TEXAS AIR CONTROL BOARD

REGULATION II

CONTROL OF AIR POLLUTION FROM SULFUR COMPOUNDS

Rule 201. Control of Sulfur Dioxide.

201.01 No person may cause, suffer, allow or permit emissions of sulfur dioxide from any sulfuric acid plant burning elemental sulfur to exceed the allowable rates specified in Table 1 and/or Curve A of Figure 1.

201.011 If a source has an effective stack height less than the standard effective stack height as determined from Table 2 and/or Curve A of Figure 2, the allowable emission rates must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.012 Effective stack height shall be calculated by the following equation:

$$h_e = h + 0.083 v_e D_e \left[1.5 + 0.82 \left(\frac{T_e - 550}{T_e}\right) D_e\right]$$

Where:
h_e = Effective stack height in feet (ft)
h = Physical stack height above ground level in feet (ft)
v_e = Stack exit velocity in feet per second (ft/sec)
D_e = Stack exit inside diameter in feet (ft)
T_e = Stack exit temperature in degrees Rankine (°R)

201.02 No person may cause, suffer, allow or permit emissions of sulfur dioxide from any sulfuric acid plant to exceed the allowable rates specified in Table 3 and/or Curve B of Figure 1.

201.021 If a source has an effective stack height less than the standard effective stack height as determined from Table 4 and/or Curve B of Figure 2, the allowable emission rates must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.022 Effective stack height shall be calculated by the equation in Rule 201.012.

201.03 No person may cause, suffer, allow or permit emissions of sulfur dioxide from any sulfur recovery plant to exceed the allowable rates specified in Table 5 and/or Curve C of Figure 1.

201.031 If a source has an effective stack height less than the standard effective stack height as determined from Table 6 and/or Curve D of Figure 2, the allowable emission rates must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.032 Effective stack height shall be calculated by the equation in Rule 201.012.

201.04 No person may cause, suffer, allow or permit emissions of sulfur dioxide from nonferrous smelters to exceed 0.8% by volume of the total flue gas.

201.041 If a source has an effective stack height less than the standard effective stack height as determined from Table 7 and/or Curve C of Figure 2, the allowable emission rates must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.042 Effective stack height shall be calculated by the equation in Rule 201.012.

201.05 No person may cause, suffer, allow or permit emissions of sulfur dioxide from any solid fossil fuel fired steam generator to exceed 3.0 lb. per million Btu heat input. New proven technology must be applied in removing sulfur dioxide from the emission from solid fossil fuel fired steam generators when it becomes available.

201.06 No person may cause, suffer, allow or permit emissions of sulfur dioxide from any liquid fuel fired steam generator, furnace or heater to exceed 440 ppm, by volume.

201.061 If a source has an effective stack height less than the standard effective stack height as determined from Table 8 and/or Figure 3, the allowable emission concentration must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.062 Effective stack height shall be calculated by the equation in Rule 201.012.

201.07 No person in Galveston or Harris Counties may cause, suffer, allow or permit emissions of sulfur dioxide from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed a net ground level concentration of 0.28 ppm averaged over any 30-minute period.

201.08 No person in Jefferson or Orange Counties may cause, suffer, allow or permit emissions of sulfur dioxide from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed a net ground level concentration of 0.32 ppm averaged over any 30-minute period.

201.09 No person may cause, suffer, allow or permit emissions of sulfur dioxide from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed a net ground level concentration of 0.4 ppm averaged over any 30-minute period.

201.091 Except in El Paso County, a property or contiguous properties are exempt from the requirements of Rule 201.09 when a new or modified emission source is constructed and operated on such property or properties after the effective date of this Rule providing all of the following conditions are met:

201.0911 The construction and operation of the new or modified emission source meets any applicable Federal New Source Performance Standard and utilized best available control technology, with consideration to the technical practicability and economic reasonableness of reducing or eliminating the emissions from the facility.

201.0912 The construction and operation of the new or modified emission source does not cause or contribute to a condition such that either the primary or the secondary sulfur dioxide air quality standards are exceeded in the area.

201.0913 Sources existing on an exempt property prior to the effective date of this Rule are and will continue to be in compliance with Rule 201.09 or an area control plan obtained pursuant to Rule 201.17.

201.10 Emission rates of sulfur dioxide from sources not regulated by Rules 201.01, 201.02, 201.03, 201.04, 201.05 and 201.06 may be set by the Executive Director as necessary to attain ambient air quality standards.

201.11 If any person is unable to comply with Rules 201.06, 201.07, 201.08 or 201.09, solely because of the non-availability of low sulfur fuels, that person may file with the Texas Air Control Board a Temporary Fuel Shortage Control Plan, which shall include all of the following:

201.111 Evidence of the non-availability of low sulfur fuels. Such evidence shall include, but not be limited to statements from suppliers of fuel as to the availability of lower sulfur fuels, the price of such fuels and the expected duration of any periods of non-availability of particular fuels. Such evidence shall be updated semi-annually as long as the Temporary Fuel Shortage Control Plan remains on file with the Texas Air Control Board or as long as it can reasonably be concluded that there may be a necessity to operate under the Temporary Fuel Shortage Control Plan.

201.112 A statement that all emission inventory data required by the Board are complete, accurate and on file with the Board.

201.113 Data for each source within the entire plant that utilizes the higher sulfur fuel. The data shall include the type, quantity and sulfur content of all the fuels to be burned, excess air to be used and the associated sulfur abatement procedure to be used, if any.

201.114 Any other information as specified by the Board or the Executive Director. The Executive Director may require more frequent and extensive monitoring for persons affected by Rule 201.11 than would normally be required for persons affected by Rules 201.06, 201.07, 201.08 and 201.09.

201.12 After a person has filed a Temporary Fuel Shortage Control Plan pursuant to Rule 201.11, the provisions of that plan will govern the operation of the source with regard to emissions of sulfur dioxide during the periods of low sulfur fuel shortages, and Rules 201.06, 201.07, 201.08 and 201.09 shall not apply during these periods, provided that the person has complied with the notification procedures of Rule 201.13 and provided that the cumulative emissions of sulfur dioxide from the entire plant will not cause or contribute to a condition in which the ambient air quality will exceed 0.5 ppm sulfur dioxide averaged over a three-hour period more than once per year. An evaluation of the plan will be made by the Executive Director using appropriate diffusion modeling. If the plan cannot adequately demonstrate that the burning of higher sulfur fuels will not cause or contribute to a

condition in which the ambient air quality will exceed 0.5 ppm sulfur dioxide averaged over a three-hour period more than once per year, then the Executive Director will notify the applicant of the inadequacy of the plan. If a revised acceptable plan is not received within fourteen (14) days of notification, the Executive Director will refer the plan to the Texas Air Control Board for appropriate action.

201.13 Any person who finds it necessary to operate under a Temporary Fuel Shortage Control Plan filed pursuant to Rule 201.11 must comply with the following notification procedures:

201.131 The Executive Director and the appropriate local air pollution control agency shall be notified in writing as soon as practicable of a fuel shortage or impending fuel shortage which causes or may cause an excessive emission that contravenes Rules 201.06, 201.07, 201.08 or 201.09. Such notification shall include an estimate of the expected duration of the fuel shortage which will necessitate the person to operate under the Temporary Fuel Shortage Control Plan.

201.132 The Executive Director and the appropriate local air pollution control agency shall be notified in writing as soon as practicable of the termination of a fuel shortage which would allow the person to operate in compliance with Rules 201.06, 201.07, 201.08 and 201.09.

201.14 Any person who files a Temporary Fuel Shortage Control Plan under 201.11 and operates under that plan pursuant to 201.12 and 201.13 must submit to the Texas Air Control Board on a semiannual basis a written report detailing the following:

201.141 The types, quantity and sulfur content of fuels burned during the prior six months and the sources at which these fuels were burned.

201.142 The program the person has undertaken to achieve compliance with the applicable Rules 201.06, 201.07, 201.08 or 201.09 by December 31, 1976, including, if applicable, the minimum time required to design, procure, install and test abatement equipment and procedures.

201.15 Rules 201.11, 201.12, 201.13 and 201.14 shall be effective only until December 31, 1976, at which time all persons must comply with Rule 201.06 and either 201.07, 201.08 or 201.09. Persons affected by Rules 201.11 and 201.12 must demonstrate through the reports required by 201.132 how compliance will be achieved with the applicable Rules 201.06, 201.07, 201.08 or 201.09 as soon as practicable, but in no event later than December 31, 1976. The

provisions of Rule 201.15 shall be reviewed periodically by the Board to determine if Rules 201.11, 201.12, 201.13 and 201.14 should be extended beyond December 31, 1976.

