Appendix B. Demonstration of Maintenance of the PM_{10} NAAQS

- Washington State Department of Ecology, Air Quality Program, July 2, 2004. Inventory Preparation and Quality Assurance Plan for the Wallula Particulate Matter (PM_{10}) Maintenance Plan Emissions Inventories.

- Washington State Department of Ecology, Air Quality Program, March 9, 2005. Wallula Particulate Matter (PM_{10}) Nonattainment Area Maintenance Plan Emission Inventories.

- Washington State Department of Ecology, Air Quality Program, Revised March 3, 2004. Protocol for Wallula PM_{10} Maintenance Demonstration, Proposed Approach.

- Washington State Department of Ecology, Air Quality Program, April 2003. Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington (Publication No. 03-02-006).

- Washington State Department of Ecology, Air Quality Program, September 2004. Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington. Addendum Addressing a Natural Event Due to High Winds, May 2, 2002, Wallula, Washington (Publication No. 05-02-004).

- Washington State Department of Ecology, Air Quality Program, October 2004. Meteorological Data, Natural Event Due to High Winds, June 5, 2000, Wallula, Washington.

- Trinity Consultants, February 2005. PM_{10} Dispersion Modeling Analysis, Wallula Pulp & Paper Mill, Boise White Paper, LLC. Kent, WA (Project 054801.0002).

- Washington State Department of Ecology, Air Quality Program. Updated January 31, 2005. Demonstration that Motor Vehicles are an Insignificant Source of PM_{10} Emissions in the Wallula Nonattainment Area. Lacey, WA.

Inventory Preparation and Quality Assurance Plan for the Wallula Particulate Matter (PM_{10}) Maintenance Plan Emissions Inventories

July 2, 2004

1 Purpose and Background of the Inventory

A PM_{10} monitor was installed near Wallula on February 28, 1986. The monitor has recorded exceedances of the PM_{10} standard since it was established. On August 7, 1987, EPA designated Wallula as a Group I PM_{10} area. Group I areas were areas with a greater than 95% probability of violating the standard. An inventory was prepared for the area in 1988 and updated in 1989. Upon enactment of the 1990 amendments to the Clean Air Act, all Group I areas were designated as nonattainment areas and classified as Moderate. An attainment plan was submitted to EPA in November 1991 with inventory base year 1990. The area was granted a temporary extension of the attainment date until December 31, 1997. EPA determined the area failed to attain the standard by the extension date and reclassified the area to Serious. A 1997 base year inventory was prepared for the Serious classification attainment plan which is pending submission to EPA.

EPA determined that Wallula attained the standard on Dec. 31, 2001. A base year 2002 inventory and projection to 2015 will be prepared for the maintenance plan. This Inventory Preparation and Quality Assurance Plan outlines the procedures and data sources that will be used to develop the maintenance plan inventories. Similar to the 1997 base year attainment plan inventory, these maintenance plan inventories are being crafted for low-wind days only; therefore, windblown dust will not be inventoried. Windblown dust events are addressed through the Natural Events Action Plan.

2 Geographic Area

The nonattainment area is a square-shaped area covering approximately 372 square kilometers and centered on the PM_{10} monitoring site near the small town of Wallula. The nonattainment area encompasses portions of Walla Walla and Benton Counties, and a very small portion of Franklin County. The boundaries were defined using Universal Transverse Mercator Coordinates (zone 11). In meters, the southwest corner coordinates are (342500, 5099975) and the northeast corner coordinates are (362500, 5118600).

The nonattainment area is a rural, primarily agricultural area. Grain and row crops are grown in the nonattainment area. There are no incorporated towns in the area; population is estimated at approximately 4800 people. There is a pulp mill near the PM_{10} monitoring site. Several small stationary sources are located in the nonattainment area. There are small amounts of highway, rail and marine traffic.

3 Temporal Resolution

The temporal resolution chosen for the base year 1997 inventory was retained for the maintenance plan inventories. The justification for the resolution is repeated here:

The cyclical trend at Wallula may be demonstrated by examining the monthly statistics of PM_{10} concentrations. Table 3-1 contains the monthly minimum, maximum, and mean concentrations plus the 0.25, 0.50, 0.75, and the 0.90 quantiles. An examination of the monthly mean and quantiles clearly demonstrates a seasonal trend. The mean and quantiles are least in the winter months. Values gradually increase in the spring, and peak values occur in the summer months of June, July, and August. For the period of 1996-2000, only the months of June through August reported maximum values greater than 100 ug/m3. Although the maximum value for April is 97 ug/m3, the second highest value for April of this period was much less. Also of importance are the significant differences between the 0.90 quantile for June through August versus the other months of the year. The variance in high concentrations is clearly focused on the period of June through September. Emissions estimates in tons per day will be calculated based on this four-month season.

Table 3-1 Wallula Monthly PM_{10} Concentrations: 1996-2000

Month	PM10 Concentrations			Quantiles			
	Min	Max	Mean	0.25	0.50	0.75	0.90
Jan	2	29	14	9	12	16	25
Feb	5	37	14	11	12	16	20
Mar	6	77	23	15	18	27	35
Apr	11	97	30	21	25	31	41
May	11	58	29	18	26	36	49
Jun	8	297	65	33	40	73	132
Jul	22	215	76	43	63	82	133
Aug	26	215	74	55	63	84	102
Sep	6	127	47	20	43	65	89
Oct	8	77	33	18	25	47	60
Nov	2	31	19	14	20	24	28
Dec	6	23	13	9	12	16	21

4 Quality Assurance Policy and Objectives

In order to provide data of sufficient quality for maintenance planning needs, quality assurance (QA) and quality control (QC) procedures are implemented as part of the inventory process. The procedures address data quality objectives of accuracy, completeness, comparability and representativeness. A brief discussion of the data quality objectives is given below.

4.1 Data Quality Objectives and Indicators

Data quality objectives of accuracy, completeness, comparability, and representativeness are addressed to ensure an inventory of high quality. The target goals for each objective are listed below.

Accuracy: All estimates must be calculated and documented using acceptable methods. Individual source requirements and availability of data and resources will affect estimation method selection.

Completeness: Completeness is addressed by ensuring that all applicable source categories are included in the inventory, and that all information required to estimate emissions is present. Applicable source categories are listed in Appendix A.

Comparability: The 2002 inventory will be compared to the 1997 base year inventory by source category. Any discrepancies (data outliers) greater than 20% involving sources that made up greater than 5% of either the 1997 or 2002 daily inventories will be corrected or justified.

The 2015 projection inventory will be compared to the 2002 base year inventory. Any discrepancies (data outliers) greater than 20% involving sources that made up greater than 5% of either the 2002 or 2015 daily inventories will be corrected or justified.

Representativeness: Actual 2002 annual and peak PM_{10} season daily emissions will be calculated for the base year inventory and be projected to 2015. Local data will be used in inventory calculations wherever possible.

5 Plan Information Sources

This plan draws upon inventory and quality assurance guidance available from state and federal agencies and partnerships.[1, 2, 3, 4] Quality assurance guidance for carbon monoxide and ozone inventories was reviewed and utilized as appropriate.[5, 6, 7] The effort will also draw upon experience gained with the 1997 base year inventory and prior SIP inventory efforts in other areas and for other pollutants.

6 Base Year 2002 Inventory Development and Quality Control Procedures

An inventory of actual emissions in the nonattainment area will be developed for base year 2002. Annual and typical PM_{10} season day emissions estimates will be made. Typical PM_{10} season day emissions are defined to be average weekday emissions for the period June-September (see section 3).

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[1] *PM-10 Emission Inventory Requirements*. Final Report. U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1994.

[2] *Emission Inventory Improvement Program, Volume IV: Quality Assurance Procedures*. EPA-454/R-97-0041. July 1997.

[3] *Guidelines and Specifications for Preparing Quality Assurance Project Plans*. Ecology Publication 91-16. May 1991.

[4] *Procedures Document for National Emissions Inventory, Criteria Air Pollutants 1985-1999*. United States Environmental Protection Agency. Office of Air Quality Planning and Standards. Research Triangle Park NC 27711. EPA-454/R-01-006. March 2001.

[5] *Emission Inventory Requirements for Carbon Monoxide State Implementation Plans*. EPA-450/4-91-011, March 1991

[6] June 4-6, 1991 EPA manual Workshop for Implementation of Clean Air Act Provisions Relating to Ozone and Carbon Monoxide Emission Inventories, June 4-6, 1991 EPA.

[7] *Guidance for the Preparation of Quality Assurance Plans for O3/CO SIP Emission Inventories*. EPA-450/4-88-023. December 1988.

For the 1997 base year inventory, a list of potential PM_{10} sources was developed using the 1990 base year inventory, local knowledge, categories as defined in PM-10 Emission Inventory Requirements (US EPA 1994),[1] and the 1999 National Emissions Inventory (NEI) PM_{10} source categories. Because the nonattainment area is predominantly an agricultural area, many of the sources on the list are not present or have only minimal activity. This list was revisited for the 2002 and 2015 inventories.

Few changes were made from the 1997 base year inventory list. All sources included in the 1997 base year inventory attainment plan inventory will be inventoried for the 2002 and 2015 inventories. A new point source that was permitted in 2002 will be included in the 2015 projection.

The source categories are listed in Appendix A and are flagged as to whether or not they were included in the inventory. Those not included are marked as either not present or insignificant in the nonattainment area. Emissions from insignificant sources were approximately 8% of the final 1999 PM_{10} NEI for Benton and Walla Walla Counties. Of this, nearly half could be attributed to woodstoves (not a summer source) and mining/quarrying (not in nonattainment area). The source list is shown in the table below.

2002 and 2015 Inventory Source List

Point Sources	Area Sources	Mobile Sources
Boise Cascade	Registered/AOP Sources < 70 PTE	Onroad
Wallula Power (new since 1997)	Agricultural Tilling	
	Paved and Unpaved Road Dust	
	Agricultural Field Burning	

The inventory development process consists of several steps. A description of each step and the quality control procedures implemented are discussed individually in the following sub-sections.

- estimation methods and data gathering
- emissions calculations and data checking
- missing data
- application of rule effectiveness and rule penetration
- corrective action
- documentation

6.1 Estimation Methods and Data Gathering

Guidance listed under “Plan Information Sources” will be utilized to select estimation methods and gather information necessary to develop the inventory. QC activities during data gathering include thorough documentation of methods and data sources, and checking for reasonableness of data obtained. General estimation methods and data sources anticipated for each source category are listed below.

6.1.1 Point Sources

For Serious nonattainment areas, the federal Clean Air Act defines point sources as any stationary source having the potential to emit 70 tons per year of PM_{10}.

Benton Clean Air Authority (BCAA), Department of Ecology (Ecology) and Energy Facility Site Evaluation Council (EFSEC) point source permitting records show that Boise Cascade was the only source with the potential to emit 70 tons or more of PM_{10} in the nonattainment area in 2002. Point sources are required to report emissions annually. The 2002 annual emissions report will be used to develop the point source inventory. The annual report includes operation schedule information that will be used to determine seasonal daily emissions.

6.1.2 Area Sources

Area sources include all stationary sources whose individual emissions fall below the 70 ton potential to emit level (e.g. woodstoves), and sources that are of short duration and/or cover larger geographic areas (e.g. prescribed fires, road dust). Emissions are typically estimated by multiplying the activity level by an emission factor in mass per activity.

6.1.2.1 Small Stationary Sources

In the 1997 base year inventory, small stationary sources emitted approximately 50 tons of PM_{10} in the nonattainment area. BCAA and Ecology register stationary emissions sources in Benton and Franklin/Walla Walla Counties, respectively. All registered and air operating permit sources (< 70 tons PTE) emitting PM_{10} will be included in the inventory. Grain elevators are exempt from the registration program. The last year of emissions data for grain elevators was 1994. The 1994 data will be used in this inventory. Sources included in the inventory are shown below. Simplot in Kennewick is a new synthetic minor source (permit issued in 2001).

Tyson Fresh Meats, Wallula (formerly IBP Inc)
PG&E #8, Wallula
Agrium, Kennewick
Sandvik, Kennewick
Simplot Feeders, Wallula
Simplot Agribusiness, Kennewick
NW Grain Growers, Wallula (formerly Walla Walla Grain Growers)

Seasonal emissions will be determined from facility-specific information if available. If not, EPA temporal allocation guidance will be utilized.[8]

6.1.2.2 All Other Area Sources

The remaining area sources inventoried include agricultural field burning, agricultural tilling, paved road dust, and unpaved road dust. The estimation methods and data sources that will be used to estimate emissions are briefly discussed below.

Agricultural Field Burning: The vast majority of burning in the nonattainment area is wheat stubble. There are other crops grown in the area but most are not burned with the exception of small acreages of alfalfa seed. Activity in acres burned, pre-burn fuel loading, fuel consumption, and PM10 emission rates are required to estimate emissions.

Ecology and BCAA burn permit records for 2002 will be examined for burning activity. If acres burned is not available, acres permitted for burning will be substituted. Ecology's agricultural

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[8] Temporal Allocation files and other information as available through the EPA Technology Transfer Network CHIEFS site.

burning permit database will be used to estimate total pre-burn tons of residue. Fuel consumption factors found in the special study performed by Air Sciences Incorporated will be used to estimate the amount of pre-burned residue actually consumed in a burn.[9] PM_{10} Emission rates for cereal grains will be taken from the Air Sciences Incorporated report. TSP emission rates for any other crop types will be taken from EPA's AP42. For all AP42 factors, PM_{10} will be estimated from TSP using profiles from the Air Resources Board in California.[10]

Agricultural Tilling: The method employed by EPA in the 1999 NEI and used in the 1997 base year inventory will be used to estimate emissions. The number of acres tilled by crop type used in the 1991 attainment plan was also used for the 1997 base year inventory after verification through local knowledge and aerial photographs. The same acreage will be used for 2002. Information from the Washington Agricultural Statistics Service will be used to disaggregate wheat acreage into spring and winter wheat. Soil types will be determined using a general soils map prepared by Washington State University in cooperation with the National Resources Conservation Service (NRCS) and Iowa State University (maintains soil series classification database). Silt content by soil type will be taken from the NEI procedures documentation.

Paved Road Dust: Emissions will be calculated by multiplying the number of vehicle miles traveled (VMT) by an emission rate in grams per mile. The number of VMT by county for 2002 is available from the Washington State Department of Transportation (WSDOT). The 2002 VMT will be allocated to the nonattainment area using the ratio of 1995 nonattainment area-to-county roadway link-volume spatial data, also available from WSDOT.

The PM_{10} emission rate in grams per mile will be calculated using the paved road dust equation in AP42. Long-term average precipitation data from the Kennewick meteorological site, which is just northwest of the area, will be obtained from the Western Regional Climate Center.

Unpaved Road Dust: Emissions will be calculated by multiplying the number of vehicle miles traveled (VMT) on unpaved roads by an emission rate in grams per mile. Estimates of the number of VMT on unpaved roads by county for 2002 will be obtained from the individual county engineers. The inventory will include roads meeting two conditions: 1) length greater than or equal to 0.5 miles, and 2) greater than 20 vehicle trips per day. Roads of less length or trips will be considered insignificant per EPA guidance.[11]

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[9] *Final Report: Cereal-Grain Residue Open-Field Burning Emissions Study*. Table 3.2. Prepared For and Funded By: Washington Department Of Ecology; Washington Association Of Wheat Growers; U.S. Environmental Protection Agency, Region 10. Prepared By: Air Sciences Inc., 421 Sw 6Th Avenue, Portland, Or 97204; 1301 Washington Avenue, Golden, Co 80401. Project No. 152-02. July 2003.

[10] *PM Size Fractions from the California Emission Inventory Development and Reporting System (CEIDARS)*. California Air Resources Board, size fractions (PM profile #430: PM10 = 0.9835, PM2.5 = 0.9379, PM profile #440: PM10 = 0.9835, PM2.5 = 0.9379, PM profile #450: PM10 = 0.9814, PM2.5 = 0.9252). March 24, 1999.

[11] *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures*. EPA-450/2-92-004. September 1992. p. 1-7.

Emission rates will be calculated using the AP42 equation for unpaved roads. The equation requires precipitation days, surface moisture content, and surface silt content. Long-term average precipitation will be obtained from the Western Regional Climate Center for the Kennewick meteorological site. Surface silt content and surface moisture content will be obtained from unpaved road dust analyses conducted by the Western Regional Air Partnership.

6.1.3 Onroad Mobile Sources

Onroad mobile source emissions are those emitted from exhaust and from brake and tire wear. Emissions are calculated by multiplying the number of vehicle miles traveled (VMT) by an emission rate in grams per mile. The number of VMT by county for 2002 is available from the Washington State Department of Transportation (WSDOT). The 2002 VMT will be allocated to the nonattainment area using the ratio of 1995 nonattainment area-to-county roadway link-volume spatial data, also available from WSDOT.

Emission rates of PM_{10} in grams per mile will be generated using EPA's MOBILE6.2 model. Local input to the model affecting PM_{10} emission rates will be obtained. The local inputs will include Washington State's vehicle registration distribution as calculated from Department of Licensing records, and diesel sulfur content available from analyses conducted by the Western Regional Air Partnership .

6.1.4 Sources Not Included In the Inventory

Some of the sources on the category list are not present or have only minimal activity in the nonattainment area. The sources are many and varied in nature, and some require significant resources to inventory. Elimination of these sources allows resources to be concentrated on the larger PM_{10} sources.

To help determine the list of insignificant sources, two primary information sources were used along with general characteristics of the nonattainment area: the 1997 base year inventory and the 1999 National Emissions Inventory (1999 NEI). Where reasonable, the 1999 NEI estimates for Benton and Walla Walla Counties were examined and a rough allocation was made to the nonattainment area using population as the surrogate (1.3% Benton County in NAA, 5.2% Walla Walla in NAA). For agricultural equipment, agricultural lands were used as the surrogate. Each category and the reason for its exclusion are listed below. Emissions from insignificant sources are estimated to be approximately 46 tons. This would have been approximately 4.5% of the 1997 base year inventory.

Commercial/Industrial/Residential Fuel Combustion: In the 1999 NEI, approximately 8 tons would be allocated to the nonattainment area using population as the ratio. Further, this is primarily made up of woodstove emissions, which are a winter source. This source was not included in the 1997 base year inventory.

Waste Disposal: In the 1999 NEI, approximately 4 tons would be allocated to the nonattainment area using population as the ratio. This source was not included in the 1997 base year inventory.

Fugitive Emissions from Construction: In the 1999 NEI, approximately 14 tons would be allocated to the nonattainment area using population as the ratio. This source was not included in the 1997 base year inventory.

All Nonroad Mobile Sources: In the 1999 NEI, approximately 10 tons would be allocated to the nonattainment area using agricultural lands as the ratio for agricultural equipment and population as the ratio for all other categories. Nonroad mobile sources were not included in the 1997 base year inventory.

Prescribed Burning: Department of Natural Resources burn permit records show that no burns took place within the nonattaiment area.

Structure Fires: In the 1999 NEI, less than 1 ton would be allocated to the nonattainment area using population as the ratio. This source was not included in the 1997 base year inventory.

Wildfires: In the 1999 NEI, 18 tons were emitted from wildfires in the entire counties of Benton and Walla Walla. It is unknown what portion of this may have occurred in the NAA, but for some perspective, the NAA is roughly 5% of the total area of Benton and Walla Walla Counties. This source was not included in the 1997 base year inventory.

Mining and Quarrying: There were no emissions from this source in the 1999 NEI.

6.2 Emissions Calculations and Data Checking

Calculations will be performed as appropriate for the given estimation method. QC checks are an integral part of calculations. Calculations will be done electronically wherever possible to minimize errors. Hand calculations will be made to verify electronic calculation equations. Calculations will be fully documented in the final inventory report. Comparisons to the 1997 inventory will be made during development to catch any potential errors.

6.3 Missing Data

Missing data will be identified by the inability to complete the calculations. If data are found to be missing, a reasonable effort will be made to acquire the data. If this is unsuccessful, estimates will be made based on past years' data or default information contained in EPA documents and models. Sources of all data will be documented.

6.4 Application of Rule Effectiveness and Rule Penetration

Rule effectiveness (RE) reflects the ability of a control device or regulation to achieve all the emissions reductions that could be achieved by full compliance at all times. Rule penetration (RP) is a measure of the extent to which a regulation may cover emissions from a source category.

RE/RP has been the subject of ongoing discussion nationally and is the topic of a draft report by the Emissions Inventory Improvement Program (EPA/STAPPA/ALAPCO).[12] Briefly, the report recognizes that control efficiencies are often based on in-use conditions, and when this is the case RE has already been taken into account. This is the situation for both point and area sources in the nonattainment area. Additionally, the majority of the point source emissions are estimated through source testing and therefore do not use control efficiencies to calculate emissions.

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[12] *Emissions Inventories and Proper Use of Rule Effectiveness*. September 23, 1998. Memorandum from EIIP Point Sources Committee Members to EIIP Steering Committee Members. September 23, 1998.

6.5 Corrective Action

Corrective and follow-up actions identified during the inventory development process will be noted and referred to the appropriate staff. Both the corrective actions identified and results of actions taken in response will be documented and kept on file (see Corrective Action Form, Appendix B)

6.6 Documentation

Written documentation specifying inventory methodology and information sources will be provided. Emissions summaries will be presented. Any paper or computer files used to assist in emissions calculations and quality checking will be kept on file.

7 Projection Year 2015 Inventory Development

The inventory will be projected to 2015. The projection will rely on quantification of future activity levels and expected effects of current and future controls. The projection inventory development process will be similar to that described for the base year inventory in Section 6. Quality control procedures described in Sections 6.1 - 6.6 will also be employed in the projection inventories. General projection methods and data sources anticipated for each source category are listed below.

7.1 Point Sources

Allowable emissions will be used for the projection inventory. In addition to Boise Cascade, One additional source will be included in the projection inventory. In 2002, the Energy Facility Site Evaluation Council (EFSEC) permitted the Wallula Power Project (Wallula Generation LLC). The allowable emissions for this new permitted source will be counted in the 2015 inventory, although it is noted that no construction has begun.

7.2 Area Sources

Area source projections are typically made using local information and/or growth surrogates. Projection methods are described below.

7.2.1 Small Stationary Sources

Each small stationary source will be projected using one of several methods: allowable emissions limit, historical emissions, 2002 baseline values, or permitting agency or source recommendation. Seasonal emissions will be calculated using seasonal information from the base year 2002 inventory. The table below shows the anticipated method for each source.

Small Stationary Source Projection Methods

Source	Projection method
Tyson Fresh Meats, Inc, Wallula	allowable or potential emissions limit
NW Grain Growers, Wallula	2002 baseline value
PG&E #8, Wallula	potential to emit
Sandvik, Kennewick	historical emissions
Agrium, Kennewick	permitting agency and source recommendation
Simplot Agribusiness, Kennewick	permitting agency recommendation
Simplot Feeders, Wallula	7-yr historical average

7.2.2 All Other Area Sources

Paved Road Dust: Emissions will be projected by multiplying the base year emission rate by the VMT growth factor. The VMT growth factor will be provided by the Washington State Department of Transportation.

Unpaved Road Dust: Two options will be explored: 1) Emissions will be projected by multiplying the base year emission rate by the population growth factor, and/or 2) The individual county engineers will provide future projections of VMT on unpaved roads.

Agricultural Field Burning and Tilling: The projection will be made in consultation with agricultural burning program staff from BCAA and Ecology's Eastern Regional Office. Staff from local agricultural extension offices may also be consulted.

7.3 Onroad Mobile Sources

Emissions will be calculated by multiplying the projected VMT by an emission rate in grams per mile. The VMT growth projection will be provided by the Washington State Department of Transportation. The growth rate will be multiplied by the base year 2002 VMT to estimate 2015 VMT. The emission rate will be specifically calculated for the projection year using MOBILE6.2.

8 Quality Assurance Procedures

Quality assurance activities are distinguished from QC activities in that they provided a more objective assessment of data quality. The QA checks (except the sensitivity analysis and range checks) will be performed by staff not involved in the inventory calculations. Several quality assurance checks will be employed to address the data quality objectives: reality/peer review checks, sample calculations, sensitivity analysis, and range checks. Details on each check are provided below. The product of the quality checking process will be a completed summary of items checked, summary of results, and recommended follow-up action. At the completion of the process, the inventory will be evaluated according to the data quality objectives (see Section 4).

8.1 Reality Check/Peer Review Check

Definition: Independent review by a knowledgeable expert

Benefit: Ensure data, assumptions, and procedures are reasonable

Objective(s) Addressed: accuracy, completeness, comparability, representativeness

Check(s): Reasonableness of methods, assumptions, and emissions estimates will be assessed. This will be accomplished by 1) comparing data sources used in the final inventory to those specified in the Inventory Preparation Plan, 2) reliance on reviewer expertise, and 3) comparison of emissions estimates to other inventory efforts, particularly the 1997 base year effort.

Limitations: None

8.2 Sample Calculations

Definition: Verification of values by replicating calculations

Benefit: Ensure calculations are done correctly

Objective(s) Addressed: accuracy

Check(s): Emissions calculations will be duplicated to check the accuracy of the arithmetic and, therefore, the resulting emissions estimate. Priority will be given to those categories identified as the largest PM_{10} contributors.

Limitations: Estimates calculated using computer models such as MOBILE6.2 will be checked using simplified assumptions to arrive at a ”ballpark” value to use as a comparison to the actual calculated value.

8.3 Sensitivity Analysis

Definition: Systematic study of how changes in parameters affect data

Benefit: Identify the parameters that have the greatest effect on data

Objective(s) Addressed: generally addresses all objectives

Check(s): A sensitivity analyses in the form of a source category PM_{10} emissions ranking will be performed. The ranking will help determine where efforts should (or should not) be concentrated.

Limitations: None

8.4 Standard Range Checks

Standard range checks address the data quality objective of comparability. The 2002 inventory will be compared to the 1997 base year inventory by source category. Any discrepancies (data outliers) greater than 20% involving sources that made up greater than 5% of either the 1997 or 2002 daily inventories will be corrected or justified.

The 2015 projection inventory will be compared to the 2002 base year inventory. Any discrepancies (data outliers) greater than 20% involving sources that made up greater than 5% of either the 2002 or 2015 daily inventories will be corrected or justified.

8.5 Corrective Action Plan

Corrective and follow-up actions identified during the quality checking process will be noted and referred to the appropriate staff. Both the corrective actions identified and results of actions taken in response will be documented and kept on file (see Corrective Action Form, Appendix B).

8.6 Quality Assurance Final Report

The final report will include discussions on inventory quality considerations for each major source category. It will summarize the results of the quality checking procedures and provide an evaluation of the inventory according to the data quality objectives. The report will include an assessment of the limitations of the inventory data.

9 External Audits

The state is willing to be audited by EPA, and make changes to this inventory preparation and quality assurance plan if warranted.

10 Responsibility

The inventory process will be a cooperative effort between the Benton Clean Air Authority and the Washington State Department of Ecology (Headquarters and Eastern Regional Office). A brief list of inventory responsibilities follows:

BCAA will provide emissions information on the small stationary sources in Benton County. BCAA will also provide information on agricultural crops and field burning in the nonattainment area.

Ecology will provide the emissions inventories for Boise Cascade and the Wallula Power project, and inventory the small stationary sources in Franklin and Walla Walla Counties. Ecology will also inventory all other area and mobile sources. Ecology will write the final inventory documentation.

Both agencies will participate in inventory review and quality assurance activities outlined in this plan. Ecology will lead the effort and provide staff who were not directly involved in the emissions calculations to do reality checks and sample calculations.

11 Schedule

The schedule for inventory document submittal to EPA Region 10 is shown below.

- Draft IP/QA Plan - July 2004
- Final IP/QA Plan - July 2004
- Draft EI - August 9, 2004
- Final EI - will be submitted with draft maintenance plan, Fall 2004

Appendix A – PM_{10} Source Categories

A list of PM_{10} emissions source categories was developed as described in Section 6. Each category is listed below. Sources marked with an 'X' will be included in the inventory. Sources marked with 'NA' are not present in the nonattainment area. Sources marked with an 'I' emit at insignificant levels and were not inventoried.

Point Sources (≥ 70 tons)

All Point Sources

- X Point Sources (≥ 70 T PTE)

Area Sources

Small Stationary Sources (< 70 T PTE)

- X Title V Sources (AOP)
- X Registered Sources

Stationary Source Fuel Combustion

- I Non-Residential
- I Residential Non-Wood
- I Residential Wood

Waste Disposal, Treatment and Recovery

- I Non-Residential
- I Residential

Fugitive Dust

- X Agricultural Tilling
- X Paved Roads
- X Unpaved Roads
- I Road Construction
- I Other Construction

Other Sources

- X Agricultural Field Burning
- NA Prescribed Burning
- I Wildfires
- I Structure Fires
- NA Mining and Quarrying

Mobile Source Categories

On-Road Vehicles

- X Exhaust
- X Brake and Tire Wear

Nonroad Vehicles and Equipment

- I Agricultural Equipment
- NA Airport Support Equipment
- I Commercial Equipment
- I Construction/ Mining Equipment
- I Industrial Equipment
- I Lawn and Garden Equipment
- I Recreational Equipment
- NA Aircraft
- I Marine Vessels, Commercial
- I Pleasure Craft
- I Locomotives
- I Railroad Equipment

Appendix B - Forms

Quality Assurance Check Form Checked by: Date:

Source Category	IPP Checklist			Reasonable	Comments/Sample Calculations
	In	Data	Meth		
Point Sources					
Boise Cascade					
Wallula Power Project					
Area Source Categories					
Sources Inventoried as Point Sources					
Title V Sources < 70 T PTE					
Registration Sources					

Quality Assurance Check Form Checked by: Date:

Source Category	IPP Checklist			Reasonable	Comments/Sample Calculations
	In	Data	Meth		
Area Source Categories					
Fugitive Dust					
Agricultural Tilling					
Paved Roads					
Unpaved Roads					
Other Sources					
Agricultural Field Burning					
Mobile Source Categories					
Onroad Mobile					
Exhaust, Brake and Tire Wear					

Corrective Action Form

Initial Information

Date: ________________ Initiator, Agency: _______________________________________
Year of Emissions Inventory: _____________
Action Category: Missing Data Calculation Errors Data input Other ________________

Problem Identification

Agency: _______________________________
Description of Problem: ____
____
____

Recommended Corrective Action

Description: ____
____
____
Referred to (person, agency): ____
Implementation target date: ________________________________

Problem Resolution

Action taken: ____
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Action taken by (person, agency): _________________________________ Date: ______________

Corrections made to Ecology HQ database, if appropriate: _________________________________
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Corrections made by (person, agency): _____________________________ Date: ______________

(Please attach any supporting information)

Wallula Particulate Matter (PM_{10}) Nonattainment Area Maintenance Plan Emissions Inventories

Prepared by
Washington State Department of Ecology Air Quality Program

March 9, 2005

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1 Introduction

1.1 Background

A PM_{10} monitor was installed near Wallula on February 28, 1986. The monitor has recorded exceedances of the PM_{10} standard since it was established. On August 7, 1987, EPA designated Wallula as a Group I PM_{10} area. Group I areas were areas with a greater than 95% probability of violating the standard. An inventory was prepared for the area in 1988 and updated in 1989. Upon enactment of the 1990 Amendments to the Clean Air Act, all Group I areas were designated as nonattainment areas and classified as Moderate with an attainment date of December 31, 1994. An attainment plan was submitted to EPA in November 1991 with inventory base year 1990. EPA granted a temporary extension of the attainment date to December 31, 1997. The area failed to attain the standard by the extension date and was reclassified as Serious. A 1997 base year inventory was prepared for the Serious classification attainment plan.

Wallula attained the standard on Dec. 31, 2001, and currently meets the criteria for redesignation to attainment. A maintenance plan is prepared as part of a redesignation request. Emissions inventories are required elements of the maintenance plan. A base year 2002 inventory and projection to 2015 were prepared for the maintenance plan. The maintenance plan inventories are described in this document. Similar to the 1997 base year attainment plan inventory, these maintenance plan inventories were crafted for low-wind days only; therefore, windblown dust was not inventoried. Windblown dust events are addressed through the Natural Events Action Plan.

1.2 Base Year Inventory Requirements

An emissions inventory is required for the base year of the maintenance plan and for the last year of the maintenance planning period. The base year inventory is an estimate of actual emissions from point, area and mobile sources in the nonattainment area. The inventory for the final year of the maintenance plan is a projection of future emissions and is based on allowable emissions from point sources and projected emissions from area and mobile sources. The inventories are expressed as estimates of annual emissions and emissions occurring on a typical PM_{10} season day (see Section 1.5). The base year chosen was 2002. The projection year is 2015.

1.3 Geographic Area

The nonattainment area is a square-shaped area covering approximately 372 square kilometers centered around the PM_{10} monitoring site. It encompasses portions of Walla Walla, Benton, and Franklin (very minor) Counties. The boundaries were defined using Universal Transverse Mercator Coordinates (zone 11). In meters, the southwest corner coordinates are (342500, 5099975) and the northeast corner coordinates are (362500, 5118600).

The nonattainment area is a rural, primarily agricultural area. Grain and row crops are grown in the area. There are no incorporated towns in the area; population is estimated at approximately 4800 people. The area includes a pulp mill and several small stationary sources. There are small amounts of highway, rail and marine traffic.

1.4 Spatial Allocation of Emissions

Point sources and some area sources were accurately located in the nonattainment area through use of geographic coordinates. Information to calculate emissions from most area and mobile sources are often only readily available at the county level and cannot be specifically located in smaller geographic areas such as the nonattainment area. In these cases, surrogates which can be accurately located are used to allocate the sources spatially. For example, county agricultural tilling activity cannot be specifically located, but it can be assigned to areas where lands are classified as under cultivation.

Spatial surrogate data in a GIS format was obtained for population, land use and land cover, and highway average daily vehicle miles traveled (ADVMT).[1, 2, 3] Allocation fractions are the ratio of the amount of the surrogate in the NAA to the amount of the surrogate in the county. Allocation fractions were calculated for each surrogate. The fractions were used to allocate county activity or emissions to the nonattainment area. Use of the allocation fractions is described within the individual source category methods sections. County statistics are shown in Table 1-1. The spatial surrogates and allocation fractions are shown in Table 1-2.

Table 1-1: County Statistics

Spatial Surrogate	County Statistics		
	Benton	Franklin	Walla Walla
Population: 2000 Census block	142,475	49,347	55,180
Highway road link ADVMT	3,397,136	1,428,037	1,151,250
Landuse km^2: MRLC code 23: commercial/industrial/transportation	63	48	26
Landuse km^2: MRLC code 81: pasture/hay	506	697	218
Landuse km^2: MRLC code 82: row crops	8	357	113
Landuse km^2: MRLC code 83: small grains	459	356	1,016
Landuse km^2: MRLC code 84: fallow	729	342	657

Table 1-2: Spatial Surrogate Fractions

Spatial Surrogate	Allocation Fractions		
	Benton	Franklin	Walla Walla
Population: 2000 Census block	0.013	0.000	0.052
Highway road link ADVMT	0.004	0.000	0.233
Landuse: MRLC code 23: commercial/industrial/transportation	0.010	0.000	0.113
Landuse: MRLC code 81: pasture/hay	0.011	0.000	0.360
Landuse: MRLC code 82: row crops	0.005	0.000	0.363
Landuse: MRLC code 83: small grains	0.019	0.000	0.007
Landuse: MRLC code 84: fallow	0.017	0.000	0.002

1.5 Season Determination

The cyclical trend at Wallula may be demonstrated by examining the monthly statistics of PM_{10} concentrations. Table 1-3 contains the monthly minimum, maximum, and mean concentrations plus the 0.25, 0.50, 0.75, and the 0.90 quantiles. An examination of the monthly mean and quantiles clearly demonstrates a seasonal trend. The mean and quantiles are least in the winter months. Values gradually increase in the spring, and peak values occur in the summer months of June, July, and August. For the period of 1996-2000, only the months of June through August reported maximum values greater than 100 ug/m3. Although the maximum value for April is 97 ug/m3, the second highest value for April of this period was much less. Also of importance are the significant differences between the 0.90 quantile for June through August versus the other months of the year. The variance in high concentrations is clearly focused on the period of June through September. Emissions estimates in tons per day will be calculated based on this four-month season.

Table 1-3: Wallula Monthly PM_{10} Concentrations: 1996-2000

Month	PM_{10} Concentrations			Quantiles			
	Min	Max	Mean	0.25	0.50	0.75	0.90
Jan	2	29	14	9	12	16	25
Feb	5	37	14	11	12	16	20
Mar	6	77	23	15	18	27	35
Apr	11	97	30	21	25	31	41
May	11	58	29	18	26	36	49
Jun	8	297	65	33	40	73	132
Jul	22	215	76	43	63	82	133
Aug	26	215	74	55	63	84	102
Sep	6	127	47	20	43	65	89
Oct	8	77	33	18	25	47	60
Nov	2	31	19	14	20	24	28
Dec	6	23	13	9	12	16	21

1.6 Application of Rule Effectiveness and Rule Penetration

Rule effectiveness (RE) reflects the ability of a control device or regulation to achieve all the emissions reductions that could be achieved by full compliance at all times. Rule penetration (RP) is a measure of the extent to which a regulation may cover emissions from a source category.

RE/RP has been the subject of ongoing discussion nationally and is the topic of a draft report by the Emissions Inventory Improvement Program (EPA/STAPPA/ALAPCO).[4] Briefly, the report recognizes that control efficiencies are often based on in-use conditions, and when this is the case RE has already been taken into account. This is the situation for both point and area sources in the nonattainment area. Moreover, the controlled point source emissions are estimated through source testing and therefore do not use control efficiencies to calculate emissions.

1.7 Inventory Planning

An Inventory Preparation and Quality Assurance Plan was submitted to EPA in July 2004. The plan was utilized during preparation and finalization of the inventories. A complete list of source categories required for a PM_{10} inventory was included as an appendix to the Inventory Preparation and Quality Assurance Plan. Many sources on the list either did not exist in the nonattainment area, or were only present at very insignificant levels. These sources were not included in the inventory. The inventory was crafted for low-wind days only; therefore, windblown dust was not inventoried. Windblown dust events are being addressed through the Natural Events Action Plan.

1.8 Report Contents and Major Contributors

This report presents emissions summaries and the methods and information sources used to develop the inventory. The Benton Clean Air Authority and Ecology's Eastern Regional Office were major contributors to this report. Many other people and agencies also contributed information essential to the completion of this report.

1.9 Contact Person

Any questions about the information contained in this report may be directed to Sally Otterson, Air Quality Program, Department of Ecology (360)-407-6806 (e-mail sott461@ecy.wa.gov).

