Revision of Modeling Scenarios Developed for the Pesticide Root Zone Model (PRZM) for use in the Office of Pesticide Programs (OPP) Risk Assessment Process (Draft Report).

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Technical Direction #2

Submitted to:

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INTRODUCTION

This draft report is submitted in support of Technical Direction (TD) No. 2 and scope of work (SOW) received from Milwina Locklear (Project Officer) on 21 December 2005. The primary purpose of this report is to document the technical approach, reiterate modifications made to the initial workplan, and provide recommendations for future considerations.

TD2 involved continued revision of existing model scenarios for surface water exposure assessments conducted by the Environmental Fate and Effects Division (EFED). This TD involved updating EFED's existing scenarios (Appendix A) and database, revising existing metadata files based on changes made to scenarios, and creating and delivering a revision log (Appendix C) documenting changes to scenarios. The current TD is intended to address both the specific and general inconsistencies identified by both CropLife America (CLA) and those outstanding issues identified internally within EFED. Inconsistencies are documented in this report and are documented in more detail in Appendix B. In cases where revisions were not applied across the board and (acceptable) inconsistencies remain, details have been provided in Appendix B.

Existing scenarios were partially revised under a previous contract (GSA Contract No. GS-00F-0019L, Order No, 4W-1996-NBLX). In the final deliverable a number of recommendations were made for the finalization of these scenarios (see page 20-21 final deliverable #2 for Work Assignment No. 2005-2 dated 31 October 2005). The report submitted here serves as an addendum to the 31 October report and is reflective of revisions and updates since the previous report. The revision log however encompasses all revisions made to scenarios under the previous and current contracts.

The following tasks were outlined in the SOW for TD2:

- Task 1: Revise Existing Scenarios to Address both General and Specific Comments Provided by CropLife America (CLA)
- Task 2: Delete extraneous source comments in the PRZM summary files.
- Task 3: Revise Existing Scenarios Irrigation Parameters using attached guidance
- Task 4: Revise Existing Scenarios to Address Both General Inconsistencies in Scenarios Identified in the Previous Contract Deliverable.
- Task 5: Resolve Inconsistencies in meteorological stations with emphasis on those scenarios located in California
- Task 6: Cross-walk existing soil parameters with the most recent data in the USDA "Soil Data Mart" and update scenarios if necessary
- Task 7: Update and Revise Scenario Documentation (Metadata Files)
- Task 8: Update Scenario Database
- Task 9: Update Scenario Revision Log

SRC submitted a workplan to EFED on 5 January 2006 to address these tasks. EFED confirmed SRC's proposed approach and provided prioritization of tasks to be completed based on the availability of funds. SRC and EFED continued to dialogue throughout the deliverable to address task specific issues as necessary and to provide periodic updates regarding technical and budgetary status. EFED provided additional prioritization after reviewing each issue and at each budgetary milestone (50%, 75% and 90%). Issues identified by SRC as well as the guidance provided by EFED are provided under the respective tasks below.

It should be noted that several of the items on p. 20-21 of the previous deliverable were not addressed based on prioritization from EFED:

1. Perform a vulnerability assessment;
2. Refine the irrigation list (EFED is presently standardizing an approach to determine scenarios requiring irrigation);
3. Cross-walk soil parameters with Soil Data Mart (SSURGO); and
4. Word process the metadata.

DELIVERABLES SUBMITTED

The following files are submitted as deliverables under TD2:

Table 1. Deliverables submitted under Technical Direction #2	
Deliverable	**Electronic File Name**
▪ Revised Metadata for each of the 85 scenarios	PRZMScenarioMetadata.wpd
▪ Revised PRZM scenario files for each of the 85 scenarios	<scenario>.txt
▪ MS Access database containing updated parameter values for each of the 85 scenarios	PRZMScenarioDatabase.mdb
▪ Revision log (Appendix C) discussing what changes were made to the scenarios and why changes were made (The revision log also includes revisions made to address CLA scenario specific comments)	PRZMScenarioRevisionLog.doc
▪ Draft report documenting the approach used for scenario revisions	PRZMScenarioRevisionsDraft.doc

TECHNICAL APPROACH

The following technical approach was used to address the tasks identified in the SOW for TD2. The tasks below revised scenarios in order to address public comments and recent modification to the PRZM model, both improving the consistency and quality of scenarios and facilitating use of existing scenarios with the latest version of the PRZM model supported by the Agency.

Task 1 – Revise existing scenarios to address both general and specific comments provided by CropLife America (CLA)

General comments by CLA have been extracted below. SRC received the additional CLA comments from EFED as part of this SOW for this TD. The additional specific comments by CLA have been addressed individually. General CLA comments are summarized below along with the approach used to address the comments.

Scenario Vulnerability

General CLA comment: *CLA finds that while some of the scenarios examined represent apparently relevant locations and weather/soil combinations, there is no apparent logic for their selection or certainty about their relative vulnerability.*

CLA also comments that "there are many ways of estimating relative vulnerability and that, with the advances in computing power achieved over the last few years, it is now a very achievable goal to conduct nationwide PRZM modeling (similar to the original MUSCRAT approach)".

A robust vulnerability assessment requires clear objectives agreed upon by stakeholders. In addition, vulnerability can be defined using a wide range of criterion, including but not limited to runoff potential, site-specific climate conditions, proximity to drinking water sources, proximity to high pesticide use areas, and proximity to sensitive species. EFED indicated that a vulnerability assessment is outside the scope of this TD and directed SRC not to conduct any work on the vulnerability assessment. EFED will conduct this separately. Some of the tools in the database supplied under the previous contract and updated here provide some useful features that allow the Agency to assess relative vulnerability across existing scenarios. This can be done by readily comparing sensitive parameters side-by-side (curve number, slope, etc.).

Soil parameter inconsistencies

General CLA comment: *Where the same soil in the same region is used for multiple crops, different values were selected for key parameters (e.g. Manning's n, Field Capacity (FC) and wilting point (WP) for Exeter Loam in CA).*

SRC performed a cross-walk of similar scenarios for the same region to ensure that the soil parameters are consistent or documented when the inconsistency is justified. Many of these were completed under the previous contract. SRC also included MI Asparagus and PR coffee included with the SOW for TD2 received from EFED.

Several of the PA scenarios used inconsistent soil parameters and were updated. PA Alfalfa, PA Turf, (York County, PA) and PA Tomato (Lancaster County, PA) scenarios all use Glenville silt loam for the simulation, but several parameters varied among the scenarios without explanation. All soil parameters for these three scenarios were updated to the Soil Data Mart parameter values for Glenville silt loam 3-8% slopes (see revision log). It's important to note however that the horizon depths for Glenville silt loam were different between the York County (alfalfa and turf) and the Lancaster County (tomato) databases; this was noted in the metadata.

TX Cotton and TX Wheat (Milam County, TX) both use Crockett fine sandy loam for the simulation, but some soil parameter values varied among the scenarios without explanation. Both scenarios were updated to the Soil Data Mart Database parameter values for Crockett fine sandy loam, 1 to 3 percent slopes, from Milam County, TX.

For the above inconsistencies, soil parameters updated to Soil Data Mart included: STITLE, USLEK, NHORIZ, CORED, THKNS, BD, THETO, THEFC, THEWP, and OC. Representative values were taken from the database, rather than the midpoint values where available. Where Field Capacity and Wilting Point were available in the database, they were used; if not available, they were calculated using data from Soil Data Mart using the Rawls and Brakensiek method described in the PRZM Manual (USEPA 1998).

General CLA comment: *The method by which the slope (%) was selected varied widely between the scenarios. While many are the average between the maximum and the minimum, many others seem to be maxima, minima or some other value between the two.*

SRC reviewed the metadata comments for each slope in order to assess whether or not slope values were selected in correspondence with current guidance (USEPA 2004). If parameters were selected in a manner consistent with guidance (including advice from extension agents) and with other similar scenarios, they were considered acceptable. If parameters were not consistent with current guidance, then they were further investigated. If parameters were derived from sources other than extension agents or the USDA official soils description database, they were updated to be consistent with the USDA official soils description database (http://soils.usda.gov/technical/classification/). Further investigation involved two steps: 1) investigation of metadata description of slope in the scenario description paragraph; 2) if slope information was not available in the paragraph, then the USDA official soil series description database was consulted. In the cases where the slope value was changed, the USLELS factor, which is calculated based on the slope value, required adjustment as a result of the new slope value. Once all slope values were confirmed as being consistent with guidance, USLELS factors were calculated using MS excel and the equation provided for USLELS in USEPA 2004. EFED agreed with this approach, however during the revision process, SRC noted an error in the 2004 guidance for the USLELS factor. The entire first term should be enclosed in parentheses and raised to the "m" power. This allows for nearly identical reproduction of Table 5-5 in the PRZM manual (USEPA 1998). The agency confirmed this error and the corrected equation (below) was used for USLELS calculations. A total of 60 scenarios required updates to the USLELS factors. Refer to Appendix B for a list of scenarios where USLELS factors were updated.

