APRIL 1974

IMPLEMENTATION PLAN REVIEW

FOR

TENNESSEE

APPENDICES

U. S. ENVIRONMENTAL PROTECTION AGENCY

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APPENDIX A

State Implementation Plan Background

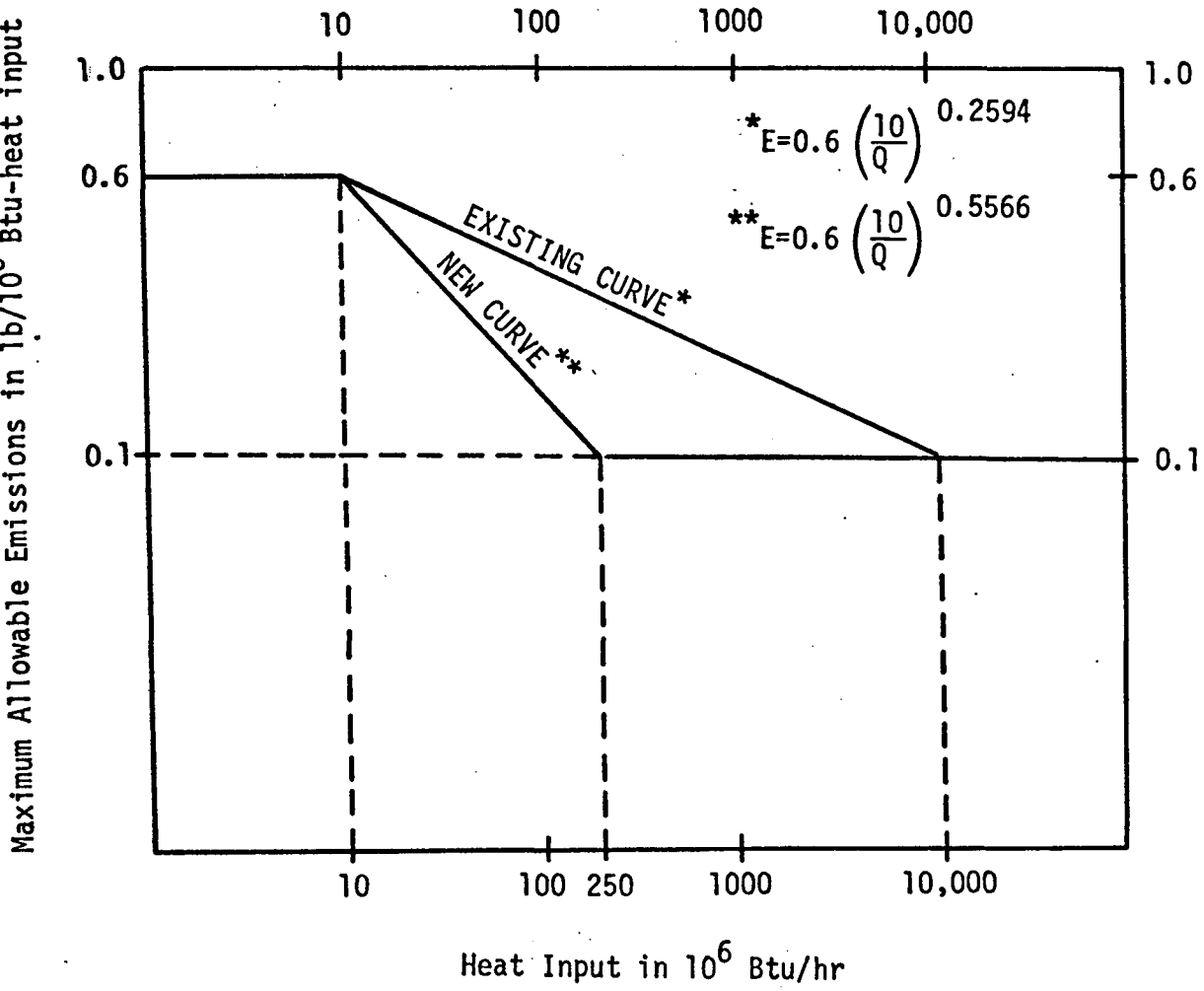

Figure A-1 Maximum Allowable Particulate Emission Standards for Fuel Burning Installations

