UTAH STATE IMPLEMENTATION PLAN
SECTION XVIII
DEMONSTRATION OF GEP STACK HEIGHT

SECTION XVIII.A Introduction

Section 123 of the Clean Air Act established requirements for regulations to be developed to insure that the degree of emission limitation required for the control of any air contaminant under an applicable State Implementation Plan is not affected by that portion of any stack height which exceeds "Good Engineering Practice"(GEP), or by any other dispersion technique.

Section 123 originally defined "Good Engineering Practice" with respect to stack heights as a stack which does not exceed 2.5 times the height of the source, unless greater height is ". . . necessary to insure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes which may be created by the source itself, nearby structures, or nearby terrain obstacles . . ." . In 1982 the EPA refined that definition by federal regulation to mean 2.5 times the height of the source for stacks in existence on January 12, 1979. For stacks in existence after January 12, 1979, GEP formula height is defined as the height of the source plus 1.5 times the lesser of the height, width or projected width of a nearby structure. Section 123 also restricts the credit allowed for the effects of other dispersion techniques.

The final regulation became effective on August 7, l985.

Under the new rules, any stack which is shorter than 65 meters is exempt from designing the stack according to Good Engineering Practice. For stacks which are taller than 65 meters, GEP stack height must be demonstrated as outlined in the definition of GEP. This demonstration may be made by using the formula height, or by means of a fluid model or field study which establishes the GEP height as the height required to ensure that "emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, nearby structures or nearby terrain features." (40 CFR 51.100(ii)(2-3)

Stacks built before January 12, 1979 and taller than 65 meters may be designed using the 2.5H formula if the source owner/operator can demonstrate the formula was used in designing and building the stack.

Stack heights in existence on or before December 31, 1970 are not subject to the August 7, 1985 Federal Regulation unless modifications have been made. Also, coal fired steam electric generating units subject to the provisions of Section 118 of the Clean Air Act, which commenced operation before July l, l957, and whose stacks were constructed under a construction contract awarded before February 8, l974, are not subject to this rule.

The state is required to demonstrate that all sources which have stacks taller than 65 meters and have emission limitations established under the SIP are in compliance with this rule. The Committee has evaluated all stacks in the state which are taller than 65 meters and determined, on a case-by-case basis, whether each stack conforms to the requirements of GEP. The following list is an inventory of all stacks in the state which exceed 65 meters and shows the allowable SO_2 emissions contained in either an approval order or Appendix IX, Part H, of the State Implementation Plan:

Source Name	Stack Height (M)	Allowable SO_2 Emissions (Ton/Year)
Deseret Units 1&2	182	1,512
U.P.&L. Hunter Units 1&2	183	4,347
U.P.&L. Hunter Units 3	183	1,283
U.P.&L. Huntington Units 1&2	183	9,448
I.P.P. Units 1&2	216	17,870
U.P.&L. Gadsby Units 1,2&3	76.2	67.7+
Geneva Steel blast furnaces 1&2	79.2	12.5 TOTAL+

Geneva Steel blast furnace	68.6	
Geneva Steel Coke Combustion 1-4	76.2	102.8 TOTAL+
Kennecott Utah Copper Smelter Main Stack	370	14,191+
Chevron USA HCC Cracker Cat. Dis.	88.4	66.7+
Chevron Research Air Heater	69.8	0
Chevron Research Retort	69.8	0+
Amax melt reactor	76.22	0
Amax electrolytics	76.22	0
Amax emergency off gas	76.22	0
Amax Spray dryers 1-3	76.22	83
Phillips thermal cat. cracking	80.8	3.5+
White River Shale Lift Pipes	76.2	-
White River Elutriators	76.2	-
White River Hydrogen Plant	76.2	-
White River Power Plants	76.2	-
White River Ball Heaters	76.2	1,180.8*
Tosco Preheat Stacks	95	-
Tosco Warm Ball Elutriators	95	-
Tosco Process Shale Wetters	95	1,166.6*

+ SO_2 emissions derived from the PM_{10} SIP adopted August 14, 1991.
* The total SO_2 emissions are given for these sources.

XVIII.B <u>GEP Stack Height analysis</u>

<u>INTERMOUNTAIN POWER PROJECT UNITS l and 2</u>

Both boilers' exhausts are ducted up the same stack. The actual stack height is 710 feet (216.46 m). The highest buildings are the boiler units both of which are 302 feet (92.07 m) in height. The nearby building width and length are 320 and 580 feet respective. The formula which applies in this case is:

HG = H + l.5 L
H = 302 feet
L = 302 feet
Hg = 302 + l.5 (302) = 755 feet (230.2 m)
The actual stack height is less than GEP.