LS = ((length/72.6)^(m))*((430*(slope/100)^2+30*(slope/100)+0.43)/6.613)

Geographical parameter inconsistencies

General CLA comment: *Geographic inconsistencies: Parameters within a specific region are inconsistent (e.g. evaporation depth and snow melt factor for San Joaquin County).*

This comment is relevant to the following parameters (excluding meteorological station identification addressed later): PFAC, SFAC and ANETD. Many of these were revised under the previous contract. SRC cross-walked these three parameters and updated according to current guidance (USEPA 2004). Scenarios are now geographically consistent within the same regions (counties). SRC included MI Asparagus and PR coffee attached to the TD received from EFED.

Snowmelt Factors (SFAC) were updated to be consistent according to PRZM Guidance (USEPA 2004) for all scenarios. Guidance indicates that the value should be set to 0 in areas where snowfall is not expected to occur or accumulate and persist for more than a day. Weather station summaries were checked at http://www.weather.gov/climate/ (NOWData) for monthly snowfall averages from 1971-2000. If all monthly averages were 0.1 inches or less, the scenario was given a value of 0 (i.e. snow is not typically expected to occur). Guidance also indicates that the snowmelt factor is dependent upon the type of crop being simulated (e.g., orchard versus field/row crop) described in the PRZM 3 Manual, Table 5.1 (USEPA 1998). SFAC is to be set to the maximum value of the minimum range of values for the specific coverage based on the crop. For row crops the “open areas” range of values was used and for orchard crops the “mixed coniferous/deciduous open areas” range of values was used. It’s important to note that that snowmelt factors for the TX scenarios are not the same. The south TX scenarios are set to 0 since snow is unlikely to occur, however the more northern scenarios are set to 0.36 as per guidance for row crops (USEPA 2004). Refer to Appendix B for a list of scenarios with updates to SFAC in the metadata and/or summary file.

Pan evapotranspiration (PFAC) values were also updated to be geographically consistent. A total of 49 scenarios required revision to the PFAC in the metadata and/or PRZM summary file. Refer to Appendix B for a list of scenarios with updates to PFAC.

Depth to which evaporation is extracted (ANETD) values were harmonized among scenarios simulated in the same geographic area. Inconsistencies documented in the metadata may be due to specific guidance or information provided by an extension agent (see metadata for TX wheat and FL Avocado for examples). PRZM Guidance (USEPA 2004) indicates using PRZM Manual Figure 5.2 (USEPA 1998), specifically: “Use the mid-point of the range of values based on location of the crop scenario. If a crop region crosses one or more boundaries, select the mid-point value of lowest range of values.” It also indicates that “for soils with limited drainage, set ANETD to 10 cm.” Refer to Appendix B for a list of scenarios with updates to ANETD in the metadata and/or summary file.

Crop parameter inconsistencies

General CLA comment: *Crop characteristics for the same crop may differ between scenarios (e.g. root depth and percentage canopy cover for cotton vary considerably between states without explanation).*

This comment is relevant to the following parameters: HTMAX, CINTCP, AMXDR, and COVMAX. The inconsistencies were harmonized in the following way. First, inconsistencies among similar crops were identified using an Access query built into the PRZM scenario database. Second, the sources of the inconsistent parameter values were evaluated to determine whether or not the parameter values should be altered. If inconsistencies were due to different, but acceptable sources (e.g. advice from extension agents), they were documented in the metadata and parameter values remained unchanged. If the inconsistencies resulted from insufficiently documented sources, a representative value with an acceptable source (e.g. extension agent, USEPA 1998, similar scenario with acceptable source) was selected and cited for the new parameter value. Refer to Appendix B for a list of scenarios in which the above parameters were modified in the metadata and/or summary file.

EFED agreed with this approach and provided further guidance related to selecting CINTCP. USEPA (2004) guidance indicates that the original reference for CINTCP is not available and that additional guidance is required for crops not on the list of crops in Table 5-4. EFED instructed SRC to choose a surrogate crop with similar canopy cover (COVMAX) and document the method for choosing the final parameter value. This approach was problematic since COVMAX does not directly correlate with the crop densities provided in Table 5-4. EFED concluded that PIC values cited in the scenarios are more robust than the Table 5.4 values. In addition, the developer of PIC (who is no longer with ORD) previously indicated that these values were derived using professional judgment to place the crops within the three categories and assign a value to each. EFED is still investigating the documentation on how those values were derived, and directed SRC to rely on the existing PIC values for those scenarios where there is a question about the CINTCP values.

Summary and metadata file inconsistencies

General CLA comment: *There are many discrepancies between the PRZM input "summary" files supplied by EFED and the matching guidance documentation for that scenario (e.g. MS cotton).*

SRC has cross-walked all parameters in the metadata with the PRZM summary files to ensure harmony. SRC noted that some parameters are not documented in the metadata and therefore the source of the parameter value is not captured in the metadata (but is in the scenario file). EFED is aware of this and advised SRC for the time being to add a statement to the introduction of the metadata regarding this issue. Refer to Task 2 for more details.

Crop/Agronomic timing issues

General CLA comment: *Permanent and semi-permanent crops such as citrus and sugarcane need to be handled consistently according to advice provided by ORD in the 1980's. Simulations need to be set up so that for the majority of years, the crops are present all year as mature specimens. The lack of a "planting date" in the documentation makes it difficult to assess how to simulate pre-emergence applications.*

SRC requested further clarification regarding how maturity date should be modeled in the current PRZM version. SRC recommend that adding a planting date under this TD was not a priority. EFED agreed and indicated that in general, the assignment of a planting or application date is outside the requirements of scenario development. EFED does not require information on the planting dates in these scenarios at this time. Resources were directed toward addressing more important issues with the scenarios.

Evergreen vs Deciduous Crops
EFED provided the following additional guidance for setting maturity dates in the scenarios. For a crop which is considered "evergreen" or with year round canopy coverage (e.g. citrus) the emergence, maturity and harvest dates should be selected to ensure full year canopy coverage. For example for citrus (see the CAcitrus scenario) the emergence date should be selected for January 1 while the maturity date can be January 2 and the harvest date December 31 (however see Jan 1 section below). This ensures year round full canopy coverage for the "evergreen" crop. For deciduous tree and orchard crops, the emergence, harvest and planting dates should be selected to coincide with the growth cycle of the leaves and/or fruit of the crop. For example, MIcherry scenario has an emergence date tied to the leaf bloom, while the emergence date is tied to the maturity of the leaf, and the harvest date tied to the harvest of the fruit.

January 1 Emergence Day
Initially SRC was instructed to set the emergence day to January 2. SRC indicated that setting the emergence date to January 2 would produce a minor conflict with previous guidance for aligning RUSLE C factors and dates with emergence dates. The previous guidance was to shift the RUSLE date that is closest to the emergence date to the first position in record 9B. The first RUSLE date for the evergreen crops will be 0101. The next step in the guidance is to move the emergence date to the first RUSLE date (i.e., January 1). EFED stated that January 2 was selected over January 1, because in previous versions of PRZM, setting the emergence date to January 1 resulted in an issue with the file transfer and array in the model. It's unclear whether this is still an issue in PRZM. SRC conducted several PRZM/EXAMS runs, but could not generate an error using Jan 1. EFED indicated to set the emergence date to Jan 1, as done for PR coffee. The Agency will revisit this issue during the review of the deliverable.

SRC also requested further guidance regarding modeling scenarios that are harvested several times during a given year (e.g., alfalfa) and once every several years (e.g., sugarcane). EFED provided the following guidance (1/31/2006) for non-standard harvest dates. Treat all multi harvest crops (such as alfalfa as a single crop rotation) as a normal crop with an initial emergence and final maturity/harvest dates. The ability to add the complexity needed in the cropping cycle can be handled in future iterations. b) Treat all multi year harvest as a continuous rotation much as specified for citrus and orchards - In keeping with this the scenario should start with emergence on Jan [1], maturity on Jan [2], and harvest on Dec 31. Note the discussion above for Jan 1 vs Jan 2 emergence date.

Emergence/Maturity/Harvest Years
In addition, SRC corrected the emergence years for a number of scenarios that emerge in one year, but mature and/or are harvested in the following year. PRZM appears to automatically determine the sequence of dates such that the emergence date will happen before the maturity and harvest dates. In a test run, PRZM automatically assigned the maturity date to the first year in the simulation and emergence date to the previous year when the emergence month is greater than the maturity month. Several of the more recent scenarios developed by EFED (e.g., FL sweetcorn) set the emergence date to the year before the initial year of the met file (1960), and the maturity and harvest years to the following year (1961). SRC followed this approach and changed IYREM from 1961 to 1960 to handle crops that may overwinter or are harvested in years subsequent to crop emergence. Changes *were made* to FLstrawberryC.txt, MIAsparagusC.txt, ORwheatC.txt, STXgrapefruit.txt, STXvegetable.txt, TXalfalfaC.txt, and TXwheatC.txt. Files received from EFED that used the above approach and *were not modified* included: FLcabbageC.txt, FLcarrotC.txt, FLsweetcornC.txt, GAOnionsC.txt, ORgrassseedC.txt.

<u>General CLA comment</u>: *Some strange cropping dates were found in both the PRZM summary files and accompanying documentation…. [some] were specified for the same cropping year thus simulating harvest taking place before emergence.*

SRC compared emergence, harvest, and maturation dates to each other to ensure that dates are reasonable. This issue was resolved under the previous comment relating to emergence/maturity/harvest years.