Table A-1. Tennessee Air Pollution Control Areas

Air Quality Control Region	Federal Number	Demographic Information: Population 1970 (Millions)	Area (Square Miles)	Population Per Square Mile	Priority Classification: Particulates	SO_x	NO_x	Proposed AQMA Designations[a]: TSP Counties	SO_x Counties
Tennessee River Valley-Cumberland Mountains(Ala.)	7	.97	15,888	61	I	I	III	(0)	(0)
Metropolitan Memphis (Ark.,Miss.)	18	.81	1,839	439	I	III	III	(0)	(0)
Chattanooga (Ga.)	55	.69	5,991	115	I	II	III	(1) Hamilton	(0)
Eastern Tennessee-Southwestern Virginia(Va.)	207	1.51	16,125	94	I	I	III	(0)	(0)
Middle Tennessee	208	1.06	13,141	80	I	II	III	(1) Davidson	(0)
Western Tennessee	209	.47	9,927	48	I	III	III	(0)	(0)

[a]As of November 14, 1974

Table A-2. Tennessee Ambient Air Quality Standards

All Concentrations in $\mu g/m^3$

		Total Suspended Particulate		Sulfur Oxides			Nitrogen Dioxide
		Annual	24-Hour	Annual	24-Hour	3-Hour	Annual
Federal	Primary	75 (G)	260[a]	80 (A)	365[a]	---	100 (A)
	Secondary	60 (G)	150[a]	---	---	1300[a]	100 (A)
State	Primary	75 (G)	260[a]	80 (A)	365[a]	---	100 (A)
	Secondary	60 (G)	150[a]	60 (A)[b]	364[a]	1300[a]	100 (A)

[a]Not to be exceeded more than once per year.

[b]Was adopted based on original EPA policy which was rescinded July, 1973

(A) Arithmetic mean
(G) Geometric mean

Table A-3. Tennessee AQCR Air Quality Status, TSP[a]

AQCR No.	No. Stations Reporting		TSP Concentration ($\mu g/m^3$)			Number of Stations Exceeding Ambient Air Quality Standards				% Reduction Required to meet Standards[d]	Controlling Standard
			Highest Reading		2nd Highest Reading	Primary		Secondary			
	24-Hr	Annual	Annual	24-Hr	24-Hr	Annual	24-Hr[c]	Annual	24-Hr[c]		
7[b]	38	18	100	1,830	1,450	4	7	7	13	+ 92	24-Hr
18[b]	20	4	93	451	289	2	1	3	8	+ 54	24-Hr
55[b]	14	2	87	302	250	1	0	2	5	+ 47	Annual
207[b]	42	1	28	528	433	0	2	0	8	+ 70	24-Hr
208	32	1	70	300	288	0	2	1	9	+ 53	24-Hr
209	9	0	-	194	164	-	0	-	1	+ 10	24-Hr

[a] 1973 air quality data in National Air Data Bank as of June 7, 1974.

[b] Interstate.

[c] Violations based on 2nd highest reading any any station.

[d] Formula:

$$\text{Maximum of} \left[\left(\frac{\text{2nd Highest 24-Hr} - \text{24-Hr Secondary Standard}}{\text{2nd Highest 24-Hr} - \text{Background}} \right) \times 100, \quad \left(\frac{\text{Annual} - \text{Annual Secondary Standard}}{\text{Annual} - \text{Background}} \right) \times 100 \right]$$

Tennessee particulate background concentration: 30 $\mu gm/m^3$

Note that this is a first approximation. EPA no longer encourages the use of rollback calculations to demonstrate NAAQS attainment. However, in the absence of dispersion modeling calculations it is the only measure available and it is used here.

Table A-4. Tennessee AQCR Air Quality Status, SO_2[a]

AQCR No.	No. Stations Reporting			SO_2 Concentration ($\mu g/m^3$)			Number of Stations Exceeding Ambient Air Quality Standards			% Reduction Required to Meet Standards[d]	Controlling Standard
				Highest Reading		2nd Highest Reading	Primary		Secondary		
	Annual	24-Hr	Cont.	Annual	24-Hr	24-Hr	Annual	24-Hr[c]	3-Hr[c]		
7[b]	0	7	3	—	218	52	—	0	0	-602	24-Hr
18[b]	0	10	1	—	290	76	—	0	0	-380	24-Hr
55[b]	2	14	0	15	44	28	0	0	—	-433	Annual
207[b]	0	22	3	—	809	581	—	1	0	+ 37	24-Hr
208	1	22	0	10	60	39	0	0	—	-700	Annual
209	No data available										

[a] 1973 air quality data in National Aerometric Data Bank as of June 7, 1974.

