



**Veridian Environmental**  
*Truth Through Science*

***Statement of Qualifications***  
***Veridian Environmental, Inc.***  
***2005***

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## **An Introduction to Veridian Environmental**

Veridian Environmental is a small woman-owned consulting firm specializing in environmental chemistry. Our adherence to sound scientific principles results in verifiable, reproducible, results that provide the most efficient solutions for our clients' environmental concerns.

Veridian Environmental has provided quality assurance chemistry consulting since 1992 in Davis, California. Prior to the formation of Veridian Environmental, our staff served the environmental industry for ten years as an affiliate of Environmental Standards under the names of Environmental Standards West, Inc. and Environmental Standards Limited, Inc. The company was acquired in 2001 by Charlotte R. Symms, MBA, President. Ms. Symms prior fifteen years of experience was in the development and management of Environmental Standards.

The services of Veridian Environmental are provided by individuals who are uniquely qualified to offer our clients innovative scientific approaches to their environmental challenges. Veridian's chemists have over sixty years of combined experience in laboratory analysis and management and over thirty years in environmental consulting. Our professionals are recognized experts in their respective fields and are adept at working as independent consultants or as members of project teams. Veridian Environmental's professionals have participated in the review and modification of US EPA protocols for environmental chemical analysis techniques.

The Veridian Environmental professional staff can provide a variety of environmental consulting services. In the area of Quality Assurance Chemistry, Veridian Environmental offers services such as the design, implementation, and maintenance of corporate laboratory programs; analytical method evaluation and development; quality assurance project plan preparation; independent validation of sample data; the performance of laboratory audits; and litigation support. These highly specialized services demand a thorough knowledge of all current chemical, radiological, and physical analysis techniques. It is important to recognize that validation and laboratory audit reports must be completely unbiased to be valid; for this reason, Veridian Environmental is completely independent and is not affiliated with any outside data-generation contractors or analytical laboratories. The specific services offered in the area of Quality Assurance Chemistry are detailed in the subsequent sections of this Statement of Qualifications (SOQ).

Our technical library contains reports, trade journals, periodicals, technical books, government documents, and publications relative to computer science, waste management, toxicology, pharmacology, chemistry, air and water pollution, biology, physics, geology, and hydrology. Veridian Environmental maintains numerous computer systems with access to the most widely used project management, accounting, modeling, design, visualization, and spreadsheet programs.

Veridian Environmental operates from a modern office complex in Davis, California, located near Sacramento. We are proud of our professional staff, modern facilities, state-of-the-art equipment, and the scope-of-services that we are able to offer our clients. For additional information about our services, please contact us at 530.758.1903 or visit our web site at [www.VeridianEnv.com](http://www.VeridianEnv.com).

## **Chemistry Quality Assurance**

### Service Strategy

Staff members of Veridian Environmental have established a reputation for excellence as independent quality assurance (QA) consultants since 1992. Our dedicated personnel have published in numerous peer-reviewed journals and have presented at many major environmental conferences.

To participate effectively as an environmental QA oversight consultant, a contractor must have significant demonstrated credentials, experience, and a stellar reputation in all areas of QA. The professionals of Veridian Environmental have performed data validation on many Superfund, Resource Conservation Recovery Act (RCRA), Clean Air Act (CAA), and non-regulatory environmental investigations in most of the US EPA Regions. A significant number of these projects involved working with private industry, engineering firms, laboratories, and other contractors as part of an overall project team.

Veridian Environmental chemists have a thorough knowledge of analytical and validation protocols and guidelines. They also recognize that to rigidly follow these guidelines in all circumstances is not always appropriate (*e.g.*, SW-846 methods). The use of good professional judgement in addressing quality assurance protocols can provide valuable assistance in reaching the best outcome to environmental issues.

Veridian Environmental maintains an unbiased, third-party perspective because we are not affiliated with any laboratory or engineering operations. Veridian Environmental personnel are accustomed to being part of a team, actively communicating and interacting with engineering firms, laboratories, other consultants, and the prime contractors on projects. The primary goal from Veridian's perspective is to advocate the best client outcome that can be scientifically defended to protect human health and the environment.

## VERIDIAN ENVIRONMENTAL, INC.

### TABLE 1 - REPRESENTATIVE CLIENT LIST

- **INDUSTRIAL/PRIVATE**

Beazer East, Inc.  
Delta Diablo Sanitation District  
ExxonMobil Company USA  
Florin-Perkins Landfill, Inc.  
GE Plastics, Inc.  
Health & Hospital Corp. Marion County  
Kerr McGee Corporation  
Kolmar, Inc.  
Merck & Company  
Mobil Chemical Company  
Mobil Oil Company  
National Steel Corporation  
Neutrogena  
Olin Corporation  
Sacramento Rendering Company  
Solutia, Inc.  
Sun World  
Tahoe Keys Marina  
VFL Technology Corporation

- **ENVIRONMENTAL LABORATORIES**

Acculabs, Inc.  
Cal Science Environmental Laboratory  
Clayton Laboratory Services  
Kiff Analytical  
NEL Laboratories  
Phillip labs  
Prima Environmental  
Recrea Environmental  
STL Chicago  
STL Onsite Technologies

- **UTILITIES**

Ameren  
Delta Diablo Sanitation District  
San Francisco Public Utilities Commission  
Southern California Edison  
South Tahoe Public Utility District

- **LEGAL**

Brown, McCarroll & Oaks  
Hatch & Parent  
Lewis and Roca  
Lionel, Sawyer & Collins  
McCutchen, Doyle, Brown & Enersen  
Miller, Sher & Sawyer  
Robinson, Bradshaw & Hinson  
Weintraub, Genshlea, Chediak & Sproul

- **GOVERNMENT**

City of San Francisco, CA  
Oakland Base Reuse Authority  
US Army Corps of Engineers

- **CONSULTANTS**

Acton-Mickelson-Environmental, Inc.  
Black & Veatch  
Brown and Caldwell  
Chung & Associates  
Clayton Group Services  
Dynamac  
Earthtec, Ltd.  
Environ Corporation  
Environmental Standards, Inc.  
Erler & Kalinowski, Inc.  
The ERM Group  
ERM North Central  
Exponent  
GeoEngineers, Inc.  
GEOFON Incorporated  
Groundwater Sciences Corporation  
Integral Consulting  
Locus Technologies  
Malcolm Pirnie, Inc.  
Michael Pisani & Associates  
Montgomery Watson  
Parsons Engineering Science, Inc.  
Philip Environmental, Inc.  
Plexus Scientific Corporation  
Program Management Corporation  
Ramos Environmental  
RCC Group  
SECOR  
Sevenson Environmental  
S&ME, Inc.  
TetraTech EM, Inc.  
TRC Environmental Solutions  
URS Group, Inc.  
Woodward Clyde Consultants

