STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF PETITION TO AMEND 20.6.2.3000 NMAC AND 20.6.2.5000 NMAC	)	**WQCC 14-15 (R)**
	)	
Navajo Refining Company, L.L.C.,	)	
	)	
Petitioner.	)	

DIRECT TESTIMONY OF

ALBERTO A. GUTIÉRREZ, RG

ON BEHALF OF

NAVAJO REFINING COMPANY, L.L.C.

June 15, 2015

Contents

1. **Please state your name and business address.** 3
2. **By whom are you employed and in what capacity?** 3
3. **Please describe the purpose of your testimony.** 3
4. **Please briefly summarize your testimony and the conclusions made in it.** 3
5. **Please describe your educational background and training.** 4
6. **What have you reviewed in preparation for your testimony?** 4
7. **What factors must be considered to ensure that underground injection wells are protective of human health and the environment?** 5
8. **How do you ensure that wells will inject waste into appropriate geologic formations?** 6
9. **How do you ensure that wells are constructed and completed in a manner that maintains well integrity?** 7
10. **How does the proposed rule ensure that wells will be operated in a manner that protects human health and the environment?** 8
11. **How does the proposed rule ensure that wells will be properly closed or plugged at the end of their useful life?** 9
12. **In your opinion, are the proposed regulations consistent with the requirements described above?** 9
13. **What classes of underground injection wells are currently operated in New Mexico?** 11
14. **Who is responsible for issuing permits and administering the UIC program in New Mexico?** 13
15. **Are UIC injection wells constructed and operated in accordance with New Mexico's current regulations protective of human health and environment?** 13
16. **Have there been any instances of contamination of groundwater of the state of New Mexico as a result of migration of fluids from UIC wells?** 13
17. **How would the proposed rule, if adopted, protect human health and the environment?** 14

1. Please state your name and business address.

My name is Alberto A. Gutiérrez. My business address is Geolex, Inc., 500 Marquette Avenue NW Suite 1350, Albuquerque, NM 87102.

2. By whom are you employed and in what capacity?

I am employed by Geolex, Inc. as its president and CEO, and I am a principal geologist and hydrogeologist for the firm. Geolex is an environmental and geologic consulting firm with extensive experience in injection well siting, permitting, construction and operation pursuant to underground injection control (UIC) regulations. Geolex and I also have extensive experience in identifying and characterizing groundwater contamination at many types of sites and developing/implementing remedial programs under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Geolex also provides extensive regulatory assistance and environmental remediation services to private industry and government throughout the United States and abroad.

3. Please describe the purpose of your testimony.

The purpose of my testimony is to provide geologic and engineering information to the Water Quality Control Commission (WQCC) that supports adoption of a permitting program for disposal wells to be used by oil refineries to dispose of process wastewaters that may be classified as hazardous due to the concentration of chemical constituents caused by water conservation and reuse measures designed to enhance protection of groundwater resources and the environment. In addition, I will provide the WQCC with information to evaluate the proposed modification of the Class I UIC regulations in the context of the state of New Mexico's UIC program generally.

4. Please briefly summarize your testimony and the conclusions made in it.

In my testimony, I explain that there are four factors that must be addressed to ensure that any deep injection well will be protective of groundwater of the state of New Mexico as well as human health and the environment. These four factors are: geology, well construction, well operation, and well closure. I also evaluate New Mexico's existing UIC program and conclude that it has been effective in protecting groundwater of the state of New Mexico. Based on a comparison of the proposed rule to the factors listed above, I also conclude that wells sited, constructed, operated, and ultimately plugged and closed in accordance with the proposed regulations will satisfy each of the factors listed above and, as a result, will be protective of the groundwater of the state of New Mexico as well as human health and the environment.

I believe that my testimony provides the WQCC with the information necessary to determine if the proposed regulations, which would provide for the permitting and operation of Class I hazardous waste injection wells for refineries, are protective of the waters of New Mexico and protective of human health and the environment. Furthermore my testimony will demonstrate that the regulations will require the submission of information throughout the permitting process to allow the New Mexico Oil Conservation Division (NMOCD) to evaluate the ability of any

particular proposed project to be protective of human health and the environment through appropriate geologic analyses, well design/construction, well operation and closure/post-closure care.

