WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY COMMENTS

Section 1.3 of the Draft Environmental Assessment (The Proposed Actions)

Comment 1. Under the proposed action only the concentration values for nickel, radium 226 and 228, and uranium are to be retained at the existing POC [Point of Compliance] wells (MW-12 and MW-74). NRC is reminded that the other analytes currently sampled at POC wells include those (i.e., beryllium, cadmium, chromium, selenium) for which there exists Federal Maximum Contaminant Levels (MCLs) or State of Wyoming groundwater protection standards (i.e., chloride, sulfate). Future sampling at both the POC wells and the POE [Point of Exposure] wells should include all of these analytes. There is concern that, unless monitored at the proposed POE wells, concentrations of any of these contaminants in groundwater that may have migrated offsite will not be detected, and could pose a threat to human health and the environment, or a violation of State of Wyoming groundwater quality standards. **(WQD)**

Response to Comment 1:
NRC and the U.S. Department of Energy (DOE) have considered the inclusion of the above mentioned analytes in the current sampling suite. By letter dated August 12, 2009, DOE submitted a draft final Long-Term Surveillance Plan (LTSP) for the Bear Creek Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site for NRC staff review. The NRC's review focused on the ground water monitoring aspects of the draft LTSP. DOE requested the elimination of the analytes beryllium, cadmium, chromium, molybdenum, and selenium from the long-term monitoring requirements for both POC and POE wells. The NRC staff agreed with this proposal because the concentration of these analytes has been at or below their respective detection limits for the past eight years in the tailings-impacted monitoring wells (See ADAMS ML093010213). However, NRC agrees with the comment that chloride and sulfate should be added to the analytes to be sampled at the POC and POE wells.

Comment 2. The results from the current fate and transport modeling are not valid. Fate and transport modeling should be applied to demonstrate that the predicted concentrations of these contaminants at the proposed POE wells does not exceed their respective Federal SDWA [Safe Drinking Water Act] MCLs (or State standards), or baseline concentrations (at the POE wells), whichever is greatest. Contaminant limits at the POE wells should adhere to Federal SDWA MCLs (or State standards), or baseline concentrations (at the POE wells), whichever is greatest. **(WQD)**

Response to Comment 2:
The constructed fate and transport model has captured essential features of the site, including subsurface geology and geochemical processes. As with any model, it has its limitations. The modeling results have been hindered by the extreme complexities associated with spatial variability. The model results at the proposed POE well MW-109 indicate that uranium concentrations are overestimated with a peak of 460 pCi/L. NRC asked the licensee to review the modeled value for POE well MW-109 and submit revised model results that more accurately reflect the measured values. In September 2012, the licensee, through its contractor Tetra Tech Geo (see ML12270A289), submitted revised predictions of uranium concentrations along Lang Draw which show a much better fit for POE well MW-109 when compared to measured values.

The measured values of uranium in well MW-109 from 2002 to 2012 are listed below.

Year	Uranium Concentration (pCi/l)
2002	39.3
2003	31.8
2004	27.0
2005	31.6
2006	32.9
2007	41.0
2008	41.4
2009	59.5
2010	64.0
2011	61.0
2012	52.2

The background water quality for uranium was established in well No. MW-9 to be 98.7 pCi/l (NRC, 1996, TER to establish background–ML12270A290). In order to demonstrate that the selection of well MW-9 as a background well is valid, the licensee determined the variation trends for "mobile species" through the time period from 1988 to 1995. The "mobile species" are pH, conductivity, total dissolved solids, chloride, and sulfate. In March 1993, total dissolved solids, chloride, and sulfate increased while prior to this date the "mobile species" were stable. Consequently, the licensee excluded data collected after March 1992 and established background for hazardous constituent concentrations as the mean plus two standard deviations. The NRC reviewer also noted that the ground water in the N-sands is naturally brackish and would be restricted to raising livestock.

The estimated level of risk using the overestimated concentrations at the POE well MW-109 is on the order of 10^{-4}, similar to the background risk for the site, and is acceptable under NUREG-1620, Rev.1 (NRC, 2003). Under 10 CFR Part 40, Appendix A, Criterion 5(B)(6), the NRC will establish site specific alternative concentration limits if it finds that the limits proposed by the licensee are as low as reasonably achievable and that there is not a substantial present or potential hazard to human health or the environment as long as the alternative concentration limits are not exceeded. The NRC is not required to compare contaminant values at a POE well to Federal or State ground water quality standards when making determinations under Criterion 5(B)(6). NRC staff has determined that the proposed ACLs for the site meet Criterion 5B(6) of 10 CFR Part 40 Appendix A.

Comment 3. Institutional controls to prohibit installation of water supplies for any use (domestic, livestock, etc.) do not apply beyond the site boundary and do not preclude the ability of the off-site landowner to install and use a water supply well for any desired purpose, including domestic and drinking water use. **(WQD)**

Response to Comment 3:
The surficial deposits, alluvium and the N-sand of concern are discontinuous in nature and partially eroded. The quantity of ground water in these deposits varies spatially, and is further dependent upon the saturated thickness. The alluvium and N-sand contain "pockets" of water; however, these units are not capable of yielding to wells with a sustainable quantity of water in the downgradient areas along Lang Draw and the Northern Flow Path beyond the proposed

long-term surveillance boundaries. Boreholes (T18 - T23) completed in the vicinity of the property boundary along the Lang Draw indicate that the alluvium and N-Sand are less than 10 feet thick, and only a minor amount of groundwater was observed (see *Delineation of N-Sand and Lang Draw Alluvium, Bear Creek Uranium Tailings Area,* S.M. Stoller Corporation, 1997 - ADAMS ML12181A053). The alluvium and N-sand does not produce enough water to be classified as an aquifer (also see response to Comment 9). It is therefore not expected that water supplies for any use (e.g., domestic, livestock) will be installed in the downgradient vicinity of the site along the Lang Draw and the North Flow Path. Also, see the response to comment 2 where NRC under UMTRCA only considers the risk at the POE wells.