1.10 Abbreviations Used Throughout the Inventory

NAA	nonattainment area
EPA	Environmental Protection Agency
Ecology	Washington State Department of Ecology
ERO	Washington State Department of Ecology's Eastern Regional Office.
BCAA	Benton Clean Air Authority. This is the local air authority having jurisdiction over all sources in the Benton County portion of the nonattainment area.
EFSEC	Energy Facility Site Evaluation Council
PM_{10}	Particulate matter less than 10 microns in diameter
tpy	tons per year
ppd	seasonal pounds per day

2 Emissions Summaries and Charts

Table 2-1: Base Year 2002 PM_{10} Emissions Summary

Category	tpy	ppd	%ppd
POINT SOURCES			
Point Sources	189	1,035	20
AREA SOURCES			
Small Stationary Sources	129	965	19
Agricultural Tilling	493	2,606	51
Paved Road Dust	50	305	6
Unpaved Road Dust	18	124	2
Agricultural Field Burning	1	0	0
ONROAD MOBILE SOURCES			
Onroad Mobile Sources	9	53	1
TOTAL ALL SOURCES	**888**	**5,087**	**100**

Table 2-2: Projection Year 2015 PM_{10} Emissions Summary

Category	tpy	ppd	%ppd
POINT SOURCES			
Point Sources	1,261	6,923	61
AREA SOURCES			
Small Stationary Sources	136	1,027	9
Agricultural Tilling	493	2,606	23
Paved Road Dust	73	447	4
Unpaved Road Dust	42	286	3
Agricultural Field Burning	6	0	0
ONROAD MOBILE SOURCES			
Onroad Mobile Sources	6	35	0
TOTAL ALL SOURCES	**2,017**	**11,325**	**100**

Figure 2-1: Base Year 2002 Daily PM_{10} Emissions

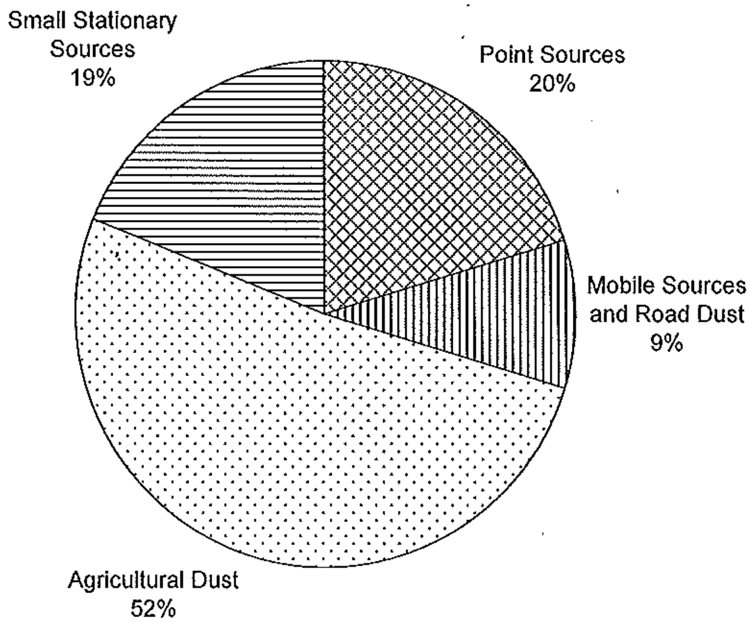
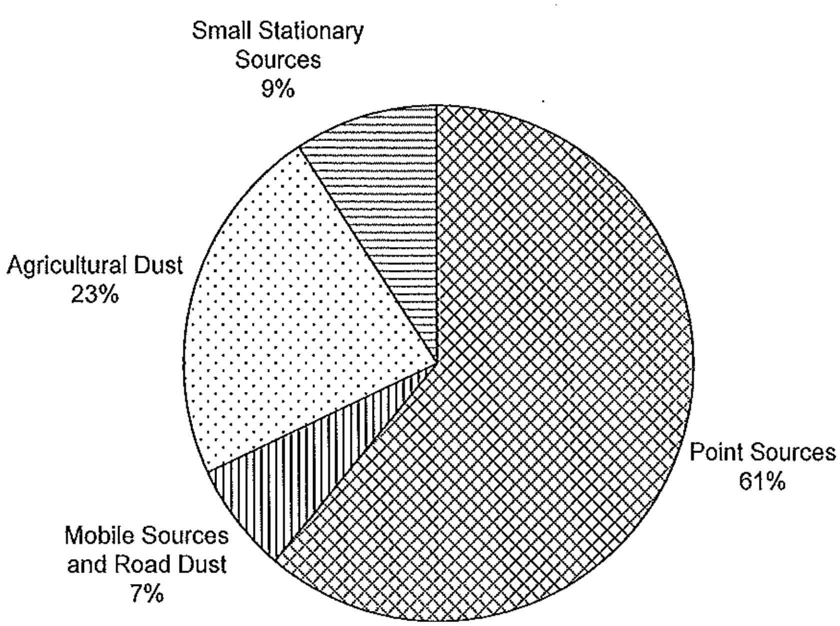


Figure 2-2: Base Year 2015 Daily PM_{10} Emissions



3 2002 Base Year Inventory Emissions Estimates

The 2002 base year inventory is an estimate of actual 2002 emissions representative of a typical PM_{10} season day. Per EPA guidance, annual emissions are also calculated.

To estimate emissions, four basic tasks were completed for each source category. The four tasks were: 1) estimate the activity level, 2) adjust/allocate the activity level (or emissions) temporally and spatially, 3) determine emission rates per the activity, and 4) estimate emissions. The tasks are described below for each source category.

3.1 Point Sources

For Serious nonattainment areas, point sources are defined as any stationary source having the potential to emit 70 tons per year of PM_{10}. Benton Clean Air Authority (BCAA) and Department of Ecology (Ecology) point source permitting records show that the Boise Cascade kraft pulp mill is only source with the potential to emit 70 tons of PM_{10} in the nonattainment area. Point sources are required to report emissions annually. The 2002 annual emissions reports were used to develop the point source inventory.[5] The annual reports include operation schedule information that was used to determine seasonal daily emissions.

For a portion of 2002, Tyson Fresh Meats (formerly IBP Inc.), did have the potential to emit greater than 70 tons of PM_{10}; however, in 2002 they were issued a permit as a synthetic minor and are below the potential to emit 70 tons.[6] Because of the new permit, and because actual emissions did not exceed 70 tons in 2002, Tyson is addressed as an area source under the small stationary source category for this inventory.

Activity Level and Emission Rate Determination

Activity is measured by process throughput as defined by source classification category (SCC) code. Examples of activity measures are amount of fuel burned, and ton of product produced. Emissions may be estimated using direct source measurement (stack testing, continuous emissions monitoring), material balance, published emission factors (emissions rates per activity), or professional judgment. The majority of the non-fugitive emissions from Boise Cascade were estimated by source test (95%).

Temporal and Spatial Allocation

Boise Cascade operated 365 day/yr in 2002. Daily emissions were calculated by dividing annual emissions by 365 days. No spatial adjustments were necessary since the source was located in the nonattainment are through use of Universal Transverse Mercator (UTM) coordinates.

Emissions Estimates

Table 3-1: Boise Cascade PM_{10} Emissions by Emission Point, 2002

Point Number	Point Description	tpy	ppd
01	Lime Kilns (New)	33	181
02	Smelt Tank Vent Rec Furn No 2	3	16
03	Kraft Rec Furn No 2 (Startup Dec 80)	20	107
04	Smelt Tank Vent Rec Furn No 3	24	132
10	Kraft Rec Furn No 3	34	186
21	Boiler #1 Nat Gas Res Oil	2	11
22	Boiler #2 Nat Gas Res Oil	7	38
23	Boiler Hog Fuel	49	268
24	Fugitive Emissions	17	94
	total	**189**	**1,035**

3.2 Area and Mobile Sources

EPA describes area sources as "facilities or activities whose individual emissions do not qualify them as point sources. Area sources represent numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant."[7] Examples of area source categories include road dust and agricultural field tilling. Mobile sources are sources that are mobile and portable and are generally internal combustion powered (e.g. cars and trucks). Emissions from area and mobile sources are typically estimated by multiplying the activity level by an emission factor in mass per activity.

3.2.1 Small Stationary Sources

Several point sources inventoried emit PM_{10}, but have less than 70 tons per year of potential emissions. Those sources are presented here as area sources.

BCAA and Ecology inventory emissions from stationary emissions sources in Benton and Franklin/Walla Walla Counties, respectively. All registered and air operating permit sources (< 70 tons PTE) emitting PM_{10} were included in the inventory. Grain elevators are exempted from the registration program. There is one grain elevator in the NAA, and its last year of emissions data was 1994. The 1994 data was used in this inventory.

Activity Level and Emission Rate Determination

Activity levels and emission rates were determined using methods similar to major point sources.

Spatial Allocation

No spatial adjustments were necessary since the sources were located in the nonattainment area using Universal Transverse Mercator (UTM) coordinates, aerial photographs and local knowledge.

Temporal Allocation

Daily emissions were calculated in one of three ways: 1) source-specific operating schedule, 2) EPA seasonal allocation factors, or 3) uniform distribution assumed. Data availability determined the method chosen. For Agrium (was Unocal in 1997), PG&E, Sandvik, and Simplot Agribusiness, source-specific operating schedule information was available from their 2002 annual emissions reports.[5] Daily emissions were calculated by dividing annual emissions by the total number of operating days. Seasonal adjustments were made to NW Grain Growers (formerly Walla Walla Grain Growers) and Simplot Feeders using temporal allocation profiles from EPA.[8] Temporal allocations were made based on Source Classification Category codes using 302020 for Simplot Feeders (feedlot), and 30200505 and 30200506 for NW Grain Growers (grain elevator). The EPA profiles showed seven days per week operation, and slightly higher activity in the summer months. Lacking other information, Tyson was assumed to operate uniformly year-round.

Emissions Estimates

Table 3-2: Small Point Source PM_{10} Emissions, 2002

Source and Location	Year of Data	tpy	ppd
NW Grain Growers, Wallula	1994	5	28
Simplot Feeders, Wallula	2002	40	219
Tyson Fresh Meats, Wallula	2002	38	208
PG&E #8, Wallula	2002	4	37
Agrium, Kennewick	2002	42	472
Sandvik, Kennewick	2002	0	1
Simplot Agribusiness, Kennewick	2002	0	0
total		**129**	**965**

3.2.2 Onroad Mobile Sources

Onroad mobile source emissions are those generated by operating vehicles on public roadways. Emissions from fuel combustion, and brake and tire wear were estimated.

Activity Level, Spatial and Temporal Allocation

The activity measurement for onroad mobile sources is the number of miles driven. The units are typically given in average daily vehicle miles traveled (ADVMT). For this inventory, 2002 Highway Performance Monitoring System (HPMS) ADVMT was obtained from the Washington State Department of Transportation (WSDOT).[9] ADVMT was allocated to the NAA using the highway ADVMT spatial surrogate as described in Section 1.4. Staff from both WSDOT and the Benton Franklin Council of Governments believed that the ADVMT allocation was reasonable.[10, 11]

WSDOT provided monthly ADVMT adjustment factors for 1990 carbon monoxide and ozone base year inventory efforts.[12] The factors were compared to similar data for 1994[13] and showed very little change. The WSDOT adjustment factors were multiplied by the ADVMT estimates and the number of days per month to estimate total monthly VMT. The average adjustment factor for June through September is 1.0645. Seasonal adjustment factors and ADVMT are shown in the following two tables.

Table 3-3: WSDOT Monthly VMT Adjustment Factors

Month	Adjustment		Month	Adjustment
Jan	0.896		Jul	1.072
Feb	0.922		Aug	1.096
Mar	0.982		Sep	1.029
Apr	1.009		Oct	1.004
May	1.019		Nov	0.963
Jun	1.061		Dec	0.951

Table 3-4: County and NAA ADVMT, 2002

County	County ADVMT	NAA fraction	NAA ADVMT (annual average)	NAA ADVMT (seasonally adjusted)
Benton	3,734,144	0.004	15,646	16,656
Franklin	1,779,494	0.000	0	0
Walla Walla	1,208,529	0.233	281,324	299,470
total	**6,722,167**		**296,971**	**316,125**

Emission Rates

Fleet average emission rates of PM_{10} in grams per mile were generated using the MOBILE6.2 model.[14] Local data was used for many of the input parameters: registration distribution, diesel sulfur content, temperature, and Reid vapor pressure (RVP).[15, 16] Not all of the parameters affect particulate emissions. Temperature, RVP, and speed have no effect on particulate emissions.

The registration distribution, and gasoline and diesel sulfur content affect emission rates. To model the effect of the Washington fleet, data from the Washington State Department of Licensing (DOL) was used to calculate the July 1 vehicle age registration distribution.[17] Because DOL does not register all transit and school buses, alternate sources of information were obtained. Transit bus data came from Federal Transit Administration Annual Report data.[18] For school buses, a Washington-specific 2001 distribution was used.[19]

Diesel sulfur content was obtained from Environ, which was contracted by the Western Regional Air Partnership to prepare onroad mobile source inventories for 1996 in response to EPA's regional haze regulations.[20] Diesel sulfur content was 310 parts per million. Gasoline sulfur content is controlled internally in MOBILE6.2 beginning in the year 2000.

Emission factors for exhaust PM_{10}, brake and tire wear are shown in Table 3-5 below. The MOBILE6.2 input and output files may be found in Figure 7-1 - Figure 7-4 in the appendix.

Table 3-5: Onroad Mobile PM_{10} Emission Rates, 2002

Source	g/mi
Exhaust	0.0542
Brake Wear	0.0125
Tire Wear	0.0097
total	**0.0764**

Emissions Estimates

Annual emissions in tons were calculated using the following equation:

V x EF x 365 days x (lb/454 g) x (T/2000 lbs)
where V = calendar year 2002 NAA ADVMT, and
EF = emission factor in g/mi

Daily emissions in pounds per day were calculated using:

V x EF x T x (lb/454 g)
where V = calendar year 2002 NAA ADVMT
EF = emission factor in g/mi, and
T = average of June - September monthly ADVMT adjustment factors (Table 3-3)

Table 3-6: Onroad Mobile PM_{10} Emissions, 2002

County	Tons per Year				Pounds per Day			
(NAA portion)	Exhaust	Brake	Tire	**total**	Exhaust	Brake	Tire	**total**
Benton	0.3	0.1	0.1	0.5	2.0	0.5	0.4	**2.8**
Franklin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Walla Walla	6.1	1.4	1.1	8.6	35.8	8.2	6.4	**50.4**
total	**6**	**1**	**1**	**9**	**38**	**9**	**7**	**53**

3.2.3 Paved Road Dust

Dust emissions are generated as vehicles pass along the roadways and disturb the layer of loose material on or near the road surface.

Activity Level, Temporal and Spatial Allocation

The activity level in ADVMT, and temporal and spatial allocation factors were the same as those used to estimate onroad mobile source emissions in Section 3.2.2 above. By assuming the same VMT, there is a small amount of double-counting since some of the VMT (< 0.1%) occurs on unpaved roads (see Section 3.2.4).

Emission Rates and Emissions Estimates

The PM_{10} emission rate in grams per mile was calculated using equations 1 and 2 in EPA's AP42.[21] Equation 1 estimates an emission rate for paved roads under dry conditions. This equation was used to calculate the daily emission rate. Equation 2 estimates an emission rate for annual average conditions by incorporating a precipitation correction factor. This equation was used to calculate annual emission rate. The AP42 equations are shown below.

$$E = k\,(sL/2)^{0.65}\,(W/3)^{1.5} - C \qquad \text{equation (1)}$$
$$E = [k\,(sL/2)^{0.65}\,(W/3)^{1.5} - C\,][1-(P/4N)] \qquad \text{equation (2)}$$

where E is the emission factor in lbs/VMT
k = particle size multiplier (0.016 for = PM_{10})
sL = silt loading in g/m^2
C = material from exhaust, brake and tire wear (AP42 default: 0.00047 lb/mi)
W = mean vehicle weight (tons)
P = number of days with at least 0.01 inches of precipitation per year
N = number of days in the year (365)

The AP42 default was used for mean vehicle weight (2.2 tons)[22] and the "C" term (0.00047 lbs/VMT). Long-term (1948-2000) annual days of precipitation greater than 0.01 inches were obtained from the Kennewick meteorological station located just northeast of the NAA.[23] There was an average of 70 days per year with precipitation greater than 0.01 inches. AP42 provides recommended values for silt loading on roads with both high (≥ 5000) and low (< 5000) average daily traffic. Most of the traffic in the nonattainment area occurs on Highway 12. In 1999-2002, volumes on Highway 12 traffic segments within the nonattainment area were greater than 5000 vehicles per day.[24] Because of the high traffic volumes, the silt loading factor for high traffic roads was chosen (0.1 g/m^2). The resulting emission rates are shown in Table 3-7.

Table 3-7: Paved Road Dust PM_{10} Emission Rates

Timeframe	(lb/mi)
Annual	9.17×10^{-4}
Seasonal Daily	9.64×10^{-4}

Emissions were calculated with the following equations:

$V_{countyNAA}$ x EF x 365 days x (T/2000 lbs) (annual emissions in tpy)
$V_{countyNAA}$ x T x EF (daily emissions in ppd)

where $V_{countyNAA}$ = 1997 NAA ADVMT for given county (Table 3-4)
T = average June-Sept monthly ADVMT adjustment factors (Table 3-3 = 1.0645)
E = emission factor in lb/VMT (Table 3-7)

Table 3-8: Paved Road Dust PM_{10} Emissions, 2002

County (NAA portion)	tpy	ppd
Benton	3	16
Franklin	0	0
Walla Walla	47	289
total	**50**	**305**

3.2.4 Unpaved Road Dust

Similar to paved roads, dust emissions are generated as vehicles pass along unpaved roadways and disturb the layer of loose material on or near the road surface.

Activity Level, Spatial and Temporal Allocation

Similar to onroad mobile sources and paved road dust, the measure of activity for unpaved road dust emissions calculations is ADVMT. The county engineers for Walla Walla, Benton and Franklin Counties provided VMT estimates on unpaved roads in the nonattainment area.[25, 26, 27] The inventory will include roads meeting two conditions: 1) length greater than or equal to 0.5 miles, and 2) greater than 20 vehicle trips per day. Roads of less length or trips will be considered insignificant per EPA guidance.[28] The majority of the traffic counts were taken during the summer months; therefore, no seasonal adjustments were made. This may tend to slightly overestimate annual emissions. NAA ADVMT is shown in Table 3-9.

Table 3-9: NAA ADVMT on Unpaved Roads, 2002

County (NAA portion)	ADVMT
Benton	149
Franklin	0
Walla Walla	149
total	**298**

Emission Rates

Seasonal daily emissions were calculated according to the unpaved road dust equation (1b) in AP42, which assumes no rainfall. Annual unpaved road dust emissions were estimated according to equation (2) in AP42.[29] The equation includes an adjustment for rainfall which acts as a control efficiency term by assuming that emissions occur only on days where the rainfall is below 0.01 inches. The AP42 equations are shown below.

$$E = [k\,(s/12)^a\,(S/30)^d \,/\, (M_{dry}/0.5)^{c}] - C \qquad \text{(Equation 1b)}$$
$$E = [k\,(s/12)^a\,(S/30)^d \,/\, (M_{dry}/0.5)^c - C] \times [(365-p)/365] \qquad \text{(Equation 2)}$$

where E is the emission factor in lbs/VMT
- k = particle size multiplier (1.8 for = PM_{10})
- a = PM_{10} constant (1)
- c = PM_{10} constant (0.2)
- d = PM_{10} constant (0.5)
- s = silt content of surface material (%)
- S = speed
- C = material from exhaust, brake and tire wear (AP42 default: 0.00047 lb/mi)
- p = number of days with at least 0.01 inches of precipitation per year
- M_{dry} = surface material moisture content (%)

Vehicle speed was not available. The VMT-weighed speed average on local roads for Spokane in 2002 was used as an estimate (30 mph).[30] The AP42 default was used for mean vehicle weight (2.2 tons). Long-term (1948-2000) annual days of precipitation greater than 0.01 inches were obtained from the Kennewick meteorological station located just northeast of the NAA.[23] There were an average of 70 days per year with precipitation greater than 0.01 inches.

The surface material silt content (3.2%) and moisture content (1%) were obtained from the

WRAP.[31, 32] Silt values used by in EPA in the 1999 NEI were derived from sampling data taken from a database of approximately 200 samples from 30 states.[33] Washington was not sampled. EPA used the national average of 3.9% for all states not sampled when they prepared the 1999 NEI.[33] Rather than using the national average for states that were not sampled, the WRAP calculated an average of 3.2% for western states using the silt content database. The WRAP value was used in this inventory. The resulting emission rates are shown in Table 3-10.

Table 3-10: Unpaved Road Dust PM_{10} Emission Rates

Timeframe	(lb/mi)
Annual	0.3373
Seasonal Daily	0.4174

Emissions Estimates

Emissions were calculated with the following equations:

$V_{countyNAA}$ x EF x 365 days x (T/2000 lbs) (annual emissions in tpy)
$V_{countyNAA}$ x EF (daily emissions in ppd)

where $V_{countyNAA}$ = 2002 NAA ADVMT for given county (Table 3-9)
E = emission factor in lb/VMT (Table 3-10)

The final emissions estimates are shown in Table 3-11.

Table 3-11: Unpaved Road Dust PM_{10} Emissions, 2002

County (NAA portion)	tpy	ppd
Benton	9	62
Franklin	0	0
Walla Walla	9	62
total	**18**	**124**

3.2.5 Agricultural Tilling

Emissions from agricultural tilling are those that occur when soil is disturbed during plowing, weeding, seeding, and other operations. Most of the tilling operations occur either before or after the dust season as defined in section 1.5. Tilling emissions are estimated based on the approach EPA used in their National Emissions Inventory (NEI).[33]

Activity Level

The activity level is measured in the number of acres planted. In the 1991 Wallula attainment plan, an estimate of the number of acres of each of three major crop types was specified.[34] The crop types and acreage were wheat: 11,740 acres, corn: 16,620 acres, and alfalfa: 22,380 acres. An additional 13,420 acres were in the Conservation Reserve Program. Examination of aerial photographs of the nonattainment area, and conversation with local staff both indicate that the 1991 attainment plan estimates are still reasonable.[35] For calculation of tilling estimates, an adjustment was made to the alfalfa acreage. Alfalfa is a perennial crop and may be grown for seed or forage. Alfalfa grown for seed is replanted every 3-4 years, while alfalfa grown for forage is replanted every 7 years. The total acreage in alfalfa was divided by 4 as an estimate of the amount of acreage that may be tilled in a given year.

Winter and spring wheat have different tilling schedules. The prior SIP estimates for wheat were not separated into winter and spring wheat. It was assumed that all of the wheat grown in the Benton County portion of the nonattainment area was winter wheat. For Walla Walla County, the nonattainment area fractions of spring and winter wheat were assumed to be the same as the county fractions (18% spring, 82% winter).[36] The fractions were almost identical to the fractions calculated in the 1997 base year inventory. Acres in the nonattainment area by county and crop type are shown in Table 3-13.

Emission Rate

The equation for calculating tilling emissions was provided in the EPA NEI documentation:

$$E = c \times k \times s^{0.6} \times p \times a$$

where E = PM_{10} emissions in lbs
- c = constant 4.8 lbs/acre-pass
- k = dimensionless particle size multiplier (0.21)
- s = silt content of surface soil
- p = number of tilling passes per timeframe
- a = acres of land planted

Soil types were determined through use of soil maps available from Washington State University.[37] Soils under cultivation in Benton County portion of the nonattainment area are classified as silt-loams, and soils in Walla Walla County are classified as loamy-sands. The silt content of the surface soil was obtained from table 4.8-6 of the NEI documentation. Silt-loams have 52% silt content and loamy-sands have 12%.

The number and type of tilling passes was obtained from Ecology Eastern Regional Office staff.[35] The type of passes and month of pass are shown in Table 3-12.

Table 3-12: Tilling Passes

Tilling	Month		Tilling	Month
Winter Wheat			**Corn**	
Plow	Oct or Feb		Plow	Oct or Nov
Cultivate	Feb		Cultivate	Feb
Rod Weed	Mar		Seed/Fertilize/Herbicide	Apr
Rod Weed	May		**Alfalfa**	
Fertilize	Mar or May		Plow	Oct or Nov
Rod Weed	Aug		Cultivate	Feb
Seed	Sep		Cultivate	Mar
Spring Wheat			Rod Weed	Mar
Plow	Oct		Seed	Mar
Cultivate	Feb		Harrow	Mar
Fertilize	Feb		Packing	Mar
Rod Weed	Feb			
Seed	Feb			
Harrow	Feb			

Table 3-13: NAA Acreage and Number of Tillings by County and Crop, 2002

County (NAA portion)	Crop	Acres	Tilling Passes		Tilling Days in Season
			Annual	Season	
Benton	Winter Wheat	5,070	7	2	61
Walla Walla	Corn	16,620	3	0	0
Walla Walla	Alfalfa	5,595	7	0	0
Walla Walla	Winter Wheat	5,476	7	2	61
Walla Walla	Spring Wheat	1,194	6	0	0

Emissions Estimates and Temporal Allocation

Emissions are calculated with the equation listed in the "Emission Rate" section above. The annual emissions estimate is calculated using the total number of tilling passes per year. Seasonal daily emissions are calculated using the number of passes in the season. Seasonal emissions are divided by the number of days in the tilling period (see Table 3-13 and Table 3-12) to calculate daily emissions. Calculated emissions are shown in Table 3-14.

Table 3-14: Tilling PM_{10} Emissions Estimates, 2002

County (NAA portion)	Crop	tpy	ppd
Benton	Winter Wheat	191	1,800
Walla Walla	Corn	112	0
Walla Walla	Alfalfa	88	0
Walla Walla	Winter Wheat	86	806
Walla Walla	Spring Wheat	16	0
total		**493**	**2,606**

3.2.6 Agricultural Burning

Agricultural burning activity includes field burning and orchard tear-out burning. Incidental burning, which is not regulated, is not included in the inventory.

Activity Level

Acres permitted for burning are tracked by the BCAA and Ecology. No burning was permitted in the Walla Walla portion of the nonattainment area in 2002.[38, 39] In the Benton County portion of the nonattainment area, 30 acres of alfalfa were burned. No orchard tear-out was permitted in the nonattainment area in 2002.

Spatial Allocation

No spatial adjustments were necessary since Ecology burn permits were issued using township, range and section. The nonattainment area includes townships 7 and 8 north, and ranges 30-32 east. Sections 1-2, 11-14, 23-26, and 35-36 are included in range 30; all sections are included in range 31; and sections 3-10, 15-22, and 27-34 are included in range 32. BCAA permit information was provided by BCAA specifically for the NAA.

Temporal Allocation

Temporal allocation of emissions is difficult to assess since burning permits were not time-specific. In Walla Walla County, agricultural field burning occurs primarily from late August to late September.[40] A significant amount may also occur in October.[39] If it is assumed that the burning all took place on a single day, approximately 1,062 lbs of PM_{10} would have been emitted. The remaining days in the season would have had no burning.

While a base year inventory is to represent a typical day, rather than an episodic day, examination of the probable cause of nonattainment was used to develop a daily temporal allocation that will be useful for maintenance planning. Only one exceedance day was recorded for Wallula that cannot be explained as a natural event. The day was July 3, 1997. This day occurred before the normal fall burning season. Additionally, filter analysis has shown that dust was the predominant component of the particulate, not combustion. Although it is possible to generate significant emissions from agricultural field burning during individual days, daily emissions are estimated at zero for the purposes of this inventory. (The current agricultural burning program relies in part on meteorology to determine whether or not burning can take place on individual days. Burn decisions are made to minimize impacts on the nonattainment area.)

Emission Rate and Emissions

The total particulate emission rate for alfalfa burning of 45 lbs/ton residue burned was taken from EPA's AP42.[41] The loading factor of 0.8 tons of residue per acre was also taken from AP42.

The PM_{10} fraction was estimated from total particulate using size fraction data from the Air Resources Board in California.[42]

Emissions in tons per year were calculated as: $E = A \times L \times R \times F \times T/2000$ lbs

where A = acres, L = loading factor (T/acre), R = emission rate (lbs/T) and F = PM_{10} as a fraction of total PM

Table 3-15: Agricultural Field Burning Parameters and PM_{10} Emissions, 2002

Acres	Loading Factor (T/acre)	Emission Rate (lbs/T)	PM_{10} Fraction	tpy	ppd
30	0.8	45	0.9835	1	1,062

4 Projection Year 2015 Inventory

Emissions projections were prepared for 2015. The emissions are based on allowable emissions limits for point sources, and projected future emissions for area and mobile sources. The estimation methods and resulting emissions estimates are presented below for each source category.

4.1 Point Sources

Two sources have the potential to emit 70 tons per year of PM_{10} in 2015: Boise Cascade and the Wallula Power Project (Wallula Generation LLC). For the 2015 projection, allowable emissions are used.

Boise Cascade: Daily allowable emissions were calculated by Trinity Consultants in consultation with Ecology.[43] Fugitive and insignificant emissions do not have allowable emissions limits. The estimate for process fugitive and insignificant emissions was an estimate of maximum emissions (Trinity). Fugitive emissions from site roads and the compost facility are representative of actual 2002 emissions. Emissions in tons per year were calculated by multiplying daily estimates by 365 days.

Table 4-1: Boise Cascade PM_{10} Allowable Emissions by Emission Point

Point Number	Point Description	PM_{10} tpy	PM_{10} ppd
01	Lime Kiln	91	500
02	No. 2 Smelt Dissolving Tank	12	67
03	No. 2 Recovery Furnace	55	300
04	No. 3 Smelt Dissoving Tank	56	304
10	No. 3 Recovery Furnace	174	952
21	No. 1 Power Boiler	204	1,116
22	No. 2 Power Boiler	217	1,191
23	Hog Fuel Boiler	53	290
24	*Process Fugitive and Insignificant Emissions	3	18
24	**Fugitive Emissions from Roads, Paved and Unpaved	16	86
24	**Fugitive Emissions from Compost Site	2	8
	total	**882**	**4,834**

* Estimated maximum emissions
** Actual 2002 emissions

Wallula Power Project: The Wallula Power Project is permitted, but no construction has begun. Daily and annual allowable emissions from the turbines, duct burners and cooling towers were obtained from their Notice of Construction (NOC) permit limits.[44] Emissions from the auxiliary boiler, emergency diesel generator and diesel fire pump were not specifically limited in the NOC since they are expected to be very insignificant. They were estimated in the Prevention of Significant Deterioration permit as shown below.[45]

Table 4-2: Wallula Power Project Allowable Emissions

Emission Unit	PM_{10} limit	PM_{10} tpy	PM_{10} ppd
Combustion gas turbines and duct burners	20.8 lbs/hr	364	1,197
Cooling towers	3.7 lbs/hr; 13.9 tpy	13.9	89
Auxiliary boiler	PSD permit estimate	0.6	3
Emergency diesel generator	PSD permit estimate	0.1	1
Diesel fire pump	PSD permit estimate	0	0
total		**379**	**2,089**

To obtain a NOC permit, new sources in nonattainment areas are required to obtain offsets and to demonstrate that there is no significant increase in ambient concentrations. The Wallula Power Project met these conditions. Accordingly, the air quality analysis demonstrating maintenance does not include this source.

4.2 Area and Mobile Sources

4.2.1 Small Stationary Sources

Small stationary source emissions were projected to 2015 in one of three ways: 1) source allowable or potential emissions, 2) use of historical emissions, or 3) facility and/or air agency estimate. The projection method and temporal allocation to ppd for each source is described.

NW Grain Growers-Wallula: Grain elevators were exempted from the State registration program. The last year of emissions data for this source was 1994. The 1994 value was retained for the 2002 base year inventory, and is also used for the 2015 projection. The temporal allocation to ppd was the same as that used for the 2002 base year inventory.

Simplot Feeders-Wallula: The average of 1997-2003 emissions was used as an estimate of 2015. Emissions in tpy from 1997 to 2003 were (in chronological order): 24, 45, 56, 62, 76, 40, and 20. The temporal allocation to ppd was the same as that used for the 2002 base year inventory.

Tyson Fresh Meats-Wallula: In 2002, Tyson (formerly IBP) was issued Order # 02AQER-5074 by the Department of Ecology. The order established the source as a synthetic minor. The potential emissions described in the order were used for the 2015 projection. Both non-fugitive and fugitive emissions were included. The temporal allocation to ppd was the same as that used for the 2002 base year inventory.

PG&E #8-Wallula: The potential to emit value of 7.7 tons per year for the site was used for the projection at the advice of Ecology staff.[46] Emissions were temporally allocated to ppd by multiplying the 2002 ratio of ppd/tpy by the estimated 2015 tpy.

Agrium-Kennewick: BCAA, in consultation with Agrium, recommended using the 2003 estimate as the maximum that would be expected by 2015.[47] Emissions were temporally allocated to ppd by multiplying the 2002 ratio of ppd/tpy by the estimated 2015 tpy.

Sandvik-Kennewick: During 1998-2001 emissions were zero or left blank on the annual emissions reports.[48] In 2002, 0.14 tpy were reported.[5] The 2002 value is used as an estimate of 2015. The temporal allocation to ppd is the same as that used in the 2002 base year inventory.

Simplot Agribusiness-Kennewick: This source was permitted as a synthetic minor in 2001. In 2002 they report emissions of less than 1 ton of TSP. BCAA believes that emissions will remain less than one ton in 2015.[47] Emissions are assumed to be zero.

Emissions Estimates

Table 4-3: Small Point Source PM_{10} Emissions, 2015

Source and Location	Year of Data	tpy	ppd
NW Grain Growers, Wallula	1994	5	28
Simplot Feeders, Wallula	2002	46	253
Tyson Fresh Meats, Wallula	2002	33	180
PG&E #8, Wallula	2002	8	70
Agrium, Kennewick	2002	44	494
Sandvik, Kennewick	2002	0	1
Simplot Agribusiness, Kennewick	2002	0	0
total		**136**	**1,027**

4.2.2 Onroad Mobile Sources

ADVMT was projected to 2015 from 2002 using the area-wide an annual growth rate of 3%.[49] The growth rate agreed well with the WSDOT growth projection of 3.1% per year on Highway 12 through 2025.[50] The total calculated growth rate from 2002 to 2015 was 46.85%.

The spatial and temporal allocation factors used in the base year 2002 inventory were also used for the 2015 projection.

Table 4-4: NAA ADVMT, 2015

County	NAA ADVMT (annual average)	NAA ADVMT (seasonally adjusted)
Benton	22,977	24,459
Franklin	0	0
Walla Walla	413,134	439,782
total	**436,112**	**464,241**

Emission Rates

MOBILE6.2 was run for 2015. All input parameters remained the same as in the base year 2002 inventory except for the registration distribution and diesel sulfur content. The registration distribution was updated to the most recent year available (2003).[51] Diesel sulfur content was set to 15 parts per million. Under current law, most diesel fuel will be required to meet a 15 ppm limit on September 1, 2006. Full implementation is expected by December 1, 2010.

Emission rates were calculated using the same methodology as in the base year 2002 inventory. Emission factors for exhaust PM_{10}, brake and tire wear are shown in Table 4-5 below. The MOBILE6.2 input and output files may be found in Figure 7-1 - Figure 7-4 in the appendix.

Table 4-5: Onroad Mobile PM_{10} Emission Rates, 2015

Source	g/mi
Exhaust	0.0121
Brake Wear	0.0125
Tire Wear	0.0097
total	**0.0344**

Table 4-6: Onroad Mobile PM_{10} Emissions, 2015

County (NAA portion)	Tons per Year				Pounds per Day			
	Exhaust	Brake	Tire	**total**	Exhaust	Brake	Tire	**total**
Benton	0.1	0.1	0.1	**0.3**	0.7	0.7	0.5	**1.9**
Franklin	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Walla Walla	2.0	2.1	1.6	**5.7**	11.7	12.1	9.4	**33.3**
total	**2**	**2**	**2**	**6**	**12**	**13**	**10**	**35**

4.2.3 Paved Road Dust

Emissions were estimated by multiplying the base year 2002 estimates by the 2002 to 2015 VMT growth rate of 46.85% described in section 4.2.2 above. The calculated emissions are shown below.

Table 4-7: Paved Road Dust PM_{10} Emissions, 2015

County (NAA portion)	tpy	ppd
Benton	4	24
Franklin	0	0
Walla Walla	69	424
total	**73**	**447**

4.2.4 Unpaved Road Dust

ADVMT projections for 2015 were provided by the County Engineers.[25, 26, 27] The emission rates were the same as used in the 2002 base year inventory (section 3.2.4). ADVMT and emissions are shown in the table below.

Table 4-8: Unpaved Road ADVMT and Dust PM_{10} Emissions, 2015

County (NAA portion)	ADVMT	tpy	ppd
Benton	506	31	211
Franklin	0	0	0
Walla Walla	180	11	75
total	**686**	**42**	**286**

4.2.5 Agricultural Tilling

No substantial changes are expected in the agricultural tilling activity level.[38] The 2002 emissions were used as an estimate of 2015 (see Table 3-14).

4.2.6 Agricultural Field Burning

Future burning estimates were made using recent burning history and in consultation with agricultural burning program staff from BCAA and Ecology's Eastern Regional Office.

Activity Level

Benton County: For the Benton County portion of the nonattainment area, the base year 2002 estimate for alfalfa burning was retained for 2015. While no orchard tear-out burning occurred in 2002, BCAA staff estimated that 25-50 acres per year would be a good estimate for 2015. The high end of 50 acres was used for this inventory projection.

Walla Walla County: For the Walla Walla County portion of the nonattainment area, historical burn permits were examined. Beginning in 2000, burning dropped significantly. From 2000 to 2003, the highest levels were 35 acres of alfalfa and 8 acres of orchard tear-out. For 2015, agricultural burn permit staff recommended using 40-50 acres of field burning, and 30-40 acres of orchard tear-out.[38] The mid-points of the ranges were used. In keeping with the 2003 dataset, the field burning was assumed to be alfalfa.

Temporal Allocation

If it is assumed that the burning all took place on a single day, approximately 12,666 lbs of PM_{10} would have been emitted. The remaining days in the season would have had no burning. It is unlikely that this would happen. Similar to the base year 2002 inventory, daily emissions are estimated at zero for the purposes of this inventory (see section 3.2.6).

Emission Rate and Emissions

The total particulate emission rates for alfalfa and orchard burning of 45 and 4 lbs/ton residue burned was taken from EPA's AP42, respectively.[41] The alfalfa loading factor of 0.8 tons of residue per acre was also taken from AP42. The Yakima Regional Clean Air Authority provided a loading factor for orchard tear-outs in their PM_{10} Maintenance Plan inventory.[52] The loading factor was 30 tons per acre and is used in this inventory.

Similar to the 2002 inventory, PM_{10} fractions was estimated from total particulate using size fraction data from the Air Resources Board in California.[42]

Emissions in tons per year were calculated as: E = A x L x R x F x T/2000 lbs

where A = acres, L = loading factor (T/acre), R = emission rate (lbs/T) and F = PM_{10} as a fraction of total PM

Table 4-9: Agricultural Field Burning Parameters and PM_{10} Emissions, 2015

County	Type	Acres	Loading Factor (T/acre)	Emission Rate (lbs/T)	PM_{10} Fraction	tpy	ppd
Benton	Alfalfa	30	0.8	45	0.9835	0.5	1,062
Benton	Orchard	50	30	4	0.9814	2.9	5,888
Walla Walla	Alfalfa	45	0.8	45	0.9835	0.8	1,593
Walla Walla	Orchard	35	30	4	0.9814	2.1	4,122
total						**6.3**	**12,666**

5 Quality Assurance Report

The quality assurance plan for the emissions inventory specified several quality assurance checks. A summary of the quality assurance checks performed and a description of the inventory process with emphasis on quality control/assurance activities follows.

5.1 Inventory Process with Emphasis on Quality Control/Assurance Activities

The inventory process is divided into several tasks. The tasks are: prioritization and identification of emissions sources, data collection procedures, emission estimations procedures, geographical allocation, validation procedures, measures to avoid double counting, calculations, rule effectiveness/penetration, and seasonal/daily adjustments. Not all tasks apply to all sources. Details for each major source category are listed below.

5.1.1 Point Sources

Prioritization and Identification of Emissions Sources

BCAA and Ecology track major, synthetic minor, and smaller point sources. One source with the potential to emit 70 tons was identified in Walla Walla County: Boise Cascade. A permitted, but not constructed source was identified for the 2015 projection: Wallula Power Project. Experienced inspectors and engineers from BCAA, EFSEC and Ecology have identified the emissions sources and the points within the sources. It is believed that all sources and emissions points have been counted.

Collection Procedures

Each year Ecology, in conjunction with BCAA, updates the point source inventory. Update Request forms (questionnaire forms) are sent to the sources. The previous year's data is on the forms for the source to review for errors and to update. Sources return the forms to BCAA, Ecology's Eastern Regional Office, or Ecology's Industrial Section for review before returning to Ecology's Air Quality Program Headquarters for further review and data entry by inventory personnel. By using this procedure, the quality of the data is enhanced since the plant, permitting authority and Ecology's Headquarters all review the data.

Emission Estimations Procedures

Emissions are estimated in one of several ways. Valid estimation methods include: source test, material balance, AP42 and other EPA factors, non-AP42 factors, or engineering guess. Data availability is one factor in the method selection. Allowable emissions estimates were based on permitted values.

In the base year inventory, all of the controlled PM_{10} emissions were estimated by source test, so rule effectiveness was not applied. Emissions in pounds per day were calculated by dividing the individual emission point annual emissions by the number of days each point operated.

Geographical Allocation

Point sources were located in the area by use of UTM coordinates.

Validation Procedures

As stated under Collection Procedures, the plant, permitting authority and Ecology Air Quality Program inventory staff have reviewed all data. This ensures reasonableness and consistency of data and calculations performed.

