 hours per year is used to estimate the emissions from the MK2 warm up line. This conservative estimate for the operation of the MK2 warm up line will more than make up for any emissions not counted from the infrequent use of the MK1 warm up line.

It is assumed for this estimate that the flow out the 6 inch warm up line is directly proportional to the flow out the stack when the warm up line is in use. The area of the MK2 warm up line is 0.196 square feet. The area of the stack is 165.130 square feet. Therefore, the flow out the warm up line is 0.119% of the flow out the stack. It is assumed that emissions are directly proportional to flow.

MK2 had 6805 hours of boiler operation in 1994. The emissions from 1994 are used because it was prior to NOx control.

It is assumed for this estimate that the MK2 precipitator is 95% efficient.

	MK2 1994 Emissions (tons)	MK2 Hourly Average Emissions ** (tons/hour)	Warm Up Line in service (hours)	Estimated Warm Up Line Emissions *** (tons)
Particulate*	35680	5.243	2200	13.73
NOx	12042	1.770	2200	4.63
SOx	22815	3.353	2200	8.78
CO	178	0.026	2200	0.07
VOC	39	0.006	2200	0.02

* Controlled Particulate Emissions in 1994 were 1784 tons.

** Calculated by dividing the 1994 emissions by the 1994 boiler hours.

*** Calculated by multiplying hourly average emissions times warm up line in service hours, then multiplying the product by 0.00119 assuming emissions are directly proportional to flow.

Modeling Requirements

The modeling requirements for Title V permit applications were discussed with the NHARD at a meeting on June 4, 1996. The NHARD stated that modeling would only be required for new or modified facilities. It was agreed that Merrimack, Newington and Schiller Stations were not new or modified facilities and therefore did not require modeling to be submitted with the Title V permit application. Attached, please find the guidance from the NHARD on modeling requirements for Title V permit applications.

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

June 10, 1996

Mr. Robert Pickering
PSNH
1000 Elm Street
Manchester, NH 03105

Dear Mr. Pickering:

As you know, the New Hampshire Department of Environmental Services, Air Resources Division (NHDES-ARD) has been in the process of revising its Rules regarding air quality modeling. These revisions are in response to comments that the current wording in the Rules presented an undue burden to the regulated community, especially to those sources whose impacts are already known and who have not undergone any recent plant modifications. In order to eliminate this burden and focus our regulatory efforts on the sources of greatest air pollution risk, NHDES-ARD has decided to revise the current modeling requirements and has already drafted language which was recently approved by the Air Resources Council.

The most important Rule revision will require modeling only for new or modified stationary sources, area sources or devices. This follows the modeling policy in place prior to the 1995 and therefore exempts existing Title V sources from performing modeling unless the Title V application reflects a modification or contains information on a new source or device. Other changes are also proposed, the most significant being the exemption from modeling for generators which are operated solely for emergency power purposes.

Since a final Rule is not expected to be adopted for several months, NHDES-ARD intends to grant pre-approved waivers to all applicable sources, especially those subject to the current Title V modeling requirements. These waivers will allow sources to be exempt from the modeling requirements as they exist in the current rule, as long as any Title V applications submitted do not include new or modified devices. The waivers will be distributed in the near future but until then the proposed changes as they relate to air quality modeling are considered to be in effect.

Please feel free to contact me at (603) 271-1377 if you have any questions.

Sincerely,

James J. Black

James J. Black
Air Quality Modeling Supervisor
Air Resources Division

AIR RESOURCES DIV.
64 No. Main Street
P.O. Box 2033
Concord, N.H. 03302-2033
Tel. 603-271-1370
FAX 603-271-1381

WASTE MANAGEMENT DIV.
6 Hazen Drive
Concord, N.H. 03301
Tel. 603-271-2900
FAX 603-271-2456

WATER RESOURCES DIV.
64 No. Main Street
P.O. Box 2008
Concord, N.H. 03302-2008
Tel. 603-271-3406
FAX 603-271-7894

WATER SUPPLY & POLLUTION CONTROL DIV.
P.O. Box 95
Concord, N.H. 03302-0095
Tel. 603-271-3503
FAX 603-271-2181

Inventory

Sorted by:status,device,description

Merrimack Station
Bow, NH

Technical Contact Person:
Roger F. Deshaies

Geodetic Lattitude: 43:08:28
Geodetic Longitude: 71:28:09

June 28, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
99	S	Crusher Primary Coal Crushers	Coal Crusher	198
100	S	Crusher Secondary Coal Crushers (4)	Coal Crusher	220
75	S	Diesel ICE Emergency Generator	Electric Generator Emergency	219
71	S	Gas Turbine Combustion Turbine Unit 1 Stack	Electric Generator Peaking	224
72	S	Gas Turbine Combustion Turbine Unit 2 Stack	Electric Generator Peaking	224
93	S	Steam Boiler Steam Boiler Unit 1 Stack	Electric Generator	433
94	S	Steam Boiler Steam Boiler Unit 2 Stack	Electric Generator	528

Status Code: S - Significant, I - Insignificant, E - Exempt, T- Trivial (EPA White Paper), NR - Considered But Not Regulated, #?? - List Item Number(See Support Data Tab)

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June 28, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
924	I	Cleaning Electrical Equipment Solvent cleaning 1,1,1-Trichloroethane	Cleaning Electrical Equipment	
921	I	Degreaser Solvent cleaning station (4)	Parts Cleaning	207
332	I	Pumps/Piping Slag Tank Warm-up Lines MK 1 & 2	Vent Blr Gas at low loads	207
85	I	Roads Haul Roads (Unpaved)	Access Roads to Station	207
80	I	Tank Bulk Gasoline Tank	MK Mobile Fleet Fuel Storage	207
278	I	Tank Shot Hoppers Ash Dumping	Maint.Daily Activ. fug/dust	207
56	I	Vent Chem Lab Hood Vents	Gas/Vapor Hood Venting	207
388	I	Vent Contractor's Room Furn Exhaust	Building Heat	223
357	I	Vent Gasoline Pump - Warehouse	Provide Fuel for Sta. Vech.	207
387	I	Vent Jet Repair Shack Furnace Exhaust	Building Heat	223
389	I	Vent Oil Storage Room Furn Exhaust	Building Heat	223
367	I	Vent Training Facility Furnace Exhaust	Building Heat	230
776	I	Vent * House Vacuum System		274
922	I	Water Side cleaning every 5 years Boiler Chemical Cleaning, Water Side - MK 1 & 2	Boiler Tube Water Side Cleaning	207
84	I	Yard Fly Ash Disposal Site	Fly Ash Storage	225

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
95	I(fugdst)	Conveyor Coal Conveyor System	Coal Feed	207
98	I(fugdst)	Railcar Unloader Coal Unloading System	Coal Handling	207
279	I(fugdst)	Tanks SCR Economizer Hoppers Ash Dumping	Flyash Removal Maint.	207
280	I(fugdst)	Tanks SCR Reactor Hoppers Ash Dumping	Flyash Removal Maint.	207
344	I(fugdst)	Vent Flyash Tank Unloading	Fyash Removal Maint.	207
97	I(fugdst)	Yard Coal Storage Yard	Coal Storage	207

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June 28, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
91	E#05	Diesel ICU Welder/Generator (Mobile)	Welding	207
111	E#05/T#13	Vent Paint Shop Hood Vents	VOC Venting During Painting	223
828	E#13	Vent Prim Pumps Vents and Tk DrainsMK1	Vents Air from Cond.&Wtr	207
281	E#13	Vent Sec. Fan Coil Drip Tank Vent MK2	Process Vent	207
835	E#13 & 16	Vent Dom Hot Wtr Tank Drain MK1	Drain for Hot Water Heater	
770	E#13/T#50	Vent Air Soot Blowing to Stm Vent MK1	Pressure Safety	223
812	E#13/T#50	Vent BFP 's Drain MK1	Drain Water	207
813	E#13/T#50	Vent BFP's Discharge Line Drains MK1	Drain Water	207
814	E#13/T#50	Vent BFP's Recirc Drain (2) MK1	Drain Water	207
286	E#13/T#50	Vent Boiler Blowdown Tank Vent MK2	Vents Process Steam	325
830	E#17	Vent Aux. Gen Fire Sys Drains (5) MK1	Fire Protection Wtr Drains	207
897	E#17	Yard Fire Training (open burning)	Fire Fighting	207
829	E#17/T#48	Pumps/Piping Mulsifyre Sys MK1	Fire Protection	207
831	E#17/T#48	Vent MT1 Fire Protect Sys Drns (2) MK1	Fire proctection	
74	E#19	Truck Motor Station Vehicles	On SiteMaint/Transportation	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
99	S	Crusher Primary Coal Crushers	Coal Crusher	198
100	S	Crusher Secondary Coal Crushers (4)	Coal Crusher	220
75	S	Diesel ICE Emergency Generator	Electric Generator Emergency	219
71	S	Gas Turbine Combustion Turbine Unit 1 Stack	Electric Generator	224
72	S	Gas Turbine Combustion Turbine Unit 2 Stack	Electric Generator	224
93	S	Steam Boiler Steam Boiler Unit 1 Stack	Electric Generator	433
94	S	Steam Boiler Steam Boiler Unit 2 Stack	Electric Generator	528

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
924	I	Cleaning Electrical Equipment Solvent cleaning 1,1,1-Trichloroethane	Cleaning Electrical Equipment	
921	I	Degreaser Solvent cleaning station (4)	Parts Cleaning	207
332	I	Pumps/Piping Slag Tank Warm-up Lines MK 1 & 2	Vent Blr Gas at low loads	207
85	I	Roads Haul Roads (Unpaved)	Access Roads to Station	207
80	I	Tank Bulk Gasoline Tank	MK Mobile Fleet Fuel Storage	207
278	I	Tank Shot Hoppers Ash Dumping	Maint.Daily Activ. fug/dust	207
56	I	Vent Chem Lab Hood Vents	Gas/Vapor Hood Venting	207
388	I	Vent Contractor's Room Furn Exhaust	Building Heat	223
357	I	Vent Gasoline Pump - Warehouse	Provide Fuel for Sta. Vech.	207
387	I	Vent Jet Repair Shack Furnace Exhaust	Building Heat	223
389	I	Vent Oil Storage Room Furn Exhaust	Building Heat	223
367	I	Vent Training Facility Furnace Exhaust	Building Heat	230
776	I	Vent * House Vacuum System		274
922	I	Water Side cleaning every 5 years Boiler Chemical Cleaning, Water Side - MK 1 & 2	Boiler Tube Water Side Cleaning	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
84	I	Yard Fly Ash Disposal Site	Fly Ash Storage	225
95	I(fugdst)	Conveyor Coal Conveyor System	Coal Feed	207
98	I(fugdst)	Railcar Unloader Coal Unloading System	Coal Handling	207
279	I(fugdst)	Tanks SCR Economizer Hoppers Ash Dumping	Flyash Removal Maint.	207
280	I(fugdst)	Tanks SCR Reactor Hoppers Ash Dumping	Flyash Removal Maint.	207
344	I(fugdst)	Vent Flyash Tank Unloading	Fyash Removal Maint.	207
97	I(fugdst)	Yard Coal Storage Yard	Coal Storage	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
91	E#05	Diesel ICU Welder/Generator (Mobile)	Welding	207
111	E#05/T#13	Vent Paint Shop Hood Vents	VOC Venting During Painting	223
828	E#13	Vent Prim Pumps Vents and Tk DrainsMK1	Vents Air from Cond.&Wtr	207
281	E#13	Vent Sec. Fan Coil Drip Tank Vent MK2	Process Vent	207
835	E#13 & 16	Vent Dom Hot Wtr Tank Drain MK1	Drain for Hot Water Heater	
770	E#13/T#50	Vent Air Soot Blowing to Stm Vent MK1	Pressure Safety	223
812	E#13/T#50	Vent BFP 's Drain MK1	Drain Water	207
813	E#13/T#50	Vent BFP's Discharge Line Drains MK1	Drain Water	207
814	E#13/T#50	Vent BFP's Recirc Drain (2) MK1	Drain Water	207
286	E#13/T#50	Vent Boiler Blowdown Tank Vent MK2	Vents Process Steam	325
830	E#17	Vent Aux. Gen Fire Sys Drains (5) MK1	Fire Protection Wtr Drains	207
897	E#17	Yard Fire Training (open burning)	Fire Fighting	207
829	E#17/T#48	Pumps/Piping Mulsifyre Sys MK1	Fire Protection	207
831	E#17/T#48	Vent MT1 Fire Protect Sys Drns (2) MK1	Fire proctection	

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
74	E#19	Truck Motor Station Vehicles	On SiteMaint/Transportation	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
359	T	Yard Oil Storage Shack Air Vents	Room Ventilation	207
394	T#01	Boat Boat	Maint. /Scrnhuse/RiverMon	207
392	T#02	Pumps/Piping Air Conditioner Units (24)	Equip. Req./Emp Comfort	230
260	T#03	Pumps/Vents SCR Pump House Blowers MK2	Bldg. Venti. /Ammonia Fum	207
390	T#03	Vent A Warehouse Vent Fans	Building Ventilation	207
779	T#03	Vent Exhaust Fans MK1	Room Ventilation	
323	T#09	Vent Septic Tank Vent	Process Ventilation	207
366	T#09	Vent Training Facility Restroom Vents	Ventilation	223
384	T#09	Vent Yard Serv Bldg Restroom Vents	Ventilation	223
393	T#13	Steam Boiler Boiler Doors (67)	Maint. Func. Outage/Dust	
363	T#13	Vent Paint Booth Exhaust	Vents Paint Fumes	207
391	T#14	Vent B Warehouse Cut-off Saw Vent	Vent when Cutting -Maint.	207
362	T#14	Vent Mach. Shop Cut-off Saw Vent	Vent. & Collects Mtl Filing	207
361	T#14 & 17	Vent Mach. Shop Welding Exhausters	Ventilates Welding Fumes	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
381	T#14 E#05	Vent Crusher House Welding Exhauster	Vent Welding Fumes	223
90	T#18	Vent Air Compressor Vents-MK1	Purge Gas Venting	223
52	T#18	Vent Air Compressor Vents-MK2	Purge Gas Venting	223
321	T#18	Vent All Aspirating Air Ports MK2	House Serv.Air to clear ports	207
365	T#18	Vent CEM Compressor Relief Valve	Pressure Safety Valve	207
792	T#18	Vent Contol Air Filter Blowdowns MK1&2	Drain Wtr from Air	223
794	T#18	Vent Control Air Rec. Blowdown MK1	Drain Wtr from Air	223
382	T#18	Vent CT1 & CT2 Air Start Comp. Relief	Air Pressure Safety Valve	223
383	T#18	Vent CT1 & CT2 Air Start Tank Relief	Air Press. Tank Safety Vlv.	223
791	T#18	Vent Flux Air Comp. Bleed Valve MK1	Drain Wtr from Air	223
795	T#18	Vent Service Air Rec. Blowdown MK1	Drain Wtr from Air	223
777	T#18	Vent Thermoprobe MK1	Vents Air from Asp. Air	
793	T#18	Vent Twist Air Comp. Bleed Valve MK1	Air Pressure Relief Valve	238
385	T#18	Vent Yard Serv Bldg Air Compressor	Air Press. Safety Valve	223

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
778	T#18 & 52	Vent Soot Blowers MK1	Vent Air or Steam when Ret	
785	T#18 & 52	Vent Soot Blowing Air Line Vent MK1	Vent SBAC Air for Sootblw	
60	T#20	Drum Morpholine (Wtr Treat)	Wtr Treatment Chem Storage	207
61	T#20	Drum N2H4 35% (Wtr Treat)	Wtr Treatment Chem Storage	207
256	T#20	Pumps/Piping 2A & 2B Vacuum Pumps MK2	Provide Vacuum for Sys.Oper	207
276	T#20	Pumps/Piping Kaydon Lube Oil Purifier MK2	Turbine Lube Oil	207
354	T#20	Tank #2 Oil Tank for Const. Shack Heat	Build.Heat Fuel Oil Storage	207
104	T#20	Tank Ammonia Tank 1-SNCR System	SNCR Ammonia Storage	207
105	T#20	Tank Ammonia Tank 2-SNCR System	SNCR Ammonia Storage	207
54	T#20	Tank Ammonia Tank-FGC System	Flue Gas Cond. Ammonia Store	207
82	T#20	Tank Bulk Oil Tank JP-4 FO (4)	Jet Fuel Storage	207
81	T#20	Tank Bulk Oil Tank #2 Fuel Oil	Startup Fuel Storage	207
352	T#20	Tank Coal Handling #2 Fuel OilTank	Bldg. Heat & Equip. Fuel	207
57	T#20	Tank Dusco Liquid Tank (Operational)	Dust Supressant	207

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58	T#20	Tank H2SO4 Acid Tank (Water Treatment)	Wtr Treatment Chem Storage	223
76	T#20	Tank Lube Oil Tank-MK1	Lube Oil Storage	203
77	T#20	Tank Lube Oil Tank-MK2	Lube Oil Storage	207
64	T#20	Tank NaOCl Anti-Foul Tank	Chem Storage for Anti-Fouling	207
65	T#20	Tank NaOH Base Tank (Wtr Treat) (Caustic)	Wtr Treatment Chem Storage	223
88	T#20	Tank Propane Gas Storage Tank	Propane Gas Storage	207
67	T#20	Tank Sulfur Tank	Flue Gas Cond. Sulfur Store	207
799	T#20	Tank Tri-Sodium & Di-Sodium Phosphate Tanks MK1 (4)	Water Treatment	223
800	T#20	Tank * Condensate Chem Day Tank MK1	Water Treatment	223
356	T#20	Vent #2 Oil Tank for Pump - Warehouse	Fuel for Sta. Trucks	207
96	T#20	Vent Coal Silo Vents	Offgas Venting	356
820	T#20	Vent Condenser Waterbox Vents (2)	Vents Air from WtrBox	203
262	T#20	Vent Cooling Water Sump Vents(2)	Vent	
338	T#20	Vent Crusher House Antifreeze Vent	Tank Vent	207

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ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
336	T#20	Vent GCT's Scavanger Pumps Tanks	Vent for Waste Oil Storage	207
78	T#20	Vent Lube Oil/Water Separator Vents	Offgas Vents on Oil Separator	257
358	T#20	Vent Portable #2Fuel Oil Tank Trailer	Occasional Use Norm Emty	207
282	T#20	Vent Redler Bunker Exhausters MK2	Exhaust Gas from Bunker	322
327	T#20	Vent SCR Ammonia Tanks (4)	Pressure Safety Valves	207
258	T#20	Vent Silo Exhausters MK1 & MK2	Exhaust from Silo's	357
259	T#20	Vent Turbine Oil Vapor Extractors MK2	Process Vent	255
355	T#20	Vent Waste Oil Tank Vent	Oil Tank Vent	207
370	T#20	Vent WWF Acid Storage Tank Vent	Tank Vent	207
368	T#20	Vent WWF Caustic Storage Tank Vent	Tank Vent	207
337	T#20 & #43	Pumps/Piping Crusher House Antifreeze Discharge (4)	Spray Anti-Freeze on Belt	207
781	T#36	Vent Ammonia Analyzer MK1 and MK2	Vent Flue Gas Sample	
274	T#43	Pumps/Piping Decarbinator System vent	Water Treatment	207
837	T#43	Vent Charcoal Wtr Filter Blowdown MK1	Vent Water	

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925	T#44	Vent Condensate Storage Tank Vents (2)	Atmospheric vent	207
264	T#46	Vent D A. Vents MK1	Vent Steam	325
288	T#46	Vent DA Tank Safety Valve Center MK2	Pressure Safety Valve	353
287	T#46	Vent DA Tank Safety Valve East MK2	Pressure Safety Valve	353
289	T#46	Vent DA Tank Safety Valve West MK2	Pressure Safety Valve	335
364	T#48/E#17	Pumps/Piping Main Fire Pump Relief Valve	Vent Wtr / Fire Protection	198
318	T#50	Vent 1st Pt HP Htr.Stm Safety ValveMK2	Pressure Safety Valve	238
316	T#50	Vent 1st Pt HP Htr.Wtr Safety Valve MK2	Pressure Safety Valve	238
319	T#50	Vent 2ndPt HP Htr.Stm Safety ValveMK2	Pressure Safety Valve	223
317	T#50	Vent 2ndPt HP Htr.Wtr Safety Valve MK2	Pressure Safety Valve	223
314	T#50	Vent 3rd Pt. Ext. Safety Valve N. MK2	Pressure Safety Valve	223
313	T#50	Vent 3rd Pt. Ext. Safety Valve S. MK2	Pressure Safety Valve	223
290	T#50	Vent 3rd Pt. Ext. Safety Valve South MK2	Pressure Safety Valve	223
823	T#50	Vent 4th Pt Htr. Drain MK1	Drain Wtr for Shutdown	223

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293	T#50	Vent 4th Pt. L.. P. Htr. Safety Valve MK2	Pressure Safety Valve	223
803	T#50	Vent 5th Pt. Htr. Vent Drain MK1	Vent Steam	223
294	T#50	Vent 5th Pt. L. P. Htr. Safety Valve MK2	Pressure Safety Valve	223
802	T#50	Vent 6th Pt. Htr. Vent Drain MK1	Vent Steam	223
295	T#50	Vent 7th Pt. L. P. Htr. Safety Valve MK2	Pressure Safety Valve	223
345	T#50	Vent Aux. Boiler Vent Valve	Vent Steam	223
311	T#50	Vent Aux. Steam Safety Valve MK2	Pressure Safety Valve	
775	T#50	Vent Aux. Stm. Safety Valves MK1 Elev5	Pressure Safety Valve	
757	T#50	Vent Cold Reheat Line Safety (3) MK1	Pressure Safety Valve	351
756	T#50	Vent Cold Reheat Line Vents (2) MK1	Vent Steam	351
763	T#50	Vent Cold RH Press. Sensing Vent MK1	Vent During Startup	351
301	T#50	Vent Cold RH Safety Valve #1 MK2	Pressure Safety Valve	
302	T#50	Vent Cold RH Safety Valve #2 MK2	Pressure Safety Valve	
303	T#50	Vent Cold RH Safety Valve #3 MK2	Pressure Safety Valve	

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July 01, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
304	T#50	Vent Cold RH Safety Valve #4 MK2	Pressure Safety Valve	
305	T#50	Vent Cold RH Safety Valve #5 MK2	Pressure Safety Valve	
306	T#50	Vent Cold RH Safety Valve #6 MK2	Pressure Safety Valve	
796	T#50	Vent Cold RH Stm Line Blowdown MK1	Drain Stm Line during Stup	
310	T#50	Vent Conv. Pass Safety Valve S.W. MK2	Pressure Safety Valve	
309	T#50	Vent Conv.Pass Safety Valve N.W. MK2	Pressure Safety Valve	
767	T#50	Vent Drum Safety (2) MK1	Pressure Safety Valve	340
766	T#50	Vent Drum Vents (2) MK1	Vent Steam	340
816	T#50	Vent Fan Coil Stm Supply FreeblowMK1	Vent to Remove Water	207
809	T#50	Vent Fan Coil STm Trp Freeblows MK1	Vent Steam	207
296	T#50	Vent Flash Tank Safety Valve E. MK2	Pressure Safety Valve	368
297	T#50	Vent Flash Tank Safety Valve Mid. MK2	Pressure Safety Valve	368
298	T#50	Vent Flash Tank Safety Valve W. MK2	Pressure Safety Valve	368
257	T#50	Vent Gland Steam Exhauster MK2	Process Vent	255

Status Code: S - Significant, I - Insignificant, E# - State Exempt List, T# - EPA White Paper Trivial List, NR - Considered But Not Regulated, (See support data for lists)

Inventory

Sorted by:status,device,description

Merrimack Station
Bow, NH

Technical Contact Person:
Roger F. Deshaies

Geodetic Latitude: 43:08:28
Geodetic Longitude: 71:28:09

July 01, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
292	T#50	Vent Gland Steam Safety Valve MK2	Pressure Safety Valve	223
299	T#50	Vent H. RH Safety Valve N. W. MK2	Pressure Safety Valve	376
271	T#50	Vent H. P. Heater Vents MK2	Vents Steam	238
300	T#50	Vent H. RH Safety Valve West MK2	Pressure Safety Valve	376
761	T#50	Vent Hot Reheat Line Safety MK1	Pressure Safety Valve	362
760	T#50	Vent Hot Reheat Line Vent MK1	Vent Steam	362
789	T#50	Vent HP Heater FW Drains MK1	Drain FW when unit off	223
788	T#50	Vent HP Heater Vents (4) MK1	Vent Steam	223
759	T#50	Vent Main Steam Line Safety MK1	Pressure Safety Valve	356
758	T#50	Vent Main Steam Line Vent MK1	Vent Steam	356
312	T#50	Vent Main Steam Safety Valve MK2	Pressure Safety Valve	372
804	T#50	Vent MainStmLineVent At Rt Vlv MK1	Vent Steam	
801	T#50	Vent Mud Drum Steam Trap (2) MK1	Vent Steam	223
307	T#50	Vent Pri. SH Safety Valve N. E. MK2	Pressure Safety Valve	346

Status Code: S - Significant, I - Insignificant, E# - State Exempt List, T# - EPA White Paper Trivial List, NR - Considered But Not Regulated, (See support data for lists)

Inventory

Sorted by:status,device,description

Merrimack Station
Bow, NH

Technical Contact Person:
Roger F. Deshaies

Geodetic Lattitude: 43:08:28
Geodetic Longitude: 71:28:09

July 01, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
308	T#50	Vent Pri. SH Safety Valve S. E. MK2	Pressure Safety Valve	346
765	T#50	Vent Sec. SH Attemp. Vents (2) MK1	Vent Steam	340
764	T#50	Vent Sec. SH Vents (2) MK1	Vent Steam	340
263	T#50	Vent Steam and Water side Vents MK2	Vent	379
836	T#50	Vent Stm Supply Trap Freeblow (4) MK1	Vent	
315	T#50	Vent Stm. Soot Blow. Safety Valve MK2	Pressure Safety Valve	
769	T#50	Vent Stm. Soot Blowing Safety MK1	Pressure Safety Valve	
768	T#50	Vent Stm. Soot Blowing Vent MK1	Vent	
805	T#50	Vent * Hot Water Htrs For Eye Wash Stations	Vent Steam	
346	T#50&46	Vent Aux. Blr. DA Vent Valve	Vent Steam	223
790	T#52	Vent Stm Sootblg Line Free Blow MK1	Vents Steam to Drain line	
386	T#52	Yard Yard Serv Bldg Steam Cleaner	Maint. Steam Cleaning	223

Inventory

Sorted by:status,device,description

Merrimack Station
Bow, NH

Technical Contact Person:
Roger F. Deshaies

Geodetic Lattitude: 43:08:28
Geodetic Longitude: 71:28:09

July 01, 1996

ID #	Status S,I,E,T,NR	Device Description	Purpose Comments	Elevation
826	NR	Pumps/Piping Sluice Line Drain to Pit	Drain Wtr/Slag for Maint	207
106	NR	Tank Bulk Oil Tank #6 FO (retired)	Main Boiler Fuel Storage	207
272	NR	Tanks Slag Tank Overflow	Drains Water from Slag TK	224
771	NR	Vent Boiler Drum N2 Supply Vent MK1	Vents Nitrogen/ Unit Off	325
284	NR	Vent Hydrogen Purity Meter	Vents Hydrogen Sample	265
832	NR	Vent Well Water Inlet Drain	Drains Well Water	
762	NR	Vent Well Waterwater Tank Overflow	Vents Water on High Level	353
838	NR	Vent Well Wtr Inlet & Outlet Drain	Drains Well Water	
834	NR	Vent Well Wtr Makeup/Cool Wtr Drain	Drains Well Water	
369	NR	Vent WWF Acid Mixing Tank Vent	Tank Vent Not Used	207
798	NR	Vents Generator H2 Vents	Vents Hydrogen/ Unit Off	
360	NR	Yard All Transformers (75)	Pressure Safety Relief	

Attached, please find the existing operating permits for Merrimack Station. Also attached, please find the previously submitted NOx RACT amended permit applications for Merrimack Station.

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

February 27, 1996

Mr. Christopher J. Barton
Staff Engineer
Public Service of New Hampshire
Merrimack Generating Station
97 River Road
Bow, NH 03304

Dear Mr. Barton:

The New Hampshire Department of Environmental Services, Air Resources Division (NHDES-ARD) concurs that the maximum firing rate of Merrimack Unit 1 should be considered 1,238 million BTU/hr. This rate, as stated in your August 17, 1995, letter is arrived at using the maximum hourly coal flow to date multiplied by the monthly composite coal heating value during that time. As such, this value is more reflective of the maximum firing rate than the 1,093 million BTU/hr appearing in the most recent permit or the 1200 million BTU/hr appearing in the application form submitted June 15, 1995.

NHDES-ARD also concurs that changes have not been made to the unit resulting in a higher firing rate but that this newer rate is indicative of a more accurate calculation of the true maximum firing rate. As such, NHDES-ARD will incorporate this new maximum firing rate into all current and future permitting activities.

If you have any questions concerning this decision, please contact Mr. Thomas Hopkins of the Air Resources Division, Engineering Bureau at (603) 271-1391.

Sincerely,

Kenneth A. Colburn
Director
Air Resources Division

cc: Brian Hennessey, EPA-New England

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Temporary Permit

Permit No.: TP-B-315
County : Merrimack
Permit Fee: N/A

This Certifies that:
Public Service Company of New Hampshire (PSNH),
Merrimack Station
has been granted a Temporary Permit for:
Unit #1, Bow, New Hampshire
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of September 8, 1994 in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until August 31, 1995.
Request for permit renewal is subject to Division requirements and must be accompanied by the appropriate equipment registration forms.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The emissions of air pollutants shall be limited by N.H. Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 1093 million BTU per hour gross heat input of coal at 2.8 pound sulfur per million BTU.

3. The operating hours of the device shall be limited to: 24 hours per day, 365 days during any consecutive twelve month period

4. The opacity of emissions shall not exceed 40%.

SEE ATTACHED SHEET FOR ADDITIONAL CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH October 25, 1994

Director, Air Resources Division

PERMFORM ARD 1 2/92

TP-B-315
PSNH, MERRIMACK STATION
UNIT #1 BOW, NH

5. Maximum annual coal usage is 359,950 tons/year. The electrostatic precipitator shall operate with all sections in service when at or above 35 MW gross generation. Below 35 MW gross generation, the electrostatic precipitator shall operate with a minimum number of sections to be determined during optimization before November 30, 1994. Quarterly reports shall be submitted indicating 40% opacity exceedances and their causes. The opacity of emissions shall not exceed 30% average per hour.

Conduct quarterly "CEM Audits" on transmissiometer (Dynatron) per 40 CFR 60, Appendix B, Section 7.1.4; Calibration Error Test. The quarterly audits shall be performed during the months of June, September, December and March. Notification shall be provided to the Division 15 days prior to each scheduled audit. The findings of each audit shall be reported no later than 15 days from the date of the field audit.

Exceedances and the cause of the 30 percent average hourly opacity limit shall be reported in writing no later than 15 days after the end of every calendar month.

Beginning January 1, 1991, the total emissions of Sulfur Dioxide (SO2) from Merrimack Station (including Units #1 and #2) and from Newington and Schiller Stations shall not exceed 55,150 tons per year.

Beginning January 1, 1991, monthly fuel usage by station, fuel type, and sulfur content shall be reported in writing to the Division. In addition, current AP-42 emission factors shall be reported.

Reinjection of flyash shall be operated at the discretion of the responsible PSNH personnel and in accordance with the Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

PSNH shall provide a summary of all coal changes at the end of every calendar month with the excess emission report. The report shall contain the following for each coal: days of use; approximate tons of coal used during the month; and an analysis of the coal (if the Division has never received one for the applicable coal).

TP-B-315
PSNH, MERRIMACK STATION
UNIT #1 BOW, NH

6. Trial Test Burns with Other Fuels

a. Prior to the use of any fuel other than previously reviewed and approved by the Department of Environmental Services, Air Resources Division ("DES/ARD"), PSNH shall submit a proposal to the DES/ARD, which shall include but not be limited to the following:

i. Type of fuel;

ii. Analysis data of the fuel proposed, which shall include proximate and ultimate analysis, volatile and semi volatile analyses (i.e. Method 8240, 8260, 8250, or 8270) and metals analysis (i.e. Method 3050 and mercury);

iii. Specification of baseline operating conditions at Merrimack Station including coal feed rate, % moisture of coal feed, ESP operating conditions, and emission values of opacity, SO2, NOx, particulate and CO (if applicable);

iv. A comprehensive test plan which shall present the proposed operating conditions for the trial burn, to include but not be limited to: length of trial; new fuel rate; means of measuring new fuel feed; description of new fuel feed process; new fuel preparations; % moisture of new fuel feed; time table for operation stability; coal feed rate; coal % moisture; ESP operating conditions; and expected emission values of opacity, SO2, NOx, total suspended particulate, and CO. The test plan shall also address the continuous tracking of operational data prior to trial, during trial, and for a short time after trial. SO2, NOx and opacity can be monitored using the existing CEM.

v. A compliance stack test protocol for total suspended particulate emissions using Method 1 through 4, Method 5 or Division approved alternate, when requested by DES/ARD;

TP-B-315
PSNH, MERRIMACK STATION
UNIT #1 BOW, NH

6. (continued)

vi. Operational parameters to be monitored and recorded which shall include but not be limited to steam flows, boiler temperatures, oxygen, etc.;

vii. The effects of the new fuel on flyash characteristics and resulting effect on the ESP operation;

viii. The effects of the new fuel on bottom ash characteristics;

ix. Specification and description of expected operational and combustion conditions when the trial burn has reached stabilization with new fuel feed; and

x. A time table or schedule with approximate dates of the trial test burn.

b. Once more knowledge is gained as to the specifics of the trial burn, DES/ARD may request additional information on the operations of the trial burn. In addition, metal emission stack testing may be required dependent upon DES/ARD review of the new fuel metal analysis.

c. If the fuel is to be consumed on a regular basis new source review or prevention of significant deterioration may apply as well as a public notice and comment period.

d. DES/ARD will respond within 30 days of receipt of a proposal with approval, conditional approval, denial or request for additional information.

e. The DES Waste Management Division may have additional requirements and concerns and should be contacted prior to any initiation of a test.

f. A summary report should be submitted to DES/ARD at the end of the trial test, which should include a summary of operational results and trends, emission values to include CEM and stack test data, and proposed future use of fuel.

TP-B-315
PSNH, MERRIMACK STATION
UNIT #1 BOW, NH

7. Selective Non-Catalytic Reduction (SNCR) NOx Controls

a. SNCR shall be installed, operated and maintained as set forth in form ARA-6 filed on September 8, 1994 to meet the NOx RACT limit contained in Part Env-A 1211 of 0.92 lb per million BTU based on a calendar day average.

b. Ammonia slip shall not exceed 10 ppm, to be measured during optimization tests and other times as required by the Division.

c. The NOx CEM required by the Phase I Acid Rain Rule shall be used to measure the NOx emissions outlet.

d. A report of proposed operating conditions based on final SNCR optimization shall be provided to the Division within 30 days final optimization.

e. The Division reserves the right to further amend the conditions contained in this permit pending the results of the optimization of the SNCR.

f. PSNH shall track ammonia consumption daily and report to the Division monthly total consumption.

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Larry Fredrick	From Chris Barton
Co. PSNH	Co. PSNH
Dept. Production	Phone # 603-224-4081 x134
Fax # 86x3283	Fax # x202

MAR/PERMITS/MX-1

October 25, 1994

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Permit to Operate

Permit No.PO-B-34
County Merrimack
Permit Fee$3000.00

This Certifies that:
Public Service Company of New Hampshire
has been granted a Permit to Operate for:
Combustion Turbine #1, Merrimack Station, Bow, NH
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of July 8, 1982 in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until August 31, 1994.
Permit renewal is subject to Division requirements and must be accompanied by the appropriate permit renewal fee.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The owner or operator of the devices as specified by this permit is subject to the Rules Governing the Control of Air Pollution for the State of New Hampshire, CHAPTERS Env-A 100-1300.

2. All equipment, facilities and systems installed and used to achieve compliance with the terms and conditions of this Permit to Operate shall at all times be maintained in good working order and be operated as efficiently as possible to minimize air pollutant emissions.

SEE ATTACHED PAGE FOR FURTHER CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH November 5, 1991

Director, Air Resources Division

Public Service Company of New Hampshire
Combustion Turbine #1
PO-B-34

3. Operating Conditions

a. The maximum operating rate is limited to 319 million BTU/hr gross heat input of #1 fuel oil.

b. The operating hours of this device are limited to 24 hrs/day and 365 days/year.

c. The opacity of emissions shall not exceed 40%.

4. Stack Criteria

The stack shall be a minimum of 20 feet high and a maximum of 10'6" by 14" rectangular in width.

5. Recordkeeping and Reporting

a. PSNH, Bow shall submit a written report to the Division of the fuel consumption for each calendar year by February 1st of the following year.

6. Malfunction

The Division shall be notified by telephone within eight working hours following any failure of air pollution control equipment, process equipment, or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen days of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of the time over which emissions were increased due to the failure, the estimated resultant emissions in excess of those allowed and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause.

The Division may at its discretion change, modify and/or amend the terms and conditions of this permit.

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Permit to Operate

Permit No.PO-B-35
County Merrimack
Permit Fee$3000.00

This Certifies that:
Public Service Company of New Hampshire
has been granted a Permit to Operate for:
Combustion Turbine #2, Merrimack Station, Bow, NH
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of July 8, 1982 in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until August 31, 1994.
Permit renewal is subject to Division requirements and must be accompanied by the appropriate permit renewal fee.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The owner or operator of the devices as specified by this permit is subject to the Rules Governing the Control of Air Pollution for the State of New Hampshire, CHAPTERS Env-A 100-1300 as adopted by the New Hampshire Department of Environmental Services, Air Resources Division.

2. All equipment, facilities and systems installed and used to achieve compliance with the terms and conditions of this Permit to Operate shall at all times be maintained in good working order and be operated as efficiently as possible so as to minimize air pollutant emissions.

SEE ATTACHED PAGE FOR FURTHER CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH November 5, 1991

Director, Air Resources Division

Public Service Company of New Hampshire
Combustion Turbine #2
PO-B-35

3. Operating Conditions

a. The maximum operating rate is limited to 319 million BTU/hr gross heat input of #1 fuel oil.

b. The operating hours of this device are limited to 24 hrs/day and 365 days/year.

c. The opacity of emissions shall not exceed 40%.

4. Stack Criteria

The stack shall be a minimum of 20 feet high and a maximum of 10'6" by 14" rectangular in width.

5. Recordkeeping and Reporting

a. PSNH, Bow shall submit a written report to the Division of the fuel consumption for each calendar year by February 1st of the following year.

6. Malfunction

The Division shall be notified by telephone within eight working hours following any failure of air pollution control equipment, process equipment, or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen days of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of the time over which emissions were increased due to the failure, the estimated resultant emissions in excess of those allowed and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause.

The Division may at its discretion change, modify and/or amend the terms and conditions of this permit.

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Permit to Operate

Permit No.: PO-B-1788
County : Merrimack
Permit Fee: $900.00

This Certifies that:
Public Service Company of New Hampshire (PSNH), Merrimack Station
has been granted a Permit to Operate for:
Emergency Diesel Generator, Bow, New Hampshire
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of March 17, 1993 in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until August 31, 1996.
Request for permit renewal is subject to Division requirements and must be accompanied by the appropriate equipment registration forms.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The emissions of air pollutants shall be limited by N.H. Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 28.7 gallons per hour of Diesel fuel.

3. The operating hours of the device shall be limited to: 743 hours per during any consecutive twelve month period.

4. The opacity of emissions shall not exceed 20%.

SEE ATTACHED SHEET FOR ADDITIONAL CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH August 31, 1993

Director, Air Resources Division

PERMFORM ARD-1 2/93

PO-B-1788
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
Emergency Diesel Generator, NH

5. Other conditions:

   a. The emission rate of Nitrogen Oxides (NOx) shall be limited to 13.46 pound per hour.

   b. Emissions of NOx shall be limited to 5 tons per year.

   c. PSNH shall report the annual fuel use and hours to the Division.

MAR/PSNH/MK-2

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Permit to Operate

Permit No.: PO-BP-2416
County : Merrimack
Permit Fee: $900.00

This Certifies that:
Public Service Company of New Hampshire (PSNH), Merrimack Station
has been granted a Permit to Operate for:
Primary Coal Crusher, Bow, New Hampshire
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of **September 9, 1982** in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until **August 31, 1996.**
Request for permit renewal is subject to Division requirements and must be accompanied by the appropriate equipment registration forms.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The emissions of air pollutants shall be limited by N.H. Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 885 tons **per hour of coal.**

3. The operating hours of the device shall be limited to: 9 **hours per day, 122 days during any consecutive twelve month period**

4. The opacity of emissions shall not exceed **20%.**

SEE ATTACHED SHEET FOR ADDITIONAL CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH August 31, 1993

Director, Air Resources Division

PO-BP-2416
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
Primary Coal Crusher, BOW, NH

5. Other conditions:

   a. Maximum annual coal throughput shall be limited to 1,240,750 tons/year. Fugitive emissions shall be controlled for the process equipment, unloading and coal piles. A Division approved particulate emission test shall be required if the device is operated near maximum capacity (reference form ARA-3 9/9/82).

MAR/PSNH/MK-2

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Permit to Operate

Permit No.: **PO-BP-2417**
County : **Merrimack**
Permit Fee: **$900.00**

This Certifies that:
Public Service Company of New Hampshire (PSNH), Merrimack Station
has been granted a Permit to Operate for:
Secondary Coal Crusher, Bow, New Hampshire
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of **September 9, 1982** in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until **August 31, 1996.**
Request for permit renewal is subject to Division requirements and must be accompanied by the appropriate equipment registration forms.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The emissions of air pollutants shall be limited by N.H. Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: **690 tons per hour of coal.**

3. The operating hours of the device shall be limited to: **6 hours per day, 365 days during any consecutive twelve month period**

4. The opacity of emissions shall not exceed **20%.**

SEE ATTACHED SHEET FOR ADDITIONAL CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH August 31, 1993

Director, Air Resources Division

PO-BP-2417
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
Secondary Coal Crusher, BOW, NH

5. Other conditions:

   a. Maximum annual coal throughput shall be limited to 1,240,750 tons/year. Fugitive emissions shall be controlled for the process equipment, unloading and coal piles. A Division approved particulate emission test shall be required if the device is operated near maximum capacity (reference form ARA-3 9/9/82).

MAR/PSNH/MK-2

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Temporary Permit

Permit No.: TP-B-316
County : Merrimack
Permit Fee: N/A

This Certifies that:
Public Service Company of New Hampshire (PSNH),
Merrimack Station
has been granted a Temporary Permit for:
Unit #2, Bow, New Hampshire
device which emits air pollutants into the ambient air as set forth in equipment registration forms (ARA 1-6), filed with this Division under date of September 8, 1994 in accordance with RSA 125-C of the New Hampshire laws of 1979, (amended 1981). This permit is valid until August 31, 1995.
Request for permit renewal is subject to Division requirements and must be accompanied by the appropriate equipment registration forms.

This permit is valid provided the device is operated in accordance with all the following legally enforceable conditions:

1. The emissions of air pollutants shall be limited by NH Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 3473 million BTU per hour gross heat input of coal at 2.8 pound sulfur per million BTU.

3. The operating hours of the device shall be limited to: 24 hours per day, 365 days during any consecutive twelve month period

4. The opacity of emissions shall not exceed 40%.

SEE ATTACHED SHEET FOR ADDITIONAL CONDITIONS.

The owner or operator of the device covered by this permit shall notify the Director 30 days prior to any proposed change to the physical structure or operation of the device covered by this permit which increases or decreases the amount of a specific air pollutant emitted by such device or which results in the emission of any additional air pollutant. The change shall not take place until a new permit application is submitted and acted upon by the Director pursuant to Env-A 600.

Any unavoidable malfunction, breakdown, or upset of the device, which results in emissions greater than those stipulated in this permit, must be reported to the Division within 8 working hours of the occurrence.

This permit (or a copy) should be appropriately displayed near the device for which it is issued.

Concord, NH October 25, 1994

Director, Air Resources Division

TP-B-316
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
UNIT #2 BOW, NH

5. Other conditions:

a. Maximum annual coal usage shall be limited to 1,143,740 tons/year. The electrostatic precipitator shall operate with all sections in service when at or above 120 MW gross generation. Below 120 MW gross generation, the electrostatic precipitator shall operate with a minimum number of sections to be determined during optimization before November 30, 1994. Any malfunction of the electrostatic precipitator shall be recorded in accordance with permit condition 8. Quarterly reports shall be submitted indicating 40% opacity exceedances and their cause. The opacity of emissions shall not exceed 30% average per hour.

b. PSNH shall conduct annual US EPA Method 5, Division approved or EPA approved alternate method stack test(s), 60 days prior to the annual outage.

c. PSNH shall conduct quarterly "CEM Audits" on transmissiometer (Dynatron) pursuant to Env-A 802.09. The quarterly audits shall be performed during the months of June, September, December and March. Notification shall be provided to the Division 15 days prior to each scheduled audit. The findings of each audit shall be reported no later than 15 days from the date of the field audit.

d. Exceedances and the cause of the 30 percent average hourly opacity limit shall be reported to the Division as soon as possible by telephone but no later than one working day and in writing no later than 15 days after the end of every calendar month.

e. If there are exceedances of the 30% average opacity limit for a 90 minute interval on 3 separate days within any 90 day period, then the Director of the Division at his discretion, may require that PSNH conduct an additional EPA Method 5, Division approves or EPA approved alternate method stack test at a time approved by the Director.

TP-B-316
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
UNIT #2 BOW, NH

f. Beginning January 1, 1991, the total emissions of Sulfur Dioxide (SO2) from Merrimack Station (including Units #1 and #2) and from Newington and Schiller Stations shall not exceed 55,150 tons per year. PSNH shall submit quarterly reports of emissions, including the method of calculation.

g. Beginning January 1, 1991, monthly fuel usage by station, fuel type, and sulfur content shall be reported in writing to the Division. In addition, current AP-42 emission factors shall be reported.

h. PSNH shall provide a summary of all coal changes at the end of every calendar month with the excess emission report. The report shall contain the following for each coal: days of use; approximate tons of coal used during the month; an analysis of the coal (if the Division has never received one for the applicable coal); and Whalco operating conditions (if different from those submitted to the Division, as required by permit condition 6.e.iii.).

6. Whalco Flue Gas Conditioning System Operational Requirements:

a. Maximum feed rate of sulfur to the SO3 injection system shall not exceed 108 pounds per hour sulfur.

b. Maximum feed rate of anhydrous ammonia shall not exceed 38 pounds per hour as NH3.

c. The Whalco Flue Gas Conditioning System SO3 injection shall be operated at all times during normal operation except as follows:

i. During start up and shutdown of Unit 2 at a unit output capacity of less than 130-140 megawatts;

ii. During use of a coal feed rate of 50% or more of Loveridge coal (from Loveridge, Blakesville, Federal #2 mine, etc.); or

iii. At such times that PSNH demonstrates to the Division that compliance with all applicable standards can be achieved without the Whalco system.

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PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
UNIT #2 BOW, NH

d. The Whalco Flue Gas Conditioning System NH3 injection shall be operated at the discretion of the responsible PSNH personnel and as demonstrated during the trial test of December 8, 1992 to December 18, 1992, Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

e. The Whalco system shall be operated at all times at such process conditions so as to maintain an opacity below the established limit on Unit 2 stack.

   i. For Bailey coal, the process conditions for minimum opacity operation are 7-8 ppm SO3 injection rate. Variations from this established operation of more than plus or minus 20% require notification to the Division if they last more than 24 hours. All plus or minus 20% deviations should be noted on the monthly report, with day, length of time, operating conditions, and reason of deviation.

   ii. The ammonia injection rate shall be operated as is determined by permit condition 6.d..

   iii. For other coals, proposed operating conditions (ie SO3 and NH3 injection rate) shall be submitted to the Division with a plan as to how the opacity will be maintained below the established limits.

f. Reinjection of flyash shall be operated at the discretion of the responsible PSNH personnel and in accordance with the trial test of December 8 -18, 1992, Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

g. Ammonia slip rate shall not exceed 10 ppmdv at 3% O2.

h. The operation of the Whalco system shall be in accordance with the application forms filed on April 8, 1993, and PSNH correspondence dated December 23, 1991.

TP-B-316
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
UNIT #2 BOW, NH

7. The Division reserves the right to further amend the conditions contained in this permit pending the results of any further process optimization and compliance testing.

8. Malfunction:

   The Division shall be notified by telephone within 8 working hours following any failure of air pollution control equipment, process equipment or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen (15) days after the end of the calendar month (on the excess emission report) of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of time over which emissions were increased due to the failure, the cause of the failure and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause.

9. Selective Catalytic Reduction (SCR) NOx Controls

   a. SCR shall be installed, operated and maintained as set forth in form ARA-6 filed on September 8, 1994 to meet the NOx RACT limit contained in Part Env-A 1211 of 1.4 lb per million BTU based on a 24-hour calendar day average.

   b. Pursuant to Part Env-A 1211, PSNH shall comply with 35.4 tons per 24-hour during the calendar period June 1 through May 31 after May 31, 1995 through may 31, 1999 and shall not exceed 12,921 tons during the calendar period June 1 through May 31.

   c. Ammonia slip shall not exceed 10 ppm at the stack outlet for the SCR and Whalco system combined, to be measured during optimization tests and other times as required by the Division.

   d. The NOx CEM required by the Phase I Acid Rain Rule shall be used to measure the NOx emissions outlet.

e. The specifics of Whalco operation may be amended based on the optimization of the SCR.

f. A report of proposed operating conditions based on final SCR optimization shall be provided to the Division within 30 days final optimization.

g. The Division reserves the right to further amend the conditions contained in this permit pending the results of the optimization of the SCR.

h. PSNH shall track ammonia consumption daily and report to the Division monthly total consumption.

10. Trial Test Burns with Other Fuels

a. Prior to the use of any fuel other than previously reviewed and approved by the Department of Environmental Services, Air Resources Division ("DES/ARD"), PSNH shall submit a proposal to the DES/ARD, which shall include but not be limited to the following:

i. Type of fuel;

ii. Analysis data of the fuel proposed, which shall include proximate and ultimate analysis, volatile and semi volatile analyses and metals analysis;

iii. Specification of baseline operating conditions at Merrimack Station including coal feed rate, % moisture of coal feed, ESP operating conditions, Whalco operating conditions and emission values of opacity, SO2, NOx, particulate and CO (if applicable);

iv. A comprehensive test plan which shall present the proposed operating conditions for the trial burn, to include but not be limited to: length of trial; new fuel rate; means of measuring new fuel feed; description of new fuel feed process; new fuel preparations; % moisture of new fuel feed; time table for operation stability; coal feed rate; coal % moisture; ESP operating conditions; Whalco operating conditions; and expected emission values of opacity, SO2, NOx, total suspended particulate, and CO. The test plan shall also address the continuous tracking of operational

data prior to trial, during trial, and for a short time after trial. SO2, NOx and opacity can be monitored using the existing CEM.

v. A compliance stack test protocol for total suspended particulate emissions using Method 1 through 4, Method 5 or Division approved alternate, when requested by DES/ARD;

vi. Operational parameters to be monitored and recorded which shall include but not be limited to steam flows, boiler temperatures, oxygen, etc.;

vii. The effects of the new fuel on flyash characteristics and resulting effect on the ESP operation;

viii. The effects of the new fuel on bottom ash characteristics;

ix. Specification and description of expected operational and combustion conditions when the trial burn has reached stabilization with new fuel feed; and

x. A time table or schedule with approximate dates of the trial test burn.

b. Once more knowledge is gained as to the specifics of the trial burn, DES/ARD may request additional information on the operations of the trial burn. In addition, metal emission stack testing may be required dependent upon DES/ARD review of the new fuel metal analysis.

c. If the fuel is to be consumed on a regular basis new source review or prevention of significant deterioration may apply as well as a public notice and comment period.

d. DES/ARD will respond within 30 days of receipt of a proposal with approval, conditional approval, denial or request for additional information.

e. The DES Waste Management Division may have additional requirements and concerns and should be contacted prior to any initiation of a test.

TP-B-316
PUBLIC SERVICE COMPANY OF NH, MERRIMACK STATION
UNIT #2 BOW, NH

f. A summary report should be submitted to DES/ARD at the end of the trial test, which should include a summary of operational results and trends, emission values to include CEM and stack test data, and proposed future use of fuel.

MAR\PERMITS\MK-2

Public Service
of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 31, 1995

D08799

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
Caller Box 2033
64 North Main Street
Concord, NH 03302-2033

Revision to TP-B-315 (PO-B-426)
Merrimack Station Unit #1

Dear Mr. Colburn:

Northeast Utilities Service Company (NUSCO) on behalf of Public Service Company of New Hampshire (PSNH) in accordance with Env-A 200 and 600 hereby submits revised Permit TP-B-315 (PO-B-426) Application Forms ARD-2 and ARD-6 in order to comply with Env-A 1211 Nitrogen Oxides (NOx). This submittal does not intend to affect non-NOx aspects of the most recent application on file for this unit, nor does it intend to affect the current permit and conditions attached thereto with respect to non-NOx aspects. It is expected, however, that the validity period of TP-B-315
(PO-B-426) will change.

As required by ENV-A-1211.16, a NOx compliance schedule was filed by NUSCO with the New Hampshire Air Resources Division (NHARD) on 9/13/94. Those portions of that filing specific to TP-B-315 (PO-B-426) are incorporated herein by reference. In particular, Schedule Section 5 incorporates this device in a plan for emission averaging as allowed in Env-A 1211.18. This depends upon the issuance by the NHARD of a federally enforceable permit per Env-A 1211.18(g). NUSCO requests the NHARD to carry forth those actions to make this permit federally enforceable without a single-source SIP revision. This unit shall be in compliance with NOx RACT by 5/31/95.

Enclosed are: 1. Revised ARD-2, and ARD-6, 2. An attached sheet of suggested permit conditions, 3. Plan for implementation of emission averaging.

A check in the amount of $3000 for the filing fee per Env-A 700 will follow.

In accordance with Part Env-A 605, the following is submitted:

1. Name and title of person to whom all orders and notices may be served:

   Ronald G. Chevalier
   Vice President

2. Name and title of person to whom all bills regarding permit fees may be rendered:

   Ronald G. Chevalier
   Vice President

If you have any questions, or need additional information, please contact Mr. Robert W. Pickering, PSNH, Production Operations Services Department, at (603)634-2390.

Very truly yours,

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

R. G. Chevalier
Vice President

Enclosures

Revised 4/5/95

NEW HAMPSHIRE ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
64 NORTH MAIN STREET
CALLER BOX 2033
CONCORD, NH 03302-2033

"Live Free or Die"

FUEL BURNING EQUIPMENT REGISTRATION
Form ARA-2

(A separate form to be completed for each stack and associated equipment. All information to be typed, and original submitted to Agency.)