5. Please describe your educational background and training.

I hold a Master's Degree (Magna Cum Laude) in Geology from the University of New Mexico, in 1980 and a Bachelor of Science (Summa Cum Laude) in Geomorphology from the University of Maryland in 1977. I have nearly 40 years of professional experience in environmental geology, geomorphology, hydrogeology and petroleum geology including work experience with the United States Geological Survey (USGS) in Reston, Virginia and Albuquerque, New Mexico, Radian Corporation of Austin, Texas, LHR Exploration in Santa Fe, New Mexico, Geoscience Consultants, Ltd. in Albuquerque, New Mexico, and Geolex, Inc., also in Albuquerque. I am a registered professional geologist with AIPG and maintain active professional registration in 21 states in the U.S.

In addition, I have extensive regulatory experience having served on the New Mexico Environmental Improvement Board for six years with four years as its Chairman and as a Commissioner with the WQCC for four years. I have over 25 peer-reviewed publications or presentations in the field including numerous publications relating to the safe and successful permitting of Class II acid gas injection (AGI) wells and the analyses of environmental issues arising from other oil and gas activities throughout North America, South America, Europe and Africa. I have testified in numerous litigation and regulatory development matters throughout the United States and have been accepted as an expert in hydrogeology, geology and petroleum geology by the New Mexico Oil Conservation Commission (NMOCC), NMOCD, New Mexico Environment Department (NMED), WQCC, Texas Railroad Commission (TRRC), the California Regional Water Quality Control Board (RWQCB), and various other state and federal agencies. I have also provided testimony in numerous matters involving the contamination or potential contamination of soil, groundwater and surface waters for numerous state and federal courts in the United States and abroad. In addition, I have participated extensively with the NMOCD and NMOCC in the development of new proposed UIC (Rule 26) regulations for the permitting and operation of Class II AGI and enhanced recovery wells. In addition, I have extensive experience over the last 15 years in the geologic analyses, well design/construction, operation and closure of Class II AGI wells under the UIC program throughout the US and similar programs in Canada and I have served as principal-in-charge of most AGI well projects in the State. My curriculum vitae is included herein as Exhibit A.

6. What have you reviewed in preparation for your testimony?

I have reviewed the petition to amend 20.6.2.3000 NMAC and 20.6.2.5000 NMAC, and numerous applications that Geolex has successfully made in support of permitting of Class II acid gas injection wells. These applications have resulted in the development, siting, design and oversight of construction and operation of all but one of the Class II AGI wells in New Mexico and various AGI and salt water disposal wells in other states including Texas, Utah, Wyoming, Oklahoma, Mississippi, and Kansas, and in Canada. I have reviewed U.S. Environmental Protection Agency (EPA) and NMOCD data on Class I wells throughout the U.S. and specifically the proposed provisions of the proposed amended rules which are similar to those for

existing disposal wells in New Mexico and throughout the U.S., and EPA's existing Class I well regulations

7. What factors must be considered to ensure that underground injection wells are protective of human health and the environment?

The four factors that must be considered to determine if any particular well is protective of groundwater, human health and the environment are:

A. Siting and geologic analyses.

In the siting of any potential injection well, it is necessary to conduct extensive geologic analyses to document that there is a geologic seal that will permanently contain wastes within the injection zone. In addition, an injection reservoir must be identified and characterized which is laterally extensive, porous and contains excess capacity for the anticipated waste disposal. These reservoirs should contain both internal seals within the injection formation, and a caprock with no transmissive fractures, faults, or porosity/permeability. As required by the proposed regulations, the injection zone must be well isolated from any fresh groundwater, at a depth sufficient to assure suitable seals and caprock which will prevent the escape of wastes from the injection zone. In addition, the proposal's corrective action provisions state that wells already existing within the area of review required by the regulations must be analyzed to assure that they do not provide potential conduits allowing wastes to escape the injection zone.

