Inter-RPO National 2002 Wildfire Emissions Inventory

Final Work Plan

WRAP

AIR SCIENCES & EC/R
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SECTION 1

WILDFIRE ACTIVITY DATA COLLECTION

Several data collection steps will be executed by the Project Team (team) of Air Sciences and EC/R to populate the database with national wildfire events for 2002. The Team will accept all available fire activity data, without regard for fire size or locations. Data collection efforts will be prioritized for fires that are greater than 100 acres in size and/or located within 50 miles of a sensitive (Class I) area. A map of the RPO (Region Planning Organization) regions that will provide the data for the effort is provided in Figure 1.

Figure 1: Map of RPO Boundaries
(Source: http://www.wrapair.org/RPO/)

Most of the data collection efforts will be performed by EC/R. The following sections describe the methods of data collection and a concise analysis of the current state of the available data.

Centralized Data Sources

1. Request from the WRAP the national raw wildfire activity data for 2002. This raw data is expected to include event data from the following agencies:

    - Forest Service National Interagency Fire Management Integrated Database (NIFMID),
    - Department of Interior 1202 Form/Shared Application Computer System (SACS),

- The Forest Service/Department of Interior ICS209 report forms (that include records for fire incidents over 100 acres for timber fires and 300 acres for grassland fires).

2. Request the quality-assured wildfire activity data sets from the RPOs that have already collected such data. At this time, it is expected that three of the RPO's will provide quality-assured data sets: VISTAS, WRAP, and the MWRPO.
3. Gather available wildfire data from the Fish and Wildlife Service Fire Management Information System (FMIS).
4. Utilize the Wildland Fire module of the National Fire Information Reporting System (NFIRS). This system is used by some state forestry agencies and municipalities and may be useful in providing information at the fire department level where other data is lacking. If data from this system is utilized, it will likely be used for gap-filling purposes.

Status of RPO Activity Data Sets

All five RPOs have compiled activity data for fire; however, the type of data collected varies from region to region. In general, the WRAP, the Midwest RPO, and VISTAS have compiled detailed incident-based databases for wildfire. Since most fire activity in the WRAP occurs on federal lands, the WRAP inventory draws on federal fire databases. However, previous data scoping studies have indicated that incident data may be available for state and private lands in California, Colorado, New Mexico, Oregon, Utah, and Wyoming. EC/R will contact these states and obtain incident data where available.

In the Midwest RPO (MWRPO) and VISTAS inventories, state agencies were also contacted to obtain data for fires on state and private lands in addition to federal data sources. In the MWRPO, all States except Illinois submitted wildfire data. EC/R has since received incident data in hard copy for 2003, which will be used as a surrogate for 2002.

In VISTAS, all states submitted data except Mississippi. EC/R has contacted the Mississippi Forestry Commission and has received 2002 incident data in electronic format. The VISTAS NIF data set includes blackened acres. Fires that did not have a start date and were only reported by month appear in the NIF file as allocated to the first day of the month. Some fires were aggregated by county (i.e., data that did not provide enough information to create separate incident records) and are included in the NIF files. (VISTAS has modeled these emissions in the base year and future year scenarios. These emissions were allocated spatially using T/R/S or county centroid and temporally using temporal profiles.)

The MANE-VU inventory also includes information from both federal and state databases. Federal data sources submitted incident data, with the exception of the Bureau of Indian Affairs

(BIA). For the BIA, 2002 wildfire data was unavailable, and data from the National Interagency Coordination Center (NICC) was used as a surrogate. Fire incident data on state- and privately-owned land was also submitted by state agencies. However, all of the incident data was summed and allocated to counties for the final inventory. Federal incident data for MANE-VU States from the federal sources listed above will be extracted, including BIA incident data. For state and private incident data, MANE-VU has agreed to contact each State and obtain the original activity data. To date, EC/R has received data from the following states: Connecticut, Maine, Massachusetts, New Jersey, New York, and Pennsylvania. Data from Delaware, Maryland, Rhode Island, and Vermont are anticipated.

The CENRAP inventory focuses on agricultural burning and prescribed fires. Wildfire incidents do not appear to have been included in this inventory. However, three of the CENRAP states – Minnesota, Missouri, and Iowa – are included in the Midwest RPO wildfire inventory. EC/R has initiated contact with the other CENRAP States and have obtained data from Arkansas, Kansas, Nebraska, Oklahoman, and Texas. Data from Louisiana are anticipated. EC/R will extract data from federal databases for wildfires in the CENRAP region (except Minnesota, Missouri, and Iowa).

Data submitted by State agencies in the Mane-Vu and CENRAP RPOs arrived in varying degrees of resolution. Table 1 summarizes the data received by the states in these regions, as well as the activity data that are available from the other RPO inventories for federal, state, and private lands. All records submitted to date have, at a minimum: acres burned; some type of location data (e.g., county-level, latitude/longitude [lat/lon], or TRS); and start date.

Data are sometimes not available at the state level, but may be collected for smaller administrative districts. EC/R will contact county fire districts if this is recommended by state agency personnel. However, in the interest of efficiency in executing the project, the Team will emphasize collecting wildland fire databases.

Table 1: Summary of Wildfire Activity Data in RPO Emissions Inventory Databases

RPO/State	Federal and Tribal Lands	Non-Federal Lands	Comments
MANE-VU			
Connecticut	T	T	County-level location data with start date, no fuel information.
Delaware	T	S	Incident data requested.
D.C.	T	n.a.	
Maine	T	T	Lat/lon location data with start date and fuel information.
Maryland	T	S	
Massachusetts	T	T	County location data with start date, some lat/lon and fuel provided.
New Hampshire	T	T	County location data with start date, no fuel information.
New Jersey	T	T	Monthly totals by county.
New York	T	T	County location data with start date, no fuel information.
Pennsylvania	T	T	Lat/lon location data with start date, fuel information.
Rhode Island	T	S	Incident data requested.
Vermont	T	S	Incident data requested.
VISTAS			
Alabama	T	T	Data included in VISTAS NIF files.
Florida	T	T	Data included in VISTAS NIF files.
Georgia	T	T	Data included in VISTAS NIF files.
Kentucky	T	T	Data included in VISTAS NIF files.
Mississippi	T	T	Lat/lon location data with start date, no fuel information.
North Carolina	T	T	Data included in VISTAS NIF files.
South Carolina	T	T	Data included in VISTAS NIF files.
Tennessee	T	T	Data included in VISTAS NIF files.
Virginia	T	T	Data included in VISTAS NIF files.
West Virginia	T	T	Data included in VISTAS NIF files.
MWRPO			
Illinois	T	T	2003 data received in hard copy, includes TRS location, start date, and fuel information.
Indiana	T	T	Data included in MWRPO NIF files.
Michigan	T	T	Data included in MWRPO NIF files.
Ohio	T	T	Data included in MWRPO NIF files.
Wisconsin	T	T	Data included in MWRPO NIF files.