01.16 This rule is applicable to all processes in nonferrous smelters, including but not limited to roasters, smelting furnaces, converters, sintering machines, blast furnaces, fuming furnaces, retorts and slag treatment plants. This rule is also applicable to sulfuric acid plants in nonferrous smelters which are used to comply with the standards set forth in this rule.

201.161 Concentration Limits. No person may cause, suffer, allow or permit emissions of sulfur dioxide to the atmosphere from any process as specified in Rule 201.16 to exceed the applicable concentration of sulfur dioxide as follows:

	SO_2 ppm (v) Maximum	
	Two Hour Avg.	Six Hour Avg.
1) Primary Copper Smelter/ for all processes other than those listed below:	---	650
Reverberatory Furnace	---	6000
2) Primary Zinc Smelter	1000	---
3) Primary Lead Smelter/ for all processes other than those listed below:	650	---
Sinter Machine Discharge End (Provided gases do not pass through Sinter bed) and Sinter Handling Equipment Emission Collection Systems	2500	---
4) Other Primary Smelter	2500	---
5) Secondary Metal Recovery Facility	3500	---
6) Sulfuric Acid Plant	---	650

201.162 Each stack or emission point in a primary smelter or secondary metal recovery facility shall have a standard effective stack height not less than that determined from the appropriate curve of Figure 4 or Table 7. When two or more gas streams either wholly or in part are discharged through a single stack, the combined flow rate of all streams shall be used to determine the required standard effec-

tive stack height. If streams with different SO_2 concentration allowables (as determined in Rule 201.161) are combined into a single stream, the required effective stack height is determined as follows:

1. Calculate a total combined stream SO_2 concentration allowable as follows:

$$PPM_T = \frac{(PPM_1)(SCFM_1) + (PPM_2)(SCFM_2) + \ldots (PPM_N)(SCFM_N)}{(SCFM_1 + SCFM_2 + \ldots SCFM_N)}$$

Where:

PPM_T = Allowable SO_2 concentration in total combined stream, ppm(v),

PPM_1 = Allowable SO_2 concentration in stream No. 1, ppm(v),

PPM_2 = Same as PPM_1 except for stream No. 2,

PPM_N = Same as PPM_1 except for Nth stream,

$SCFM_1$ = Effluent flow rate of stream No. 1, scfm,

$SCFM_2$ = Same as $SCFM_1$ except for stream No. 2,

$SCFM_N$ = Same as $SCFM_1$ except for Nth stream.

2. Calculate interpolation constant (K_T) for the total combined stream as follows:

$$K_T = \frac{(PPM_T - PPM_L)(K_H - K_L)}{(PPM_H - PPM_L)} + K_L$$

Where:

K_T = Interpolation constant for use in standard effective stack height equation shown below,

PPM_T = Allowable SO_2 concentration in total combined stream calculated above, and

IF PPM_T:	PPM_L	PPM_H	K_L	K_H
650 to 1000	650	1000	0.50	0.61
1000 to 2500	1000	2500	0.61	0.90
> 2500	2500	3500	0.90	1.17

3. Calculate standard effective stack height (H_e) for total combined stream as follows:

$H_e = K_T (q)^{0.5}$ feet

Where:

K_T = Interpolation constant calculated above

$q = (SCFM_1 + SCFM_2 + \ldots SCFM_N)$, scfm.

201.162.1 If a stack or emission point has an effective stack height less than the standard effective stack height as determined in Rule 201.162, the allowable concentration of sulfur dioxide must be reduced by multiplying it by:

$$\left(\frac{\text{Effective Stack Height}}{\text{Standard Effective Stack Height}}\right)^2$$

201.162.1 Effective stack height shall be calculated by the equation in Rule 201.012.

201.163 The owner or operator of a nonferrous smelter shall utilize best engineering techniques to capture and vent fugitive SO_2 emissions through a stack or stacks. Such techniques shall include, but not be limited to:

201.163.1 Operating and maintaining all ducts, flues, and stack in a leakfree condition.

201.163.2 Operating and maintaining all process equipment and gas collection systems in such a fashion that leakage of SO_2 gases will be prevented to the maximum extent possible.

201.163.3 Whenever possible, using gas collection systems and/or ducting collected SO_2 emissions through the tallest stack or stacks serving the facility.

201.164 The owner or operator of any primary smelter subject to the provisions of Rule 201.16 shall install, calibrate, maintain and operate a measurement system(s) approved by the Executive Director for continuously monitoring sulfur dioxide concentrations in the effluent of each process subject to Rule 201.161. The Executive Director shall not require continuous monitoring for sources emitting insignificant amounts of SO_2 into the atmosphere. "Continuous monitoring" is defined as sampling and recording of at least one measurement of sulfur dioxide concentration

in each 15-minute period from the effluent of each affected process or the emission control system serving each affected process.

201.165 Persons affected by Rule 201.16 shall be in compliance with the provisions contained therein as soon as practicable, but not later than May 31, 1975. All persons affected by this rule shall continue to be governed by Rule 201.04 until compliance with Rule 201.16 can be achieved, but not later than May 31, 1975, at which time Rule 201.16 shall supersede Rule 201.04.

201.17 Any person or persons who own or operate a source or sources which emit sulfur dioxide may request the Texas Air Control Board for relief from the requirements of Rule 201.09 by filing with the Executive Director an application for an Area Control Plan. An application for an Area Control Plan shall include, but is not limited to, a combination of evidence that best available control technology is being employed at all the affected sources, having due regard for the technical practicability and the economic reasonableness of reducing or eliminating the emissions of sulfur dioxide resulting from the affected facilities; and, an ambient air sampling system for the recording of sulfur dioxide levels in the affected area. Any person or persons filing an Application for an Area Control Plan must demonstrate the capability of all sources in the affected area of the State to maintain all promulgated sulfur dioxide ambient air standards.

201.18 Upon recommendation by the Executive Director, the Texas Air Control Board may enter a Board Order exempting those sources who have filed an Application pursuant to Rule 201.17 from the requirements of Rule 201.09, conditioned upon the person or persons complying with the remaining terms of the Board Order.

201.19 No person or persons who have been issued a Board Order establishing an Area Control Plan pursuant to Rule 201.18 may cause or contribute to a condition in which the ambient air quality in the affected area of the State will exceed 0.5 ppm sulfur dioxide averaged over a three-hour period more than once per year.

Rule 202. Persons affected by Rule 201 of this Regulation shall be in compliance with the provisions contained herein no later than December 31, 1973. No later than six months after the effective date of this Regulation, any person affected by this Regulation shall submit to the Texas Air Control Board a written report on his compliance status, including but not limited to, the minimum time required to design, procure, install and test abatement

equipment or procedures. Progress reports shall be submitted to the Board every four months commencing in August of 1972 until compliance is achieved.

All persons shall continue to be governed by the provisions of Regulation III which became effective on February 22, 1968, until December 31, 1973, at which time Rule 201 shall supersede the previous Regulation III with regard to sulfur dioxide emissions.

Rule 203. Control of Hydrogen Sulfide.

203.1 No person may cause, suffer, allow or permit emissions of hydrogen sulfide from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed a net ground level concentration of 0.08 ppm averaged over any 30-minute period if the downwind concentration of hydrogen sulfide affects a property used for residential, business or commercial purposes.

203.2 No person may cause, suffer, allow or permit emissions of hydrogen sulfide from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed a net ground level concentration of 0.12 ppm averaged over any 30-minute period if the downwind concentration of hydrogen sulfide affects only property used for other than residential, recreational, business or commercial purposes, such as industrial property and vacant tracts and range lands not normally occupied by people.

Rule 204. Control of Sulfuric Acid.

204.1 No person may cause, suffer, allow or permit emissions of sulfuric acid from a source or sources operated on a property or multiple sources operated on contiguous properties to exceed:

1) A net ground level concentration of 15 µg per cubic meter of air averaged over any 24-hour period; or

2) A net ground level concentration of 50 µg per cubic meter of air averaged over a one-hour period of time more than once during any consecutive 24-hour period; or

3) 100 µg per cubic meter of air maximum at any time.

Rule 205. Calculation Methods.

205.1 Determination of the net ground level concentration shall be performed in accordance with the procedures outlined in Appendix A for hydrogen sulfide and Appendix B for sulfuric acid.

Rule 206. Rules 203, 204 and 205 hereof shall be in force immediately and shall supersede the previous Regulation III of the Texas Air Control Board which became effective on February 22, 1968 with regard to hydrogen sulfide and sulfuric acid emissions.