<u>Lack of documentation or use of inappropriate sources</u>

General CLA comment: *Key information is missing [from the scenario documentation]*.

EFED indicated that this was not a priority, and should only be completed at the end if sufficient funds remained. SRC included a general statement in the metadata introduction as instructed by EFED to alert users to this issue. More information is provided under the summary for Task 2.

SRC also requested EFED clarification on which parameters originally assigned using PIC are most sensitive and which should be parameterized individually. A number of soil, climatic and agronomic parameters were originally set using PIC as an option. In many cases, the developer did not rely on PIC but instead used the Soil Data Mart, conversations with soil scientists in county extension offices, or published literature. A list of PIC values in order of importance is provided below:

CN, USLEK, USLES, USLEP, CORED, NHORIZ, THKNS, BD, THETO, THEFC, THEWP, OC, PFAC, SFAC, ANETD, CINTCP, AMXDR, HTMAX.

- Curve Numbers (CN) for all scenarios reference the GLEAMS Manual Table H-4 which is an acceptable source based on USEPA 2004 guidance.

- USLEK is documented based on an acceptable source in addition to PIC. NC Alfalfa was updated to Soil Data Mart (for the surface horizon).

- USLELS factors were updated according to USEPA 2004 guidance. More details on this update can be found in the previous section under soil parameter inconsistencies.

- USLEP factors are affected by slope values and crop type. USLEP factors were harmonized based on USEPA 2004 guidance.

- CORED, NHORIZ, THKNS, BD, THETO, THEFC, THEWP, and OC. For these soil parameters assigned using PIC the scenario developer indicated in the metadata that the parameterization was confirmed using the NRCS Soils Characterization Database or another acceptable source. EFED indicated that it is not necessary to second guess the scenario developer in this case since the developer indicated that the parameter was confirmed using a source as per USEPA 2004 guidance.

- PFAC, SFAC, ANETD, CINTCP, AMXDR, HTMAX. For these non-soil parameters SRC has parameterized values individually using acceptable sources based on USEPA (2004) Guidance. Additional information is provided in the sections related to geographic and crop parameter inconsistencies.

Parameterization of wilting point and field capacity

General CLA comment: *IN CA tomato and almond scenarios, some subsurface horizons have anomalous values with WP=FC. This may give rise to erroneous output. It is suggested that the Ra[w]ls and Brakensiek method recommended by the PRZM user manual be used to calculate WP and FC.*

SRC examined all FC and WP values to identify anomalous values. Only two scenarios (CA Tomato and CA Almond) were identified to have equal field capacity and wilting point values. No scenarios have WP greater than FC. PR coffee, FL Turf, and FL Avocado have WP approaching FC, however this occurs in the deeper horizons and will not impact shallow rooted plants.

For CA Almond, the wilting point (THEWP) for the third horizon was changed from in accordance with the PRZM Manual, Table 5-25 for sandy loam. The previous value was equal to the field capacity and was too high for a wilting point for a sandy loam according to Table 5-25. The field capacity value is now within the acceptable range in Table 5-25.

For CA Tomato, the field capacity (THEFC) for the third horizon was changed in accordance with the PRZM Manual, Table 5-25 for clay. The previous value was equal to the wilting point and was too low for a field capacity for clay, according to Table 5-25. The wilting point value is within the acceptable range in Table 5-25.

As noted previously, for these soil parameters assigned using PIC the scenario developer indicated in the metadata that the parameterization was confirmed using the NRCS Soils Characterization Database or another acceptable source. SRC and EFED agreed that it is not necessary to second guess the scenario developer since the developer indicated that the parameter was confirmed using a source as per the 2004 guidance.

Weather station assignment

CLA general comment: *With the move to SAMSON weather datasets, care should be taken to ensure that the selected weather stations are appropriate (e.g. Montgomery AL, selected to represent Eastern NC and Burlington, IA for Illinois corn).*

See summary for Task 5.

Irrigation parameters

CLA general comment: *It will be important to ensure in the final scenarios that irrigation types and amounts are appropriate and consistent between crops/scenarios.*

See summary for Task 3.

Lack of robustness and general QA/QC

This TD addresses QAQC of existing scenarios. SRC offers to continue dialogue with the Agency about increasing the robustness of QAQC procedures for future scenarios using existing tools that may be enhanced. EFED indicated that no work along these lines need be done at this time.

CLA general comment: *CLA indicated that scenario results should be compared to observed water and soil runoff amount. P. 19 CLA comments also states that EFED has performed a "reality-check" and "fine-tuning" as necessary.*

EFED indicated that SRC should repeat the "reality-check" performed by EFED.

Task 2 - Delete extraneous source comments in the PRZM summary files.

SRC deleted extraneous source comments in the PRZM summary file. Each parameter maintains the default description of the parameter in the summary file. In the workplan, SRC noted to EFED that approximately 25 parameters are not documented in the metadata (see metadata introduction for missing parameters). SRC indicated that transferring each of these parameters and comments to the metadata would require additional resources. EFED reviewed the list in the workplan and indicated that, should the contractor have sufficient funds remaining after completion of all other tasks should these parameters be added to the metadata files. Ultimately, EFED decided to add the following statement to the metadata:

"There are a number of input parameters which have not been listed in this metadata file. Many of these represent parameter flags which are default values and do not change from scenario to scenario. Others are captured in the scenario file and have not been transferred to the metadata file. Finally, there are others (such as parameters for furrow irrigation) which are not currently used. A listing of the parameters which are not captured in this metadata file are listed below. Future updates to the metadata will attempt to include these where possible."

For parameters not documented in the metadata, SRC maintained any source comments in the PRZM summary file that related to the parameterization. These source comments may be transferred to the metadata in the future.

Task 3 – Revise existing scenarios irrigation parameters

SRC cross-walked the existing scenarios that already include irrigation with guidance provided in the TD. Scenarios that presently do not include irrigation were not be updated; OPP is presently determining how to best evaluate and include irrigation in additional scenarios.

Irrigation parameters were updated for the twelve scenarios where irrigation had already been incorporated into the scenario. Irrigation parameters were updated in accordance with the Irrigation Guidance for developing PRZM Scenario, revised June 15, 2005 (USEPA 2005). Irrigation parameters were determined based on reference information for the crop and region which was previously referenced for the scenario. USDA Crop Profiles were also used as a reference, as well as notes from conversations with extension agents to determine Irrigation Type (USEPA 2005, Table 3). Default values provided in the Guidance were used when specific information was not available in the reference material for the Leaching Factor (FLEACH) and the Fraction of Water Capacity when Irrigation is Applied (PCDEPL). The Maximum Rate at which Irrigation is Applied (RATEAP) was determined from Table 1 using the cropping curve number and *f* from Table 1.

During the irrigation revision process, SRC recognized that EFED noted several scenarios were parameterized by performing a sensitivity analysis using the previous version of PRZM (e.g., GA onions). EFED directed SRC to update these scenarios to the current irrigation guidance (USEPA 2005) as well. SRC updated all twelve scenarios to be consistent with the guidance provided.

A number of CLA comments indicated that the documentation stated that the crop is typically irrigated, but not irrigation was simulated in the PRZM file. SRC indicated to EFED that this is an issue for roughly 30 of the scenarios. For the time being, EFED directed SRC to address this issue by adding the following statement to the introduction of the metadata:

"Several existing scenarios incorporate irrigation into the scenario and as such have been parameterized for either over-canopy or under-canopy irrigation. A number of other scenarios indicate in the metadata file that a significant portion of the crop in the geographic area identified utilize irrigation. To date, EFED has not incorporated irrigation into these scenarios. EFED is currently evaluating a standardized approach for determining when a scenario should include irrigation and this will be reflected in future revisions to these scenarios."

The above comment has been added to the metadata.

Task 4 – Revise existing scenarios to address both general inconsistencies in scenarios identified in the previous contract deliverable.

SRC revised general inconsistencies identified in the previous contract deliverable. Refer to Appendix B for inconsistencies addressed and a summary of parameter harmonization.

Task 5 - Resolve inconsistencies in meteorological stations with emphasis on those scenarios located in California.

The following approach was proposed in SRCs workplan and approved by EFED. SRC conducted an analysis of the current weather station assignment in the PRZM summary files to verify that the weather station is appropriate. According to guidance received with this TD for selecting weather stations, meteorological stations are to be associated with a scenario based on 1) the availability of meteorological data required by PRZM, 2) a station's proximity to the scenario location, and 3) the representativeness of the station. MLRAs are no longer considered in selecting a meteorological station (as done under previous USEPA 2004 guidance).

SRC conducted an analysis of the proximity of each scenario location to available weather stations. The analysis first obtained the geographic locations of weather stations that have data required by PRZM (found at http://www.epa.gov/ceampubl/tools/metdata/index.htm). Second, the distance from the scenario county to the assigned weather station was computed for all scenarios. Next, the geographically closest station was identified (based on county centroid). The results of the meteorological station analysis are provided in Appendix B. Where a scenario was not assigned to the nearest weather station, an analysis of the representativeness of the present station versus the nearest station was conducted. In cases where the more distant station was more representative than a closer station, the justification for selecting the more distant station was provided in the metadata.