B. Well design and construction

As reflected by the proposed regulations, an injection well must be designed and constructed with multiple strings of casing comprised of compatible materials, cemented to the surface and verified by appropriate cement bond logs and tests, and appropriate infrastructure that will assure there is no escape of injection fluids outside the wellbore that could threaten overlying groundwater resources. The design and construction of the well must consider the appropriate material and equipment selection for the specific waste stream and geologic conditions as identified in factor 1 above. Wells must be designed to contain appropriate monitoring equipment to monitor pressure and well integrity as required by the proposed regulations.

C. Well Operation and Maintenance

The safe operation of injection wells require the implementation of a series of procedures including regular inspection, testing and maintenance to assure that the well equipment continues to provide the protection of groundwater and the environment envisioned through the original design and construction. As required by the proposed regulations, the periodic mechanical integrity testing of the well in addition to the monitoring and required reporting of pressure and other injection conditions act together to provide ongoing assurance that the well continues to be protective of groundwater and the environment. These procedures and protective measures assure that well and disposal zone integrity are maintained throughout the operational life of the well.

D. Closure, post-closure care and financial assurance

At the end of the useful life of the well or facility, the proposed regulations incorporate procedures for the closure (plugging) of the well in accordance with current best practices, as well as requirements for post-closure care, to avoid the potential escape of wastes contained within the injection zone through the well which is being decommissioned. In addition, these proposed regulations contain provisions for financial assurance which assure the State that the funds will be available to conduct the closure and post-closure activities consistent with regulatory requirements and the post-closure care and monitoring will be conducted to assure continued integrity and containment of the wastes within the disposal zone.

8. How do you ensure that wells will inject waste into appropriate geologic formations?

There are several steps involved in identifying potentially suitable injection zones (siting or feasibility analyses) for Class I hazardous wastes before a determination can be made that any particular location or reservoir are appropriate for injection of wastes. Each of the steps outlined here is generally required by the proposed regulations. These steps have been used successfully over the past 10-15 years in New Mexico and elsewhere to evaluate the suitability of geologic reservoirs for other UIC disposal wells. The following generic description of the components of a siting and feasibility analysis are not necessarily applicable at all sites and geologic conditions, and the relative importance of specific data sets or analysis methodology will vary as appropriate from site to site.

The primary focus in the initial stages of study involves identification and characterization of wells in the area in which an injection well is to be drilled, and the geologic and hydrogeologic conditions in the project area. The first steps in characterizing a potential injection zone are to identify and characterize the stratigraphic section in the area, identify all fresh groundwater (<10,000 TDS) zones, and clearly establish the maximum depth of groundwater of the state of New Mexico in order to develop an appropriately protective well design and monitoring system. As an additional step, a permit applicant could establish the baseline water quality of groundwater of the state of New Mexico in the project area by reviewing all available data on water wells within the project area and the well's area of review. These data can be obtained from a variety of sources in New Mexico, including but not limited to, the records of the office of the State Engineer. As part of the analysis of the deep stratigraphy in the area and the identification of a potentially suitable injection zone, an analysis of potential injection zones and oil and gas zones in the area of review, as well as identification of plugged and abandoned wells and dry holes which could form potential conduits for migration of wastes from candidate injection reservoirs, should be conducted.

Based on the available well and well log control data in the area of interest, a potential injection zone is then selected on the basis of its propensity for porosity and suitable permeability that would accommodate injection needs. In rare cases where there is not enough well control data to conduct a comprehensive assessment resulting in a quantified judgment, other subsurface investigation techniques may be employed. In most cases, that would involve evaluation of commercially available or newly acquired seismic data to evaluate a potential injection zone. Using these techniques, suitable zones separated from all fresh groundwater resources by impermeable strata and not containing economically viable mineral resources within the area of

review can be identified. It should also ideally be confined more locally by impermeable strata both within and immediately adjacent to (above and below) the candidate injection interval.

Once suitable injection zone candidates are identified, the depositional environment(s) of the zones must be determined in order that the geometry and architecture of the zone (lateral extent and shape of the zone) are understood and characterized. These factors also provide data inputs to calculate plume extent and geometry given expected injection rates and injection fluid capacity. Cross-sections showing the distribution of porous and permeable injection zones, as well as seals and caprock, are constructed to analyze and illustrate the permeability pathways within the formation.