Date Adopted: January 26, 1972
Date Filed with Secretary of State: February 4, 1972
Date Effective: March 5, 1972

Amendment of Rule 201 by adding Rules 201.11, 201.12, 201.13, 201.14 and 201.15; Amendment of Rule 202; and addition of Rules 203, 204, 205 and 206.

Date Adopted: December 19, 1973
Date Filed with Secretary of State: December 20, 1973
Date Effective: January 19, 1974

Amendment of Rule 201.09 by adding Rule 201.091, 201.16, 201.17, 201.18 and 201.19.

Date Adopted: January 30, 1975
Date Filed with Secretary of State: February 3, 1975
Date Effective: March 5, 1975

TABLE 1

SULFURIC ACID PLANTS BURNING ELEMENTAL SULFUR

ALLOWABLE SULFUR DIOXIDE EMISSION RATES
FOR SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	RATE OF EMISSION
scfm	lb/hr
1,000	19.8
2,000	39.6
4,000	79.2
6,000	119.0
8,000	158.0
10,000	198.0
20,000	396.0
40,000	792.0
60,000	1190.0
80,000	1580.0
100,000	1983.0

Interpolation and extrapolation of the data in this Table shall be accomplished by the use of the equation E=0.0198 q, where E is the allowable emission rate in lb/hr and q is the stack effluent flow rate in scfm.

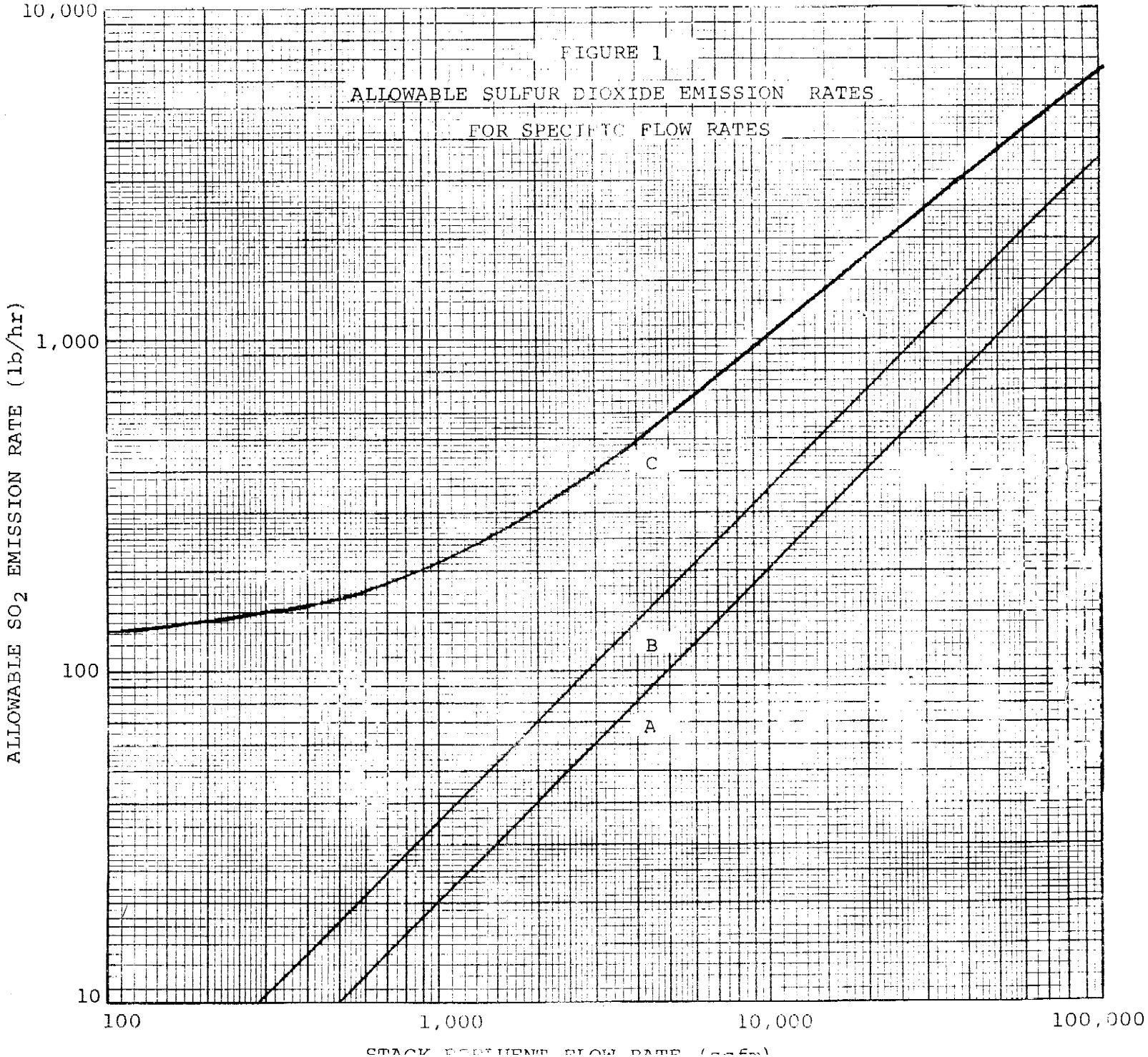


FIGURE 1
ALLOWABLE SULFUR DIOXIDE EMISSION RATES
FOR SPECIFIC FLOW RATES
ALLOWABLE SO_2 EMISSION RATE (lb/hr)
10,000
1,000
100
10
C
B
A
100
1,000
10,000
100,000

TABLE 2

SULFURIC ACID PLANTS BURNING ELEMENTAL SULFUR

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	STANDARD EFFECTIVE STACK HEIGHT
scfm	ft
1,000	28
2,000	40
4,000	56
6,000	69
8,000	79
10,000	89
20,000	125
40,000	177
60,000	217
80,000	250
100,000	280

Interpolation and extrapolation of the data in this Table shall be accomplished by the use of the equation $H_e = 0.885\ q^{0.5}$, where H_e is the standard effective stack height in ft. and q is the effluent flow rate in scfm.