Comment 4. What type of institutional controls to restrict groundwater use within the long-term surveillance boundary are proposed? Are they monitored for effectiveness and durability? Are they enforceable; how? **(WQD)**

Response to Comment 4:
Use of ground water is restricted within the long-term surveillance boundary through control of access to the site by the DOE. Site inspection will be conducted periodically to evaluate the integrity and effectiveness of the tailings cover, the access control fence, and to conduct ground water monitoring.

Comment 5. While land ownership may not include existing groundwater use, one should not assume this will remain the same through time and that there will never be any exposure pathways in this vein. **(WQD)**

Response to Comment 5:
Within the long-term surveillance boundary, land ownership will be in the control of DOE. For the alluvium and N-sand units downgradient of the long-term surveillance boundary along the Lang Draw and Northern Flow Path, insufficient water is available for domestic/livestock well development.

Section 3.3.2 Ground Water

Comment 6. The Wasatch Formation is described as costal or deltaic, the formation is fluvial. Was the opinion provided by S.M. Stoller made by a Wyoming licensed professional geologist? **(WQD)**

Response to comment 6:
The impacted geologic units at the site include the surficial alluvium and the N-sand, which form the uppermost stratigraphic zones of the Wasatch formation. The Wasatch Formation is the main sedimentary unit immediately beneath the tailings basin and described as coastal or deltaic (Zhu, et. al, 2002). The lithologies encountered north of the Bear Creek site are typical of sediments deposited in a fluvial environment (S.M Stoller, 1997- ADAMS ML12181A053).

The resumes of the two geologists from S.M. Stoller who did the field work for the 1997 report are attached at the end of this response letter. As you can see, Mr. James Moran is a Wyoming licensed professional geologist.

Comment 7. Please state NRC's definition of an "aquifer". **(WQD)**

Response to Comment 7:
NRC's definition of an "aquifer": A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs. Any saturated zone created by uranium or thorium recovery operations would not be considered an aquifer unless the zone is or potentially is: (1) hydraulically interconnected to a natural aquifer, (2) capable of discharge to surface water, or (3) reasonably accessible because of migration beyond the vertical projection of the boundary of the land transferred for long-term government ownership and care in accordance with Criterion 11 of Appendix A, 10 CFR Part 40. NRC's definition of "ground water" is: *Ground water* means water below the land surface in a zone of saturation. For purposes of Appendix A, ground water is the water contained within an aquifer as defined above.

The U.S. Environmental Protection Agency (EPA) defines a potential source of drinking water as one which is capable of yielding a quantity of drinking water to a well or spring sufficient for the needs of an average family (US EPA, 1986). The sufficient yield criterion has been established at 150 gallons/day.

Comment 8. Lack of a description of the presence of water on well logs (filed with the State of Wyoming) down to a certain depth is not conclusive evidence that shallow groundwater does not exist. The licensee and a Wyoming licensed professional geologist should review other geologic/hydrologic reports available for the area and region, including those developed by the U.S. and State Geological Surveys, to evaluate the potential for the presence of water at shallow depths. As an alternative, the licensee should install monitoring wells to confirm the presence/absence of water at shallower depths. **(WQD)**

Response to Comment 8:
The licensee submitted an extensive report to NRC in April 1997 titled, *Delineation of N-Sand and Lang Draw Alluvium Bear Creek Uranium Tailings Area* (S.M. Stoller Corporation, 1997 - ML12181A053) in which it presents information from 20 boreholes ranging in depth from 40 feet to 120 feet below ground surface. The work was conducted by a Wyoming licensed professional geologist.

Section 4.3 Groundwater

Comment 9. Provide the basis for the statement that the shallow, impacted, saturated units are not viable aquifers at the site. Define 'viable aquifer'. NRC should incorporate State of Wyoming, Department of Environmental Quality definitions for 'aquifer', 'groundwater', 'underground water', and 'water in the vadose zone' in its evaluation of which groundwaters are afforded protection under State rules and regulations. **(WQD)**

Response to Comment 9:
Based on State of Wyoming, Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters, adopted March 2005, "aquifer" means a zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use. "Background" means the constituents or parameters and the concentrations or measurements which describe water quality and water quality variability prior to a subsurface discharge. "Groundwater" means subsurface water that fills available openings in rock or soil materials such that they may be considered water saturated under hydrostatic pressure. "Underground Water" means subsurface water, which is any body of water under the surface of the earth,

including water in the vadose zone and groundwater. "Vadose Zone" means the unsaturated zone in the earth, between the land surface and the top of the first saturated aquifer which is not a perched water aquifer. The vadose zone characteristically contains liquid water under less than atmospheric pressure, and water vapor and air or other gases at atmospheric pressure. Perched water bodies exist within the vadose zone.