Table 1: Summary of Wildfire Activity Data in RPO Emissions Inventory Databases (continued)

RPO/State	Federal and Tribal Lands	Non-Federal Lands	Comments
CENRAP			
Arkansas	---	T	TRS location data with start date and fuel information.
Iowa	T	T	Data included in MWRPO NIF files.
Kansas	---	T	County location data with start date and fuel information.
Louisiana	---	---	Incident data requested.
Minnesota	T	T	Data included in MWRPO NIF files.
Missouri	T	T	Data included in MWRPO NIF files.
Nebraska	---	T	County location data with start and end date, some fuel and lat/lon data included.
Oklahoma	---	T	Lat/lon data with start date and fuel information.
Texas	---	T	County location data with start date and some fuel.
WRAP			
Alaska	T	---	Previous data scoping studies have indicated that incident data may be available for state and private lands in California, Colorado, New Mexico, Oregon, Utah, and Wyoming. Data quality of wildfire data on federal lands is consistent across all states and includes lat/lon, start date, and fuel information.
Arizona	T	---	
California	T	---	
Colorado	T	---	
Idaho	T	---	
Montana	T	---	
New Mexico	T	---	
Nevada	T	---	
North Dakota	T	---	
Oregon	T	---	
South Dakota	T	---	
Utah	T	---	
Washington	T	---	
Wyoming	T	---	

"T"denotes incident data.
"S" denotes summary data.
"n.a. " denotes not applicable.
"--- " denotes not included.

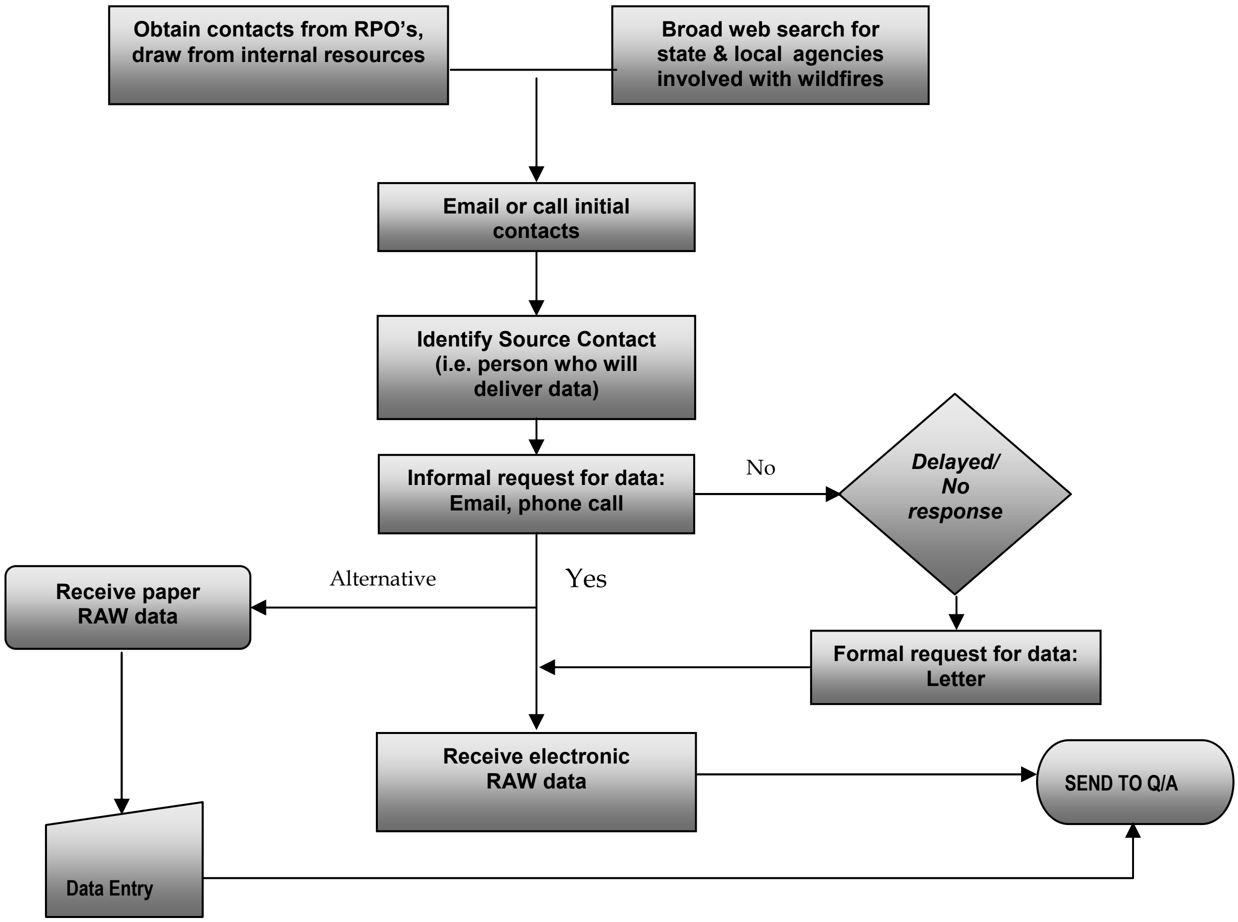
Decentralized Data Sources

1. For RPOs that do not have a quality-assured 2002 emissions inventory in place (potentially including MANE-VU and CENRAP), obtain raw activity data from available on-line electronic databases for federal, state, and private lands.

2. After initial review of the above data sources (Items 1 – 5), identify states in all RPO's in which activity data may be lacking and contact individual state and local agencies to obtain activity data.
3. Only if no other data are available, attempt to use detailed National Situation Reports, 2002 Wildfire Statistics, and Bureau of Land Management fire occurrence data from the National Interagency Fire Center web site.
4. Where obvious data gaps exist, we will dedicate up to 60 hours to contact fire marshals (or other appropriate sources of local data) in an attempt to gather data from these potential sources of information. If possible, data collection efforts will be prioritized for larger fires more proximate to Class I areas.

The focus of the data collection effort from decentralized data sources will be on areas in which wildfire activity data is lacking or incomplete. We will place particular emphasis on data collection of the required data fields for the emissions inventory (i.e., burn date, acres burned, fire location.) Data requests will also include a request for several additional useful data fields, such as fire end date and fuel information (e.g., National Fire Danger Rating System [NFDRS] fuel model), that will improve the overall accuracy of the emission calculations and the temporal and spatial resolution of the database. Figure 1 illustrates the methods we will use to collect data from state and local agencies, and (potentially) private industrial companies. The Team will draw from many resources for wildfire data, including the contacts obtained while developing the emission inventories for the MWRPO and WRAP and other project experience.

Figure 2: Wildfire Activity Data Collection



In order to obtain incident data, EC/R intends to pursue each contact through multiple means. Calls and/or e-mails to each contact will be made to "informally" request activity data. If necessary, EC/R will follow up with a formal letter either from the Team or a representative from the appropriate RPO to obtain data. As a rule, each agency will be contacted a maximum of three times in the effort to obtain the data.

Where incident data is not readily available, a survey at the municipality or fire department level may be more appropriate for filling data gaps. Examples of survey questions are provided in the text box

Sample Survey Questions
Does wildfire occur in your area?
Do you respond to wildfires?
Do you keep records of wildfires?
…including acres burned?
…dates and location?
Do you have summary wildfire information?
What percentage of wildfires are grassland vs. forest fires?

SECTION 2

INVENTORY STRUCTURING AND ACTIVITY DATA REFINEMENT

This work plan establishes criteria to define the level of detail that will be collected for each individual fire event and utilized for emission calculations. Data availability, fire size, and proximity to Class I areas or Metropolitan Statistical Areas (MSA) (identified in Table 1 of the Request for Proposal) are the critical factors to consider in defining the level of effort to collect the data and the complexity of the emission calculations. Much of the inventory and data management tasks will be performed by Air Sciences.

