The Challenge of Air Quality Permit Approval for a Glass Plant near Mount Rainier and Olympic National Parks

Control #57

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ABSTRACT

Locating a new air pollution source near national parks and wilderness areas increases the need for a more thorough evaluation of air quality impacts and available emission control methods. This paper discusses the complexity and unique hurdles of the air quality permit process for a 650 ton per day float glass plant proposed for western Washington State. This process required 24 months and resulted in the use of air pollution control measures more effective than similar projects in the U.S. The plant required air quality permits from both the local and state air pollution control agencies with oversight by five federal agencies. The state issued a Prevention of Significant Deterioration (PSD) air quality permit with requirements for the evaluation of Best Available Control Technology (BACT) and near-field air quality impacts. Selection of the emission control methods are discussed. A unique method developed to screen regional sources for the near-field modeling analysis is explained. In addition, the project was located within 200 kilometers of seven Class I air quality areas including Mount Rainier and Olympic National Parks. A separate evaluation was required by the National Park Service and U.S. Forest Service to assess far-field impacts on air quality standards, regional visibility and acid deposition. A review of impacts on endangered species was required by the National Marine Fisheries and US Fish and Wildlife Services. While prior float glass projects elsewhere in the U.S. had established BACT for the industry, the proximity to the Class I areas required greater control of the proposed air pollution emissions. Despite the effort taken to verify compliance with air quality permit requirements, the permit was challenged after issuance. Project construction was delayed until the USEPA Environmental Appeals Board verified compliance with the PSD and BACT requirements.

INTRODUCTION

A 650 ton per day float glass plant was proposed for western Washington State. The location was an undeveloped greenfield site, and was classified as an attainment area, complying with all national ambient air quality standards. As with other float glass plants in construction in the U.S., air pollution emissions exceeded the thresholds at which an air quality permit was required under the Prevention of Significant Deterioration (PSD) regulations. This permit was required prior to the start of construction.[1]

Review of an air quality permit application is typically conducted solely by the state or local regulatory agency. In this case, the agency was the Washington Department of Ecology (Ecology).[2,3] For this state, however, air pollutants subject to the major source PSD regulations are approved by Ecology, while other, minor source emissions, are approved by the local agency, the Southwest Clean Air Agency, which issues its own, separate air quality permit.[4,5]

Most states have SIP-approved PSD programs and have received full authority to implement the PSD regulations by USEPA under their State Implementation Plans. Washington State, however, has a delegated PSD program, which retains USEPA oversight of permits issued under the PSD regulations. As a result, the air quality permit application for the project was also reviewed by staff from USEPA Region 10. Another important consideration was that, unlike SIP-approved PSD programs, a PSD air quality permit issued by Ecology could be challenged by submission of a petition to the federal Environmental Appeals Board (EAB). When a petition is submitted, the permit is no longer valid, and project construction stops until the petition is processed by the EAB.

The glass plant site was located in an area with numerous Class I Air Quality Areas including national parks and wilderness areas.[1,2,6] Under the PSD regulations, impacts on these areas must be considered. While the USEPA *New Source Review Workshop Manual* suggests a 100-km distance for evaluation of impacts on these areas, the federal land managers (FLM) from the National Park Service and U.S. Forest Service more commonly use 200-km and 300-km to determine if a project requires their consideration. For the project site, seven (7) areas were within 200 km. FLM for these areas required an analysis of the project air quality impacts. These areas and their distances to the project site included in the following:

- Mt. Rainier National Park (74 km)
- Mt. Adams National Wilderness Area (80 km)
- Goat Rocks National Wilderness Area (81 km)
- Columbia River Gorge National Scenic Area (116 km)
- Mt. Hood National Wilderness Area (121 km)
- Olympic National Park (141 km)
- Alpine Lakes National Wilderness Area (143 km)

While the Columbia River Gorge is not an official Class I area, federal land managers requested that it be included in the air quality impact analysis.

Due to the involvement of USEPA Region 10 for issuance of the PSD air quality permit, the project was also subject to the consultation requirements under 50 CFR 600 Subpart K and Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act.[7] Federal agencies are required to consult with National Oceanic and Atmospheric Administration (NOAA) , National Marine Fisheries Service & U.S. Fish & Wildlife Service regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect Essential Fish Habitat: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. NOAA consultation required the air quality permit applicant to prepare a biological assessment. This assessment was to determine the impacts, if any, on fish populations of chinook, steelhead and salmon resulting the crossing of local streams by project natural gas and water pipelines. NOAA consultation and approval was required prior to issuance of the PSD air quality permit.

The project was considered a Major Industrial Development under state and county laws. It would be the first project approved as part of a new industrial park. As a result, an environmental impact statement or EIS was required and prepared by Lewis County, where the project was located.[8] The EIS evaluated all project impacts, including those on air quality. Approval of the final EIS was required prior to issuance of the air quality permits.

So while similar float glass plants have been approved in other states with issuance of an air quality permit by the state regulatory agency, this plant in Washington State required the involvement and approval of the following agencies:

- Washington Department of Ecology
- Southwest Clean Air Agency
- USEPA Region 10
- National Park Service
- U.S. Forest Service
- National Oceanic and Atmospheric Administration
- U.S. Fish & Wildlife Service
- Lewis County

The involvement of regulatory agencies other than the state agency added to the complexity and timing of the air quality approval process. In addition, the need to evaluate and minimize the air quality impacts on nearby Class I Air Quality Areas resulted in more effective air pollution control methods compared to other float glass plants in the U.S.