[b] Interstate.

[c] Violations based on 2nd highest reading at any station.

[d] Formula:

$$\text{Maximum of } \left[\left(\frac{\text{2nd Highest 24-Hr - 24-Hr Standard}}{\text{2nd Highest 24-Hr}}\right) \times 100,\ \left(\frac{\text{Annual - Annual Standard}}{\text{Annual}}\right) \times 100\right]$$

Note that this is a first approximation. EPA no longer encourages the use of rollback calculations as a means of demonstrating NAAQS attainment. However, in the absence of dispersion modeling results it is the only measure available and it is used here.

Table A-5. Tennessee Fuel Combustion Source Summary

AQCR No.	Power Plants[a]	Other Fuel Combustion Point Sources[b]	Area Sources[c]	Total Emissions[d] (10^3 tons/year) TSP	SO_2	% Emissions from Tennessee Fuel Combustion Sources TSP	SO_2
7[e]	0	0	16	342	457	1	2
18[e]	1	0	1	18	81	22	90
55[e]	0	2	1	78	218	13	4
207[e]	4	5	27	277	423	39	72
208	3	1	30	181	792	70	98
209	0	3	20	17	8	18	63
Total	8	11	95	913	1,979	28	59

[a]Tennessee plants

[b]Tennessee plants contributing 90% of the particulate and SO_2 emissions, or 1,000 or more tons per year.

[c]Tennessee counties

[d]AQCR total

[e]Interstate

Table A-6. Tennessee Emissions Summary, TSP[a]

AQCR		Total (10^3 tons/yr)	%	Electricity Generation (10^3 tons/yr)	%	Industrial/Commercial/ Institutional Point Source (10^3 tons/yr)	%	Area Source (10^3 tons/yr)	%
7	Tennessee	35	4	0	0	<1	<1	2	5
	Other	307	33	239	78	10	3	6	2
	Total	342	37	239	70	10	3	8	2
18	Tennessee	17	2	<1	2	2	11	2	12
	Other	1	<1	0	0	0	0	<1	15
	Total	18	2	<1	2	2	10	2	12
55	Tennessee	25	3	0	0	9	37	1	4
	Other	53	6	10	19	2	4	2	4
	Total	78	9	10	13	11	14	3	4
207	Tennessee	177	19	47	27	55	31	6	4
	Other	100	11	39	39	21	21	4	4
	Total	277	30	86	31	76	27	10	4
208		181	20	120	66	3	2	4	2
209		17	2	0	0	1	8	2	9
	Total	913	100	455	50	103	11	29	3

[a]Emission data from Reference 6.

Table A-7. Tennessee Emissions Summary, SO_2[a]

AQCR		Total (10^3 tons/yr)	%	Electricity Generation (10^3 tons/yr)	%	Industrial/Commercial/ Institutional Point Source (10^3 tons/yr)	%	Area Source (10^3 tons/yr)	%
7	Tennessee	11	1	0	0	<1	<1	7	67
	Other	446	23	406	91	31	7	8	2
	Total	457	24	406	89	31	7	15	3
18	Tennessee	80	4	69	86	1	1	3	4
	Other	1	<1	0	0	0	0	<1	22
	Total	81	4	69	86	1	1	3	4
55	Tennessee	28	1	0	0	4	14	4	13
	Other	190	10	179	94	3	2	4	2
	Total	218	11	179	82	7	3	8	3
207	Tennessee	382	19	246	64	47	12	12	3
	Other	41	2	26	63	8	19	6	16
	Total	423	21	272	64	55	13	18	4
208		792	40	731	92	31	4	11	1
209		8	<1	0	0	2	21	3	35
	Total	1979	100	1657	84	127	6	58	3

[a]Emission data from Reference 6.