In general, the emission inventory data set will have the following structure:

- Raw data will be imported and formatted in a database environment (dBase file format).
- Data processing, data augmentation, QA/QC tasks, and formatted output tasks will be performed in the ArcView environment.
- Essential information for each event, look-up functions, and emission calculations will be performed in Microsoft Excel.
- Output files will be exported in the appropriate (prescribed) format using scripting environment.

The Team's first objective will be to attempt to perform the most refined method with site-specific activity data to estimate emissions on **every record**. If the available data precludes the most refined method, then additional, less refined methods will be employed. The least-refined method will rely on default assumptions for hourly distribution, regional composite fuel type identification, default fuel moisture, and default fuel consumption.

2.1 Data Completeness Checks

Automated routines to evaluate each record for data completeness will be implemented. Records flagged as containing insufficient critical temporal, spatial, and activity information will be reviewed and removed to a companion data set. Critical elements are:

- Location as lat/lon, UTM, or valid legal description.
- Start date as month and day.
- Area burned in acres.

Gap-filling of data required for emissions calculation will be performed according to the following list:

- Fuel Model assigned by GIS-overlay (by fire event coordinate location).
- Fuel moisture assigned by GIS-overlay (by fire event coordinate location and date).

The level of detail of information to seek for each fire event record is dependent on its size and proximity to Class I areas (Table 2).

Table 2: Wildfire Emissions Inventory Development.

Event Acres	Distance From MSA or Class I Area	Spatial Resolution[1]	Diurnal Resolution	Fuel ID[2]	Fuel Moisture	Fuel Consumption
10-99 (Class C)	>50 miles	Lat/Long TRS Centroid	Default Hourly Distribution	NFDRS GIS layer or Regional Composite[1]	Default[3]	By default fuel moisture[5]
10-99 (Class C)	<50 miles	Lat/Long TRS Centroid	Default Hourly Distribution	NFDRS GIS layer or Regional Composite[1]	Default[3]	By default fuel moisture[5]
100-999 (Class D-E)	>50 miles	Lat/Long TRS Centroid	Default Hourly Distribution	NFDRS GIS layer or Regional Composite[1]	Default[3] or GIS–based[4]	By default or GIS-based fuel moisture[5,6]
100-999 (Class D-E)	<50 miles	Lat/Long TRS Centroid	Default Hourly Distribution	NFDRS GIS layer or Regional Composite[1]	GIS–based[4]	By GIS-based fuel moisture[6]
1000+ (Class F-G)		Lat/Long TRS Centroid	Default Hourly Distribution	NFDRS GIS layer or Regional Composite[1]	GIS–based[4]	By GIS-based fuel moisture[6]

1 Spatial resolution in order of preference, where latitude/longitude provides the most detail and the county centroids the least detail.

2 Fuel model loading derived from fuel ID, specifically, NFDRS fuel model, or regional composite if latter method more appropriate or NFDRS not available.

3 Default moisture will be defined as one of six 1,000-hr fuel classes (see description of FEPS implementation).

4 GIS-based fuel moisture will be based on 1,000-hr fuel moisture for that day (derived from WFAS data).

5 Fuel consumption will be set to modeled consumption for default fuel moisture class using FEPS.

6 Fuel consumption will be set to modeled consumption for GIS-based fuel moisture class using FEPS.

2.2 Source Comparison and Incident Evaluation

The following methodology is proposed to check the wildfire databases for potential duplicate entries:

- Implement GIS routines to identify potentially duplicate fire event records in the database. The GIS routines will test for proximity of fire location data, similarly timed fire events, and similarity of incident names or incident numbers.
- Implement methods to identify fire complexes (multiple fires that are managed as one for suppression purposes). Fire complexes can appear in wildfire event databases in addition to the multiple fires that comprise the complexes and result in double counting events in the database. Methods used to identify complexes may include consulting with land managers in each region. Complex checking will focus on the largest wildfire events in the inventory and events with the string "complex" in the name. The activity detail contained in the suite of individual pre-complex records will be maintained in the single complex entry in the database to more precisely represent the complexes in the emission inventory.

  This duplicate checking technique has been executed for the WRAP. VISTAS data does not include fire name information and will be taken into account in the method. This technique is expected to work best for federal data.
- A strawman document that contains more detail of the duplicate checking and fire complex identification methods and including preliminary results will be circulated to the Inter-RPO Steering Committee (Committee) for review and approval. A list of the Committee members is included in Appendix D.

2.3 Inventory Refinement and Incident Processing

The proposed inventory refinement and incident processing steps are described below. The GIS based data augmentation techniques proposed to be used for this project have been developed as part of the WRAP 2002 wildfire inventory.

<u>GIS Data Augmentation.</u> The Team currently possesses and will implement a number of GIS routines used to augment fire activity data. GIS routines will include, but not necessarily be limited to:

- Assign latitude and longitude (lat/lon) for fire events when other location information (e.g., UTM coordinates) or less specific location information (e.g., legal description [township/range/section] or county) is included in the raw data. In most cases, GIS-assigned lat/lon will be placed at the centroid of the geographic area (Township/Range/Section or county) identified for the record.

- Assign other location information using reference tables, such as state and county FIPS codes, RPO identifier, SCC, and time zones.
- Assign fuel loadings when fuel loading is not included in the raw data (see Task 4).

Perimeter to Blackened Acres Adjustment. Raw data for fire size (acres) that is deemed to represent "perimeter acres" will be converted to "blackened acres." A scalar of 0.66 will be applied to adjust the fire size downward (David Sandberg, 7/13/2004 conference call). All raw activity datasets collected will have their events flagged as representing either perimeter or blackened areas; the scalar will be applied to these events accordingly. (For instance, USDA – Forest Service and state data from VISTAS will be flagged as representing blackened acres.) A list of the perimeter versus blackened acres categorization of the raw datasets will be circulated to the Committee for review.

Daily Growth of Multi-Day Fires. Events in the database may appear as multi-day events. We will implement a modified version of the "spreading oval" algorithm contained in the Fire Emission Production Simulator (FEPS) (the primary fuel consumption and emissions model our Team is proposing to use for this project) to calculate daily growth of multi-day events. This is the method utilized in WRAP's 2002 emission inventory for wildfire. Wildfires greater than 100 acres will be allocated to the first two-thirds of the duration indicated in the source data. The FEPS "spreading oval" algorithm will be used to emulate a geometric fire growth (FEPS version 1.0 Jan-04 Eqn. 20). The fire growth of each day as a percent of the multi-day total will be calculated as:

$$\text{Percent Day}_i = (\text{Day}_i^2 / \text{Days}_n^2)) - (\text{Day}_{i-1}^2 / \text{Days}_n^2)$$

Where: i = sequence number of days from the event's start date, and n is the total number of days in the shortened wildfire duration.

The daily allocation percentage will be applied to the total multi-day acreage to arrive at daily fire growth in acres burned. The applicability of this technical method will be specifically evaluated for Alaska fires and be revised as necessary.

Other Data Refinements. Raw wildfire data records will not have all the fields that are needed to prepare an emission inventory that is temporally and spatially well resolved and that has all of the data that may be useful (or necessary) for the dispersion model-ready files. Therefore, Air Sciences will implement a number of in-hand record refinement and incident processing steps. The Team also recognizes that some significant fire event records will not only be incomplete, but the data quality and completeness may not be improved through the inventory refinement and incident processing steps. Data quality issues may include the following: missing dates and locations; dates which are filled in but appear to have been set at default values (e.g., "1/1 through 12/31"); faulty locations, such as locations over large bodies of water; coordinates which do not correspond with the reported county; or large fires reported within urbanized areas. The team will attempt to remedy all data quality and completeness problems for Class D & E (100 – 999 acres) that are within 50 miles of Class I areas or MSA's and for Class F & G events (>1,000 acres). Air Sciences will begin by initiating follow-up requests to the entity that supplied the original record.