PROJECT DESCRIPTION

The proposed float glass plant would use a 200 mmbtu per hour natural gas-fired furnace to melt sand, limestone and other raw materials to generate a continuous 16 foot wide ribbon of flat glass for windows and other glass applications. The cut glass lites are shipped off site for the manufacture of products such as double-pane insulated glass units, finished windows and doors, or mirrors.[1,2,4]

The furnace is the primary source of air pollution emissions. Minor additional emissions are generated by raw materials handling operations, application of sulfur dioxide to the glass surface, use of lubricants for cutting glass, and back-up electrical generators.

The approved project air pollution emissions are summarized below:

- Nitrogen Oxides (NO_x) - 883 TPY
- Carbon Monoxide (CO) - 772 TPY
- Particulate Matter (PM) -121 TPY
- Sulfur Dioxide (SO_2) - 72 TPY
- Volatile Organic Compounds (VOC) -56 TPY
- Sulfuric Acid Mist (H_2SO_4) - 6.9 TPY
- Fluorides (Fl_2) - 2.9 TPY
- Lead (Pb) - 0.03 TPY

Air pollutants subject to the PSD air quality regulations were NO_x, CO, PM, SO_2 and VOC. Under the PSD regulations, emissions were controlled using Best Available Control Technology or BACT.

As noted, the glass furnace generated the majority of the project emissions. Control methods, emission limitations, and compliance methods are summarized in Table 1.

Table 1. Glass Furnace Air Pollution Control Methods

Pollutant	*Control Method*	*Emission Limitation*	*Compliance Method*
PM	Electrostatic Precipitator	0.09 lbs/ton (front-half) 0.85 lbs/ton (total with condensible)	Stack Test
SO_2	Spray Drier Scrubber	0.6 lbs/ton (3-hour average)	Continuous Emissions Monitor
NO_x	3R Process	7 lbs/ton of glass, 24-hour average)	Continuous Emissions Monitor
CO	3R Process	16.0 lbs/ton of glass (1-hour average) 6.5 lbs/ton of glass (12-month average)	Continuous Emissions Monitor

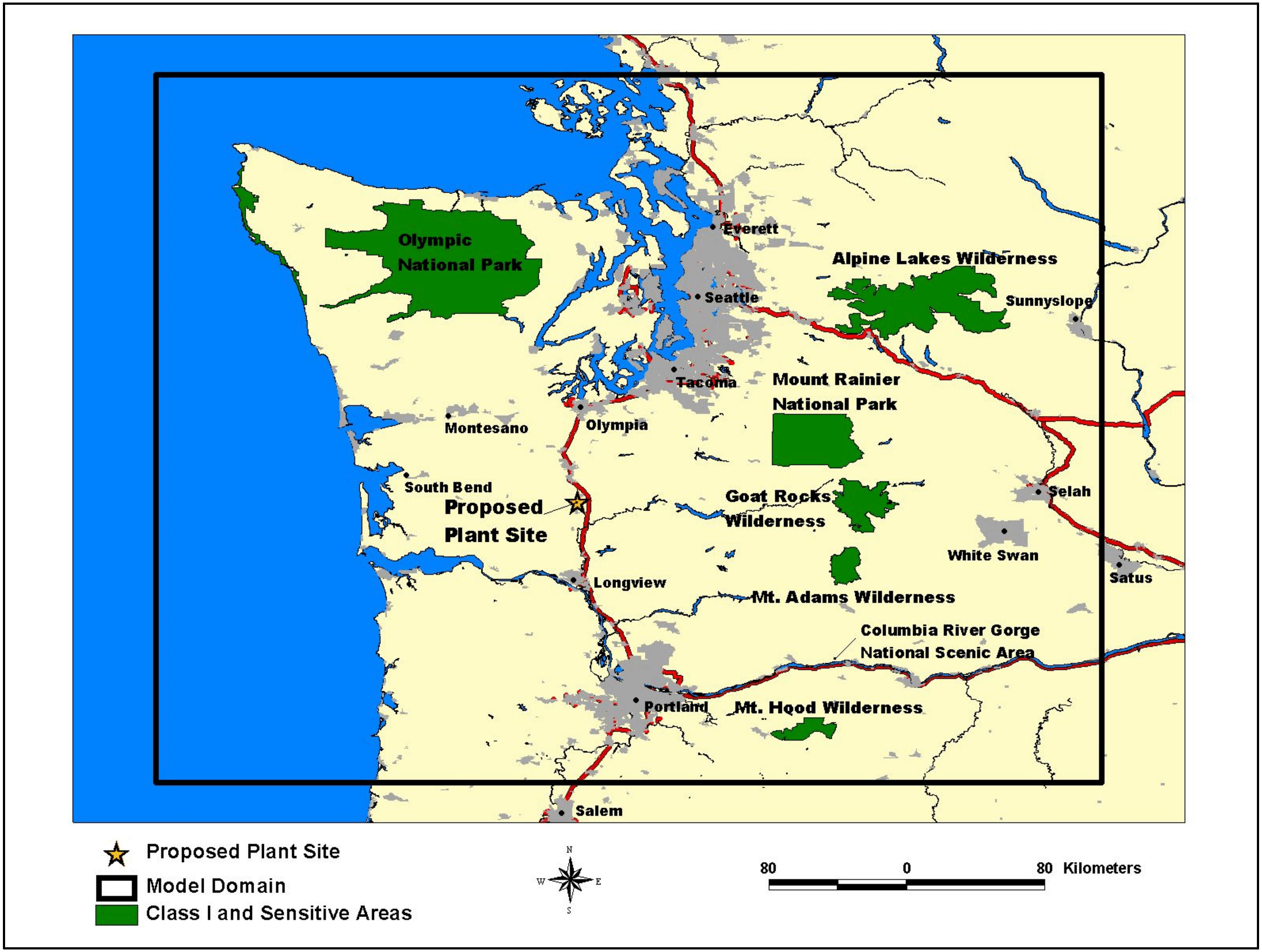
Prior float glass plants have not required add-on control equipment for PM or SO_2 as BACT.[9] Due to modern furnace design and operating methods, the uncontrolled furnace emissions are relatively low so that additional controls are not considered cost effective. For this project, add-on controls for PM and SO_2 were necessary to reduce air quality impacts at more distant Class I areas. These controls consisted of an electrostatic precipitator and spray drier scrubber. Without emission controls, visibility and acidic deposition rates would exceed significant impact levels.