It is important to identify all wells, whether active, plugged, or dry holes that penetrate through the proposed injection zone within the area of review, as these have a bearing on the protection of groundwater resources. The selection of an appropriate injection zone along with a careful evaluation of any potential man-made conduits (wells) within the area of review assures that no injected wastes will escape out of the intended injection zone and assures that injected wastes will not migrate up or down section via natural pathways (such as fractures) or improperly completed or plugged wells. The well construction or plugging reports of all wells that penetrate through the zone within the area of review must be examined, and determination made of any exposure behind production casing of any producing zones due to lack of suitable annular cements or plugs. If any such exposure is found, the permit can include conditions of approval that require remediation of these wellbores by the operator of the injection well.

The structural features of the region are also important to understanding the fluid flow pathways the injected wastes are likely to follow, and ultimately are factored into the plume analysis that must be included as part of the required post-closure plan. A number of factors may be considered when analyzing the anticipated plume from an injection well. Regional dip of the sediments, as well as the presence of fractures and faults, needs to be fully characterized in order to anticipate any natural factors that could cause extraordinary escape of fluids up or down the stratigraphic section. Downhole test data, such as data from drillstem tests run in wells in the area, are used to determine the regional pressure and temperature gradients, which are also factors that go into the no migration demonstration. Once all the geologic, structural, and downhole parameters are established, calculations can then be made to determine expected reservoir capacity, and models constructed to predict fluid migration plume paths and affected area within the reservoir over various time periods.

9. How do you ensure that wells are constructed and completed in a manner that maintains well integrity?

Once an application is made and approved to drill an injection well, the drilling is carefully supervised and data essential to determination of reservoir properties is collected during and after drilling. Although the precise steps taken for any given well installation will vary on a site by site basis depending on local conditions, the follow generally occur. Sidewall or whole core samples may be collected in the well in order to get laboratory measurements of porosity, permeability, water chemistry, and any indication of potential hydrocarbon production. Downhole wireline logs are run, which can include: several types of porosity logs (acoustic, density, neutron); resistivity logs to determine relative permeability and water saturations in the zone; Formation

Micro-imager (FMI) logs to map reservoir heterogeneity, structural dip, and fractures; and cement bond logs to examine the integrity of cement after each string of casing is set. The logs are evaluated and specific zones identified for perforation within the approved injection interval. Core data is collected or wireline tests run to establish native fluid chemistry in the zone, to establish compatibility with injection fluids. Once the zones are perforated, they may be swab tested to determine fluid recovery, fluid chemistry, and establish non-productivity to hydrocarbons, and then step rate tests conducted across all sets of perforations to establish transmissivity and injection rates.

The designs of these wells as required by the proposed regulations require setting of surface casing into an impermeable formation below the lowest potable water source. This design often includes multiple casing and cement intervals to isolate fresh groundwater. Production (i.e., injection) casing is set within the surface casing, cemented to the surface, and constructed with materials which will assure the integrity of the base of the production casing exposed to waste stream in the injection zone below the packer. These wells typically have the outermost surface casing set with cement to the surface below the depth of the deepest groundwater of the state of New Mexico. In some cases, it may be necessary to set and cement to the surface an intermediate casing to a depth which will further protect any usable but not potable water (>10,000 TDS) or other formations of interest, at the discretion of the Agency, even though the surface casing string is what is required to protect groundwater of the state of New Mexico. Finally, the injection casing is also set and cemented to the surface. This provides a minimum of four alternating layers of steel casing and cement which serve to isolate the injection zone from any potential of injected wastes affecting shallower zones by travelling up the well bore. In addition, a circumferential cement bond log is run for each of these casing strings to assure that an appropriate bond between cement and casing and cement and formation insures the integrity of the well. A typical well design is included as Exhibit B.

Cement bond logs will assure casing seal to formations. In some cases, it may be appropriate to conduct radioactive tracer surveys across perforated intervals in order to verify containment of fluids within the intended injection zone(s). Appropriate corrosion resistant tubing will be inserted inside the production casing and stabbed into a compatible packer with annular space filled with inert corrosion-inhibited fluid and monitored for pressure to indicate potential tubing leak before it can affect production casing.