The statement that the shallow, impacted, saturated units (surficial alluvium and N-sand) are not viable aquifers at the site is based on their limited extent with very limited yield. The thickness of the N-sand exhibits significant spacial variability. In the vicinity downgradient of the property boundary along the Lang Draw, the N-sand is less than 10 feet thick. In the immediate vicinity downgradient of the property boundary along the North Flow Path (around boring T08), the N-sand thickness is approximately 15 feet (S.M. Stoller Corporation, 1997). The N-sand actually pinches out northwest of the Lang Draw area (offsite boring locations T21, T22 and T23) and to the northeast around the North Flow Path (offsite boring locations T09, T10, and T16). Although the N-sand is thicker along the North Flow Path, it is discontinuous and is separated by interbeded silts and clays due to a change of depositional environments. In addition, based on the ground water level recovery data collected in MW-109 (located in the Lang Draw) during the July 2012 sampling event (Figure 1), it is estimated that these thin sand units (alluvium and N-sand) exhibit a hydraulic conductivity in the order of 10^{-6} cm/sec (i.e., hydraulically equivalent to a silt). As such, the saturated units (alluvium and N-sand) in the downgradient vicinity of the Bear Creek site boundary along the Lang Draw and the North Flow Path are not likely to produce enough yield to be classified as a viable aquifer defined by the US EPA. Again, see the response to comment 2 where NRC under UMTRCA only considers the risk at the POE wells and does not consider groundwaters that are afforded protection under State rules and regulations.

Comment 10. Provide the basis for the statement that relocation of the POE wells should enable the site to stay in compliance with revised ACLs. If sampling is discontinued for some analytes having Federal SDWA MCLs or state groundwater standards, how will NRC and/or DOE determine whether compliance for those analytes is achieved, or not? **(WQD)**

Response to Comment 10:
The downgradient relocation of the POE wells will provide a greater travel distance and additional natural attenuation for the tailings seepage-impacted ground water. Although NRC has concluded that no ground water monitoring is required for this site, NRC is recommending that DOE conduct limited monitoring in order to verify the predictive accuracy of the revised ground water model. Again, see the response to comment 2.

Comment 11. Provide the modeled, or predicted concentrations for the analytes described above at the proposed revised POE wells to support the statement that relocation of the POE wells should enable the site to stay in compliance. Monitoring should continue long enough to validate the model predictions. **(WQD)**

Response to Comment 11:
NRC agrees with WDEQ that monitoring should continue long enough to validate the model predictions. The revised predicted concentrations along Lang Draw were submitted to NRC (ML12270A289). Revised model values for well MW-109 show that the concentration of uranium will be below background for at least thirty years and this will be included in the Safety

Evaluation Report (SER) as a guideline for DOE. It is anticipated that limited monitoring will be required for a thirty year period following the transfer of the site to DOE.

Section 5.0 Monitoring

Comment 12. Until the Technical Evaluation Report (TER) regarding monitoring (subsequent to license transfer to DOE) has been developed and accepted in support of the proposed license amendment, the current monitoring program and frequency should remain in place, with the exception of establishing new POE wells with revised compliance limits for those analytes as described above. WDEQ requests an opportunity to review and comment on the TER before it is accepted. **(WQD)**

Response to Comment 12:
The annual sampling event to satisfy License Condition No. 47 has taken place for 2012 and can be found in ADAMS at ML12241A381. NRC intends to finalize the EA and SER prior to the next scheduled sampling event. It is not NRC's policy to provide SERs to a State for review and comments before it is made public.

Conclusions

Given the deficiencies identified above, it is premature to determine that a finding of no significant impact (FONSI) is appropriate until those deficiencies have been resolved.

Response to unnumbered comment:

The NRC will revise the draft EA based on Wyoming's comments and NRC staff's responses. NRC staff believes the deficiencies identified above have been addressed and that the FONSI is still valid.

References

State of Wyoming, Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters, adopted March 16, 2005.

S.M. Stoller Corporation, "Delineation of N-Sand and Lang Draw Alluvium, Bear Creek Uranium Tailings Area," April 1997. ADAMS ML12181A053.

Tetra Tech Geo, 2012. "Revised Predictions of Uranium Concentrations along Lang Draw," September, 2012. ADAMS ML12270A289**.**

US EPA, 1986 Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy, EC-G-2002-113.