NO_x is the air pollutant with the greatest emissions. The *3R Process* is currently the preferred NO_x control method for float glass plants in Europe and the U.S.[1,2,9] It is a proprietary process licensed by Pilkington PLC. It uses excess natural gas fuel to reduce NO_x to nitrogen within the heat recovery regenerators of the furnace. This is similar to the reburn process used in coal-fired boilers. Earlier float glass projects have approved the 3R Process as an "Innovative Control Method" since it has not been used for a full furnace campaign of 12 years, and long-term effects on furnace operation are still being studied. These earlier projects have received NO_x limitations based on 30-day rolling averages. This long-term averaging period was acceptable since the National Ambient Air Quality Standard or NAAQS for NO_x is based on a long-term annual average.

For this project, a more stringent short-term 24-hour NO_x limitation was required due to short-term air quality standards at nearby Class I areas. Besides the NAAQS, the project was evaluated for effects on 24-hour average regional visibility at nearby Class I areas. The short-term limitation was necessary to demonstrate the project would not exceed the significant impact level specified for visibility by the NPS and USFS. Compared to other plants with 30-day average limitations, this project required more intense monitoring of furnace and 3R Process operation to assure emissions are within the daily limitation.

Figure 1 shows the project site location and surrounding Class I Air Quality Areas.

Figure 1 - Proposed Plant Site and Surrounding Class I Air Quality Areas



NEAR-FIELD AIR QUALITY IMPACT ANALYSIS

Requirements and Air Quality Standards

An air quality modeling evaluation was required for all air pollutants subject to the PSD requirements. The modeling procedures were based on the federal requirements for PSD regulations described in the 1990 USEPA draft document, *New Source Review Workshop Manual*. A modeling protocol describing the anticipated near-field modeling procedures was submitted to Ecology and discussed at a pre-application meeting.[10] The analysis was to evaluate compliance with the following near-field air quality standards in the area immediately surrounding the project site:

- Class II Area Significant Impact Levels (SIL)
- Preconstruction Ambient Monitoring Exemption Thresholds
- Class II Area PSD Increments
- National Ambient Air Quality Standards (NAAQS)
- Washington Ambient Air Quality Standards (AAQS)
- Washington Toxic Air Pollutant Acceptable Source Impact Levels (ASIL)

Near-Field Modeling Procedures

Due to complex terrain near the project site, the AERMOD dispersion model was chosen over the tradition ISC3 model. This alternative model was expected to provide a more accurate near-field modeling analysis. The project analysis was conducted approximately two years before USEPA officially approved the replacement of the ISC3 model with AERMOD so both Ecology and USEPA approvals were needed to allow use of an alternative model for this project.

Meteorological data were used from one year of measurements at a gas turbine project near the glass plant site. These data were processed using the AERMET model.

Near-Field Modeling Results

Due to the use of a 175 foot stack and air pollution control measures used for glass furnace emissions, the predicted near-field impacts were relatively low. The following conclusions were reached:[1,2]

- Except for NO_x, all other criteria air pollutants (i.e. CO, PM, SO_2 and VOC) were less than the Class II area significant impact levels (SIL). As a result, no pollutant, except NO_x, required further analysis to verify compliance with either the Class II area PSD increments or the NAAQS;

- All criteria air pollutants were below the preconstruction ambient monitoring exemption thresholds;

- Fluoride emissions complied with the Washington State AAQS.

- All Toxic Air Pollutants were predicted to comply with their applicable ASIL. Evaluated pollutants included the following: H_2SO_4, Fluorides, Arsenic, Beryllium, Benzo(a)pyrene, Total PAH, Cadmium, Nickel, Formaldehyde, Benzene, Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h,)anthracene, and Indeno(1,2,3-cd)pyrene.