Table A-8. Tennessee Required Emission Reduction[a]

AQCR	Estimated Particulate Emission Reduction Required		Estimated SO_2 Emission Reduction Required	
	10^3 tons/yr	%	10^3 tons/yr	%
7[b]	+315	+92	-2751	-602[c]
18[b]	+ 10	+54	- 308	-380[c]
55[b]	+ 37	+47	- 944	-433[c]
207[b]	+194	+70	+ 157	+ 37
208	+ 96	+53	-5544	-700[c]
209	+ 2	+10	d	d

[a]Based on a proportional change of emissions to air quality. Note that this is a first approximation. EPA no longer encourages the use of rollback calculations to demonstrate NAAQS attainment. However, in the absence of dispersion modeling results it is the only measure available and it is used here.

[b]Interstate.

[c]Exceptionally large negative numbers indicate current air quality is very good. In this range, the proportional calculations do not give a good picture of allowable emission increases. They are included here only as general indicators.

[d]No data available.

Table A-9. Tennessee Fuel Combustion Emission Regulations

Particulate Matter

A. Choice of Standards - Existing Fuel Burning Equipment

The owner or operator of existing fuel burning equipment may elect to be regulated by emission limits established by either Subsection 1 or 2 of this section unless otherwise indicated. After July 1, 1975, all existing fuel burning installations shall be required to comply with the emission regulations as given in Subsection 2. The owner or operator of a facility in existance on or before the effective date of this regulation must designate, in writing, to the Technical Secretary, not later than July 1, 1972, which Subsection is selected. In the event the owner or operator makes no selection within the prescribed time period, Subsection 2 will be applicable.

1. Diffusion Equation

For existing installations up to and including 4000 million Btu per hour total plant heat input, the maximum allowable particulate emission shall be as determined by the following equation, provided, however, that no emission in excess of six tenths (0.6) pounds per million Btu shall be permitted from any installation. Such limit shall be achieved by August 9, 1973.

$$D = \frac{20650\ a\ h}{Q^{0.75}}$$

in which D is the maximum allowable particulate emission in pounds per million Btu heat input, h is the stack height in feet, a is a diminsionless factor of 0.67 for stacks of 200 feet height and less, and 0.80 for stacks in excess of 200 feet, and Q is the combined heat input in Btu per hour to the entire fuel burning installation.

Table A-9. Tennessee Fuel Combustion Emission Regulations (Cont'd)

When more than one stack of the same height serves a given installation, the allowable emission limit as determined by the above equation shall be further reduced by dividing the emission limit so obtained by $n^{0.25}$, where n is the number of stacks of equal height. Stacks varying in height may be construed as being of equal height provided a weighted average stack height is used in computing the allowable emission limit.'

2. Heat Input

The maximum allowable particulate emission limits as given in this Subsection are based upon the total plant rate of input to one or more stacks.

For existing installations up to and including 4000 million Btu per hour total plant heat input, the maximum allowable particulate emission shall be determined from Figure A-1, existing curve, shall be achieved by August 9, 1973.

Emission limits for all existing fuel burning installations in excess of 4000 million Btu per hour will be determined by Figure 2-2, existing particulate curve, up to 10,000 million Btu per hour heat input. Emission limits from existing installations in excess of 10,000 million Btu per hour will be determined from Figure A-1. This allowable emission standard must be attained on or before July 1, 1975.

B. New Fuel Burning Equipment

For fuel burning installations constructed after the effective date of this regulation, the maximum allowable particulate emission shall be determined from Figure A-1, new particulate curve, based upon the total plant rate of heat input to one or more stacks. This allowable emission standard must be attained at the time such fuel burning installation begins operation.

Sulfur Dioxide

A. On or after July 1, 1975, the owner or operator of an air contaminant source located in a Class I County shall not cause, soffer, allow or permit the emission from that source of sulfur oxides (calculated as sulfur dioxide) in excess of 1.6 pounds per million Btu heat input, maximum 2 hour average.

B. On or after July 1, 1975, the owner or operator of an air contaminant source located in a Class II County shall not cause, suffer, allow or permit the emission from that source of sulfur oxides (calculated

Table A-9. Tennessee Fuel Combustion Emission Regulations (Cont'd)

as sulfur dioxide) in excess of 3.0 pounds per million Btu heat input maximum 2 hour average.