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION
DESCRIPTION (Designation used by applicant: e.g. # 1 Unit, Unit A, etc.): Unit #1 (MK1)
EQUIPMENT LOCATION (No. & Street, Town, Telephone): 97 River Road, Bow, NH 224-4081
DATE DESIGNED: 1957
INSTALLATION DATE: 1960

V MAJOR ACTIVITY OF FIRM
☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Pwr

VI BURNER DESIGN
1. TYPE OF SOLID FUEL BURNERS
☒ CYCLONE ☐ PULVERIZED WET / DRY ☐ SPREADER STOKER ☐ UNDER FEED STOKER ☐ OVER FEED STOKER ☐ HAND-FIRED ☒ WITH FLY ASH RE-INJECTION b) ☒ WITHOUT FLY ASH RE-INJECTION ☐ OTHER (Specify)
2. TYPE OF LIQUID FUEL BURNERS
☐ PRESSURE GUN ☐ ROTARY CUP ☐ STEAM ATOMIZATION ☐ AIR ATOMIZATION ☒ OTHER (Specify) Mechanical
TEMPERATURE BEFORE INJECTION 220 °F
3. MANUFACTURER
EQUIPMENT Babcock & Wilcox EQUIPMENT MODEL NO. RB-337
BURNER Babcock & Wilcox BURNER MODEL NO.
4. FLUE GAS
TOTAL ACFM 480000 @ 300 °F AND 15 % EXCESS AIR
5. COMBUSTION
☐ TANGENTIAL FIRING ☐ OPPOSITE END FIRING ☒ ONE END ONLY FIRING ☐ LIMITED EXCESS AIR FIRING ☐ FLUE GAS RECIRCULATION ☐ STAGED COMBUSTION ☐ BIASED FIRING
6. OPERATING HOURS FOR THIS UNIT
Hours/day 24 Days/year a) 365

VII STACK INFORMATION
STACK MONITOR USED? ☒ YES ☐ NO (Specify) Enviroplan-NOx + SO2 Dynatron-Particulate
INSIDE DIAMETER AT TOP OF STACK 8.6 FT.
HEIGHT OF GAS DISCHARGE ABOVE GROUND LEVEL 225 FT.
OTHER UNITS USING THIS STACK? ☐ YES (Identify) ☒ NO
OTHER STACKS ON THIS UNIT? ☐ YES (Specify) ☒ NO

VIII CONTROL EQUIPMENT
(If control equipment is used, Form APCA-6 must also be filed for this unit)
☐ SETTLING CHAMBER ☐ AFTER-BURNER ☐ WATER SPRAY ☐ BAG-HOUSE ☐ WETTED BAFFLES
☐ CYCLONE ☐ VAPOR RECOVERY ☐ SCRUBBER ☐ FABRIC FILTER ☒ ELECTROSTATIC PRECIPITATOR
☒ OTHER (Specify) Selective Non-Catalytic Reduction (SNCR) ☐ NONE

IX FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of lbs., gals. or cu. ft.)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☒ COAL	Bituminous	2.3	6.8	c) 620000 Klb	1200
	Anthracite				
☒ OIL	#4 or #2	0.4	0.0	30 K gal	Ignition Only
	#4, #5, #6				
☐ NAT GAS					
☐ LP GAS					
		BTU/Ton	% Moisture		
☐ BARK					
☐ WOOD/BARK					
☐ WOOD					
☐ SLUDGE					
☐ OTHER					

FUEL SUPPLIER

Name	Town or City
Varies (see list supplied to Division)	

SEASONAL USE

	%
Dec Feb	25
Mar May	25
Jun Aug	25
Sep Nov	25

REMARKS: Revise TP-B-315(PO-B-426)
a) Permit condition operating hours.-Actual operating hours submitted monthly.
b) Capable of flyash reinjection or no reinjection
c) Typical annual usage varies with annual capacity factor.

X FUEL ADDITIVES
MANUFACTURER'S NAME: Not Applicable
ADDRESS: _____ PHONE: _____
SPECIFIC IDENTIFICATION OF ADDITIVE: _____
CONSUMPTION RATE: _____ gallons / 1000 gallons of oil

XI CERTIFICATION
I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)
DATE: _____
SIGNED: _____ TITLE: Vice President

MANUFACTURED BY PRECON INDUSTRIES PRINTING DEPARTMENT

Revised 4/5/95

"Live Free or Die"

N.H. Air Resources Division
64 North Main St., Caller Box 2033
Concord, NH 03302-2033
Tel.: 603/271-1370

AIR POLLUTION CONTROL EQUIPMENT REGISTRATION

Form ARA-6 No. 1 of 2

(A separate form to be completed for each control equipment. All information to be typed and original submitted to Agency.)

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant, e.g. # 1 Unit, Unit A, etc.): Unit #1 (MK1)

EQUIPMENT LOCATION (No. & Street, Town, Telephone): 97 River Road, Bow, NH 224-4081

DATE DESIGNED: 1957

INSTALLATION DATE: 1960 b)

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Power

VI TYPE OF CONTROL EQUIPMENT

☐ BAFFLED SETTLING CHAMBER ☐ WIDE-BODIED CYCLONE ☐ LONG CONE CYCLONE ☐ MULTIPLE CYCLONE (12" Dia. Range) ☐ MULTIPLE CYCLONE (6" Dia. Range) ☐ IRRIGATED LONG-CONE CYCLONE ☒ ELECTROSTATIC PRECIPITATOR ☐ IRRIGATED ELECTROSTATIC PRECIPITATOR

☐ SPRAY TOWER ☐ ABSORPTION TOWER ☐ VENTURI SCRUBBER ☐ WET-FAN SCRUBBER ☐ BAG HOUSE ☐ AFTERBURNER ☐ CARBON ABSORPTION ☐ OTHER (Specify)

VII POLLUTANTS ENTERING CONTROL EQUIPMENT

MATERIAL: Particulate

RATE OF ENTERING EMISSIONS: MAXIMUM (lbs/hr) 6375 NORMAL (lbs/hr) 4250 ANNUAL (tons/yr) 17312 a)

METHOD USED TO DETERMINE ENTERING EMISSIONS: ☒ STACK TEST ☐ ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☐ OTHER (Specify)

VIII POLLUTANTS EMITTED AFTER CONTROL EQUIPMENT

MATERIAL: Particulate

RATE OF EMISSION: MAXIMUM (lbs/hr) 216 NORMAL (lbs/hr) 144 ANNUAL (tons/yr) 587 a)

METHOD USED TO DETERMINE EMISSIONS: ☒ STACK TEST ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☐ OTHER (Specify)

FINAL USE OF COLLECTED POLLUTANTS (e.g. recycle, dump, etc.): concrete admixture or landfill

IX AUXILIARY FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (in thousands of lbs., gals. or cu. ft.)	MAXIMUM FIRING RATE (in millions of BTU/HR)
☐ OIL	#1 or #2			NA	NA
	#4, #5, #6			NA	NA
☐ NAT GAS					
☐ LP GAS					
☐ OTHER					

XIII PARTICLE SIZE ANALYSIS (if available)

SIZE OF PARTICLES	PERCENT OF TOTAL	COLLECTION EFFICIENCY
0 - 1 Microns	8	NA
1 - 10 Microns	10	NA
10 ~~XXXXXX~~ Over 44 Microns	82	NA
~~XXXXXXXX~~		

REMARKS: Revise TP-B-315 (PO-B-426)

a) Precipitator inlet and outlet emission rates are based on the average of its acceptance test.

b) New supplementary precipitator designed 3/1987 and installed 11/1989.

X CONTROL EQUIPMENT OPERATING CONDITIONS

TOTAL GAS VOLUME THRU UNIT (ACFM) 480000 @ 300 °F AND 12 % CO_2

INLET TEMPERATURE (°F) 300 OUTLET TEMPERATURE (°F) 300

PRESSURE DROP (inches of water) 2 WATER OR LIQUID RECYCLE RATE (GPM) NA

VOLTAGE 55KV SPARK RATE <5 per min. MILLIAMPS 2000/TR set (10 TR sets)

XI COST ANALYSIS

CAPITAL COST 10,000,000 INSTALLATION COST

OPERATING COST 136,000 per year

XII. FACILITIES SERVED

(List all application numbers of equipment served by this control unit.)

1 MK1 Boiler 2

3 4

5 6

XIV CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE:

SIGNED: TITLE: Vice President

MANUFACTURED BY PRISON INDUSTRIES PRINTING DEPARTMENT

Revised 4/5/95

N.H. Air Resources Division
64 North Main St., Caller Box 2033
Concord, NH 03302-2033
Tel.: 603/271-1370

"Live Free or Die"

AIR POLLUTION CONTROL EQUIPMENT REGISTRATION

Form ARA-6 No. 2 of 2

(A separate form to be completed for each control equipment. All information to be typed and original submitted to Agency.)

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION	DESCRIPTION (Designation used by applicant, e.g. # 5 Unit, Unit A, etc.)	EQUIPMENT LOCATION (No. & Street, Town, Telephone)	DATE DESIGNED	INSTALLATION DATE
	Unit #1 (MK1)	97 River Road, Bow, NH 224-4081	1957	1960 e)

V MAJOR ACTIVITY OF FIRM: ☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Powe

VI TYPE OF CONTROL EQUIPMENT: ☐ BAFFLED SETTLING CHAMBER ☐ WIDE-BODIED CYCLONE ☐ LONG CONE CYCLONE ☐ MULTIPLE CYCLONE (12" Dia. Range) ☐ MULTIPLE CYCLONE (6" Dia. Range) ☐ IRRIGATED LONG-CONE CYCLONE ☒ ELECTROSTATIC PRECIPITATOR ☐ IRRIGATED ELECTROSTATIC PRECIPITATOR

☐ SPRAY TOWER ☐ ABSORPTION TOWER ☐ VENTURI SCRUBBER ☐ WET-FAN SCRUBBER ☐ BAG HOUSE ☐ AFTERBURNER ☐ CARBON ABSORPTION ☒ OTHER (Specify) Selective Non-Cataly Reduction

VII POLLUTANTS ENTERING CONTROL EQUIPMENT

MATERIAL: Oxides of Nitrogen (NOx)

RATE OF ENTERING EMISSIONS. MAXIMUM (lbs/hr) 1608 NORMAL (lbs/hr) 1608 ANNUAL (tons/yr) 7043 a)

METHOD USED TO DETERMINE ENTERING EMISSIONS: ☒ STACK TEST ☐ ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☒ OTHER (Specify) NOx Analyz

VIII POLLUTANTS EMITTED AFTER CONTROL EQUIPMENT

MATERIAL: Oxides of Nitrogen (NOx) b)

RATE OF EMISSION: MAXIMUM (lbs/hr) 1608 NORMAL (lbs/hr) 1104 c) ANNUAL (tons/yr) 4836

METHOD USED TO DETERMINE EMISSIONS: ☐ STACK TEST ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☒ OTHER (Specify) CEMS

FINAL USE OF COLLECTED POLLUTANTS (e.g. recycle, dump, etc.) No collected pollutant

IX AUXILIARY FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of lbs., gals. or cu. ft.)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☐ OIL	#1 or #2			NA	NA
	#4, #5, #6			NA	NA
☐ NAT GAS					
☐ LP GAS					
☐ OTHER					

XIII PARTICLE SIZE ANALYSIS (If available)

SIZE OF PARTICLES	PERCENT OF TOTAL	COLLECTION EFFICIENCY
0 - 1 Microns	NA	
1 - 10 Microns	NA	
10 - 44 Microns	NA	
over 44 Microns	NA	

X CONTROL EQUIPMENT OPERATING CONDITIONS

d) TOTAL GAS VOLUME THRU UNIT (ACFM) 480000 @ 300 °F AND 12 % CO_2

INLET TEMPERATURE (°F) NA OUTLET TEMPERATURE (°F) NA

PRESSURE DROP (inches of water) NA WATER OR LIQUID RECYCLE RATE (GPM) NA

VOLTAGE NA SPARK RATE NA MILLIAMPS NA

XI COST ANALYSIS

CAPITAL COST 2,500,000 INSTALLATION COST Included in C.C

OPERATING COST 483,304

XII FACILITIES SERVED (List all application numbers of equipment served by this control unit.)

1 MK1 Boiler 2

3 4

5

REMARKS: Revise TP-B-3 5 (PO-B-426)

a) Annual tons/yr of NOx based on maximum emission rate of 1. lbs per MMBtu and capacity factor of 1.0.

b) SNCR process results in residual ammonia slip. Maximum slip is 10 ppm.

c) Normal NOx emission based on 24-hour calendar day average 0.92 lbs per MMBtu. An individual hour NOx emission may be higher or lower than 1104 lbs.

d) SNCR is a chemical reaction within the boiler flue gas passages.

e) SNCR designed 1994, installed 4/1995.

XIV CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE:

SIGNED Vice President

MANUFACTURED BY FRISCH INDUSTRIES PRINTING DEPARTMENT

PSNH MERRIMACK STATION
Bow, New Hampshire
TP-B-315 (PO-B-426)

Federally Enforceable Operating Conditions

1. The emission of air pollutants shall be limited by N.H. Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 1093 million BTU per hour gross heat input of coal at 2.8 pound sulfur per million BTU.

3. The operating hours of the device shall be limited to: 24 hours per day, 365 days during any consecutive twelve month period.

4. The opacity of emissions shall not exceed 40%.

5. Maximum annual coal usage is 359,950 tons/year. The electrostatic precipitator shall operate with all sections in service when at or above 35 MW gross generation. Below 35 MW gross generation, the electrostatic precipitator shall operate with a minimum number of sections to be determined during optimization before November 30, 1994. Quarterly reports shall be submitted indicating 40% opacity exceedances and their causes. The opacity of emissions shall not exceed 30% average per hour.

   Conduct quarterly "CEM Audits" on transmissiometer (Dynatron) per 40 CFR 60, Appendix B, Section 7.1.4. Calibration Error Test. The quarterly audits shall be performed during the months of June, September, December and March. Notification shall be provided to the Division 15 days prior to each scheduled audit. The findings of each audit shall be reported no later than 15 days from the date of the field audit.

   Exceedances and the cause of the 30 percent average hourly opacity limit shall be reported in writing no later than 15 days after the end of every calendar month.

   Beginning January 1, 1991, the total emissions of Sulfur Dioxide (S02) from Merrimack Station (including Units #1 and #2) and from Newington and Schiller Stations shall not exceed 55,150 tons per year.

   Beginning January 1, 1991, monthly fuel usage by station, fuel type, and sulfur content shall be reported in writing to the Division. In addition, current AP-42 emission factors shall be reported.

   Reinjection of flyash shall be operated at the discretion of the responsible PSNH personnel and in accordance with the Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

PSNH shall provide a summary of all coal changes at the end of every calendar month with the excess emission report. The report shall contain the following for each coal: days of use; approximate tons of coal used during the month; and an analysis of the coal (if the Division has never received one for the applicable coal).

6. Trial Test Burns with Other Fuels

   a) Prior to the use of any fuel other than previously reviewed and approved by the Department of Environmental Services, Air Resources Division ("DES/ARD"), PSNH shall submit a proposal to the DES/ARD, which shall include but not be limited to the following:

      i. Type of fuel:

      ii. Analysis data of the fuel proposed, which shall include proximate and ultimate analysis, volatile and semi volatile analyses (i.e. Method 8240, 8260, 8250, or 8270) and metals analysis (i.e. Method 3050 and mercury);

      iii. Specification of baseline operating conditions at Merrimack Station including coal feed rate, % moisture of coal feed, ESP operating conditions, and emission values of opacity, S02, NOx, particulate and CO (if applicable);

      iv. A comprehensive test plan which shall present the proposed operating conditions for the trial burn, to include but not be limited to: length of trial; new fuel rate; means of measuring new fuel feed; description of new fuel feed process; new fuel preparations; % moisture of new fuel feed; time table for operation stability; coal feed rate; coal % moisture; ESP operating conditions; and expected emission values of opacity, S02, NOx, total suspended particulate, and CO. The test plan shall also address the continuous tracking of operational data prior to trial, during trial, and for a short time after trial. S02, NOx and opacity can be monitored using the existing CEM.

      v. A compliance stack test protocol for total suspended particulate emissions using Method 1 through 4, Method 5 or Division approved alternate, when requested by DES/ARD;

      vi. Operational parameters to be monitored and recorded which shall include but not be limited to steam flows, boiler temperatures, oxygen, etc.;

      vii. The effects of the new fuel on flyash characteristics and resulting effect on the ESP operation;

      viii. The effects of the new fuel on bottom ash characteristics;

ix. Specification and description of expected operational and combustion conditions when the trial burn has reached stabilization with new fuel feed; and

x. A time table or schedule with approximate dates of the trial test burn.

b) Once more knowledge is gained as to the specifics of the trial burn, DES/ARD may request additional information on the operations of the trial burn. In addition, metal emission stack testing may be required dependent upon DES/ARD review of the new fuel metal analysis.

c) If the fuel is to be consumed on a regular basis new source review or prevention of significant deterioration may apply as well as a public notice and comment period.

d) DES/ARD will respond within 30 days of receipt of a proposal with approval, conditional approval, denial or request for additional information.

e) The DES Waste Management Division may have additional requirements and concerns and should be contacted prior to any initiation of a test.

f) A summary report should be submitted to DES/ARD at the end of the trial test, which should include a summary of operational results and trends, emission values to include CEM and Stack test data, and proposed future use of fuel.

7. Selective Non-Catalytic Reduction (SNCR) NOx Controls

a) Ammonia slip shall not exceed 10 ppm, to be measured during optimization tests and other times as required by the Division.

b) The NOx CEM required by the Phase I Acid Rain Rule shall be used to measure the NOx emissions outlet.

c) A report of proposed operating conditions based on final SNCR optimization shall be provided to the Division within 30 days final optimization.

d) The Division reserves the right to further amend the conditions contained in this permit pending the results of the optimization of the SNCR. Adequate time shall be provided to PSNH in order to respond and/or comply with any amended conditions.

e) PSNH shall track ammonia consumption daily and report to the Division monthly total consumption.

8. Emissions of NOx shall be limited in accordance with Env-A 1211 by means of the two Alternative NOx Reduction Options (ANRO) submitted in the compliance schedule for this device on 9/13/94.

9. ANRO1 As a cyclone-fired unit, the unit NOx emissions shall not exceed 0.92 lbs per MMBtu based on a 24-hour calendar day average in accordance with Env-A 1211.03(c)(1)(b)(1).

10. ANRO 2 As a cyclone fired unit, the unit NOx emission shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be accordance with Env-A 1211.18 and Env-A 607.

11. In accordance with RSA 125-J:61, emission averaging between PSNH devices subject to RACT shall be in the ratio of 1:1.

12. Compliance with the NOx RACT emission standard in ANRO 1 shall be determined by an initial compliance stack test prior to 8/31/95 and subsequent periodic stack tests every 3 years thereafter per Env-A 1211.21. A stack test report shall be submitted within 30 days after the test. The Relative Accuracy Test Audit (RATA) required by Env-A 806 or 40 CFR Part 75 shall be used for this purpose with concurrence of the Division. The RATA uses the test methods required by Env-A 1211.21(d). Compliance with the NOx RACT emission standard in ANRO 1 shall also be demonstrated by the NOx CEMS required in condition 7.b. and Env-A 1211.22.

13. Compliance with the NOx RACT weighted average allowable emission rate in pounds of NOx per day, as directed by Env-A1211.18(d) in ANRO 2, shall be based on the actual NOx CEMS measurements being used in interpretation #4 of the emission averaging implementation plan. The NOx CEMS are requied by Env-A 1211.18(k)(1)(a), Env-A 1211.22 and condition 7.b.

14. The quality assurance requirements and procedures of 40 CFR Part 60 Appendix F and Env-A 805 shall be followed for the CEMS. Where these requirements conflict with or duplicate requirements of 40 CFR Part 75, the latter requirements shall prevail.

15. Recordkeeping and reporting shall be in accordance with Env-A 901.06 and 901.07. The additional recordkeeping and reporting required by Env-A 1211.18(h) shall be made if this device takes part in daily emission averaging in a given calendar year. A report shall be submitted for any calendar year by April 15 of the following year in a suitable format in that instance.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

IMPLEMENTATION OF NOx EMISSION AVERAGING UNDER
ENV-A 1211.18 AND ENV-A 607

PURPOSE

This document outlines the procedures and methods that PSNH shall use in order to emission average its NOx RACT units and devices as allowed for in Env-A 1211.18 and Env-A 607. This document is intended to be a general attachment to the NOx RACT permit applications and is intended to augment the PSNH facilities NOx compliance Schedules submitted to the NH Air Resources Division for each NOx RACT unit or device on 13 September, 1994. PSNH regards emission averaging as an Alternative NOx Reduction Option (ANRO).

INTERPRETATION

In order to implement emission averaging, PSNH has been required to interpret Env-A 1211.18 and Env-A 607 in a manner that makes emission averaging both workable and achievable. The intent is to average the NOx emissions of selected participating operating NOx RACT units or devices on a calendar day basis such that the totality of pounds of NOx allowed to be emitted daily from all such participating operating units or devices is not exceeded during that calendar day per Env-A 1211.18(d). A different calendar day may or may not include a different set of participating operating units or may not be a day when any emission averaging is necessary. The following interpretations are made:

1. In the equation found in Env-A 1211.18(i) the sum E is a system NOx emission cap in allowable pounds over a calendar day, where the system is the selected set of participating operating NOx RACT units or devices. Thus E may vary depending on the composition of the set from calendar day to calendar day.

2. A_i for the ith unit or device is the NOx emission limitation given in Env-A 1211.03 - 1211.14 and Env-A 1211.17. Unless the NHARD provides the appropriate conversion factors, it will not be possible to incorporate in a PSNH averaging scheme those RACT units or devices limited by Env-A 1211.06, since the measurement units are not in lbs NOx per MMBtu, but rather in ppmvd.

3. B_i for the ith unit or device is the maximum heat input limitation in MMBtu per hour that appears as a condition in a permit to operate or a Title V permit multiplied by 24 hours per day.

4. Compliance is achieved when, for a calendar day in which emission averaging is used, the sum E' representing the totality of all pounds of NOx actually emitted through the calendar day by the set of participating operating NOx RACT units and devices is less than or equal to E at the end of the calendar day:

$$E' \leq E$$

The equation for E' is similar to that for E, being:

$$E' = (A1' \times B1') + (A2' \times B2') + \cdots + (An' \times Bn')$$

Where: E' = the total actual NOx emissions from a set of selected participating operating NOx RACT units and devices over a particular calendar day in pounds per day.

A_i ' = the actual NOx emission rate of the ith unit or device participating in the emission averaging. For a unit with Continuous Emission Monitor Systems (CEMS), this value may be the average of the valid hourly NOx emission rates over the entire calendar day in pounds per MMBtu. If the CEMS is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the highest rate in pounds of NOx per hour found in the most recent NOx compliance test that is required by Env-A 1211.21 per Env-A 1211.18(k)(1)(b)(1).

B_i ' = the actual heat input or hours of operation over the calendar day of the ith unit or device participating in the emission averaging. For a unit with CEMS, this value may be the sum of the valid hourly heat input (in MMBtu per hour) over the entire calendar day in MMBtu per day. If this monitoring system is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the total hours of operation over the calendar day per Env-A 1211.18(k)(1)(b)(2).

A_i 'X B_i '= The actual NOx emission rate in pounds per day of the ith unit or device participating in the emission averaging. For a unit or device with CEMS, this value shall be the sum of the hourly values of the actual NOx emission rate in pounds per hour for every valid operating hour in the calendar day. The hourly value shall be given by the product of the actual hourly NOx emission rate in pounds per MMBtu and the actual heat input in MMBtu per hour for that hour as measured by the CEMS. If this monitoring system is malfunctioning, these values shall be calculated using the alternative monitoring method planned for the unit.

5. Emission averaging may be initiated and terminated for a set of selected participating operating NOx RACT units or devices at any time during a particular calendar day when it is used. Compliance with Env-A 1211, however, shall be based upon emission averaging over that entire calendar day for the set of participating operating NOx RACT units and devices.

6. For the purposes of RACT compliance, the transfer ratio of emission reductions between participating operating NOx RACT units and devices in a set shall be 1:1 in accordance with RSA 125-J:6I.

7. Compliance with the recordkeeping requirements of Env-A 1211.18(h) shall be satisfied if the provisions of Env-A 901.06 and Env-A 901.07 are met and the record of emission averaging for a calendar day in which it is used will show the following:

   a) Identity of each participating unit or device
   b) The day of occurrence
   c) The values for E, E' and E - E'
   d) The values for A_i, A_i', B_i and B_i' for each participating unit or device
   e) The values for $A_i X B_i$ and $A_i' X B_i'$ for each participating unit or device

NOx RACT Unit and Device Identification

The PSNH NOx RACT units and devices that are eligible to participate in emission averaging are given below:

Unit(s) Located at Merrimack Station:

Merrimack Unit I (MK1)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 113.5 megawatts.
Merrimack Unit 2 (MK2)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 320 megawatts.
Combustion Turbine 1 (MKCT1)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.
Combustion Turbine 2 (MKCT2)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.

Unit(s) Located at Newington Station:

Newington Unit 1 (NT1)	Tangentially fired utility boiler, capable of firing oil only, or cofiring gas and oil, with a net generating capacity of 406 megawatts.

Auxiliary Boiler 1 (NT Aux 1)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).
Auxiliary Boiler 2 (NT Aux 2)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).

Unit(s) Located at Schiller Station:

Schiller Unit 4 (SR4)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 45 megawatts firing coal, and 47.5 megawatts firing oil.
Schiller Unit 5 (SR5)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 47 megawatts firing coal, and 49.6 megawatts firing oil.
Schiller Unit 6 (SR6)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 48 megawatts firing coal, and 48 megawatts firing oil.
Combustion Turbine (SRCT1)	Oil or natural gas fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22 megawatts.

Allowable NOx Emissions During Emission Averaging

The allowable NOx emission in pounds per day for the eligible units and devices is given by multiplying the respective allowable emission rate, A_i, by the respective maximum permitted firing rate, B_i. These values are given below:

A_{MK1} = 0.92 lbs/MMBtu

B_{MK1}=1093 MMBtu/hr, 26,232 MMBtu/day

A_{MK1} X B_{MK1}=24,133 lbs/day

A_{MK2}=[Merrimack Unit 2 maximum daily emissions will be limited by

B_{MK2} Env-A 1211.03(d.), to 35.4 tons per day, or 70,800 lbs per day]

A_{MK2} X B_{MK2}=70,800lbs/day

A_{MKCT1}=0.9 lbs/MMBtu

B_{MKCT1}=319 MMBtu/hr, 7656 MMBtu/day

A_{MKCT1} X B_{MKCT1} = 6890 lbs/day

A_{MKCT2}=0.9 lb/MMBtu

B_{MKCT2}=319 MMBtu, 7656 MMBtu/day

A_{MKCT2} X B_{MKCT2} = 6890 lbs/day

A_{NT1}=0.35 lbs/MMBtu (oil only), 0.25 lbs/MMBtu (oil and gas)

B_{NT1}=4350 MMBtu/hr, 104,400 MMBtu/day

A_{NT1} X B_{NT1} = 36,540 lbs/day (oil only)

A_{NT1} X B_{NT1} = 26,100 lbs/day (oil and gas)

A_{NTAUX1}=0.2 lbs/MMBtu

B_{NTAUX1}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX1}X B_{NTAUX1}=481 lbs/day

A_{NTAUX2}=0.2 lbs/MMBtu

B_{NTAUX2}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX2} X B_{NTAUX}=481 lbs/day

A_{SR4}=0.5 lbs/MMBtu (coal or oil)

B_{SR4}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR4} X B_{SR4} = 6888 lbs/day (coal or oil)

A_{SR5}=0.5 lbs/MMBtu (coal or oil)

B_{SR5}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR5} X B_{SR5} = 6888 lbs/day (coal or oil)

A_{SR6}=0.5 lbs/MMBtu (coal or oil)

B_{SR6}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR6} X B_{SR6} = 6888 lbs/day (coal or oil)

A_{SRCT1}=0.9 lbs/MMBtu (oil or gas)

B_{SRCT1}=290 MMBtu/hr, 6960 MMBtu/day

A_{SRCT1} X B_{SRCT1} = 6264 lbs/day (oil or gas)

Operational Thresholds

It shall be the duty of the operator of an eligible unit or device to:

1. Track the actual NOx emission rate in pounds per MMBtu of the unit or device hourly from the start of a calendar day.

2. Maintain the unit or device in compliance with its applicable NOx RACT emission limit in pounds per MMBtu. The operator must be assured that there is adequate indication that this NOx emission limitation, which is based on a calendar day average, shall not be exceeded. The calendar day average does not count non-operating hours.

3. Take corrective action to prevent an exceedance through operational control.

4. Start the process of emission averaging if other measures are deemed inadequate or more costly. Under emission averaging, the NOx RACT emission limitation would be expressed in pounds per day.

5. Document for the record the start of the emission averaging, the set of participating units or devices used for emission averaging, and the resulting actual NOx RACT emission levels in pounds per day for each participating unit or device for each calendar day of emission averaging.

6. Perform the same action as in 5. above if the operator of a participating unit or device was not the initiator of the emission averaging process.

Public Service
of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 31, 1995

D08792

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
Caller Box 2033
64 North Main Street
Concord, NH 03302-2033

SUBJECT: Revision to TP-B-316 (PO-B-427)
Merrimack Station Unit #2

Dear Mr. Colburn:

Northeast Utilities Service Company (NUSCO) on behalf of Public Service Company of New Hampshire (PSNH) in accordance with Env-A 200 and 600 hereby submits revised Permit TP-B-316 (PO-B-427) Application Forms ARD-2 and ARD-6 in order to comply with Env-A 1211 Nitrogen Oxides (NOx). This submittal does not intend to affect non-NOx aspects of the most recent application on file for this unit, nor does it intend to affect the current permit and conditions attached thereto with respect to non-NOx aspects. It is expected, however, that the validity period of TP-B-316
(PO-B-427) will change.

As required by ENV-A-1211.16, a NOx compliance schedule was filed by NUSCO with the New Hampshire Air Resources Division (NHARD) on 9/13/94. Those portions of that filing specific to TP-B-316 (PO-B-427) are incorporated herein by reference. In particular, Schedule Section 5 incorporates this device in a plan for emission averaging as allowed in Env-A 1211.18. This depends upon the issuance by the NHARD of a federally enforceable permit per Env-A 1211.18(g). NUSCO requests the NHARD to carry forth those actions to make this permit federally enforceable without a single-source SIP revision. This unit shall be in compliance with NOx RACT by 5/31/95.

Enclosed are: 1. Revised ARD-2, and ARD-6, 2. An attached sheet of suggested permit conditions, 3. Plan for implementation of emission averaging.

A check in the amount of $3000 for the filing fee per Env-A 700 will follow.

In accordance with Part Env-A 605, the following is submitted:

1. Name and title of person to whom all orders and notices may be served:

Ronald G. Chevalier
Vice President

2. Name and title of person to whom all bills regarding permit fees may be rendered:

Ronald G. Chevalier
Vice President

If you have any questions, or need additional information, please contact Mr. Robert W. Pickering, PSNH, Production Operations Services Department, at (603)634-2390.

Very truly yours,

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

R. G. Chevalier
Vice President

Enclosures

FUEL BURNING EQUIPMENT REGISTRATION
Form ARA-2

(A separate form to be completed for each stack and associated equipment. All information to be typed, and original submitted to Agency.)

Revised 4/5/95

"Live Free or Die"

NEW HAMPSHIRE ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
64 NORTH MAIN STREET
CALLER BOX 2033
CONCORD, NH 03302-2033

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm St.,Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm St.,Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant: e.g. B 1 Unit, Unit A, etc.)	EQUIPMENT LOCATION (No. & Street, Town, Telephone)	DATE DESIGNED	INSTALLATION DATE
Unit #2 (MK2)	97 River Road, Bow, NH 224-4081	1966	1968

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Pow

VI BURNER DESIGN

1. TYPE OF SOLID FUEL BURNERS
☒ CYCLONE ☐ PULVERIZED WET / DRY ☐ SPREADER STOKER ☐ UNDER FEED STOKER ☐ OVER FEED STOKER ☐ HAND-FIRED ☒ WITH FLY ASH RE-INJECTION b) ☒ WITHOUT FLY ASH RE-INJECTION ☐ OTHER (Specify)

2. TYPE OF LIQUID FUEL BURNERS
☒ PRESSURE GUN ☐ ROTARY CUP ☐ STEAM ATOMIZATION ☐ AIR ATOMIZATION ☐ OTHER (Specify) TEMPERATURE BEFORE INJECTION NA °F

3. MANUFACTURER EQUIPMENT Babcock & Wilcox EQUIPMENT MODEL NO. UP-42
BURNER Babcock & Wilcox BURNER MODEL NO.

4. FLUE GAS 1.2 TOTAL ACFM Million @ 335 °F AND 17 % EXCESS AIR

5. COMBUSTION
☐ TANGENTIAL FIRING ☒ OPPOSITE END FIRING ☐ ONE END ONLY FIRING ☐ LIMITED EXCESS AIR FIRING ☐ FLUE GAS RECIRCULATION ☐ STAGED COMBUSTION ☐ BIASED FIRING

6. OPERATING HOURS FOR THIS UNIT a) Hours/day 24 Days/year 365

VII STACK INFORMATION

STACK MONITOR USED? ☒ YES ☐ NO (Specify) ~~Enviroplan NOx +~~ Dynatron-Particulate SO2
INSIDE DIAMETER AT TOP OF STACK 14.5 FT.
HEIGHT OF GAS DISCHARGE ABOVE GROUND LEVEL 317 FT.
OTHER UNITS USING THIS STACK? OR ☐ YES (Identify) ☒ NO
OTHER STACKS ON THIS UNIT? ☐ YES (Specify) ☒ NO

VIII CONTROL EQUIPMENT

(If control equipment is used, Form APCA-6 must also be filed for this unit)
☐ SETTLING CHAMBER ☐ AFTER-BURNER ☐ WATER SPRAY ☐ BAG-HOUSE ☐ WETTED BAFFLES
☐ CYCLONE ☐ VAPOR RECOVERY ☐ SCRUBBER ☐ FABRIC FILTER ☒ ELECTROSTATIC PRECIPITATOR
☒ OTHER (Specify) Flue Gas Conditioning Selective Catalytic Reduction ☐ NONE

IX FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of lbs., gals. etc.)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☒ COAL	Bituminous	2.3	6.8	c) 1,861,500Klb	3500
	Anthracite				
☒ OIL	☒ #2 or #2	0.4	0.0	30 K gal	Ignition only
	#4, #5, #6				
☐ NAT GAS					
☐ LP GAS					
	BTU/Ton	% Moisture			
☐ BARK					
☐ WOOD/BARK					
☐ WOOD					
☐ SLUDGE					
☐ OTHER					

FUEL SUPPLIER

Name	Town or City
Varies (see list supplied to Division)	

SEASONAL USE

	%
% Dec-Feb	25
% Mar-May	25
% Jun-Aug	25
% Sep-Nov	25

REMARKS: Revise TP-B-316(PO-B-427)
a) Permit condition operating hours, actual Operating hours submitted monthly
b) Capable of flyash reinjection or no reinjection
c) Typical annual usage varies with annual capacity factor.

X FUEL ADDITIVES

MANUFACTURER'S NAME: DUSCO
ADDRESS: 4460 Lake Forest Dr., Cinn, OH PHONE: 513-733-1200
SPECIFIC IDENTIFICATION OF ADDITIVE: 8207
CONSUMPTION RATE: 1 lb per ton coal

XI CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding fake and misleading statements.)

DATE:
SIGNED: TITLE: Vice President

MANUFACTURED BY PERSON INDUSTRIES PRINTING DEPARTMENT

AIR POLLUTION CONTROL EQUIPMENT REGISTRATION

Form ARA-6 No. 1 of 2

(A separate form to be completed for each control equipment. All information to be typed and original submitted to Agency.)

Revised 4/5/95

"Live Free or Die"

N.H. Air Resources Division
64 North Main St., Caller Box 2033
Concord, NH 03302-2033
Tel.: 603/271-1370

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm Street Manchester, NH	03105	669-4000
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V MAJOR ACTIVITY OF FIRM: ☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Power

VI TYPE OF CONTROL EQUIPMENT: ☐ BAFFLED SETTLING CHAMBER ☐ WIDE-BODIED CYCLONE ☐ LONG CONE CYCLONE ☐ MULTIPLE CYCLONE (12" Dia Range) ☐ MULTIPLE CYCLONE (6" Dia Range) ☐ IRRIGATED LONG CONE CYCLONE ☒ ELECTROSTATIC PRECIPITATOR ☐ IRRIGATED ELECTROSTATIC PRECIPITATOR

☐ SPRAY TOWER ☐ ABSORPTION TOWER ☐ VENTURI SCRUBBER ☐ WET-FAN SCRUBBER ☐ BAG HOUSE ☐ AFTERBURNER ☐ CARBON ABSORPTION ☒ OTHER (Specify) c) Flue Gas Conditioning

VII POLLUTANTS ENTERING CONTROL EQUIPMENT

MATERIAL: Particulate

RATE OF ENTERING EMISSIONS: MAXIMUM (lbs/hr) 12857 NORMAL (lbs/hr) 8571 ANNUAL (tons/yr) 31,910

METHOD USED TO DETERMINE ENTERING EMISSIONS: ☐ STACK TEST ☐ ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☒ OTHER (Specify) a)

VIII POLLUTANTS EMITTED AFTER CONTROL EQUIPMENT

MATERIAL: Particulate

RATE OF EMISSION: MAXIMUM (lbs/hr) 900 NORMAL (lbs/hr) 600 ANNUAL (tons/yr) 2234

METHOD USED TO DETERMINE EMISSIONS: ☒ STACK TEST b) ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☐ OTHER (Specify)

FINAL USE OF COLLECTED POLLUTANTS (e.g. recycle, dump, etc.) Landfill

IX AUXILIARY FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of lbs., gals. or cu. ft.)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☐ OIL	#1 or #2			NA	NA
	#4, #5, #6			NA	NA
☐ NAT GAS					
☐ LP GAS					
☐ OTHER					

X CONTROL EQUIPMENT OPERATING CONDITIONS

TOTAL GAS VOLUME THRU UNIT (ACFM) 1.2 Million 335 °F AND 12.8 % CO_2

INLET TEMPERATURE (°F) 340 OUTLET TEMPERATURE (°F) 335

PRESSURE DROP (inches of water) 0.4 WATER OR LIQUID RECYCLE RATE (GPM) NA

VOLTAGE 40 KV SPARK RATE 10 MILLIAMPS 200

XI COST ANALYSIS

CAPITAL COST 1,149,686 INSTALLATION COST

OPERATING COST 62,104 per year

XII FACILITIES SERVED (list all application numbers of equipment served by this control unit.)

1 MK2 Boiler 2

3 4

5 6

XIII PARTICLE SIZE ANALYSIS (if available)

SIZE OF PARTICLES	PERCENT OF TOTAL	COLLECTION EFFICIENCY
XXXXXX	---	NA
0 - 10 Microns	69.0	NA
10 - 44 Microns	12.25	NA
over 44 Microns	18.75	NA

REMARKS: Revise TP-B-316 (PO-B-427)

a) Calculated from Stack Test of March 1985 using 93% precipitator efficiency.

b) Based on March, 1985 Stack Test.

c) SO3/NH3 injection, 38 lb per hour max NH3, 108 lb per hour max sulfur. Capable of operating without NH3 injection.

XIV CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE:

SIGNED: TITLE: Vice President

MANUFACTURED BY PRISON INDUSTRIES PRINTING DEPARTMENT

Revised 4/5/95

N.H. Air Resources Division
64 North Main St., Caller Box 2033
Concord, NH 03302-2033
Tel.: 603/271-1370

"Live Free or Die"

AIR POLLUTION CONTROL EQUIPMENT REGISTRATION

Form ARA-6 No. 2 of 2

(A separate form to be completed for each control equipment. All information to be typed and original submitted to Agency.)

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm St., Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm St., Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant: e.g. # 1 Unit, Unit A, etc.): Unit #2 (MK2)

EQUIPMENT LOCATION (No. & Street, Town, Telephone): 97 River Road, Bow, NH 224-4081

DATE DESIGNED: 1966 d)

INSTALLATION DATE: 1968

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Power

VI TYPE OF CONTROL EQUIPMENT

☐ BAFFLED SETTLING CHAMBER ☐ WIDE-BODIED CYCLONE ☐ LONG CONE CYCLONE ☐ MULTIPLE CYCLONE (12" Dia. Range) ☐ MULTIPLE CYCLONE (6" Dia. Range) ☐ IRRIGATED LONG-CONE CYCLONE ☒ ELECTROSTATIC PRECIPITATOR ☐ IRRIGATED ELECTROSTATIC PRECIPITATOR Selective Catalytic Reduction

☐ SPRAY TOWER ☐ ABSORPTION TOWER ☐ VENTURI SCRUBBER ☐ WET-FAN SCRUBBER ☐ BAG HOUSE ☐ AFTERBURNER ☐ CARBON ABSORPTION ☒ OTHER (Specify)

VII POLLUTANTS ENTERING CONTROL EQUIPMENT

MATERIAL: Oxides of Nitrogen (NOx)

RATE OF ENTERING EMISSIONS. MAXIMUM (lbs/hr) 9310 NORMAL (lbs/hr) 9310 ANNUAL (tons/yr) 40,778 a)

METHOD USED TO DETERMINE ENTERING EMISSIONS: ☒ STACK TEST ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☒ OTHER (Specify) NOx Analyze

VIII POLLUTANTS EMITTED AFTER CONTROL EQUIPMENT

MATERIAL: Oxides of Nitrogen (NOx) b)

RATE OF EMISSION: MAXIMUM (lbs/hr) 9310 NORMAL (lbs/hr) 2950 c) ANNUAL (tons/yr) 12921

METHOD USED TO DETERMINE EMISSIONS ☐ STACK TEST ☐ VENDOR DATA ☐ MATERIAL BALANCE ☐ EMISSION FACTORS ☒ OTHER (Specify) design calcs

FINAL USE OF COLLECTED POLLUTANTS (e.g. recycle, dump, etc.): No collected pollutant. Spent catalyst to controlled disposal

IX AUXILIARY FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of lbs., gals. or cu. ft.)	MAXIMUM FIRING RATE (In millions of Btu/hr)
☐ OIL	#1 or #2			NA	NA
	#4, #5, #6			NA	NA
☐ NAT GAS					
☐ LP GAS					
☐ OTHER					

XIII PARTICLE SIZE ANALYSIS (If available)

SIZE OF PARTICLES	PERCENT OF TOTAL	COLLECTION EFFICIENCY
0 - 1 Microns	NA	
1 - 10 Microns	NA	
10 - 44 Microns	NA	
over 44 Microns	NA	

X CONTROL EQUIPMENT OPERATING CONDITIONS

TOTAL GAS VOLUME THRU UNIT (ACFM) 1.2 Million 335 °F AND 12.8 % CO_2

INLET TEMPERATURE (°F) 625-720 OUTLET TEMPERATURE (°F) 625-720

PRESSURE DROP (inches of water) 5.0(1995) WATER OR LIQUID RECYCLE RATE (GPM) NA

VOLTAGE NA SPARK RATE NA MILLIAMPS NA

XI COST ANALYSIS

CAPITAL COST 19,322,000 INSTALLATION COST

OPERATING COST 1,625,000 per year excluding catalyst cost

XII FACILITIES SERVED

(List all application numbers of equipment served by this control unit.)

1 MK 2 Boiler 2

3 4

5

REMARKS: Revise TP-B-316 (PO-B-427)

a) Annual tons/yr of NOx based on maximum emission rate of 2.66 lbs per MMBtu and capacity factor of 1.0.

b) SCR process results in residual ammonia slip. Maximum slip is 10 ppm.

c) Normal NOx emission based on 35.4 tons per 24 hour calendar day. An individual hour NOx emission may be higher or lower than 2950 lbs.

d) SCR designed 1994, installed 5/1995.

XIV CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE:

SIGNED

MANUFACTURED BY PERSON INDUSTRIES PRINTING DEPARTMENT

PSNH MERRIMACK STATION
Bow, New Hampshire
TP-B-316 (PO-B-427)

Federally Enforceable Operating Conditions

1. The emission of air pollutants shall be limited by NH Code of Administrative Rules, CHAPTERS Env-A 100-1300.

2. The maximum operating rate shall be limited to: 3473 million BTU per hour gross heat input of coal at 2.8 pound sulfur per million BTU.

3. The operating hours of the device shall be limited to: 24 hours per day, 365 days during any consecutive twelve month period.

4. The opacity of emission shall not exceed 40%.

5. Other conditions:

   a) Maximum annual coal usage shall be limited to 1,143,740 tons/year. The electrostatic precipitator shall operate with all sections in service when at or above 120 MW gross generation. Below 120 MW gross generation, the electrostatic precipitator shall operate with a minimum number of sections to be determined during optimization before November 30, 1994. Any malfunction of the electrostatic precipitator shall be recorded in accordance with permit condition 7. Quarterly reports shall be submitted indicating 40% opacity exceedances and their cause. The opacity of emissions shall not exceed 30% average per hour.

   b) PSNH shall conduct annual US EPA Method 5, Division approved or EPA approved alternate method stack test(s), 60 days prior to the annual outage.

   c) PSNH shall conduct quarterly "CEM Audits" on transmissiometer (Dynatron) pursuant to Env-A 805.06(e). The quarterly audits shall be performed during the months of June, September, December and March. Notification shall be provided to the Division 15 days prior to each scheduled audit. The findings of each audit shall be reported no later than 15 days from the date of the field audit.

   d) Exceedances and the cause of the 30 percent average hourly opacity limit shall be reported to the Division as soon as possible by telephone but no later than one working day and in writing no later than 15 days after the end of every calendar month.

e) If there are exceedances of the 30% average opacity limit for a 90 minute interval on 3 separate days within any 90 day period, then the Director of the Division at his discretion, may require that PSNH conduct an additional EPA Method 5, Division approved or EPA approved alternate method stack test at a time approved by the Director.

f) Beginning January 1, 1991, the total emissions of Sulfur Dioxide (SO2) from Merrimack Station (including Units #1 and #2) and from Newington and Schiller Stations shall not exceed 55,150 tons per year. PSNH shall submit quarterly reports of emissions, including the method of calculation.

g) Beginning January 1, 1991, monthly fuel usage by station, fuel type, and sulfur content shall be reported in writing to the Division. In addition, current AP-42 emission factors shall be reported.

h) PSNH shall provide a summary of all coal changes at the end of every calendar month with the excess emission report. The report shall contain the following for each coal: days of use; approximate tons of coal used during the month; an analysis of the coal (if the Division has never received one for the applicable coal); and Wahlco operating conditions (if different from those submitted to the Division, as required by permit condition 6.e.iii.).

6. Wahlco Flue Gas Conditioning System Operational Requirements:

a) Maximum feed rate of sulfur to the SO3 injection system shall not exceed 108 pounds per hour sulfur.

b) Maximum feed rate of anhydrous ammonia shall not exceed 38 pounds per hour as NH3.

c) The Wahlco Flue Gas Conditioning System S03 injection shall be operated at all times during normal operation except as follows:

i. During start up and shutdown of Unit 2 at a unit output capacity of less than 130-140 megawatts;

ii. During use of a coal feed rate of 50% or more of Loveridge coal (from Loveridge, Blacksville, Federal #2 mine, etc.); or

iii. At such times that PSNH demonstrates to the Division that compliance with all applicable standards can be achieved without the Wahlco system.

d) The Wahlco Flue Gas Conditioning System NH3 injection shall be operated at the discretion of the responsible PSNH personnel and as demonstrated during the trial test of December 8, 1992 to December 18, 1992, Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

e) The Wahlco system shall be operated at all times at such process conditions so as to maintain an opacity below the established limit on Unit 2 stack.

i. For Bailey coal, the process conditions for minimum opacity operation are 7-8 ppm SO3 injection rate. Variations from this established operation of more than plus or minus 20% require notification to the Division if they last more than 24 hours. All plus or minus 20% deviations should be noted on the monthly report, with day, length of time, operating conditions, and reason of deviation.

ii. The ammonia injection rate shall be operated as is determined by permit condition 6.d..

iii. For other coals, proposed operating conditions (i.e. S03 and NH3 injection rate) shall be submitted to the Division with a plan as to how the opacity will be maintained below the established limits.

f) Reinjection of flyash shall be operated at the discretion of the responsible PSNH personnel and in accordance with the trial test of December 8 -18, 1992, Division correspondence of February 26, 1993, PSNH correspondence of March 8, 1993, and the meetings of March 15 and 16, 1993.

g) Ammonia slip rate shall not exceed 10 ppmdv at 3% 02.

h) The operation of the Wahlco system shall be in accordance with the application forms and PSNH correspondence dated December 23, 1991, except as may be modified per condition 18.

7. Malfunction:

The Division shall be notified by telephone within 8 working hours following any failure of air pollution control equipment, process equipment or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen (15) days after the end of the calendar month (on the excess emission report) of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of time over which emissions were increased due to the failure, the cause of the failure and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause. The foregoing shall not apply to NOx emissions if the unit is participating in NOx RACT emission averaging at the time.

8. Selective Catalytic Reduction (SCR) NOx Controls

   a) Ammonia slip shall not exceed 10 ppm at the stack outlet for the SCR and Wahlco system combined, to be measured during optimization tests and other times as required by the Division.

   b) The NOx CEM required by the Phase I Acid Rain Rule shall be used to measure the NOx emissions outlet.

   c) The specifics of Wahlco operation may be amended based on the optimization of the SCR.

   d) A report of proposed operating conditions based on final SCR optimization shall be provided to the Division within 30 days after final optimization.

   e) PSNH shall track ammonia consumption daily and report to the Division monthly total consumption.

9. Trial Test Burns with Other Fuels

   a) Prior to the use of any fuel other than previously reviewed and approved by the Department of Environmental Services, Air Resources Division ("DES/ARD"), PSNH shall submit a proposal to the DES/ARD, which shall include but not be limited to the following:

      i. Type of fuel;

      ii. Analysis data of the fuel proposed, which shall include proximate and ultimate analysis, volatile and semi volatile analyses and metals analysis;

      iii. Specification of baseline operating conditions at Merrimack Station including coal feed rate, % moisture of coal feed, ESP operating conditions, Wahlco operating conditions and emission values of opacity, S02, NOx, particulate and CO (if applicable);

      iv. A comprehensive test plan which shall present the proposed operating conditions for the trial burn, to include but not be limited to: length of trial; new fuel rate; means of measuring new fuel feed; description of new fuel feed process; new fuel preparations; % moisture of new fuel feed; time table for operation stability; coal feed rate; coal % moisture; ESP operating conditions; Wahlco operating conditions; and expected emission value of opacity, S02, NOx total suspended particulate, and CO. The test plan shall also address the continuous tracking of operational data prior to trial, during trial, and for a short time after trial. S02, NOx and opacity can by monitored using the existing CEMS.

      v. A compliance stack test protocol for total suspended particulate emissions using Method 1 through 4, Method 5 or Division approved alternate, when requested by DES/ARD;

vi. Operational parameters to be monitored and recorded which shall include but not be limited to steam flows, boiler temperature, oxygen, etc.;

vii. The effects of the new fuel on flyash characteristics and resulting effect on the ESP operation;

viii. The effects of the new fuel on bottom ash characteristics;

ix. Specification and description of expected operational and combustion conditions when the trial burn has reached stabilization with new fuel feed; and

x. A time table or schedule with approximate dates of the trial test burn.

b) Once more knowledge is gained as to the specifics of the trial burn, DES/ARD may request additional information on the operations of the trial burn. In addition, metal emission stack testing may be required dependent upon DES/ARD review of the new fuel metal analysis.

c) If the fuel is to be consumed on a regular basis new source review or prevention of significant deterioration may apply as well as a public notice and comment period.

d) DES/ARD will respond within 30 days of receipt of a proposal with approval, conditional approval, denial or request for additional information.

e) The DES Waste Management Division may have additional requirements and concerns and should be contacted prior to any initiation of a test.

f) A summary report should be submitted to DES/ARD at the end of the trial test, which should include a summary of operational results and trends, emission values to include CEM and stack test data, and proposed future use of fuel.

10. Emission of NOx shall be limited in accordance with Env-A 1211 by means of the two Alternative NOx Reduction Options (ANRO) submitted in the compliance schedule for this device on 9/13/94.

11. ANRO 1 As a cyclone-fired unit, the unit's NOx emissions shall be 1.40 lb./MMBtu on a 24-hour calendar day average in accordance with Env-A 1211.03(c)(1)(b)(2)(ii). In accordance with Env-A 1211.03(d) the unit's NOx emission shall be further limited in the period May 31, 1995 through May 31, 1999 to 35.4 tons per calendar day in accordance with Env-A 1211.03(d)(1) for calendar periods of June 1 through May 31 and to 12921 total tons in accordance with Env-A 1211.03(d)(2) for the same calendar periods of June 1 through May 31.

12. ANRO 2 As a cyclone-fired unit, the unit NOx emissions shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be in accordance with Env-A 1211.18 and Env-A 607.

13. In accordance with RSA 125-J:61, emission averaging between PSNH devices subject to RACT shall be in the ratio of 1:1.

14. Compliance with the NOx RACT emission standards in ANRO 1 shall be determined by an initial compliance stack test prior to 8/31/95 and subsequent periodic stack tests every 3 years thereafter per Env-A 1211.21. A stack test report shall be submitted within 30 days after the test. The Relative Accuracy Test Audit (RATA) required by Env-A 806 or 40 CFR Part 75 shall be used for this purpose with concurrence of the Division. The RATA uses the test methods required by Env-A 1211.21(d). Compliance with the NOx RACT emission standard in ANRO 1 shall also be demonstrated by the NOx CEMS required in condition 8.b. and Env-A 1211.22.

15. Compliance with the NOx RACT weighted average allowable emission rate in pounds of NOx per day, as directed by Env-A 1211.18(d) in ANRO 2, shall be based on the actual NOx CEMS measurements being used in interpretation #4 of the emission averaging implementation plan. The NOx CEMS are required by Env-A 1211.18(k)(1)(a), Env-A 1211.22 and Condition 8.b.

16. The quality assurance requirements and procedures of 40 CFR Part 60 Appendix F and Env-A 805 shall be followed for the CEMS. Where these requirements conflict with or duplicate requirements of 40 CFR Part 75, the latter requirements shall prevail.

17. Recordkeeping and reporting shall be in accordance with Env-A 901.06 and 901.07. The additional recordkeeping and reporting required by Env-A 1211.18(h) shall be made if this device takes part in daily emission averaging in a given calendar year. A report shall be submitted for any calendar year by April 15 of the following year in a suitable format in that instance.

18. The Division reserves the right to further amend the conditions contained in this permit pending the results of any further process optimization and compliance testing. Adequate time shall be provided to PSNH in order to respond and/or comply with any amended conditions.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

IMPLEMENTATION OF NOx EMISSION AVERAGING UNDER
ENV-A 1211.18 AND ENV-A 607

PURPOSE

This document outlines the procedures and methods that PSNH shall use in order to emission average its NOx RACT units and devices as allowed for in Env-A 1211.18 and Env-A 607. This document is intended to be a general attachment to the NOx RACT permit applications and is intended to augment the PSNH facilities NOx compliance Schedules submitted to the NH Air Resources Division for each NOx RACT unit or device on 13 September, 1994. PSNH regards emission averaging as an Alternative NOx Reduction Option (ANRO).

