SECTION 7

QUALITY CONTROL/QUALITY ASSURANCE

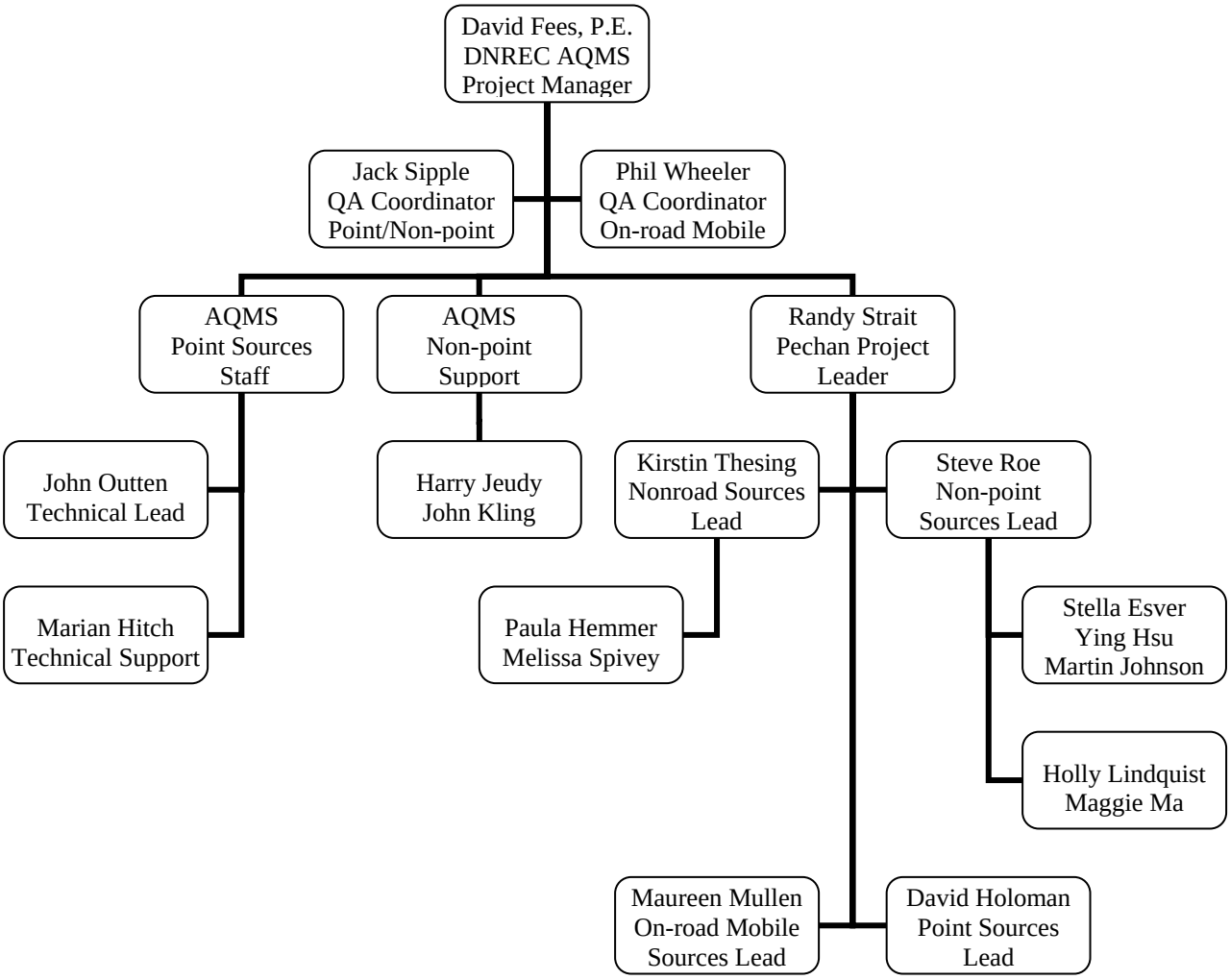
Quality control (QC) is a system of activities employed by the inventory development team to ensure the quality of the inventory in the course of its preparation. QC procedures include the use of approved emission estimation methodologies, technical reviews and data validations. Quality assurance (QA) is a system of review and audit that is conducted by personnel other than the inventory development team. The QA review assesses the effectiveness of the QC efforts and the completeness and accuracy of the inventory.