DEVELOPMENT OF NO_x REGIONAL INVENTORY

Lewis County Screening Method

Due to a predicted impact above its SIL, further analysis was required for NO_x to demonstrate compliance with its Class II area PSD increment and the NAAQS. Prior to conducting these analyses, a regional inventory of NO_x emissions sources was developed. These additional sources would be modeled with the project to determine compliance with air quality standards.[1]

The development of an emissions inventory is a complicated process. The most straight-forward approach is to include every source of NO_x emissions in the region in a modeling analysis. If there are few sources, this is a reasonable approach. However, if there are hundreds of sources, this would require considerable effort to compile the stack parameters and emission rates for all the sources. Much of this information is not readily available. For this project, there were over 1,500 sources of NO_x in the region. A procedure was developed to screen these sources and identify those to be included in a final modeling analysis.

Initial inventories of air pollution sources were obtained from regulatory agencies for Washington and counties surrounding the project site in Lewis County. The agencies included the following:

- Department of Ecology
- Southwest Clean Air Agency
- Puget Sound Clean Air Agency
- Olympic Clean Air Agency
- Yakima Clean Air Agency

Due to the number of facilities in the initial inventories, a method was needed to screen and eliminate those sources with an insignificant impact on the project area. The modeling protocol for this project had proposed use of the *20D Method* to screen regional sources and eliminate those with an insignificant impact on the project modeling domain. This is a common approach developed by the North Carolina Department of Environment and Natural Resources. It has been used for previous PSD modeling analyses for air quality permit applications in the U.S. However, the Department of Ecology concluded use of the *20D Method* was not appropriate for this project.

With DOE approval, an alternative method was developed to screen regional sources. This established a relationship between emissions, distance and the desired concentration, which in this case was a fraction (i.e. 10%) of the SIL for NO_x. This alternative *Lewis County Screening Method* was based on two assumptions: 1) downwind concentrations are proportional to the emission rate, and 2) downwind concentrations are inversely proportional to distance.

For assumption 1), the relationship between the downwind concentration and emission rate was developed from AERMOD modeling runs using the equation:

$$C = C_{max} * E/E_{max}$$

where:

C = predicted concentration at emission rate E
C_{max} = maximum predicted concentration
E_{max} = emissions used to predict the maximum concentration
E = emission rate for predicted concentration

For assumption 2), the relationship between the downwind concentration and distance was developed from the same AERMOD modeling runs using the maximum predicted concentration and the related distance using the equation:

$$C_{max} = X/D_{max}$$

and

$$X = C_{max} * D_{max}$$

where:

X = a distance coefficient derived from the AERMOD modeling runs
D_{max} = distance to the maximum concentration

Assumptions 1) and 2) can be combined to yield the following formula:

$$C = C_{max} * (D_{max} * E) / (D * E_{max})$$

If C is the desired fraction of the SIL, 10% or 0.1 $\mu g/m^3$, then

$$0.1 = C_{max} * (D_{max} * E) / (D * E_{max})$$

or

$$E = 0.1 (D * E_{max}) / (C_{max} * D_{max})$$

or

$$E = 0.1 E_{max} /(C_{max} * D_{max}) D$$

or

$$E = AD, \text{ where } A = 0.1 E_{max} /(C_{max} * D_{max})$$

Thus, if E > AD, the predicted concentration for the stack will exceed 10% of the SIL, or 0.1 μg/m^3.

The value of coefficient, A, was developed for various stack heights from 30 feet to 210 feet in 10 foot increments. This was based on a nominal exit velocity of 2,500 feet per minute, exit temperature of 300 °F, and an emission rate of 100 tons per year. These stack parameters were considered representative of a typical source of NOx, such as an industrial boiler.

Each stack height was evaluated using AERMOD, project meteorological data, terrain DEM files, and a 100-meter spaced polar receptor grid large enough to predict the maximum concentrations for each stack height. Table 2 summarizes the coefficient, A, derived for each stack height. The smallest coefficient A was 5.4. This was used as a conservative screening tool for those sources where the stack height was not available from local or state agencies. If a stack height was included in the inventory, a higher coefficient A corresponding to the stack height was used for screening.

The screening procedures described above were used to evaluate each source of NO_x and compile a final list of sources to be included in the modeling analysis. Of the 1,576 sources of NO_x originally provided by the agencies, only three sources were found to be close enough and have sufficient NO_x emissions to have a significant impact on the project impact area. Therefore, the screening of regional sources significant reduced the number of sources which needed to be included in the next phase of the modeling analysis. These three sources were retained for the final inventory. It was conservatively assumed that all NAAQS sources retained in the final inventory were constructed after the PSD baseline date and consumed PSD increment.

Screening Method Verification

In response to questions from USEPA Region 10, further modeling was conducted to verify the accuracy of the Lewis County Screening Method for determining if regional sources should be included in additional modeling analyses.[11] This method is premised on downwind concentrations being inversely proportional to distance, where the relationship between concentration and distance was derived from the maximum predicted concentration for each potential stack height. To verify the accuracy of this assumption, the AERMOD model was used to predict concentrations for each stack height out to a distance of 50 km. The results were then compared with the concentration predicted by the Lewis County Screening Method.

For short stacks less than 30 meters, the Lewis County Screening Method over-predicted the results for the majority of the receptors (i.e. 81 to 98%). For those instances where the concentration was under-predicted, the ratio of actual to predicted concentration for each stack height was typically less than a factor of 2, with a maximum ratio of 3.