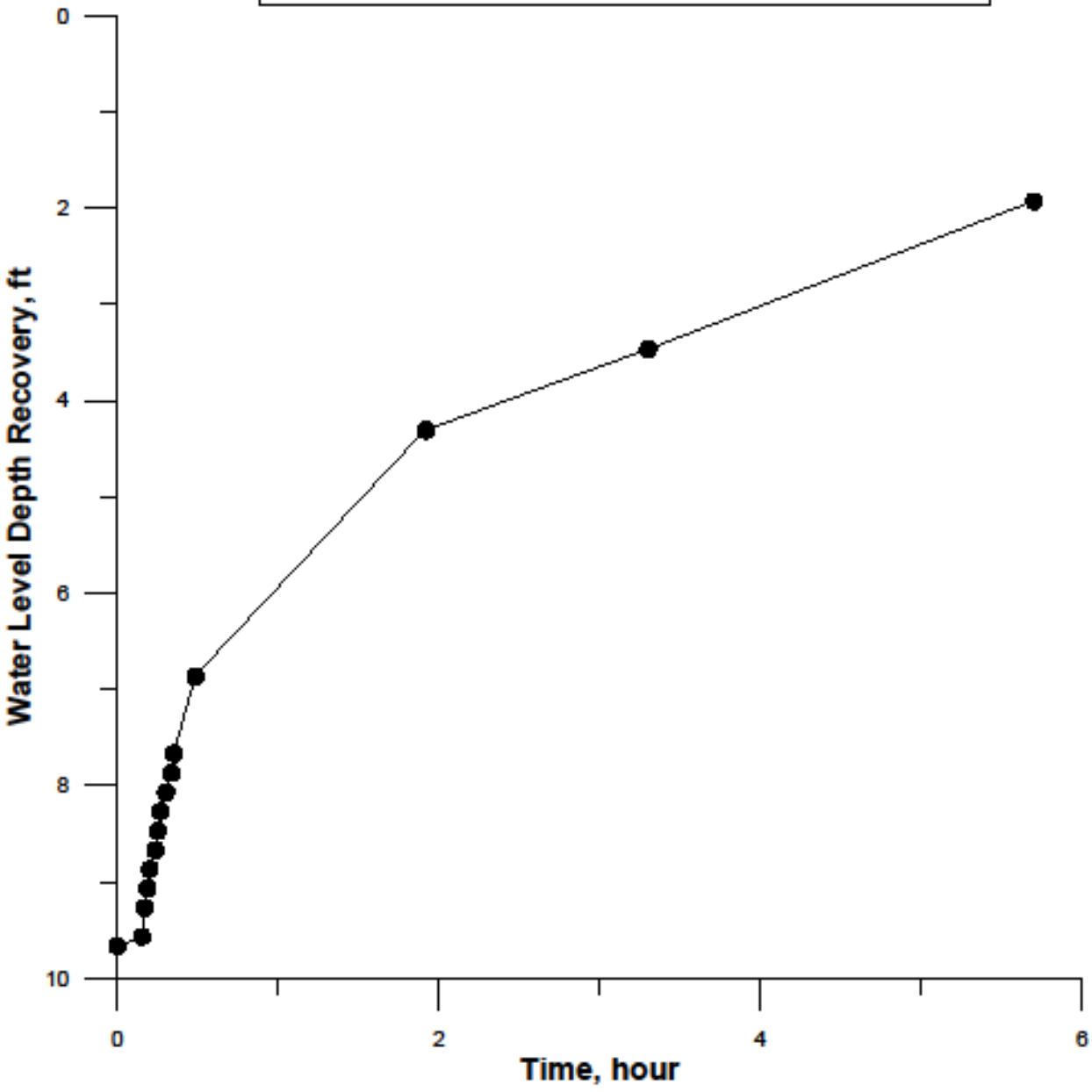
U.S. Nuclear Regulatory Commission (NRC), 1996. Technical Evaluation Report Establishing Background Levels of Constituents at MW-9 for the Bear Creek Uranium Mill Facility. ADAMS ML12270A290.

NRC, 1997. Technical Evaluation Report on Requested License Conditions Changes for the Bear Creek Uranium Mill Facility. ADAMS ML12250A422.

NRC 2003, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978, NUREG-1620, Rev.1.

Zhu, C., G.M. Anderson, and D.S. Burden, 2002. Natural attenuation reactions at a uranium mill tailings site, western U.S.A., Ground Water, Vol. 40(1), p. 5-13.

Figure 1. Water Level Recovery at MW-109



Experience Summary

- 28 years of project and regulatory experience in the mining and environmental industries. Mr. Moran has held positions as a senior manager, Principal, Sr. Vice President, and Chairman during the recreation of two environmental consulting firms (Union Pacific's USPCI Consulting and S.M. Stoller).
- 15 years of experience in regulatory negotiation, corrective action design, and environmental remediation of contaminated sites.
- More than 10 years of experience in the mining industry, with focus on *in situ* mine planning, evaluations and cost estimates, *in situ* mining, *in situ* process development, and groundwater remediation associated with *in situ* mining and uranium mill tailings operations.
- Managed geologists, hydrogeologists, engineers, and technicians in the evaluation, system design, construction, and system operation of *in situ* remediation and groundwater projects.
- Soil remediation projects include excavation, treatment, and disposal of hydrocarbon, metals, and solvent-contaminated soils. Groundwater projects include a variety of hydrogeologic environments involving miscible/immiscible organic and inorganic contaminants.
- Performed mine evaluations throughout the western United States and held positions at mines in the Grants, New Mexico uranium district, South Texas trend, and Wyoming's Powder River Basin.

Areas of Expertise

- Groundwater and Soil Characterization/Remediation
- Correction Action Design
- Water Treatment/Project Design
- Mine Evaluation/Design
- *In situ* Mining and Restoration

Project Experience

The S.M. Stoller Corporation, 1995—Present

Chairman of Stoller Nuclear Group, LLC. Since May 2006, Chairman of the Board of the Stoller Nuclear Group, LLC. The Stoller Nuclear Group is comprised of the S.M. Stoller Corporation, RWE NUKEM Corporation, and WESKEM, LLC. This LLC was formed to combine the complementary skills, systems, tools, and techniques of the three companies in providing a full range of nuclear services to the Department of Energy (DOE) and the nuclear power industry.
Chairman of Stoller-Navarro Joint Venture. Since 2003, Chairman of the Board of the Joint Venture between S.M. Stoller Corporation and Navarro Research and Engineering, Inc. This J-V currently manages a $250M, five-year contract to conduct all environmental work at the Nevada Test Site, perhaps the most contaminated site in the nation. As Chairman, is responsible for architectural and engineering support to the Department of Energy (DOE) at the

Test Site. The Stoller-Navarro J-V is staffed with approximately 150 full-time engineers, geologists, geohydrologists, health physicists, environmental scientists, and others performing characterization and interim corrective measures at the Nevada Test Site and six other locations of underground nuclear tests in the United States. Works with the client to ensure superior performance in meeting all environmental milestones and attaining a superior program performance.

