Chapter 9
Quality Assurance

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THE Environmental Monitoring Section (EMS) of the Savannah River Site's (SRS) Environmental Protection Department (EPD) maintains a quality assurance (QA) program to continuously verify the integrity of data generated by its own environmental monitoring program and by its subcontracted laboratories.

Various definitions have been suggested for QA and quality control (QC). Frequently, the terms are used interchangeably. In the EMS program, QA consists of the system whereby the laboratory can assure clients and other outside entities, such as government agencies and accrediting bodies, that the laboratory is generating data of proven and known quality. QC refers to those operations undertaken in the laboratory to ensure that the data produced are generated within known probability limits of accuracy and precision.

Although QC represents the core activity in a QA program, the latter encompasses planned and systematic actions necessary to provide the evidence needed to assure that quality is achieved. The QA program has two basic goals:

- to create a management system that reduces the probability of error
- to detect and correct any errors that have occurred

Another QA component is quality assessment, which refers to the evaluation activities that provide assurance that the QC job is being done effectively.

Each aspect of the EMS environmental monitoring program, from sample collection to data reporting, must address QC and quality assessment standards defined in the *Savannah River Site Environmental Monitoring Section Quality Assurance Plan* (WSRC–3Q1–2, Volume 3, Section 8000).

This chapter summarizes the EMS QA/QC program. Guidelines and applicable standards for the program are referenced in appendix A, "Applicable Guidelines, Standards, and Regulations."

Tables containing the 2001 QA/QC data can be found in *SRS Environmental Data for 2001* (WSRC–TR–2001–00475). Nonradiological detection limits also are provided in *SRS Environmental Data for 2001*.

A more complete description of the QA/QC program can be found in *Savannah River Site Environmental Monitoring Section Plans and Procedures* (WSRC–3Q1–2, Volume 1, Section 1100).

QA/QC for Environmental Monitoring Section Laboratories

General objectives of the QA/QC program include

- validity, traceability, and reproducibility of reported results
- comparability of results within databases
- representativeness of each sample to the population or condition being measured
- accuracy and precision

Training for Personnel

EMS personnel are responsible for understanding and complying with all requirements applicable to the activities with which they are involved. Consequently, appropriate training courses are provided to assist them in fulfilling their responsibilities. Courses include training on applicable QA procedures, Occupational Safety and Health Administration-mandated training, and General Employee Training. Regulations and procedures that govern the environmental monitoring program are emphasized.

EMS analysts begin with specific training determined by job assignment. The section's technical work is

Statistical Terms

mean measurement of central tendency, commonly called the average

mean relative difference measure of reproducibility of identical chemical analyses

percent difference measure of accuracy used to compare "known" values with laboratory measurements; represents the absolute difference between the known and measured value divided by the known value; usually multiplied by 100 to be expressed as a percentage

based on its environmental procedures in sampling, radiochemistry, water quality, counting room, and data management and computer support.

Internal Quality Assurance Program

Specific QA checks and accepted practices are conducted by each EMS group, as described in the following paragraphs.

Field Sampling Group

Blind Sample Program EMS routinely conducts a blind sample program for field measurements of pH to assess the quality and reliability of field data measurements. Measurements of pH are taken in the field using the same equipment as is used for routine measurements.

During 2001, blind pH field measurements were taken for 24 samples. All field pH measurements were within the U.S. Environmental Protection Agency's (EPA's) suggested acceptable control limit of ± 0.4 pH units of the true (known) value.

Instrumentation Calibration EMS personnel also measure total residual chlorine, dissolved oxygen, and temperature in water samples; but because of the difficulties in providing field standards, these measurements are not suitable for a blind sample program. Therefore, quality control of these analyses relies instead on instrumentation calibration, per the section's procedures.

Chemistry and Counting Laboratories

Laboratory performance is evaluated through instrument checks, control charts, and data analyses. Within the Environmental Chemistry and Analysis group, graphical control checks and numerical trending are conducted on technician and method performance, with reports generated for sample results that exceed warning limits. The counting laboratory runs source checks and instrument backgrounds and performs calibrations regularly to monitor and characterize instrumentation.

