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Section No. 17.0
Revision No. 6
Date: September 15, 1991

Ann Marie Flaherty
Manager, Phase II
CompuChem Laboratories

Responsibilities: Ms. Flaherty is responsible for the integration, technical review and audit, word processing and full service deliverables package of the data generated by CompuChem's analytical laboratories.

Education: Ms. Flaherty received an undergraduate degree in Industrial Relations/Psychology from the University of North Carolina at Chapel Hill in 1982.

Experience: Prior to joining CompuChem, Ms. Flaherty was employed at IBM as a PP&C Clerk. Before being promoted to her current position, Ms. Flaherty held the positions of Scheduling Clerk, Report Integration Clerk and Supervisor of Scheduling and SampleSaver.

Ms. Flaherty was promoted to Manager of Production Planning and Control in 1986 and was responsible for managing daily activities of the production and scheduling functions.

Ms. Flaherty has attended several seminars including Fundamentals of Supervision (24 hours) at Capital Associated Industries in 1985, Advanced Leadership Development Program (27 hours) at CAI in 1985, and Zenger Miller Frontline Leadership Training (24 hours) in 1988.

Hire Date: December 27, 1982

AR302180

Section No. 17.0
Revision No. 6
Date: September 15, 1991

L. Richard Flynn
Developmental Chemist
CompuChem Laboratories

Responsibilities: Mr. Flynn is responsible for methods development and implementation, special projects, and analysis. Mr. Flynn assists the laboratory personnel in resolving technical issues.

Education: Mr. Flynn has an undergraduate degree in Chemistry from the University of North Carolina at Chapel Hill.

Experience: Prior to coming to CompuChem, Mr. Flynn was employed at the Research Triangle Institute where his duties included performing general analytical laboratory functions involved with trace organic analysis. Through the various laboratory positions Mr. Flynn held, he has gained eight (8) years of experience in the operation of the GC/MS/DS in analyzing environmental samples. In addition, he has six (6) years of experience in the interpretation of mass spectra gathered in GC/MS analysis. Also, he has two (2) years of experience using the purge and trap technique for volatile organics.

Hire Date: January 14, 1981

AR302181

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Linda L. Fowler
Senior Quality Assurance Specialist
CompuChem Laboratories

Responsibilities: Ms. Fowler is responsible for ensuring that data generated by all laboratory stations complies with established QC acceptance criteria. In addition, Ms. Fowler resolves problems associated with data quality and the overall QA program, as well as auditing laboratory data packages and evaluating laboratory data qualifying notices.

Education: Ms. Fowler received a B.S. degree in Medical Technology from the University of Oklahoma, in conjunction with the Texas Medical Center in Houston, Texas.

Experience: Ms. Fowler joined CompuChem as a Senior Data Review Specialist, responsible for performing interpretation of volatile and semivolatile data generated by the GC/MS Laboratory.

Prior to her positions at CompuChem, Ms. Fowler held the position of GC/MS Operator at Oklahoma Children's Memorial Hospital, where she performed tasks related to therapeutic drug monitoring and development of procedures for evaluation of inborn errors of metabolism. Additional research and development activities include GC and MS analysis at Baylor College of Medicine in Houston, Texas.

Ms. Fowler has had 73 months of experience in GC/MS analysis and data review.

Hire Date: August 8, 1983

AR302182

Section No. 17.0
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Date: September 15, 1991

Pam Frye
GC Technician III
CompuChem Laboratories

Responsibilities: Ms. Frye is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution and screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, she must become familiar with using software programs to monitor EPA sequences.

Education: Ms. Frye received a B.S. degree in Chemistry from Radford University in December of 1989.

Experience: Ms. Frye has nine months of experience working as a GC Technician II.

Hire Date: January 8, 1990

AR302183

Section No. 17.0
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Date: September 15, 1991

Emmanuel Ferew
Sample Preparation Technician III
CompuChem Laboratories

Responsibilities: As a Sample Preparation Technician III, Mr. Ferew is responsible for performing most of the procedures associated with the extraction/ preparation of solid and liquid matrices for subsequent GC or GC/MS analysis. In addition, he is responsible for the accurate completion of associated paperwork, and for learning more complex procedures such as herbicides and ZHEs, so as to be able to perform them routinely.

Education: Mr. Ferew currently attends Durham Technical College and UNC-Chapel Hill and is working toward a degree in Industrial Business Management. He also attended the Technical College of Austria, Vienna, where he obtained an associate degree in Computer Technology in 1982.

Experience: Mr. Ferew has 21 months of experience in sample preparation techniques.

Hire Date: December 18, 1989

AR302184

Section No. 17.0
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Date: September 15, 1991

Larry Alan Goll
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Mr. Goll is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Mr. Goll received a B.A. degree in Chemistry from West Virginia University, in Morgantown, WV.

Experience: While completing his undergraduate degree, Mr. Goll gained three (3) years of experience with the carbon packed GC and one (1) year of experience with the MS.

Mr. Goll has had 26 months of experience in GC/MS analysis and 18 months of experience in data review.

Hire Date: May 11, 1988

AR302185

Section No. 17.0
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Date: September 15, 1991

Tim Goodfellow
Laboratory Automation Specialist
CompuChem Laboratories

Responsibilities: Mr. Goodfellow is responsible for the design, development, and implementation of computer programs and systems to collect data from instruments, verify collected data, post data to the database, and generate deliverable items.

Education: Mr. Goodfellow received a B.S. degree in Natural Resources Recreation Management from North Carolina State University (Raleigh, NC) in 1978.

Experience: Prior to joining CompuChem, Mr. Goodfellow was a Quality Engineer at ITT Telecom in Raleigh, NC (1983-1985). Before that, Mr. Goodfellow was an Analyst Programmer, Recreational Services Division, at the U.S. Naval Military Personnel Command in Washington, D.C. (1979-81). In addition, Mr. Goodfellow has done consulting work.

Hire Date: January 20, 1986

AR302186

Section No. 17.0
Revision No. 6
Date: September 15, 1991

George Griffith, Ph.D.
Inorganic Chemist I
CompuChem Laboratories

Responsibilities: Dr. Griffith is responsible for Lachet Autoanalyzer analyses for the Inorganics Laboratory.

Education: Dr. Griffith has a B.S. in Science Education from the University of Florida (1953), an M.A. (1963) and a Ph.D. (1969) in English from Vanderbilt University (Nashville, TN).

Experience: Dr. Griffith was a Research Associate at the University of Florida. Dr. Griffith has also worked as a Chemist for Seaboard Railroad Company and as a Laboratory Technician for Armour Fertilizer Company.

Dr. Griffith has had 22 months of experience in TPH, TOC, TOX, and Oil/Grease analysis, and less than six months of experience as an Inorganics Chemist.

Hire Date: November 6, 1989

AR302187

Section No. 17.0
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Date: September 15, 1991

Peter Hill
Mixed Waste Senior Radiochemist
CompuChem Laboratories

Responsibilities: Mr. Hill is responsible for performing radiological analysis in the wet radiochemical and radioactivity counting laboratories, including sample dissolution/extraction, radiochemical separations for natural radionuclides, fission products and transuranics, as well as radioisotope source preparation, and alpha/beta/gamma counting.

Education: Mr. Hill received an undergraduate degree in Chemistry in 1982 from Guilford College (NC).

Experience: Before Mr. Hill assumed his current position at CompuChem, he was a QA Specialist and was responsible for ensuring that data generated by all laboratory stations complied with established QC acceptance criteria. Before he became a QA Specialist, Mr. Hill was a Technical Reviewer, responsible for final review of data packages for completeness and compliance to protocol.

Prior to joining CompuChem, Mr. Hill held the position of Chemist at Environmental Testing Inc. (1985-1986). His responsibilities included the collection, analysis and reporting of air, water, soil and sludge samples.

Mr. Hill has 18 months of experience in radiochemistry.

Hire Date: August 25, 1986

AR302188

Section No. 17.0
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Date: September 15, 1991

Bryce Holmes
Inorganics Chemist I
CompuChem Laboratories

Responsibilities: Mr. Holmes is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples, as well as gaining a thorough knowledge of SOWs associated with inorganics procedures.

Education: Mr. Holmes received a B.S. degree in Biology in 1976 from Livingstone College. He has earned twelve (12) hours towards an M.B.A. at UNC-Chapel Hill, and is currently enrolled in Wake Forest University's Babcock School of Business MBA weekend program. Mr. Holmes has also been involved in independent study in instrumental analysis at A&T State University.

Experience: Prior to joining CompuChem Mr. Holmes had two years of experience in environmental analysis in research and analytical laboratories. He has conducted biological and chemical analysis of water, waste water and soil. He has gained some GC/MS experience with volatile organic compounds (VOC).

Mr. Holmes has had 39 months of experience in cyanide analysis and 9 months of experience in flameless AA analysis.

Hire Date: June 1, 1988

AR302189

Section No. 17.0

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Date: September 15, 1991

Carl Hooker
Inorganics Lab Technician III
CompuChem Laboratories

Responsibilities: Mr. Hooker is responsible for Metals Digestion (Plasma and Furnace), mercury preparation, cyanide distillation and analysis, pH, Sulfide determination, SW846 Metals preparation, and learning the operation of AAIL.

Education: Mr. Hooker earned a B.S. degree in Biology from North Carolina Agricultural and Technical State University in 1980.

Experience: Prior to joining CompuChem, Mr. Hooker was a Quality Control Supervisor/Production Supervisor with Pepsi-Cola Company (1981-1989). Before that, Mr. Hooker was a Laboratory Analyst at Northrop Environmental (1981).

Mr. Hooker has had 18 months of experience in sample preparation.

Hire Date: February 5, 1990

AR302190

Section No. 17.0
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Date: September 15, 1991

Patricia B. Hopkins
Final Technical Reviewer
CompuChem Laboratories

Responsibilities: Ms. Hopkins is responsible for final technical review of commercial samples, organic and inorganic platinum and EPA cases such that adherence to contract protocols and internal quality guidelines are met. In addition, a Technical Reviewer is responsible for resolving issues and incidents noted in the review process with the appropriate laboratory, consulting with the technical and/or quality director/manager to ensure internal quality of deliverable data.

Education: Ms. Hopkins received a B.S. in Chemistry from North Carolina Central University in 1985.

Experience: From 1985 to 1986, Ms. Hopkins was employed as Clinical Laboratory Technician at Duke Hospital. From 1982-1985, Ms. Hopkins held various part-time and temporary positions while attending college.

Ms. Hopkins was a GC/MS Operator at CompuChem, responsible for performing analyses of environmental samples using GC/MS.

Ms. Hopkins has had 37 months of experience in technical review.

Hire Date: July 21, 1986

AR302191

Section No. 17.0
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Date: September 15, 1991

Sarah A. Hubbard
Senior Data Review Specialist
CompuChem Laboratories

Responsibilities: Ms. Hubbard is responsible for performing the final technical review/audit of sample data packages generated by the GC/MS Laboratory in an accurate and timely manner, and for ensuring that all data generated meets CompuChem's quality standards and complies with customer and/or contractual requirements.

Education: Ms. Hubbard has a B.E. degree in Chemical Engineering from Vanderbilt University and an M.S. in Analytical Chemistry from the University of New York in Binghamton.

Experience: Prior to her promotion, Ms. Hubbard was a Senior GC/MS Operator in the GC/MS Laboratory. Before joining CompuChem, Ms. Hubbard was employed as a Scientist with Northrop Services, Inc., where she employed GC in the analysis of air pollutants. She has also been employed with I.B.M. as a Chemist and as an Associate Engineer.

Through the various laboratory positions she held, Ms. Hubbard has gained 21 years of experience in the operation of the GC/MS/DS on environmental samples. She also has one year of experience using the purge and trap technique for volatile organics.

Ms. Hubbard has had 81 months of experience in GC/MS analysis and data review.

Hire Date: June 1, 1982

AR302192

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Robert Hamrick
Manager, Inorganics Laboratory
CompuChem Laboratories

Responsibilities Mr. Hamrick is responsible for managing the Inorganics Laboratory, ensuring the production of data in a cost-effective and timely manner so that laboratory production goals are met.

Education Mr. Hamrick received a B.S. degree in Zoology from Southeastern Louisiana University (1975).

Experience Prior to joining CompuChem, Mr. Hamrick was Division Manager, Inorganic Chemistry Division, at ETC/Toxicon in Baton Rouge, Louisiana (1988-90). Before that, Mr. Hamrick was Laboratory Manager at Analytical and Environmental Testing, Inc. in Baton Rouge (1985-88). In addition, Mr. Hamrick was a Special Laboratory Technician (Analytical Services) at Exxon Company, U. Baton Rouge Refinery (1979-85).

Mr. Hamrick has 7 years of experience in the use of ICP, 5 years of experience in GFAA, Flame AA and Hydride AA technologies for the analysis of inorganic compounds in environmental samples, as well as familiarity with NPDES, SW-846, and EPA CLP protocol.

Hire Date: September 4, 1990

AR302193

Section No. 17.0
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Date: September 15, 1991

Gail Hwang
Inorganics Chemist I
CompuChem Laboratories

Responsibilities: Ms. Hwang is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples as well as gaining a thorough knowledge of SOPs associated with inorganic procedures.

Education: Ms. Hwang received a B.S. degree in Food Science from North Carolina State University in 1985.

Experience: Prior to joining CompuChem, Ms. Hwang was a Laboratory Assistant in the Department of Chemical Engineering at North Carolina State University (January 1989-May 1990).

Ms. Hwang has had 16 months of experience in ICP, flameless A.A., flame and cold vapor A.A., and cyanide analysis.

Hire Date: May 21, 1990

AR302194

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Joanne Jennings
Laboratory Automation Specialist
CompuChem Laboratories, Inc.

Responsibilities: Ms. Jennings is responsible for developing and maintaining laboratory automation software. Ms. Jennings is also responsible for evaluating and identifying areas of laboratory operations that would benefit (interms of speed, efficiency, and data quality) from the implementation of laboratory automation software.

Education: Ms. Jennings received a B.A. in Biology in 1976 from the University of Virginia at Charlottesville. Ms. Jennings received an M.S. in Computer Science in 1990 from North Carolina State University in Raleigh, NC.

Experience: Prior to joining CompuChem, Ms. Jennings was a Medical Technologist (ASCP) Shift Supervisor at Craven County Hospital (New Bern, NC) from 1983-88. Before that, Ms. Jennings was Assistant Center Director at Alpha Therapeutic Corporation in Honolulu, Hawaii from 1981-3. Ms. Jennings was also a Medical Technologist (ASCP) at Pitt County Memorial Hospital in Greenville, NC from 1979-81. Ms. Jennings was Assistant Technical Director with Tidewater American Red Cross in Greenville, NC from 1978-79.

Ms. Jennings has had 4 years of experience in MIS.

Hire Date: July 30, 1990

AR302195

Section No. 17.0
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Date: September 15, 1991

Linda F. Jones
Inorganics Chemist III
CompuChem Laboratories

Responsibilities: Ms. Jones is responsible for the analysis of inorganic samples by ICAP, GFAAS, and cold vapor, as well as the preparation of data packages in a timely and accurate manner. Her position is strongly oriented toward analysis via the prescribed techniques, and is therefore more of a production position.

Education: Ms. Jones received an undergraduate degree in Pre-Med Studies (Chemistry/Biology) from Pfeiffer College (NC).

Experience: Ms. Jones received four years of training in chemistry and the natural sciences prior to joining CompuChem.

Ms. Jones joined CompuChem as Senior Lab Assistant and subsequently was promoted to Inorganics Technician and Senior Inorganics Technician.

Ms. Jones has had 80 months of experience in sample preparation, ICP, flameless AA, and cyanide analysis.

Hire Date: July 19, 1983

AR302196

Section No. 17.0
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Date: September 15, 1991

Ann H. Kim
Inorganics Data Review Specialist
CompuChem Laboratories

Responsibilities: Ms. Kim is responsible for the data review of environmental inorganics samples determined by flame/flameless AA spectrophotometry, ICP, and cold vapor/hydride AA spectrophotometry. She is also responsible for identifying continued problems with completed data and recommending corrective actions in a timely and accurate manner. Also, assisting with the determination of data problems associated with instrumentation performance issues and resolving and rectifying the problems are part of Ms Kim's responsibilities.

Education: Ms. Kim received a B.A. degree in Chemistry from North Carolina State University in 1987. Currently, she is taking graduate courses at NCSU.

Experience: Ms. Kim has been employed at CompuChem since May 1988 and has held the position of Inorganics Chemist I and Chemist II. Prior to joining CompuChem, she was a Lab Technician at NCSU's Chemical Engineering Department (1987) and NCSU's Biochemistry Department (1983).

Ms. Kim has had 10 months of experience in reviewing Inorganics Laboratory data.

Hire Date: May 9, 1988

AR302197

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Maged Ishak
GC Technician III
CompuChem Laboratories

Responsibilities: Mr. Ishak is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution of extracts, screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, he must be familiar with using software programs to monitor EPA sequences.

Education: Mr. Ishak received a B.S. Degree in Chemistry from Cairo University (Egypt) in 1971.

Experience: Mr. Ishak joined CompuChem as a Sample Preparation Technician in the Environmental Sample Preparation Laboratory. Prior to joining CompuChem, Mr. Ishak held the positions of Chemist at Burroughs Wellcome Company (1987), Plater at Tricircuits Incorporated (1986), and Silkscreener at Perry Circuits (1983 - 1985). In addition, Mr. Ishak taught high school Biology/Chemistry with the Ministry of Education in Egypt (1976 - 1980), and was an Officer in the Egyptian Air Force (1973 - 1976).

Mr. Ishak has 39 months of experience in GC analysis.

Hire Date: August 10, 1987

AR302198

Section No. 17.0
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Date: September 15, 1991

Margaret Lane
Glassware Preparation Technician
CompuChem Laboratories

Responsibilities: As a Glassware Preparation Technician, Ms. Lane is responsible for the preparation and inventory of all glassware associated with the environmental laboratory areas, and for preparing approved glasswool, sodium sulfate and sample containers for Environmental Sample Preparation Laboratory.

Education: Ms. Lane is currently working toward her GED.

Experience: Ms. Lane has less than 6 months of experience as a Glassware Preparation Technician.

Hire Date: July 23, 1990

AR302199

Section No. 17.0
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Date: September 15, 1991

Robert K. Laryea
Inorganics Laboratory Technician III
CompuChem Laboratories

Responsibilities: Mr. Laryea is responsible for metals digestion (plasma and furnace), mercury preparation, cyanide distillation, pH, SW-846 metals preparation, and learning the operation of AAIL.

Education: Mr. Laryea has four years of college at North Carolina Central University in Durham, North Carolina with concentrations in Physical Education and Chemistry.

Experience: Prior to joining CompuChem, Mr. Laryea was in charge of the Fisher Mercury Analyzer by automated cold vapor technique. He tested metopal volatile solids in water.

Mr. Laryea has had 35 months of experience in sample preparation, flame and cold vapor AA, and cyanide analysis.

Hire Date: August 22, 1988

AR302200

Section No. 17.0
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Date: September 15, 1991

Linda Leathers
Glassware Preparer
CompuChem Laboratories

Responsibilities: As a Glassware Preparer, Ms. Leathers is responsible for the preparation and inventory of all glassware associated with the environmental laboratory areas, and for preparing reagents such as glass wool and sodium sulfate for the Environmental Sample Preparation Laboratory. She also prepares SampleSaver glassware which is shipped to clients to use in gathering environmental samples.

Education: Ms. Leathers received her high school diploma from Northern High School (Durham, NC) in 1986.

Experience: Ms. Leathers worked on a temporary basis as a Glassware Preparer at CompuChem (August 1990-September 1990) and as an FDT Recieving Clerk in September and October of 1990.

Hire Date: October 22, 1990

AR302201

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Ray Leathers
GC/MS Technician II, Volatile Preparation Lab
CompuChem Laboratories

Responsibilities: As a GC/MS Technician II, Mr. Leathers is responsible for miscellaneous laboratory duties including setting up glassware configurations for technicians, performing dry weight and pH procedures, assisting technicians with their work when appropriate, and preparing environmental samples for volatiles analysis.

Education: Mr. Leathers received his high school diploma from Northern High School (Durham, NC). He also attended Durham Technical College for four months.

Experience: Prior to becoming a GC/MS Technician II, Mr. Leathers was a Senior Laboratory Assistant, responsible for performing TCLP sample preparations. Before that, Mr. Leathers was a Sample Custodian at CompuChem (August 1988-July 1990).

Mr. Leathers has less than six months of experience in preparation of VOAs.

Hire Date: September 16, 1988

AR302202

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Janet G. Livingston
Senior Quality Assurance Specialist
CompuChem Laboratories

Responsibilities: Ms. Livingston is responsible for ensuring that data generated by all laboratory stations complies with established QC acceptance criteria. In addition, Ms. Livingston resolves problems associated with data quality and the overall QA program, as well as auditing laboratory data packages and evaluating laboratory data qualifying notices.

Education: Ms. Livingston received a B.S. degree in Biology with a minor in Chemistry from Appalachian State University in Boone, North Carolina, in 1981.

Experience: Ms. Livingston began employment at CompuChem as a Biomedical Technician in FDT extractions where she was responsible for screening and GC/MS analysis of biological fluids for detection of drugs of abuse.

Subsequently, Ms. Livingston was promoted to volatile GC/MS Operator in the environmental GC/MS Laboratory where she analyzed water and soil samples on Finnigan OWA GC/MS instruments using the purge and trap method. Ms. Livingston was then promoted to the position of Technical Reviewer.

Prior to joining CompuChem, Ms. Livingston was employed for one (1) year and a half (1/2) as a Medical Technologist at Roche Biomedical Laboratories, Inc., in Burlington, NC, where she performed clinical diagnostic testing on biological fluids using radioimmunoassays.

Ms. Livingston has 20 months of experience in quality assurance.

Hire Date: February 7, 1983

AR302203

Section No. 17.0

Revision No. 6

Date: September 15, 1991

James D. Lowery
Senior Laboratory Assistant, Extractions Lab
CompuChem Laboratories

Responsibilities: As a Senior Laboratory Assistant, Mr. Lowery is responsible for miscellaneous laboratory duties including setting up glassware configurations for technicians, performing dry weight and pH procedures, and assisting technicians with their work when appropriate.

Education: Mr. Lowery received a Bachelor of Arts in History & Government from King's College (1965) and a Master of Arts in Biology Education from the College of St. Thomas (1969). He has also earned 21 credits in Earth Science from Bloomsburg State University.

Experience: Prior to joining CompuChem, Mr. Lowery taught Life and Earth Sciences courses to ninth grade students.

Mr. Lowery has seven years of practical laboratory experience.

Hire Date: August 18, 1991

AR302204

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Bill D. Livingston
Supervisor 2nd Shift GC/MS Laboratory
CompuChem Laboratories

Responsibilities: In his current position, Mr. Livingston is responsible for overseeing the analysis of samples and interpretation of data using GC/MS.