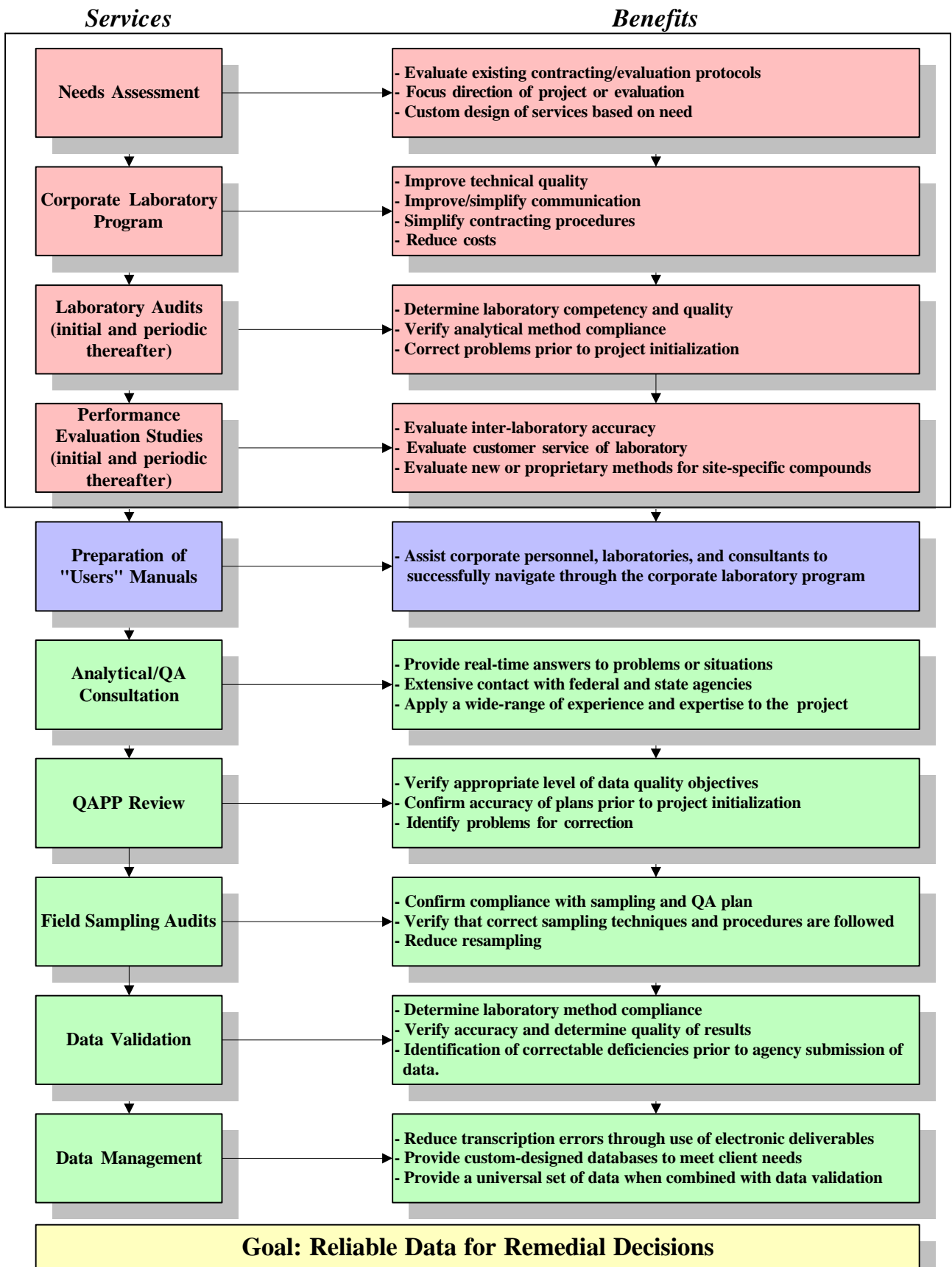
## Specific Technical Capabilities

Veridian Environmental Chemistry QA expertise includes the following:

- QA Documentation Preparation and Third-Party QA Documentation Review
  - Data Quality Objective (DQO) Development
  - Sampling and Analysis Plans (SAP)
  - Quality Assurance Project Plans (QAPjP)
  - Standard Operating Procedures (SOPs)
  
- Corporate Laboratory Programs and Third-Party Coordination and Oversight
  - Design, Implementation, and Maintenance of Corporate Laboratory Contract Programs
  - Third-Party Oversight and Auditing of Field Activities
  - Analytical Project Specifications and Request for Proposal (RFP) Preparation
  - Laboratory Audits
  - Performance Evaluation (PE) Studies
  - Laboratory Contract Negotiations
  
- Independent Validation of Laboratory Sample Results
  
- Chemistry Consultation
  - Expert Testimony/Litigation Support
  - Analytical Methods Evaluation and Development
  - Analytical Database Management

These key services provided by Veridian Environmental are summarized in the following sections. Figure 1 provides an example of how many of our services can be integrated to provide a comprehensive Quality Assurance program. A well-designed Quality Assurance program can help to assure accuracy, avoid duplication of sampling and analysis, reduce the occurrence of Notices of Violation (NOVs) based on inappropriate use of methods, and thus enhance our clients' financial and technical outcomes from environmental investigations.

**Figure 1**  
**Integrated Quality Assurance Services**



## **Preparation and Third-Party Review of Project Plans and Documentation**

In order to ensure that data do not have to be recollected to defend a potential liability, all environmental investigation must be conducted as if the findings are to be defended in a court of law. To be successful in using the data in a court of law, every aspect of the investigation must be appropriately documented. Just as important, however, is planning. The objective of the investigation must be carefully thought out, and the quality of the data must meet the required need. Samples must be collected in a manner that will afford the interpreter of the results the best information and analytical methods must provide detection limits suitable to the objective. Veridian Environmental defines Data Quality Objectives (DQOs) that ensure that the data meet the required project needs. To ensure that the DQOs are met, Veridian Environmental carefully reviews Sampling and Analysis Plans (SAPs), Quality Assurance Project Plans (QAPjPs), Standard Operating Procedures (SOPs), and analytical objectives through coordinated reviews by staff chemists.

### **Data Quality Objective (DQO) Development and Performance-Based Measurement Systems (PBMS)**

DQOs are qualitative and quantitative statements that ensure that data of known and documented quality are obtained. The US EPA has stated that the development of DQOs is one of the most important steps in ensuring the quality of environmental data. With the on-set of performance-based measurement systems (PBMS), the need for carefully developed DQOs has become even more critical to ensure project success. Veridian Environmental follows the guidelines set forth in DQOs for Superfund (US EPA 1993), DQO Decision Error Feasibility Trials (DEFT) software (US EPA 1994), and Guidance for the DQOs Process (US EPA 1994) to determine DQOs that are appropriate for the intended use of the data. Data collected and analyzed in conformance with these guidance documents can be used in uncertainty analyses through the application of statistical techniques and in the evaluation of risk.

DQOs are identified during project scoping and the development of the Sampling and Analysis Plan (SAP). The variability in site characteristics, the intended use of data, resource availability, and individual client needs make the preparation of a generic set of DQOs impossible. Our staff is experienced in defining data needs and specifying those criteria that enable the project-specific objectives to be satisfied.

### **Sampling and Analysis Plan (SAP)**

Obtaining defensible data from field sampling operations is a critical first step in any type of environmental impact assessment. When significant problems occur as a result of the collection of unrepresentative data and invalidation of the field sampling effort, the costs to the client in both time and money can be substantial. The Veridian Environmental staff is experienced in SAP preparation and review. The SAP must document the location and type of each sample, the correct sampling and analysis methods, and the proper number of QC samples to be included in the investigation in order to meet the project DQOs.

### Quality Assurance Project Plan (QAPjP)

The development of a QAPjP will improve the technical quality of project data and the consistency and cost efficiency of field sampling and laboratory analyses. For many RCRA, CAA, and CERCLA projects, consultants prepare project-specific QAPjPs. As a QA consultant to many projects, Veridian Environmental has prepared numerous project-specific QAPjPs by carefully documenting the sampling and analysis QA and QC protocols necessary to achieve the project DQOs. Factors such as timeliness, cost efficiency, and a firm's relationship with regulators can be significantly enhanced when a well-written QAPjP is submitted to a regulatory agency for review.

Contractors may, on occasion, have to prepare a QAPjP without having time for regulatory concurrence, and thus proceed with the project "at risk." Veridian Environmental personnel provide a valuable resource to industrial clientele by serving as independent reviewers of QAPjPs prepared by sampling consultants and by providing information on the plan's appropriateness, level of detail, and likelihood of acceptance by the receiving regulatory agency.

### Standard Operating Procedures (SOPs)

It is advantageous to coordinate with laboratories to generate project-specific analytical SOPs in order to maintain control over the qualitative and quantitative reliability of the data. When multiple laboratories are used for a project, the preparation of project-specific analytical SOPs will ensure that project laboratories will generate data using the same analytical requirements. At first glance, the preparation of SOPs may appear to be unnecessary because the analytical method should specify how to perform the analysis. Unfortunately, many of the current analytical methods (*e.g.*, SW-846) have unclear requirements that often result in different method interpretations. Project-specific analytical SOPs that detail project requirements will eliminate method interpretation and prevent the generation of incomparable data. This coordination is particularly important with respect to the project DQOs and will ensure that one set of quantitative criteria will be used to define acceptable data, qualify data, and reject data.

Veridian Environmental has also developed a significant number of project-specific validation and laboratory auditing SOPs. The current US EPA validation documents are all based on analytical methods that are used for Superfund (CERCLA) projects. When SW-846 methods are used, validation SOPs must be based on these RCRA methods. The use of project-specific validation and laboratory auditing SOPs will allow for common qualification of analytical data, regardless of which laboratory has analyzed the samples.

### **Corporate Laboratory Programs and Third-Party Coordination and Oversight**

Veridian Environmental has extensive experience in all facets of Corporate Laboratory Program development, field QA oversight, and the evaluation and selection of analytical laboratories. These services are further defined in the following sections.

## Design, Implementation, and Maintenance of Corporate Laboratory Programs

The development of a Corporate Laboratory Program not only improves technical quality, customer service, laboratory consistency, and cost efficiency, but it also provides a better mechanism for streamlining conventional contracting practices. The process begins with a review and evaluation of the laboratory and analytical program currently employed. Information is collected pertaining to how laboratories are currently evaluated by the client and how client contracting is performed. In addition, a present and future needs assessment is performed to define and establish goals for the number of laboratories, parameters of interest, number of samples to be analyzed, analytical method requirements, level of data and QC, regulatory requirements, and cost requirements.

The next step determines which laboratories meet the corporation's requirements established during the needs assessment phase by issuing a qualifications survey to candidate laboratories. A review of the information provided by these laboratories helps to focus the development of the Corporate Laboratory Program by reducing the number of laboratories requiring further review to those that can meet the client's requirements. The laboratories identified for further review then participate in a performance evaluation (PE) study for routinely analyzed and/or client-specific analytes. This study provides information regarding analytical accuracy and precision and a critique of customer service, sample log-in and receipt, and data package deliverables.

The selected laboratories are then audited by Veridian Environmental's experienced analytical chemists who evaluate each laboratory for sample receipt and management procedures, facilities, equipment and instrumentation, analytical expertise, adherence to analytical methods and SOPs, QA/QC procedures, data handling, and organizational communications. A detailed solicitation for analytical work that specifies corporate technical and costing requirements is also prepared for submission to these laboratories. The laboratories' responses to the solicitation are then reviewed for both technical compliance and cost.