Quality control and quality assurance were conducted throughout the inventory development process and at multiple levels. This section of the report presents the QA/QC procedures established in the inventory preparation plans and how these procedures were executed.

7.1 Project Organizational Chart

The following chart provides the organizational structure established to develop the 2002 inventory. Responsibilities of key personnel are described in Section 1 of this report.

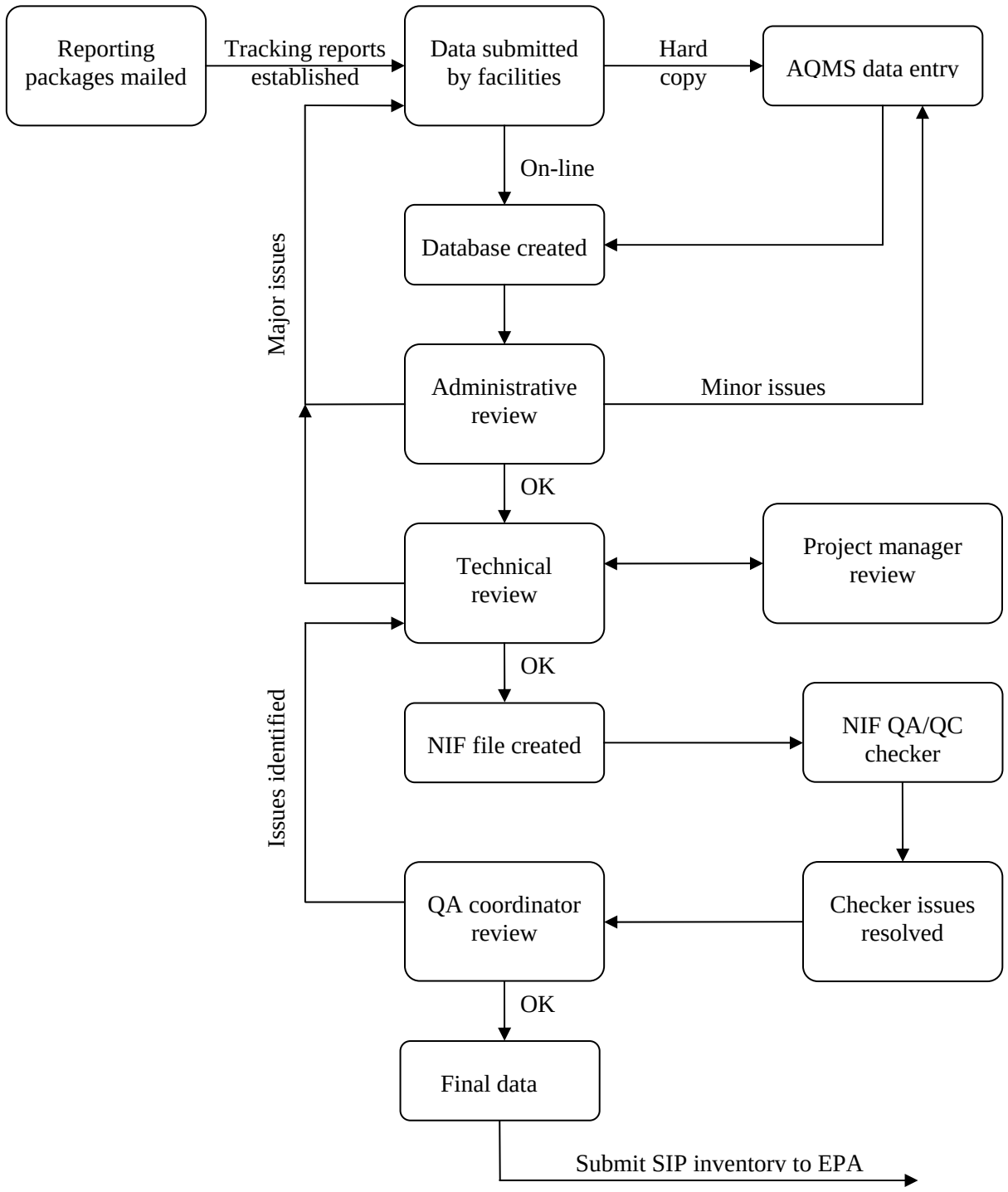
Figure 7-1. Project Organizational Chart



7.2 QA/QC for Point Source Inventory

The point source inventory was prepared by AQMS staff with assistance from Pechan after data were received from facilities. Figure 7-2 provides a data flow diagram employed for developing the point source inventory.