C. On or after July 1, 1975, the owner or operator of an air contaminant source located in a Class II I County shall not cause, suffer, allow or permit the emission from that source of sulfur oxides (calculated as sulfur dioxide) in excess of 4.0 pounds per million Btu heat input, maximum 2 hour average.

D. After January 1, 1973, fuel burning installations with a rated capacity of 250 million Btu per hour or less heat input, constructed after April 3, 1972, shall not cause, suffer, allow or permit the emission of sulfur oxides (calculated as sulfur dioxide) in excess of those limits specified in A), B) and C) above.

E. After January 1, 1973, the owner or operator of an air contaminant source with more than 250 million Btu per hour heat input, constructed after April 3, 1972, shall not cause, suffer, allow or permit the emission from that source of sulfur oxides (calculated as sulfur dioxide) in excess of the following:

a. 0.08 lbs per million Btu heat input, maximum 2 hour average, when liquid fossil is burned.

b. 1.2 lbs per million Btu heat input, maximum 2 hour average, when solid fossil fuel is burned.

c. Where different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration. Compliance shall be determined by using the following formula:

$$\frac{Y(0.80) + Z(1.2)}{X + Y + Z}$$

where: X = % of total heat input derived from gaseous fossil fuel

Y = % of total heat input derived from liquid fossil fuel

Z = % of total heat input derived from solid fossil fuel

Table A-9. Tennessee Fuel Combustion Emission Regulations (Continued)

as sulfur dioxide) in excess of 3.0 pounds per million Btu heat input maximum 2 hour average.

C. On or after July 1, 1975, the owner or operator of an air contaminant source located in a Class II I County shall not cause, suffer, allow or permit the emission from that source of sulfur oxides (calculated as sulfur dioxide) in excess of 4.0 pounds per million Btu heat input, maximum 2 hour average.

D. After January 1, 1973, fuel burning installations with a rated capacity of 250 million Btu per hour or less heat input, constructed after April 3, 1972, shall not cause, suffer, allow or permit the emission of sulfur oxides (calculated as sulfur dioxide) in excess of those limits specified in A), B) and C) above.

E. After January 1, 1973, the owner or operator of an air contaminant source with more than 250 million Btu per hour heat input, constructed after April 3, 1972, shall not cause, suffer, allow or permit the emission from that source of sulfur oxides (calculated as sulfur dioxide) in excess of the following:

a. 0.08 lbs per million Btu heat input, maximum 2 hour average, when liquid fossil is burned.

b. 1.2 lbs per million Btu heat input, maximum 2 hour average, when solid fossil fuel is burned.

c. Where different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration. Compliance shall be determined by using the following formula:

$$\frac{Y(0.80) + Z(1.2)}{X + Y + Z}$$

where: X = % of total heat input derived from gaseous fossil fuel

Y = % of total heat input derived from liquid fossil fuel

Z = % of total heat input derived from solid fossil fuel

Table A-10. Tennessee County Classification for SO_2

County	Classification
Polk	IA
Sullivan, Roane, Maury	I
Humpherys	II
All others	III

APPENDIX B

Regional Air Quality Assessment

Table B-1. Tennessee AQCR Candidacy Assessment for Particulate Regulation Relaxation

AQCR		Stations with Particulate Air Quality Violations[a]	Expected Attainment Date	Counties with Proposed Particulate AQMA Designations	Total Particulate Emissions (10^3 tons/yr)	% Emissions from Tennessee Fuel Combustion	Estimated Emission Reduction Required for NAAQS (10^3 tons/yr)	Particulate Priority
Tennessee River Valley - Cumberland Mountains[b]	7	14	7/75	0	342	1	+315	I
Metropolitan Memphis[b]	18	9	7/75	0	18	22	+ 10	I
Chattanooga[b]	55	6	7/75	1	78	13	+ 37	I
Eastern Tennessee - Southwestern Virginia[b]	207	8	7/75	0	277	39	+194	I
Middle Tennessee	208	9	7/75	1	181	70	+ 96	I
Western Tennessee	209	1[c]	7/75	0	17	18	+ 2	I

[a]Total number of stations given on Table A-3.

[b]Interstate.

[c]No annual data.