INTERPRETATION

In order to implement emission averaging, PSNH has been required to interpret Env-A 1211.18 and Env-A 607 in a manner that makes emission averaging both workable and achievable. The intent is to average the NOx emissions of selected participating operating NOx RACT units or devices on a calendar day basis such that the totality of pounds of NOx allowed to be emitted daily from all such participating operating units or devices is not exceeded during that calendar day per Env-A 1211.18(d). A different calendar day may or may not include a different set of participating operating units or may not be a day when any emission averaging is necessary. The following interpretations are made:

1. In the equation found in Env-A 1211.18(i) the sum E is a system NOx emission cap in allowable pounds over a calendar day, where the system is the selected set of participating operating NOx RACT units or devices. Thus E may vary depending on the composition of the set from calendar day to calendar day.

2. A_i for the ith unit or device is the NOx emission limitation given in Env-A 1211.03 - 1211.14 and Env-A 1211.17. Unless the NHARD provides the appropriate conversion factors, it will not be possible to incorporate in a PSNH averaging scheme those RACT units or devices limited by Env-A 1211.06, since the measurement units are not in lbs NOx per MMBtu, but rather in ppmvd.

3. B_i for the ith unit or device is the maximum heat input limitation in MMBtu per hour that appears as a condition in a permit to operate or a Title V permit multiplied by 24 hours per day.

4. Compliance is achieved when, for a calendar day in which emission averaging is used, the sum E' representing the totality of all pounds of NOx actually emitted through the calendar day by the set of participating operating NOx RACT units and devices is less than or equal to E at the end of the calendar day:

$$E' \leq E$$

The equation for E' is similar to that for E, being:

$$E' = (A1' \times B1') + (A2' \times B2') + \cdots + (An' \times Bn')$$

Where: E' = the total actual NOx emissions from a set of selected participating operating NOx RACT units and devices over a particular calendar day in pounds per day.

A_i ' = the actual NOx emission rate of the ith unit or device participating in the emission averaging. For a unit with Continuous Emission Monitor Systems (CEMS), this value may be the average of the valid hourly NOx emission rates over the entire calendar day in pounds per MMBtu. If the CEMS is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the highest rate in pounds of NOx per hour found in the most recent NOx compliance test that is required by Env-A 1211.21 per Env-A 1211.18(k)(1)(b)(1).

B_i ' = the actual heat input or hours of operation over the calendar day of the ith unit or device participating in the emission averaging. For a unit with CEMS, this value may be the sum of the valid hourly heat input (in MMBtu per hour) over the entire calendar day in MMBtu per day. If this monitoring system is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the total hours of operation over the calendar day per Env-A 1211.18(k)(1)(b)(2).

A_i 'X B_i '= The actual NOx emission rate in pounds per day of the ith unit or device participating in the emission averaging. For a unit or device with CEMS, this value shall be the sum of the hourly values of the actual NOx emission rate in pounds per hour for every valid operating hour in the calendar day. The hourly value shall be given by the product of the actual hourly NOx emission rate in pounds per MMBtu and the actual heat input in MMBtu per hour for that hour as measured by the CEMS. If this monitoring system is malfunctioning, these values shall be calculated using the alternative monitoring method planned for the unit.

5. Emission averaging may be initiated and terminated for a set of selected participating operating NOx RACT units or devices at any time during a particular calendar day when it is used. Compliance with Env-A 1211, however, shall be based upon emission averaging over that entire calendar day for the set of participating operating NOx RACT units and devices.

6. For the purposes of RACT compliance, the transfer ratio of emission reductions between participating operating NOx RACT units and devices in a set shall be 1:1 in accordance with RSA 125-J:6I.

7. Compliance with the recordkeeping requirements of Env-A 1211.18(h) shall be satisfied if the provisions of Env-A 901.06 and Env-A 901.07 are met and the record of emission averaging for a calendar day in which it is used will show the following:

a) Identity of each participating unit or device
b) The day of occurrence
c) The values for E, E' and E - E'
d) The values for A_i, A_i', B_i and B_i' for each participating unit or device
e) The values for A_i X B_i and A_i 'X B_i ' for each participating unit or device

NOx RACT Unit and Device Identification

The PSNH NOx RACT units and devices that are eligible to participate in emission averaging are given below:

Unit(s) Located at Merrimack Station:

Merrimack Unit I (MK1)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 113.5 megawatts.
Merrimack Unit 2 (MK2)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 320 megawatts.
Combustion Turbine 1 (MKCT1)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.
Combustion Turbine 2 (MKCT2)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.

Unit(s) Located at Newington Station:

Newington Unit 1 (NT1)	Tangentially fired utility boiler, capable of firing oil only, or cofiring gas and oil, with a net generating capacity of 406 megawatts.

Auxiliary Boiler 1 (NT Aux 1)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).
Auxiliary Boiler 2 (NT Aux 2)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).

Unit(s) Located at Schiller Station:

Schiller Unit 4 (SR4)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 45 megawatts firing coal, and 47.5 megawatts firing oil.
Schiller Unit 5 (SR5)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 47 megawatts firing coal, and 49.6 megawatts firing oil.
Schiller Unit 6 (SR6)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 48 megawatts firing coal, and 48 megawatts firing oil.
Combustion Turbine (SRCT1)	Oil or natural gas fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22 megawatts.

Allowable NOx Emissions During Emission Averaging

The allowable NOx emission in pounds per day for the eligible units and devices is given by multiplying the respective allowable emission rate, A_i, by the respective maximum permitted firing rate, B_i. These values are given below:

A_{MK1} = 0.92 lbs/MMBtu

B_{MK1}=1093 MMBtu/hr, 26,232 MMBtu/day

A_{MK1} X B_{MK1}=24,133 lbs/day

A_{MK2}=[Merrimack Unit 2 maximum daily emissions will be limited by

B_{MK2} Env-A 1211.03(d.), to 35.4 tons per day, or 70,800 lbs per day]

A_{MK2} X B_{MK2}=70,800lbs/day

A_{MKCT1}=0.9 lbs/MMBtu

B_{MKCT1}=319 MMBtu/hr, 7656 MMBtu/day

A_{MKCT1} X B_{MKCT1} = 6890 lbs/day

A_{MKCT2}=0.9 lb/MMBtu

B_{MKCT2}=319 MMBtu, 7656 MMBtu/day

A_{MKCT2} X B_{MKCT2} = 6890 lbs/day

A_{NT1}=0.35 lbs/MMBtu (oil only), 0.25 lbs/MMBtu (oil and gas)

B_{NT1}=4350 MMBtu/hr, 104,400 MMBtu/day

A_{NT1} X B_{NT1} = 36,540 lbs/day (oil only)

A_{NT1} X B_{NT1} = 26,100 lbs/day (oil and gas)

A_{NTAUX1}=0.2 lbs/MMBtu

B_{NTAUX1}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX1}X B_{NTAUX1}=481 lbs/day

A_{NTAUX2}=0.2 lbs/MMBtu

B_{NTAUX2}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX2} X B_{NTAUX}=481 lbs/day

A_{SR4}=0.5 lbs/MMBtu (coal or oil)

B_{SR4}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR4} X B_{SR4} = 6888 lbs/day (coal or oil)

A_{SR5}=0.5 lbs/MMBtu (coal or oil)

B_{SR5}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR5} X B_{SR5} = 6888 lbs/day (coal or oil)

A_{SR6}=0.5 lbs/MMBtu (coal or oil)

B_{SR6}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR6} X B_{SR6} = 6888 lbs/day (coal or oil)

A_{SRCT1}=0.9 lbs/MMBtu (oil or gas)

B_{SRCT1}=290 MMBtu/hr, 6960 MMBtu/day

A_{SRCT1} X B_{SRCT1} = 6264 lbs/day (oil or gas)

Operational Thresholds

It shall be the duty of the operator of an eligible unit or device to:

1. Track the actual NOx emission rate in pounds per MMBtu of the unit or device hourly from the start of a calendar day.

2. Maintain the unit or device in compliance with its applicable NOx RACT emission limit in pounds per MMBtu. The operator must be assured that there is adequate indication that this NOx emission limitation, which is based on a calendar day average, shall not be exceeded. The calendar day average does not count non-operating hours.

3. Take corrective action to prevent an exceedance through operational control.

4. Start the process of emission averaging if other measures are deemed inadequate or more costly. Under emission averaging, the NOx RACT emission limitation would be expressed in pounds per day.

5. Document for the record the start of the emission averaging, the set of participating units or devices used for emission averaging, and the resulting actual NOx RACT emission levels in pounds per day for each participating unit or device for each calendar day of emission averaging.

6. Perform the same action as in 5. above if the operator of a participating unit or device was not the initiator of the emission averaging process.

Public Service of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 31, 1995

D08790

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
Caller Box 2033
64 North Main Street
Concord, NH 03302-2033

Revision to PO-B-034
Merrimack Station Combustion Turbine CT-1

Dear Mr. Colburn:

Northeast Utilities Service Company (NUSCO) on behalf of Public Service Company of New Hampshire (PSNH) in accordance with Env-A 200 and 600 hereby submits a revised Permit PO-B-034 Application Form ARD-2 in order to comply with Env-A 1211 Nitrogen Oxides (NOx). This submittal does not intend to affect non-NOx aspects of the most recent application on file for this unit, nor does it intend to affect the current permit and conditions attached thereto with respect to non-NOx aspects. It is expected, however, that the validity period of PO-B-034 will change.

As required by ENV-A-1211.16, a NOx compliance schedule was filed by NUSCO with the New Hampshire Air Resources Division (NHARD) on 9/13/94. Those portions of that filing specific to PO-B-034 are incorporated herein by reference. In particular, Schedule Section 5 incorporates this device in a plan for emission averaging as allowed in Env-A 1211.18. This depends upon the issuance by the NHARD of a federally enforceable permit per Env-A 1211.18(g). NUSCO requests the NHARD to carry forth those actions to make this permit federally enforceable without a single-source SIP revision. This unit shall be in compliance with NOx RACT by 5/31/95.

Enclosed are: 1. Revised ARD-2, 2. An attached sheet of suggested permit conditions, 3. Plan for implementation of emission averaging.

A check in the amount of $3000 for the filing fee per Env-A 700 will follow.

In accordance with Part Env-A 605, the following is submitted:

1. Name and title of person to whom all orders and notices may be served:

   Ronald G. Chevalier
   Vice President

2. Name and title of person to whom all bills regarding permit fees may be rendered:

   Ronald G. Chevalier
   Vice President

If you have any questions, or need additional information, please contact Mr. Robert W. Pickering, PSNH, Production Operations Services Department, at (603)634-2390.

Very truly yours,

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

R. G. Chevalier
Vice President

Enclosures

Revised 4/5/[illegible]

AIR RESOURCES DIVISION
64 NORTH MAIN STREET
CALLER BOX 2033
CONCORD, NH 03302-2033

FUEL BURNING EQUIPMENT REGISTRATION
Form ARA-2

(A separate form to be completed for each stack and associated equipment. All information to be typed, and original submitted to Agency.)

"Live Free or Die"

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of New Hampshire	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant: e.g. # 1 Unit, Unit A, etc.)	EQUIPMENT LOCATION (No. & Street, Town, Telephone)	DATE DESIGNED	INSTALLATION DATE
Combustion Turbine #1 (MKCT1)	97 River Road, Bow, NH 244-4081	1967	1968

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Pow

VI BURNER DESIGN

1. TYPE OF SOLID FUEL BURNERS: ☐ CYCLONE ☐ PULVERIZED WET / DRY ☐ SPREADER STOKER ☐ UNDER FEED STOKER ☐ OVER FEED STOKER ☐ HAND-FIRED ☐ WITH FLY ASH RE-INJECTION ☐ WITHOUT FLY ASH RE-INJECTION ☒ OTHER (Specify) none

2. TYPE OF LIQUID FUEL BURNERS: ☒ PRESSURE GUN ☐ ROTARY CUP ☐ STEAM ATOMIZATION ☐ AIR ATOMIZATION ☐ OTHER (Specify) _____ TEMPERATURE BEFORE INJECTION 80 °F

3. MANUFACTURER: EQUIPMENT Pratt & Whitney EQUIPMENT MODEL NO. FT4A-8LF; BURNER Pratt & Whitney BURNER MODEL NO. 697195

4. FLUE GAS: TOTAL ACFM _____ @ 840 °F AND _____ % EXCESS AIR

5. COMBUSTION: ☐ TANGENTIAL FIRING ☐ OPPOSITE END FIRING ☒ ONE END ONLY FIRING ☐ LIMITED EXCESS AIR FIRING ☐ FLUE GAS RECIRCULATION ☐ STAGED COMBUSTION ☐ BIASED FIRING

6. OPERATING HOURS FOR THIS UNIT a) Hours/day 24 Days/year 365

VII STACK INFORMATION

STACK MONITOR USED? ☐ YES ☒ NO (Specify) _____

INSIDE DIAMETER AT TOP OF STACK 10'6" X 14' FT.

HEIGHT OF GAS DISCHARGE ABOVE GROUND LEVEL 20 FT.

OTHER UNITS USING THIS STACK? ☐ YES (Identify) _____ ☒ NO

OTHER STACKS ON THIS UNIT? ☐ YES (Specify) _____ ☒ NO

VIII CONTROL EQUIPMENT

(If control equipment is used, Form APCA-6 must also be filed for this unit.)

☐ SETTLING CHAMBER ☐ AFTER-BURNER ☐ WATER SPRAY ☐ BAG-HOUSE ☐ WETTED BAFFLES

☐ CYCLONE ☐ VAPOR RECOVERY ☐ SCRUBBER ☐ FABRIC FILTER ☐ ELECTROSTATIC PRECIPITATOR

☐ OTHER (Specify) _____ ☒ NONE

IX FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (in thousands of ~~XX~~ gals. ~~XXXX~~)	MAXIMUM FIRING RATE (in millions of BTU/HR)
☐ COAL	Bituminous				
	Anthracite				
☒ OIL	#1 or #2	0.2	0.0	b) 50,282	319.0
	#4, #5, #6				
☐ NAT GAS					
☐ LP GAS					
		BTU/Ton	% Moisture		
☐ BARK					
☐ WOOD/BARK					
☐ WOOD					
☐ SLUDGE					
☐ OTHER					

FUEL SUPPLIER

Name	Town or City
Varies (See list provided to Division)	

SEASONAL USE

% Dec Feb	40
% Mar May	10
% Jun Aug	40
% Sep Nov	10

REMARKS:

Revise PO-B-34

a) Operation limited per attached condition sheet.

b) Average use: 1979-1981

X FUEL ADDITIVES

MANUFACTURER'S NAME: Not Applicable

ADDRESS: _____ PHONE: _____

SPECIFIC IDENTIFICATION OF ADDITIVE: _____

CONSUMPTION RATE: _____ gallons / 1000 gallons of oil

XI CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE: _____

SIGNED: _____ TITLE: Vice President

MANUFACTURED BY PRISON INDUSTRIES PRINTING DEPARTMENT

PSNH MERRIMACK STATION
Bow, New Hampshire
PO-B-034

Federally Enforceable Operating Conditions

1. The owner or operator of the devices as specified by this permit is subject to the Rules Governing the Control of Air Pollution for the State of New Hampshire, CHAPTERS Env-A 100-1300.

2. Operating Conditions

   a. The maximum operating rate is limited to 319 million BTU/hr gross heat input of #1 fuel oil.

   b. The operating hours of this device are limited to 24 hrs/day and 365 days/year.

   c. The opacity of emissions shall not exceed 40%.

3. Stack Criteria

   The Stack shall be a minimum of 20 feet high and a maximum of 10'6" by 14" rectangular in width.

4. Recordkeeping and Reporting

   a. PSNH, Bow shall submit a written report to the Division of the fuel consumption for each calendar year by February 1st of the following year.

5. Malfunction

   The Division shall be notified by telephone within eight working hours following any failure of air pollution control equipment, process equipment, or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen days of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of the time over which emissions were increased due to the failure, the estimated resultant emissions in excess of those allowed and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause. The foregoing shall not apply to NOx emissions if the unit is participating in NOx RACT emission averaging at the time.

6. Emissions of NOx shall be limited in accordance with Env-A 1211 by means of the four Alternative NOx Reduction Options (ANRO) submitted in the compliance schedule for this device on 9/13/94.

7. ANRO 1 As a load shaving unit, the units NOx RACT emission limit shall be no greater than 0.9lb per MMBtu based on an hourly average for any type of fuel per Env-A 1211.13(b).

8. ANRO 2 As a load shaving unit, the unit NOx emissions shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be in accordance with Env-A 1211.18 and Env-A 607.

9. ANRO 3 Load shaving status shall be lost if the NOx emissions from this device exceed 50 tons in any consecutive 12 month period. The device shall then be a simple cycle combustion turbine. NOx RACT emissions shall be limited to an hourly average of 75 ppmvd when firing oil. This limit is as corrected to 15% oxygen.

10. ANRO 4 As a simple cycle turbine, the unit shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be in accordance with Env-A 1211.18 and Env-A 607.

11. In accordance with RSA 125-J:6I, emission averaging between PSNH devices subject to RACT shall be in the ratio of 1:1.

12. Compliance with the NOx RACT emission standards in ANRO 1 and ANRO 3 shall be determined by an initial compliance stack test prior to 8/31/95 and subsequent periodic stack tests every 3 years thereafter per Env-A 1211.21. Method 20 of 40 CFR Part 60 Appendix A shall be used. Compliance with Env-A 1211.21 shall be deemed compliance with Env-A 806 as proposed.

13. The most recent periodic stack test shall be used to establish the correlation between the heat input to the device, the stack volumetric NOx concentration in ppmvd, and the NOx emission rate in lbs NOx/MMBtu and lbs NOx /hour. The most recent value of the NOx emission rate so determined shall be used as the actual worst case emission rate for this device when emission averaging is used for compliance with Env-A 1211.18(i) in accordance with Env-A 1211.18(k)(1)(b)(1).

14. For purposes of emission averaging, the actual hours of operation per day shall be used for compliance in accordance to Env-A 1211.18(k)(1)(b)(2).

15. Recordkeeping and reporting shall be in accordance with Env-A 901.06 and 901.07. The additional recordkeeping and reporting required by Env-A 1211.18(h) shall be made if this device takes part in daily emission averaging in a given calendar year. A report shall be submitted for any calendar year by April 15 of the following year in a suitable format in that instance.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

IMPLEMENTATION OF NOx EMISSION AVERAGING UNDER
ENV-A 1211.18 AND ENV-A 607

PURPOSE

This document outlines the procedures and methods that PSNH shall use in order to emission average its NOx RACT units and devices as allowed for in Env-A 1211.18 and Env-A 607. This document is intended to be a general attachment to the NOx RACT permit applications and is intended to augment the PSNH facilities NOx compliance Schedules submitted to the NH Air Resources Division for each NOx RACT unit or device on 13 September, 1994. PSNH regards emission averaging as an Alternative NOx Reduction Option (ANRO).

INTERPRETATION

In order to implement emission averaging, PSNH has been required to interpret Env-A 1211.18 and Env-A 607 in a manner that makes emission averaging both workable and achievable. The intent is to average the NOx emissions of selected participating operating NOx RACT units or devices on a calendar day basis such that the totality of pounds of NOx allowed to be emitted daily from all such participating operating units or devices is not exceeded during that calendar day per Env-A 1211.18(d). A different calendar day may or may not include a different set of participating operating units or may not be a day when any emission averaging is necessary. The following interpretations are made:

1. In the equation found in Env-A 1211.18(i) the sum E is a system NOx emission cap in allowable pounds over a calendar day, where the system is the selected set of participating operating NOx RACT units or devices. Thus E may vary depending on the composition of the set from calendar day to calendar day.

2. A_i for the ith unit or device is the NOx emission limitation given in Env-A 1211.03 - 1211.14 and Env-A 1211.17. Unless the NHARD provides the appropriate conversion factors, it will not be possible to incorporate in a PSNH averaging scheme those RACT units or devices limited by Env-A 1211.06, since the measurement units are not in lbs NOx per MMBtu, but rather in ppmvd.

3. B_i for the ith unit or device is the maximum heat input limitation in MMBtu per hour that appears as a condition in a permit to operate or a Title V permit multiplied by 24 hours per day.

4. Compliance is achieved when, for a calendar day in which emission averaging is used, the sum E' representing the totality of all pounds of NOx actually emitted through the calendar day by the set of participating operating NOx RACT units and devices is less than or equal to E at the end of the calendar day:

$$E' \leq E$$

The equation for E' is similar to that for E, being:

$$E' = (A1' \times B1') + (A2' \times B2') + \cdots + (An' \times Bn')$$

Where: E' = the total actual NOx emissions from a set of selected participating operating NOx RACT units and devices over a particular calendar day in pounds per day.

A_i ' = the actual NOx emission rate of the ith unit or device participating in the emission averaging. For a unit with Continuous Emission Monitor Systems (CEMS), this value may be the average of the valid hourly NOx emission rates over the entire calendar day in pounds per MMBtu. If the CEMS is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the highest rate in pounds of NOx per hour found in the most recent NOx compliance test that is required by Env-A 1211.21 per Env-A 1211.18(k)(1)(b)(1).

B_i ' = the actual heat input or hours of operation over the calendar day of the ith unit or device participating in the emission averaging. For a unit with CEMS, this value may be the sum of the valid hourly heat input (in MMBtu per hour) over the entire calendar day in MMBtu per day. If this monitoring system is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the total hours of operation over the calendar day per Env-A 1211.18(k)(1)(b)(2).

A_i 'X B_i '= The actual NOx emission rate in pounds per day of the ith unit or device participating in the emission averaging. For a unit or device with CEMS, this value shall be the sum of the hourly values of the actual NOx emission rate in pounds per hour for every valid operating hour in the calendar day. The hourly value shall be given by the product of the actual hourly NOx emission rate in pounds per MMBtu and the actual heat input in MMBtu per hour for that hour as measured by the CEMS. If this monitoring system is malfunctioning, these values shall be calculated using the alternative monitoring method planned for the unit.

5. Emission averaging may be initiated and terminated for a set of selected participating operating NOx RACT units or devices at any time during a particular calendar day when it is used. Compliance with Env-A 1211, however, shall be based upon emission averaging over that entire calendar day for the set of participating operating NOx RACT units and devices.

6. For the purposes of RACT compliance, the transfer ratio of emission reductions between participating operating NOx RACT units and devices in a set shall be 1:1 in accordance with RSA 125-J:6I.

7. Compliance with the recordkeeping requirements of Env-A 1211.18(h) shall be satisfied if the provisions of Env-A 901.06 and Env-A 901.07 are met and the record of emission averaging for a calendar day in which it is used will show the following:

   a) Identity of each participating unit or device
   b) The day of occurrence
   c) The values for E, E' and E - E'
   d) The values for A_i, A_i', B_i and B_i' for each participating unit or device
   e) The values for A_i X B_i and A_i 'X B_i ' for each participating unit or device

NOx RACT Unit and Device Identification

The PSNH NOx RACT units and devices that are eligible to participate in emission averaging are given below:

Unit(s) Located at Merrimack Station:

Merrimack Unit I (MK1)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 113.5 megawatts.
Merrimack Unit 2 (MK2)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 320 megawatts.
Combustion Turbine 1 (MKCT1)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.
Combustion Turbine 2 (MKCT2)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.

Unit(s) Located at Newington Station:

Newington Unit 1 (NT1)	Tangentially fired utility boiler, capable of firing oil only, or cofiring gas and oil, with a net generating capacity of 406 megawatts.

Auxiliary Boiler 1 (NT Aux 1)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).
Auxiliary Boiler 2 (NT Aux 2)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).

Unit(s) Located at Schiller Station:

Schiller Unit 4 (SR4)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 45 megawatts firing coal, and 47.5 megawatts firing oil.
Schiller Unit 5 (SR5)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 47 megawatts firing coal, and 49.6 megawatts firing oil.
Schiller Unit 6 (SR6)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 48 megawatts firing coal, and 48 megawatts firing oil.
Combustion Turbine (SRCT1)	Oil or natural gas fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22 megawatts.

Allowable NOx Emissions During Emission Averaging

The allowable NOx emission in pounds per day for the eligible units and devices is given by multiplying the respective allowable emission rate, A_i, by the respective maximum permitted firing rate, B_i. These values are given below:

A_{MK1} = 0.92 lbs/MMBtu

B_{MK1}=1093 MMBtu/hr, 26,232 MMBtu/day

A_{MK1} X B_{MK1}=24,133 lbs/day

A_{MK2}=[Merrimack Unit 2 maximum daily emissions will be limited by

B_{MK2} Env-A 1211.03(d.), to 35.4 tons per day, or 70,800 lbs per day]

A_{MK2} X B_{MK2}=70,800lbs/day

A_{MKCT1}=0.9 lbs/MMBtu

B_{MKCT1}=319 MMBtu/hr, 7656 MMBtu/day

A_{MKCT1} X B_{MKCT1} = 6890 lbs/day

A_{MKCT2}=0.9 lb/MMBtu

B_{MKCT2}=319 MMBtu, 7656 MMBtu/day

A_{MKCT2} X B_{MKCT2} = 6890 lbs/day

A_{NT1}=0.35 lbs/MMBtu (oil only), 0.25 lbs/MMBtu (oil and gas)

B_{NT1}=4350 MMBtu/hr, 104,400 MMBtu/day

A_{NT1} X B_{NT1} = 36,540 lbs/day (oil only)

A_{NT1} X B_{NT1} = 26,100 lbs/day (oil and gas)

A_{NTAUX1}=0.2 lbs/MMBtu

B_{NTAUX1}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX1}X B_{NTAUX1}=481 lbs/day

A_{NTAUX2}=0.2 lbs/MMBtu

B_{NTAUX2}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX2} X B_{NTAUX}=481 lbs/day

A_{SR4}=0.5 lbs/MMBtu (coal or oil)

B_{SR4}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR4} X B_{SR4} = 6888 lbs/day (coal or oil)

A_{SR5}=0.5 lbs/MMBtu (coal or oil)

B_{SR5}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR5} X B_{SR5} = 6888 lbs/day (coal or oil)

A_{SR6}=0.5 lbs/MMBtu (coal or oil)

B_{SR6}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR6} X B_{SR6} = 6888 lbs/day (coal or oil)

A_{SRCT1}=0.9 lbs/MMBtu (oil or gas)

B_{SRCT1}=290 MMBtu/hr, 6960 MMBtu/day

A_{SRCT1} X B_{SRCT1} = 6264 lbs/day (oil or gas)

Operational Thresholds

It shall be the duty of the operator of an eligible unit or device to:

1. Track the actual NOx emission rate in pounds per MMBtu of the unit or device hourly from the start of a calendar day.

2. Maintain the unit or device in compliance with its applicable NOx RACT emission limit in pounds per MMBtu. The operator must be assured that there is adequate indication that this NOx emission limitation, which is based on a calendar day average, shall not be exceeded. The calendar day average does not count non-operating hours.

3. Take corrective action to prevent an exceedance through operational control.

4. Start the process of emission averaging if other measures are deemed inadequate or more costly. Under emission averaging, the NOx RACT emission limitation would be expressed in pounds per day.

5. Document for the record the start of the emission averaging, the set of participating units or devices used for emission averaging, and the resulting actual NOx RACT emission levels in pounds per day for each participating unit or device for each calendar day of emission averaging.

6. Perform the same action as in 5. above if the operator of a participating unit or device was not the initiator of the emission averaging process.

Public Service of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 31, 1995

D08791

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
Caller Box 2033
64 North Main Street
Concord, NH 03302-2033

Revision to PO-B-035
Merrimack Station Combustion Turbine CT-2

Dear Mr. Colburn:

Northeast Utilities Service Company (NUSCO) on behalf of Public Service Company of New Hampshire (PSNH) in accordance with Env-A 200 and 600 hereby submits a revised Permit PO-B-035 Application Form ARD-2 in order to comply with Env-A 1211 Nitrogen Oxides (NOx). This submittal does not intend to affect non-NOx aspects of the most recent application on file for this unit, nor does it intend to affect the current permit and conditions attached thereto with respect to non-NOx aspects. It is expected, however, that the validity period of PO-B-035 will change.

As required by ENV-A-1211.16, a NOx compliance schedule was filed by NUSCO with the New Hampshire Air Resources Division (NHARD) on 9/13/94. Those portions of that filing specific to PO-B-035 are incorporated herein by reference. In particular, Schedule Section 5 incorporates this device in a plan for emission averaging as allowed in Env-A 1211.18. This depends upon the issuance by the NHARD of a federally enforceable permit per Env-A 1211.18(g). NUSCO requests the NHARD to carry forth those actions to make this permit federally enforceable without a single-source SIP revision. This unit shall be in compliance with NOx RACT by 5/31/95.

Enclosed are: 1. Revised ARD-2, 2. An attached sheet of suggested permit conditions, 3. Plan for implementation of emission averaging.

A check in the amount of $3000 for the filing fee per Env-A 700 will follow.

In accordance with Part Env-A 605, the following is submitted:

1. Name and title of person to whom all orders and notices may be served:

   Ronald G. Chevalier
   Vice President

2. Name and title of person to whom all bills regarding permit fees may be rendered:

   Ronald G. Chevalier
   Vice President

If you have any questions, or need additional information, please contact Mr. Robert W. Pickering, PSNH, Production Operations Services Department, at (603)634-2390.

Very truly yours,

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

R. G. Chevalier
Vice President

Enclosures

Revised 4/5/95

NEW HAMPSHIRE ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
64 NORTH MAIN STREET
CALLER BOX 2033
CONCORD, NH 03302-2033

FUEL BURNING EQUIPMENT REGISTRATION

Form ARA-2

(A separate form to be completed for each stack and associated equipment. All information to be typed, and original submitted to Agency.)

"Live Free or Die"

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of New Hampshire	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant e.g. # 1 Unit, Unit A, etc.)	EQUIPMENT LOCATION (No. & Street, Town, Telephone)	DATE DESIGNED	INSTALLATION DATE
Combustion Turbine #2 (MKCT2)	97 River Road, Bow, NH 244-4081	1968	1969

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Powe

VI BURNER DESIGN

1. TYPE OF SOLID FUEL BURNERS
☐ CYCLONE ☐ PULVERIZED WET / DRY ☐ SPREADER STOKER ☐ UNDER FEED STOKER ☐ OVER FEED STOKER ☐ HAND-FIRED ☐ WITH FLY ASH RE-INJECTION ☐ WITHOUT FLY ASH RE-INJECTION ☒ OTHER (Specify) none

2. TYPE OF LIQUID FUEL BURNERS
☒ PRESSURE GUN ☐ ROTARY CUP ☐ STEAM ATOMIZATION ☐ AIR ATOMIZATION ☐ OTHER (Specify) _____ TEMPERATURE BEFORE INJECTION 80 °F

3. MANUFACTURER EQUIPMENT Pratt & Whitney EQUIPMENT MODEL NO. FT4A-9LF
BURNER Pratt & Whitney BURNER MODEL NO. 697195

4. FLUE GAS TOTAL ACFM _____ @ 840 °F AND _____ % EXCESS AIR

5. COMBUSTION
☐ TANGENTIAL FIRING ☐ OPPOSITE END FIRING ☒ ONE END ONLY FIRING ☐ LIMITED EXCESS AIR FIRING ☐ FLUE GAS RECIRCULATION ☐ STAGED COMBUSTION ☐ BIASED FIRING

6. OPERATING HOURS FOR THIS UNIT a)
Hours/day 24 Days/year 365

VII STACK INFORMATION

STACK MONITOR USED? ☐ YES ☒ NO (Specify) _____
INSIDE DIAMETER AT TOP OF STACK 10'6" X 14' FT.
HEIGHT OF GAS DISCHARGE ABOVE GROUND LEVEL 20 FT.
OTHER UNITS USING THIS STACK? ☐ YES (Identify) _____ ☒ NO
OTHER STACKS ON THIS UNIT? ☐ YES (Specify) _____ ☒ NO

VIII CONTROL EQUIPMENT

(If control equipment is used, Form APCA-6 must also be filed for this unit.)
☐ SETTLING CHAMBER ☐ AFTER-BURNER ☐ WATER SPRAY ☐ BAG-HOUSE ☐ WETTED BAFFLES
☐ CYCLONE ☐ VAPOR RECOVERY ☐ SCRUBBER ☐ FABRIC FILTER ☐ ELECTROSTATIC PRECIPITATOR
☐ OTHER (Specify) _____ ☒ NONE

IX FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of XX gals. XXXX)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☐ COAL	Bituminous				
	Anthracite				
☒ OIL	#1 or #2	0.2	0.0	b) 50,282	319.0
	#4, #5, #6				
☐ NAT GAS					
☐ LP GAS					
		BTU/lbs	% Moisture		
☐ BARK					
☐ WOOD/BARK					
☐ WOOD					
☐ SLUDGE					
☐ OTHER					

FUEL SUPPLIER Name	Town or City	SEASONAL USE
Varies	(See list provided to Division)	% Dec Feb: 40
		% Mar May: 10
		% Jun Aug: 40
		% Sep Nov: 10

REMARKS:
Revise PO-B-35
a) Operation limited per attached condition sheet.
b) Average use: 1979-1981

X FUEL ADDITIVES

MANUFACTURER'S NAME: Not Applicable
ADDRESS: _____ PHONE: _____
SPECIFIC IDENTIFICATION OF ADDITIVE: _____
CONSUMPTION RATE: _____ gallons / 1000 gallons of oil

XI CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE: _____
SIGNED: _____ TITLE: Vice President

MANUFACTURED BY PEGON INDUSTRIES PRINTING DEPARTMENT

PSNH MERRIMACK STATION
Bow, New Hampshire
PO-B-035

Federally Enforceable Operating Conditions

1. The owner or operator of the devices as specified by this permit is subject to the Rules Governing the Control of Air Pollution for the State of New Hampshire, CHAPTERS Env-A 100-1300 as adopted by the New Hampshire Department of Environmental Services, Air Resources Division.

2. Operating Conditions

   a. The maximum operating rate is limited to 319 million BTU/hr gross heat input of #1 fuel oil.

   b. The operating hours of this device are limited to 24 hrs/day and 365 days/year.

   c. The opacity of emissions shall not exceed 40%.

3. Stack Criteria

   The Stack shall be a minimum of 20 feet high and a maximum of 10'6" by 14" rectangular in width.

4. Recordkeeping and Reporting

   a. PSNH, Bow shall submit a written report to the Division of the fuel consumption for each calendar year by February 1st of the following year.

5. Malfunction

   The Division shall be notified by telephone within eight working hours following any failure of air pollution control equipment, process equipment, or failure of a process to operate in a normal manner which results in an increase in emissions above any allowable emission limit. In addition, the Division shall be notified in writing within fifteen days of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of the time over which emissions were increased due to the failure, the estimated resultant emissions in excess of those allowed and the corrective actions taken to restore normal operation. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violation of this permit or of any law or regulation which such malfunction may cause. The foregoing shall not apply to NOx emissions if the unit is participating in NOx RACT emission averaging at the time.

6. Emissions of NOx shall be limited in accordance with Env-A 1211 by means of the four Alternative NOx Reduction Options (ANRO) submitted in the compliance schedule for this device on 9/13/94.

7. ANRO 1 As a load shaving unit, the units NOx RACT emission limit shall be no greater than 0.9lb per MMBtu based on an hourly average for any type of fuel per Env-A 1211.13(b).

8. ANRO 2 As a load shaving unit, the unit NOx emissions shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be in accordance with Env-A 1211.18 and
Env-A 607.

9. ANRO 3 Load shaving status shall be lost if the NOx emissions from this device exceed 50 tons in any consecutive 12 month period. The device shall then be a simple cycle combustion turbine. NOx RACT emissions shall be limited to an hourly average of 75 ppmvd when firing oil. This limit is as corrected to 15% oxygen.

10. ANRO 4 As a simple cycle turbine, the unit shall be a component of the emission averaging plan given in the compliance schedule and the implementation plan. The averaging plan shall be in accordance with Env-A 1211.18 and Env-A 607.

11. In accordance with RSA 125-J:6I, emission averaging between PSNH devices subject to RACT shall be in the ratio of 1:1.

12. Compliance with the NOx RACT emission standards in ANRO 1 and ANRO 3 shall be determined by an initial compliance stack test prior to 8/31/95 and subsequent periodic stack tests every 3 years thereafter per Env-A 1211.21. Method 20 of 40 CFR Part 60 Appendix A shall be used. Compliance with Env-A 1211.21 shall be deemed compliance with Env-A 806 as proposed.

13. The most recent periodic stack test shall be used to establish the correlation between the heat input to the device, the stack volumetric NOx concentration in ppmvd, and the NOx emission rate in lbs NOx/MMBtu and lbs NOx /hour. The most recent value of the NOx emission rate so determined shall be used as the actual worst case emission rate for this device when emission averaging is used for compliance with Env-A 1211.18(i) in accordance with Env-A 1211.18(k)(1)(b)(1).

14. For purposes of emission averaging, the actual hours of operation per day shall be used for compliance in accordance to Env-A 1211.18(k)(1)(b)(2).

15. Recordkeeping and reporting shall be in accordance with Env-A 901.06 and 901.07. The additional recordkeeping and reporting required by Env-A 1211.18(h) shall be made if this device takes part in daily emission averaging in a given calendar year. A report shall be submitted for any calendar year by April 15 of the following year in a suitable format in that instance.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

IMPLEMENTATION OF NOx EMISSION AVERAGING UNDER ENV-A 1211.18 AND ENV-A 607

PURPOSE

This document outlines the procedures and methods that PSNH shall use in order to emission average its NOx RACT units and devices as allowed for in Env-A 1211.18 and Env-A 607. This document is intended to be a general attachment to the NOx RACT permit applications and is intended to augment the PSNH facilities NOx compliance Schedules submitted to the NH Air Resources Division for each NOx RACT unit or device on 13 September, 1994. PSNH regards emission averaging as an Alternative NOx Reduction Option (ANRO).

INTERPRETATION

In order to implement emission averaging, PSNH has been required to interpret Env-A 1211.18 and Env-A 607 in a manner that makes emission averaging both workable and achievable. The intent is to average the NOx emissions of selected participating operating NOx RACT units or devices on a calendar day basis such that the totality of pounds of NOx allowed to be emitted daily from all such participating operating units or devices is not exceeded during that calendar day per Env-A 1211.18(d). A different calendar day may or may not include a different set of participating operating units or may not be a day when any emission averaging is necessary. The following interpretations are made:

1. In the equation found in Env-A 1211.18(i) the sum E is a system NOx emission cap in allowable pounds over a calendar day, where the system is the selected set of participating operating NOx RACT units or devices. Thus E may vary depending on the composition of the set from calendar day to calendar day.

2. A_i for the ith unit or device is the NOx emission limitation given in Env-A 1211.03 - 1211.14 and Env-A 1211.17. Unless the NHARD provides the appropriate conversion factors, it will not be possible to incorporate in a PSNH averaging scheme those RACT units or devices limited by Env-A 1211.06, since the measurement units are not in lbs NOx per MMBtu, but rather in ppmvd.

3. B_i for the ith unit or device is the maximum heat input limitation in MMBtu per hour that appears as a condition in a permit to operate or a Title V permit multiplied by 24 hours per day.

4. Compliance is achieved when, for a calendar day in which emission averaging is used, the sum E' representing the totality of all pounds of NOx actually emitted through the calendar day by the set of participating operating NOx RACT units and devices is less than or equal to E at the end of the calendar day:

$$E' \leq E$$

The equation for E' is similar to that for E, being:

$$E' = (A1' \times B1') + (A2' \times B2') + \cdots + (An' \times Bn')$$

Where: E' = the total actual NOx emissions from a set of selected participating operating NOx RACT units and devices over a particular calendar day in pounds per day.

A_i ' = the actual NOx emission rate of the ith unit or device participating in the emission averaging. For a unit with Continuous Emission Monitor Systems (CEMS), this value may be the average of the valid hourly NOx emission rates over the entire calendar day in pounds per MMBtu. If the CEMS is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the highest rate in pounds of NOx per hour found in the most recent NOx compliance test that is required by Env-A 1211.21 per Env-A 1211.18(k)(1)(b)(1).

B_i ' = the actual heat input or hours of operation over the calendar day of the ith unit or device participating in the emission averaging. For a unit with CEMS, this value may be the sum of the valid hourly heat input (in MMBtu per hour) over the entire calendar day in MMBtu per day. If this monitoring system is malfunctioning, this value may be calculated using the alternative monitoring method planned for the unit. For units or devices without CEMS, this value shall be the total hours of operation over the calendar day per Env-A 1211.18(k)(1)(b)(2).

A_i 'X B_i '= The actual NOx emission rate in pounds per day of the ith unit or device participating in the emission averaging. For a unit or device with CEMS, this value shall be the sum of the hourly values of the actual NOx emission rate in pounds per hour for every valid operating hour in the calendar day. The hourly value shall be given by the product of the actual hourly NOx emission rate in pounds per MMBtu and the actual heat input in MMBtu per hour for that hour as measured by the CEMS. If this monitoring system is malfunctioning, these values shall be calculated using the alternative monitoring method planned for the unit.

5. Emission averaging may be initiated and terminated for a set of selected participating operating NOx RACT units or devices at any time during a particular calendar day when it is used. Compliance with Env-A 1211, however, shall be based upon emission averaging over that entire calendar day for the set of participating operating NOx RACT units and devices.

6. For the purposes of RACT compliance, the transfer ratio of emission reductions between participating operating NOx RACT units and devices in a set shall be 1:1 in accordance with RSA 125-J:6I.

7. Compliance with the recordkeeping requirements of Env-A 1211.18(h) shall be satisfied if the provisions of Env-A 901.06 and Env-A 901.07 are met and the record of emission averaging for a calendar day in which it is used will show the following:

   a) Identity of each participating unit or device
   b) The day of occurrence
   c) The values for E, E' and E - E'
   d) The values for A_i, A_i', B_i and B_i' for each participating unit or device
   e) The values for A_i X B_i and A_i 'X B_i ' for each participating unit or device

NOx RACT Unit and Device Identification

The PSNH NOx RACT units and devices that are eligible to participate in emission averaging are given below:

Unit(s) Located at Merrimack Station:

Merrimack Unit I (MK1)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 113.5 megawatts.
Merrimack Unit 2 (MK2)	Cyclone fired wet bottom utility boiler, coal fuel, with a net generation capacity of 320 megawatts.
Combustion Turbine 1 (MKCT1)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.
Combustion Turbine 2 (MKCT2)	Oil fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22.5 megawatts.

Unit(s) Located at Newington Station:

Newington Unit 1 (NT1)	Tangentially fired utility boiler, capable of firing oil only, or cofiring gas and oil, with a net generating capacity of 406 megawatts.

Auxiliary Boiler 1 (NT Aux 1)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).
Auxiliary Boiler 2 (NT Aux 2)	Oil fired auxiliary boiler subject to the requirements of Env-A 1211.12, per Env-A 1211.02(j).

Unit(s) Located at Schiller Station:

Schiller Unit 4 (SR4)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 45 megawatts firing coal, and 47.5 megawatts firing oil.
Schiller Unit 5 (SR5)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 47 megawatts firing coal, and 49.6 megawatts firing oil.
Schiller Unit 6 (SR6)	Dry-bottom utility boiler, capable of firing coal, oil, or any combination thereof, with a net generating capacity of 48 megawatts firing coal, and 48 megawatts firing oil.
Combustion Turbine (SRCT1)	Oil or natural gas fired combustion turbine, operated as a load shaving unit per Env-A 1211.01(x.), with a net generating capacity of 22 megawatts.

Allowable NOx Emissions During Emission Averaging

The allowable NOx emission in pounds per day for the eligible units and devices is given by multiplying the respective allowable emission rate, A_i, by the respective maximum permitted firing rate, B_i. These values are given below:

A_{MK1} = 0.92 lbs/MMBtu

B_{MK1}=1093 MMBtu/hr, 26,232 MMBtu/day

A_{MK1} X B_{MK1}=24,133 lbs/day

A_{MK2}=[Merrimack Unit 2 maximum daily emissions will be limited by

B_{MK2} Env-A 1211.03(d.), to 35.4 tons per day, or 70,800 lbs per day]

A_{MK2} X B_{MK2}=70,800lbs/day

A_{MKCT1}=0.9 lbs/MMBtu

B_{MKCT1}=319 MMBtu/hr, 7656 MMBtu/day

A_{MKCT1} X B_{MKCT1} = 6890 lbs/day

A_{MKCT2}=0.9 lb/MMBtu

B_{MKCT2}=319 MMBtu, 7656 MMBtu/day

A_{MKCT2} X B_{MKCT2} = 6890 lbs/day

A_{NT1}=0.35 lbs/MMBtu (oil only), 0.25 lbs/MMBtu (oil and gas)

B_{NT1}=4350 MMBtu/hr, 104,400 MMBtu/day

A_{NT1} X B_{NT1} = 36,540 lbs/day (oil only)

A_{NT1} X B_{NT1} = 26,100 lbs/day (oil and gas)

A_{NTAUX1}=0.2 lbs/MMBtu

B_{NTAUX1}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX1}X B_{NTAUX1}=481 lbs/day

A_{NTAUX2}=0.2 lbs/MMBtu

B_{NTAUX2}=710 gallons per hour #2 oil, 100.1 MMBtu/hr, 2403 MMBtu/day

A_{NTAUX2} X B_{NTAUX}=481 lbs/day

A_{SR4}=0.5 lbs/MMBtu (coal or oil)

B_{SR4}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR4} X B_{SR4} = 6888 lbs/day (coal or oil)

A_{SR5}=0.5 lbs/MMBtu (coal or oil)

B_{SR5}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR5} X B_{SR5} = 6888 lbs/day (coal or oil)

A_{SR6}=0.5 lbs/MMBtu (coal or oil)

B_{SR6}=574 MMBtu/hr, 13,776 MMBtu/day

A_{SR6} X B_{SR6} = 6888 lbs/day (coal or oil)

A_{SRCT1}=0.9 lbs/MMBtu (oil or gas)

B_{SRCT1}=290 MMBtu/hr, 6960 MMBtu/day

A_{SRCT1} X B_{SRCT1} = 6264 lbs/day (oil or gas)

Operational Thresholds

It shall be the duty of the operator of an eligible unit or device to:

1. Track the actual NOx emission rate in pounds per MMBtu of the unit or device hourly from the start of a calendar day.

2. Maintain the unit or device in compliance with its applicable NOx RACT emission limit in pounds per MMBtu. The operator must be assured that there is adequate indication that this NOx emission limitation, which is based on a calendar day average, shall not be exceeded. The calendar day average does not count non-operating hours.

3. Take corrective action to prevent an exceedance through operational control.

4. Start the process of emission averaging if other measures are deemed inadequate or more costly. Under emission averaging, the NOx RACT emission limitation would be expressed in pounds per day.

5. Document for the record the start of the emission averaging, the set of participating units or devices used for emission averaging, and the resulting actual NOx RACT emission levels in pounds per day for each participating unit or device for each calendar day of emission averaging.

6. Perform the same action as in 5. above if the operator of a participating unit or device was not the initiator of the emission averaging process.

Public Service
of New Hampshire

1000 Elm Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

June 5, 1995

Mr. Kenneth A. Colburn, Director
Air Resources Division
NH Department of Environmental Services
Caller Box 2033
64 North Main Street
Concord, NH 03302-2033

SUBJECT: Revision to PO-B-1788
Merrimack Station Emergency Generator 1

Dear Mr. Colburn:

Northeast Utilities Service Company (NUSCO) on behalf of Public Service Company of New Hampshire (PSNH) in accordance with Env-A 200 and 600 hereby submits a revised Permit PO-B-1788 Application Form ARD-2 in order to comply with Env-A 1211 Nitrogen Oxides (NOx). This submittal does not intend to affect non-NOx aspects of the most recent application on file for this device, nor does it intend to affect the current permit and conditions attached thereto with respect to non-NOx aspects. It is expected, however, that the validity period of PO-B-1788 will change.

As required by ENV-A-1211.16, a NOx compliance schedule was filed by NUSCO with the New Hampshire Air Resources Division (NHARD) on 9/13/94. Those portions of that filing specific to PO-B-1788 are incorporated herein by reference. This unit was in compliance with NOx RACT by 5/31/95.

Enclosed are: 1. Revised ARD-2, 2. An attached sheet of suggested permit conditions, 3. A check in the amount of $900 for the filing fee per Env-A 700.

In accordance with Part Env-A 605, the following is submitted:

1. Name and title of person to whom all orders and notices may be served:

Ronald G. Chevalier
Vice President

2. Name and title of person to whom all bills regarding permit fees may be rendered:

Ronald G. Chevalier
Vice President

If you have any questions, or need additional information, please contact Mr. Robert W. Pickering, PSNH, Production Operations Services Department, at (603)634-2390.

Very truly yours,

NORTHEAST UTILITIES SERVICE COMPANY
As Agent for Public Service Company
of New Hampshire

R. G. Chevalier
Vice President

Enclosures

RWP\lm\mkeg1.ltr

FUEL BURNING EQUIPMENT REGISTRATION

Form ARA-2

(A separate form to be completed for each stack and associated equipment. All information to be typed, and original submitted to Agency.)

REVISED 4/5/95

"Live Free or Die"

N.H. DEPARTMENT OF ENVIRONMENTAL SERVICES
AIR RESOURCES DIVISION
64 NORTH MAIN STREET
CALLER BOX 2033
CONCORD, NH 03302-2033

	LEGAL NAME	BUSINESS ADDRESS (No. & Street, County or Town)	ZIP CODE	PHONE
I FIRM	Public Service Co. of NH	1000 Elm Street, Manchester, NH	03105	669-4000
II DIVISION	Production	1000 Elm Street, Manchester, NH	03105	669-4000
III APPLICANT	Merrimack Generating Station	97 River Road, Bow, NH	03304	224-4081

IV INSTALLATION

DESCRIPTION (Designation used by applicant e.g. B & T Unit, Unit A, etc.)	EQUIPMENT LOCATION (No. & Street, Town, Telephone)	DATE DESIGNED	INSTALLATION DATE
Emergency Generator #1 (MKEG1)	97 River Road, Bow, NH 244-4081	1988	1988

V MAJOR ACTIVITY OF FIRM

☐ MANUFACTURER ☐ OFFICE ☐ RETAIL OR WHLSE. STORE ☐ SCHOOL OR CHURCH ☐ HOTEL/MOTEL OR APARTMENT ☐ HOSPITAL OR LABORATORY ☐ WAREHOUSE ☐ FEDERAL, STATE OR LOCAL GOVERNMENT ☒ OTHER (Specify) Electric Pow

VI BURNER DESIGN

1. TYPE OF SOLID FUEL BURNERS
☐ CYCLONE ☐ PULVERIZED WET / DRY ☐ SPREADER STOKER ☐ UNDER FEED STOKER ☐ OVER FEED STOKER ☐ HAND-FIRED ☐ WITH FLY ASH RE-INJECTION ☐ WITHOUT FLY ASH RE-INJECTION ☒ OTHER (Specify) None

2. TYPE OF LIQUID FUEL BURNERS
☐ PRESSURE GUN ☐ ROTARY CUP ☐ STEAM ATOMIZATION ☐ AIR ATOMIZATION ☒ OTHER (Specify) Diesel Combustion — TEMPERATURE BEFORE INJECTION Ambient °F

3. MANUFACTURER — EQUIPMENT Jordan Milton — EQUIPMENT MODEL NO. B406BD1
BURNER Caterpiller — BURNER MODEL NO 534HP

4. FLUE GAS — TOTAL ACFM 2700 @ 1000 °F AND ---- % EXCESS AIR

5. COMBUSTION
☐ TANGENTIAL FIRING ☐ OPPOSITE END FIRING ☒ ONE END ONLY FIRING ☐ LIMITED EXCESS AIR FIRING ☐ FLUE GAS RECIRCULATION ☐ STAGED COMBUSTION ☐ BIASED FIRING

6. OPERATING HOURS FOR THIS UNIT — Hours/day 24 — a) Days/year 365

VII STACK INFORMATION

STACK MONITOR USED? ☐ YES ☒ NO (Specify) ____
INSIDE DIAMETER AT TOP OF STACK 0.5 FT.
HEIGHT OF GAS DISCHARGE ABOVE GROUND LEVEL 12 FT.
OTHER UNITS USING THIS STACK? ☐ YES (Identify) ____ ☒ NO
OTHER STACKS ON THIS UNIT? ☐ YES (Specify) ____ ☒ NO

VIII CONTROL EQUIPMENT

(If control equipment is used, Form APCA-6 must also be filed for this unit.)
☐ SETTLING CHAMBER ☐ AFTER-BURNER ☐ WATER SPRAY ☐ BAG-HOUSE ☐ WETTED BAFFLES
☐ CYCLONE ☐ VAPOR RECOVERY ☐ SCRUBBER ☐ FABRIC FILTER ☐ ELECTROSTATIC PRECIPITATOR
☐ OTHER (Specify) ____ ☒ NONE

IX FUEL

TYPE		% Sulfur	% Ash	ANNUAL USAGE (In thousands of XX gals, XXXX)	MAXIMUM FIRING RATE (In millions of BTU/HR)
☐ COAL	Bituminous				
	Anthracite				
☒ OIL	#1 or #2	0.4	0.0	a) 1435	4
	#4, #5, #6				
☐ NAT GAS					
☐ LP GAS					
		BTU/Ton	% Moisture		
☐ BARK					
☐ WOOD/BARK					
☐ WOOD					
☐ SLUDGE					
☐ OTHER					

FUEL SUPPLIER — Name: Varies (see list provided to Division) — Town or City:

SEASONAL USE
% Dec-Feb: 25
% Mar-May: 25
% Jun-Aug: 25
% Sep-Nov: 25

REMARKS: Revise PO-B-1788
a) Operation for 500 hours per 12-month period as an emergency generator. Device could be unpredictably operated longer depending on the duration of emergencies. Engine rated at 534 HP.

X FUEL ADDITIVES

MANUFACTURER'S NAME: None
ADDRESS: ____ PHONE: ____
SPECIFIC IDENTIFICATION OF ADDITIVE: ____
CONSUMPTION RATE: ____ gallons / 1000 gallons of oil

XI CERTIFICATION

I certify that I have examined the above information and that to the best of my knowledge it is true and complete. (Signature subjects signer to provisions of the New Hampshire Revised Statutes Annotated regarding false and misleading statements.)

DATE: ____
SIGNED: ____ TITLE: Vice Presiden

MANUFACTURED BY PERLON INDUSTRIES POSTING DEPARTMENT

References

TECHNOLOGY TRANSFER NETWORK (TTN) 1

EMISSION MEASUREMENT TECHNICAL INFORMATION CENTER 2

CLEARINGHOUSE FOR INVENTORIES AND EMISSION FACTORS 2

ENV - A 609.03(C) EXEMPT ACTIVITIES 3

EPA WHITE PAPER #1 (ATTACHMENT A) 4

EPA WHITE PAPER #2 (COVER ONLY) 8

LETTER # 96.010 FROM NEW HAMPSHIRE DES AIR RESOURCES DIVISION DATED MARCH 26, 1996 10

OTHER LETTERS FROM THE NH DES ARD 10

EPA AP42 EMISSIONS FACTORS 10

TECHNOLOGY TRANSFER NETWORK (TTN)

The Office of Air Quality Planning and Standards (OAQPS) is responsible for directing the national efforts of the Environmental Protection Agency (EPA) to meet air quality goals, particularly for smog, hazardous air pollutants, carbon monoxide, lead, particulate matter (soot, dust, etc.), sulfur dioxide, nitrogen oxides, and visibility. The OAQPS is the primary office responsible for implementing the Clean Air Act Amendments of 1990, with direct responsibility for provisions affecting urban and rural air quality, hazardous air pollutants, operating permits, and enforcement. The Clean Air Act Amendments Bulletin Board System (CAAA BBS) is designed to provide access to information on the Clean Air Act amendments of 1990. Through this electronic information dissemination vehicle, the CAAA BBS allows regulators, the regulated community and members of the general public to easily obtain access to that information that is relevant to the Clean Air Act (CAA) amendments of 1990. In this manner, the task of understanding, implementing and complying with the requirements of the new law will be made easier.