FIGURE 2

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

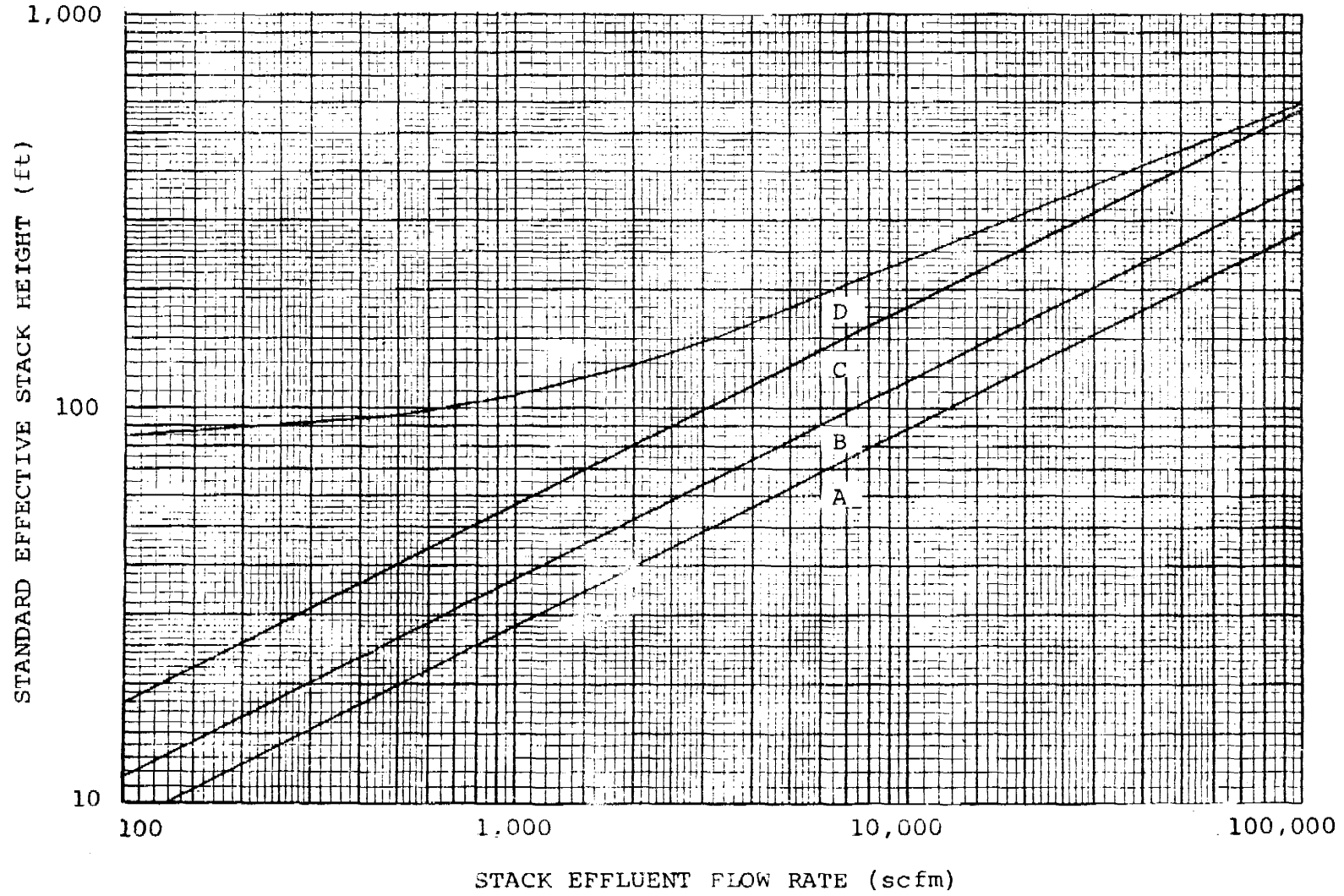


TABLE 3

SULFURIC ACID PLANTS BURNING OTHER THAN ELEMENTAL SULFUR

ALLOWABLE SULFUR DIOXIDE EMISSION RATES
FOR SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	RATE OF EMISSION
scfm	lb/hr
1,000	34.7
2,000	69.4
4,000	138.8
6,000	208.2
8,000	277.6
10,000	347.0
20,000	694.0
40,000	1388.0
60,000	2082.0
80,000	2776.0
100,000	3470.0

Interpolation and extrapolation of the data in this Table shall be accomplished by the use of the equation $E = 0.0347\ q$, where E is the allowable emission rate in lb/hr and q is the stack effluent flow rate in scfm.

TABLE 4

SULFURIC ACID PLANTS BURNING OTHER THAN ELEMENTAL SULFUR

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	STANDARD EFFECTIVE STACK HEIGHT
scfm	ft
1,000	37
2,000	52
4,000	74
6,000	91
8,000	105
10,000	117
20,000	165
40,000	234
60,000	287
80,000	331
100,000	370

Interpolation and extrapolation of the data in this Table shall be accomplished by the use of the equation $H_e = 1.17\ q^{0.5}$, where H_e is the standard effective stack height in ft. and q is the stack effluent flow rate in scfm.

TABLE 5

SULFUR RECOVERY PLANTS

ALLOWABLE SULFUR DIOXIDE EMISSION BASED ON SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	RATE OF EMISSION
scfm	lb/hr
1,000	214
2,000	305
3,000	396
4,000	487
5,000	579
6,000	670
7,000	759
8,000	845
9,000	929
10,000	1012
20,000	1766
30,000	2447
40,000	3084
50,000	3690

Interpolation and extrapolation of the data in this Table for stack effluent flow rates less than or equal to 4,000 scfm shall be accomplished by the use of the equation $E = 123.4 + 0.091\ q$, where E is the allowable emission rate in lb/hr and q is the stack effluent flow rate in scfm. Interpolation and extrapolation of the data for stack effluent flow rates in excess of 4,000 scfm shall be accomplished by the use of the equation $E = 0.614\ q^{0.8042}$

TABLE 6

SULFUR RECOVERY PLANTS

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

EFFLUENT FLOW RATE	STANDARD EFFECTIVE STACK HEIGHT
scfm	ft
100	85
500	96
1,000	109
2,000	129
3,000	148
4,000	164
5,000	178
6,000	192
7,000	204
8,000	215
9,000	226
10,000	236
20,000	311
30,000	366
40,000	411
50,000	450
60,000	484
80,000	544
100,000	595

Interpolation and extrapolation of the data for stack effluent flow rates less than or equal to 4,000 scfm shall be accomplished by the use of the equation $H_e = 7.4 \quad 123.4 + 0.091\ q^{0.5}$, where H_e is the standard effective stack height in feet and q is the stack effluent flow rate in scfm. Interpolation and extrapolation of the data for stack effluent in excess of 4,000 scfm shall be accomplished by the use of the equation $H_e = 5.8\ q^{0.402}$.

TABLE 7

(Reference Fig. 4)

NON FERROUS SMELTERS

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

Column A - Primary Copper Smelter
Primary Lead Smelter (all processes except sintering machine discharge end and equipment ventilation)
Metallurgical Sulfuric Acid Plant

Column B - Primary Zinc Smelter

Column C - Other Primary Smelters
Primary Lead Smelter Sintering Machine Discharge End and Equipment Ventilation

Column D - Secondary Metal Recovery Facilities

EFFLUENT FLOW RATE	STANDARD EFFECTIVE STACK HEIGHT			
SCFM	FEET			
(q)	A (650 PPM)	B (1000 PPM)	C (2500 PPM)	D (3500 PPM)
1,000	16	19	28	37
2,000	22	27	40	52
4,000	32	39	57	74
6,000	39	47	70	91
8,000	45	55	80	105
10,000	50	61	90	117
20,000	71	86	127	165
40,000	100	122	180	234
60,000	122	149	220	287
80,000	141	173	255	331
100,000	158	193	285	370
200,000	224	273	402	523
400,000	316	386	569	740
600,000	387	473	697	906
800,000	447	546	805	1046
1,000,000	500	610	900	1170
Interpolation Constant (K)	0.50	0.61	0.90	1.17

Interpolation and extrapolation of the data in this table shall be accomplished by the use of the equation $He = K(q)^{0.5}$, where "He" is the standard effective stack height in feet, "K" is the interpolation constant shown above and "q" is the effluent flow rate in SCFM.

TABLE 8

STEAM GENERATORS, BOILERS AND HEATERS BURNING LIQUID FUEL

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATE

EFFLUENT FLOW RATE	STANDARD EFFECTIVE STACK HEIGHT
scfm	ft.
1,000	15
2,000	22
4,000	31
6,000	38
8,000	44
10,000	49
20,000	69
40,000	98
60,000	120
80,000	138
100,000	155

Interpolation and extrapolation of the data in this Table shall be accomplished by the use of the equation $H_e = 0.49\ q^{0.50}$, where H_e is the standard effective stack height in feet and q is the stack effluent flow rate in scfm.