SECTION 3

EMISSION CALCULATIONS

The Team has reviewed the existing methods and assumptions used by WRAP, LADCO, Mane-Vu, and VISTAS. The following section provides a concise summary that identifies the specific differences between the RPO's in-use methods and the methodologies implemented by the Team for this project.

The methods developed (or, in some cases, already in hand) and implemented will be consistent with the priorities indicated in Table 1. The technical tasks to build the inputs for and execute the emission calculations will be performed by both EC/R and Air Sciences.

3.1 Overview of Existing RPO Methods

Table 3 summarizes the methods used by each RPO in calculating wildfire emissions. Each RPO methodology reflects region-specific inputs for fuel loading and fuel consumption in varying levels of specificity. For example, MANE-VU calculated statewide fuel loading and consumption based on NFDRS default values and land cover percentages. The WRAP and VISTAS used NFDRS default loadings modified by regional expert input to produce fuel consumption. The MWRPO used the Forest Service Photo Series to develop fuel loadings and cross-referenced the Series to NFDRS fuel classes. FOFEM was then used to compute fuel consumption and emission factors.

Sources of emission factors for RPOs included tables from the EPA 2002 Report Development of Emissions Inventory Methods for Wildland Fire (Battye & Battye, 2002), the EPA 2003 Report Short-term Improvements to the Wildland Fire Component of the NEI, and EPA's AP-42 emission factor database. Second-day smoldering augmentation factors in the VISTAS and MANE-VU inventories were derived from the EPA 2003 report. The WRAP developed a composite of emission factors based on the EPA 2002 report and the AP-42 database.

Table 3: RPO-Specific Wildfire Emission Calculation Methodologies

RPO	Fuel Loading	Fuel Consumption	Emission Factors
VISTAS	Used the following hierarchy: 1. State-supplied data. 2. NFDRS default data provided by Bruce Bayle, USFS. 3. Material burned with NFDRS assigned. 4. State-specific defaults based on averaged NFRDS models (from Table 3 of the EPA report) modified by Bruce Bayle.	Used the following method to calculate total fuel consumed: • 100% of 1 and 10-hr fuels • 50% of 100-hr fuels • 10% of 1,000-hr fuels • 40% of live woody fuels • 10% of live herbaceous fuels	Developed using Table 2 of the EPA 2003 Report; augmented fuel classes A, B, C, F, and L by 17%.
MANE-VU	Developed statewide loadings based on NFDRS defaults.	Developed state-specific weighted-average consumption based on Tables 1 and 3 of the EPA Report.	Developed using Table 4 of the EPA 2003 report and augmented by state-average smoldering factors in Table 3.
WRAP	Used explicit fuel loading data when available, NFDRS fuel models when provided, and GIS-assigned NFDRS fuel model with duff and crown added based on expert input from Sam Sandberg, USFS and agreed to by the Emissions Task Team of the Fire Emissions Joint Forum.	Adjusted NFDRS defaults based on expert input.	Developed look-up tables using the EPA report and AP-42. Augmented selected fuel classes for second-day smoldering.
MWRPO	Developed fuel-specific loadings based on the Forest Service Photo Series for the Midwest and Southeast, cross-walked with NFDRS fuel categories.	Computed in FOFEM using Photo Series inputs for all NFDRS classes except I, J, and K. Used FOFEM defaults for these.	• Computed from FOFEM emission outputs for $PM_{2.5}$, PM_{10}, CH_4, CO, CO_2, NO_X, and SO_X for flaming and smoldering. • Computed from the EPA report for EC and OC. • Computed from the results of the National Fire Emissions Workshop for NH_3 and VOC.

3.2 Fuel Loading

The fuel loading component of emissions estimation is a critical step in the development of accurate emission estimates for fire. It has been noted that uncertainties in fuel loading and consumption affect emissions estimates far more than emission factors. The Team will use the hierarchy of available fuel loading (presented in the table below) for each fire event. Consistent with the methodologies implemented by other RPOs to date, only one fuel loading value will be utilized for each daily fire event in the database.

Fuel Loading Hierarchy

Hierarchy No.	Type of Fuel Loading Data	Units	Source of Data
1	Fuel Consumed (observed)	tons	Raw data
2	Fuel Available (observed)	tons	Raw data
3	Fuel Loading (observed)	tons/acre	Raw data
4	NFDRS Fuel Model (observed)	n/a	Raw data
5	Fuel type description (observed)	n/a	Raw data
6	GIS-assigned NFDRS Fuel Model	n/a	GIS-routine
7	Regional Composite Fuel Loading	tons/acre	Default (RPO or state specific

In the event that Class D & E (100 – 999 acres) or F & G (>1,000 acres) fires are assigned a regional composite fuel loading during the implementation of the system-wide data refinement and augmentation routines, the individual event will be researched, and reasonable efforts will be made to acquire a fuel identification from the highest step possible in the fuel loading hierarchy.

Fuel loading and fuel consumption from the WRAP, VISTAS, selected states in CENRAP, and the MWRPO have been compiled from each RPO's fire emission inventory documentation and are shown in Table 4. These values were informed by regional expert input, the Photo Series Classification System developed by the Forest Service, and/or NFDRS default loadings. Appendix A provides a more detailed table, which includes individual size class loadings for each fuel category. Total fuel loadings shown in both tables were obtained by summing the individual loadings.

The Team will develop similar tables for the remaining states in CENRAP using region-specific expert input and the photo series classification system loadings. A partial list of regional fire experts is included in Appendix D. MARAMA has provided statewide weighted consumption averages (calculated from NFDRS defaults) in their documentation. The Team will develop fuel-specific loadings for each NFDRS class in the Northeast. Expert input to modify the NFDRS default fuel loadings will be solicited.

Our team recognizes that the region represented by each RPO can have unique fuel loading and fuel consumption. These are represented in the methods developed by each RPO for the regional fire emission inventories. One goal of the national fire emissions inventory is that the calculation methods should be as comparable as possible between each RPO. This requires a review and comparison of the current fuel loading and fuel consumption methodologies for each of the RPOs. To this end, the Team proposes to develop a strawman document that summarizes the fuel loading and fuel consumption for each RPO and highlights the main differences. This strawman document will be reviewed by the fire experts from each RPO with the goal to standardize the fuel loading as much as possible, while maintaining sufficient characteristics unique to each RPO where appropriate. This approach has several advantages, including (1) making state to state fire activity comparisons as comparable as possible, and (2) optimizing the effort involved in the FEPS modeling to calculate fuel consumption and fire emissions. This is especially important considering that fuel load and consumption are of the most influential factors in the estimation of total fire emissions (less so than pollutant emission factors). Section 3.3.1 describes the FEPS model in more detail.