Measures to Avoid Double Counting as Area Sources

Boise Cascade is a kraft pulp mill, and the Wallula Power Project is a power generation operation. They did not duplicate any of the area source categories.

5.1.2 Area and Nonroad Mobile Sources

Prioritization and Identification of Sources

There is no size cutoff for area sources. All source categories listed in the EPA's *PM-10 Emission Inventory Requirements* (September 1994) were inventoried or stated to be of little or no significance. Additional sources were included from BCAA and Ecology source registration records.

Collection Procedures

Area source data collection methods were mainly chosen from EPA guidance. Resource constraints and the relative importance of the source category were considered when collection procedures. Where good local data was accessible, it was used and documented in the inventory text.

Emission Estimation Methods and Consistency of Application

Inventory methods were mainly chosen from EPA guidance including the Procedures Document for the 1999 National Emissions Inventory, and *PM-10 Emission Inventory Requirements* (September 1994). All methods are documented in the inventory text. Resource constraints and the relative importance of the source category were considered when choosing estimation methodology.

Calculations

All calculations are documented along with assumptions, engineering judgments, and references in the inventory text. Calculations for most of the area/nonroad sources were done electronically. Emissions were calculated according to general EPA guidance. Any deviation was documented in the inventory text.

Rule Effectiveness/Penetration

No control programs were assumed for agricultural tilling, road dust and some of the small stationary sources. Control programs could affect individual small stationary sources and agricultural field burning. For small stationary sources with controls, efficiencies are normally based on in-use conditions; therefore, RE has already been taken into account. Agricultural burning is controlled by issuing permits. While some illegal burning may occur, it was not estimated since agricultural burning emissions are not counted in the daily inventory.

Seasonal Adjustment and Typical Day

Verified air quality data was used to determine the four month PM_{10} season (June-Sept). All seasonal allocation methods and factors are documented in the inventory text.

Geographical Allocation

Area sources not specifically pinpointed were located using appropriate surrogates in GIS format, local agency knowledge, and/or aerial photography. Allocations are documented in the inventory text.

Validation Procedures

Spot checks to ensure reasonableness and consistency of data and calculations were performed as the inventory was being completed and during proofing of the draft. Some consistency checks include: year of data, reporting units, and spatial surrogate allocations.

Measures to Avoid Double Counting as Area Sources

None of the area source categories were duplicated under point sources. While road dust at one time had some overlap with the Onroad Mobile sector, the new AP42 road dust calculations exclude the portion of emissions that are attributed to exhaust, brake and tire wear. Therefore, double-counting did not occur.

5.1.3 Onroad Mobile Sources

Estimating emissions from onroad mobile sources required developing emission factors to be used with vehicle miles traveled data. Highway Performance Monitoring System VMT was used with GIS roadway and volume information to estimate VMT in the NAA. HPMS is the national VMT reporting system and follows a QA procedure. The focus of QA was on MOBILE6.2 and the combining of the resulting emissions factors with the VMT data.

Prioritizing Sources and Data Elements

MOBILE6.2 allows the substitution of local data for national default data. The model year registration distribution and diesel fuel sulfur content affect particulate emissions, and may be locally derived. These inputs were therefore identified as a priority fields. For the base year, a 2002 distribution specific to Washington was developed using State Dept. of Licensing data. For the 2015 projection, the most recent year of data was used (2003). Fuel parameters specific to eastern Washington were obtained.

Emission Estimation Methods and Consistency of Application

Use of MOBILE6.2 is documented in the inventory text. The input file was provided in the inventory documentation. The input and output files are available electronically on request from EPA. Use of emission factors and VMT data are also explained in the inventory text.

Calculations

Emissions calculations and seasonal allocations were performed electronically.

Seasonal Adjustment and Typical Day

Verified air quality data was used to determine the four month PM_{10} season (June-Sept). All seasonal allocation methods and factors are documented in the inventory text. The VMT provided by the WSDOT represented a typical day, so no daily adjustment was necessary. A seasonal adjustment was made using WSDOT estimates from traffic data. The average monthly adjustment value for June - September was used.

Geographical Allocation

County-level VMT was allocated to the NAA using roadway and volume GIS data at 0.5 km resolution.

Validation Procedures

Spot checks to ensure reasonableness, consistency of data and accuracy of calculations were performed as the inventory was being completed and during proofing of the draft. Checks included: 1) MOBILE6.2 input files contained the flag settings and inputs documented in the inventory text, and 2) verification of year of data, reporting units, and spatial surrogate allocations.

5.2 Summary of Quality Checking Procedure

5.2.1 IP/QA Plan Adherence, Reality/Peer Review, Sample Calculations

The inventory source category list in the inventory preparation plan was checked against the inventory for inclusion of all appropriate source categories. Information sources and emissions estimation methods specified in the inventory preparation plan were also checked against the inventory. Reality/peer review, and sample calculation checks were performed on the final inventory.

Overall, the inventory preparation plan had been followed. For all sources, methods, data, and inventory assumptions were judged reasonable. Spot sample calculations verified inventory results. The checking procedure brought out errors in the inventory text, and areas where the readability of the text could be improved. Follow-up corrective actions were taken.

5.2.2 Standard Range Check

The standard range checks specified in the quality assurance plan are shown in Table 5-1 and. The check involved comparing the 2002 base year inventory to the 1997 base year inventory, and comparing the 2015 projection to the 2002 base year inventory. A brief explanation is given for discrepancies greater than 20% involving sources that made up greater than 5% of the daily inventories.

Comparison Discrepancies 2002 and 1997

<u>Point Sources</u>: Boise Cascade was the only source counted as a point source in the inventory. Boise Cascade emissions fluctuate from year-to-year according to production, the combination of fuels burned, and source test results. The reduction seen in the comparison of 2002 to 1997 was primarily due to reductions in emissions from the hog fuel boiler and smelt tank number 3. A full investigation was not made into these individual differences.

<u>Small Point Sources</u>: Most of the increase in emissions was due to higher emissions reported in 2002 for Agrium, Tyson Fresh Meats, and Simplot-Wallula.

Table 5-1: Comparison of 2002 and 1997 PM_{10} Emissions Estimates

Category	1997		2002		
	ppd	% ei	ppd	% ei	% change
POINT SOURCES					
Point Sources	1,340	29	1,035	20	-23
AREA SOURCES					
Small Stationary Sources	275	6	965	19	251
Agricultural Tilling	2,615	56	2,606	51	0
Paved Road Dust	289	6	305	6	5
Unpaved Road Dust	105	2	124	2	19
Agricultural Field Burning	0	0	0	0	
ONROAD MOBILE SOURCES					
Onroad Mobile Sources	64	1	53	1	-17
total	**4,689**	**100**	**5,087**	**100**	**9**

Comparison Discrepancies 2015 and 2002

Point Sources: The 2002 inventory was an inventory of actual emissions that had only a single source, Boise Cascade. The 2015 inventory was based on allowable emissions, which can be much higher than actual emissions. In addition to Boise Cascade, the 2015 inventory included a newly permitted source, Wallula Power. To obtain its NOC permit, Wallula Power was required to obtain offsets and to demonstrate that there is no significant increase in ambient concentrations. Since Wallula Power met these conditions, this source is not included in the air quality analysis demonstrating maintenance.

Paved Road Dust: Emissions are proportional to VMT. Because VMT was projected to increase approximately 47% between 2002 and 2015, emissions were projected to increase the same.

Table 5-2: Comparison of 2015 and 2002 PM_{10} Emissions Estimates

Category	2002		2015		
	ppd	% ei	ppd	% ei	% change
POINT SOURCES					
Point Sources	1,035	22	6,923	61	569
AREA SOURCES					
Small Stationary Sources	965	21	1,027	9	6
Agricultural Tilling	2,606	56	2,606	23	0
Paved Road Dust	305	6	447	4	47
Unpaved Road Dust	124	3	286	3	130
Agricultural Field Burning	0	0	0	0	
ONROAD MOBILE SOURCES					
Onroad Mobile Sources	53	1	35	0	-34
total	**5,087**	**109**	**11,325**	**100**	**123**

5.2.3 Sensitivity Analysis (Ranking)

The base and projection year inventory rankings may be seen in Table 2-1 and Table 2-2. On an average low-wind summer day in the base year 2002 inventory, agricultural tilling makes up 51% of the emissions, stationary sources (point and area) make up 39%, and onroad mobile sources and road dust contribute 9%. This emissions inventory accounting is a very limited and simple summarization of emissions. The large variability possible in both meteorological conditions and source activity will affect emissions and their impact on air quality. This helps point out weaknesses in the "typical" day, nonattainment area approach that is required for a base year inventory.

In the projection to 2015, the mandatory use of point source allowable emissions increases the point source estimate to more than 6 times the base year estimate, making stationary sources 70% of the total inventory. With this large increase in the point source category, all other sources' contributions are diminished in the ranking. Agricultural dust is 23%, onroad mobile and road dust are 7%.

5.3 Conclusion

The inventory accuracy, completeness and comparability objectives were met. All estimates were calculated and documented using accepted methods (accuracy). All source categories in the IPP were addressed in the inventory, and all information required to estimate emissions was present (completeness). The 2002 inventory was comparable with the 1997 base year inventory. For all but the point sources, the 2015 inventory estimates were comparable with the 2002 inventory. For point sources, allowable emissions were much higher than the base year estimates.

6 References

[1] *Census 2000 Redistricting Data (Public Law 94-171) Summary File, 2000 Census of Population and Housing, Technical Documentation.* US Department of Commerce, US Census Bureau. Census block information available from ftp website: files ssgeo.upl (where ss = state).

[2] Multi-resolution Land Characteristics, National Land Cover Data. United States Geologic Survey. 1992 data, 30 m resolution.

[3] Washington State Department of Transportation. 1995 ADVMT data from TRIPS, HPMS and GIS systems. Elizabeth Church (TRIPS), Pat Whitaker (HPMS), Marci Mitchell and Ron Cihon (GIS), Lloyd Fergestrom (MPO liaison).

[4] *Emissions Inventories and Proper Use of Rule Effectiveness.* September 23, 1998. Memorandum from EIIP Point Sources Committee Members to EIIP Steering Committee Members. September 23, 1998.

[5] Washington Emissions Data System, 2002.

[6] Washington Department of Ecology Order No. 02AQER-5074 issued December 6, 2002.

[7] *Handbook for Criteria Pollutant Inventory Development: A Beginner's Guide for Point and Area.* Sources United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. EPA-454/R-99-037, September 1999.

[8] Temporal Allocation files by SCC code as available through the EPA Technology Transfer Network CHIEFS site (files tprl_xref_042902.dbf, month_prof_042902.dbf, week_prof_121400.dbf, downloaded 7-24-2002).

[9] *HPMS Miles and VMT by County.* Washington State Department of Transportation. 2002 data. July 1, 2003.

[10] Email from Mark Kushner, Benton-Franklin Council of Governments. June 24, 2004.

[11] Email from Rick Gifford, Washington State Department of Transportation. June 21, 2004.

[12] Hertzog, Barbara and Borden, Hank. *Adjustment Factors for Vehicle Miles Traveled.* Washington State Department of Transportation. July 1992.

[13] *Annual Traffic Report.* Washington State Department of Transportation. Pages XVI - XX (monthly traffic count data).

[14] MOBILE6.2. US Environmental Protection Agency. Executable file dated 9/24/2003.

[15] Climate Summary - Temperature. Kennewick. Long-term (1948-2000) temperature data. Western Regional Climate Center. Average max and min for June – Sept. Available from Internet website. Downloaded Oct. 2002.

[16] personal conversation with Maureen Mullen, Pechan and Associates (under contract to EPA).

1996 and 1999 winter and summer survey data from the American Automobile Manufacturers' Association. January 4, 2001.

[17] Department of Licensing electronic data. Database snapshot July 2002.

[18] National Transit Database Data Tables. Table titled *Age Distribution of Active Revenue Vehicle Inventory: Details by Transit Agency Directly Operated Service*. Federal Transit Administration. Data table for 2001. http://www.ntdprogram.com/NTD/ntdhome.nsf/Docs/NTDPublications?OpenDocument.

[19] Spreadsheet schoolbuses2001.xls. Registration data provided by the Puget Sound Clean Air Agency.

[20] Draft 2003 Report from Environ on mobile source emissions inventories developed for the Western Regional Air Partnership. Onroad gasoline and diesel fuel sulfur levels by county.

[21] *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*. AP42. Section 13.2.1 (12/03).

[22] *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*. AP42. Section 13.2.2 (9/98).

[23] Climate Summary - Precipitation. Kennewick. Long-term (1948-2000) precipitation data. Western Regional Climate Center. Available from Internet website. Downloaded Oct. 2002.

[24] *2002 Annual Traffic Report*. Washington State Department of Transportation.

[25] Email from Tim Fife, PE, Public Works Director/County Engineer, Franklin County Public Works Department to Sally Otterson, Department of Ecology. August 23, 2002. Estimate of unpaved road activity.

[26] Facsimile from John Dirr, Walla Walla County Department of Public Works to Sally Otterson, Department of Ecology. July 9, 2004. Estimate of unpaved road activity.

[27] Emails from Ross B. Dunfee, PE, Public Works Director/County Engineer, Benton County Department Public Works Engineering Division to Sally Otterson, Department of Ecology. September 12, 2002 and July 16, 2004 Estimate of unpaved road activity.

g Tran and Alison Pollack to John Kowalczyk and Mike Boyer. ıst emission factors. April 9, 2002.

· *National Emissions Inventory, Criteria Air Pollutants 1985-1999.* ntal Protection Agency. Office of Air Quality Planning and Standards. JC 27711. EPA-454/R-01-006. March 2001.

n for Particulate Matter in the Wallula Study Area. A Plan for Attaining 'onal Ambient Air Quality Standard for PM_{10}. Washington State November 1991.

:h Jon Jones, Department of Ecology Eastern Regional Office. Oct. 29,

Bulletin. Washington Agricultural Statistics Service; Olympia, Department of Agriculture, National Agricultural Statistics Service.

sity Soil Maps as constructed from information from the US Department :sources Conservation Service. Available at ı.edu/washingtonsoil/.

:ology Eastern Regional Office. Permit information for January – June activity. July 2004.

: database. Washington State Department of Ecology. Permit records)ec 8, 2003.

:h Karen Wood, Department of Ecology, Eastern Regional Office.

ant Emission Factors, Volume I: Stationary Point and Area Sources. uarv 1995. Table 2.5-5 (10/92 reformatted 1/95). Headfire burning.

:h David Wendland, Washington State Department of Ecology Eastern
;, 2004.

:h John St. Clair, Benton Clean Air Agency. June 10, 2004.

ata System, 1998-2001.

Plan for the Tri-Cities Metropolitan Area and the Benton-Franklin-
-2020. November 2001.

l email from Rick Gifford, Washington State Department of
)4.

electronic data. Database snapshot July 2003.

Burning Emissions, and *C. Y. 2000 Ag Burn Information for PM10*
. Worksheets in spreadsheet ag_burn_data29Jan03-2.xls. Yakima
ority. Feb. 2003.

7 Appendix

Figure 7-1: MOBILE6.2 Input File

```
****************    Header Section     ****************
MOBILE6 INPUT FILE
POLLUTANTS          :
PARTICULATES        : SO4 OCARBON ECARBON GASPM LEAD BRAKE TIRE
RUN DATA
****************      Run Section      ****************
REG DIST            : c:\mob62\mobile6\run\param\reg2002.txt
FUEL PROGRAM        : 3
NO REFUELING        :
****************    Scenario Section   ****************
SCENARIO RECORD     : 2002,07,c071,0,None
CALENDAR YEAR       : 2002
EVALUATION MONTH    : 7
MIN/MAX TEMP        : 55.9 85.4
ABSOLUTE HUMIDITY   : 38.0
FUEL RVP            : 8.5
PARTICLE SIZE       : 10.0
DIESEL SULFUR       : 310
PARTICULATE EF      : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

END OF RUN
****************      Run Section      ****************
REG DIST            : c:\mob62\mobile6\run\param\reg2003.txt
FUEL PROGRAM        : 3
NO REFUELING        :
****************    Scenario Section   ****************
SCENARIO RECORD     : 2015,07,c071,0,None
CALENDAR YEAR       : 2015
EVALUATION MONTH    : 7
MIN/MAX TEMP        : 55.9 85.4
ABSOLUTE HUMIDITY   : 38.0
FUEL RVP            : 8.5
PARTICLE SIZE       : 10.0
DIESEL SULFUR       : 15
PARTICULATE EF      : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

END OF RUN
```

Figure 7-2: Washington 2002 Registration Distribution

```
REG DIST            :
* WA 2002 (veh 1-13, 16); FTA 2001 (veh 15); PSCAA 2001 (veh 14)
 01 0.042 0.056 0.061 0.057 0.057 0.058 0.052 0.058 0.051 0.054 0.046 0.051 0.047 0.043
0.039 0.035 0.030 0.025 0.020 0.012 0.008 0.007 0.007 0.009 0.079
 02 0.012 0.018 0.032 0.033 0.036 0.036 0.038 0.037 0.055 0.048 0.041 0.055 0.048 0.057
0.053 0.059 0.066 0.046 0.045 0.031 0.025 0.022 0.021 0.016 0.071
 03 0.026 0.047 0.048 0.042 0.049 0.051 0.033 0.040 0.051 0.040 0.037 0.034 0.035 0.036
0.027 0.019 0.023 0.022 0.019 0.013 0.011 0.015 0.012 0.030 0.242
 04 0.015 0.037 0.051 0.058 0.049 0.056 0.042 0.052 0.045 0.040 0.043 0.046 0.034 0.050
0.043 0.037 0.043 0.034 0.030 0.018 0.017 0.020 0.014 0.019 0.110
```

```
 05 0.036 0.061 0.064 0.062 0.054 0.068 0.049 0.056 0.055 0.041 0.037 0.034 0.041 0.039
0.029 0.016 0.024 0.021 0.018 0.011 0.008 0.008 0.008 0.022 0.141
 06 0.077 0.133 0.098 0.114 0.052 0.083 0.050 0.046 0.035 0.030 0.022 0.017 0.022 0.023
0.017 0.011 0.018 0.015 0.013 0.007 0.007 0.007 0.007 0.016 0.080
 07 0.052 0.105 0.069 0.115 0.053 0.050 0.033 0.044 0.040 0.030 0.027 0.024 0.034 0.034
0.026 0.019 0.021 0.019 0.016 0.009 0.008 0.011 0.012 0.019 0.131
 08 0.020 0.051 0.079 0.074 0.037 0.071 0.045 0.054 0.044 0.037 0.033 0.039 0.050 0.038
0.023 0.016 0.022 0.017 0.012 0.007 0.008 0.011 0.010 0.018 0.185
 09 0.028 0.049 0.080 0.071 0.035 0.049 0.047 0.047 0.043 0.037 0.040 0.029 0.047 0.034
0.026 0.020 0.019 0.021 0.014 0.007 0.009 0.007 0.014 0.022 0.207
 10 0.022 0.041 0.056 0.060 0.043 0.043 0.036 0.047 0.034 0.030 0.029 0.031 0.032 0.025
0.022 0.020 0.021 0.021 0.015 0.010 0.012 0.015 0.018 0.028 0.288
 11 0.018 0.030 0.036 0.040 0.034 0.029 0.031 0.041 0.022 0.023 0.028 0.035 0.047 0.034
0.036 0.036 0.028 0.035 0.026 0.015 0.019 0.029 0.026 0.037 0.269
 12 0.014 0.028 0.034 0.033 0.029 0.027 0.030 0.046 0.032 0.028 0.029 0.039 0.048 0.041
0.041 0.036 0.034 0.043 0.031 0.016 0.021 0.029 0.031 0.041 0.220
 13 0.037 0.059 0.081 0.074 0.059 0.057 0.058 0.065 0.055 0.044 0.037 0.036 0.044 0.047
0.038 0.030 0.025 0.025 0.020 0.007 0.008 0.011 0.012 0.015 0.059
 14 0.012 0.075 0.072 0.070 0.081 0.045 0.047 0.069 0.079 0.072 0.058 0.066 0.051 0.033
0.028 0.024 0.027 0.018 0.014 0.006 0.012 0.013 0.010 0.010 0.010
 15 0.144 0.130 0.116 0.102 0.088 0.074 0.060 0.046 0.032 0.025 0.024 0.023 0.023 0.022
0.021 0.019 0.015 0.011 0.007 0.006 0.005 0.004 0.004 0.003 0.002
 16 0.061 0.079 0.065 0.057 0.046 0.036 0.034 0.030 0.027 0.027 0.019 0.519 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
```

Figure 7-3: Washington 2003 Registration Distribution

```
REG DIST             :
* WA 2003 (veh 1-13, 16); FTA 2001 (veh 15); PSCAA 2001 (veh 14)
 01 0.041 0.058 0.059 0.064 0.060 0.058 0.059 0.052 0.057 0.051 0.051 0.045 0.048 0.045
0.040 0.035 0.031 0.026 0.021 0.017 0.010 0.007 0.006 0.005 0.056
 02 0.011 0.019 0.020 0.035 0.035 0.037 0.038 0.039 0.038 0.057 0.048 0.042 0.055 0.048
0.055 0.052 0.057 0.063 0.044 0.043 0.029 0.023 0.021 0.019 0.073
 03 0.023 0.040 0.049 0.050 0.042 0.047 0.050 0.033 0.041 0.052 0.040 0.037 0.034 0.035
0.035 0.027 0.018 0.022 0.021 0.018 0.012 0.010 0.014 0.011 0.242
 04 0.018 0.025 0.039 0.057 0.056 0.048 0.055 0.040 0.052 0.046 0.039 0.044 0.045 0.035
0.047 0.039 0.037 0.037 0.030 0.026 0.020 0.019 0.016 0.012 0.120
 05 0.036 0.055 0.063 0.064 0.062 0.051 0.066 0.047 0.053 0.052 0.039 0.035 0.031 0.039
0.036 0.027 0.014 0.022 0.019 0.016 0.010 0.007 0.007 0.007 0.144
 06 0.062 0.107 0.126 0.091 0.105 0.047 0.076 0.045 0.042 0.032 0.026 0.019 0.016 0.020
0.020 0.015 0.010 0.016 0.012 0.010 0.006 0.006 0.006 0.006 0.080
 07 0.081 0.073 0.097 0.063 0.105 0.051 0.046 0.029 0.040 0.037 0.027 0.024 0.022 0.031
0.030 0.023 0.015 0.018 0.016 0.014 0.007 0.007 0.009 0.010 0.125
 08 0.026 0.032 0.056 0.077 0.074 0.033 0.072 0.045 0.051 0.043 0.035 0.033 0.038 0.049
0.036 0.024 0.015 0.021 0.015 0.011 0.006 0.008 0.010 0.008 0.185
 09 0.030 0.044 0.054 0.081 0.071 0.035 0.051 0.044 0.046 0.043 0.033 0.039 0.027 0.046
0.031 0.023 0.016 0.017 0.018 0.010 0.007 0.009 0.007 0.010 0.210
 10 0.021 0.030 0.045 0.060 0.062 0.045 0.044 0.036 0.046 0.033 0.029 0.028 0.031 0.032
0.024 0.021 0.020 0.020 0.020 0.014 0.009 0.011 0.015 0.018 0.288
 11 0.016 0.022 0.032 0.039 0.042 0.035 0.029 0.031 0.044 0.023 0.024 0.028 0.034 0.046
0.032 0.035 0.035 0.029 0.033 0.023 0.013 0.018 0.028 0.024 0.287
 12 0.018 0.015 0.030 0.036 0.037 0.031 0.030 0.032 0.048 0.033 0.030 0.030 0.038 0.045
0.041 0.041 0.035 0.034 0.040 0.030 0.015 0.020 0.027 0.029 0.236
 13 0.054 0.030 0.062 0.079 0.073 0.059 0.056 0.056 0.062 0.053 0.042 0.034 0.034 0.041
0.044 0.035 0.027 0.022 0.023 0.017 0.006 0.007 0.010 0.011 0.063
 14 0.012 0.075 0.072 0.070 0.081 0.045 0.047 0.069 0.079 0.072 0.058 0.066 0.051 0.033
0.028 0.024 0.027 0.018 0.014 0.006 0.012 0.013 0.010 0.010 0.010
 15 0.144 0.130 0.116 0.102 0.088 0.074 0.060 0.046 0.032 0.025 0.024 0.023 0.023 0.022
0.021 0.019 0.015 0.011 0.007 0.006 0.005 0.004 0.004 0.003 0.002
 16 0.062 0.088 0.078 0.065 0.056 0.044 0.035 0.033 0.029 0.027 0.026 0.457 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
```

Figure 7-4: MOBILE6.2 Output File

```
***************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                              *
* Input file: M62_WALM.IN (file 1, run 1).                                *
***************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2002,07,c071,0,None
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                           Calendar Year:  2002
                                   Month:  July
               Gasoline Fuel Sulfur Content:  279. ppm
                 Diesel Fuel Sulfur Content:  310. ppm
                     Particle Size Cutoff: 10.00 Microns
                         Reformulated Gas:  No

      Vehicle Type:    LDGV    LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
              GVWR:             <6000    >6000    (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.4873   0.2596   0.1110            0.0440   0.0012   0.0022   0.0897   0.0049   1.0000
--------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
              Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
             GASPM:   0.0048   0.0068   0.0158   0.0095   0.0734   ------   ------   ------   0.0205   0.0092
           ECARBON:   ------   ------   ------   ------   ------   0.2560   0.1201   0.2823   ------   0.0259
           OCARBON:   ------   ------   ------   ------   ------   0.0722   0.1728   0.1384   ------   0.0129
               SO4:   0.0040   0.0057   0.0056   0.0057   0.0091   0.0037   0.0056   0.0195   0.0010   0.0062
  Total Exhaust PM:   0.0088   0.0125   0.0214   0.0152   0.0825   0.3320   0.2984   0.4402   0.0215   0.0542
             Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
              Tire:   0.0080   0.0080   0.0080   0.0080   0.0087   0.0080   0.0080   0.0264   0.0040   0.0097
          Total PM:   0.0293   0.0331   0.0420   0.0357   0.1037   0.3525   0.3190   0.4792   0.0381   0.0764
--------------------------------------------------------------------------------------------------------------
```

```
***********************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                          *
* Input file: M62_WALM.IN (file 1, run 2).                            *
***********************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # #
* 2015,07,c071,0,None
* File 1, Run 2, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2015
                                Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
          Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                   Reformulated Gas:  No
```

Vehicle Type: GVWR:	LDGV	LDGT12 <6000	LDGT34 >6000	LDGT (All)	HDGV	LDDV	LDDT	HDDV	MC	All Veh
VMT Distribution:	0.3368	0.3631	0.1529		0.0448	0.0003	0.0022	0.0953	0.0046	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0040	0.0039	0.0039	0.0161	------	------	------	0.0205	0.0042
ECARBON:	------	------	------	------	------	0.0250	0.0167	0.0504	------	0.0048
OCARBON:	------	------	------	------	------	0.0070	0.0241	0.0262	------	0.0026
SO4:	0.0003	0.0005	0.0005	0.0005	0.0018	0.0002	0.0003	0.0009	0.0001	0.0005
Total Exhaust PM:	0.0043	0.0044	0.0044	0.0044	0.0179	0.0322	0.0411	0.0775	0.0206	0.0121
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0085	0.0080	0.0080	0.0260	0.0040	0.0097
Total PM:	0.0248	0.0250	0.0250	0.0250	0.0390	0.0527	0.0616	0.1161	0.0371	0.0344

Protocol for Wallula PM_{10} Maintenance Demonstration

Proposed Approach

Revised March 3, 2004

Air Quality Program
Washington State Department of Ecology

I. Basis

Technical work resulting from the reclassification to serious has provided an understanding of the Wallula PM_{10} nonattainment area. The Air Quality Program analyzed meteorology and PM_{10} concentrations in the nonattainment area. Bacon Donaldson of Vancouver, British Columbia performed scanning electron microscopy of some filters. A more extensive examination of the filters was undertaken with computer controlled scanning electron microscopy by R. J. Lee. This work included source attribution through chemical mass balance modeling.

From these analyses a number of conclusions can be drawn:

- The area has three typical summer-day wind patterns. Fifty percent of 22 analyzed days had high winds from the south-to-southwest and organized flow through Wallula Gap. Twenty percent had low wind speeds and disorganized flow from the north (west-northwest-to-east-northeast). Thirty percent of the time the wind regime was some combination of these two flow regimes with part of the day moderate south-to-southwest flow and the remainder low winds from northerly directions. Any other wind pattern would be atypical.
- Elevated PM_{10} concentrations are found between May through September.
- Except for one exceptional set of circumstances that occurred on a low wind day in 1997, all recent (1997 and onward) exceedances of the 24-hour PM_{10} have been due to wind-blown dust.
- The material on the filter is basically dust. While it is possible, for example, to find combustion particles attributable to the Boise Paper pulp and paper mill, the particles are at best quite sparse, the overall mass is low and the R. J. Lee study concluded that they had no significance as a source. Similarly, the R.J. Lee analysis found that contributions from the other nearby and thus obvious sources, IBP and the Simplot feedlot, were not significant.

II. Maintenance Demonstration Analysis

The Air Quality Program proposes to perform a demonstration of continued maintenance through a speciated rollback that depends largely upon the use of already developed information.

1. Perform an analysis of elevated PM_{10} concentrations below the level of the 24-hour PM_{10} standard to determine those that may be identified and flagged as windblown dust natural events.
2. In coordination with EPA, choose 3-to-5 days of elevated concentrations for further analysis of continued maintenance. The chosen days will have either moderate-to-high southerly flows or low, disorganized northerly flows. Examination of a day exhibiting both flow regimes does not add anything to the analysis.
3. Develop source profiles to account for all the mass on the filter. Use the revised (the effective variance) source profiles presented in Table 2 of the R. J. Lee Final Report to generate an initial profile. Where there are two possible values (e.g., agricultural soil and unpaved road dust), choose the higher and then normalize the profile to 100% so all mass is accounted for. If normalization is not done, a certain percent of the mass will represent unknown.
4. For days with southerly winds, source profiles are available for two concentrations: 100 $\mu g/m^3$ (7/4/98) and 43 $\mu g/m^3$ (7/23/99). When elevated concentrations lie above 70 $\mu g/m^3$, use a normalized profile based on the 7/4/98 profile. When elevated concentrations lie below 70 $\mu g/m^3$, base the normalized profile on the 7/23/99 profile. The profiles are given in Table 1.

Table 1. Source Profiles for Moderate-to-High Southerly Winds

Source	Range of Concentrations for Application of Profile			
	>70 $\mu g/m^3$		<70 $\mu g/m^3$	
	Initial Profile	Normalized Profile	Initial Profile	Normalized Profile
Agricultural Soil/ Unpaved Road Dust	20.4	25.4	52.5	57.8
Compost	59.8	74.6	30.5	33.6
IBP			1.8	2.0
NW Grain Dust			1.7	1.9
Simplot Feedlot			4.4	4.8
Unknown	19.8		9.1	
Total	100.0	100.0	100.0	100.0
Base Source Profile—Concentration (date)	100 $\mu g/m^3$ (7/4/98)		43 $\mu g/m^3$ (7/23/99)	

5. For days with northerly winds, source profiles are available for two concentrations: 135 $\mu g/m^3$ (6/28/98) and 55 $\mu g/m^3$ (8/10/99). When elevated concentrations lie above 90 $\mu g/m^3$, base the normalized profile on the 6/29/98 profile. When elevated concentrations lie below 90 $\mu g/m^3$, base the normalized profile on the 8/10/99 profile. The profiles are given in Table 2.

Table 2. Source Profiles for Low Northerly Winds

Sources	Range of Concentrations for Application of Profile			
	$>90\ \mu g/m^3$		$<90\ \mu g/m^3$	
	Initial Profile	Normalized Profile	Initial Profile	Normalized Profile
Agricultural Soil/ Unpaved Road Dust	43.6	53.2	49.8	59.5
Compost	36.9	45.0	33.9	40.5
IBP	1.5	1.8		
Unknown	18.0		16.3	
Total	100.0	100.0	100.0	100.0
Base Source Profile—Concentration (date)	135 $\mu g/m^3$ (6/28/98)		55 $\mu g/m^3$ (8/10/99)	

6. For each of the selected days, project the speciated components to 2015 according to the projected increase in the emissions inventory or allowable emissions. The end result is that agricultural soil/unpaved road dust will increase due to increased VMT on paved roads and IBP will be factored up to reflect permitted allowable PM_{10} emissions.
7. Compare the projected totals on each day with the 24-hour standard of 150 $\mu g/m^3$. If the projected concentration is 150 or less, continued maintenance is demonstrated. If not, controls are needed to reduce projected emissions to equal to or less than 150 $\mu g/m^3$

Documentation of a Natural Event Due to High Winds, May 02, 2002
Walla Walla, Washington

Addendum Addressing a Natural Event Due to High Winds, May 2, 2002
Wallula, Washington

Publication Number 05-02-004
September 2004

If you require this document in another format, please contact Tami Dahlgren at (360) 407-6800. If you are a person with a speech or hearing impairment, call 711 or 1-800-833-6388 for TTY.

Documentation of a Natural Event Due to High Winds, May 02, 2002 Walla Walla, Washington

Addendum Addressing a Natural Event Due to High Winds, May 2, 2002 Wallula, Washington

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Prepared by:

Washington State Department of Ecology
Air Quality Program

September 2004

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Contents

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Summary

This addendum supplies new information and uses information in the Walla Walla natural events documentation for May 2, 2002 to document the May 2, 2002 Wallula PM_{10} concentration as a natural event that should be excluded from any assessment of the attainment status of the Wallula PM_{10} nonattainment area. During the preparation of the PM_{10} maintenance plan for the Wallula nonattainment area, the Washington State Department of Ecology (Ecology) realized that the May 2, 2002 PM_{10} concentration of 134 $\mu g/m^3$ at Wallula, Washington was elevated by the same regional conditions responsible for the exceedance of the PM_{10} standard of 150 $\mu g/m^3$ at Walla Walla on the same day. Ecology had determined that the Walla Walla exceedance was a natural event caused by high winds and thus should be excluded from any assessment of the attainment status for Walla Walla, Washington.

Overview

In April 2003 Ecology submitted documentation to the United States Environmental Protection Agency (EPA) in support of a data flag for the May 2, 2002, particulate matter, 10 microns and smaller, (PM_{10}) concentration at Walla Walla, Washington. The high-volume Federal Reference Method (FRM) monitor at Walla Walla had measured a filter-based PM_{10} concentration of 169 $\mu g/m^3$ on that date. This concentration exceeds the primary 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) for PM_{10} of 150 $\mu g/m^3$. Ecology determined that this exceedance was a natural event caused by high winds and thus should be excluded from any assessment of the attainment status for Walla Walla, Washington. Ecology flagged the data point for May 2, 2002, in the Air Quality System (AQS) database maintained by EPA to specify the data point as a natural event due to high winds. EPA responded to Ecology's documentation with a letter dated June 24, 2003 that acknowledged the documentation and agreed to place a second, EPA flag on the Walla Walla data point for May 2, 2002 in the AQS database.

During the preparation of the maintenance plan for the Wallula PM_{10} nonattainment area, Ecology realized that the May 2, 2002 concentration of 134 $\mu g/m^3$ measured by the Wallula high-volume FRM monitor was elevated by the same regional conditions responsible for the exceedance at Walla Walla on the same day. The May 2, 2002 Wallula concentration thus qualifies as a natural event due to high winds. When qualified as a natural event due to high winds, the May 2, 2002 concentration is not used for any attainment assessment of the Wallula nonattainment area, including the demonstration of maintenance in a maintenance plan.

This Addendum to *Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington* (Ecology publication 03-02-006, April 2003) does not stand by itself. The Addendum adds additional information related to PM_{10} concentrations, wind speed and wind direction at Wallula. This information is considered along with information in the April 2003 documentation to determine the May 2, 2002 Wallula concentration is a natural event.

Discussion of the topics EPA's Natural Events Policy, Ecology's response to high wind events on the Columbia Plateau, and Best Available Control Measure (BACM) implementation are not repeated in this Addendum. The interested reader is referred to the April 2003 documentation of the May 2, 2002, Walla Walla natural event.

Evaluation of the May 2, 2002 Concentration at Wallula, Washington

1. PM_{10} Monitoring

1.1. Wallula PM_{10} Monitoring: The Wallula high-volume FRM monitor measured a filter-based PM_{10} concentration 134 $\mu g/m^3$ on May 2, 2002. The monitor was located in the approximate geographic center of the Wallula PM_{10} nonattainment area (see Appendix A). The Wallula monitor operated on a 1-in-6-day schedule.

The May 2, 2002 concentration of 134 $\mu g/m^3$ was much higher than any other concentration measured in the second quarter of 2002. Monthly maxima for April and June 2002 were 61 and 34 $\mu g/m^3$, respectively. The second highest concentration for May 2002 was 25 $\mu g/m^3$.

The only other PM_{10} concentration over 85 $\mu g/m^3$ measured at Wallula during the year 2002 was the high wind natural event of September 29, 2002. The PM_{10} concentration was 197 $\mu g/m^3$. Ecology developed natural event documentation for the September exceedance. Both Ecology and EPA have flagged the exceedance as a natural event due to high winds in the AQS database. As a result, this data point is excluded from consideration in assessing attainment of the PM_{10} standard in Wallula.

The annual average PM_{10} concentration for the year 2002 at Wallula was 36.8 $\mu g/m^3$ and the average PM_{10} concentration for the second quarter, 35.21 $\mu g/m^3$. Both of these are well below the annual standard of 50 $\mu g/m^3$. Wallula PM_{10} data for the year 2002 are found in Appendix B.

1.2. Other PM_{10} Monitoring: The high-volume FRM PM_{10} monitor in Walla Walla measured a filter-based PM_{10} exceedance of 169 $\mu g/m^3$ on May 2, 2002. The Walla Walla monitor is approximately 27 miles east of the Wallula monitor (see Appendix A).

Ecology prepared natural events documents for the May 2, 2002, exceedance and flagged the data point in the AQS database. EPA Region 10 acknowledged the documentation in a letter dated June 24, 2003 and committed to flagging the data point in the AQS database. As a result, this data point is excluded from consideration in assessing attainment of the PM_{10} standard in Walla Walla.

2. Meteorological Data

2.1. Wallula Meteorological Data: Data from a meteorological station collocated with the Wallula PM_{10} monitor show that winds easily exceeded Ecology's definition for a high wind event. The meteorological station is operated by Boise Paper Solutions—Wallula Mill. Ecology wishes to thank Boise for sharing the data from the station with Ecology.