The following scenarios were found to be associated with meteorological stations that were not the closest geographically to the scenario county: CA alfalfa; CA citrus; CA lettuce; LA sugarcane; OR filberts.

Task 6 - Cross-walk existing soil parameters with the most recent data in the USDA "Soil Data Mart" and update scenarios if necessary.

SRC provided EFED with the findings of a preliminary Soil Data Mart cross-walk on 1/27/2006. Based on the initial cross-walk, nearly half of the scenarios utilize a soil type that is not listed in Soil Data Mart for the given scenario location. Many scenario developers relied on PIC and the NRCS soil characterization database (as per guidance). EFED indicated that SRC should not spend further resources to update parameters based on Soil Data Mart, except in cases where SRC has been relying on Soil Data Mart to harmonize scenarios.

Task 7 - Update and revise scenario documentation (Metadata Files)

SRC revised the scenario documentation in conjunction with summary file revisions. Upon completing scenario revisions, the metadata was cross-walked with the scenario files to ensure harmony.

Task 8 - Update scenario database

An updated MS Access database containing the PRZM summary file parameters is submitted with this deliverable.

Task 9 - Update scenario revision log

The scenario revision log (Appendix C) has been updated and is provided in Microsoft Word as Attachment D of this deliverable.

ADDITIONAL ITEMS

The items listed below have been postponed and/or are under consideration by EFED. They are provided here for future reference.

1. Add irrigation to scenarios that are typically irrigated. SRC has provided initial recommendations under the previous contract. EFED is standardizing procedures for determining scenarios that should be irrigated.
2. Transfer parameters listed in the PRZM summary files but not in the metadata to the metadata. Refer to Task 2 and the metadata introduction for more details.
3. EFED is considering whether or not the carbamate metadata should be kept in the same document as the other scenarios.
4. EFED is considering whether or not a statement of "standard" vs "OP" vs "carbamate" should be included in the introduction of each scenario.
5. EFED is considering options to parameterize files using Soil Data Mart.

GUIDANCE REVISIONS SUGGESTED

A number of revisions and clarifications were made to guidance throughout the scenario revision process. In addition to being discussed in the appropriate places in this report, they are being summarized here for the Agency's convenience. It is recommended that the following updates be made to the scenario development guidance.

1. For a crop and/or which is considered "evergreen" or with year round canopy coverage (e.g. citrus) the emergence, maturity and harvest dates should be selected to insure full year canopy coverage. For example for citrus (see the CAcitrus scenario) the emergence date should be selected for January 1 while the maturity date can be January 2 and the harvest date December 31. This insures year round full canopy coverage for the "evergreen" crop.
2. For deciduous tree and orchard crops, the emergence, harvest and planting dates should be selected to coincide with the growth cycle of the leaves and/or fruit of the crop. For example, MIcherry scenario has an emergence date tied to the leaf bloom, while the emergence date is tied to the maturity of the leaf, and the harvest date tied to the harvest of the fruit.
3. Non-Standard harvest dates - Treat all multi harvest crops (such as alfalfa as a single crop rotation) as a normal crop with an initial emergence and final maturity/harvest dates. The ability to add the complexity needed in the cropping cycle can be handled in future iterations
4. Treat all multi year harvest as a continuous rotation much as specified for citrus and orchards - In keeping with this the scenario should start with emergence on Jan 1, maturity on Jan 2, and harvest on Dec 31
5. DPN- Correct USEPA (2004) Guidance document where it states "Lower horizons can be set from 1 – 10". This should state "1 – 5"
6. Provide guidance for developing Turf scenarios. Guidance for Turf is found only in the metadata for PA and FL Turf.

7. Irrigation Guidance—Correct the error in Table 3 regarding over-canopy irrigation with IRTYP 4.
8. NHORIZ- (Number of Horizons) use all the horizons as described for the soil to eliminate personal judgment on consolidating soil parameters for lower horizons.
9. USLEK – (Kfactor) use the value from the surface horizon for the soil.
10. BD, THEFC,THEWP, OC — use representative values from Soil Data Mart where available rather than the midpoint of the range.

QUALITY ASSURANCE

SRC implemented QAQC procedures tailored to this individual technical direction to ensure that the deliverables submitted to the Agency are of highest quality to support the Agency's objectives. Deliverables were inspected by the SRC project manager and other QAQC personnel when necessary. Documentation of the internal QAQC process will be maintained and can be made available to the Agency upon request.

REFERENCES

SRC 2005. Scenario Development for the Pesticide Root Zone Model (PRZM) for use in the Office of Pesticide Programs (OPP) Risk Assessment Process: Comprehensive Revision and Update of PRZM scenarios. Revised October 31, 2005.

USEPA 1998. Carsel, R.F., J.C. Imhoff, P.R. Hummel, J.M. Cheplick, and A.S. Donigian, Jr. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in the Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

USEPA 2004. Pesticide Root Zone Model (PRZM) Field and Orchard Crop Scenarios: Guidance for Selecting Field Crop and Orchard Scenario Input Parameters. November 15, 2001; Revisions July 2004.

USEPA 2005. Irrigation Guidance for developing PRZM scenarios. Memo dated June 15, 2005.

Appendix A. Currently Approved Scenarios to Revise

Standard Scenarios (50)*

CAalmondIC
CAcitrusIC
CAcottonIC
CAfruitIC
CAgrapesIC
CAlettuce
CAonionIC
CAtomatoIC
FLavacadoC
FLcabbageC
FLcarrotC
FLcitrusC
FLcucumberC
FLpeppersC
FLstrawberryC
FLsugarcaneC
FLtomatoC
FLturfC
GAonionsC
GApeachesC
GApecansC
IDNpotato_WirrigC
ILcornC
KSsorghumC
LAsugarcaneC
MEpotatoC
MIasparagusC
MIbeansC
MIcherriesC
MNsugarbeetC
MScottonC
NCappleC
NCcornEC
NCcottonC
NCpeanutC
NCsweetpotatoC
NCtobaccoC
NDcanolaC
NDwheatC
NYgrapesC
OHcornC
ORappleC
ORfilbertsC
ORgrassseedC
ORhopsC
ORmintC
ORsnbeanC
PAappleC
PAturfC
PRcoffee

OP Cumulative Scenarios (22)

CAalfalfaIC
CAcornC
CAsugarbeetIC
FLsweetcornC
MNalfalfaC
MScornC
MSsoybeanC
NCcalfalfaC
NCcornWC
NDcornC
ORberriesC
ORswcornC
ORwheatC
ORXmastreeC
PAalfalfaC
PAcornC
PAtomatoC
TXalfalfaC
TXcornC
TXcottonC
TXsorghumC
TXwheatC

Carbamate Cumulative Scenarios (13)

WAonion
WAbean
WAorchard
WApotato
STXvegetable
STXmelon
STXgrapefruit
STXcotton
STXcorn
PAvegetable
ILbean
ILalfalfa
FLpotato

Appendix B. Summary of Inconsistencies and Harmonization.

CROP PARAMETER HARMONIZATION

CLA commented that "*Crop characteristics for the same crop may differ between scenarios (e.g. root depth and percentage canopy cover for cotton vary considerably between states without explanation).*"

This comment is relevant to the following parameters: HTMAX, CINTCP, AMXDR, COVMAX. These parameters were harmonized by identifying inconsistencies among crops located in different counties using an Access query built into the PRZM scenario database; 2) determining the sources of the inconsistent parameter values; and 3) evaluating whether or not the inconsistent parameter values should be modified. If inconsistencies were identified and a) if the inconsistencies arose from acceptable sources (e.g. advice from extension agents), they were documented and the parameter values remained unchanged; b) if the inconsistencies arose from insufficiently documented sources, a representative value with an acceptable source (e.g. extension agent, USEPA 2004 guidance, similar scenario with acceptable source) was selected and cited for the new parameter value.

CINTCP

All CINTCP values were harmonized between similar crops. Inconsistencies remain among PAvegetable and STXvegetable scenarios. The differences in CINTCP values of vegetable crops were justified in the metadata as being attributed to the representation of different vegetable crops. PAvegetable is representative of potato and pumpkin crops and STXvegetable is representative of carrot, onion and cabbage crops. The PAvegetable value is consistent with potato crops. The STXvegetable value is consistent with FLcarrotC (but not onion scenarios).

HTMAX

All HTMAX values were harmonized between similar crops. The following 25 scenarios required modification of the metadata and/or PRZM summary file:

> CAalfalfaIC, CAcottonIC, CAgrapesIC, FLpotato, FLsweetcornC, ILbean, ILcornC, KSsorghumC, MIbeansC, MScottonC, NCcornWC, NCcottonC, NDwheatC, OHcornC, ORappleC, ORsnbeanC, ORwheatC, PAtomatoC, STXcorn, STXcotton, TXcornC, TXcottonC, TXsorghumC, WAbean, WAorchard.

Several scenarios have HTMAX inconsistencies that remain and are justified based on local expert opinion or other acceptable sources:

> PAalfalfaC.txt, NCalfalfaC.txt, TXalfalfaC, CAcitrusIC, FLcitrusC, TXcornC, STXcorn, NYGrapesC, CAgrapesIC, CAsugarbeetIC, MNsugarbeetC, ORswcornC, FLsweetcornC, CAtomato_WirrigC, FLturfC, and PAturfC.