Upon review of the PE study, the facility-specific audits, and the responses to the solicitation, the laboratories are ranked to identify the laboratories that best meet present and future needs of the client. In conjunction with the laboratory evaluation process, Veridian Environmental personnel work to improve the knowledge base of the client's personnel by developing client-specific manuals and training sessions to provide corporate personnel with information that enables them to better communicate with laboratory personnel and to make more informed decisions regarding the analytical requirements of their individual projects.

### Third-Party Oversight and Auditing of Field Activities

Field auditing of the sampling process ensures that field application of the method sampling techniques is performed as described by the specified method and that each aspect of a sampling activity is thoroughly documented for future reference. The techniques employed in sample handling, recovery, and preservation are also closely scrutinized to ensure that each sample is received by the laboratory in a condition that best reflects its condition at the time of sampling.

## Request for Proposal (RFP) for Analytical Services Preparation

Veridian Environmental has prepared comprehensive analytical RFPs for many specific projects and Corporate Laboratory Programs. The RFP, which defines all technical and cost requirements, is prepared after performing a needs assessment to define and establish goals for the number of laboratories, parameters of interest, number of samples to be analyzed, analytical method requirements, level of data and QC, regulatory requirements, and cost requirements. All aspects, including client services, bottlenecks, analyses, QC samples, turn-around-time, reporting format, electronic deliverables, and sample disposal are presented in a detailed solicitation to provide a rigorous comparison of the candidate laboratories with respect to technical and cost considerations.

The candidate laboratory proposals are carefully evaluated from technical, contractual, and cost standpoints. Based on the evaluation, a detailed final report is prepared and submitted to the client for consideration for final award. The areas that are typically addressed in the final report include the laboratory's organization and personnel, facility and equipment, QA/QC procedures, data management and electronic deliverable capabilities, applicable experience and certifications, PE scores, on-site audit scores, overall ability and capacity to perform the project, responsiveness to the RFP, and cost.

### Laboratory Audits and NELAP

Veridian Environmental personnel have performed numerous audits of laboratories nationwide on behalf of potentially responsible party (PRP) committees, engineering firms, and the laboratories (for in-house QA/QC purposes). Veridian Environmental laboratory audits are extremely rigorous and generally exceed regulatory-based and International Standards Organization (ISO) Guide 25 audit strategies. With the initiation of the National Environmental Laboratory Accreditation Program (NELAP), the number of regulatory audits will substantially drop to once every two years. It is therefore particularly advantageous to perform a detailed on-site audit to assess liabilities that may arise from use of a specific laboratory in a particular program or for a specific CAA, NPDES, RCRA, or CERCLA project. If a laboratory is audited immediately prior to use, the laboratory personnel can, in effect, be trained by Veridian Environmental personnel to perform acceptable work for our clients.

Typically, a Veridian Environmental laboratory audit consists of examining and assessing the following:

- Facilities and Equipment
- Organization and Personnel Qualifications
- Written Analytical and Non-Analytical SOPs and QA Plans
- Sample Administration Area and the Procedures For Entering Samples Into the Laboratory Information Management System (LIMS)
- Sample Storage Areas

- Sample Preparation Areas
- QA/QC Department
- Organic and Inorganic Instrumentation and Wet Chemistry Areas
- Data Reduction/Data Package Preparation
- Data Storage Areas (Hardcopy And Electronic)
- Client Service Area and Data Inquiry Services

#### Performance Evaluation (PE) Studies

Sound analytical QA programs include the periodic submittal of single-blind and double-blind PE samples to project laboratories to provide an assessment of laboratory performance; laboratories should receive single-blind or double-blind performance samples at least annually. Performance samples are custom-made to include the specific analytes of interest at specific concentrations of interest, are typically custom-made to be more “real world,” and include pre-moistened soils and concrete chip matrices. Upon receipt of laboratory results, Veridian Environmental evaluates the data relative to the certified “true values” and prepares a report on the results. For programs for which the data quality is a particularly sensitive issue, Veridian Environmental personnel have coordinated with many industrial clients and sampling consultants to have carefully-prepared double-blind performance samples arrive at a site on a particular day of sampling in the same type of bottleware being used for sampling. These performance samples are fictitiously labeled and placed in the cooler with site samples for delivery to the laboratory.

#### Laboratory Contract Negotiations

Veridian Environmental has provided assistance in developing or reviewing laboratory contracts to minimize future financial liabilities by helping to negotiate terms and conditions favorable to industrial clients. Additionally, Veridian Environmental has provided services to aid in contract dispute resolution pertaining to analytical issues.

#### **Independent Validation of Laboratory Sample Results**

Analytical results that are generated from a variety of samples become the basis for assessments and remedial decisions. The degree to which data are valid can make the difference between a correct assessment and an unnecessary cleanup effort. Data users have historically assumed that laboratory-reported results are absolute, accurate, and reliable because laboratory analysis is rather expensive. This assumption, however, has proven time and time again to be a costly mistake. Within the last decade, the need for independent data validation has been significantly realized. A long-term misconception that data validation is a luxury and not a necessity has been fostered by the fees associated with analytical services and the assumption that valid data are always generated because laboratories have QA groups. With the high frequency of Agency rejection of data *after* exhaustive reports have been prepared, data validation is automatically required in most environmental investigations as part of the overall QA program.

Through the Veridian Environmental data validation process, we can determine if a particular analysis conforms to client, method, and regulatory agency specifications. We can also determine if the original analysis was performed correctly and if the results are usable and able to “stand up” during litigation proceedings. In many cases, our expertise has helped change the outcome of an environmental investigation and has contributed to considerable savings of time and money for our clients.

We strongly believe that it is more beneficial for an independent third party to conduct the data validation. The validation of data by the firm that has collected the samples may represent a conflict of interest. Veridian Environmental’s nationally renowned Chemistry Consultation-Data Validation experts provide independent validation of analytical data. Veridian Environmental has performed independent third-party data validations for hundreds of Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), RCRA, state-lead, and Clean Air Act (CAA) programs nationwide.

Our data validation process involves carefully examining all raw analytical data and extracting usable data from sample results that appear to have been compromised by common laboratory-oriented problems (*e.g.*, sample bottle contamination, incorrect equipment calibrations, and technical difficulties). A rigorous and non-biased review of laboratory-generated analytical data has often demonstrated serious analytical problems for at least some of the results that were to be used as the basis for major risk-management decisions. The Veridian Environmental staff brings a variety of analytical expertise to client projects including organic, inorganic, radiological, and dioxin/furan analyses. Veridian Environmental has extensive experience with the US EPA’s functional guidelines regarding data validation and can offer a critical review of an analytical data package that can determine which of the reported data are valid and defensible and which are not.

Veridian Environmental offers several levels of data validation review based on client needs and the available laboratory data deliverables. These review levels range from qualification based on tabulated quality control (QC) summaries to rigorous validation of raw analysis data. Additionally, Veridian Environmental is continuing to develop electronic data qualification tools for in-house or client-based analytical databases.

### **Chemistry Consultation**

Very often, questions will arise during an investigation that necessitates phone calls and/or conference calls to obtain information and advice on complex analytical and QA-related issues. Veridian Environmental personnel have expertise in, and knowledge of, all published analytical methods (pros/cons, limitations, *etc.*). Our personnel have negotiated with the most difficult US EPA regions and state agencies regarding their reactions to analytical/QC problems and their expectations relative to corrective action. Many of Veridian Environmental’s clients consider this real-time QA assistance with projects an extremely valuable resource.

### Expert Testimony

Veridian Environmental personnel have provided chemistry and QA litigation support services to private industry, insurance companies, and legal firms. Third-party damage claims review, including CERCLA cost recovery claims analysis, provides our clients with a technical basis for challenging unrealistic damage claims as well as punitive and compensatory claims.

Veridian Environmental provides technical review of investigation and remediation documents such that professional firms can confidently question opposing witnesses on key issues of critical technical importance. Veridian Environmental can suggest deposition strategies or attend depositions on behalf of our clients.

### Analytical Methods Evaluation and Methods Development

Many investigation projects have unique chemicals of concern for which standard US EPA methods are not applicable. Additionally, many projects may require special sample analysis preparation procedures, non-routine analytical techniques, low detection limits, or analytical modifications to reduce interferences in the analysis. Veridian Environmental provides analytical method evaluation or method development expertise to provide solutions for non-routine chemical analysis. These services may include altering the design of a US EPA method to achieve a certain goal or developing a totally new analytical method for a specific chemical or analysis matrix.

Veridian Environmental chemists have critiqued analytical methods proposed by regulatory bodies on a client's behalf to determine if the method was suitable and/or scientifically sound. Additionally, we have developed numerous analytical methods or alterations to existing methods to provide defensible and valid analysis results for non-routine chemicals/analytes.

### Data Management

It has been Veridian Environmental's experience that the utilization of a centralized data management system is the best method to quickly and accurately obtain results in highly usable and flexible formats. This is of particular importance when faced with a large volume of data for one or many projects being conducted by multiple sampling consultants.

Veridian Environmental has the capability to assist clients by designing and implementing a custom data management solution. Depending on management requirements, a data management solution based on either current Relational Database Management System (RDBMS) or client/server technology can be employed.