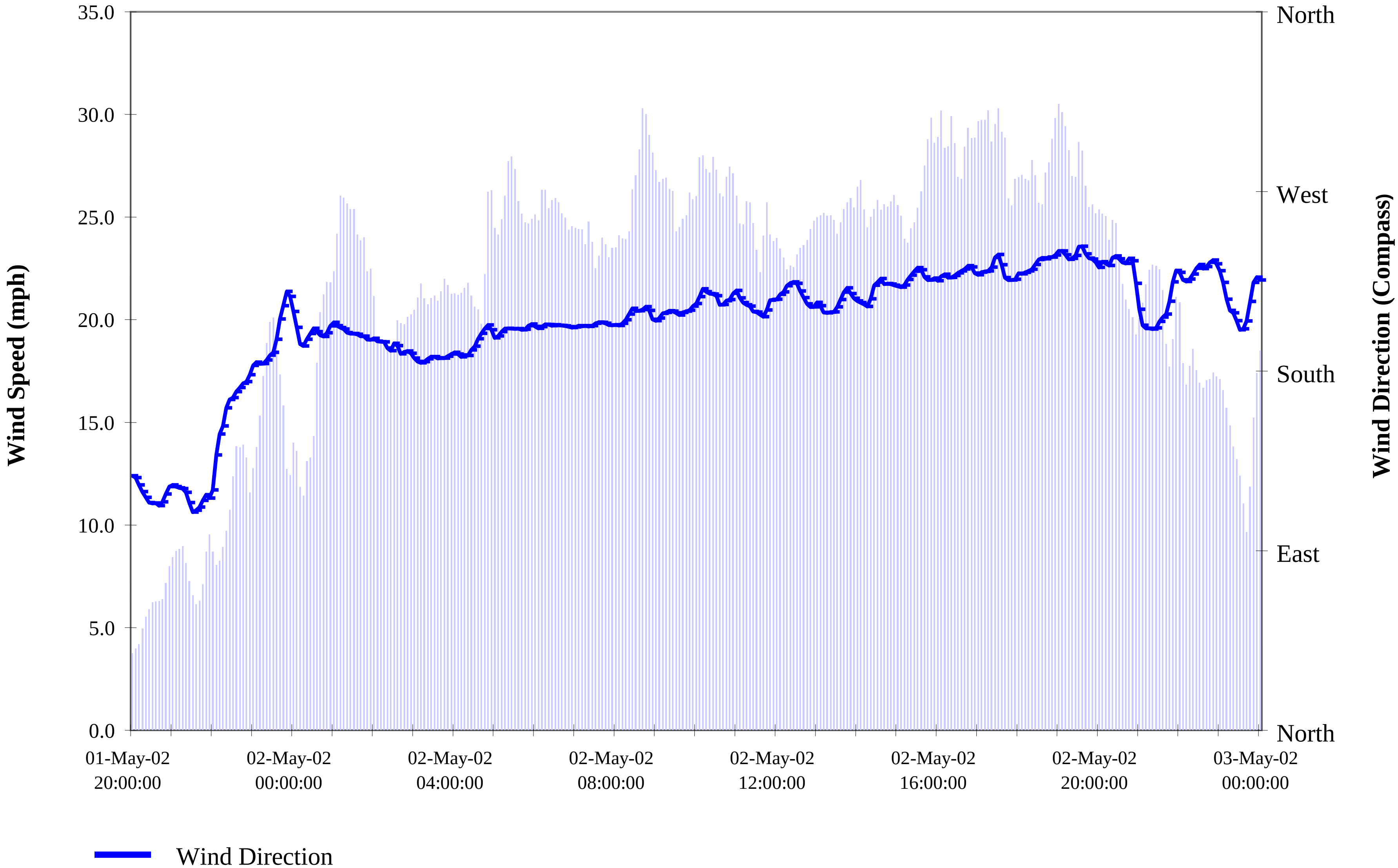
Ecology's definition requires winds of 18 mph or more for a two-hour period. Winds exceeded 20 mph from 1 a.m. through 10 p.m. on May 2, 2002 (see Table 1 and Figure 1). Winds were generally from the southwest and south-southwest during this period. The complete set of meteorological data for May 2, 2002, is found in Appendix C.

Table 1. Hourly Wind Observations for Wallula, Washington, May 2, 2002

Time (Day-Month-Year Hour:Minute:Second)	Speed (MPH)	Wind Direction	
		Degrees	Compass
02-May-2002 00:00:00	14.0	210	SW
02-May-2002 01:00:00	22.4	204	SSW
02-May-2002 02:00:00	21.2	196	SSW
02-May-2002 03:00:00	20.5	186	S
02-May-2002 04:00:00	21.3	189	S
02-May-2002 05:00:00	24.5	197	SSW
02-May-2002 06:00:00	25.1	202	SSW
02-May-2002 07:00:00	24.5	202	SSW
02-May-2002 08:00:00	23.5	203	SSW
02-May-2002 09:00:00	27.3	205	SSW
02-May-2002 10:00:00	26.0	214	SSW
02-May-2002 11:00:00	26.0	220	SW
02-May-2002 12:00:00	24.0	216	SW
02-May-2002 13:00:00	25.0	214	SSW
02-May-2002 14:00:00	26.5	215	SW
02-May-2002 15:00:00	25.6	223	SW
02-May-2002 16:00:00	28.9	225	SW
02-May-2002 17:00:00	29.7	228	SW
02-May-2002 18:00:00	26.9	229	SW
02-May-2002 19:00:00	30.5	240	WSW
02-May-2002 20:00:00	25.4	232	SW
02-May-2002 21:00:00	20.1	211	SW
02-May-2002 22:00:00	20.9	229	SW
02-May-2002 23:00:00	17.1	230	SW
03-May-2002 00:00:00	18.5	226	SW

2.2. Other Meteorological Data: *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003) reported on National Weather Service data for Pendleton, Oregon and Walla Walla, Washington. In Pendleton, winds ranged from 20 to 37 mph between 7 a.m. and midnight on May 2, 2002. West-southwest winds in Walla Walla

Figure 1. Wind Speed & Wind Direction, May 1-2, 2002, Wallula, Washington



Addendum for Wallula, Washington
Natural Event of May 2, 2002

ranged from 22 to 28 mph from 1 p.m. to 5 p.m. on the same date. The interested reader is referred to the documentation for more detail.

2.3. Precipitation Prior to May 2, 2002: The following discussion is adapted from *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003).

Conditions were dry prior to the high winds of May 2, 2002. Table 2 summarizes precipitation data from several meteorological sites in south-central Washington and neighboring Oregon. These sites are operated by the National Weather Service (Walla Walla and Pendleton), Washington State University's (WSU's) Public Agricultural Weather System (PAWS) (McNary, R.Eby, Finley, College Place and Touchet) and the United States Bureau of Reclamation's (USBR's) AGRIMET system (Hermiston and Echo). The sites, which are generally located to the south, southwest and west of Wallula and Walla Walla, were selected on the basis of the west-southwest, southwest, south-southwest and south winds observed on May 2, 2002 in Wallula and Walla Walla. All sites are greater lie within 30 miles of Wallula. A map showing the location of the sites is found in Appendix A.

Eight of the ten stations reported no precipitation 72 hours prior to the natural event. Three stations reported no precipitation four days prior to the natural event. McNary and Echo report no precipitation 17 days prior to the natural event.

Table 2. Precipitation Prior to a Natural Event Due to High Winds, May 2, 2002

STATION	PRECIPITATION 72 hrs. prior to May 2, 2002	DATE	DAYS prior to May 2, 2002, with no precipitation
Pendleton, OR	0.01	4-29-2002	2
Hermiston, OR (HRMO)	0.0	NA	3
Hermiston, OR (HERO)	0.0	NA	10
Echo, OR (ECHO)	0.0	NA	17
Walla Walla	0.0	NA	3
McNary	0.0	NA	17
R.Eby	0.0	NA	4
Finley	0.0	NA	4
College Place	0.0	NA	4
Touchet	0.95	5-02-2002	NA

While Touchet reported precipitation on May 2, 2002, the data show high winds preceded the precipitation. Fifteen-minute wind speed, wind direction and precipitation data show the first measured precipitation occurred at 8 a.m. From midnight to 8 a.m. the average wind speed was 19 mph, with a 15-minute high of 23 mph.

Further, no precipitation was reported at Touchet on April 28, 29, 30 or May 1. The data do show 0.25 inch of precipitation on April 27, 2002. This means that no precipitation was recorded at Touchet for at least 96 hours prior to May 02, 2002.

2.4. Comparison of Average January – April Precipitation for the Area to Precipitation in 2002:
The following discussion is adapted from *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003).

In order to further assess the general dryness of soils in the area prior to the high winds, Table 3 compares average precipitation for January – April with January – April precipitation in 2002. The PAWS network reports both average precipitation and the current year's data. A similar comparison for Hermiston and Echo, Oregon requires first a period of record report from the Western Regional Climate Center and second accumulated precipitation reported by the USBR's Hermiston and Echo AGRIMET stations.

Table 3. Comparison of Average January–April 2002 Precipitation with 2002 Precipitation

STATION	AVERAGE PRECIPITATION January – April (in.)	2002 PRECIPITATION January – April (in.)	PERCENT OF AVERAGE
College Place	5.8	3.41	59
R.Eby	3.6	2.45	68
McNary	4.0	1.65	41
Touchet	3.5	1.82	53
Finley	NA	NA	NA
Hermiston, OR (HRMO)	3.61	2.10	58
Echo, OR (ECHO)	3.97	2.21	56

All sites report below average precipitation for January - April 2002, when compared with the historical record. Conditions for the area generally range from less than 50 percent of average (McNary) to about 70 percent of average (R.Eby).

Findings

The meteorological data from Boise's meteorological station collocated with the Wallula FRM PM_{10} monitor show that May 2, 2002 was characterized by windy conditions. Winds generally from the southwest and south-southwest exceeded 20 mph from 1 a.m. through 10 p.m. on May 2, 2002. Ecology's definition for a high wind event only requires winds of 18 mph or more for a two-hour period. Windy conditions were also present in Pendleton, Oregon and Walla Walla, Washington.

Conditions were dry. Much of the area lying upwind of Wallula with respect to the predominant wind directions on May 2, 2002 had received no precipitation for 96 or more hours prior to that date. Moreover, April through June precipitation in 2002 at weather stations to the south and west of the Wallula PM_{10} monitoring site was generally between 50 and 60 percent of average precipitation for the four-month period.

Ecology found that BACM was implemented on agricultural fields in Benton and Walla Walla counties. BACM implementation is discussed in *Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington* (Ecology publication 03-02-006, April 2003).

Under the dry conditions so common in this area the windy conditions are likely to have raised the dust that led to the measured elevated PM_{10} concentrations at Wallula. Similar to the previously documented high wind natural event at Walla Walla, Washington on May 2, 2002, the monitored PM_{10} concentration of 134 $\mu g/m^3$ at Wallula, Washington, on May 2, 2002 is reasonably attributed to a natural event due to high winds.

Appendix A

Locations of PM_{10} Monitoring Sites and Meteorological Stations

- Map of Particulate Matter (PM_{10}) monitoring sites and meteorological stations in Benton Franklin and Walla Walla counties, Washington and adjoining Oregon, 2002
- Map of the Wallula PM_{10} Nonattainment Area

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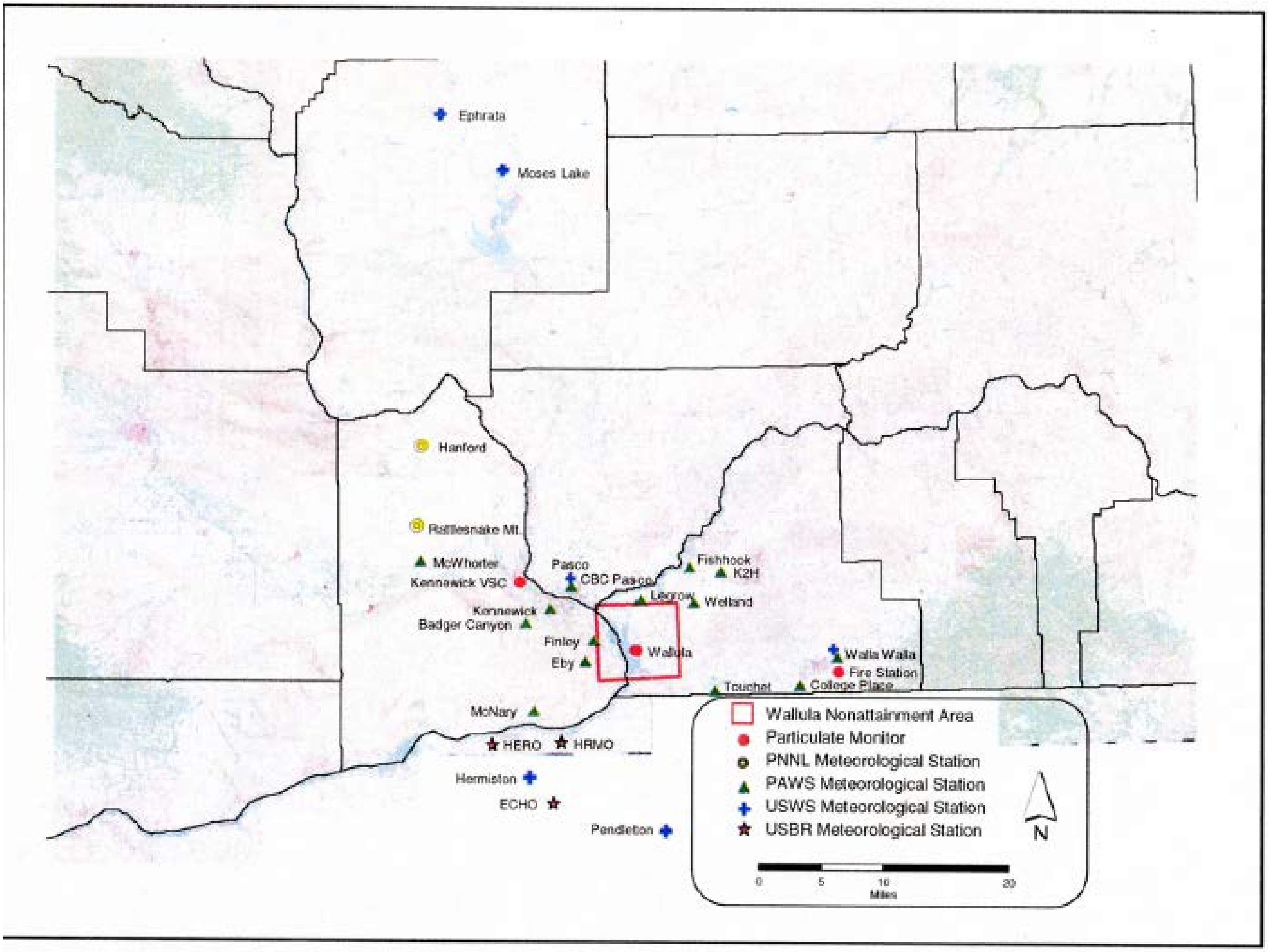

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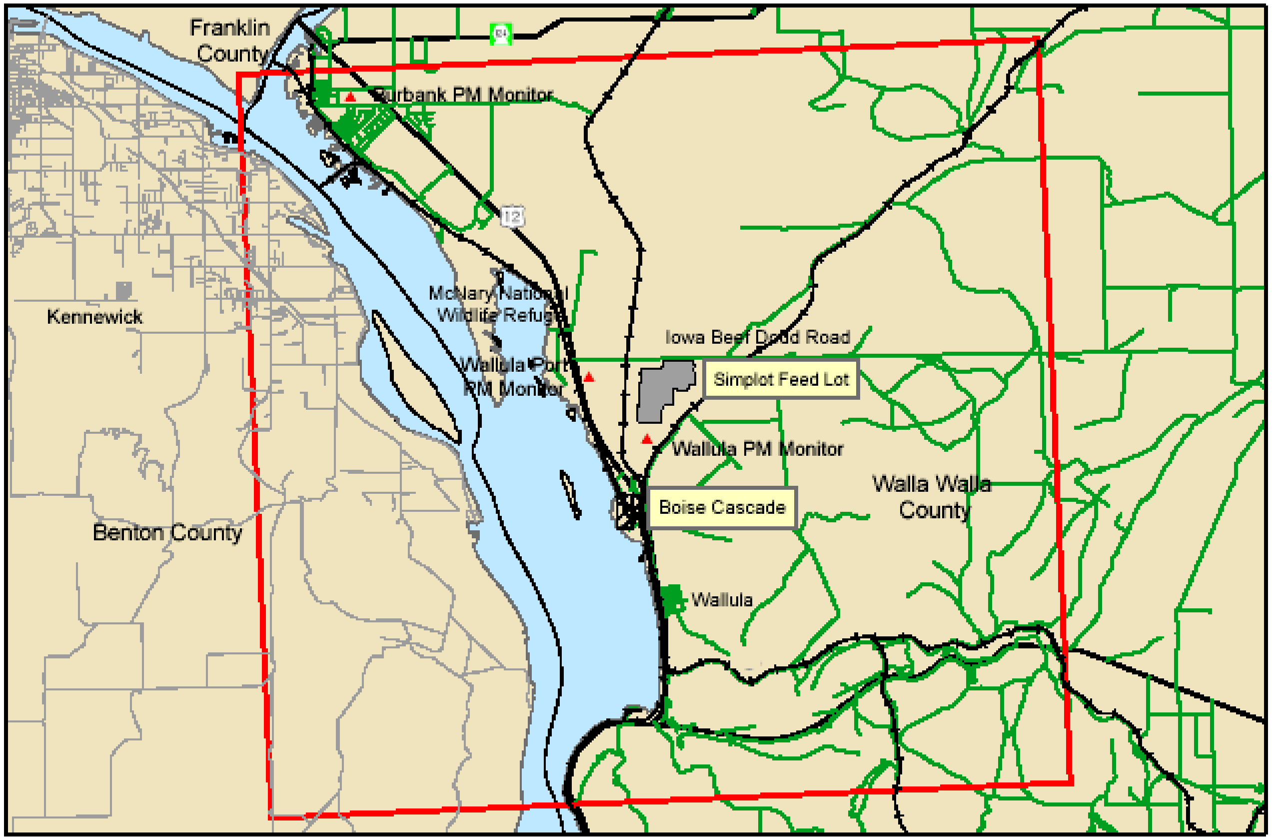
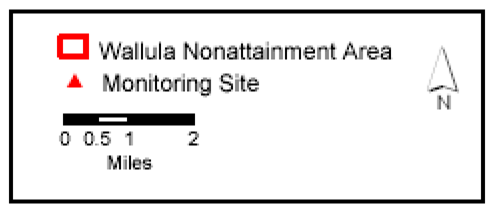
Addendum for Wallula, Washington
Natural Event of May 2, 2002



Wallula Nonattainment Area



Washington State Department of Ecology
Air Quality Program

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Appendix B

2002 PM_{10} Monitoring Data
Wallula, Washington

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Annual Parameter Report

Reporting Year: 2002

Time of Report: 09/15/04 08:38

STATION: WALLULA

SITE: 0711001 AIRS : Parameter Code: 81102 Method Code: 063 Units Code: 001 Decimal Positioner: 0

Parameter: PM10 SAROAD: Parameter Code: 81102 Method Code: 63 Units Code: 01 Units:

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX	MEAN	NO
1		10				21	47	71							
2	8			61	134										
3			11												
4											52	17			
5									33	21					
6															
7		7				15	50	28							
8				49	18										
9	12														
10											10				
11									52	28		12			
12								42							
13						25	63								
14	13			28	16										
15															
16										50	28	8			
17									18						
18								35							
19			51			26	35								
20	19			29	25										
21			17												
22											19	16			
23									83	32					
24								56							
25						34	64								
26	6			12											
27			44												
28											26	9			
29									197	21					
30								43							
31															
AVG	12	8	31	36	48	24	52	46	77	30	27	12		34	
MAX	19	10	51	61	134	34	64	71	197	50	52	17	197		
DAYS	5	2	4	5	4	5	5	6	5	5	5	5			56

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Appendix C

May 1-2, 2002 Meteorological Data
Wallula, Washington

Courtesy of Boise Paper Solutions—Wallula Mill

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
01-May-02 20:00:00	3.8	**127**	**SE**	**68.7**	5
01-May-02 20:05:00	4.0	**127**	**SE**	**68.5**	3
01-May-02 20:10:00	4.2	**123**	**SE**	**68.2**	2
01-May-02 20:15:00	5.0	**119**	**ESE**	**67.8**	2
01-May-02 20:20:00	5.5	**117**	**ESE**	**67.5**	2
01-May-02 20:25:00	5.9	**114**	**ESE**	**67.1**	1
01-May-02 20:30:00	6.2	**114**	**ESE**	**66.6**	1
01-May-02 20:35:00	6.3	**114**	**ESE**	**65.9**	1
01-May-02 20:40:00	6.3	**112**	**ESE**	**65.5**	1
01-May-02 20:45:00	6.4	**114**	**ESE**	**65.0**	1
01-May-02 20:50:00	7.2	**118**	**ESE**	**64.7**	1
01-May-02 20:55:00	8.0	**122**	**ESE**	**64.7**	1
01-May-02 21:00:00	8.4	**123**	**ESE**	**64.6**	1
01-May-02 21:05:00	8.7	**122**	**ESE**	**64.6**	1
01-May-02 21:10:00	8.8	**121**	**ESE**	**64.5**	1
01-May-02 21:15:00	9.0	**121**	**ESE**	**64.5**	1
01-May-02 21:20:00	8.2	**119**	**ESE**	**64.4**	1
01-May-02 21:25:00	7.3	**114**	**ESE**	**64.1**	1
01-May-02 21:30:00	6.6	**109**	**ESE**	**63.3**	1
01-May-02 21:35:00	6.1	**110**	**ESE**	**62.7**	1
01-May-02 21:40:00	6.3	**112**	**ESE**	**62.6**	1
01-May-02 21:45:00	7.1	**115**	**ESE**	**62.5**	1
01-May-02 21:50:00	8.7	**118**	**ESE**	**62.4**	1
01-May-02 21:55:00	9.5	**116**	**ESE**	**62.6**	1
01-May-02 22:00:00	8.7	**120**	**ESE**	**62.6**	1
01-May-02 22:05:00	8.1	**138**	**ESE**	**62.6**	1
01-May-02 22:10:00	8.3	**148**	**SE**	**63.2**	1
01-May-02 22:15:00	8.9	**152**	**SSE**	**63.5**	1
01-May-02 22:20:00	9.7	**162**	**SSE**	**63.5**	1
01-May-02 22:25:00	10.7	**166**	**SSE**	**63.9**	1
01-May-02 22:30:00	12.4	**167**	**SSE**	**63.8**	1
01-May-02 22:35:00	13.8	**170**	**SSE**	**63.5**	1
01-May-02 22:40:00	13.8	**172**	**S**	**63.3**	1
01-May-02 22:45:00	13.9	**174**	**S**	**62.9**	1
01-May-02 22:50:00	13.3	**175**	**S**	**62.4**	1
01-May-02 22:55:00	11.6	**178**	**S**	**62.0**	1
01-May-02 23:00:00	12.8	**183**	**S**	**61.9**	1
01-May-02 23:05:00	13.8	**184**	**S**	**61.8**	1
01-May-02 23:10:00	15.3	**184**	**S**	**61.5**	1
01-May-02 23:15:00	17.3	**184**	**S**	**61.2**	1
01-May-02 23:20:00	18.9	**185**	**S**	**61.1**	1
01-May-02 23:25:00	19.9	**188**	**S**	**61.1**	1
01-May-02 23:30:00	20.1	**189**	**S**	**61.1**	1
01-May-02 23:35:00	18.7	**196**	**S**	**61.0**	1
01-May-02 23:40:00	17.3	**206**	**SSW**	**61.0**	1
01-May-02 23:45:00	15.8	**213**	**SSW**	**60.7**	1
01-May-02 23:50:00	12.7	**220**	**SW**	**60.0**	1
01-May-02 23:55:00	12.4	**217**	**SW**	**59.5**	1
02-May-02 00:00:00	14.0	**210**	**SW**	**59.4**	1
02-May-02 00:05:00	13.6	**202**	**SSW**	**59.5**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 00:10:00	11.9	**194**	**SSW**	**59.3**	1
02-May-02 00:15:00	11.4	**193**	**S**	**59.0**	1
02-May-02 00:20:00	13.1	**196**	**SSW**	**58.9**	1
02-May-02 00:25:00	13.3	**199**	**SSW**	**58.7**	1
02-May-02 00:30:00	14.3	**201**	**SSW**	**58.6**	1
02-May-02 00:35:00	17.9	**200**	**SSW**	**58.4**	1
02-May-02 00:40:00	20.4	**198**	**SSW**	**58.3**	1
02-May-02 00:45:00	21.2	**197**	**SSW**	**58.0**	1
02-May-02 00:50:00	21.8	**199**	**SSW**	**57.6**	1
02-May-02 00:55:00	21.8	**202**	**SSW**	**57.2**	1
02-May-02 01:00:00	22.4	**204**	**SSW**	**56.8**	1
02-May-02 01:05:00	24.2	**203**	**SSW**	**56.5**	1
02-May-02 01:10:00	26.0	**202**	**SSW**	**56.4**	1
02-May-02 01:15:00	25.9	**201**	**SSW**	**56.3**	1
02-May-02 01:20:00	25.7	**199**	**SSW**	**56.1**	1
02-May-02 01:25:00	25.4	**199**	**SSW**	**56.0**	1
02-May-02 01:30:00	25.4	**199**	**SSW**	**55.8**	1
02-May-02 01:35:00	24.2	**198**	**SSW**	**55.6**	1
02-May-02 01:40:00	23.9	**197**	**SSW**	**55.5**	1
02-May-02 01:45:00	24.0	**197**	**SSW**	**55.3**	1
02-May-02 01:50:00	22.4	**196**	**SSW**	**55.2**	1
02-May-02 01:55:00	22.5	**196**	**SSW**	**55.1**	1
02-May-02 02:00:00	21.2	**196**	**SSW**	**55.0**	1
02-May-02 02:05:00	19.0	**195**	**SSW**	**54.9**	1
02-May-02 02:10:00	19.0	**195**	**SSW**	**54.8**	1
02-May-02 02:15:00	19.0	**195**	**SSW**	**54.7**	1
02-May-02 02:20:00	19.0	**191**	**SSW**	**54.8**	1
02-May-02 02:25:00	18.7	**190**	**S**	**54.8**	1
02-May-02 02:30:00	18.8	**194**	**S**	**55.0**	1
02-May-02 02:35:00	20.0	**193**	**SSW**	**55.2**	1
02-May-02 02:40:00	19.8	**189**	**S**	**55.2**	1
02-May-02 02:45:00	19.8	**189**	**S**	**55.1**	1
02-May-02 02:50:00	20.1	**190**	**S**	**55.0**	1
02-May-02 02:55:00	20.2	**189**	**S**	**54.8**	1
02-May-02 03:00:00	20.5	**186**	**S**	**54.8**	1
02-May-02 03:05:00	21.1	**185**	**S**	**54.8**	1
02-May-02 03:10:00	21.8	**184**	**S**	**54.8**	1
02-May-02 03:15:00	21.0	**185**	**S**	**54.8**	1
02-May-02 03:20:00	20.8	**186**	**S**	**54.8**	1
02-May-02 03:25:00	21.0	**187**	**S**	**54.8**	1
02-May-02 03:30:00	21.2	**187**	**S**	**54.8**	1
02-May-02 03:35:00	20.9	**186**	**S**	**54.8**	1
02-May-02 03:40:00	21.4	**187**	**S**	**54.8**	1
02-May-02 03:45:00	22.0	**186**	**S**	**54.8**	1
02-May-02 03:50:00	21.7	**187**	**S**	**54.8**	1
02-May-02 03:55:00	21.3	**188**	**S**	**54.8**	1
02-May-02 04:00:00	21.3	**189**	**S**	**54.8**	1
02-May-02 04:05:00	21.2	**188**	**S**	**54.8**	1
02-May-02 04:10:00	21.3	**187**	**S**	**54.8**	1
02-May-02 04:15:00	21.6	**188**	**S**	**54.8**	1
02-May-02 04:20:00	21.8	**188**	**S**	**54.8**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 04:25:00	21.2	**190**	**S**	**54.8**	1
02-May-02 04:30:00	20.6	**192**	**SSW**	**54.7**	1
02-May-02 04:35:00	20.5	**196**	**SSW**	**54.7**	1
02-May-02 04:40:00	19.8	**199**	**SSW**	**54.7**	1
02-May-02 04:45:00	22.2	**201**	**SSW**	**54.7**	1
02-May-02 04:50:00	26.2	**203**	**SSW**	**54.7**	1
02-May-02 04:55:00	26.3	**201**	**SSW**	**54.7**	1
02-May-02 05:00:00	24.5	**197**	**SSW**	**54.7**	1
02-May-02 05:05:00	24.2	**198**	**SSW**	**54.7**	1
02-May-02 05:10:00	24.9	**200**	**SSW**	**54.7**	1
02-May-02 05:15:00	26.0	**201**	**SSW**	**54.6**	1
02-May-02 05:20:00	27.7	**201**	**SSW**	**54.6**	1
02-May-02 05:25:00	28.0	**201**	**SSW**	**54.6**	1
02-May-02 05:30:00	27.4	**201**	**SSW**	**54.6**	1
02-May-02 05:35:00	25.8	**201**	**SSW**	**54.6**	1
02-May-02 05:40:00	25.1	**201**	**SSW**	**54.6**	2
02-May-02 05:45:00	24.7	**201**	**SSW**	**54.7**	4
02-May-02 05:50:00	24.7	**203**	**SSW**	**54.7**	7
02-May-02 05:55:00	24.9	**203**	**SSW**	**54.7**	11
02-May-02 06:00:00	25.1	**202**	**SSW**	**54.7**	18
02-May-02 06:05:00	24.8	**201**	**SSW**	**54.7**	26
02-May-02 06:10:00	26.3	**202**	**SSW**	**54.7**	35
02-May-02 06:15:00	26.3	**203**	**SSW**	**54.8**	45
02-May-02 06:20:00	25.4	**203**	**SSW**	**54.9**	57
02-May-02 06:25:00	25.8	**203**	**SSW**	**54.9**	70
02-May-02 06:30:00	25.9	**203**	**SSW**	**55.0**	82
02-May-02 06:35:00	25.7	**203**	**SSW**	**55.2**	96
02-May-02 06:40:00	25.2	**203**	**SSW**	**55.3**	110
02-May-02 06:45:00	25.0	**203**	**SSW**	**55.4**	125
02-May-02 06:50:00	24.4	**202**	**SSW**	**55.4**	140
02-May-02 06:55:00	24.6	**202**	**SSW**	**55.4**	155
02-May-02 07:00:00	24.5	**202**	**SSW**	**55.4**	169
02-May-02 07:05:00	24.4	**203**	**SSW**	**55.4**	185
02-May-02 07:10:00	24.4	**202**	**SSW**	**55.5**	201
02-May-02 07:15:00	23.7	**203**	**SSW**	**55.5**	213
02-May-02 07:20:00	24.8	**202**	**SSW**	**55.7**	223
02-May-02 07:25:00	23.8	**203**	**SSW**	**55.9**	240
02-May-02 07:30:00	22.5	**204**	**SSW**	**56.1**	258
02-May-02 07:35:00	23.1	**204**	**SSW**	**56.2**	272
02-May-02 07:40:00	24.0	**204**	**SSW**	**56.3**	285
02-may-02 07:45:00	23.7	**204**	**SSW**	**56.4**	300
02-May-02 07:50:00	23.0	**203**	**SSW**	**56.7**	317
02-May-02 07:55:00	23.5	**203**	**SSW**	**56.9**	333
02-May-02 08:00:00	23.5	**203**	**SSW**	**57.1**	348
02-May-02 08:05:00	24.1	**203**	**SSW**	**57.4**	364
02-May-02 08:10:00	24.0	**204**	**SSW**	**57.8**	379
02-May-02 08:15:00	23.9	**206**	**SSW**	**58.2**	395
02-May-02 08:20:00	24.3	**208**	**SSW**	**58.6**	409
02-May-02 08:25:00	26.4	**211**	**SSW**	**59.1**	424
02-May-02 08:30:00	27.0	**210**	**SSW**	**59.3**	440
02-May-02 08:35:00	28.3	**210**	**SSW**	**59.5**	458

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 08:40:00	30.3	**211**	**SSW**	**59.6**	474
02-May-02 08:45:00	30.0	**212**	**SSW**	**59.8**	490
02-May-02 08:50:00	29.0	**210**	**SSW**	**59.9**	505
02-May-02 08:55:00	28.1	**206**	**SSW**	**60.1**	518
02-May-02 09:00:00	27.3	**205**	**SSW**	**60.3**	532
02-May-02 09:05:00	26.7	**206**	**SSW**	**60.6**	546
02-May-02 09:10:00	26.9	**209**	**SSW**	**61.0**	556
02-May-02 09:15:00	26.9	**209**	**SSW**	**61.5**	561
02-May-02 09:20:00	26.4	**210**	**SSW**	**62.0**	557
02-May-02 09:25:00	26.3	**210**	**SSW**	**62.2**	554
02-May-02 09:30:00	24.3	**209**	**SSW**	**62.4**	576
02-May-02 09:35:00	24.5	**208**	**SSW**	**62.6**	607
02-May-02 09:40:00	24.9	**209**	**SSW**	**62.9**	629
02-May-02 09:45:00	25.1	**210**	**SSW**	**63.2**	645
02-May-02 09:50:00	26.2	**210**	**SSW**	**63.6**	631
02-May-02 09:55:00	25.9	**212**	**SSW**	**63.7**	592
02-May-02 10:00:00	26.0	**214**	**SSW**	**63.7**	587
02-May-02 10:05:00	27.9	**217**	**SW**	**63.8**	618
02-May-02 10:10:00	28.0	**221**	**SW**	**63.8**	662
02-May-02 10:15:00	27.3	**220**	**SW**	**63.9**	691
02-May-02 10:20:00	27.2	**219**	**SW**	**64.1**	704
02-May-02 10:25:00	27.9	**219**	**SW**	**64.4**	714
02-May-02 10:30:00	27.3	**218**	**SW**	**64.5**	717
02-May-02 10:35:00	26.2	**213**	**SW**	**64.7**	724
02-May-02 10:40:00	26.0	**213**	**SSW**	**64.9**	735
02-May-02 10:45:00	27.0	**215**	**SW**	**65.3**	743
02-May-02 10:50:00	27.5	**216**	**SW**	**65.6**	759
02-May-02 10:55:00	27.1	**219**	**SW**	**65.8**	775
02-May-02 11:00:00	26.0	**220**	**SW**	**65.9**	783
02-May-02 11:05:00	24.7	**217**	**SW**	**65.8**	792
02-May-02 11:10:00	24.7	**214**	**SW**	**66.0**	804
02-May-02 11:15:00	25.8	**213**	**SW**	**66.4**	813
02-May-02 11:20:00	25.7	**212**	**SSW**	**66.6**	820
02-May-02 11:25:00	24.7	**210**	**SSW**	**66.8**	826
02-May-02 11:30:00	23.4	**209**	**SSW**	**67.1**	835
02-May-02 11:35:00	22.3	**208**	**SSW**	**67.3**	841
02-May-02 11:40:00	24.1	**207**	**SSW**	**67.5**	839
02-May-02 11:45:00	25.7	**211**	**SSW**	**67.8**	840
02-May-02 11:50:00	24.1	**215**	**SSW**	**67.9**	813
02-May-02 11:55:00	23.8	**216**	**SW**	**67.9**	800
02-May-02 12:00:00	24.0	**216**	**SW**	**68.0**	835
02-May-02 12:05:00	23.5	**218**	**SW**	**68.1**	858
02-May-02 12:10:00	23.0	**220**	**SW**	**68.3**	864
02-May-02 12:15:00	22.4	**223**	**SW**	**68.4**	869
02-May-02 12:20:00	22.6	**224**	**SW**	**68.7**	875
02-May-02 12:25:00	22.6	**225**	**SW**	**69.0**	875
02-May-02 12:30:00	23.2	**224**	**SW**	**69.3**	876
02-May-02 12:35:00	23.5	**220**	**SW**	**69.5**	876
02-May-02 12:40:00	23.6	**217**	**SW**	**69.7**	870
02-May-02 12:45:00	23.9	**214**	**SW**	**69.9**	869
02-May-02 12:50:00	24.4	**212**	**SSW**	**70.1**	878

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 12:55:00	24.8	**212**	**SSW**	**70.3**	858
02-May-02 13:00:00	25.0	**214**	**SSW**	**70.4**	834
02-May-02 13:05:00	25.1	**213**	**SW**	**70.4**	796
02-May-02 13:10:00	25.2	**209**	**SSW**	**70.3**	797
02-May-02 13:15:00	25.1	**209**	**SSW**	**70.5**	843
02-May-02 13:20:00	25.1	**209**	**SSW**	**70.7**	885
02-May-02 13:25:00	24.9	**210**	**SSW**	**70.9**	816
02-May-02 13:30:00	24.2	**212**	**SSW**	**70.6**	729
02-May-02 13:35:00	24.8	**216**	**SSW**	**70.4**	655
02-May-02 13:40:00	25.4	**219**	**SW**	**70.3**	657
02-May-02 13:45:00	25.7	**222**	**SW**	**70.2**	634
02-May-02 13:50:00	25.9	**219**	**SW**	**70.1**	580
02-May-02 13:55:00	25.5	**216**	**SW**	**69.8**	597
02-May-02 14:00:00	26.5	**215**	**SW**	**70.1**	731
02-May-02 14:05:00	26.8	**214**	**SW**	**70.6**	801
02-May-02 14:10:00	25.4	**213**	**SW**	**70.8**	801
02-May-02 14:15:00	24.5	**212**	**SSW**	**70.9**	810
02-May-02 14:20:00	25.0	**216**	**SSW**	**71.3**	801
02-May-02 14:25:00	25.4	**223**	**SW**	**71.8**	793
02-May-02 14:30:00	25.8	**225**	**SW**	**72.1**	797
02-May-02 14:35:00	25.4	**226**	**SW**	**72.2**	790
02-May-02 14:40:00	25.6	**224**	**SW**	**72.3**	780
02-May-02 14:45:00	25.5	**224**	**SW**	**72.3**	770
02-May-02 14:50:00	25.8	**223**	**SW**	**72.3**	760
02-May-02 14:55:00	26.1	**223**	**SW**	**72.3**	750
02-May-02 15:00:00	25.6	**223**	**SW**	**72.3**	737
02-May-02 15:05:00	25.1	**222**	**SW**	**72.1**	726
02-May-02 15:10:00	23.9	**223**	**SW**	**71.8**	718
02-May-02 15:15:00	23.8	**226**	**SW**	**71.9**	705
02-May-02 15:20:00	24.5	**228**	**SW**	**72.2**	696
02-May-02 15:25:00	24.7	**230**	**SW**	**72.4**	685
02-May-02 15:30:00	25.4	**232**	**SW**	**72.4**	680
02-May-02 15:35:00	26.3	**231**	**SW**	**72.6**	676
02-May-02 15:40:00	27.5	**227**	**SW**	**72.5**	667
02-May-02 15:45:00	28.8	**226**	**SW**	**72.4**	652
02-May-02 15:50:00	29.9	**226**	**SW**	**72.2**	615
02-May-02 15:55:00	28.6	**227**	**SW**	**72.0**	605
02-May-02 16:00:00	28.9	**225**	**SW**	**71.8**	604
02-May-02 16:05:00	30.2	**228**	**SW**	**71.7**	593
02-May-02 16:10:00	28.4	**228**	**SW**	**71.5**	580
02-May-02 16:15:00	28.4	**227**	**SW**	**71.3**	576
02-May-02 16:20:00	29.9	**227**	**SW**	**71.0**	564
02-May-02 16:25:00	28.6	**228**	**SW**	**70.7**	538
02-May-02 16:30:00	26.9	**229**	**SW**	**70.5**	526
02-May-02 16:35:00	26.9	**230**	**SW**	**70.4**	513
02-May-02 16:40:00	28.4	**231**	**SW**	**70.2**	499
02-May-02 16:45:00	29.4	**233**	**SW**	**70.1**	487
02-May-02 16:50:00	28.8	**232**	**SW**	**69.9**	470
02-May-02 16:55:00	28.9	**229**	**SW**	**69.6**	372
02-May-02 17:00:00	29.7	**228**	**SW**	**69.1**	347
02-May-02 17:05:00	29.7	**230**	**SW**	**68.9**	366