For taller stacks greater than 30 meters, the Lewis County Screening Method over-predicted the results for the majority of the receptors (i.e. 72 to 87%). For those instances where the concentration was under-predicted, the ratio of actual to predicted concentration for each stack height was typically less than a factor of 2, with a maximum ratio of 6 for the tallest stack. Taller stacks are likely to be associated with the larger sources of NO_x, such as industrial and utility boilers. It is expected that these larger boilers would operate closer to their capacity so that reported actual emissions would be closer to their allowable or potential emissions.

Since the Lewis County Screening Method is based on 10% of the SIL for NO_x, there was a 10-fold safety factor incorporated into the screening procedure. This safety factor provided a margin of safety to address instances when the actual concentration was under-predicted. This verification procedure was accepted by USEPA Region 10 so the Lewis County Screening Method could be used to screen regional sources.

Table 2 Development of Coefficient A for Lewis County Screening Method

Stack Height (feet)	*Modeled Emission Rate, E_{max} (TPY)*	*Maximum Annual Concentration, C_{max} (μg/m³)*	*Distance to Maximum, D_{max} (km)*	*Screening Threshold Concentration (μg/m³)*	*Estimated Coefficient A for E = AD*
30	100	14.10	0.1	0.1	7.1
40	100	9.21	0.2	0.1	**5.4**
50	100	6.31	0.2	0.1	7.9
60	100	4.37	0.3	0.1	7.6
70	100	3.38	0.3	0.1	9.9
80	100	2.56	0.3	0.1	13.0
90	100	2.01	0.4	0.1	12.4
100	100	1.63	0.4	0.1	15.4
110	100	1.36	0.5	0.1	14.8
120	100	1.14	0.5	0.1	17.6
130	100	0.97	0.6	0.1	17.1
140	100	0.84	0.6	0.1	19.9
150	100	0.73	0.7	0.1	19.6
160	100	0.64	0.7	0.1	22.4
170	100	0.56	0.8	0.1	22.4
180	100	0.50	0.8	0.1	25.2
190	100	0.44	0.8	0.1	28.5
200	100	0.39	0.8	0.1	32.2
210	100	0.35	0.8	0.1	36.1

where: $A = Co/C_{max} * E_{max}/D_{max}$

NAAQS Compliance Analysis

To evaluate compliance with the NAAQS for NO_x, project sources were modeled with the regional sources surviving the screening procedures using the Lewis County Screening Method.[1,2] For the annual averaging period, the predicted maximum concentration was added to the background concentration for comparison with the NAAQS. Based on this analysis, no exceedence of the NAAQS for NO_x resulted from this project. The combined annual average impact of all sources including background was predicted to be 33.7 $\mu g/m^3$, well below the NAAQS of 100 $\mu g/m^3$.

PSD Increment Consumption Analysis

To evaluate cumulative consumption of the Class II area PSD increments, project sources were modeled with the regional sources surviving the screening procedures using the Lewis County Screening Method.[1,2] Based on this analysis, no exceedence of the PSD increment for NO_x resulted from this project. The combined annual average impact of all sources was predicted to be 2.7 $\mu g/m^3$, well below the increment of 25 $\mu g/m^3$.

FAR-FIELD AIR QUALITY IMPACT ANALYSIS

Requirements and Air Quality Standards

The project was located within 200 kilometers of seven Class I air quality areas, including Mount Rainier and Olympic National Parks. A separate evaluation was required by the National Park Service and U.S. Forest Service to assess far-field impacts on air quality standards, and air quality related values including acid deposition and regional visibility.[1,6,11]

SIL for PSD Increments

Air pollutant concentrations were compared with the Class I significant impact levels or SIL. If any SIL was exceedence, a cumulative impact analysis considering other air pollution sources in the modeling domain would need to be conducted. As previously discussed for the near-field NO_x analysis, the development of regional inventories is a complicated process. This task becomes extremely complicated and time consuming if it must consider an area as large at the modeling domain for the Class I area impact analysis. For a prior project, a regional inventory was compiled to verify compliance with the Class I area PSD increments at a national park. This inventory required that sources be identified in all seven states surrounding the park.

As with other modeling analyses involving non-project emission sources, there is a potential that the combined impact of all regional sources may exceed the applicable standard. At this point, there are no clear requirements or guidelines to determine whether the project caused or exacerbated the predicted standard violations, or whether the project should be held accountable for the impacts of other existing facilities.

To avoid the time and uncertainty necessary to compile and model a regional source inventory, it was a goal of the modeling analysis to maintain glass plant impacts below the Class I area SIL.

Deposition

Project emissions of SO_2 and NO_x were modeled to estimate sulfur and nitrogen deposition rates at each Class I area. These were compared with the Deposition AnalysisThresholds (DAT) of 0.005 kg/ha/yr for either element. These significant impact levels for acidic deposition were developed by the National Park Service specifically for Class I areas in the western U.S. If deposition rates exceeded the DAT, a cumulative impact analysis considering other air pollution sources in the modeling domain would need to be conducted. For the reasons noted above for the increment SIL, it was a goal of the modeling analysis to maintain glass plant impacts below the DAT for deposition.

Regional Haze

Project emissions of PM, SO_2 and NO_x were modeled to estimate impacts on regional haze and visibility. If the predicted 24-hour average change in light-extinction coefficient, $\blacktriangle B_{ext}$, was greater than 5%, then a cumulative impact analysis considering other air pollution sources in the modeling domain would need to be conducted. For the reasons noted above for the increment SIL and deposition DAT, it was a goal of the modeling analysis to maintain glass plant impacts below the significant impact level for regional haze.

