April 10, 2014

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
STRATA ENERGY, INC.	)	Docket No. 40-9091-MLA
	)	
(Ross In Situ Recovery Uranium Project)	)	ASLBP No. 12-915-01-MLA-BD01
	)	

AFFIDAVIT OF KATHRYN JOHNSON CONCERNING
DRAFTING ERROR IDENTIFIED BY JOINT INTERVENORS
IN THE STRATA ROSS FSEIS

I, Kathryn Johnson, do hereby state as follows:

1. My name is Dr. Kathryn Johnson. I am a geochemist employed as a contractor for the U.S. Nuclear Regulatory Commission (NRC) by Attenuation Environmental Company for the last three years as a subject matter expert in geology and water quality. My statement of qualifications is attached to this affidavit.

2. In my capacity as a contractor for the NRC, I assisted in the preparation of portions of the NRC staff's draft and final supplemental environmental impact statements for the proposed Ross *in situ* uranium recovery project. The sections to which I made significant contributions are Sections 2, 3.4, 3.5, 4.4, 4.5, 5.6 and 5.7.

3. The NRC staff issued the Final Environmental Impact Statement (FSEIS) for the proposed Ross project on February 28, 2014. On March 31, 2013, the Joint Intervenors filed a motion to migrate their admitted contentions to the Staff's FSEIS or, in the alternative, to amend their admitted contentions to apply to the FSEIS, as well as leave to admit two new environmental contentions. Their submission was accompanied by a declaration of Drs. Richard Abitz and Lance Larson. In their motion and in Drs. Abitz's and Larson's declaration, the Joint Intervenors identify an error in Section 4.5.1.3 of the FSEIS.

4. Section 4.5.1.3 of the FSEIS includes a new discussion of historic approvals of

aquifer restoration activities by the NRC. The FSEIS describes three facilities that received NRC's approval for aquifer restoration activities and the groundwater quality parameters in those wellfields for which the NRC approved restoration. In the FSEIS's description of one of those facilities, Crow Butte Wellfield 1, the NRC states that "[t]he NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre-operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001)." As Drs. Abitz and Larson note, based upon the information in the source document, the relevant portion of that statement should instead describe the concentration for uranium as 18 *times* the post-licensing, pre-operational uranium concentration. The use in error of the term "18 percent" in the FSEIS was a drafting mistake that does not affect the NRC staff's analysis of the potential impacts of the proposed action on restored groundwater quality of the ore-zone and surrounding aquifers, or the staff's conclusion that such potential impacts would be SMALL.

5. To confirm that the drafting error did not affect the FSEIS's analysis or conclusions, I reviewed the underlying documents on NRC's approvals of the restoration of the three facilities described in Section 4.5.1.3. As a result of my review, I would like to offer further clarifying information concerning the FSEIS's description of Crow Butte Wellfield 1.

6. The document referenced in the FSEIS as "Crow Butte Resources, 2001" is a response to a request from the NRC staff for additional information to support Crow Butte's request for approval of groundwater restoration in its Wellfield Unit 1.[1] In that document, dated August 24, 2001, Crow Butte provided data for each monitored constituent as an average concentration for all restoration wells over a six-month monitoring period. Crow Butte reported that 17 water quality constituents were returned to levels that met the primary restoration goal of below the baseline average concentration, and 10 constituents, including uranium and radium-

[1] Letter from Stephen P. Collings, Crow Butte Resources, Inc., to Melvyn Leach, NRC (Aug. 24, 2001) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML012710072).

226, met the secondary restoration goal of concentrations below the UIC permit standards. Crow Butte reported the stabilization average water quality level for uranium as 1.73 mg/L, compared to a baseline water quality level of 0.092 mg/L. Thus, the average level of uranium in Wellfield 1 after restoration efforts was approximately 18 times the baseline level.

7. By letter dated March 29, 2002, the NRC staff denied Crow Butte's request for approval of Wellfield Unit 1 restoration. The letter and accompanying technical evaluation report stated that the basis for the NRC's denial was the agency's concern about whether the concentration levels for the monitored constituents would remain below levels protective of human health and the environment. Specifically, Crow Butte's data suggested that six groundwater constituents, including uranium and radium-226, showed strongly increasing concentration trends over the six-month stabilization period. The NRC directed Crow Butte to resume stability monitoring and to provide the results of the monitoring to the NRC.