<u>AMAX</u>

The Amax melt reactor, electrolytics, emergency off gas and spray dryers l - 3 represent six stacks which are independently suspended inside a common concrete shell and have an actual exit height of 250 feet (76.22 m). The nearby building is the reactor building having a height of 113 feet, a length of 133 feet and a combined width of 120 feet. The formula which applies is:

Hg = H + 1.5 L
H = ll3 feet
L = 113 feet
Hg = 113 + 1.5 (113) = 282.5 feet (86.13 m)

The actual stack height is less than GEP

TOSCO

There are eighteen stacks in question. The project has received a PSD approval but has not started construction. The proposed height for each of the eighteen stacks is 3ll.6 feet (95 m). The nearby structure is the fractionation unit which has a height of ll3 feet (34.45 m). The formula which applies is:

Hg = H + l.5 L
H = ll3 feet
L = lesser dimension of height or projected width of
nearby combined structures = ll3 feet
Hg = 282.5 feet (86.l3 m)

The stacks will exceed GEP by 29.l feet (8.87 m). The current PSD feasibility permit does not contain specific emission limitations on any of the stacks. Under the PSD feasibility permitting process, specific emission limitations are not established until detailed plans are available for the phases of the project. When TOSCO decides to proceed with construction of this project, an approval order will be issued with specific emission limitations based on final BACT determinations from the review of the detailed plans. At that time, emission limits will be determined using GEP stack heights.

WHITE RIVER SHALE OIL CORP

WRSOC will have nine stacks which are taller than 213.2 feet (65 m). They are:

l. Phase I boiler, 3 stacks, 250 feet (76.22 m)

2. Phases II and III, Tosco II retorts, 2 stacks each, four total, 250 feet (76.22 m)

3. Phases II and III, boilers, one stack each, two total, 250 feet (76.22 m).

The lift pipes, elutriators and ball heater stacks are influenced by the retort building whose dimensions are 90 feet by 50 feet and 230 feet high. The formula which applies is:

Hg= H + 1.5 L
H = 230 feet
L = 50 feet, the lesser of the height or projected width.
Hg= 230 + 1.5 (50) = 305 feet
The actual stack height is 55 feet less than GEP.

The hydrogen plants and power plants are influenced by the boiler building whose dimensions are 450 feet by 300 feet and 100 feet high. The formula which applies is:

Hg= H + 1.5 L
H = 100 feet
L = 100 feet, the lesser of the height or projected width.
Hg= 100 + 1.5 (100) = 250 feet
The actual stack height is GEP.

DESERET GENERATION UNIT #1

Deseret Generation has one stack. Its actual height is 600 feet (182.93 m). The boiler building next to the stack has a height of 233.5 feet (70.88 m), a length of 363 feet, and a projected width of 256 feet. The formula to be used in this case is:

Hg = H + l.5 L
H = 233.5 feet
L = 233.5 feet
Hg = 233.5 + l.5 (233.5) = 584 feet (177.9 m)

The stack exceeds GEP by l6 feet (5 m). Unit #2, although not currently constructed, has identical building dimensions as the first unit. The formula to be used in this case is:

Hg = 233.5 + 1.5 (233.5) = 584 feet (177.9 m)

Since both stacks exceeded GEP formula height, a modeling analysis was performed to determine the impact of a lower allowable stack height.

<u>HUNTER 1 and 2</u>

These two plants are similar in design. The actual stack heights are both 600.58 feet (183.10 m). The generator buildings for units 1, 2 and 3 are next to each other. The nearby building height is 242.78 feet with a combined building length of 687 feet and a projected width of 334 feet. The lesser dimension used in the formula is the building height. The formula to be used is:

Hg = H + 1.5 L
H = 242.78 feet
L = 242.78 feet
Hg = 242.78 + 1.5 (242.78) = 606.95 feet (185.05 m)
The stacks are less than GEP by 6.37 feet (1.9 m).