Note that PAvegetable and STXvegetable were inconsistent since they represent different crops. PA vegetable is representative of potato and pumpkin crops and STX vegetable is representative of carrot, onion and cabbage crops. The remaining crops were consistent with each other.

AMXDR

All AMXDR values were harmonized between similar crops. Scenarios with AMXDR inconsistencies between crop types were found to result from 1) differences in sources: local expert opinion or other acceptable sources; or 2) cases where the AMXDR was set to the maximum soil depth (CORED) and the values differed among scenarios. Scenarios with justified inconsistencies include: CAalfalfaC, ILalfalfa, PAalfalfaC, PAappleC, ORappleC, WAorchards, NCappleC, CAcitrusC, FLcitrusC, IDNpotato_wirrigC, CAsugarbeetC, MNsugarbeetC, CAtomato_wirrigC, FLtomatoC, PAtomatoC, and TXwheatC. PAvegetable and STXvegetable were inconsistent since they represent different crops. PAvegetable is representative of potato and pumpkin crops and STXvegetable is representative of carrot, onion and cabbage crops. Inconsistencies were noted and justified in the metadata. The remaining crops were consistent with each other.

COVMAX

All COVMAX values were harmonized between similar crops. The following scenarios have (acceptable) inconsistencies in COVMAX between crop types due to local expert opinion or other acceptable sources: PAappleC, ORappleC, WAorchards, NCappleC, CAcitrusIC, FLcitrusC, NCcottonC, NYGrapesC, CAgrapesIC, CAtomato_wirrigC, FLtomatoC, and PAtomatoC. PAvegetable and STXvegetable were inconsistent since they represent different crops. PA vegetable is representative of potato and pumpkin crops and STX vegetable is representative of carrot, onion and cabbage crops. Inconsistencies were noted and justified in the metadata. The remaining crops were consistent with each other.

SOIL PARAMETER INCONSISTENCIES

SLP

A total of 56 revisions were made to slope factors in the metadata and/or scenario file based on USEPA 2004 guidance. Refer to the revision log (Appendix C) for each scenario for more details.

CAcottonIC, CAfruitIC, CAfruitIC, CAlettuce, FLpotato, FLstrawberryC, GApeachesC, GApecansC, ILalfalfa, ILbean, ILcornC, KSsorghumC, LAsugarcaneC, MEpotatoC, MIAsparagusC, MIAsparagusC, MIbeansC, MIcherriesC, MNalfalfaC, MNsugarbeetC, MScottonC, NCalfalfaC, NCappleC, NCcornWC, NCcottonC, NDcornC, ORappleC, ORberriesC, ORfilbertsC, ORgrassseedC, ORhopsC, ORhopsC, ORmintC, ORsnbeanC, ORswcornC, ORwheatC, ORXmastreeC, PAalfalfaC, PAcornC, PAtomatoC, PAturfC, PAturfC, PAvegetable, STXgrapefruit, TXalfalfaC, TXcornC, TXcottonC, TXcottonC, TXsorghumC, TXwheatC, WAbean, WAbean, WAonion, WAorchard, WApotato, WApotato

USLELS

A total of 60 USLELS factors were recalculated based on the following equation revised from USEPA 2004 guidance. Refer to the revision log (Appendix C) for each scenario for more details.

LS = ((length/72.6)^(m))*((430*(slope/100)^2+30*(slope/100)+0.43)/6.613)

The LS factor was changed for the following scenarios:

CAalfalfaIC, CAalmondIC, CAcitrusIC, CAcottonIC, CAfruitIC, CAgrapesIC, CAlettuce, CAonionIC, CAsugarbeetIC, CAtomato_WirrigC, FLavacadoC, FLcitrusC, FLstrawberryC, FLsugarcaneC, FLturfC, GAonionsC, GApecansC, IDNpotato_WirrigC, ILalfalfa, ILbean, ILcornC, KSsorghumC, LAsugarcaneC, MIAsparagusC, MIbeansC, MIcherriesC, MNalfalfaC, MNsugarbeetC, MScornC, MScottonC, MSsoybeanC, NCappleC, NCcornWC, NCcottonC, NCtobaccoC, NDcanolaC, NDcornC, NDwheatC, OHcornC, ORappleC, ORberriesC, ORfilbertsC, ORgrassseedC, ORhopsC, ORmintC, ORsnbeanC, PAalfalfaC, PAappleC, PAcornC, PAturfC, PAvegetable, TXalfalfaC, TXcornC, TXcottonC, TXsorghumC, TXwheatC, WAbean, WAonion, WAorchard, WApotato

GEOGRAPHIC INCONSISTENCIES

ANETD

Minimum depth to which evaporation is extracted (ANETD) factors were updated in the metadata and/or the PRZM summary file for the following 63 scenarios. Refer to the revision log (Appendix C) for more details.

> CAalfalfaIC, CAalmondIC, CAcitrusIC, CAcornC, CAcottonIC, CAfruitIC, CAgrapesIC, CAlettuce, CAonionIC, CAsugarbeetIC, CAtomato_WirrigC, FLcabbageC, FLcarrotC, FLcitrusC, FLcucumberC, FLpeppersC, FLsugarcaneC, FLsweetcornC, FLtomatoC, GAonionsC, IDNpotato_WirrigC, ILcornC, KSsorghumC, MIAsparagusC, MIbeansC, MIcherriesC, MNalfalfaC, MNsugarbeetC, MScottonC, MSsoybeanC, NCalfalfaC, NCappleC, NCcornEC, NCcornWC, NCcottonC, NCpeanutC, NCsweetpotatoC, NCtobaccoC, NDcanolaC, NDcornC, NDwheatC, NYgrapesC, OHcornC, ORappleC, ORberriesC, ORfilbertsC, ORgrassseedC, ORhopsC, ORmintC, ORsnbeanC, ORswcornC, ORwheatC, ORXmastreeC, PAappleC, PAcornC, PAtomatoC, STXgrapefruit, STXmelon, STXvegetable, WAbean, WAonion, WAorchard, WApotato

PFAC

Pan evapotranspiration (PFAC) factors were also updated to be geographically consistent. PFAC were adjusted in the metadata and/or the PRZM summary file for the following 14 scenarios. Refer to the revision log (Appendix C) for more details.

> CAalmondIC, CAcitrusIC, CAcottonIC, CAgrapesIC, CAtomato_WirrigC, ILalfalfa, ILbean, MScottonC, ORberriesC, ORhopsC, STXgrapefruit, STXmelon, STXvegetable, TXcottonC

SFAC

The following 49 scenarios required updates in the metadata and/or the PRZM summary file based on current guidance (USEPA 2004). Refer to the revision log (Appendix C) for more details.

> MNsugarbeetC, GApeachesC, GApecansC, ORgrassseedC, ORmintC, ORsnbeanC, ORswcornC, GAonionsC, MScottonC, NCcornEC, NCcottonC, NCpeanutC, NCsweetpotatoC, ORhopsC, NCappleC, ORfilbertsC, PAappleC, WAorchard, PAcornC, WApotato, WAbean, WAonion, NCcornWC, MScornC, MSsoybeanC, CAlettuce, IDNpotato_WirrigC, KSsorghumC, TXcottonC, PAalfalfaC, PAtomatoC, PAturfC, NYgrapesC, OHcornC, CAalfalfaIC, CAcornC, CAcottonIC, NDcanolaC, NDwheatC, TXcornC, TXwheatC, CAonionIC, CAgrapesIC, CAcitrusIC, CAalmondIC, CAtomato_WirrigC, MNalfalfaC, MIcherriesC, ORappleC

METEOROLOGICAL STATIONS

Meteorological stations were checked for consistency among scenarios located in the same county and for geographic proximity to the scenario county. Current EFED guidance dictates using the closest available station that contains the required data for PRZM (available stations can be found at http://www.epa.gov/ceampubl/tools/metdata/index.htm). If a more representative station is available, but is not the closest, the choice of the further station must be clearly documented. Results of the analysis are provided below. The only scenarios that are located in the same county but have different weather station assignments are located in California. These scenarios are discussed first. Details for each individual scenario are provided afterward.

California Scenarios

Several scenarios in California were inconsistent with each other. Specifically, scenarios located in the same counties are not always assigned to the same met station.

<u>Fresno County Scenarios</u>: CA citrus, cotton, and fruit are generally representative of Fresno County and more broadly the Central Valley. CA cotton and fruit are associated with the Fresno, CA meteorological station, whereas CA citrus is assigned to the Bakersfield, CA station. This inconsistency appears acceptable when considering the

major production region for CA citrus is located in the southern Central and San Joaquin Valleys. Refer to the discussion of CA citrus below for more detail. A description of the met file justification for CA citrus has been added to the metadata.

San Joaquin County Scenarios: CA alfalfa, almond, and tomato scenarios are representative of San Joaquin County, and more broadly the Central Valley. CA almond is associated with the Sacramento weather station which is the geographically closest station (see comment below relating to the representativeness of the weather station). The alfalfa and tomato scenarios are associated with the Fresno Station, which are not the geographically closest stations with available data. However, they are more representative of the crop production areas (see discussion below).