8. By letter dated October 11, 2002, Crow Butte provided the additional groundwater monitoring data requested by the staff. Crow Butte reported that the average wellfield groundwater concentrations of uranium during the 1999 stabilization period ranged from 1.09 to 2.33 mg/L, with an average concentration of 1.73 mg/L. During the 2002 additional monitoring period requested by the NRC, the average groundwater concentrations of uranium in six representative wells ranged from 1.6 to 1.8 mg/L, with an average concentration of 1.66 mg/L. The last three sets of measurements recorded an average concentration of approximately 1.6 mg/L. On February 12, 2003, the NRC staff concluded that the additional stability monitoring data submitted by Crow Butte in the October 11, 2002 report demonstrated that restoration of Wellfield Unit 1 was acceptable and resulted in constituent levels that would remain below levels protective of human health and the environment, in accordance with 10 CFR 40.31(h) and 10 CFR Part 40, Appendix A, Criterion 5F. As described in Section 4.5.1.3 of the Strata Ross FSEIS, the NRC staff also changed the applicable condition in Crow Butte's license to require additional stability monitoring.

9. In developing the discussion of historic approvals of aquifer restoration activities for the proposed Ross project FSEIS, the reported uranium concentration in Crow Butte's 2001 report, 1.73 mg/L, was used instead of the reported uranium concentrations in Crow Butte's October 11, 2002, report because the 2001 report presented an average value that included all of the wells being monitoring for restoration for comparison to the post-licensing, pre-operational uranium concentration of 0.092 mg/L. The stability monitoring data provided by Crow Butte after the NRC denied their initial request for aquifer restoration (Figure 1 of their October 11, 2002 report), is from only six representative wells. The FSEIS's description of approved uranium concentration restoration values for Crow Butte Wellfield 1 could have used either the 1.66 mg/L average concentration value or the final 1.6 mg/L concentration value reported by Crow Butte in 2002 for comparison to the post-licensing, pre-operational baseline uranium concentration value, instead of the 1.73 mg/L value reported in 2001. However, the 2002 values are still approximately 18 times greater than the baseline concentration value of 0.092 mg/L (18.0 and 17.3 times greater, respectively). Therefore, no material difference has resulted from the use of the 2001 value in lieu of either of the 2002 values.

10. Ultimately, in approving Crow Butte's request for wellfield restoration, the NRC determined that the uranium concentrations measured at the close of restoration were protective of human health and the environment. Further, it is important to note that when the NRC denied Crow Butte's initial request, the NRC's concern was not about whether the reported constituent levels were protective of human health and the environment, as the NRC staff stated that the groundwater quality in Wellfield 1 had been restored to the baseline concentrations or the secondary restoration standards established by license condition (uranium less than 5 mg/L, met the secondary standard) – but rather, whether the levels of uranium and other constituents in the groundwater would remain below that level in light of an apparent upward trend in the concentration of six of those constituents. Therefore, the fact that the NRC initially denied Crow Butte's request for approval of wellfield restoration after the 2001 value for uranium was

reported does not impact the FSEIS's description, analysis or conclusion regarding historical experience with restoration of Crow Butte Wellfield 1.

11. In the course of my review, I also identified errors in the reported numerical values contained in the following statements: "At the time the NRC approved the restoration of Wellfield 1 at the Crow Butte facility, the wellfield averages for 30 of the 37 water-quality parameters were returned to either post-licensing, pre-operational levels concentrations or Wyoming's Class I Domestic Use standards and the EPA's Drinking Water MCLs. Concentrations of calcium, carbonate, potassium, magnesium, and molybdenum, for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 60 percent." The corrections to these statements are contained in the following paragraph:

12. Crow Butte's NRC license initially required the analysis of 35 groundwater constituents to determine pre-operational groundwater quality (Crow Butte Resources, 2000)[2]. The NRC amended Crow Butte's license in 2001 to modify the constituent list in License Condition 10.3B to duplicate the constituents contained in the Restoration Table in CBR's Class III UIC permit issued by the NDEQ. Because of this amendment, several constituents that were originally discussed in Crow Butte's first restoration report were no longer considered restoration parameters by the NRC. The 27 constituents listed in Tables 2 and 3 in Crow Butte Resources (2001) are those in the modified parameter list contained in that license amendment (Crow Butte Resources, 2001). The average concentrations of 34 constituents (the required 35 constituents minus temperature) at the end of restoration compared to baseline concentrations are reported by the NRC in Table 5 of NUREG/CR-6870, which discusses the geochemical issues in groundwater restoration at ISR facilities (NRC, 2007). Of the 34 constituents, 23 were returned to post-licensing, pre-operational concentrations. The average concentrations of two

[2] Letter from Stephen P. Collings, Crow Butte Resources, Inc., to John Surmeier, NRC (Jan. 14, 2000) (ADAMS Accession No. ML003677825).

constituents, arsenic and iron, were returned to levels lower than the Wyoming's Class I Domestic Use standards, which for these two constituents are identical to the EPA's Drinking Water MCLs and Standards in the UIC Permit from the State of Nebraska NDEQ held by Crow Butte (Crow Butte Resources, 2001). The average concentration of one constituent, vanadium, was returned to the Wyoming Class II standard for agricultural use, which is lower than the UIC Permit Standard. Concentrations of six constituents – alkalinity, bicarbonate, calcium, potassium, magnesium, and molybdenum – for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 65 percent.

13. The above correction to the description of groundwater quality in Crow Butte Resource's Wellfield 1 at the time of restoration approval does not affect the FSEIS's characterization of NRC-approved historic restoration values or its conclusion that the potential impacts of aquifer restoration to groundwater quality of the ore-zone and surrounding aquifers would be SMALL. It remains the case that most of the groundwater quality parameters in wellfields for which the NRC has approved restoration, as described in the FSEIS and in this affidavit, were either returned to post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few parameters that exceeded these standards, the concentrations in the groundwater did not change the class of use and did not represent a potential impact to the groundwater outside the aquifer-exemption boundary.

11. I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.

Executed in Accord with 10 CFR 2.304(d)

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Kathryn Johnson, Ph.D.

Executed in Hill City, SD
this 10th day of April, 2014

NAME: **KATHRYN O. JOHNSON, Ph.D.**
24054 Palmer Gulch Road
Hill City, SD 57745
605.574.2024; 605.391.9955; kjohnson@johnsonenviro.com

EDUCATION:
Studies in Science, Technology and Public Policy, George Washington University, 1997.
Ph.D. 1986. Geology (Thesis: Geochemical Model of the Migration of Trace Metals from Uranium Mill Tailings) SD School of Mines and Technology, Rapid City, SD.
M.S. 1977. Chemistry, Iowa State University, Ames, IA.
B.S. 1975. Chemistry and Mathematics, Black Hills State, Spearfish, SD.

APPOINTMENTS:
2005 to present gubernatorial appointment to the SD Board of Regents.
Ten years of service on the SD Board of Minerals and Environment, 1995-2005.
Appointment by Senator Daschle to the Congressional Commission on the Advancement of Women and Minorities in Science, Eng & Tech, 1998-2000.
Member of Nat'l Research Council Comm. on Women in Science & Eng, 2000-2002.
Bush Foundation Leadership Fellow 1997.

ASSOCIATIONS: South Dakota Association of Environmental Professionals

CAREER SUMMARY:

Over 30 years of environmental consulting specializing in geochemistry, geohydrology, contaminant fate and transport, mass balance, and partitioning of inorganic and organic compounds between water, solid and air phases as applied to site investigations, permitting, treatment, technology development and remedial designs. As project manager consistently completed projects within budget and satisfied clients. Further experience includes: project and program planning, geochemical modeling and speciation analysis; data collection and analysis; evaluation of remediation technologies, compliance planning; development of investigative and remediation strategies with the EPA and State Agencies; expert testimony; and training. Projects have involved, soil, groundwater and surface water, mine waste, hazardous and solid waste, petroleum, agricultural waste, radioactive materials, landfills, and underground storage tanks. Dr. Johnson has provided support in legal disputes of liability, cost allocation, insurance coverage, and toxic tort. She has served as an expert witness and given trial testimony. Technical experience includes:

- Assessment of laboratory and field data to interpret fate and transport mechanisms and pathways that have occurred from sources through unsaturated soils, groundwater and air.
- Geochemical sampling, chemical analysis, data interpretation and modeling with PHREEQE and MINTEQ to characterize fate and transport of contaminants through environmental systems including contamination sources, speciation of contaminants, groundwater, surface water, and lakes.
- Provided technical expertise to preparation of Environmental Impact Statements, Environmental Assessments under NEPA regulations.
- Coupling technical information with policy considerations to develop project and program plans.
- Application of geochemistry to engineering to develop cost-effective, innovative technologies for remediation, waste treatment, minimization and reuse.
- Coupling geochemistry of metals, organic compounds, and nutrients with hydrology for contaminant transport analysis, watershed assessment, water quality evaluation, and groundwater and soils remediation.
- Numerical analysis and geo-statistics to determine distribution and relationships among constituents in contaminated media and association to sources and probabilistic confidence and uncertainty.

Project experience includes both government and private clients. Project scopes have ranged from highly specialized geohydrological and geochemical problems to major interdisciplinary programs. Expertise includes a working knowledge of the Environmental Protection Agency regulations as well as many state environmental regulations. Authored over 40 articles and reports on environmental and geochemical aspects of hazardous wastes, mining wastes, uranium mill tailings, radioactive waste and industrial processes.

WORK EXPERIENCE:

1990 - Present. JOHNSON ENVIRONMENTAL CONCEPTS, Rapid City, SD
OWNER/PRINCIPAL - Provides consultant services in geochemistry, geohydrology and environmental science related to environmental impacts, remediation technologies, waste management, regulatory analysis, and permitting. Representative projects include:

5RMK International, Boise ID. In role of Director of Environmental and Permitting Services will market and organize specific project opportunities in 5RMK's Resource Development Market, primarily in the Mining, Oil & Gas and Water Resource sectors.

United States Nuclear Regulatory Commission. Under an employment contract with Environmental Attenuation Company, serving as task manager and technical specialist for the preparation of NEPA documents; specifically supplemental environmental impact statements and environmental assessments for uranium in-situ recovery projects in Wyoming.

Davis Graham & Stubbs. – Provided litigation support for case involving a historic mining and milling site.

RESPEC, Inc. – Provided support to the Jurong Rock Cavern Project with PHREEQC modeling of interactions of seawater injected into bedrock and recommendations for water treatment.

Confidential Client. Providing technical management of an effort to develop and permit a gold resources project.

United States Department of Justice. Provided litigation support as a designated expert on a case involving historic phosphate mining wastes located in southeast Idaho.

Enviroscientists, Inc. – Provided geochemistry support to the initial planning for a NEPA Environmental Impact Statement for the proposed Simplot Dairy Syncline phosphate mine in SE Idaho for Bureau of Land Management.

Sunoco, Inc. and Beveridge and Diamond, P.C. – Provided technical support as a designated expert in litigation involving fate and transport of volatile organic compounds through a fracture controlled hydrological system.

TerraGraphics Environmental Engineering, Inc. Providing geochemical expertise in support of Idaho Department of Environmental Quality's development and evaluation of remedial actions for source control, and water treatment in the Coeur d'Alene Basin per the Records of Decision for the Bunker Hill Mining and Metallurgical Complex Superfund Site.

Millennium Science & Engineering. Supporting Idaho Department of Environment Quality and US Forest Service by reviewing EIS documents, permit assessments, fate and transport modeling, and laboratory test methods of selenium geochemistry in phosphate mining in Southeastern Idaho.

Private Clients and Small Business Administration. – Conduct Environmental Site Assessments for property transactions.

Beveridge and Diamond, P.C. Evaluation of remedial actions for source removal and plume control for migration of chlorinated solvents through groundwater.

RESPEC, Rapid City, SD. Assessed groundwater geochemical data and development of treatment protocols for a water circulation design for underground gas storage facilities.