Far-Field Modeling Procedures

The air quality impact analysis for the Class I areas was conducted following the procedures recommended by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) and the Interagency Workgroup on Air Quality Modeling (IWAQM). Procedures for both a screening and a refined CALPUFF modeling analysis are presented in the 1998 USEPA FLAG 2 report, *Interagency Workgroup On Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts.* A modeling protocol describing the anticipated near-field modeling procedures was submitted to Ecology and discussed at a pre-application meeting.[10]

For this project, a refined CALPUFF analysis was conducted.[1,6,11] No screening analysis was conducted due to the close proximity of the Class I areas. Key features of the analysis were as follows:

- Use of the most recent versions of the CALMET and CALPUFF modeling software released by EarthTech, Inc. in July of 2003;

- Use of a CALMET-developed meteorological and land use MM5 data evaluated from three 12-month periods (i.e., 1998 to 1999, 2000 to 2001 and 2001 to 2002);

- A modeling domain approximately 400 km on a side including a 94 x 103 grid cells with 4 km spacing, covering the areas from northwestern Oregon to southeastern Vancouver Island east to the Cascade Mountains. The SW corner of the modeling domain was in the Pacific Ocean, approximately 140 km west of the Oregon coastline and approximately 80 km south of the latitude of the mouth of the Columbia River. Refer to Figure 1 for a depiction of the modeling domain.

- 12-km MM5 data with 32 pressure-based vertical levels reduced to 10 vertical layers.

- Use of pseudo precipitation and upper air stations, extracted from MM5 data, to provide detailed coverage in the mountainous areas.

- Hourly surface observations from approximately 95 stations that provided cloud cover, ceiling height, temperature, and relative humidity. The domain's winds are based solely on the MM5 data.

- Land use and terrain data from 1:250,000 scale USGS data sets.

- Monthly average measured ozone data for the visibility analysis;

- Particle sizing and speciation for particulate matter emissions from project stacks

Since the initial modeling protocol for the project was submitted to the FLM for approval, there were several significant changes in Class I area modeling procedures which complicated the Class I area analysis, since these changes need to be incorporated into the project analysis. These included release of new versions of the CALMET-CALPUFF models and expansion of the required analysis time period from one year to three years of MM5 data. While these delayed the Class I area analysis, incorporation of these changes were essential for FLM approval of the project.

Evaluation of Normal and Maintenance Operations

As with most modeling analyses, the Class I air quality impact analysis was conducted assuming the proposed glass plant was operating normally at full capacity. After several years of plant operation, it was expected that there would periods of furnace maintenance when the 3R Process used to control the glass furnace NO_x emissions must be shut off. NO_x emissions during this period were expected to double. It was required by Ecology and the FLM that a separate analysis of impacts on regional visibility be conducted for the maintenance periods.

Far-Field Modeling Results

Comparison with Class I Increment Significant Impact Levels

Air pollutant concentrations at all seven areas were predicted to be well below the Class I area significant impact levels (SIL). Therefore no further PSD Class I area increment analysis is required.[1,2,6]

Had any of the SIL been exceeded due to project emissions, then a cumulative increment consumption analysis would have been required. This analysis would have required preparation of an inventory of other increment-consuming emission sources surrounding the Class I area of interest. Since FLM consider the impacts of sources located 200 to 300 km from the Class I area, preparation of the regional inventory can be a difficult and time consuming task. For another project located near Smokey Mountains National Park, a regional inventory was compiled for PM emissions.[12] Source information from ten separate state or local agencies was originally obtained. After screening, 595 additional sources besides the project were included in the cumulative increment consumption analysis. Due to the complexities of preparing a regional source inventory, a goal of the project design of the air pollution control measures was assuring impacts due to project emissions were less than the Class I area SIL.

Comparison with Deposition Analysis Thresholds

Sulfur and nitrogen deposition rates were compared with the Deposition Analysis Thresholds (DAT) of 0.005 kg/ha/yr each. For sulfur, both annual average and 3-year average deposition rates at all seven areas were predicted to be less than the DAT. Annual average nitrogen deposition rates at two areas slightly exceeded the DAT, while 3-year average deposition rates did not exceed the DAT at any of the seven areas. These results were considered sufficient by the FLM to conclude that project emissions would not have a significant impact with respect to acidic deposition.[11]

Similar to the requirements for the PSD increments, had the DAT been exceeded, a cumulative deposition analysis may have been required by the FLM. This would have incorporated other sources of sulfur and nitrogen which impacted the same Class I area. For the same reasons cited for the PSD increments, a goal of the project design of the air pollution control measures was assuring impacts due to project emissions were less than the DAT for deposition of sulfur and nitrogen.