The following scenarios are not associated with the geographically closest weather station based on the scenario county. Their selection has been justified and documented in the metadata. Further details are provided below.

CA Alfalfa

The Fresno, California meteorological station is selected for this scenario. As noted above, the scenario represents San Joaquin County, and more broadly the Central Valley. Although there are closer meteorological stations to San Joaquin County, Fresno is located in the center of the Central Valley and is more representative of Central Valley alfalfa production.

CA Almond

The Sacramento, California meteorological station is used for this scenario. As noted above, the scenario represents San Joaquin County, and more broadly the Central Valley. The Sacramento station is the closest station available to San Joaquin county and lies in the center of California almond production. The 1999 USDA crop profile for California almonds states that over 99% of the almonds in California are produced in the San Joaquin and Sacramento Valleys. Approximately 80% of the production is in the San Joaquin Valley. Kern and Fresno Counties in the south and Merced and Stanislaus in the north are the highest producing counties in the San Joaquin Valley (15). Glenn, Butte, and Colusa Counties in the Northern Sacramento Valley account for approximately 15% of the annual production in the state with the remainder being grown in the southern part of the Sacramento Valley (15). Other regions of the state account for <1% of the almond production

CA Tomatoes

The Fresno, California meteorological station is selected for this scenario. The scenario represents San Joaquin County, and more broadly the Central Valley. Although the Fresno station is not the geographically closest metrological station to San Joaquin County, The Fresno met station is located in the middle of Central Valley and is more representative climatologically for Central Valley tomato production. The 2000 USDA crop profile for tomatoes (fresh market) indicates that 45% of the state's fresh market tomatoes are produced in San Joaquin, Stanislaus and Merced counties. The 1999 USDA crop profile for processing tomatoes indicates the San Joaquin Valley south of Merced County produces 35 to 40%. Additionally, in 2004, Fresno produced the highest harvested acreage of tomatoes in the US based on the 2004 USDA NASS census of agriculture.

CA Citrus

The Bakersfield, California meteorological station located in southern San Joaquin Valley is selected for this scenario.   The scenario is generally representative of Fresno County. Although Bakersfield is not the geographically closest station to Fresno County, it is most representative of the scenario since it lies in the middle of the citrus growing region. The USDA 2003 crop profile for California citrus indicates that citrus is grown in four regions: San Joaquin Valley Region, the Coastal-Intermediate Region, the Interior Region, and the Desert Region, with over 50% of CA citrus is grown in the San Joaquin Valley.

CA Lettuce

The Santa Maria, California meteorological station is selected for this scenario. The scenario is located in Monterey County. Although there are closer stations to Monterey County, the Santa Maria station is the closest coastal station and is therefore more relevant climatologically for this coastal scenario. In addition, the 2001 USDA crop profile for CA lettuce indicates that lettuce is planted in three primary production areas in California, with the principal production in the coastal areas of Salinas, Watsonville, and Santa Maria.

CA Sugarbeet

The Fresno, California meteorological station is selected for this scenario. As noted in the metadata this scenario represents a large geographic range including the Central and San Joaquin Valleys. Based on the USDA 2002 census of agricultural, the top sugar beet producing counties in California (in order by harvested tons) are Imperial, Fresno, Merced, and Kern counties. The Fresno meteorological station is selected for this scenario since it is generally in the geographic center of the Central Valley, and also the geographically closest station to the top sugar beet producing counties. Although there are closer meteorological stations to San Joaquin County (used for soil parameters), Fresno is located in the center of the Central Valley and is more representative of large geographic extent of sugar beet production areas.

LA Sugarcane

The meteorological station associated with this scenario is located in Baton Rouge, Louisiana (W13970). Although the Baton Rouge station is not the closest met station, it is more representative of the geographic areas where sugarcane is grown in Louisiana. The 1999 USDA crop profile for LA sugarcane indicates that it is grown in at least 21 parishes in the south central part of the state, extending from Rapides Parish near the center of the state, south to Lafourche Parish south of New Orleans and west to near Lake Charles in Calcasieu Parish. In addition,   Baton Rouge is approximately in the center of LA sugarcane production based on the 2004 USDA NASS census of agriculture.

OR Filberts (hazelnuts)

The scenario uses the Salem, Oregon station. The scenario is located in Washington County, approximately 40 miles from the Oregon seacoast. Although the Portland station is closer to the centroid of the Washington County, the Salem station is more representative of the geographic areas where filberts are grown. The USDA 1999 crop profile for Oregon Hazelnuts indicates production in the following counties in order of production: Yamhill, Washington, Marion, Clackamas, Lane, Polk, Linn, and Benton. The Salem station is located in the middle of the filbert production counties referenced above. In addition, the Salem station is closer to the seacoast (approx. 50 mi.) than the Portland (approx. 60 mi.) station and is expected to experience climate conditions more similar to the scenario location.

IL Alfalfa, IL Beans

These scenarios originally referenced Peoria, but were changed during the previous contract to Moline based on guidance to select the nearest met station in the same MLRA. Updated guidance from EFED stated to use the closest station, regardless of MLRA. If a further station was chosen because it was more representative climatologically, then it should be clearly documented. Because, the scenarios originally used Peoria, IL (the closest available station), the scenarios were switched back from Moline to Peoria, IL.

IL Corn

Metadata references meteorological station as Burlington, IA (W14931), while the scenario file references Moline, IL (W14923). In fact, the Peoria, IL station (W14842) is the closest available station relative to McLean County. In addition, the IL alfalfa and IL beans scenarios located in McLean County also use W14842. The meteorological station was changed to Peoria, IL (W14842), the closest station as per guidance, and to be consistent with the IL corn and beans scenarios.

Pennsylvania Scenarios

The following PA scenarios were originally associated with the Allentown meteorological station (14737) which is not the closest weather station: PA alfalfa, PA apple, PA corn, PA tomato, PA turf. It is believed that these scenarios were developed before (or based on scenarios developed before) the switch to the SAMSON weather data. The SAMSON weather data include a closer station located in Harrisburg that is a better choice for these scenarios. Although the two stations are similar as far as average annual precipitation (Harrisburg-103.0 cm/yr ; Allentown-105.6 cm/yr) and average daily precipitation (Harrisburg-0.28 cm/day; Allentown-0.29 cm/day), Harrisburg has on average more precipitation for the majority of the growing season (refer to Figure B-1, May - September). The increased rainfall during the growing season is an important consideration since pesticides are more likely to be applied during the growing season for these scenarios. As a result, the meteorological station designation was change from Allentown to Harrisburg for the following scenarios: PA alfalfa, PA apple, PA corn, PA tomato, PA turf.

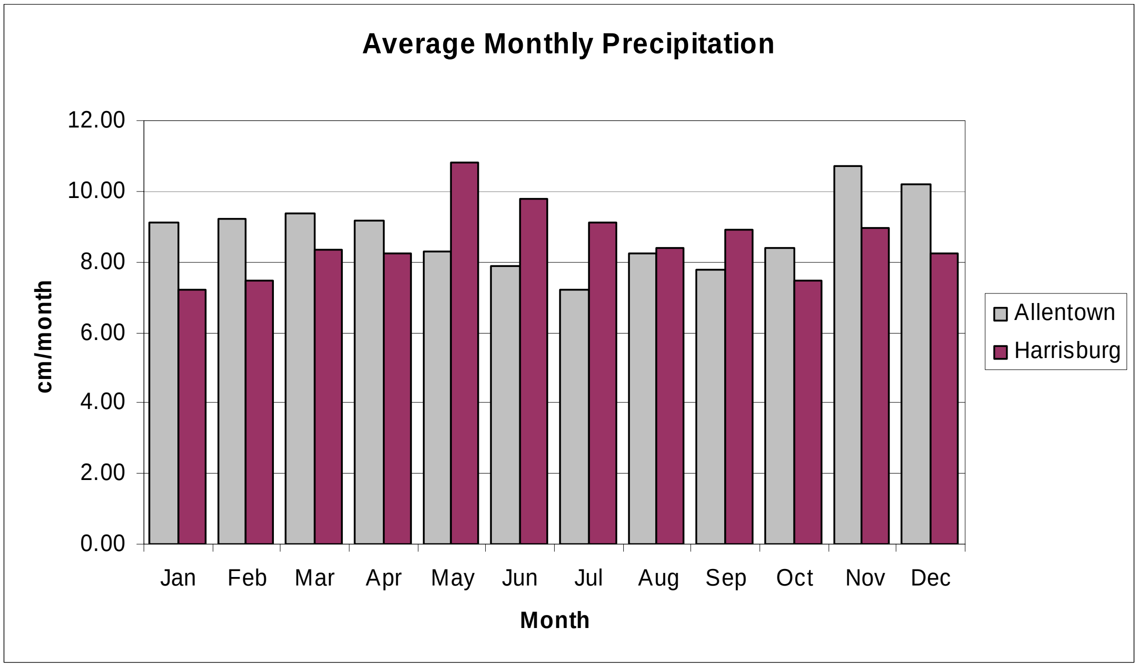

Figure B-1. Average monthly precipitation over 30 years obtained from PRZM meteorological daily value files for Allentown and Harrisburg stations.