Table B-2. Tennessee AQCR Candidacy Assessment for SO_2 Regulation Relaxation

AQCR		Stations with SO_2 Air Quality Violations[a]	Expected Attainment Date	Counties with Proposed SO_2 AQMA Designations	Total SO_2 Emissions (10^3 tons/yr)	% Emissions from Tennessee Fuel Combustion	Estimated Emission Reduction Required for NAAQS (10^3 tons/yr)	SO_2 Priority
Tennessee River Valley-Cumberland Mountains[b]	7	0[c]	d	0	457	2	-2.751	I
Metropolitan Memphis[b]	18	0[c]	d	0	81	90	- 308	III
Chattanooga[b]	55	0	d	0	218	4	- 944	II
Eastern Tennessee-Southwestern Virginia[b]	207	1[c]	7/75	0	423	72	+ 157	I
Middle Tennessee	208	0	d	0	792	98	-5.544	II
Western Tennessee	209	e	f	0	8	63	e	III

[a]Total number of stations given on Table A-4.

[b]Interstate.

[c]No annual data.

[d]Presently meeting standards.

[e]No data available.

[f]Attainment schedule indicates region is below standards; current data is unavailable.

APPENDIX C

Power Plant Assessment

Table C-1. Tennessee Power Plant Assessment

AQCR	Plant	1975 Capacity (Mw)	Estimated 1975 Fuel Use		% S under SIP Regulations[b]	% S Allowed By Model
			Fuel	Quantity[a]		
18[c]	T. H. Allen	990	Coal	1,200	2.5	4.7
			Gas	N/A	N/A	N/A
207[c]	Bull Run	950	Coal	2,185	2.5	2.5
	Kingston	1,700	Coal	3,935	0.7	< 0.7
	John Seiver	823.3	Coal	1,587	2.5	2.5
	Watts Bar	240	Coal	100	2.5	2.5
208	Gallatin	1,255.2	Coal	2,611	2.5	5.5
	Johnsonville	1,485.2	Coal	2,860	0.7	< 0.7
	Cumberland 1&2[d]	2,600	Coal	7,148	2.5	6.0

[a]Coal use in 10^3 tons/year; oil use in 10^3 gallons/yr; gas use in $10^6 ft^3$/yr
Estimates based on 1971 fuel use patterns plus planned additions.

[b]Modeling results supplied by EPA, Region IV

[c]Interstate

[d]Cumberland #1 went on line in 1972; Cumberland #2 went on line in 1973

Table C-2. Tennessee Power Plant Evaluation Summary

AQCR	Fuel	1975 Fuel Required by SIP Regulations[a] < 1%	1-2%	2-3%	> 3%	1975 Fuel Required by Modified Regulations[c] < 1%	1-2%	2-3%	> 3%
18[b]	Coal			1,200					1,200
	Gas	N/A							
207[b]	Coal	3,935		3,872		3,935		3,872	
208	Coal	2,860		9,759		2,860			9,759

[a]Fuel requirements based on 1971 fuel use patterns at 1975 consumption rates plus any new units. Coal use in 10^3 tons/yr

[b]Interstate

[c]Highest percent sulfur that can be burned without violating primary NAAQS for SO_2.

APPENDIX D

Industrial, Commercial, Institutional Point Source Assessment

Table D-1. Major Tennessee Industrial/Commercial/ Institutional Source Fuel Consumption

AQCR	Plant	Fuel	Estimated Fuel Consumption[a]
55[b]	Central Soya Company	Residual Oil	3,423
		Gas	450
	Du Pont	Coal	65
		Distillate Oil	2,200
207[b]	Beaunit Fibers Corp.	Coal	235.4
		Gas	740.0
	American Enka	Coal	267.7
		Oil	4,120
	Southern Extract	Coal	31.13
		Gas	263
	Tennessee Eastman Company	Coal	1,574.5
		Distillate Oil	48.0
		Gas	200.0
	Mead Corporation	Coal	174.2
208	E. J. DuPont	Coal	139.2
		Gas	86
209	Milan Army Ammunition Plant	Coal	21.48
		Residual Oil	900
	Tennessee Pulp and Paper Co.	Oil	360
		Gas	1,050
	University of Tennessee	Coal	5.01

[a]Coal use in 10^3 tons/yr; oil use in 10^3 gallons/yr; gas use in $10^6 ft^3$/yr

[b]Interstate