Private Clients, Rapid City, SD. Sampled and assessed leaded-paint based contamination. Assessment of groundwater geochemical data for transport of petroleum hydrocarbons for the purposes of land development.

Bechtel SAIC Company, LLC, Las Vegas NV. Served as a Technical Specialist on a Quality Assurance Audit of the Physical and Chemical Environment Model of the Yucca Mountain Performance Assessment.

Sunoco, Inc. and Beveridge and Diamond, P.C. Provided technical litigation support relating to Horse Heaven mercury mine in central Oregon.

RESPEC, Rapid City, SD. Provided support as a technical specialist to BECHTEL SAIC COMPANY, LLC on the Yucca Mountain Site Recommendation and License Application as a nuclear waste disposal site, including Independent Assessment of TSPA-LA, Model Validation Status Review, Model Surveillance BQA-SI-04-048, independent technical assessment of model development and validation, and Performance-Based Audit of Analysis Report Products and Processes.

Bechtal BWXT Idaho, Idaho Falls ID. Provided technical support to the INEEL Regional Mine Waste Initiative. Organized a symposium of active and passive treatment technologies likely to play a role in water remediation in the Coeur d'Alene Basin. Provide expertise to study of groundwater source terms for Canyon Creek in Coeur d'Alene Basin.

Idaho Department of Environmental Quality/TerraGraphics. On behalf of the Coeur d'Alene Basin Commission prepared work plans for the implementation of the Record of Decision.

South Dakota Schools of Mines and Technology, Rapid City, SD – Instructor of Chemistry for two semesters.

Homestake Mining Company, Lead SD - Conducted Environmental Site Assessments on facilities located at the historic Yates shaft in Lead South Dakota.

Sunoco, Inc. and Beveridge and Diamond, P.C. - Evaluated remedial technologies and developed expert opinions on the environmental impacts of metals and acidity in surface water from past and recent operations of the Summitville Mine in Colorado.

Idaho Department of Environmental Quality - Managed and developed the State's remedial plan for the historic mining impacts to the Coeur d'Alene River Basin including water quality of metals and nutrients, tailings distribution, and health exposures from lead in soil. Responsibilities also include working with EPA throughout the RI/FS process, selection of the proposed plan and arriving at a Record of Decision. Designed and implemented a community outreach process to define consensus and common ground of a remedial plan. Applied geochemical principals to the development of innovative remediation technologies for removal of metals from water

South Dakota School of Mines & Technology, Rapid City, SD - Appointment for Spring 2001 of Instructor in Civil and Environmental Engineering, teaching Principles of Aqueous/Solid Environmental Remediation.

Property Owners - Developed plans for investigation and remediation of soil and water contaminated with metals, pesticides and hydrocarbons and managed sampling, removal and disposal.

Eastern Research Group, Lexington MA. Peer review of the revisions by the US EPA to the geochemical model, MINTEQA2, developed in support of the Hazardous Waste Identification Rule.

Holme Roberts and Owen, Denver CO. Provided geochemical expertise and expert testimony on mobility and transport of petroleum chemicals in the soil and groundwater at Southern Pacific RR yards for legal dispute involving allocation of damages from remediation costs.

Rand Corporation, Washington DC. Provided support to the White House Office of Science & Technology Policy on analysis of air quality models and modeling results used by EPA to predict fate and transport of ozone, particulate matter, and hazardous air pollutants, for setting regulatory policy.

White House Office of Science & Technology Policy, Washington DC. Fall 1997. Completed a 4-month internship on environmental policy with emphasis on air pollutants. Reviewed and analyzed EPA's Mercury Study Report to Congress including the emissions inventory, speciation and the modeled fate and transport.

Equus Farms, Denver CO. Applying geochemical expertise to analysis of the processes controlling the pathway of nitrogen and phosphorus in liquid hog manure applied to agricultural soil in the South Platte River Watershed. Provided testimony to the Colorado Water Quality Control Commission.

RE/SPEC Inc., Rapid City, SD and Sofergaz, Houston, TX - As part of a feasibility assessment for underground petroleum storage, conducted geochemical analysis on clays within bedded salt to evaluate chemical reactions affecting the clay mineralogy when subjected to brine.