Table 4: Fuel Loading and Fuel Consumption Values by RPO and Fuel Class

	VISTAS		*MWRPO/CENRAP Selected States*		*WRAP*	
NFDRS Fuel Model	Total Loading	Fuel Consumption	Total Loading	Fuel Consumption	Total Loading	Fuel Consumption
A	0.5	0.5	1.05	1.01	0.5	0.5
B	19.5	12.35	6.12	4.49	19.5	19.5
C	2.7	2			6.7	4.7
D	6.75	4.275	12.39	11.84	22.45	15.6
E	3.25	2.375	3.58	2.57	4.35	3.8
F	15	8.85	NA	NA	15	15
G	22.5	8.45	66.09	43.09	59.9	43.5
H	7.5	3.95	34.64	22.24	43.1	27.5
I	46	30.2	109.23	79.3	64.2	55.1
J	25.5	12	85.25	59.42	42.4	34
K	9.5	6.25	44.28	29.71	19.2	14.4
L	0.75	0.3	2.61	2.61	0.75	0.75
Peat	NA	NA	31.09	21.64	NA	NA
N	5	3.8	4.83	4.83	5	5
O	17	9.5	64.86	20.43	75.2	46.1
P	3.5	2.5	NA	NA	26.8	16.4
Q	12	7.25	6.12	4.49	96.7	57.6
R	2.5	1.55	3.58	2.57	3.6	3.1
S	3	2.55	NA	NA	35.6	19.3
T	4.5	3.75	2.2	2.15	4.5	4.5
U	5	3.75	6.12	4.49	29.8	19.1

3.3 Fuel Consumption: FEPS Modeling

3.3.1 Description of the FEPS Model

The Team proposes to calculate fuel consumption using the Fire Emissions Production Simulator, developed by the USDA – Forest Service, Pacific Northwest Research Station, Fire and Environmental Research Applications Team (FEPS model, version 1.0.0, http://www.fs.fed.us/pnw/fera/feps.). The FEPS model will be run for each of the NFDRS fuel models and for each of the six fuel moisture classes in the model. For each of these combinations the model will be used to estimate a unique fuel consumption (Section 3.3.3), emission factor (Section 3.4) and smoldering fraction (Section 3.5).

3.3.2 Fuel Moisture Content

Each fire event's date and location will be used to assign 1,000-hour fuel moisture content. Daily national coverage maps of 1,000-hour fuel moisture content for 2002 from the Wildland Fire Assessment System (WFAS) and archived by the CAMFER Lab at U.C. Berkeley will be accessed via GIS routines and return the 1,000-hour fuel moisture content for each event in the database. Daily WFAS data is derived from hourly data collected at the national network of Remote Automated Weather Stations (RAWS). Any missing daily 2002 data set will be gap-filled with the next previous available day's data. The distance of each fire event to the nearest RAWS station will be recorded in the emission inventory. This value may give a first order measure of reliability of the moisture value looked up.

The WFAS does not archive 1,000-hour fuel moisture content data for Alaska in the same manner that it does for the lower 48 states. The Team will derive appropriate look-up tables of fuel moisture content in Alaska (using RAWS data, for example) and submit the tables to the Committee, the WRAP, and appropriate entities in Alaska for review and approval.

Implementation of these techniques will result in every event in the wildfire database having a percent fuel moisture content. The percent fuel moisture value of each event will fall into one of six FEPS fuel moisture classes, specifically: very dry, dry, moderate, moist, wet, and very wet. The fuel moisture category for each event will be used by FEPS to determine fuel consumption rates and emission factors for each event.

3.3.3 Fuel Consumption

The Team will use FEPS to develop reference tables for fuel consumption percentages. Unique fuel consumption will be calculated for (at least) 120 combinations of the NFDRS fuel models, (20 models) by fuel moisture classes (6 classes). Where deemed appropriate additional combination may be generated for additional fuel loading types unique by RPO, and by the fire intensity levels defined in FEPS (two classes, low and severe wildfire).

As shown in Table 4, fuel consumption by vegetative class has been developed for the WRAP, the MWRPO, VISTAS, and Iowa, Missouri, and Minnesota in CENRAP. We will compare these factors with FEPS consumption outputs. We will use the original fuel *loading* values identified in the above table as inputs to the FEPS fuel *consumption* model. RPO-specific fuel consumption (and other outputs) by fuel model tables resulting from the FEPS runs will be distributed for review by regional experts. It is possible that the explicit fuel consumption values provided by some RPO's in the raw activity data will be relied upon in the final emissions inventory.

3.4 Emission Factors

The emission inventory will include estimates for 11 pollutants. The FEPS model will be used to estimate emissions of CO, CH_4, and $PM_{2.5}$. TSP, PM_{10}, NO_X, and SO_2 will be estimated using emission factors from FOFEM. VOC and NH_3 will be estimated based on numerical relationships with CO emissions, and EC and OC will be estimated as percentages of $PM_{2.5}$. The coarse component of PM_{10} (PMC) will be calculated as the difference between the PM_{10} and $PM_{2.5}$ emission factors. To calculate emissions of VOC, EC, OC, and NH_3, various resource documents, including U.S. EPA's report "Development of Emissions Inventory Methods for Wildland Fire" (EC/R, 2001), emission factor methods employed by RPOs (WRAP 1996 and 2002, LADCO 2001-2003, VISTAS 2002), and updates and recommendations from the 2004 National Fire Workshop in New Orleans have been accessed to develop the numerical relationships presented in Table 5.

Table 5: Numerical Relationships for NH3, VOC, OC, and EC

Pollutant	Numerical Relationship	
NH_3	0.016 x CO	
VOC	Forest Fuels:	0.23 x CO
	Grasslands:	0.15 x CO
OC	0.47 x $PM_{2.5}$	
EC	0.061 x $PM_{2.5}$	

Emission factors will be generated in FEPS for each of the six fuel moisture regimes in FEPS. The result of this analysis will be a suite of emission factors (in lb/ton) for each of the six fuel moisture regimes for each of the fuel model categories.

Another aspect of FEPS that will be explored is the use of emission factors for two fire phases, flaming and smoldering. FEPS separates fire emissions in three fire phases, flaming, short-term smoldering (<=2 hours), and long-term smoldering (over 2 hours). Initial exploratory runs with FEPS indicates that the flaming and short-term smoldering phase emission factors could be combined into an emission factor for the first day of the fire, while the long-term smoldering phase emission factor could be applied to the second smoldering day. This methodology will be explored in combination with the methodology for the smoldering emissions (see next section).

3.5 Smoldering Emissions

As mentioned earlier, the emission factors for CO, CH_4, and $PM_{2.5}$ derived by FEPS will include the effect of smoldering for the day of the event. The FEPS output per fuel model and moisture regime will also include a percent of smoldering emissions on the day(s) *following* a fire event. These emissions (and associated fuel consumption) will be allocated to the subsequent calendar day.

Hourly Emissions Profile. The Team will work with RPOs to define an hourly emission profile specific to each region (using the daily profiles currently used by WRAP, MWRPO, and VISTAS (if available). These hourly emission profiles and the algorithm used in FEPS to distribute hourly emissions will be evaluated for their suitability as methods to use in the Inter-RPO emission inventory to distribute the fire emissions on an hourly basis. The Team is prepared to deliver the hourly profile information in the appropriate format for each RPO. The hourly emissions profile(s) will be submitted to the Committee for its review and approval and included in the Final Work Plan.

3.6 Vertical Plume Profile

Plume characteristics for each fire event will be "hard-wired" into the model-ready input files. The method, developed by the WRAP and used (with modifications) by other RPOs in an effort to represent the effects of buoyancy and heat release on plumes from fire, assigns a height of the bottom of the plume (meters), a height of the top of the plume (meters), and the percentage of the emissions fumigated into the first layer (percent) for each hour of the day.

The Team will review the methodology as used in the WRAP 2002 inventory together with the main developer David Sandberg (USDA – Forest Service, FERA) for its suitability as a default set of plume characteristics to be applied nationwide.