Similar designs have been implemented successfully without any instances of groundwater contamination or leakage problems at similar deep zones in southeastern New Mexico, Texas, and Alberta for many years, including many such installations which my firm has designed, permitted and installed.

10. How does the proposed rule ensure that wells will be operated in a manner that protects human health and the environment?

The operation of these wells consistent with the proposed regulations requires the constant monitoring of injection and annular pressures and the regular periodic pressure testing of the production and intermediate casing strings with regularly scheduled mechanical integrity tests (MITs) such as a Braden Head (BH) test for the surface casing. All of these wells are given a conservative maximum allowable operating pressure (MAOP) approved by the Agency as a

condition of approval which further ensures that the wells will be operated in such a manner as to not damage the isolating characteristics of the injection zone in the immediate vicinity of the well. The continuous monitoring combined with a periodic testing program as required by the proposed regulations assures that there is an immediate detection of any condition which could result in an escape of injected fluid out of the injection zone in the immediate vicinity of the wellbore. In addition, the regulations require periodic MITs tests which are independent confirmation of the well's integrity. These tests are required every year for the proposed Class I hazardous waste disposal wells and have been demonstrated to be successful in the case of Class II AGI wells to assure continued integrity of the wellbore and protection of groundwater resources during the operational life of the wells.

In addition to the periodic testing of the wells, the reporting to the Agency of the volumes of wastes injected and demonstration of the operation of the well within permit limits and constraints is required by the proposed regulations to allow independent verification by the Agency of the permittee's compliance with permit conditions.

11. How does the proposed rule ensure that wells will be properly closed or plugged at the end of their useful life?

The proposed rules contain detailed requirements to assure that the wells are properly closed (plugged and abandoned) and that an operator demonstrates financial assurance to ensure that the resources are available to plug the well in a manner that protects groundwater of the state of New Mexico by maintaining the isolation of the injection zone and assuring that the well itself does not become a conduit for wastes injected into the disposal zone to potentially affect other zones. These plugging and post-closure requirements are similarly imposed on production wells which also have the potential to result in the leakage of residual hydrocarbons from the production zones which could affect overlying groundwater resources.

The financial assurance requirements within the proposed regulations provide the State with non-cancelable financial instruments to assure that funds are available for the proper closure (plugging) and post-closure monitoring to assure that the wells are maintained and monitored to ensure containment of injected wastes in perpetuity.

12. In your opinion, are the proposed regulations consistent with the requirements described above?

Yes. I have reviewed the proposed regulations as well as EPA's regulations for Class I hazardous waste injection wells and have concluded that, under the proposed rule, a successful applicant for a Class I hazardous waste injection well permit would be required to comply with each of the steps generally described above. Table 1 provides a summary of the specific sections of the proposed regulations that cover each of the four factors discussed above which are needed to assure that any of the proposed Class I wells are protective of the groundwater of the state of New Mexico. Of course, there are also many other sections of the proposed regulations that generally support the approach I have described above. Based on this review, it is my opinion that any Class I hazardous waste injection well permitted in compliance with the proposed regulations would be protective of groundwater of the state of New Mexico as well as of human health and the environment.

TABLE 1 CROSS REFERENCE AMONG TESTIMONY, PROTECTIVENESS FACTORS TO BE CONSIDERED FOR CLASS I HAZARDOUS WASTE INJECTION WELLS AND EXISTING AND PROPOSED REGULATIONS

Questions in Testimony Addressing Each Factor	Factors Required to Assure Protectiveness of Permitted Class I UIC Wells	Relevant Sections of 20.6.2.XXXX NMAC (existing regulations in italics; proposed regulation in underlined text)
7, 8	A. Siting and Geologic Analyses	*5102(A);5103(A-L);5104(A-B); 5210(A-C)* 5352(A-D); 5353; 5354(A-E); 5360(A-D)
7,9	B. Well Design and Construction	*5204(A-D);* 5355(A-D); 5356(A-F)
7,10	C. Well Operation and Maintenance	*5204(A-D);* 5357(A-J); 5358(A-F); 5359(A-B); 5360(A-D)
7,11	D. Closure and Post-Closure Care	5361(A-D); 5362(A-C); 5363

13. What classes of underground injection wells are currently operated in New Mexico?

EPA's regulations cover five classes of injection wells which are found in New Mexico. Table 2 includes the latest EPA inventory for UIC wells in Region 6 (2010), which includes New Mexico. To my knowledge, there are currently no Class VI wells in New Mexico.