FIGURE 3

STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

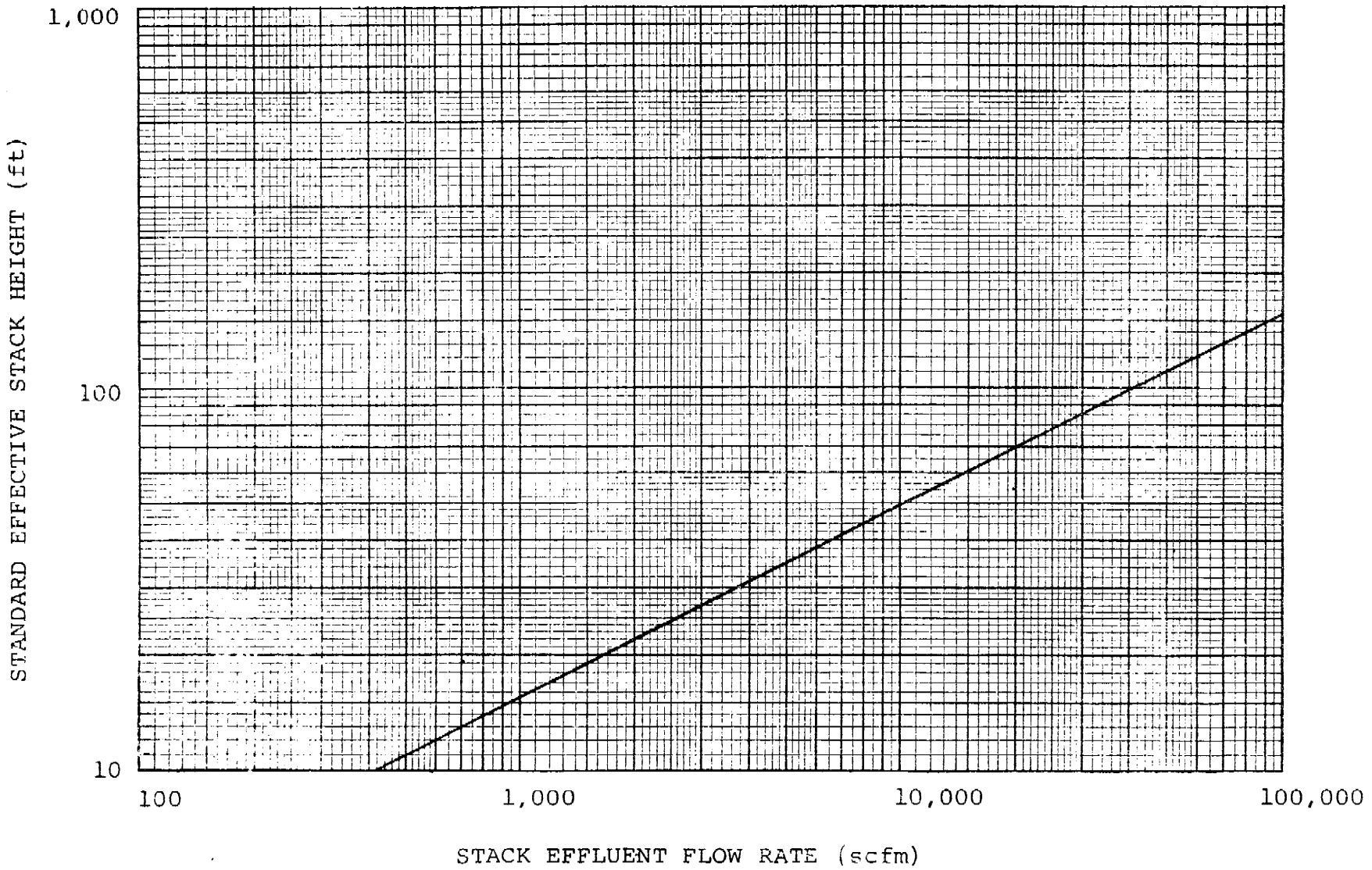
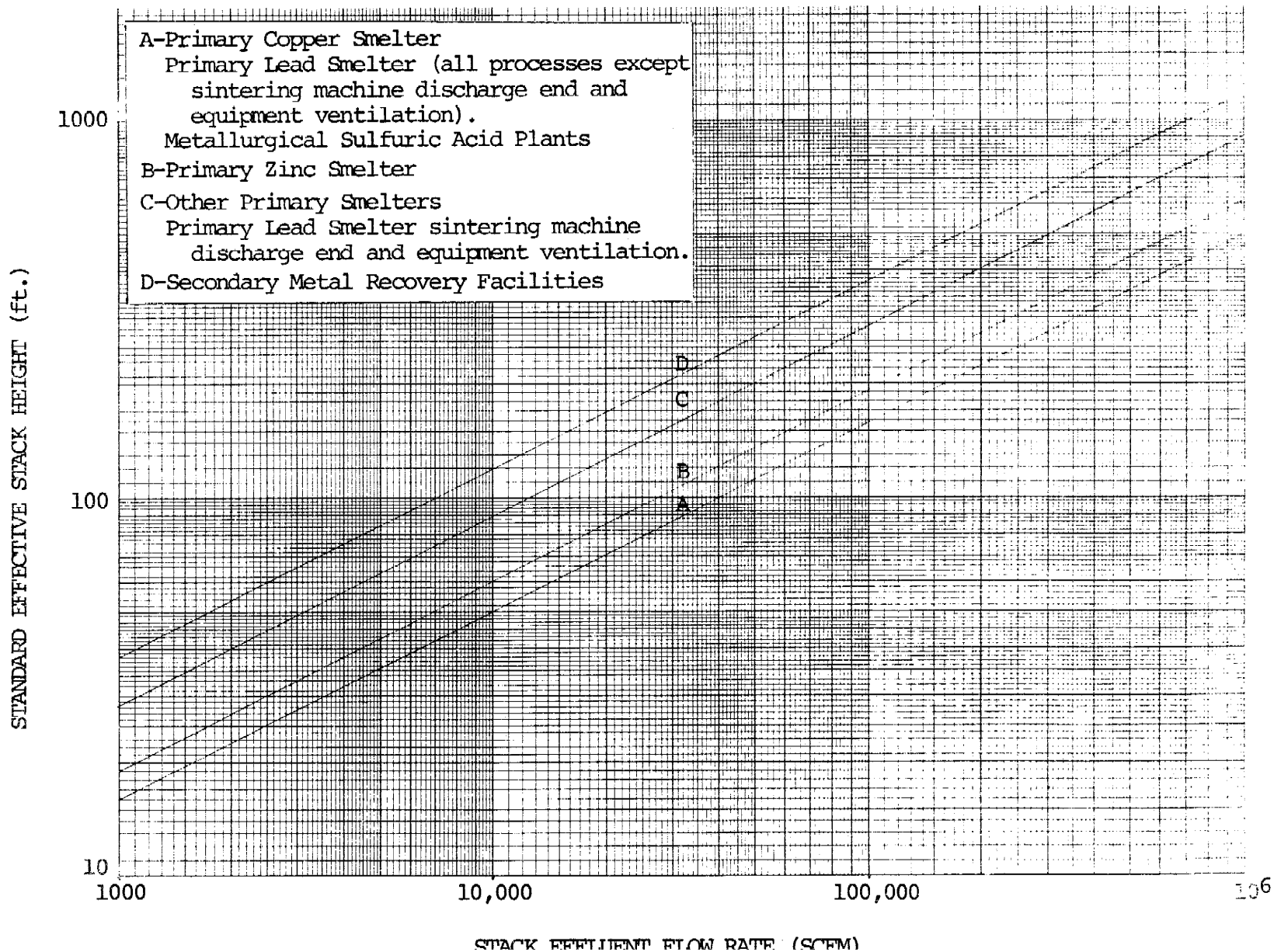


FIGURE 4
NON FERROUS SMELTERS
STANDARD EFFECTIVE STACK HEIGHT
BASED ON SPECIFIC FLOW RATES

(Reference Table 7)



I. Determination of compliance with emission limits.

In most cases downwind samples will suffice; however, if the sampled properties are suspected of being influenced by an upwind source of H_2S, then both upwind and downwind samples will be taken. The concentration of H_2S in the "downwind sample" less the concentration in the "upwind sample" shall be used in determining whether the emissions from the property comply with the requirements of Rule 203 of this Regulation. Calculated maximum allowable emission rates or ground level concentrations which are obtained by the Method in Section II below may be used in determining whether a property is in compliance with the emission limits specified.

II. Calculations of H_2S Concentrations from Stack Samples and Measurements

The maximum allowable H_2S emission rate which may be made from a stack on a property to comply with the emission limit set forth in Rule 203 of this Regulation may be calculated by Sutton's equation which has been modified to consider the critical wind speed and to correspond to a 30 minute air sample. Additional credit on stack emissions can be obtained if the distance from the stack to the property line is greater than thirty (30) stack heights. Those properties with greater than 30 stack heights to the property line should contact the Executive Director to obtain the proper correction factor.

A. For exit stack gas for temperatures of less than 125°F.

1. Rule 203.1. The H_2S ambient air level is 0.08 ppm for 30 minutes.

$$Qa = 8 \times 10^{-4} \, V_s d_s^{\,2} \, \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (1)$$

where:

Q_a = emission rate, lbs/hr

V_s = stack exit velocity, ft/sec.

d_s = exit stack diameter, ft.

h_s = physical stack height, ft.

To plot Graph II, assume a basic stack height of 100 ft. and plot $\left[\frac{d_s}{100}\right]^{1.29}$ for various stack diameters versus stack velocity.

2. Rule 203.2. The H_2S ambient air level of 0.12 ppm for 30 minutes.

$$Q_a = 12 \times 10^{-4} V_s d_s^2 \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (2)$$

Symbols same as in equation (1) above.

B. For exit stack gas for temperatures greater than 125°F.

1. Rule 203.1. The H_2S ambient air level is 0.08 ppm for 30 minutes.

$$Q_a = 1.68 \times 10^{-3} V_s d_s \left[1.5 + 0.82\left(\frac{\Delta T}{T_s}\right) d_s\right] h_s \qquad (3)$$

where:

Q_a = emission rate, lbs/hr

V_s = stack exit velocity, ft/sec.

d_s = exit stack diameter, ft.

ΔT = temperature difference between stack gas and the outdoor atmosphere in °Rankine. An outdoor temperature of 90°F (550°R) is assumed in preparing dispersion graphs.

T_s = stack exit temperature in °Rankine.

To plot Graph III assume a basic stack height of 100 ft. and an exit velocity of 20 ft/sec. Let stack gas temperature vary with stack diameter.

2. Rule 203.2. The H_2S ambient air level is 0.12 ppm for 30 minutes.

$$Q_a = 2.52 \times 10^{-3} \; V_s \; d_s \left[1.5 + 0.82 \left(\frac{\Delta T}{T_s} \right) d_s \; h_s \right] \qquad (4)$$

Symbols same as used in equation (3).

Example 1 (Temperature of stack gas less than 125°F.)