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 17:10:00	29.7	**230**	**SW**	**68.9**	362
02-May-02 17:15:00	30.2	**230**	**SW**	**68.8**	371
02-May-02 17:20:00	28.7	**232**	**SW**	**68.7**	363
02-May-02 17:25:00	29.5	**237**	**SW**	**68.7**	341
02-May-02 17:30:00	30.3	**238**	**WSW**	**68.5**	332
02-May-02 17:35:00	29.2	**233**	**WSW**	**68.5**	331
02-May-02 17:40:00	28.9	**227**	**SW**	**68.4**	322
02-May-02 17:45:00	25.9	**226**	**SW**	**68.0**	310
02-May-02 17:50:00	25.6	**226**	**SW**	**67.7**	307
02-May-02 17:55:00	26.9	**226**	**SW**	**67.4**	293
02-May-02 18:00:00	26.9	**229**	**SW**	**67.2**	271
02-May-02 18:05:00	27.1	**229**	**SW**	**66.9**	249
02-May-02 18:10:00	26.9	**229**	**SW**	**67.0**	233
02-May-02 18:15:00	26.8	**230**	**SW**	**67.0**	220
02-May-02 18:20:00	27.8	**231**	**SW**	**66.9**	205
02-May-02 18:25:00	27.0	**233**	**SW**	**66.7**	186
02-May-02 18:30:00	25.7	**236**	**SW**	**66.4**	163
02-May-02 18:35:00	25.6	**237**	**WSW**	**66.1**	137
02-May-02 18:40:00	27.2	**236**	**WSW**	**65.6**	111
02-May-02 18:45:00	27.7	**237**	**SW**	**65.0**	94
02-May-02 18:50:00	28.8	**237**	**WSW**	**64.4**	93
02-May-02 18:55:00	29.8	**238**	**WSW**	**63.8**	89
02-May-02 19:00:00	30.5	**240**	**WSW**	**63.4**	87
02-May-02 19:05:00	30.1	**240**	**WSW**	**63.0**	81
02-May-02 19:10:00	29.4	**238**	**WSW**	**62.7**	62
02-May-02 19:15:00	28.3	**236**	**WSW**	**62.3**	45
02-May-02 19:20:00	27.0	**236**	**SW**	**62.0**	36
02-May-02 19:25:00	27.0	**238**	**WSW**	**61.5**	31
02-May-02 19:30:00	28.7	**242**	**WSW**	**61.1**	25
02-May-02 19:35:00	28.2	**242**	**WSW**	**60.8**	18
02-May-02 19:40:00	26.5	**239**	**WSW**	**60.4**	13
02-May-02 19:45:00	25.5	**237**	**WSW**	**60.0**	9
02-May-02 19:50:00	25.6	**236**	**SW**	**59.6**	7
02-May-02 19:55:00	25.2	**234**	**SW**	**59.3**	5
02-May-02 20:00:00	25.4	**232**	**SW**	**59.0**	3
02-May-02 20:05:00	25.2	**235**	**SW**	**58.7**	2
02-May-02 20:10:00	25.0	**234**	**WSW**	**58.4**	1
02-May-02 20:15:00	23.9	**233**	**SW**	**58.1**	1
02-May-02 20:20:00	24.9	**237**	**SW**	**57.8**	1
02-May-02 20:25:00	24.7	**238**	**WSW**	**57.6**	1
02-May-02 20:30:00	23.0	**236**	**WSW**	**57.3**	1
02-May-02 20:35:00	21.7	**234**	**SW**	**56.9**	1
02-May-02 20:40:00	21.0	**234**	**SW**	**56.6**	1
02-May-02 20:45:00	20.5	**236**	**SW**	**56.3**	1
02-May-02 20:50:00	20.1	**235**	**WSW**	**56.2**	1
02-May-02 20:55:00	19.3	**224**	**SW**	**55.9**	1
02-May-02 21:00:00	20.1	**211**	**SW**	**55.6**	1
02-May-02 21:05:00	20.8	**203**	**SSW**	**55.2**	1
02-May-02 21:10:00	21.7	**201**	**SSW**	**55.1**	1
02-May-02 21:15:00	22.4	**201**	**SSW**	**55.0**	1
02-May-02 21:20:00	22.7	**201**	**SSW**	**54.9**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 21:25:00	22.6	**202**	**SSW**	**54.8**	1
02-May-02 21:30:00	22.5	**205**	**SSW**	**54.7**	1
02-May-02 21:35:00	21.4	**207**	**SSW**	**54.6**	1
02-May-02 21:40:00	18.8	**209**	**SSW**	**54.4**	1
02-May-02 21:45:00	17.7	**215**	**SSW**	**54.2**	1
02-May-02 21:50:00	19.0	**225**	**SW**	**54.0**	1
02-May-02 21:55:00	21.1	**230**	**SW**	**54.2**	1
02-May-02 22:00:00	20.9	**229**	**SW**	**54.3**	1
02-May-02 22:05:00	17.9	**226**	**SW**	**54.1**	1
02-May-02 22:10:00	16.8	**225**	**SW**	**53.7**	1
02-May-02 22:15:00	17.8	**226**	**SW**	**53.6**	1
02-May-02 22:20:00	18.6	**229**	**SW**	**53.6**	1
02-May-02 22:25:00	17.6	**231**	**SW**	**53.6**	1
02-May-02 22:30:00	16.9	**233**	**SW**	**53.5**	1
02-May-02 22:35:00	16.7	**231**	**SW**	**53.4**	1
02-May-02 22:40:00	17.0	**232**	**SW**	**53.3**	1
02-May-02 22:45:00	17.1	**234**	**SW**	**53.1**	1
02-May-02 22:50:00	17.4	**236**	**SW**	**53.0**	1
02-May-02 22:55:00	17.2	**234**	**SW**	**52.9**	1
02-May-02 23:00:00	17.1	**230**	**SW**	**52.8**	1
02-May-02 23:05:00	16.6	**224**	**SW**	**52.6**	1
02-May-02 23:10:00	15.7	**216**	**SW**	**52.4**	1
02-May-02 23:15:00	14.9	**210**	**SSW**	**52.1**	1
02-May-02 23:20:00	13.8	**209**	**SSW**	**52.1**	1
02-May-02 23:25:00	13.2	**205**	**SSW**	**52.3**	1
02-May-02 23:30:00	12.4	**201**	**SSW**	**52.4**	1
02-May-02 23:35:00	11.1	**201**	**SSW**	**52.5**	1
02-May-02 23:40:00	9.7	**205**	**SSW**	**52.3**	1
02-May-02 23:45:00	11.9	**215**	**SSW**	**51.9**	1
02-May-02 23:50:00	15.2	**224**	**SW**	**51.9**	1
02-May-02 23:55:00	17.4	**227**	**SW**	**51.9**	1
03-May-02 00:00:00	18.5	**226**	**SW**	**51.9**	1

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Documentation of a Natural Event Due to High Winds, May 02, 2002 Walla Walla, Washington

Addendum Addressing a Natural Event Due to High Winds, May 2, 2002 Wallula, Washington

Publication Number 05-02-004
September 2004

Printed on Recycled Paper

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Documentation of a Natural Event Due to High Winds, May 02, 2002 Walla Walla, Washington

Addendum Addressing a Natural Event Due to High Winds, May 2, 2002 Wallula, Washington

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Prepared by:

Washington State Department of Ecology
Air Quality Program

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Summary

This addendum supplies new information and uses information in the Walla Walla natural events documentation for May 2, 2002 to document the May 2, 2002 Wallula PM_{10} concentration as a natural event that should be excluded from any assessment of the attainment status of the Wallula PM_{10} nonattainment area. During the preparation of the PM_{10} maintenance plan for the Wallula nonattainment area, the Washington State Department of Ecology (Ecology) realized that the May 2, 2002 PM_{10} concentration of 134 $\mu g/m^3$ at Wallula, Washington was elevated by the same regional conditions responsible for the exceedance of the PM_{10} standard of 150 $\mu g/m^3$ at Walla Walla on the same day. Ecology had determined that the Walla Walla exceedance was a natural event caused by high winds and thus should be excluded from any assessment of the attainment status for Walla Walla, Washington.

Overview

In April 2003 Ecology submitted documentation to the United States Environmental Protection Agency (EPA) in support of a data flag for the May 2, 2002, particulate matter, 10 microns and smaller, (PM_{10}) concentration at Walla Walla, Washington. The high-volume Federal Reference Method (FRM) monitor at Walla Walla had measured a filter-based PM_{10} concentration of 169 $\mu g/m^3$ on that date. This concentration exceeds the primary 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) for PM_{10} of 150 $\mu g/m^3$. Ecology determined that this exceedance was a natural event caused by high winds and thus should be excluded from any assessment of the attainment status for Walla Walla, Washington. Ecology flagged the data point for May 2, 2002, in the Air Quality System (AQS) database maintained by EPA to specify the data point as a natural event due to high winds. EPA responded to Ecology's documentation with a letter dated June 24, 2003 that acknowledged the documentation and agreed to place a second, EPA flag on the Walla Walla data point for May 2, 2002 in the AQS database.

During the preparation of the maintenance plan for the Wallula PM_{10} nonattainment area, Ecology realized that the May 2, 2002 concentration of 134 $\mu g/m^3$ measured by the Wallula high-volume FRM monitor was elevated by the same regional conditions responsible for the exceedance at Walla Walla on the same day. The May 2, 2002 Wallula concentration thus qualifies as a natural event due to high winds. When qualified as a natural event due to high winds, the May 2, 2002 concentration is not used for any attainment assessment of the Wallula nonattainment area, including the demonstration of maintenance in a maintenance plan.

This Addendum to *Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington* (Ecology publication 03-02-006, April 2003) does not stand by itself. The Addendum adds additional information related to PM_{10} concentrations, wind speed and wind direction at Wallula. This information is considered along with information in the April 2003 documentation to determine the May 2, 2002 Wallula concentration is a natural event.

Discussion of the topics EPA's Natural Events Policy, Ecology's response to high wind events on the Columbia Plateau, and Best Available Control Measure (BACM) implementation are not repeated in this Addendum. The interested reader is referred to the April 2003 documentation of the May 2, 2002, Walla Walla natural event.

Evaluation of the May 2, 2002 Concentration at Wallula, Washington

1. PM_{10} Monitoring

1.1. Wallula PM_{10} Monitoring: The Wallula high-volume FRM monitor measured a filter-based PM_{10} concentration 134 μg/m^3 on May 2, 2002. The monitor was located in the approximate geographic center of the Wallula PM_{10} nonattainment area (see Appendix A). The Wallula monitor operated on a 1-in-6-day schedule.

The May 2, 2002 concentration of 134 μg/m^3 was much higher than any other concentration measured in the second quarter of 2002. Monthly maxima for April and June 2002 were 61 and 34 μg/m^3, respectively. The second highest concentration for May 2002 was 25 μg/m^3.

The only other PM_{10} concentration over 85 μg/m^3 measured at Wallula during the year 2002 was the high wind natural event of September 29, 2002. The PM_{10} concentration was 197 μg/m^3. Ecology developed natural event documentation for the September exceedance. Both Ecology and EPA have flagged the exceedance as a natural event due to high winds in the AQS database. As a result, this data point is excluded from consideration in assessing attainment of the PM_{10} standard in Wallula.

The annual average PM_{10} concentration for the year 2002 at Wallula was 36.8 μg/m^3 and the average PM_{10} concentration for the second quarter, 35.21 μg/m^3. Both of these are well below the annual standard of 50 μg/m^3. Wallula PM_{10} data for the year 2002 are found in Appendix B.

1.2. Other PM_{10} Monitoring: The high-volume FRM PM_{10} monitor in Walla Walla measured a filter-based PM_{10} exceedance of 169 μg/m^3 on May 2, 2002. The Walla Walla monitor is approximately 27 miles east of the Wallula monitor (see Appendix A).

Ecology prepared natural events documents for the May 2, 2002, exceedance and flagged the data point in the AQS database. EPA Region 10 acknowledged the documentation in a letter dated June 24, 2003 and committed to flagging the data point in the AQS database. As a result, this data point is excluded from consideration in assessing attainment of the PM_{10} standard in Walla Walla.

2. Meteorological Data

2.1. Wallula Meteorological Data: Data from a meteorological station collocated with the Wallula PM_{10} monitor show that winds easily exceeded Ecology's definition for a high wind event. The meteorological station is operated by Boise Paper Solutions—Wallula Mill. Ecology wishes to thank Boise for sharing the data from the station with Ecology.

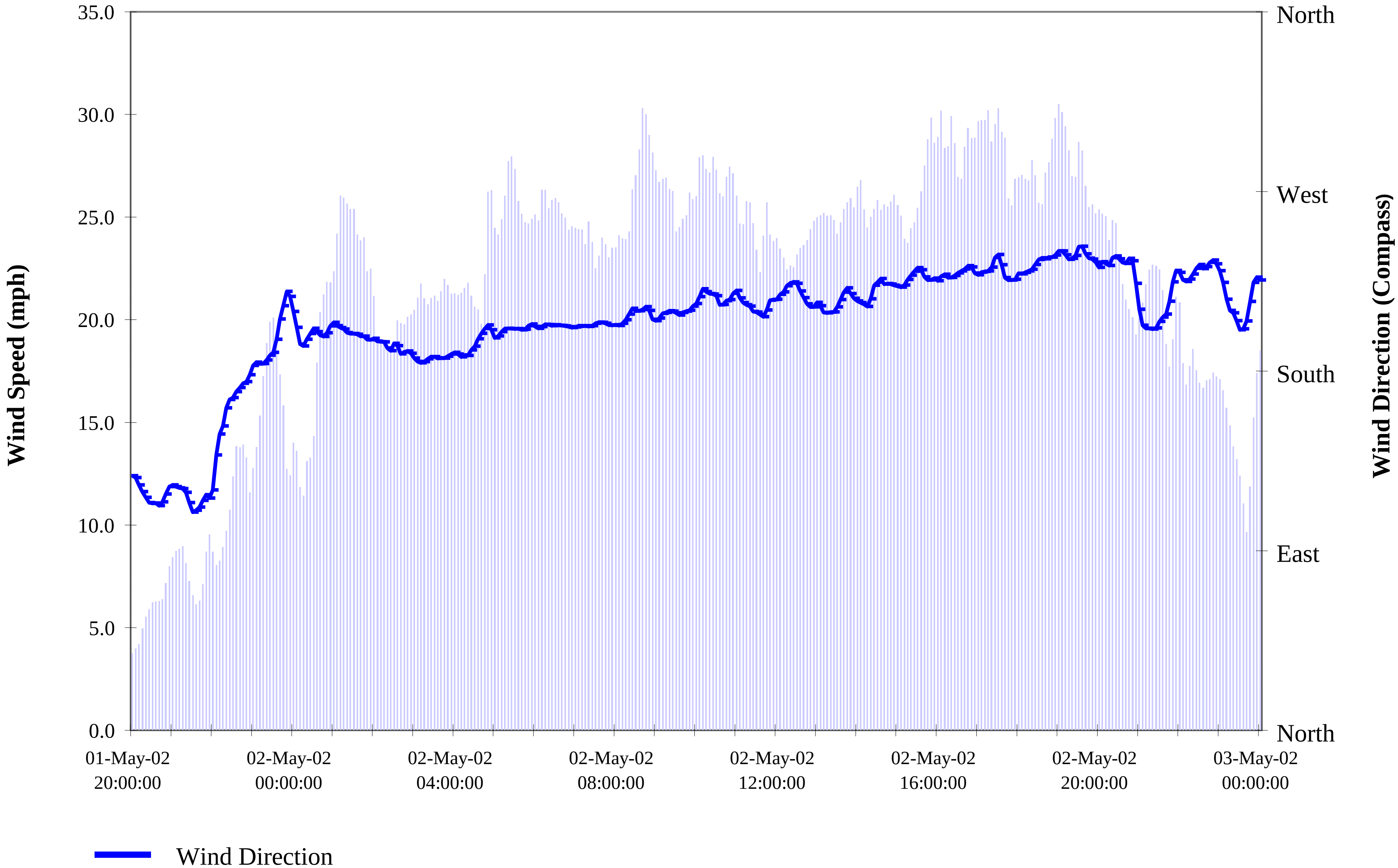
Ecology's definition requires winds of 18 mph or more for a two-hour period. Winds exceeded 20 mph from 1 a.m. through 10 p.m. on May 2, 2002 (see Table 1 and Figure 1). Winds were generally from the southwest and south-southwest during this period. The complete set of meteorological data for May 2, 2002, is found in Appendix C.

Table 1. Hourly Wind Observations for Wallula, Washington, May 2, 2002

Time (Day-Month-Year Hour:Minute:Second)	Speed (MPH)	Wind Direction	
		Degrees	Compass
02-May-2002 00:00:00	14.0	210	SW
02-May-2002 01:00:00	22.4	204	SSW
02-May-2002 02:00:00	21.2	196	SSW
02-May-2002 03:00:00	20.5	186	S
02-May-2002 04:00:00	21.3	189	S
02-May-2002 05:00:00	24.5	197	SSW
02-May-2002 06:00:00	25.1	202	SSW
02-May-2002 07:00:00	24.5	202	SSW
02-May-2002 08:00:00	23.5	203	SSW
02-May-2002 09:00:00	27.3	205	SSW
02-May-2002 10:00:00	26.0	214	SSW
02-May-2002 11:00:00	26.0	220	SW
02-May-2002 12:00:00	24.0	216	SW
02-May-2002 13:00:00	25.0	214	SSW
02-May-2002 14:00:00	26.5	215	SW
02-May-2002 15:00:00	25.6	223	SW
02-May-2002 16:00:00	28.9	225	SW
02-May-2002 17:00:00	29.7	228	SW
02-May-2002 18:00:00	26.9	229	SW
02-May-2002 19:00:00	30.5	240	WSW
02-May-2002 20:00:00	25.4	232	SW
02-May-2002 21:00:00	20.1	211	SW
02-May-2002 22:00:00	20.9	229	SW
02-May-2002 23:00:00	17.1	230	SW
03-May-2002 00:00:00	18.5	226	SW

2.2. Other Meteorological Data: *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003) reported on National Weather Service data for Pendleton, Oregon and Walla Walla, Washington. In Pendleton, winds ranged from 20 to 37 mph between 7 a.m. and midnight on May 2, 2002. West-southwest winds in Walla Walla

Figure 1. Wind Speed & Wind Direction, May 1-2, 2002, Wallula, Washington



Addendum for Wallula, Washington
Natural Event of May 2, 2002

ranged from 22 to 28 mph from 1 p.m. to 5 p.m. on the same date. The interested reader is referred to the documentation for more detail.

2.3. Precipitation Prior to May 2, 2002: The following discussion is adapted from *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003).

Conditions were dry prior to the high winds of May 2, 2002. Table 2 summarizes precipitation data from several meteorological sites in south-central Washington and neighboring Oregon. These sites are operated by the National Weather Service (Walla Walla and Pendleton), Washington State University's (WSU's) Public Agricultural Weather System (PAWS) (McNary, R.Eby, Finley, College Place and Touchet) and the United States Bureau of Reclamation's (USBR's) AGRIMET system (Hermiston and Echo). The sites, which are generally located to the south, southwest and west of Wallula and Walla Walla, were selected on the basis of the west-southwest, southwest, south-southwest and south winds observed on May 2, 2002 in Wallula and Walla Walla. All sites are greater lie within 30 miles of Wallula. A map showing the location of the sites is found in Appendix A.

Eight of the ten stations reported no precipitation 72 hours prior to the natural event. Three stations reported no precipitation four days prior to the natural event. McNary and Echo report no precipitation 17 days prior to the natural event.

Table 2. Precipitation Prior to a Natural Event Due to High Winds, May 2, 2002

STATION	PRECIPITATION 72 hrs. prior to May 2, 2002	DATE	DAYS prior to May 2, 2002, with no precipitation
Pendleton, OR	0.01	4-29-2002	2
Hermiston, OR (HRMO)	0.0	NA	3
Hermiston, OR (HERO)	0.0	NA	10
Echo, OR (ECHO)	0.0	NA	17
Walla Walla	0.0	NA	3
McNary	0.0	NA	17
R.Eby	0.0	NA	4
Finley	0.0	NA	4
College Place	0.0	NA	4
Touchet	0.95	5-02-2002	NA

While Touchet reported precipitation on May 2, 2002, the data show high winds preceded the precipitation. Fifteen-minute wind speed, wind direction and precipitation data show the first measured precipitation occurred at 8 a.m. From midnight to 8 a.m. the average wind speed was 19 mph, with a 15-minute high of 23 mph.

Further, no precipitation was reported at Touchet on April 28, 29, 30 or May 1. The data do show 0.25 inch of precipitation on April 27, 2002. This means that no precipitation was recorded at Touchet for at least 96 hours prior to May 02, 2002.

2.4. Comparison of Average January – April Precipitation for the Area to Precipitation in 2002:
The following discussion is adapted from *Documentation of a Natural Event Due to High Winds, May 02, 2002. Wallula, Washington* (April 2003).

In order to further assess the general dryness of soils in the area prior to the high winds, Table 3 compares average precipitation for January – April with January – April precipitation in 2002. The PAWS network reports both average precipitation and the current year's data. A similar comparison for Hermiston and Echo, Oregon requires first a period of record report from the Western Regional Climate Center and second accumulated precipitation reported by the USBR's Hermiston and Echo AGRIMET stations.

Table 3. Comparison of Average January–April 2002 Precipitation with 2002 Precipitation

STATION	AVERAGE PRECIPITATION January – April (in.)	2002 PRECIPITATION January – April (in.)	PERCENT OF AVERAGE
College Place	5.8	3.41	59
R.Eby	3.6	2.45	68
McNary	4.0	1.65	41
Touchet	3.5	1.82	53
Finley	NA	NA	NA
Hermiston, OR (HRMO)	3.61	2.10	58
Echo, OR (ECHO)	3.97	2.21	56

All sites report below average precipitation for January - April 2002, when compared with the historical record. Conditions for the area generally range from less than 50 percent of average (McNary) to about 70 percent of average (R.Eby).

Findings

The meteorological data from Boise's meteorological station collocated with the Wallula FRM PM_{10} monitor show that May 2, 2002 was characterized by windy conditions. Winds generally from the southwest and south-southwest exceeded 20 mph from 1 a.m. through 10 p.m. on May 2, 2002. Ecology's definition for a high wind event only requires winds of 18 mph or more for a two-hour period. Windy conditions were also present in Pendleton, Oregon and Walla Walla, Washington.

Conditions were dry. Much of the area lying upwind of Wallula with respect to the predominant wind directions on May 2, 2002 had received no precipitation for 96 or more hours prior to that date. Moreover, April through June precipitation in 2002 at weather stations to the south and west of the Wallula PM_{10} monitoring site was generally between 50 and 60 percent of average precipitation for the four-month period.

Ecology found that BACM was implemented on agricultural fields in Benton and Walla Walla counties. BACM implementation is discussed in *Documentation of a Natural Event Due to High Winds, May 02, 2002, Walla Walla, Washington* (Ecology publication 03-02-006, April 2003).

Under the dry conditions so common in this area the windy conditions are likely to have raised the dust that led to the measured elevated PM_{10} concentrations at Wallula. Similar to the previously documented high wind natural event at Walla Walla, Washington on May 2, 2002, the monitored PM_{10} concentration of 134 $\mu g/m^3$ at Wallula, Washington, on May 2, 2002 is reasonably attributed to a natural event due to high winds.

Appendix A

Locations of PM_{10} Monitoring Sites and Meteorological Stations

- Map of Particulate Matter (PM_{10}) monitoring sites and meteorological stations in Benton Franklin and Walla Walla counties, Washington and adjoining Oregon, 2002

- Map of the Wallula PM_{10} Nonattainment Area

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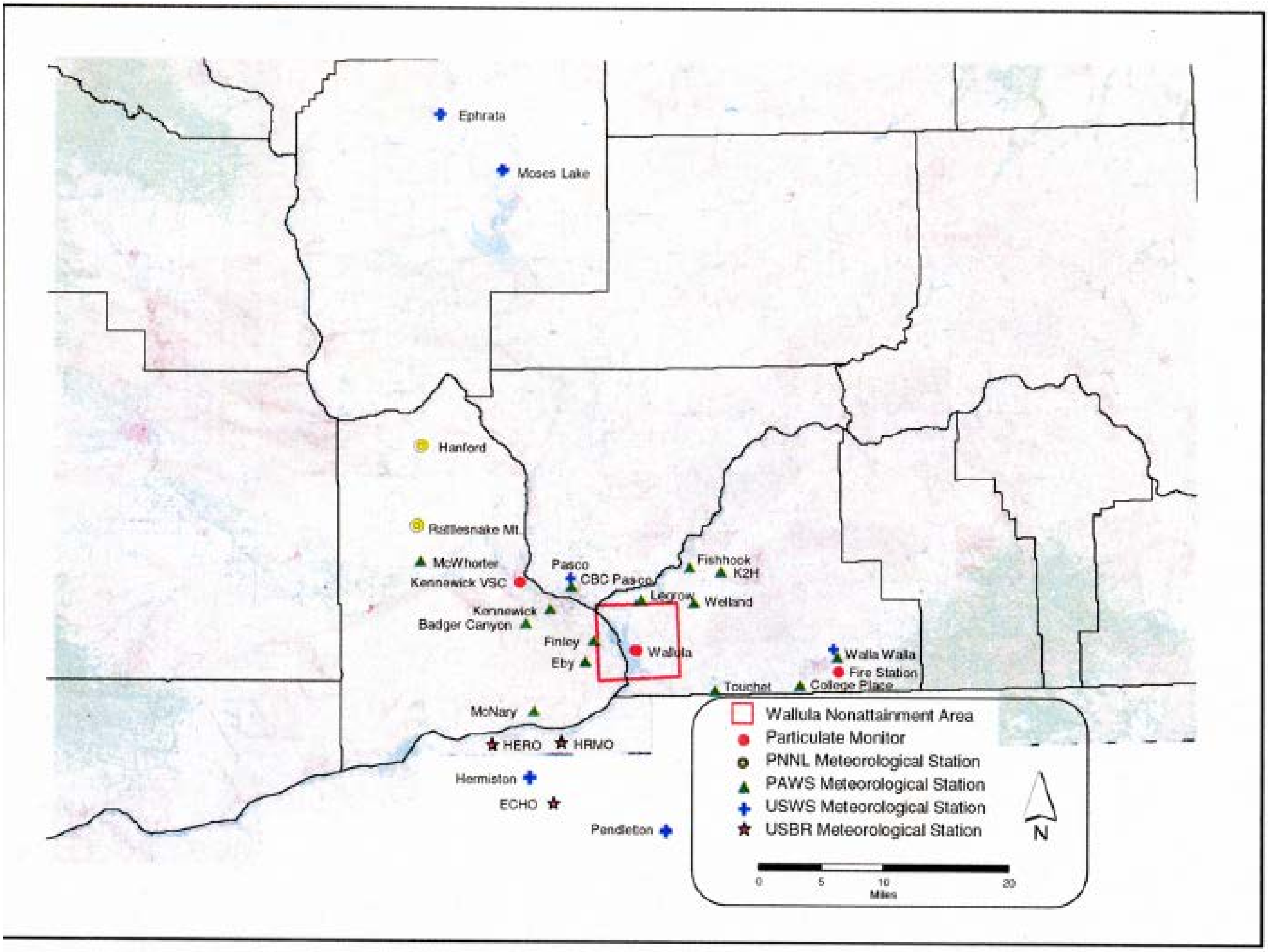

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Natural Event of May 2, 2002

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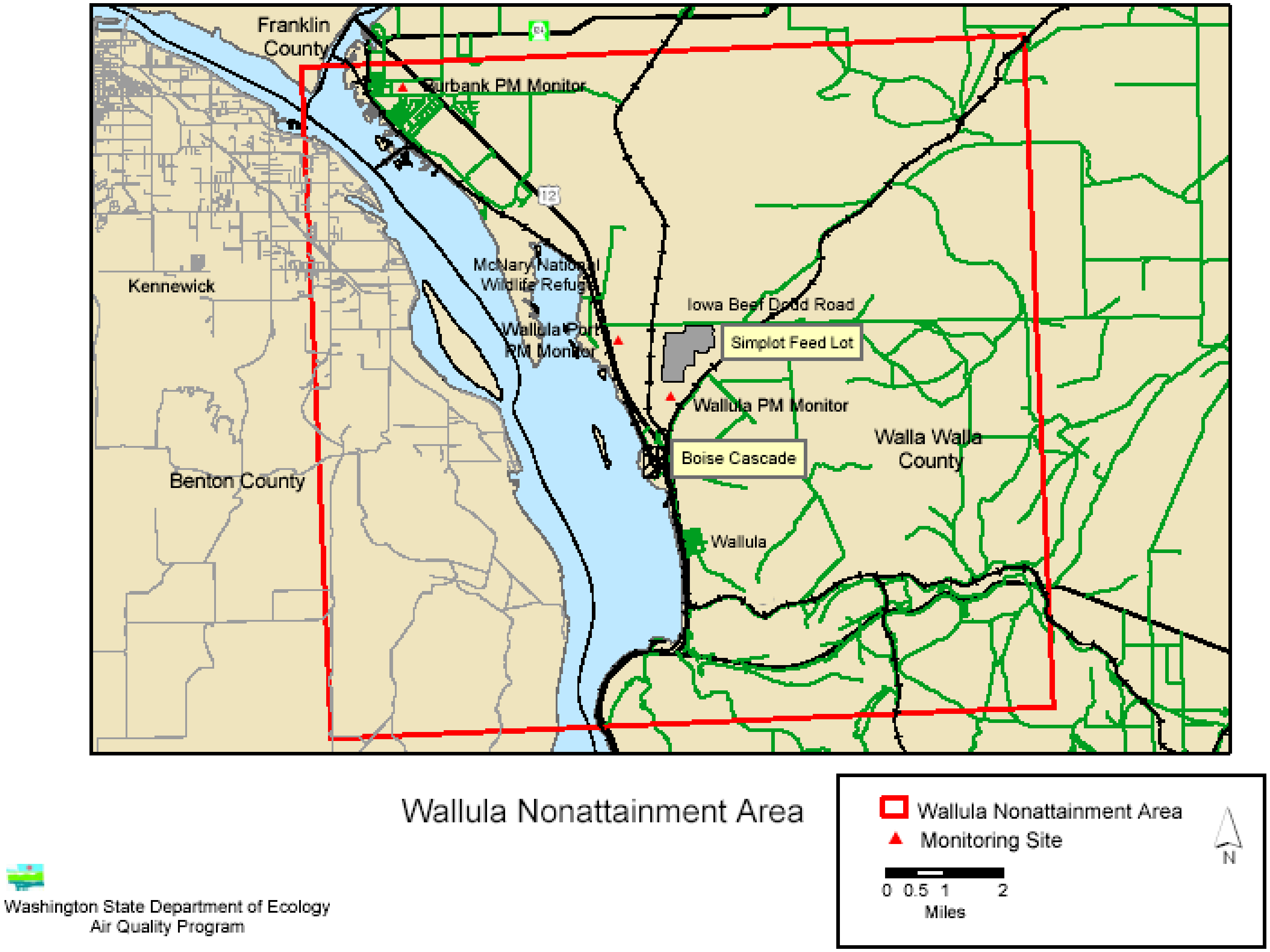
Natural Event of May 2, 2002



Addendum for Wallula, Washington
Natural Event of May 2, 2002

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Appendix B

2002 PM_{10} Monitoring Data
Wallula, Washington

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Annual Parameter Report

Reporting Year: 2002

Time of Report: 09/15/04 08:38

STATION: WALLULA

SITE: 0711001 AIRS : Parameter Code: 81102 Method Code: 063 Units Code: 001 Decimal Positioner: 0

Parameter: PM10 SAROAD: Parameter Code: 81102 Method Code: 63 Units Code: 01 Units:

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX	MEAN	NO
1		10				21	47	71							
2	8			61	134										
3			11												
4											52	17			
5									33	21					
6															
7		7				15	50	28							
8				49	18										
9	12														
10											10				
11									52	28		12			
12								42							
13						25	63								
14	13			28	16										
15															
16										50	28	8			
17									18						
18								35							
19			51			26	35								
20	19			29	25										
21			17												
22											19	16			
23									83	32					
24								56							
25						34	64								
26	6			12											
27			44												
28											26	9			
29									197	21					
30								43							
31															
AVG	12	8	31	36	48	24	52	46	77	30	27	12		34	
MAX	19	10	51	61	134	34	64	71	197	50	52	17	197		
DAYS	5	2	4	5	4	5	5	6	5	5	5	5			56

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Appendix C

May 1-2, 2002 Meteorological Data
Wallula, Washington

Courtesy of Boise Paper Solutions—Wallula Mill

Addendum for Wallula, Washington
Natural Event of May 2, 2002

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
01-May-02 20:00:00	3.8	**127**	**SE**	**68.7**	5
01-May-02 20:05:00	4.0	**127**	**SE**	**68.5**	3
01-May-02 20:10:00	4.2	**123**	**SE**	**68.2**	2
01-May-02 20:15:00	5.0	**119**	**ESE**	**67.8**	2
01-May-02 20:20:00	5.5	**117**	**ESE**	**67.5**	2
01-May-02 20:25:00	5.9	**114**	**ESE**	**67.1**	1
01-May-02 20:30:00	6.2	**114**	**ESE**	**66.6**	1
01-May-02 20:35:00	6.3	**114**	**ESE**	**65.9**	1
01-May-02 20:40:00	6.3	**112**	**ESE**	**65.5**	1
01-May-02 20:45:00	6.4	**114**	**ESE**	**65.0**	1
01-May-02 20:50:00	7.2	**118**	**ESE**	**64.7**	1
01-May-02 20:55:00	8.0	**122**	**ESE**	**64.7**	1
01-May-02 21:00:00	8.4	**123**	**ESE**	**64.6**	1
01-May-02 21:05:00	8.7	**122**	**ESE**	**64.6**	1
01-May-02 21:10:00	8.8	**121**	**ESE**	**64.5**	1
01-May-02 21:15:00	9.0	**121**	**ESE**	**64.5**	1
01-May-02 21:20:00	8.2	**119**	**ESE**	**64.4**	1
01-May-02 21:25:00	7.3	**114**	**ESE**	**64.1**	1
01-May-02 21:30:00	6.6	**109**	**ESE**	**63.3**	1
01-May-02 21:35:00	6.1	**110**	**ESE**	**62.7**	1
01-May-02 21:40:00	6.3	**112**	**ESE**	**62.6**	1
01-May-02 21:45:00	7.1	**115**	**ESE**	**62.5**	1
01-May-02 21:50:00	8.7	**118**	**ESE**	**62.4**	1
01-May-02 21:55:00	9.5	**116**	**ESE**	**62.6**	1
01-May-02 22:00:00	8.7	**120**	**ESE**	**62.6**	1
01-May-02 22:05:00	8.1	**138**	**ESE**	**62.6**	1
01-May-02 22:10:00	8.3	**148**	**SE**	**63.2**	1
01-May-02 22:15:00	8.9	**152**	**SSE**	**63.5**	1
01-May-02 22:20:00	9.7	**162**	**SSE**	**63.5**	1
01-May-02 22:25:00	10.7	**166**	**SSE**	**63.9**	1
01-May-02 22:30:00	12.4	**167**	**SSE**	**63.8**	1
01-May-02 22:35:00	13.8	**170**	**SSE**	**63.5**	1
01-May-02 22:40:00	13.8	**172**	**S**	**63.3**	1
01-May-02 22:45:00	13.9	**174**	**S**	**62.9**	1
01-May-02 22:50:00	13.3	**175**	**S**	**62.4**	1
01-May-02 22:55:00	11.6	**178**	**S**	**62.0**	1
01-May-02 23:00:00	12.8	**183**	**S**	**61.9**	1
01-May-02 23:05:00	13.8	**184**	**S**	**61.8**	1
01-May-02 23:10:00	15.3	**184**	**S**	**61.5**	1
01-May-02 23:15:00	17.3	**184**	**S**	**61.2**	1
01-May-02 23:20:00	18.9	**185**	**S**	**61.1**	1
01-May-02 23:25:00	19.9	**188**	**S**	**61.1**	1
01-May-02 23:30:00	20.1	**189**	**S**	**61.1**	1
01-May-02 23:35:00	18.7	**196**	**S**	**61.0**	1
01-May-02 23:40:00	17.3	**206**	**SSW**	**61.0**	1
01-May-02 23:45:00	15.8	**213**	**SSW**	**60.7**	1
01-May-02 23:50:00	12.7	**220**	**SW**	**60.0**	1
01-May-02 23:55:00	12.4	**217**	**SW**	**59.5**	1
02-May-02 00:00:00	14.0	**210**	**SW**	**59.4**	1
02-May-02 00:05:00	13.6	**202**	**SSW**	**59.5**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 00:10:00	11.9	**194**	**SSW**	**59.3**	1
02-May-02 00:15:00	11.4	**193**	**S**	**59.0**	1
02-May-02 00:20:00	13.1	**196**	**SSW**	**58.9**	1
02-May-02 00:25:00	13.3	**199**	**SSW**	**58.7**	1
02-May-02 00:30:00	14.3	**201**	**SSW**	**58.6**	1
02-May-02 00:35:00	17.9	**200**	**SSW**	**58.4**	1
02-May-02 00:40:00	20.4	**198**	**SSW**	**58.3**	1
02-May-02 00:45:00	21.2	**197**	**SSW**	**58.0**	1
02-May-02 00:50:00	21.8	**199**	**SSW**	**57.6**	1
02-May-02 00:55:00	21.8	**202**	**SSW**	**57.2**	1
02-May-02 01:00:00	22.4	**204**	**SSW**	**56.8**	1
02-May-02 01:05:00	24.2	**203**	**SSW**	**56.5**	1
02-May-02 01:10:00	26.0	**202**	**SSW**	**56.4**	1
02-May-02 01:15:00	25.9	**201**	**SSW**	**56.3**	1
02-May-02 01:20:00	25.7	**199**	**SSW**	**56.1**	1
02-May-02 01:25:00	25.4	**199**	**SSW**	**56.0**	1
02-May-02 01:30:00	25.4	**199**	**SSW**	**55.8**	1
02-May-02 01:35:00	24.2	**198**	**SSW**	**55.6**	1
02-May-02 01:40:00	23.9	**197**	**SSW**	**55.5**	1
02-May-02 01:45:00	24.0	**197**	**SSW**	**55.3**	1
02-May-02 01:50:00	22.4	**196**	**SSW**	**55.2**	1
02-May-02 01:55:00	22.5	**196**	**SSW**	**55.1**	1
02-May-02 02:00:00	21.2	**196**	**SSW**	**55.0**	1
02-May-02 02:05:00	19.0	**195**	**SSW**	**54.9**	1
02-May-02 02:10:00	19.0	**195**	**SSW**	**54.8**	1
02-May-02 02:15:00	19.0	**195**	**SSW**	**54.7**	1
02-May-02 02:20:00	19.0	**191**	**SSW**	**54.8**	1
02-May-02 02:25:00	18.7	**190**	**S**	**54.8**	1
02-May-02 02:30:00	18.8	**194**	**S**	**55.0**	1
02-May-02 02:35:00	20.0	**193**	**SSW**	**55.2**	1
02-May-02 02:40:00	19.8	**189**	**S**	**55.2**	1
02-May-02 02:45:00	19.8	**189**	**S**	**55.1**	1
02-May-02 02:50:00	20.1	**190**	**S**	**55.0**	1
02-May-02 02:55:00	20.2	**189**	**S**	**54.8**	1
02-May-02 03:00:00	20.5	**186**	**S**	**54.8**	1
02-May-02 03:05:00	21.1	**185**	**S**	**54.8**	1
02-May-02 03:10:00	21.8	**184**	**S**	**54.8**	1
02-May-02 03:15:00	21.0	**185**	**S**	**54.8**	1
02-May-02 03:20:00	20.8	**186**	**S**	**54.8**	1
02-May-02 03:25:00	21.0	**187**	**S**	**54.8**	1
02-May-02 03:30:00	21.2	**187**	**S**	**54.8**	1
02-May-02 03:35:00	20.9	**186**	**S**	**54.8**	1
02-May-02 03:40:00	21.4	**187**	**S**	**54.8**	1
02-May-02 03:45:00	22.0	**186**	**S**	**54.8**	1
02-May-02 03:50:00	21.7	**187**	**S**	**54.8**	1
02-May-02 03:55:00	21.3	**188**	**S**	**54.8**	1
02-May-02 04:00:00	21.3	**189**	**S**	**54.8**	1
02-May-02 04:05:00	21.2	**188**	**S**	**54.8**	1
02-May-02 04:10:00	21.3	**187**	**S**	**54.8**	1
02-May-02 04:15:00	21.6	**188**	**S**	**54.8**	1
02-May-02 04:20:00	21.8	**188**	**S**	**54.8**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 04:25:00	21.2	**190**	**S**	**54.8**	1
02-May-02 04:30:00	20.6	**192**	**SSW**	**54.7**	1
02-May-02 04:35:00	20.5	**196**	**SSW**	**54.7**	1
02-May-02 04:40:00	19.8	**199**	**SSW**	**54.7**	1
02-May-02 04:45:00	22.2	**201**	**SSW**	**54.7**	1
02-May-02 04:50:00	26.2	**203**	**SSW**	**54.7**	1
02-May-02 04:55:00	26.3	**201**	**SSW**	**54.7**	1
02-May-02 05:00:00	24.5	**197**	**SSW**	**54.7**	1
02-May-02 05:05:00	24.2	**198**	**SSW**	**54.7**	1
02-May-02 05:10:00	24.9	**200**	**SSW**	**54.7**	1
02-May-02 05:15:00	26.0	**201**	**SSW**	**54.6**	1
02-May-02 05:20:00	27.7	**201**	**SSW**	**54.6**	1
02-May-02 05:25:00	28.0	**201**	**SSW**	**54.6**	1
02-May-02 05:30:00	27.4	**201**	**SSW**	**54.6**	1
02-May-02 05:35:00	25.8	**201**	**SSW**	**54.6**	1
02-May-02 05:40:00	25.1	**201**	**SSW**	**54.6**	2
02-May-02 05:45:00	24.7	**201**	**SSW**	**54.7**	4
02-May-02 05:50:00	24.7	**203**	**SSW**	**54.7**	7
02-May-02 05:55:00	24.9	**203**	**SSW**	**54.7**	11
02-May-02 06:00:00	25.1	**202**	**SSW**	**54.7**	18
02-May-02 06:05:00	24.8	**201**	**SSW**	**54.7**	26
02-May-02 06:10:00	26.3	**202**	**SSW**	**54.7**	35
02-May-02 06:15:00	26.3	**203**	**SSW**	**54.8**	45
02-May-02 06:20:00	25.4	**203**	**SSW**	**54.9**	57
02-May-02 06:25:00	25.8	**203**	**SSW**	**54.9**	70
02-May-02 06:30:00	25.9	**203**	**SSW**	**55.0**	82
02-May-02 06:35:00	25.7	**203**	**SSW**	**55.2**	96
02-May-02 06:40:00	25.2	**203**	**SSW**	**55.3**	110
02-May-02 06:45:00	25.0	**203**	**SSW**	**55.4**	125
02-May-02 06:50:00	24.4	**202**	**SSW**	**55.4**	140
02-May-02 06:55:00	24.6	**202**	**SSW**	**55.4**	155
02-May-02 07:00:00	24.5	**202**	**SSW**	**55.4**	169
02-May-02 07:05:00	24.4	**203**	**SSW**	**55.4**	185
02-May-02 07:10:00	24.4	**202**	**SSW**	**55.5**	201
02-May-02 07:15:00	23.7	**203**	**SSW**	**55.5**	213
02-May-02 07:20:00	24.8	**202**	**SSW**	**55.7**	223
02-May-02 07:25:00	23.8	**203**	**SSW**	**55.9**	240
02-May-02 07:30:00	22.5	**204**	**SSW**	**56.1**	258
02-May-02 07:35:00	23.1	**204**	**SSW**	**56.2**	272
02-May-02 07:40:00	24.0	**204**	**SSW**	**56.3**	285
02-may-02 07:45:00	23.7	**204**	**SSW**	**56.4**	300
02-May-02 07:50:00	23.0	**203**	**SSW**	**56.7**	317
02-May-02 07:55:00	23.5	**203**	**SSW**	**56.9**	333
02-May-02 08:00:00	23.5	**203**	**SSW**	**57.1**	348
02-May-02 08:05:00	24.1	**203**	**SSW**	**57.4**	364
02-May-02 08:10:00	24.0	**204**	**SSW**	**57.8**	379
02-May-02 08:15:00	23.9	**206**	**SSW**	**58.2**	395
02-May-02 08:20:00	24.3	**208**	**SSW**	**58.6**	409
02-May-02 08:25:00	26.4	**211**	**SSW**	**59.1**	424
02-May-02 08:30:00	27.0	**210**	**SSW**	**59.3**	440
02-May-02 08:35:00	28.3	**210**	**SSW**	**59.5**	458