The OAQPS provides many types of information services to EPA Headquarters and Regional Offices, State and local air pollution control agencies, consultants, industry, and the general public free of charge.

The OAQPS Technology Transfer Network (TTN) is comprised of electronic bulletin boards that cover a wide range of air pollution control topics. The telephone number to call to access the OAQPS TTN is (919) 541-5742. The TTN operates 24 hours a day except on Mondays, when it is inaccessible from 8:00 a.m. to noon, East Coast time.

EMISSION MEASUREMENT TECHNICAL INFORMATION CENTER

The EMTIC BBS provides technical guidance on stationary source emission testing issues, particularly to people who conduct and/or oversee emissions tests in support of the development and implementation of emission standards, emission factors, and State implementation plans.

This test methods in the Compliance Test Method References section of the application where taken

CLEARINGHOUSE FOR INVENTORIES AND EMISSION FACTORS

The CHIEF BBS provides access to tools for estimating emissions of air pollutants and performing air emission inventories. CHIEF will serve as EPA's central clearinghouse for the latest information on air emission inventories and emission factors. Emission estimation data bases, newsletters, announcements, and guidance on performing inventories will be included in CHIEF.

FIRE is a data base management system developed for use on personal computers. It contains rated emission factors for criteria and toxic air pollutants. These factors are refered to as AP-42 factors. The system is distributed on one diskette and is available for downloading from the Clearinghouse for Inventories and Emission Factors (CHIEF) bulletin board system. It is available free at the Clearinghouse for Inventories and Emission Factors (CHIEF) Bulletin Board via OAQPS TTN BBS.

A Report generated by this system was used to estimate some the emissions for this application. These Emissions factor

Env - A 609.03(c) Exempt Activities

The numbers here are referenced in the station emissions inventory.

Env-A 609.03, The following activities shall be classified as exempt activities:

(1) Open burning activities conducted in accordance with Env-A 1000.

(2) Activities such as copying and duplication activities performed in an office, and use of typewriters, printers, blueprinting and pens:

(3) Interior maintenance activities, such as janitorial cleaning and the use of cleaning a products and air fresheners other than the cleaning of any process equipment except as allowed under (16), below;

(4) The use of bathroom and locker room ventilation;

(5) The activities of maintenance limited to welding, gluing, painting of process equipment and soldering, but excluding VOC degreasing operations;

(7) First aid or emergency medical care provided at the facility, including related activities such as sterilization and medicine preparation;

(8) Laundry operations, other than dry-cleaning, to service uniforms or clothing used at the facility;

(9) Architectural maintenance activities conducted to take care of the buildings and structures at the facility, including repainting, roofing and sandblasting, unless subject to an applicable requirement;

(10) Exterior maintenance activities conducted to take care of the grounds of the facility, including lawn care and pest controls;

(11) Food preparation, including barbecuing for service facility cafeterias and dining rooms, but excluding such activities which are connected to preparation of packaged food for off-site consumption:

(12) The use of portable space heaters which can be carried and relocated by an employee;

(13) The use of steam vents which do not emit any regulated pollutants, air toxics, CO, or HAPS;

(14) The venting of particulate emissions from processes equipped with removal equipment and which are vented inside of the building;

(15) The use of laboratory ventilation hoods for educational, research and development facilities, excluding hoods used for any production or pilot processes unless otherwise regulated under Section 112 of the Act or Env-A 1300;

(16) The use of consumer products in a manner consistent with how the general public would use the product;

(17) The use of fire control equipment including maintenance and employee training;

(18) The characterization of waste sites and feasibility tests;

(19) The venting of emissions from mobile equipment and off-road equipment such as automobiles, forklifts, trucks and construction equipment, except for air conditioning systems regulated under Section 609 of the Act; and

(20) The venting of emissions from cooling towers, evaporators or HVAC systems which do not emit regulated air pollutants, CO, air toxics or HAPS, except for devices subject to a MACT standard under National Emissions Standards for Hazardous Air Pollutants for source categories, 40 CFR 63, or devices subject to Title V of the Act.

EPA WHITE PAPER #1 (Attachment A)

July 10, 1995

MEMORANDUM

SUBJECT: White Paper for Streamlined Development of Part 70 Permit Applications
FROM: Lydia N. Wegman, Deputy Director /s/
Office of Air Quality Planning and Standards (MD-10)
TO: Director, Air, Pesticides and Toxics
Management Division, Regions I and IV
Director, Air and Waste Management Division,
Region II
Director, Air, Radiation and Toxics Division,
Region III
Director, Air and Radiation Division,
Region V
Director, Air, Pesticides and Toxics Division,
Region VI
Director, Air and Toxics Division,
Regions VII, VIII, IX, and X

Please find attached a White Paper on Part 70 permit applications. The paper is designed to streamline and simplify the development of part 70 permit applications. The guidance was developed to respond to the concerns of industry and permitting authorities that preparation of initial permit applications was proving more costly and burdensome than necessary to achieve the goals of the Title V permit program.

The White Paper provides several streamlining improvements. Among them, it allows industry to:

- Provide emissions descriptions, and not emissions estimates, for emissions not regulated at the source, unless such estimates are needed for other purposes such as calculating permit fees;

- Submit checklists, rather than emission descriptions, for insignificant activities based on size/production rate and for risk management plans potentially owed under section 112(r);

- Provide citations for applicable requirements, with qualitative descriptions for each emissions unit, and for prior new source review (NSR) permits;

- Exclude certain trivial and short-term activities from permit applications;

- Provide group treatment for activities subject to certain generally-applicable requirements;

- Certify compliance status without requiring re-consideration of previous applicability decisions;

- Use the Part 70 permit process to identify environmentally significant terms of NSR permits, which should be incorporated into the part 70 permit as federally-enforceable terms; and

- Submit tons per year estimates only where meaningful to do so and not, for example, for section 112(r)-only pollutants; such estimates should be based on generally-available information rather than new studies or testing.

There is an immediate need for the implementation of this guidance. Increasing numbers of sources are becoming subject to the requirement to file a complete part 70 application as more State part 70 programs are approved. I strongly encourage you to work with your States to effect near-term use of the White Paper guidance to streamline the application process.

I want to thank you and your staff for your support in developing this guidance and invite your suggestions on what additional guidance is needed to improve further the initial implementation of title V. If you should have any questions regarding the attached guidance, please contact Michael Trutna at (919) 541-5345 or Jeff Herring at (919) 541-3195.

The numbers here are referenced in the station emissions inventory.

EPA WHITE PAPER FOR

STREAMLINED DEVELOPMENT OF PART 70 PERMIT APPLICATIONS

July 10, 1995

I. INTRODUCTION

The EPA is issuing this guidance to enable States to take immediate steps to reduce the costs of preparing and reviewing initial part 70 permit applications. A perceived lack of clarity in these requirements has led to an unintended escalation in permit application costs. Too often, sources have felt compelled to make conservative assumptions to assure themselves of receiving the "application shield" and avoiding enforcement actions.

ATTACHMENT A

LIST OF ACTIVITIES THAT MAY BE TREATED AS "TRIVIAL"

The following types of activities and emissions units may be presumptively omitted from part 70 permit applications. Certain of these listed activities include qualifying statements intended to exclude many similar activities.

1. Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources.

2. Air-conditioning units used for human comfort that do not have applicable requirements under title VI of the Act.

3. Ventilating units used for human comfort that do not exhaust air pollutants into the ambient air from any manufacturing/industrial or commercial process.

4. Non-commercial food preparation.

5. Consumer use of office equipment and products, not including printers or businesses primarily involved in photographic reproduction.

6. Janitorial services and consumer use of janitorial products.

7. Internal combustion engines used for landscaping purposes.

8. Laundry activities, except for dry-cleaning and steam boilers.

9. Bathroom/toilet vent emissions.

10. Emergency (backup) electrical generators at residential locations.

11. Tobacco smoking rooms and areas.

12. Blacksmith forges.

13. Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification.

14. Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification.

15. Portable electrical generators that can be moved by hand from one location to another.

16. Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic.

17. Brazing, soldering and welding equipment, and cutting torches related to manufacturing and construction activities that do not result in emission of HAP metals.

18. Air compressors and pneumatically operated equipment, including hand tools.

19. Batteries and battery charging stations, except at battery manufacturing plants.

20. Storage tanks, vessels, and containers holding or storing liquid substances that will not emit any VOC or HAP.

21. Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.

22. Equipment used to mix and package, soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.

23. Drop hammers or hydraulic presses for forging or metalworking.

24. Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.

25. Vents from continuous emissions monitors and other analyzers.

26. Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.

27. Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation.

28. Equipment used for surface coating, painting, dipping or spraying operations, except those that will emit VOC or HAP.

29. CO_2 lasers, used only on metals and other materials which do not emit HAP in the process.

30. Consumer use of paper trimmers/binders.

31. Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substances being processed in the ovens or autoclaves or the boilers delivering the steam.

32. Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants.

33. Laser trimmers using dust collection to prevent fugitive emissions.

34. Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents.

35. Routine calibration and maintenance of laboratory equipment or other analytical instruments.

36. Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis.

37. Hydraulic and hydrostatic testing equipment.

38. Environmental chambers not using hazardous air pollutant (HAP) gasses.

39. Shock chambers.

40. Humidity chambers.

41. Solar simulators.

42. Fugitive emission related to movement of passenger vehicles, provided the emissions are not counted for applicability purposes and any required fugitive dust control plan or its equivalent is submitted.

43. Process water filtration systems and demineralizes.

44. Demineralized water tanks and demineralizer vents.

45. Boiler water treatment operations, not including cooling towers.

46. Oxygen scavenging (de-aeration) of water.

47. Ozone generators.

48. Fire suppression systems.

49. Emergency road flares.

50. Steam vents and safety relief valves.

51. Steam leaks.

52. Steam cleaning operations.

53. Steam sterilizers.

EPA WHITE PAPER #2 (cover only)

March 5, 1996

MEMORANDUM

SUBJECT: White Paper Number 2 for Improved Implementation of The Part 70 Operating Permits Program

FROM: Lydia N. Wegman, Deputy Director /s/
Office of Air Quality Planning and Standards (MD-10)

TO: Director, Office of Ecosystem Protection, Region I
Director, Environmental Planning and Protection Division, Region II
Director, Air, Radiation and Toxics Division, Region III
Director, Air, Pesticides and Toxics Management Division, Region IV
Director, Air and Radiation Division, Region V
Director, Multimedia Planning and Permitting Division, Region VI
Director, Air, RCRA and TSCA Division, Region VII
Assistant Regional Administrator, Office of Pollution Prevention, State and Tribal Assistance, Region VIII
Director, Air and Toxics Division, Region IX
Director, Office of Air, Region X

Please find attached White Paper Number 2 for improved implementation of part 70 operating permits programs. This guidance is intended to enable State and local agencies to take further steps to reduce the complexity and preparation costs of part 70 permit applications and of the part 70 permits themselves. It is intended to supplement, not obviate, the guidance provided in EPA's "White Paper for Streamlined Development of part 70 Permit Applications" (July 10, 1995). This guidance is consistent with and furthers the goals of the Presidential initiatives to streamline and reinvent government.

The attached guidance is divided into five sections as follows:

II. A. Streamlining Multiple Applicable Requirements On The Same Emissions Unit(s).

II. B. Development Of Applications And Permits For Outdated SIP Requirements.

II. C. Treatment Of Insignificant Emissions Units.

II. D. Use Of Major Source And Applicable Requirement Stipulation.

II. E. Referencing Of Existing Information In Part 70 Permit Applications And Permits.

Streamlining will lead to substantial reductions in permitting burdens and improved part 70 implementation by allowing for the first time multiple applicable emissions limits and work practices expressed in different forms and averaging times to be reduced to a single set of requirements (which can be an alternative to all those requirements being subsumed). It will also allow various monitoring, recordkeeping, and reporting requirements that are not critical to assuring compliance with the streamlined (most stringent) limit to be subsumed in the permit. Any such streamlining must provide that compliance with the streamlined limit would assure compliance with all applicable requirements. In addition, substantial reductions in burden are expected to result from the reduced confusion and cost where locally adopted rules differ from the EPA-approved State implementation plan, the streamlined treatment of insignificant emissions units, the use of stipulations by sources as to which regulations apply, and the cross referencing rather than repetition of certain existing information.

There is an immediate need for the implementation of this guidance. A large number of sources have filed complete part 70 applications, and increasing numbers of these submittals are being processed for permit issuance. I strongly encourage you to work with your States to effect near-term use of this guidance.

Substantial contributions to this White Paper have come from the California Title V Implementation Working Group. I want to thank you and your staff for your support and Region IX in particular for their leadership and considerable efforts in developing and completing this paper. I invite your suggestions on what additional guidance is needed to improve further the initial implementation of title V. If you should have any questions regarding the attached guidance, please contact Michael Trutna at (919) 541-5345, Ginger Vagenas of Region IX at (415) 744-1252, or Roger Powell at (919) 541-5331.

STATE OF NEW HAMPSHIRE
Intra-Departmental Communication
Air Resources Division

To: PSNH Title V File

memo 96.010

From: Tom Hopkins TH
Alan Moulton AM

Date: March 26, 1996

Subject: Resolution of Issues Raised in March 13 Meeting (memo 96.008)

Several questions/issues concerning the completion of Title V applications were raised by PSNH during the meeting of March 13. These questions/issues were summarized in memo 96.008. Answers to these questions/issues are presented below.

General

- Emissions from insignificant activities need to be quantified in the application only when needed to determine applicability to a rule (e.g., NESHAP standard).
- "Trivial" activities as defined in White Paper I can be excluded.
- Storage tank vents, pump house room vents, and bulk chemical storage room vents shall be treated as trivial activities if the vapor pressure of the regulated material(s) being handled is less than 1.52 psia at 60°F.
- Steam vents and room/building air vents shall be treated as trivial activities.
- Dust emissions generated during ESP cleaning shall be considered maintenance and treated as a trivial activity.
- Radon emissions from coal ash piles shall be quantified in the application.
- Radionuclide emissions shall be treated like all other HAPs. If the emission point is trivial or exempt, the emission point may be excluded; if the emission point is significant or insignificant, the emission point shall be included and quantified.

Newington Station Specific

- The unvented sandblaster shall be considered exempt.

Unresolved issues at Newington Station brought up during the March 13 meeting include the handling of the open aerated water treatment tank located beneath the ESP and the settling pond. More information is needed before a determination can be made regarding the handling of these units. If these units are used to process boiler water, according to White Paper I they shall be considered trivial. If these units do not process boiler water, they shall be considered trivial if the vapor pressure is below 1.52 psia at 60°F and significant/insignificant if the vapor pressure is above 1.52 psia at 60°F (provided regulated materials are present).

cc: PSNH Title V Team

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

November 17, 1995

Mr. Robert W. Pickering
Public Service of New Hampshire
P.O. Box 330
1000 Elm Street
Manchester, NH 03105-0330

Subject: Relative Accuracy Audits for Volumetric Flow Monitors.

Dear Mr. ~~Pickering~~ Bob:

The New Hampshire Department of Environmental Services, Air Resources Division (NHDES-ARD) has reviewed Public Service of New Hampshire's (PSNH's) request to be exempted from the state relative accuracy audit requirements specified in Env-A 805.06(d) as applied to the volumetric flow monitors installed at Merrimack, Newington, and Schiller Stations. In conclusion of this review, NHDES-ARD has determined that the three PSNH facilities will not be required to perform the referenced audits for the following reasons:

1. The volumetric flow monitors were installed in fulfillment of the 40 CFR Part 75 Federal Acid Rain Program and in fulfillment of this regulation, PSNH is performing the required quality assurance (QA) efforts. These efforts include;

   a. Annual or semi-annual relative accuracy test audits of the volumetric flow monitors at low, mid and high plant load levels; and

   b. Daily calibration error tests of the flow monitor at 0-20% and 50-70% of the span of the monitor.

   NHDES-ARD believes these QA procedures ensure technically accurate readings of the stack flow; and

2. NHDES-ARD CEM and permit requirements do not require the measurement of volumetric flow from any of the three stations in order for PSNH to demonstrate compliance with state or Federal 40 CFR Part 60 requirements.

If you have questions on the above, please contact Jack Glenn of the Compliance Bureau at (603) 271-6546.

Sincerely,

Kenneth A. Colburn
Director
Air Resources Division

JCG/jcg

CC: M. Hilgemeier, NHDES ARD
A. Bodnarik, NHDES ARD
T. Hopkins, NHDES ARD
A. Moulton, NHDES ARD
J. Glenn, NHDES ARD

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State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

December 12, 1995

Mr. John M. MacDonald
Director, Fossil & Hydro Production
Public Service of New Hampshire
P.O. Box 330
1000 Elm Street
Manchester, NH 03105-0330

Subject: Calculation of SO_2 Emissions

Dear Mr. MacDonald:

This letter is in response to your letter, dated August 28, 1995, and numerous subsequent discussions held between Air Resources Division (ARD) staff and Mr. Robert W. Pickering of PSNH regarding the calculation of sulfur dioxide (SO_2) emissions. Specifically, PSNH has requested that they be allowed to continue to use data derived from daily sampling and laboratory sulfur analysis results in conjunction with fuel flow rate to estimate sulfur dioxide emissions from Merrimack, Newington, and Schiller Stations for calendar year 1995. This specified calculation approach ("AP-42 procedure") uses the above data combined with AP-42 formulae which assume that all sulfur in the fuel is oxidized to SO_2. Such an assumption is believed to be reasonable when estimating emissions on a long term basis. Please note that the purpose of the emissions estimates is to demonstrate compliance with the NH Acid Deposition Control Program (Env-A 406) SO_2 cap of 55,150 tons per year. In consideration of the request, the following information has been considered:

a. The procedure specified above has been used by PSNH to show compliance with the 55,150 ton per year SO_2 cap starting with calendar year 1991. ARD has found this method acceptable in the absence of SO_2 continuous emission monitors (CEMs) at Merrimack and Newington Stations during this time period. Although Schiller had a time-shared SO_2 CEM system installed since the mid 1980's, ARD considered the use of the AP-42 procedure at Schiller station to be reasonable because;

   i. The CEM did not have a volummetric flow monitor installed, therefore precluding the direct use of the CEM system to calculate tons per year of SO_2;

   ii. ARD believes that the AP-42 procedure is acceptably accurate on a long term basis; and

AIR RESOURCES DIV.
64 No. Main Street
Caller Box 2033
Concord, N.H. 03302-2033
Tel. 603-271-1370
Fax 603-271-1381

WASTE MANAGEMENT DIV.
6 Hazen Drive
Concord, N.H. 03301
Tel. 603-271-2900
Fax 603-271-2456

WATER RESOURCES DIV.
64 No. Main Street
P.O. Box 2008
Concord, N.H. 03302-2008
Tel. 603-271-3406
Fax 603-271-1381

WATER SUPPLY & POLLUTION CONTROL DIV.
P.O. Box 95
Concord, N.H. 03302-0095
Tel. 603-271-3503
Fax 603-271-2181

iii. For practical reasons the AP-42 approach made sense (i.e. determining what data to substitute during CEM downtime is not an issue with the AP-42 procedure).

b. Only after the installation and certification of new CEM systems in late 1994 and early 1995 have such monitors been considered for this calculation. As you are aware the three new CEM systems were installed as required in 40 CFR Part 75.

c. For a number of reasons specified in PSNH's letter to EPA, dated July 13, 1995, CEM-derived SO_2 emissions have been significantly overestimated at Merrimack and Newington Stations for calendar year 1995. ARD has reviewed the data and agrees that the CEM approach, in conformance with Part 75, would result in overestimation of the emissions. Please note, however, that ARD believes that CEM data by itself provides accurate emission measurements but is only limited when the instrumentation is experiencing downtime or when the CEM is limited by the constraints imposed by Part 75. Such constraints include the data substitution techniques required by Part 75 which tend to overestimate emissions and by data biasing procedures which only allow biasing of volummetric flow data in the high direction.

d. ARD believes that the use of the AP-42 procedure will allow PSNH to plan their fuel purchases and plant operation more effectively in order to operate within the 55,150 ton SO_2 cap.

After consideration of the above, ARD approves the use of the AP-42 procedure for demonstration of compliance with Env-A 406 for calendar year 1995. If you have questions on the above, please contact Jack Glenn of the Compliance Bureau at (603) 271-6546.

Sincerely,

Kenneth A. Colburn
Director
Air Resources Division

JCG/jcg

CC: R. Pickering, PSNH
M. Hilgemeier, NHDES ARD
A. Bodnarik, NHDES ARD
C. Wright, NHDES ARD
T. Hopkins, NHDES ARD
A. Moulton, NHDES ARD
J. Glenn, NHDES ARD

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POLLUTANT NAME	: Sulfur oxides (SOx)
CAS NUMBER	:
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	:
UNITS	:
UNITS EXTENSION	:
MATERIAL	:
ACTIVITY	:
REPORTED FACTOR	: 3.80000E+01
UNITS	: Lb/Ton/Wt. % Sulfur
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: D
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Expressed as SO2, including SO2, SO3, and gaseous sulfates. Multiply the emission factor provided by the wt. % sulfur content of the fuel to obtain emission factor in lb/activity units.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 06/25/1993
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000332

POLLUTANT NAME	: Nitrogen oxides (NOx)
CAS NUMBER	:
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 3.38000E+01
UNITS	: Lb/Ton
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 3.38000E+01
UNITS	: Lb/Ton
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: C
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Expressed as NO2. Generally, 95+ volume % of nitrogen oxides present in combustion exhaust will be in the form of NO, the rest NO2. To express factors as NO, multiply factors by 0.66.
PRC_PARMS	: All factors represent emission at baseline operation (i.e., 60 to 110% load and no NOx control measures).
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 06/28/1993
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000383

POLLUTANT NAME	: Carbon monoxide
CAS NUMBER	: 630-08-0
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 5.00000E-01
UNITS	: Lb/Ton
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 5.00000E-01
UNITS	: Lb/Ton
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: A
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Values of 1 or 2 orders of magnitude higher can occur when combustion is not complete. Emission factors for CO2 emissions from coal combustion should be calculated using CO2/ton coal = 73.3C, where C is the wt. percent carbon content of the coal.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 07/12/1993
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000440

POLLUTANT NAME	: Particulate matter (PM), filterable
CAS NUMBER	:
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	:
UNITS	:
UNITS EXTENSION	:
MATERIAL	:
ACTIVITY	:
REPORTED FACTOR	: 2.00000E+00
UNITS	: Lb/Ton
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: E
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Does not include condensible PM. Multiply the emission factor provided by the weight percent ash content of the coal to obtain lb/ton EF.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	: EPA Method 5 (front half catch)
CORRECTION	:
RESEARCHER	: RH
DATE	: 04/21/1995
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000501

POLLUTANT NAME	: Particulate matter (PM), filterable
CAS NUMBER	:
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: MULTIPLE CYCLONE W/ FLY ASH REINJECTION
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.20000E+01
UNITS	: Lb/Ton
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.20000E+01
UNITS	: Lb/Ton
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: E
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Does not include condensible PM.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 04/24/1995
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000824

POLLUTANT NAME	: Volatile organic compounds (VOC)
CAS NUMBER	:
SCC	: 10100203
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Bituminous/Subbituminous Coal
	: Cyclone Furnace (Bituminous Coal)
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.10000E-01
UNITS	: Lb/Ton
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.10000E-01
UNITS	: Lb/Ton
UNITS EXTENSION	: Coal Burned
MATERIAL	: Coal
ACTIVITY	: Burned
FACTOR QUALITY	: B
REFERENCE:	: EPA. 1995. Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	: Nominal values achievable under normal operating conditions. Values one or two orders of magnitude higher can occur when combustion is not complete.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 06/23/1994
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0005711

POLLUTANT NAME	:	Sulfur oxides (SOx)
CAS NUMBER	:	
SCC	:	20100901
SCC NAME	:	Internal Combustion Engines
	:	Electric Generation
	:	Kerosene/Naphtha (Jet Fuel)
	:	Turbine
CONTROL DEVICE 1	:	UNCONTROLLED
CONTROL DEVICE 2	:	
STANDARD FACTOR	:	1.40000E+02
UNITS	:	Lb/1000 Gallons
UNITS EXTENSION	:	Burned
MATERIAL	:	
ACTIVITY	:	Burned
REPORTED FACTOR	:	1.40000E+02
UNITS	:	Lb/1000 Gal
UNITS EXTENSION	:	Oil Burned
MATERIAL	:	Oil
ACTIVITY	:	Burned
FACTOR QUALITY	:	U
REFERENCE:	:	Emission factor is transferred from oil-fired engines.
SECONDARY REF:	:	
NOTES	:	Edited 05/19/92 Multiply the emission factor provided by the weight percent sulfur content of the fuel to obtain emission factor in lb/activity units.
PRC_PARMS	:	
SIC CODE	:	
SIC NAME	:	
RANGE	:	
TESTS	:	
LOCATION	:	
METHODS	:	
CORRECTION	:	
RESEARCHER	:	
DATE	:	/ /
DATA SOURCE	:	AFSEF
REC_ID	:	AFSEF_001218

POLLUTANT NAME	: Nitrogen oxides (NOx)
CAS NUMBER	:
SCC	: 20100901
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Kerosene/Naphtha (Jet Fuel)
	: Turbine
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 6.78000E+01
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 6.78000E+01
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001217

POLLUTANT NAME	: Carbon monoxide
CAS NUMBER	: 630-08-0
SCC	: 20100901
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Kerosene/Naphtha (Jet Fuel)
	: Turbine
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.54000E+01
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.54000E+01
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001213

POLLUTANT NAME	: Particulate matter (PM), filterable
CAS NUMBER	:
SCC	: 20100901
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Kerosene/Naphtha (Jet Fuel)
	: Turbine
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 5.00000E+00
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 5.00000E+00
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001216

POLLUTANT NAME	: Volatile organic compounds (VOC)
CAS NUMBER	:
SCC	: 20100901
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Kerosene/Naphtha (Jet Fuel)
	: Turbine
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 4.77000E+00
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 4.77000E+00
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. In: Air Emissions Species Manual, Volume 1, Volatile Organic Compound Species Profiles. EPA-450/2-88-003a. U.S. Environmental Protection Agency.
SECONDARY REF:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. Also in: Air Emission Species Manual, Volume 1: Volatile Organic Compound Species Profiles. EPA-450/2-88-003a. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001214

POLLUTANT NAME	: Sulfur oxides (SOx)
CAS NUMBER	:
SCC	: 10100501
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Distillate Oil
	: Grades 1 and 2 Oil
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.44000E+02
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.43600E+02
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: A
REFERENCE:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Total SOx emissions are reported as SO2.
SECONDARY REF:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Emission factors for distillate oil use in utility boilers are assuming emissions are similar to industrial boilers.
NOTES	: Multiply the emission factor provided by the weight percent sulfur content of the fuel to obtain emission factor in lb/activity units.
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: 09/20/1995
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_000175

POLLUTANT NAME	: Nitrous oxide
CAS NUMBER	: 10024-97-2
SCC	: 10100501
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Distillate Oil
	: Grades 1 and 2 Oil
CONTROL DEVICE 1	: NO CONTROL SPECIFIED, ASSUME UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.54000E-05
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.10000E-07
UNITS	: Lb/MMBtu
UNITS EXTENSION	: Heat Input
MATERIAL	: Heat Input
ACTIVITY	:
FACTOR QUALITY	: E
REFERENCE:	: EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	: RH
DATE	: 04/25/1995
DATA SOURCE	: AP42_UF
REC_ID	: AP42_0000161

POLLUTANT NAME	: Carbon monoxide
CAS NUMBER	: 630-08-0
SCC	: 10100501
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Distillate Oil
	: Grades 1 and 2 Oil
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 5.00000E+00
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 5.00000E+00
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: A
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Emission factors for distillate oil use in utility boilers are assuming emissions are similar to industrial boilers.
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_000170

POLLUTANT NAME	: Particulate matter (PM), filterable
CAS NUMBER	:
SCC	: 10100501
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Distillate Oil
	: Grades 1 and 2 Oil
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 2.00000E+00
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 2.00000E+00
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: A
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Emission factors for distillate oil use in utility boilers are assuming emissions are similar to industrial boilers.
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_000173

POLLUTANT NAME	: Volatile organic compounds (VOC)
CAS NUMBER	:
SCC	: 10100501
SCC NAME	: External Combustion Boilers
	: Electric Generation
	: Distillate Oil
	: Grades 1 and 2 Oil
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 2.00000E-01
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 2.00000E-01
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: A
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	: EPA. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. Emission factors for distillate oil use in utility boilers are assuming emissions are similar to industrial boilers.
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_000171

POLLUTANT NAME	: Sulfur oxides (SOx)
CAS NUMBER	:
SCC	: 20100102
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Distillate Oil (Diesel)
	: Reciprocating
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 3.12000E+01
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 3.12000E+01
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001176

POLLUTANT NAME	: Nitrogen oxides (NOx)
CAS NUMBER	:
SCC	: 20100102
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Distillate Oil (Diesel)
	: Reciprocating
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 4.69000E+02
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 4.69000E+02
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001175

POLLUTANT NAME	: Carbon monoxide
CAS NUMBER	: 630-08-0
SCC	: 20100102
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Distillate Oil (Diesel)
	: Reciprocating
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 1.02000E+02
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 1.02000E+02
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001171

POLLUTANT NAME	: Particulate matter (PM), filterable
CAS NUMBER	:
SCC	: 20100102
SCC NAME	: Internal Combustion Engines
	: Electric Generation
	: Distillate Oil (Diesel)
	: Reciprocating
CONTROL DEVICE 1	: UNCONTROLLED
CONTROL DEVICE 2	:
STANDARD FACTOR	: 3.35000E+01
UNITS	: Lb/1000 Gallons
UNITS EXTENSION	: Burned
MATERIAL	:
ACTIVITY	: Burned
REPORTED FACTOR	: 3.35000E+01
UNITS	: Lb/1000 Gal
UNITS EXTENSION	: Oil Burned
MATERIAL	: Oil
ACTIVITY	: Burned
FACTOR QUALITY	: U
REFERENCE:	: EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:
NOTES	:
PRC_PARMS	:
SIC CODE	:
SIC NAME	:
RANGE	:
TESTS	:
LOCATION	:
METHODS	:
CORRECTION	:
RESEARCHER	:
DATE	: / /
DATA SOURCE	: AFSEF
REC_ID	: AFSEF_001174

POLLUTANT NAME	:	Volatile organic compounds (VOC)
CAS NUMBER	:	
SCC	:	20100102
SCC NAME	:	Internal Combustion Engines
	:	Electric Generation
	:	Distillate Oil (Diesel)
	:	Reciprocating
CONTROL DEVICE 1	:	UNCONTROLLED
CONTROL DEVICE 2	:	
STANDARD FACTOR	:	3.21000E+01
UNITS	:	Lb/1000 Gallons
UNITS EXTENSION	:	Burned
MATERIAL	:	
ACTIVITY	:	Burned
REPORTED FACTOR	:	3.21000E+01
UNITS	:	Lb/1000 Gal
UNITS EXTENSION	:	Oil Burned
MATERIAL	:	Oil
ACTIVITY	:	Burned
FACTOR QUALITY	:	U
REFERENCE:	:	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.
SECONDARY REF:	:	EPA. In: Air Emissions Species Manual, Volume 1, Volatile Organic Compound Species Profiles. EPA-450/2-88-003a. U.S. Environmental Protection Agency.
NOTES	:	
PRC_PARMS	:	
SIC CODE	:	
SIC NAME	:	
RANGE	:	
TESTS	:	
LOCATION	:	
METHODS	:	
CORRECTION	:	
RESEARCHER	:	
DATE	:	/ /
DATA SOURCE	:	AFSEF
REC_ID	:	AFSEF_001172

The numbers here are referenced in the station emissions inventory.

Env-A 609.03, The following activities shall be classified as exempt activities:

(1) Open burning activities conducted in accordance with Env-A 1000.

(2) Activities such as copying and duplication activities performed in an office, and use of typewriters, printers, blueprinting and pens:

(3) Interior maintenance activities, such as janitorial cleaning and the use of cleaning a products and air fresheners other than the cleaning of any process equipment except as allowed under (16), below;

(4) The use of bathroom and locker room ventilation;

(5) The activities of maintenance limited to welding, gluing, painting of process equipment and soldering, but excluding VOC degreasing operations;

(7) First aid or emergency medical care provided at the facility, including related activities such as sterilization and medicine preparation;

(8) Laundry operations, other than dry-cleaning, to service uniforms or clothing used at the facility;

(9) Architectural maintenance activities conducted to take care of the buildings and structures at the facility, including repainting, roofing and sandblasting, unless subject to an applicable requirement;

(10) Exterior maintenance activities conducted to take care of the grounds of the facility, including lawn care and pest controls;

(11) Food preparation, including barbecuing for service facility cafeterias and dining rooms, but excluding such activities which are connected to preparation of packaged food for off-site consumption;

(12) The use of portable space heaters which can be carried and relocated by an employee;

(13) The use of steam vents which do not emit any regulated pollutants, air toxics, CO, or HAPS;

(14) The venting of particulate emissions from processes equipped with removal equipment and which are vented inside of the building;

(15) The use of laboratory ventilation hoods for educational, research and development facilities, excluding hoods used for any production or pilot processes unless otherwise regulated under Section 112 of the Act or Env-A 1300;

(16) The use of consumer products in a manner consistent with how the general public would use the product;

(17) The use of fire control equipment including maintenance and employee training;

(18) The characterization of waste sites and feasibility tests;

(19) The venting of emissions from mobile equipment and off-road equipment such as automobiles, forklifts, trucks and construction equipment, except for air conditioning systems regulated under Section 609 of the Act; and

(20) The venting of emissions from cooling towers, evaporators or HVAC systems which do not emit regulated air pollutants, CO, air toxics or HAPS, except for devices subject to a MACT standard under National Emissions Standards for Hazardous Air Pollutants for source categories, 40 CFR 63, or devices subject to Title V of the Act.

The numbers here are referenced in the station emissions inventory.

EPA WHITE PAPER FOR

STREAMLINED DEVELOPMENT OF PART 70 PERMIT APPLICATIONS

July 10, 1995

I. INTRODUCTION

The EPA is issuing this guidance to enable States to take immediate steps to reduce the costs of preparing and reviewing initial part 70 permit applications. A perceived lack of clarity in these requirements has led to an unintended escalation in permit application costs. Too often, sources have felt compelled to make conservative assumptions to assure themselves of receiving the "application shield" and avoiding enforcement actions.

ATTACHMENT A

LIST OF ACTIVITIES THAT MAY BE TREATED AS "TRIVIAL"

The following types of activities and emissions units may be presumptively omitted from part 70 permit applications. Certain of these listed activities include qualifying statements intended to exclude many similar activities.

1. Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources.

2. Air-conditioning units used for human comfort that do not have applicable requirements under title VI of the Act.

3. Ventilating units used for human comfort that do not exhaust air pollutants into the ambient air from any manufacturing/industrial or commercial process.

4. Non-commercial food preparation.

5. Consumer use of office equipment and products, not including printers or businesses primarily involved in photographic reproduction.

6. Janitorial services and consumer use of janitorial products.

7. Internal combustion engines used for landscaping purposes.

8. Laundry activities, except for dry-cleaning and steam boilers.

9. Bathroom/toilet vent emissions.

10. Emergency (backup) electrical generators at residential locations.

11. Tobacco smoking rooms and areas.

12. Blacksmith forges.

13. Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification.

14. Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-

greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification.

15. Portable electrical generators that can be moved by hand from one location to another.

16. Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic.

17. Brazing, soldering and welding equipment, and cutting torches related to manufacturing and construction activities that do not result in emission of HAP metals.

18. Air compressors and pneumatically operated equipment, including hand tools.

19. Batteries and battery charging stations, except at battery manufacturing plants.

20. Storage tanks, vessels, and containers holding or storing liquid substances that will not emit any VOC or HAP.

21. Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.

22. Equipment used to mix and package, soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.

23. Drop hammers or hydraulic presses for forging or metalworking.

24. Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.

25. Vents from continuous emissions monitors and other analyzers.

26. Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.

27. Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation.

28. Equipment used for surface coating, painting, dipping or spraying operations, except those that will emit VOC or HAP.

29. CO_2 lasers, used only on metals and other materials which do not emit HAP in the process.

30. Consumer use of paper trimmers/binders.

31. Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substances being processed in the ovens or autoclaves or the boilers delivering the steam.

32. Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants.

33. Laser trimmers using dust collection to prevent fugitive emissions.

34. Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents.

35. Routine calibration and maintenance of laboratory equipment or other analytical instruments.

36. Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis.

37. Hydraulic and hydrostatic testing equipment.

38. Environmental chambers not using hazardous air pollutant (HAP) gasses.

39. Shock chambers.

40. Humidity chambers.

41. Solar simulators.

42. Fugitive emission related to movement of passenger vehicles, provided the emissions are not counted for applicability purposes and any required fugitive dust control plan or its equivalent is submitted.

43. Process water filtration systems and demineralizes.

44. Demineralized water tanks and demineralizer vents.

45. Boiler water treatment operations, not including cooling towers.

46. Oxygen scavenging (de-aeration) of water.

47. Ozone generators.

48. Fire suppression systems.

49. Emergency road flares.

50. Steam vents and safety relief valves.

51. Steam leaks.

52. Steam cleaning operations.

53. Steam sterilizers.

Attached, please find the following Material Safety Data Sheets (MSDS) as agreed upon by the NHARD and PSNH at the June 4, 1996 meeting. Also attached, please find the relevant chemical vapor pressures.

Gasoline
#2 fuel oil
#4 fuel oil
#6 fuel oil
Jet Fuel
Lubricating Oils
Hydraulic Oils
Sodium Hypochlorite - condenser water side, biofouling
Ferrous Sulfate - condenser water side, Schiller
Sulfuric Acid - water treatment, stored in high concentration, used in dilute solution
Sodium Hydroxide - caustic, water treatment
Sodium Phosphate - Boiler water treatment
Hydrazine - Boiler water treatment
Morpholine - Boiler water treatment
Ammonia, aqueous - water treatment, pH correction, SNCR
Ammonia, anhydrous - Whalco, SCR, stored as a liquid under pressure, used as a gas
Hydrochloric Acid - chemical cleaning solvent, infrequent activity
Acetic Acid - chemical cleaning solvent, infrequent activity
Formic Acid - Chemical cleaning solvent, infrequent activity
Hydroflouric Acid - Chemical cleaning solvent, infrequent activity
Thiourea - Chemical cleaning solvent, infrequent activity
Sulfur - Molten, Whalco, Merrimack
Propane - Storage to fill cylinders, Merrimack
Limestone - fluxing, Merrimack
Propylene Glycol - antifreeze
Sodium Molybdate - closed cooling water system
Tolyltriazole - closed cooling water system
1,1,1 Trichloroethane - Solvent cleaning by electricians
Solvent Cleaning Sinks - ZEP and safety clean
Natural Gas - Lines purged when shutting down
Methane - coal silos and bunkers

MOBIL MATERIAL SAFETY DATA BULLETIN

MOBIL OIL CORPORATION
ENVIRONMENTAL AFFAIRS AND TOXICOLOGY
P.O. BOX 1031
PRINCETON, NJ 08540

********** PRODUCT IDENTIFICATION **********

AUTOMOTIVE GASOLINES

SUPPLIER: MOBIL OIL CORP.
CHEMICAL NAMES AND SYNONYMS: HYDROCARBON
USE OF DESCRIPTION: MOTOR FUEL
HEALTH EMERGENCY TELEPHONE: (212) 883-4411
TRANSPORT EMERGENCY TELEPHONE: (800) 424-9300 (CHEMTREC)

********** TYPICAL CHEMICAL AND PHYSICAL PROPERTIES **********

(FOR ADDITIONAL INFORMATION PLEASE CONTACT YOUR LOCAL MARKETING OFFICE.)

APPEARANCE:
CLEAR TO YELLOW LIQUID
ODOR: HYDROCARBON
RELATIVE DENSITY: 15/4 C
0.7-0.76

VISCOSITY: AT 100 F, SUS
30.0
AT 40 C, CST
1.0
BOILING RANGE: 75-430 F
FLASH POINT: F(C) METHOD
-40(-40) (ASTM D-56)

SOLUBILITY IN WATER: NEGLIGIBLE
VAPOR PRESSURE: 400.0 MM HG 20C
(REID VAPOR PRESSURE: 9-15 PSIA)

********** INGREDIENTS **********

HAZARDOUS INGREDIENTS:	WT PCT (APPROX)	EXPOSURE LIMITS (TWA): MG/M3	PPM	EXPOSURE LIMIT SOURCE
GASOLINE	100	900	300	ACGIH-TLV
FOR MOBIL REGULAR GASOLINE ONLY:				
LEAD ALKYL COMPOUNDS	0.1	0.1 (Note: as Pb-skin)		ACGIH-TLV

NOTE: EXPOSURE LIMITS SHOWN ARE FOR GUIDANCE ONLY. FOLLOW APPLICABLE REGULATIONS.

********** FIRE AND EXPLOSION HAZARD DATA **********

FLASH POINT: F(C) (METHOD)
-40(-40) (ASTM D-56)

FLAMMABLE LIMITS:
LEL: 1.1 UEL: 7.6

NFPA CODES:
HEALTH 1
FLAMMABILITY 3
REACTIVITY 0

EXTINGUISING MEDIA:
CO2, FOAM, DRY CHEMICAL OR WATER FOG.

SPECIAL FIRE FIGHTING PROCEDURES:
FIREFIGHTERS MUST USE SELF-CONTAINED BREATHING APPARATUS. COOL STORAGE DRUMS WITH WATER SPRAY. EVACUATE AREA. PREVENT RUNOFF FROM FIRE CONTROL OR DILUTION FROM ENTERING STREAMS OR DRINKING WATER SUPPLY.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
EXTREMELY FLAMMABLE LIQUID. VAPOR ACCUMULATION COULD FLASH AND/OR EXPLODE IF IN CONTACT WITH OPEN FLAME.

**********HEALTH HAZARD SUMMARY**********

THRESHOLD LIMIT VALUE (IF ESTABLISHED): 300 PPM
EFFECTS OF OVEREXPOSURE: MODERATE SKIN IRRITATION. SLIGHT EYE IRRITATION. RESPIRATORY IRRITATION, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS.

********** EMERGENCY AND FIRST AID PROCEDURES **********

EYE CONTACT: FLUSH WITH WATER
SKIN CONTACT: WASH CONTACT AREAS WITH SOAP AND WATER. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
INHALATION: REMOVE FROM FURTHER EXPOSURE. IF UNCONSCIOUSNESS OCCURS, SEEK IMMEDIATE MEDICAL ASSISTANCE AND CALL A PHYSICIAN. IF BREATHING HAS STOPPED, USE MOUTH TO MOUTH RESUSCITATION.
INGESTION: DO NOT INDUCE VOMITING. ADMINISTER VEGETABLE OIL. GET MEDICAL ASSISTANCE. (NOTE TO PHYSICIAN: MATERIAL IF ASPIRATED INTO THE LUNGS MAY CAUSE CHEMICAL PNEUMONITIS. TREAT APPROPRIATELY)

********** REACTIVITY DATA **********

STABILITY:STABLE CONDITIONS TO AVOID: HEAT, SPARKS, FLAME AND BUILD UP OF STATIC ELECTRICITY
INCOMPATABILITY (MATERIALS TO AVOID): HALOGENS, STRONG ACIDS, ALKALINES, AND OXIDIZERS
HAZARDOUS DECOMPOSITION PRODUCTS: CARBON MONOXIDE (CO) FROM INCOMPLETE COMBUSTION.
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR CONDITIONS TO AVOID: NA

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

********** SPILL OR LEAK PROCEDURES **********

ENVIRONMENTAL IMPACT:

REPORT SPILLS AS REQUIRED TO APPROPRIATE AUTHORITIES. IN CASE OF ACCIDENT OR ROAD SPILL NOTIFY CHEMTREC (800) 424-9300. U.S. COAST GUARD REGULATIONS REQUIRE IMMEDIATE REPORTING OF SPILLS THAT COULD REACH ANY WATERWAY INCLUDING INTERMITTENT DRY CREEKS. COAST GUARD TOLL FREE NUMBER 800-424-8802.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED:

ELIMINATE ALL IGNITION SOURCES. REMOVE LEAKING CONTAINERS TO SAFE AREA. ADSORB ON FIRE RETARDANT TREATED SAWDUST, DIATOMACEOUS EARTH, ETC. SHOVEL UP AND DISPOSE OF AT AN APPROPRIATE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH CURRENT APPLICABLE LAWS AND REGULATIONS, AND PRODUCT CHARACTERISTICS AT TIME OF DISPOSAL. RUNOFF MAY CREATE FIRE OR EXPLOSION HAZARD IN SEWER SYSTEM.

WASTE MANAGEMENT:

DISPOSE OF WASTE BY SUPERVISED INCINERATION IN COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.

********** SPECIAL PROTECTION INFORMATION **********

EYE PROTECTION: IF EYE CONTACT IS LIKELY, SAFETY GLASSES WITH SIDE SHIELDS OR CHEMICAL TYPE GOGGLES SHOULD BE WORN.

SKIN PROTECTION: IF PROLONGED OR REPEATED SKIN CONTACT IS LIKELY, IMPERVIOUS GLOVES SHOULD BE WORN. GOOD PERSONAL HYGIENE PRACTICES SHOULD ALWAYS BE FOLLOWED.

RESPIRATORY PROTECTION: APPROVED RESPIRATORY EQUIPMENT MUST BE USED WHEN VAPOR OR MIST CONCENTRATIONS ARE UNKNOWN OR EXCEED THE TLV.

VENTILATION: VENTILATION REQUIRED AND EQUIPMENT MUST BE EXPLOSION PROOF. USE AWAY FROM ALL IGNITION SOURCES. USE IN WELL VENTILATED AREA WITH LOCAL EXHAUST VENTILATION.

OTHER: AVOID PROLONGED REPEATED SKIN CONTACT AND BREATHING MISTS/VAPORS.

********** SPECIAL PRECAUTIONS **********

HANDLING: AVOID CONTACT WITH SKIN. AVOID INHALATION OF VAPORS OR MISTS.

USE IN WELL VENTILATED AREA AWAY FROM ALL IGNITION SOURCES.

STORAGE: GROUND AND BOND ALL TRANSFER AND STORAGE EQUIPMENT; USE NON-SPARKING TOOLS AND EQUIPMENT. DRUMS MUST BE GROUNDED AND BONDED AND EQUIPPED WITH SELF-CLOSING VALVES, PRESSURE VACUUM BUNGS AND FLAME ARRESTERS. STORE AWAY FROM ALL IGNITION SOURCES IN A COOL AREA EQUIPPED WITH AN AUTOMATIC SPRINKLING SYSTEM. OUTSIDE OR DETACHED STORAGE PREFERRED.

STORED MATERIALS MUST BE LABELED AS: EXTREMELY FLAMMABLE. VAPOR HARMFUL.

********** TOXICOLOGICAL DATA **********

ACUTE

ORAL TOXICITY: (RATS)

LD50: > 5 G/KG. CONSIDERED TO BE NO MORE THAN SLIGHTLY TOXIC BASED ON SINGLE DOSE LEVEL TESTING AT 5 G/KG.

DERMAL TOXICITY: (RABBITS)

LD50: > 2 G/KG. CONSIDERED TO BE NO MORE THAN SLIGHTLY TOXIC BASED ON SINGLE DOSE LEVEL TESTING AT 2 G/KG.

INHALATION TOXICITY: (RATS)

TOXIC (ESTIMATED) -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

EYE IRRITATION: (RABBITS)

MAY CAUSE SLIGHT IRRITATION -- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

SKIN IRRITATION: (RABBITS)

MODERATELY IRRITATING TO RABBITS. MAY CAUSE MODERATE IRRITATION ON PROLONGED OR REPEATED CONTACT.

SUBACUTE AND MUTAGENICITY (SUMMARY)

NO INFORMATION AVAILABLE

CHRONIC OR SPECIALIZED (SUMMARY)

RECENT STUDIES WITH LABORATORY ANIMALS HAVE SHOWN THAT GASOLINE VAPORS WHEN ADMINISTERED IN HIGH CONCENTRATIONS OVER A PROLONGED PERIOD OF TIME, CAUSED KIDNEY DAMAGE AND KIDNEY CANCER IN RATS AND LIVER CANCER IN MICE. AS FAR AS SCIENTISTS KNOW, LOW LEVEL OR INFREQUENT EXPOSURE TO GASOLINE VAPORS IS UNLIKELY TO BE ASSOCIATED WITH CANCER OR OTHER SERIOUS DISEASES IN HUMANS.

REGULAR LEADED GASOLINE CONTAINS LEAD COMPOUNDS. LEAD CAN BE A CUMULATIVE POISON.

OTHER DATA

GASOLINE CONSISTS OF A COMPLEX BLEND OF PETROLEUM/PROCESSING DERIVED PARAFFINIC, OLEFINIC, NAPHTHENIC AND AROMATIC HYDROCARBONS WHICH MAY CONTAIN UP TO 5 PERCENT BENZENE; AND DOSAGES OF MULTIFUNCTIONAL ADDITIVES. MAY CONTAIN LEAD ANTIKNOCK COMPOUNDS. THE LEAD CONTENT MAY VARY IN COMPLIANCE WITH EPA AND STATE REGULATIONS.

ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPT.
MANAGER OF PRODUCT SAFETY INFORMATION, PHONE: 609-737-5596

REVISED:
12/1/84

SECTION 1 - MANUFACTURER INFORMATION

MANUF/DIST : GLOBAL PETROLEUM CORPORATION
800 SOUTH STREET EMERGENCY PHONE.....: 800-424-9300
P.O. BOX 9161 PREPARATION/REVISION DATE: 1/27/92
WALTHAM MA 02254
PREPARER/CONTACT: RON KENNY

LOCATION : REVERE, MA

TRADE NAME/SYNONYMS...: NO. 2 DIESEL FUEL
CHEMICAL NAME/SYNONYMS: PETROLEUM DISTILLATE, DIESEL
CHEMICAL FAMILY.....: HYDROCARBON
FORMULA.....: MIXTURE, MIDDLE DISTILLATE
PRODUCT CODE.....: 0007

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM (HMIS)

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**************************
*                        *
*   HEALTH..... 2        *
*   FLAMMABILITY.. 2     *
*   REACTIVITY.... 0     *
*   PROTECTION.... 0     *
*                        *
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SECTION 2 - HAZARDOUS INGREDIENTS

THIS PRODUCT CONTAINS HAZARDOUS INGREDIENTS : YES

CHEMICAL/COMMON NAME	CAS-NUMBER	%	PEL-OSHA	TLV-ACGIH
DIESEL FUEL	68476346	100	N/A	N/A
HYDRODESULFURIZED MIDDLE DISTILLATE	64742809	<100	N/A	N/A
STRAIGHT RUN MIDDLE DISTILLATES	64741442	<100	N/A	N/A
KEROSENE	8008206	<100	N/A	N/A
DISTILLATES, LIGHT CATALYTIC CRACKED	64741599	<100	N/A	N/A
NAPHTALENE	91203	<3.0	10ppm	10ppm

THIS PRODUCT CONTAINS CARCINOGENS (NTP, IARC, or OSHA):NO

SECTION 3 - HEALTH HAZARD DATA

HEALTH EFFECTS (Acute And Chronic)-
EYE CONTACT-NOT EXPECTED TO CAUSE PROLONGED OR SIGNIFICANT EYE IRRITATION
SKIN CONTACT-SUBSTANCE IS A MODERATE SKIN IRRITANT SO CONTACT WITH THE SKIN WOULD CAUSE PROLONGED INJURY TO THE AFFECTED AREA. SIGNS AND SYMPTOMS MAY INCLUDE PAIN OR A FEELING OF HEAT, DISCOLORATION, SWELLING, AND BLISTERING.
DERMAL TOXICITY-IF ABSORBED THROUGH THE SKIN, THIS SUBSTANCE IS CONSIDERED PRACTICALLY NON-TOXIC TO INTERNAL ORGANS.
INHALATION-PROLONGED BREATHING OF VAPORS CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. SIGNS AND SYMPTOMS OF (CN) EFFECTS MAY INCLUDE ONE OR MORE OF THE FOL-

LOWING: HEADACHE, DIZZINESS, LOSS OF APPETITE, WEAKNESS AND LOSS OF COORDINATION.
INGESTION-STOMACH IRRITATION, GASTRITIS, MILD EXCITATION, LOSS OF CONCIOUSNESS, CONVULSIONS, CYANOSIS, CONGESTION AND CAPILLARY HEMORRHAGING OF THE LUNG AND INTERNAL ORGANS. ASPIRATION HAZARD IF VOMITING OCCURS.
PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE DERMATITIS.

PRIMARY ROUTES OF ENTRY-
INHALATION, ABSORPTION, AND INGESTION IF HYGENIC PRACTICES NOT OBSERVED.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE-
PRE-EXISTING DERMATITIS MAY BE AGGRAVATED.(NIOSH) RECOMMENDS THAT WHOLE DIESEL EXHAUST BE REGARDED AS A "POTENTIAL OCCUPATIONAL CARCINOGEN".

EMERGENCY FIRST AID PROCEDURES-
EYE CONTACT- AS A PRECAUTION, FLUSH EYES WITH FRESH WATER FOR 15 MINUTES. REMOVE CONTACT LENSES IF WORN.
SKIN CONTACT-REMOVE CONTAMINATED CLOTHES. WASH SKIN THOROUGHLY WITH SOAP AND WATER. WASH CONTAMINATED CLOTHES.
INHALATION-MOVE PERSON TO FRESH AIR. APPLY ARTIFICIAL RESPIRATION IF NOT BREATHING. GET MEDICAL ATTENTION.
INGESTION-DO NOT INDUCE VOMITING. IF SPONTANEOUS VOMITING OCCURS, HOLD THE VICTIM'S HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

SECTION 4 - CHEMICAL DATA

BOILING POINT (F)....: <675 F	SPECIFIC GRAVITY (WATER=1).....: 0.87
VAPOR PRESSURE (mmHg): 1.6	PERCENT VOLATILE BY VOLUME (%).....: N/A
VAPOR DENSITY (AIR=1): 8	EVAPORATION RATE (N-BUTYL ACETATE =1): 0.01

SOLUBILITY IN WATER-
NIL

APPEARANCE AND ODOR INFORMATION-
CLEAR TO LIGHT AMBER LIQUID. MAY BE DYED RED.

SECTION 5 - PHYSICAL HAZARD DATA

FLASH POINT (Method Used): 125 F FLAMMABLE LIMITS : Lel=0.6 UEL=7.5

EXTINGUISHING MEDIA-
DRY CHEMICAL, CARBON DIOXIDE, FOAM, AND WATER SPRAY.

SPECIAL FIRE FIGHTING PROCEDURES-
USE A WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS. USE A SMOTHERING TECHNIQUE FOR EXTINGUISHING FIRE OF A COMBUSTIBLE LIQUID. DO NOT USE A FORCED WATER STREAM DIRECTLY ON OIL FIRES AS THIS WILL SCATTER THE FIRE.