How many lbs/hr of H_2S can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The stack gases temperature is 100°F and the distance to property line is 3000 ft. Emissions under Rule 203.1.

Solution

1. The ratio of stack diameter to 100 ft. is $\frac{4}{100} = 0.04$
2. Enter ordinate of Graph II with 0.04; go horizontally to intersection of 30 ft/sec. velocity curve. At the intersection read on the abscissa 24 lbs/hr on (Rule 203.1) scale. This is the permitted value for a 100 ft. stack.
3. Correct emissions for a 200 ft. stack. Enter Graph I at 200 ft and obtain correction factor of 2.3. Thus the emissions become 24 x 2.3 = 55 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

Example 2 (Temperature of stack gas greater than 125°F)

How many lbs/hr of H_2S can be discharged from a 200 ft. stack having a 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The temperature of the exit gases is 400°F. Emissions under Rule 203.1.

Solution

1. Enter ordinate of Graph III with 400; go horizontally to intersection of 4 ft. diameter, read on the abscissa on Rule 203.1 scale 36 lbs/hr emission. This is permitted

value for 100 ft stack and exit velocity of 20 ft/sec.

2. Correct for stack height of 200 ft. This is direct ratio and becomes $\frac{200'}{100'} = 2$. The emission now becomes 36 x 2 = 72 lbs/hr.

3. Correct for stack exit velocity of 30 ft/sec. This is a direct ratio and becomes $\frac{30}{20} = 1.5$. The allowed emission now becomes 72 x 1.5 = 108 lbs/hr.

Note: Less than 30 stack heights to property line - no credit.

APPENDIX B

I. Determination of Compliance with Emission Limits. In most cases downwind samples will suffice; however, if the sampled properties are suspected of being influenced by an upwind source of H_2SO_4, then both upwind and downwind samples will be taken. The concentration of H_2SO_4 in the "downwind sample" less the concentration in the "upwind sample" shall be used in determining whether the emissions from the property comply with the requirements of Rule 204 of this Regulation. Calculated maximum allowable emission rates or ground level concentrations which are obtained by the Method in Section II below may be used in determining whether a property is in compliance with the emission limits specified.

II. Calculations of H_2SO_4 Concentrations from Stack Samples and Measurement The maximum allowable H_2SO_4 emission rate which may be made from a stack on a property to comply with the emission limit set forth in Rule 204 of this Regulation may be calculated by Sutton's equation which has been modified to consider the critical wind speed and to correspond to one hour sample. Additional credit on stack emissions can be obtained if the distance from the stack to the property line is greater than 30 stack heights. Those properties with greater than 30 stack heights to the property line should contact the Executive Director to obtain the proper correction factor.

A. For exit stack gas for temperatures of less than 125°F.

1. Rule 204.1 - The H_2SO_4 ambient air level of 80 $\mu g/M^3$ for one hour is used.

$$Q_a = 5.56 \times 10^{-4} V_s d_s^2 \frac{1}{\left[\frac{d_s}{h_s}\right]^{1.29}} \qquad (1)$$

where,

Q_a = emission rate, lbs/hr

V_s = stack exit velocity, ft/sec.

d_s = exit stack diameter, ft.

h_s = physical stack height, ft.

To plot Graph IV assume a basic stack height of 100 ft. and plot $\left[\frac{d_s}{100}\right]^{1.29}$ for various stack diameters versus stack velocity.

B. For exit stack gas for temperature greater than 125°F.

1. Rule 204.1 - The H_2SO_4 ambient air level of 80 ug/M^3 for one hour is used.

$$Q_a = 12.32 \times 10^{-4} V_s d_s \left[1.5 + 0.82 \left(\frac{\Delta T}{T_s}\right) d_s\right] h_s \qquad (2)$$

where,

Q_a = emission rate, lbs/hr

V_s = stack exit velocity, ft/sec

d_s = exit stack diameter; ft.

h_s = physical stack height, ft.

ΔT = temperature difference between stack gas and the outdoor atmosphere in °Rankine. An outdoor temperature of 90°F (550°R) is assumed in preparing dispersion graphs.

T_s = stack exit temperature in °Rankine.

To plot Graph V, assume a basic stack height of 100 feet and an exit velocity of 20 ft/sec. Let stack gas temperature vary with stack diameter.

Example 1 (Temperature of stack gas less than 125°F)

How many lbs/hr of H_2SO_4 can be discharged from a 200 ft stack having 4 ft exit diameter (ID) and a 30 ft/sec exit gas velocity? The temperature of the exit gases is 100°F.

Solution

1. The ratio of stack diameter to 100 ft is $\frac{4}{100} = 0.04$.
2. Enter ordinate of Graph IV with 0.04; go horizontally to intersection of 30 ft/sec. velocity curve. At this intersection read on the abscissa 17 lbs/hr. This is the permitted value for a 100 ft. stack.
3. Correct emissions for a 200 ft. stack. Enter Graph I at 200 ft. and obtain correction factor of 2.3. Thus the emissions become 17 x 2.3 = 39 lbs/hr.

Example 2 (Temperature of stack gas greater than 125°F)

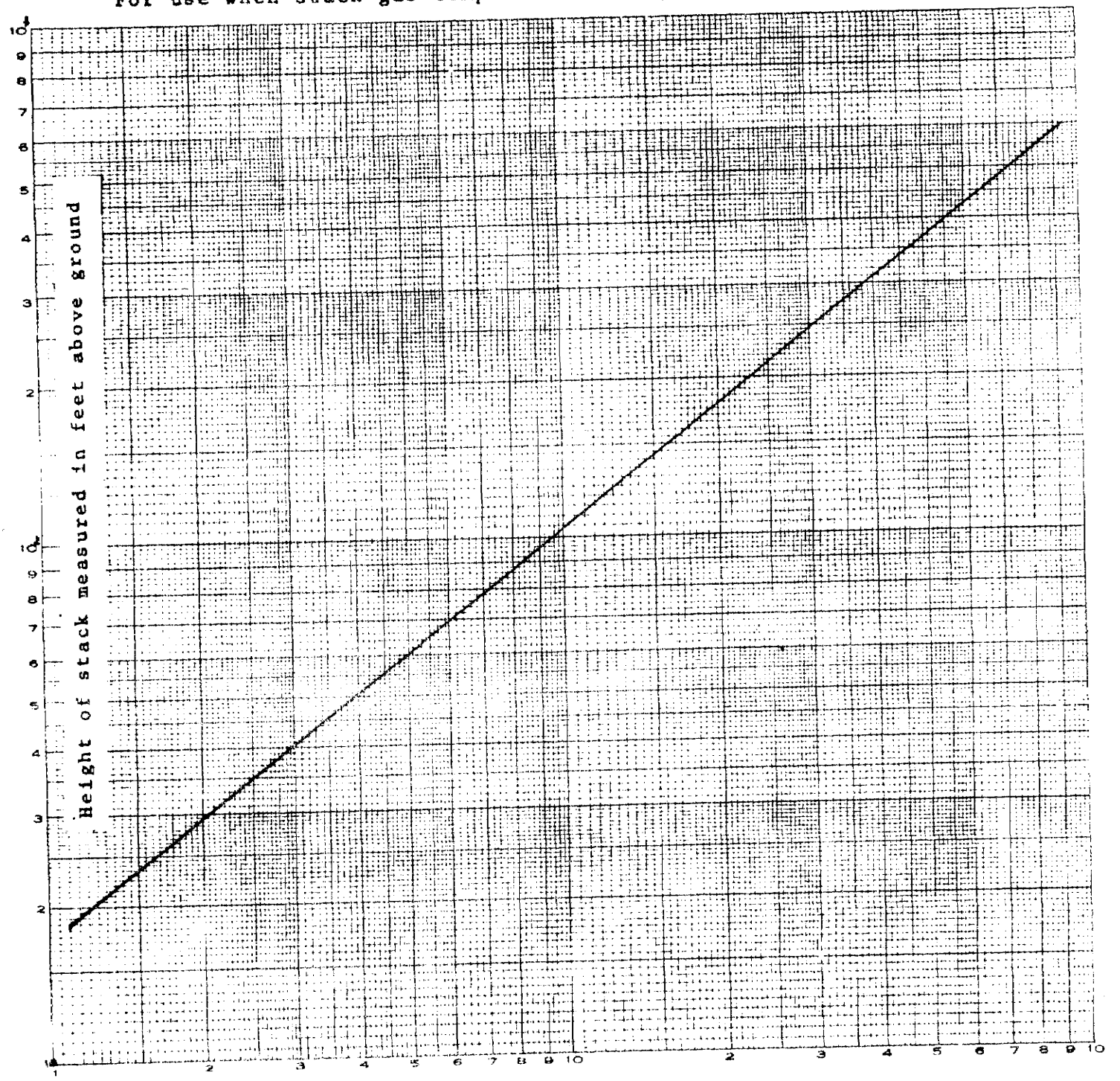
How many lbs/hr of H_2SO_4 can be discharged from a 200 ft. stack having a 4 ft. exit diameter (ID) and a 30 ft/sec. exit gas velocity. The temperature of the exit gases is 400°F.