## **Toxicology and Risk Assessment**

### Service Strategy

State-of-the-art public health and ecological risk assessments are critical components of remedial investigations (RIs) and risk analyses of proposed remedial alternatives. Veridian Environmental provides risk assessment and toxicology services to its clients by combining vast experience and expertise in this area and employing sound toxicological principles to develop cost-effective and defensible exposure scenarios and quantitative estimates of risk in accordance with all RCRA/CERCLA/Clean Air Act (CAA) and state guidelines. In addition, Veridian Environmental can oversee second-party (PRP consultant) RI/FS work plans and risk analysis of proposed alternatives.

Veridian Environmental is experienced in performing cost-effective quantitative risk evaluations for liability underwriters, property transfer investigations, brownfield redevelopment, environmental audits, or for pre-scoping formal remedial investigations.

Site-specific cleanup standards are often a very economical choice when compared to generically derived standards that may not reflect actual site conditions. In this area, Veridian Environmental has the essential experience and credentials to develop defensible cleanup levels for both human and ecological exposures. In addition, our toxicological expertise is essential for developing acceptable intake levels for those compounds without established intake guidelines.

Veridian Environmental can provide reliable health and toxicology data to support regulatory submissions, compliance obligations, and liability controls, and to answer community or worker concerns about chemicals.

### Specific Technical Capabilities

Veridian Environmental's Toxicology and Risk Assessment expertise includes the following areas:

- Human Health and Ecological Risk Assessments
- Toxicology
- Expert Testimony and Litigation Support
- Environmental Impact Assessments and Policy
- Permitting Studies (NPDES and Air Toxics)
- Wetland Impact Studies/Audits
- Contaminant Fate and Transport Modeling
- Development of Acceptable Intake Levels for Uncharacterized Chemicals
- Development of Defensible Risk-Based Cleanup Goals for Chemicals in Soil, Groundwater, and Air
- Risk Reduction versus Cost Analysis to Assist in Remedy Selection

- Preparation of Chemical Toxicity Profiles
- Advanced Air Dispersion Modeling

### **Development of a Baseline Risk Assessment**

It has been said, “There are as many types of risk assessments as there are risk assessors.” In general, that adage is true. Veridian Environmental’s risk assessments comply with US EPA, regional, and state regulatory requirements, as defined by the location of the site, oversight agency, and type of closure or relief of liability desired by the client. In addition to sophisticated database management and advanced statistical analyses, defensible, innovative methods and exposure assumptions are often incorporated into Veridian Environmental risk assessments to minimize client costs and/or liability while still gaining regulatory approval. Veridian Environmental uses up-to-date risk assessment techniques to evaluate health and environmental conditions associated with a site; these conditions are critical components for Remedial Investigations (RIs) as well as for risk analyses of proposed remedial alternatives.

### **Stochastic Modeling**

We believe that one technique, stochastic modeling, is of great potential value to our clients. The US EPA recommends that all risk assessment activities include some degree of uncertainty analysis to provide proper perspective to risk management decision-makers (US EPA, 1989). Nevertheless, despite qualitative discussions of uncertainty in the assessment of risk, risk assessors and managers have no way of knowing the degree of conservatism or “reasonableness” represented in an assessment. The US EPA Region III’s *Use of Monte Carlo Simulation in Risk Assessments* (1994) states:

EPA risk managers, though aware of the uncertainty, must still justify their decision to either accept or reduce the single-point risk. If the risk is close to the maximum acceptable level, it is likely that different assumptions would have produced a different risk number, leading to a different decision. In this way, single-point risk assessment methods place the risk assessor in an inappropriate risk management role.

Recent US EPA guidance on risk characterization (US EPA, 1992) discusses this problem in depth and recommends the use of multiple risk descriptors in addition to protective single-point risk estimates. Inclusion of these additional risk descriptors provides the public with more complete information on the likelihood of various risk levels and provides risk managers with multiple risk-based cleanup goals from which to choose. This guidance mentions Monte Carlo Simulation as an effective source of multiple risk descriptors.

Monte Carlo Simulation considers the worst-case assumptions and the most probable outcomes, as well as the entire value range of the variables involved in the estimations of exposure. The methodology combines the uncertainties identified in the scenarios of potential concern. Rather

than inputting a single upper-bound value (such as a soil ingestion rate of 200 mg/day for a child), the computerized Monte Carlo analysis is choreographed to run thousands of iterations, selecting, at random, values within the specified ranges of a “probability density function” (PDF) for each major variable. Thus, the full ranges of model and parameter assumptions can be combined to calculate the entire probability distribution of the exposure variables, rather than just the upper-bound single-point estimation or default values. In this framework, a complete distribution of risk is derived. This probability distribution of risk will afford any upper-bound estimate desired, such as the upper 95th percentile. The upper 95th percentile is what the US EPA hopes to achieve when it multiplies a series of conservative point estimates and terms it the “reasonable maximum exposure”; in truth, the resulting estimate is usually closer to the 99th percentile or greater.

Computer tools for stochastic modeling have been in use by Mr. Robert Fares since 1991. Stochastic modeling is a powerful method of risk assessment requiring modest additional time or effort above that required by traditional assessments. Veridian Environmental brings together the experience and expertise of Mr. Fares in this area and employs sound toxicological principles to develop cost-effective and defensible exposure scenarios and quantitative estimates of risk.

### **Development of Cleanup Standards**

There are three options for determining cleanup standards for constituents in an environmental medium. The first, and usually the most expensive in regard to remediation costs, is to clean up to background conditions. The second alternative is to remediate to generic cleanup standards developed by state, regional, or federal agencies. Generic cleanup standards, by nature, are conservatively-derived to protect various populations under different exposure scenarios. These generic standards are developed for a generic site, which could be extremely different from most real-world sites.

The alternative to remediating your site to someone else’s standards is to develop site-specific cleanup standards. Our experience has shown that every \$1,000 spent on development of site-specific cleanup standards has saved clients over \$250,000 in potential remediation costs. The remedial investigation/feasibility study (RI/FS), or any environmental investigation, is a lengthy, time-consuming and money-consuming process. These investigations begin with site characterization; by the time the process approaches the remediation stage, too many companies just agree to generic cleanup standards and may be unaware that there are very cost-effective and defensible alternatives. Site-specific cleanup standards are, on average, an order of magnitude higher than generic cleanup standards.

Veridian Environmental risk assessors employ one of the most innovative techniques in risk assessment in the development of defensible, health-based soil cleanup goals. A standard risk-based cleanup criteria calculation involves performing the risk assessment “backwards”; this calculation focuses on developing a cleanup goal based on the concentration in soil that would result in a cancer risk of one-in-one million or a hazard quotient of 1.0 (or other acceptable regulatory benchmark) that must be met by every soil sample on site. A more logical approach now embraced by regulations

involves performing a forward risk assessment iteratively. This iteratively-run risk assessment analyzes the data at the site and identifies what soils need to be remediated and to what concentration for the 95 percent upper confidence limit of the mean concentration (95% UCL) to result in a cancer risk of one-in-one million or a hazard quotient of 1.0. It is important to note that if an entire site were remediated to a universal soil concentration corresponding to an acceptable risk (as is normally performed), the new 95% UCL of the remediated site would fall well-below the cleanup goal, and significant and unnecessary “overcleaning” would have been performed. The delineation of areas requiring remediation is, therefore, not a point-by-point comparison of sampling results to a cleanup goal, but a comparison of the 95% UCL to either a cancer risk of one-in-one million (or other appropriate benchmark) or a hazard quotient of 1.0.

### **Multipathway Human Health Risk Assessments for RCRA Part B Incinerator Permits**

Obtaining a final RCRA Part B permit has become a critical component of the business plans of facilities using waste-derived fuels. The use of waste-derived fuels for the purpose of energy recovery serves a beneficial function in that it reduces the need for less environmentally friendly disposal methods. The US EPA’s current policy requires a multipathway health risk assessment (MPHRA) to be conducted in support of the facility’s permit application. The complexity of an MPHRA requires use of advanced modeling techniques, current toxicology information, and, at times, Monte Carlo simulations to assess the inherent uncertainty of the risk assessment methods.

US EPA’s *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (EPA/600/6-90/003) forms the basis for US EPA’s guidance regarding indirect pathway risk assessments. The exposure assumptions provided in the above-referenced document are conservative. For example, the US EPA wants an operator to assume that 100% of the milk consumed by a potential receptor is produced within a 50-km radius of the facility or that a water source could be a residential cistern, both of which would most likely be not true in today’s world. The degree of conservatism is compounded by the required use of the upper 95% confidence limit of each exposure parameter and is further exacerbated by combining those worse than worst case exposures across multiple exposure pathways (*i.e.*, direct inhalation, indirect ingestion of mother’s milk, ingestion of cow’s milk, ingestion of soil, ingestion of recreationally-caught fish, dermal contact with soil, *etc.*). In most cases, the regulatory default point estimate approach will provide risk estimates that are well beyond the upper 95th percentile.

Veridian Environmental has developed an effective methodology for performing indirect pathway risk assessments that may, in many cases, result in substantial cost savings compared with conventional approaches. Our methodology is based on the following processes:

- Limiting the potential list of chemicals of concern during the development of the Source Test Protocol using US EPA’s own guidance
- Using refined US EPA-approved air dispersion and deposition models

- Applying only those indirect pathways and exposure estimates that are relevant to a facility by an investigation of the area of impact

We believe this to be a cost-effective approach to fulfilling US EPA's indirect pathway risk assessment regulatory requirements. To maximize the cost effectiveness of this approach, it is critical that Veridian Environmental risk assessment and quality assurance (QA) experts be involved from the beginning of a project, the point at which the Source Test Protocol is developed.