TABLE 2 DISTRIBUTION OF UIC WELLS IN THE U.S. IN EPA REGION 6 (as of 2010)

STATE	CLASS I HW	CLASS I OTHER	CLASS II	CLASS III	CLASS IV	CLASS V
AR	4	9	1093	0	0	281
LA	15	22	3731	89	0	213
NM	0	5	4585	10	0	1414
OK	0	6	10629	2	2	1928
TX	58	50	52016	6075	4	32594

(Source: http://water.epa.gov/type/groundwater/uic/upload/UIC-Well-Inventory_2010-2.pdf)

There are Non-Hazardous Class I, Class II, Class III and Class V underground injection wells currently permitted and operating throughout the State of New Mexico. The current distribution of UIC wells in New Mexico is provided in Table 3.

TABLE 3 DISTRIBUTION OF CURRENT UIC WELLS PERMITTED IN STATE OF NEW MEXICO

CLASS I		CLASS II			CLASS III	CLASS V
NON-HW	HW WELLS	AGI WELLS	SWDW	EOR	BRINE	MISC.
5	0	15	911	3,521	36	1,005

(Source: New Mexico Oil Conservation Division and New Mexico Environment Department)

Currently, there are 5 active and 1 inactive Class I non-hazardous wells operating in the State, all of which inject non-hazardous wastes and all related to refinery wastes, including those operated by Navajo Refining in southeast New Mexico. Table 4 provides a summary of the six Class I non-hazardous wells currently permitted in New Mexico.

TABLE 4 STATUS OF CLASS I WELLS CURRENTLY PERMITTED IN NEW MEXICO

Order Number	County	Well Location	Entity	Operator	API Number(s)
UICI-10-0	Lea	Unit H, Section 35, Township 19S, Range 36E	Monument #1	MONUMENT DISPOSAL, INC.	3002537918 (Inactive)
UICI-9-0	San Juan	Unit I, Section 27, Township 29, Range 11	GIANT BLOOMFIELD CLASS I, DISPOSAL NO. 001	SAN JUAN REFINING CO	3004529002
UICI-8-1	Eddy	Unit O, Section 31, Township 17S, Range 28 E	NAVAJO-WDW1	NAVAJO REFINING COMPANY, L.L.C.	3001527592
UICI-8-2	Eddy	Unit E, Section 12, Township 18S, Range 27E	WDW NO.002, NAVAJO-WDW2	NAVAJO REFINING COMPANY, L.L.C.	3001520894
UICI-8-3	Eddy	Unit N, Section 01,Township 18S, Range 27E	WDW No.003 , NAVAJO-WDW3	NAVAJO REFINING COMPANY, L.L.C.	3001526575
UICI-5-0	San Juan	Unit E, Section 2, Township 29N, Range 12W	SUNCO DISPOSAL NO.001, Key-SUNCO CLASS I (GW-235)	AGUA MOSS, LLC	3004528653

Class II wells inject brines and other fluids associated with oil and gas production, and hydrocarbons for storage. The Class II wells in New Mexico consist of salt water disposal wells, enhanced oil recovery wells, and AGI wells.

Class III wells inject fluids associated with solution mining of minerals beneath the lowermost groundwater of the state of New Mexico. Currently, there are approximately 36 active Class III wells in the State.

Class V wells within the state of New Mexico include 1,005 wells which are largely used for geothermal purposes or for the injection of domestic wastes or aquifer recharge. There are currently 160 discharge permits covering the 1,005 wells, meaning that many of the permits cover multiple wells.