Figure 7-2. Point Source Inventory Data Flow Diagram



The AQMS point sources inventory staff followed up with every facility that received a reporting package until either the facility submitted inventory data or it was determined the facility did not need to report (either it did not operate in 2002 or did not meet the reporting criteria.) Therefore, 100% of Delaware facilities known to AQMS to meet the reporting criteria were successfully surveyed.

Next, staff reviewed all facility submissions through the use of the Administrative Completeness Determination checklist followed by a detailed technical review. Emissions data were compared to previous years' data to assess reasonableness and comparability. Data entered into the database by AQMS staff were spot checked by the technical lead. The technical review involved creating a detailed report from the database for each facility. The report allowed AQMS inventory staff to identify missing, suspicious or conflicting data. Any critical issues were identified and noted on the report. Corrections were made on the report as well as within the database. For QA purposes, the database automatically creates an audit trail of changes made.

Besides the detailed report, numerous database queries, reports and spreadsheets were created to identify information that appeared to be missing, in error, or inconsistent with other related information. The ozone season QA/QC report was generated for each facility to assist in analyzing ozone season daily emissions.

AQMS staff identified all EGUs that reported CEM data for SO_2 and NO_x to EPA's Emissions Tracking System (ETS). Staff compared 2002 emissions reported to ETS against emissions recorded in *i*-STEPS® and resolved several discrepancies between the two sets of data. ORIS facility codes are used by the EPA to identify EGUs in the NEI. Pechan identified ORIS IDs for Delaware facilities using in-house data it obtained from the U.S. Energy Information Administration. Pechan added the ORIS IDs in the NIF 3.0 site table since *i*-STEPS® does not contain a field to hold the ORIS ID.

Once all corrections were made to the data based on the technical review, the NIF files were created. EPA's QA/QC checker was used to verify the integrity of the NIF files. The checker was used to validate FIPS codes, SCCs, SIC codes, and North American Industry Classification System **(**NAICS) codes. The checker was also used to validate the following fields: actual throughput units, material, material input/output, emission factor units, emission numeric value units, seasonal throughput percentages, and operating time fields. These checks were completed periodically throughout the inventory development process. Any duplicate records, invalid codes, or missing data that are necessary to the NEI were flagged by the checker and addressed.

The technical lead periodically presented summaries of the point source inventory database to the project manager for review. Finally, once the technical lead and project manager deemed the inventory to be accurate and complete, the data were sent to the QA Coordinator for a final review.

Pechan augmented the QA/QC of the point source inventory in a number of ways. Pechan created a QA/QC tracking spreadsheet containing numerous issues that they would address in the course of developing the point sources inventory. The results of the QA/QC review and the final resolution of the issue were documented in the tracking spreadsheet. The tracking spreadsheet is provided in the supporting documentation contained on the CD accompanying this report.

Pechan reviewed emission factors to verify correct matching of emission factors and process SCCs. Emission factor values expressed in units other than SCC units were converted to match the SCC units. The conversion factors were documented and checked to ensure that they were correct and correctly applied.

Pechan evaluated MACT standard compliance status for all facilities known to be subject to one or more MACT standards. Pechan also analyzed TRI data, to identify emissions not reported to AQMS and to assess the accuracy of VOC emissions data that were reported.

Due to reported discrepancies by the Delaware Solid Waste Authority regarding amounts of landfill gas recovered being larger than estimated landfill gas generated, Pechan independently calculating emissions for the active landfills based on the latest models and site-specific data and assumptions.

Pechan supported AQMS in QA of the data in *i*-STEPS® using spot checks of data to identify data gaps and data codes that did not comply with NIF data coding specifications. Pechan reviewed throughput data to identify processes with emissions greater than zero but with missing actual throughput values. Pechan also analyzed the NIF PrimaryPCTControlEfficiency, PCTCapture Efficiency, and TotalCaptureControlEfficiency fields to identify potential inconsistencies between the fields. Pechan reported the results to AQMS who evaluated the results and corrected the errors.