Comparison with Regional Visibility Threshold

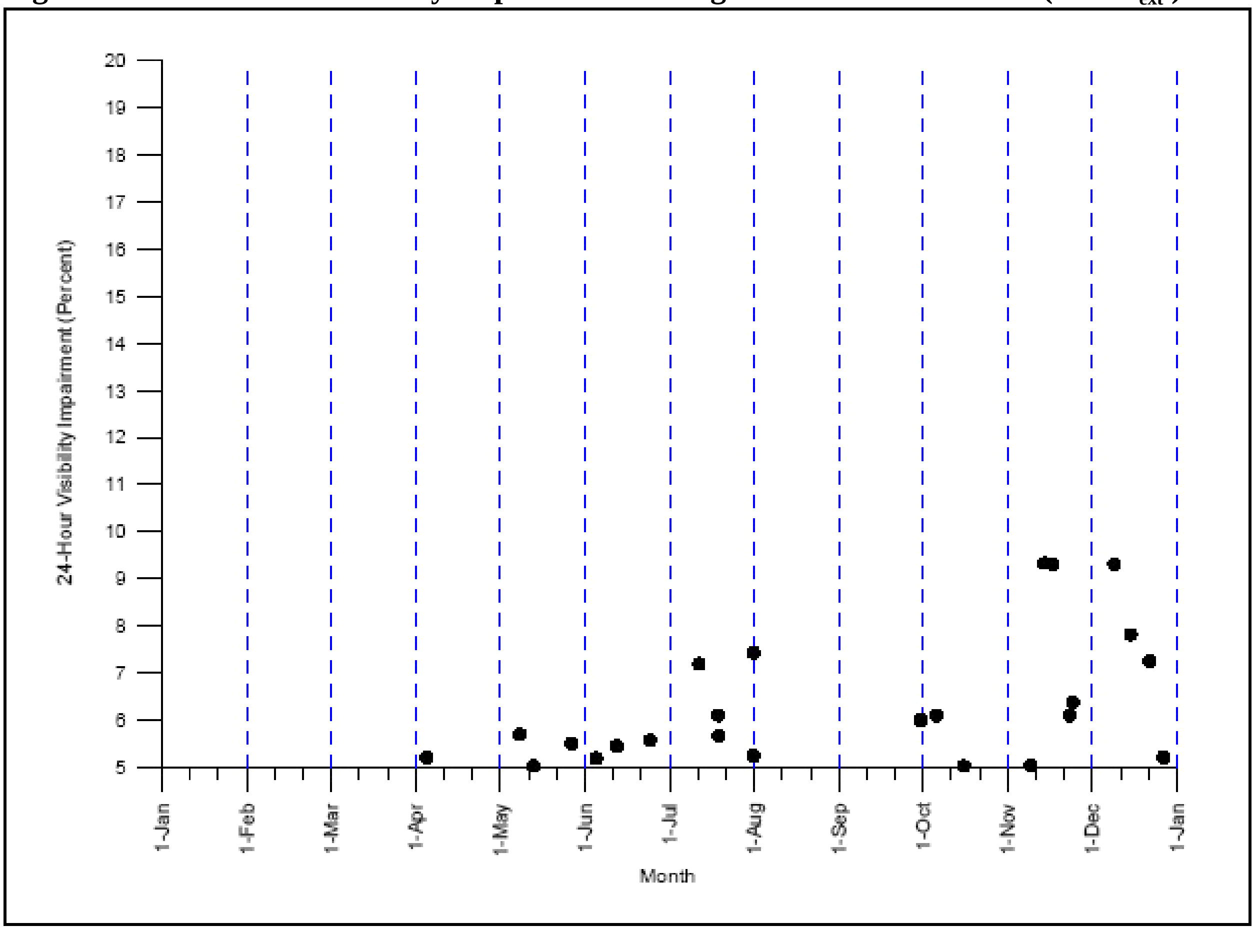
For normal operating conditions, the regional visibility threshold of 5% $\blacktriangle b_{ext}$ was predicted to be exceeded a total of 41 days at five of the seven Class I areas evaluated. Despite their infrequent use, FLM required that it be assumed that the diesel-fired emergency generators could operate on any given day. This was a conservative modeling assumption which significantly affected the visibility modeling results. To reduce the number of days with significant visibility impacts, it was necessary to propose the use of a selective catalytic reduction or SCR control system to reduce NO_x emissions from the emergency generators by 90%. The addition of the SCR control system reduced the days with significant visibility impacts from 41 to just one day.[11]

The CALPUFF modeling results for regional visibility were based on the default background visibility which is representative of the top 5 percentile of measured clearest days. The actual weather data for the day of high visibility impacts showed inclement weather including rain, 100% humidity and poor background visibility. Since the visibility on this day was already impaired due to the weather conditions, no exceedence of the 5% $\blacktriangle b_{ext}$ significant impact threshold for visibility was assumed to occur. These modeling results for normal operating conditions were considered sufficient by the FLM to conclude that project emissions would not have a significant impact with respect to regional visibility.

A separate analysis was conducted for periods of furnace maintenance when NO_x emissions doubled.[11] For these periods, it was assumed that the emergency generators would not operate. When the higher NO_x emissions due to furnace maintenance were considered, the regional visibility threshold of 5% $\blacktriangle b_{ext}$ was predicted to be exceeded a total of 37 days at five of the seven Class I areas evaluated. These days occurred throughout the year.

When inclement weather and poor visibility were considered, the number of days for which the project was predicted to have a significant visibility impact was reduce from 37 to 24. Most importantly, the months of January, February, March, July, August and September had no predicted significant visibility impacts. As a result, the air quality permit for the project required that furnace maintenance only occur during the months of January, February, March, July and September.[2,3] August was excluded due to the anticipated peak use of the Class I areas by the general public during this month. Figure 2 summarizes the predicted visibility impacts based on emissions occurring during furnace maintenance.