<u>HUNTER #3</u>

The actual height is 600.58 feet (183.10 m). The generator buildings for units 1, 2 and 3 are next to each other. The lesser dimension used in the formula is the building height. The formula to be used is:

Hg = H + l.5 L
L = 242.78 feet
H = 242.78 feet
Hg = 242.78 + 1.5 (242.78) = 606.95 feet (185.05 m).
The stack is less than GEP by 6.37 feet (1.9 m)

<u>HUNTINGTON 1 and 2</u>

The actual stack heights for both units are 600 feet (182.93 m). The nearby generation buildings have a height of 232 feet with a combined length of 488 feet and a width of 315 feet. The formula to be used is:

Hg = H + 1.5 L
H = 232 feet
L = 232 feet
Hg = 232 + 1.5 (232) = 580 feet

Both stacks exceed GEP by 20 feet. A modeling analysis was performed to determine the impact of a lower allowable stack height.

<u>CHEVRON RESEARCH</u>

The permit for this source has expired. The source is shut down.

<u>GENEVA STEEL</u>

This source has been grandfathered (see technical support document). The following stacks were in existence as of the given date:

Blast Furnaces 1, 2 & 3 June 19, 1946
Coke Combustion 1 - 4 June 19, 1946

<u>PHILLIPS PETROLEUM CORPORATION</u>

This source has been grandfathered (see technical support document). The following stack was in existence as of the given date:

Thermal Cat cracking Fall, 1952

CHEVRON USA

This source has been grandfathered (see technical support document). The following stack was in existence as of the given date:

HCC Cracker Cat. Dis. Fall, 1950

GADSBY UNITS 1, 2, 3

These units have been grandfathered (see technical support document). The following stacks were in existence as of the given date:

Gadsby 1	1951
Gadsby 2	1952
Gadsby 3	1955

XVIII.C G.E.P. Modeling Analysis

UP&L HUNTINGTON UNITS 1 and 2

Since the actual height of the stacks are 600 feet, a modeling analysis was performed to determine if the calculated GEP stack height would have affected the setting of emission limitations for the units at the time of the permitting of the units. The procedure in modeling the effect of the lower stack height was to use both short term and long term screening modeling of SO_2 impacts from both the 600 and 580 foot stack heights. The impacts from the two different stack heights were compared. There is no significant difference in ambient impacts from emissions at either stack height, and therefore, the additional 20 feet of actual stack height over the calculated GEP height has no impact on ambient air quality.

The initial screening modeling results for both short and long term impacts show that the change in impacts from lowering the stack 20 feet is less that one tenth of one percent, and is therefore considered to be negligible.

A modeling study was performed by North American Weather Consultants (NAWC) in late 1970. The report, entitled "A Meteorological Evaluation of Dispersion of Stack Effluent from the proposed power plant in Huntington Canyon, Emery County, Utah" dated April 1971, examined potential plume impacts during worst case meteorological conditions from a 400 foot stack. The results of the report indicated that the highest expected concentrations were less than all applicable standards, and further indicated that even though the impacts were considered significant, the duration of such impacts was short lived. NAWC later analyzed a 600 foot stack height and recommended that height to avoid potential problems with impacts on the Bear Creek Ranger Station located in Huntington Canyon. In conclusion, the report indicates there is no adverse impacts caused by a 400 foot or a 600 foot stack.

As a result of modeling performed by the Bureau of Air Quality and the report from NAWC, it has been determined that the lower GEP stack height (580 feet) would have no impact on the original emission limitations established for both U.P.&L. Huntington Units #1&2.

DESERET GENERATION UNITS 1&2

Since the actual height of the stacks are 600 feet, a modeling analysis was performed to determine if the calculated GEP stack height would have affected the setting of emission limitations for the units at the time of the permitting of the units. The procedure in modeling the effect of the lower stack height was to use both short term and long term screening modeling of SO_2 impacts from both the 600 and 584 foot stack heights. The impacts from the two different stack heights were compared. There is no significant difference in ambient impacts from emissions at either stack height, and therefore, the additional 20 feet of actual stack height over the calculated GEP height has no impact on ambient air quality.

The results of the short term modeling in flat terrain show that a maximum increase in concentrations of .13 percent can be expected by lowering the allowable stack height from 600 to 584 feet. This amounts to a total SO_2 concentration of 51 UG/M^3 for a one hour period located very close to the generation units. Impacts in complex terrain were less than those on flat terrain, where the expected increase from a lower stack height was 2.5 percent of a total predicted impact of 0.41 UG/M^3 for a 24-hour average. Annual average impacts in complex terrain were about the same as those predicted in flat terrain. The expected increase in concentrations was predicted to be 5.6 percent of a total predicted impact of 0.7 UG/M^3. Other PSD sources were included in the modeling runs for cumulative impact analysis in the areas of expected maximum impacts as predicted by models for the Deseret G&T units. Cumulative impact analysis indicates that no new violation of any applicable PSD or NAAQS are predicted to occur as a result of modeling Deseret G&T units 1&2 at the lower stack height. The highest predicted cumulative increment was 21.6 UG/M^3 SO_2 for a three-hour average, located near the Paraho-Ute oil shale facility.