Pechan verified that data collected from various data sources were correctly entered or transcribed into a common format. Pechan assisted AQMS point source staff with compiling emission factors and speciation data from several data sources into the *i*-STEPS® database management system. After the data were compiled into the database, the data were compared to the original data sources to verify that the data were correctly transcribed. Documentation of the sources of the data was verified to ensure the references for the data were documented correctly.

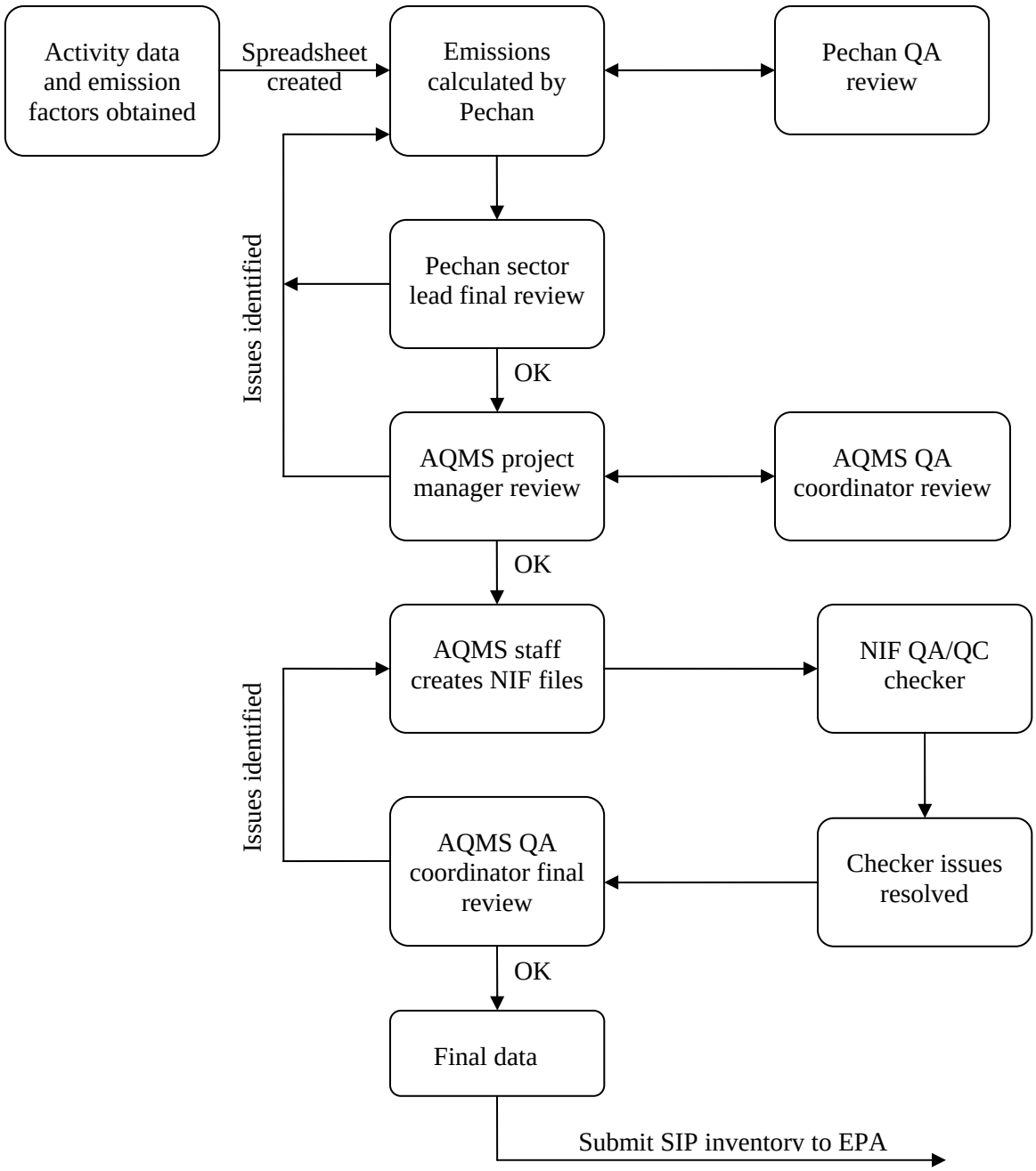
Regarding control equipment data, Pechan identified records with control efficiencies of less than one percent. AQMS investigated and corrected the data as needed (e.g., decimal values were converted to percentage values, if necessary). Pechan confirmed that emissions are zero for all processes that show the overall control efficiency (capture and control) as 100 percent for a given pollutant. AQMS confirmed that *i*-STEPS® is correctly accounting for and recording the overall control efficiency in the NIF for processes with multiple control devices.