PA Alfalfa

The scenario is located in York County. The Allentown met station (14737) was originally assigned to this scenario; however the Harrisburg station (14751) is approximately 60 miles closer to York County. There is no crop profile for PA alfalfa. Neither the metadata nor scenario file describes how the met station was selected. Based on the discussion above, the meteorological station designation was change from Allentown to Harrisburg for this scenario.

PA Apple

The scenario is located in Lancaster County. The Allentown met station (14737) was originally assigned to this scenario; however the Harrisburg station (14751) is approximately 30 miles closer to Lancaster County. There is no crop profile for PA apple. Neither the metadata nor scenario file describes how the met station was selected. Metadata does state soils are found in the Northern Piedmont region. Based on the discussion above, the meteorological station designation was change from Allentown to Harrisburg for this scenario.

PA Corn

The scenario is located in Lancaster County. The Allentown met station (14737) was originally assigned to this scenario; however the Harrisburg station (14751) is approximately 30 miles closer to Lancaster County. The 2004 USDA crop profile for PA corn indicates the leading corn production counties by acreage are Lancaster, York, Franklin, Berks, and Chester. These five counties account for nearly one-third of the Pennsylvania corn acreage. The Harrisburg station is also closer to these scenarios that the Allentown station (presently assigned). Neither the metadata nor scenario file describes how the met station was selected. Based on the discussion above, the meteorological station designation was change from Allentown to Harrisburg for this scenario.

PA Tomato

The scenario is located in Adams and Lancaster Counties. The Allentown met station (14737) was originally assigned to this scenario; however the Harrisburg station (14751) is approximately 30 miles closer to Lancaster County. Based on the discussion above, the meteorological station designation was change from Allentown to Harrisburg for this scenario.

PA Turf

The scenario is located in York County. The Allentown met station (14737) was originally assigned to this scenario; however the Harrisburg station (14751) is approximately 60 miles closer to York County. There is no crop profile for PA Turf. The scenario file indicates that this scenario was modified from the PA alfalfa scenario. This is presumed to be the reason for using the Allentown station. Based on the discussion above, the meteorological station designation was change from Allentown to Harrisburg for this scenario.

Scenario File	Scenario County	Current Metstation Assignment, wban (distance)	Geographically Closest Station, wban (distance)	Dist. is Based On County	Closest	Comment
CAalfalfaIC	San Joaquin	Fresno, CA 93193 (113.5 mi.)	Sacramento, CA 23232 (45.8 mi.)	San Joaquin, California	NO	Fresno is appropriate (see metadata for details)
CAcitrusIC	Fresno	Bakersfield, CA 23155 (97.7 mi.)	Fresno, CA 93193 (5.7 mi.)	Fresno, California	NO	Bakersfield is appropriate (see metadata for details)
CAlettuceC	Monterey	Santa Maria, CA 23273 (106.9 mi.)	Fresno, CA 93193 (80.7 mi.)	Monterey, California	NO	Santa Maria is appropriate (see metadata for details)
CAtomato_WirrigC	San Joaquin	Fresno, CA 93193 (113.5 mi.)	Sacramento, CA 23232 (45.8 mi.)	San Joaquin, California	NO	Fresno is appropriate (see metadata for details)
FLturfC	Osceola	Daytona Beach, FL 12834 (82.8 mi.)	Tampa, FL 12842 (78.1 mi.)	Osceola, Florida	NO	Difference in distance is not significant based on spatial data resolution. Maintained Daytona Beach.
LAsugarcaneC	South-central Louisiana	Baton Rouge, LA 13970 (76.1 mi.)	New Orleans, LA 12916 (51.5 mi.)	Terrebonne, Louisiana	NO	Baton Rouge is appropriate (see metadata for details)
ORfilbertsC	Washington	Salem, OR 24232 (43.5 mi.)	Portland, OR 24229 (25.3 mi.)	Washington, Oregon	NO	Salem is appropriate. (see metadata for details)
ORXmasTreeC	Benton	Salem, OR 24232 (36.7 mi.)	Eugene, OR 24221 (28.3 mi.)	Benton, Oregon	NO	Difference in distance is not significant based on spatial data resolution. Keep Salem station designation.
CAalmondIC	San Joaquin	Sacramento, CA 23232 (45.8 mi.)	Sacramento, CA 23232 (45.8 mi.)	San Joaquin, California	YES	Closest Station - No Change
CAcornC	Stanislaus/San Joaquin	Sacramento, CA 23232 (45.8 mi.)	Sacramento, CA 23232 (45.8 mi.)	San Joaquin, California	YES	Closest Station - No Change
CacottonIC	Fresno	Fresno, CA 93193 (5.7 mi.)	Fresno, CA 93193 (5.7 mi.)	Fresno, California	YES	Closest Station - No Change
CAfruitIC_rev_3.txt	Fresno	Fresno, CA 93193 (5.7 mi.)	Fresno, CA 93193 (5.7 mi.)	Fresno, California	YES	Closest Station - No Change
CAgrapesIC	Southern San Joaquin Valley	Fresno, CA 93193 (5.7 mi.)	Fresno, CA 93193 (5.7 mi.)	Fresno, California	YES	Closest Station - No Change
CAonionIC	Kern	Bakersfield, CA 23155 (11.1 mi.)	Bakersfield, CA 23155 (11.1 mi.)	Kern, California	YES	Closest Station - No Change
CAsugarbeetIC	Central Valley, CA	Fresno, CA 93193 (5.7 mi.)	Fresno, CA 93193 (5.7 mi.)	Fresno, California	YES	Closest Station - No Change
FLcabbageC	Manatee	Tampa, FL 12842 (38.4 mi.)	Tampa, FL 12842 (38.4 mi.)	Manatee, Florida	YES	Closest Station - No Change

Scenario File	Scenario County	Current Metstation Assignment, wban (distance)	Geographically Closest Station, wban (distance)	Dist. is Based On County	Closest	Comment
FLcarrotC	Palm Beach	West Palm Beach, FL 12844 (22.1 mi.)	West Palm Beach, FL 12844 (22.1 mi.)	Palm Beach, Florida	YES	Closest Station - No Change
FLcitrusC	Collier and Hendry	West Palm Beach, FL 12844 (69.1 mi.)	West Palm Beach, FL 12844 (69.1 mi.)	Hendry, Florida	YES	Closest Station - No Change
FLcucumberC	Collier and Hendry	West Palm Beach, FL 12844 (69.1 mi.)	West Palm Beach, FL 12844 (69.1 mi.)	Hendry, Florida	YES	Closest Station - No Change
FLpeppersC	Collier and Hendry	West Palm Beach, FL 12844 (69.1 mi.)	West Palm Beach, FL 12844 (69.1 mi.)	Hendry, Florida	YES	Closest Station - No Change
FLpotato	St. John's	Jacksonville, FL 13889 (41.4 mi.)	Jacksonville, FL 13889 (41.4 mi.)	St. Johns, Florida	YES	Closest Station - No Change
FLstrawberryC	Hillsborough	Tampa, FL 12842 (11.8 mi.)	Tampa, FL 12842 (11.8 mi.)	Hillsborough, Florida	YES	Closest Station - No Change
FLsugarcaneC	Hendry	West Palm Beach, FL 12844 (69.1 mi.)	West Palm Beach, FL 12844 (69.1 mi.)	Hendry, Florida	YES	Closest Station - No Change
FLsweetcornC	Palm Beach	West Palm Beach, FL 12844 (22.1 mi.)	West Palm Beach, FL 12844 (22.1 mi.)	Palm Beach, Florida	YES	Closest Station - No Change
FLtomatoC	Manatee/Collier/Lee	West Palm Beach, FL 12844 (69.1 mi.)	West Palm Beach, FL 12844 (69.1 mi.)	Hendry, Florida	YES	Closest Station - No Change
GAOnionsC	Toombs	Savannah, GA 03822 (66 mi.)	Savannah, GA 03822 (66 mi.)	Toombs, Georgia	YES	Closest Station - No Change
GAPeachesC	Peach	Macon, GA 03813 (15.4 mi.)	Macon, GA 03813 (15.4 mi.)	Peach, Georgia	YES	Closest Station - No Change
GAPecansC	Mitchell and Dougherty	Tallahassee/Apalachicola, FL 93805 (60.9 mi.)	Tallahassee/Apalachicola, FL 93805 (60.9 mi.)	Mitchell, Georgia	YES	Closest Station - No Change
IDNpotato_WirrigC	Bingham	Pocatello, ID 24156 (27.2 mi.)	Pocatello, ID 24156 (27.2 mi.)	Bingham, Idaho	YES	Closest Station - No Change
ILalfalfa	McLean	Peoria, IL 14842 (43.7 mi.)	Peoria, IL 14842 (43.7 mi.)	McLean, Illinois	YES	Was originally Peoria. Set back to Peoria.
ILbeans	McLean	Peoria, IL 14842 (43.7 mi.)	Peoria, IL 14842 (43.7 mi.)	McLean, Illinois	YES	Was originally Peoria. Set back to Peoria.
ILCornC	McLean	Peoria, IL 14842 (43.7 mi.)	Peoria, IL 14842 (43.7 mi.)	McLean, Illinois	YES	Set to Peoria which is closest and consistent with other Moline scenarios.
KSsorghumC	Osage	Topeka, KS 13996 (29.7 mi.)	Topeka, KS 13996 (29.7 mi.)	Osage, Kansas	YES	Closest Station - No Change