Routine samples prepared and counted in EMS laboratories are subject to a variety of quality control checks to assess and ensure validity. The Environmental Chemistry and Analysis group prepares spike, blank, duplicate, and blind samples to check the performance of routine analyses. Spike samples and blank samples are used to calculate a recovery efficiency of an analytical method, to adjust for background radiation, and to evaluate counting equipment performance.

Blind Tritium Samples Blind tritium samples provide a continuous assessment of laboratory sample preparation and counting. The tritium activity is unknown to the technicians preparing the samples or the counting laboratory personnel. The blind samples

QA Terminology in the Laboratory

accuracy degree of agreement between a measurement and an accepted reference or true value

bias systematic (constant) underestimation or overestimation of the true value

spike sample sample to which a known amount of a substance has been added

precision measure of mutual agreement among individual measurements of the same property, under prescribed, similar conditions.

duplicate sample repeated but independent determinations on the same sample

blind sample (blind duplicate) mock sample of known constituent(s) or concentration(s); used as a control

blank samples clean samples analyzed to establish a baseline or background value used to adjust or correct results

control chart graphical chart of some measured parameter for a series of samples are prepared from National Institute of Standards and Technology (NIST)-traceable material or standardized against NIST material. The results are added to control charts to identify trends. During 2001, 12 blind samples were analyzed for tritium. All tritium results were within the control limits except two, which were close to the method detection limits. The results of these blind samples were used to validate analytical work in the chemistry and counting laboratories.

Laboratory Certification The EMS laboratory is certified by the South Carolina Department of Health and Environmental Control (SCDHEC) for the following analytes:

- under the Clean Water Act (CWA)—chemical oxygen demand, total suspended solids, and field pH, total residual chlorine, and temperature
- under the Resource Conservation and Recovery Act (RCRA)—50 volatile organic compounds (VOCs)

During 2001, the EMS laboratory was certified for 26 metal analytes under the CWA program and 27 metal analytes under the RCRA program by the SCDHEC Office of Laboratory Certification.

Data Verification and Validation

Results received from the counting laboratory are electronically evaluated by the Environmental Monitoring Computer Automation Program (EMCAP). Sample parameters—such as air flows, counting aliquots, and decay times—are flagged if values exceed preset limits or vary significantly from previous entries. An acceptance range for each analysis, based on historical results, is calculated for all routine environmental samples. Sample results outside the acceptance range are submitted for individual review, which may result in repeating the analyses, recounting, recalculating, or resampling for verification.

Before data are reported, they must be reviewed and validated by qualified personnel. Electronic verification is performed on 100 percent of the data stored in EMS databases. Through this verification, data anomalies are removed or data are rejected if there is disagreement with EMS QA/QC policies. The validation methods and criteria are documented in *WSRC Quality Assurance Manual* (WSRC–1Q, section 21–1, “Quality Assurance Requirements for the Collection and Evaluation of Environmental Data”) and in EMS environmental geology procedures. Quality control requirements for managing, evaluating, and publishing environmental monitoring data are defined in WSRC–3Q1–2, volume 3, section 8000 (procedure 8250, “Quality Control Program for Environmental Data Management and Publications”).

In 2001, an automated capability was implemented for the statistical evaluation of duplicate samples in the EMS laboratory. This process eliminated manual data entry and thus reduced the possibility of human error. More timely evaluations of duplicate measurements were performed, resulting in a significant quality assurance check regarding sample measurements.

External Quality Assurance Program

In 2001, the EMS laboratory participated in the U.S. Department of Energy (DOE) Quality Assurance Program (QAP), an interlaboratory comparison program that tracks performance accuracy and tests the quality of environmental data reported to DOE by its contractors.

Under this program, the DOE Environmental Measurements Laboratory (DOE/EML) sends samples to participating laboratories twice a year and compares the laboratories’ results to program values. These comparisons verify the accuracy of EMS radiochemical analytical results. The quality control chemist maintains control charts to monitor trends and bias for each matrix (e.g., water, air filter, vegetation, soil) and analysis for various nuclides.