In addition, the plume rise algorithms of three other models may be evaluated for their suitability to provide diurnal plume characteristics. This evaluation may include the algorithms used in FEPS, those used in the Smoke Input Spreadsheet (SIS), and those used in DAYSMOKE. SIS allows the user to estimate fire emissions and dispersion through an Excel spreadsheet as the interface. The actual calculation in SIS are based on CONSUME (fire spread) and CALPUFF (plume characteristics). SIS was developed by Air Sciences for the USDA Forest Service as a tool to assist fire managers in evaluating the potential dispersion of actual fire events. VISTAS has used modified equations from the USDA – Forest Service Southern Research Station project DAYSMOKE (project leader Dr. Gary Achtemeier) to distribute wildfire and prescribed fire into vertical layers. The plume profile method and a summary of the review of the alternative methods will be submitted to the Committee for its review and approval and included in the Final Work Plan.

SECTION 4

EMISSIONS OUTPUT FORMATS

Deliverables for this project will be formatted using the EPA's National Inventory Format version 3.0 (NIF3). The NIF3 is the format most widely used by state and local agencies to transfer data to the EPA's National Emission Inventory (NEI). It is also the input format being used with the Open Emissions Model now under development.

EC/R used the NIF3 point source emissions format during their project with the Lake Michigan Air Directors Consortium (LADCO) to develop a Midwest fire inventory. The Team proposes to extent this format for this project as well. The NIF3 point source emissions format provides the flexibility needed to organize fire emissions data that is county- or sub-county-specific and is assigned to modeling layers. The table in Appendix B shows how fire emissions data will be organized into seven different NIF3 files: transmittal, site, emission unit, emission release point, emission process, emission period, and emission.

The transmittal and site files provide a record of the source and vintage of the data. The emission unit file holds the fuel model of each fire, and the emission release point file contains the geographic location of each fire as well as the model layer heights. Each fire's fuel type and fuel load is kept in the emission process file, and the time duration of each fire is recorded in the emission period file. Actual fire emission values by pollutant and model layer are listed in the emission file.

SMOKE-ready emission inventory files in PT/IDA format will also be supplied as PTINV, PTDAY, and PTHOUR text files. The definition of this format and example files are provided in Appendix C.

APPENDIX A

Draft Look-Up Tables of Regional Fuel Loading and Consumption Factors by NFDRS Vegetative Class

Fuel Model	1 hr	10-hr	100-hr	1,000-hr	Live Woody /Shrub	Live Herbaceous	Litter	Duff	Crown	Total Loading	Fuel consumption
					VISTAS						
A	0.2					0.3	[TBD]	[TBD]	[TBD]	0.5	0.5
B	3.5	4	0.5		11.5					19.5	12.35
C	0.4	1			0.5	0.8				2.7	2
D	2	1			3	0.75				6.75	4.275
E	1.5	0.5	0.25		0.5	0.5				3.25	2.375
F	2.5	2	1.5		9					15	8.85
G	2.5	2	5	12	0.5	0.5				22.5	8.45
H	1.5	1	2	2	0.5	0.5				7.5	3.95
I	12	12	10	12						46	30.2
J	7	7	6	5.5						25.5	12
K	2.5	2.5	2	2.5						9.5	6.25
L	0.25					0.5				0.75	0.3
N	1.5	1.5			2					5	3.8
O	2	3	3	2	7					17	9.5
P	1	1	0.5		0.5	0.5				3.5	2.5
Q	2	2.5	2	1	4	0.5				12	7.25
R	0.5	0.5	0.5		0.5	0.5				2.5	1.55
S	0.5	0.5	0.5	0.5	0.5	0.5				3	2.55
T	1	0.5			2.5	0.5				4.5	3.75
U	1.5	1.5	1		0.5	0.5				5	3.75
					MWRPO/CENRAP Selected States (Iowa, Missouri, Minnesota)						
A (TP01)	0	0	0	0	0.10	0.95				1.05	1.01
C (JP04)	0.3	0.2	0.1	0.3	0.549	0.034	1.42	3.22		6.12	4.49
D (PS04)	5.45	3.17					2.39		1.38	12.39	11.84
E (MO05)	0.6	1.0					0.64	1.34		3.58	2.57
G (MP10)	0.4	0.7	1.3	10.6	0.08	0.02	2.68	28.31	22	66.09	43.09

Fuel Model	1 hr	10-hr	100-hr	1,000-hr	Live Woody /Shrub	Live Herbaceous	Litter	Duff	Crown	Total Loading	Fuel consumption
H (MP05)	0.1	0.2	0.6	1.8	0.1265	0.096	2.57	10.44	18.7	34.64	22.24
I (FOFEM)	3.67	7.43	17	28		0.23	2.7	34	16.2	109.23	79.30
J (FOFEM)	2.67	5.43	12	18	0	0.15	2.2	34	10.8	85.25	59.42
K (FOFEM)	1.17	3.93	7	8		0.08	1.7	17	5.4	44.28	29.71
L (TP12)						1.75	0.86			2.61	2.61
Peat (MP10)					0.02	0.08	2.68	28.31		31.09	21.64
N (TP17)						4.71	0.12			4.83	4.83
O (PS03)	4.94	1.38					2.48	55	1.06	64.86	20.43
Q (JP04)	0.3	0.2	0.1	0.3	0.549	0.034	1.42	3.22		6.12	4.49
R (MO05)	0.6	1.0					0.64	1.34		3.58	2.57
T (TP06)					0.1255	2.196	0.572			2.2	2.15
U (JP04)	0.3	0.2	0.1	0.3	0.549	0.034	1.42	3.22		6.12	4.49

Fuel Model	1 hr	10-hr	100-hr	1,000-hr	Live Woody /Shrub	Live Herbaceous	Litter	Duff	Crown	Total Loading	Fuel consumption
						WRAP					
A	0.2	0	0	0	0	0.3		0	0	0.5	0.5
B	3.5	4	0.5	0	11.5	0		0	0	19.5	19.5
C	0.4	1	0	0	0.5	0.8		4	0	6.7	4.7
D	2	1	0	0	3	0.75		7.7	8	22.45	15.6
E	1.5	0.5	0.25	0	0.5	0.5		1.1	0	4.35	3.8
F	2.5	2	1.5	0	9	0		0	0	15	15
G	2.5	2	5	12	0.5	0.5		18.2	19.2	59.9	43.5
H	1.5	1	2	2	0.5	0.5		16.9	18.7	43.1	27.5
I	12	12	10	12	0	0		18.2	0	64.2	55.1
J	7	7	6	5.5	0	0		16.9	0	42.4	34
K	2.5	2.5	2	2.5	0	0		9.7	0	19.2	14.4
L	0.25	0	0	0	0	0.5		0	0	0.75	0.75
N	1.5	1.5	0	0	2	0		0	0	5	5
O	2	3	3	2	7	0		58.2	0	75.2	46.1
P	1	1	0.5	0	0.5	0.5		13.3	10	26.8	16.4
Q	2	2.5	2	1	4	0.5		57.9	26.8	96.7	57.6
R	0.5	0.5	0.5	0	0.5	0.5		1.1	0	3.6	3.1
S	0.5	0.5	0.5	0.5	0.5	0.5		32.6	0	35.6	19.3
T	1	0.5	0	0	2.5	0.5		0	0	4.5	4.5
U	1.5	1.5	1	0	0.5	0.5		10.6	14.2	29.8	19.1