Technical Manager, Grand Junction Operations. From 2002 to 2003, directed 80 geologists, engineers, chemists, and staff on multiple DOE environmental restoration projects throughout the United States. These projects included the 26 DOE UMTRA groundwater projects and technical staff support for other projects such as the Atlas mill tailings site at Moab, Utah, and the Pinellas site in Florida.

Stoller Project Manager (subcontract to IT Corp.) in the design and construction of the perched groundwater recovery system for the DOE Pantex Plant in Amarillo, TX. Managed the technical staff in the interpretation of subsurface geology and hydrogeology for the project. Manager for Stoller's Lafayette, Colorado office.

Project Manager on the Ditches and Playas ICM and Firing Site 5 ICM at the DOE Pantex Plant, Amarillo, TX. Senior Project Manager of Pantex Firing Site 5 ICM. The project included recordation of over 150,000 radiological surveys; collection and analysis of over 1,400 soil samples; and excavation of 3,300 anomalies and 1,700 cubic yards of radioactive soil. Activities resulted in cleanup and closure of the first firing site at Pantex.

USPCI / Union Pacific Corporation, 1989—1995

Principal Geologist. Provided senior review of project manager and various consulting services for the Parsons waste pond closure in Parsons, Kansas. Performed cost estimates, prepared budgets, and monitored and prepared schedule. Project included design and implementation of a corrective action plan to close waste ponds impacted with hydrocarbon/chrome sludges, alternative analysis, design, cost estimates, regulatory negotiations, water treatment, sludge dewatering, excavation, and on-site thermal treatment.

Senior Project Manager for the Union Pacific Railroad Las Vegas project. Provided client communication, regulatory communication support, budget, schedules, and management of a project team of 25 professionals and technicians in addition to miscellaneous subcontractors during the implementation of this $20 million project. Project included design and implementation of one of the largest soil remediation projects in the United States. Other activities included excavation and on-site thermal treatment of approximately 400,000 tons of hydrocarbon-impacted soil; excavation, shipment, and disposal of 30,000 tons of lead-contaminated soil; and design and installation of eight groundwater recovery systems for recovery of diesel, bunker fuel, and solvents.

Senior Project Manager. Managed team of geologists, hydrogeologists, design engineer, and data technician in data collection and evaluation. Prepared interim measure reports for state regulatory agency. Project included RI/FS interim measure investigation, characterization, and design of a groundwater remediation system for the control of a DNAPL plume from a closed RCRA landfill. Project activities included soil borings and sample analyses, well installations,

hydrological tests, modeling, and recovery system design and installation in a fracture flow-type environment.
Senior Project Manager for the Omaha groundwater system modification. Managed project engineer, monitored schedule and budget progress, and facilitated client communication. Project included evaluation, pilot testing, design, and modification of 35 gpm oil/water separation system to satisfy water discharge permit criteria.
Program Manager of several groundwater remediation projects. Supervised a team of geologists, hydrogeologists, and engineers for projects requiring groundwater characterization, evaluation, and remediation. Provided regulatory agency and client contacts; negotiated project consent agreements; provided quality assurance of proposals, reports, and remedial action plans; implemented and maintained technical policies and procedures; and managed group revenue and profit goals. Projects included the assessment and evaluation of groundwater contaminant plumes, and design, installation, and operation of remediation and control systems. Locations ranged throughout the United States with approximately 25 active groundwater remediation systems. Designs ranged from French drains and multi-well recovery to infiltration and process treatment systems.
Senior Geologist for the Laramie Tie Plant Superfund Site. Led activities at the Laramie Tie Plant Superfund Site and was requested by Union Pacific Railroad to review hydrologic data and recommendations of multiple consultants on the application of *in situ* soil washing at a creosote-contaminated site on the south side of Laramie, Wyoming.
Compiled geohydrologic information and provided evaluation and outlined challenges to successful implementation of the soil washing program. In Mr. Moran's review, he noted that the area to be remediated was in a floodplain and that its geology included a number of clays, and that the expected success of contaminant recovery would be affected in many areas. His observations on *in situ* soil washing were found to be correct. Ultimately, the railroad installed a slurry wall and is currently conducting recovery of the creosote.

Rocky Mountain Energy, 1980—1986

Senior Geologist for the Mount Lucas Project. Evaluated an acquisition opportunity at a uranium *in situ* prospect on the shore of the Corpus Christi drinking water reservoir in the South Texas Mineral District. Project included mine design, feasibility study, ore reserve calculations, and permit requirements and schedule.
Senior Geologist. Evaluated the liabilities and economic potential of a hardrock uranium mine in north-central Washington. Project included preliminary open pit design, ore grade and reserve calculations, and assessment of restoration requirements to support acquisition decision.
Senior Geologist. Evaluated the liabilities and economic potential of an open pit, underground, and *in situ* uranium mine in Wyoming's Powder River Basin. Project included feasibility study and cost estimates for mining and restoration activities.
Senior Geologist. Evaluated the economic potential of the uranium breccia pipe deposits in the Arizona Strip area. Project included economic analysis of mines; viability of satellite milling operations in the Grants, New Mexico, and Blanding, Utah areas; and evaluation of existing mines (Hack Canyon, Orphan, Canyon, etc.) and exploration targets. Studies supported decision to initiate a $5 million/year exploration program.