Morrison-Maierle Environmental Corporation & Montana State Department of Lands, Helena, MT. Responsible for the geochemical component of the Environmental Impact Statement for the Seven-Up Pete Joint Venture's MacDonald Gold Mine Project. Coupled geochemistry, hydrology, and limnology in developing a model of the future pit lake chemistry.

Glanker Brown, Memphis, TN. Provided geochemical expertise to Velsicol Chemical Company and the City of Memphis in litigation for recovery of remediation costs of a CERCLA landfill site.

IMC Agrico Company, Orlando, FL. Geochemical modeling of the chemical reactions occurring between phosphoric acid wastes and the Floridan aquifer system.

Brobeck Phleger & Harrison, San Francisco. Provided geochemical expertise and expert testimony on the mobility and transport of pesticides and other organic chemicals in the soil and groundwater at the Rocky Mountain Arsenal in support of their representation of Shell Chemical.

S.M. Stoller Corporation, Boulder, CO. Reviewed hydrologic and geochemical data collected by Sandia National Laboratories for the Waste Isolation Pilot Plant against established technical criteria to determine data quality relative to compliance for certification of the facility.

GEOTEK Engineering, Sioux Falls, SD. Evaluate mobility of constituents from a solid waste landfill to select parameters, develop sampling protocol and statistical methods for a groundwater monitoring program

Rust Environment and Infrastructure, Minneapolis, MN. Provide permitting support for drilling and sampling at Ellsworth Air Force Base, SD.

Plains Manufacturing, Rapid City, SD. Investigated creosote contaminated soil, managed remediation activities, and arranged for disposal of hazardous wastes and contaminated soil.

Amoco Oil Company, Bairoil, WY. Evaluation of the rate of pyrite oxidation from pyritic oily sludges in carbonate soils in waste disposal area, as part of a permit for landfarm disposal.

Wyoming Refining, Denver, CO. Calculated the planning distance for a hypothetical release of petroleum products from the Ellsjet facility into the surface water system. Completed regulatory requirements for a contained release.

Preston Gates and Ellis, Seattle, WA and Burlington Northern Railroad Overland Park, KS. Provided technical support for a legal dispute relating to allocation of remedial costs among several potential PRPs. Used statistical methods, numerical analysis of bulk chemical data, and scanning electron speciation information to develop a model of distinct signatures of various metallurgical waste materials contributing lead and other metals to contaminated soil.

Fall River Properties, Fall River County, SD. Geohydrological characterization for permit application for ash disposal facility, including installation of groundwater monitoring wells, data interpretation, reporting and negotiations with SD regulatory agency. Evaluated the variable hydrologic conditions of saturation and unsaturation in shale rock and the interaction between surface and shallow subsurface water.

Various Underground Storage Tank Projects, SD. Conducted site assessments defining the extent of contamination of soil and water, developed corrective action plans and managed soil excavation. Efforts have included borings for soil sampling, vapor monitoring, sampling for lab analyses, and data interpretation.

Property Owners and Financial Institutions, SD. Environmental Site Assessments and audits of operations for permitting and real estate transactions.

Burlington Northern Railroad Overland Park, KS. Created a data base of Superfund Sites which have the cleanup remedies established and calculated the relative risk based upon frequency of occurrence and cost.

Holme Roberts and Owen, Denver, CO AND Cotter Corporation, CO. Geohydrological assessment of ongoing remediation activities to cleanup uranium and molybdenum from soil and groundwater for toxic tort litigation associated with Cotter's uranium mill in Canon City, CO. Provided expert testimony to a jury trial in Cotter's defense.

Power Engineering & Barrick Goldstrike Mines, Inc. NV. Modeled the carbonate equilibria as a function of temperature and pressure in water pumped from a mine.

Morrison Knudsen Corporation, Denver, CO. Geochemical modeling by PHREEQE analysis of data from leaching studies and statistical analysis of bulk chemical data to predict the metal bearing species in slag and tailings and to assess mobility of Pb, As, Zn, Cd from slag at the California Gulch Site for Denver & Rio Grand Railroad.