Education: Mr. Livingston received a B.S. degree in Biology with a minor in Chemistry from Gardner-Webb in 1981.

Experience: From 1981 to 1983, Mr. Livingston worked as Chemical Technologist with Roche Biomedical Laboratories. Mr. Livingston joined CompuChem in February of 1983 as Biomedical Technician. Since then he has held positions as GC/MS Operator Trainee and GC/MS Operator.

Mr. Livingston has 66 months of experience in GC/MS.

Hire Date: February 7, 1983

AR302205

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Frederick Littlejohn
GC/MS Chemist III
CompuChem Laboratories

Responsibilities: Mr. Littlejohn is responsible for the analysis of environmental samples utilizing GC/MS and for the generation of complete data packages in an accurate and timely manner. He is also responsible for training and overseeing the activities of lower level chemists.

Education: Mr. Littlejohn received a B.S. degree in Chemistry from North Carolina State University in 1985.

Experience: From 1983+1985, Mr. Littlejohn worked as a Biological Aide with NIEHS. From 1985-1986 Mr. Littlejohn was employed as an Animal Laboratory Technician with Charles River Laboratories. In 1986 Mr. Littlejohn was employed as a General Laboratory Technician with CIBA-GIEGY Biological Laboratory.

Mr. Littlejohn has had 63 months of experience in GC/MS analysis.

Hire Date: July 14, 1986

AR302206

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Rajesh Maingi
GC/MS Chemist III
CompuChem Laboratories

Responsibilities: Mr. Maingi is responsible for the analysis of environmental samples utilizing GC/MS and for the generation of complete data packages in an accurate and timely manner. Also responsible for training and overseeing the activities of lower level chemists.

Education: Mr. Maingi received a degree in Nuclear Engineering/Chemical Engineering from North Carolina State University in 1987.

Experience: Mr. Maingi has experience in sales and receiving. Mr. Maingi has nine (9) months of experience in the operation of a GC/MS/DS on environmental samples.

Mr. Maingi has had 80 months of experience in GC/MS analysis.

Hire Date: July 16, 1984

AR302207

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Charles T. Mann
Manager, Environmental GC/MS Laboratory
CompuChem Laboratories

Responsibilities: Mr. Mann is responsible for ensuring that the production of the GC/MS Semivolatiles Laboratory is conducted in a timely and accurate manner. This includes coordinating the production effort with supervisors on other shifts.

Education: Mr. Mann received a B.A. degree in Chemistry from Wake Forest University in 1985.

Experience: Mr. Mann joined CompuChem as a part-time GC/MS Operator in 1984 prior to his permanent full-time employment in 1985. He has over one (1) year of experience in the operation of a GC/MS/DS on environmental samples. Mr. Mann was promoted to a supervisory position in 1986, and was responsible for performing timely and accurate analysis of samples using GC/MS.

Mr. Mann has had 75 months of experience in GC/MS analysis.

Hire Date: July 6, 1984

AR302208

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Vanessa Manuel
GPC Chemist
CompuChem Laboratories

Responsibilities: Ms. Manuel is responsible for processing soil samples following the 3/90 EPA CLP SOW for preparing pesticides and semivolatiles through GPC cleanup, preventive maintenance, and instrument calibration on a daily and weekly basis per the 3/90 SOW. Ms. Manuel is also responsible for performing automated Florisil cleanup for pesticides soil and water samples.

Education: Ms. Manuel received her diploma from Prince George High School in 1985. She is currently attending the University of North Carolina-Chapel Hill, working toward a B.A. in Chemistry.

Experience: Prior to joining CompuChem, Ms. Manuel was a Lab Assistant in the Environmental Science department at the University of North Carolina-Chapel Hill (March 1987-April 1990).

Ms. Manuel has had 12 months of practical laboratory experience in sample preparation and six months of experience in GPC cleanup of environmental samples.

Hire Date: September 17, 1990

AR302209

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Michael Mattocks
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Mr. Mattocks is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation, specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Mr. Mattocks received a B.S. degree in Chemistry from North Carolina Central University in 1986.

Experience: From 1983-1986 Mr. Mattocks was employed as a Laboratory Technician with NIEHS. In 1986 Mr. Mattocks was employed with Duke University as a Laboratory Assistant.

Mr. Mattocks joined CompuChem as a GC/MS Operator Trainee in 1986. Subsequently, he was promoted to GC/MS Operator, responsible for analyzing environmental samples using GC/MS.

Mr. Mattocks has had 42 months of experience in GC/MS analysis and data review.

Hire Date: June 29, 1986

AR302210

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Douglas P. McCormack
Manager of GC Laboratory
CompuChem Laboratories

Responsibilities: Mr. McCormack is responsible for overseeing the development and application of gas chromatographic methods for the analysis of pesticides, herbicides, and other toxic materials, as well as supervising the interpretation of the resulting data.

Education: Mr. McCormack received an undergraduate degree in Environmental Chemistry and Biology from East Carolina University and has engaged in graduate studies in Plant Pathology at North Carolina State University.

Experience: Mr. McCormack was previously a Chemist III in the GC Laboratory at CompuChem, and was responsible for developing and applying gas chromatographic methods for the analysis of pesticides, herbicides and other toxic materials, as well as interpreting the resulting data.

Mr. McCormack was employed as a lower level Chemist in the GC Laboratory for five years. From 1981-1984, Mr. McCormack was employed at North Carolina State University as a Research Assistant. From 1977 - 1981, Mr. McCormack was employed at Durham County Health Department as a Sanitarian II.

Mr. McCormack has had 79 months of experience in GC analysis.

Hire Date: October 1, 1984

AR302211

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Michael McRoy
GC/MS Technician
CompuChem Laboratories

Responsibilities: Mr. McRoy is responsible for sample preparation for volatiles and semivolatiles; Zero Headspace Extraction preparation; and sample screening on the GC/MS.

Education: Mr. McRoy obtained a B.S. degree in Wildlife Biology from North Carolina State University in 1990.

Experience: Mr. McRoy has nine months of experience in his current job.

Hire Date: September 17, 1990

AR302212

Section 17.0
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Date: September 15, 1991

Tamblyn McNair
Mixed Waste Radiochemist
CompuChem Laboratories

Responsibilities: Ms. McNair is responsible for dissolution of soils for subsequent radiochemical analysis, wet radiochemical analysis of soils, waters, filters, vegetation and other environmental matrices for a wide variety of natural radionuclides, transuranics, and fission products. In addition, Ms. McNair is responsible for the preparation of separated radionuclides for alpha/beta/gamma counting and for use of nuclear counting equipment.

Education: Ms. McNair received her B.S. degree in Biology from North Carolina Central University in 1988.

Experience: Ms. McNair worked at CompuChem in the Sample Preparation Laboratory as a Technician III before being promoted to her current position.

Prior to joining CompuChem, Ms. McNair worked as a Research Assistant in the Department of Biology at North Carolina Central University (1984-1988).

Ms. McNair has had 20 months of experience in sample preparation and less than six month of experience in radiochemistry.

Hire Date: November 14, 1988

AR302213

Section No. 17.0
Revision No. 6
Date: September 15, 1991

James E. Medlin
Inorganics Chemist II
CompuChem Laboratories

Responsibilities: Mr. Medlin is responsible for the analysis of inorganic samples by ICAP, GFAAS, and Cold Vapor, as well as the preparation of data packages in a timely and accurate manner. This position is strongly oriented toward analysis via the prescribed techniques, and is therefore more of a production position.

Education: Mr. Medlin received a B.S. in Chemistry/Biology from Appalachian State University in 1987.

Experience: Mr. Medlin has had 44 months of experience in ICP, flameless A.A., flame and cold vapor A.A., and cyanide analysis.

Hire Date: December 7, 1987

AR302214

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Elizabeth Megonigal
2nd Shift Supervisor, Sample Preparation
Laboratory
CompuChem Laboratories

Responsibilities: Ms. Megonigal is responsible for overseeing production on one shift for the Environmental Sample Preparation Laboratory, ensuring that all scheduled samples are extracted with the highest quality and productivity.

Education: Ms. Megonigal also ensures that adequate supplies and reagents are available in the laboratory at all times, and that all SOPs are followed correctly in preparing environmental samples for subsequent GC or GC/MS analysis.

Ms. Megonigal received a B.S. degree in Chemistry from Old Dominion University in Norfolk, Virginia, in 1986.

Experience: Prior to joining CompuChem, Ms. Megonigal held the positions of Chemist at E.I. Dupont in Aiken, SC (1988-89), Laboratory Technician at the University of Georgia Savannah River Ecology Lab (1987-88), Chemist at Environmental and Chemical Services, Inc. in New Ellenton, SC (1986-87), and Laboratory Technician at Chemical Ethanol Producers, Inc. in Chesapeake, Virginia (1984-86).

Ms. Megonigal has 18 months of experience in supervising sample preparation.

Hire Date: February 26, 1990

AR302215

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Girgis B. Mikhael
GC/MS Chemist III
CompuChem Laboratories

Responsibilities: Mr. Mikhael is responsible for the analysis of environmental samples utilizing GC/MS and for the generation of complete data packages in an accurate and timely manner. He is also responsible for training and overseeing the activities of lower level chemists.

Education: Mr. Mikhael received a Bachelor of Pharmacy & Pharmaceutical Chemistry degree from the University of Cairo in 1962. In addition, he received a degree in Industrial Pharmacy in 1974.

Experience: Prior to accepting his present position, Mr. Mikhael worked as a Hospital Pharmacist in Bab El Sheria Hospital from 1962 to 1964. He then worked in pharmaceutical supply from 1964 to 1972 for the Egyptian Army. Later he took a position with the Health Department as a Supervisor of Pharmacies from 1972 to 1984, while also working at Victoria Drug Store as a manager during the same years. In 1984 Mr. Mikhael emigrated to the United States.

Mr. Mikhael has had 83 months of experience in GC/MS.

Hire Date: September 18, 1984

AR302216

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Douglas B. Moore
GC/MS Chemist III
CompuChem Laboratories

Responsibilities: Mr. Moore is responsible for the analysis of environmental samples utilizing GC/MS and for the generation of complete data packages in an accurate and timely manner. He is also responsible for training and overseeing the activities of lower level chemists.

Education: Mr. Moore received a B.S. degree in Chemistry from Guilford College (NC) in 1985.

Experience: Mr. Moore joined CompuChem in 1986 as a GC/MS Operator Trainee.

Mr. Moore has 63 months of experience in GC/MS analysis.

Hire Date: July 7, 1986

AR302217

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Steve Moore
Radiochemist, Mixed Waste Lab
CompuChem Laboratories

Responsibilities: Mr. Moore is responsible for dissolution of soils for subsequent radiochemical analysis, wet radiochemical analysis of soils, waters, filters, vegetation and other environmental matrices for a wide variety of natural radionuclides, transuranics, and fission products. In addition, Mr. Moore is responsible for the preparation of separated radionuclides for alpha/beta/gamma counting and for use of nuclear counting equipment.

Education: Mr. Moore received his B.S. degree in Chemistry from UNC-Charlotte in 1989.

Experience: Mr. Moore began working at CompuChem in September of 1990 as a GC/MS Chemist I. Mr. Moore has had less than six months of experience as a radiochemist.

Hire Date: September 10, 1990

AR302218

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Robert Mullin
Sample Custodian
CompuChem Laboratories

Responsibilities: Mr. Mullin is responsible for the initial receipt, identification, preparation and initiation of chain-of-custody for every sample received in the Environmental Laboratory area.

Education: Mr. Mullin received a certificate in electronics from MTI in Saddlebrook, NJ (1976). In addition, Mr. Mullin attended North East Missouri University in Kirksville, MO (1973-74), where he studied mathematics and electronics.

Experience: Prior to joining CompuChem, Mr. Mullin worked as a mechanic for the US Postal Service (1980-88). In addition, Mr. Mullin was in the US Air Force (1977).

Mr. Mullin has 20 months of experience in the storage of environmental samples.

Hire Date: February 13, 1989

AR302219

Section No. 17.0

Revision No. 6

Date: September 15, 1991

Mary Kathleen Murphy
Inorganics Data Entry Clerk
CompuChem Laboratories

Responsibilities: Ms. Murphy is responsible for performing the clerical duties necessary to the operation of the Inorganics Laboratory, including case processing and initial data review.

Education: Ms. Murphy received a B.S. degree in Biology from St. Andrews Presbyterian College in 1983.

Experience: Prior to Ms. Murphy's present position, she was an Administrative Specialist III at CompuChem. Prior to that she held the positions of Senior Data Entry Operator, Data Entry Operator, and Scheduling Clerk at CompuChem.

Hire Date: August 22, 1983

AR302220

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Robert E. Meierer
Vice President, Quality Assurance & Technology
CompuChem Corporation

Responsibilities: Mr. Meierer is the Vice President of Quality Assurance and is responsible for assuring that all Corporate Laboratories (CompuChem Laboratories and ChemWest Laboratories) consistently produce high quality and reliable data, and that all necessary certification and licensing requirements are met by the laboratories.

Education: Mr. Meierer received an Associate degree in Industrial Chemistry from the Erie County Technical Institute in 1963, and an undergraduate degree in Chemistry from the State University of New York at Buffalo in 1971. He has taken advanced studies in Analytical Chemistry and Business Administration from the State University at Buffalo.

Experience: Prior to joining CompuChem, Mr. Meierer held positions as Laboratory Manager with Radian Corporation and as Department Head, Analytical Laboratory; Special Contamination Monitoring, The Carborundum Company from 1969-1980.

In his previous position with CompuChem as Technical Development Scientist, Mr. Meierer was responsible for providing technical assistance to operational laboratories for procedure development and implementation and problem-solving. Mr. Meierer has previously been employed with CompuChem as Manager of Analytical Laboratories where he was responsible for directing the efforts for the Sample Preparation Laboratories, the Inorganic Laboratory, the GC Laboratory, and the Standards Laboratory.

AR302221

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Robert E. Meierer
Vice President, Quality Assurance & Technology
CompuChem Corporation

Experience:

Through the variety of laboratory positions Mr. Meierer had held, he has gained ten (10) years of experience in the interpretation of mass spectra gathered in GC/MS analysis. In addition, Mr. Meierer has gained six (6) years of experience in the preparation of extracts from environmental or hazardous waste samples.

Further, he has gained three (3) years of experience in organochlorine pesticide residue and PCB analysis, including clean-up procedures such as column chromatography, of environmental samples.

Publications:

Meierer, R.E., Whitehead, R.J. "Making an On-Site Evaluation of an Analytical Services Laboratory," Environmental Claims Journal, Vol. 1, 4 (Summer 1989).

Meierer, R.E., Whitehead, R.J. "Quality Assurance: In Search of Excellence," Environmental Lab, November 1989.

Meierer, R.E., Ragsdale, P.L. "Validation of Toxicity Characteristic Leaching Procedure (TCLP) and Application to Industrial Wastes," paper presented in Washington, D.C. at the USEPA Symposium on Solid Waste Testing and Quality Assurance, July 13, 1987.

AR302222

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Robert E. Meierer
Vice President, Quality Assurance & Technology
CompuChem Corporation

Publications:

Meierer, R.E., Myers R.L., Whitehead, R.J., "Quality Assurance Studies Based On Analytical Condition Codes," paper presented to the Fifth Annual EPA Contract Laboratory Program Conference, U.S. EPA, August 1, 1985.

Meierer, R.E., "GC/MS: Applications For The Determination of Organic Constituents In Hazardous Waste," paper presented at the Twelfth Annual Conference on Waste Technology, NSWMA, October 18, 1983.

Meierer, R.E., Ragsdale P.L., and Mills, P.E., "Quality Assurance of Support Functions In A Large Hazardous Wastes Analytical Laboratory," paper presented before the division of Environmental Chemistry, American Chemical Society, March 29, 1982.

Meierer, R.E., "Laboratory Data Credibility and Reliability," paper presented in Milwaukee, Wisconsin on March 8, 1980, at the Federation of Environmental Technologists Conference.

Shaffer, P.T.B., Meierer, R.E., McGee, C.D., "Virus Recovery From Natural Water" JAWWA., 69 (10), 528-531 (1977).

Cook, G.A., Meierer, R.E., and Shields, B.M. "Combustibility Tests on Several Flame-Resistant Fabrics in Compressed Air, Oxygen Enriched Air, and Pure Oxygen. "Textile Research, 37:591 (1967).

Cook, G.A., Meierer, R. E., Shields, B.M., and Nevins, H.E. "Effects of Gas Composition on Burning Rates Inside Decompression Chambers at Pressures Up To 350 Feet of SeaWater." Paper presented at 54th Annual Meeting, Under-Ocean Technology, January 17, 1967 (Published by the Compressed Gas Association).

AR302223

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Laura E. Nixon
Inorganic Lab Technician III
CompuChem Laboratories

Responsibilities: Ms. Nixon is responsible for metals digestion (plasma and furnace), mercury preparation, cyanide distillation and analysis, pH, sulfide determination, SW-846 metals preparation, and learning the operation of AAIL.

Education: Ms. Nixon received a Bachelor of Science degree in Biology from Appalachian State University in 1990.

Experience: Prior to joining CompuChem, Ms. Nixon was employed as a Laboratory Technician at Roche Biomedical Laboratories (7 months), a formulation technician at Sherwin Williams Chemical Coatings Division (5 months), and an HLA laboratory technician at Genetics Design, Inc.

Ms. Nixon has 1 year of experience as a laboratory technician.

Hire Date: August 19, 1991

AR302224

Section No. 17.0
Revision No. 6
Date: September 15, 1991

E. Robin Nowell
Senior Data Review Specialist
CompuChem Laboratories

Responsibilities: As a Senior Data Review Specialist, Ms. Nowell is responsible for performing the final technical review/audit of sample data packages generated by the GC/MS Laboratory in an accurate and timely manner, and for ensuring that all data generated meets CompuChem's quality standards and complies with customer and/or contractual requirements.

Education: Ms. Nowell attended N.C. State University from 1974 to 1981, working toward a B.S. degree in Zoology and Chemistry. She re-enrolled and began classes in January 1991, and is working toward a degree in Chemistry. In February 1990, Ms. Nowell completed an in-house mass spectral interpretation course taught by a university professor consulting to CompuChem.

Experience: Prior to joining CompuChem, Ms. Nowell worked as a Laboratory Technician with Burroughs Wellcome from 1981-1982.

Ms. Nowell began employment at CompuChem as a Biomedical Technician in FDT where she was responsible for extractions, screening, and GC/MS analysis of biological fluids for detection of drugs of abuse.

Subsequently, Ms. Nowell was promoted to GC/MS operator in the environmental GC/MS Laboratory where she analyzed water and soil samples on Finnigan OWA GC/MS instruments. Ms. Nowell was then promoted to the position of Technical Reviewer, which she held for 2 years. She then transferred to the Data Review department and held the position of Data Review Specialist for two years prior to her promotion to Senior Data Review Specialist in September 1989.

Ms. Nowell has had 69 months of experience in data review/technical review.

Hire Date: February 7, 1983

AR302225

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Donna Parrish
GC Technician III
CompuChem Laboratories

Responsibilities: Ms. Parrish is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution of extracts, screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, Ms. Parrish must become familiar with using software programs to monitor EPA sequences.

Education: Ms. Parrish is currently attending North Carolina State University where she is planning to graduate in July 1991 with B.S. degrees in Biochemistry and Biology.

Experience: Ms. Parrish has less than six months of experience as a GC Technician II.

Hire Date: March 1, 1990

AR302226

Section No. 17.0
Revision No. 6
Date: September 15, 1991

David R. Pimentel
Sample Prep Technician II
CompuChem Laboratories

Responsibilities: Mr. Pimentel is responsible for developing an understanding of Sample Preparatory Laboratory techniques and procedures, becoming familiar with the glassware used in the laboratory, and for learning some of the wet chemistry techniques involved in liquid-liquid and solid-liquid extractions.

Education: Mr. Pimentel completed his junior year at East Valley High School (Terrace Heights, WA).

Experience: Prior to joining CompuChem, Mr. Pimentel worked as a Glassware Preparer at Burroughs Wellcome Company (temporary) and as a Laboratory Assistant at Rhone-Poulenc (temporary), both in RTP, NC.

Mr. Pimentel has had 24 months of experience in glassware preparation and 15 months of sample preparation experience.

Hire Date: May 31, 1988

AR302227

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Linda A. Pittman
Sample Preparation Technician IV
CompuChem Laboratories

Responsibilities: Ms. Pittman is responsible for performing all procedures associated with the extraction/preparation of organic matrices for subsequent GC or GC/MS analysis. In addition, she is responsible for the preparation of all paperwork associated with samples. She is also a skilled problem-solver when difficult or unusual matrices must be prepared, and she is expected to train lower level technicians.

Education: Ms. Pittman received a high school equivalency diploma in 1967.

Experience: Prior to joining CompuChem, Ms. Pittman was employed with Burlington Industries as a Machine Operator in 1976.

Ms. Pittman joined CompuChem in 1980 as a Senior Lab Assistant and Glassware Preparer in the Sample Preparation Laboratory. She also worked as a lower level technician in the Sample Preparation Laboratory from 1982-1988.

Ms. Pittman has had 109 months of experience in sample preparation.

Hire Date: May 28, 1980

AR302228

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Fernando Quiamboa
Sample Preparation Technician II
CompuChem Laboratories, Inc.

Responsibilities: Mr. Quiambo is responsible for developing an understanding of Sample Preparatory Laboratory techniques and procedures, becoming familiar with the glassware used in the laboratory, and for learning some of the wet chemistry techniques involved in liquid-liquid and solid-liquid extractions.

Education: Mr. Quiambo took one year of medical technician classes at Manila Central University (Philippines) and received a certificate in a clinical trainee course at Barnes Hospital (St. Louis, MO)

Experience: Mr. Quiambo worked as a temporary employee at CompuChem for one year before joining the company on a permanent basis. Previously, Mr. Quiamboa worked as a lab technician at the Duke Blood Gas Lab (1981-84), at Duke Animal Research Lab (1975-78), and at the Washington Medical Center (1970-75).

AR302229

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Don Rayno
Manager, Mixed Waste Laboratory
CompuChem Laboratories

Responsibilities: Mr. Rayno is responsible for managing the Mixed Waste Laboratory, assuring the production of accurate data in a cost and time effective manner so that laboratory goals are met.

Education: Mr. Rayno earned an A.S. degree in Math and Science from Adirondack Community College in 1975. In addition, Mr. Rayno received a B.S. degree in Chemistry from Rensselaer Polytechnic Institute in Troy, NY.

Experience: Prior to joining CompuChem, Mr. Rayno worked as a Radiological Scientist at Argonne National Laboratory in NJ (1977-83). From 1983-89 Mr. Rayno was a Radiochemist at North Carolina State University's Nuclear Services Laboratory (Raleigh, NC).

Mr. Rayno has had 18 months of experience in managing the Mixed Waste Laboratory.