APPENDIX B

Proposed Organization of Fire Data into NIF3 Format

NIF3 Table	NIF3 Field	Fire Variable or Assigned Value
Transmittal	Record Type	“TR”
Transmittal	FIPS	FIPS
Transmittal	Organization Name	Agency
Transmittal	Transaction Type	“00"
Transmittal	Inventory Year	Year
Transmittal	Inventory Type Code	“CRIT”
Transmittal	Format Version	3
Site	Record Type	“SI”
Site	FIPS	FIPS
Site	State Facility Id.	Site Id.
Site	Facility Name	Fac_name
Site	Submittal Flag	”Add”
Emission Unit	Record Type	“EU”
Emission Unit	FIPS	FIPS
Emission Unit	State Facility Id.	Site Id.
Emission Unit	Emission Unit Id.	Fuel Model
Emission Unit	Submittal Flag	“Add”
Emission Release Point	Record Type	“ER”
Emission Release Point	FIPS	FIPS
Emission Release Point	State Facility Id.	Site Id.
Emission Release Point	Emission Release Point Id.	Model Layer
Emission Release Point	Emission Release Point Type	“05"
Emission Release Point	Stack Height	Model Layer Height
Emission Release Point	X Coordinate	Longitude
Emission Release Point	Y Coordinate	Latitude
Emission Release Point	XY Coordinate Type	“LATLON”
Emission Release Point	Emission Release Point Description	Model Layer Height Description

NIF3 Table	NIF3 Field	Fire Variable or Assigned Value
Emission Release Point	Submittal Flag	"Add"
Emission Process	Record Type	"EP"
Emission Process	FIPS	FIPS
Emission Process	State Facility Id.	Site Id.
Emission Process	Emission Unit Id.	Fuel Model
Emission Process	Emission Release Point Id.	Model Layer
Emission Process	Process Id.	Fuel Type
Emission Process	SCC	SCC
Emission Process	Emission Process Description	Fuel Description
Emission Process	Heat Content	Fuel Load (tons/acre)
Emission Process	Sulfur Content	Percent Flame
Emission Process	Ash Content	Percent Burned
Emission Process	Submittal Flag	"Add"
Emission Period	Record Type	"PE"
Emission Period	FIPS	FIPS
Emission Period	State Facility Id.	Site Id.
Emission Period	Emission Unit Id.	Fuel Model
Emission Period	Process Id.	Fuel Type
Emission Period	Start Date	Year/Month/Day
Emission Period	End Date	Year/Month/Day
Emission Period	Start Time	"0001"
Emission Period	End Time	"0059"
Emission Period	Actual Throughput	Acres burned per day
Emission Period	Material I/O	"I"
Emission Period	Submittal Flag	"Add"
Emission	Record Type	"EM"
Emission	FIPS	FIPS
Emission	State Facility Id.	Site Id.

NIF3 Table	NIF3 Field	Fire Variable or Assigned Value
Emission	Emission Unit Id.	Fuel Model
Emission	Process Id.	Fuel Type
Emission	Pollutant Code	Pollutant
Emission	Emission Release Point Id.	Model Layer
Emission	Start Date	Year/Month/Day
Emission	End Date	Year/Month/Day
Emission	Start Time	0101
Emission	End Time	0159
Emission	Emission Numeric Value	Emissions
Emission	Emission Unit Numerator	“TON”
Emission	Emission Type	“30"
Emission	Factor Numeric Value	Emission Factor
Emission	Factor Unit Numerator	“lbs”
Emission	Factor Unit Denominator	“tons”
Emission	Submittal Flag	“Add”

APPENDIX C

SMOKE Input PT File Examples

This appendix contains example excerpts from the SMOKE input PT files PTINV, PTHOUR, and PTDAY. The emission inventory will be converted from a relational data table (DBF) to the suite of three SMOKE input files. A custom ESRI ArcView script will be used to export each single database file to the three PT text files as defined by the WRAP Modeling Forum.

Table C.1 describes the fixed width format of the SMOKE Input PT files

Table C.1: File Format of SMOKE Input PT Files for Wildland Burning.

PTINV-File		PTHOUR-File		PTDAY-File	
Variable Name	Column Width	Variable Name	Column Width	Variable Name	Column Width
State FIP	2	State FIP	2	State FIP	2
County FIP	3	County FIP	3	County FIP	3
Fire name (short)	15	Fire name (short)	15	Fire name (short)	15
"0" value	15	"0" value	12	"0" value	12
"1" value	12	"1" value	12	"1" value	12
Blank space	14	Blank space	12	Blank space	12
Fire name (full)	40	Variable name (3 lines per fire)	5	Pollutant name (8 line per fire)	5
SCC	10	Date (mm/dd/yr)	8	Date (mm/dd/yr)	8
Blank space	19	Time zone	3	Time zone	3
"72." value	3	Value hour 0	7	Daily emissions	18
Blank space	93	To…	…	SCC	11
"0010" value	4	Value hour 23	7		
Latitude (deg)	9	Blank space	9		
Longitude (deg)	9	SCC	10		

Excerpts of PTINV, PTHOUR, and PTDAY files for six fire days appear on the following three pages, respectively.

```
#PTINV 200409101932
#COUNTRY US
#YEAR 2002
#DESC POINT SOURCE FIRE EMISSIONS
0224003244                 0          1           TANACROSS                         2810015001            72.                                                                                          001063.386944-143.33111
0209003245                 0          1           DEBRIS RX                         2810015000            72.                                                                                          001064.866667-147.60000
0209018959                 0          1           DEBRIS RX                         2810015000            72.                                                                                          001064.866667-147.60000
0202003246                 0          1           CAMPBELL                          2810015001            72.                                                                                          001061.116667-149.70000
0212203247                 0          1           MYSTERY6                          2810015000            72.                                                                                          001060.654167-150.26138
0212215278                 0          1           MYSTERY6                          2810015000            72.                                                                                          001060.654167-150.26138
```