Reference samples for the QAP program—including soil/sediment, water, vegetation, and air filter samples—are prepared by DOE/EML and sent to the participating laboratories. Analytical results are reported to DOE/EML and are compared with the test results of other laboratories. DOE/EML evaluates the results and distributes a report to the participating laboratories. Results are rated as acceptable (A), acceptable with warning (W), and not acceptable (N). Control charts are maintained according to DOE/EML control limits. The following EMS analytical methods and instruments are tested in these studies:

- gamma emitters by gamma spectroscopy
- actinides by alpha spectroscopy
- strontium and gross alpha/beta by gas-flow proportional counters
- tritium by liquid scintillation

Work was completed in March on the 54th set of QAP samples for a radiological laboratory intercomparison. EMS analyzed 12 isotopes in air, 12 in soil, seven in vegetation, and 11 in water for a total of 42 results. Thirty-six of the results were rated “A,” four were rated “W,” and two were rated “N.” A performance rating of 95 percent acceptable was achieved for this study. (This rating was calculated by dividing the "As" and the "Ws" by the total number of results.)

In QAP set 55, which was completed in September, EMS analyzed 12 isotopes in air, 14 in soil, seven in vegetation, and 11 in water for a total of 44 results. Thirty-five of the results were rated "A," eight were rated "W," and one was rated "N." A performance rating of 98 percent acceptable was achieved for this study. (This rating was calculated by dividing the "As" and the "Ws" by the total number of results.) EMS QA personnel consider 80 percent to be a minimum acceptance rate in this program.

The March results rated nonacceptable were for lead-212 in soil and for tritium in water. EMS investigated each nonacceptable result to determine its cause, its seriousness. and appropriate corrective measures. Investigation conclusions were:

- Lead-212 in soil appeared biased low by 30 percent, probably due to spectral interference. Other low-energy gamma emitters seemed biased low by 10–20 percent, suggesting that instrument efficiency calibration curves need to be adjusted. Lead-212 is not a nuclide of major concern in the monitoring program.
- Tritium in water was reported as 268 percent high. This result was calculated incorrectly. A spike value was identified erroneously as a duplicate measurement and was averaged with the sample result. Had this computation error not occurred, the result would have been within acceptable limits. Software correction is the best long-term corrective measure. For the short term, manual data transfers can prevent this error from recurring.

The September results showed one nonacceptable result. Americium-241 on an air filter was reported as biased low by 62 percent. Americium-241 is a nuclide of major concern in the monitoring program. Investigation of this result was inconclusive. Instrument control charts showed no long-term bias for americium-241, and the sample preparation history showed no irregularities.

QA/QC for Subcontract Laboratories/Environmental Monitoring Section Laboratories

Subcontract laboratories providing analytical services must have a documented QA/QC program and meet the quality requirements defined in WSRC–1Q. The subcontract laboratories used during 2001 and the types of analyses performed are listed in table 9–1.

EMS personnel perform an annual evaluation of each subcontract laboratory to ensure that the laboratories maintain technical competence and follow the required QA programs. Each evaluation includes an examination of laboratory performance with regard to sample receipt, instrument calibration, analytical procedures, data verification, data reports, records management, nonconformance and corrective actions, and preventive maintenance. EMS provides reports of the findings and recommendations to each laboratory and conducts followup evaluations as necessary.

Nonradiological Liquid Effluents

Nonradiological liquid effluent samples are collected at each permitted SRS outfall according to requirements in the National Pollutant Discharge Elimination System (NPDES) permit issued by SCDHEC (discussed in appendix A, page 143). Effluent samples are analyzed by four laboratories—three onsite laboratories and one subcontract laboratory. Laboratories must be certified by SCDHEC for all analyses. The EMS laboratory performs analyses for temperature, pH, most total suspended solids, and total residual chlorine. The Site Utilities Division (SUD) Wastewater Laboratory performs analyses for pH, biological oxygen demand, and total suspended solids on sanitary facility wastewater samples. The TNX Effluent Treatment Facility performs analyses for temperature and pH. Shealy Environmental Services, Inc. (SESI), was the primary subcontractor for the NPDES program throughout 2001.

Interlaboratory Comparison Program

Interlaboratory comparison studies are used to compare the quality of results between laboratories performing the same analyses.

During 2001, SESI and other EMS subcontract laboratories (listed on page 133) participated in various InterlaB WatR™ Supply Water Pollution (WP) and Water Supply (WS) Performance Evaluation Programs. Performance results by the subcontract laboratories can be found in table 9–2.