Blake Cassels and Graydon, Toronto, Canada AND International Minerals & Chemical Corp. (Canada) Ltd. Geochemical modeling by PHREEQE of salt mineral dissolution from IMC's Saskatchewan Potash Mine in support of litigation for mine and resource loss. Evaluated the equilibrium conditions between salt minerals and brine and calculated the concentrations of major cations and anions in the brine as a function of the salt minerals in the rock.

EnviroSearch, Salt Lake City, UT. Geochemical modeling by PHREEQE of chromium speciation and mobility in different pH and Eh environments in shallow aquifer in Salt Lake valley. Adapted PHREEQE to consider the naturally occurring high ionic strengths of the groundwater in the Salt Lake Valley.

Jacobs Engineering Group, Inc. (US EPA Subcontract). Provided oversight of collecting over 4500 soil

samples and of the arsenic analysis by field XRF for the Whitewood Creek, SD Superfund Site. Developed a database for reporting of arsenic concentrations to plan soil remediation of sediments along Whitewood Creek, SD by Homestake Mining Company.

Hathaway, Speight & Kunz AND Sinclair Oil Company, Cheyenne, WY. Geohydrological assessment of transport of organic compounds from Sinclair's petroleum refinery in support of toxic tort litigation associated with contaminated groundwater in Brookhurst, WY.

1986 - 1990. MORRISON KNUDSEN ENVIRONMENTAL SERVICES, Boise, ID.

PROJECT MANAGER/GEOCHEMIST - Managed geoscience department of about 15 professionals. Managed projects with all aspects of environmental audits, regulatory reviews, investigations, studies, design and construction for waste management projects. Directed project controls and procedures required to manage the cost and schedule aspects of a project and ensures all quality assurance/quality control and health and safety requirements are met. Experienced in managing and supervising MK personnel and subcontractors. Examples of relevant projects while at Morrison Knudsen:

Weldon Spring Site Remedial Action Project - U.S. Department of Energy. Managed the technical efforts of the RI report, including the analysis of hydrology, water quality and geologic data. Key contaminants include radionuclides from uranium processing wastes and organic compounds from munitions production. Focus was on transport and migration through fractured limestone bedrock within a complex geochemical environment.

Mixed Waste Landfill Groundwater Assessment - ESCO, Portland, OR. Assessment of groundwater contamination by metals from a landfill of foundry wastes located in an industrial park with several other sources of contamination. Provided guidance to client on strategies for dealing with regulatory agencies.

Uranium Mill Tailings Remedial Action Project - U.S. Department of Energy. Provided geochemical analysis for groundwater protection and restoration aspects of the design criteria for remediation of several sites. Modeling focused on transport and retardation of redox-sensitive metals and sulfate. Developed design of geochemical barrier of peat and clay to retard certain metals by precipitation as chemically reduced forms as well as adsorption.

Bergsoe Metals, St. Helens, OR - Bogle & Gates, Seattle, WA. Provided consulting services to Bogle and Gates representing East Asiatic Corporation in their ownership position in a secondary lead smelter. Preformed sampling of sediments for lead, interpreted soil and groundwater chemical data and assessed waste management and water treatment options.

Underground Storage Tank Project - Wyman Gordon, Chicago, IL. Managed a project in Illinois to remove and abandon in-place nine underground storage tanks containing petroleum products ranging in volume from 3,000 gallons to 210,000 gallons.

Litigation Support - Tennessee Valley Authority. Provided expert testimony on groundwater contamination from uranium mill tailings in New Mexico. Modeled leaching from source, transport, and retardation as well as groundwater restoration by a pump and reinjection system.

Titanium Production Plant Waste Treatment and Disposal - International Titanium, Inc, Moses Lake, WA. Project Manager for a comprehensive remedial investigation, feasibility study, remedial design and remedial action for the closure of a titanium plant in Moses Lake, Washington. The production plant involved mixed hazardous and low-level radioactive waste materials. Managed environmental site characterization of groundwater and soils on site. Directed the design, evaluation, construction and operations of chemical processes that eliminated the chemically hazardous nature and reduced the volume of low-level radioactive waste by ten.