As a result of modeling performed by the Bureau of Air Quality, there would be no significant effect on ambient air quality by using a lower (584 feet) GEP stack height in establishing emission limitations for both Deseret G&T generating units #1&2.

KENNECOTT

Kennecott was required under the State Implementation Plan to proceed with a wind tunnel demonstration to determine a GEP stack height at the Utah smelter. The study was designed to determine if excessive concentrations resulting from downwash, wakes and eddy effects occur as a result of the Oquirrh mountains to the south. The two objectives of the study were to determine:

(1) If a 40 percent increase in maximum ground level concentrations occurs when the nearby terrain is included in the wind tunnel modeling over and above the maximum ground level concentration measured in the absence of such nearby terrain, and

(2) If such a concentration occurs, does it cause or contribute to an exceedence of the 3 hour SO_2 NAAQS of 1300 UG/M^3.

Several protocol meetings were held between Kennecott, the Bureau of Air Quality, and the EPA to finalize a design for the wind tunnel study.

A report was submitted by Kennecott documenting the wind tunnel modeling study entitled *Good Engineering Stack Height Demonstration*, dated February 1, 1986. The results of the demonstration show that the 1215 foot stack is below GEP height. The demonstration showed that the highest expected increase in concentrations due to downwash and eddy effects occurred during light wind speeds (3.45 M/S). With the current stack height of 1215 feet, it could be expected that a 56.4 percent increase in concentrations could result as a result of downwash, wakes or eddy effects.

In documenting an exceedence of the standard, the actual emissions during 1982 were used in conjunction with a calculated wind persistence frequency for the conditions used in the tunnel. The emission frequency curve was used to determine the minimum emission rate necessary to cause an exceedence of a standard. The actual emissions from the smelter during 1982 were used in the analysis because it was determined that NSPS emission limits were infeasible due to economic reasons. It was determined that with an expected emission rate of 22,000 pounds of SO_2 per hour for a three hour average, predicted to occur 2110 hours out of the year, a concentration of 1301 UG/M^3 was predicted to occur 0.72 times per year. This means that the three hour standard can be expected to be exceeded two times in a three year period.

In 1986, the Air Conservation Committee accepted the conclusion as described in the Kennecott *Good Engineering Practice Stack Height Demonstration*, dated February 1, 1986. The stack was determined by the Committee to meet all requirements as set forth in the Federal GEP stack height regulations, as promulgated on August 7, 1985, and was considered to be at or less than GEP stack height.

The Utah Air Quality Board has determined that the stack height demonstration submitted by Kennecott in 1986 remains valid with the emission limits adopted in 1991 in Section IX, Part H, PM_{10}, of this SIP. The basis for this conclusion is explained below.

EPA regulations contained in 40 CFR 60, Subpart P, allow the use of emission rates specified in the applicable new source performance standard (NSPS), and EPA has indicated in a letter from Irwin Dickstein, EPA Region VIII, to Roderick K. Davey of Kennecott dated July 18, 1991, that "NSPS is the presumptive norm for stack height analyses." In the December 5, 1988, Federal Register (53 FR 48945), EPA determined that the 1986 Kennecott demonstration would remain valid if the NSPS emission rate were used. The emission rate adopted in 1991 was based upon double contact acid plant technology, which is considered as NSPS for the smelter acid plant tail gas, and Kennecott is required under Section IX, Part H.2.b.V. of this SIP and in conjunction with all applicable rules contained in R446 of the Utah Administrative Code, to meet this emission limit which is equivalent to NSPS for the smelter acid plant tail gas (40 CFR 60.163(a), 60.165(c), and 60.165(d)(2)).

The Utah Air Quality Board has determined that the Kennecott GEP demonstration meets all the requirements as set forth in the federal GEP stack height regulations, as promulgated on July 8, 1985. The Board has determined that the Kennecott Utah Copper smelter main stack does not exceed GEP height.

* Note: See the technical support document and the Kennecott economic analysis of BART.