Senior Geologist. Provided evaluation, design, and installation of groundwater recovery wells for leaking uranium tailings impoundment in Wyoming.
Senior Geologist. Coordinated geological staff with facility process engineers and facility manager in the evaluation of roll-front deposits at the Reno Creek Project, west of Wright, Wyoming. Investigation of the lithological and hydrogeological environments and process chemistry led to the recommendation to change pilot operations from a sulfuric to a sodium bicarbonate lixiviant. Subsequent pilot operations demonstrated successful uranium mobilization and the first approved groundwater restoration of a uranium *in situ* test in Wyoming.
Process Manager / Wellfield Supervisor. Planned and performed *in situ* pilot tests at Nine Mile Lake Project, north of Casper, Wyoming, and Reno Creek Project, west of Wright, Wyoming, utilizing both sulfuric acid and sodium bicarbonate lixiviants to leach a deposit at approximately 300 to 500 feet bgs. During these projects investigated various processes to achieve restoration of groundwater quality consistent with Wyoming Department of Environmental Quality standards.
Processes included the utilization of ion exchange, activated carbon, reverse osmosis, and ultra filtration with tests of various oxidants (hydrogen peroxide, oxygen, Karros acid, and Fenton's reagent) and reductants (sodium sulfite). Mr. Moran attained the first approved restoration of groundwater quality for a wellfield pattern in Wyoming.

Wyoming Mineral Corporation, 1977—1980

Senior Mine Geologist. Directed mine development, delineation programs, and well field design, installation, and operation at a commercial *in situ* mining operation in Texas. Responsible for all well field operations and site hydrogeological and geological staff in performance of pump tests, ore reserve calculations, flow-net management, permit support, and budget justifications.
Operations Geologist. Supervised uranium mine development, well construction, and well restoration activities at the Lamprecht Mine near Three Rivers, Texas. Directed associate geologist and drilling operations during the installation of more than 1,500 injection, recovery, and monitor wells leading to the recovery of $40 million of uranium.

Employment History

- *Senior Vice President*, The S.M. Stoller Corporation, Lafayette, CO, 1997–Present
- *Chairman*, Stoller-Navarro Joint Venture, Las Vegas, NV, 2002–Present
- *Boulder Office Manager*, The S.M. Stoller Corporation, Lafayette, CO, 1995–1997
- *Principal Geologist*, U.S. Pollution Control, Inc., Boulder, CO, 1994–1995
- *Senior Geologist*, USPCI, Boulder, CO, 1988–1993
- *Senior Geologist*, Union Pacific Environmental Services, Boulder, CO, 1986–1987
- *Senior Geologist*, Rocky Mountain Energy, Broomfield, CO, 1982–1986
- *Senior Geologist*, Rocky Mountain Energy, Nine Mile Lake ISL Pilot Plant, Casper, WY, 1980–1981
- *Senior Geologist*, Wyoming Mineral Corporation, Bruni ISL Mine, Bruni, TX, 1979–1980

- *Operations Geologist*, Wyoming Mineral Corporation, Lamprecht ISL Mine, Three Rivers, TX, 1977–1978
- *Geophysical Logging Technician*, Century Geophysical, Grants, NM, 1976–1977

Education

- B.S., Geological Sciences, University of Texas at Austin, 1975
- Investment Decisions and Economic Analysis, Colorado School of Mines, 1982

Technical Skills, Certification and Training

- Registered Geologist – Arkansas, Indiana, Wyoming, Missouri
- OSHA HAZWOPER 40-hour Training
- OSHA Supervisor Training
- OSHA 8-hour Refresher Training

Professional Organizations

- American Institute of Mining Engineers (1977–Present)

Clearances

- DOE "Q" clearance (active)

Experience Summary

- 27 years as a professional geologist; 20 years within the environmental consulting industry preceded by 7 years underground mining. Licensed Professional Geologist in Texas and Utah.
- Accomplished field operations manager with progressive experience in project planning, execution, control, and closing; ensures data acquisition and documentation is focused and detailed.
- Associated technical experience includes analysis and interpretation of scientific data and report preparation.
- Safety Trained Supervisor - hazard recognition and analysis, regulatory compliance, employee training and communications.

Areas of Expertise

- Senior level management of construction and investigative field operations
- Hands-on supervision of drilling operations, well installations, lithologic and geophysical logging
- Preparing work plans, health & safety plans, quality plans, and project record-keeping

Project Experience

The S.M. Stoller Corporation, 1997—Present

Field Supervisor at the DOE Pantex Plant, August and September 2011

Zone 12 Ditch Liner Repair Project (Quality Representative, OSHA Competent Person, and Waste Manager). Supervised ten subcontractor personnel who performed sediment removal, liner anchor-installation, and liner patching activities. Prepared planning documents, safety documents (AHAs), and daily performance reports.

*Well Drilling BOA Releases 8 & 9 (F*ield Manager, Site Safety Supervisor, Geologist, and Waste Manager). *ARCH drilling was used to install two perched aquifer groundwater monitoring wells. S*upervised the drilling crew, well development technician, geophysical logging engineer, and survey team; a total of eight subcontractor personnel. Prepared and reviewed planning documents, safety documents, daily performance and final reports, and performed contract administration.