Solution

1. Enter ordinate of Graph V with 400; go horizontally to intersection of 4 ft. diameter and read on abscissa 26 lbs/hr emission. This is permitted value for 100 ft. stack and exit velocity of 20 ft./sec.
2. Correct for stack height. Thus $\frac{200}{100} = 2$. We now have 26 x 2 = 52 lbs/hr.
3. Correct for stack exit velocity of 30 ft/sec. This is a direct ratio and becomes $\frac{30}{20} = 1.5$. The emission now is 52 x 1.5 = 78 lbs/hr.

Correction Factors for Stack Height

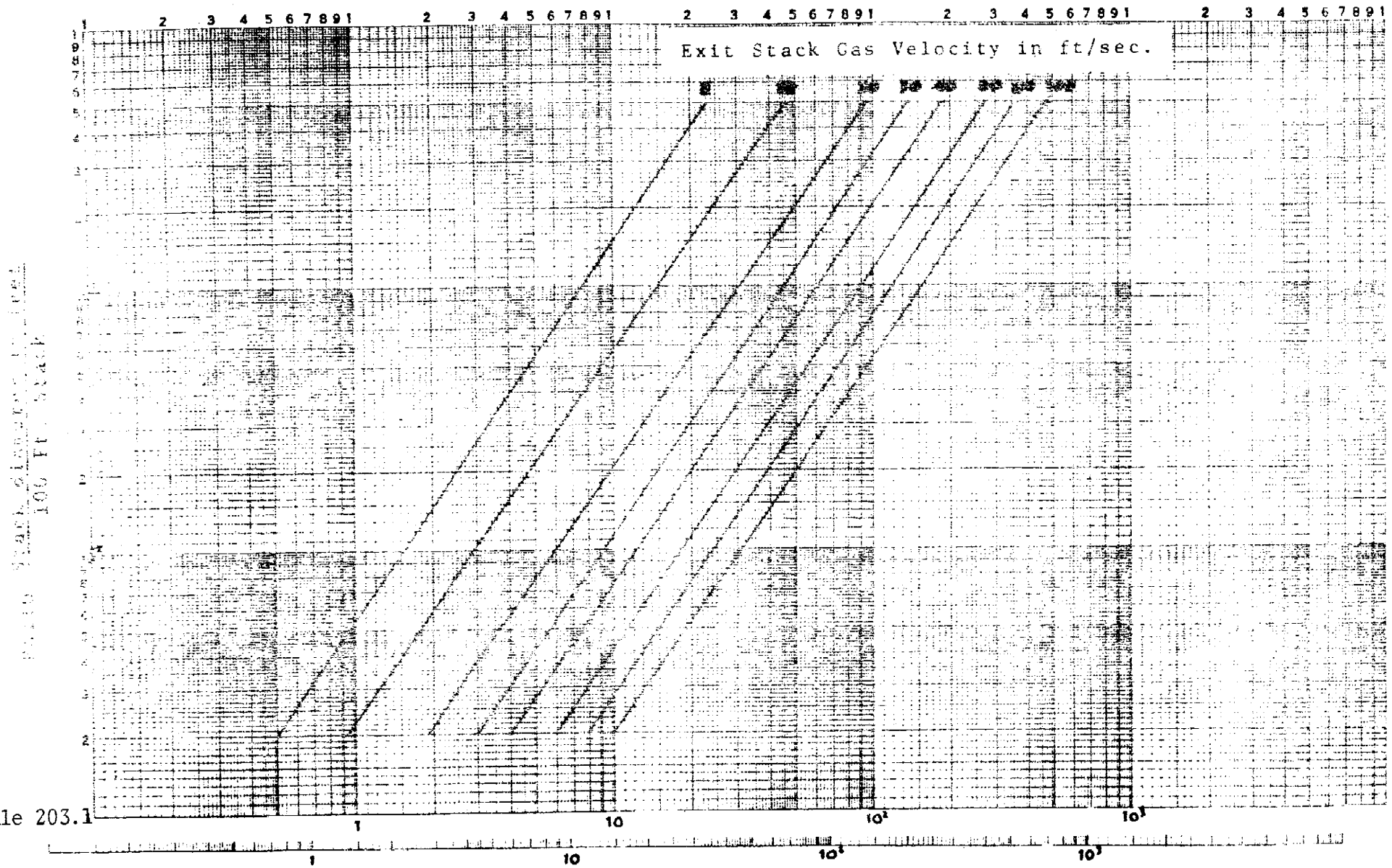
For use when stack gas temperature is equal or less than 125°F



CORRECTION FACTORS

GRAPH I

Addition 2-15-74



Rule 203.1

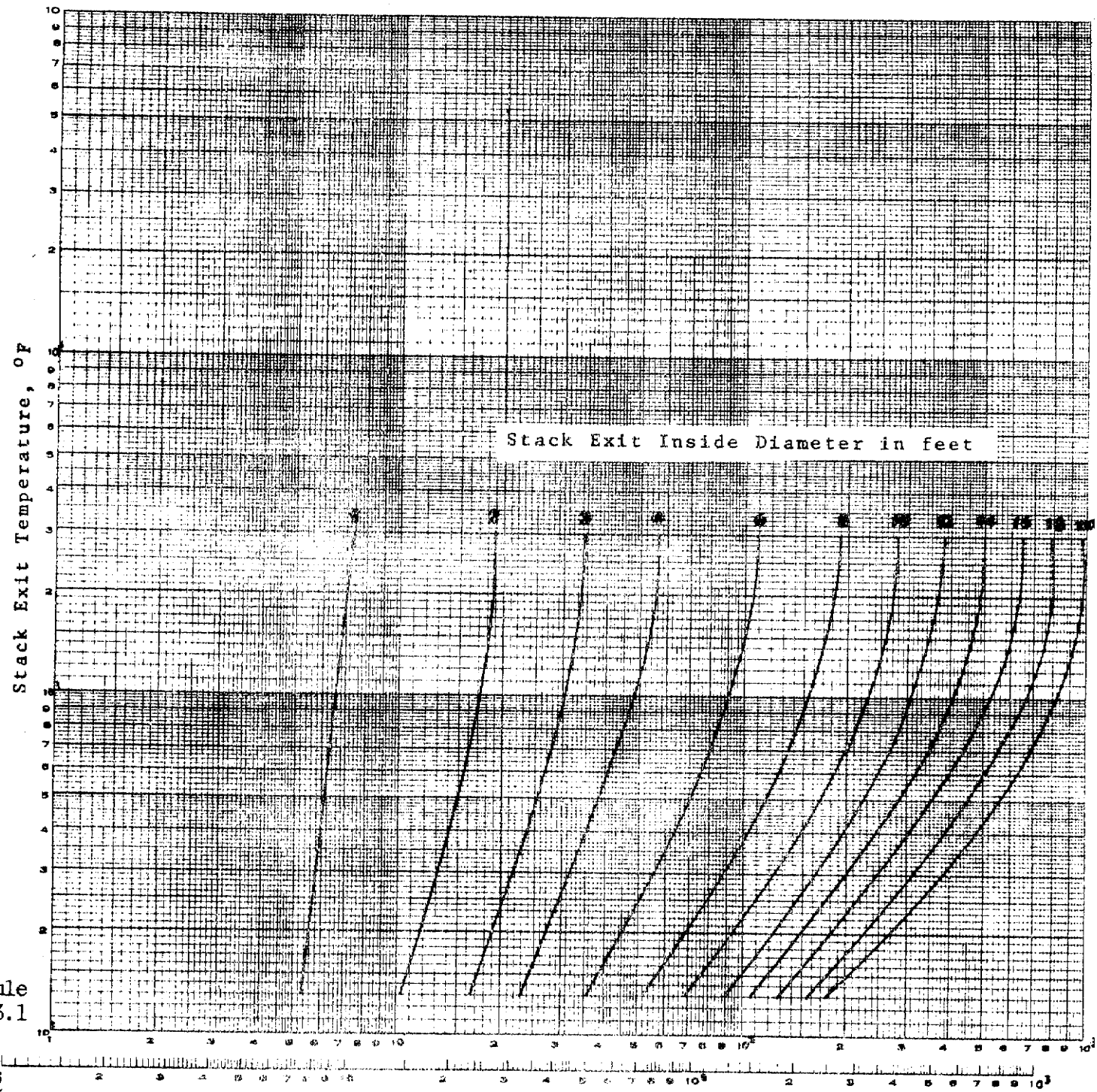
Rule 203.2

HYDROGEN SULFIDE

GRAPH II

(Exit Stack Gas Temperature Less Than 125°F)