1979 - 1986. GECR, INC., Rapid City, SD. President/Principal Consultant. Applied geochemistry and hydrology to site characterization and waste management in the study of environmental impacts from uranium mill tailings, high-level nuclear waste, and other groundwater contamination sources associated with the mining industry. Extensively used the geochemical computer code, PHREEQE in computer modeling of thermodynamic mineral reactions, and trace metal and radionuclide mobility. Prior experience included the involvement in development of analytical procedures for organic compounds. Consulting projects for industrial clients included:

Geochemical evaluation of contamination from a uranium mill site designated by EPA and CERCLA and participation in technical settlement discussions between the Cotter Corporation and the Colorado State Department of Law.

Evaluation of mobilization of toxic elements and water quality in aquifers disturbed by mining activities. Modeling the mobility of toxic metals released from cyanide milling ponds.

Involvement with Department of Energy Projects included:

Investigation of the geochemical character of shale as a potential repository for high-level nuclear waste; Served as Co-Project Manager on the four-year program for geochemical characterization of Department of Energy Uranium Mill Tailings Remedial Action Program. Coupled geochemical and hydrological concepts and developed a workable model to describe contaminant transport of radionuclide and chemical components from the tailings in groundwater in accordance with Nuclear Regulatory Commission and EPA guidance and regulations.

1977 - 1979. Nutritional Physiology Laboratory, Iowa State University, Ames, IA. Laboratory Manager. Managed chemical analysis of organic compounds for research projects in the Nutritional Physiology Department. Developed analytical methods for specialized analysis. Supervised staff technicians.

PUBLICATIONS & PRESENTATIONS:

Wallace, Michael G., Kathryn O. Johnson, John D. Osnes, Eric L. Krantz, Crystal M. Hocking. 2013. Hydrogeological and Geochemical Evaluations in Support of Mine Water Management for the Jurong Rock Cavern Project, Singapore. Presented at International Mine Water Association Conference, Colorado CO, August 2013.

Johnson, K. 2010. Conceptual Model of Selenium Release from Shale Units Within the Meade Peak Member of the Phosphoria Formation. Presented at the 2010 Geological Society of America Denver Annual Meeting (31 October - November 2010), Session No. 232, Wednesday, 3 November 2010.

Johnson, K., R. Mayes, and P. Wichlacz. 2004. A New Approach to Integrating a Superfund, "Megasite" Cleanup into Management of the Coeur d'Alene River Basin. Water Resources IMPACT, Vol. 6, No. 3, pp 22 – 24. American Water Resources Association. www.awra.org

Johnson, K. "Diversity for Survival". Geotimes. American Geological Institute. September, 2000.

Johnson, K. "Advancement of the Understanding of Chemical Behavior in the Environment". Presented at the 213th ACS National Meeting. San Francisco, CA. April 13-17, 1997.

Johnson, K. Surface Water Quality-Chemical Effects. Section in "Mining Environmental Handbook, Effects of Mining on the Environment and American Environmental Controls on Mining", Jerrold J. Marcus, editor. Imperial College Press. 1996.

Johnson, K. Geochemical Model of Water Quality in Pit Lake in Oxidized Tuff, McDonald Gold Mine. Prepared for Morrison-Maierle Environmental Corporation, 910 Helena Avenue, Helena, MT. October 1996.

Johnson, K. "Understanding the Foundations of Environmental Science: Chemistry and Analytical Issues". Presentation of the Environmental Science Course, An Introduction for Lawyers and other Environmental Professionals. Executive Enterprises, Washington DC. 1993-1998 Conferences in Washington, DC, Chicago & San Francisco.

Johnson, K. and D. J. Carpenter. Retardation of Arsenic, Selenium, Molybdenum, Vanadium, and Uranium by Redox Reactions. Presented at the Colorado Groundwater Association Annual Meeting, Denver CO. 1991.

Carpenter, D. and K.O. Johnson. Retardation of Uranium and Associated Elements by Chemical Reduction and Precipitation. Published in "Proceedings of Waste Management '90 Conference", Volume 1, pp 539-546, Tucson NM. February 1990.

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