An accredited commercial provider, Environmental Resources Associates (ERA), administered these programs. The format for the WP statistical summary is based on EPA's national standards for water proficiency testing studies criteria. The format for the WS statistical summary is based on the Safe Drinking Water Act regulated acceptance limits. The statistical summaries are designed to show subcontract laboratories' performance against the national WP

Table 9–1
Subcontract Laboratories for 2001

EMAX Laboratories, Inc.
(Torrence, Calif.)

- groundwater nonradiological analyses

General Engineering Laboratories
(Charleston, S.C.)

- groundwater radiological and nonradiological analyses
- soil/sediment
- waste characterization

General Engineering Mobile Laboratory
(formerly RFI Mobile Laboratory)
(Savannah River Site)

- groundwater radiological and nonradiological analyses
- soil radiological and nonradiological analyses

Lionville Laboratory (formerly Recra LabNet Philadelphia)
(Lionville, Pa.)

- groundwater nonradiological analyses
- soil/sediment
- waste characterization

Microseeps, Inc.
(Pittsburgh, Pa.)

- groundwater nonradiological analyses
- soil gas
- soil/sediment
- site evaluation

Sanford Cohen & Associates
(Montgomery, Al.)

- groundwater radiological analyses
- soil/sediment radiological analyses
- waste characterization radiological analyses

Shealy Environmental Services, Inc.
(Cayce, S.C.)

- NPDES analyses
- analyses for SRS streams and the Savannah River

Thermo NUtech
(Oak Ridge, Tenn.)

- groundwater radiological analyses

and WS studies formerly run by EPA. The proficiency rating is calculated as follows: acceptable parameters divided by total parameters analyzed, multiplied by 100.

EPA uses WP and WS results to certify laboratories for specific analyses. As part of the recertification process, EPA requires that subcontract laboratories investigate the outside-acceptance-limit results and implement corrective actions as appropriate.

All laboratories (commercial and government) that analyze NPDES samples participate in the Discharge Monitoring Report–Quality Assurance (DMR–QA) study. Under this program, the laboratories obtain test samples from ERA. This provider, as required by EPA, is accredited by NIST. For the 2001 DMR–QA study, SESI used the WP 76 study (table 9–2).

The test samples from the provider have known chemical parameters—such as chemical oxygen demand—and contain known concentrations of constituents—such as total suspended solids, oil and grease, and certain trace metals. The report contains a statistical analysis of all data, as well as documentation of the known sample value, with stated acceptance limits and warning limits. Accepted variations from the known sample value depend on a variety of factors, including the precision of the analysis and the extent to which the results can be reproduced.

SESI reported acceptable results for 15 of 15 NPDES parameters and acceptable results for seven of nine voluntary analytes. EMS reported acceptable results for three of three parameters, SUD reported acceptable results for one of three parameters, and TNX Effluent Treatment Facility reported an acceptable result for one parameter. SESI's results were not acceptable for total Kjeldahl nitrogen and nitrate. SUD's results were not acceptable for pH and biological oxygen demand. Both SESI and SUD have corrective action plans in place to investigate and correct problems, and both reported acceptable results on subsequent samples for the unacceptable parameters.

EMS subcontract laboratories are required to have a corrective action plan to investigate and correct problems encountered in their performance.

Intralaboratory Comparison Program

SRS's intralaboratory program compares performance within a laboratory by analyzing duplicate and blind samples throughout the year. NPDES DMR protocol requires SRS to assign a "0" value to all nondetect values for reporting purposes. To facilitate data evaluation and provide consistency,

Table 9–2 Subcontract Laboratory Performance in ERA Water Pollution and Water Supply Studies

Laboratory	Water Pollution Studies (Percent Acceptable)	Water Supply Studies (Percent Acceptable)
Lionville	WP 72 (98%)[a]	WS 60 (98%)[b]
General Engineering	WP 75 (100%)	WS 54 (95%)[c]
General Engineering Mobile Lab	WP 75 (93%)[d]	
SESI	WP 74 (97%)[e]	WP 76 (100%)[f]

a Results for ammonia as N, total residual chlorine, and 2,4, 5–T were not acceptable.

b Results for fluoride, hexachlorobenzene, and simazine were not acceptable.

c Results for thallium, total organic carbon, bromide dichlorodifluromethane, dildrin, endrin, lindane, and methoxychlor were not acceptable.

d Results for phananthrene aroclor 1232, 1254, 1232, and 1254, dieldrin, benzo(b)fluoranthene, bis(2–chloroethyl)ether, 2,4–dinitrotoluene, hexachlorocyclopentadiene, isophorane, N–nitrosodiphenylamine, and 2–methylphenol were not acceptable.

e Results for potassium, sodium, nitrate as N, total Kjeldahl nitrogen, boron, molybdenum, and hexavalent chromium were not acceptable.

f All required NPDES results were acceptable. SESI had a 92% acceptable rate on voluntary analyte results. Results for total Kjeldahl nitrogen and nitrate were unacceptable. These analytes are not part of the NPDES program.