Hire Date: September 5, 1989

AR302230

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Valgena Respass
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Ms. Respass is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Ms. Respass received a B.S. degree in Chemistry from Elizabeth City State University (NC), and also completed one year of graduate studies in Textile Chemistry at North Carolina State University.

Experience: Ms. Respass joined CompuChem in 1985 as a Senior Laboratory Assistant in the Environmental Sample Preparation Laboratory, and later was promoted to Senior Sample Preparation Technician and GC/MS Operator.

Ms. Respass also had laboratory supervisory experience while engaging in graduate level studies at NCSU from 1986-1987.

Ms. Respass has had 18 months of experience in GC/MS data review.

Hire Date: August 19, 1985

AR302231

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Mark Riggs
GC Technician III
CompuChem Laboratories

Responsibilities: Mr. Riggs is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution of extracts, screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, Mr. Riggs must become familiar with using software programs to monitor EPA sequences.

Education: Mr. Riggs received his B.A. degree in Foreign Languages in 1975 at the University of North Carolina-Asheville, and received his M.A. in Foreign Languages in 1977 from the University of Tennessee-Knoxville.

Experience: Prior to joining CompuChem, Mr. Riggs was employed by Northern Telecom as Quality Control Inspector from July 1985 to December 1985.

Mr. Riggs joined CompuChem in 1986. Before being promoted to his current position, he was a Sample Preparation Technician, responsible for the preparation of samples of different matrices for analysis by GC and GC/MS.

Mr. Riggs has had 17 months of experience in GC.

Hire Date: January 6, 1986

AR302232

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Diana Scammell
Technical Marketing Project Manager
CompuChem Laboratories

Responsibilities: Ms. Scammell is responsible for providing guidance on special projects by reviewing client requirements in conjunction with the laboratory capacity and subsequent management of the project. This includes: review of request for proposals (RFPs), coordinating scope of work with the laboratory, designing reporting format, and resolving associated inquiries. Acts as a technical liaison between CompuChem Laboratories and the client, investigate and resolve technical inquiries. She also acts as technical liaison between the Marketing Department and the laboratories.

Education: Ms. Scammell attended Virginia Polytechnic Institute & State University in Blacksburg, VA.
(96 hours towards Biology/Animal Science).

Experience: Prior to joining CompuChem Laboratories, Ms. Scammell was a Laboratory Technician for Virginia Polytechnic Institute & State University where she collected water & sediment samples and performed routine chemical analysis. Before being promoted to Technical Marketing Project Manager, Ms. Scammell held the position of Environmental Projects Manager and Technical Review Specialist.

Hire Date: January 15, 1980

AR302233

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Michael Schapira
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Mr. Schapira is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Mr. Schapira received a B.S. degree in Biochemistry from North Carolina State University in 1987.

Experience: Prior to being promoted to a GC/MS Data Review Specialist, Mr. Schapira worked as a GC/MS Operator at CompuChem from January 1989 - January 1990.

Mr. Schapira has 18 months of experience in reviewing GC/MS data.

Hire Date: January 9, 1989

AR302234

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Katy Sedgwick
GC Chemist I
CompuChem Laboratories

Responsibilities: As a GC Chemist I, Ms. Sedgwick is responsible for both technical and analytical duties involved in the analysis of environmental extracts for the presence of pesticides, herbicides, and other toxic materials through the use of gas chromatographic methods.

Education: Ms. Sedgwick received a B.A. degree from Meredith College in 1986. Prior to that she received an A.A.S. degree from Southwestern Technical College in Environmental Science Technology.

Experience: Ms. Sedgwick worked as an Analytical Chemist Technician at Bristol-Myers (Morrisville, NC) from 1981-1990. Her duties included instrument maintenance, calibration, and operation and sample preparation and testing. She has experience in HPLC, UV, GC, IR, AA, fluorimetry, dissolution and other analytical instrumentation.

Ms. Sedgwick has had 14 months of experience as a GC Technician.

Hire Date: September 19, 1990

AR302235

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Valerie Smith
GPC Chemist
CompuChem Laboratories

Responsibilities: Ms. Smith's responsibility is to process soil samples following the 3/90 EPA CLP SOW for pesticides and semivolatiles preparation through GPC cleanup, preventive maintenance, and instrument calibration on a daily and weekly basis per the 3/90 SOW. Ms. Smith is also responsible for performing automated Florisil cleanup for pesticide soil and water samples.

Education: Ms. Smith received her B.A. degree in Chemistry from the University of North Carolina at Chapel Hill in June 1991.

Experience: Ms. Smith has had less than six months of experience in GPC cleanup, and six months of experience in sample preparation.

Hire Date: September 4, 1990

AR302236

Section No. 17.0
Revision No. '6
Date: September 15, 1991

Vicki Spencer
Mixed Waste Radiochemist
CompuChem Laboratories

Responsibilities: Ms. Spencer is responsible for dissolution of soils for subsequent radiochemical analysis, wet radiochemical analysis of soils, waters, filters, vegetation and other environmental matrices for a wide variety of natural radionuclides, transuranics, and fission products. In addition, Ms. Spencer is responsible for the preparation of separated radionuclides for alpha/beta/gamma counting and for use of nuclear counting equipment.

Education: Ms. Spencer received a B.S. degree in Biology from Meredith College (Raleigh, NC) in 1989.

Experience Prior to joining CompuChem, Ms. Spencer was a Co-op student at CP&L Shearon Harris Energy and Environmental Center in New Hill, NC (1989).

Ms. Spencer has 18 months of experience in radiochemistry.

Hire Date: January 15, 1990

AR302237

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Debbie Spivey
Inorganics Chemist I
CompuChem Laboratories

Responsibilities: Ms. Spivey is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples, as well as gaining a thorough knowledge of SOPs associated with inorganic procedures.

Education: Ms. Spivey attended the University of North Carolina-Charlotte from 1980-1982, and received a B.S. degree in Textile Chemistry from North Carolina State University in 1986.

Experience: Prior to joining CompuChem, Ms. Spivey was an ICP Chemist at ASV Services in Reidsville, NC, from 1988-90.

Ms. Spivey has had 18 months of experience in ICP, flameless A.A., flame and cold vapor A.A., and cyanide analysis.

Hire Date: March 12, 1990

AR302238

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Toney C. Spruell
Final Technical Reviewer
CompuChem Laboratories

Responsibilities: Mr. Spruell is responsible for final technical review of commercial samples, organic and inorganic platinum and EPA cases such that adherence to contract protocols and internal quality guidelines are met. In addition, Mr. Spruell is responsible for resolving issues and incidents noted in the review process with the appropriate laboratory, consulting with the technical and/or quality director/manager to ensure internal quality of deliverable data.

Education: Mr. Spruell received training in Biology at the University of North Carolina from 1975-1978, and training from Durham Technical Institute in Engineering from 1979-1980.

Experience: From May 1978 to August 1983, Mr. Spruell was employed with Monsanto as a Chemical Engineering Research Technician, responsible for research and development on the hollow fiber membrane project (Prism Separators). Mr. Spruell joined CompuChem in 1983 and has held the positions of GC/MS Trainee, GC/MS Operator and Senior GC/MS Operator. Mr. Spruell was responsible for the analysis of environmental volatile samples utilizing GC/MS.

Mr. Spruell has had 37 months of experience in technical review of CompuChem data packages.

Hire Date: August 22, 1983

AR302239

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Debra L. Stanley
Supervisor, Sample Preparation Laboratory
Third Shift
CompuChem Laboratories

Responsibilities: Ms. Stanley is responsible for overseeing production on one shift for the Environmental Sample Preparation Laboratory, ensuring that all scheduled samples are extracted with the highest quality and productivity. Ms. Stanley ensures that adequate supplies and reagents are available in the laboratory at all times, and that all SOPs are followed correctly in preparing environmental samples for subsequent GC or GC/MS analysis.

Education: Ms. Stanley received an A.A.S. degree in Medical Technology from the Career Academy (Atlanta, GA) in 1972.

Experience: Prior to joining CompuChem, Ms. Stanley was a Medical Technician at Spring Hope Clinic (NC) from 1972-1979.

Since joining CompuChem in 1980, Ms. Stanley has worked as a Laboratory Technician (Sample Preparation), and a GC/MS Operator.

Ms. Stanley has had 55 months of experience in sample preparation.

Hire Date: May 12, 1980

AR302240

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Shaun Starnes
GC/MS Chemist I
CompuChem Laboratories

Responsibilities: As a GC/MS Chemist I, Mr. Starnes is responsible for learning the operations of GC/MS instrumentation and procedures involved in GC/MS analysis of VOC or SVOC in environmental samples.

Education: Mr. Starnes received a B.S. degree in Chemistry from North Carolina State University in 1987. He is currently working toward a B.S. degree in Computer Science at NCSU and expects to receive the degree in May of 1992.

Experience: Mr. Starnes has 12 months of experience in GC/MS analysis of environmental samples.

Hire Date: September 4, 1990

AR302241

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Sandra Renee Story
Inorganics Chemist I
CompuChem Laboratories

Responsibilities: Ms. Story is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples as well as gaining a thorough knowledge of SOWs associated with inorganic procedures.

Education: Ms. Story received a Bachelor of Arts in Chemistry from East Carolina University (1991). She completed courses in general & organic chemistry, inorganic chemistry, quantitative and instrumental analysis, and physical chemistry.

Experience: While attending East Carolina University, Ms. Story gained practical laboratory experience in high pressure liquid chromatography, gas chromatography, atomic absorption spectroscopy, and spectrophotometry.

Ms. Story has less than six months experience in inorganic chemistry.

Hire Date: August 5, 1991

AR302242

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Owen K. Studt
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Mr. Studt is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Mr. Studt received a B.A. degree in Physics from Elon College in 1983 and is pursuing studies in Business Computer Programming at Durham Technical Community College. Mr. Studt received a certificate in Electronic Assembly from Durham Technical Community College in 1985.

Experience: Mr. Studt joined CompuChem in 1985 as a Senior Laboratory Assistant in the Environmental Sample Preparation Laboratory. Mr. Studt was later promoted to GC Technician, responsible for providing technical support for the GC Lab.

Mr. Studt subsequently became a GC/MS Operator, responsible for analyzing environmental samples using GC/MS.

Prior to joining CompuChem, Mr. Studt was employed at AKD Gardens as a Supervisor/Analyst (1983-1984).

Mr. Studt has had 15 months of experience in data review.

Hire Date: May 22, 1985

AR302243

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Roy M. Sutton, Ph.D.
Developmental Chemist
CompuChem Laboratories

Responsibilities: Dr. Sutton is responsible for the accurate and complete technical review of the data generated by the GC/MS Laboratory in order to assure the highest quality data, applying stated quality control policies, and maintaining the records necessary to support these policies.

Education: Dr. Sutton received a B.S. degree in Entomology from Clemson University in 1974, and in 1978 he received a Ph.D. in Entomology from Clemson University.

Experience: Prior to joining CompuChem, Dr. Sutton was employed with Burlington Industries Inc., Corporate Research and Development, where he gained experience in infrared spectrophotometry, gas chromatography, mass spectrometry, and nuclear magnetic resonance.

Through the various laboratory positions Dr. Sutton held, he has gained six (6) years of experience in the interpretation of mass spectra gathered in GC/MS analysis. In addition, he has four (4) years of experience in the operation of the GC/MS/DS on environmental samples and two (2) years of experience in the preparation of extracts from environmental or hazardous waste samples. Dr. Sutton also has three (3) years of experience using the purge and trap technique for volatile organics.

Hire Date: September 6, 1983

AR302244

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Genie M. Taylor
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Ms. Taylor is responsible for providing expertise to the GC/MS Laboratory in the areas of spectral interpretation specifically as it relates to data review and standard operating procedures. Other responsibilities include routing data to appropriate GC/MS personnel, identifying continuing problems in returned data and processed data, and generating SOP material as needed.

Education: Ms. Taylor received a B.S. degree in Biology from North Carolina Central University in 1981.

Experience: Prior to joining CompuChem Ms. Taylor was a Sales Clerk for JC Penney (1981-1982). Ms. Taylor also gained six (6) months of experience as a Biological Aide with the U.S. Forest Service, where she prepared water and soil samples. Prior to being promoted to her present position at CompuChem, Ms. Taylor held positions as GC/MS Operator Trainee, Sr. Lab Assistant, and GC/MS Technician.

Ms. Taylor has had 108 months of experience in GC/MS analysis.

Hire Date: December 27, 1982

AR302245

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Eddie Howard Thompson
Technician IV
CompuChem Laboratories

Responsibilities: Mr. Thompson is responsible for performing all procedures associated with the extraction/preparation of organic matrices for subsequent GC or GC/MS analysis. In addition, he is responsible for the preparation of all paperwork associated with samples. He is also a skilled problem-solver when difficult or unusual matrices must be prepared, and he is expected to train lower level technicians.

Education: Mr. Thompson received his high school diploma at Valley High School (Sacramento, CA) in 1983.

Experience: Mr. Thompson has 67 months of experience in sample preparation. Prior to assuming his current position, Mr. Thompson worked as a glassware preparer for CompuChem.

Hire Date: June 3, 1985

AR302246

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Scott Turner
GC Technician III,
CompuChem Laboratories

Responsibilities: Mr. Turner is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution of extracts, screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, he must become familiar with using software programs to monitor EPA sequences.

Education: Mr. Turner received a B.S. degree in Conservation from North Carolina State University in 1988.

Experience: Mr. Turner has had 14 months of experience in GC.

Hire Date: September 10, 1990

AR302247

Section No. 17.0
Revision No. '6
Date: September 15, 1991

Amy Tutor
GC Technician III
CompuChem Laboratories

Responsibilities: Ms. Tutor is responsible for the technical aspects of gas chromatographic instrumental analysis, including diluting extracts, screening extracts, checking standards to ensure they are within specified EPA and commercial protocols, and maintaining the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, Ms. Tutor must become familiar with using software programs to monitor EPA sequences.

Education: Ms. Tutor received her B.S. degree in Chemistry in 1991 from Elon College.

Experience: Ms. Tutor joined CompuChem in June 1988. Before being promoted to her current position, she was a Sample Preparation Technician, responsible for the preparation of samples of different matrices for analysis by GC and GC/MS.

Ms. Tutor has had 48 months of experience in preparation of samples, and less than six months of experience in GC analysis of environmental samples.

Hire Date: June, 1988

AR302248

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Melissa Tyndall
GC Chemist III
CompuChem Laboratories

Responsibilities: Ms. Tyndall is responsible for developing and applying gas chromatographic methods for the analysis of pesticides, herbicides, and other toxic materials, including interpreting the resulting data.

Education: Ms. Tyndall received a B.A. degree in Chemistry/Zoology from UNC-Chapel Hill, NC.

Experience: Ms. Tyndall has 11 years of clinical analysis experience.

Ms. Tyndall has had 42 months of experience in GC analysis.

Hire Date: June 15, 1987

AR302249

Section No. 17.0
Revision No. 6
Date: September 15, 1991

John C. Tzavaras
Developmental Chemist II
CompuChem Laboratories

Responsibilities: Mr. Tzavaras is responsible for the training of all laboratory personnel in the preparation and analyses of samples of all types for the determination of metals, cyanide, phenols, and any other inorganic constituent using instrumentation available in the Inorganics Laboratory. He is also responsible for the review of data from a technical quality standpoint. This position also involves the acquisition of a thorough knowledge of SOPs and IPs associated with the processing of inorganic samples. This is essentially a non-production position.

Education: Mr. Tzavaras received an undergraduate degree in Chemistry from Tufts University in 1976 and an A.A.S. degree from Durham Technical Institute in Electronics Engineering Technology in 1985.

Experience: From 1977-1980 Mr. Tzavaras was employed by Instrumentation Laboratory as a Product Specialist. From 1976-1977, Mr. Tzavaras was employed by Herbert V. Shuster, Inc. as an Analytical Chemist. Mr. Tzavaras has had 155 months of experience in all of the analytical methods used in the Inorganics Laboratory.

Hire Date: January 2, 1980

AR302250

Section No. 17.0
Revision No. 6
Date: September 15, 1991

G.K. VERKERK
Chief Executive Officer and President
CompuChem Corporation

Responsibilities: Mr. Verkerk is Chief Executive Officer and President of CompuChem Corporation and is responsible for the daily operations of CompuChem's analytical laboratories and management of the total business function.

Education: Mr. Verkerk received his Doctorandus (Drs.) degree in Economics and Business Administration from Vrije University, Amsterdam, Netherlands, in 1977.

Experience: Prior to joining CompuChem, Mr. Verkerk was employed as Vice President and Chief Financial Officer at Signal Environmental Systems, where he was accountable for financial management and results. Mr. Verkerk has held various financial and general management positions at M. W. Kellogg in the United States and Europe.

AR302251

Section No. 17.0

Revision No. 6

Date: September 15, 1991

Joe Venable
Glassware Preparer
CompuChem Laboratories

Responsibilities: Mr. Venable is responsible for the preparation and inventory of all glassware associated with the environmental laboratory areas, and for preparing reagents such as glass wool and sodium sulfate for Environmental Sample Preparation Laboratory. He also prepares SampleSaver glassware which is shipped to clients to use in gathering environmental samples.

Education: Mr. Venable received his high school diploma in 1949.

Experience: Prior to joining CompuChem, Mr. Venable was employed by Marriott/Service Systems as Assistant Manager (1985). Mr. Venable has had 41 months of experience in preparation of laboratory glassware.

Hire Date: May 19, 1986

AR302252

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Jun M. Versola
GC/MS Data Review Specialist
CompuChem Laboratories

Responsibilities: Mr. Versola is responsible for final technical review of commercial samples, organic and inorganic platinum and EPA cases such that adherence to contract protocols and internal quality guidelines are met. In addition, a Technical Reviewer is responsible for resolving issues and incidents noted in the review process with the appropriate laboratory, consulting with the technical and/or quality director/manager to ensure internal quality of deliverable data.

Education: Mr. Versola earned a B.S. degree in Microbiology from North Carolina State University in 1990.

Experience: Prior to assuming his current position, Mr. Versola a GC/MS Operator at CompuChem.

Mr. Versola has less than six months of experience in data review.

Hire Date: June 4, 1990

AR302253

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Eric S. Vidacovich
Chemist I
CompuChem Laboratories

Responsibilities: Mr. Vidacovich is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples, as well as gaining a thorough knowledge of SOPs associated with inorganics procedures.

Education: Mr. Vidacovich intermittently attended Texas A & M University, North Texas State University and Richland Junior College (Dallas) from 1977-1983, where he completed 146 hours towards a B.S. in Biology.

Experience: Prior to joining CompuChem, Mr. Vidacovich held the positions of Research Technician at Duke Medical Center, Physical Science Technician at the US EPA, Research Technician at the Virginia Medical Center Oral Disease Research Laboratory, Research Technician at the University of Texas Dental School, and Bacteriology Technician at Medical Laboratories Incorporated (Texas). Before assuming his current position at CompuChem, Mr. Vidacovich was an FDT Quality Control Standards Technician in the QC Laboratory.

Mr. Vidacovich has had 10 months of experience in Flameless A.A., Flame and Cold Vapor A.A. analysis.

Hire Date: July 11, 1988

AR302254

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Melanie Walker
GC Technician III
CompuChem Laboratories

Responsibilities: Ms. Walker is responsible for the technical aspects of gas chromatographic instrumental analysis, including the dilution and screening of extracts, checking of standards to ensure they are within specified EPA and Commercial protocols, and the maintenance of the GCs themselves. This includes column maintenance and troubleshooting maintenance of mechanical parts. In addition, she must become familiar with using software programs to monitor EPA sequences.

Education: Ms. Walker attended North Carolina State University where she received two B.S. degrees, one in Biochemistry and one in Microbiology.

Experience: Ms. Walker has 15 months of experience as a GC Technician III.

Hire Date: March 5, 1990

AR302255

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Angela Wall
Sample Preparation Technician II
CompuChem Laboratories

Responsibilities: Ms. Wall is responsible for developing an understanding of Sample Preparation Laboratory techniques and procedures, becoming familiar with the glassware used in the laboratory, and for learning some of the wet chemistry techniques involved in liquid-liquid and solid-liquid extractions.

Education: Ms. Wall graduated from Northern High School (Durham, NC) in 1985. She also attended Rutledge College in 1987.

Experience: Prior to assuming her current position, Ms. Wall was a Glassware Preparer in the Sample Preparation Lab.

Ms. Wall has 37 months of experience in sample preparation and glassware preparation.

Hire Date: May 23, 1989

AR302256

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Ralph C. Waymer
Inorganics Chemist I
CompuChem Laboratories

Responsibilities: Mr. Waymer is responsible for learning the analytical methods and instrumentation operations involved in processing inorganic samples as well as gaining a thorough knowledge of SOWs associated with inorganic procedures.

Education: Mr. Waymer holds a B.S. degree in Biology from South Carolina State College.

Experience: Mr. Waymer worked for East Carolina University's School of Medicine as a Research Technician from 1984-88. He has less than six months of experience in inorganic sample analysis and instrumentation operations.

Hire Date: June 4, 1990

AR302257

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Phil Williamson
Staff Consultant, Lab Instrumentation
CompuChem Laboratories

Responsibilities: Mr. Williamson is responsible for bringing new technologies and methods to the environmental GC/MS laboratory. Mr. Williamson has in-depth knowledge of data systems (GC/MS and PC-based), and writes software (system-level and user-level) utilizing assembler languages, Fortran, Pascal and C. Mr. Williamson is part of CompuChem's Research and Development team.

Education: Mr. Williamson received a B.S. degree in Chemistry from North Carolina State University in 1969.

Experience: Prior to joining CompuChem, Mr. Williamson was a Service Engineer with Finnigan MAT in San Jose, California (1978-80). Before that, Mr. Williamson was a Forensic Chemist with the North Carolina State Bureau of Investigation in Raleigh, NC (1970-78).

Hire Date: August 1, 1980

AR302258

Section No. 17.0
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Date: September 15, 1991

Robert J. Whitehead
Manager of Quality Assurance
CompuChem Laboratories

Responsibilities: As the Manager of Quality Assurance, Mr. Whitehead is responsible for managing the Environmental QA and Forensic Drug Testing QA operations.

Education: Mr. Whitehead received an undergraduate degree in Biology, with a secondary emphasis in Chemistry, from the University of North Carolina at Chapel Hill. Mr. Whitehead has also participated in a number of Continuing Education Programs and symposia associated with Statistical Quality Control, Analytical QA/QC, Analytical Techniques, Waste Testing and Quality Assurance, Quality Circles Concepts, and Advanced Leadership Training.

Experience: Before his promotion to Manager of Quality Assurance, Mr. Whitehead was employed at CompuChem Laboratories as a Senior QA Specialist, responsible for ensuring that data generated by all lab stations complied with established acceptance criteria. Prior to this, Mr. Whitehead was employed at CompuChem Laboratories as a GC/MS Operator, with responsibility for the operation of a GC/MS system, spectral interpretation, and quantitative data analyses.