### **Risk Communications**

Public participation in the risk assessment process includes public hearings on the initial findings at a site, involvement during the design of work and sampling plans, and the presentation of the final risk assessment. We recommend that you be prepared for the community's questions regarding all of these phases of a risk assessment. The best way to communicate risk is to start by performing scientifically-valid and defensible risk assessments followed by effective translation of hazard into non-technical, relative-risk terms. It is informative and advantageous to compare the hypothetical risks associated with a site to risks encountered every day by typical humans. Veridian Environmental risk communication personnel have experience in participating in public meetings and communicating risk in terms that are easily understood by the general public.

### **Consulting Personnel**

Veridian Environmental has organized a highly experienced professional staff to provide environmental support and consultation to our clients. Detailed descriptions of the key staff members are provided below. Professional Profiles that further detail the experience and qualifications of each member of the staff can be provided upon request.

### **Key Professional Staff**

#### **Charlotte R. Symms - President**

Charlotte Symms has over thirty-five years of business management and development experience, including fifteen years in the field of environmental consulting. She was a key member of the founding team of Environmental Standards in Valley Forge, Pennsylvania in 1987 and served as the corporate controller of Environmental Standards through 2001. One of her outstanding accomplishments as controller was the acquisition of land and development of the corporate headquarters building for Environmental Standards in 1996. She was also responsible for personnel, benefits, banking and finance, corporate insurance, and property management. Ms. Symms began working on business development for the west coast affiliate, Environmental

Standards Limited, Inc. in 2001 and acquired that company through a spin-off from the parent effective January 1, 2002 to form the new company of Veridian Environmental, Inc.

Ms. Symms received a B.A. degree in Communication Science with a minor in Chemistry from the University of Washington in Seattle and an MBA degree in finance from St. Joseph's University in Philadelphia. Her prior experience includes sales, marketing, accounting and management for various organizations including an import-export company, a close tolerance sheet metal manufacturer, non-profit hockey associations and as the sole proprietor of a bookkeeping and secretarial service. Prior to joining Environmental Standards, Ms. Symms served for five years as corporate business manager for a New Jersey health care company that provided mobile CT and MRI scanning to hospitals throughout the United States.

### **David A. Kashiwagi – Director of Information Technology**

Mr. Kashiwagi has over twenty-five years of combined Information Technology and Finance experience. His experience includes over ten years of full enterprise and departmental level project management in both the private and public sectors. The management of these projects included budget, procurement, staffing, communications, and project coordination. The larger of these projects included multi-million dollar budgets and utilized multiple departmental staff resources numbering into the hundreds. In addition, his experience includes a very strong Finance and Information Technology background. He was one of the first to be included in Sprint's corporate Project Management program.

While at Sprint, Mr. Kashiwagi served as Senior Project Manager in the relocation of the data center from Rancho Cordova, California to Dallas, Texas. His responsibilities included providing division and corporate management with change management status reports and the escalation of project issues that affected project critical path timeliness. He managed the reallocation and downsizing of human, infrastructure, and equipment resources during the transition phases of the project and independently managed the final stages of the data center and tape library equipment moves and disposition and tear down of the data center facilities.

He has been with Veridian Environmental since early 2004. His responsibilities include the oversight and management of the information technology environment for the company.

### **Kendra K. Curtis - Senior Chemist**

Ms. Curtis has eighteen years of analytical/quality assurance chemistry experience. Specifically, her experience includes analyzing and evaluating samples of various matrices for chemical and radiochemical parameters employing both instrumental and classical methods of analysis. As a Senior Chemist, Ms. Curtis's responsibilities include validation and evaluation of organic, inorganic, and radiological data deliverables for water and soil samples analyzed according to CLP, SW-846, US EPA, and US DOE protocols using national, regional, and state validation guidelines. In addition, Ms. Curtis has assisted in the development of internal radiological data

validation standard operating procedures and provided third-party review and critique of radiological data validation guidelines.

Prior to joining Environmental Standards, Inc., Ms. Curtis was a Senior Chemistry Technician in the nuclear power industry for eight years. She analyzed and evaluated samples for both chemical and radiochemical parameters using a wide variety of instrumental and classical methods. She also provided corrective action recommendations to operations personnel based on analytical data trends observed for various plant systems. In addition, she managed the Canberra gamma spectroscopy system, which included maintaining and troubleshooting the instrumentation, training new personnel on usage, and writing and revising associated standard operating procedures.

Ms. Curtis was also an analytical chemist for eight months. Her responsibilities included analyzing transformer oil and soil samples for polychlorinated biphenyls using SW-846 methodologies. In addition, she analyzed boiler water samples for inorganic parameters.

#### **F. Thomas Kwoka - Senior Chemist**

Mr. Kwoka has twenty-one years of analytical/quality assurance chemistry experience. Specifically, his experience includes analyzing and evaluating samples of various matrices for environmental and hazardous parameters employing both instrumental and classical methods of analysis. As a Senior Chemist, Mr. Kwoka's responsibilities include validation and evaluation of organic and inorganic data deliverables for water and soil samples analyzed according to CLP, SW-846, US EPA, and US DOE protocols using national, regional, and state validation guidelines. In addition, Mr. Kwoka has assisted in the development of internal laboratory standard operating procedures and provided third-party review and critique of data validation guidelines. He has extensive expertise in forensic chemical analysis of underground storage tank sites utilizing fuel fingerprinting of various well contaminants to determine off-site encroachment of another hydrocarbon fuel causing co-mingling of products

Prior to joining Veridian Environmental, Mr. Kwoka was the Laboratory Director for Acculabs, Inc. Davis, CA facility for four years. His responsibilities included the day-to-day business operations, personnel requirements, customer service, marketing and budgetary compliance, final data review and signing and overall laboratory Quality Assurance program. Mr. Kwoka is also skilled in the analysis of organic samples via GC and GC/MS instrumentation.

Mr. Kwoka was the Laboratory Manager for Herguth Laboratories from 1993 to 1998. Mr. Kwoka was responsible for all aspects of the laboratories operation, including production status, personnel management, technician training, methods review and development, special project management and instrument maintenance. Mr. Kwoka drafted the laboratories ISO 9000 Quality Assurance Program and saw the company through receiving final certification from Lloyd's Registry.

Mr. Kwoka was the Quality Assurance Manager and Chemlab Manager for CompuChem Corporation from 1986 to 1993. He was responsible for all aspects of the QA program, including SOP preparation, methods development, California DHS and EPA-CLP audits preparation. As Chemlab Manager, he was responsible for the Organic Extraction, Dioxin Extraction and Wet Chemistry departments. He managed the personnel for those departments, as well as scheduling work, reviewing data, standards preparation, methods development and hazardous waste disposal.

Mr. Kwoka's environmental work experience started at California Analytical Laboratories (currently Severn Trent Laboratories) in 1983. Mr. Kwoka was the Dioxin Extractions Supervisor. He performed all extraction and clean-up techniques for the analysis of 2,3,7,8-TCDD/TCDF and Cl<sub>4</sub> to Cl<sub>8</sub> Dioxins and Furans. Mr. Kwoka developed new techniques used in the analysis of biological samples for dioxins and furans. He also prepared standards for the GC/MS instruments.

#### **Scott W. Pieters – Quality Assurance Chemist**

Mr. Pieters has twenty years of analytical and quality assurance experience. He has five years of experience performing gas chromatography/mass spectroscopy (GC/MS) analyses for organic contaminants. Mr. Pieters has prepared quality standard operating procedures (SOPs), analyzed performance evaluation (PE) samples, and performed method detection limit (MDL) studies.

His experience includes over ten years at major U.S. EPA contracting laboratories performing analysis of semi-volatile organic samples using U.S. EPA CLP protocols; SW-846 Methods; Methods for the Chemical Analysis of Water and Wastes; and the U.S. EPA Series 500, 600, and 8000 Methods. He has also performed analysis on 33 percent of radiochemistry samples collected for the Chernobyl nuclear power plant incident in March 1985.

While working at McClellan Central Laboratory, he developed a method for the purification of cadmium with a new final mount form. At other facilities, Mr. Pieters performed extraction and cleanup of dioxin/furan semi-volatile industrial wastes, pesticides, herbicides and total petroleum hydrocarbon samples using various techniques. He is familiar with data generation, write-up, and review of various protocols.

He has been with Veridian Environmental since mid-2004. His responsibilities include the preparation and review of data validation reports.

#### **Venkat Rao, Ph.D., DABT - Toxicologist**

Dr. Rao is a Board-Certified toxicologist with 20 years of research experience in the fields of pharmacology and biochemistry with a specialized focus on the chemical-biological interactions

in hazard analysis and product performance evaluation. He is the Director of the Health Effects and Risk Analysis Practice at DynCorp. Dr. Rao brings a unique combination of highly specialized technical expertise in biomedical science with extensive experience in developing scientific tools and methodologies in the development of national policies in the areas of public health and environmental protection. As the program manager of the EPA's Antimicrobial Pesticide Efficacy Evaluation Contract with the Office of Pesticide Programs (OPP) and the Hazardous Waste Listing Program of the Office of Solid Waste (OSW) he is responsible for the technical direction, staffing, performance, and contract oversight. Dr. Rao was the project manager of the EPA's highly regarded Toxicant Interaction Program of the Office of Toxic Substances (OPPT) which was involved in highly specialized scientific tools (chemical structure-activity relationships) as the basis for analysis of chemicals for carcinogenicity under pre-manufacturing notification program (PMN).