SRS assigns a value of “0” to all QA/QC nondetect analysis results.

SESI and the EMS laboratory analyzed a total of 93 duplicate samples during 2001. SESI analyzed 66 duplicate samples for various parameters, and EMS analyzed 27 duplicate samples for various parameters. Nondetectable results were reported for 74 of the 93 duplicate samples.

Percent difference calculations showed that six of the 66 duplicate samples analyzed by SESI were outside the EMS internal QA/QC requirement (± 20 percent of the true value).Three of the exceptions were at or near the detection limit, where accuracy is influenced more by uncertainties associated with analytical capability. Generally, exceptions in this range are not considered a problem.The other three exceptions appeared to be related to an analytical error, sample contamination, or improper sampling techniques.

Percent difference calculations showed that four of the 27 duplicate samples analyzed by EMS were outside the EMS internal QA/QC requirement (± 20 percent of the true value). Three of the exceptions were at or near the detection limit, where accuracy is influenced more by uncertainties associated with analytical capability. Generally, exceptions in this range are not considered a problem. The other exception appeared to be related to either an analytical error, sample contamination, or improper sampling techniques.

SESI and EMS analyzed a total of 128 blind samples during 2001. SESI analyzed 90 blind samples for various parameters, and EMS analyzed 38 blind samples for various parameters. Nondetectable results were reported for 90 of the 128 blind samples.

Percent difference calculations showed that 10 of the 89 blind samples analyzed by SESI were outside the EMS internal QA/QC requirement (± 20 percent of the true value). Eight of the exceptions were at or near the detection limit, where accuracy is influenced more by uncertainties associated with analytical capability. Generally, exceptions in this range are not considered a problem. The other two exceptions appeared to be related to an analytical error, sample contamination, or improper sampling techniques.

Percent difference calculations showed that five of the 38 blind samples analyzed by EMS were outside the EMS internal QA/QC requirement (± 20 percent of the true value). Four of the exceptions were at or near the detection limit, where accuracy is influenced more by uncertainties associated with analytical capability. Generally, exceptions in this range are not considered a problem. The other exception appeared to be related to either an analytical error, sample contamination, or improper sampling techniques.

Results for the duplicate and blind sampling programs met expectations, with no indications of consistent problems in the laboratory.

Stream and River Water Quality

The water quality program requires quality checks of 10 percent of the samples to verify analytical results. Analyses are required to be performed by a certified laboratory. Duplicate grab samples from SRS streams and the Savannah River were analyzed by SESI and the EMS laboratory in 2001. SESI analyzed samples for hardness, herbicides, nitrate + nitrite, phosphorus, pesticides, and total organic carbon. EMS analyzed duplicate samples for chemical oxygen demand, metals, and total suspended solids. A total of 664 analyses were performed.

Thirty-one samples were outside the ± 20 percent acceptance limit. For all of these results, the actual differences were small and the parameter concentrations low. Fifteen of the 31 analyses were at or near the detection limit, where accuracy is influenced more by uncertainties associated with analytical capability. Exceptions in this range generally are not considered a problem. The remaining 16 analyses—one for nickel, three for phosphorus, two for copper, one for manganese, two for chemical oxygen demand, one for mercury, and six for total suspended solids—could be attributed to laboratory analytical error, sample contamination, or improper sampling technique.

Groundwater

Groundwater analyses at SRS are performed by subcontract laboratories. During 2001, EMAX Laboratories, Inc., the EMS laboratory, General Engineering Laboratories, Lionville Laboratory, and Microseeps, Inc., were the primary subcontractors for nonradiological analyses. General Engineering Laboratories, Sanford Cohen & Associates, and Thermo NUtech were the primary subcontractors for radiological analyses. In addition, General Engineering Mobile Laboratory performed onsite analyses of volatile and semivolatile organics and metals.