Mr. Whitehead has two (2) years of experience in the operation of the GC/MS/DS on environmental samples and eight (8) years of experience in the interpretation of mass spectra gathered in GC/MS analysis. Mr. Whitehead also has two (2) years of experience using the purge and trap

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Section No. 17.0

Revision No. 6

Date: September 15, 1991

Robert J. Whitehead
Manager of Quality Assurance
CompuChem Laboratories

Experience:

technique for volatile organics and one (1) year of experience in the preparation of extracts from environmental or hazardous waste samples. In addition, Mr. Whitehead has six (6) years of experience in conducting QA system and performance audits, and has been directly involved in the development of numerous QA Project Plans and QA Program Plans following QAMS-005/80 and QAMS-004/80 guidelines.

Publications:

Whitehead, R.J., "Statistical Quality Control for the Analytical Laboratory," Proceedings from the Analytical Techniques and Residuals Management in Water Pollution Control Specialty Conference, Water Pollution Control Federation, April 20, 1988.

Meierer, R.E., Whitehead, R.J., "Making an On-Site Evaluation of an Analytical Services Laboratory," Environmental Claims Journal Vol. 1, No. 4, Summer 1989.

Presentations:

Whitehead, R.J., Meierer, R.E., "Laboratory Data Credibility and Reliability." Paper presented in Milwaukee, Wisconsin, on March 8, 1980, at the Federation of Environmental Technologists Conference.

Whitehead, R.J., "Commercial Laboratories: The Delicate Balance between Quantity and Quality." Paper presented in Research Triangle Park, NC, on October 25, 1990, at the Eleventh Annual Analytical Laboratory Managers Association Conference.

Meierer, R.E., Myers, R.L., Whitehead, R.J., "Quality Assurance Studies Based on Analytical Condition Codes." Paper presented at the Fifth Annual Contract Laboratory Program Conference, August 1, 1985.

AR302260

Section No. 17.0
Revision No. 6
Date: September 15, 1991

Stephanie W. Winfield
Technical Reviewer
CompuChem Laboratories

Responsibilities: Ms. Winfield is responsible for final technical review of commercial samples, organic and inorganic platinum and EPA cases such that adherence to contract protocols and internal quality guidelines are met. In addition, Ms. Winfield is responsible for resolving issues and incidents noted in the review process with the appropriate laboratory, consulting with the technical and/or quality director/manager to ensure internal quality of deliverable data.

Education: Ms. Winfield received a B.S. degree in Chemistry from North Carolina State University in 1984 with a Computer Science minor.

Experience: Prior to assuming her current position, Ms. Winfield worked as a GC/MS Operator Trainee and later GC/MS Operator, responsible for analyzing semivolatile EPA samples as well as commercial BNA samples using a Finnigan OWA. Ms. Winfield also worked in Forensic Drug Testing GC/MS Laboratory for three (3) months.

From 1984-1985 Ms. Winfield was employed at Research Triangle Institute as an Organic Chemist I, where she synthesized and analyzed organic compounds, mainly for the National Institute on Drug Abuse contract. She ensured the quality of final product using NMR, IR, UV, and optical rotation. Ms. Winfield also utilized general bench chemistry techniques plus HPLC work with peptides.

Ms. Winfield has had 5 months of experience in data review, and six months of experience in technical review.

Hire Date: October 14, 1985

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Section No. 17.0
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Date: September 15, 1991

Cindy Young
Report Preparation Systems Coordinator
CompuChem Laboratories

Responsibilities: Ms Young is responsible for maintaining the integrity of the software and systems application in the Report Preparation Department. She establishes and maintains databases, evaluates and installs software, creates programs to further automate procedures, and investigates and resolves questions in the ESP and PDP systems.

Education: Ms. Young holds a B.S. degree in Business Administration from the University of Central Florida (1984).

Experience: Prior to becoming a Systems Coordinator, Ms. Young was Supervisor of Report Preparation, responsible for directing the compilation and production of CLP and non-CLP data packages and diskette deliverables.

Before joining CompuChem, Ms. Young was a supervisor at Aero Enterprises, Inc. (1986-87), a Realtor Associate for Coldwell Banker, Inc. (1985-86), and an Estee Lauder Manager at Ivey's (1984-85).

Hire Date: November 9, 1987

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Section No. 17.0
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Date: September 15, 1991

Marshall Yount
GC/MS Chemist I
CompuChem Laboratories

Responsibilities: As a GC/MS Chemist I, Mr. Yount is responsible for learning the operations of GC/MS instrumentation and procedures involved in GC/MS analysis of VOC or SVOC in environmental samples.

Education: Mr. Yount received a BS degree in Business Administration in 1982 from East Carolina University (Greenville, NC). In 1989 he completed his BS in Chemistry from North Carolina State University.

Experience: Before joining CompuChem Mr. Yount worked as an Associate Scientist at Radian Corporation from 1989 to 1990. He has 12 months GC/MS experience.

Hire Date: September 3, 1991

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Attachment 1

**CHEMWEST Analytical Laboratories Inc.
Quality Assurance Plan
and Other Relevant Information**

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CHEMWEST Quality Assurance Program Plan

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QUALITY ASSURANCE PROGRAM PLAN

CHEMWEST Analytical Laboratories, Inc.

600W North Market Boulevard

Sacramento, CA 95834

This document conforms to "Guidelines and Specifications for Preparing Quality Assurance Program Plans" (QAMS-004/80) as published by the EPA's Quality Assurance Management Staff, Office of Monitoring Systems and Quality Assurance, Office of Research and Development.

Manager of Quality Assurance: _____

Copy Issued to: _____

Date Issued: _____ Revision Number: _____

Copy Number: _____

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APPENDIX F

QUALITY CONTROL CHART EXAMPLE

** REVISION 1: JANUARY 15, 1989
REVISION 2: FEBRUARY 15, 1989

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1.0 QUALITY ASSURANCE PROGRAM PLAN IDENTIFICATION FORM

Document Title: Quality Assurance Program Plan: CHEMWEST Analytical
Laboratories, Inc.

Document Control Number: _____

Organization Title: CHEMWEST Analytical Laboratories, Inc.

Address: 600 W North Market Boulevard

Sacramento, CA. 95834

Responsible Official: Joel C. Bird

Telephone: (916) 923-0840

Title: President

Quality Assurance Officer: Steven C. Madden

Telephone: (916) 923-0840

Address: 600 W North Market Boulevard

Sacramento, CA. 95834

Plan Coverage: Environmental Laboratory, including:

Sample Control

Sample Preparation Laboratory

High-Hazard Laboratory

GC/MS Laboratory

GC Laboratory

Inorganics Laboratory

Data Control

Quality Assurance

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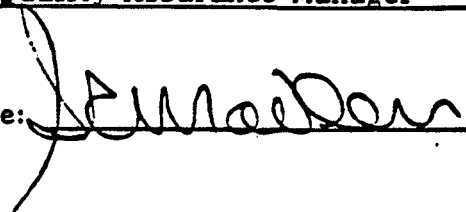
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Concurrences

(1) Name: Steven C. Madden

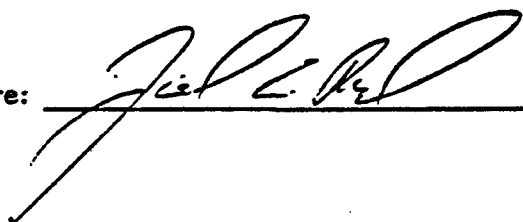
Title: Quality Assurance Manager

Signature: 

Date: 2/22/89

(2) Name: Joel C. Bird

Title: President

Signature: 

Date: 2-22-89

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2.0 INTRODUCTION

The entire CHEMWEST staff is dedicated to providing reliable, high quality data to our clientele. CHEMWEST management believes that Quality Assurance is not only a management function, but that every individual in the laboratory is responsible for assuring the quality of their analytical data. Therefore, each person generating or monitoring data within the laboratory is trained in evaluating data, monitoring control limits, and taking the corrective action necessary to assure a reliable, high quality product for all CHEMWEST customers.

The Quality Assurance Manager is responsible for the overall Quality Assurance program at CHEMWEST. The Quality Assurance Manager reports directly to the President of CHEMWEST, and works closely with the various Technical Managers to assure that all CHEMWEST data is consistently reliable and of the highest quality.

The CHEMWEST Quality Assurance program meets or exceeds EPA recommended guidelines, with quality control samples accounting for at least 10% of the total number of samples analyzed. This data can be used to update control limits, or in the case of programs with defined control limits, the data serves to demonstrate overall lab performance.

Data is reviewed at several levels, including the analyst, the Laboratory Manager, the Project Manager, and a final review by the Vice-President of Technical Services, or designate, with a percentage of the data audited by the Quality Assurance Manager or staff.

The laboratory must demonstrate that the analytical procedures and techniques are in control. This is initially established by the use of specified laboratory proficiency or method validation studies. Once the studies are complete and the data has been assessed, normal Quality Control activities are performed. These activities include blanks, method blank spikes, method blank spikes duplicates, matrix spikes, matrix spike duplicates, and surrogates, for many organic analyses. The latter which help evaluate total system control on a per sample basis.

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3.0 QUALITY ASSURANCE POLICY STATEMENT

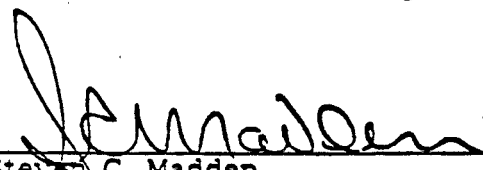
3.1 Statement of Authority and Responsibility

This document is the Quality Assurance Program Plan for Environmental Operations at CHEMWEST Laboratories. The plan describes the activities of the Laboratory necessary to meet or exceed the data quality objectives of CHEMWEST's clients.

The Management of CHEMWEST Laboratories is fully and firmly committed to the Quality Assurance Program described in this plan. Each officer and manager, as well as all staff members, as assigned in accordance with this plan, are obligated to comply with it's stated requirements, responsibilities, and objectives.

The Quality Assurance program will be maintained and expanded or modified as necessary, to ensure that all reportable data are of the highest quality.

The Manager of Quality Assurance is responsible for the contents of the Plan and is committed to assuring that the stated requirements are met. The Manager of Quality Assurance has the additional responsibility and authority to terminate nonconforming work.



Steven C. Madden

Manager of Quality Assurance, CHEMWEST Analytical Laboratories, Inc.



Joel C. Bird

President, CHEMWEST Analytical Laboratories, Inc.

Robert E. Meierer

Corporate Vice-President of Quality Assurance, CompuChem Corporation

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4.0 QUALITY ASSURANCE MANAGEMENT

4.1 Introduction

The CHEMWEST Quality Assurance group, under the direction of the CHEMWEST Quality Assurance Manager, reports directly to the President of CHEMWEST, and operates independently of production areas. The CHEMWEST Quality Assurance Manager and staff monitors and reviews all CHEMWEST laboratory units.

The CHEMWEST Quality Assurance Department has access to the CompuChem Vice-President of Quality Assurance and staff, as a resource for Quality Assurance information of benefit to all members of the Corporation.

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4.2 Assignment of Responsibilities

The Quality Assurance (QA) group operates independently of all data generating areas. The QA Manager reports directly to the President of CHEMWEST.

4.2.1 Responsibilities of the QA Program

The main responsibilities of the CHEMWEST QA program are to assure the generation and reporting of high quality results, to identify and implement policies to improve quality, and to maintain the necessary records that document laboratory performance. The success or failure of the program depends on all of the CHEMWEST staff carrying out the various steps of the program.

4.2.2 Responsibilities and Authority of the QA Manager

- o To be certain that the laboratory achieves QA objectives, the Manager of Quality Assurance monitors and directs the QA Program goals, in strict adherence to the procedures and requirements stated in this plan.
- o The QA Manager is independent of, and separate from, all personnel directly involved in the direction and operation of the technical program.
- o The QA Manager has the final authority to stop or change any incorrect or improper analytical procedure, to assure data or product quality.

4.2.3 Duties of the QA Manager and Staff

- o Monitoring the QA Program as documented in the QA Program Plan and ensuring that the Program is carried out.
- o Developing and implementing new QA Program approaches, including statistical procedures and techniques.
- o Conducting regular audits and inspections, reporting the results to management, and when needed, ensuring that corrective action is taken.
- o Maintaining current copies of all measurement procedures routinely used in the laboratories, including subcontract laboratories.

4.2.3 Duties of the QA Manager and Staff (continued)

- o Informing management of the status of the QA Program.
- o Seeking out and evaluating new ideas and current developments in the field of QA and recommending means for their application wherever advisable.
- o Advising Marketing on appropriate QC procedures concerning sample analyses.
- o Implementing or modifying procedures as needed.
- o Spot-checking work in progress for quality and completeness.
- o Providing information to laboratory managers on out-of-control analyses and providing recommendations for corrective action.
- o Overseeing corrective action as required.
- o Ensuring that each laboratory meets all requirements, as documented in this plan, as well as in their specific SOPs.
- o Ensuring generation, analysis, and documentation of QC Data.
- o Establishing control limits, using QC data from routine analyses.
- o Providing information and documentation for audits or inspections.
- o Writing QA narratives for inclusion in data packages.
- o Conducting unannounced audits.
- o Reviewing and approving Performance Evaluation sample data before release.
- o Coordinating projects with laboratory management and staff.
- o Introducing internal "blind" check samples into the system, including blind performance checks of subcontractors, and reporting the results to management.

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4.2.3 Duties of the QA Manager and Staff (continued)

- o Ensuring that all standards are approved and traceable to reference standards provided by the National Bureau of Standards (NBS), the EPA, or other reputable source, as available.

4.2.4 Responsibilities of All CHEMWEST Staff

- o Preventative maintenance on instruments and equipment, including routine and scheduled.
- o Compliance with methods and SOPs as written.
- o Ensuring that the instruments meet calibration and tuning requirements.
- o Ensuring that instrument maintenance, analysis, and calibration logs are maintained.
- o Responding to corrective action requirements.
- o Performance of action steps based on Quality Control acceptance criteria.
- o Continuous monitoring of generated data for compliance with QC Acceptance Criteria.

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4.3 Communications

The QA group communicates to other areas of the laboratory and to Management via memos, reports, and personal conversations. They distribute memos and reports, as required, to appropriate laboratory managers and staff detailing the results of internal and external audits, blind QC samples, and data audit reviews. These memos and reports indicate when corrective action is needed, or in many cases they are used to reaffirm that the laboratory areas are performing in a satisfactory manner.

Periodically, the QA group produces a report summarizing its activities. Typically, the information in this report includes the results of internal and external audits, the labs' performance on internal blind QC samples, the labs' performance on external performance evaluation (PE) samples, summaries of special studies conducted, and summaries of any other activities conducted by the QA Department. This report is sent to the CHEMWEST officers and Laboratory Managers, and is available for the entire staff to study as appropriate.

The Management Organizational Chart indicates the Officers and Laboratory Managers of CHEMWEST Analytical Laboratories, Inc.

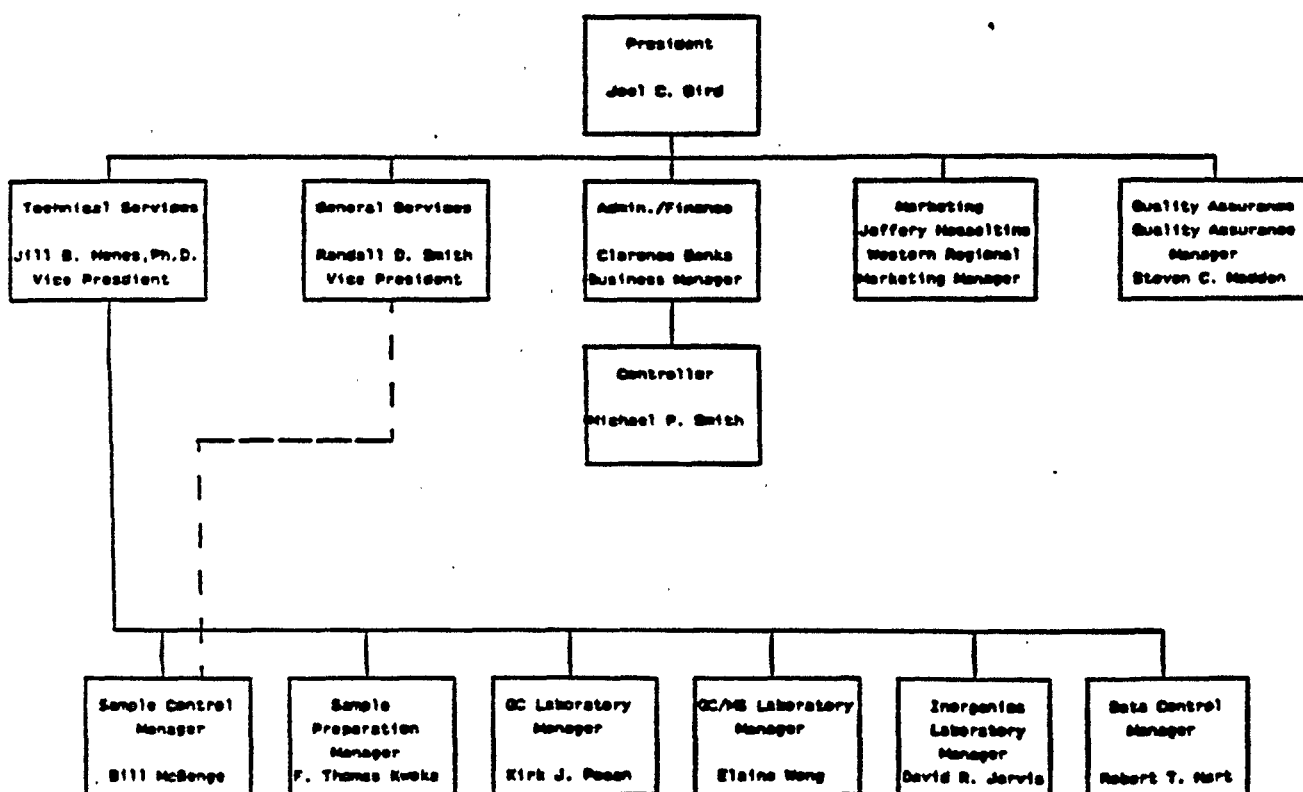
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4.3.1 Management Organizational Chart

ORGANIZATIONAL CHART Management/Administration



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4.4 Document Control

Document control procedures, as described in Section 1.4.1 of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I (EPA-600/9-76-005), were used in the production of the QA Program Plan and are followed in the production of other documents vital to the operation of the laboratory. This document control system includes distribution lists, an historical file of all updated standard operating procedures, and appropriate sign-offs to assure the use of correct methods and techniques.

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4.5 QA Program Assessment

The QA Manager and staff conducts periodic assessments of the total QA Program. Based on these assessments, a semi-annual written status report of QA activities and progress is forwarded to the President of CHEMWEST. These QA reports include such information as:

- o Status of, or Changes to, QA Program Plans
- o Status of any QA Project Plans
- o Measures of Data Quality
- o Significant QA Problems, Accomplishments, and Recommendations
- o Results of Performance Audits
- o Results of Systems Audits
- o Status of QA Requirements for Contracts and Grants
- o Summary of QA Training (internal and external QA/QC seminars)

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5.0 PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS

5.1 Introduction

! With over 45 employees, CHEMWEST offers the scientific and technical expertise needed to service the analytical needs of our customers. In addition to our skilled analytical laboratory personnel (with expertise in organic and inorganic analyses), CHEMWEST assigns Project Managers to our customers, providing a liaison between the client and the laboratory.

The following Section. 5.2, presents a list of the CHEMWEST Laboratory staff. Organizational Charts for CHEMWEST, and the resumes of the officers, managers, and lead technical personnel, are presented in Appendix A, by laboratory area.

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5.2 CHEMWEST Staff

Officers/Administration

Joel C. Bird	President
Jill B. Henes, Ph.D.	Vice President of Technical Services
Randall D. Smith	Vice President of General Services [In-House Service Specialist]
W. Clarence Banks	Business Manager
Michael P. Smith	Controller
Rosanne Marquette	Administrative Assistant
Mary Ellen Bird	Receptionist

Quality Assurance

Steven C. Madden	Quality Assurance Manager [Quality Assurance Officer]
I. Jane LaTona	Quality Assurance Specialist

Sample Control

Bill McBenge	Sample Control Manager [Sample Custodian]
Michelle Toliver	Sample Control Technician
Gary Biase	Sample Control Technician

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5.2 CHEMWEST Staff (continued)

Sample Preparation Laboratory

F. Thomas Kwoka	Sample Preparation Manager [Sample Preparation Laboratory Supervisor; Dioxin Extraction Specialist]
Charles F. Taylor	Associate Chemist [Extraction/Concentration Expert]
James Kitchen	Associate Chemist [Extraction/Concentration Expert]
Helen Smpardos	Associate Chemist
Scott W. Pieters	Laboratory Technician [Extraction/Concentration Expert]
Pamela McCorduck	Laboratory Technician

GC Laboratory

Kirk J. Poca	GC Manager [GC Laboratory Supervisor; Pesticide Residue Analysis Expert]
Troy J. Galloway	GC Specialist [Pesticide Residue Analysis Expert]
Vincent C. Paul	GC Specialist
Brucie Estill	GC Specialist
Harvey J. Conard	GC Specialist [Pesticide Residue Analysis Expert]
Matthew Monagle	GC Specialist

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5.2 CHEMWEST Staff (continued)

GC/MS Laboratory

Elaine Wong	GC/MS Laboratory Manager [GC/MS Laboratory Supervisor; Mass Spectral Interpretation Specialist]
John Medina, Jr.	GC/MS Specialist [Dioxin Specialist; GC/MS Operator; Mass Spectral Interpretation Specialist]
Richard M. Henson	GC/MS Specialist [GC/MS Operator]
Annette D. Oleski	GC/MS Specialist
Debbie A. Fox	GC/MS Specialist

Inorganics Laboratory

David R. Jarvis	Inorganic Manager [Inorganic Laboratory Supervisor; ICP Spectroscopist; ICP Operator; AA Operator]
Jana Malcolm-Brown	Inorganic Specialist [AA Operator; ICP Operator; Classical Techniques Analyst; Inorganic Chemist]
Linda C. Schneider	Inorganic Specialist [Inorganic Sample Preparation Specialist]
Janet C. Harlan	Inorganic Specialist
Allan W. Wong	Inorganic Specialist [Classical techniques Analyst; AA Operator; Inorganic Chemist]
Joyce H. Yoshioka	Inorganic Specialist
Stephen C. Crisp-Grieser	Inorganic Specialist
Nancy Melicharek	Inorganic Specialist

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5.2 CHEMWEST Staff (continued)

Data Control

Robert T. Hart	Data Control Manager
Carol L. Trimble	Data Control Specialist [Organic and Inorganic Data Reporting and Delivery Officer]
Denise Syljuberget	Data Control Specialist
Peter J. Gienger	Data Control Assistant [Dioxin Data Reporting and Delivery Specialist]
Barbara Wiggins	Data Control Specialist

Marketing

Jeffery Hesseltine	Western Regional Marketing Manager
Marjorie M. Namba	Sales Representative
Toni C. Weeks	Technical Service Representative
Ron Russell	Sales Representative

Note: The titles in brackets (i.e., [GC/MS Operator]) represent EPA functional titles.