NUSUAL FIRE AND EXPLOSION HAZARDS-
FLOWING OIL CAN BE IGNITED BY SELF GENERATED STATIC ELECTICITY. FIRE HAZARD IS GREATER AS LIQUID TEMPERATURE RISES ABOVE 85 F.

...COMPATIBILITY (Materials To Avoid)-
MAY REACT WITH STRONG OXIDIZING AGENTS.

HAZARDOUS DECOMPOSITION PRODUCTS-
NDA

WILL HAZARDOUS POLYMERIZATION OCCUR-
POLYMERIZATION WILL NOT OCCUR.

CONDITIONS TO AVOID FOR POLYMERIZATION-
N/A

IS THE PRODUCT STABLE-
STABLE.

CONDITIONS TO AVOID FOR STABILITY-
N/A

SECTION 6 - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-
CONSIDERED TO BE A WATER POLLUTANT AND RELEASES OF THIS PRODUCT SHOULD BE PREVENTED FROM CONTAMINATING SOIL AND WATER AND FROM ENTERING DRAINAGE AND SEWER SYSTEMS. ELIMINATE ALL OPEN FLAME IN VICINITY OF SPILL OR RELEASED VAPOR. STOP THE SOURCE OF LEAK OR RELEASE. CONTAIN LIQUID TO PREVENT FURTHER CONTAMINATION OF SOIL, SURFACE WATER OR GROUNDWATER. CLEAN UP SMALL SPILLS USING SORBENT MATERIALS OR PUMPING.

WASTE DISPOSAL METHODS-
PLACE CONTAMINATED MATERIALS IN DISPOSAL CONTAINERS AND DISPOSE OF IN A MANNER CONSISTENT WITH APPLICABLE REGULATIONS.

SECTION 7 - EXPOSURE CONTROL INFORMATION

VENTILATION-
LOCAL EXHAUST: N/A
SPECIAL.....: N/A
MECHANICAL (General): EXPLOSION PROOF
OTHER.....: N/A

RESPIRATORY PROTECTION-
USE APPROVED RESPIRATORY PROTECTIVE EQUIPMENT FOR CLEANING LARGE SPILLS OR ENTRY INTO LARGE TANKS, VESSELS OR OTHER CONFINED SPACES.

PROTECTIVE GLOVES-
WEAR IMPERVIOUS GLOVES WHEN CONTACT WITH SKIN MAY OCCUR.

OTHER PROTECTIVE EQUIPMENT-
REMOVE CONTACT LENSES AND WEAR CHEMICAL SAFETY GLASSES OR GOGGLES WHERE CONTACT WITH LIQUID MAY OCCUR.

OTHER ENGINEERING CONTROLS-
PROVIDE ADEQUATE VENTILATION :(1) TO MEET OCUPATIONAL EXPOSURE LIMITS, (2) TO PREVENT THE FORMATION OF EXPLOSIVE ATMOSPHERES AND (3) TO PREVENT OXYGEN DEFICIENT ATMOSPHERES, ESPECIALLY IN CONFINED SPACES.

WORK PRACTICES-
DO NOT USE OR STORE NEAR FLAME, SPARKS OR HOT SURFACES. USE ONLY IN WELL VENTILATED AREA. KEP CONTAINER CLOSED. DO NOT WELD, HEAT OR DRILL CONTAINER. REPLACE CAP OR BUNG. EMPTIED CONTAINER STILL CONTAIN HAZARDOUS OR EXPLOSIVE VAPOR OR LIQUID. DO NOT USE PRESSURE TO EMPTY DRUM OR EXPLOSION MAY RESULT. DO NOT USE AS A PORTABLE HEATER OR APPLIANCE FUEL. TOXIC FUMES MAY ACCUMULATE AND CAUSE DEATH.

HYGIENIC PRACTICES-
LAUNDER SOILED CLOTHING. KEEP HEAD AWAY FROM CONTAINER WHEN OPENING OR DISPENSING. WASH THOROUGHLY AFTER HANDLING.

SECTION 8 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE-
PLACARD REQUIRED ONLY WHEN MATERIAL IS CONTAINED IN PACKAGING OR CONTAINER THAT EXCEEDS 110 GALLONS OR IN TANK CAR OR TANK TRUCK. TRANSPORT AND HANDLE IN ACCORDANCE WITH DOT REGULATIONS. USE SELF-CONTAINED BREATHING APPARATUS OR SUPPLIED-AIR MASK FOR LARGE SPILLS IN CONFINED AREA.

MAINTENANCE PRECAUTIONS-
USE SPARK-PROOF TOOLS. MATERIAL MAY BE AT ELEVATED TEMPERATURES AND/OR PRESSURES. EXERCISE DUE CARE WHEN OPENING BLEEDERS AND SAMPLING PORTS.

OTHER PRECAUTIONS-
PROPER SHIPPING NAME:FUEL OIL, No. 2 COMMBUSTIBLE LIQUID NA 1993

ADDITIONAL COMMENTS-
THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE TO US AND IS BELIEVED TO BE CORRECT. HOWEVER, GLOBAL MAKES NO WARRANTY, EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE PRODUCT DESCRIBED HEREIN.

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:34:26.8
PPTS21M1

<<< BROWSE >>> M S D S # 4070 - S E C T I O N 1 - A G E N E R A L

MANUFACTURER NAME...: AMERADA HESS CORPORATION
1 HESS PLAZA

ACTIVE MSDS.....: Y

APPROVED MSDS.....: Y

DATE PREPARED
08 / 31 / 1989

WOODBRIDGE NJ 07095

NU STOCK COMMODITY CODE:
MANUFACTURERS CODE ID : REVISED

TRADE/PRODUCT NAME.....: #4 RESIDUAL FUEL OIL L/S
CHEMICAL NAME / SYNONYM.:
CHEMICAL FAMILY.....: PETROLEUM HYDROCARBON
TRAINING NAME.....: FUELS/LUBRICANTS/OILS

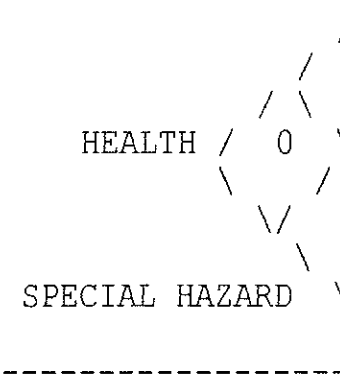
EMERGENCY TELEPHONE NO..:(800) 424 - 9300 EXT. 0
INFORMATION TELEPHONE NO:(201) 750 - 6000 EXT. 0

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 1

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:34:26.8
<<< BROWSE >>> M S D S - S E C T I O N 1 - B PPTS21M2
ACTIVE MSDS: Y G E N E R A L

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

---------- N.F.P.A. CODES ----------



FLAMMABILITY- FROM 0 (WILL NOT BURN)
TO 4 (VERY FLAMMABLE)
HEALTH- FROM 0 (NO HEALTH HAZARD)
TO 4 (EXTREMELY HAZARDOUS)
REACTIVITY- FROM 0 (STABLE)
TO 4 (EXPLOSIVE REACTION)
SPECIAL HAZARD- R FOR RADIATION HAZARD
W FOR REACTIVITY TO WATER
OX FOR OXIDIZER

LABEL INFORMATION:

TARGET ORGAN/HEALTH EFFECTS:
SKIN,EYES: HOT LIQUID; MODERATE
LOCAL IRRITANT.
INHALATION: CONFINED SPACES; DIZZ-
INESS,DROWSINESS,HEADACHE.

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 2

19960604 11:34:49.6

<<< BROWSE >>> M S D S - S E C T I O N 2 PPTS22M1

H A Z A R D O U S I N G R E D I E N T S

ACTIVE MSDS: Y

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

INGREDIENT NAME: PETROLEUM DISTILLATES (NOC) CAS # 68476-31-3
INGREDIENT TYPE:
OSHA PEL.....: 000500.00000 PPM PERCENT OF PRODUCT:
ACGIH TLV.....: 000400.00000 PPM CAS NO.: 8002-05-9
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

INGREDIENT NAME: SULFUR
INGREDIENT TYPE:
OSHA PEL.....: 000005.00000 MG/M3 PERCENT OF PRODUCT: 0001.000
ACGIH TLV.....: 000005.00000 MG/M3 CAS NO.: 7704-34-9
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

PF13=LOGOFF PF15=MAIN MENU

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:35:05.0
PPTS23M1

<<< BROWSE >>> M S D S - S E C T I O N 3
P H Y S I C A L / C H E M I C A L D A T A

ACTIVE MSDS: Y PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

BOILING POINT...: 350-700 F	SCALE:
SPECIFIC GRAVITY: VARIES 0.887	VAPOR PRES(MMHG): 0.007 PSIA @ 100F
MELTING POINT...:	SCALE:
PERCENT VOLATILE: NIL	VAPOR DEN(AIR=1): LESS THAN 0.1
EVAPORATION RATE: NA	EVAP. METHOD....:

SOLUBILITY (H2O): NIL

APPEARANCE/ODOR.: BROWN TO BLACK, SEMI-VISCOUS LIQUID. PETROLEUM ODOR.

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:35:20.4
PPTS24M1

<<< BROWSE >>> M S D S - S E C T I O N 4
F I R E & E X P L O S I O N H A Z A R D D A T A
ACTIVE MSDS: Y

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

FLASH POINT.....:
N/A :
COC :
TCC : 130. F
OTHER :

FLAMMABLE LIMITS...:

LEL PERCENT: 3.90 % UEL PERCENT: 20.10 %

EXTINGUISHING MEDIA: CO2: X FOAM: X
WATER: DRY CHEMICAL: X WATER FOG: X

PF13 = LOGOFF PF15 = MAIN MENU

<<< BROWSE >>> M S D S - S E C T I O N 4 (CONT.)
F I R E & E X P L O S I O N H A Z A R D D A T A
PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

SPECIAL FIRE FIGHTING PROCEDURES

WATER IS NOT ORDINARILY EFFECTIVE, SOLID HOSE STREAMS TEND TO SCATTER LIQUID & SPREAD FIRE. WATER SPRAY COOLS THE BURNING SURFACE & EXCLUDES AIR TO CONTROL OR EXTINGUISH FIRE.

UNUSUAL FIRE AND EXPLOSION HAZARDS

FLAMMABLE. VAPORS MAY FORM EXPLOSIVE MIXTURES WITH AIR.

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:35:55.8
PPTS25M1

<<< BROWSE >>> M S D S - S E C T I O N 5 - A
H E A L T H H A Z A R D D A T A

ACTIVE MSDS: Y

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

PRODUCT PEL/TLV.: 400.00000

UNIT OF MEASURE.: PPM

CARCINOGENIC....:	NTP....:	IARC MONOGRAPHS:	OSHA REGULATED:
	MUTAGEN:	TERATOGEN.....:	NEUROTOXIN....:

ROUTES OF ENTRY.: INHALATION: X SKIN: X INGESTION:

PF13 = LOGOFF PF15 = MAIN MENU

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

EFFECTS OF OVER-EXPOSURE

HOT LIQUID IS A MODERATE LOCAL IRRITANT.
INHALATION IN CONFINED SPACES MAY RESULT IN DIZZINESS, DROWSINESS, HEADACHE.

SIGNS AND SYMPTOMS

AS ABOVE

PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: FLUSH FOR AT LEAST 15 MIN WITH LOW PRESSURE WATER. CALL PHYSICIAN.
SKIN CONTACT: FLOOD AREA WITH WATER, APPLY ICE COMPRESSES, DO NOT REMOVE ADHERED MATERIAL, CALL PHYSICIAN.
INGESTION: REMAIN CALM, CALL PHYSICIAN.

MEDICAL CONDITIONS AGGRAVATED

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:36:41.3
<<< BROWSE >>> M S D S - S E C T I O N 6 PPTS26M1
R E A C T I V I T Y D A T A

ACTIVE MSDS: Y
PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

STABILITY...: STABLE

STABILITY CONDITIONS TO AVOID

NFPA 0

INCOMPATABILITY

PF13 = LOGOFF PF15 = MAIN MENU

MODIFIED: 11/28/1989 BY: PERIPXC 19960604 11:36:41.3
<<< BROWSE >>> M S D S - S E C T I O N 6 PPTS26M2
R E A C T I V I T Y D A T A

ACTIVE MSDS: Y
PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

HAZARDOUS DECOMPOSITION

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

POLYMERIZATION CONDITIONS TO AVOID
NOT SHOCK SENSITIVE

PF13 = LOGOFF PF15 = MAIN MENU NEXT SECTION NO: 7

MODIFIED: 00/00/0000 BY: 19960604 11:37:12.6
PPTS27M1

<<< BROWSE >>> M S D S - S E C T I O N 7
ACTIVE MSDS: Y P R E C A U T I O N S F O R S A F E H A N D L I N G
PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

STEPS - RELEASE OR SPILLS

SHUT OFF LEAK, CONTAIN SPILL, PREVENT PUBLIC ACCESS, NOTIFY HEALTH & POLLUTION AGENCIES, IN ACCORDANCE WITH PLANT "SPILL PREVENTION CONTROL & COUNTERMEASURES PLAN" (SPCC).

WASTE DISPOSAL METHOD

CONTACT STATE POLLUTION AGENCY

PF13 = LOGOFF PF15 = MAIN MENU

MODIFIED: 00/00/0000 BY: 19960604 11:37:12.6
PPTS27M2

<<< BROWSE >>> M S D S - S E C T I O N 7
ACTIVE MSDS: Y P R E C A U T I O N S F O R S A F E H A N D L I N G
PRODUCT NAME: #4 RESIDUAL FUEL OIL L/S
MANUFACTURER NAME: AMERADA HESS CORPORATION

PRECAUTIONS HANDLING AND STORING

KEEP AWAY FROM FLAMES, SPARKS, EXCESSIVE TEMPERATURES.

PRECAUTIONS OTHER

DOT CLASSIFICATION: COMBUSTIBLE LIQUID DOT ID NO. UN 1993

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 8

MATERIAL SAFETY DATA SHEET

Manufacturers/Suppliers Names:

The Belcher Company of New York, Inc.
The Belcher Company of Tennessee, Inc.
Belcher New England, Inc.
Belcher Oil Company
Belcher Towing Company
Coastal Eagle Point Oil Company
Coastal Hercules, Inc.
Coastal Refining & Marketing, Inc.
Coastal States Crude Gathering Company
Coastal States Trading, Inc.
Coastal Tankships U.S.A., Inc.
Coscol Marine Corporation
Coscol Petroleum Corporation
Derby Refining Company
Pacific Refining Company
Texas Tankship Agency, Inc.
Western Fuel Oil Company

Address: 9 Greenway Plaza
Houston, Texas 77046

Info Phone: (713) 877-1400

Emergency Phone: (713) 877-1400

PRODUCT IDENTIFICATION

Trade Name: Residual Fuel Oil, Bunker Fuel Oil **Date Revised: 10-07-85**
Synonyms: Fuel Oil No. 6, Bunker Fuel, Residual Fuel Oil

Chemical Name and/or Family or Description: Petroleum Hydrocarbon; A distillate of a high viscosity residual oil.

COMPOSITION

INGREDIENT	CAS NUMBER	WT%	OCCUPATIONAL EXPOSURE LIMITS* PEL	TLV	OTHER	UNITS
Complex mixture of Paraffinic, Olefinic, Naphthenic and Aromatic Hydrocarbons	068-553-00-4	>99	5 (as Oil Mist)	5		mg/m³

* 8-hour TWA unless otherwise specified.

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point 760 mmHg: 500°F
Vapor Pressure mmHg @ 20°C: 0.2
Solubility in H_2O%: Insoluble
pH: N.A.
Appearance: Black liquid to heavy paste
% Volatile by Volume: 100
Melting Point: −20°F
Vapor Density (Air = 1): N.A.
Specific Gravity: 0.97
Evaporation Rate: (Ethyl Ether = 1) <0.01
Odor: Mild petroleum odor
Viscosity (Method, Temp.): <300 @ 50°C, SFS
N.A. = Not Available

FIRE AND EXPLOSION DATA

Flash Point: >140°F (PMCC) **Autoignition Temperature:** 765°F
Flammable Limits in Air % by Vol. **Lower:** 3.9 **Upper:** 20.1
Extinguishing Media: Dry chemical, carbon dioxide, foam, and water spray.
Special Fire Fighting Procedure: Use a water spray to cool fire-exposed containers. Use a smothering technique for extinguishing fire of this combustible liquid. Do not use a forced water stream directly on oil fires as this will scatter the fire. Firefighters should wear self-contained breathing apparatus and full protective clothing.
Unusual Fire or Explosion Hazard: Flowing oil can be ignited by self-generated static electricity; containers should be grounded and bonded.

REACTIVITY DATA

Stability: Stable
Hazardous Polymerization: Will not occur.
Conditions to Avoid/Incompatibility: Strong oxidizing agents, heat, spark, flame and build-up of static electricity.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, sulfur dioxide and hydrocarbons.

HEALTH HAZARD DATA

Carcinogenicity: **NTP:** No **IARC Monographs:** No **OSHA Regulated:** No
Threshold Limit Value: 5 mg/m³ (oil mist) OSHA and ACGIH

MATERIAL SAFETY DATA SHEET

JET-A Kerosene JUN 1 9 1984 -0497

MARKETED BY:
THE STANDARD OIL COMPANY (OHIO)
BORON OIL COMPANY
BP OIL INC.
Midland Building
Cleveland, Ohio 44115

CORPORATE EMERGENCY TELEPHONE NO. (PUBLIC ACCOUNTS AND SUPPLY DEPT.)
FROM WITHIN OHIO: 800-362-8059
FROM OUTSIDE OHIO: 800-321-8642
CHEMTREC (CMA): 800-424-9300

DESCRIPTION

CHEMICAL NAME: Petroleum hydrocarbons CAS REGISTRY NO.: 8008-20-6
SYNONYMS: Refined straight-run petroleum distillate, Aviation turbine fuel, Aviation kerosine
CHEMICAL FAMILY: Hydrocarbons FORMULA: Mixture MOL. WT.: N.A.
COMPOSITION: Refined petroleum hydrocarbons distilling within the range of 300° to 500°F (paraffins, naphthenes, aromatics) plus very minor amounts (ppm range) of metal deactivator and antistatic agent. Product contains not more than 0.3% combined sulfur and 20% aromatic hydrocarbons, and is treated to meet maximum water and particulate limits.

STATEMENT OF HEALTH HAZARD

HAZARD DESCRIPTION: Combustible liquid. No acute effects from limited incidental contact. Ingestion may be accompanied by aspiration into lungs, which can cause severe pneumonitis.
EXPOSURE LIMITS: 500 ppm threshold limit value (TLV) for vapors; 5 mg/M^3 for oil mist in air (8-hour time-weighted average exposure, OSHA 29 CFR 1910.1000, Table Z-1).

EMERGENCY TREATMENT

EFFECTS OF OVEREXPOSURE: Vapors may irritate eyes, nose, and throat, and at high concentration cause headache, dizziness. Excessive prolonged or repeated skin contact may cause drying, dermatitis due to defatting action common to all oils. Ingestion may create discomfort, but without lasting effect. Aspiration of liquid oil into lungs can cause dangerous pneumonitis. Inhalation of mist is not known to have adverse effects but should be avoided.
EMERGENCY AID: Eyes: flush with copious water for 15 min., holding eyelids apart and away from eyeball. Skin contact: remove contaminated clothing and wash contacted areas with mild soap and water. Use emollient cream if needed. Inhalation of vapors: remove patient to fresh air, administer oxygen or artificial respiration if needed. Swallowing: Do not induce vomiting because of risk of aspiration. After spontaneous vomiting, monitor patient for difficult breathing. EFFECT OF LIQUID IN LUNGS MAY BE DELAYED ONE OR TWO DAYS. IF SYMPTOMS PERSIST OR EXPOSURE IS SEVERE, SEEK PROMPT MEDICAL HELP.
NOTE TO PHYSICIAN: Petroleum aspiration may cause severe pneumonitis ("oil pneumonia"). Vomiting should not be induced, and gastric lavage should be undertaken with consideration of endotracheal intubation, especially in an unconscious patient.

PHYSICAL DATA

BOILING PT.: Initial: 300°F
VAPOR PRESSURE: at 68°F: 0.4 mm. Hg
SPECIFIC GRAVITY: at 60°F: 0.825
PERCENT VOLATILE: at 100°F: 0%
FREEZING PT.: Not applicable
VAPOR DENSITY (Air=1): 4.7
SOLUBILITY IN WATER: Negligible
EVAPORATION RATE (Water=1): Slower
APPEARANCE AND ODOR: Colorless or straw-colored clear liquid with hydrocarbon odor.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: min. 100°F (ASTM D 93) AUTOIGNITION TEMP.: 410°F
FLAMMABLE LIMITS IN AIR: LOWER: 0.7% UPPER: 5.0%
EXTINGUISHING MEDIA: Foam, carbon dioxide, dry chemicals, water fog, sand or earth.
SPECIAL FIRE-FIGHTING PROCEDURES: Do not direct water directly into fire to avoid splatter, spread. Use water to cool threatened surroundings. Avoid breathing fumes. Use self-contained air supply if needed.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Product is a combustible liquid. Exposure to extreme heat may cause pressure in closed containers. Atomized mist or heated vapor may ignite with explosive violence.

410134-00 MOBIL HEAVY DUTY 40

Lubricating oils

1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 01/01/95

PRODUCT NAME: MOBIL HEAVY DUTY 40
SUPPLIER: MOBIL OIL CORP.
PRODUCTS AND TECHNOLOGY DEPT.
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Emergency (call collect):	609-737-4411	
Product and MSDS Information:	800-662-4525	703-849-3265
CHEMTREC:	800-424-9300	202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: PET. HYDROCARBONS AND ADDITIVES

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

This product is not formulated to contain ingredients which have exposure limits established by regulatory agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.

See Section 15 for European Label Information.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined not to be hazardous.
EFFECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: Dark Amber Liquid. DOT ERG No. - NA

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.
SKIN CONTACT: Wash contact areas with soap and water.
INHALATION: Not expected to be a problem.
INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.
SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.
SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): > 224(435) (ASTM D-92). Flammable limits - LEL: NA, UEL: NA.
NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0
HAZARDOUS DECOMPOSITION PRODUCTS: Metal oxides. Carbon monoxide. Elemental oxides.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Adsorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.
ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.
PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: No special precautions are necessary beyond normal good hygiene practices. See Section 8 for additional personal protection advice when handling this product.
STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.
RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.
EYE PROTECTION: Normal industrial eye protection practices should be employed.
SKIN PROTECTION: No special equipment required. However, good personal hygiene practices should always be followed.
EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits. However, a threshold limit value of 5.00 mg/m3 is suggested for oil mist.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
COLOR: Dark Amber
ODOR: Mild
ODOR THRESHOLD: NA
pH: NA
BOILING POINT C(F): > 316(600)
MELTING POINT C(F): NA
FLASH POINT C(F): > 224(435) (ASTM D-92)
FLAMMABILITY: NA
AUTO FLAMMABILITY: NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: < 0.1
VAPOR DENSITY: > 2.0
EVAPORATION RATE: NA
RELATIVE DENSITY, 15/4 C: 0.891
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5

(Section continued next page)

VISCOSITY AT 40 C, cSt: 144.2
VISCOSITY AT 100 C, cSt: > 14.5
POUR POINT C(F): < -15(5)
FREEZING POINT C(F): NE
VOLATILE ORGANIC COMPOUND: EXEMPT IN U.S.
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Metal oxides. Carbon monoxide. Elemental oxides.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

OTHER ACUTE TOXICITY DATA: The acute toxicological results summarized above are based on testing of representative Mobil products. Exposure to vapors generated at 400F at levels 400 times the TLV for oil mists (5 mg/m3), then cooled to room temperature, resulted in no significant adverse effects.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Representative Mobil formulations have been tested at the Mobil Environmental and Health Sciences Laboratory by dermal applications to rats 5 days/week for 90 days at doses

(Section continued next page)

significantly higher than those expected during normal industrial exposure. Extensive evaluations, including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Dermal exposure of pregnant rats to representative formulations did not cause adverse effects in either the mothers or their offspring.

---CHRONIC TOXICOLOGY (SUMMARY)---

The base oils in this product are severely solvent refined and/or severely hydrotreated. Chronic mouse skin painting studies of severely treated oils showed no evidence of carcinogenic effects. These results are confirmed on a continuing basis using the Mobil Modified Ames Test.

---SENSITIZATION (SUMMARY)---

Representative Mobil formulations have not caused skin sensitization in guinea pigs.

---OTHER TOXICOLOGY DATA---

Used gasoline engine oils have shown evidence of skin carcinogenic activity in laboratory tests when no effort was made to wash the oil off between applications. Used oil from diesel engines did not produce this effect.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS:

Acute LC/EC50 Fish: Juvenile Rainbow Trout: Practically non-toxic ---Based on testing of similar products.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at any government approved waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

(Section continued next page)

RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

14. TRANSPORT INFORMATION

USA DOT: NOT REGULATED BY USA DOT.

RID/ADR: NOT REGULATED BY RID/ADR.

IMO: NOT REGULATED BY IMO.

IATA: NOT REGULATED BY IATA.

15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA, and EINECS/ELINCS.

EU Labeling: EU labeling not required.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

This product contains the following SARA (313) Toxic Release Chemicals:

CHEMICAL NAME	CAS NUMBER	CONC.
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2:1) (ZDDP)	68649-42-3	1.81%

(Section continued next page)

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
COPPER (ELEMENTAL ANALYSIS) (0.02%)	7440-50-8	22
ZINC (ELEMENTAL ANALYSIS) (0.13%)	7440-66-6	22
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2: 1) (ZDDP) (1.81%)	68649-42-3	18, 20, 21, 22, 24, 25

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen

16. OTHER INFORMATION

USE: AUTOMOTIVE ENGINE OIL

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

See container label for ingredient information.

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For Mobil Use Only: MHC: 1* 1* 0* 1* 1*, MPPEC: A, REQ: US - MARKETING, SAFE USE: L

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(Section continued next page)

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524777-00 MOBIL SHC ATF (UNDYED)

1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 01/01/95

PRODUCT NAME: MOBIL SHC ATF (UNDYED)
SUPPLIER: MOBIL OIL CORP.
PRODUCTS AND TECHNOLOGY DEPT.
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Emergency (call collect):	609-737-4411	
Product and MSDS Information:	800-662-4525	703-849-3265
CHEMTREC:	800-424-9300	202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: SYN. HYDROCARBONS AND ADDITIVES

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

This product is not formulated to contain ingredients which have exposure limits established by regulatory agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.

See Section 15 for European Label Information.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined not to be hazardous.
EFFECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: Red Liquid. DOT ERG No. - NA

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.
SKIN CONTACT: Wash contact areas with soap and water.
INHALATION: Not expected to be a problem.
INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.
SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.
SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): > 180(356) (ASTM D-92). Flammable limits - LEL: NA, UEL: NA.
NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Adsorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.
ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.
PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: No special precautions are necessary beyond normal good hygiene practices. See Section 8 for additional personal protection advice when handling this product.
STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.
RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.
EYE PROTECTION: Normal industrial eye protection practices should be employed.
SKIN PROTECTION: No special equipment required. However, good personal hygiene practices should always be followed.
EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits. However, a threshold limit value of 5.00 mg/m3 is suggested for oil mist.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
COLOR: Red
ODOR: Mild
ODOR THRESHOLD: NA
pH: NA
BOILING POINT C(F): > 316(600)
MELTING POINT C(F): NA
FLASH POINT C(F): > 180(356) (ASTM D-92)
FLAMMABILITY: NA
AUTO FLAMMABILITY: NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: < 0.1
VAPOR DENSITY: > 2.0
EVAPORATION RATE: NA
RELATIVE DENSITY, 15/4 C: 0.839
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5

(Section continued next page)

VISCOSITY AT 40 C, cSt: 35.0
VISCOSITY AT 100 C, cSt: < 8.1
POUR POINT C(F): < -51(-60)
FREEZING POINT C(F): NE
VOLATILE ORGANIC COMPOUND: EXEMPT IN U.S.
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Not applicable ---Harmful concentrations of mists and/or vapors are unlikely to be encountered through any customary or reasonably foreseeable handling, use, or misuse of this product.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Representative Mobil formulations of these synthetic lubricants have been tested at Mobil Environmental and Health Sciences Laboratory by dermal applications to rats 5 days/week for 90 days at doses significantly higher than those expected during normal industrial exposure. Extensive evaluations including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

(Section continued next page)

---OTHER TOXICOLOGY DATA---

This product is formulated with a synthetic hydrocarbon as the base stock. The Mobil Environmental and Health Sciences Laboratory has tested representative synthetic base stocks to assess their potential adverse effects on human health. Assessment of human health effects was based on acute oral, dermal, and inhalation toxicity; eye and skin irritation; subchronic dermal toxicity and reproductive studies; guinea pig sensitization; and mutagenicity and chromosomal damage assays. None of these base stocks appears to pose a health hazard to humans under conditions of expected use.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS: Not established.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at any government approved waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

RCRA INFORMATION: Disposal of unused product may be subject to RCRA regulations (40 CFR 261) due to the characteristic(s)/chemical(s) listed below. Disposal of the used product may also be regulated due to ignitability, corrosivity, reactivity, or toxicity as determined by the Toxicity Characteristic Leaching Procedure (TCLP).

CADMIUM: .0001 PCT (TCLP)

14. TRANSPORT INFORMATION

USA DOT: NOT REGULATED BY USA DOT.

RID/ADR: NOT REGULATED BY RID/ADR.

IMO: NOT REGULATED BY IMO.

IATA: NOT REGULATED BY IATA.

15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA, EINECS/ELINCS, MITI, and DSL.

EU Labeling: EU labeling not required.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

This product contains no chemicals reportable under SARA (313) toxic release program.

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
TOLUENE (0.17%)	108-88-3	22

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen

16. OTHER INFORMATION

USE: AUTOMATIC TRANSMISSION FLUID

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

See container label for ingredient information.

****

For Mobil Use Only: MHC: 1* 1* NA 1* 1*, MPPEC: A, REQ: US - MARKETING, SAFE USE: L

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Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of the product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user and WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. Nothing is intended as a recommendation for uses which infringe valid patents or as extending license under valid patents. Appropriate warnings and safe handling procedures should be provided to handlers and users. Use or re-transmission of the information contained herein in any other format than the format as presented is strictly prohibitted. Mobil neither represents nor warrants that the format, content or product formulas contained in this document comply with the laws of any other country except the United States of America.

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480301-00 MOBIL MOTOR OIL 20W-50

1. PRODUCT AND COMPANY IDENTIFICATION

APPROVAL DATE: 04/25/95

PRODUCT NAME: MOBIL MOTOR OIL 20W-50
SUPPLIER: MOBIL OIL CORP.
PRODUCTS AND TECHNOLOGY DEPT.
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Emergency (call collect):	609-737-4411	
Product and MSDS Information:	800-662-4525	703-849-3265
CHEMTREC:	800-424-9300	202-483-7616

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: PET. HYDROCARBONS AND ADDITIVES

INGREDIENTS CONSIDERED HAZARDOUS TO HEALTH:

This product is not formulated to contain ingredients which have exposure limits established by regulatory agencies. It is not hazardous to health as defined by the European Union Dangerous Substances/Preparations Directives. See Section 15 for a regulatory analysis of the ingredients.

See Section 15 for European Label Information.

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined not to be hazardous.
EFFECTS OF OVEREXPOSURE: No significant effects expected.
EMERGENCY RESPONSE DATA: Dark Amber Liquid. DOT ERG No. - NA

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.
SKIN CONTACT: Wash contact areas with soap and water.
INHALATION: Not expected to be a problem.
INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.
SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.
SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Flash Point C(F): > 190(374) (ASTM D-92). Flammable limits - LEL: NA, UEL: NA.
NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0
HAZARDOUS DECOMPOSITION PRODUCTS: Metal oxides. Carbon monoxide. Elemental oxides.

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Adsorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.
ENVIRONMENTAL PRECAUTIONS: Prevent spills from entering storm sewers or drains and contact with soil.
PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: No special precautions are necessary beyond normal good hygiene practices. See Section 8 for additional personal protection advice when handling this product.
STORAGE: Do not store in open or unlabelled containers. Store away from strong oxidizing agents or combustible material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION: No special requirements under ordinary conditions of use and with adequate ventilation.
RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.
EYE PROTECTION: Normal industrial eye protection practices should be employed.
SKIN PROTECTION: No special equipment required. However, good personal hygiene practices should always be followed.
EXPOSURE LIMITS: This product does not contain any components which have recognized exposure limits. However, a threshold limit value of 5.00 mg/m3 is suggested for oil mist.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
COLOR: Dark Amber
ODOR: Mild
ODOR THRESHOLD: NA
pH: NA
BOILING POINT C(F): > 316(600)
MELTING POINT C(F): NA
FLASH POINT C(F): > 190(374) (ASTM D-92)
FLAMMABILITY: NA
AUTO FLAMMABILITY: NE
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: < 0.1
VAPOR DENSITY: > 2.0
EVAPORATION RATE: NA
RELATIVE DENSITY, 15/4 C: 0.887
SOLUBILITY IN WATER: Negligible
PARTITION COEFFICIENT: > 3.5

(Section continued next page)

VISCOSITY AT 40 C, cSt: 152.1
VISCOSITY AT 100 C, cSt: > 17.0
POUR POINT C(F): < -24(-11)
FREEZING POINT C(F): NE
VOLATILE ORGANIC COMPOUND: EXEMPT IN U.S.
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Metal oxides. Carbon monoxide. Elemental oxides.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

OTHER ACUTE TOXICITY DATA: The acute toxicological results summarized above are based on testing of representative Mobil products. Exposure to vapors generated at 400F at levels 400 times the TLV for oil mists (5 mg/m3), then cooled to room temperature, resulted in no significant adverse effects.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Representative Mobil formulations have been tested at the Mobil Environmental and Health Sciences Laboratory by dermal applications to rats 5 days/week for 90 days at doses

(Section continued next page)

significantly higher than those expected during normal industrial exposure. Extensive evaluations, including microscopic examination of internal organs and clinical chemistry of body fluids, showed no adverse effects.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Dermal exposure of pregnant rats to representative formulations did not cause adverse effects in either the mothers or their offspring.

---CHRONIC TOXICOLOGY (SUMMARY)---

The base oils in this product are severely solvent refined and/or severely hydrotreated. Chronic mouse skin painting studies of severely treated oils showed no evidence of carcinogenic effects. These results are confirmed on a continuing basis using the Mobil Modified Ames Test.

---SENSITIZATION (SUMMARY)---

Representative Mobil formulations have not caused skin sensitization in guinea pigs.

---OTHER TOXICOLOGY DATA---

Used gasoline engine oils have shown evidence of skin carcinogenic activity in laboratory tests when no effort was made to wash the oil off between applications. Used oil from diesel engines did not produce this effect.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS:

Acute LC/EC50 Fish: Juvenile Rainbow Trout: Practically non-toxic ---Based on testing of similar products.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at any government approved waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

(Section continued next page)

RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

14. TRANSPORT INFORMATION

USA DOT: NOT REGULATED BY USA DOT.

RID/ADR: NOT REGULATED BY RID/ADR.

IMO: NOT REGULATED BY IMO.

IATA: NOT REGULATED BY IATA.

15. REGULATORY INFORMATION

Governmental Inventory Status: All components comply with TSCA, EINECS/ELINCS, and DSL.

EU Labeling: EU labeling not required.

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:
This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

This product contains the following SARA (313) Toxic Release Chemicals:

CHEMICAL NAME	CAS NUMBER	CONC.
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2:1) (ZDDP)	68649-42-3	1.81%

(Section continued next page)

The following product ingredients are cited on the lists below:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
COPPER (ELEMENTAL ANALYSIS) (0.02%)	7440-50-8	22
ZINC (ELEMENTAL ANALYSIS) (0.13%)	7440-66-6	22
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2: 1) (ZDDP) (1.81%)	68649-42-3	18, 20, 21, 22, 24, 25

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

Code key: CARC = Carcinogen; SUS = Suspected Carcinogen

16. OTHER INFORMATION

USE: AUTOMOTIVE ENGINE OIL

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

See container label for ingredient information.

****

For Mobil Use Only: MHC: 1* 1* 0* 1* 1*, MPPEC: A, REQ: US - MARKETING, SAFE USE: L

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(Section continued next page)

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Mobil

Already on Sys. w/ 11-22-82 # 0032 NT

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490110 PAGE 1

MOBIL MATERIAL SAFETY DATA BULLETIN

MOBIL OIL CORPORATION
ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPT.

150 EAST 42ND STREET
NEW YORK, N.Y. 10017 (USA)

********** PRODUCT IDENTIFICATION **********

MOBIL AERO HFA

SUPPLIER:
MOBIL OIL CORP.

CHEMICAL NAMES AND SYNONYMS:
PET. HYDROCARBONS AND ADDITIVES

USE OR DESCRIPTION:
AVIATION HYDRAULIC FLUID

HEALTH EMERGENCY TELEPHONE:
(212)883-4411

TRANSPORT EMERGENCY TELEPHONE:
(800)424-9300(CHEMTREC)

OTHER DESIGNATION:
(TRN 490110)

********** TYPICAL CHEMICAL AND PHYSICAL PROPERTIES **********

APPEARANCE:
RED LIQUID

ODOR:
MILD

RELATIVE DENSITY: 15/4 C
0.876

MELTING POINT: F(C)
NA

BOILING POINT: F(C)
>450(232)

VAPOR PRESSURE:MM HG 20C
< 1.0

VISCOSITY: AT 100 F, SUS 78.8 AT 40 C, CS 14.4

VISCOSITY: AT 210 F, SUS 45.0 AT 100 C, CS 5.6

SOLUBILITY IN WATER: NEGLIGIBLE

PH: NA

POUR POINT: F(C)
-75(-59)

FLASH POINT: F(C) (METHOD)
205(96) (ASTM D-92)

NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

********** INGREDIENTS **********

	WT PCT (APPROX)	TLV(TWA):	MG/M3	PPM
HAZARDOUS INGREDIENTS:				
CONVENT. REFINED MINERAL OILS	85			
NON-HAZARDOUS INGREDIENTS:				
ADDITIVES AND/OR OTHER INGREDS.	< 15			

NOTE: TLVS SHOWN FOR GUIDANCE ONLY. FOLLOW APPLICABLE REGULATIONS.

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

********** FIRE AND EXPLOSION HAZARD DATA **********

FLASH POINT: F(C) (METHOD) FLAMMABLE LIMITS: LEL UEL
205(96) (ASTM D-92) .6 7.0
EXTINGUISHING MEDIA:
CARBON DIOXIDE, FOAM, DRY CHEMICAL AND WATER FOG.
SPECIAL FIRE FIGHTING PROCEDURES:
FIREFIGHTERS MUST USE SELF-CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
NONE

********** HEALTH HAZARD DATA **********
THRESHOLD LIMIT VALUE: (IF ESTABLISHED)

EFFECTS OF OVEREXPOSURE:
****NOTE: THIS PRODUCT CONTAINS CONVENTIONALLY REFINED MINERAL OILS WHICH MAY CONTAIN TRACE QUANTITIES OF POLYCYCLIC AROMATIC HYDROCARBONS (PCAH). UNDER CONDITIONS OF POOR PERSONAL HYGIENE AND PROLONGED, REPEATED CONTACTS, SOME PCAH HAVE BEEN SUSPECTED AS A CAUSE OF SKIN CANCER IN HUMANS. SLIGHT EYE IRRITATION. MODERATE SKIN IRRITATION.

********** EMERGENCY AND FIRST AID PROCEDURES **********
EYE CONTACT:
FLUSH WITH WATER.

SKIN CONTACT:
WASH CONTACT AREAS WITH SOAP AND WATER. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

INHALATION:
NOT EXPECTED TO BE A PROBLEM.

INGESTION:
DO NOT INDUCE VOMITING. ADMINISTER VEGETABLE OIL. GET MEDICAL ASSISTANCE. (NOTE TO PHYSICIAN: MATERIAL IF ASPIRATED INTO THE LUNGS MAY CAUSE CHEMICAL PNEUMONITIS. TREAT APPROPRIATELY)

********** REACTIVITY DATA **********
STABILITY: (THERMAL, LIGHT, ETC.) CONDITIONS TO AVOID:
STABLE HEAT,SPARKS,FLAME AND BUILD UP OF STATIC ELECTRICITY.
INCOMPATIBILITY: (MATERIALS TO AVOID)
STRONG OXIDIZERS
HAZARDOUS DECOMPOSITION PRODUCTS:
CARBON MONOXIDE.
HAZARDOUS POLYMERIZATION: CONDITIONS TO AVOID:
WILL NOT OCCUR

********** SPILL OR LEAK PROCEDURE **********

ENVIRONMENTAL IMPACT:

REPORT SPILLS AS REQUIRED TO APPROPRIATE AUTHORITIES. U. S. COAST GUARD REGULATIONS REQUIRE IMMEDIATE REPORTING OF SPILLS THAT COULD REACH ANY WATERWAY INCLUDING INTERMITTENT DRY CREEKS. REPORT SPILL TO COAST GUARD TOLL FREE NUMBER 800-424-8802.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED:

ADSORB ON FIRE RETARDANT TREATED SAWDUST, DIATOMACEOUS EARTH, ETC. SHOVEL UP AND DISPOSE OF AT AN APPROPRIATE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH CURRENT APPLICABLE LAWS AND REGULATIONS, AND PRODUCT CHARACTERISTICS AT TIME OF DISPOSAL.

WASTE MANAGEMENT:

DISSOLVE WASTE IN A SOLVENT AND DISPOSE BY SUPERVISED INCINERATION IN COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.

********** SPECIAL PROTECTION INFORMATION **********

EYE PROTECTION:

NORMAL INDUSTRIAL EYE PROTECTION PRACTICES SHOULD BE EMPLOYED.

SKIN PROTECTION:

IF PROLONGED OR REPEATED SKIN CONTACT IS LIKELY, OIL IMPERVIOUS GLOVES SHOULD BE WORN. GOOD PERSONAL HYGIENE PRACTICES SHOULD ALWAYS BE FOLLOWED.

RESPIRATORY PROTECTION:

NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE AND WITH ADEQUATE VENTILATION.

VENTILATION:

NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE AND WITH ADEQUATE VENTILATION. USE IN WELL VENTILATED AREA AWAY FROM ALL IGNITION SOURCES.

OTHER:

********** SPECIAL PRECAUTIONS **********

HANDLING: AVOID CONTACT WITH SKIN.

STORAGE: SEE APPENDIX FOR PRECAUTIONARY LABEL. L230

********** TOXICOLOGICAL DATA **********

ACUTE

ORAL TOXICITY: (RATS)
LD50: > 5 G/KG SLIGHTLY TOXIC(ESTIMATED) ---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

DERMAL TOXICITY: (RABBITS)
LD50: > 2 G/KG SLIGHTLY TOXIC(ESTIMATED) ---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

INHALATION TOXICITY: (RATS)
NOT APPLICABLE ---HARMFUL CONCENTRATIONS OF MISTS AND/OR VAPORS ARE UNLIKELY TO BE ENCOUNTERED THROUGH ANY CUSTOMARY OR REASONABLY FORESEEABLE HANDLING, USE, OR MISUSE OF THIS PRODUCT.
EYE IRRITATION: (RABBITS)
MAY CAUSE SLIGHT IRRITATION. EYE IRRITATION SCORES: 3.7 AT 24 HOURS, 3.0 AT 48 HOURS, 0.2 AT 72 HOURS---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.
SKIN IRRITATION: (RABBITS)
MAY CAUSE MODERATE IRRITATION ON PROLONGED OR REPEATED CONTACT. PRIMARY IRRITATION SCORE: 4.5/8---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

SUBACUTE AND MUTAGENICITY (SUMMARY)

CHRONIC OR SPECIALIZED (SUMMARY)

OTHER DATA

APPENDIX
PRECAUTIONARY LABEL TEXT FOR PACKAGED PRODUCTS

CONTAINS CONVENTIONALLY REFINED MINERAL OIL

CAUTION.

MAY CAUSE IRRITATION OR MORE SERIOUS SKIN
DISORDERS ON PROLONGED, REPEATED SKIN CONTACT.

AVOID CONTACT WITH SKIN.
CLOTHING WET WITH THIS PRODUCT SHOULD BE REMOVED.

FIRST AID: IN CASE OF SKIN CONTACT, THOROUGHLY WASH AREA
WITH SOAP AND WATER.
REMOVE CONTAMINATED CLOTHING AND SHOES.

WASH CONTAMINATED CLOTHING BEFORE REUSE.
DISCARD SHOES IF MATERIAL HAS PENETRATED TO INSIDE SURFACE.

FOR INDUSTRIAL USE ONLY.

KEEP OUT OF REACH OF CHILDREN.

NOT INTENDED OR SUITABLE FOR USE IN OR
AROUND A HOUSEHOLD OR DWELLING.

REFER TO PRODUCT MATERIAL SAFETY DATA BULLLETIN
FOR FURTHER SAFETY AND HEALTH INFORMATION.

MOBIL OIL CORPORATION, NEW YORK, N.Y. L-230 (1/80)

Product Safety Information

-0527A

FYRQUEL® EHC

Fire Resistant Hydraulic Fluid

(Mixed Triaryl Phosphate Esters)

This Product Safety Information Sheet is principally directed to managerial, safety, hygiene and medical personnel. The description of physical, chemical and toxicological properties and handling advice is based on experimental results and past experience. It is intended as a starting point for the development of health and safety procedures.

This Product Safety Information Sheet meets the material safety data sheet (MSDS) requirements of the federal OSHA Hazard Communication standard (29 CFR 1910.1200).

New Issue 1/86
MIX.390.S

I. PHYSICAL/CHEMICAL PROPERTIES

COMPOSITION:

Mixed triaryl phosphate esters. This product contains triphenyl phosphate; CAS Registry Number: 115-86-6; and a proprietary component.

PHYSICAL STATE/DESCRIPTION:

Clear transparent liquid

DECOMPOSITION TEMPERATURE:

Greater than 665°F (352°C)

VAPOR PRESSURE:

Less than 0.1 mmHg at 100°F (37.8°C)

POUR POINT: 0°F (-18°C)

FLASH POINT:

Greater than 455°F (235°C)

MISCIBILITY:

Less than 0.1g/100 mL in water

VISCOSITY:

208-230 SUS at 100°F (37.8°C)

IN CASE OF SUSPECTED POISONING, REFER TO THE INFORMATION IN SECTION VII:HUMAN HEALTH AND THE PROCEDURE AND EMERGENCY CONTACTS IN SECTION VIII:FIRST AID.

IN CASE OF SPILLAGE, REFER TO THE PROCEDURE AND EMERGENCY CONTACTS IN SECTION X:SPILL HANDLING OR CALL CHEMTREC 800-424-9300.

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*Registered trademark of Stauffer Chemical Company

Stauffer believes all information given herein is accurate [illegible]

II. CHEMICAL REACTIVITY

Hydrolyzes slowly at ambient temperature when exposed to wet alkaline or acidic conditions. Also hydrolyzes at temperatures of 150°F (66°C) or greater when exposed to atmospheric moisture. Upon hydrolysis, phenol, substituted phenols and aryl phosphoric acids are formed.

III. STABILITY

Stable at temperatures below 150°F (66°C) and atmospheric pressure. In the absence of moisture, it is stable to much higher temperatures.

IV. FIRE HAZARD

Not defined as flammable or combustible. Under fire conditions, may support combustion and decompose to give off toxic materials such as phosphoric oxides. However, the product is self-extinguishing once the source of ignition is removed.

FIREFIGHTING TECHNIQUE

Exposure to triphenyl phosphate or to the proprietary component, which are present in this product, may cause cholinesterase inhibition (refer to SECTION VIII: FIRST AID).

Products of combustion are irritating to the respiratory tract and may cause breathing difficulty and pulmonary edema. Symptoms may be delayed several hours or longer depending upon the extent of exposure.

As in any fire, prevent human exposure to fire, smoke, fumes or products of combustion. Evacuate nonessential personnel from the fire area. Firefighters should wear full-face, self-contained breathing apparatus and impervious protective clothing.

Use standard firefighting techniques to extinguish fires involving this material -- use water spray, dry chemicals or carbon dioxide.

Keep fire-exposed containers cool with a water spray to prevent rupture due to excessive heat. High pressure water hose may spread product from broken containers increasing contamination or fire hazard.

Contaminated buildings, areas and equipment must not be used until they are properly decontaminated.

VI. TOXICOLOGY

Toxicology information on this product is not available. Toxicology data for the major product components are provided below.

INGESTION

The acute oral LD50 for each major product component is greater than 5,000 mg/kg in both male and female rats. A single dose of 5,000 mg/kg produced a mild to moderate decrease in physical activity, diarrhea, and no mortality in male and female rats.

SKIN CONTACT

The acute dermal LD50 for each major product component is greater than 2,000 mg/kg in rabbits.

Mild irritant to rabbit skin.

EYE CONTACT

Mild irritant to rabbit eyes.

T-6681, T-10962

VII. HUMAN HEALTH

Principal routes of exposure are skin contact and inhalation. Skin and eye contact with the product may result in mild irritation. The major components of this product are cholinesterase inhibitors. Therefore, exposure to sufficient quantities of the product may cause cholinesterase inhibition.

Symptoms of cholinesterase inhibition may include salivation, sweating, headache, nausea, muscle twitching, tremors, incoordination, blurred vision, tears, abdominal cramps, diarrhea, and chest discomfort.

The product also contains a proprietary component which has been shown to cause nerve damage in animals. Signs and symptoms of nerve damage may include weakness, numbness and tingling sensation of the hands and feet, muscle cramps, and loss of motor function.

There are no data available which address medical conditions that are generally recognized as being aggravated by exposure to this product. (Reader should consult SECTION VI: TOXICOLOGY for effects observed in experimental animals under controlled laboratory conditions using similar materials.)

VIII. FIRST AID

CALL A POISON CENTER OR A PHYSICIAN IMMEDIATELY

If a known exposure occurs or is suspected, immediately start the recommended procedures below. Simultaneously contact a Poison Center, a physician or the nearest hospital.

FOR ADDITIONAL MEDICAL OR TOXICOLOGICAL INFORMATION, CALL COLLECT, DAY OR NIGHT, STAUFFER CHEMICAL COMPANY, (203) 226-6602 OR CHEMTREC 800-424-9300

NOTE: Be sure to advise the person contacted that components of this product are cholinesterase inhibitors. Inform the person contacted of the type and extent of exposure, describe the victim's symptoms, and follow the advice given.

NOTE TO MEDICAL PERSONNEL

Exposure to this product may cause cholinesterase inhibition. If cholinesterase inhibition is suspected, atropine by injection is antidotal. 2-PAM (Protopam Chloride) is also antidotal when administered early and in conjunction with atropine.

INGESTION

If swallowed, immediately give several glasses of water and induce vomiting by gagging the victim with a finger placed on the back of the victim's tongue. Give fluids until vomitus is clear. If victim is unconscious or convulsing, do not induce vomiting or give anything by mouth.

SKIN CONTACT

Flush all affected areas with plenty of water for several minutes. Remove and clean any contaminated clothing and shoes. Seek medical attention if skin irritation occurs.

EYE CONTACT

Flush the eyes with plenty of running water for at least 15 minutes. Hold the eyelids apart during the flushing to ensure rinsing of the entire surface of the eye and lids with water. Seek medical attention if eye irritation occurs.

INHALATION

If inhaled, remove to fresh air. If breathing becomes difficult, oxygen may be given, preferably with a physician's advice. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

IX. INDUSTRIAL HYGIENE

The recommendations described in this section are provided as general guidance for minimizing exposure when handling this product. Because use conditions will vary depending upon customer applications, specific safe handling

procedures should be developed by a person knowledgeable of the intended use conditions and equipment. During the development of safe handling procedures, consideration should be given to the need for cleaning of equipment and piping systems to render them nonhazardous before maintenance and repair activities are performed.

ENGINEERING CONTROLS

In those cases where engineering controls are indicated by the use conditions, the following traditional exposure control techniques may be used to effectively minimize employee exposure: local exhaust ventilation or enclosed system design in combination with appropriate use of personal protective equipment.

INGESTION

All food should be kept in a separate area away from the storage/use location. Eating, drinking and smoking should be prohibited in areas where there is a potential for significant exposure to this material. Before eating, hands and face should be thoroughly washed.

SKIN CONTACT

Skin contact with liquid or its aerosol should be minimized through the use of suitable protective clothing, gloves and footwear selected with regard for use condition exposure potential. Unprotected skin exposed to vapors, aerosol or mist should be thoroughly washed at the end of the work shift.

EYE CONTACT

Eye contact with liquid or its aerosol should be avoided through the use of chemical safety glasses, goggles or a face shield selected with regard for use condition exposure potential.

INHALATION

If use conditions generate airborne aerosol, the material should be handled in an open (e.g., outdoor) or well-ventilated area. Where adequate ventilation is not available, use NIOSH-approved organic vapor respirators with dust, mist and fume filters to reduce exposure. Where exposure potential under the use conditions necessitates a higher level of protection, use a positive-pressure, air-supplied respirator.

EXPOSURE LIMITS

No exposure limits have been established for this product. However, the product contains triphenyl phosphate for which the following exposure limits apply:

The federal OSHA Permissible Exposure Limit (PEL) is 3 mg/m3 as an 8-hour time-weighted average (29 CFR 1910.1000).

The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended an 8-hour time-weighted average Threshold Limit Value (TLV) which is the same as the above PEL (ACGIH, 1985).

PEL'S and TLV'S refer to airborne concentrations measured in the breathing zone by appropriate sampling techniques.

X. SPILL HANDLING

Make sure all personnel involved in the spill cleanup follow good industrial hygiene practices (refer to SECTION IX: INDUSTRIAL HYGIENE).

Any person entering either a significant spill area or an unknown concentration of a vapor or aerosol should use a positive-pressure self-contained breathing apparatus or a positive-pressure air-supplied respirator with escape pack.

Small spills can be handled routinely. Use adequate ventilation and wear a NIOSH-approved organic vapor respirator with dust, mist and fume filter to prevent inhalation exposure. Wear protective clothing to prevent skin and eye contact. Use the following procedures:

Soak up pooled liquid with a suitable absorbent such as clay, sawdust or kitty litter. Sweep up absorbed material and place in a chemical waste container for disposal (refer to SECTION XIII: DISPOSAL OF MATERIAL). Generously cover contaminated area with a slurry of common household powdered laundry detergent and water. Using a stiff brush, work the slurry into cracks and crevices. Allow to stand for 2-3 minutes, then flush with water. Repeat if necessary.

Large spills should be diked and pumped to salvage according to a predetermined plan. For assistance in developing a plan, contact the Specialty Chemicals Group, Stauffer Chemical Company, Westport, CT 06881.

IN CASE OF SPILL EMERGENCY,
DAY OR NIGHT, CALL CHEMTREC
800-424-9300.

XI. CORROSIVITY TO MATERIALS OF CONSTRUCTION

Noncorrosive to glass or metals. However, because the product has plasticizing properties, it may soften or deteriorate certain plastics and elastomers (particularly vinyl-based resins, neoprene, and natural rubbers).

XII. STORAGE REQUIREMENTS

Containers should be stored in a cool, dry, well-ventilated area away from flammable materials and sources of heat or flame.