SRS requires that subcontract laboratories investigate the outside-acceptance-limit results and implement corrective actions as appropriate.

Internal QA

During 2001, approximately 5 percent of the samples collected (radiological and nonradiological) for the RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) programs were submitted to the primary laboratory for analysis as blind duplicates and to a different laboratory as a QA check. The laboratories' results were evaluated on the basis of the percentage within an acceptable concentration range.

A statistical measure, the mean relative difference (MRD), is calculated to assess result reproducibility and laboratory performance. The laboratories also analyze approximately 10 percent of samples as intralaboratory QA checks. Interlaboratory comparisons were conducted between the following:

- General Engineering/Lionville
- General Engineering/Microseeps
- General Engineering/Sanford Cohen & Associates
- General Engineering Mobile/Sanford Cohen & Associates
- Lionville/General Engineering Mobile
- Thermo NUtech/General Engineering
- Thermo NUtech/General Engineering Mobile

Analytes outside or near acceptance limits do not appear to be systematic or to exhibit any identifiable trends. Full results for all QA/QC evaluations, including MRD calculations where appropriate, can be obtained by contacting the manager of the Westinghouse Savannah River Company (WSRC) Environmental Protection Department (EPD) at 803–725–1728.

External QA (Environmental Resource Associates Standards)

Water Pollution and Water Supply Studies During 2001, General Engineering, General Engineering Mobile, and Lionville participated in various WP and WS studies (WP and WS studies are described on page 130). Performance result summaries can be found in table 9–2.

Quarterly Assessments During 2001, EMS conducted quality assessments of the primary analytical laboratories to review their performance on certain analyses. Each laboratory received a set of certified environmental quality control standards from ERA, and its results were compared with the ERA-certified values and performance acceptance limits. The performance acceptance limits are listed as guidelines for acceptable analytical results, given the limitations of the EPA methods used to determine these parameters. The performance acceptance limits closely approximate the 95 percent confidence interval.

ERA became a certified producer of standards for the EPA WP/WS program in 1999. To accommodate this program, the compound list for several standards produced by ERA was expanded to incorporate the

Table 9–3 Subcontract Laboratory Performance on ERA Standards

Laboratory	Percent Within Limits 1st Quarter 2001	2nd Quarter 2001	3rd Quarter 2001
EMS		95.5[a]	95.5[b]
General Engineering	98.3[c]	98.3[d]	94.5[e]
General Engineering–Mobile Lab	95.2[f]	94.4[g]	88.2[h]
Microseeps		92.3[i]	97.8j
Lionville	93.8[k]	94.2[l]	84.1[m]

a The result for strontium was not acceptable.
b The result for strontium was not acceptable.
c Results for chloride, 2,4,5–T, and total phosphates (as P) were not acceptable.
d Results for chloride, dimethyl phthalate, and total phosphates (as P) were not acceptable.
e Results for bis(2–chloroethyl) ether, PCB 1016, trichloroethylene, and turbidity were not acceptable.
f Results for benzo[a]anthracene, dieldrin, di–n–butyl phthalate, fluorene, and xylenes were not acceptable.
g Results for benzo[b]fluoranthene, benzo[k]fluoranthene, 4–chloroaniline, endrin, hexachlorobutadiene, toxaphene, and 1,2,4–trichlorobenzene were not acceptable.
h Results for 1,3–dichlorobenzene, 1,2–dichloropropane, dieldrin, endrin, 1,2,4–trichlorobenzene, and trichloroethylene were not acceptable.
i Results for acetone, bis(2–chloroethoxy) methane, 2–chloronaphthalene, 1,1–dichloroethane, 1,2–dichloroethane, 2,4–dimethyl phenol, dimethyl phthalate, 2,4–dinitrophenol, nickel, and PCB 1242 were not acceptable.
j Results for antimony, cobalt, and iron were not acceptable.
k Results for ammonia nitrogen, bis(2–chloroethoxy) methane, 2,4–D, 1,2–dichlorobenzene, di–n–octyl phthalate, fluoride, hexachloroethane, pH, toxaphene, and 1,2,4–trichlorobenzene and were not acceptable.
l Results for acenaphthylene, ammonia nitrogen, 1,4–dichlorobenzene, dichloromethane (methylene chloride), fluoride, hexachlorobutadiene, naphthalene, 1,2,4–trichlorobenzene, total phosphates (as P), and toxaphene and were not acceptable.
m Results for 2,4–D, 1,3–dichlorobenzene, 2–methyl–4,6–dinitrophenol, and tetrachloroethylene were not acceptable.

full set of the National Environmental Laboratory Accreditation Conference (NELAC) analytes. Laboratories now are asked to identify standards that are below detection as well as those that are above detection.