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MEpotatoC	Aroostook	Caribou, ME 14607 (27.9 mi.)	Caribou, ME 14607 (27.9 mi.)	Aroostook, Maine	YES	Closest Station - No Change
MIAsparagusC	Oceana	Muskegon, MI 14840 (33.2 mi.)	Muskegon, MI 14840 (33.2 mi.)	Oceana, Michigan	YES	Closest Station - No Change
MIbeansC	Huron	Flint, MI 14826 (72.2 mi.)	Flint, MI 14826 (72.2 mi.)	Huron, Michigan	YES	Closest Station - No Change
MICherriesC	Leelanau	Traverse City, MI 14850 (18.7 mi.)	Traverse City, MI 14850 (18.7 mi.)	Leelanau, Michigan	YES	Closest Station - No Change
MNalfalfaC	Polk	Fargo, ND 14914 (64.7 mi.)	Fargo, ND 14914 (64.7 mi.)	Polk, Minnesota	YES	Closest Station - No Change
MNsugarbeetC	Polk	Fargo, ND 14914 (64.7 mi.)	Fargo, ND 14914 (64.7 mi.)	Polk, Minnesota	YES	Closest Station - No Change
MScornC	Southern MS Valley Uplands	Jackson, MS 03940 (35.2 mi.)	Jackson, MS 03940 (35.2 mi.)	Yazoo, Mississippi	YES	Closest Station - No Change
MScottonC	Yazoo	Jackson, MS 03940 (35.2 mi.)	Jackson, MS 03940 (35.2 mi.)	Yazoo, Mississippi	YES	Closest Station - No Change
MSsoybeanC	Yazoo	Jackson, MS 03940 (35.2 mi.)	Jackson, MS 03940 (35.2 mi.)	Yazoo, Mississippi	YES	Closest Station - No Change
NCalfalfaC	Western North Carolina	Asheville, NC 03812 (12.9 mi.)	Asheville, NC 03812 (12.9 mi.)	Buncombe, North Carolina	YES	Closest Station - No Change
NCappleC	Henderson	Asheville, NC 03812 (8.2 mi.)	Asheville, NC 03812 (8.2 mi.)	Henderson, North Carolina	YES	Closest Station - No Change
NCcornEC	Pitt	Raleigh/Durham, NC 13722 (79.6 mi.)	Raleigh/Durham, NC 13722 (79.6 mi.)	Pitt, North Carolina	YES	Closest Station - No Change
NCcornWC	Henderson	Asheville, NC 03812 (8.2 mi.)	Asheville, NC 03812 (8.2 mi.)	Henderson, North Carolina	YES	Closest Station - No Change
NCcottonC	Piedmont/Coastal Plain	Raleigh/Durham, NC 13722 (69.7 mi.)	Raleigh/Durham, NC 13722 (69.7 mi.)	Halifax, North Carolina	YES	Closest Station - No Change
NCpeanutC	Pitt	Raleigh/Durham, NC 13722 (79.6 mi.)	Raleigh/Durham, NC 13722 (79.6 mi.)	Pitt, North Carolina	YES	Closest Station - No Change
NCSweetPotatoC	Johnston	Raleigh/Durham, NC 13722 (32.1 mi.)	Raleigh/Durham, NC 13722 (32.1 mi.)	Johnston, North Carolina	YES	Closest Station - No Change
NCtobaccoC	Johnston and Pitt	Raleigh/Durham, NC 13722 (32.1 mi.)	Raleigh/Durham, NC 13722 (32.1 mi.)	Johnston, North Carolina	YES	Closest Station - No Change
NDcanolaC	Cavalier	Minot, ND 24013 (135.3 mi.)	Minot, ND 24013 (135.3 mi.)	Cavalier, North Dakota	YES	Closest Station - No Change
NDcornC	Pembina	Fargo, ND 14914 (132.8 mi.)	Fargo, ND 14914 (132.8 mi.)	Pembina, North Dakota	YES	Closest Station - No Change

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NDwheatC	Cass	Fargo, ND 14914 (20.9 mi.)	Fargo, ND 14914 (20.9 mi.)	Cass, North Dakota	YES	Closest Station - No Change
NYGrapesC	Chautauqua	Erie, PA 14860 (41.9 mi.)	Erie, PA 14860 (41.9 mi.)	Chautauqua, New York	YES	Closest Station - No Change
OHCornC	Darke and Pickaway	Dayton, OH 93815 (27.2 mi.)	Dayton, OH 93815 (27.2 mi.)	Darke, Ohio	YES	Closest Station - No Change
ORappleC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORberriesC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORgrassseedC	Linn	Salem, OR 24232 (37.6 mi.)	Salem, OR 24232 (37.6 mi.)	Linn, Oregon	YES	Closest Station - No Change
ORhopsC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORmintC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORsnbeansC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORswcornC	Marion	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
ORwheatC	Willamette Valley	Salem, OR 24232 (10.3 mi.)	Salem, OR 24232 (10.3 mi.)	Marion, Oregon	YES	Closest Station - No Change
PAalfalfaC	York	Harrisburg, PA 14751 (18.9 mi.)	Harrisburg, PA 14751 (18.9 mi.)	York, Pennsylvania	YES	Changed from Allentown to Harrisburg. Refer to Revision Log.
PAappleC	Lancaster	Harrisburg, PA 14751 (31.4 mi.)	Harrisburg, PA 14751 (31.4 mi.)	Lancaster, Pennsylvania	YES	Changed from Allentown to Harrisburg. Refer to Revision Log.
PAcornC	Lancaster	Harrisburg, PA 14751 (31.4 mi.)	Harrisburg, PA 14751 (31.4 mi.)	Lancaster, Pennsylvania	YES	Changed from Allentown to Harrisburg. Refer to Revision Log.
PAtomatoC	Adams and Lancaster	Harrisburg, PA 14751 (31.4 mi.)	Harrisburg, PA 14751 (31.4 mi.)	Lancaster, Pennsylvania	YES	Changed from Allentown to Harrisburg. Refer to Revision Log.
PAturfC	York	Harrisburg, PA 14751 (18.9 mi.)	Harrisburg, PA 14751 (18.9 mi.)	York, Pennsylvania	YES	Changed from Allentown to Harrisburg. Refer to Revision Log.
PAvegetable	Southeastern Pennsylvania	Harrisburg, PA 14751 (31.4 mi.)	Harrisburg, PA 14751 (31.4 mi.)	Lancaster, Pennsylvania	YES	Closest Station - No Change
STXcorn	Hildago and Cameron	Brownsville, TX 12919 (61.1 mi.)	Brownsville, TX 12919 (61.1 mi.)	Hidalgo, Texas	YES	Closest Station - No Change
STXcotton	Hildago and Cameron	Brownsville, TX 12919 (61.1 mi.)	Brownsville, TX 12919 (61.1 mi.)	Hidalgo, Texas	YES	Closest Station - No Change
STXgrapefruit	Hildago and	Brownsville, TX	Brownsville, TX	Hidalgo, Texas	YES	Closest Station - No Change

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	Cameron	12919 (61.1 mi.)	12919 (61.1 mi.)			
STXmelon	Hildago and Cameron	Brownsville, TX 12919 (61.1 mi.)	Brownsville, TX 12919 (61.1 mi.)	Hidalgo, Texas	YES	Closest Station - No Change
STXvegetable	Hildago and Cameron	Brownsville, TX 12919 (61.1 mi.)	Brownsville, TX 12919 (61.1 mi.)	Hidalgo, Texas	YES	Closest Station - No Change
TXalfalfaC	Milam	Austin, TX 13958 (56.2 mi.)	Austin, TX 13958 (56.2 mi.)	Milam, Texas	YES	Closest Station - No Change
TXcornC	Milam	Austin, TX 13958 (56.2 mi.)	Austin, TX 13958 (56.2 mi.)	Milam, Texas	YES	Closest Station - No Change
TXcottonC	Milam	Austin, TX 13958 (56.2 mi.)	Austin, TX 13958 (56.2 mi.)	Milam, Texas	YES	Closest Station - No Change
TXsorghumC	Milam	Austin, TX 13958 (56.2 mi.)	Austin, TX 13958 (56.2 mi.)	Milam, Texas	YES	Closest Station - No Change
TXwheatC	Blacklands prairie region	Austin, TX 13958 (56.2 mi.)	Austin, TX 13958 (56.2 mi.)	Milam, Texas	YES	Closest Station - No Change
WAbeans	Grant	Yakima, WA 24243 (69.8 mi.)	Yakima, WA 24243 (69.8 mi.)	Grant, Washington	YES	Closest Station - No Change
WAonions	Grant	Yakima, WA 24243 (69.8 mi.)	Yakima, WA 24243 (69.8 mi.)	Grant, Washington	YES	Closest Station - No Change
WAorchards	Grant	Yakima, WA 24243 (69.8 mi.)	Yakima, WA 24243 (69.8 mi.)	Grant, Washington	YES	Closest Station - No Change
WApotato	Grant	Yakima, WA 24243 (69.8 mi.)	Yakima, WA 24243 (69.8 mi.)	Grant, Washington	YES	Closest Station - No Change

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