Store away from foodstuffs or animal feed. Exercise due caution to prevent damage to or leakage from the container.

Prolonged storage at elevated temperatures under wet alkaline conditions should be avoided. Care should be taken to prevent moisture condensation in the container.

Carbon steel is the preferred material of construction for storage containers. The material is commonly shipped in lined or treated (phosphetized) drums. At temperatures below 40°F (4.4°C), the viscosity is such that improved pumping rates may be achieved by warming. Temperatures from 80-100°F (27-37.8°C) provide good rates of flow.

XIII. DISPOSAL OF MATERIAL

Material that cannot be used or chemically reprocessed should be disposed of at an approved facility in accordance with any applicable regulations under the Resource Conservation and Recovery Act. NOTE: State and local regulations may be more stringent than Federal.

XIV. DISPOSAL OF CONTAINER

Dispose of empty containers according to any applicable regulations under the Resource Conservation and Recovery Act. NOTE: State and local regulations may be more stringent than Federal.

FOR NONEMERGENCY HANDLING INFORMATION, CONTACT THE SPECIALTY CHEMICALS GROUP, STAUFFER CHEMICAL COMPANY, WESTPORT, CT 06881 OR PHONE (203) 222-3000.

REFERENCES CITED

The American Conference of Governmental Industrial Hygienists (ACGIH). (1985). THRESHOLD LIMIT VALUES AND BIOLOGICAL EXPOSURE INDICES FOR 1985-86. ACGIH: Cincinnati, OH

HARCROS CHEMICALS INC
KANSAS CITY, KANSAS

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: SODIUM HYPOCHLORITE SOLN 55GL DATE: 07/11/89 PAGE 01
PRODUCT CODE: 26-11626-02

CAS # 007681-52-9

FORMULA: NaOCl

CHEMICAL FAMILY: Hypochlorite

CHEMICAL NAME AND SYNONYMS: Sodium Hypochlorite Solution; Javel Water Bleach; Soda Water Bleach; Hypo; Chlorine Bleach; Vertex Concentrate; Sunny Sol; Super Shock

SUPPLIERS NAME: Harcros Chemicals Inc
5200 Speaker Rd
Kansas City Ks 66106
SUPPLIERS PHONE NUMBER: 913-321-3131
TRANSPROTATION EMERGENCY PHONE NUMBER: 1-800-424-9300

S.A.R.A. INFORMATION

HAZARDS: Fire: Pressure: Reactivity: Acute: Yes Chronic:
PHYSICAL DATA: Mixture:Yes Pure: Solid: Liquid:Yes Gas:

SECTION I Hazardous Ingredients

Ingredient	Percent	TLV
Sodium Hypochlorite (CAS # 7681-52-9)	10.5%	N/E *
Sodium Hydroxide (CAS # 1310-73-2)<>	0.8 to 2.4	PEL/TWA 8Hr 2 mg/m(3) OSHA TLV/TWA 8Hr 2 mg/m(3) Ceiling - ACGIH 86/87
* Chlorine (Available)	Approx 10.0%	PEL/TWA 8Hr 1 ppm Ceiling - OSHA TLV/TWA 8Hr 1 ppm STEL 3ppm ACGIH 86/87

<>-This chemical is subject to S.A.R.A. Title III section 313 part 372 reporting.

SECTION II Health Hazards

Threshold Limit Value: As indicated in Section I.

Potential Effects of Exposure:

Acute - Irritating effects increase with strength of solution and time of exposure.

Chronic - Constant irritant to eyes, throat.

Eyes: Causes severe eye irritation.

Skin: Irritation, reddening, damage with long or repeated exposure.

Inhalation: Fumes from exposed solution very irritating to mucous membranes, may cause sneezing. Grossly excessive exposure can cause bronchitis, and pneumonia, and corrosion of the respiratory tract in severe cases.

CONTINUED ON PAGE 02

MATERIAL SAFETY DATA SHEET

SECTION II Health Hazards CONTINUED

Ingestion: Causes irritation of membranes of the mouth and throat, stomach pain and possible ulceration. In severe cases can produce circulatory collapse, lethargy, delidium, convulsions, and coma. Ingestion of small quantities (a few tablespoons) can be fatal to children. Oral LD(50) (rat): 13 g/kg with 5.25% NaOCl and 5 g/kg with 12. NaOCl (Sodium Hypochlorite).

First aid:

Eyes: Flush with water for 15 minutes while holding eyelids open. Get medical attention as soon as possible.

Skin: Flush with water while removing contaminated clothing and shoes. Follow by washing with soap and water. DO NOT reuse clothing or shoes until cleaned. If irritation persists, get medical attention.

Inhalation: Remove person to fresh air. If distress persists call a physician immediately.

Ingestion: If accidentally swallowed, drink water or milk and obtain medical attention promptly. DO NOT induce vomiting, or administer baking soda or acidic antidotes. If vomiting occurs spontaneously, keep head lower than hips to prevent aspiration into lungs.

Other Information: Not listed as carcinogen or potential carcinogen by NTP, IARC or OSHA.

ADVICE TO PHYSICIAN: Antidote - give Sodium Thiosulfate orally.

SECTION III Special Protection Information

Respiratory Protection: When fumes present use NIOSH-approved respirator with a chlorine canister or supplied air respirator, consult your equipment supplier.

Ventilation Required: No special ventilation is needed unless the product is exposed to decomposition conditions; i.e. in a spill or in an acid condition.

Protective Clothing:

Eyes: Splash-proof goggles should be used when dispensing sodium hypochlorite in this concentration.

Skin: Rubber gloves for handling, rubber apron and boots if splashing may occur, and in emergency spill situations.

Additional Protective Measures: Safety shower, eye bath and washing facilities should be available.

CONTINUED ON PAGE 03

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: SODIUM HYPOCHLORITE SOLN 55GL DATE: 07/11/89 PAGE 03
PRODUCT CODE: 26-11626-02

SECTION IV Fire & Explosion Hazard Data

Flash Point (Method): Non-flammable

Flammable Limits (% Volume in Air):

Upper: N/A

Lower: N/A

Extinguishing Media: Use water to cool containers, knock down fumes if released.

Special Fire Fighting Procedures: Avoid fumes from spilled or exposed liquid, dilute copiously, ventilate, and be prepared to use respiratory protection if needed. Acid contamination will produce very irritating fumes similar to chlorine gas.

Unusual Fire and Explosion Hazards: Product decomposes when heated; decomposition products may cause containers to rupture or explode. Vigorous reaction possible with organic materials or oxidizing agents; may result in a fire.

SECTION V Physical Data

Boiling Point: Decomposes

Specific Gravity (H(2)O=1): Approx. 1.14

Vapor Pressure (MM HG.): V.P. of water & V.P. of decomposition products

Vapor Density (AIR=1): N/A

Evaporation Rate (_____=1): N/A

Solubility in Water: Complete

Percent Volatile by Volume: Variable - water vapor and products of decomposition.

pH: Approx. 12 - 13

Appearance and Odor: Light yellowish green liquid with-chlorine odor.

SECTION VI Reactivity Data

Stability: Solutions of sodium hypochlorite are fairly stable in concentrations below 1%. Stability decreases with concentration, heat, light exposure, decrease in pH, and contamination with heavy metals, such as nickel, cobalt, copper and iron.

Incompatibility: Avoid contamination with heavy metals (act as catalysts), reducing agents, organics, ether, amines, ammonium acetate, cellulose, ammonia, acids, or acid pH.

CONTINUED ON PAGE 04

MATERIAL SAFETY DATA SHEET

SECTION VI Reactivity Data CONTINUED

Hazardous Decomposition Products; Hypochlorous acid (HOCL), chlorine, hydrochloric acid. Composition depends upon temperature and decrease in pH. Additional decomposition products, which depend upon pH, temperature and time, are sodium chloride, sodium chlorate and oxygen.

Hazardous Polymerization: Will not occur

SECTION VII Spill and Leak Procedures

Steps to be taken if material is released or spilled:

Dike to contain spill, DO NOT allow to enter sewers or streams. Flush with water to dilute as much as possible, avoid heat and contamination with acid materials. If using absorbent to soak up a small spill avoid sawdust and other combustibles.

Waste Disposal Method:

Reduce by adding reducing agents such as bisulfites or ferrous salt solutions. Some heat will be produced. May neutralize with reducing agents. Keep on alkaline side and dilute with copious quantities of water. Principal end product is salt water (NaCl). Dispose in conformance with applicable local, state, and federal regulations.

EPA - Resource Conservation and Recovery Act (RCRA) Regulations As produced, this material is a product and not a waste. If discarded or intended to be discarded as is, it is a corrosive hazardous waste as defined in RCRA (40 CFR 261.22). The EPA hazardous waste number is D002.

SECTION VIII D.O.T. Shipping Information

Proper Shipping Name:	HYPOCHLORITE SOLUTION MORE THAN 7% AVAILABLE CHLORINE BY WEIGHT
Hazard Class:	CORROSIVE MATERIAL
ID Number:	UN1791
Label Requirements:	CORROSIVE
Reportable Quantity:	ALL SHIPMENTS ARE REPORTABLE
Other Information:	

SECTION IX Additional Information

This information may be of importance to you:

Sodium Hypochlorite is manufactured only in solution form. "Household bleach" contains not more than 7% Sodium Hypochlorite (+6.67 wt. % available chlorine) with about.

CONTINUED ON PAGE 05

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: SODIUM HYPOCHLORITE SOLN 55GL DATE: 07/11/89 PAGE 05
PRODUCT CODE: 26-11626-02

SECTION IX Additional Information CONTINUED

.6-1.75% excess Sodium Hydroxide for stability control. Industrial bleach contains from 7% to 15% Sodium Hypochlorite (6.67-13.06 weight % available chlorine) with 1-3% excess Sodium Hydroxide for stability control. Household Bleach is much less hazardous, the less stringent safety measures given on the household bleach container should be observed.

Sodium Hypochlorite does not exist as such in the vapor phase, unless as a component of a mist or fumes. This product is listed in the Toxic Substances Control Act (TSCA) inventory of chemical substances.

Store in vented, closed clean, non-corrodable containers in a cool, dry location, away from direct sunlight and not adjacent to chemicals which may react with the product if spillage occurs. If closed containers become heated, they should be vented to release decomposition products (mainly oxygen under normal decomposition). DO NOT mix or contaminate with ammonia, hydrocarbon acids, alcohols, ethers.

Long storage periods should be avoided as product degrades with age.

Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Containers of this material may be hazardous when emptied. "Empty" containers retain product residues. Observe all hazard precautions outlined in this sheet.

NPCA HMIS 102C

********** E N D O F R E P O R T **********

NAME: GENE TURNER DATE ISSUED: 11/04/1987
DATE REVISED: 07/30/1987

< = LESS THAN N/A = NOT APPLICABLE UNK = UNKNOWN
> = MORE THAN N/D = NOT DETERMINED
N/E = NOT ESTABLISHED

The information provided in this Material Safety Data Sheet has been obtained from sources believed to be reliable. Harcros Chemicals Inc provides no warranties, either expressed or implied and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your information, consideration and investigation. You should satisfy yourself that you have all current data relevant to your particular use. Harcros Chemicals Inc knows of no medical condition, other than those noted on this material safety data sheet, which aregenerally recognized as being aggravated by exposure to this product.

MATERIAL SAFETY DATA SHEET

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Ferrous Sulfate, 7-Hydrate	$FeSO_4 \cdot 7H_2O$
SYNONYM OR CROSS REFERENCE	CAS NO: 7720-78-7
Copperas	

SECTION II. HAZARDOUS INGREDIENTS

MATERIAL		NATURE OF HAZARD

SECTION III. PHYSICAL DATA

BOILING POINT	MELTING POINT
	Loses $3H_2O$ at 58°C.
VAPOR PRESSURE	SPECIFIC GRAVITY
	1.89
VAPOR DENSITY (AIR=1)	PERCENT VOLATILE BY VOLUME (%)
WATER SOLUBILITY	EVAPORATION RATE
Soluble	(_____ = 1)

APPEARANCE
Blue-green, odorless crystals or granules

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper

FIRE EXTINGUISHING MEDIA

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE
Unknown

HEALTH HAZARDS
Harmful if swallowed. LD_{50}(rat) = 0.5-5g/kg

FIRST AID PROCEDURES If swallowed, give milk at once and then induce vomiting. Gastric lavage with water. Get medical attention.

CHEMICAL NAME

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (materials to avoid)

Alkalies, soluble carbonates, gold and silver salts, lead acetate, lime water

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL AND DISPOSAL PROCEDURES

SPILLS

Sweep up and remove.

DISPOSAL

Dispose in landfill providing local environmental regulations permit. Prevent pollution of water intake areas.

SECTION VIII - PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

Dust mask may be appropriate if dust is present

VENTILATION	LOCAL	SPECIAL
	MECHANICAL (general)	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
	Safety glasses

OTHER PROTECTIVE EQUIPMENT

SECTION IX - HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING

Store in container at room temperature that
Store in tightly-closed container at room temperature.

SECTION X - MISCELLANEOUS INFORMATION

See Merck Index, 9th ed., 1976, item 3982 for additional information.

Date Issued:_____ Revision:_____ Approved by R. M. Mitchell

Manager, Quality Assurance

The information provided in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the users responsibility to determine the suitability of this information for the adoption of safety precautions as may be necessary. We reserve the right to revise Material Safety Data Sheets from time to time as new technical information becomes available. The user has the responsibility to contact the company to make sure that the sheet is the latest one issued.

DU PONT

-0100A

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

NAME
Sulfuric Acid, 77 to 100%

GRADE
60° Tech., 66° Tech.,
1.835 Electrolyte, 98% Tech.,
99% Tech., 100% Tech.

CAS REGISTRY NO.
7664-93-9

CAS NAME
Sulfuric Acid

I.D. NOS./CODES
NIOSH Registry No.: WS5600000

MANUFACTURER/DISTRIBUTOR
E. I. du Pont de Nemours & Co. (Inc.)

ADDRESS
Wilmington, DE 19898

CHEMICAL FAMILY
Mineral Acid

FORMULA
H_2SO_4

TSCA INVENTORY STATUS
Reported/Included

SARA/TITLE III STATUS
See ADDITIONAL INFORMATION and HAZARDOUS COMPONENTS sections

PRODUCT INFORMATION PHONE
(800) 441-9442

MEDICAL EMERGENCY PHONE
(800) 441-3637

TRANSPORTATION EMERGENCY PHONE
CHEMTREC (800) 424-9300

PHYSICAL DATA

BOILING POINT, 760 mmHg
193°C to 327°C (380°F to 621°F)
See page 2 for specific grades

MELTING POINT
-35°C to 11°C (-31°F to 51°F)
See page 2

SPECIFIC GRAVITY
1.70 to 1.85
See page 2

VAPOR PRESSURE
<0.3 mmHg at 25°C (77°F)
<0.6 mmHg at 38°C (100°F)

VAPOR DENSITY
3.4

SOLUBILITY IN WATER
100%

pH INFORMATION
<1

EVAPORATION RATE (Butyl Acetate = 1)
<1

FORM
Liquid

APPEARANCE
Oily; clear to turbid

COLOR
Colorless to light gray

ODOR
Odorless

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process

PHYSICAL PROPERTIES (FROM PAGE 1)

Grade	Boiling Point °C	Boiling Point °F	Melting Point °C	Melting Point °F	Specific Gravity
60° Technical	193	380	-12	10	1.706
66° Technical	279	535	-35	-31	1.835
1.835 Electrolyte	279	535	-35	-31	1.835
98% Technical	327	621	-2	29	1.844
99% Technical	310	590	4	40	1.842
100% Technical	274	526	11	51	1.839

HAZARDOUS COMPONENTS

MATERIAL(S)	CAS NO.			APPROXIMATE %
Sulfuric Acid*	7664-93-9	60°	Technical	77.7
		66°	Technical	93.2
		1.835	Electrolyte	93.2
		98%	Technical	98.0
		99%	Technical	99.0
		100%	Technical	100

*Regulated as a Toxic Chemical under Section 313 of Title III/SARA, and 40 CFR Part 372.

NONHAZARDOUS COMPONENT

Water	7732-18-5	0-22

HAZARDOUS REACTIVITY

INSTABILITY
Stable, but reacts violently with water and organic materials with evolution of heat.

INCOMPATIBILITY
Vigorous reactions occur with water; alkaline solutions; metals; metal powders; carbides; chlorates; fulminates; nitrates; picrates; strong oxidizing, reducing, or combustible organic materials. Hazardous gases are evolved on contact with chemicals such as cyanides, sulfides, and carbides.

DECOMPOSITION
Releases sulfur dioxide at extremely high temperatures.

POLYMERIZATION
Will not occur.

FIRE AND EXPLOSION DATA

FLASH POINT
Will not burn.

FLAMMABLE LIMITS IN AIR, % BY VOL.
LOWER Not applicable.
UPPER Not applicable.

AUTOIGNITION TEMPERATURE
Not applicable.

AUTODECOMPOSITION TEMPERATURE
Not available.

FIRE AND EXPLOSION HAZARDS
Reacts with most metals, especially when dilute, to give flammable, potentially explosive hydrogen gas.

EXTINGUISHING MEDIA
Use media as appropriate for combustibles in area. Use water spray to cool containers exposed to fire; do not get water inside containers.

SPECIAL FIREFIGHTING INSTRUCTIONS
Evacuate personnel to a safe area. Keep personnel removed and upwind of fire. Generates heat upon addition of water, with possible spattering. Wear full protective clothing. Runoff from fire control may cause pollution. Neutralize runoff with lime, soda ash, etc., to prevent corrosion of metals and formation of hydrogen gas. Wear self-contained breathing apparatus (SCBA) if fumes or mists are present.

HEALTH HAZARD INFORMATION

PRINCIPAL HEALTH HAZARDS (Including Significant Routes, Effects, Symptoms of Overexposure, and Medical Conditions Aggravated by Exposure)

Causes severe burns to eyes, skin and all body tissues. Inhalation of mist may cause lung damage.

Inhalation 1-hour LC_{50}: 347 ppm in rats
Oral LD_{50}: 2140 mg/kg in rats

The concentrated compound is corrosive to the skin and the eye of animals. By ingestion it is moderately toxic in animals causing corrosion of mucosal surfaces. Toxic effects described in animals from single exposures by inhalation include respiratory irritation. Animal testing indicates that this compound does not have the potential to produce carcinogenic, mutagenic, embryotoxic, or reproductive effects.

Human health effects of overexposure to the liquid by skin or eye contact may cause eye corrosion with corneal or conjunctival ulceration; or skin burns or ulceration. Ingestion of the liquid may cause severe burns to the mucous membranes of the mouth and esophagus. Repeated or prolonged contact with mists may cause eye irritation with discomfort, tearing, or blurring of vision; or skin irritation with discomfort or rash. Human health effects of overexposure by inhalation may include irritation of the upper respiratory passages or erosion of dental surfaces. Higher exposures by inhalation may lead to temporary lung irritation effects with cough, discomfort, difficulty breathing, or shortness of breath; or possibly modest initial symptoms, followed in hours by severe shortness of breath, requiring prompt medical attention.

HEALTH HAZARD INFORMATION (cont'd)

Although two epidemiology studies did suggest a possible association between sulfuric acid exposure and respiratory tract tumors, conclusions from these studies are very limited because of significant deficiencies. In one study for example, only a small number of workers was sampled, and there was exposure to other materials including diethyl sulfate, an IARC and NTP carcinogen. In the other study there was exposure to other acids, plus the smoking histories of the workers were ignored in the development of the study conclusion. Based on the overall weight of evidence from all human and chronic animal studies, we conclude that no causal relationship between sulfuric acid exposure and respiratory tract tumors has been shown.

Individuals with preexisting diseases of the lungs may have increased susceptibility to the toxicity of excessive exposures.

CARCINOGENICITY

Not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.

EXPOSURE LIMITS [PEL (OSHA), TLV (ACGIH), AEL (DU PONT), ETC.]

OSHA 8-hour Time Weighted Average (TWA) and ACGIH TLV(R)-TWA are 1 mg/m^3 (ACGIH STEL = 3 mg/m^3). The Du Pont AEL 8 and 12-hour TWA is 1 mg/m^3.

SAFETY PRECAUTIONS

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor or mists.
Keep containers closed.
Do not add water to contents while in container because of violent reaction.
Wash thoroughly after handling.

FIRST AID

In case of contact: immediately (within seconds) flush the skin or eyes with plenty of water (preferably cold water) for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

While the patient is being transported to a medical facility, apply compresses of iced water. If medical treatment must be delayed, immerse the affected area in iced water. If immersion is not practical, compresses of iced water can be applied. Avoid freezing tissues.

Note to Physician: Continued washing of the affected area with cold or iced water will be helpful in removing the last traces of sulfuric acid. Creams or ointments should not be applied before or during the washing phase of the treatment.

If inhaled: Remove to fresh air immediately and have patient lie down and remain quiet. Apply artificial respiration if breathing has stopped. Give oxygen if breathing is difficult. Call a physician.

If swallowed: Do not induce vomiting. Give large quantities of water. Call a physician. Do not give carbonates. Never give anything by mouth to an unconscious person.

PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES

Good general ventilation should be provided to keep vapor and mist concentrations below the exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Have available and wear as appropriate for exposure conditions when handling containers or operating equipment containing sulfuric acid: chemical splash goggles; full-length face shield/chemical splash goggle combination; acid-proof gauntlet gloves, apron, and boots; long sleeve wool, acrylic, or polyester clothing; acid-proof suit and hood; and OSHA permissible respiratory protection. In case of emergency or where there is a strong possibility of considerable exposure, wear a complete acid suit with hood, boots, and gloves. If acid vapor or mist are present and exposure limits may be exceeded, wear OSHA permissible respiratory protection.

DISPOSAL INFORMATION

AQUATIC TOXICITY

The 48-hour TLm in flounder is 100-300 ppm.

SPILL, LEAK OR RELEASE

Stop flow if possible. Review "Fire and Explosion Hazards" and "Safety Precautions" before proceeding with clean up. Use appropriate protective equipment during clean up. Soak up small spills with dry sand, clay, or diatomaceous earth. Dike large spills and cautiously dilute, neutralize with lime or soda ash, and transfer to waste water treatment system. Prevent liquid from entering sewers, waterways, or low areas. Comply with Federal, State, and local regulations on reporting releases. Superfund reportable discharge is 1000 lbs.

WASTE DISPOSAL

Cleaned-up material is a RCRA Hazardous Waste. Do not flush to surface water or sanitary sewer system. Comply with Federal, State, and local regulations. If approved, neutralize and transfer to waste treatment system.

SHIPPING INFORMATION

DOT (172.101)

PROPER SHIPPING NAME
Sulfuric Acid

HAZARD CLASS
Corrosive Material

UN NO.
1830

DOT LABEL(S)
Corrosive

DOT PLACARD (TT/TC)
Corrosive

DOT/IMO (172.102)

PROPER SHIPPING NAME
Sulphuric Acid

HAZARD CLASS
Corrosive Material, 8

UN NO.
1830

PACKAGING GROUP II

SHIPPING INFORMATION (cont'd)

REPORTABLE QUANTITY
1000 lb/454 kg

SHIPPING CONTAINERS
Tank cars, tank trucks, 55 gallon stainless steel drums.

ADDITIONAL INFORMATION AND REFERENCES

STORAGE CONDITIONS
Keep out of sun and away from heat, sparks, and flame. Keep container tightly closed and (drum) closure up to prevent leakage. Loosen closure carefully. Relieve internal pressure when received and at least weekly thereafter. Do not use pressure to empty. Be sure closure is securely fastened before moving container. Do not wash out container or use it for other purposes; replace closure after each withdrawal and return it with empty container.

NPCA - HMIS RATINGS		NFPA RATINGS	
Health (Acute)	3	Health	3
Flammability	0	Flammability	0
Reactivity	2	Reactivity	2
Personal Protection	-	Unusual Hazards	W

Personal Protection rating to be supplied by user depending on use conditions.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

Product Hazard Categories:		Lists:	
Chronic Health	- Yes	Extremely Hazardous Substance	- Yes
Acute Health	- Yes	CERCLA Hazardous Substance	- Yes
Fire Hazard	- No	Toxic Chemical	- Yes
Pressure Hazard	- No		
Reactivity Hazard	- Yes		

For further information, see Du Pont Sulfuric Acid "Storage and Handling Bulletin."

DATE OF LATEST REVISION/REVIEW: 10/88

PERSON RESPONSIBLE FOR MSDS:
J. C. WATTS
Du Pont Co.
Chemicals & Pigments Department
Chestnut Run Plaza
P.O. Box 80709
Wilmington, DE 19880-0709
(302) 999-4946

118547C

DUPONT

480 Democrat Road, Gibbstown, New Jersey 08027, Phone (609) 423-6003

MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

Chemical Name: Sodium Hydroxide, solid	Catalog Number: SX0590, SX0593, SX0600, SX0603, SX0605
Trade Name & Synonyms: Caustic Soda, Lye, Sodium Hydrate	Chemical Family: Inorganic Base
Formula: NaOH	Formula Weight: 40.00

Boiling Point, 760 mm Hg (°C)	1390°	Specific Gravity (H_2O = 1)	2.13
Melting Point (°C)	318.4°	Solubility in H_2O, % by wt. at 20°C	42
Vapor Pressure at 20°C	NA	Appearance and Odor white, odorless,	
Vapor Density (air = 1)	NA	deliquescent pellets, flakes or granules	
Percent Volatiles by Volume	none	Evaporation Rate (Butyl Acetate = 1)	NA

Flash Point (test method) NA	Flammable Limits	Lel -	Uel -

Extinguishing Media -

Special Hazards and Procedures -

Unusual Fire and Explosion Hazards -

Stable x	Conditions to Avoid Contact with water generates much heat. Use caution.
Unstable	

Materials to Avoid

( ) Water (x) Acids ( ) Bases ( ) Corrosives ( ) Oxidizers

( ) Other (specify) Chlorinated hydrocarbons, Aluminum

Hazardous Decomposition Products none

Steps to be Taken in Case Material is Released or Spilled Sweep up excess and flush area with water.

Waste Disposal Method To be performed in compliance with all current local, state and federal regulations.

We believe the data contained herein is factual, however, it is offered solely for your consideration, investigation, and verification. Do not take as a warranty.

Threshold Limit Value

2 mg/cu.m.

Effects of Overexposure

Causes severe burns on contact with any body tissue, frequently resulting in deep ulceration.

First Aid Procedures

Immediately remove clothing and wash all areas of contact with large amounts of water, giving top priority to eyes if affected. Call phycisian. If ingested, do not induce vomit give large amounts of water internally. Get medical attention.

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Exhaust ventilation required if dust or mist present - also proper respirator should be worn. Safety goggles, face shield, protective gloves and clothing should be worn.

DOT Hazard Class: Corrosive material

USe caution when cleaning empty drums or equipment as violent reaction with water, steam or solvent may occur.

(refer to section 3 through 8)

EMERGENCY PHONE NUMBER (513) 631-0445

AUTHORIZED SIGNATURE Bruce Cox

DATE ISSUED: 9-1-81

DATE REVISED: 6/81

Product Safety Information

TRISODIUM PHOSPHATE, CHLORINATED
(Chlorinated Trisodium Phosphate)

This Product Safety Information Sheet is principally directed to managerial, safety, hygiene and medical personnel. The description of physical, chemical and toxicological properties and handling advice is based on experimental results and past experience. It is intended as a starting point for the development of health and safety procedures.

I. PHYSICAL AND CHEMICAL PROPERTIES

Formula $(Na_3PO_4 \cdot 11H_2O)_4 \cdot NaOCl$; CAS #56802-99-4
Formula Weight 1,523
Physical State Fine white granular solid
Bulk Density (approx.) 50 lbs/ft³
Melting Point N/A — Decomposes to release chlorine
Solubility 21g/100g H_2O @ 77°F/25°C
Odor Chlorine or hypochlorite-like
pH 11.8 (1% aqueous solution)

II. CHEMICAL REACTIVITY

This material is not compatible with organic compounds or acids and when heated or upon acidification will lose chlorine.

This material, upon contact with certain food products or their residues which contain reducing sugars, may react to form deadly carbon monoxide gas. Proper tank entry and occupancy procedures should be observed. Monitor the tank atmosphere for the presence of carbon monoxide.

III. STABILITY

This material will lose available chlorine as environmental temperature and humidity increase.

IV. FIRE HAZARD

This material is considered noncombustible. However, under fire conditions it may decompose to give off toxic chlorine fumes.

V. FIREFIGHTING TECHNIQUE

Vapors may be irritating to the respiratory tract and may cause breathing difficulty and pulmonary edema. Symptoms may be delayed several hours or longer depending upon exposure.

As in any fire, prevent human exposure to fire, smoke, fumes or products of combustion. Evacuate nonessential personnel from the fire area.

When there is a potential for exposure to smoke, fumes or products of combustion, firefighters should wear full-face, self-contained breathing apparatus and impervious clothing such as gloves, hoods, suits and rubber boots.

Use standard firefighting techniques in extinguishing fires involving this material — use water, dry chemicals, foam, carbon dioxide or other suitable suffocation agents.

VI. TOXICOLOGY

Exhibits acute toxicological properties typical of a highly alkaline material. Extensive eye or tissue damage may occur from contact with the solid material or concentrated aqueous solutions.

Ingestion
Ingestion of this material may cause severe tissue damage to all portions of the gastrointestinal tract. Symptoms will include pain and burning in all portions of the mouth, throat, and gastrointestinal tract with which chlorinated trisodium phosphate makes contact. Nausea, vomiting, cramps and diarrhea may also occur.

Skin Contact
Contact with concentrated solutions may cause immediate local reaction, including reddening, itching and irritation, followed by loss of surface layers of the skin. Continued contact with dilute solutions may lead to chronic dermatitis. Contact with the solid materials, if not washed or removed from the skin, may cause local reactions including irritation and loss of surface layers within minutes.

Eye Contact
Contact with this material may cause extensive eye damage, either in dry form or in solution. Symptoms will include pain, watering and reddening of the eyes. The possibility of severe eye damage exists if concentrated solutions are splashed into the eyes and not promptly and properly treated.

In case of suspected exposure, refer to the procedure and emergency contacts in Section VII — FIRST AID.
In case of spillage, refer to the procedure and emergency contacts in Section IX — SPILL HANDLING.
In case of suspected animal poisoning, call a veterinarian or call collect, day or night (203) 226-6602 (Stauffer Chemical Company) or (800) 424-9300 (CHEMTREC).
In case of contamination with other materials, call (800) 424-9300 (CHEMTREC).

[illegible]

Stauffer
STAUFFER CHEMICAL COMPANY
[illegible]

Inhalation
Inhalation of excessive quantities of this material will produce local irritation in the respiratory tract. A burning sensation in the nose and throat, as well as coughing (and in high concentrations) choking, may be noted. Continued deep inhalation may cause lung irritation.

VII. FIRST AID

CALL A PHYSICIAN IMMEDIATELY

If a known exposure occurs or is suspected, immediately initiate the recommended procedures below. Simultaneously contact a physician, or the nearest hospital, or the nearest Poison Control Center. Inform the person contacted of the type and extent of exposure, describe the victim's symptoms, and follow the advice given. For additional information call collect, day or night, Stauffer Chemical Company (203) 226-6602 or Chemtrec (800) 424-9300

Ingestion
Do *NOT* induce vomiting. Immediately give large quantities of water. If vomiting does occur, give fluids again. Never give anything by mouth to an unconscious person. Call a physician or the nearest Poison Control Center immediately.

Skin Contact
Immediately flush all affected areas with large amounts of water for at least 15 minutes while removing any contaminated clothing. Do not attempt to neutralize with chemical agents. Obtain medical advice immediately.

Eye Contact
Immediately flush the eyes with large quantities of running water for a minimum of 15 minutes. Hold the eyelids apart during the flushing to ensure rinsing of the entire surface of the eye and lids with water. Do not attempt to neutralize with chemical agents. Obtain medical attention as soon as possible. Oils or ointments should not be used. Continue the flushing for an additional 15 minutes if the physician is not immediately available.

Inhalation
Remove from contaminated atmosphere. If breathing has ceased, clear the victim's airway and start mouth-to-mouth artificial respiration, which may be supplemented by the use of a bag-mask respirator or a manually triggered, oxygen-supply capable of delivering one liter/second or more. If the victim is breathing, oxygen may be delivered from a demand-type or continuous-flow inhalator, preferably with a physician's advice.

VIII. INDUSTRIAL HYGIENE

Ingestion
All food should be kept in a separate area away from the working location. Eating, drinking, and smoking should be prohibited in areas where there is a potential for significant exposure to this material. Before eating, hands and face should be thoroughly washed.

Skin Contact
Skin contact should be prevented through the use of impervious clothing, gloves and footwear.

Eye Contact
Eye contact should be prevented through the use of chemical safety glasses, goggles or a face shield.

Inhalation
If dust is generated, it should be controlled by local-exhaust ventilation. Where this is not feasible, inhalation can be prevented through the use of a NIOSH-approved particulate-filter respirator.

IX. SPILL HANDLING

Make sure all personnel involved in the spill cleanup follow good industrial hygiene practices (Refer to Section VIII)

Small spills can be handled routinely. Use adequate ventilation and wear a respirator or a dust mask to prevent inhalation. Wear suitable protective clothing and eye protection to prevent skin and eye contact. Use the following procedures.

Sweep up the spilled material being careful not to create dust. Place the sweepings into an appropriate chemical waste container. Seal container and dispose of in an approved landfill. Flush the spill area with water to remove any residue.

IN CASE OF EMERGENCY, CALL DAY OR NIGHT
(800) 424-9300 (CHEMTREC)

X. CORROSIVITY TO MATERIALS OF CONSTRUCTION

This material, when kept dry, is not corrosive to materials commonly used in the construction of process equipment, storage and shipping containers.

However, the material in solution forms hypochlorite which is corrosive to carbon steel and stainless steel.

XI. STORAGE REQUIREMENTS

This material is hygroscopic and tends to cake slightly during storage. Therefore, when not in use containers should be kept closed at all times. Store in a cool, dry, well-ventilated area. Exercise due caution to prevent damage to or leakage from the container.

XII. DISPOSAL OF UNUSED MATERIAL

Material that cannot be used or chemically reprocessed should be disposed of in an approved landfill or in such a manner that will not adversely affect the environment.

XIII. DISPOSAL OF CONTAINER

Empty containers may be discarded with the general trash or incinerated by means which provide appropriate environmental pollution controls.

HARCROS CHEMICALS INC
KANSAS CITY, KANSAS

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: PHOS SODA TRI CRYS MED 100# DATE: 08/09/89 PAGE 01
PRODUCT CODE: 16-07486-01

CAS # 010101-89-0

FORMULA: Na(3)PO(4).12H(2)O.1/4NaOH

CHEMICAL FAMILY: Phosphates

CHEMICAL NAME AND SYNONYMS: Trisodium Phosphate Crystals; Trisodium Phosphate Dodecahydrate; TSP Crystals; Trisodium Orthophosphate

SUPPLIERS NAME: Harcros Chemicals Inc
5200 Speaker Rd
Kansas City Ks 66106
SUPPLIERS PHONE NUMBER: 913-321-3131
TRANSPROTATION EMERGENCY PHONE NUMBER: 1-800-424-9300

S.A.R.A. INFORMATION

HAZARDS: Fire: Pressure: Reactivity: Acute: Yes Chronic:
PHYSICAL DATA: Mixture: Pure:Yes Solid:Yes Liquid: Gas:

SECTION I Hazardous Ingredients

Ingredient	Percent	TLV
Trisodium Phosphate Crystals (CAS # 7601-54-9)	100	NUISANCE DUST PEL TWA 8Hr 15 mg/m(3) Total Dust OSHA PEL TWA 8Hr 5 mg/m(3) Respirable Dust OSHA TLV TWA 8Hr 10 mg/m(3) Total Dust ACGIH

SECTION II Health Hazards

Threshold Limit Value: As indicated in Section I.

Potential Effects of Exposure (listed by primary routes of entry)

Eyes: Can cause eye burns.

Skin: Strong irritant; chemical burns possible.

Inhalation: Small amounts of dust very irritating. Large exposure can cause tissue burns.

Ingestion: Slightly toxic due to high pH. Ingestion may injure mouth, throat and gastrointestinal tract. LD(50) (Rat): 6.5g/kg.

First aid:

Eyes: Immediately flush with water for 15 minutes while holding eyelids open. Get medical attention.

Skin: Flush with water while removing contaminated clothing and shoes. Follow by washing with soap and water. Do not reuse clothing or shoes until cleaned. If irritation persists, get medical attention.

CONTINUED ON PAGE 02

MATERIAL SAFETY DATA SHEET

SECTION II Health Hazards CONTINUED

Inhalation: Remove victim to fresh air and provide oxygen if breathing is difficult. Give artificial respiration if not breathing. Get medical attention.

Ingestion; DO NOT induce vomiting. Immediately give large quantities of water. If vomiting does occur, keep head below hips to prevent aspiration and give fluids again. Never give anything by mouth to an unconscious person. Call a physician or the nearest Poison Control Center.

Other Information:

Notes to Physician:

Strongly alkaline, may remove sebaceous oils leaving skin unprotected and may cause chemical burns. Accessible exposed tissues should be flushed thoroughly with water, and any corneal burns warrant consultation of an ophthalmologist.

Ingestion may result in nausea, vomiting, and burns, especially of the esophagus. Attempts to neutralize ingested material with acids may cause excess heat and gas production which can increase the risk of perforation. Dilution may do likewise, but when the dry material is ingested, adherence of particles to the esophageal mucosa may assure perforation so that immediate drinking of cold water or milk is advised.

Burns of the esophagus and/or stomach sufficient to determine if deep and/or circumferential burns are present, because they are most likely to result in esophageal stenosis. Prevention of the latter is controversial, though most authorities favor early corticosteroid and/or prophylactic dilatiation therapy. Demulcents may provide some relief of mild to moderate pain; severe pain may require opiates. Treatment otherwise is symptomatic and supportive, with attention to the possible complications of glottal obstruction, esophageal perforation and shock.

CARCINOGENICITY: Not known to be carcinogenic

MUTAGENICITY: Not known to be mutagenic

PRINCIPLE ROUTES OF ABSORPTION: Inhalation, dermal contact, eye contact, ingestion.

SECTION III Special Protection Information

Respiratory Protection: Use NIOSH approved equipment suitable for nuisance dust when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for given application.

Ventilation Required: Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

Protective Clothing:

Eyes: Wear chemical safety goggles to prevent eye contact.

Skin: Wear appropriate impervious gloves and protective clothing

CONTINUED ON PAGE 03

HARCROS CHEMICALS INC
KANSAS CITY, KANSAS

MATERIAL SAFETY DATA SHEET

SECTION III Special Protection Information CONTINUED

to prevent skin contact. Launder contaminated clothing and clean protective equipment before reuse.

Additional Protective Measures: Safety shower, eye bath and washing facilities should be available.

SECTION IV Fire & Explosion Hazard Data

Flash Point (Method): Non-flammable

Flammable Limits (% Volume in Air):

Upper: N/A

Lower: N/A

Extinguishing Media: As appropriate for the surrounding fire.

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards: Material in aqueous solution is corrosive to aluminum, galvanized iron and zinc and may generate flammable hydrogen gas as a result of this reaction.

SECTION V Physical Data

Boiling Point: Over 1000 deg. C

Melting Point: 75 deg. C. (Decomposes), loses 12H(2)O @ 100 deg. C.

Specific Gravity (H(2)O=1): 1.62 @ 68 deg. F.

Bulk Density: lbs/cu.ft.

Powder - 61-65

Granular - 58-64

Vapor Pressure (MM HG.): Non-volatile

Vapor Density (AIR=1): Non-volatile

Evaporation Rate (____=1): Non-volatile

Solubility in Water: 11.6g/100g at 77 deg. F

Percent Volatile by Volume: Non-volatile

pH: 1% solution at 77 deg. F-12.0

Appearance and Odor: White, crystalline, free-flowing granules or powder; odorless

CONTINUED ON PAGE 04

MATERIAL SAFETY DATA SHEET

SECTION VI Reactivity Data

Stability: Stable

Incompatibility: Because of high pH, may attack aluminum, galvanized iron & zinc. On contact with certain food products or their residues which contain reducing sugars may react to form carbon monoxide. Proper tank entry and occupancy procedures should be observed.

Hazardous Decomposition Products: None

Hazardous Polymerization: Will not occur.

SECTION VII Spill and Leak Procedures

Steps to be taken if material is released or spilled: Sweep, scoop or vacuum up all spilled material, contaminated soil and other contaminated material and place in containers. If possible, complete cleanup on a dry basis. After all practical dry cleanup has been done, residual contamination can be flushed with plenty of water.

Waste Disposal Method:

Dispose of non-salvageable material in a disposal facility in accordance with all local, state and federal regulations.

Sodium phosphate, tribasic, as currently defined, is a hazardous substance in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund) and in the current federal regulations 40 CFR, Part 116 (Section 311, Clean Water Act) with a reportable quantity of 5,000 pounds when released to the environment. Since federal, state and local laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

SECTION VIII D.O.T. Shipping Information

Proper Shipping Name:	NONE
Hazard Class:	NONE
ID Number:	NONE
Label Requirements:	NONE
Reportable Quantity:	NONE

Other Information:

CONTINUED ON PAGE 05

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: PHOS SODA TRI CRYS MED 100# DATE: 08/09/89 PAGE 05
PRODUCT CODE: 16-07486-01

SECTION IX Additional Information

This information may be of importance to you:

Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Food Grade: FDA-GRAS list, permitted in foods-1979; USDA-Permitted in meat.

Material is hygroscopic, tending to cake in storage, keep container closed and stored in a cool dry location.

HMIS RATING:

Health-2
Flammability-0
Reactivity-0
Special Protection-F

********* E N D O F R E P O R T *********

NAME: GENE TURNER DATE ISSUED: 10/28/1985
DATE REVISED: 10/22/1987

< = LESS THAN
> = MORE THAN
N/A = NOT APPLICABLE
N/D = NOT DETERMINED
N/E = NOT ESTABLISHED
UNK = UNKNOWN

The information provided in this Material Safety Data Sheet has been obtained from sources believed to be reliable. Harcros Chemicals Inc provides no warranties, either expressed or implied and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your information, consideration and investigation. You should satisfy yourself that you have all current data relevant to your particular use. Harcros Chemicals Inc knows of no medical condition, other than those noted on this material safety data sheet, which aregenerally recognized as being aggravated by exposure to this product.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 1819

PPTRS002

S E C T I O N 1 - A

MANUFACTURER NAME: LONDON NUCLEAR LIMITED
ADDRESS LINE 1 : 4056 DORCHESTER ROAD
ADDRESS LINE 2 : NIAGARA FALLS,
ADDRESS LINE 3 :
TOWN : ONTARIO, CANADA STATE: ZIP: L2E 6V9

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID :

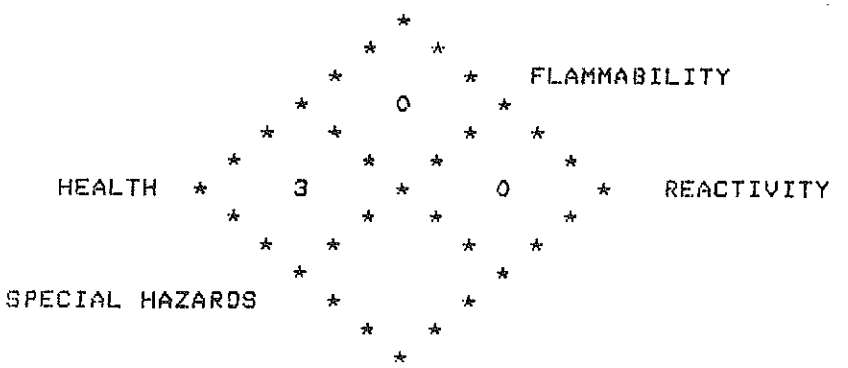
TRADE/PRODUCT NAME.....: HYDRAZINE (35% AQUEOUS SOLUTION)
CHEMICAL NAME/SYNONYM....: AMERIZINE; SCAV-OX (MSDS 3154 & 538)
CHEMICAL FAMILY.....: NONE ENTERED BY LONDON NUCLEAR
TRAINING NAME.....: HYDRAZINE

EMERGENCY TELEPHONE NO..: 000-000-0000 00000

INFORMATION TELEPHONE NO: 416-356-1543 00000

DATE PREPARED : 02 / 01 / 1984

S E C T I O N 1 - B



FLAMMABILITY - FROM 0 (W
HEALTH - FROM 0 (NO HEAL
REACTIVITY - FROM 0 (STA
SPECIAL HAZARDS - R R W REAC OX OXID

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
TARGET ORGAN/HEALTH EFFECTS:
INHALED,INGESTED: HARMFUL
CONTACT: IRRITATION/BURNS, OVEREX-
POSURE MAY CUSE DEATH,TEMPORARY
BLINDNESS,DIZZINESS,NAUSEA.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 1819

PPTRS002

S E C T I O N - 2

INGREDIENT NAME: HYDRAZINE HYDRATE
INGREDIENT TYPE:
OSHA PEL.....:
ACGIH TLV.....:
OTHER LIMITS...:
REGULATED BY...:

PERCENT OF PRODUCT:
CAS NO. : 7803-

S E C T I O N - 3

BOILING POINT	: 109	CELSIUS	
SPECIFIC GRAVITY	: 1.0	VAPOR PRES(MMHG)	:
MELTING POINT	: (-)65	CELSIUS	
PERCENT VOLATILE	: 100%	VAPOR DEN(AIR = 1)	:
EVAPORATION RATE	:	EVAP. METHOD	:
SOLUBILITY (H20)	: COMPLETELY MISCIBLE		

APPEARANCE/ODOR.....: COLORLESS TO STRAW COLORED LIQUID.

S E C T I O N - 4

FLASH POINT.....:
COC :
TCC :
OTHER :

FLAMMABLE LIMITS..:
LEL PERCENT: 4.70 % UEL PERCENT: 100.00 %

EXTINGUISHING MEDIA : WATER

SPECIAL FIRE PROCEDURES : N/A
VAPOR SOLUTION NOT FLAMMABLE

FIRE & EXPLOSION HAZARDS: NONE BELOW 40% AQUEOUS SOLUTION.
FLASH POINT: NONE IF < 40% N2H2 (ASTM METHOD)

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 1819

PPTRS002

S E C T I O N 5

PRODUCT TLV.....: 0.10000
UNIT OF MEASURE....: PPM

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.:
MUTAGEN.....: TERATOGEN..... :

ROUTES OF ENTRY....: INHALATION: X SKIN: X INGESTION: X

EFFECTS OF OVEREXPOSURE : HARMFUL BY INGESTION, SKIN CONTACT OR INHALATION.
OVEREXPOSURE MAY CAUSE DEATH, TEMPORARY BLINDNESS, NAUSEA,
DIZZINESS AND DAMAGE TO INTERNAL ORGANS.

SIGNS & SYMPTOMS : CONTACT MAY CAUSE IRRITATION/BURNS

EMERGENCY AND FIRST AID : SKIN/EYES: WASH WITH LARGE AMOUNTS OF FLOWING WATER.
INGESTION: FOR SOLUTION < 35%, INDUCE VOMITING.
INHALATION: REMOVE TO FRESH AIR.
IN ALL CASES - CALL PHYSICIAN IMMEDIATELY.

MEDICAL CONDITIONS : ***** N O N E E N T E R E D *****

S E C T I O N - 6

STABILITY .....: STABLE

'STABILITY'
CONDITIONS TO AVOID : HIGH TEMPERATURE, DIRECT SUNLIGHT.

INCOMPATABILITY.....: ORGANIC MATERIALS, OXIDIZING ACIDS.

HAZARDOUS DECOMP.....: NONE

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : N/A

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 1619

PPTRS002

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : RINSE WITH WATER, NEUTRALIZE AQUEOUS SOLUTION WITH CALCIUM HYPOCHLORITE OR HYDROGEN PEROXIDE.

WASTE DISPOSAL METHOD : DISPOSE OF BY MEANS AS TO COMPLY WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS OR CONTACT A LICENSED DISPOSAL AGENCY.

PRECAUTIONS - :
HANDLING AND STORING : STORE IN ORIGINAL CONTAINER. DO NOT STORE NEAR COMBUSTIBLE MATERIALS. AVOID UNNECESSARY CONTACT WITH AIR.

OTHER : SEE MANUFACTURER'S LITERATURE FOR FURTHER INFORMATION (E.G. OLIN CHEMICALS)

S E C T I O N - 8

RESPIRATOR TYPE : NIOSH/MOHS APPROVED SELF CONTAINED BREATHING APPARATUS

VENTILATION- LOCAL EXHAUST: _____X SPECIAL:
MECHANICAL : OTHER :

PROTECTIVE GLOVES.....: YES, SEE BELOW

EYE PROTECTION.....: GOGGLES

OTHER PROTECTION.....: APRON OR PROTECTIVE SUIT, BOOTS, FULL FACE MASK.

WORK / HYGENIC.....: WEAR BUTYL RUBBER (DISPOSABLE) OR POLYVINYL CHLORIDE GLOV').

S E C T I O N - 9

MISCELLANEOUS DATA.....:

S E C T I O N 1 - A

MANUFACTURER NAME: TEXACO CHEMICAL COMPANY
ADDRESS LINE 1 : P O BOX 27707
ADDRESS LINE 2 :
ADDRESS LINE 3 :
TOWN : HOUSTON STATE: TX ZIP: 77227

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID : 70C

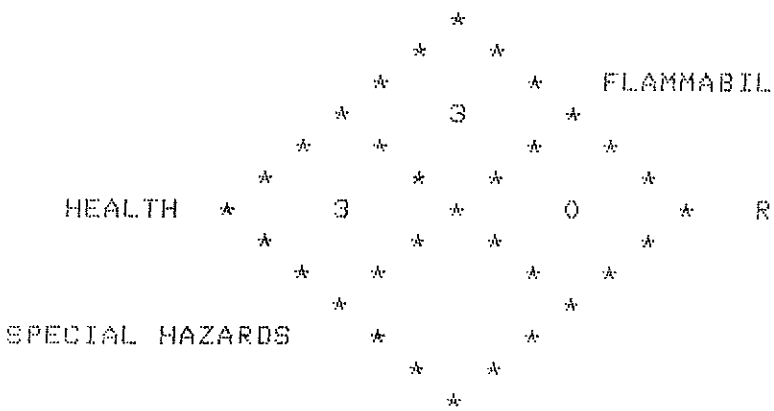
TRADE/PRODUCT NAME.....: 70203 MORPHOLINE
CHEMICAL NAME/SYNONYM....: MORPHOLINE
CHEMICAL FAMILY.....: MORPHOLINE
TRAINING NAME.....: MISCELLANEOUS

EMERGENCY TELEPHONE NO..: 914-831-3400 00000

INFORMATION TELEPHONE NO: 914-838-7204 00000

DATE PREPARED : 04 / 27 / 1993

S E C T I O N 1 - B



FLAMMABILITY - FR
HEALTH - FROM 0
REACTIVITY - FROM
SPECIAL HAZARDS -

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
HEALTH EFFECTS/TARGET ORGAN
EYE/SKIN:IRRITANT,REDNESS,SWELLING,
BURNS.INHALATION:NASAL DISCHARGE,
COUGHS,NOSE/THROAT/CHEST PAIN.
INGESTED:MOUTH/THROAT/STOMACH BURNS

S E C T I O N - 2

INGREDIENT NAME: MORPHOLINE
INGREDIENT TYPE:
OSHA PEL.....: 20.00000 PARTS PER MILLION PERCENT OF PRODUCT
ACGIH TLV.....: 20.00000 PARTS PER MILLION CAS #0.
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

S E C T I O N - 3

BOILING POINT : 263 FAHRENHEIT
SPECIFIC GRAVITY : 1.0017 VAPOR PRES(MMHG) : 7
MELTING POINT : NOT LISTED
PERCENT VOLATILE : NOT LISTED VAPOR DEN(AIR = 1): 3.0
EVAPORATION RATE : NOT LISTED EVAP. METHOD : NOT LISTED
SOLUBILITY (H2O) : < 10%

APPEARANCE/ODOR.....: CLEAR, COLORLESS LIQU., AMMONIA ODOR

S E C T I O N - 4

FLASH POINT.....:
COC :
TCC :
OTHER :

FLAMMABLE LIMITS..:
LEL PERCENT: 1.0 UEL PERCENT: 10.0

EXTINGUISHING MEDIA : CO2 FOAM DRY CHEMICAL

SPECIAL FIRE PROCEDURES : WATER MAY BE INEFFECTIVE ON FLAMES,BUT SHOULD BE USED
COOL FIRE-EXPOSED CONTAINERS.IF A LEAK OR SPILL HAS
IGNITED,USE WATER SPRAY TO DISPERSE THE VAPORS & TO P
PROTECTION FOR PERSONNEL ATTEMPTING TO STOP THE LEAK.

FIRE & EXPLOSION HAZARDS: DANGER! FLAMMABLE MATERIALS MAY RELEASE VAPORS THA
LONG DISTANCES,IGNITE AND FLASH BACK.CONTAINERS MAY
IN A FIRE.DO NOT EXPOSE TO HEAT,SPARKS,FLAME OR OTHER
SOURCES OF IGNITION. EXPLOSIVE AIR-VAPOR MIXTURES MAY

S E C T I O N 5

PRODUCT TLV.....:
UNIT OF MEASURE....:

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.:
MUTAGEN.....: TERATOGEN..... :

ROUTES OF ENTRY....: INHALATION: X SKIN: X INGESTION:

EFFECTS OF OVEREXPOSURE : EYES:IRRITANT,PAIN,W/EXCESS BLINKING/TEAR PRODUCTION,
& SWELLING,CHEMICAL BURNS.SEVERE DAMAGE CAN CAUSE BLI
SKIN:SEVERE IRRITATION W/PAIN,REDNESS & SWELLING W/CH
BURNS,BLISTER FORMATION,POSSIBLE TISSUE DESTRUCTION.I
IRRITATING,NASAL DISCHARGE,COUGHING,DISCOMFORT/PAIN I
NOSE,THROAT & CHEST.SEVERE OVEREXPOSURE MAY RESULT IN
CULTY BREATHING,HEADACHE,NAUSEA,VOMITING,DROWSINESS;L

SIGNS & SYMPTOMS : *DAMAGE.INGESTED:BURNING OF MOUTH,THROAT,STOMACH W/AS
& CHEST PAIN,NAUSEA,VOMITING,DIARRHEA,THIRST,WEAKNESS
LAPSE.ASPIRATION MAY OCCUR DURING SWALLOWING OF VOMIT
RESULTING IN LUNG DAMAGE.PROLONGED SKIN CONTACT/OVERE
MAY RESULT IN ABSORPTION OF POTENTIALLY HARMFUL AMOUN

EMERGENCY AND FIRST AID : IN ALL CASES:GET IMMEDIATE MEDICAL ATTENTION.EYES:FLU
WATER 15 MIN,HOLDING LIDS APART;CONTINUE ADD'L 15 MIN
ICAL ATTN NOT IMMED.AVAILABLE.SKIN:FLUSH WATER 15 MIN
CONTAM.CLOTHING,WASH BEFORE REUSE,DESTROY NON-RESISTA
WEAR.INGEST:IF CONSCIOUS/CAN SWALLOW,GIVE 2 GLASSES
OZ.DON'T INDUCE VOMITING.NEVER GIVE BY MOUTH TO UNCON
CONVULSING PERSON.INHALE:REMOVE TO FRESH AIR.NOT BREA
GIVE ARTIFICIAL RESP. DIFFICULT BREATHING: GIVE OXYGE

MEDICAL CONDITIONS : OVEREXP:VAPOR,DUST,MIST MAY AGGRAVATE EXISTING RESPIR
CONDITIONS(ASTHMA,BRONCHITIS,INFLAMMATORY OR FIBROTIC
DISEASE).SKIN CONTACT MAY AGGRAVATE EXISTING DERMATIT

EPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T #

PETRS002

S E C T I O N - 5

STABILITY .....