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 08:40:00	30.3	**211**	**SSW**	**59.6**	474
02-May-02 08:45:00	30.0	**212**	**SSW**	**59.8**	490
02-May-02 08:50:00	29.0	**210**	**SSW**	**59.9**	505
02-May-02 08:55:00	28.1	**206**	**SSW**	**60.1**	518
02-May-02 09:00:00	27.3	**205**	**SSW**	**60.3**	532
02-May-02 09:05:00	26.7	**206**	**SSW**	**60.6**	546
02-May-02 09:10:00	26.9	**209**	**SSW**	**61.0**	556
02-May-02 09:15:00	26.9	**209**	**SSW**	**61.5**	561
02-May-02 09:20:00	26.4	**210**	**SSW**	**62.0**	557
02-May-02 09:25:00	26.3	**210**	**SSW**	**62.2**	554
02-May-02 09:30:00	24.3	**209**	**SSW**	**62.4**	576
02-May-02 09:35:00	24.5	**208**	**SSW**	**62.6**	607
02-May-02 09:40:00	24.9	**209**	**SSW**	**62.9**	629
02-May-02 09:45:00	25.1	**210**	**SSW**	**63.2**	645
02-May-02 09:50:00	26.2	**210**	**SSW**	**63.6**	631
02-May-02 09:55:00	25.9	**212**	**SSW**	**63.7**	592
02-May-02 10:00:00	26.0	**214**	**SSW**	**63.7**	587
02-May-02 10:05:00	27.9	**217**	**SW**	**63.8**	618
02-May-02 10:10:00	28.0	**221**	**SW**	**63.8**	662
02-May-02 10:15:00	27.3	**220**	**SW**	**63.9**	691
02-May-02 10:20:00	27.2	**219**	**SW**	**64.1**	704
02-May-02 10:25:00	27.9	**219**	**SW**	**64.4**	714
02-May-02 10:30:00	27.3	**218**	**SW**	**64.5**	717
02-May-02 10:35:00	26.2	**213**	**SW**	**64.7**	724
02-May-02 10:40:00	26.0	**213**	**SSW**	**64.9**	735
02-May-02 10:45:00	27.0	**215**	**SW**	**65.3**	743
02-May-02 10:50:00	27.5	**216**	**SW**	**65.6**	759
02-May-02 10:55:00	27.1	**219**	**SW**	**65.8**	775
02-May-02 11:00:00	26.0	**220**	**SW**	**65.9**	783
02-May-02 11:05:00	24.7	**217**	**SW**	**65.8**	792
02-May-02 11:10:00	24.7	**214**	**SW**	**66.0**	804
02-May-02 11:15:00	25.8	**213**	**SW**	**66.4**	813
02-May-02 11:20:00	25.7	**212**	**SSW**	**66.6**	820
02-May-02 11:25:00	24.7	**210**	**SSW**	**66.8**	826
02-May-02 11:30:00	23.4	**209**	**SSW**	**67.1**	835
02-May-02 11:35:00	22.3	**208**	**SSW**	**67.3**	841
02-May-02 11:40:00	24.1	**207**	**SSW**	**67.5**	839
02-May-02 11:45:00	25.7	**211**	**SSW**	**67.8**	840
02-May-02 11:50:00	24.1	**215**	**SSW**	**67.9**	813
02-May-02 11:55:00	23.8	**216**	**SW**	**67.9**	800
02-May-02 12:00:00	24.0	**216**	**SW**	**68.0**	835
02-May-02 12:05:00	23.5	**218**	**SW**	**68.1**	858
02-May-02 12:10:00	23.0	**220**	**SW**	**68.3**	864
02-May-02 12:15:00	22.4	**223**	**SW**	**68.4**	869
02-May-02 12:20:00	22.6	**224**	**SW**	**68.7**	875
02-May-02 12:25:00	22.6	**225**	**SW**	**69.0**	875
02-May-02 12:30:00	23.2	**224**	**SW**	**69.3**	876
02-May-02 12:35:00	23.5	**220**	**SW**	**69.5**	876
02-May-02 12:40:00	23.6	**217**	**SW**	**69.7**	870
02-May-02 12:45:00	23.9	**214**	**SW**	**69.9**	869
02-May-02 12:50:00	24.4	**212**	**SSW**	**70.1**	878

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 12:55:00	24.8	**212**	**SSW**	**70.3**	858
02-May-02 13:00:00	25.0	**214**	**SSW**	**70.4**	834
02-May-02 13:05:00	25.1	**213**	**SW**	**70.4**	796
02-May-02 13:10:00	25.2	**209**	**SSW**	**70.3**	797
02-May-02 13:15:00	25.1	**209**	**SSW**	**70.5**	843
02-May-02 13:20:00	25.1	**209**	**SSW**	**70.7**	885
02-May-02 13:25:00	24.9	**210**	**SSW**	**70.9**	816
02-May-02 13:30:00	24.2	**212**	**SSW**	**70.6**	729
02-May-02 13:35:00	24.8	**216**	**SSW**	**70.4**	655
02-May-02 13:40:00	25.4	**219**	**SW**	**70.3**	657
02-May-02 13:45:00	25.7	**222**	**SW**	**70.2**	634
02-May-02 13:50:00	25.9	**219**	**SW**	**70.1**	580
02-May-02 13:55:00	25.5	**216**	**SW**	**69.8**	597
02-May-02 14:00:00	26.5	**215**	**SW**	**70.1**	731
02-May-02 14:05:00	26.8	**214**	**SW**	**70.6**	801
02-May-02 14:10:00	25.4	**213**	**SW**	**70.8**	801
02-May-02 14:15:00	24.5	**212**	**SSW**	**70.9**	810
02-May-02 14:20:00	25.0	**216**	**SSW**	**71.3**	801
02-May-02 14:25:00	25.4	**223**	**SW**	**71.8**	793
02-May-02 14:30:00	25.8	**225**	**SW**	**72.1**	797
02-May-02 14:35:00	25.4	**226**	**SW**	**72.2**	790
02-May-02 14:40:00	25.6	**224**	**SW**	**72.3**	780
02-May-02 14:45:00	25.5	**224**	**SW**	**72.3**	770
02-May-02 14:50:00	25.8	**223**	**SW**	**72.3**	760
02-May-02 14:55:00	26.1	**223**	**SW**	**72.3**	750
02-May-02 15:00:00	25.6	**223**	**SW**	**72.3**	737
02-May-02 15:05:00	25.1	**222**	**SW**	**72.1**	726
02-May-02 15:10:00	23.9	**223**	**SW**	**71.8**	718
02-May-02 15:15:00	23.8	**226**	**SW**	**71.9**	705
02-May-02 15:20:00	24.5	**228**	**SW**	**72.2**	696
02-May-02 15:25:00	24.7	**230**	**SW**	**72.4**	685
02-May-02 15:30:00	25.4	**232**	**SW**	**72.4**	680
02-May-02 15:35:00	26.3	**231**	**SW**	**72.6**	676
02-May-02 15:40:00	27.5	**227**	**SW**	**72.5**	667
02-May-02 15:45:00	28.8	**226**	**SW**	**72.4**	652
02-May-02 15:50:00	29.9	**226**	**SW**	**72.2**	615
02-May-02 15:55:00	28.6	**227**	**SW**	**72.0**	605
02-May-02 16:00:00	28.9	**225**	**SW**	**71.8**	604
02-May-02 16:05:00	30.2	**228**	**SW**	**71.7**	593
02-May-02 16:10:00	28.4	**228**	**SW**	**71.5**	580
02-May-02 16:15:00	28.4	**227**	**SW**	**71.3**	576
02-May-02 16:20:00	29.9	**227**	**SW**	**71.0**	564
02-May-02 16:25:00	28.6	**228**	**SW**	**70.7**	538
02-May-02 16:30:00	26.9	**229**	**SW**	**70.5**	526
02-May-02 16:35:00	26.9	**230**	**SW**	**70.4**	513
02-May-02 16:40:00	28.4	**231**	**SW**	**70.2**	499
02-May-02 16:45:00	29.4	**233**	**SW**	**70.1**	487
02-May-02 16:50:00	28.8	**232**	**SW**	**69.9**	470
02-May-02 16:55:00	28.9	**229**	**SW**	**69.6**	372
02-May-02 17:00:00	29.7	**228**	**SW**	**69.1**	347
02-May-02 17:05:00	29.7	**230**	**SW**	**68.9**	366

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 17:10:00	29.7	**230**	**SW**	**68.9**	362
02-May-02 17:15:00	30.2	**230**	**SW**	**68.8**	371
02-May-02 17:20:00	28.7	**232**	**SW**	**68.7**	363
02-May-02 17:25:00	29.5	**237**	**SW**	**68.7**	341
02-May-02 17:30:00	30.3	**238**	**WSW**	**68.5**	332
02-May-02 17:35:00	29.2	**233**	**WSW**	**68.5**	331
02-May-02 17:40:00	28.9	**227**	**SW**	**68.4**	322
02-May-02 17:45:00	25.9	**226**	**SW**	**68.0**	310
02-May-02 17:50:00	25.6	**226**	**SW**	**67.7**	307
02-May-02 17:55:00	26.9	**226**	**SW**	**67.4**	293
02-May-02 18:00:00	26.9	**229**	**SW**	**67.2**	271
02-May-02 18:05:00	27.1	**229**	**SW**	**66.9**	249
02-May-02 18:10:00	26.9	**229**	**SW**	**67.0**	233
02-May-02 18:15:00	26.8	**230**	**SW**	**67.0**	220
02-May-02 18:20:00	27.8	**231**	**SW**	**66.9**	205
02-May-02 18:25:00	27.0	**233**	**SW**	**66.7**	186
02-May-02 18:30:00	25.7	**236**	**SW**	**66.4**	163
02-May-02 18:35:00	25.6	**237**	**WSW**	**66.1**	137
02-May-02 18:40:00	27.2	**236**	**WSW**	**65.6**	111
02-May-02 18:45:00	27.7	**237**	**SW**	**65.0**	94
02-May-02 18:50:00	28.8	**237**	**WSW**	**64.4**	93
02-May-02 18:55:00	29.8	**238**	**WSW**	**63.8**	89
02-May-02 19:00:00	30.5	**240**	**WSW**	**63.4**	87
02-May-02 19:05:00	30.1	**240**	**WSW**	**63.0**	81
02-May-02 19:10:00	29.4	**238**	**WSW**	**62.7**	62
02-May-02 19:15:00	28.3	**236**	**WSW**	**62.3**	45
02-May-02 19:20:00	27.0	**236**	**SW**	**62.0**	36
02-May-02 19:25:00	27.0	**238**	**WSW**	**61.5**	31
02-May-02 19:30:00	28.7	**242**	**WSW**	**61.1**	25
02-May-02 19:35:00	28.2	**242**	**WSW**	**60.8**	18
02-May-02 19:40:00	26.5	**239**	**WSW**	**60.4**	13
02-May-02 19:45:00	25.5	**237**	**WSW**	**60.0**	9
02-May-02 19:50:00	25.6	**236**	**SW**	**59.6**	7
02-May-02 19:55:00	25.2	**234**	**SW**	**59.3**	5
02-May-02 20:00:00	25.4	**232**	**SW**	**59.0**	3
02-May-02 20:05:00	25.2	**235**	**SW**	**58.7**	2
02-May-02 20:10:00	25.0	**234**	**WSW**	**58.4**	1
02-May-02 20:15:00	23.9	**233**	**SW**	**58.1**	1
02-May-02 20:20:00	24.9	**237**	**SW**	**57.8**	1
02-May-02 20:25:00	24.7	**238**	**WSW**	**57.6**	1
02-May-02 20:30:00	23.0	**236**	**WSW**	**57.3**	1
02-May-02 20:35:00	21.7	**234**	**SW**	**56.9**	1
02-May-02 20:40:00	21.0	**234**	**SW**	**56.6**	1
02-May-02 20:45:00	20.5	**236**	**SW**	**56.3**	1
02-May-02 20:50:00	20.1	**235**	**WSW**	**56.2**	1
02-May-02 20:55:00	19.3	**224**	**SW**	**55.9**	1
02-May-02 21:00:00	20.1	**211**	**SW**	**55.6**	1
02-May-02 21:05:00	20.8	**203**	**SSW**	**55.2**	1
02-May-02 21:10:00	21.7	**201**	**SSW**	**55.1**	1
02-May-02 21:15:00	22.4	**201**	**SSW**	**55.0**	1
02-May-02 21:20:00	22.7	**201**	**SSW**	**54.9**	1

Time Day-month-year Hour : min. : sec.	Speed MPH	Wind Dir. Degrees	Wind Dir. Compass	Temp Deg. F	Solar Radiation
02-May-02 21:25:00	22.6	**202**	**SSW**	**54.8**	1
02-May-02 21:30:00	22.5	**205**	**SSW**	**54.7**	1
02-May-02 21:35:00	21.4	**207**	**SSW**	**54.6**	1
02-May-02 21:40:00	18.8	**209**	**SSW**	**54.4**	1
02-May-02 21:45:00	17.7	**215**	**SSW**	**54.2**	1
02-May-02 21:50:00	19.0	**225**	**SW**	**54.0**	1
02-May-02 21:55:00	21.1	**230**	**SW**	**54.2**	1
02-May-02 22:00:00	20.9	**229**	**SW**	**54.3**	1
02-May-02 22:05:00	17.9	**226**	**SW**	**54.1**	1
02-May-02 22:10:00	16.8	**225**	**SW**	**53.7**	1
02-May-02 22:15:00	17.8	**226**	**SW**	**53.6**	1
02-May-02 22:20:00	18.6	**229**	**SW**	**53.6**	1
02-May-02 22:25:00	17.6	**231**	**SW**	**53.6**	1
02-May-02 22:30:00	16.9	**233**	**SW**	**53.5**	1
02-May-02 22:35:00	16.7	**231**	**SW**	**53.4**	1
02-May-02 22:40:00	17.0	**232**	**SW**	**53.3**	1
02-May-02 22:45:00	17.1	**234**	**SW**	**53.1**	1
02-May-02 22:50:00	17.4	**236**	**SW**	**53.0**	1
02-May-02 22:55:00	17.2	**234**	**SW**	**52.9**	1
02-May-02 23:00:00	17.1	**230**	**SW**	**52.8**	1
02-May-02 23:05:00	16.6	**224**	**SW**	**52.6**	1
02-May-02 23:10:00	15.7	**216**	**SW**	**52.4**	1
02-May-02 23:15:00	14.9	**210**	**SSW**	**52.1**	1
02-May-02 23:20:00	13.8	**209**	**SSW**	**52.1**	1
02-May-02 23:25:00	13.2	**205**	**SSW**	**52.3**	1
02-May-02 23:30:00	12.4	**201**	**SSW**	**52.4**	1
02-May-02 23:35:00	11.1	**201**	**SSW**	**52.5**	1
02-May-02 23:40:00	9.7	**205**	**SSW**	**52.3**	1
02-May-02 23:45:00	11.9	**215**	**SSW**	**51.9**	1
02-May-02 23:50:00	15.2	**224**	**SW**	**51.9**	1
02-May-02 23:55:00	17.4	**227**	**SW**	**51.9**	1
03-May-02 00:00:00	18.5	**226**	**SW**	**51.9**	1

Meteorological Data
Natural Event Due to High Winds
June 5, 2000, Wallula, Washington

Prepared by:

Washington State Department of Ecology
Air Quality Program

October 2004

Contents

Summary

This report provides and analyzes meteorological information associated with the elevated PM_{10} concentration of 90 $\mu g/m^3$ measured at Wallula on June 5, 2000. The information establishes a basis for reasonably attributing the elevated concentration to a natural event due to high winds. While the 90 $\mu g/m^3$ measured at Wallula is not over the PM_{10} standard of 150 $\mu g/m^3$, the designation of this data point as a natural event means that it does not need to be considered in determining the attainment status of the Wallula PM_{10} nonattainment area. The June 5, 2000 PM_{10} concentration is therefore not used for the demonstration of maintenance of the PM_{10} standard in the maintenance plan for the Wallula nonattainment area.

Overview

Under the U. S. Environmental Protection Agency's (EPA's) Natural Events Policy, PM_{10} concentrations attributable to windblown dust are not considered in determining the attainment status of an area. Ecology has focused its identification of natural events on PM_{10} concentrations that exceed the PM_{10} concentration of 150 $\mu g/m^3$ though there have been some exceptions where lower concentrations were considered.

During the preparation of the redesignation request and maintenance plan for the Wallula PM_{10} nonattainment area, the 90 $\mu g/m^3$ measured at Wallula on June 5, 2000 was a candidate for the air quality analysis demonstrating continued maintenance of the PM_{10} standard. Review of the meteorological data associated with this data point led to the finding that it could reasonably be considered a natural event.

This analysis of the meteorological data was prepared to document this finding. Since the data point occurred in 2000 and would not be considered in any future assessments of maintenance, full natural events documentation was not prepared.

Evaluation of the June 5, 2000 Concentration at Wallula, Washington

1. PM_{10} Monitoring

1.1. Wallula PM_{10} Monitoring: The high-volume FRM monitor located at Wallula, Washington measured a filter-based PM_{10} concentration 90 $\mu g/m^3$ on June 5, 2002. The monitor was situated in the approximate geographic center of the Wallula PM_{10} nonattainment area (see Appendix A) and used to determine the attainment status of the area. The Wallula monitor operated on a 1-in-6-day schedule.

The June 5, 2000 concentration of 90 $\mu g/m^3$ was much higher than any other concentration measured to that date in 2000. The next highest concentration was 42 $\mu g/m^3$ measured on April

12, 2000. The five PM_{10} concentrations measured in May 2000 varied from 11 to 30 $\mu g/m^3$. The last measurement before June 5 was 18 $\mu g/m^3$ on May 30, 2000. Wallula PM_{10} data for the year 2002 are found in Appendix B.

2. Meteorological Data

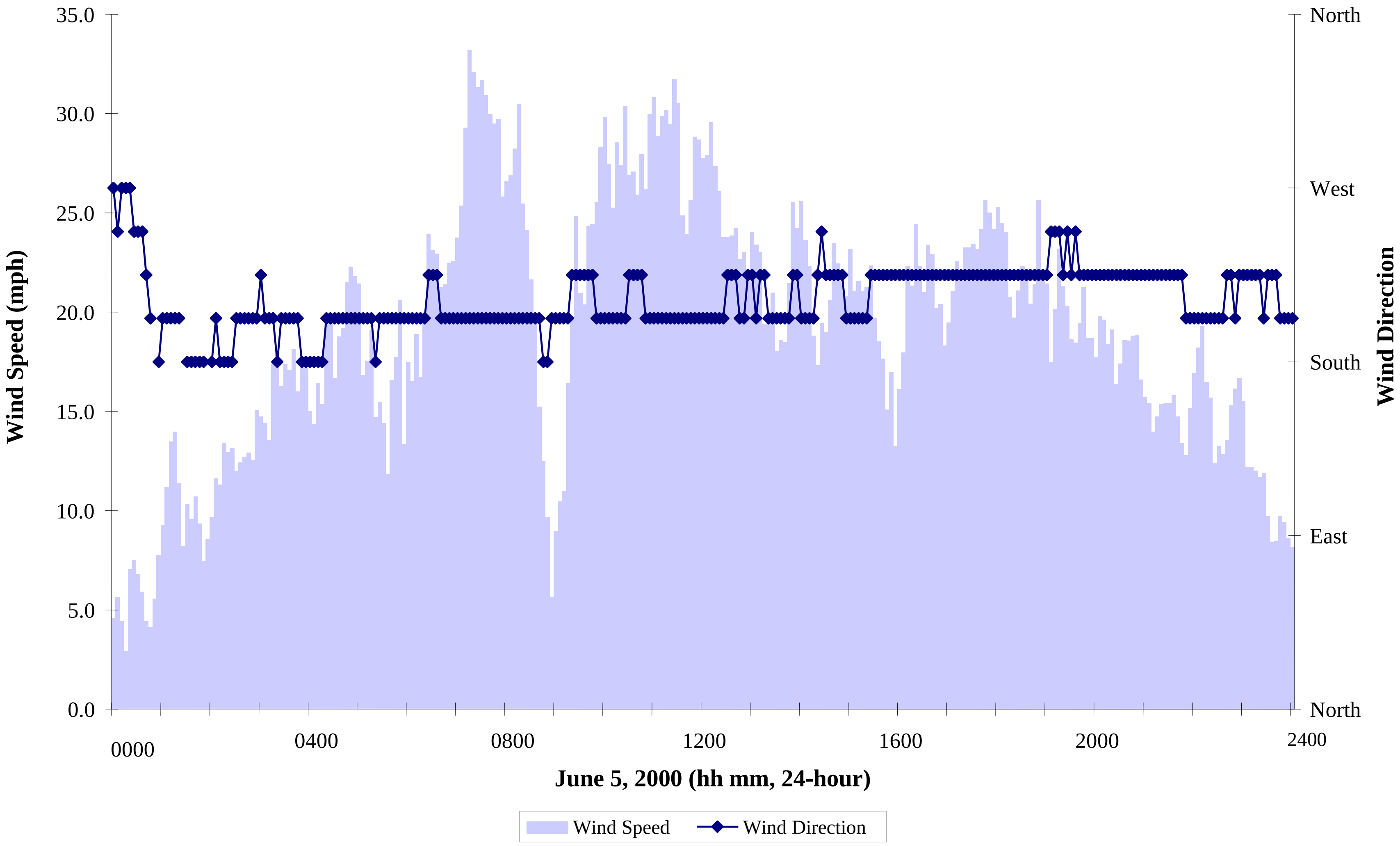
2.1. Wallula Meteorological Data: Data from a meteorological station collocated with the Wallula PM_{10} monitor show that winds easily exceeded Ecology's definition for a high wind event. The meteorological station is operated by Boise Paper Solutions—Wallula Mill. Ecology wishes to thank Boise for sharing the data from the station with Ecology.

Ecology's definition requires winds of 18 mph or more for a two-hour period. Hourly wind observations extracted from the complete record of measurements every 5 minutes show winds exceeded 18 mph from 5 to 8 a.m., 10 a.m. to 3 p.m. and 5 to 7 p.m. on June 5, 2002 (Table 1 and Figure 1). Winds were generally from the south-southwest and southwest during these periods. The complete set of wind record for June 5, 2000 is shown in Figure 1 and found in Appendix C.

Table 1. Hourly Wind Observations for Wallula, Washington, June 5, 2000

Time (Day-Month-Year Hour:Minute:Second)	**Speed (MPH)**	**Wind Direction**
05-June-2000 00:00:00	4.6	W
05-June-2000 01:00:00	9.3	SSW
05-June-2000 02:00:00	9.7	S
05-June-2000 03:00:00	14.7	SW
05-June-2000 04:00:00	15.0	S
05-June-2000 05:00:00	21.4	SSW
05-June-2000 06:00:00	17.5	SSW
05-June-2000 07:00:00	23.8	SSW
05-June-2000 08:00:00	26.6	SSW
05-June-2000 09:00:00	8.9	SSW
05-June-2000 10:00:00	29.8	SSW
05-June-2000 11:00:00	30.8	SSW
05-June-2000 12:00:00	27.8	SSW
05-June-2000 13:00:00	24.0	SW
05-June-2000 14:00:00	25.6	SSW
05-June-2000 15:00:00	23.2	SSW
05-June-2000 16:00:00	16.1	SW
05-June-2000 17:00:00	19.5	SW
05-June-2000 18:00:00	25.3	SW
05-June-2000 19:00:00	21.4	SW
05-June-2000 20:00:00	17.7	SW
05-June-2000 21:00:00	15.7	SW
05-June-2000 22:00:00	16.9	SSW
05-June-2000 23:00:00	15.5	SW
06-June-2000 00:00:00	8.1	SSW

Figure 1. Wind Speed and Wind Direction, June 5, 2000, Wallula, Washington



Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

2.3. Precipitation Prior to June 5, 2000: Data from Washington State University's (WSU's) Public Agricultural Weather System (PAWS) network show that overall, conditions in south-central Washington were wetter, often much wetter, than normal in May 2000 (Table 2). These wetter than normal conditions probably played a part in the low PM_{10} levels measured at Wallula in May 2000.

Table 2. Comparison of Average May Precipitation with May 2000 Precipitation

STATION	AVERAGE MAY PRECIPITATION (in.)	MAY 2002 PRECIPITATION (in.)	PERCENT OF AVERAGE
CBC - Pasco	0.5	0.55	110%
Kennewick	0.8	0.63	79%
R. Eby	0.9	1.62	180%
Touchet	0.8	0.95	119%
College Place	1.3	2.36	182%
Walla Walla	2.2	4.03	183%

With one exception, conditions were dry at reviewed meteorological sites during the 72-hours prior to the high winds of June 5, 2000 (Table 3). The exception was Walla Walla, which received 0.16 inches of rainfall in this period. The other sites had no precipitation 4-to-5 days before the natural event. All of the meteorological sites are lie within 30 miles of Wallula. A map showing the location of the sites is found in Appendix A.

Table 3. Precipitation Prior to a Natural Event Due to High Winds, June 5, 2000

STATION	PRECIPITATION 72 hrs. prior to June 5, 2000		DAYS prior to June 5, 2000 with no precipitation
	INCHES	DATE	
CBC - Pasco	0.0	n/a	5
Kennewick	0.0	n/a	5
R. Eby	0.0	n/a	5
Touchet	0.0	n/a	5
College Place	0.0	n/a	4
Walla Walla	0.16 (0.6/0.2/0.8)	June 2/3/4, 2000	0

Findings

The meteorological data from Boise's meteorological station collocated with the Wallula FRM PM_{10} monitor show that May 2, 2002 was characterized by windy conditions. Winds generally from the south-southwest and southwest exceeded 18 mph from 5 to 8 a.m., 10 a.m. to 3 p.m. and 5 to 7 p.m. on June 5, 2002. Ecology's definition for a high wind event only requires winds of 18 mph or more for a two-hour period.

Even though conditions in south-central Washington were wetter, often much wetter, than normal in May 2000, only one site, Walla Walla, had measured precipitation in the 72 hours preceding the elevated PM_{10} concentration measured at Wallula on June 5, 2000. While Walla Walla lies almost 30 miles to the east of Wallula, winds measured at Wallula on June 5 were from the south-southwest and southwest. The other meteorological sites experienced rainfall 4-to-5 days before the natural event.

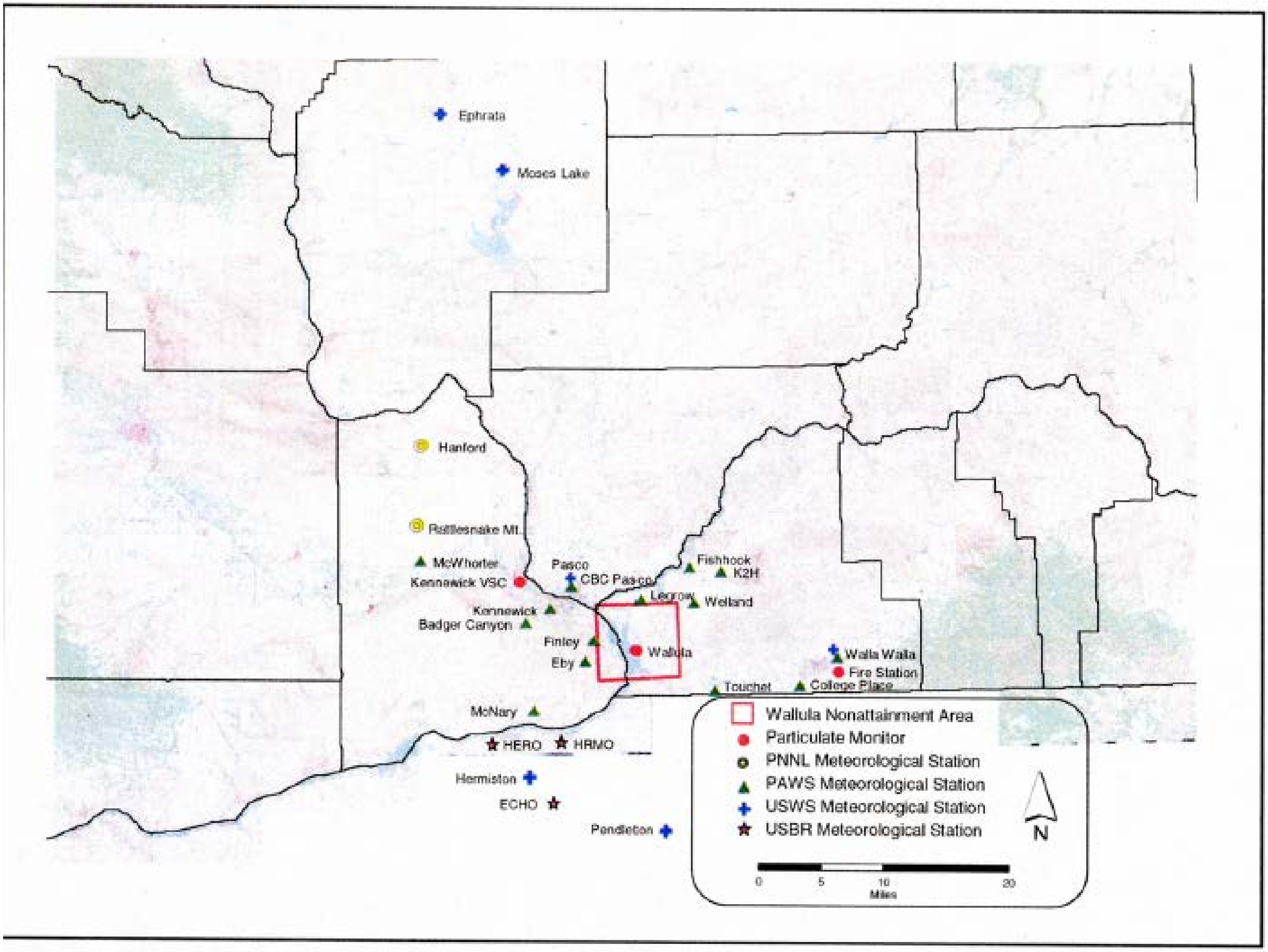
The monitored PM_{10} concentration of 90 $\mu g/m^3$ at Wallula, Washington on June 5, 2000 is reasonably attributed to a natural event due to high winds. The dry weather directly preceding the natural event of June 5, 2000 and the high winds on the day of the event combined to produce the elevated PM_{10} concentration.

Appendix A

Locations of PM_{10} Monitoring Sites and Meteorological Stations

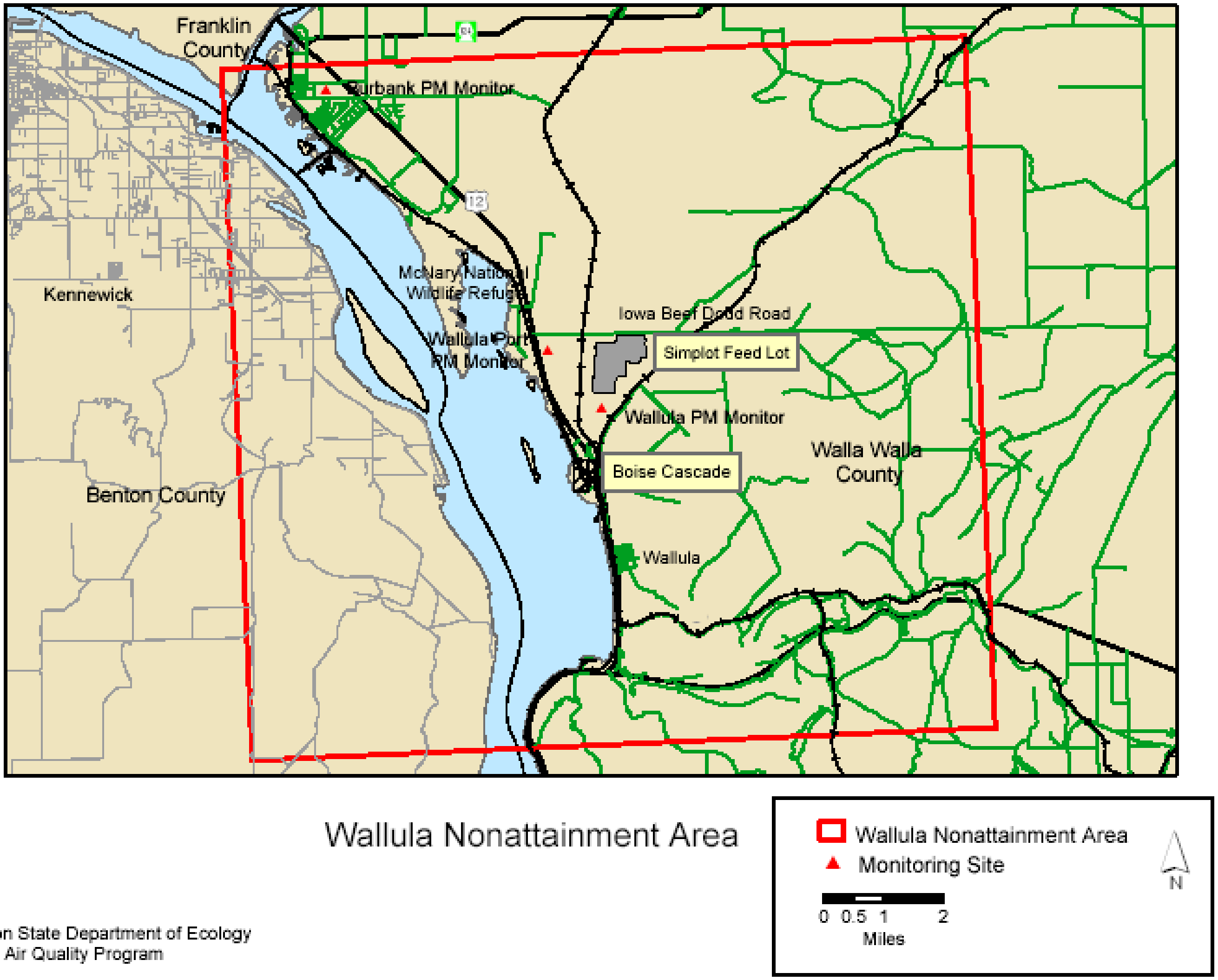
- Map of Particulate Matter (PM_{10}) monitoring sites and meteorological stations in Benton Franklin and Walla Walla counties, Washington and adjoining Oregon, 2002
- Map of the Wallula PM_{10} Nonattainment Area

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington



Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington



Wallula Nonattainment Area

Washington State Department of Ecology
Air Quality Program

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

Appendix B

2000 PM_{10} Monitoring Data
Wallula, Washington

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 4, 2004

(81102) PM10 Total 0-10um STP

SITE ID: 53-071-1001 POC: 2		CAS NUMBER:
COUNTY: (071) WALLA WALLA	STATE: (53) WASHINGTON	LATITUDE: 46.130702
CITY:(00000) NOT IN A CITY	AQCR: (230) SOUTH CENTRAL WASHINGTON	LONGITUDE: -118.914162
SITE ADDRESS: NEDROW FARM / WALLULA JUNCTION	URBANIZED AREA:0000) NOT IN AN URBAN AREA	UTM ZONE: 11
SITE COMMENTS: PM10 AND SLAMS TSP SITE ESTAB. 2/28/86	LAND USE: AGRICULTURAL	UTM NORTHING: 5110147
MONITOR COMMENTS: MODEL: HI-VOL SA1200	LOCATION SETTING: RURAL	UTM EASTING: 352128
		ELEVATION-MSL: 0
		PROBE HEIGHT: 4

SUPPORT AGENCY: (1136) WASHINGTON STATE DEPARTMENT OF ECOLOGY
MONITOR TYPE: SLAMS — REPORT FOR: 2000 — DURATION: 24 HOURS
COLLECTION AND ANALYSIS METHOD: (063) HI-VOL SA/GMW-1200 GRAVIMETRIC — UNITS: UG/CU METER (25 C)
REPORTING ORG: (1136) WASHINGTON STATE DEPARTMENT OF ECOLOGY — MIN DETECTABLE: 4

	MONTH											
Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	2		16									
2											20	20
3									6	16		
4								66				
5						90	22					
6		20		37	11							
7	7		14									
8											12	
9									14	43		
10								215 A				
11						8	36					
12		5		42	26							
13	5		19									
14											21	
15									27	17		
16								99				
17						100	61					
18		15		23	22							
19	10		6									
20											31	17
21									16	8		
22								53				
23						49	75					
24				29	30							
25	11	9	22									
26											22	7
27									49	20		
28												
29						126	30	42				
30				22	18							
31	15		28									
NO.:	6	4	6	5	5	5	5	5	5	5	5	3
MAX:	15.	20.	28.	42.	30.	126.	75.	215.	49.	43.	31.	20.

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

MEAN:	8.3	12.3	17.5	30.6	21.4	74.6	44.8	95.0	22.4	20.8	21.2	14.7

ANNUAL OBSERVATIONS: 59 ANNUAL MEAN: 32.2 ANNUAL MAX: 215.

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the regi

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT
QUALIFIER CODES:

Oct. 4, 2004

Qualifier Code	Qualifier Description	Qualifier Type
A	HIGH WINDS	NAT

Note: Qualifier codes with regional concurrence are shown in upper case,
and those without regional concurrence are shown in lower case.