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5.3 Training

There are several types of training at CHEMWEST. For new employees, training consists of one-on-one training by the Laboratory Manager or an experienced analyst. This training follows an organized format with stated objectives and evaluations at various intervals.

A second form of training is for new instrumentation or new procedures. Instrument manufacturers usually provide training courses and certificates for those individuals who successfully complete their programs. For those who take manufacturer's training courses, the certificates of completion are maintained in the employee's records. Managers and analysts who are trained by the manufacturer are then responsible for instructing and training other employees and updating the employees training records. New procedures are first performed by Laboratory Managers or experienced analysts. After documentation of successful performance, they are responsible for instructing and training other employees and updating the employees' training records.

In addition to the initial training, employees are encouraged to participate in continuing education. The continuing education may be of several forms. Intragroup or laboratory short educational or review sessions are conducted by the manager of the group or laboratory area. Training, related to laboratory wide programs, such as Safety and Quality Assurance, and particular projects or programs, such as the EPA Contract Laboratory Program, is also given at periodic intervals by experienced staff members. A variety of local seminars, workshops, and lectures are made available to the employees. Attendees report to other employees on the content of these seminars in laboratory meetings. Other laboratory meetings involve topics such as troubleshooting or recent developments that have appeared in the scientific literature.

CHEMWEST provides employees with an Educational Assistance Program. This program provides reimbursement for courses that enhance the employee's job performance and opportunities for advancement.

The following are examples of the training programs used in specific areas of the laboratory.

5.3.1 Sample Control Training

The quality of work in the Sample Control area sets the tone of performance for all other sections of the laboratory. Before they are allowed to independently open sample containers, sign chain-of-custody records, fill out sample

5.3.1 Sample Control Training (continued)

tickets, fill bottle requests, or any of the other tasks common to sample control, a sample control specialist must demonstrate their ability to perform these tasks carefully and completely. This can be done by first having the new employee perform the work with either the Manager or an experienced specialist, and then have them perform the tasks independently, followed by a detailed review. The elements that can be evaluated in this manner include:

- o The ability to demonstrate proper handling of potentially hazardous samples.
- o The ability to provide proper, legible, and complete documentation.
- o The ability to produce precise and reproducible work.
- o The ability to exercise correct judgement.

5.3.2 Organic and Inorganic Sample Preparation Training

The quality of work in the Sample Preparation area is crucial to the overall quality of CHEMWEST analytical data. Before they are allowed to independently begin the preparation of samples, an associate chemist or laboratory technician must demonstrate their proficiency with the procedure. This can be done by first having the new employee perform the procedures for blanks and blank spikes, with the Laboratory Manager or an experienced analyst, and then have them perform the same tasks independently, followed by analysis of the samples they have prepared, and comparing and evaluating the results against established criteria. Blind samples can also be submitted for continuing evaluations of the analyst's performance. The elements that can be evaluated in this manner include:

- o The ability to produce or demonstrate acceptable recoveries of spiked compounds from the samples.
- o The ability to produce prepared samples showing no evidence of sample contamination.
- o The ability to provide proper documentation for the procedure.
- o The ability to produce precise and reproducible work.

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5.3.2 Organic and Inorganic Sample Preparation Training (continued)

- o The ability to exercise correct scientific judgement and technical competence.

5.3.3 GC, GC/MS, and Inorganic Analysis Training

The quality of work in the analysis areas of the laboratory is central to the overall quality of CHEMWEST analytical data. Before beginning the analysis of samples, a chemist must demonstrate proficiency with the analytical instrumentation and methods. This can be done by having the new employee work closely with the Laboratory Manager or an experienced analyst to perform routine maintenance and calibrations of the instrumentation, and analyze blank and blank spike samples, with data workup, followed by their performing these tasks independently with comparison and evaluation of the results against established criteria. Blind samples can also be submitted for continuing evaluations of the analyst's performance. The elements that can be evaluated in this manner include:

- o The ability to perform routine maintenance and acceptable calibration of instrumentation.
- o The ability to perform acceptable calculations and data workup.
- o The ability to provide proper documentation for the analyses.
- o The ability to produce precise and reproducible work.
- o The ability to exercise correct scientific judgement and technical competence.

5.3.4 Data Control Training

The quality of work in the Data Control area of the laboratory is the most visible means of demonstrating the overall quality of CHEMWEST analytical data. Before beginning to produce reports of analytical data, a data control specialist must demonstrate an understanding of the CHEMWEST reporting process. This can be done by having the new employee work closely with the Manager or an experienced specialist to produce reports, followed by their producing reports independently, followed by a detailed review. Spot checks of completed reports can act as a means for continuing evaluations of the specialist's performance. The elements that can be evaluated in this manner include:

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5.3.4 Data Control Training (continued)

- o The ability to produce complete and technically correct reports.
- o The ability to produce proper documentation for various reporting formats.
- o The ability to produce precise and reproducible work.
- o The ability to exercise correct judgement and technical competence.

5.3.5 Training Documentation

In addition to retaining certificates of completion from manufacturer's training courses, outside seminars, or other formal training programs, employee's training is documented on the CHEMWEST Training Record. Individual laboratory managers, or experienced staff members, who provide employee training are responsible for updating the employee's Training Record, which is retained in their personnel file.

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5.3.5.1 CHEMWEST Training Record

CHEMWEST Training Record		
Employee Name	Laboratory Section	
Title/Position of Employee	Laboratory Section Manager	
TASK _____		

The above named employee has successfully completed training in this task.		
Reviewer	Title/Position	Date
Laboratory Section Manager	Date	
TASK _____		

The above named employee has successfully completed training in this task.		
Reviewer	Title/Position	Date
Laboratory Section Manager	Date	
TASK _____		

The above named employee has successfully completed training in this task.		
Reviewer	Title/Position	Date
Laboratory Section Manager	Date	
TASK _____		

The above named employee has successfully completed training in this task.		
Reviewer	Title/Position	Date
Laboratory Section Manager	Date	
TASK _____		

The above named employee has successfully completed training in this task.		
Reviewer	Title/Position	Date
Laboratory Section Manager	Date	

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6.0 FACILITIES, EQUIPMENT, AND SERVICES

6.1 Introduction

CHEMWEST Laboratories, Inc. is located in Sacramento, California. The laboratory facility has 12,800 square feet of office and laboratory space. The warehouse facility, located adjacent to the laboratory, has 1,800 square feet of storage space. Sufficient heating, ventilating, and air conditioning systems are in place to provide adequate temperature control for both personnel and equipment. Repair and maintenance on these systems is provided through a service contract with a local air conditioning service organization.

Building entry security and admission to various controlled access areas within the laboratory, is managed by a Schlage Electronics 5795A Security Management System, based on restricted key card entry, installed and maintained by Honeywell Protection Services. The exterior entry doors and the doors of the controlled access areas of the laboratory are equipped with electronic key card readers. Building security is maintained at all times. The visitors' entrance is secured, and visitors are escorted through the facility by members of the staff only after signing a Visitor's Register.

A burglar alarm systems is also in place to provide additional security when the facility is closed. The burglar alarm system is monitored off-site, and when an alarm sounds, the off-site personnel alert the appropriate laboratory personnel and the Sheriff's office.

Smoke detectors and heat sensors, plus associated pull stations and fire alarm horns, are provided throughout the building for fire protection, and are maintained by Honeywell Protection Services. Adequate fire extinguisher, emergency equipment, and first-aid supplies are also provided and maintained by Solon Fire Control and Zee Medical Services, Inc.. The fire detection systems are monitored off-site by Honeywell Protection Services. When an alarm sounds, the off-site personnel alert the appropriate laboratory personnel and the Fire Department.

The temperature of both the walk-in refrigerator and the walk-in freezer are monitored 24 hours a day by Honeywell Protection Services to ensure maintenance of proper temperatures. When an alarm sounds, the off-site personnel alert the appropriate laboratory personnel, and corrective action is initiated.

The CHEMWEST Laboratory contains sophisticated, state-of-the art instrumentation and computer equipment capable of performing most organic and inorganic analyses. The list includes multiple GC/MS Systems, multiple Gas

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6.1 Introduction (continued)

! Chromatographs, ICAP Systems, and AA/GFAA Systems with associated data collection and processing computers, plus multiple IBM Compatible Personal Computers. The laboratory also has a full complement of support equipment and instrumentation, such as hoods, a walk-in refrigerator, a walk-in freezer, individual refrigerators and freezers, autoanalyzers, sonicators, and pH meters.

Routine instrument and equipment maintenance is performed by the experienced CHEMWEST analysts, within a particular laboratory area, who normally use the equipment. Major instrument malfunctions or failures are repaired by either in house service specialists employed by CHEMWEST on a full-time basis, or by appropriate manufacturer or third party service representatives. A unique instrument maintenance log book is kept for each individual instrument in each of the laboratories.

The following sections include the CHEMWEST laboratory floor plan and facility space allocation, descriptions of the various laboratory areas by function and equipment, instrument/equipment inventory lists, and instrument/equipment maintenance particulars.

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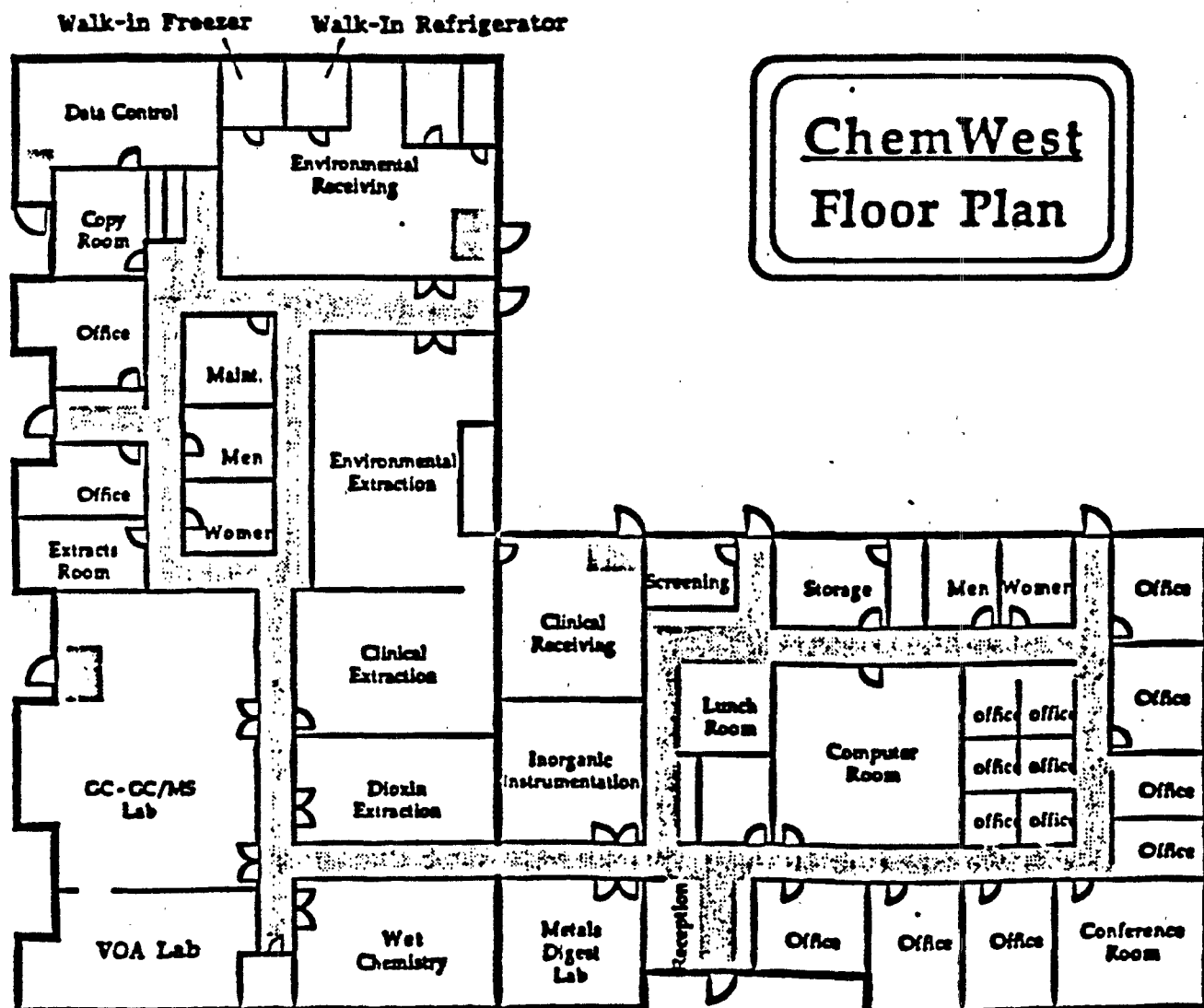
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6.2 Laboratory Floor Plan and Space Allocation

6.2.1 Laboratory Floor Plan



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6.2.2 Laboratory Space Allocation

<u>Individual Areas</u>	<u>Square Feet</u>
o Sample Control, including:	1,050
Walk-In Refrigerator	[60]
Walk-In Freezer	[60]
o Organic Sample Prep. Lab	520
o High Hazard Sample Prep. Lab	320
o GC and GC/MS Lab, including:	1,360
VOA Room	[350]
o GC and GC/MS Refrigerator Room	120
o ICP/AA (Metals) Laboratory	300
o Wet Chemistry/Inorganics Sample Digestion Lab	650
o Data Control	480
o Computer Room and Data Storage	540
o Electronics Repair Shop	120
o Office Areas	2,340
o Clinical (Separate from Environmental Operations)	1,150
o Miscellaneous	3,850
o Warehouse/Storage	1,800
Total Floor Space	14,600

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6.3 Laboratory Areas

6.3.1 Sample Control

This area is located in the rear of the laboratory facility. Arriving samples are identified and introduced into the CHEMWEST sample control system. The sample control area for environmental samples has approximately 1,050 square feet of floor space, approximately 60 square feet of bench space for receiving and opening samples, and ample storage shelving.

Both a 60 square foot walk-in refrigerator (2°C to 4°C) and a 60 square foot walk-in freezer (-7°C to -13°C) are located in Sample Control for storage of environmental samples. The temperature of both units is recorded daily. Access to each unit is key card controlled and the temperature activated alarm system of each unit is monitored by Honeywell Protection Services. In the event of temperature fluctuations, the appropriate laboratory personnel are notified by Honeywell Protection Services, and corrective action is initiated. Repair and maintenance on these units is provided through a service contract with a local refrigeration service organization.

6.3.2 Organic Sample Preparation Laboratory

The organic sample preparation laboratory is a controlled access area with approximately 520 square feet of space, including five add-air fume hoods, two sonic dismembrators, two custom steam baths for Kuderna-Danish concentrations, two nitrogen blowdown apparatus, an orbital shaker, three vacuum ovens, a sink, and 90 square feet of bench space. Adequate cabinet space is provided for glassware and equipment storage. This area also has two Gas Chromatographs for pre-extraction screening of GC and GC/MS samples, post-extraction screening of GC and GC/MS extracts, and pre-analysis screening of GC/MS volatile samples.

6.3.3 High Hazard Sample Preparation Laboratory

A separate laboratory area, with approximately 320 square feet of space, has been designated for the sample preparation of high-hazard samples, such as those requiring analysis for 2,3,7,8-TCDD. This laboratory includes two add-air fume hoods, one equipped with a HEPA filtration unit, rotary evaporators, soxhlet extraction apparatus, a sink, a refrigerator, and ample storage space for the glassware and other associated equipment necessary for the extraction of high hazard samples. The glassware is specific for this laboratory, and is cleaned and maintained separately from the glassware in other laboratory areas.

6.3.4 GC and GC/MS Laboratory

The combined GC and GC/MS laboratory is a controlled access area, which has, including the associated refrigerator room and the VOA room, approximately 1360 square feet of space.

The laboratory's ten analytical gas chromatographs (Varian 3300s and 3400s) are equipped with packed and/or capillary injectors, and automatic liquid samplers or purge and trap units, including automatic samplers. They are interfaced with a Hewlett-Packard 3357 data acquisition computer for data processing. A variety of gas chromatographic detectors are available, including Flame Ionization (FID), Flame Photometric (FPD), Electron Capture (ECD), Thermionic Specific (TSD, sometimes referred to as TID, NPD, or AFID), Photoionization (PID), and Electrodeless (ELCD, commonly referred to as a Hall Detector).

The laboratory's four GC/MS systems (three Finnigan 5100s and one Extrel 4001) are configured with both packed and capillary GC columns. The Extrel system is equipped with a purge and trap unit, including automatic sampler, and is dedicated to the analysis of volatile organics. Electron impact sources are used on all systems, and chemical ionization sources are available for two of the Finnigan 5100 systems. Each GC/MS instrument is equipped with its own dedicated microprocessor for data processing. Two stand-alone data systems are available for additional off-line processing.

Because of the contamination problems frequently experienced in the analysis of volatile organics, a separate walled area, of approximately 350 square feet, within the GC and GC/MS laboratory, has been designated for volatile analyses only. This area has its own separate air conditioning unit, a closed loop carbon filtration system, a fume hood, and a water still and nitrogen bubbler apparatus for the preparation of volatile free blank water. The Extrel GC/MS and four gas chromatographs, performing volatile organic analyses, are located in this separate laboratory area.

Both GC and GC/MS sample extracts are kept in refrigerators or freezers, as appropriate, located in the GC and GC/MS refrigerator room. GC and GC/MS calibration and reference standards, both neat and in solution, are kept in refrigerators or freezers, as appropriate, in this room. Separate refrigerators and freezers for the storage of both EPA and non-EPA volatile samples, and those for volatile standards, are also located in this room.

6.3.5 Inorganics (Metals/Digestion/Wet Chemistry) Laboratories

The Inorganics section of the laboratory is comprised of three separate rooms, with a total area of approximately 950 square feet. The Metals area

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6.3.5 Inorganics (Metals/Digestion/Wet Chemistry) Laboratories (continued)

has one Thermo Jarrel-Ash 9000 Inductively Coupled Plasma (ICP) unit, two Perkin-Elmer 5100Z Graphite Furnace AAs, and one IL Video 12E AA with Graphite Furnace, 440 Organic Vapor Accessory, and Varian VGA95 Hydride Generation apparatus, all with associated data acquisition and reduction systems.

In the Inorganics Digestion area, there are two fume hoods, a Barnstead Nanopure II water purification system with a Corning MegaPure still, a Perkin-Elmer 50B Mercury Analyzer, a sink, and sufficient storage space for the ancillary digestion glassware and apparatus.

The Inorganics Wet Chemistry area includes two add-air fume hoods, one Technicon TRACC 800 autoanalyzer, one Orion 940 Selective Ionanalyzer, one Perkin-Elmer 1310 Infrared Spectrophotometer, two UV/VIS spectrophotometer, distillation units for cyanide, distillation units for total phenols, one Labconco Auto Distillation/Digestion System, and a Barnstead Nanopure II water purification system, plus several other analytical instruments required to perform classical wet chemical analyses.

6.3.6 Data Control Area

The Data Control Area includes both the copy room and a separate office area where all data reports, including CLP reports, are prepared. A Kodak Ektaprint 150 copier-duplicator with finisher-sorter is located in this area to provide the high volume, high quality copying required for high throughput report preparation. Three smaller copiers are located in Sample Control, the main office area, and the GC and GC/MS Laboratory for lower volume copying needs. Five IBM-AT compatible computer systems, including printers and appropriate software, are located in this area. They are used in the report preparation process.