Dr. Rao is the Program Director for the CDC-PHPPO Assessment of Laboratory Testing of Mycobacterium tuberculosis Program (under contract to DynCorp) and the lead for the CDC-PHPPO program on the performance evaluation and quality assurance of human molecular genetic testing (hMGT) under a joint program with Duke University and DynCorp (subcontract). These programs provide highly specialized laboratory system testing and analysis of critical importance to CDC mission in public health and disease prevention.

Dr. Rao has over 15 years of technical and project management experience covering an array of federal government agencies and program that include, All offices of EPA, U.S. Army, Centers for Disease Control and Prevention (CDC), Agency for Toxic Substances and Disease Registry (ATSDR), Department of Energy and the Joint Vaccine Acquisition Program.

As the Director of the Biosafety and Environmental Affairs of the DynPort Vaccine Company, Dr. Rao has the oversight of over 30 subcontractors on the microbiologic risks and safety of products under Joint Vaccine Acquisition Program of the U.S. Department of Defense. Dr. Rao leads a practice area with a focus on public health/medical informatics in infectious disease surveillance and hazard analysis (TB, HIV), risk assessment (Antimicrobial products and vaccines), and environmental health. These projects support development of the scientific framework, which would then form the elements of regulatory programs by the EPA, CDC and U.S. Army. Ongoing projects with the private sector include studies and assessment of in-door biological pollution, development of microbial resistance to Antimicrobial products, and industrial hygiene.

Dr. Rao was the project manager and principal investigator of a large analysis of the Army's health risk appraisal program, which contributed to a major programmatic review of the Army's health promotion program. As principal investigator, Dr. Rao has performed studies physiological monitoring for environmental exposure and environmental impact of demilitarization program. These studies were performed under contract to Army Operational Medicine Research Program, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM, Aberdeen PG, MD); Army Combat Casualty Care Program (USAMRMC), Chemical and Biological Defense Command (CBDCOM, Aberdeen PG, MD).

Dr. Rao received his Professional Bachelor's Degree in Pharmacy from Bangalore University (1980), Masters Degree in Pharmacology from Bangalore University (1983), a Masters Degree in Toxicology from Wayne State University (1988), and a Ph.D. in Biochemistry from the Indian Institute of Science (1988). He was Board Certified by the American Board of Toxicology in 1996 and Re-certified in 2000. Dr. Rao was formerly a Fellow of the U.S. National Academy of Sciences under the Young Investigators Program (1994-95), Fellow of the American Association for Advancement of Sciences Environmental Fellowship Program (1992), Robert C. Barnard Environmental Scholarship (1992), and 1985 Recipient of the Graduate Scholarship of the Rotary International Foundation (USA). Dr. Rao has numerous publications in peer-reviewed journals, technical reports, book chapters, and meeting proceedings in the areas of toxicology, pharmacology, and risk assessment.

### **Robert J. Fares – Senior Risk Assessor**

Mr. Fares has over twenty-five years of broad-based experience in the performance of exposure and risk assessments, statistical analysis, field sampling and monitoring, photogrammetric techniques, aquatic bioassay techniques, environmental fate and transport studies of chemical pollutants, acid deposition issues, report writing, literature reviews, data management, and project management. He has over eighteen years of experience in assessing multimedia exposures and associated risks for chemicals in the vicinity of hazardous waste sites, chemicals released from point sources (e.g., stacks, outfalls), contaminants released as nonpoint sources (e.g., vertical and lateral movement of pesticides resulting from different agricultural techniques), and chemicals released from commercially available products and furnishings during use by consumers. Mr. Fares has over thirteen years of experience in the development of experimental designs and computer models, sampling strategies, and statistical analysis of exposure-related data. Because of his familiarity with commercially available stochastic modeling software, Mr. Fares is currently a Beta tester of software produced by Palisade Corporation (@Risk, BestFit, Top Rank, and Risk View) and Decisioneering, Inc. (Crystal Ball). Mr. Fares is also very active in the Society for Risk Analysis (SRA) and served as Chair of the Exposure Assessment Specialty Group during 1994. In addition, he reviews papers submitted for inclusion in *Risk Analysis*, the SRA journal, and is on the committee responsible for selection of papers for the SRA annual meetings.

Mr. Fares has developed an innovative method to use stochastic modeling (e.g., Monte Carlo analysis) to back-calculate risk-based cleanup standards. The US EPA is considering including this procedure in forthcoming guidance documents for the estimation of ecological soil screening levels and probabilistic risk assessment. In addition, Mr. Fares is involved in using pareto analysis and stochastic modeling to assess the cost risks associated with renovating and putting into operation a Russian nuclear power plant in Eastern Europe.

Mr. Fares has been involved in numerous exposure and human health risk assessment projects. He served as acting chief of the Industrial Resources Branch for over one year. As Project Manager for a subcontract for the US EPA Office of Water Enforcement and Permits (OWEP) support, Mr. Fares directed and conducted Performance Audit Inspections in US EPA Region V

and oversaw the laboratory analysis of sludge samples from Regions III and V. Mr. Fares presented a discussion on the utility of Monte Carlo analysis in exposure and risk assessments at the US EPA Eighth Annual Risk Assessors Group Conference in Atlanta, Georgia, on May 5, 1993. He was the only contractor invited to speak at the conference.

### **Representative Consulting Experience**

The following project descriptions present a summary of example projects performed by the quality assurance chemistry staff of Veridian Environmental.

## **Chemistry Consultation and Quality Assurance Oversight**

### **Case Study One – Hawthorne Army Depot Bioremediation Project**

Veridian Environmental Participates as a team member in an ongoing bio-remediation soil composting project of explosive residues at former ordnance manufacturing sites within the Hawthorne Weapons Army Depot (HWAD) (formerly called the Naval Ammunition Depot) located at Hawthorne, Nevada. Twenty-four sites have been identified where explosive contaminated wastewater was disposed into catchment pits. Many of the sites contain more than one pit. Over seventy years of use, these pits have become contaminated with explosive impacted soils. The constituents of concern include ammonium picrate, HMX, RDX and TNT.

Phase 1 of the project involved review and approval of the Final Field Sampling Plan and the Final Quality Assurance Plan. As the Project Chemist for the site, Tom Kwoka, Veridian Senior Chemist, set up an on-site laboratory and trained field personnel in screening techniques for explosive residue by UV-VIS Spectrophotometry. Mr. Kwoka makes monthly visits to the HWAD site for laboratory and field auditing of personnel practices. Mr. Kwoka is a liaison between the two engineering firms performing the field work, three laboratories providing analytical analysis, the Army Corp of Engineers – Sacramento Office and environmental managers at the Hawthorne Army Depot.

Phase 2 of the project involves 100 per cent data validation of all laboratory data. Routine analyses include Explosive Residue using LC/MS/MS by SW-846 Method 8321 and Total Petroleum Hydrocarbons using GC/FID by SW-846 Method 8015B. Data is validated in accordance with National Functional Guidelines (EPA 1999), Section 1452 CDQMP (USACE) Version 1.08, and Appendix I “Shell for Analytical Chemistry Requirements” EM 200-1-3, Feb 01. Once data validation is completed, composted materials can then be returned to the excavated pits.

During data validation, a quantitation error was discovered. Through a more thorough investigation of the calibration data, an error in how calibration factors were being recorded was discovered. This corrective action allowed quantitated results that previously were above remediation goals to now fall below remediation goals. This saved the client having to perform additional bio-remediation cleanup and additional laboratory costs, as well as unnecessary downtime in the field.

At the beginning of the project, laboratory QC was failing at a 50% rate due to the unusual nature of the compost material. Through extensive work with the laboratories, matrix spike acceptance rates are now above 90%.

### **Case Study Two – Quality Assurance Activities for the Remedial Design Investigation of the MRI Superfund Site**

Veridian was retained by an engineering consulting firm to provide Quality Assurance Oversight on the Remedial Design Investigation at the MRI Superfund Site in Tampa, Florida. The MRI Superfund site is a former de-tinning and recycling facility and portions of its soil and groundwater are contaminated with elevated concentrations of metal analytes. Dr. Jill Henes of Veridian was named as the Quality Assurance Consultant for the project. Dr. Henes prepared a Quality Assurance Project Plan that was submitted to EPA for approval. It was accepted with a few minor corrections. Prior to the project, she conducted an on-site audit of the primary contract laboratory to identify and solve potential problems with laboratory methodology. Several conference calls amongst the primary laboratory, the QA Laboratory, the QA Officer and the QA Consultant were conducted to ensure comparability of the data and address any technical difficulties the labs encountered. Anticipating difficulties with the difficult groundwater matrix present in certain areas of the site, test samples were sent to the laboratory so that difficulties could be addressed. Because of ultra-low detection limits desired for the project, specially prepared sample containers were tested and used for the project. During the project, Dr. Henes helped the laboratories resolve any analytical issues that cropped up including how to address a precipitation problem in the mercury analysis. At the end of the project, a representative portion of the analytical data was subjected to a full level four validation. During this process, the quality of the data including its accuracy, precision, representativeness, sensitivity, completeness and comparability was assessed. The final work products were an audit report of the primary laboratory, Quality Assurance Reports on the data sets validated and a Report on the Quality Assurance activities conducted for the MRI Superfund Project which summarized all of the steps taken to ensure the quality of the data and address technical difficulties encountered during the project.