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

Appendix C

June 4-5, 2000 Meteorological Data Wallula, Washington

Courtesy of Boise Paper Solutions—Wallula Mill

Natural Event Meteorological Data
June 5, 2000, Wallula, Washington

Year	Month Day	Time HHMM 24 HR	Speed MPH	Wind Dir.	Temp Deg. F
2000	June 4	2200	**8.7**	**NW**	**74.2**
2000	June 4	2205	**8.7**	**NW**	**73.7**
2000	June 4	2210	**6.4**	**NW**	**73.3**
2000	June 4	2215	**7. 0**	**NW**	**73.7**
2000	June 4	2220	**6.5**	**NNW**	**73.1**
2000	June 4	2225	**4.9**	**NNW**	**72.9**
2000	June 4	2230	**2.5**	**N**	**72.0**
2000	June 4	2235	**1.5**	**WNW**	**72.0**
2000	June 4	2240	**3.2**	**WNW**	**72.4**
2000	June 4	2245	**4.4**	**NW**	**72.4**
2000	June 4	2250	**3.0**	**NW**	**72.6**
2000	June 4	2255	**0.9**	**NW**	**72.2**
2000	June 4	2300	**0.8**	**SSW**	**71.0**
2000	June 4	2305	**4.1**	**2000**	**70.2**
2000	June 4	2310	**4.7**	**SW**	**70.2**
2000	June 4	2315	**5.5**	**WSW**	**72.2**
2000	June 4	2320	**4.5**	**WSW**	**73.1**
2000	June 4	2325	**4.6**	**WSW**	**73.3**
2000	June 4	2330	**2.8**	**W**	**73.7**
2000	June 4	2335	**2.1**	**SW**	**72.6**
2000	June 4	2340	**6.2**	**WSW**	**72.8**
2000	June 4	2345	**5.7**	**WSW**	**74. 0**
2000	June 4	2350	**5.4**	**WSW**	**73.8**
2000	June 4	2355	**5.1**	**W**	**73.8**
2000	June 5	0000	**4.6**	**W**	**74.4**
2000	June 5	0005	**5.7**	**WSW**	**74.4**
2000	June 5	0010	**4.4**	**W**	**74.6**
2000	June 5	0015	**2.9**	**W**	**74.6**
2000	June 5	0020	**7.0**	**W**	**74.7**
2000	June 5	0025	**7.5**	**WSW**	**74.6**
2000	June 5	0030	**6.8**	**WSW**	**74.7**
2000	June 5	0035	**5.9**	**WSW**	**74.7**
2000	June 5	0040	**4.4**	**SW**	**74.6**
2000	June 5	0045	**4.1**	**SSW**	**74. 0**
2000	June 5	0050	**5.6**	**0**	**71.9**
2000	June 5	0055	**7.8**	**S**	**70.4**
2000	June 5	0100	**9.3**	**SSW**	**71. 0**
2000	June 5	0105	**11.2**	**SSW**	**71.5**
2000	June 5	0110	**13.5**	**SSW**	**71.3**
2000	June 5	0115	**14.0**	**SSW**	**70.8**
2000	June 5	0120	**11.4**	**SSW**	**69.7**
2000	June 5	0125	**8.2**	**0**	**69.5**
2000	June 5	0130	**10.3**	**S**	**68.6**
2000	June 5	0135	**9.6**	**S**	**67.7**
2000	June 5	0140	**10.7**	**S**	**67.5**
2000	June 5	0145	**9.4**	**S**	**68.1**

2000	June 5	0150	**7.4**	**S**	**68.4**
2000	June 5	0155	**8.6**	**0**	**68.6**
2000	June 5	0200	**9.7**	**S**	**68.1**
2000	June 5	0205	**11.6**	**SSW**	**69.3**
2000	June 5	0210	**11.3**	**S**	**70.1**
2000	June 5	0215	**13.4**	**S**	**69.3**
2000	June 5	0220	**13.0**	**S**	**69. 0**
2000	June 5	0225	**13.2**	**S**	**68.8**
2000	June 5	0230	**12.0**	**SSW**	**68.8**
2000	June 5	0235	**12.4**	**SSW**	**69. 0**
2000	June 5	0240	**12.7**	**SSW**	**69.5**
2000	June 5	0245	**12.9**	**SSW**	**70.2**
2000	June 5	0250	**12.5**	**SSW**	**70.2**
2000	June 5	0255	**15.1**	**SSW**	**70.1**
2000	June 5	0300	**14.7**	**SW**	**70.2**
2000	June 5	0305	**14.4**	**SSW**	**69.9**
2000	June 5	0310	**13.6**	**SSW**	**69.5**
2000	June 5	0315	**17.4**	**SSW**	**70.1**
2000	June 5	0320	**17.9**	**S**	**69.9**
2000	June 5	0325	**16.3**	**SSW**	**69.9**
2000	June 5	0330	**17.4**	**SSW**	**70.1**
2000	June 5	0335	**17.1**	**SSW**	**70.1**
2000	June 5	0340	**18.1**	**SSW**	**69.7**
2000	June 5	0345	**16.0**	**SSW**	**69.9**
2000	June 5	0350	**17.4**	**S**	**69.5**
2000	June 5	0355	**17.4**	**S**	**69.5**
2000	June 5	0400	**15.0**	**S**	**69.5**
2000	June 5	0405	**14.4**	**0**	**69.5**
2000	June 5	0410	**16.4**	**S**	**69.5**
2000	June 5	0415	**15.4**	**S**	**69.5**
2000	June 5	0420	**20.0**	**SSW**	**69.5**
2000	June 5	0425	**19.8**	**SSW**	**69.5**
2000	June 5	0430	**16.7**	**SSW**	**69.3**
2000	June 5	0435	**18.8**	**SSW**	**69. 0**
2000	June 5	0440	**19.2**	**SSW**	**69.3**
2000	June 5	0445	**21.5**	**SSW**	**69.5**
2000	June 5	0450	**22.3**	**SSW**	**69.7**
2000	June 5	0455	**21.8**	**SSW**	**70.1**
2000	June 5	0500	**21.4**	**SSW**	**70.1**
2000	June 5	0505	**16.8**	**SSW**	**69.7**
2000	June 5	0510	**17.6**	**SSW**	**69.5**
2000	June 5	0515	**19.1**	**SSW**	**69.9**
2000	June 5	0520	**14.7**	**S**	**70.1**
2000	June 5	0525	**15.5**	**SSW**	**69.7**
2000	June 5	0530	**14.4**	**SSW**	**70.2**
2000	June 5	0535	**11.8**	**SSW**	**70.2**
2000	June 5	0540	**16.6**	**SSW**	**70.4**
2000	June 5	0545	**17.7**	**SSW**	**70.2**
2000	June 5	0550	**20.6**	**SSW**	**70.2**
2000	June 5	0555	**13.3**	**SSW**	**70.4**

2000	June 5	0600	**17.5**	**SSW**	**70.2**
2000	June 5	0605	**16.5**	**SSW**	**70.1**
2000	June 5	0610	**18.9**	**SSW**	**69.7**
2000	June 5	0615	**16.7**	**SSW**	**69.3**
2000	June 5	0620	**19.5**	**SSW**	**69.2**
2000	June 5	0625	**23.9**	**SW**	**69.3**
2000	June 5	0630	**23.1**	**SW**	**69.5**
2000	June 5	0635	**23.0**	**SW**	**69.5**
2000	June 5	0640	**21.3**	**SSW**	**69.3**
2000	June 5	0645	**21.4**	**SSW**	**69.2**
2000	June 5	0650	**22.5**	**SSW**	**69.0**
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2000	June 5	0700	**23.8**	**SSW**	**68.8**
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2000	June 5	0715	**33.2**	**SSW**	**69.0**
2000	June 5	0720	**32.1**	**SSW**	**69.5**
2000	June 5	0725	**31.3**	**SSW**	**69.9**
2000	June 5	0730	**31.7**	**SSW**	**70.2**
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2000	June 5	0740	**30.0**	**SSW**	**69.3**
2000	June 5	0745	**29.5**	**SSW**	**69.3**
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2000	June 5	0755	**25.8**	**SSW**	**69.5**
2000	June 5	0800	**26.6**	**SSW**	**69.9**
2000	June 5	0805	**26.9**	**SSW**	**69.5**
2000	June 5	0810	**28.2**	**SSW**	**69.7**
2000	June 5	0815	**30.5**	**SSW**	**70.1**
2000	June 5	0820	**25.5**	**SSW**	**70.6**
2000	June 5	0825	**24.1**	**SSW**	**71.0**
2000	June 5	0830	**21.7**	**SSW**	**71.1**
2000	June 5	0835	**19.8**	**SSW**	**71.7**
2000	June 5	0840	**15.2**	**SSW**	**72.2**
2000	June 5	0845	**12.5**	**S**	**72.2**
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2000	June 5	0855	**5.7**	**SSW**	**72.6**
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2000	June 5	0905	**10.5**	**SSW**	**74.4**
2000	June 5	0910	**11.0**	**SSW**	**74.6**
2000	June 5	0915	**16.4**	**SSW**	**75.1**
2000	June 5	0920	**19.7**	**SW**	**74.7**
2000	June 5	0925	**24.9**	**SW**	**74.0**
2000	June 5	0930	**21.0**	**SW**	**73.1**
2000	June 5	0935	**20.4**	**SW**	**72.4**
2000	June 5	0940	**24.3**	**SW**	**72.2**
2000	June 5	0945	**24.4**	**SW**	**72.2**
2000	June 5	0950	**25.5**	**SSW**	**72.2**
2000	June 5	0955	**28.3**	**SSW**	**72.2**
2000	June 5	1000	**29.8**	**SSW**	**72.4**
2000	June 5	1005	**27.5**	**SSW**	**72.9**

2000	June 5	1010	**25.3**	**SSW**	**73.1**
2000	June 5	1015	**28.5**	**SSW**	**73.8**
2000	June 5	1020	**27.4**	**SSW**	**74.7**
2000	June 5	1025	**30.4**	**SSW**	**75.5**
2000	June 5	1030	**26.9**	**SW**	**76.4**
2000	June 5	1035	**27.1**	**SW**	**76.2**
2000	June 5	1040	**25.9**	**SW**	**75.1**
2000	June 5	1045	**28.0**	**SW**	**74.2**
2000	June 5	1050	**26.2**	**SSW**	**73.7**
2000	June 5	1055	**30.0**	**SSW**	**73.5**
2000	June 5	1100	**30.8**	**SSW**	**73.7**
2000	June 5	1105	**28.9**	**SSW**	**73.7**
2000	June 5	1110	**29.9**	**SSW**	**73.7**
2000	June 5	1115	**30.2**	**SSW**	**73.1**
2000	June 5	1120	**29.5**	**SSW**	**72.8**
2000	June 5	1125	**31.8**	**SSW**	**72.6**
2000	June 5	1130	**30.5**	**SSW**	**72.6**
2000	June 5	1135	**24.9**	**SSW**	**72.4**
2000	June 5	1140	**23.9**	**SSW**	**71.9**
2000	June 5	1145	**25.7**	**SSW**	**72.8**
2000	June 5	1150	**28.8**	**SSW**	**72.4**
2000	June 5	1155	**28.7**	**SSW**	**72.6**
2000	June 5	1200	**27.8**	**SSW**	**72.2**
2000	June 5	1205	**27.9**	**SSW**	**72.4**
2000	June 5	1210	**29.6**	**SSW**	**72.6**
2000	June 5	1215	**27.4**	**SSW**	**73.5**
2000	June 5	1220	**26.1**	**SSW**	**73.5**
2000	June 5	1225	**23.8**	**SSW**	**74.4**
2000	June 5	1230	**23.8**	**SW**	**76.0**
2000	June 5	1235	**23.9**	**SW**	**78.0**
2000	June 5	1240	**24.3**	**SW**	**78.0**
2000	June 5	1245	**22.7**	**SSW**	**78.2**
2000	June 5	1250	**23.0**	**SSW**	**78.5**
2000	June 5	1255	**21.8**	**SW**	**78.5**
2000	June 5	1300	**24.0**	**SW**	**78.2**
2000	June 5	1305	**23.4**	**SSW**	**78.0**
2000	June 5	1310	**23.0**	**SW**	**78.0**
2000	June 5	1315	**19.4**	**SW**	**78.0**
2000	June 5	1320	**19.9**	**SSW**	**78.0**
2000	June 5	1325	**21.0**	**SSW**	**78.2**
2000	June 5	1330	**18.0**	**SSW**	**78.2**
2000	June 5	1335	**18.6**	**SSW**	**77.8**
2000	June 5	1340	**18.5**	**SSW**	**77.4**
2000	June 5	1345	**21.5**	**SSW**	**77.8**
2000	June 5	1350	**25.5**	**SW**	**78.7**
2000	June 5	1355	**24.3**	**SW**	**78.9**
2000	June 5	1400	**25.6**	**SSW**	**78.9**
2000	June 5	1405	**23.6**	**SSW**	**78.2**
2000	June 5	1410	**22.3**	**SSW**	**78.0**
2000	June 5	1415	**18.8**	**SSW**	**79.1**

2000	June 5	1420	**17.3**	**SW**	**80.1**
2000	June 5	1425	**19.5**	**WSW**	**81.2**
2000	June 5	1430	**19.0**	**SW**	**80.3**
2000	June 5	1435	**20.6**	**SW**	**79.2**
2000	June 5	1440	**23.5**	**SW**	**78.7**
2000	June 5	1445	**22.5**	**SW**	**78.7**
2000	June 5	1450	**21.6**	**SW**	**78.7**
2000	June 5	1455	**20.8**	**SSW**	**78.7**
2000	June 5	1500	**23.2**	**SSW**	**78.2**
2000	June 5	1505	**21.1**	**SSW**	**77.8**
2000	June 5	1510	**21.6**	**SSW**	**78.0**
2000	June 5	1515	**21.1**	**SSW**	**78.0**
2000	June 5	1520	**21.3**	**SSW**	**77.6**
2000	June 5	1525	**22.3**	**SW**	**77.8**
2000	June 5	1530	**19.7**	**SW**	**77.4**
2000	June 5	1535	**18.5**	**SW**	**78.5**
2000	June 5	1540	**17.7**	**SW**	**80.0**
2000	June 5	1545	**15.1**	**SW**	**80.7**
2000	June 5	1550	**17.0**	**SW**	**80.3**
2000	June 5	1555	**13.3**	**SW**	**80.1**
2000	June 5	1600	**16.1**	**SW**	**80.1**
2000	June 5	1605	**18.0**	**SW**	**79.8**
2000	June 5	1610	**22.3**	**SW**	**79.2**
2000	June 5	1615	**21.3**	**SW**	**78.7**
2000	June 5	1620	**24.4**	**SW**	**78.2**
2000	June 5	1625	**22.3**	**SW**	**78.2**
2000	June 5	1630	**21.0**	**SW**	**78.0**
2000	June 5	1635	**23.4**	**SW**	**77.6**
2000	June 5	1640	**22.9**	**SW**	**77.3**
2000	June 5	1645	**20.2**	**SW**	**77.4**
2000	June 5	1650	**20.4**	**SW**	**77.1**
2000	June 5	1655	**18.3**	**SW**	**76.5**
2000	June 5	1700	**19.5**	**SW**	**76.4**
2000	June 5	1705	**21.1**	**SW**	**76.7**
2000	June 5	1710	**22.6**	**SW**	**77.3**
2000	June 5	1715	**22.0**	**SW**	**77.3**
2000	June 5	1720	**23.3**	**SW**	**77.3**
2000	June 5	1725	**23.3**	**SW**	**76.9**
2000	June 5	1730	**23.4**	**SW**	**76.4**
2000	June 5	1735	**23.2**	**SW**	**76.2**
2000	June 5	1740	**24.2**	**SW**	**75.8**
2000	June 5	1745	**25.7**	**SW**	**75.8**
2000	June 5	1750	**25.0**	**SW**	**75.8**
2000	June 5	1755	**24.2**	**SW**	**75.1**
2000	June 5	1800	**25.3**	**SW**	**75.1**
2000	June 5	1805	**24.5**	**SW**	**74.7**
2000	June 5	1810	**24.0**	**SW**	**74.4**
2000	June 5	1815	**20.8**	**SW**	**74.0**
2000	June 5	1820	**19.7**	**SW**	**73.5**
2000	June 5	1825	**21.1**	**SW**	**72.9**

2000	June 5	1830	**22.3**	**SW**	**72.9**
2000	June 5	1835	**21.9**	**SW**	**72.6**
2000	June 5	1840	**20.4**	**SW**	**72.4**
2000	June 5	1845	**21.4**	**SW**	**72.2**
2000	June 5	1850	**25.6**	**SW**	**72.4**
2000	June 5	1855	**21.7**	**SW**	**72.2**
2000	June 5	1900	**21.4**	**SW**	**71.7**
2000	June 5	1905	**17.5**	**WSW**	**71.5**
2000	June 5	1910	**20.2**	**WSW**	**71.1**
2000	June 5	1915	**23.2**	**WSW**	**71.0**
2000	June 5	1920	**21.3**	**SW**	**71.0**
2000	June 5	1925	**20.3**	**WSW**	**71.0**
2000	June 5	1930	**18.7**	**SW**	**70.8**
2000	June 5	1935	**18.5**	**WSW**	**70.2**
2000	June 5	1940	**19.4**	**SW**	**70.2**
2000	June 5	1945	**21.3**	**SW**	**70.2**
2000	June 5	1950	**18.7**	**SW**	**70.1**
2000	June 5	1955	**18.7**	**SW**	**69.7**
2000	June 5	2000	**17.7**	**SW**	**69.5**
2000	June 5	2005	**19.8**	**SW**	**69.5**
2000	June 5	2010	**19.6**	**SW**	**69.2**
2000	June 5	2015	**18.4**	**SW**	**68.8**
2000	June 5	2020	**19.1**	**SW**	**68.8**
2000	June 5	2025	**16.4**	**SW**	**68.3**
2000	June 5	2030	**17.4**	**SW**	**67.7**
2000	June 5	2035	**18.6**	**SW**	**67.7**
2000	June 5	2040	**18.6**	**SW**	**67.4**
2000	June 5	2045	**18.8**	**SW**	**67.4**
2000	June 5	2050	**18.9**	**SW**	**67.4**
2000	June 5	2055	**16.6**	**SW**	**67.2**
2000	June 5	2100	**15.7**	**SW**	**66.6**
2000	June 5	2105	**15.4**	**SW**	**66.6**
2000	June 5	2110	**14.0**	**SW**	**66.3**
2000	June 5	2115	**14.7**	**SW**	**66.1**
2000	June 5	2120	**15.4**	**SW**	**65.9**
2000	June 5	2125	**15.4**	**SW**	**65.9**
2000	June 5	2130	**15.4**	**SW**	**65.9**
2000	June 5	2135	**15.8**	**SW**	**65.9**
2000	June 5	2140	**14.7**	**SW**	**65.7**
2000	June 5	2145	**13.4**	**SW**	**65.6**
2000	June 5	2150	**12.8**	**SSW**	**65.4**
2000	June 5	2155	**15.2**	**SSW**	**65.2**
2000	June 5	2200	**16.9**	**SSW**	**65.4**
2000	June 5	2205	**18.2**	**SSW**	**65.2**
2000	June 5	2210	**19.3**	**SSW**	**65.2**
2000	June 5	2215	**16.5**	**SSW**	**65.2**
2000	June 5	2220	**15.7**	**SSW**	**64.7**
2000	June 5	2225	**12.4**	**SSW**	**63.9**
2000	June 5	2230	**13.3**	**SSW**	**63.8**
2000	June 5	2235	**12.8**	**SSW**	**63.0**

2000	June 5	2240	**13.5**	**SW**	**62.5**
2000	June 5	2245	**15.3**	**SW**	**62.5**
2000	June 5	2250	**16.2**	**SSW**	**62.3**
2000	June 5	2255	**16.7**	**SW**	**62.1**
2000	June 5	2300	**15.5**	**SW**	**61.8**
2000	June 5	2305	**12.2**	**SW**	**61.4**
2000	June 5	2310	**12.2**	**SW**	**61.1**
2000	June 5	2315	**12.0**	**SW**	**60.5**
2000	June 5	2320	**11.7**	**SW**	**60.2**
2000	June 5	2325	**11.9**	**SSW**	**60.2**
2000	June 5	2330	**9.8**	**SW**	**59.8**
2000	June 5	2335	**8.4**	**SW**	**59.6**
2000	June 5	2340	**8.5**	**SW**	**59.4**
2000	June 5	2345	**9.7**	**SSW**	**59.6**
2000	June 5	2350	**9.4**	**SSW**	**59.4**
2000	June 5	2355	**8.6**	**SSW**	**59.4**
2000	June 6	0000	**8.1**	**SSW**	**59.3**

PM_{10} DISPERSION MODELING ANALYSIS

WALLULA PULP & PAPER MILL

BOISE WHITE PAPER, LLC

Wallula, Washington

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Trinity Consultants

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1. INTRODUCTION

Boise White Paper, LLC (Boise) currently owns and operates a pulp and paper mill located north of Wallula, Washington (Wallula Mill), along Highway 12 in Walla Walla County. The Washington State Department of Ecology (Ecology) and United States Environmental Protection Agency (USEPA) are currently in the regulatory process of transitioning the Wallula area from a PM_{10} non-attainment to an attainment area. In order to support this process, Ecology has requested a dispersion modeling analysis of allowable PM_{10} emissions from the Wallula Mill in order to verify that a PM_{10} National Ambient Air Quality Standards (NAAQS) exceedance (24-hour standard) will not occur if the point sources at the mill were to emit at the maximum allowable levels. This report provides the background information, dispersion modeling methodologies, and results of this analysis.

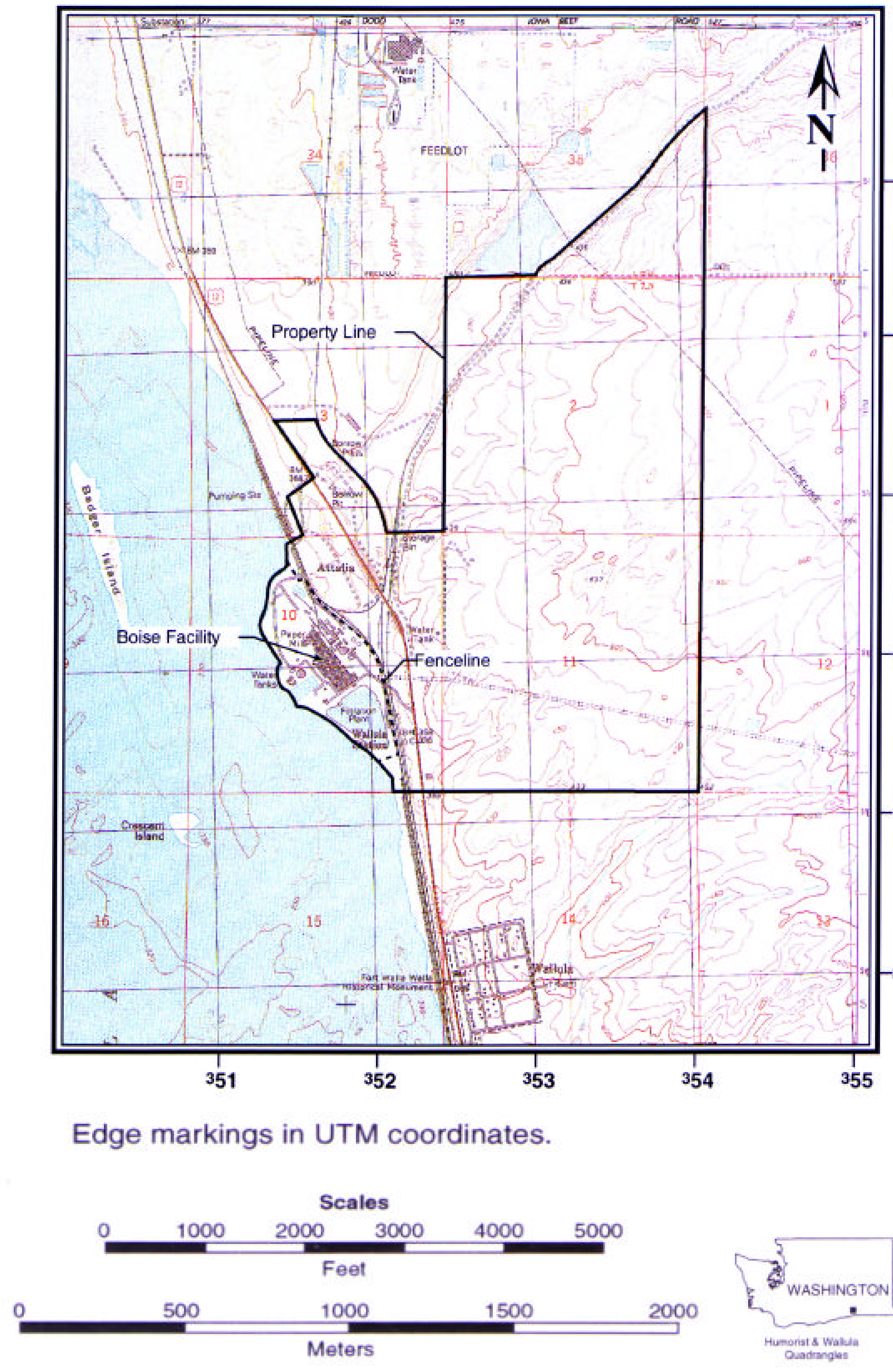
This analysis was based upon a dispersion modeling protocol sent by Mr. Clint Bowman, Ecology, to the USEPA in December 2004, and subsequent correspondences between, Trinity Consultants (Trinity) and Ecology during January 2005.

2. FACILITY DESCRIPTION

The Wallula Mill produces market pulp and fine white paper using a kraft pulping process and corrugating medium using a neutral-sulfite semi-chemical (NSSC) process. The primary air emission sources at the mill include two recovery furnaces, two smelt dissolving tanks, one hog fuel boiler, two power boilers, and a lime kiln. The Wallula Mill is located at Universal Transverse Mercator (UTM) coordinates 5,107,207 Northing and 351,761 Easting.[1] An area map is shown below in Figure 2-1. A topographic map showing the facility location is provided in Figure A-1 of Appendix A.

[1] UTM zone 11, NAD 27

FIGURE 2-1. AREA MAP OF THE WALLULA MILL



2.1 EMISSION SOURCES

Based upon the agreement between Boise and Ecology, only point sources at the Wallula Mill are included in this modeling analysis. The PM_{10} emissions from fugitive and other insignificant sources are not included because the emissions are considered to be insignificant relative to the point sources at the mill (see Section 2.1.2). The location of the PM_{10} point sources at the Wallula Mill in addition to the stack parameters used in the analysis are provided in Tables 2-1 and 2-2 below.

TABLE 2-1. EMISSION SOURCE PARAMETERS IN ENGLISH UNITS

Source	Source ID	UTM East (m)	UTM North (m)	Stack Height [a] (ft)	Stack Temp. [a] (º F)	Exit Velocity [a] (ft/sec)	Stack Diameter [a] (ft)
No. 2 Smelt Dissolving Tank	SRC37	351716.6	5107225	167	145	20.4	3.35
No. 2 Recovery Furnace	SRC38	351735.6	5107258	175	320	27.3	8.92
No. 3 Smelt Dissolving Tank	SRC34	351710.7	5107245	167	143	37.6	5.42
No. 3 Recovery Furnace	SRC30	351699.2	5107243	175	370	45.5	13.00
Lime Kiln	SRC31	351879.7	5107146	88.25[b]	172	27.5	6.00
Hog Fuel Boiler	SRC35	351728.6	5107287	85	138	33.5	7.75
No. 1 Power Boiler	SRC36	351753.3	5107211	117.6	350	36.4	8.00
No. 2 Power Boiler	SRC32	351763.1	5107191	99	230	70.2	5.50

[a] This information obtained from October 1, 2004 and October 7, 2004 e-mails from Ray Lam (Boise) and Rose Marie Blair (formerly Boise) to Chris Drechsel (Trinity) and the 2001 PSD application.

[b] Boise is currently evaluating a higher stack height (108.25 ft) for a separate permit action request; however, the current height is used for this evaluation.

TABLE 2-2. EMISSION SOURCE PARAMETERS IN METRIC UNITS

Source	Source ID	UTM East (m)	UTM North (m)	Stack Height [a] (m)	Stack Temp. [a] (k)	Exit Velocity [a] (m/sec)	Stack Diameter [a] (m)
No. 2 Smelt Dissolving Tank	SRC37	351716.6	5107225	50.9	336	6.21	1.02
No. 2 Recovery Furnace	SRC38	351735.6	5107258	53.3	433	8.32	2.72
No. 3 Smelt Dissolving Tank	SRC34	351710.7	5107245	50.9	335	11.47	1.65
No. 3 Recovery Furnace	SRC30	351699.2	5107243	53.3	461	13.87	3.96
Lime Kiln	SRC31	351879.7	5107146	26.9 [b]	351	8.38	1.83
Hog Fuel Boiler	SRC35	351728.6	5107287	25.9	332	10.21	2.36
No. 1 Power Boiler	SRC36	351753.3	5107211	35.8	450	11.09	2.44
No. 2 Power Boiler	SRC32	351763.1	5107191	30.2	383	21.40	1.68

[a] This information obtained from October 1, 2004 and October 7, 2004 e-mails from Ray Lam and Rose Marie Blair (Boise) to Chris Drechsel (Trinity) and the 2001 PSD application.

[b] Boise is currently evaluating a higher stack height (108.25 ft) for a separate permit action request; however, the current height is used for this evaluation.

2.1.1 POINT SOURCE PM_{10} ALLOWABLE EMISSION RATES

The allowable emission rates of PM_{10} from the Wallula Mill point sources are presented in Table 2-3. These mass emission rates were developed by determining the maximum short-term PM limit (i.e., gr/dscf) currently established for each emission unit and assuming that each source is operating at this limit for an entire 24-hour period. In addition, since most established limits are for PM (versus PM_{10}), the emission rates account for the fact that not all PM emissions are in the form of PM_{10}. These emission rates were developed with the cooperation and approval of Ecology.[2] It is important to note that the mill PM_{10} emissions are typically much less than the allowable levels used in this analysis. Detailed emission calculations can be found in Appendix B.

[2] Ecology approval of point source PM_{10} emission rates gained during January 14, 2005 meeting between Boise and Ecology.

TABLE 2-3. PM_{10} ALLOWABLE EMISSION RATE

Source	Source ID	PM_{10} Emissions (lb/hr)	PM_{10} Emissions (lb/day)
No. 2 Smelt Dissolving Tank	SRC37	2.80	67.13
No. 2 Recovery Furnace	SRC38	12.49	299.76
No. 3 Smelt Dissolving Tank	SRC34	12.68	304.30
No. 3 Recovery Furnace	SRC30	39.68	952.32
Lime Kiln	SRC 31	20.85	500.37
Hog Fuel Boiler	SRC35	12.09	290.24
No. 1 Power Boiler	SRC36	46.50	1,116.07
No. 2 Power Boiler	SRC32	49.63	1,191.16
Total		**196.72**	**4721.35**

2.1.2 FUGITIVE & INSIGNIFICANT EMISSION SOURCES

As discussed above, fugitive and other insignificant emission sources were not included in this modeling analysis given that they are considered insignificant relative to the point sources at the Wallula Mill. Table 2-4 below provides an estimate of the maximum PM emissions from the various process fugitive and other emission sources at the Wallula Mill.

TABLE 2-4. PROCESS FUGITIVE AND INSIGNIFICANT EMISSION SOURCES

Source	PM_{10} Emissions (lb/day)
Hog Fuel Chip Pile [a]	3.13
Kamyr Chip Pile [a]	7.52
M&D Sawdust Pile [a]	3.34
NSSC Pins Pile [a]	2.51
Drop points	0.11
Blowers & Unloading	0.80
Kamyr Cyclone	0.0006
Container Plant Cyclone	0.90
Total	**18.31**

[a] Emissions from these sources are estimated as total PM versus PM_{10}. Therefore, PM_{10} emissions are overestimated.

The total maximum PM_{10} emissions of process fugitive and other insignificant sources at the Wallula Mill is only 0.39% of the allowable point source PM_{10} emissions. Therefore, these emission sources are not included in this modeling analysis. However, in order to account for these additional emissions and as requested by Ecology, the modeled results are scaled upward (see Section 4).

3.1 STANDARDS AND CRITERIA LEVELS

This modeling analysis is performed to determine if the allowable PM_{10} emissions from the Wallula Mill impact attainment of the PM_{10} 24-hour NAAQS. The primary NAAQS are the maximum concentration ceilings, measured in terms of total concentration of a pollutant in the atmosphere, that define the "levels of air quality which the USEPA judges are necessary, with an adequate margin of safety, to protect the public health."[3] Secondary NAAQS define the levels that "protect the public welfare from any known or anticipated adverse effects of a pollutant." The secondary NAAQS for PM_{10} is equivalent to the primary. Results from the modeling analysis combined with the appropriate background concentrations are compared to the NAAQS for PM_{10} (24-hour average). This criteria level is summarized in Table 3-1.

TABLE 3-1. 24-HOUR NAAQS FOR PM_{10}

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)
PM_{10}	24-hr	150 [a]

[a] Not to be exceeded more than once per year as described in WAC 173-470-100.

3.2 MODEL SELECTION

The AERMOD-PRIME version 02222 dispersion model is selected for this analysis. This USEPA non-guideline model is best suited for this analysis since it handles complex terrain effectively and incorporates the PRIME advanced downwash algorithms. A newer version of AERMOD-PRIME (04079) has been released; however, this updated version only impacts the deposition and depletion algorithms within the model. Deposition and depletion is not being accounted for in this modeling analysis. The USEPA has proposed revisions to 40 CFR 51 Appendix W to approve AERMOD-PRIME as a "guideline" model. [4]

3.3 TERRAIN ELEVATION

Terrain elevations for receptors, buildings, and sources are taken from digital elevation models (DEMs) supplied by the United States Geologic Survey (USGS).[5] DEMs provide elevations based on 30 meter (m) grid spacing. Elevations are converted from the DEM grid spacing to the air dispersion model spacing by interpolating from the four DEM elevation values closest to the modeling object

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[3] 40 CFR §50.2(b).

[4] Modeling guideline revisions are proposed in the Federal Register, 65 FR 21506

[5] Obtained at http://edc.usgs.gov/geodata/

point. These data are interpolated using Trinity's *BREEZE SUITE* software. All data obtained from the DEM files are checked for completeness and spot-checked for accuracy.

3.4 METEOROLOGY AND LAND USE

Five years (1995-1999) of meteorological data are used in this modeling analysis. The primary raw data set for this analysis was collected on-site at the Wallula Mill. The following variables were collected (all at 10 meters): wind direction, wind speed, temperature, solar radiation, U vector, V vector, sigma theta, horizontal stability, vertical stability. The on-site observations were supplemented with cloud cover data from the Walla Walla Regional Airport. Missing data was filled in accordance with USEPA guidance (Procedures for Substituting Missing NWS Data for Regulatory Modeling - Atkinson and Lee). Longer periods that could not be filled were left as missing. It is important to note that this meteorological data set was originally developed during the 2001 PSD permitting effort for the mill and with the guidance and cooperation from Ecology. For this modeling analysis, Ecology and Boise agreed that the same data set would be used without the need to reprocess.

Land use in the area of the Wallula Mill has been analyzed using aerial photography and digital land use records to assess the particular land use types surrounding the Wallula Mill.

As shown in the aerial photograph in Figure 3-2, the Wallula Mill is surrounded by cultivated land and by water. The sector percentages and their land use values for albedo, bowen and surface roughness are presented below in Table 3-2.

FIGURE 3-2. LAND USE CHARACTERISTICS

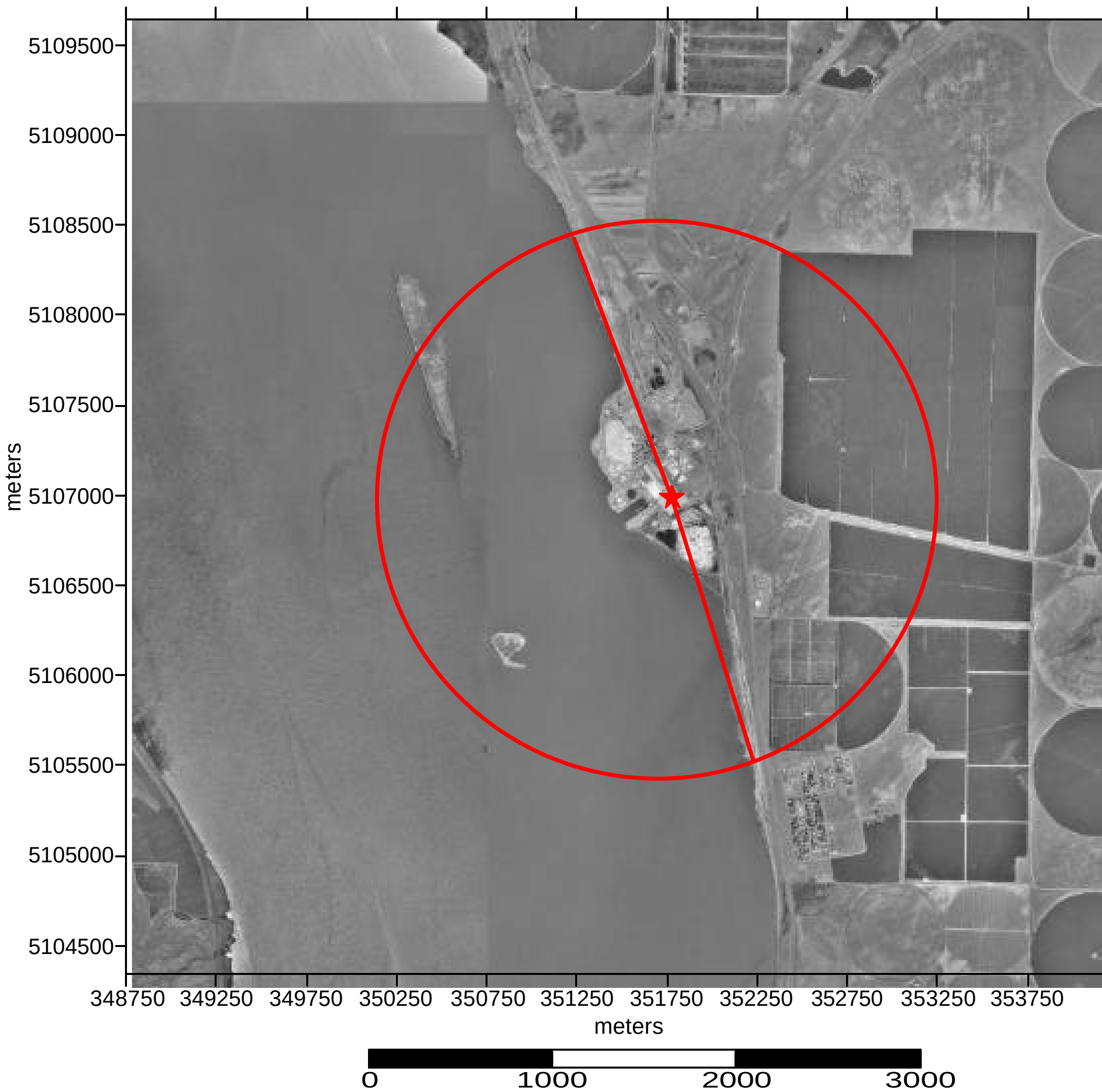


TABLE 3-2. SURFACE CHARACTERISTICS BY LAND USE AND SEASON

Land Use/Sector	Season	Albedo	Bowen Ratio	Surface Roughness (m)
Cultivated Land (330° to 165°)	Spring	0.14	0.3	0.03
	Summer	0.2	0.5	0.2
	Autumn	0.18	0.7	0.05
	Winter	0.6	1.5	0.01
Water (165° to 330°)	Spring	0.12	0.1	0.0001
	Summer	0.1	0.1	0.0001
	Autumn	0.14	0.1	0.0001
	Winter	0.2	1.5	0.0001

3.5 BUILDING DOWNWASH

The emissions units at the Wallula Mill are evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the buildings were absent.

Direction-specific building dimensions and the dominant downwash structure parameters used as input to the dispersion models are determined using the *BREEZE-WAKE/BPIP* software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 95086.[6] BPIP is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents.