Addition 2-15-74



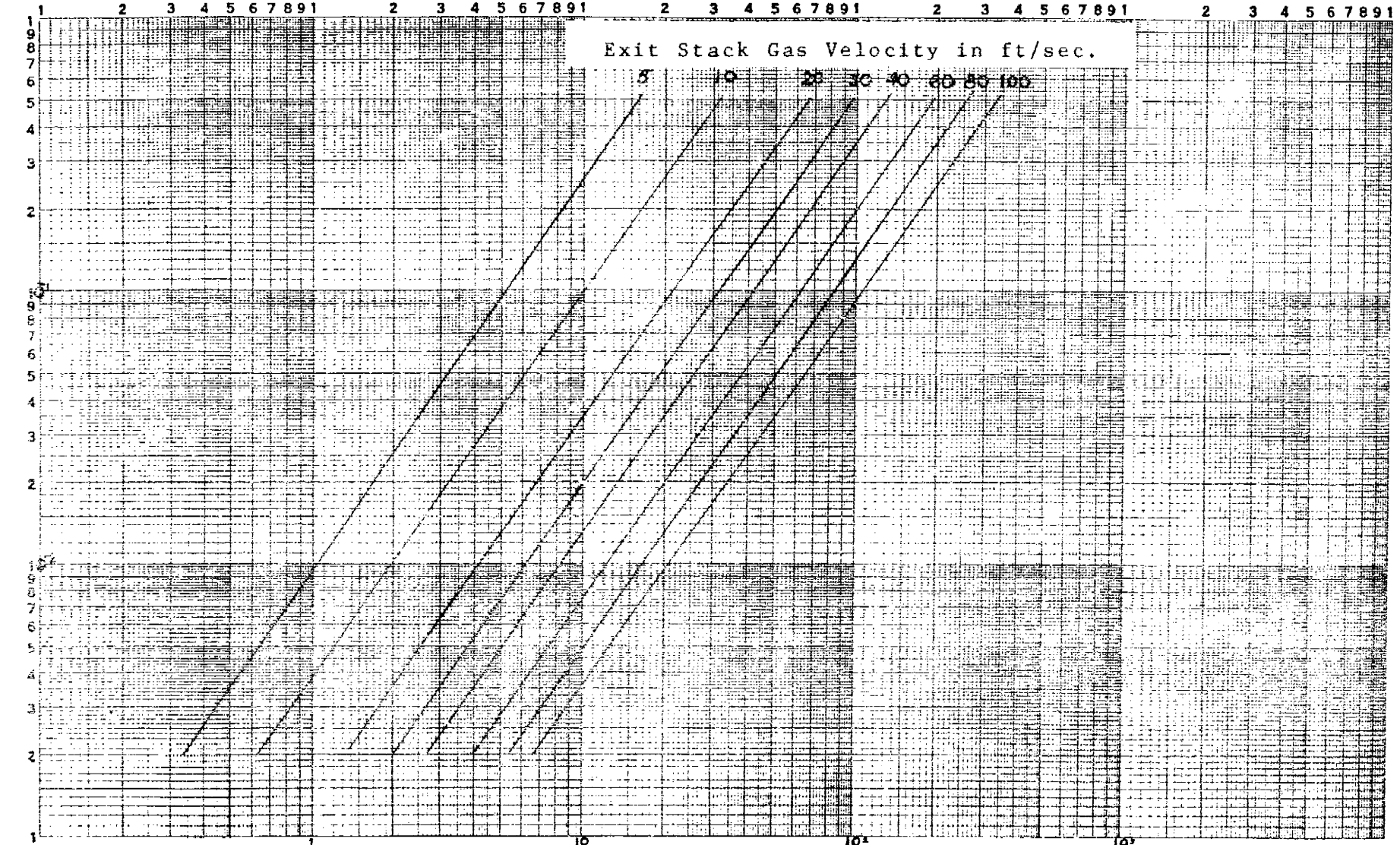
Rule 203.1

Rule 203.2

HYDROGEN SULFIDE

GRAPH II

For Use When the Exit Temperature is greater than 125°F



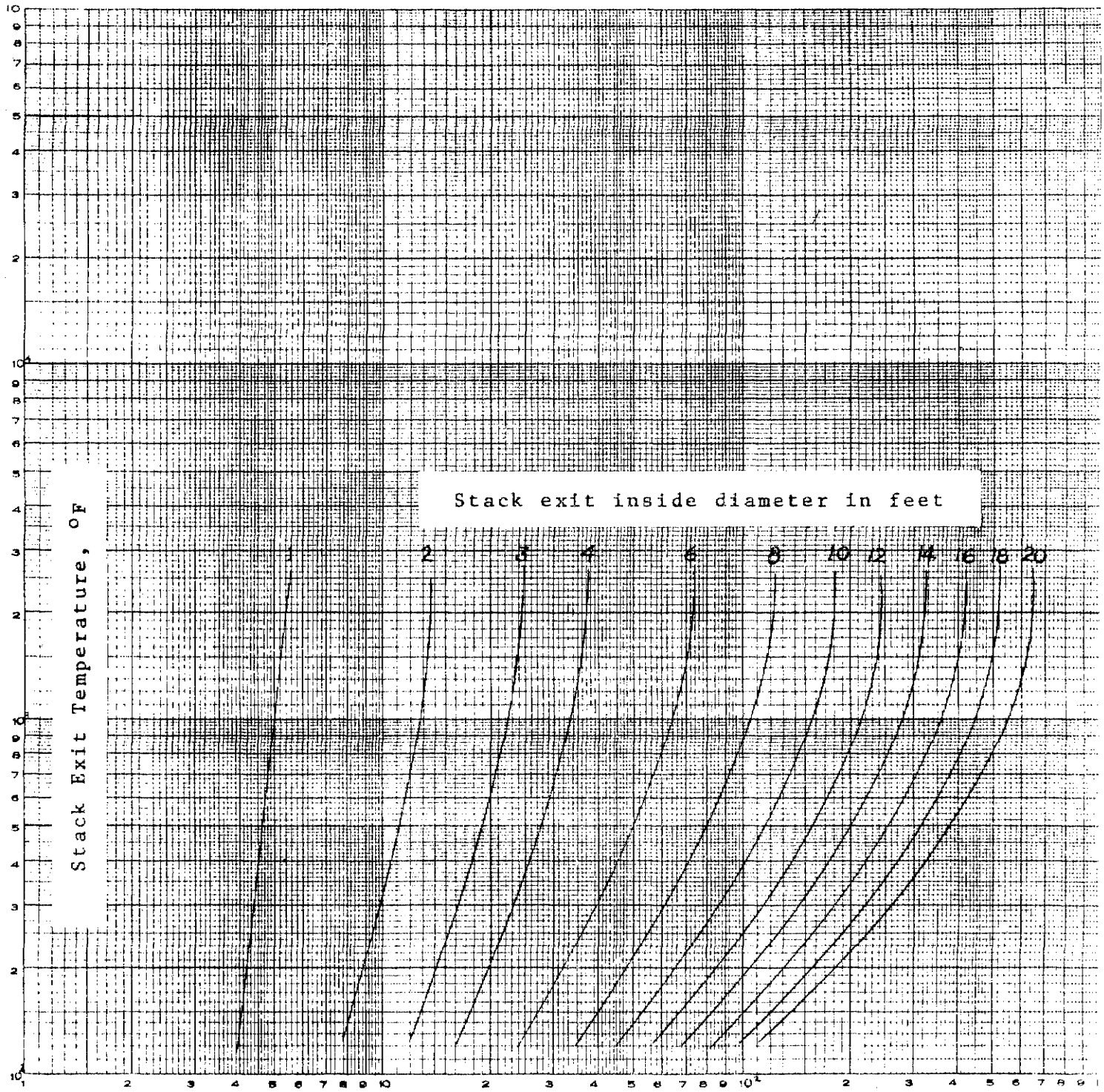
Rule 204.1

SULFURIC ACID MIST

(Exit Stack Gas Temperature Less Than 125°F)

GRAPH IV

Addition 2-15-74



Rule 204.1

SULFURIC ACID MIST

GRAPH V

Stack Emission Rate in lbs/hr.

For Use When The Exit Temperature is greater than 125°F

Addition 2-15-74