Construction Supervisor at Rocky Flats, March 2011

Mounds Solar Ponds Treatment System (Construction Supervisor). Managed and directed the work of seven subcontractor personnel during execution of construction activities for the discharge gallery and solar panel footers. Documented all site activities, monitored and controlled quality assurance/quality control on excavations, pipe installations, backfill/compaction, formwork and concrete. Performed site safety supervision, filed detailed performance reports, and redlined construction as-built plans.

Field Manager at Colorado School of Mines Research Institute Site, CSM, January 2011

CSMRI Field Work (Field Manager). Executed site drilling activities for installation of seven groundwater monitoring wells using a sonic drilling rig. Supervised five personnel including: drilling subcontractor, staff geologists, and radiation technician. Provided site safety supervision, daily performance reports, quality assurance/quality control, completed detailed lithologic logs for submission to State regulators, and performed contract administration.

Senior Geologist at Paducah Gaseous Diffusion Plant, November 2010

Southeast C-400 Field Sampling Plan (Technical Support and Document Preparation). Evaluated field methods relevant to planned drilling operations intended to verify existing site data and as part of a technical team, prepared planning documents for regulatory approval.

Field Manager / Geologist at the DOE Pantex Plant, 2010.

Southeast Pump and Treat System Wellhead Reconfiguration Project, September 2010 (Field Supervisor and Technical Support). Prepared all field operations documents; reviewed, corrected, and approved electrical and heavy equipment subcontractor AHAs and prepared the project lift plan; coordinated contractor mobilization activities and trained subcontractor personnel. During mobilization and project startup, supervised the work of the construction subcontractor.

*Well Drilling BOA - Releases 6 and 7, March/August 2010 (F*ield Manager, Site Safety Supervisor, Geologist, and Waste Manager). *ARCH and mud rotary drilling methods were used to install Ogallala/Dockum Aquifer and perched aquifer monitoring wells. Planned, executed, and controlled all project field activities. On-site duties required s*upervision of eight subcontractor personnel including: the drilling crew and well development technician, the geophysical logging engineer, and the survey team. Prepared all planning documents, safety documents (three AHAs), performance and final reports and performed contract administration.

- *Technical Supervisor / Geologist* at the DOE Nevada Test Site, 2009.

  2009 Fiscal Year UGTA Drilling Project, May through October (Technical Lead and Geologist). Responsible for on-site field operations related to collection and evaluation of hydrogeologic data supporting drilling operations in deep groundwater aquifers. Supervised a field chemist and sampling technician while monitoring and documenting all drilling operations, lithologic logging and maintaining geological control, performed quality assurance, and prepared daily field reports.

Field Manager / Geologist at the DOE Pantex Plant, 2007 – 2009.

Pantex Well Drilling BOA – Releases 1 through 4, October 2008 through March 2009 (Field Manager). ARCH and mud rotary drilling methods were used for installation of perched aquifer and Ogallala/Dockum Aquifer monitoring wells. *Planned, executed, and controlled all project field activities. On-site responsibilities included* project management, site safety supervision, geology, waste management, and erosion control; supervised 16 personnel including: 3 drilling crews and well development technicians, geophysical logging engineer, survey team, and 3 staff geologists. Prepared all planning

documents, safety documents (three AHAs), performance and final reports and performed contract administration.

Playa 1 Perched Aquifer Dewatering Project, July 2007 through September 2008 (Field Manager). Supervised 10 people during drilling operations and installation and pump testing of 10 perched aquifer groundwater extraction wells (July through September 2007) with additional duties as geologist, site safety supervisor and waste manager. Then managed geotechnical sample collection and initial construction activities for a 60' x 80' steel building that would house a 300-gpm groundwater treatment system; supervising up to 10 subcontractor personnel. Trained additional Stoller construction supervisor personnel assigned to the project. Wrote or reviewed all Activity Hazard Analysis (total 12) and related project safety documents for all trades involved in the project. From January through September 2008: supported the project performing quality control, permitting, performance reporting, and intermittent construction supervision.

Drilling Supervisor / Geologist at the DOE Moab, Utah UMTRA Site, 2005/2006.

May and September 2006. Managed and directed execution of drilling, well installation, and well development activities for expansion of the alluvial well field at Moab, Utah; then installed riverbank piezometers adjacent to the well field. Supervised four personnel, monitored drilling safety, performed quality assurance/quality control, produced detailed geologic logs, and prepared daily reports.

October 2005 through January 2006. At Crescent Junction, Utah supervised wire-line core drilling operations to depths of 200 feet in the Mancos Shale. Performed core logging and conducted formation packer testing. Characterization activities were used to determine the suitability of the site for construction of a uranium mill tailings disposal cell. Supervised the drilling crew and the geophysical logging engineer (4 persons).

Remediation Manager for New Mexico Oil and Gas Production Sites, February – November 2006

Managed, directed, and controlled characterization, remediation, and reclamation activities related to hydrocarbon and chloride contamination at oil and gas production sites in southeastern New Mexico. Negotiated with regulators of the New Mexico Oil Conservation Division and U.S. Bureau of Land Management to achieve acceptable remediation results that targeted regulatory cleanup levels while allowing for site-specific factors and conditions. Planned and executed project activities, conducted daily safety supervision, prepared performance reports, and performed QA/QC, confirmation sampling, data evaluation, and final closure reports.

Site Supervisor / Geologist at the DOE Central Nevada Test Area, April – August 2005.