The structures shown in Table A-1 of Appendix A are included in the downwash analysis. The location of the buildings relative to the emission sources is shown in Figure A-2 of Appendix A. The location of the emission sources are also presented in Figure A-3.

3.6 RECEPTORS

In this air dispersion modeling analysis, ground-level concentrations are calculated at receptors as defined as follows:

- ▲ A "fine" grid, spaced every 50 m, extending 2,000 m from the property boundary of the facility
- ▲ "Fence-line" discrete receptors, spaced every 50 m along the facility fence-line.

[6] USEPA. *User's Guide to the Building Profile Input Program.* Research Triangle Park, NC. EPA-454/R-93-038.

- Discrete receptors placed along portions Boise's property line and along Highway 12 near the mill.

The fence-line boundary of the Wallula Mill is represented by the fence of the mill and the water line of the Columbia River used in the 2001 PSD analysis for the mill. A discrete receptor is also placed in the location of the PM_{10} monitoring station (UTM coordinates 5,108,587 Northing and 352172 Easting.[7])

These modeling domain covers a region extending from all edges of the Wallula Mill boundary to the point where impacts from the PM_{10} allowable emissions are no longer significant. A contour plot of the PM_{10} modeling results shows that the PM_{10} concentration dissipates significantly before the boundaries of the receptor grid are reached (A contour plot of the modeled results can be found in Appendix C.)

Appendix A contains figures of the receptor locations for the fence-line grid and the fine grid. All provided UTM coordinates are in NAD 27.

3.7 BACKGROUND CONCENTRATION

For compliance with the NAAQS, a background concentration is added to the modeled concentration for PM_{10}. The background PM_{10} concentration was provided by Ecology as agreed upon by Ecology and USEPA Region 10.[8] The background PM_{10} concentration used in this analysis is 52.0 $\mu g/m^3$.[9] The Ecology description of how this background concentration is determined is provided in Appendix E.

[7] UTM zone 11, NAD 27

[8] Per February 24, 2005 email from Clint Bowman, Ecology, to Chris Drechsel, Trinity Consultants.

[9] Per paper written by Clint Bowman, Ecology, entitled: "Background Determination for Wallula, Washington", February 24, 2005 email from Clint Bowman, Ecology, to Chris Drechsel, Trinity Consultants.

4. PM_{10} Dispersion Modeling Results

In this analysis, the maximum allowable emission rate of PM_{10} is modeled for comparison against the 24-hour NAAQS. As this modeling analysis utilizes a complete 5-year appended data set, 5 exceedances are allowed for the period. Therefore, the highest 6th high PM_{10} (24-hour) modeling result for the entire domain is reported below in Table 4-1. The 6th high value at the PM_{10} monitoring station is also presented.

Table 4-1. PM_{10} NAAQS Analysis Results

		Location of Maximum Impact [a]					
File Name	**Day of Maximum impact**	**UTM East (km)**	**UTM North (km)**	**PM_{10} Concentration (mg/m^3)**	**Background PM_{10} Concentration (mg/m^3)**	**Total Calculated PM_{10} Concentration (mg/m^3)**	**NAAQS PM_{10} Standard (mg/m^3**
PMfine.LST	1/27/1999	351787.3	5107388.0	87.93[b]	52.0	139.93	150 [c]
PM_{10} Monitoring Station	9/18/1998	352171.8	5108587.0	28.03[b]	52.0	80.03	150 [c]

[a] UTM Zone 11, NAD 27.
[b] Results shown are sixth-high concentrations.
[c] Not to be exceeded more than once per year as described in WAC 173-470-100.

As shown in Table 4-1, the 24-hour result of modeling the maximum PM_{10} allowable emissions does not exceed the NAAQS of 150 μg/m^3. In addition, in order to account for the process fugitive and other insignificant sources at the mill, these results can be scaled by the ratio of these emissions from these sources and the total modeled point source PM_{10} emission rate (0.39%). This 0.39% increase changes the modeled result by an insignificant amount. A concentration contour plot of the PM_{10} NAAQS results is provided in Figure C-1 of Appendix C. Modeling files can be found in Appendix D.

This dispersion modeling analysis demonstrates that the maximum allowable PM_{10} emissions from the facility will not cause or contribute to a violation of the 24-hour PM_{10} NAAQS.

FIGURE A-1. TOPOGRAPHIC MAP

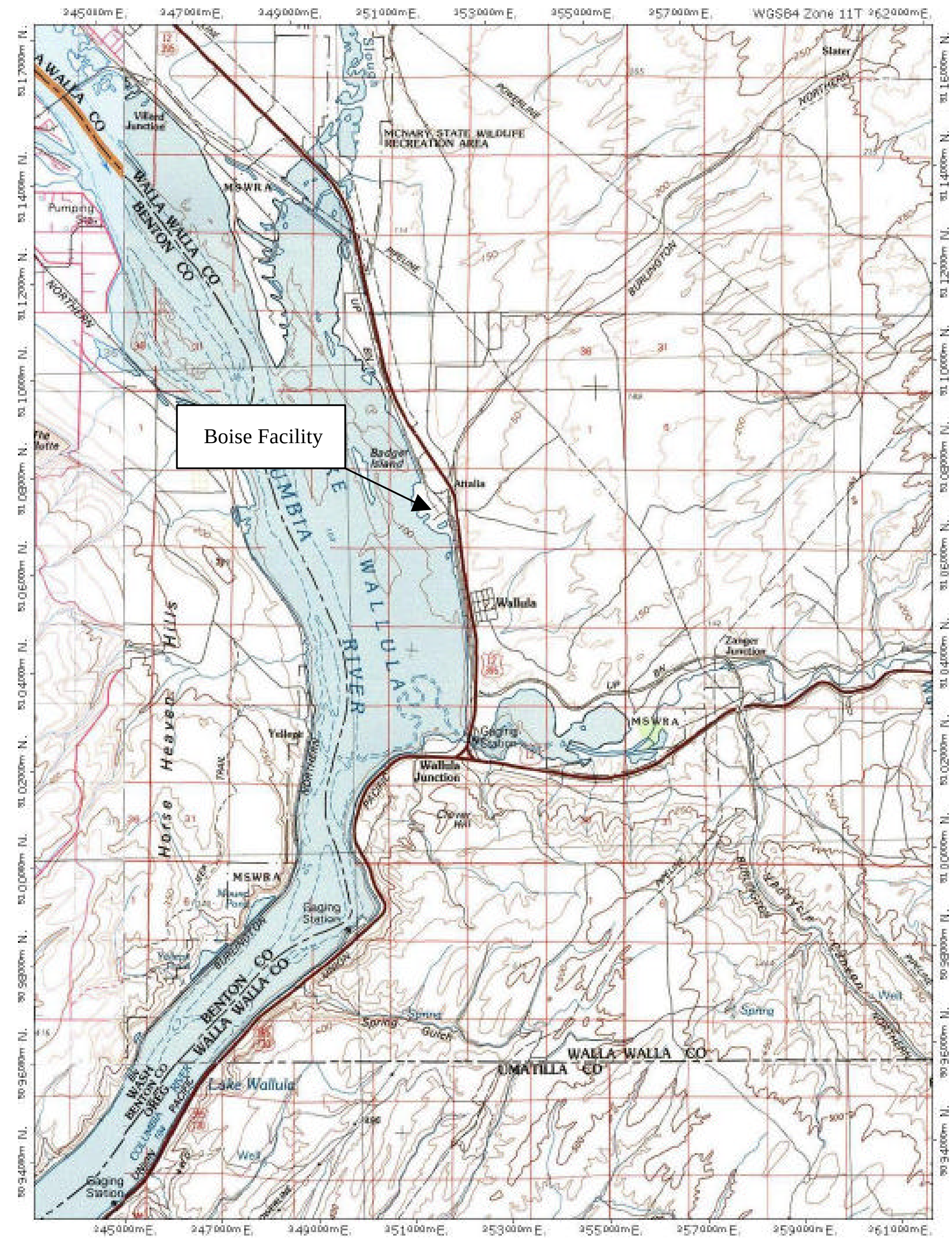


TABLE A-1. MAJOR STRUCTURES AT THE BOISE WALLULA PULP & PAPER MILL [a]

	Description	Model Source ID	UTM (x)	UTM (y)	Elevation[b] (meters)	Height (meters)	Radius (meters)
1	Container Plant	BLDG1	351827	5107007	107	12.5	
2	Roll Paper Warehouse	BLDG2	351769.4	5106964.9	106	10.82	
3	Paper Machine #3	BLDG3	351778.7	5106990.9	106	25.6	
4	Pulp Mill "D"	BLDG4	351690	5107185	106	26.16	
5	Bleach Plant	BLDG5	351640	5107225.7	105	28.65	
6	Strong Black Liquor Shelf	BLDG6	351689.1	5107261	106	10.36	
7	North Precip	BLDG7	351709.7	5107280.6	106	18.59	
8	South Precip	BLDG8	351718	5107269	106	18.59	
9	bhousea	BLDG9a	351766.3	5107190	107	18.9	
10	p&ra	BLDG9b	351750.4	5107211.4	107	31.70999	
11	p&rb	BLDG9c	351742.9	5107235.8	107	31.70999	
12	p&rc	BLDG9d	351747.3	5107229.8	106	33.83999	
13	p&rd	BLDG9e	351732.9	5107238	107	51.21999	
14	p&re	BLDG9f	351739.1	5107241.9	107	64.02001	
15	Demineralization	BLDG10	351785.5	5107171.6	108	10.92	
16	Paint Shop	BLDG11	351817.8	5107163.1	108	7.98	
17	Maintenance Shop	BLDG12	351802	5107147.7	107	9.58001	
18	Personnel Bldg	BLDG13	351872.1	5107063.4	107	8.23	
19	Personnel Bldg 2	BLDG14	351885.1	5107082.2	108	8.23	
20	White Liquor Clarifier	BLD35	351815.9	5107192.9	108	9.75	8.38
21	#2 Lime Mud Washer	BLD36	351802.4	5107209.3	108	9.75	9.14
22	Multipurpose Liquor Clarifier	BLD37	351791.9	5107224.5	108	13.41	8.38
23	Green Liquor Clarifier	BLD38	351781.8	5107239.2	107	9.75	8.38
24	Pink Liquor Bldg	BLDG19	351777.4	5107251.5	107	11.43	
25	Hog Fuel Boiler House	BLDG20	351761.1	5107292.6	108	25.3	
26	Lime Kiln Discharge Bldg	BLDG21	351820.6	5107243.7	108	16.46	

TABLE A-1. MAJOR STRUCTURES AT THE BOISE WALLULA PULP & PAPER MILL[a] (CONTINUED)

	Description	Model Source ID	UTM (x)	UTM (y)	Elevation[b] (meters)	Height (meters)	Radius (meters)
27	Lime Kiln Feed Bldg	BLDG22	351886.1	5107139.7	108	19.7358	
28	CIO2 Bldg	BLDG23	351843.8	5107252.3	108	26.42	
29	Bldg South of Lime Kiln	BLDG24	351913	5107168.3	109	10.97	
30	Bldg SE of Lime Kiln	BLDG25	351905.8	5107136.7	108	9.909999	
31	Clarifier	BLD39	351572.1	5106963.5	105	9.3	28.04
32	Clearwell	BLD40	351498.8	5106931.4	103	7.770001	13.26
33	Tank West of Clearwell	BLD41	351480	5106910.7	104	11.58	9.14
34	Water Treatment Bldg	BLDG29	351526.6	5106919.9	104	9.979999	
35	Caustic Tank	BLD42	351643.4	5106800.7	104	8.929999	10.29
36	Administration Bldg	BLDG31	351702.7	5106777.6	105	6.55	
37	Stock Tank #6	BLD43	351596.3	5107142.6	105	25.3	8.69
38	#10 High Density Storage	BLD44	351619.3	5107151.5	105	25.3	8.69
39	#7 High Density Storage	BLD45	351636.5	5107163.3	106	25.5	8.99
40	#6 High Density Storage	BLD46	351624.8	5107177.6	105	24.08	6.94
41	Stock Tank #4	BLD47	351607.8	5107166.7	105	25.3	8.69
42	Stock Tank #3	BLD48	351594.6	5107184.2	105	25.3	8.69
43	#5 High Density Storage	BLD49	351652	5107165.3	106	16.46	5.42
44	15% Black Liquor Storage	BLD50	351683.5	5107282.5	106	15.24	9.14
45	Pulp Mill "H"	BLDG40	351647	5107200.3	106	30.50999	
46	Pulp Mill "J"	BLDG41	351664.2	5107208.2	105	22.86	
47	Paper Machine #1 & #2	BLDG42	351824	5107025	107	19.13	
48	Electrostatic Precipitator (HFB)	BLDG3	351737.7	5107296.5	107	28.6512	
49	Power Boiler #1	BLDG4	351747	5107298.2	107	28.6512	

[a] Based on Facility Plot Plan

[b] The elevations of the building are determined from DEM data.

FIGURE A-2. MAJOR STRUCTURES AT THE BOISE WALLULA PULP & PAPER MILL

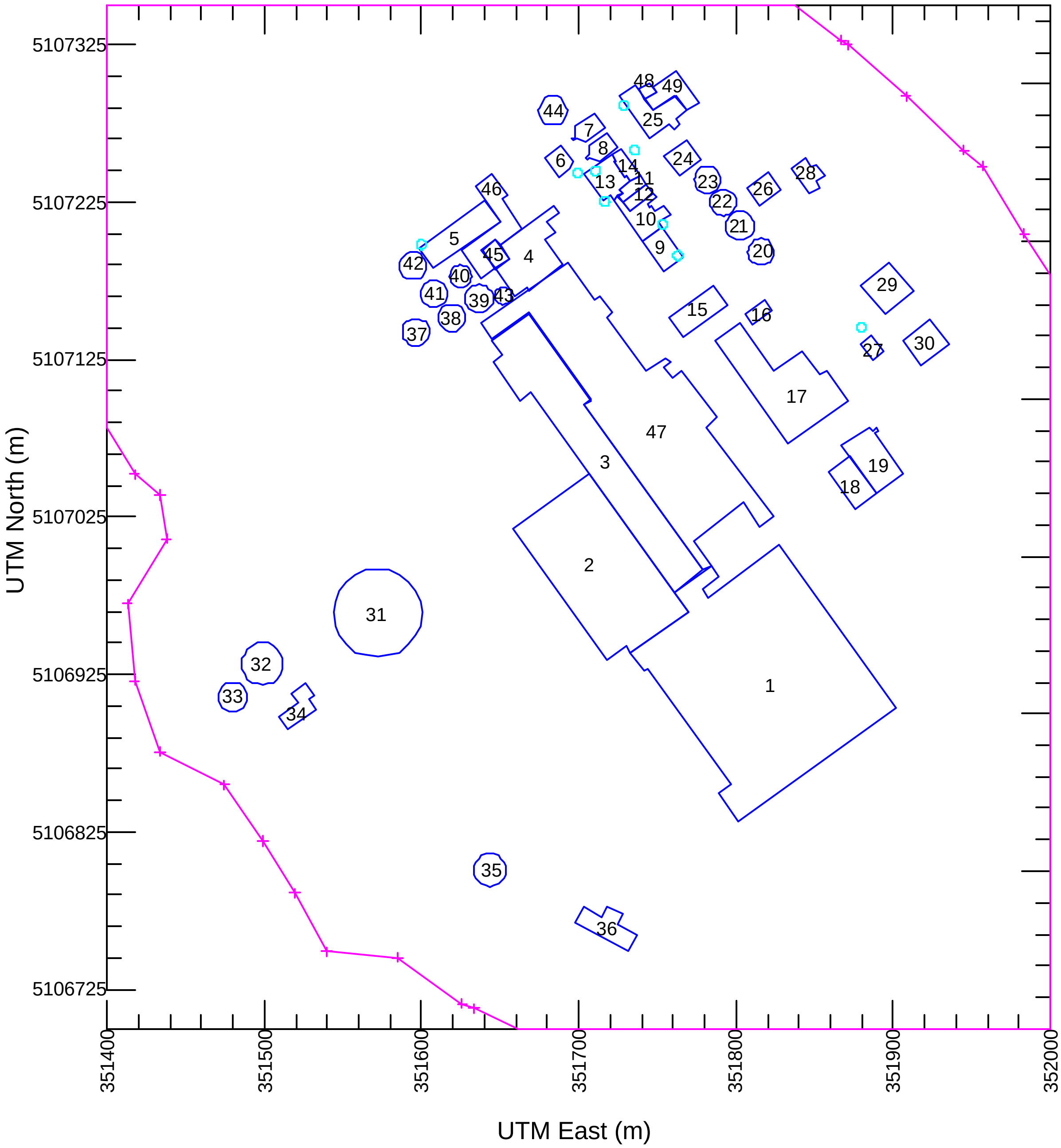


TABLE A-2. EMISSION POINT SOURCES AT THE BOISE WALLULA PULP & PAPER MILL

	Source	Source ID	UTM East (m)	UTM North (m)
1	No. 2 Smelt Dissolving Tank	SRC37	351716.6	5107225
2	No. 2 Recovery Furnace	SRC38	351735.6	5107258
3	No. 3 Smelt Dissolving Tank	SRC34	351710.7	5107245
4	No. 3 Recovery Furnace	SRC30	351699.2	5107243
5	Lime Kiln	SRC31	351879.7	5107146
6	Hog Fuel Boiler	SRC35	351728.6	5107287
7	No. 1 Power Boiler	SRC36	351753.3	5107211
8	No. 2 Power Boiler	SRC32	351763.1	5107191

FIGURE A-3. EMISSION POINT SOURCES AT THE BOISE WALLULA PULP & PAPER MILL

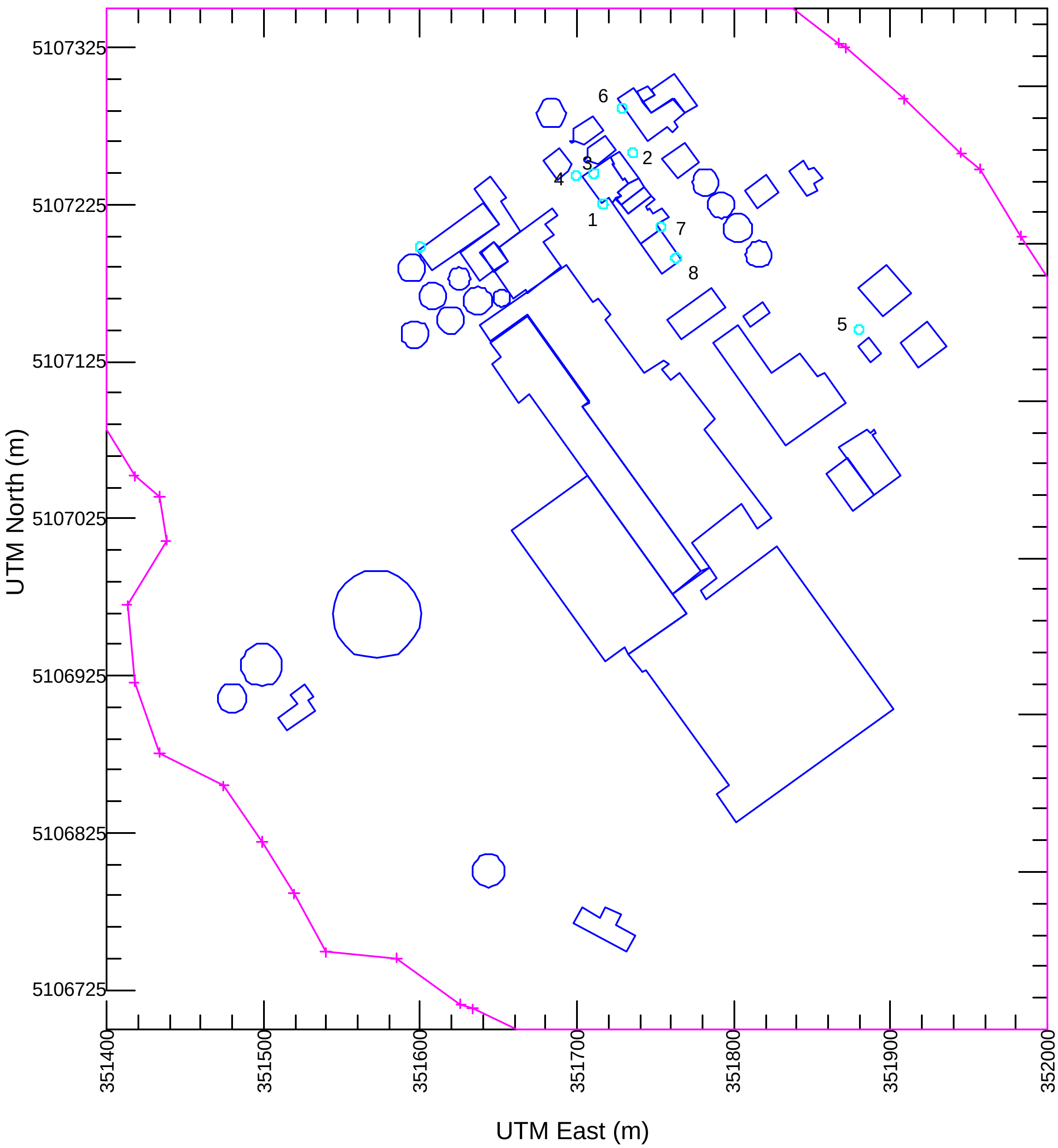
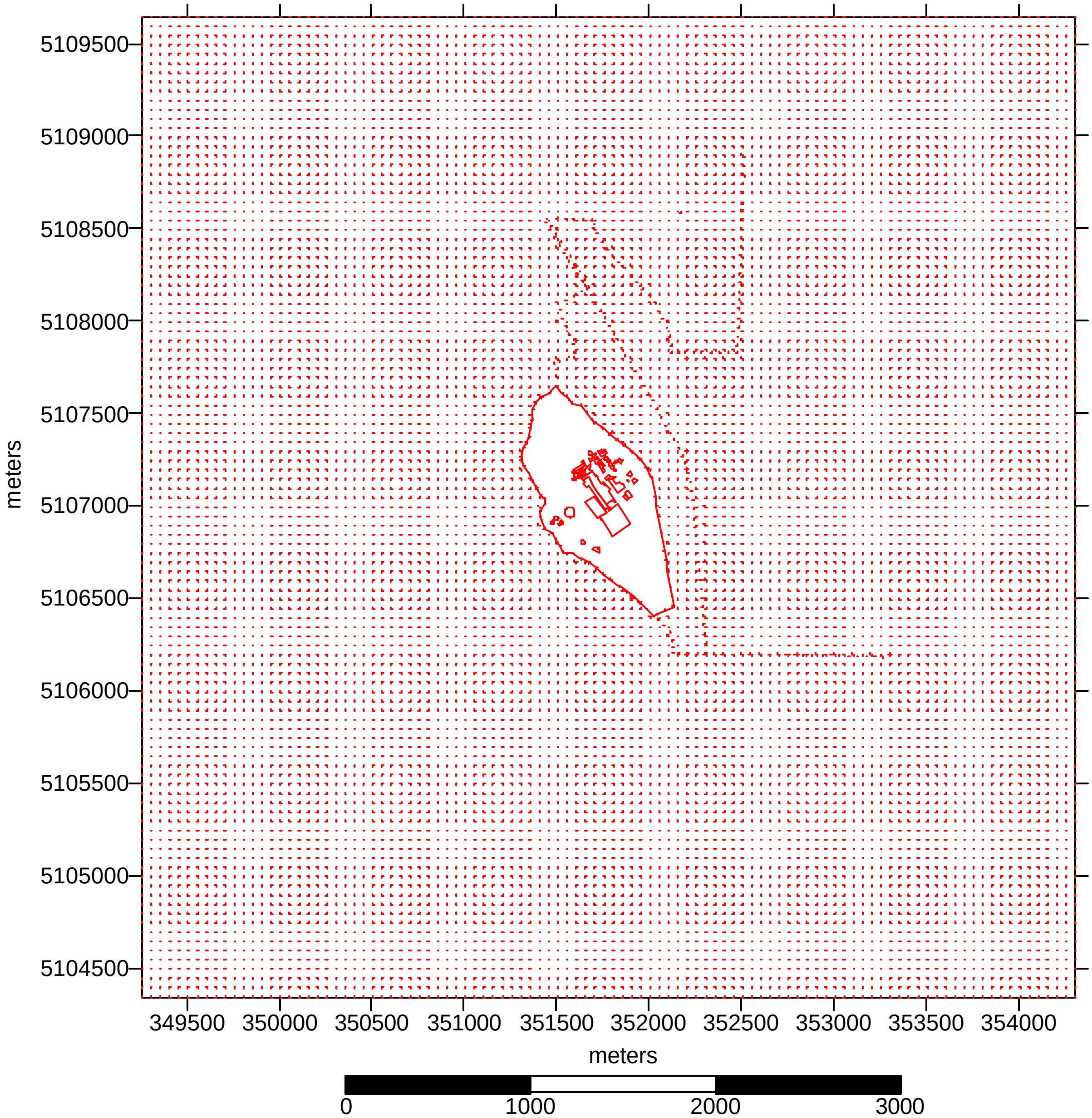


FIGURE A-4. RECEPTOR LOCATIONS FOR FENCE-LINE GRID AND FINE GRID AT THE BOISE WALLULA PULP & PAPER MILL



APPENDIX B

Boise - Wallula

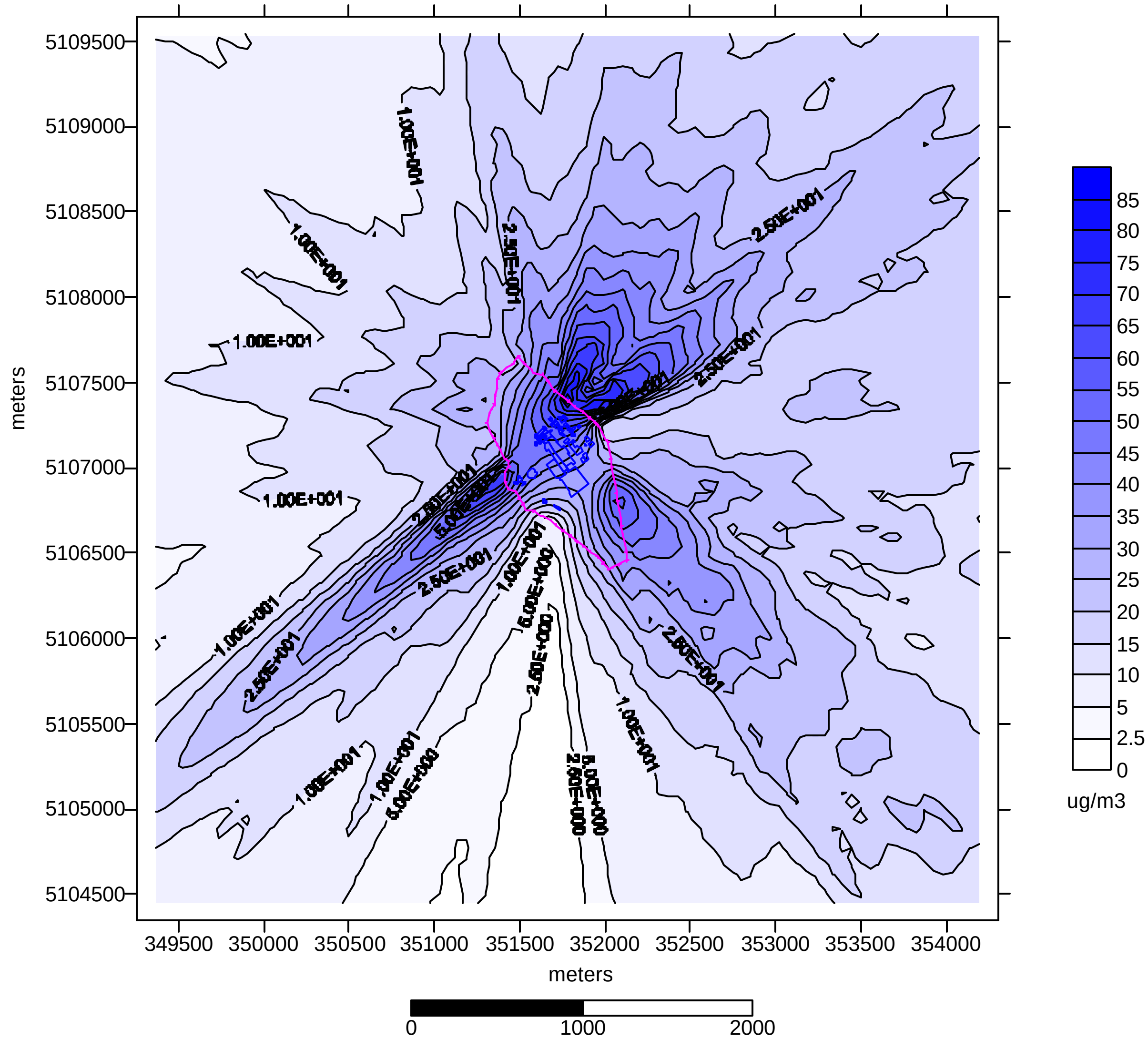
PM_{10} 24-hour Allowable Emission Rates

Prepared by Trinity Consultants - Project 054801.0002

	Allowables						
Emission Unit	**Emission factor**	**Trinity PM lb/hr**	**Trinity PM lb/day**	**Trinity PM10 lb/hr**	**Trinity PM10 lb/day**	**Flowrate (dscfm)**	**Notes**
HFB	0.04 gr/dscf @ 12% CO2	28.89	693.36	12.09	290.24	84,262	Limit from Title V. Flow rate provided by Rose-Marie Blair in a October 11, 2004 e-mail and corrected to 9% O2 (equivalent to 12% CO2). Assumed 41.86% of the PM is PM10 or smaller according to October 25, 2004 e-mail from Ray Lam
PB1	0.1 gr/dscf @ 7% O2	54.07	1297.76	46.50	1116.07	63,085	Limit from Title V. Flow rate calculated based upon a Boise provided rate of 110,000 acfm (used in 2001 PSD), but corrected to dscfm assuming 350 degrees F and 12% moisture. Assumed 86% of the PM is PM10 or smaller according AP-42 Table 1.3-5.
PB2	0.1 gr/dscf @ 7% O2	57.71	1385.07	49.63	1191.16	67,330	Limit from Title V. Flow rate calculated based upon a Boise provided rate of 100,000 acfm (used in 2001 PSD), but corrected to dscfm assuming 230 degrees F and 12% moisture. Assumed 86% of the PM is PM10 or smaller according AP-42 Table 1.3-5.
RB2	0.044 gr/dscf @ 8% O2	16.70	400.75	12.49	299.76	44,275	Limit from Title V & MACT II limit. Flow rate provided by Rose-Marie Blair in a October 11, 2004 e-mail and corrected to 8% O2. Assumed 74.8% of the PM is PM10 or smaller according to AP-42, Table 10.2-3.
RB3	0.027 gr/dscf @ 8% O2	53.05	1273.15	39.68	952.32	229,220	Limit is from 2001 PSD. Flow rate provided by Rose-Marie Blair in a October 11, 2004 e-mail and corrected to 8% O2. Assumed 74.8% of the PM is PM10 or smaller according to AP-42, Table 10.2-3.
LK	0.064 gr/dscf @ 10% O2	21.21	509.02	20.85	500.37	38,663	Limit is MACT II limit. Flow rate provided by Rose-Marie Blair in a October 11, 2004 e-mail and corrected to 10% O2. Assumed 98.3% of the PM is PM10 or smaller according AP-42 Table 10.2-4.
SDT2	0.2 lb/ton BLS	3.13	75.00	2.80	67.13	N/A	Limit is MACT II limit and based upon 375 tons BLS/day capacity. Assumed 89.5% of the PM is PM10 or smaller according AP-42 Table 10.2-7.
SDT3	0.2 lb/ton BLS	14.17	340.00	12.68	304.30	N/A	Limit is MACT II limit and based upon 1700 tons BLS/day capacity. Assumed 89.5% of the PM is PM10 or smaller according AP-42 Table 10.2-7.
Total			**5974.11**	**196.72**	**4721.34**		

APPENDIX C

FIGURE C-1. PM$_{10}$ 6TH HIGH MODELING RESULTS



APPENDIX D

THE MODELING CD IS LOCATED AT THE BACK OF THE BINDER.

APPENDIX E

Background Determination for Wallula, Washington

Background values of PM_{10} have been computed using monitoring data from Turnbull Slough from 1991 through 2001 using the 75th percentile to define the background level for each calendar month (Figure 1). These data seem to represent a background concentration free from the effects of urban and agricultural sources. Using the 75th percentile effectively rules out natural events such as the contribution from wind-blown dust which is a frequent occurrence in Eastern Washington.

At the request of EPA Region 10 background values of PM_{10} at Wallula, Washington suitable for use with dispersion modeling of the Boise facility located there were computed from five years of monitoring done in 1995 through 1999. The distribution of concentrations for each calendar month are shown in Figure 2. Meteorology from these years had been used in dispersion modeling using the AERMOD model to estimate the ground-level concentrations produced by operating the Boise Wallula facility at its allowable emission rate.

Analysis began by extracting the maximum concentrations for each of the 11 days found in the table of the 50 highest modeled ground-level concentrations produced by AERMOD. The second step of the analysis extracted all PM_{10} concentrations monitored at Wallula for the 1995 to 1999 period. The third step involved using the surface OUTPUT file produced by the AERMOD meteorological preprocessor, AERMET, to compute daily wind runs and total daily sums of the inverse of the scaling velocities, u* and w* to characterize each day of the period.

The final step in the analysis was to find meaningful relationships between the predicted concentrations and the daily summed inverse scaling velocities and/or the daily wind run. There was too much scatter in relationships using the scaling velocities but the relationships between daily wind runs and the predictions (Figure 3) were sufficiently tight to permit further analysis. The distribution of the daily wind run against the ranked concentrations from the "Top50" table is:

25%	50%	75%	90%	95%
162.35	193.30	226.95	265.60	285.90

That is, 50 percent of the highest daily concentrations found in the "Top50" table occurred on days with daily wind runs less than 193.3

The observed concentrations on days with wind runs between 162 and 227 (the inter-quartile range) without regard to the time of year have the following distribution:

25%	50%	75%	90%
18.0	30.0	52.0	93.6

Recognizing that the concentrations in Eastern Washington, especially in the Wallula area, have significant contributions from wind-blown dust even when the dust generation area is well removed from the affected area, the background level should be defined carefully. It seems from the distribution that the 90th percentile is affected by wind-blown dust and the 75th percentile value of 52 would represent a satisfactory compromise between environmental conservatism and a desire to avoid the influence of wind-blown dust events. Only an annual distribution was computed as there were an insufficient number of observations to develop distributions for February, March, and December.

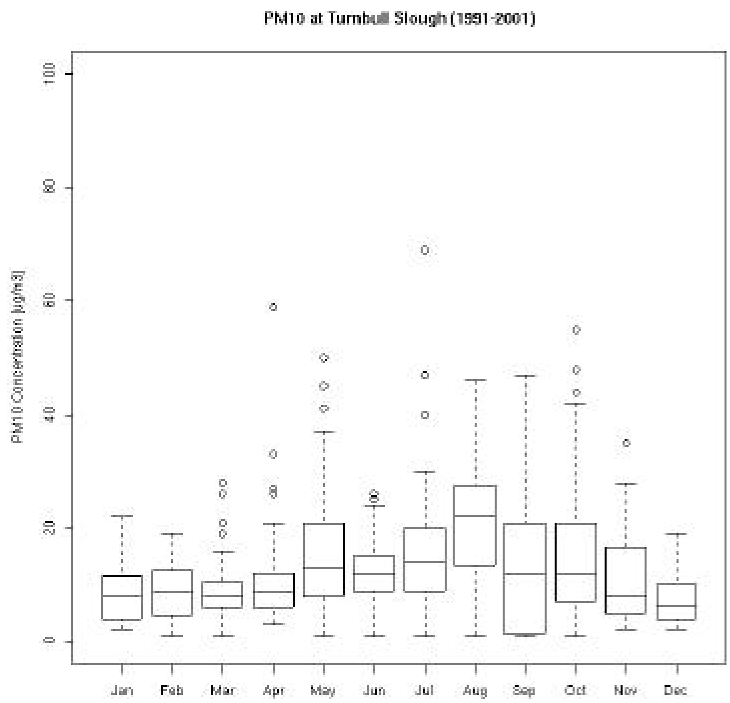


Figure 1. Distribution of PM_{10} concentration at Turnbull Slough, WA by month.

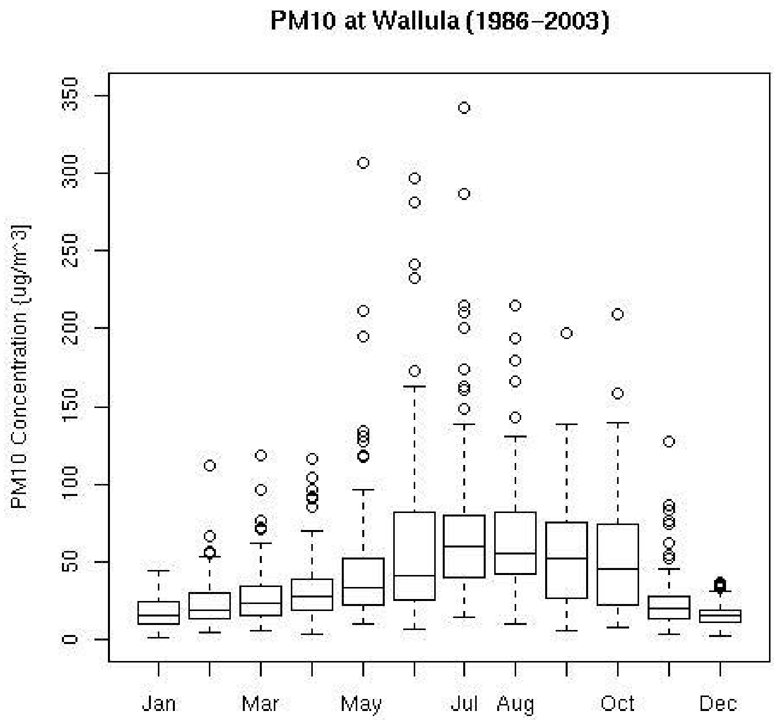


Figure 2. Distribution of PM_{10} concentration at Wallula, WA by month using all observations.

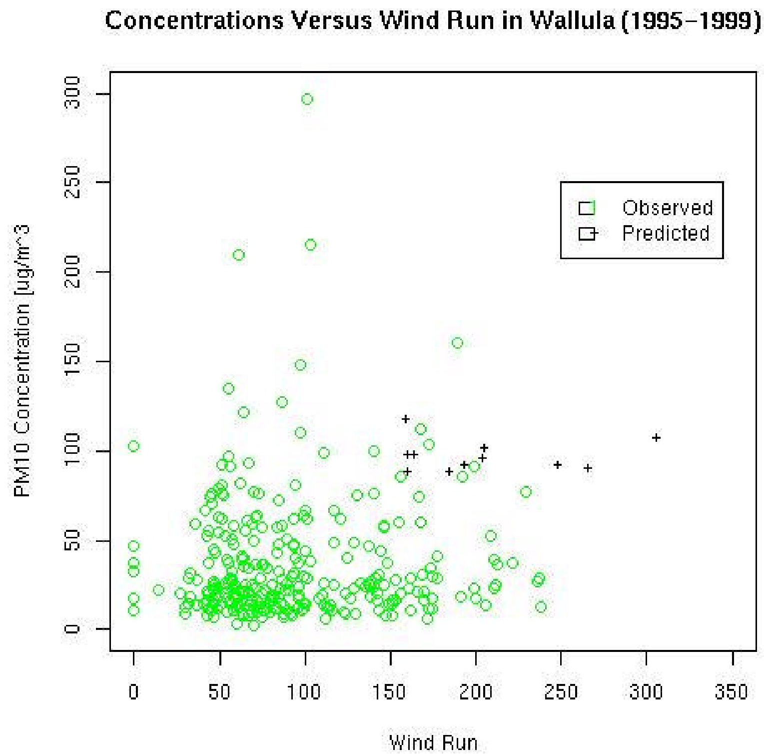


Figure 3. Observed and maximum predicted concentrations for observed daily wind runs at Wallula, WA.