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6.4 Instrument/Equipment Inventory

6.4.1 GC/MS Analytical Instrumentation and Equipment

- 2 - Finnigan 5100SP GC/MS Systems with Turbomolecular Pumps, Incos III/Nova 4X Data Systems, including the NBS 42000 compound Mass Spectral Library, and Printronix Printers
- 1 - Finnigan 5100EF GC/MS System with Turbomolecular Pump, Incos III/Nova 4X Data System, including the NBS 42000 compound Mass Spectral Library, and Printronix Printer
- 1 - Extrel ELQ-4001 GC/MS System with Diffusion Pump, Incos III/Nova 4X Data System, including the NBS 42000 compound Mass Spectral Library, and Printronix Printer
- 2 - Finnigan Stand Alone Incos III/Nova 4X Data System, including the NBS 42000 compound Mass Spectral Library, and Printronix Printers
- 1 - Tekmar LSC-2 Purge and Trap Unit with 10-Port Automatic Sampler
- 1 - Tekmar LSC-2000 Purge and Trap System with 16-Port Automatic Sampler
- 1 - IBM-AT Compatible Computer with Dot Matrix Printer, Interface to Finnigan GC/MS Data Systems, and Finnigan Formaster Software for CLP Forms Generation
- 2 - IBM-AT Compatible Computers with Dot Matrix Printers

6.4.2 Gas Chromatographic Analytical Instrumentation and Equipment

- 1 - Varian 5560 High Performance Liquid Chromatograph with Variable Wavelength UV Detector, Fluorescence Detector, and Automatic Sampler
- 11 - Varian 3400 Gas Chromatographs
- 1 - Varian 3300 Gas Chromatograph
- 6 - Varian Electron Capture Detectors (ECD)
- 4 - Varian Flame Ionization Detectors (FID)
- 4 - Tracor Photoionization Detectors (PID)

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6.4.2 Gas Chromatographic Analytical Instrumentation and Equipment (continued)

- 5 - OI Electrolytic Conductivity Detectors (ELCD - Hall type)
- 2 - Tracor Electrolytic Conductivity Detectors (ELCD - Hall type)
- 2 - Varian Thermionic Specific Detectors (TSD)
- 1 - Varian Flame Photometric Detector (FPD)
- 3 - Varian Split/Splitless Capillary Injectors
- 5 - Tekmar LSC-2 Purge and Trap Systems with 10-Port Automatic Samplers
- 1 - Tekmar LSC-4000 Purge and Trap System with 10-Port Automatic Sampler
- 4 - Varian 8035 Automatic Liquid Samplers
- 1 - Perkin-Elmer/Nelson "TurboChrome" Data Acquisition System with 386 Computer and Dot Matrix Printers
- 1 - Hewlett-Packard 3357 Laboratory Data Acquisition System
- 1 - Hewlett-Packard "A" Series Laboratory Data Acquisition System
- 1 - Varian 654 Data Acquisition System
- 1 - IBM-AT Compatible Computer with Dot Matrix Printer
- 1 - IBM-XT Compatible Computer with Dot Matrix Printer

6.4.3 Inorganic Analytical Instrumentation and Equipment

- 1 - Thermo Jarrel-Ash Model 61 ICP with Autosampler and IBM PS-2 Model 50 Data System and Dot Matrix Printer
- 2 - Perkin-Elmer 5100Z Graphite Furnace AAs with Autosamplers and IBM-AT Compatible Data Systems with Dot Matrix Printers
- 1 - Instrumentation Laboratories Video 12E AA with Graphite Furnace, 440 Organic Vapor Accessory, and Data System

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6.4.3 Inorganic Analytical Instrumentation and Equipment (continued)

- 1 - Perkin-Elmer 50B Mercury Analyzer
- 1 - Varian VGA95 Hydride Generation Apparatus
- 1 - Perkin-Elmer 1310 Infrared Spectrophotometer
- 1 - Technicon TRAAC 800 Autoanalyzer with IBM XT Data System and Dot Matrix Printer
- 1 - Dionex Ion Chromatograph with Automatic Sampler and Hitachi Integrator
- 1 - Milton-Roy Spectronic 21 UV/VIS Spectrophotometer
- 1 - Sequoia-Turner 390 UV/VIS Spectrophotometer
- 1 - Orion 940 Ionanalyzer with RS232 Computer Interface and Specific Ion Electrodes for pH, F⁻, NH₃, Cl₂, ClO₃, and Oxygen (DO and BOD)
- 1 - Monitek 21 Nephelometer (Turbimeter)
- 1 - YSI 35 Conductivity Meter
- 1 - Rotary Extractor for TCLP/EP Tox Extractions
- 1 - Labconco COD Digestion Unit (plus Hach COD Kit)
- 1 - Penske-Martens Closed Cup Flashpoint Apparatus
- 1 - Labconco Rapid Still II Auto Distillation/Digestion System (Kjeldahl)
- 1 - Blue M Fecal Coliform Incubator
- 1 - Barnstead Nanopure II with Corning MegaPure MP-3A Still
- 1 - Barnstead Nanopure II with Barnstead Fistreen #2 Still
- 1 - Top Loading Balance, Scientific Products TL1600
- 1 - Boekel Desiccator
- 2 - Blue M Water Baths

6.4.3 Inorganic Analytical Instrumentation and Equipment (continued)

Miscellaneous Laboratory Glassware and Method Apparatus

- CN Distillation Apparatus
- Imhoff Cones
- Nessler Tubes
- Titration Apparatus
- Certified Thermometer (Fisher Scientific 14985-5E)

6.4.4 Sample Preparation Instrumentation and Equipment

- 1 - Hewlett-Packard 5880 Gas Chromatograph with dual Electron Capture Detectors (ECD) and dual Split/Splitless Injectors
- 1 - Hewlett-Packard 5790 Gas Chromatograph with Flame Ionization Detector (FID) and Split/Splitless Injector
- 3 - Top Loading Balances, 2 Scientific Products TL1600 and 1 Mettler 3200
- 1 - Analytical Balance, Scientific Products SP180
- 1 - pH Meter, Scientific Products
- 2 - Rotary Evaporators, Haake Buchler
- 2 - Steam Baths, 10 Place, Custom
- 2 - Sonic Dismembrator, Artek Model 300
- 32 - Soxhlet Extraction Apparatus
- 20 - Kuderna-Danish Concentration Apparatus
- 1 - Muffle Furnace, Thermolyne 1400
- 3 - Ovens, VWR Scientific 1305U
- 1 - 40 Place Orbital Shaker, Labline
- 4 - Nitrogen Blowdown Apparatus

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6.4.4 Sample Preparation Instrumentation and Equipment (continued)

1 - Dry Bath, Thermolyne

1 - Centrifuge

Various Sizes of the Following Laboratory Glassware:

- Separatory Funnels
- Flasks
- Beakers
- Chromatography Columns

6.4.5 Additional Computer Instrumentation and Equipment

- 15 - IBM-AT Compatible Computers
- 2 - IBM-XT Compatible Computers
- 2 - IBM-AT Compatible Lap Top Computers
- 2 - Epson GQ-3500 Laser Printers.
- 1 - Hewlett-Packard Laser Jet II Laser Printer
- 7 - Daisy Wheel Letter Quality Printers
- 14 - Dot Matrix Printers
- 4 - 1200 Baud Modems
- 1 - Stand Alone FAX Machine
- 1 - Internal FAX Board for AT-Compatible Computer

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6.5 Instrument Maintenance

The operational condition of instruments is one of the keys to the successful completion of analytical tasks. This requirement is further magnified by the necessity to complete large projects in a limited period of time. CHEMWEST's staff is knowledgeable, competent, and committed to proper instrument maintenance and repair, so as to assure clients that equipment will be in good operating condition and available when needed to generate their data.

Routine instrument and equipment maintenance is performed by the experienced CHEMWEST analysts, within a particular laboratory area, who normally use the equipment. Major instrument malfunctions or failures are repaired by either in house service specialists employed by CHEMWEST on a full-time basis, or by appropriate manufacturer or third party service representatives. Preventive maintenance, as well as major instrument repairs, is normally performed on-site. An in-house stock of spare parts allows for the rapid repair of most common service problems.

The CHEMWEST Vice-President of General Services, Randall D. Smith, has full maintenance and repair responsibility for GC/MS instrumentation. Mr. Smith has over six years of experience as a GC/MS systems engineer, and is fully qualified to perform the required GC/MS service. CHEMWEST maintains full service agreements with instrument manufacturers or third party service vendors, for other major instruments, which include periodic maintenance visits by the vendor, to further assure the operational integrity of all equipment and instrumentation. CHEMWEST staff members do assist in determining the magnitude of service problems before outside vendors are called.

All major pieces of CHEMWEST instrumentation have their own Instrument Maintenance/Repair Logs and individual maintenance files, within their respective laboratories, to record and hold instrument service records. All maintenance or repair services performed on the instruments are either recorded in the log book or filed, on an instrument specific basis, to maintain an on-going historical record of the date and time of work performed. Equipment manuals are located with the instrumentation, and are readily available to all analysts to assist in the use, calibration, maintenance, and troubleshooting of the instrument.

6.5.1 Specific Instrument Maintenance

6.5.1.1 Gas Chromatographic/Mass Spectrometric Systems

A gas chromatographic/mass spectrometric system (GC/MS) includes:

6.5.1.1 Gas Chromatographic/Mass Spectrometric Systems (continued)

- o The basic GC/MS unit, with all of its associated GC/MS pneumatic and vacuum equipment.
- o The associated computer and its peripherals.
- o All associated concentration/injection devices.

Each GC/MS is assigned a number or letter designation, and its own bound, numbered Instrument Maintenance/Repair Log. All maintenance, repairs, or changes performed on a GC/MS instrument, whether done by CHEMWEST staff or an outside vendor, are documented in the associated log book. These events include:

- o Electronic/mechanical maintenance repair
- o Firmware changes
- o Software changes
- o Consumables replacement (ie., traps, columns, etc.)

In addition to the bound log books, there are files within the GC/MS laboratory to hold any additional documentation not easily entered into the log books. Examples include:

- o Maintenance/repair receipts
- o Vendor generated software change documentation
- o Schematic/diagrams of system changes

6.5.1.2 Gas Chromatographic Systems

A gas chromatographic system (GC) includes:

- o The basic GC oven, with its associated injectors and pneumatics.

6.5.1.2 Gas Chromatographic Systems (continued)

- o All integral and peripheral detectors.
- o All associated concentration/injection devices.

Each GC is assigned a number or letter designation, and its own bound, numbered Instrument Maintenance/Repair Log. All maintenance, repairs, or changes performed on a GC instrument, whether done by CHEMWEST staff or an outside vendor, are documented in the associated log book. These events include:

- o Electronic/mechanical maintenance/repair
- o Firmware changes
- o Pneumatic changes
- o Consumables replacement (ie., syringes, traps, but not septa - these are documented on cards attached to each instrument)

In addition to the bound log books, there are files within the chromatography laboratory to hold any additional documentation not easily entered into the log books. Examples include:

- o Maintenance/repair receipts
- o Vendor generated detector maintenance/repair documentation
- o Schematics/diagrams of system changes

6.5.1.3 Chromatography Data Acquisition System

The chromatography data acquisition system includes:

- o The basic computer(s).
- o All peripherals attached to the main computer, such as disk drives, terminals, A/D's, etc. that are not part of any other system.

The chromatography data acquisition system has its own bound, numbered Instrument Maintenance/Repair/General Record book. All maintenance, repairs, changes, and pertinent information concerning the chromatography data acquisition system, whether coming from CHEMWEST staff or an outside

6.5.1.3 Chromatography Data Acquisition System (continued)

vendor, is documented in the record book. In addition to the record, there are files within the chromatography laboratory to hold any additional information not easily entered into the record book.

6.5.1.4 Inductively Coupled Argon Plasma System

An inductively coupled plasma system (ICP) includes:

- o The basic ICP unit, with all of its associated pneumatic and vacuum equipment.
- o The associated computer and its peripherals.
- o All associated concentration/injection devices.

Each ICP is assigned a number or letter designation, and its own bound, numbered Instrument Maintenance/Repair Log. All maintenance, repairs, or changes performed on an ICP, whether done by CHEMWEST staff or an outside vendor, are documented in the associated log book. These events include:

- o Electronic/mechanical maintenance/repairs
- o Firmware changes
- o Software changes
- o Consumables replacement

In addition to the bound log books, there are files within the Inorganic Laboratory to hold any additional documentation not easily entered into the log books. Examples include:

- o Maintenance/repair receipts
- o Vendor generated software change documentation
- o Schematic/diagrams of system changes

6.5.1.5 General Instruments

For those major instruments not covered specifically (ie. IRs, AA's, etc.), each unit is assigned a number or letter designation and it's own bound, numbered Instrument Maintenance/Repair Log. Most smaller instruments are

6.5.1.5 General Instruments (continued)

assigned a group Instrument Maintenance/Repair Log. All maintenance, repairs, or changes performed on the instrument(s), whether done by CHEMWEST staff or an outside vendor, are documented in the associated log book. These events include:

- o Electronic/mechanical maintenance/repair
- o Firmware changes
- o Software changes
- o Consumables replacement

In addition to the bound log books, there are files within the specific laboratory to hold any additional documentation not easily entered into the log books. Examples include:

- o Maintenance/repair receipts
- o Vendor generated software change documentation
- o Schematic/diagrams of system changes

6.5.2 Maintenance Documentation Review

All maintenance, repair, and general log and record books within the individual laboratories are frequently reviewed by the Laboratory Manager to insure that they are being maintained. A spot review of the associated files is also periodically conducted to insure their proper maintenance as well.

6.5.3 Documenting Instrument Malfunction or Failure

When an analyst notes an instrument malfunction or failure, the following steps are completed to insure both the correct and timely correction of the instrument problem, and to provide an historical record of the instrument performance.

- o Advise the Laboratory Manager of the instrument malfunction or failure.
- o Document the instrument malfunction or failure in the appropriate Instrument Maintenance/Repair Log book.

6.5.3 Documenting Instrument Malfunction or Failure (continued)

- o Fill out the log by recording the date, time, operator's initials, and a short description of the problem, including pertinent details.
- o Utilize a CHEMWEST Corrective Action Form to provide both the initial notification to other managers and staff of the need for corrective action, and a description of the problem.
 - o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who may be affected by the problem.
- o Work with the Laboratory Manager and the Vice-President of General Services to determine the extent of the problem.
- o If outside service is required, contact the appropriate manufacturers' service manager to request service.
 - o If in-house service is required, order any needed parts, and initiate the repair.
- o Add the Corrective Action Plan to the CHEMWEST Corrective Action Form to provide further notification of impending corrective action.
 - o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who may be affected by the problem.
- o After resolution of the problem, document the instrument repair in the appropriate Instrument Maintenance/ Repair Log book, and file pertinent documents in the instrument file.
- o Add the Completion/Outcome to the CHEMWEST Corrective Action Form to complete the notification of corrective action process.
 - o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who were affected or informed of the problem.

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6.5.3.1 CHEMWEST Corrective Action Form

CHEMWEST Corrective Action Form					
INITIATED BY		Date: _____			
Name: _____		Title: _____			
CV/EPA Case No.: _____		Sample No.: _____			
Other: _____					
REPORTED TO		Date: _____			
Name: _____		Title: _____			
COPIES TO					
Lab Mgrs.	SC ☐	GC/MS ☐	QA Mgr. ☐	Tech. Rep. ☐	Other ☐
	SP ☐	IN ☐	Lab Dir. ☐	(Case) File ☐	
	GC ☐	DC ☐	Proj. Mgr. ☐		
Description of Problem: _____					

Corrective Action Plan: _____					

INITIATED BY					
Date: _____					
Name: _____		Title: _____			
Name: _____		Title: _____			
Completion/Outcome: _____					

REVIEWED/APPROVED BY					
Date: _____		Title: _____			
Name: _____		Title: _____			
Lab Mgrs.	SC ☐	GC/MS ☐	QA Mgr. ☐	Tech. Rep. ☐	Other ☐
	SP ☐	IN ☐	Lab Dir. ☐	(Case) File ☐	
	GC ☐	DC ☐	Proj. Mgr. ☐		

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7.0 DATA GENERATION

7.1 Standard Operating Procedures

Standard Operating Procedures (SOPs) are developed and used to implement the routine Quality Control practices required for the laboratories' testing projects and the analyses performed, and also for the inspection and maintenance of the facilities, equipment, and services.

SOPs are distributed by laboratory area, with each section of the laboratory receiving it's own set of SOPs. Complete copies of the SOPs are maintained in the Quality Assurance office. If a question arises concerning the procedure followed for an activity in one of these areas, the SOPs for that particular area are consulted to resolve the question. These SOPs are also a valuable source of material for training purposes.

Quality Assurance supports all sections of the laboratory in the developing, writing, editing, revising, and maintaining of current Standard Operating Procedures. All procedures remain the property of CHEMWEST Laboratories, and all procedures that go outside the laboratory are considered COMPANY CONFIDENTIAL.

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7.2 Instrument/Method Calibration

To assure that the analytical results generated from all of CHEMWEST's laboratory instrumentation and methods are of the highest quality, a rigorous program of calibration and quality control has been established for these systems.

All of CHEMWEST's analytical instruments and methods are calibrated before analyses are performed, and are also recalibrated at regular intervals. Both initial calibration and recalibrations are performed as specified by particular methods, or contract specifications, and are generally consistent with the manufacturer's recommendations. Instrument or method response is subjected to checks between the regular recalibrations. The nature and frequency of such checks are specified in the appropriate instrument or method SOPs. All calibrations are traceable to primary standards of measurement. Where the concept of traceability of measurements to primary standards is not applicable, the laboratory provides satisfactory evidence of correlation or accuracy of test results. The laboratory maintains adequate records of all calibrations, recalibrations, and in-service maintenance checks of instruments and ancillary equipment. The schedule of maintenance checks is based upon the experience of CHEMWEST's analysts and service personnel.

Analysts, managers, and QA staff inspect calibration data for completeness and validity. Data is checked for arithmetic and procedural errors. Recurring errors, caused either by individual analysts or by ambiguously worded instructions, are brought to the attention of laboratory management for corrective action.

The following procedures are representative of those used in calibrating CHEMWEST's instruments or methods systems.

7.2.1 GC/MS Systems

GC/MS systems are first tuned using specific instrument and method parameters, and are then calibrated for quantitation. Specific methods or projects may impose variations and/or different acceptance criteria upon both the tuning and calibration techniques. These specific requirements are found in the CHEMWEST SOP or Quality Assurance Project Plan covering the particular method or project in question.

The following procedures are representative of those used for calibrating CHEMWEST's GC/MS systems. They follow the guidelines established in the "USEPA Contract Laboratory Program, Statement of Work for Organic Analysis", 7/87 revision, the Federal Register "Appendix A to Part 136 -

7.2.1 GC/MS Systems (continued)

Industrial Wastewater", 10/26/84, and "Test Methods for Evaluating Solid Wastes (SW-846)", 3rd. Edition, 11/86.

7.2.1.1 Initial Calibration and Tuning Procedure

Initial calibration and tuning of the GC/MS systems is both instrument and method specific, and includes the following general actions. Initial calibration of the GC/MS system is performed according to the manufacturer's procedure, using FC-43 (Perfluorotributylamine), the appropriate calibration program, and the proper documentation protocol.

The instrument is then tuned by introducing the proper tuning compound into the GC/MS system (ie. Bromofluorobenzene (BFB) for volatiles, or Decafluorotriphenylphosphine (DFTPP) for semi-volatiles), making the correct instrument adjustments to meet the method specific tuning criteria, running the proper GC/MS tuning program, and documenting the tune. The tuning criteria, for both BFB and DFTPP, are given in Appendix B.

7.2.1.2 Calibration Procedure

For each analyte, or group of analytes, five concentration levels of standards are prepared by dilution of one or more stock standards, including the addition of a known and constant amount of one or more internal standards (ISSs), with an appropriate solvent. One of the standards is at a concentration near the method reporting limit, and the other concentrations define the working range of the system. Each of the calibration standards is introduced into the GC/MS system using the technique to be used for introduction of actual samples (ie. 2- to 5-ul liquid injections, purge & trap, etc.).

A series of Relative Response Factors (RRFs) is calculated for each analyte, at each standard concentration, for the mass peak of interest that is specific for that analyte. The RRF is the ratio of the Response Factor (RF) of the analyte ($RF = \text{area or height of analyte response} / \text{concentration of analyte}$) to the RF of the appropriate internal standard. An average RF is calculated for each analyte for use in quantitation.

The Percent Relative Standard Deviation (%RSD) of the RRFs for particular target compounds, called Calibration Check Compounds (CCCs), must be less than or equal to 30%. In addition, the RRF for other target compounds, called System Performance Check Compounds (SPCCs), must meet defined minimum values. The initial calibration is considered valid only if both of these

7.2.1.2 Calibration Procedure (continued)

criteria are met. The CCC and SPCC compounds and criteria are given in Appendix B.

The system performance and calibration of every GC/MS system must be verified each twelve hours during analysis, by the introduction of one or more calibration standards. The twelve hour period starts from the moment of injection of the appropriate tuning compound that yields a valid tune. The SPCCs for continuing calibration must meet the same criteria as for the initial calibration. The Percent Difference (%D) between the initial average RRF and the continuing calibration RRF for the CCC compounds must be less than or equal to 25%. If both of these sets of criteria are met, sample analysis can continue during the next twelve hour period. If one, or both, of these criteria are not met, corrective action must be initiated. If corrective action cannot bring the system back within the required specifications, or if no source for the problem can be determined, a new initial calibration must be performed prior to additional sample analyses.

7.2.2 Chromatography Systems

The chromatographic systems are calibrated using either external or internal standard techniques. Specific methods or projects may impose variations and/or different acceptance criteria upon the calibration technique. These specific requirements are found in the CHEMWEST SOP or Quality Assurance Project Plan covering the particular method or project in question.

The following procedures are representative of those used for calibrating CHEMWEST's GC systems. They follow the guidelines established in "Test Methods for Evaluating Solid Wastes (SW-846)", 3rd. Edition, 11/86, and the Federal Register "Appendix A to Part 136 - Methods for Organic Analysis for Organic Chemical Analysis of Municipal and Industrial Wastewater", 10/26/84.

7.2.2.1 Calibration Procedure

For each analyte, or group of analytes, three to five concentration levels of standards are prepared by dilution of one or more stock standards with an appropriate solvent. If the internal standard method is to be used, a known and constant amount of one or more internal standards (ISs) is also added. One of the standards is at a concentration near the method reporting limit, and the other concentrations define the working range of the system. Each of the calibration standards is introduced into the GC system using the technique to be used for introduction of actual samples (i.e. 2- to 5-ul liquid injections, purge & trap, etc.).

7.2.2.1 Calibration Procedure (continued)

Either a series of Response Factors (RFs), for external standard methods, or Relative Response Factors (RRFs), for internal standard methods, or a Calibration Curve is calculated for each analyte, at each standard concentration. The RF is the ratio of the area or height response of the analyte to the concentration of the analyte, and the RRF is the ratio of the RF for the analyte to the RF of the appropriate internal standard. The Calibration Curve is a plot of the concentration of the analyte versus either Response, for external standard methods, or Relative Response, for internal standard methods. The slope and intercept, as well as the residual, R (or its square, R^2), of the Calibration Curve, is calculated using regression techniques.

If the residual, R , from the regression calculation from the standard concentrations and responses, is greater than or equal to 0.995 (or R^2 greater than or equal to 0.990), the Calibration Curve is considered valid, and the slope and intercept can be used for calculation. As an alternate criteria, if the % Relative Standard Deviation (%RSD) of the RFs or RRFs is less than or equal to 20%, the average RRF can be used for calculations.

The calibration of every GC system must be verified after each set of ten samples analyzed, by the introduction of one or more mid-range calibration standards. The Percent Difference (%D) between the initial mid-range RF or RRF and the continuing calibration RF or RRF must be less than or equal to 15%. If this criteria is met, sample analysis can continue during the next ten sample period. If this criteria is not met, corrective action must be initiated. If corrective action cannot bring the system back within the required specifications, or if no source for the problem can be determined, a new initial calibration must be performed prior to additional sample analyses.

7.2.3 ICP, GFAA, and Other AA Systems

Inductively coupled plasma (ICP), graphite furnace (GFAA), and other atomic absorption (AA) systems are calibrated daily by an external standard calibration process. Specific methods or projects may impose variations and/or different acceptance criteria upon the calibration technique. These specific requirements are found in the CHEMWEST SOP or Quality Assurance Project Plan covering the particular method or project in question.

The following procedures are representative of those used for calibrating CHEMWEST's ICP, GFAA, and AA systems. They follow the guidelines established in the "USEPA Contract Laboratory Program, Statement of Work for Inorganic Analysis", 7/87 revision, the Federal Register "Appendix C to Part

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7.2.3 ICP, GFAA, and Other AA Systems (continued)

136 - Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes Method 200.7", 10/26/84, "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, and "Test Methods for Evaluating Solid Wastes (SW-846)", 3rd. Edition, 11/86.

7.2.3.1 Calibration Procedure

For each analyte or group of analytes to be analyzed, three to five concentration levels are prepared by diluting aliquots of one or more stock standards with an appropriate Type II water/acid mixture. For GFAA or other AA analyses, one of the standards is at a concentration near the method reporting limit, and the other concentrations define the working range of the system. The initial calibration standards, followed by the calibration blank solution, are introduced into the appropriate system using the technique used for the introduction of actual samples. The system is calibrated using the manufacturer's recommended procedure.

Immediately following the initial calibration, the accuracy of the initial calibration is verified by analysis of an Initial Calibration Verification (ICV) solution. The ICV is prepared in the same manner as the initial calibration standards, but it is from a different source and approximately 10% of their concentration. For the initial calibration to be valid, the deviation of the ICV results from the actual values cannot exceed plus or minus 10% of the true value. The initial calibration criteria are given in Appendix C.

The initial calibration of every system must be verified after each ten sample analysis, by the introduction of Continuing Calibration Verification (CCV) standards and the calibration blank. The CCV standards are prepared in the same manner and at the same concentration as the initial calibration standard. The results of the CCV standards cannot exceed plus or minus 10% of the true value. If this criteria is not met, the system must be recalibrated and all samples analyzed since the last acceptable CCV analysis must be re-analyzed. The continuing calibration criteria are given in Appendix C.