'STABILITY'
CONDITIONS TO AVOID : STABILITY NOT LISTED.PRODUCTS EVOLVED WHEN SUBJECTED OR COMBUSTION;TOXIC LEVELS OF AMMONIA,COMBUSTION PRO NITROGEN,CARBON MONOXIDE,CARBON DIOXIDE,IRRITATING AL & KETONES MAY BE FORMED ON BURNING IN A LIMITED AIR S

INCOMPATABILITY.....: MATERIAL REACTS VIOLENTLY WITH HEAT,STRONG OXIDIZERS, DO NOT ADD OR FORMULATE WITH NITRITES.

HAZARDOUS DECOMP.....: PRODUCTS EVOLVED WHEN SUBJECTED TO HEAT OR COMBUSTIO LEVELS OF AMMONIA,COMBUSTION PRODUCTS OF NITROGEN,CA MONOXIDE,CARBON DIOXIDE,IRRITATING ALDEHYDES AND KETO BE FORMED ON BURNING IN A LIMITED AIR SUPPLY.

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : HAZARDOUS POLYMERIZATIONS DO NOT OCCUR.

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : ELIMINATE IGNITION SOURCES INCLUDING INTERNAL COMBUST INES,POWER TOOLS.VENTILATE AREA.KEEP PEOPLE AWAY.STA & WARN OF POSSIBLE DOWNWIND EXPLOSION HAZARD.AVOID B VAPOR,CONTACT W/SKIN/EYES/CLOTHING.USE SCBA OR SUPPL MASK FOR LG SPILLS,CONFINED AREAS.CONTAIN SPILL IF P REMOVE W/INERT ABSORBENT.PREVENT ENTRY IN SEWERS,WATE

WASTE DISPOSAL METHOD : PRODUCT HAS RCRA CHARACTERISTIC OF IGNITABILITY.IF DI IN PRESENT FORM,HAS HAZARDOUS # OF D001.IT IS RESPON OF USER OF PRODUCT TO DETERMINE,AT TIME OF DISPOSAL,W PRODUCT MEETS RCRA CRITERIA.PRODUCT USES,TRANSFORMAT TURES,PROCESSES MAY CHANGE CLASSIFICATION TO NONHAZAR HAZARDOUS FOR REASON OTHER THAN/IN ADDITION TO IGNITA

PRECAUTIONS - :
HANDLING AND STORING : TRANSPORT,HANDLE,STORE IN ACCORDANCE W/OSHA REGS 1910 DOT REGS.GROUND,BOND SHIPPING CONTAINER,TRANSFER LINE RECEIVING CONTAINER.USE SPARK-PROOF TOOLS.KEEP AWAY F HEAT,SPARKS,FLAME & OTHER SOURCES OF IGNITION.MATERI BE AT ELEVATED TEMPS AND/OR PRESSURES.EXERCISE DUE CA OPENING BLEEDERS & SAMPLING PORTS.KEEP CONTAINER CLOS

OTHER : DANGER! FLAMMABLE LIQUID & VAPOR.CORROSIVE-CAUSES EY BURNS.HARMFUL OR FATAL IF SWALLOWED.MAY CAUSE RESPIRA TRACT IRRITATION,ALLERGIC SKIN REACTION.ASPIRATION H

SWALLOWED-MAY ENTER LUNGS & CAUSE DAMAGE.DO NOT ADD
-MAY FORM SUSPECTED CANCER-CAUSING NITROSAMINES.USE A
VENTILATION.WASH THOROUGHLY AFTER HANDLING.

S E C T I O N - 8

RESPIRATOR TYPE : AIRBORNE CONCENTRATIONS S/B KEPT TO LOWEST LEVELS.IF
MIST,DUST GENERATED,USE RESPIRATOR MSHA/NIOSH APPD.SU
AIR RESPIRATORY PROTECTION S/B USED FOR CLEANING LARG
OR UPON ENTRY INTO TANKS,VESSELS,OTHER CONFINED SPACE

VENTILATION- LOCAL EXHAUST: NOT LISTED SPECIAL: NOT LISTED
MECHANICAL : NOT LISTED OTHER : EXPLOSIONPROOF

PROTECTIVE GLOVES.....: "CHEMICAL/PETROLEUM DISTILLATES RESISTANT"REQUIRED

EYE PROTECTION.....: CHEMICAL TYPE GOGGLES W/FACE SHIELD MUST BE WORN.

OTHER PROTECTION.....: PROTECTIVE CLOTHING (UNIFORMS,COVERALLS,LAB COATS) MU
WORN.LAUNDER OR DRY-CLEAN WHEN SOILED.WHEN HANDLING L
QUANTITIES,IMPERVIOUS SUITS,RUBBER BOOTS,GLOVES MUST

WORK / HYGENIC.....: EYE WASH & SAFETY SHOWER S/B AVAILABLE NEARBY WHEN TH
PRODUCT IS HANDLED OR USED.WASH THOROUGHLY AFTER USE.

S E C T I O N - 9

MISCELLANEOUS DATA.....:

GRACE

Organic Chemicals Division
W.R. Grace & Co.
55 Hayden Avenue
Lexington, Mass. 02173

MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: HAMPSHIRE® Aqua Ammonia
MSDS NUMBER: 1179

MSDS RELEASE DATE: 06/25/86

CHEMICAL DESCRIPTION: Water solution of ammonium hydroxide, or aqua ammonia.

PRODUCT TSCA/CAS NUMBER: 1336-21-6

SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME & CAS NO.	% PRESENT	TLV/PEL
Ammonia [7664-41-7]	Less than 20	50 ppm
Methanol [67-56-1]	Less than 1	200ppm

SECTION THREE - PHYSICAL DATA

BOILING POINT: N.A. decomposes
VAPOR PRESSURE: About 1 atm. at 80°F
VAPOR DENSITY: 0.6
WATER SOLUBILITY: Miscible
APPEARANCE: Water white liquid

SPECIFIC GRAVITY: 0.90
% VOLATILE BY WT: 100%
EVAPORATION RATE: Very rapid
pH: Very basic
ODOR: Strong pungent,suffocating

SECTION FOUR - FIRE FIGHTING DATA

FLASH POINT: Non Flammable
FLAMMABLE LIMIT - LEL: 16%

METHOD USED: Unknown
UEL: 25%

EXTINGUISHING MEDIA: Water

SPECIAL FIRE FIGHTING PROCEDURES: Use water on an Ammonia spill only if large quantities (at least 100 parts of water for each part of ammonia) are available.

UNUSUAL FIRE & EXPLOSION HAZARDS:Wear self-contained breathing apparatus with a full facepiece operated in pressure-chem and/or other positive pressure mode.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein, the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the [illegible] are not within the control of Grace, Grace assumes no responsibility for [illegible] the use of this [illegible]. The material described herein is [illegible] including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with [illegible] federal [illegible] and regulations.

SECTION EIGHT - PERSONNEL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Engineering controls should be used to reduce environmental concentrations to the permisible level of exposure. Respirators can be used where work controls are not feasible. Only respirators which have been approved by the MSHA or by NIOSH can be used. Also a complete respiratory protection program should be motivated, i.e., chemical cartridge respirator, supplied-air respirator or self-contained breathing apparatus based on air concentrations of ammonia.

VENTILATION: Local exhaust, mechanical if provided.

PROTECTIVE GLOVES: Impervious rubber gloves.

EYE PROTECTION: Face shields of eight inch minimum, splash-proof goggles and eyewash fountain if available.

OTHER PROTECTIVE EQUIPMENT: Employees should be provided with impervious aprons. Non-impervious clothing which becomes wet with ammonia should be removed promptly.

SECTION NINE - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Avoid any physical contact, and excessive heat.

OTHER PRECAUTIONS: Liquid ammonia will attack some forms of plastics, rubbers and coatings.

SECTION TEN - REGULATORY COMMENTS

OSHA...HAMPSHIRE Aqua Ammonia is <u>not</u> expected to contain chemicals designated as carcinogens or suspect carcinogens by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC) or OSHA according to the definitions or concentration limitations of the "Hazard Communication Standard" 29 CFR 1910.1200.

DOT..... HAMPSHIRE Aqua Ammonia is a hazardous material according to the Hazardous Materials Transportation Act and DOT regulation 49 CFR 172.101. Solution concentration will determine the DOT Hazard Class and DOT Label as follows:

- AMMONIUM HYDROXIDE (containing not less than 12% but not more than 44% ammonia) CORROSIVE MATERIAL - NA 2672. DOT label required: Corrosive

- AMMONIUM HYDROXIDE (containing less than 12% ammonia) ORM-A, NA 2672. DOT label required: None

EPA..... HAMPSHIRE Aqua Ammonia contains only chemicals listed on the TSCA "Chemical Substance Inventory."

S E C T I O N 1 - A

MANUFACTURER NAME: LAROCHE INDUSTRIES, INC.
ADDRESS LINE 1 : 1100 JOHNSON FERRY ROAD, N.E.
ADDRESS LINE 2 :
ADDRESS LINE 3 :
TOWN : ATLANTA STATE: GA ZIP: 30342

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID : SB91

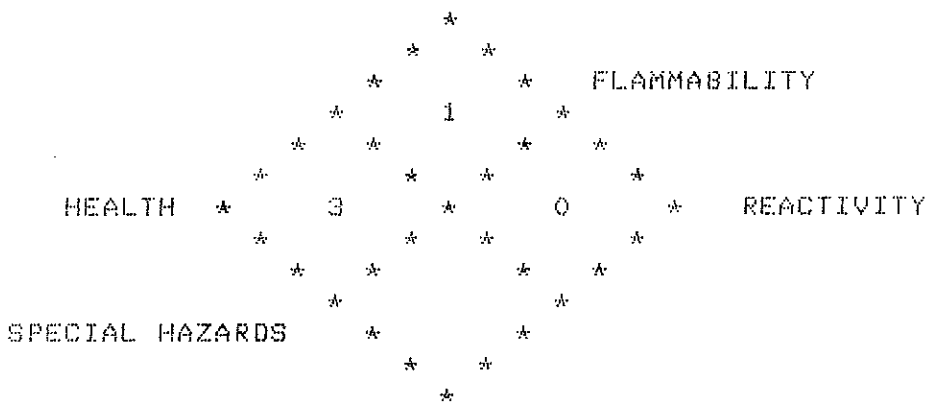
TRADE/PRODUCT NAME.....: ANHYDROUS AMMONIA
CHEMICAL NAME/SYNONYM....: AMMONIA
CHEMICAL FAMILY.....: NOT LISTED
TRAINING NAME.....: CORROSIVE

EMERGENCY TELEPHONE NO..: 404-491-7987 00000

INFORMATION TELEPHONE NO: 404-851-0300 00000

DATE PREPARED : 04 / 20 / 1993

S E C T I O N 1 - B



FLAMMABILITY - FRO
HEALTH - FROM 0 (
REACTIVITY - FROM
SPECIAL HAZARDS -
0

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
TARGET ORGAN/HEALTH EFFECTS:
REACTS CORROSIVELY W/ALL BODY TISS-
UES. INHALED: OBSTRUCTS BREATHING
SKIN: TISSUE DAMAGE,FROSTBITE,CHEM-
ICAL BURNS. EYES: CORROSION,PAIN.

S E C T I O N - 2

INGREDIENT NAME: AMMONIA
INGREDIENT TYPE:
OSHA PEL.....:
ACGIH TLV.....: 25.00000 PARTS PER MILLION
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

PERCENT OF PRODUCT:
CAS NO. :

INGREDIENT NAME: WATER
INGREDIENT TYPE:
OSHA PEL.....:
ACGIH TLV.....:
OTHER LIMITS...: PEL/TLV NONE ESTAB'D
REGULATED BY...:

PERCENT OF PRODUCT:
CAS NO. :

INGREDIENT NAME: OIL
INGREDIENT TYPE:
OSHA PEL.....: 5.00000 MILLIGRAMS/CUBIC METER
ACGIH TLV.....: 5.00000 MILLIGRAMS/CUBIC METER
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

PERCENT OF PRODUCT:
CAS NO. :

S E C T I O N - 3

BOILING POINT : -28.1'F
SPECIFIC GRAVITY : 0.62 @ 60'F
MELTING POINT : -107.9 'F
PERCENT VOLATILE : 100%
EVAPORATION RATE : NOT LISTED.
SOLUBILITY (H2O) : 33% WT. @ 68'F

FAHRENHEIT
VAPOR PRES(MMHG) : 4802.9 @ 60'F
FAHRENHEIT
VAPOR DEN(AIR = 1): 0.60 @ 32'F
EVAP. METHOD : NOT LISTED

APPEARANCE/ODOR.....: COLORLESS GAS OR LIQUID W/EXTREMELY PUNGENT ODOR.

S E C T I O N - 4

FLASH POINT.....:
COC :
TCC :
OTHER :

FLAMMABLE LIMITS..: 16-25% IN AIR
LEL PERCENT: UEL PERCENT:

EXTINGUISHING MEDIA : WATER FOG

SPECIAL FIRE PROCEDURES : EXTINGUISHING MEDIA: WITH A SOURCE OF IGNITION AMMONIA BURN IN THE RANGE OF 16-25% IN AIR. USE WATER FOG OR S TO EXTINGUISH FLAMES. STOP FLOW OF GAS; MOVE CONTAI FROM FIRE ZONE IF POSSIBLE. STAY CLEAR OF TANK HEADS. WATER TO COOL FIRE EXPOSED CONTAINERS & PROTECT PERSON

FIRE & EXPLOSION HAZARDS: USE WATER SPRAY TO CONTROL VAPORS. PERSONNEL MUST BE E ED W/APPROPRIATE PROTECTIVE CLOTHING & RESPIRATORY EQU DO NOT PUT WATER ON LIQUID AMMONIA.

S E C T I O N 5

PRODUCT TLV.....: 25.00000
UNIT OF MEASURE....:

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.:
MUTAGEN.....: TERATOGEN..... :

ROUTES OF ENTRY....: INHALATION: X SKIN: X INGESTION:

EFFECTS OF OVEREXPOSURE : AMMONIA IS A VERY STRONG BASE & REACTS CORROSIVELY W/A BODY TISSUES. INHALATION: DEPENDING ON EXPOSURE CONCEN TION & DURATION, EFFECTS CAN BE NONE OR MILD IRRITATIO OBSTRUCTION OF BREATHING FROM LARYNGEAL & BRONCHIAL SP TO EDEMA & SEVERE DAMAGE OF MUCOUS MEMBRANES OF RESPI TRACT W/POSSIBLE FETAL RESULT. SKIN: PROLONGED CONTACT HIGH CONCENTRATIONS CAN CAUSE PAINFUL TISSUE DAMAGE, *

SIGNS & SYMPTOMS : * FROSTBITE & SERIOUS CHEMICAL BURNS. EYES: CORROSION, REDNESS,CONJUNCTIVA ULCERATION,CORNEA & LENS OPACITIES OCCUR. INGESTION: DO NOT INDUCE VOMITING. HAVE VICTIM LARGE QUANTITIES OF WATER IF CONSCIOUS. IMMED. SEEK ME AID. NEVER GIVE ANYTHING BY MOUTH TO UNCONSCIOUS PERSO

EMERGENCY AND FIRST AID : INHALATION: REMOVE FROM EXPOSURE.STOPPED BREATHING/DIF BREATHING: ADMINISTER ARTIFICIAL RESPIRATION OR OXYGEN NEEDED. SKIN: IMMED. FLUSH W/LGE QTYS WATER FOR AT L

15 MIN WHILE REMOVING CLOTHING. CLOTHING FROZEN TO S.I
SHOULD SE THAWED W/WATER BEFORE REMOVAL. SEEK MED AID.
EYES: FLUSH W/LGE AMTS WATER FOR 15 MIN. SEEK MED AID
INGESTION: DO NOT INDUCE VOMITING. GIVE 1-2 GLASSES O
WATER. IMMED. SEEK MED AID. NEVER GIVE ANYTHING BY MO

MEDICAL CONDITIONS : * TO UNCONSCIOUS PERSON.
MEDICAL CONDITIONS AGGRAVATED: NONE LISTED BY LAROCHE

S E C T I O N - 6

STABILITY .....: STABLE

'STABILITY'
CONDITIONS TO AVOID : NOT APPLICABLE

INCOMPATABILITY.....: AMMONIA REACTS VIOLENTLY W/STRONG ACIDS.UNDER CERTAIN
IONS,AMMONIA REACTS W/BROMINE,CHLORINE,FLUORINE OR IOD
FORM COMPOUNDS WHICH EXPLODE SPONTANEOUSLY. REPORTED T
EXPLOSIVE FULMINATE-LIKE COMPOUNDS W/GOLD,SILVER OR ME

HAZARDOUS DECOMP.....: HYDROGEN ON HEATING TO OVER 850'F. THE DECOMPOSITION
ERATURE MAY BE LOWERED TO 575'F BY CONTACT W/CERTAIN M
SUCH AS NICKEL.

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : NOT APPLICABLE

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : STOP LEAK IF FEASIBLE. AVOID BREATHING AMMONIA. EVACUATE PERSONNEL NOT EQUIPPED W/PROTECTIVE CLOTHING & EQUIPMENT.USE COPIOUS AMTS OF WATER SPRAY OR FOG TO ABSORB AMMONIA. DO OT PUT WATER ON LIQUID. CONTAIN RUN-OFF TO PREVENT AMMONIA FROM ENTERING A STREAM,LAKE,SEWER,OR DITCH. IN CASE OF RELEASE TO ENVIRONMENT,REPORT SPILLS TO 800-424-8802 NAT'L RESPONSE TR

WASTE DISPOSAL METHOD : RECOVER AMMONIA IF FEASIBLE. OTHERWISE,LET AMMONIA EVAPORATE IF APPROPRIATE. ONLY PERSONNEL EXPERIENCED W/AMMONIA SPIL S SHOULD ADD WATER TO LIQUID AMMONIA. DISPOSE OF DILUTED AMMONIA AS A FERTILIZER OR IN AN INDUSTRIAL PROCESS. FOR HAZARDOUS WASTE REGULATIONS CALL 800-424-9346, THE RCRA HOTLINE.

`RECAUTIONS - :
HANDLING AND STORING : PROTECT CONTAINERS FROM EXCESSIVE HEAT (GREATER THAN 120'F) OR PHYSICAL DAMAGE. USE ONLY APPROVED PRESSURE VESSELS WITH APPROP.RELIEF DEVICES. ZINC,COPPER & COPPER BASE ALLOYS S CH AS BRASS ARE RAPIDLY CORRODED BY MOIST AMMONIA. EXPANSION OF LIQUID MAY CAUSE OVER FILLED CONTAINERS TO RUPTURE. PROLONGED INHALATION OF HIGH CONC. MAY CAUSE BRONCHITIS *

OTHER : * &/OR PNEUMONIA, W/SOME RESIDUAL REDUCTION IN PULMONARY FUN CTIONS. SYMPTOMS OF LUNG EDEMA ARE OFTEN LATENT (USUALLY FEW HRS) & ARE AGGRAVATED BY PHYSICAL EFFORT. RARE ALLERGIC MANIFESTATIONS MAY OCCUR FROM INHALATION. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING W/AMMONIA. EFFECTIVE RESP R- ATORY PROTECTION DEPENDS UPON TYPE & MAGNITUDE OF EXPOSURE.

S E C T I O N - 8

RESPIRATOR TYPE : NIOSH/MSHA APPROVED RESPIRATORY PROTECT FOR AMMONIA MUST BE USED WHEN EXPOSURE LIMITS ARE EXCEEDED. APPROP.PROTECTION DEPENDS ON THE TYPE & MAGNITUDE OF EXPOSURE.

VENTILATION- LOCAL EXHAUST: SHOULD BE USED SPECIAL: NOT LISTED
MECHANICAL : NOT LISTED OTHER : GENERAL DILUTION

PROTECTIVE GLOVES.....: RUBBER

EYE PROTECTION.....: CHEM.SPLASH GOGGLES TO PREVENT FROM LIQUID/VAPORS

OTHER PROTECTION.....: USE RUBBER GLOVES & RUBBER OR PVC/NYLON/PVC LAMINATE PROTECTIVE CLOTHING TO PREVENT SKIN CONTACT. A FACE SHIELD SHOULD BE USED WHEN APPROPRIATE TO PREVENT CONTACT W/SPLASHED LIQ.

WORK / HYGENIC.....: EMERGENCY EYE WASH STATIONS & DELUGE SHOWERS SHOULD BE AVAILABLE IN THE WORK AREA.POST A LIST OF TELEPHONE NUMBERS.

S E C T I O N - 9

MISCELLANEOUS DATA.....:

MATERIAL SAFETY DATA SHEET

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

CHEMICAL NAME

SECTION I . IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Hydrochloric Acid	HCl
SYNONYM OR CROSS REFERENCE Hydrogen Chloride Hydrochloride	CAS NO: 7647-01-0

SECTION II . HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD

SECTION III . PHYSICAL DATA

BOILING POINT About 110°C.	MELTING POINT
VAPOR PRESSURE 212 mm Hg at 20°C.	SPECIFIC GRAVITY 1.19
VAPOR DENSITY (AIR=1) 1.3	PERCENT VOLATILE BY VOLUME (%)
WATER SOLUBILITY Complete	EVAPORATION RATE (_____= 1)

APPEARANCE
Clear, colorless to light-yellow, fuming liquid; acrid odor.

SECTION IV . FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used) None	FLAMMABLE LIMITS	Lower	Upper

FIRE EXTINGUISHING MEDIA: Water, neutralize with chemically basic substances such as soda ash or slaked lime.

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD: Highly corrosive to most metals with evolution of hydrogen gas, which is highly flammable when mixed with air.

SECTION V . HEALTH HAZARD

THRESHOLD LIMIT VALUE
5 ppm (10 mg/M^3) orl-rbt LD_{50}: 900 mg/kg

HEALTH HAZARDS
Causes severe burns. May be fatal if swallowed.

FIRST AID PROCEDURES: Call a physician. In case of eye contact, flush with water for at least 15 minutes. For skin contact, flood with tap water, then water containing sodium bicarbonate. Do not give emetics. Give tap water, milk or milk of magnesia. Give whites of eggs beaten with water. Do not get in eyes, on skin or clothing. Do not breathe vapor.

SECTION VI . REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	

INCOMPATABILITY (materials to avoid)

Reacts with metals to produce hydrogen gas. Iron and aluminum are corroded readily.

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII . SPILL AND DISPOSAL PROCEDURES

SPILLS

Cover with sodium carbonate or an equal mixture of soda ash and slaked lime. Add water if necessary to form slurry. Alternatively, for small spills, use J.T. Baker's Acid Spill® Clean Up Kit (Product No. 4442); for large spills, use J.T. Baker's Neutrasorb® Acid Neutralizer (Product No. 4456).

DISPOSAL

Contact professional disposal service

SECTION VIII . PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

Self-contained breathing apparatus

VENTILATION	LOCAL	SPECIAL
	X	
	MECHANICAL (general)	OTHER
	X	

PROTECTIVE GLOVES	EYE PROTECTION
Rubber gloves	Safety glasses or goggles

OTHER PROTECTIVE EQUIPMENT

Approved working clothes. Have body shield available.

SECTION IX . HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING

Keep in tightly closed container in a cool place. Loosen closure cautiously.

SECTION X . MISCELLANEOUS INFORMATION

Do not get in eyes, on skin or clothing. Do not breathe vapor. Wash thoroughly after handling.

Date Issued: 3/84

Approved by R. M. Mitchell
Manager, Quality Assurance

Revision No. & Date Issued: _____

The information provided in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the users responsibility to determine the suitability of this information for the adoption of safety precautions as may be necessary. We reserve the right to revise Material Safety Data Sheets from time to time as new technical information becomes available. The user has the responsibility to contact the company to make sure that the sheet is the latest one issued.

MATERIAL SAFETY DATA SHEET

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

SECTION I . IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Acetic Acid, Glacial	CH_3COOH
SYNONYM OR CROSS REFERENCE	CAS NO:
Methane carboxylic acid; Ethanoic Acid	64-19-7

SECTION II . HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD

SECTION III . PHYSICAL DATA

BOILING POINT	MELTING POINT
240°C	Freezing point 62°F.
VAPOR PRESSURE	SPECIFIC GRAVITY
@ 20°C. 11.3mm	1.05
VAPOR DENSITY (AIR=1)	PERCENT VOLATILE BY VOLUME (%)
2.07	
WATER SOLUBILITY	EVAPORATION RATE
Soluble	(_____ = 1)

APPEARANCE
Clear, colorless liquid with strong pungent odor of vinegar.

SECTION IV . FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper
103°F. (closed cup)	@ 212°	5.4%	16%

FIRE EXTINGUISHING MEDIA: Water spray, dry chemical or carbon dioxide

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD
Gives off flammable vapor above its flash point

SECTION V . HEALTH HAZARD

THRESHOLD LIMIT VALUE
10 ppm orl-rat LD_{50}: 3310 mg/kg

HEALTH HAZARDS
Causes severe burns. POISON May be fatal if swallowed. Harmful if inhaled.

FIRST AID PROCEDURES Call a physician. If swallowed, do not give emetics. Give tap water, milk or milk of magnesia. Give whites of eggs beaten with water. If inhaled, remove to fresh air. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

SECTION VI . REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		Can react vigorously with oxidizing material
	STABLE	X	

INCOMPATABILITY (materials to avoid)

Carbonates; Hydroxides; many oxides and phosphates, etc.

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII . SPILL AND DISPOSAL PROCEDURES

SPILLS Eliminate all sources of ignition. Cover contaminated surfaces with soda ash or sodium bicarbonate. Mix and add water if necessary. Scoop up slurry and wash neutral (make litmus test) waste down drain with excess water, if local environmental regulations permit.

DISPOSAL Dispose through a waste treatment plant if local environmental regulations permit.

SECTION VIII . PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

Self-contained breathing apparatus

VENTILATION	LOCAL	SPECIAL
	X	
	MECHANICAL (general)	OTHER
	X	

PROTECTIVE GLOVES	EYE PROTECTION
Rubber gloves	Face shield

OTHER PROTECTIVE EQUIPMENT

Approved working clothes

SECTION IX . HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING

Keep away from heat and open flame. Keep in tightly closed container at a temperature above 17°C. (63°F.). If frozen, thaw by moving closed container to warm area. Loosen closure cautiously.

SECTION X . MISCELLANEOUS INFORMATION

Do not get liquid or vapor in eyes, on skin, on clothing. Avoid breathing vapor. Wash thoroughly after handling.

Date issued: 8/3/83 Revision: Approved by R. M. Mitchell

Manager, Quality Assurance

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- 00X'S

- 00

MATERIAL SAFETY DATA SHEET

(APPROVED BY THE U.S. DEPARTMENT OF LABOR AS - "essentially similar" to form OSHA-20)

DOW

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

FORM No. 174-242-73

Section 1 – NAME & PRODUCT

Manufacturer's Name	City, State and Zip Code	Emergency Phone No. 24 hour
DOW CHEMICAL U.S.A.	Midland, Michigan 48640	517 - 636-4400

Date this form written	Prepared by (Signature)
June 1, 1973	C T Kunimel

Trade Name: DIS-L006 Formic Acid 90%

Synonyms: Methanoic Acid

Section 2 – INGREDIENTS

	%	TLV (Units)
Formic acid	90	
Water	10	

Section 3 – PHYSICAL DATA

BOILING POINT (°F.)	223.7	SOLUBILITY IN WATER	Complete
VAPOR PRESSURE (mm Hg at 20°C)	22	SPECIFIC GRAVITY (H_2O : 1)	1.210
VAPOR DENSITY (air : 1)	1.6	% VOLATILE BY VOLUME	100%

APPEARANCE: Clear colorless fuming liquid with pungent odor.

Section 4 – FIRE AND EXPLOSION HAZARD DATA

Flash Point (and method used)	Flammable Limits (STP in air)	
142°F Tag Open Cup	L.F.L.	U.F.L.

EXTINGUISHING MEDIA: ☒ Water Fog ☐ Foam ☒ Alcohol Foam ☒ CO_2 ☒ Dry Chemical ☐ Other

Special Fire Fighting Protection Equipment and Hazards

Self-contained breathing apparatus in closed areas.

Section 5 – REACTIVITY DATA

STABILITY (Normal Conditions)				Conditions to avoid
X	STABLE		UNSTABLE	Can release hydrogen when in contact with metals

INCOMPATIBILITY

Materials to avoid

☐ Water ☐ Acid ☐ Base ☐ Corrosive ☒ Oxidizing Material

Other ☒ Hydrogen peroxide, furfuryl alcohol, sulfuric acid.

Hazardous Decomposition Products

Formic acid vapor, carbon dioxide, carbon monoxide.

HAZARDOUS POLYMERIZATION			Conditions to avoid
		MAY OCCUR	
	X	WILL NOT OCCUR	

Section 6 – SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled

Use proper protective equipment. Flush chemical to sewer for small spills. Confine by diking, soak up with absorbent material. Flush area with water.

Disposal Method

Incineration in adequate facilities or bury in approved landfill or discharge to biological treatment after consulting local authorities. Dilute to meet local regulations before discharge to receiving waters.

(FRONT)

Section 7 – HEALTH HAZARD DATA

Ingestion

Moderate single dose oral toxicity. However, formic acid is corrosive hence the main problem will be damage to mouth and to the esophagus.

Eye Contact

A burn.

Skin Contact

A burn.

Skin Absorption

Not likely to be a problem because of skin burn.

Inhalation

TLV: 5 ppm (1972)

Effects of Overexposure

Vapor irritating to eyes, nose and throat.

FIRST AID PROCEDURE			
EYE Flush with flowing water at least 15 minutes	EYES: Get medical help immediately. If physician has not arrived by first 15 minutes continue flushing eyes for another 15 minutes. SKIN: Immediately flush skin with plenty of water preferably in a shower while removing all contaminated clothing. Wash clothing before reuse or discard. INHALATION: Get person to fresh air and get medical help promptly. INGESTION: Not likely a problem. If swallowed, immediately give plenty of water (or milk if immediately available). DO NOT induce vomiting. Get medical help immediately.*	Never give fluids or induce vomiting if patient is unconscious or having convulsions

Section 8 – SPECIAL PROTECTION INFORMATION

Ventilation

Sufficient to control to TLV.

Respiratory Protection (Specify type)

For short exposure 1/2 hour or less and up to 2% a full face mask and an acid gas canister. For emergencies a self-contained breathing apparatus.

Protective Clothing

Clean body covering clothing, rubber gloves, apron and boots and a face shield even a rubber suit depending upon possible exposure.

EYE PROTECTION							
	☐	Not normally necessary	☐	Safety glasses without side shields	☐	Safety glasses with side shields	☒ Chemical workers goggles

☐ Gas tight goggles or equivalent ☒ Other Eye fountain and safety shower at work site.

Section 9 – SPECIAL PRECAUTIONS OR OTHER COMMENTS

Precautions to be taken in handling and storing

Do not get on skin or in eyes. Do not breathe vapors.

*NOTE TO PHYSICIAN: Formic acid is corrosive to tissue. If gastric lavage is done use esophagoscopic control.

NOTICE: The information herein is given in good faith but no warranty, express or implied, is made.

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

SECTION I . IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Hydrofluoric Acid	HF (in water)
SYNONYM OR CROSS REFERENCE	CAS NO: 7664-39-3

CHEMICAL NAME

SECTION II . HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD

SECTION III . PHYSICAL DATA

BOILING POINT	MELTING POINT
About 226°F	
VAPOR PRESSURE HF @ 20°C. 48%: 10 mm Hg	SPECIFIC GRAVITY 1.1-1.2
VAPOR DENSITY (AIR=1) 0.7	PERCENT VOLATILE BY VOLUME (%) 100
WATER SOLUBILITY Complete	EVAPORATION RATE (Ether = 1) >1.00

APPEARANCE
Colorless fuming liquid; sharp, penetrating odor.

SECTION IV . FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper
N.A. Non-Flammable	N.A.		

FIRE EXTINGUISHING MEDIA Water spray recommended as giving minimum splashing hazard.

SPECIAL FIRE-FIGHTING PROCEDURES Wear self-contained breathing apparatus approved by NIOSH; special protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARD Difficult to contain as it corrodes most substances except lead, wax, polyethylene and platinum. May generate hydrogen in contact with some metals.

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE 2 mg/M^3

HEALTH HAZARDS Causes skin irritation and burns. Severe irritation of eyes and eyelids. Effects are frequently delayed. Extremely irritating to respiratory tract.

FIRST AID PROCEDURES Inhalation: Remove at once to uncontaminated area - call a physician. For severe exposure, administer oxygen. Keep patient warm but not hot. Eyes: Flush immediately with water for 15 minutes - call a physician. Skin: Summon a physician and immediately flush with large quantities of cool water while removing contaminated clothing and shoes until all acid is removed, pay attention to skin under nails. Follow by immersing affected part in iced alcoholic or aqueous benzalkonium chloride solution, iced 70% alcohol or an ice-cold saturated solution of magnesium sulfate (epsom salt). If the burn is in such an area that it is impracticable to immerse the part, then apply solution with saturated compresses, which should be changed at least every 2 minutes. If these solutions are not available, continue washing in cool water for 2 to 4 hours or until medical attention is obtained.

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (materials to avoid)

Fluorine, arsenic trioxide, phosphorous pentoxide, alkalies.

HAZARDOUS DECOMPOSITION PRODUCTS

HF gas evolution increases with temperature.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL AND DISPOSAL PROCEDURES

SPILLS

Flush immediately, neutralize carefully with soda ash or lime and again flush with water.

DISPOSAL

Contact a professional disposal service.

SECTION VIII - PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

Self-contained breathing apparatus or supplied air (hose mask)

VENTILATION	LOCAL Strong natural or forced draft or complete enclosure of material	SPECIAL
	MECHANICAL (general)	OTHER

PROTECTIVE GLOVES Gauntlet-type, of neoprene, plasticized PVC or equivalent	EYE PROTECTION Chemical safety goggles and face shield

OTHER PROTECTIVE EQUIPMENT

See (1) below

SECTION IX - HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING

Store only in approved containers, avoid glass and some metals. Store below 125°F., preferably below 100°F., in well-ventilated area.

SECTION X - MISCELLANEOUS INFORMATION

(1) Full coverage of body with clothing including hat at all times (not required with small quantities); also rubber shoes with soles of neoprene or equivalent. When exposure is probable, wear complete protective clothing and use an acid hood with plastic window.

Date Issued:_____ Revision:_____ Approved by R. M. Mitchell

Manager, Quality Assurance

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MODIFIED: 10/19/1993 BY: PERIPXC 19960604 11:29:39.0
PPTS21M1

<<< BROWSE >>> M S D S # 2608 - S E C T I O N 1 - A G E N E R A L

MANUFACTURER NAME...: J. T. BAKER INC.

222 RED SCHOOL LANE

| ACTIVE MSDS.....: Y |
| APPROVED MSDS.....: Y |
| DATE PREPARED 09 / 09 / 1987 |

PHILLIPSBURG NJ 08865

NU STOCK COMMODITY CODE:
MANUFACTURERS CODE ID : 4123

TRADE/PRODUCT NAME.....: THIOUREA
CHEMICAL NAME / SYNONYM.: THIOCARBAMIDE; ISOTHIOUREA
CHEMICAL FAMILY.....: NONE ENTERED BY J.T. BAKER
TRAINING NAME.....: MISCELLANEOUS

EMERGENCY TELEPHONE NO..:(908) 859 - 2151 EXT. 0
INFORMATION TELEPHONE NO:(800) 424 - 8802 EXT. 0

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 1

ACTIVE MSDS: Y

PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

INGREDIENT NAME: THIOUREA
INGREDIENT TYPE:
OSHA PEL.....: PERCENT OF PRODUCT: 0095.000
ACGIH TLV.....: CAS NO.: 62-56-6
OTHER LIMITS...:
REGULATED BY...: - MASSACHUSETTS -

INGREDIENT NAME:
INGREDIENT TYPE:
OSHA PEL.....: PERCENT OF PRODUCT:
ACGIH TLV.....: CAS NO.:
OTHER LIMITS...:
REGULATED BY...: - -

MODIFIED: 10/19/1993 BY: PERIPXC 19960604 11:31:02.0
PPTS23M1

<<< BROWSE >>> M S D S - S E C T I O N 3
P H Y S I C A L / C H E M I C A L D A T A

ACTIVE MSDS: Y PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

BOILING POINT...: N/A SCALE:

SPECIFIC GRAVITY: 1.40 VAPOR PRES(MMHG): N/A

MELTING POINT...: 177 DECOMPOSES SCALE: CELSIUS

PERCENT VOLATILE: 0 VAPOR DEN(AIR=1): 2.6

EVAPORATION RATE: N/A EVAP. METHOD....: BUTYL ACETATE = 1

SOLUBILITY (H2O): MODERATE (1 TO 10%)

APPEARANCE/ODOR.: WHITE CRYSTALLINE SOLID WITH NO ODOR

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 4

MODIFIED: 10/19/1993 BY: PERIPXC 19960604 11:31:35.9
PPTS24M1

<<< BROWSE >>> M S D S - S E C T I O N 4
F I R E & E X P L O S I O N H A Z A R D D A T A
ACTIVE MSDS: Y

PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

FLASH POINT.....:
N/A : N. A.
COC :
TCC :
OTHER :

FLAMMABLE LIMITS...: N. A.

LEL PERCENT: UEL PERCENT:

EXTINGUISHING MEDIA: CO2: FOAM:
WATER: DRY CHEMICAL: WATER FOG:

PF13 = LOGOFF PF15 = MAIN MENU

<<< BROWSE >>> M S D S - S E C T I O N 4 (CONT.)

F I R E & E X P L O S I O N H A Z A R D D A T A

PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

SPECIAL FIRE FIGHTING PROCEDURES

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE. FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

UNUSUAL FIRE AND EXPLOSION HAZARDS

NOTE: DECOMPOSES AT MELTING POINT.
DUST MAY FORM EXPLOSIVE MIXTURE WITH AIR.
TOXIC GASES PRODUCED: AMMONIA, SULFUR DIOXIDE, CARBON MONOXIDE, CARBON DIOXIDE, NITROGEN OXIDES.

MODIFIED: 10/19/1993 BY: PERIPXC 19960604 11:32:02.2
PPTS25M1

<<< BROWSE >>> M S D S - S E C T I O N 5 - A
H E A L T H H A Z A R D D A T A

ACTIVE MSDS: Y
PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

PRODUCT PEL/TLV.:

UNIT OF MEASURE.:

CARCINOGENIC....: NTP....: X IARC MONOGRAPHS: X OSHA REGULATED:
MUTAGEN: TERATOGEN.....: NEUROTOXIN....:

ROUTES OF ENTRY.: INHALATION: X SKIN: X INGESTION: X

PF13 = LOGOFF PF15 = MAIN MENU

PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

EFFECTS OF OVER-EXPOSURE

INHALATION OF DUST MAY CAUSE IRRITATION TO UPPER RESPIRATORY TRACT. CONTACT WITH SKIN MAY CAUSE ULCERS, LOCAL DISCOLORATION, ECZEMA. SKIN ABSORPTION MAY BE HARMFUL. CONTACT CAN CAUSE EYE IRRITATION. INGESTION MAY CAUSE ALLERGIC SKIN ERUPTIONS, RETARD BLOOD COAGULATION, AND DAMAGE THYROID GLAND. CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE DAMAGE TO BLOOD, LIVER, AND THYROID.

SIGNS AND SYMPTOMS

PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN. IF SWALLOWED, IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. INDUCE VOMITING. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

MEDICAL CONDITIONS AGGRAVATED

SKIN DISORDERS, THYROID DISORDERS, LIVER DISORDERS, BLOOD DISORDERS.

R E A C T I V I T Y D A T A

ACTIVE MSDS: Y
PRODUCT NAME: THIOUREA
MANUFACTURER NAME: J. T. BAKER INC.

STABILITY...: STABLE

STABILITY CONDITIONS TO AVOID

HEAT, DUSTING

INCOMPATABILITY

STRONG OXIDIZING AGENTS, ACROLEIN, NITRIC ACID, HYDROGEN PEROXIDE.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 5643

PPTRS002

S E C T I O N 1 - A

MANUFACTURER NAME: FISHER SCIENTIFIC
ADDRESS LINE 1 : CHEMICAL DIVISION
ADDRESS LINE 2 : 1 REAGENT LANE
ADDRESS LINE 3 :
TOWN : FAIRLAWN STATE: NJ ZIP: 07410

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID :

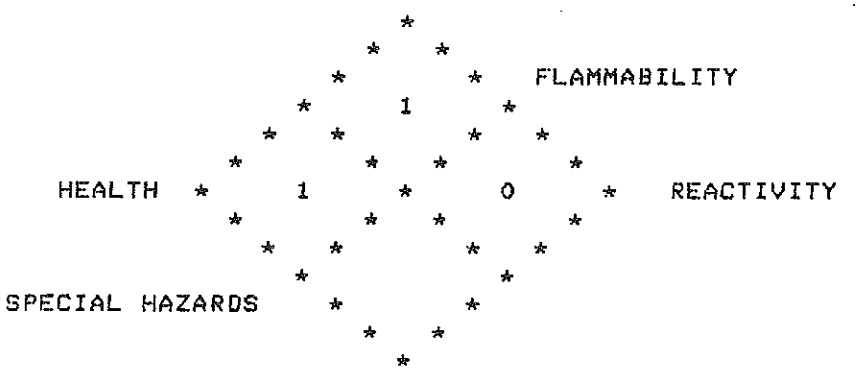
TRADE/PRODUCT NAME.....: SULFUR
CHEMICAL NAME/SYNONYM....: AGRI-SUL; BENSULFOID; COSAN; CRYSTEX; ELOSAL;
CHEMICAL FAMILY.....: NON-METALLIC ELEMENT
TRAINING NAME.....: LABORATORY REAGENT

EMERGENCY TELEPHONE NO..: 201-796-7100 00000

INFORMATION TELEPHONE NO: 201-796-7100 00000

DATE PREPARED : 12 / 03 / 1990

S E C T I O N 1 - B



FLAMMABILITY - FROM 0 (W:
HEALTH - FROM 0 (NO HEAL
REACTIVITY - FROM 0 (STA
SPECIAL HAZARDS - R R)I
W REAC
OX OXID

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
TARGET ORGAN/HEALTH EFFECTS:
NASAL: LG AMTS DUST; INFLAMMATION.
SKIN,EYES: IRRITATION,REDNESS,PAIN.
SMALL PARTICLES MORE TOXIC THAN
LARGER ONES BY INGESTION.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 5643

PPTRS002

S E C T I O N - 2

INGREDIENT NAME: SULFUR
INGREDIENT TYPE:
OSHA PEL.....: 5.00000 MILLIGRAMS/CUBIC METER PERCENT OF PRODUCT: 10(
ACGIH TLV.....: 5.00000 MILLIGRAMS/CUBIC METER CAS NO. : 7704-
OTHER LIMITS...:
REGULATED BY...: CONNECTICUT - MASSACHUSETTS - FEDERAL GOVERNMENT

S E C T I O N - 3

BOILING POINT : 832'F FAHRENHEIT
SPECIFIC GRAVITY : 2.07 VAPOR PRES(MMHG) : 1 @ 184'C
MELTING POINT : 235'F
PERCENT VOLATILE : NOT LISTED VAPOR DEN(AIR =1): NOT LISTED
EVAPORATION RATE : NOT LISTED EVAP. METHOD : NOT LISTED
SOLUBILITY (H20) : INSOLUBLE

APPEARANCE/ODOR.....: ODORLESS,TASTLESS PALE YELLOW SOLID

S E C T I O N - 4

FLASH POINT.....:
COC :
TCC :
OTHER : 405. FAHRENHEIT

FLAMMABLE LIMITS..: LEL: 35 GM/M3
LEL PERCENT: UEL PERCENT:

EXTINGUISHING MEDIA : FOAM WATER DRY CHEMICAL

SPECIAL FIRE PROCEDURES : MOVE CONTAINER FROM FIRE AREA IF W/OUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES TIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. MASSIVE FIRE IN CARGO AREA: USE UNMANNED HOSE HOLDER/MONITOR NOZZLES OR W/DRAW FROM AREA & LET FIRE BURN.

FIRE & EXPLOSION HAZARDS: APPLY WAER IF FLOODING QTYS AS FOG. COOL FIRE EXPOSED CONTAINERS W/FLOODING AMTS WATER APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING VAPORS/DUST. KEEP UPWIND.

S E C T I O N 5

PRODUCT TLV.....:
UNIT OF MEASURE....:

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.:
MUTAGEN.....: TERATOGEN..... :

ROUTES OF ENTRY....: INHALATION: X SKIN: X INGESTION: X

EFFECTS OF OVEREXPOSURE : INHALED: LG AMTS DUST MAY CAUSE CATARRHAL INFLAMMATION OF NASAL MUCOSA LEADING TO HYPERPLASIA W/NASAL SECRETIONS.
SKIN: IRRITATION,REDNESS,PAIN,SENSITIVITY TO SULFUR PARTICULARLY WHEN USED AS A TOPICAL AGENT IS RARE.
EYES: IRRITATION. DUST; IRRITATION,REDNESS,PAIN W/LACRIMATION,PHOTPHOBIA,CONJUNCTIVITIS & BLEPHAROCONJUNCTIVITIS.
INGESTED: LG DOSES BY MOUTH MAY LEAD TO HYDROGEN SULFIDE

SIGNS & SYMPTOMS : * PRODUCTION CHIEFLY DUE TO BACTERIAL ACTION W/IN THE COLON W/LESSER AMTS THIS UNLIKELY/RARE. SMALL PARTICLES GENERAL MORE TOXIC THAN LARGE ONES.

EMERGENCY AND FIRST AID : INHALED: MOVE TO FRESH AIR. STOPPED BREATHING: ARTIFICIAL RE RESPIRATION. KEEP WARM/AT REST. GET MED ATTN IMMED.
SKIN: REMOVED CONTAM.CLOTHING,SHOES. WASH AREA W/SOAP/MILD DETERGENT & WATER TIL NO CHEM.REMAINS, ABOUT 15-20 MIN. G MED ATTN. EYES: WASH IMMED.W/LG AMTS WATER OR NORMAL SALINE LIFTING LIDS OCCASIONALLY ABOUT 15-20 MIN. GET MED ATTN.
INGESTED: TREAT SYSTOMATICALLY/SUPPORTIVELY. GET MED ATTN
IF VOMITING, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION

MEDICAL CONDITIONS : NONE LISTED

S E C T I O N - 6

STABILITY .....: STABLE

'STABILITY'
CONDITIONS TO AVOID : STABLE UNDER NORMAL TEMPERATURES & PRESSURES
AVOID CONTACT W/HEAT,SPARKS,FLAMES OR OTHER SOURCES OF IGNI-
TION. MAT'L EXTREMELY FLAMMABLE & MAY BURN RAPIDLY W/FLAR -
BURNING EFFECT.

INCOMPATABILITY.....: ALKALI METAL NITRIDES, ALUMINUM POWDER, AMMONIA, AMMONIUM
NITRATE, BORON,BROMATES,CADMIUM,CALCIUM,CALCIUM HYPOCHLORITE
CALCIUM PHOSPHIDE,CARBON(ACTIVATED),CHLORATES,CHLORINE DIOX-
IDE,CHLORINE MONOXIDE,CHLORINE TRIOXIDE, SEE MSDS FOR MOR .

HAZARDOUS DECOMP.....: TOXIC OXIDES OF SULFUR.

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : NONE LISTED

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : SHUT OFF IGNITION SOURCES. DO NOT TOUCH MATERIAL.
SMALL SPILLS: USE CLEAN SHOVEL, PLACE INTO CLEAN,DRY CONT IN
ER & COVER. MOVE CONTAINERS FROM SPILL AREA. LGR SPILLS:
WET DOWN W/WATER & DIKE FOR LATER DISPOSAL. NO SMOKING,FLAME
OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY.
ISOLATE HAZARD AREA & DENY ENTRY.

WASTE DISPOSAL METHOD : EXTINGUISHING MEDIA: SUITABLE FOR TYPE OF SURROUNDING MAT ..
OBSERVE ALL FED., STATE & LOCAL REGS WHEN STORING OR DISPOS-
ING THIS SUBSTANCE. FOR ASSISTANCE, CONTACT DIST.DIRECTOR
OF ENVIRONMENTAL PROTECTION AGCY

PRECAUTIONS - :
HANDLING AND STORING : STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

OTHER : AVOID CONTACT W/HEAT, SPARKS, FLAMES OR OTHER SOURCES OF
IGNITION. MATERIAL IS EXTREMELY FLAMMABLE & MAY BURN RAP J-
LY W/FLARE-BURNING EFFECT.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 5643

PPTRS002

S E C T I O N - 8

RESPIRATOR TYPE : ANY DUST/MIST RESPIRATOR W/FULL FACEPIECE.
ANY AIR PURIFYING FULL FACEPIECE RESP W/HIGH EFF.PART.FILTER
FIREFIGHTING: SELF CONTAINED BREATHING APPARATUS W/FULL F CE
PIECE OPERATED IN PRESSURE DEMAND OR OTHER POS.PRESS.MODE.

VENTILATION- LOCAL EXHAUST: NOT LISTED SPECIAL: NOT LISTED
MECHANICAL : GEN'L DILUTION OTHER : NOT LISTED

PROTECTIVE GLOVES.....: APPROP.PROTECTIVE GLOVES

EYE PROTECTION.....: SPLASH PROOF OR DUST RESIST SAFETY GOGGLES

OTHER PROTECTION.....: WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING & EQUIP-
MENT TO PREVENT REPEATED/PROLONGED SKIN CONTACT W/THIS SUB-
STANCE.

WORK / HYGENIC.....: EYE WASH FOUNTAIN W/IN THE IMMEDIATE WORK AREA FOR EMERGENCY
USE.

S E C T I O N - 9

MISCELLANEOUS DATA.....:

MATERIAL SAFETY DATA SHE -0496A

P.O. Drawer 1410 - 1600 E. Hill St., Long Beach, CA 90801
Contact: Safety Department - Telephone: (213) 427-5471

February 1989

WARNING STATEMENT

DANGER! Extremely Flammable. Keep away from heat, sparks and open flame. Vapor reduces oxygen available for breathing and may cause suffocation in confined spaces. Use only with adequate ventilation. Odor may not provide adequate warning of potentially hazardous concentrations. Vapor is heavier than air and collects in low levels. Liquid may cause freeze burn similar to frostbite.

I. Product Identification

Product Name: Petrolane Propane
Chemical Name: Propane
Synonyms: LP-Gas, Bottled Gas
Chemical Family: Paraffinic Hydrocarbon
Chemical Formula: C_3H_8
DOT Proper Shipping Name: Liquefied Petroleum Gas
DOT Hazard Class: Flammable Gas
DOT I.D. Number: UN1075

Transportation Emergency Telephone:
800-424-9300 (CHEMTREC)

NFPA Classification:

Health	1	Slightly Toxic
Fire	4	Extremely Flammable
Reactivity	0	Stable

II. Hazardous Ingredients

Component	CAS Number	%	OSHA PEL	ACGIH TLV
Ethane	74-84-0	0-6	None established	Simple asphyxiant
Propane	74-98-6	87-97	1000 ppm (8hr)	Simple asphyxiant
Propylene	115-07-1	0-5	None established	Simple asphyxiant
Butane	106-97-8	0-2.5	None established	800 ppm (8 hr)

III. Physical Data

Boiling Point: -44°F
Melting Point: -309°F
Vapor Pressure: 208 psig (max.) @ 100°F
Vapor Density (Air=1): 1.5
Specific Gravity (H_2O=1): 0.504
Appearance and Odor: Colorless, odorless in pure form. Propane contains a foul smelling, skunk-like warning agent(odorant). The odorant is effective, in most instances, but not everyone can smell the odor. The ability of people to detect odors varies widely. Also, certain chemical reactions with material in the propane system can reduce the propane odor level. No odorant will be 100% effective in all circumstances. If odor level appears to be weak, notify propane supplier immediately.

% Volatile by Volume: 100%
Solubility in Water: Insoluble
Evaporation Rate(Bu Ac=1): N/A
Gas Volume @ Atm. Pressure & 60°F (Cu. ft. gas/gal. liquid): 36.4

IV. Fire and Explosion Data

Flash Point (Method Used): -156°F (estimated)
Flammable Limits (% Volume in Air): Lower 2.1% Upper 9.5%

Extinguishing Media: Dry chemical, foam or CO_2 for small fires. Stop flow of gas first.

Special Fire Fighting Procedures and Precautions: Elimimate sources of ignition. Evacuate area. Notify fire department. Allow only trained, properly protected personnel in area. Shut off source of gas, if possible. Allow fire to burn itself out after gas flow is shut off. High volume water supply can be used to cool heat-exposed pressure containers and nearby equipment. Approach a flame enveloped container from the side, never the head ends. Use extreme caution when applying water to a container which has been exposed to heat or flame for more than a short time. Shock of cool water on hot metal could cause container rupture. For uncontrollable fires and when flame is impinging on container, withdraw all personnel and evacuate surrounding vicinity immediately.

Unusual Fire and Explosion Hazards: Products of combustion may yield carbon monoxide, a toxic gas. Uncontrolled vapors spread rapidly, are heavier than air and are extremely flammable.

V. Reactivity Data

Stability: Stable Conditions to Avoid: High heat, sparks, open flame
Materials to Avoid: Strong oxidizing agents
Hazardous Decomposition Products: Incomplete combustion can cause carbon monoxide, a toxic gas.
Hazardous Polymerization: Will not occur Conditions to Avoid: None

VI. Health Hazard Data

Product is not listed as carcinogenic by NTP, IARC or OSHA. Product may contain a trace, but detectable amount of benzene, a chemical listed by the State of California and known to cause cancer or reproductive toxicity.

Routes of Entry / Acute Effects of Overexposure:

Inhalation: Exposure to high concentrations of the vapor causes dizziness, drowsiness, nausea or unconsciousness due to anesthetic properties.

Skin Contact: Liquid can cause freeze burns similar to frostbite if contact with skin occurs. No skin absorption is expected.

Eye Contact: Liquid can cause freeze burns if contact with eyes occurs.

Ingestion: Ingestion is not expected to occur in normal use.

Chronic Effects of Overexposure: No abnormal reactions reported following exposure to 1000 ppm for 8 hours per day, 5 days per week, for 2 weeks.

Medical Conditions Generally Aggravated by Exposure: Persons with chronic respiratory diseases should avoid exposure.

VII. Emergency and First Aid Procedures

Eye Contact: Flush with water. Obtain medical assistance if contact with liquid has occurred.

Skin Contact: If freeze burn occurs, remove contaminated clothes, shoes and jewelry. Immerse burned area in warm (not hot) water. Keep immersed. Call for medical assistance.