After internal *i*-STEPS calculations were executed, AQMS generated a NIF transaction file. Pechan reviewed this file to verify that emissions had been calculated correctly and that the routine used to extract data from *i*-STEPS to NIF worked correctly. Pechan analyzed the emissions data for unexpectedly high values relative to other records in the inventory. For each pollutant, Pechan ranked emission records in descending order and reviewed the top records to identify any potential outliers.

7.3 QA/QC for Non-point and Non-road Inventory

The non-point and non-road sector inventories were prepared by Pechan with assistance by AQMS inventory staff in obtaining local activity data. AQMS was an integral part of the review process of these source sectors, as can be seen in Figure 7-3.

Figure 7-3. Non-point and Non-road Inventory Data Flow Diagram



AQMS and Pechan implemented multiple QA/QC activities during the development of the 2002 non-point and non-road inventory. These activities were conducted during inventory planning, data collection and analysis, emission calculations and the development of data files. Three levels of QA/QC activities were conducted during each phase of the project. The first level was conducted by Pechan who developed the emission estimates for non-point and non-road source categories. Pechan performed internal QA/QC checks employing senior staff to review the work performed by other members of the Pechan team. Results of the checks were documented in a QA/QC workbook contained within each source category spreadsheet. When issues were

identified, the resolution of the issue was also documented in the spreadsheet. Once Pechan's final draft numbers were received by the AQMS inventory team a second level of QA/QC checks were performed on the data. Any errors identified by AQMS staff were brought to Pechan's attention for correction. Every source category was reviewed by AQMS inventory staff during this second level of QA/QC. The third level of QA/QC checks were conducted by staff of AQMS' Planning Branch not involved with the development of the inventory. AQMS' Planning Branch was considered an objective third party that had the technical skills to fully grasp the complexities of the inventory, but was removed enough from the methodologies and procedures that they could review the inventory in an objective manner.

The Inventory Preparation Plans (IPPs) for the non-point and non-road source sectors were developed by Pechan. AQMS was directly involved in the development of the IPPs and conducted a technical review of two draft versions and the final version. AQMS approved the methodologies to be used for each non-point and non-road source category. Data collection was conducted by both AQMS and Pechan. All 2002 activity data collected were compared to past inventories, where possible, to check for reasonableness.

Pechan performed numerous QA checks to the non-point and non-road data. The first QA review they performed involved a check of the emission factors presented in the IPP against the emission factors used in the calculation spreadsheets and the emission factors reported in the NIF files. Any discrepancy in factors was corrected. A check was also performed on the activity data in the spreadsheets and NIF files to verify they were in the correct units, as specified in the IPP. Pechan performed spot checks to verify that all data received was transcribed or compiled correctly. Any necessary assumptions or conversion factors were documented and reviewed before application to the activity data calculations. Spot checks on the calculations were performed (one for each SCC) to verify the results. Also, the control parameters, temporal allocation profiles, and spatial surrogates (as applicable) were checked to verify that they correspond to the values provided in the IPP. After being applied to the activity data or emissions, Pechan checked that the emission factors and temporal profiles were applied correctly by doing spot checks and sample hand calculations. For source categories that were geo-coded, Pechan plotted these in GIS to verify that sources fell within the appropriate county.

AQMS also performed extensive checks of the spreadsheets after receiving them from Pechan. Errors were brought to Pechan's attention, corrected by Pechan, and documented in the QA/QC workbook. For most source categories, at least three iterations of the calculation spreadsheets were developed based on the several levels of review.

In running the NONROAD model, the user must specify a modeling scenario by the inventory year, geographic area (nation, state, county), time period (annual, seasonal, monthly, daily), and the equipment categories. For all other required variables, the NONROAD model provides default input values. When the user prepares an input file (referred to in NONROAD as an "option file"), the model creates a corresponding ASCII text file. This file was printed so that the scenario inputs, as well as any default input values that were changed, could be reviewed for correctness.