Figure 2 - Class I Area Visibility Impairment During Furnace Maintenance (% ▲b_{ext})



Preparation and Release of Draft Air Quality Permit

After the near-field and far-field modeling analyses had demonstrated the project would either have impacts below significant impact levels or comply with appropriate air quality standards, draft air quality permits were prepared by Ecology and the Southwest Clean Air Agency.[14,15] These were released for public comments and a public hearing.

Public comments on the draft air quality permit were submitted by those living near the project site and a representative of the local construction union. The most significant comments were those related to the adequacy of the glass furnace NO_x emission limitations compared to those achieved at other glass plants in the U.S. and Europe, and the potential use of other NO_x control methods for the furnace such as oxy-fuel burners and selective catalytic reduction. Detailed responses to the public comments were prepared by the Department of Ecology.[15] No comments were submitted by the FLM for nearby Class I air quality areas or Region 10 of USEPA.

A biological assessment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act. This was reviewed by both USEPA Region 10 and NOAA. It was concluded that there would be no impacts on fish populations resulting from the crossing of local streams by project natural gas and water pipelines.[7]

Concurrent with the review of the air quality permit application for the project, a comprehensive environmental impact statement was prepared and released for public comments and public hearings. After incorporating public comments, a final environmental impact statement was published.[8]

APPEAL TO ENVIRONMENTAL APPEALS BOARD

Following publication of the final EIS, receipt of NOAA approval, and preparation of the response to public comments, the final air quality permits were issued.[3,5] As previously noted, an important consideration is that unlike SIP-approved PSD programs, a PSD air quality permit issued by Ecology could be challenged by submission of a petition to the federal Environmental Appeals Board (EAB).

After issuance of the final air quality construction permits by the state and local regulatory agencies, a petition was filed with the EAB by the union for the local construction trades.[16] Issues raised in the petition were as follows:

- In its Best Available Control Technology (BACT) analysis, Ecology failed to provide justification for eliminating the use of oxy-fuel burners as a potential NO_x control method for the glass furnace. The majority of glass furnaces are equipped with traditional natural gas-fired burners. Several float glass furnaces had recently been constructed using oxy-fuel burners. This design reduces the amount of combustion air required, and associated NO_x emissions. Ecology concluded that a float glass furnace equipped with oxy-fuel burners was not yet a proven technology and technically infeasible for the project.

- In its BACT analysis, Ecology failed to establish appropriate NO_x emission limitations for the glass furnace. There had been tests demonstrating that lower NO_x emissions had been achieved, though on a short-term basis. Ecology concluded that no other float glass furnace had been approved with lower NO_x limitations than for the project, and achieving lower emissions increased the risk of refractory damage, a condition which had begun to occur at existing float glass plants using the 3R Process.

- Ecology failed to include the trackmobile, used to move rail cars in and out of the materials handling building, as part of the facility stationary source subject to the PSD requirements, most importantly the need for a BACT analysis. Ecology had concluded the trackmobile was not a stationary source subject to the PSD requirements, and its tailpipe emissions were specifically exempted from consideration as secondary emissions in the project impact analysis.

Submission of this petition to EAB caused the final PSD air quality permit issued by Ecology to no longer be valid, and stopped project construction, except grading, until the petition could be reviewed and processed by the EAB. In response to the petition, the permit applicant and Ecology submitted briefs reviewing the issues raised in the petition and concluding the BACT analysis had been properly conducted.[17,18] Approximately two months after the petition was submitted, the EAB ruled on the petition and denied review of the permit. It concluded that OBCT had failed to demonstrate in its Petition that Ecology's permitting decision was erroneous or warranted review by EAB.[19] This decision allowed project construction to proceed.

Concurrent with the filing of the petition to the EAB, a petition was also filed with the Pollution Control Hearings Board for the State of Washington. [20] The issues raised in this petition were similar to the federal petition. However, this petition was withdrawn prior to the final decision by the EAB.[21]

PERMIT SCHEDULE

The following schedule was necessary for issuance of the final air quality permit:

Months	Milestone
0	Pre-application Meeting & Submission of Modeling Protocol
7	Submission of Air Quality Permit Application
10	Response to Agency Comments
16	Issuance of Draft Air Quality Permits
19	Issuance of Final Air Quality Permits
24	Final Permits Effective with EAB Decision

CONCLUSIONS

The location of a proposed float glass plant significantly affected the complexity of the air quality permit issuance process. Review of an air quality permit application is typically conducted solely by the state or local regulatory agency. For this site, eight separate agencies were involved in determining the schedule, procedures and requirements to allow permit issuance.

The proximity of seven Class I Air Quality Areas resulted in the need for additional air pollution control measures, superior to those approved for recent glass plant projects elsewhere in the U.S. These included the following:

- Installation of an ESP-spray drier control system for furnace emissions of PM and SO_2.
- Furnace emission limitation for NO_x based on a 24-hour rather than a 30-day rolling average.
- Installation of an SCR control system for NO_x emissions from the emergency generators.
- Condition that furnace maintenance only occur during four specific months of the year.

Despite the superior air pollution control measures, the final air quality permit was still challenged and its effectiveness delayed until reviewed by the USEPA Environmental Appeals Board. From the pre-application meeting to approval of the final permit required 24 months, at which time construction of the new float glass plant began.

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KEY WORDS

permit, permitting, glass, Class I, visibility, deposition