NELAC is a voluntary association of state and federal agencies with full opportunity for input from the private sector. NELAC's purpose is to establish and promote mutually acceptable performance standards for the operation of environmental laboratories. EPA's National Environmental Laboratory Accreditation Program provides support to NELAC. When the standards are adopted by the state and federal agencies, NELAC will oversee the accrediting authority programs.

Results from the laboratories (EMS, General Engineering, General Engineering Mobile, Microseeps, and Lionville) for the first three quarters are summarized in table 9–3. Fourth-quarter results were not available.

Soil/Sediment

Environmental investigations of soils and sediments, primarily for RCRA/CERCLA units, are performed by subcontract laboratories (General Engineering, General Engineering Mobile, Lionville, Microseeps,, and Sanford Cohen & Associates —table 9–1, page 131).

Data are validated by EMS according to EPA standards for analytical data quality unless specified otherwise by site customers. Sixty projects were begun in 2001. Most projects, when completed, include a project summary report, which contains

- a project QA/QC summary
- a discussion of validation findings
- tables of validated and qualified data

The EMS validation program is based on an EPA guidance document, *Data Quality Objectives Process for Superfund* (EPA–540–R–93–071). This document identifies QA issues to be addressed, but it does not formulate a procedure for how to evaluate these inputs, nor does it propose pass/fail criteria to apply to data and documents. Hence, the EMS validation program necessarily contains elements from—and is influenced by—several other sources, including

- *QA/QC Guidance for Removal Activities*, interim final guidance, EPA–540–G–90–004
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA–540/R–94/012
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA–540/R–94/013
- T*est Methods for Evaluating Solid Waste*, EPA, November 1986, SW–846, Third Edition
- *Data Validation Procedures for Radiochemical Analysis*, WHC–SD–EN–SPP–001

Data management personnel in the soil/sediment program perform additional functions to ensure the quality of the data released by EMS. Two people enter the data for each entry to help eliminate errors, and all field, shipping, invoice, and analytical data are 100 percent verified.

Relative percent difference for the soil/sediment program is calculated for field duplicates and laboratory duplicates. A summary of this information is presented in each project report prepared by the Environmental Geochemistry Group of EMS.

Data Review

Several detailed data validation activities have been added to the QA program for groundwater and soil/sediment analyses procured from offsite commercial laboratories:

- laboratory data record reviews (since 1993)
- radiological data reviews (since 1996)
- metals interference reviews (since 1997)

The detailed data review is described in *Savannah River Site Environmental Monitoring Section Plans and Procedures*.

In 2001, the major QA issues that were discovered and addressed in connection with these programs included

- systematic misreporting of gamma spectroscopy detection limits at one laboratory
- systematic calculation errors for five nuclides at another laboratory

These findings illustrate that, although laboratory procedures are well defined, analytical data quality does benefit from technical scrutiny.

Conclusion

The QA/QC program reviews the performance of SRS organizations and its subcontractors to ensure that relevant quality control criteria are satisfied.

Reviews include

- laboratory audits
- field audits of sampling activities
- examination of sample preservation techniques and sample shipping process
- interlaboratory comparisons
- evaluation of analytical results of blanks, standards, and duplicates

Review of SRS subcontractor laboratories indicated that all met or exceeded the performance target criteria. Review of SRS's environmental sampling and analytical programs indicated that most data met applicable quality standards. Any deviations encountered were addressed by appropriate corrective action plans.

Quality assurance goals for the coming year include the following:

- Monitor closely the newly completed acceptance criteria for samples analysis within EMS and its subcontract laboratories.
- Complete EMS's plan to minimize the impact on the quality of sample analysis during EMS's move to a new laboratory facility.