#PTHOUR 200409101932
#COUNTRY US
#YEAR 2002
#DESC HOURLY DATA FOR FIRE EMISSIONS
#DATA LAY1F PBOT PTOP CONSU

0224003244	0	1	LAY1F02/15/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.45	0.42	0.36	0.28	0.25	0.22	0.20	0.19	0.25	0.28	0.36	0.46	0.47	0.47	0.47	2810015001
0224003244	0	1	PBOT 02/15/02AKT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	1.17	3.24	12.96	51.84	158.76	207.36	262.44	292.41	317.55	207.36	158.76	51.84	1.17	0.29	0.29	0.29	2810015001
0224003244	0	1	PTOP 02/15/02AKT	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	3.11	8.64	34.56	138.24	423.36	552.96	699.84	779.76	846.81	552.96	423.36	138.24	3.11	0.78	0.78	0.78	2810015001
0209003245	0	1	LAY1F05/08/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.46	0.44	0.40	0.34	0.32	0.30	0.29	0.29	0.32	0.34	0.40	0.46	0.47	0.47	0.47	2810015000
0209003245	0	1	PBOT 05/08/02AKT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2810015000
0209003245	0	1	PTOP 05/08/02AKT	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.09	0.26	1.02	4.10	12.54	16.38	20.74	23.10	25.09	16.38	12.54	4.10	0.09	0.02	0.02	0.02	2810015000
0209018959	0	1	LAY1F05/09/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.46	0.44	0.40	0.34	0.32	0.30	0.29	0.29	0.32	0.34	0.40	0.46	0.47	0.47	0.47	2810015000
0209018959	0	1	PBOT 05/09/02AKT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2810015000
0209018959	0	1	PTOP 05/09/02AKT	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.09	0.26	1.02	4.10	12.54	16.38	20.74	23.10	25.09	16.38	12.54	4.10	0.09	0.02	0.02	0.02	2810015000
0202003246	0	1	LAY1F08/19/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.45	0.42	0.36	0.28	0.25	0.22	0.20	0.19	0.25	0.28	0.36	0.46	0.47	0.47	0.47	2810015001
0202003246	0	1	PBOT 08/19/02AKT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	1.17	3.24	12.96	51.84	158.76	207.36	262.44	292.41	317.55	207.36	158.76	51.84	1.17	0.29	0.29	0.29	2810015001
0202003246	0	1	PTOP 08/19/02AKT	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	3.11	8.64	34.56	138.24	423.36	552.96	699.84	779.76	846.81	552.96	423.36	138.24	3.11	0.78	0.78	0.78	2810015001
0212203247	0	1	LAY1F06/20/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.45	0.42	0.36	0.28	0.25	0.22	0.20	0.19	0.25	0.28	0.36	0.46	0.47	0.47	0.47	2810015000
0212203247	0	1	PBOT 06/20/02AKT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	1.17	3.24	12.96	51.84	158.76	207.36	262.44	292.41	317.55	207.36	158.76	51.84	1.17	0.29	0.29	0.29	2810015000
0212203247	0	1	PTOP 06/20/02AKT	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	3.11	8.64	34.56	138.24	423.36	552.96	699.84	779.76	846.81	552.96	423.36	138.24	3.11	0.78	0.78	0.78	2810015000
0212215278	0	1	LAY1F06/21/02AKT	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.46	0.45	0.42	0.36	0.28	0.25	0.22	0.20	0.19	0.25	0.28	0.36	0.46	0.47	0.47	0.47	2810015000
0212215278	0	1	PBOT 06/21/02AKT	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	1.17	3.24	12.96	51.84	158.76	207.36	262.44	292.41	317.55	207.36	158.76	51.84	1.17	0.29	0.29	0.29	2810015000
0212215278	0	1	PTOP 06/21/02AKT	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	3.11	8.64	34.56	138.24	423.36	552.96	699.84	779.76	846.81	552.96	423.36	138.24	3.11	0.78	0.78	0.78	2810015000

```
#PTDAY 200409101932
#COUNTRY US
#YEAR 2002
#DESC POINT SOURCE FIRE EMISSIONS
#DATA PM10 PM2_5 VOC NH3 NOX CO SO2 PMC
0224003244                0          1           PM10 02/15/02AKT          0.365300 2810015001
0224003244                0          1           PM2_502/15/02AKT          0.313300 2810015001
0224003244                0          1           VOC  02/15/02AKT          0.176800 2810015001
0224003244                0          1           NH3  02/15/02AKT          0.016900 2810015001
0224003244                0          1           NOX  02/15/02AKT          0.080600 2810015001
0224003244                0          1           CO   02/15/02AKT          3.757000 2810015001
0224003244                0          1           SO2  02/15/02AKT          0.022100 2810015001
0224003244                0          1           PMC  02/15/02AKT          0.052000 2810015001
0209003245                0          1           PM10 05/08/02AKT          0.438360 2810015000
0209003245                0          1           PM2_505/08/02AKT          0.375960 2810015000
0209003245                0          1           VOC  05/08/02AKT          0.212160 2810015000
0209003245                0          1           NH3  05/08/02AKT          0.020280 2810015000
0209003245                0          1           NOX  05/08/02AKT          0.096720 2810015000
0209003245                0          1           CO   05/08/02AKT          4.508400 2810015000
0209003245                0          1           SO2  05/08/02AKT          0.026520 2810015000
0209003245                0          1           PMC  05/08/02AKT          0.062400 2810015000
0209018959                0          1           PM10 05/09/02AKT          0.037261 2810015000
0209018959                0          1           PM2_505/09/02AKT          0.031957 2810015000
0209018959                0          1           VOC  05/09/02AKT          0.018034 2810015000
0209018959                0          1           NH3  05/09/02AKT          0.001724 2810015000
0209018959                0          1           NOX  05/09/02AKT          0.008221 2810015000
0209018959                0          1           CO   05/09/02AKT          0.383214 2810015000
0209018959                0          1           SO2  05/09/02AKT          0.002254 2810015000
0209018959                0          1           PMC  05/09/02AKT          0.005304 2810015000
0202003246                0          1           PM10 08/19/02AKT          0.857050 2810015001
0202003246                0          1           PM2_508/19/02AKT          0.735050 2810015001
0202003246                0          1           VOC  08/19/02AKT          0.414800 2810015001
0202003246                0          1           NH3  08/19/02AKT          0.039650 2810015001
0202003246                0          1           NOX  08/19/02AKT          0.189100 2810015001
0202003246                0          1           CO   08/19/02AKT          8.814500 2810015001
0202003246                0          1           SO2  08/19/02AKT          0.051850 2810015001
0202003246                0          1           PMC  08/19/02AKT          0.122000 2810015001
0212203247                0          1           PM10 06/20/02AKT          1.746019 2810015000
0212203247                0          1           PM2_506/20/02AKT          1.497476 2810015000
0212203247                0          1           VOC  06/20/02AKT          0.845049 2810015000
0212203247                0          1           NH3  06/20/02AKT          0.080777 2810015000
0212203247                0          1           NOX  06/20/02AKT          0.385243 2810015000
0212203247                0          1           CO   06/20/02AKT         17.957282 2810015000
0212203247                0          1           SO2  06/20/02AKT          0.105631 2810015000
0212203247                0          1           PMC  06/20/02AKT          0.248544 2810015000
0212215278                0          1           PM10 06/21/02AKT          1.746019 2810015000
0212215278                0          1           PM2_506/21/02AKT          1.497476 2810015000
0212215278                0          1           VOC  06/21/02AKT          0.845049 2810015000
0212215278                0          1           NH3  06/21/02AKT          0.080777 2810015000
0212215278                0          1           NOX  06/21/02AKT          0.385243 2810015000
0212215278                0          1           CO   06/21/02AKT         17.957282 2810015000
0212215278                0          1           SO2  06/21/02AKT          0.105631 2810015000
0212215278                0          1           PMC  06/21/02AKT          0.248544 2810015000
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APPENDIX D

Inter-RPO Steering Committee and Regional Fire Experts

This appendix lists the Inter-RPO Steering Committee members and regional fire experts providing guidance on this project.

Committee Members	Regional Fire Experts (Partial List 3/5/2005)
Peter Lahm, USDA - Forest Service (WO)	David (Sam) Sandberg, USDA - Forest Service (FERA)
Tom Pace, USEPA OAQPS	Trent Wickman, USDA - Forest Service
Tom Moore, WRAP	Dr. Gary Achtemeier, USDA - Forest Service
Annette Sharp, CENRAP	Greg Stella, Alpine Geophysics / VISTAS
Chuck Layman, CENRAP	
Megan Schuster, MANE-VU	
Pat Brewer, VISTAS	
Mark Janssen, Midwest RPO	
Charles E. Sams, USDA - Forest Service	
Darla Potter, WRAP (WY DEQ)	
Mark Fitch, WRAP (AZ DEQ)	
Bill Beal, USEPA	
Bruce Bayle, USDA - Forest Service R8	