In addition to the above calibration standards, the interelement and background correction factors for the ICP systems are verified following the initial calibration and at the end of the analytical run, or twice per eight hours. This requires the analysis of the Interferant Check Sample (ICS), which is prepared in the same manner as the ICV, but contains high concentrations of known interfering analytes. Results of the ICS cannot exceed plus or minus 20% of the true value. If this criteria is not met, the

7.2.3.1 Calibration Procedure (continued)

ICP must be recalibrated and all samples analyzed since the last acceptable ICS analysis must be re-analyzed.

7.2.3.2 Additional Calibration Procedures

In addition to the daily calibration/recalibration procedures, the Instrument Detection Levels (IDLs) for all ICP, GFAA, and other AA systems are determined on a quarterly basis. The IDLs are determined by multiplying, by three, the average of the standard deviations, obtained on three nonconsecutive days, from the analysis of standard solutions of each analyte in reagent water. The concentration of each analyte is from 3 to 5 times the IDL, and seven consecutive measurements per day are required.

For ICPs, a Linear Range Analysis (LRA) is performed quarterly, by analyzing a liner range verification check standard. Results of this analysis must be within plus or minus 5% of the true value. The LRA concentration represents the upper limit of the ICP linear range, beyond which dilutions must be performed for analysis.

The interelement and background correction factors for ICPs are determined annually by analysis of Interference Check Samples.

7.2.4 General Instrument Systems

Calibration of general analytical systems and methods is carried out in accordance with both instrument manufacturer's specifications and the particular requirements of specific analytical methods or Project Plans. These specific requirements, as well as the various acceptance criteria, are found in the CHEMWEST SOP or the Project Plan covering the particular instrument or method. Some of the criteria given in Appendix C may be applied to ceretain inorganic test procedures, as defined in their specific SOPs.

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7.3 Sample Control

The basic components for maintaining sample control, including chain-of-custody, are to ensure that the samples and aliquots or extracts are at all times either in the possession of the appropriate laboratory staff member or maintained in a secure area, and that adequate documentation accompanies the samples throughout the laboratory.

CHEMWEST accomplishes these objectives as part of the sample control system. This system includes procedures for documentation of the receipt of the sample into the laboratory using chain-of-custody records. These documents give information about those taking the samples, the collection time, date, location and the type of analysis required. Though CHEMWEST supplies instructions on the correct methods of sample collection, CHEMWEST's clients are responsible for implementing these instructions for samples they collect. When the samples are received in the laboratory, the documents are signed by the receiving staff.

The integrity of the samples within the laboratory is assured by the security of the facility itself. Building security is controlled by a restricted key card entry system, as described in Section 6.1. Samples are kept in a locked refrigerator, or in secure storage if refrigeration is not required, before, during, and after analysis. When the analyses are complete the final extracts for the extractable portions of the sample are kept in a locked freezer. These storage locations are the responsibility of the Sample Control Manager (Sample Custodian). The following is a general description of CHEMWEST's Sample Control system.

7.3.1 Sample Receipt, Chain-of-Custody, Storage, and Disposal

All incoming samples are checked by the CHEMWEST Sample Control Department for irregularities, such as broken or leaking containers, errors in labeling or descriptions and chain-of-custody discrepancies. Any irregularities are noted on the chain of custody and when necessary, the client is immediately notified as part of the corrective action process. After receipt, samples are photographed, logged in to the CHEMWEST system, assigned a CHEMWEST number and a sample folder. The signed and dated chain of custody is placed into the sample folder along with any other pertinent traffic information.

The Project Manager, assigned to a particular client, is responsible for tracking the status of the samples throughout the laboratory. Samples are kept in a secure area by the Sample Control Department, and are signed out in the Sample Control sample log book by the analysts who will prepare the

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7.3.1 Sample Receipt, Chain-of-Custody, Storage, and Disposal (continued)

samples for analysis. Samples for organic volatiles analysis are kept in secure storage in the laboratory area where the analyses will be performed.

During all stages of sample analysis, sample log books, laboratory worksheets, workbooks and/or any other associated documents are initialed and dated by the analysts performing the work. These items are also reviewed, signed, and dated by the individual Laboratory Managers. The samples remain in the custody of the Sample Control Department until they are disposed of. The hold time of the samples before disposal is governed by method, project, or other specific client requirements. These requirements are detailed in the appropriate Sample Control SOP, the specific Project Plan, or the client folder.

7.3.2 Containers, Preservatives, and Storage Conditions

The type of container, proper preservative, and correct storage conditions for use in the collection of samples for analysis are quite sample, method, and project specific. CHEMWEST utilizes recognized lists of recommended containers, preservatives and storage conditions, such as in 40 CFR Part 136, "Table II.-Required Containers, Preservation Techniques, and Holding Times", July 1, 1986, EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", March 1983, and SW-846, "Test methods for Evaluating Solid Wastes", 3rd. Edition, November 1986, as well as specific recommendations in individual methods to guide our clients in making the correct choice for particular samples. Lists from these sources are given in Appendix D.

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7.4 Additional Laboratory Policies to Achieve QA Objectives

7.4.1 Surrogates

Applicable surrogate compounds, when available for a particular method, are added to each organic sample requiring GC/MS or GC analysis. These surrogate compounds are quantitatively analyzed by either GC/MS or GC. The percent recovery data of surrogate compounds, by sample, and matrix, and perhaps analyst, are used to form the statistical basis upon which preparation techniques are monitored. Surrogate recoveries must meet Acceptance Criteria before the analytical data is released.

When, during the course of an analysis, surrogate recoveries fail to meet QC Acceptance Criteria, and checks of instrument performance, calculations, internal standard responses, cannot explain the failure, reanalysis of the sample must be performed. If reanalysis does not yield acceptable surrogate recoveries, or if matrix interference is suspected, reextraction and reanalysis of the sample must be performed. If surrogate recoveries still do not meet QC Acceptance Criteria, the data affected by the poor surrogate recoveries is qualified by a narrative in the CHEMWEST report cover letter.

7.4.2 Reagents

With each new lot of reagents, a reagent blank is prepared and analyzed to assure that reagents do not introduce contaminants or interferences into samples or extracts. In addition, a minimum of one method blank is prepared each time samples are extracted using a particular preparation technique. The purpose of the method blank is to ensure that contaminants are not introduced by the glassware, reagents, personnel, or sample preparation environment.

7.4.3 Standards

Calibration standards are traceable to the National Bureau of Standards (NBS) or EPA, whenever such standards are available. Commercial sources of standards and reagents are checked for purity, and approved prior to their use in analysis.

All standards prepared for use throughout the laboratory are assigned an identification number. This number is entered into bound standard notebooks with all information regarding the preparation of that standard, including date, initials of preparer, source of standard (including lot number or other identifier), name of each compound, mass or concentration of each compound in source, final volume, solvent used, and final concentration of each

7.4.3 Standards (continued)

compound in the completed standard. All standard containers are labelled with the standard's identification number and date.

7.4.3.1 Preparation of Standards

- o Stock calibration of QC standards are prepared from neat material, or concentrated solutions, obtained from Aldrich, Supelco, Chem Service, Cambridge Isotope Labs, the EPA Standards Repository, or other acceptable sources.
- o Working calibration or QC standards are prepared by dilution from stock standards.
- o Whenever a standard is prepared, the "recipe" is recorded in the Standards Log Book. The source of the standard, lot number, purity and manufacture date are also recorded. No correction is made for standards greater than 96% purity.
- o The prepared standard is given a unique lab ID number that is used to track that individual standard throughout the lab.

7.4.3.2 Traceability of Standards

- o Before a new stock standard is used, it is checked for concentration accuracy by comparing a dilution of the newly prepared standard to a known reference standard solution, diluted to the same concentration (i.e., comparing a standard prepared from Chem Service neat material to an EPA reference standard). If reference solutions are not available, the new stock may be compared to a dilution of a second standard, prepared from neat material from a different lot number, or from purchased concentrated or working solutions, of a different lot number, diluted to the same concentration.
- o The instrument response obtained for each compound in the dilution of the newly prepared stock standard is compared to the response obtained from the dilution of the reference standard.
- o If the instrument responses are within +/- 15% (for all but a few compounds recognized as being chromatographically or analytically atypical), the new stock standard is considered traceable. If they do not agree within +/-15%,

7.4.3.2 Traceability of Standards (continued)

the standard may not be used until the discrepancy has been resolved.

- o Before a working standard is put into production, it is checked for concentration accuracy by comparing a dilution of the newly prepared standard to the previous working standard solution, diluted to the same concentration.
- o The instrument response obtained for each compound in the dilution of the newly prepared stock standard is compared to the response obtained from the dilution of the previous working standard.
- o If the instrument responses are within $\pm 15\%$ (for all but a few compounds recognized as being chromatographically or analytically atypical), the new working standard is considered traceable. If they do not agree within $\pm 15\%$, the new standard may not be used until the discrepancy has been resolved.
- o For working standards, the first step in resolving a discrepancy can be comparison of the new working standard to a known reference standard solution, diluted to the same concentration (i.e., comparing a standard prepared from Chem Service neat material to an EPA reference standard). If reference solutions are not available, the new working standard may be compared to a dilution of a second standard, prepared from neat material from a different lot number, or from purchased concentrated or working solutions, of a different lot number, diluted to the same concentration. If agreement is within $\pm 15\%$, the standard is considered traceable, and if no agreement is obtained, a new stock standard must be prepared.
- o Alternatively, another new working standard can be prepared, and compared to the previous working standard, as above. If they agree within $\pm 15\%$, the new working standard is considered traceable. If they do not agree, the new working standard must either be compared to a reference standard (see above), or a new stock standard must be prepared.

7.4.3.2 Traceability of Standards (continued)

- o The working lifetime of standard preparations are dependent upon the compound types comprising the standards. In general, organic standards, such as those used in the EPA Contract Laboratory Program, have a shelf life of 1 year for BNAs and Pesticides, and 6 months for VOAs (2 months for gases), unless comparison to check standards indicates loss of standard integrity. Many inorganic standards, such as metals, have a shelf life of ca. 1 year. Additional information on standard shelf life is given in specific method SOPs.

7.4.3.3 Reference Standards

The Environmental Protection Agency's Quality Assurance Materials Bank (QAMB) will supply primary standards (calibration standards, surrogate standards, matrix spiking standards, and internal standards), contingent upon their availability, to commercial laboratories currently working under contract to the EPA. It is emphasized that these primary standards are only for traceability and quantitative verification of standards. There are insufficient quantities to have these available to serve as working standards. CHEMWEST either prepares it's own working standards or buys prepared standards from commercial sources.

Caution is exercised when mixing these reference standards together, particularly the multicomponent standards. Chemical reactions, such as acid/base reactions, Schiff base formations (reactions of aldehydes and ketones with Primary amines), hydrolysis, isotopic exchange and others may occur.

7.4.4 Sources of Reagents

CHEMWEST obtains the reagents, including solvents, used for sample preparation and analysis from a variety of commercial sources, in both neat and solution form. Individual laboratory and method SOPs indicate the specific source of these materials. Lot numbers and other pertinent information about the various materials are documented in the appropriate laboratory log or workbooks. These sources include, but are not limited to:

- o Aldrich
- o J. T. Baker
- o Banco

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7.4.4 Sources of Reagents (continued)

- o Cambridge Isotope Labs
- o Chem Service
- o EM Science
- o Fisher
- o Kodak
- o Mallinkrodt
- o Scientific Products
- o Stohler/KOR
- o Supelco
- o VWR Scientific

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7.5 Quality Assurance Project Plans

When QA Project Plans are required for a specific project, they will generally be prepared to conform with either "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80), as prepared by the EPA's Office of Monitoring Systems and Quality Assurance, Office of Research and Development, or "Guidance for Preparation of Combined Work/ Quality Assurance project Plans for Environmental Monitoring (OWRS QA-1), as prepared by EPA's Office of Water Regulations and Standards. The latter is considered, by the EPA's Quality Assurance Monitoring Staff, to be an acceptable alternative to QAMS-005/80.

The following sub-sections concerning QA Project Plans are referenced in both the above mentioned QAMS-005/80, and in "Guidelines for Preparing Quality Assurance Program Plans" (QAMS-004/80), with which this overall CHEMWEST Program Plan complies.

7.5.1 Elements of a Quality Assurance Project Plan

For those specific projects requiring a QA Project Plan, each item in the following list must be considered and addressed in the plan:

- o Title Page, with provision for approval signatures
- o Table of Contents
- o Project Description
- o Project Organization and Responsibilities
- o QA Objectives for Measurement Data, in terms of precision, accuracy, completeness, comparability, and representativeness
- o Sampling Procedures
- o Sample Custody
- o Calibration Procedures, Frequency, and References
- o Analytical Procedures
- o Data Analysis, Validation, and Reporting
- o Internal QC Checks and Frequency

7.5.1 Elements of a Quality Assurance Project Plan (continued)

- o Performance and Systems Audits and Frequency
- o Preventive Maintenance Procedures and Schedules
- o Specific Procedures to be used to routinely assess data precision, completeness, accuracy, comparability, and representativeness of the specific measurement parameters involved.
- o Corrective Action
- o QA Reports to Management

7.5.2 Review of Activities/SOPs in Quality Assurance Project Plans

QA Project Plans provide for both the review of all activities which could directly or indirectly influence data quality and for the determination of those operations which must be covered by Standard Operating Procedures (SOPs). Activities and operations to be reviewed may include:

- o General Network Design
- o Specific Sampling Site Selection
- o Sampling and Analytical Methodology
- o Probes, Collection Devices, Storage Containers, and Sample Additives or Preservatives
- o Special Precautions, such as heat, light, reactivity, combustibility, and holding times.
- o Federal Reference, Equivalent or Alternate Test Procedures
- o Instrument Selection and Use
- o Calibration and Standardization
- o Preventive and Remedial Maintenance
- o Replicate Sampling
- o Blind and Spiked Samples

7.5.2 Review of Activities/SOPs in Quality Assurance Project (continued)

- o Collated Samplers
- o QC Procedures, such as intralaboratory and intrafield activities and interlaboratory and interfield activities.
- o Documentation
- o Sample Custody
- o Transportation
- o Safety
- o Data Handling Procedures
- o Service Contracts
- o Measurement of Precision, Accuracy, Completeness, Representativeness, and Comparability
- o Document Control

7.5.3 Document Control

QA project plans are prepared in a document control format, such as the one outlined in Section 4.4 of this Quality Assurance Program Plan, with arrangement for revision, as needed, and with a record of the official distribution.

7.5.4 QA Project Plan Preparation and Responsibilities

The quality requirements in proposals from prospective customers are identified during the initial review and evaluation of the proposal. When the quality requirements have been identified, the designated QA staff member ensures that they are adequately addressed in the QA Project Plan for that particular project.

The following is a list of the Quality Assurance Program Objectives to be met as a proposal becomes and operational project:

- o The development of a specific QA Project Plan for the project, if either required by the customer, or deemed advisable by company management.

7.5.4 QA Project Plan Preparation and Responsibilities (continued)

- o The assignment of responsibilities for achieving the required level of quality for materials, services, and data, including overall quality assurance.
- o Providing the necessary organization and appropriate staff level to implement the required quality assurance activities.
- o The development of working plans and procedures to implement the Quality Assurance Project Plan.
- o The implementation of the QA Plan.
- o The coordination of QA activities with the customer, sub-contractors, vendors, etc.

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8.0 DATA PROCESSING

8.1 Data Collection

The analytical data generated by the GC/MS, GC, ICP, AA, and other laboratory instrumentation is produced and presented in a variety of forms, including analog graphic (ie. GC/MS and GC chromatograms), bar graph (ie. GC/MS spectra), printed tabular (ie. GC/MS quantitation sheets and GC integrator reports), and even hand transcribed observations from instrument readouts (ie. pH). The various outputs that are produced include information such as the analog or digital instrument response, calculated retention times, tentative identifications of compounds or elements, calculated concentrations, and comparisons to standards. The specific form of the output is a property of the particular instrument and its computer software, if the instrument data collection is computer controlled, or the standard format specified for each analysis type.

Data output is monitored for consistency, and if incomplete or incorrect output is produced, the appropriate corrective action steps are taken. These steps follow the procedures established for each analysis and method, and are consistent with the instrument manufacturer's recommendations. The analog or digital output of applicable instruments is visually checked for reasonableness (i.e. are chromatographic peak baselines correctly assigned). Processed data, such as areas or calculated concentrations, is checked either visually or manually (ie. are the calculations correctly done).

In the data review process (see Section 8.2, Data Validation, following), the analytical data is compared to available sample history information, sample preparation narratives, QC data, QC Acceptance Criteria, etc. to judge the validity of the results.

The ancillary data that is produced for internal use and not typically reported to customers as part of the analytical data package, includes the following:

- o Laboratory worksheets
- o Laboratory notebook entries
- o Sample tracking system forms
- o Sample preparation log sheets
- o Instrument logbook records

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8.1 Data Collection (continued)

- o Standard records
- o Maintenance records
- o Calibration records
- o Associated quality control

This information is available for inspection during audits, or can be included in deliverable packages depending upon the specific needs of the client or Project Plan.

A complete record of each sample's progress through the laboratory, from sample receipt to reporting, is documented in the sample folder. Document control and chain-of-custody procedures and requirements, and the associated documentation, are specified in those specific SOPs (see also Section 7.3, Sample Control, and Section 7.3.1, Sample Receipt, Chain-of-Custody, Storage, and Disposal).

8.2 Data Validation

Both the analysts and the managers of each laboratory section review the data generated in their laboratory to insure that it meets all of the applicable analytical and quality control requirements. After data generation and workup, data and calculations undergo a peer review process, where a second analyst reviews the work of the initial analyst. Before the data is released to the Project Manager and Document Control staff, either the Laboratory Manager, or a senior analyst designated by the Laboratory Manager, performs a final review the data. The data review processes include the following items:

- o Check that the analysis was performed as specified by the client or Project Plan.
- o Check that all of the required samples were analyzed.
- o Check that no contaminants were present in blanks at greater than the Quality Control Acceptance limits.
- o Check that the required number of blanks, spikes, duplicates, standards, etc., were analyzed.
- o Check that all surrogate and spike recoveries are within the quality acceptance limits.
- o Verify that instrument calibration is acceptable.
- o Verify that instrument tuning is acceptable.
- o Verify that internal standard responses are acceptable.
- o Check/verify that quantitations were performed properly.
- o Check/verify that qualitative identifications were performed properly.
- o Check/verify that any method/client/Project specific analytical or quality control parameters are acceptable.
- o Document any problems or exceptions to the above criteria (ie. Corrective Action Forms and Sample Narratives).

8.2 Data Validation (continued)

The data validation process includes the use of:

- o Dated and signed entries by analysts and supervisors on work-sheets.
- o Sample tracking and numbering systems to logically follow the progress of samples through the laboratory.
- o Quality control acceptance criteria to judge the acceptability of specific data.

Steps and checks used to validate the precision and accuracy of the measured parameters, and to support the representativeness, comparability and completeness of the work include:

- o Description of the calibration of methods and instruments;
- o Description of routine instrument checks (noise levels, drift, linearity, etc);
- o Documentation on traceability of instrument standards, samples and data;
- o Description of applicable performance audits with appropriate audit materials;
- o Description of the controls for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision);
- o Description of levels of routine maintenance to ensure analytical reliability;
- o Documentation of sample preservation and transport.

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8.3 Data/Report Storage

Procedures are being established for every stage of data processing in which a permanent collection of data is stored, to ensure data integrity and security. Specific QA project plans or client instructions indicate how specific types of data are stored with respect to media, conditions, location, retention time, and access. The following chart indicates the general guidelines for data storage.

<u>Media</u>	<u>Conditions</u>	<u>Location</u>	<u>Retention Time</u>	<u>Access</u>
Hardcopy	secure storage	in laboratory building	indefinite ¹ 120 days ²	Designated Personnel
Hardcopy	locked warehouse	near to laboratory building	indefinite ¹ 120 days ²	Designated Personnel
Electronic	secure storage	in laboratory building	indefinite ¹ 120 days ²	Designated Personnel

¹ Commercial² EPA

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8.4 Transcription

All data transcriptions for final reports to commercial clients or EPA-CLP are performed by Data Control Staff and are reviewed for transcription errors before returning to the Project Manager and appropriate laboratory managers for final review. Data transcription requirements vary by method, client, and Project, but they are all monitored by the Data Control Manager and the Project Manager in accordance with the various customer requirements for accuracy and legibility.

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8.5 Data Reduction

Data reduction includes all processes, that change either the form, quantity of data values, or the number of data items. The original data set from which the new set is generated cannot be recovered from the new set.

Data reduction frequently includes the computation of summary statistics. Documentation of the method of calculation is required. Frequently, a hand calculator or computer will be used in this process. The documentation permits the reviewer to check the validity of the data reduction process. All of the computer generated compound lists containing reportable results include the formulae used in the computation process.

It is CHEMWEST's policy to report results to two significant figures, unless specifically altered by a particular method, Project Plan, or client request. A minimum, however, of one extra significant figure is carried through all calculations, until the mathematical manipulations are complete, at which time normal rounding off procedures are applied.

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9.0 DATA QUALITY ASSESSMENT

9.1 Introduction

9.1.1 Accuracy

The Laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on similar samples. Percent Recovery Criteria, published by the EPA as part of the EPA-CLP for organic and inorganic analyses, or published in the Federal Register (October 26, 1984), or those determined from laboratory performance data, are used to evaluate accuracy in method blank spike and matrix spike Quality Control samples. The formula for determining accuracy is:

$$\text{Percent Recovery} = 100 \times \frac{\text{Measured Concentration}}{\text{Spiked Concentration}}$$

9.1.2 Precision

The Laboratory objective for precision is to equal or exceed the precision demonstrated for the applied analytical methods on similar samples. Relative Percent Difference (RPD) criteria, published by the EPA as part of the EPA Contract Laboratory Program (CLP) for organic and inorganic analyses or those determined from laboratory performance data, are used to evaluate precision between method blank spike duplicates and matrix spike duplicates. The formula for determining Relative Percent Differences (RPD) is:

$$\text{RPD} = 100 \times \frac{\text{Conc}_s - \text{Conc}_{sd}}{\frac{\text{Conc}_s + \text{Conc}_{sd}}{2}}$$

Conc_s = measured concentration for spike

Conc_{sd} = measured concentration for spike duplicate

9.1.3 Representativeness

The representativeness of the data from the sampling sites depends on the sampling procedures. The representativeness of the analytical data is a function of the procedures used in processing the samples. The objective for representativeness is to provide data of the same high quality as other analyses of similar samples, using the same methods during the same time period within the laboratory. Representativeness can be determined for this

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9.1.3 Representativeness (continued)

objective by a comparison of the quality control data for these samples against other data for similar samples analyzed at the same time.