Inhalation: Remove victim from further exposure and into fresh air. Provide oxygen if breathing is labored. If victim is unconscious, seek immediate medical attention. If breathing has stopped, give artificial respiration.

Ingestion: Not expected to occur in normal use.

VIII. Spill or Leak Procedures

Product is extremely flammable. Vapor is heavier than air and may collect at lower levels. Flammable concentrations may be present below nose level. If there is a leak but no fire, do not light the escaped gas. Eliminate all ignition sources. Do not smoke, use a nearby phone or actuate electrical switches. Evacuate the area. If possible, remove leaking container to safe area. Stop flow of gas or allow vapor to disperse in a safe area. Water spray can be used to help dilute vapor concentration in air.

Dispose of gas only by controlled burning in compliance with local laws and regulations.

IX. Handling and Storage Precautions

Store in an authorized location (outside, detached storage is preferred) with adequate ventilation. Keep away from heat and ignition sources. Inspect cylinders frequently for leaks, dents, gouges and corrosion with emphasis on bottom of cylinder. Store cylinders in upright position or with pressure relief valves in vapor space. Do not drop or abuse cylinders. Keep container valve closed and plugged when not in use. Install protective caps when cylinders are not connected for use. Empty containers retain some residue, so they should be treated as if they are full.

X. Personal Protection Information

Ventilation: Use adequate ventilation to maintain exposures below recommended limits.

Respiratory Protection: Use a NIOSH-approved respirator if area is thought to contain unknown concentration of gas.

Eye Protection: Use safety goggles or safety glasses with side shields.

Protective Clothing: No special garments are necessary, but avoid skin contact with liquid because of possibility of freeze burn. Propane resistant gloves are recommended.

XI. Communication with Employees and Purchasers

This Material Safety Data Sheet (MSDS) alerts the reader to the potential safety and health hazards of propane. It also contains valuable reference material relating to the safe use and handling of the product. Make sure that this information is shared with all employees and purchasers who use or handle the product. It is an important part of the OSHA hazard communication program.

This information is believed to be accurate as of the date of issue, but is offered without guarantee. Conditions of use and suitability for use are beyond Company control, therefore, all risks of use of the product are assumed by the user. COMPANY EXPRESSLY DISCLAIMS ALL WARRANTIES OF EVERY KIND INCLUDING WARRANTIES OF MERCHANTIBILITY AND FITNESS FOR ANY PARTICULAR PURPOSE. Company assumes no responsibility for any injuries or damages caused by the product even if safety procedures are followed as outlined herein. Nothing herein is intended to be construed as permission or recommendation for use of the product in any manner which might infringe existing patents.

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 3114

PPTRS002

S E C T I O N 1 - A

MANUFACTURER NAME: UNION CARBIDE CORPORATION
ADDRESS LINE 1 : TARRYTOWN TECHNICAL CENTER
ADDRESS LINE 2 :
ADDRESS LINE 3 :
TOWN : TARRYTOWN STATE: NY ZIP: 10591

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID :

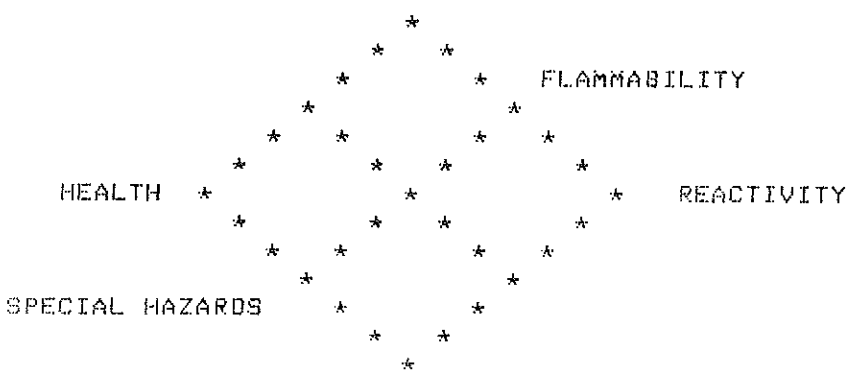
TRADE/PRODUCT NAME.....: PROPYLENE GLYCOL SOLVENT (INDUSTRIAL GRADE)
CHEMICAL NAME/SYNONYM....: 1,2-PROPENEDIOL
CHEMICAL FAMILY.....: GLYCOLS & TRIOLS
TRAINING NAME.....: SOLVENT

EMERGENCY TELEPHONE NO..: 914-789-2232 00000

INFORMATION TELEPHONE NO: 000-000-0000 00000

DATE PREPARED : 01 / 01 / 1986

S E C T I O N 1 - B



FLAMMABILITY - FROM 0 'W
HEALTH - FROM 0 (NO HEAL
REACTIVITY - FROM 0 (STA
SPECIAL HAZARDS - R R)I
W REAC
OX OXID

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
TARGET ORGAN/HEALTH EFFECTS:
SKIN, EYE, INGESTION, INHALATION:
NO ADVERSE EFFECTS FROM AVAILABLE
INFORMATION.

S E C T I O N - 2

INGREDIENT NAME: PROPYLENE GLYCOL SOLVENT
INGREDIENT TYPE:
OSHA PEL.....:
ACGIH TLV.....:
OTHER LIMITS...:
REGULATED BY...:

PERCENT OF PRODUCT: 10
CAS NO. :

S E C T I O N - 3

BOILING POINT	: 187.3	CELSIUS	
SPECIFIC GRAVITY	: 1.0381 @ 20/20C	VAPOR PRES(MMHG)	: 0.1
MELTING POINT	:		
PERCENT VOLATILE	: NIL	VAPOR DEN(AIR = 1)	: 2.62
EVAPORATION RATE	: 0.005	EVAP. METHOD	: BUTYL ACETATE = 1
SOLUBILITY (H2O)	: COMPLETE		

APPEARANCE/ODOR.....: WATER WHITE LIQUID. MILD ODOR

S E C T I O N - 4

FLASH POINT.....:

COC	:	225.	FAHRENHEIT
TCC	:	214.	FAHRENHEIT
OTHER	:		

FLAMMABLE LIMITS..:
LEL PERCENT: 2.60 % UEL PERCENT: 12.50 %

EXTINGUISHING MEDIA : CO2 FOAM DRY CHEMICAL WATER FOG

SPECIAL FIRE PROCEDURES : USE CARBON DIOXIDE OR DRY CHEMICAL FOR SMALL FIRES. ALCOHOL TYPE FOAM OR WATER SPRAY FOR LARGE FIRES. USE SELF CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING.

FIRE & EXPLOSION HAZARDS: NONE
NOTE: SEE "WARNING" STATEMENT ATTACHED TO MSDS FROM UNION CARBIDE CORP.

S E C T I O N 5

PRODUCT TLV.....:
UNIT OF MEASURE....:

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.: (
MUTAGEN.....: TERATOGEN..... :)

ROUTES OF ENTRY....: INHALATION: SKIN: INGESTION:

EFFECTS OF OVEREXPOSURE : INGESTION, SKIN ABSORPTION, SKIN CONTACT, INHALATION, EYE CONTACT: NO EVIDENCE OF ADVERSE EFFECTS FROM AVAILABLE INFORMATION.

SIGNS & SYMPTOMS : ***** N O N E E N T E R E D *****

EMERGENCY AND FIRST AID : INGESTION: NO HARMFUL EFFECTS EXPECTED.
SKIN: WASH WITH SOAP & WATER.
INHALATION: NO EMERGENCY CARE ANTICIPATED.
EYES: FLUSH WITH WATER.

MEDICAL CONDITIONS : NONE LISTED

S E C T I O N - 6

STABILITY .....: STABLE

'STABILITY'
CONDITIONS TO AVOID : NONE

INCOMPATABILITY.....: NONE
NOTE: SEE "WARNING" STATEMENT ATTACHED TO MSDS FROM UNION CARBIDE CORP.

HAZARDOUS DECOMP.....: BURNING CAN PRODUCE CARBON MONOXIDE AND/OR CARBON DIOXIDE

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : NONE

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : SMALL SPILLS SHOULD BE FLUSHED WITH LARGE QUANTITIES OF WATER. LARGER SPILLS SHOULD BE COLLECTED FOR DISPOSAL.

WASTE DISPOSAL METHOD : INCINERATE IN A FURNACE WHERE PERMITTED UNDER APPROPRIATE FEDERAL, STATE & LOCAL REGULATIONS.

PRECAUTIONS - :

HANDLING AND STORING : NORMAL PRECAUTIONS COMMON TO GOOD MANUFACTURING PRACTICE SHOULD BE FOLLOWED IN HANDLING & STORAGE.

OTHER : NONE

S E C T I O N - 8

RESPIRATOR TYPE : NONE REQUIRED

VENTILATION- LOCAL EXHAUST: SPECIAL:
MECHANICAL : X OTHER :

PROTECTIVE GLOVES.....: NONE REQUIRED, BUT RUBBER IS SUGGESTED

EYE PROTECTION.....: SAFETY GLASSES

OTHER PROTECTION.....: NONE LISTED.

WORK / HYGENIC.....: EYE BATH. SAFETY SHOWER.

S E C T I O N - 9

MISCELLANEOUS DATA.....:

AMAX Minerals+Energy

MATERIAL SAFETY DATA SHEET

SODIUM MOI (Crystall -0373A

PRODUCT IDENTITY	EMERGENCY CONTACT
CHEMICAL NAME: Molybdic Acid, Disodium Salt TRADE NAME: Sodium Molybdate (Crystalline) FORMULA: $Na_2MoO_4.2H_2O$ CAS NO.: 7631-95-0 PHYSICAL FORM: Powder	CORP. MANAGER OF INDUSTRIAL HYGIEN AMAX INC. AMAX CENTER GREENWICH, CONNECTICUT 06836 TELEPHONE NO.: (203) 629-7112

COMPOSITION

MATERIAL	CAS NO.	%	PERMISSIBLE AIR LEVEL
Sodium Molybdate (Crystalline)	10102-40-6	100.0	OSHA: 5 mg/m^3 ACGIH: 5 mg/m^3

HEALTH HAZARD INFORMATION

OSHA PERMISSIBLE EXPOSURE LEVEL: 5 mg/m^3
ACGIH THRESHOLD LIMIT VALUE: 5 mg/m^3

PRIMARY ROUTE OF ENTRY: Inhalation, skin and eye contact.

SYMPTOMS AND EFFECTS

ACUTE OVEREXPOSURE: May result in eye or respiratory tract irritation.

CHRONIC OVEREXPOSURE: USSR studies in 1961 & 1966 found signs of gout in factory workers and among inhabitants of molybdenum rich areas of Armenia. However, a 1979 U.S. study found no evidence of molybdenum induced gout.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY THIS MATERIAL:

Chronic respiratory disease and gout may be aggravated by exposure to this material.

IS THIS MATERIAL CONSIDERED TO BE CARCINOGENIC BY:

NTP? No IARC? No OSHA? No

EMERGENCY AND FIRST AID PROCEDURES

If a person breathes in a large amount of dust, remove from exposure; if breathing has stopped, perform artificial respiration. Call a physician.

If irritation of the eyes, nose or throat occur, remove from exposure, flush eyes with water for 15 minutes and call a physician.

EXPOSURE CONTROL MEASURES

ENGINEERING: Use ventilation to maintain exposure levels within the OSHA limit.

PERSONAL PROTECTIVE EQUIPMENT: Use a NIOSH/MSHA approved respirator if exposures exceed the OSHA limit. Wear eye protection when handling material.

REACTIVITY DATA

STABILITY: This material is stable.

INCOMPATABILITY: None known.

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION: Will not occur.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: Not applicable (NA). FLAMMABLE LIMITS: LEL NA UEL NA

EXTINGUISHING MEDIA: Dry chemical or dry sand.

SPECIAL FIRE FIGHTING PROCEDURES: Wear protective fire fighting clothing and self contained breathing equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: See "Reactivity Data" section above.

PRECAUTIONS FOR SAFE HANDLING AND USE

PRECAUTIONS FOR HANDLING AND STORAGE: None necessary.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Cleanup by vacuuming to minimize dust exposure. Provide cleanup employees with respirators for dusty conditions.

WASTE DISPOSAL METHODS: Dispose of in accordance with federal, state and local laws and regulations.

NOTE: THIS MATERIAL WAS REPORTED ON THE INITIAL TSCA INVENTORY.

PHYSICAL/CHEMICAL CHARACTERISTICS

MELTING POINT: 687°C SPECIFIC GRAVITY (H_2O=1): 2.56

VAPOR PRESSURE @ 20°C: Essentially 0 SOLUBILITY IN WATER: 56 gm/100cc @ 0°C

APPEARANCE AND ODOR: White, odorless powder.

DATE PREPARED: November 14, 1985 DATE REVISED: Original

MATERIAL SAFETY DATA SHEET COBRATEC® TT-50-S

RECI -1111A

AUG 19 1987

SAFETY DEPT.

SECTION I

MANUFACTURER	PMC Specialties Group, Inc.
ADDRESS:	501 Murray Road Cincinnati, Ohio 45217
EMERGENCY TELEPHONE:	(513) 242-3300
CHEMICAL NAME AND SYNONYMS:	Sodium Tolyltriazole, 50% Water Solution
TRADE NAME AND SYNONYMS:	COBRATEC® TT-50-S
CHEMICAL FAMILY:	Triazole
FORMULA:	$C_7H_6N_3Na$
CAS REGISTRY NUMBER:	64665-57-2
DOT SHIPPING CLASSIFICATION:	Corrosive Liquid N.O.S. - NA 1760
PRODUCT NUMBER:	X18WT7440

SECTION II HAZARDOUS INGREDIENTS

MATERIAL:	%	TLV (Units)
Tolyltriazole, sodium salt	50	Not Established
Sodium Hydroxide, CAS No. 1310-73-2	<0.5	TWA=2mg/m^3

SECTION III PHYSICAL DATA

BOILING POINT, 760mm. Hg:	~100°C
FREEZING POINT:	-8°C
SPECIFIC GRAVITY:	1.19 @ 25°C
VAPOR PRESSURE AT 20°C.	0.04 mm
VAPOR DENSITY:	Not Applicable
SOLUBILITY IN WATER:	Miscible in all proportions
% VOLATILES BY VOLUME:	50% as water
EVAPORATION RATE (Butyl Acetate = 1):	Not Applicable
APPEARANCE AND ODOR:	Clear, yellow to amber solution, nearly odorless, pH =13.5

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	Not Applicable
AUTOIGNITION TEMPERATURE:	Not Applicable
FLAMMABLE LIMITS IN AIR:	
LOWER Not Applicable UPPER	Not Applicable
EXTINGUISHING MEDIA:	Not Applicable

SPECIAL FIRE FIGHTING PROCEDURES: Full protective equipment including self-contained breathing apparatus should be used, when COBRATEC® TT-50-S is present during a fire. During emergency conditions over exposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain Medical Attention.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Closed containers may rupture or explode due to steam pressure build-up when exposed to extreme heat. Water may be used to cool closed containers.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: None established. For Sodium Hydroxide TWA=2mg/m^3

EFFECTS OF OVEREXPOSURE: Corrosive. It is an irritant. Prolonged contact can be destructive to tissue. Contact with the eyes may severely damage delicate eye tissue. Exposure to large amounts is capable of producing serious injury.

EMERGENCY AND FIRST AID PROCEDURES: If on SKIN: Wash affected area thoroughly with soap and water. Remove contaminated clothing, rings, etc. If in EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention. If SWALLOWED: Never give anything by mouth to an unconscious person. DO NOT INDUCE VOMITING. Give large amounts of water, vinegar 1:4 or lemon juice. Follow with milk. Seek medical attention.

TOXICITY DATA:(Tolyltriazole)

Oral LD_{50} (rats): 675 mg/kg.

Dermal LD_{50} (rabbit): >2 gm/kg

Inhalation 3 hour LC_{50} (rats): >1.75 mg/L*

* Actual concentration measured in breathing zone. COBRATEC® TT-50-S is a highly caustic material and should be considered corrosive to the eyes and skin.

SECTION VI REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY: Oxidizing agents, strong acids
HAZARDOUS DECOMPOSITION PRODUCTS: By fire: carbon dioxide, carbon monoxide, nitrogen oxides, HCN possible in reducing atmospheres.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED: Pick up spill on suitable absorbent material. Flush spill area with water.

WASTE DISPOSAL METHOD: Sanitary landfill or incinerate in approved facilities in accordance with local, state, and federal regulations regarding pollution. Do not heat or incinerate in closed containers.

SECTION VIII SPECIAL PROTECTIVE INFORMATION

RESPIRATORY PROTECTION: If personal exposure cannot be controlled below applicable exposure limits by ventilation, wear respiratory devices approved by NIOSH/MSHA for protection against organic vapors, dusts, fumes and mists.

VENTILATION: Local exhaust is recommended.
PROTECTIVE GLOVES: Necessary to avoid skin contact.
EYE PROTECTION: Use safety glasses with unperforated side shields, or full face shield when danger of splashing is great.
OTHER PROTECTIVE EQUIPMENT: Rubber apron or similar protective clothing to prevent contact with skin or clothes.

SECTION IX SPECIAL PRECAUTIONS

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CORROSIVE MATERIAL Avoid contact with skin, eyes, and clothing. DO NOT TAKE INTERNALLY. Clean up spills immediately.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep containers tightly closed when not in use. Store only in containers which are resistant to caustic solutions.

DATE PREPARED: June 26, 1985

MATERIAL SAFETY DATA SHEET

-0429

PRODUCT NAME Cable Clean (aerosol) #02069	# MSDS#02069
MANUFACTURED BY: CRC CHEMICALS	Phone (215) 674-4500
885 LOUIS DRIVE, WARMINSTER, PA. 18974	

1. INGREDIENTS

	CAS #	ACGIH TLV	OSHA PEL	Other Limits	%
1,1,1 Trichloroethane	71-55-6	350	350		89.2
Diethylene ether	123-91-1	25	100		
Methyl butynol	115-19-5	N/A	N/A		<6.8
Sec. butyl alcohol	78-92-2	100	150		
Carbon dioxide	124-34-9	5000	5000		4.0

2. PHYSICAL DATA (does not include carbon dioxide propellent)

Specific Gravity	1.293 (@70°F)	Vapor Pressure	73 mm Hg @ 20°C	% Volatile	100 %
Boiling Point	164°F	Evaporation Rate	Rapid		
Freezing Point	N/A	Vapor Density	4.16 (air = 1)		

Appearance and Odor: Colorless liquid - irritating odor at high concentrations.

Solubility: Slight solubility in water - good solvent for many organic materials.

3. FIRE AND EXPLOSION DATA

Flashpoint None	Method TCC, COC, TOC	Flammable Limits	
Extinguishing Media	Water, fog	LEL 7.0	UEL 15.5

Unusual Hazards: Aerosol cans may explode if their temperature exceeds 130°F.

4. REACTIVITY AND STABILITY

Stability: Good - Avoid exposures to open flames, arcs, and high temperatures.

Hazardous decomposition products: Thermal - Hydrogen chloride, chlorine and some phosgene.

Materials to avoid: Avoid storage in aluminum containers or contact with aluminum and/or zinc powder.

5. PROTECTION INFORMATION

Ventilation: Maintain vapor concentration below TLV - Use mechanical means if necessary.

Respiratory: Above TLV use self contained breathing apparatus (air mask or vapor mask).

Gloves	solvent resistant	Eye & Face	Safety glasses

Other Protective Equipment: Not normally required for aerosol product usage.

MSDS 002069

6. HEALTH HAZARD DATA

Primary Routes of Entry	Inhalation and skin contact
Signs and Symptoms of Exposure	
1. Acute Overexposure	Inhalation - headaches, dizziness, anesthesia, unconsciousness. Eyes - causes pain and some irritation. Skin - irritation on repeated exposures.
2. Chronic Overexposure	Repeated overexposures may cause liver and kidney effects.
Medical Conditions Generally Aggravated by Exposure	High levels (8000 ppm +) of vapor may cause cardiac arrthymias.

Chemical Listed as Carcinogen or Potential Carcinogen — National Toxicology Program: Yes ☐ No ☒ — IARC Monographs: Yes ☐ No ☒ — OSHA: Yes ☐ No ☒

Emergency and First Aid Procedures	(If symptoms persist, call a physician)
1. Inhalation	Remove to fresh air , apply artificial respiration if necessary.
2. Eyes	Flush for 15 minutes with large amounts of water.
3. Skin	Remove contaminated clothing; wash exposed area with soap and water.
4. Ingestion	Do not induce vomiting - Call physician.

7. SPILL OR LEAK PROCEDURES

Precautions to be taken in Handling and Storage	Store in a cool, dry place.
Steps to be taken in case Materials is released or spilled	Usually not a problem with aerosols . Area should be ventilated and absorbent used to pick up excess material.
Waste Disposal	Discarded full cans or partially filled cans are considered Hazardous Waste - Dispose of in conformance with Local, State and Federal regulation

8. SPECIAL PRECAUTIONS AND USE DIRECTIONS

Avoid prolonged skin contact or breathing of vapors. Since vapors are heavier than air, aerosols should not be used in confined areas or low spots without adequate ventilation. If vapors are suspected in a low area, do not enter unless special breathing apparatus is used and an observer is present for assistance.

Keep aerosols away from heat.

PREPARED BY: Allen B. Reed

ORIGINAL DATE OR DATE OF REVISION Nov. 30 1987

SAFETY-KLEEN 105 SOLVENT

MATERIAL SAFETY DATA SHEET FOR U.S.A. AND CANADA #0098

SECTION 1 -- PRODUCT AND PREPARATION INFORMATION

PRODUCT INFORMATION

IDENTITY (TRADE NAME):	SAFETY-KLEEN 105 SOLVENT
SYNONYMS:	Mineral Spirits, Stoddard Solvent, Petroleum distillates, Petroleum naphtha
SK PART NUMBER(S):	6617
FAMILY/CHEMICAL NAME:	Aliphatic hydrocarbon
PRODUCT USE:	Cleaning and degreasing metal parts. If this product is used in combination with other chemicals, refer to the Material Safety Data Sheets for those chemicals.

24-HOUR EMERGENCY TELEPHONE	*MEDICAL:*	*TRANSPORTATION:*
These numbers are for emergency use only. If you desire non-emergency information about this product, please call a telephone number listed below.	**1-800-752-7869 (U.S.A.)** **1-312-942-5969 (CANADA)** **RUSH POISON CONTROL CENTER** **CHICAGO, ILLINOIS, U.S.A.**	**1-708-888-4660 (U.S.A.)** **SAFETY-KLEEN ENVIRONMENT, HEALTH AND SAFETY DEPARTMENT** **1-613-996-6666 (CANADA)** **CANUTEC**

MANUFACTURER/SUPPLIER: Safety-Kleen Corp. - 777 Big Timber Road - Elgin, IL, U.S.A. 60123
Telephone number: 1-800-669-5840
Safety-Kleen Canada Inc. - 3090 Blvd. Le Carrefour - Suite 300 - Chomedey Laval
Quebec, Canada H7T 2J7 Telephone number: 1-800-363-2260

PREPARATION INFORMATION

MSDS FORM NO.: 82310 *REVISION DATE:* January 15, 1992

ORIGINAL ISSUE DATE: July 20, 1989 *SUPERSEDES:* December 14, 1990

PREPARED BY: Product MSDS Coordinator *APPROVED BY:* MSDS Task Force

TELEPHONE NUMBER: **For Product Technical Information Call 1-312-694-2700 (U.S.A.); 1-800-363-2260 (Canada)**

SECTION 2 -- HAZARDOUS COMPONENTS

NAME	SYNONYM	CAS NO.	WT%	OSHA PEL TWA (ppm)	OSHA PEL STEL (ppm)	ACGIH TLV TWA (ppm)	ACGIH TLV STEL (ppm)	OTHER DATA LD[a]	OTHER DATA LC
Parts Washer Solvent (consists predominantly of C9-C13 saturated hydrocarbons)	Mineral Spirits	64741-41-9	85.0	100[c]	N.Av.	100[c]	N.Av.	>5000[c]	>5500[b,c] mg/m^3/4 hours
C8$^+$ Aromatics	N.Av.	mixture	12.0	N.Av.	N.Av.	N.Av.	N.Av.	N.Av.	N.Av.
*Xylene[e]	Dimethylbenzene	1330-20-7	1.0	100	150	100	150	4300	5000[b] ppm/4 hours
*Ethylbenzene[e]	Phenylethane	100-41-4	0.5	100	125	100	125	3500	4000[d] ppm/4 hours

- 4 -

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Individuals with pre-existing lung, cardiac, central nervous system or skin disorders may have increased susceptibility to the effects of exposure.

CARCINOGENICITY: IARC classifies chemicals by their carcinogenic risk, including agents that are known, probable or possible carcinogens. NTP classifies chemicals as either known carcinogens or for which there is a limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in experimental animals.

Perchloroethylene is listed by IARC as a possible carcinogen. Perchloroethylene is classified by NTP as having limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in experimental animals.

Also see Section 9.

OTHER POTENTIAL HEALTH HAZARDS: The following information is required by Canadian WHMIS regulations. Irritancy is covered in Signs and Symptoms of Exposure in Section 4. There is no known human sensitization or toxicologically synergistic product associated with this material. Xylene and toluene have demonstrated experimental effects for reproductive toxicity, mutagenicity and teratogenicity. Studies indicate ethylbenzene and 1,1,1-trichloroethane are experimental teratogens.

SECTION 5 -- FIRE AND EXPLOSION HAZARD DATA

EMERGENCY RESPONSE GUIDE NUMBER: 27
Reference Emergency Response Guidebook (DOT 5800.5)

FIRE AND EXPLOSION HAZARDS: Vapor explosion hazard may occur indoors, outdoors or in sewers. Decomposition and combustion products may be toxic. Heated containers may rupture, explode or be thrown into the air. Vapors are heavier than air and may travel great distances to ignition source and flash back. Not sensitive to mechanical impact. Material may be sensitive to static discharge, which could result in fire or explosion.

FIRE FIGHTING PROCEDURES: NFPA 704 Rating 0-2-0 (Health-Fire-Reactivity)
Keep storage containers cool with water spray. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection.

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical or water spray.

CONDITIONS OF FLAMMABILITY: Heat, sparks or flame.

FLASH POINT: 105°F (40°C) SETA

AUTOIGNITION TEMPERATURE: 473°F (245°C)

FLAMMABLE LIMITS IN AIR: *LOWER:* 0.7 Vol.% *UPPER:* 6.0 Vol.%

HAZARDOUS COMBUSTION PRODUCTS: Burning may produce carbon monoxide.

SECTION 6 -- REACTIVITY DATA

STABILITY: Stable under normal temperatures and pressures, and not reactive with water.

INCOMPATIBILITY (MATERIALS AND CONDITIONS TO AVOID): Acids, oxidizing agents or chlorine may cause a violent reaction. Avoid heat, sparks or flame.

HAZARDOUS POLYMERIZATION: Not known to occur under normal temperatures and pressures.

SPECIFIC GRAVITY:	0.77 to 0.80 at 60/60°F (16/16°C) (water = 1)
DENSITY:	6.4 to 6.7 lbs/gal
VAPOR DENSITY:	4.9 (air = 1)
VAPOR PRESSURE:	2 mm Hg at 68°F (20°C)
BOILING POINT:	304 to 435°F (151 to 224°C)
FREEZING POINT:	Not available
pH:	7 (water extraction)
VOLATILE ORGANIC COMPOUNDS: (US EPA DEFINITION)	100 WT%; 6.4 to 6.7 lbs/gal; 770 to 800 g/l
EVAPORATION RATE:	0.1 (butyl acetate = 1)
SOLUBILITY IN WATER:	Slight
COEFFICIENT OF WATER/OIL DISTRIBUTION:	Not available
MOLECULAR WEIGHT:	142 (approximately)

SECTION 9 -- OTHER REGULATORY INFORMATION

TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	COMBUSTIBLE LIQUID, N.O.S. (Mineral Spirits)
DOT CLASS:	Combustible Liquid
DOT ID NUMBER:	NA1993, PGIII
TDG CLASSIFICATION:	Naphtha, solvent, Class 3.3, UN1256, P.G. III

SARA TITLE III:

Product contains toxic chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. Toxic constituents are listed with an asterisk in Section 2 of this Material Safety Data Sheet.

Product poses the following physical and health hazards as defined in 40 CFR 370.3 (Sections 311, 312 of SARA Title III):

Immediate (Acute) Health Hazard
Delayed (Chronic) Health Hazard
Fire Hazard

WHMIS CLASSIFICATION:

Class B3, Combustible Liquids;
Class D2A, Infectious and Toxic Materials, Other Toxic Effects, Very Toxic Material;
Class D2B, Infectious and Toxic Materials, Other Toxic Effects, Toxic Material

User assumes all risks incident to the use of this product. To the best of our knowledge, the information contained herein is accurate. However, Safety-Kleen assumes no liability whatsoever for the accuracy or completeness of the information contained herein. No representations or warranties, either expressed or implied, or merchantability, fitness for a particular purpose or of any other nature are made hereunder with respect to information or the product to which information refers. The data contained on this sheet apply to the material as supplied to the user.

MATERIAL SAFETY DATA SHEET

AND SAFE HANDLING AND DISPOSAL INFORMATION

ZEP MANUFACTURING COMPANY
RST IN MAINTENANCE PRODUCTS

ISSUE DATE: 07/12/89 ZEP BIG ORANGE
SUPERSEDES: 06/15/88 PRODUCT NUMBER: 0415
Industrial Solvent Degreaser

SECTION I - EMERGENCY CONTACTS

ZEP MANUFACTURING COMPANY
P.O. BOX 2015
ATLANTA, GEORGIA 30301

TELEPHONE: (404)352-1680 BETWEEN 8:00 AM-5:00 PM (EST)
NON-OFFICE HOURS, WEEKENDS, AND HOLIDAYS: AREA CODE 404
435-2973, 351-2952, 432-2873
LOCAL POISON CONTROL CENTER .....

TRANSPORTATION EMERGENCY:
(404)922-0923 or

CHEMTREC: TOLL FREE 1-800-424-9300 ALL CALLS RECORDED
DISTRICT OF COLUMBIA (202)483-7616 ALL CALLS RECORDED

SECTION II - HAZARDOUS INGREDIENTS

DESIGNATIONS	TLV (PPM)	EFFECTS (SEE REVERSE)	% IN PROD.
** D-LIMONENE ** orange distillate; citrus terpene; cyclohexene, 1-methyl-4-(1-methylethenyl)-, (R)- CAS# 5989-27-5; RTECS# GW6360000; OSHA PEL N/D	N/D	CBL SEN	> 90
** ALCOHOLS, C11-C15-SECONDARY, ETHOXYLATED ** CAS# 68131-40-8; RTECS# WZ5200000; OSHA PEL N/D	N/D	EIR	< 5
** NONYLPHENOXYPOLY(ETHYLENEOXY)ETHANOL ** poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy; CAS# 9016-45-9; RTECS# MD905000; OSHA PEL- N/D	N/D	EIR	< 5

SECTION III - HEALTH HAZARD DATA

SPECIAL NOTE: MSDS data pertains to the product as dispensed from the container. Adverse health effects would not be expected under recommended conditions of use (diluted) so long as prescribed safety precautions are practiced.

ACUTE EFFECTS OF OVEREXPOSURE:
THIS PRODUCT CAN BE AN EYE IRRITANT. INFLAMMATION OF EYE TISSUE IS CHARACTERIZED BY REDNESS, WATERING, AND/OR ITCHING.
ONE OF THE INGREDIENTS IN THIS PRODUCT HAS CAUSED SENSITIZATION REACTIONS IN A SMALL PERCENTAGE OF THE GENERAL POPULATION.

SECTION III - H E A L T H H A Z A R D D A T A (CONTINUED)

CHRONIC EFFECTS OF OVEREXPOSURE:
CONTACT, ESPECIALLY IF PROLONGED OR REPEATED, MAY CAUSE REDNESS, ITCHING, OR BLISTERING OF THE SKIN.
NONE OF THE HAZARDOUS INGREDIENTS ARE LISTED AS CARCINOGENS BY IARC, NTP, & OSHA

EST'D PEL/TLV: NOT ESTABLISHED PRIMARY ROUTES OF ENTRY: N/A

HMIS CODES: HEALTH 1; FLAM. 2; REACT. 0; PERS. PROTECT. A ; CHRONIC HAZ. NO

FIRST AID PROCEDURES:

SKIN : WASH CONTAMINATED SKIN THOROUGHLY WITH SOAP OR A MILD DETERGENT. APPLY A SKIN CREAM WITH LANOLIN. GET MEDICAL ATTENTION IF IRRITATION PERSISTS.

EYES : IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES, OCCASIONALLY LIFTING UPPER AND LOWER LIDS. GET MEDICAL ATTENTION AT ONCE.

ALE: MOVE EXPOSED PERSON TO FRESH AIR. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION PROMPTLY.

NGEST: IF THIS PRODUCT IS SWALLOWED, DO NOT INDUCE VOMITING. IF VICTIM IS CONSCIOUS GIVE PLENTY OF WATER TO DRINK. GET MEDICAL ATTENTION AT ONCE.

SECTION IV - S P E C I A L P R O T E C T I O N I N F O R M A T I O N

ROTECTIVE CLOTHING : THE USE OF NEOPRENE, NITRILE OR NATURAL RUBBER GLOVES IS STRONGLY RECOMMENDED, ESPECIALLY FOR PROLONGED CONTACT.

YE PROTECTION : WEAR TIGHT-FITTING SPLASH-PROOF SAFETY GLASSES ESPECIALLY IF CONTACT LENSES ARE WORN.

ESPIRATORY PROTECTION: NO SPECIAL MEASURES ARE REQUIRED.

ENTILATION : NO SPECIAL MEASURES ARE REQUIRED.

ECTION V - P H Y S I C A L, D A T A

OILING POINT (F)	: 338-375	SPECIFIC GRAVITY	: 0.844
APOR PRESSURE(MMHG)	: N/A	PERCENT VOLATILE BY VOLUME (%)	: 93.8
APOR DENSITY(AIR=1)	: N/A	EVAPORATION RATE(CCL4 =1)	: ~33
OLUBILITY IN WATER	: EMULSIFIES	PH(CONCENTRATE)	: N/A
		PH(USE DILUTION OF 1:20	): 7.6

PPEARANCE AND ODOR : ORANGE LIQUID WITH A CITRUS ODOR

F TION VI - F I R E A N D E X P L O S I O N D A T A

LASH POINT(F) (METHOD USED): 121F (TCC)
LAMMABLE LIMITS LEL N/A UEL N/A
XTINGUISHING MEDIA : FOAM, DRY CHEMICAL, CO2
PECIAL FIRE FIGHTING: FIRE EXPOSED DRUMS SHOULD BE COOLED WITH STREAM OF WATER.
NUSUAL FIRE HAZARDS : NONE

SECTION VII - R E A C T I V I T Y D A T A

STABILITY	: STABLE
INCOMPATIBILITY(AVOID)	: HEAT, FLAME, SPARK, STRONG ACIDS AND/OR OXIDIZERS
POLYMERIZATION	: WILL NOT OCCUR.
HAZARDOUS DECOMPOSITION	: CARBON DIOXIDE, CARBON MONOXIDE, AND OTHER UNIDENTIFIED ORGANIC COMPOUNDS.

SECTION VIII - S P I L L A N D D I S P O S A L P R O C E D U R E S

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
IMMEDIATELY ELIMINATE ALL FLAME, IGNITION AND HIGH-HEAT SOURCES. ABSORB SPILL ON INERT ABSORBENT MATERIAL (eg ZEP-O-ZORB). PICK UP AND PLACE RESIDUE IN A CLEAN, D.O.T. SPECIFICATION CONTAINER FOR DISPOSAL. WASH AREA THOROUGHLY WITH A DETERGENT SOLUTION AND RINSE WELL WITH WATER.

WASTE DISPOSAL METHOD:
LIQUIDS CANNOT BE SENT TO LANDFILLS UNLESS SOLIDIFIED. UNUSABLE PRODUCT AND COLLECTED, SPENT MATERIAL MAY REQUIRE DISPOSAL AS A HAZARDOUS WASTE AT A PERMITTED TREATMENT/STORAGE/DISPOSAL FACILITY. SOLVENT WASTES MAY REQUIRE TREATMENT TO MEET THE APPROPRIATE STANDARDS BEFORE DISPOSAL IN A CHEMICAL OR INDUSTRIAL WASTE LANDFILL. CONSULT LOCAL, STATE, AND FEDERAL AGENCIES FOR PROPER DISPOSAL METHOD IN YOUR AREA.

CRA HAZ. WASTE NOS. : D001

SECTION IX - S P E C I A L P R E C A U T I O N S

PRECAUTIONS TO BE TAKEN WHEN HANDLING AND STORING:
COMBUSTIBLE! STORE AND USE AWAY FROM HEAT, SPARKS, OPEN FLAME, OR ANY SOURCE OF IGNITION.
POST "NO SMOKING" SIGNS ACCORDING TO LOCAL REGULATIONS FOR COMBUSTIBLE LIQUIDS.
KEEP PRODUCT AWAY FROM SKIN AND EYES.
Store tightly closed container in a dry area at temps. between 40-120 degrees F.
KEEP OUT OF THE REACH OF CHILDREN.

SECTION X - T R A N S P O R T A T I O N D A T A

DOT PROPER SHIPPING NAME
NONE
DOT HAZARD CLASS: N/A
DOT I.D. NUMBER : N/A DOT LABEL/PLACARD: NONE
PA TSCA CHEMICAL INVENTORY - ALL INGREDIENTS ARE LISTED
CWA 40CFR PART 117 SUBSTANCE(RQ IN A SINGLE CONTAINER): N/A

MODIFIED: 03/14/1988 BY: USPPSXT 19960604 11:40:13.4
PPTS21M1

<<< BROWSE >>> M S D S # 2881 - S E C T I O N 1 - A G E N E R A L

MANUFACTURER NAME...: EXXON COMPANY, USA
P.O. BOX 2180

| ACTIVE MSDS.....: Y |
| APPROVED MSDS.....: Y |
| DATE PREPARED |
| DATE NOT ON SHEET |

HOUSTON TX 772522180

NU STOCK COMMODITY CODE:
MANUFACTURERS CODE ID :

TRADE/PRODUCT NAME.....: NATURAL GAS
CHEMICAL NAME / SYNONYM.: METHANE
CHEMICAL FAMILY.....: PETROLEUM HYDROCARBON
TRAINING NAME.....: FUELS/LUBRICANTS/OILS

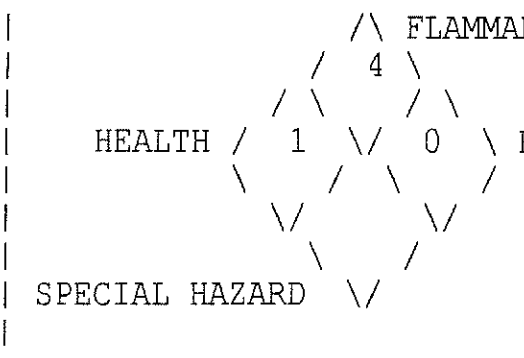
EMERGENCY TELEPHONE NO..:(713) 656 - 2424 EXT. 0
INFORMATION TELEPHONE NO:(713) 656 - 2443 EXT. 0

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 1

MODIFIED: 03/14/1988 BY: USPPSXT 19960604 11:40:13.4
<<< BROWSE >>> M S D S - S E C T I O N 1 - B PPTS21M2
ACTIVE MSDS: Y G E N E R A L

PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

---------- N.F.P.A. CODES ----------



FLAMMABILITY- FROM 0 (WILL NOT BURN)
TO 4 (VERY FLAMMABLE)
HEALTH- FROM 0 (NO HEALTH HAZARD)
TO 4 (EXTREMELY HAZARDOUS)
REACTIVITY- FROM 0 (STABLE)
TO 4 (EXPLOSIVE REACTION)
SPECIAL HAZARD- R FOR RADIATION HAZARD
W FOR REACTIVITY TO WATER
OX FOR OXIDIZER

LABEL INFORMATION:

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 2

19960604 11:40:42.8

<<< BROWSE >>> M S D S - S E C T I O N 2 PPTS22M1

H A Z A R D O U S I N G R E D I E N T S

ACTIVE MSDS: Y

PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

INGREDIENT NAME: METHANE (AS A GAS)
INGREDIENT TYPE:
OSHA PEL.....: PERCENT OF PRODUCT: 0100.000
ACGIH TLV.....: CAS NO.: 74-82-8
OTHER LIMITS...: TLV: 1000 PPM.
REGULATED BY...: - MASSACHUSETTS -

INGREDIENT NAME:
INGREDIENT TYPE:
OSHA PEL.....: PERCENT OF PRODUCT:
ACGIH TLV.....: CAS NO.:
OTHER LIMITS...:
REGULATED BY...: - -

PF13=LOGOFF PF15=MAIN MENU

MODIFIED: 03/14/1988 BY: USPPSXT 19960604 11:40:56.9
PPTS23M1

<<< BROWSE >>> M S D S - S E C T I O N 3
P H Y S I C A L / C H E M I C A L D A T A

ACTIVE MSDS: Y PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

BOILING POINT...: -258 SCALE: FAHRENHEIT

SPECIFIC GRAVITY: 0.555 VAPOR PRES(MMHG): 760 MM HG AT 70'F

MELTING POINT...: SCALE:

PERCENT VOLATILE: VAPOR DEN(AIR=1): 0.41

EVAPORATION RATE: EVAP. METHOD....:

SOLUBILITY (H2O): NEGLIGIBLE

APPEARANCE/ODOR.: COLORLESS, ODORLESS GAS

PF13=LOGOFF PF15=MAIN MENU NEXT SECTION NO: 4

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PPTS24M1

<<< BROWSE >>> M S D S - S E C T I O N 4
F I R E & E X P L O S I O N H A Z A R D D A T A
ACTIVE MSDS: Y

PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

FLASH POINT.....:
N/A :
COC :
TCC : 305. - F
OTHER :

FLAMMABLE LIMITS...:

LEL PERCENT: 5.30 % UEL PERCENT: 15.00 %

EXTINGUISHING MEDIA: CO2: FOAM:
WATER: DRY CHEMICAL: WATER FOG:

PF13 = LOGOFF PF15 = MAIN MENU

<<< BROWSE >>> M S D S - S E C T I O N 4 (CONT.)

F I R E & E X P L O S I O N H A Z A R D D A T A

PRODUCT NAME: NATURAL GAS

MANUFACTURER NAME: EXXON COMPANY, USA

SPECIAL FIRE FIGHTING PROCEDURES

DO NOT ATTEMPT TO EXTINGUISH UNTIL SOURCE IS SHUT OFF.
ALLOW FIRE TO BURN OUT.

UNUSUAL FIRE AND EXPLOSION HAZARDS

METHANE IS EXTREMELY FLAMMABLE AND WILL FORM FLAMMABLE OR EXPLOSIVE MIXTURES IN AIR. EMERGENCY & FIRST AID PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS WHERE THE OXYGEN CONTENT IS BELOW 18% AND SHOULD EXERCISE EXTREME CARE WHERE A POTENTIAL FOR FIRE OR EXPLOSION EXISTS.

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PPTS25M1

<<< BROWSE >>> M S D S - S E C T I O N 5 - A
H E A L T H H A Z A R D D A T A

ACTIVE MSDS: Y
PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

PRODUCT PEL/TLV.: 1000.00000

UNIT OF MEASURE.: PPM

CARCINOGENIC....: NTP....: IARC MONOGRAPHS: OSHA REGULATED:
MUTAGEN: TERATOGEN.....: NEUROTOXIN....:

ROUTES OF ENTRY.: INHALATION: X SKIN: X INGESTION:

PF13 = LOGOFF PF15 = MAIN MENU

PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

EFFECTS OF OVER-EXPOSURE

METHANE IS A SIMPLE ASPHYXIANT. IT MAY CAUSE ASPHYXIATION.
SKIN EXPOSURE TO LIQUID METHANE MAY CAUSE FROSTBITE.
SKIN CONTACT WITH LIQUID METHANE MAY CAUSE CRYOGENIC "BURNS"
OR FROST BITE.

SIGNS AND SYMPTOMS

INHALATION: HIGH CONCENTRATIONS MAY EXCLUDE AN ADEQUATE
SUPPLY OF OXYGEN TO THE LUNGS CAUSING DIZZINESS, DEEPER
BREATHING AND POSSIBLY NAUSEA AND EVENTUAL UNCONSCIOUSNESS.
SKIN CONTACT: CONTACT WITH LIQUID METHANE MAY CAUSE "BURNS"
OR FROSTBITE OF EXPOSED SKIN.

PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT: TREAT FOR FROSTBITE AS APPROPRIATE IF THERE IS SIGNIFICANT SKIN CONTACT. INHALATION: IF OVERCOME BY GAS, REMOVE FROM EXPOSURE IMMEDIATELY TO FRESH AIR. OBTAIN PROPER MEDICAL ASSISTANCE. IF BREATHING IS IRREGULAR OR STOPPED, GIVE ARTIFICIAL RESPIRATION.

MEDICAL CONDITIONS AGGRAVATED

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<<< BROWSE >>> M S D S - S E C T I O N 6 PPTS26M1
R E A C T I V I T Y D A T A

ACTIVE MSDS: Y
PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

STABILITY...: STABLE

STABILITY CONDITIONS TO AVOID
AVOID HIGH TEMPERATURE OR HEAT.

INCOMPATABILITY

PF13 = LOGOFF PF15 = MAIN MENU

R E A C T I V I T Y D A T A

ACTIVE MSDS: Y
PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

HAZARDOUS DECOMPOSITION

HAZARDOUS POLYMERIZATION:

POLYMERIZATION CONDITIONS TO AVOID

MODIFIED: 00/00/0000 BY: 19960604 11:42:49.8
PPTS27M1

<<< BROWSE >>> M S D S - S E C T I O N 7
ACTIVE MSDS: Y P R E C A U T I O N S F O R S A F E H A N D L I N G
PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

STEPS - RELEASE OR SPILLS

REMOVE ALL IGNITION SOURCES.
KEEP PEOPLE CLEAR OF THE AREA.
AVOID BREATHING VAPORS.
VENTILATE CONFINED SPACES.
SPILLS OR RELEASES SHOULD BE REPORTED, IF REQUIRED, TO THE APPROPRIATE LOCAL, STATE, AND FEDERAL REGULATORY AGENCIES.

WASTE DISPOSAL METHOD

NOT APPLICABLE - THE VERY HIGH VOLATILITY OF THIS MATERIAL WILL CAUSE EXTREMELY RAPID EVAPORATION AND NO OTHER DISPOSAL METHOD IS NEEDED OR SHOULD BE ATTEMPTED.

PF13 = LOGOFF PF15 = MAIN MENU

MODIFIED: 00/00/0000 BY: 19960604 11:42:49.8
PPTS27M2

<<< BROWSE >>> M S D S - S E C T I O N 7
ACTIVE MSDS: Y P R E C A U T I O N S F O R S A F E H A N D L I N G
PRODUCT NAME: NATURAL GAS
MANUFACTURER NAME: EXXON COMPANY, USA

PRECAUTIONS HANDLING AND STORING

KEEP CONTAINERS CLOSED WHEN NOT IN USE. DO NOT STORE NEAR HEAT, SPARKS, FLAME, OR STRONG OXIDANTS. VENTILATE STORAGE AREAS WHERE NECESSARY. DO NOT HANDLE NEAR HEAT, SPARKS, FLAME OR STRONG OXIDANTS.

PRECAUTIONS OTHER

THE AIRBORNE CONCENTRATION CAN REDUCE THE OXYGEN CONTENT OF THE AMBIENT AIR BY DISPLACEMENT IF THERE IS A SIGNIFICANT LEAK AND CARE SHOULD BE TAKEN TO INSURE THAT THE OXYGEN LEVEL IS MAINTAINED AT GREATER THAN 18 MOLAR PERCENT AT NORMAL ATMOSPHERIC PRESSURE WHICH IS EQUIVALENT TO A PARTIAL PRESSURE OF 135 MM HG.

S E C T I O N 5

PRODUCT TLV.....:
UNIT OF MEASURE....:

CARCINOGENIC..... NTP.....: IARC MONOGRAPHS.:
MUTAGEN.....: TERATOGEN..... :

ROUTES OF ENTRY....: INHALATION: X SKIN: INGESTION:

EFFECTS OF OVEREXPOSURE : TLV: ASPHYXIANT.
SUFFOCATION, DIZZINESS, HEADACHE, NAUSEA, LOSS OF CONCCIOUS-NESS AND DEATH CAN OCCUR. CONTACT WITH LIQUID METHANE CAN CAUSE FREEZE BURNS.

SIGNS & SYMPTOMS : AS ABOVE

EMERGENCY AND FIRST AID : REMOVE TO FRESH AIR. ARTIFICIAL RESPIRATION IF REQUIRED.

MEDICAL CONDITIONS : NONE LISTED

S E C T I O N - 6

STABILITY .....: STABLE

'STABILITY'
CONDITIONS TO AVOID : AVOID MIXING WITH AIR. AVOID MIXTURE OF LIQUID METHANE WITH LIQUID OXYGEN.

INCOMPATABILITY.....: N/A

HAZARDOUS DECOMP.....: N/A

HAZARDOUS POLYMR.....: WILL NOT OCCUR

'POLYMERIZATION'
CONDITIONS TO AVOID : ***** N O N E E N T E R E D *****

S E C T I O N - 7

STEPS - RELEASE OR SPILLS : VENTILATE AREA. SHUT OFF METHANE SOUCE IF POSSIBLE. REMOVE SOURCES OF HEAT OR IGNITION. PAINTING SUSPECTED AREA WITH SOAP SOLUTION MAY BE USED TO DETECT A LEAK.

WASTE DISPOSAL METHOD : REMOVE CYLINDER TO OUTDOORS OR VENTILATED HOOD. ALLOW GAS TO DISCHARGE AT A SLOW MODERATE RATE.

PRECAUTIONS - :

HANDLING AND STORING : STORE IN A WELL VENTILATED AREA AWAY FROM OXIDIZERS, SOUR IS OF HEAT & IGNITION. NO PART OF CYLINDER SHOULD BE EXPOSED TO TEMPERATURES ABOVE 125F.

OTHER : DO NOT DEFACE CYLINDER OR LABELS. RETURN WITH POSITION PRESSURE. NO SMOKING WHERE METHANE IS USED OR STORED. METHANE LINES CAN BE TESTED FOR LEAKAGE WITH NITROGEN PRESSURE "BEFORE" USE.

S E C T I O N - 8

RESPIRATOR TYPE : SELF CONTAINED BREATHING APPARATUS

VENTILATION- LOCAL EXHAUST: X SPECIAL:
MECHANICAL : X OTHER :

PROTECTIVE GLOVES.....:

EYE PROTECTION.....: SAFETY GLASSES

OTHER PROTECTION.....: SAFETY GLASSES, SAFETY SHOES WHEN HANDLING CYLINDERS.

WORK / HYGENIC.....: ***** N O N E E N T E R E D *****

REPORT NO. TSR002 M A T E R I A L S A F E T Y D A T A S H E E T # 3343

PPTRS002

S E C T I O N 1 - A

MANUFACTURER NAME: SCOTT SPECIALTY GASES
ADDRESS LINE 1 : ROUTE 611 NORTH
ADDRESS LINE 2 :
ADDRESS LINE 3 :
TOWN : PLUMSTEADVILLE STATE: PA ZIP: 18949

ACTIVE MSDS : Y NU STOCK COMMODITY CODE :

APPROVED MSDS : Y MANUFACTURERS CODE ID : 1651

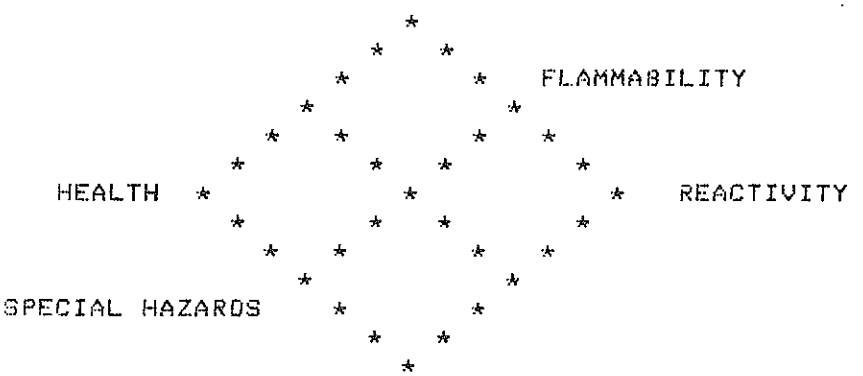
TRADE/PRODUCT NAME.....: METHANE
CHEMICAL NAME/SYNONYM....: METHYL HYDRIDE
CHEMICAL FAMILY.....: HYDROCARBON GAS
TRAINING NAME.....: INDUSTRIAL GAS

EMERGENCY TELEPHONE NO..: 215-766-8861 00000

INFORMATION TELEPHONE NO: 201-754-7700 00000

DATE PREPARED : DATE NOT ON SHEET

S E C T I O N 1 - B



FLAMMABILITY - FROM 0 'W
HEALTH - FROM 0 (NO HEAI
REACTIVITY - FROM 0 (STAI
SPECIAL HAZARDS - R R II
W REAC
OX OXID

LABEL INFORMATION.: HEALTH EFFECTS / TARGET ORGAN
TARGET ORGAN/HEALTH EFFECTS:
RESPIRATORY TRACT: SUFFOCATION,DIZZ
INESS,HEADACHE,NAUSEA,LOSS OF CON-
SCIOUSNESS & DEATH CAN OCCUR.
LIQUID CONTACT; FREEZE BURNS

S E C T I O N - 9

MISCELLANEOUS DATA.....:

Chemical Vapor Pressures

Chemicals	Vapor Pressures
gasoline	7.73 psia @ 68 f
#2 fuel oil	0.03 psia @ 68 f
#4 fuel oil	0.007 psia @ 100 f
#6 fuel oil	0.004 psia @ 70 f
Jet fuel	0.002 psia @ 68 f
Lubricating oils	0.002 psia @ 68 f
Hydraulic oils	0.02 psia @ 68 f
Sodium Hypochlorite	0.34 psia @ 68 f
Ferrous Sulfate	Solid, made into dilute solution
Sulfuric acid	0.000 psia @ 68 f
Sodium hydroxide	0.02 psia @ 1362 f
Sodium Phosphate	Solid, made into dilute solution
Hydrazine	0.28 psia @ 77 f
Morpholine	0.13 psia @ 68 f
Ammonia, aqueous	4.59 psia @ 32 f
Ammonia, anhydrous	147 psia @ 78 f
Hydrochloric acid	4.10 psia @ 68 f
Acetic Acid	0.21 psia @ 68 f
Formic Acid	0.44 psia @ 68 f
Hydroflouric Acid	2.13 psia @ 68 f
Thiourea	Solid, made into dilute solution
Sulfur (MK)	Solid, heated to keep molten
Propane (MK)	14.7 psia @ -43.8 f
Limestone	Solid, used as a solid
propylene glycol	0.21 psia @ 77 f
Sodium molybdate	Solid, made into dilute solution
Tolyltriazole	0.001 psia @ 68 f
1,1,1 Trichloroethane	1.41 psia @ 68 f
Solvent Cleaning Sinks	0.04 psia @ 68 f
Natural Gas	14.7 psia @ 70 f