**Case Study Three – Data Validation, Quality Assurance Consulting and Data Management for the Phase II Environmental Site Assessment of the production areas at the Longhorn Army Ammunition Plant in Karnack, Texas**

Veridian was retained by an engineering consulting firm to provide quality assurance support on the Phase II Environmental Site Assessment of the production areas at the Longhorn Army Ammunition Plant in Karnack, Texas. Because of former ammunition production activities, portions of the sites soil and groundwater have been contaminated with organic and inorganic pollutants. A full suite of organic analyses including volatiles, semivolatiles, pesticides, TPH and explosives as well as low-detection metals analyses were conducted on samples from the site by the contract laboratories. Prior to project-start, Veridian reviewed and commented on the QAPP and worked extensively with the laboratories to ensure that the detection limits and quality control criteria incorporated in the QAPP would be sufficient to ensure the quality of the data. As part of the project, Dr. Henes coordinated the efforts of developing a method for safely analyzing the explosive CL-20 and this method was used to analyze project samples. During the project, Dr. Henes conducted conference calls with the laboratories and project personnel to address technical issues with the project activities. One hundred percent of the analytical data was subjected to a Level 4 or Level 3 quality assurance review. The final work products were complete Quality Assurance Reviews for all of the data sets produced by the laboratories and electronic database deliverables of the analytical data and the qualifiers codes.

### **Case Study Four - Water and Waste Water Treatment Facility**

Quality assurance and technical oversight were provided to a large California water treatment facility. A study was initiated by the facility because of suspected laboratory quality issues that could negatively affect its NPDES permit requirements. Tasks included a comprehensive audit of the laboratory; a review of the existing laboratory Quality Assurance Project Plan (QAPjP), field sampling protocols, and standard operating procedures (SOPs); and appropriate revisions to the QAPjP, protocols, and SOPs to meet ELAP and California DHS standards. This proactive approach to improving QA/QC within the facility resulted in a favorable regulatory audit and eliminated the risk of potential fines associated with permit-related issues.

### **Case Study Five - Steam Remediation Project**

Participation as a team member in a pilot project to remediate a former utility pole yard site for a California utility company. The project involved evaluation of analytical requirements to monitor the success of the steam process, selection and implementation of on-line monitoring technologies that were best suited to meeting project requirements, implementation of a quality assurance program for the project, and continued quality assurance oversight to ensure that results are definitive and of sufficient quality to meet regulatory scrutiny.

## **Laboratory Auditing/Corporate Laboratory Programs**

### **Case Study One - Petroleum Refinery Environmental QA Oversight**

A quality assurance officer and quality assurance oversight were provided for a large California refinery water quality laboratory and all approved subcontract laboratories. An audit was initiated to address potential discharge permit violations and laboratory deficiencies identified during a previous multimedia audit conducted by the EPA. The Department of Justice had been called in to investigate laboratory practices because of the serious nature of the potential violations. Tasks included a comprehensive laboratory audit, interaction with the refinery staff to develop a corrective action plan to improve performance, review and revision of SOPs, development and implementation of sample log-in procedures, and attendance at regulatory meetings to discuss impact of those improvements. It should be noted that during the follow-up audit, no serious deficiencies were identified. Management believes that all fines associated with the previously-identified laboratory deficiencies have been greatly reduced or eliminated entirely. Ongoing QA/QC oversight is also being provided to ensure that the current quality assurance plan meets state and other regulatory requirements.

## **Field Chemistry and Environmental Sampling**

### **Case Study One – Florin-Perkins Landfill, Inc. Project**

Veridian Environmental is the lead environmental management company for Florin-Perkins Landfill, Inc. (FPLI). FPLI manages two landfill sites, Florin-Perkins Landfill and Jackson Road Landfill. Veridian assists FPLI with their environmental issues related to landfill practices. Veridian is responsible for all semi-annual and annual groundwater monitoring programs which includes field sampling, groundwater elevation measurements, analytical data review, statistical data calculations and final monitoring reports. As part of Veridian's work, FPLI utilizes the expertise of Veridian's technical staff to perform one-time projects related to protecting groundwater quality objectives. Veridian has helped ensure that FPLI does not violate the Waste Discharge Requirements Orders issued by the California Regional Water Quality Control Board for both of the landfills.

### **Case Study Two – FEMA KSYC Radio Station Project**

Veridian Environmental participated as a team member in a groundwater monitoring and site investigation project for the Federal Emergency Management Agency's KSYC Radio Station located in Yreka, CA. The project involved sampling the local groundwater supply well for petroleum hydrocarbons. A nearby UST which provided fuel for the stations backup generator had recently been removed and contaminated soil was detected under the tank. As part of the project, Veridian helped perform a one mile radius search for sensitive receptor sites and both drinking water supply wells and irrigation supply wells. The search involved both a visual search and utilization of well installation logs on file with the local water board located in Red Bluff, CA.

### **Data Validation**

#### **Case Study One - DOD Radiological and Non-Radiological Analysis**

Data validation of samples collected from a US Air Force Base was performed. The samples were analyzed for both radiological and non-radiological parameters. The radiological analyses included gross alpha, gross beta, radium-226, and radium-228. It was discovered during data validation that the laboratory was unable to determine if the high radium-226 concentrations in some of its method blanks were due to laboratory control sample carryover. Suggestions were provided for ways in which the laboratory could reduce carryover from laboratory control samples and could ensure that the method blank results were valid. The laboratory reanalyzed all samples using these suggestions at no additional cost to the client.

#### **Case Study Two - Oak Ridge National Laboratory Waste Area Grouping**

As part of implementing the Phase II Remedial Investigation Work Plan for Groundwater at Waste Area Grouping (WAG 1) at Oak Ridge National Laboratory, 65 monitoring wells are sampled on a quarterly basis. WAG 1 is a 150-acre site at ORNL, which includes all of the former ORNL radioisotope research, production, and maintenance facilities; former waste management areas; and some former administrative facilities. Data validation of the samples being collected at this site was

performed. Sample analyses included both radiological and non-radiological parameters. The radiological parameters included gross alpha, gross beta, tritium, strontium-90, cesium-137, promethium-147, radium-226, radium-228, technetium-99, uranium-234/235/236/238, thorium-228/230/232, nickel-63, and cobalt-60. The procedures used for analysis include US EPA 900 series and HASL-300 methods.

During validation, it was discovered that the laboratory had neglected to perform a daily calibration verification on one of the instruments used for analysis and had not addressed this issue in the Case Narrative. The run logs had not initially been provided for the instrument in question, and it therefore was not apparent that the calibration verification had not been performed until the missing run logs were submitted.

### **Case Study Three - Oak Ridge K-25 Site Investigation**

As part of the radiological characterization survey of the areas at the Oak Ridge K-25 Site in Oak Ridge, Tennessee, surface-soil samples were collected from inactive waste sites to characterize the nature and extent of any radiological contamination within the boundary of each site. The K-25 Environmental Restoration Program intended to use the results of this survey to designate sites that require further characterization. Data validation of the samples collected at these sites was performed. The required sample analyses included technetium-99, gamma spectroscopy, neptunium-237, plutonium-238/239/240, uranium-234/235/236/238, and thorium-228/230/232. The procedures used for analysis included US EPA 900 Series and HASL-300 methods.

In our quality assurance reports to the client, suggestions were provided as to how the laboratory could improve its reporting methods and cumbersome sample numbering system. In addition, there were numerous deliverables missing from the majority of data packages provided; the data reviewer contacted the laboratory and was able to obtain all of the missing documents.

Our data validation conclusions provided the client with an assessment of the validity and reliability of their sample data. The client was then able to perform a more accurate characterization survey, and additional unnecessary characterization surveys may have been avoided. In addition, the client could use this information on the laboratory's reporting practices in selecting laboratories for future subcontracts.

### **Case Study Four - Aberdeen Proving Ground Investigation**

Data validation of samples collected from Michaelsville Landfill, Aberdeen Proving Grounds, Maryland was performed. The samples were analyzed for both radiological and non-radiological parameters. The radiological analyses included gross alpha, gross beta, and total uranium.

It was discovered during data validation that the laboratory was incorrectly calculating the minimum detectable activities (MDAs) for the gross alpha and gross beta analyses. The data reviewer contacted the laboratory, and all affected MDAs were recalculated and the analysis reports were

reissued. In some cases, the corrected MDAs were higher than originally reported by a factor of five.

The data validation conclusions provided the client with an indication of the validity and reliability of their sample data. Without such a complete review of the data, the client may not have learned that the MDAs initially reported for the gross alpha and gross beta analyses were incorrect.