9.1.4 Comparability

The results of analyses can be compared with analyses performed by other laboratories, because the objectives of the laboratory for comparability are:

- o To demonstrate traceability of standards to NBS or EPA sources;
- o To use standard methodology;
- o To report results from similar matrices in consistent units;
- o To apply appropriate levels of quality control within the context of the Laboratory Quality Assurance Program Plan;
- o To participate in interlaboratory studies to document laboratory performance.

By using traceable standards and standard methods, the analytical results can be compared to other laboratories operating in a similar manner. The QA Program Plan documents internal performance, and the interlaboratory studies document performance compared to other laboratories. Quarterly laboratory proficiency studies are performed as a means of monitoring intralaboratory performance.

9.1.5 Completeness

CHEMWEST's objective for completeness is to be able to provide analyses for 100% of the intact samples received, for which backup sample is available should initial analysis not meet acceptance criteria. When requested, the completeness of an analysis can be documented by including in the report sufficient information to allow the data user to assess the quality of the results. The information delivered might include such items as: chromatograms, raw data reports, spectra, QC data, and summaries of results. Additional information, such as Laboratory worksheets, workbook entries, etc. are stored with the sample results in the Laboratory. The raw data (prior to data reduction) is archived indefinitely on magnetic tape for those instruments possessing this capability. All analytical information, per sample, is retained by the laboratory, whether or not the client requests this ancillary information.

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9.2 Methods For Attaining Quality Control Objectives

The analytical and quality control objectives for each sample are achieved by careful attention to both the particular analyses requested by the client, on a case by case basis, and the overall objectives of the client or Project specific programs. Particular analyses are associated with specific sample preparation and instrument procedures and are dependent on sample matrix, fraction type, QC requirements, and detection limit requirements.

The types and frequencies of QC samples processed with a sample are program specific, and most can be found in the following references:

- o "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis", 8/87;
- o "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis", 7/87;
- o "Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", USEPA, Federal Register, Vol. 49, No. 209, October 26, 1984;
- o "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986;
- o Specific State or Federal Agency regulatory requirements;
- o Specific State or Federal Agency Project Plans;
- o Customer specific QC sample requests.

For example, the State of California Department of Health Services requires Method Blanks, sample Duplicates, and Matrix Spikes/Matrix Spike Duplicate pairs at a frequency of one each for every batch of samples for each type of matrix, or for each 20 samples for each type of matrix (10% frequency), whichever is more frequent.

At CHEMWEST, Method Blank Spikes and Method Spike Duplicates are prepared and analyzed at a frequency of one pair for each 20 samples for each type of matrix (10% frequency), and are reported to the customer as Laboratory Quality Control Samples (LQCSs). Matrix Spikes and Matrix Spike Duplicates are prepared and analyzed at a frequency of one pair for each 40 samples for each type of matrix (5% frequency), unless the particular client, Project, or Program dictates a different frequency. Surrogate compounds, when suitable for a particular analysis, are also analyzed with each sample.

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9.2 Methods For Attaining Quality Control Objectives (continued)

Tables of QC Control Limits for inorganic and organic analyses are included in Appendix E.

Blind samples are also sent to the laboratory for analysis. These may take the form of replicates or external quality control samples. These samples are obtained either from outside sources, and contain known concentrations of specific compounds, or they are produced in house under the direction of the QA group.

The laboratory also analyzes Performance Evaluation and Check samples provided by Federal and State Government Agencies and Programs, as well as those provided by specific clients. Examples of Government provided samples include the Contract Laboratory Program Quarterly PE samples, and the EPA-EMSL, Cincinnati, WP/WS samples. Unless prohibited by the particular Government group submitting the samples, Government provided PE sample results are available for inspection. Client specific PE data is considered proprietary and is not generally available for inspection.

9.2.1 Organic Analysis

Additional specific information, with regard to the surrogate and spike analysis discussions given in the following sections, is available in particular Method SOPs or Project Plans. Information in these sources may take precedence over the more general discussions that follow.

9.2.1.1 Organic Surrogate Analysis

Applicable surrogate compounds, when available for a particular method, are added to each organic sample requiring GC/MS or GC analysis. These surrogate compounds are quantitatively analyzed by either GC/MS or GC. The percent recovery data of surrogate compounds, by sample, and matrix, and perhaps analyst, are used to form the statistical basis to determine whether the sample processing and analysis functions are in control. Surrogate recoveries must meet Acceptance Criteria before the analytical data is released.

Tables of QC Control Limits for organic surrogate analyses are included in Appendix E. For those organic analyses included in the "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis", 8/87 (i.e., GC/MS Volatiles, GC/MS Semi-Volatiles, and GC Organochlorine Pesticides and PCBs), the initial acceptance criteria have been set at the CLP levels. For analyses not included in the CLP SOW, the initial acceptance criteria have been estimated from the CLP levels. CHEMWEST will be determining internal

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9.2.1.1 Organic Surrogate Analysis (continued)

QC Acceptance Criteria for surrogate recovery, from internally generated laboratory data, as soon as possible, as recommended in Method 8000, "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986 (see Section 9.3, Interpretation of QC Results, following). The limits will be updated when this data is available.

When, during the course of an analysis, surrogate recoveries fail to meet QC Acceptance Criteria, and checks of instrument performance, calculations, and internal standard responses, cannot explain the failure, reanalysis of the sample must be performed. If reanalysis does not yield acceptable surrogate recoveries, or if matrix interference is suspected, reextraction/repreparation and reanalysis of the sample must be performed. If surrogate recoveries still do not meet QC Acceptance Criteria, the data affected by the poor surrogate recoveries is qualified by a narrative in the CHEMWEST report cover letter.

9.2.1.2 Organic Spike Analysis

Method Blank Spikes (MBSs) and Method Spike Duplicates (MBSDs), reported to the client as Laboratory Quality Control Samples (LQCSs), are prepared and analyzed at a frequency of one pair for each 20 samples for each type of matrix (10% frequency). Matrix Spikes (MSs) and Matrix Spike Duplicates (MSDs) are analyzed at a frequency of one pair for each 40 samples (i.e., 5% frequency) or as defined by the particular client, Project, or Program.

The compounds spiked in the MBS/MBSDs (LQCSs) and MS/MSDs for a particular analytical method are an analyte sub-set of the entire target analyte list for that method. In addition to the QC samples already mentioned, an MBS/MBSD pair containing the entire target compound list for a particular method is prepared and analyzed at a frequency of one pair for each 200 samples (1% frequency).

9.2.1.2.1 Organic Method Blank Spike Analysis

If the QC Acceptance Criteria for Recovery and Relative Percent Difference are not met for the MBS/MBSD, corrective action must be taken. The initial corrective action may include analysis of a check standard (from a different source than the calibration standards) followed by reextraction/repreparation and analysis of the MBS/MBSD. If the problem is in the calibration, all affected samples will be reanalyzed. If the problem is not in the calibration, all affected samples, including QC samples, will be reextracted and analyzed.

The initial acceptance criteria for the MBSs and MBSDs have been estimated from data available in the "USEPA Contract Laboratory Program, Statement of CHEMWEST Analytical Laboratories, Inc."

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9.2.1.2.1 Organic Method Blank Spike Analysis (continued)

Work for Organics Analysis", 8/87; "Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", USEPA, Federal Register, Vol. 49, No. 209, October 26, 1984; and "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986. CHEMWEST will be determining internal QC Acceptance Criteria for Blank Spike recovery and RPD, from internally generated laboratory data, as soon as possible (see Section 9.3, Interpretation of QC Results, following). The limits will be updated when this data is available. Tables of QC Control Limits for organic spike analyses are included in Appendix E.

9.2.1.2.2 Organic Matrix Blank Spike Analysis

MS and MSD evaluation or acceptance criteria are very programmatic. For example, spiked samples processed following procedures designated in "Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", USEPA, Federal Register, Vol. 49, No. 209, October 26, 1984 (the EPA "600" Series methods) must meet the acceptance criteria specified in those methods. For spiked samples processed under methods where acceptance criteria are not completely specific (i.e., "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986), CHEMWEST has adopted internal criteria to be used as decision guidelines.

If the QC Acceptance Criteria for the MS, and if required, the MSD, are not met, the MBS/MBSD will be evaluated. If the QC criteria are met in the MBS/MBSD, the problem will be considered to be a matrix effect and will be narrated in the CHEMWEST report cover letter. If the QC Acceptance Criteria for Recovery and Relative Percent Difference are not met for the MBS/MBSD, corrective action must be taken (see Section 9.2.1.2.1).

The initial evaluation criteria for the MSs and MSDs have been estimated from data available in the "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis", 8/87; "Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", USEPA, Federal Register, Vol. 49, No. 209, October 26, 1984; and "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986. Tables of QC Control Limits for organic spike analyses are included in Appendix E.

9.2.2 Inorganic Analysis

Additional specific information, with regard to the surrogate and spike analysis discussions given in the following sections, is available in particular Method SOPs or Project Plans. Information in these sources may take precedence over the more general discussions that follow.

Method Blank Spikes (MBSs) and Method Blank Spike Duplicates (MBSDs), reported to the client as Laboratory Quality Control Samples (LQCSs), are prepared and analyzed at a frequency of one pair for each 20 samples for each type of matrix (10% frequency). Matrix Spikes (MSs) and a sample Duplicates (DUPs) are analyzed at a frequency of one pair for each 40 samples (i.e., 5% frequency) or as defined by the particular client, Project, or Program.

9.2.2.1 Inorganic Method Blank Spike Analysis

If the QC Acceptance Criteria for Recovery and Relative Percent Difference are not met for the MBS/MBSD, corrective action must be taken. The initial corrective action may include analysis of a check standard (from a different source than the calibration standards) followed by redigestion/repreparation and analysis of the MBS/MBSD. If the problem is in the calibration, all affected samples will be reanalyzed. If the problem is not in the calibration, all affected samples, including QC samples, will be redigested/reprepared and analyzed. The initial acceptance criteria for the MBSs and MBSDs have been estimated from data available in the "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis", 7/87, and "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986. CHEMWEST will be determining internal QC Acceptance Criteria for Blank Spike recovery and RPD, from internally generated laboratory data, as soon as possible (see Section 9.3, Interpretation of QC Results, following). The limits will be updated when this data is available. Tables of QC Control Limits for inorganic spike analyses are included in Appendix E.

9.2.2.2 Inorganic Matrix Spike and Duplicate Analysis

MS and DUP evaluation or acceptance criteria are very programmatic. For example, spiked samples processed following procedures designated in "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986, must meet the acceptance criteria specified in those methods. For spiked samples processed under methods where acceptance criteria are not completely specific, CHEMWEST has adopted internal criteria to be used as decision guidelines.

9.2.2.2 Inorganic Matrix Spike and Duplicate Analysis (continued)

If the QC Acceptance Criteria for the MS or the DUP, are not met, techniques such as serial dilution, or the method of standard additions, will be applied, if applicable to the particular analysis. If these techniques do not yield results within acceptable limits, or they are not applicable to the particular method, the MBS/MBSD will be evaluated. If the QC criteria are met in the MBS/MBSD, the problem will be considered to be a matrix effect and will be narrated in the CHEMWEST report cover letter. If the QC Acceptance Criteria for Recovery and Relative Percent Difference are not met for the MBS/MBSD, corrective action must be taken (see Section 9.2.2.1).

The initial evaluation criteria for the MSs and DUPs have been estimated from data available in the "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis", 7/87, and "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986. Tables of QC Control Limits for organic spike analyses are included in Appendix E.

9.2.2.3 ICP Interference Check Sample

In addition to the QC samples discussed in Sections 9.2.2.1 and 9.2.2.2, at the beginning and end of each Inductively Coupled Plasma (ICP) analysis shift, an ICP Interference Check Sample is analyzed. This analysis verifies inter-element and background correction factors, since it assesses analytes of interest in the presence of high concentration levels of other known interfering elements. Control limits for this test are included in Appendix E.

9.2.3 Method Blanks

The minimum criteria for the evaluation and frequency of method blanks are addressed in their applicable method references. The Quality Assurance group routinely audits method blank data to ensure that criteria are being adhered to, and that potential sources of contamination are identified before samples are affected. In addition, numerous Quality Control samples are introduced regularly into the system to monitor the cleanliness of the glassware preparation operation, volatile instrumentation, volatile sample bottle storage facility, inorganics sample bottle preparation, and sample storage refrigerators.

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9.3 Interpretation of QC Results

The management and staff of CHEMWEST makes every attempt to generate data of the highest quality possible and will continue to apply state-of-the-art analytical methodologies to ensure that data continues to be of the best quality available. CHEMWEST makes every attempt to produce and deliver analytical data which has been demonstrated to meet contractual, Project, method, or client required quality control acceptance criteria. Should anomalies occur in the processing and/or the analysis of samples which affect that objective, Quality Assurance or Laboratory narratives are typically included in the cover letter delivered with the data results, to provide proper qualification of the data.

9.3.1 Laboratory Generated QC Acceptance Limits

As described earlier in this section, QC Acceptance Criteria for precision and accuracy can be contract, client, or project mandated. CHEMWEST also offers a variety of analytical services using methodologies where the QC requirements for accuracy and precision are method mandated. In both the "Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", USEPA, Federal Register, Vol. 49, No. 209, October 26, 1984, and "Test Methods for Evaluating Solid Wastes", USEPA, SW-846, 3rd. Edition, November, 1986, it is recommended that the laboratory periodically update control limits based on internally generated data. It is CHEMWEST's intent to do so, once a database of sufficient size is generated.

Control limits will be based on the following formulae:

$$LCL = \bar{X} - 3SD$$

$$UCL = \bar{X} + 3SD$$

LCL = Lower Control Limit

UCL = Upper Control Limit

$\bar{X}$ = Mean Percent Recovery (some circumstances may require the use of single determinations, $\bar{X}$, rather than means)

SD = Standard Deviation

All QC sample results are tabulated immediately following analysis and compared to the method, contract, Project, or client mandated Quality Control Acceptance limits for precision and accuracy, as described in

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9.3.1 Laboratory Generated QC Acceptance Limits (continued)

preceding Sections. Out-of-control results are evaluated as indicated in those Sections. No outlying data is released until the laboratory has verified that unacceptable results are attributable to the sample matrix.

The laboratory is currently developing the Quality Control databases and applications software necessary to calculate QC Acceptance Criteria based on laboratory generated data for each sample matrix, concentration level (Low/-Medium), and sample type (acid, volatile, etc.).

9.3.2 Quality Control Charts

The same Quality Control databases, referred to in Section 9.3.1, contain the data that will be used to plot control charts for each sample matrix, concentration level (Low/Medium), and sample type (acid, volatile, etc.). Various application software is being tested by the CHEMWEST Quality Assurance group to evaluate its effectiveness in producing Quality Control Charts. An example of a QC Chart is given in Appendix F.

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10.0 CORRECTIVE ACTION

10.1 Introduction

The Quality Assurance group is responsible for conducting periodic inspections or audits of the quality systems, data generation, and support systems of the laboratory. The purpose of the internal audits is to assist management in identifying and correcting deficiencies and to reinforce acceptable practices. This ensures that services meet the requirements of the Laboratory QA Program as well as the client. These inspections help to ensure that the policies of the laboratory for production of high quality data are being followed, and include laboratory standard operating procedures, instrument procedures, sample preparation procedures, and data review policies. If discrepancies are found, corrective action is taken.

Additional information on out-of-control situations is located in this QA Program Plan in the applicable parts of Sections 6.5, Instrument Maintenance, 7.0, Data Generation, and 9.0, Data Quality Assessment.

10.1.1 Documentation of Corrective Action

The major vehicle for documenting corrective action at CHEMWEST is the Corrective Action Form. When an analyst notes an out-of-control situation, some of which are described in the following Sections, the following steps are completed to insure both the correct and timely correction of the situation, and to provide an historical record of the action.

- o Advise the Laboratory Manager of the out-of-control situation.
- o Utilize a CHEMWEST Corrective Action Form to provide both the initial notification to other managers and staff of the need for corrective action, and a description of the problem.
- o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who may be affected by the problem.
- o Work with the Laboratory Manager and the Quality Assurance Manager, or designate, to determine the extent of the problem.
- o If help is required from other laboratory groups, meet with the Managers or designated staff members from the groups, to determine a course of action.

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10.1.1 Documentation of Corrective Action (continued)

- o Add the Corrective Action Plan to the CHEMWEST Corrective Action Form to provide further notification of impending corrective action.
- o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who may be affected by the problem.
- o Add the Completion/Outcome to the CHEMWEST Corrective Action Form to complete the notification of corrective action process.
- o Send a copy of the CHEMWEST Corrective Action Form to the Vice-President of Technical Services, the Quality Assurance Manager, and any additional staff members who were affected or informed of the problem.

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10.1.2 CHEMWEST Corrective Action Form

An example of the CHEMWEST Corrective Action Form can be found in Section 6.5.3.1.

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10.2 Out of Control Situations

There are a number of conditions that could constitute an "out of control" situation for an instrument, an analysis, or a method.

10.2.1 Out of Control Situations for Instruments

For instruments, these are usually mechanical or electronic problems that require either maintenance or repair. In such cases, logical troubleshooting steps, as detailed in specific instrument SOP's or manuals, are undertaken to isolate the problem, and correction is done by either CHEMWEST staff or outside vendors trained in instrument maintenance or repair.

10.2.2 Out of Control Situations for an Analysis

For a particular analysis, out of control conditions arise when tuning standards, calibration standards, internal standards or surrogates fail to meet method specific acceptance criteria. Each specific method SOP includes steps to follow for the resolution of these conditions, and they include, but are not limited to, the following general actions, as appropriate.

10.2.2.1 Tuning Standards

- o Check that all instrument parameters are correct
- o Reanalyze at least twice
- o Make up new standard solutions
- o Retune

10.2.2.2 Calibration Standards/Internal Standards

- o Check that all instrument parameters are correct
- o Reanalyze at least twice
- o Perform instrument specific maintenance
- o Generate new calibration data
- o Prepare new calibration standards.

10.2.2.3 Surrogates

- o Check that all instrument parameters are correct
- o Check for possible matrix interference with internal standard areas, if applicable
- o Check for possible matrix interference with surrogate areas.
- o Reanalyze at least twice
- o Reextract
- o Reanalyze

10.2.3 Out of Control Situations for a Method

For a method, out of control conditions occur when quality control data, such as blanks, duplicates and spikes, do not meet the quality acceptance criteria. Each specific method SOP details the out of control conditions for the method. Out of control situations include, but are not limited to, the following general conditions, as appropriate.

10.2.3.1 Blanks

- o "Out of control" if background is greater than two to five times the Reporting Limit (method/analyte specific).

10.2.3.2 Spikes

- o "Out of control" if the analyte recovery is outside of the method specific QC Acceptance Criteria.
- o "Out of control" if the RPD between spike duplicates is outside the method specific QC Acceptance Criteria.

10.3 Resolution of Out-of-Control Situations

Each specific method SOP includes steps to follow for the resolution of these conditions, and they include, but are not limited to the following general actions, as appropriate.

10.3.1 Blanks

- o Reanalyze at least twice
- o Perform method/instrument specific maintenance
- o Reanalyze
- o Reextract
- o Reanalyze

10.3.3 Spikes

- o Check that no other out of control conditions exist
- o Reanalyze at least twice
- o Reextract
- o Reanalyze

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10.4 Systems Audits

A Systems Audit is an inspection and review of an entire data generation and support system. Quality related activities are reviewed, assessed, and compared against the Quality Assurance Program requirements for compliance. The audit includes the evaluation of personnel, facilities, Standard Operating Procedures (SOPs), and records. Systems Audits generally follow performance audits, (usually by state or EPA auditors, required for certification and contract awards), and may be instituted as part of corrective action monitoring programs. These are done at least once each quarter.

If deficiencies are observed during a performance audit, the QA group evaluates the audit report and initiates a follow-up Systems Audit, with emphasis on actions necessary to correct the deficiencies. A Corrective Action Report is completed, detailing all remedial actions taken, and issued to the Director of Quality Assurance for approval. If corrective action cannot be taken immediately, the anticipated date of action is provided. Once approved, the report is forwarded to the performance auditing agency or client.

Many of the objectives of a routine Systems Audit are similar to those a client or independent auditor would hope to accomplish during an On-Site Laboratory Evaluation and Data Audit. These goals include ensuring the following:

1. The necessary quality control (including corrective action measurement) is being applied;
2. Adequate facilities and equipment are available to perform the client's required scope-of-work;
3. The personnel are qualified to perform the assigned tasks;
4. Complete documentation is available, including sample Chain-of-Custody;
5. Proper analytical methodology is being applied;
6. Acceptable data handling techniques are being used;
7. Corrective actions identified in any previous on-site visits have been implemented;
8. The Laboratory Management continues to demonstrate a commitment to quality.

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10.4 Systems Audits (continued)

These objectives may be documented by completing a Laboratory Evaluation Checklist. In response to performance audits, any corrective actions taken are noted with reference to the auditor's deficiency report and the lab's Standard Operating Procedures. Should a quantitative or qualitative error be noted in a Data Audit, a blind Performance Evaluation (P.E.) sample may be entered into the system to test affected parameters.

Additionally, Laboratory Proficiency Tests may be scheduled if method performance is in question. Specifics of these two programs are outlined in the following sections.

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10.5 Performance Audits

These audits are quantitative checks of quality-related activities and instrumentation to verify conformance with the requirements of the laboratory's QA/QC programs. They are conducted by the QA Manager or the QA staff on a regular basis, using available certified reference materials, standards and devices.

Laboratory Proficiency Tests are routinely performed for new methods and personnel. These tests consist of quadruplicate blank spikes, containing a full complement of parameters to be analyzed by the method. The replicate results are analyzed by the QA Specialist who generates a summary report to the Manager of QA. This report includes the standard deviation and mean recovery for each of the replicate parameters, and the data are used to statistically validate method and/or personnel proficiency.

Blind Performance Evaluation (P.E.) samples are introduced into the system by the QA Department at least once per quarter. Parameters and methods are chosen for these studies based upon independent P.E. sample results (from certifying agencies or clients), Laboratory Proficiency Test results, Method Validation studies, or results from batch-related QC samples (sample spikes, blank spikes, duplicates, and method blanks). The existence of these P.E. samples is known only to the personnel involved in preparing the sample and scheduling the analytical requirements into the data management system. A thorough report, detailing the entire data generation and support functions, is completed by a member of the QA staff and reviewed by the Manager of QA and senior management.

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10.6 Audits by the Data Generators

Corrective action is minimized through the development and implementation of routine internal system controls. Analysts are provided with specific criteria that must be met for each procedure, operation, or measurement system. The SOP Manual documents correct procedures and provides a standard of comparison to ensure that laboratory personnel know and follow correct procedures at all times. Each measurement procedure, system, and instrument has predetermined limits to indicate when corrective action is required before data become acceptable. Standard Operating Procedures are established to identify the corrective actions and approval of SOPs is established organizationally. The Quality Assurance staff audits a percentage of the data to monitor the effectiveness of the system controls.

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