Pechan created four NONROAD input files (fall, spring, summer, and winter) for each county. Pechan reviewed all input files to ensure that the input values were correct. For those equipment categories where Pechan obtained State-specific or local data, Pechan replaced appropriate inputs

in the model population and county allocation fraction files, and reviewed the updated files for accuracy before the model runs were performed.

After the model runs, Pechan checked each message file (.msg file) associated with an output file for errors. Pechan investigated all error messages, took corrective actions if necessary, and repeated the run. Once the output files were checked, an SCC-level, county-level emission summary was generated. Pechan performed spot checks to ensure that emission results seemed reasonable and matched the results obtained using the NONROAD reports.

Once the emission calculations were deemed accurate and complete, Pechan created NIF files. Pechan reviewed the NIF data files for duplicate records based on FIPs codes (state and county) and SCCs. Pechan ranked emission records in descending order and review the top records to identify any potential outliers. As an overall check, Pechan and AQMS reviewed State and SCC-level annual emissions summaries for reasonableness compared to previous inventories and emission estimates reported by other states in the Mid-Atlantic region.

AQMS applied the QA/QC checker to the non-point and non-road NIF files. The checker evaluated formatting and content of the NIF files. The checker also flagged duplicate records and performed integrity checks to verify the relationships between the five NIF tables. Any record violating the integrity check was analyzed and corrected. Range checks of the emission estimates are also performed by the checker. Each flagged out-of-range value was evaluated and corrected. If a flagged value was deemed correct, an explanation in a notes field was added to the checker output file to verify the appropriateness of the emission value despite being flagged by the range check. The outputs of the QA/QC checker are included in the source documentation accompanying this report.

7.4 QA/QC for On-road Mobile Inventory

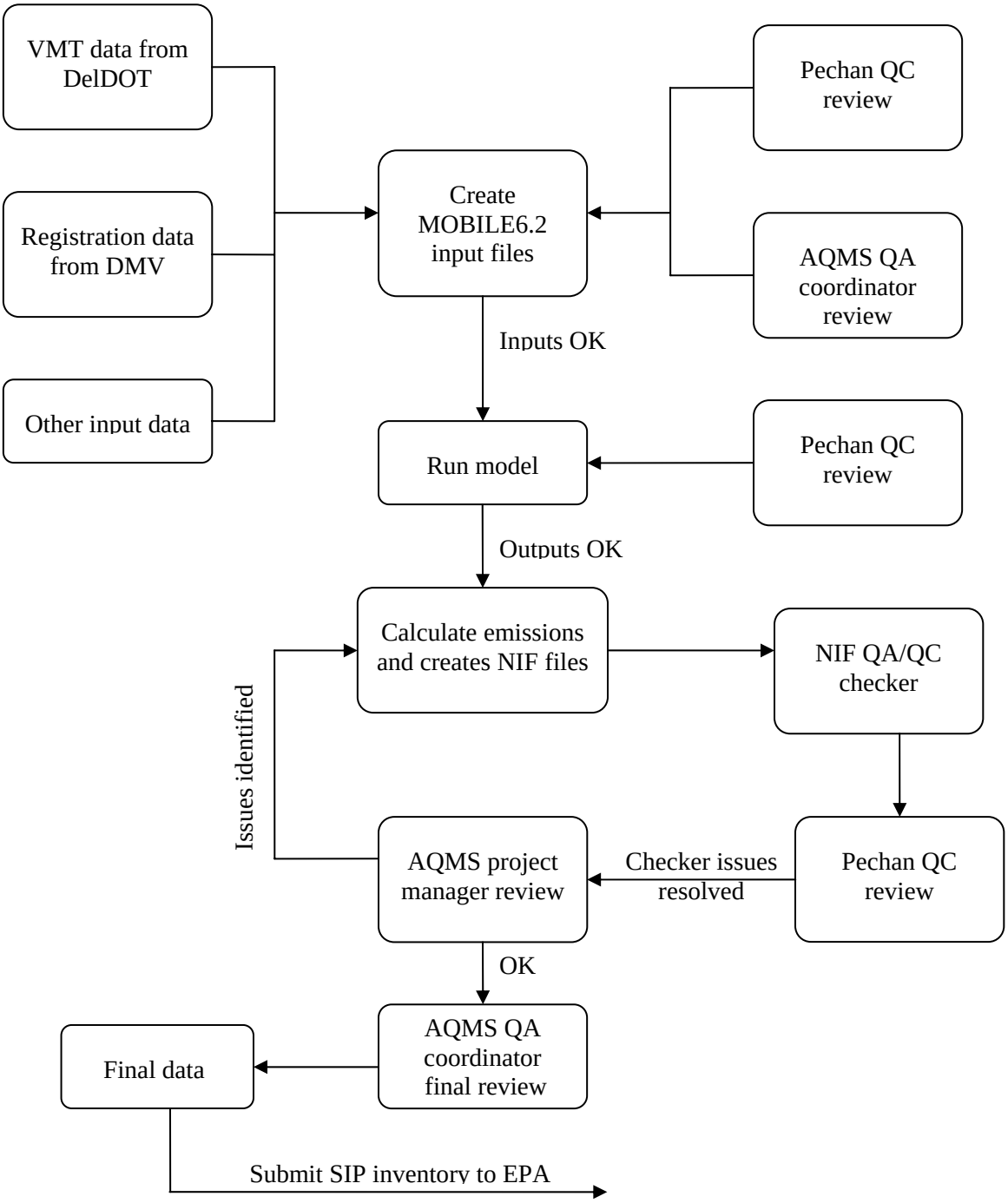
The on-road mobile inventory was prepared by Pechan with assistance by AQMS inventory staff in obtaining local activity data. Figure 7-4 provides a detailed data flow diagram for the development of the on-road mobile inventory.