## **Toxicology and Risk Assessment**

### **Case Study One – Former Electronic Manufacturing Site**

#### **Project: Indoor Vapor Intrusion Modeling**

An electronic equipment manufacturing site in Michigan had been used by an adjacent property as a process waste dump and landfill for 30 years. As a result, residual levels of halogenated chlorinated solvents were present in subsurface soils and groundwater at the site. At the time of the assessment, the property was zoned industrial; however, there was great potential for residential development. A risk assessment was performed to assess exposures to both industrial workers and potential future residents. The risk assessment concluded that direct contact scenarios were not posing unacceptable hazards and risks to potential human receptors because the chemical wastes were located in subsurface soils and the groundwater supply was not considered potable. However, volatile organic compound (VOC) vapor emissions from subsurface soil and groundwater and their subsequent infiltration into hypothetical buildings (both industrial and residential) constructed directly over affected areas were a larger concern at the site.

To assess indoor exposures to these VOC vapors, a sophisticated model was developed to estimate indoor air concentrations and the associated hazards and risks. The model, based on the works of Paul C. Johnson and Robert A. Ettinger, was being utilized at the same time by the Michigan Department of Environmental Quality to develop generic indoor air inhalation criteria. As a result of the development of this advanced vapor intrusion model and the use of site-specific soil parameters, the number of deed restrictions requiring the installation of passive, sub-foundation venting systems, such as those used for radon gas were dramatically reduced and the property has become much more attractive to future investors.

### **Case Study Two – Portland Cement Facility**

#### **Project: Multipathway Health Risk Assessment**

A multi-pathway health risk assessment (MPHRA) was conducted as part of the facility's RCRA Part B Permit requirements. The client, as part of an industry association, had negotiated a generic protocol with the Regional US EPA and the state environmental and health officials. The generic protocol (established for a group of cement kilns in the region) set out the elements to be included in a screening level or hybrid MPHRA but contained certain elements that were not appropriate for the client's site. The client was concerned that the use of inappropriate assumptions in the MPHRA would severely limit the facility's hours of operation, reduce the types of waste used in its fuel blending operations, or place unwarranted emission limitations on its stack emissions.

A site-specific MPHRA protocol was prepared and a MPHRA conducted in partial fulfillment of US EPA requirements to obtain a final Resource Conservation and Recovery Act (RCRA) Part B Permit for cement facilities burning or planning to burn hazardous waste. A review of the generic protocol (prepared by another environmental consulting firm) revealed a number of inconsistencies and errors in the modeling algorithms.

From the initial generic protocol, a hybrid MPHRA protocol was developed, which incorporated certain site-specific parameters with various US EPA-proposed default parameters to determine exposure; errors in algorithms proposed in the generic MPHRA protocol were corrected at this time.

The MPHRA was conducted using appropriate fate and transport modeling to derive exposure point concentrations. Chemical-specific emission rates were calculated from the facility's trial burn data.

The results of the MPHRA showed that the hypothetical maximally exposed individual was an adult home gardener. For each individual constituent of concern (COC) evaluated and for all chemicals taken together, both the cancer risk and the non-cancer health hazard were predicted to be within ranges acceptable to US EPA.

### **Case Study Three – Fortune 100 Company**

#### **Project: Type C Cleanup**

Site-specific, health-based soil cleanup criteria (Type C) were developed under provisions of Michigan Act 307 for a commercial site in Detroit. The risk assessment was approved by MDNR and was among the first Type C cleanup proposals to be accepted in Michigan. Risk assessment strategies were employed to minimize remediation requirements, which were originally estimated to cost \$12-18 million, but actually cost only about \$750,000. The cleanup standard for arsenic in soil at this industrial site was 46 mg/kg.

### **Case Study Four – Jefferson-Conner Industrial Revitalization Project**

**Project: Fate and Transport Model**

A detailed and rigorous contaminant fate and transport model was developed as part of an Environmental Impact Statement required for the development of the Jefferson-Conner Industrial Revitalization Project in Detroit, Michigan. Regulatory concerns surrounding environmental conditions at the property were prohibiting redevelopment of the property as the new corporate headquarters for the Chrysler Corporation and other office concerns.

Through implementation of remedial strategies developed, it was shown that soil contamination would not pose a significant acute or chronic health hazard. The remaining obstacle to redevelopment was an assessment of the effect residual chemicals could have on long-term groundwater quality.

To assess the effect of remedial action plan implementation, groundwater flow as well as the fate and transport of site contaminants were modeled. The site hydrogeology was particularly complex, not lending itself to the application of available modeling programs; consequently, a site-specific model was developed that would be more useful for the intended purposes of the data. Modeling included evaluation of contaminant transport through the vadose (unsaturated) zone and the saturated zone. Special consideration was given to the site-specific sorptive qualities of the soil and the natural oxidation, volatilization, and biodegradation processes existing at the site.

The report demonstrated that, even under the most conservative assumptions, the off-site impacts of facility compounds in groundwater would be insignificant. Thus, containment of off-site migrating groundwater was not necessary and was excluded from the final site remedy. Further, it was concluded in the fate and transport modeling report that capping, or installation of a lateral retaining or interception system for the groundwater, would result in no real, or even hypothetical, added environmental protection.

The results of the investigation were presented to the regional development authority for its review and consideration. The time and cost savings from the modeling effort resulted in project approval and construction of the new Chrysler World Headquarters. Tens of millions of dollars were saved in remediation costs, and the property development process was accelerated significantly, relative to initial project time estimates.

**Case Study Five – PRP Group Consisting of Fortune 500 Firms**

**Project: Region V Baseline Risk Assessment**

A review was conducted of the Baseline Risk Assessment prepared by a Region V US EPA contractor for a Superfund RI/FS and alternative and defensible risk-based cleanup goals were developed. This review was performed during the comment period prior to the signing of a US EPA ROD.

Comments were prepared detailing the unjustified excesses and departures from US EPA's own national guidance; these excesses and departures served to artificially exaggerate trivial risks into the

egregiously unrealistic risks posed by the site. It was very clear that the agency's contractor used assumptions and methodologies that guaranteed the extreme exaggeration of estimates of hypothetical risks at the expense of scientific credibility, as well as at the expense of sound, consistent, and defensible policy.

The discovery and documentation of these errors and deficiencies presented a defensible basis for an alternative ROD with reduced remediation costs at this CERCLA site by more than \$16 million.

### **Case Study Six – Fortune 100 Company**

#### **Project: PCB Contamination**

A former industrial manufacturing site with a 1,000,000-square foot building on-site was deeded to a large midwestern city. Subsequently, building interior surfaces were found to be contaminated with polychlorinated biphenyls (PCBs). The city decided that initiating an adversarial action against the former property owner under CERCLA might be a useful mechanism for resolving the environmental stigma now associated with the property. The former owner was forced to repurchase the property and undertook an extensive investigation followed by interim cleanup involving power washing of interior surfaces. At issue was whether the bulk of the building could now be demolished and used as construction fill on-site for development of a new manufacturing facility.

The Fortune 100 company commissioned a search of the records of the Michigan Department of Natural Resources (MDNR) to determine which consultant had negotiated the highest soil PCB cleanup goals under a Type C (site-specific) assessment as established in Michigan's Environmental Response Act (MERA). That search revealed that Environmental Standards had negotiated the highest cleanup goal on record in the State of Michigan. Environmental Standards was then retained to perform risk assessments on the proposed demolition and on-site burial of the building debris.

Risk assessments were performed for off-site airborne release during crushing operations; future direct contact with subsurface materials and groundwater vulnerability was also examined. In all cases, estimated risks were notably below target risks established by the state (under Part 201 Amendments which had just been signed into law). In addition, the risk assessment report included a detailed discussion on risk perspectives and noted that nearby residents would incur far less exposure to PCBs as a result of the building demolition than from the other commonplace exposures to PCBs in the diet and in urban air in general.

The cost savings that resulted from avoiding off-site disposal of the demolition debris was tens of millions of dollars.

## **Case Study Seven - Financial Investment Group**

### **Project: Toxicological Testing and Consumer Exposure Risk Assessment**

A review was conducted for an investment group to evaluate potential adverse impacts resulting from the consumer use or subsequent disposal of ceramic tiles manufactured from integrated spent pot liner (SPL) material. The aluminum SPL material was proposed to be recycled as a feedstock in the production of glass materials that may be used in the production of ceramic tiles at a SPL vitrification plant to be located in Canada.

Appropriate environmental laboratory testing methods were evaluated and selected to provide data on constituency of the material and potential leachability of tile constituents. Laboratory tests were conducted in parallel with two competitive brands of unglazed floor tiles currently in use by consumers. Leachability tests undertaken included the American Society for Testing and Materials (ASTM) Water Leaching Test and the Procedure d'Evaluation des Caracteristiques de Dechets Solides et Boues Pompables. Data examined in this investigation indicate that this vitrified material should not pose an environmental problem if landfilled in large quantities.

Maximum concentrations of detected analytes in leachates were also evaluated in terms of potential adverse human health effects as a consequence of consumer use. Worst-case assumptions were employed. For example, in an interior kitchen application, it was assumed that all counter-top and floor tiles had lost their protective glaze and that exposure occurred daily to wet tile surfaces for adult and toddler exposure scenarios. Using recognized risk assessment methodologies developed by US EPA, the resultant hypothetical exposures identified were two or more orders of magnitude below conservatively derived acceptable daily exposure levels. This study demonstrated that a very limited possibility exists for an adverse health outcome as a consequence of long-term exposure to elements detected in tile leachates identified in this study. The findings of this study provided the investment group with a level of comfort regarding the consumer use of this product.