Site Supervisor for the installation of three monitoring/validation wells drilled and completed to collect geologic, geophysical, hydrological, and geochemical data. Boreholes were advanced to depths of 4,100 ft, 3,660 ft, and 4,220 ft below ground surface. Directed and managed field activities to include pad construction, drilling, well construction, well development, borehole geophysics, geological and radiological sampling, and implementation of the work plan and health and safety plan. Supervised 6

persons: geologist, radiation control technician, and 4-man drill crew on a daily basis, along with intermittent additional subcontractor personnel.

Field / Task Manager at the DOE Pantex Plant, 2000 - 2004.

Multiple Operable Units (MOU) Project: Senior-level Geologist managing geologic and hydrogeologic data collection and supervising field activities during subsurface investigations using air rotary casing hammer, mud rotary, auger, and direct push drilling methods. Installations included 51 wells (average depth 270 feet) completed in the perched aquifer, Ogallala Aquifer, and intermediate vadose zone of the Ogallala Formation.

All Inclusive RFI Task Order (ARTO) Project: Senior-level Geologist supervising the drilling and geological activities required for the installation of 7 Ogallala Aquifer monitoring wells, 1 perched aquifer monitoring well, 8 FLUTe® soil-gas wells, and 14 soil-vapor extraction/injection wells. Produced detailed lithologic logs of boreholes and ensured the quality of geophysical borehole logs made during the investigation. Interpreted field data and constructed geologic maps and cross-sections correlating the stratigraphic sequence and hydrogeologic relationships within the study area.

Fiscal Year 2000 Groundwater Investigation: Drilling Task Manager supervising the drilling and geological activities required for the installation of 14 perched aquifer monitoring wells to depths of about 300 feet and 7 Ogallala Aquifer monitoring wells to depths of about 900 feet using ARCH and mud-rotary drilling methods.

Group II RCRA Landfills: Drilling Task Manager, used geoprobe and hollow-stem auger drilling methods to collect surface and subsurface soil samples within and adjacent to the landfills.

Burning Grounds High Explosives Composting Facility: Construction Task Manager, the project involved erection of two Coverall buildings, 350 feet long and 55 feet wide, used for composting high-explosives-contaminated soils excavated at the Burning Grounds.

Firing Site 5 Interim Corrective Measure (depleted uranium soil remediation project): Task Manager for soil excavation activities, radiological control, and soil stockpile management.

Field Supervisor at the DOE Rocky Flats Environmental Technology Site, 1999.

903 Pad Lip Area: Supervised a seven-person crew sampling plutonium-contaminated soils and prepared USCS soil-boring logs; direct-push sampling methods and Level C PPE were used.

T-1 Trench, Pyrophoric Depleted Uranium Source Removal Project: Sampling and Inerting Pad Technician. Sampled and inerted more than 170 drums containing pyrophoric depleted uranium, cemented cyanides, and hazardous debris. All work was performed using Level B personal protective equipment within a negative-pressure temporary containment structure.

Demolition of Building 729: As a Field Chemist, provided PCB immunoassay screening services to qualitatively determine the level of PCBs present in roofing materials. The analysis was critical to the project construction schedule and landfill acceptance of debris.

USPCI/Laidlaw, 1992—1997, Project Manager/Geologist

Project Manager / Geologist. Conducted site investigations, tank removals, soil remediations, and groundwater assessments at sites across 19 states as part of the Union Pacific Railroad UST Program. Management responsibilities included daily client contact, extensive database management, and budget accountability.

Echo-Bay Minerals, 1987—1989, Project Geologist

Project Geologist, Congress Mine, Arizona. Responsible for geology department personnel, geological control of production mining operations, drilling exploration, ore reserve calculations, preparation of geologic maps and cross-sections, grade control, ore shipments, and environmental compliance at a 600-ton-per-day underground gold mine. Characterized heap-leach and tailing-dumps for residual cyanide and metals values and stabilized leachate ponds.

Sunnyside Gold/Standard Metals, 1983—1987, Mine Geologist

Mine Geologist at Sunnyside Mine, Silverton, Colorado. Conducted surface and subsurface sampling for daily grade control and ore reserve calculations, designed and managed exploration diamond-core drilling projects, logged and sampled drill core, calculated ore reserves, prepared surface and underground geologic maps and cross-sections, provided geo-technical support to the mining department, and performed underground surveying and surface-water sampling.

Employment History

- *Senior Geologist*, The S.M. Stoller Corporation, Broomfield, CO, 1997–Present
- *Project Manager / Geologist*, USPCI/Laidlaw, Boulder, CO, 1992–1997
- *Project Geologist*, Echo-Bay Minerals, Congress, Arizona, 1987–1989
- *Mine Geologist*, Sunnyside Gold/Standard Metals Corp., Silverton, Colorado, 1983–1987

Education

- B.S., Geology, Fort Lewis College, Durango, CO, 1982
- A.S., Hazardous Materials Management, Front Range Community College, Westminster, CO, 1989

Technical Skills, Certification and Training

- Texas Professional Geologist (#576)
- Utah Professional Geologist (#5552407)
- Project Management Professional (#1478415) Project Management Institute
- Construction Health and Safety Technician (#C2791) Board of Certified Safety Professionals
- Safety Trained Supervisor (#IEX07669) Board of Certified Safety Professionals
- DOE Site Safety Supervisor Training (30-hr)
- OSHA Construction Safety and Health Training (10-hr)
- OSHA HAZWOPER Health and Safety Training with annual refreshers

- OSHA Supervisor Training
- U.S. DOE Radiological Worker II

Clearances

- DOE “Q” - inactive