To create MOBILE6.2 input files, Pechan prepared databases of the various input parameters, including temperature, fuel inputs, VMT mix data, registration data, and control programs such as inspection and maintenance (I/M) programs associated with each county in the inventory. Each of these input databases were compared to the original source of data and any differences flagged for review and corrected. These input parameters were then pulled into MOBILE6.2 input files using internal database programs. Once the MOBILE6.2 input files were generated, the data in the input files were compared to the data in the databases. Some of the specific checks performed are as follows: Does the temperature data in the MOBILE6.2 input file match the temperature database for the specific county? Is the fuel data incorporated with the correct temperature data? Are the correct external data files, such as registration distributions, being called in the input file? Is the full set of speeds needed modeled for each set of monthly parameters? Is the number of scenarios equal to the number of speed/roadway type combinations multiplied by the number of months or seasons being modeled?

Once the input files were run by MOBILE6.2 and output files created, the following checks were made: Is the number of output files of each type (TB1, TAB) equal to the number of input files? Are all of the TB1 output files of the same size? Do all output files have the same number of

scenarios as the input files? Were any error messages generated by MOBILE6.2? For those outputs that did not meet the specified tests, the input files were examined for potential errors and rerun once corrected.

Figure 7-4. On-road Mobile Inventory Data Flow Diagram



All processing of VMT data was checked to ensure the VMT totals remained the same regardless of the level of aggregation or disaggregation of the data. The VMT data were summed at several levels of detail for review. These include VMT totals by functional roadway class and county. These totals were compared to the 2002 Highway Performance Monitoring System (HPMS)

county-level functional class VMT provided by DelDOT. After Pechan broke out the VMT data by vehicle class, the VMT data were totaled by vehicle class and the resulting VMT fractions based on these totals were compared to the VMT fractions used to split out the VMT by vehicle type.

For each pollutant, the county-level emission estimates for 12 months were summed to estimate annual emissions. Pechan then back-calculated emission factors for each pollutant by dividing the annual emissions by the annual VMT at the county level and converted to grams per mile. These estimated emission factors were compared to the range of emission factors produced by MOBILE6.2 to ensure that the overall emission factors are of the correct magnitude. Hand calculations were performed on a number of the individual emissions to ensure that the emission calculation programs were working correctly. Pechan checked the overall emissions by pollutant and vehicle type for reasonableness in relation to one another (e.g., VOC emissions highest for gas vehicles, and NO_x highest for heavy-duty diesel vehicles, etc.).

As an overall check, Pechan and AQMS reviewed State and SCC-level annual emission summaries. Pechan compared emissions to the on-road emission inventory calculated by Pechan for the preliminary 2002 on-road NEI and verified that emissions as reported by State and by SCC were reasonable and expected for 2002.