14. Who is responsible for issuing permits and administering the UIC program in New Mexico?

New Mexico has been delegated authority by EPA to administer the UIC program in the state. Responsibility for administering the UIC program in New Mexico is split between NMED and NMOCD. Class I and Class II injection wells related to oil and gas production or processing operations (including refinery operations) are administered by NMOCD. All other injection wells are administered by the Ground Water Quality Bureau of NMED. This division of authority is outlined in the 1982 Joint Powers Agreement between the Environmental Improvement Division, the Oil Conservation Divisions, and the Minerals and Mining Division and the 1989 WQCC Delegation of Responsibilities to NMED and NMOCD. As a result, permits for the wells associated with the proposed regulations would be reviewed, approved and monitored by the NMOCD.

15. Are UIC injection wells constructed and operated in accordance with New Mexico's current regulations protective of human health and environment?

Yes, existing UIC wells have been demonstrated to be protective of groundwater and human health and the environment in New Mexico. My research combined with investigations and discussions with NMOCD and NMED demonstrate that there have not been any documented instances of impairment of groundwater resources due to the operation of injection wells in New Mexico pursuant to UIC regulations.

16. Have there been any instances of contamination of groundwater of the state of New Mexico as a result of migration of fluids from UIC wells?

Based on my knowledge and discussions with NMOCD and NMED technical staff, I am not aware of any information on UIC wells in New Mexico suggesting that a properly permitted UIC well has resulted in contamination of fresh water resources. Clearly there are numerous documented cases of produced water contaminating ground water resources; however, these instances, to the best of my knowledge, are, in contrast, only related to surface disposal of produced water in pits or surface discharges resulting from tank loading/unloading operations or drilling pits. In fact, the use of injection wells (Class II) instead of older methods of handling produced water (like evaporation pits and ponds) has resulted in a safer and more environmentally friendly disposal mechanism with a greater degree of protection of the State's groundwater resources.

Further, as far as Class II AGI wells are concerned, many of which I have worked with during both permitting and operational stages, there have been no incidents resulting in impairment or contamination of groundwater since these wells began to be used in New Mexico in the late 1990s. Additionally, the recent sampling of H_2S during the drilling of a redundant well at the Linam Facility near Hobbs has demonstrated that the siting and construction of an adjacent Class

II AGI well have assured that the injected wastes are well contained within the injection reservoir. In my experience, there have been some operational, compliance, verification and maintenance issues associated with some Class II deep injection wells, but nothing that resulted in impairment or contamination of groundwater.

17. How would the proposed rule, if adopted, protect human health and the environment?

As described more fully above, by proposing regulations that are based on EPA's Class I hazardous waste injection well program and that incorporate each of four requirements discussed above, the proposed regulations provide even further protection of groundwater of the state of New Mexico than existing state and federal UIC regulations. Given the track record of UIC wells permitted under existing State regulations, it is my opinion that the proposed regulations, which incorporate additional safeguards, will protect groundwater of the state of New Mexico, along with human health and the environment.

In the case of the proposed regulations on Class I hazardous waste disposal wells associated with refinery activities, the larger area of investigation (2 miles vs 0.5 or 1.0 mile) as compared to Class I nonhazardous or Class II wells in New Mexico, along with the requirements for closure and post-closure care, assure that these wells will be even more protective of the waters of the state of New Mexico than current state or federal UIC regulations. Further, by providing refineries with the opportunity to implement water conservation measures that reduce the need for fresh groundwater resources, these proposed regulations will enhance the prevention of waste of the precious resources of groundwater of the state of New Mexico.

Alberto A. Gutiérrez, RG

Date: 6/15/2015

GEOLEX®
INCORPORATED

CURRICULUM VITAE
Alberto Alejandro Gutiérrez, CPG

PERSONAL

Name:	Alberto Alejandro Gutiérrez
Birthdate:	August 8, 1955
Birthplace:	La Habana, Cuba
Citizenship:	United States
Languages:	English, Spanish, and French

Specialization: Contaminant Fate and Transport & Risk Assessment, Evaluation of Environmental Liability, Cost Allocation & Source Fingerprinting, Expert Witness Testimony, Forensic Geochemistry, Hydrogeology, Soil & Groundwater Remediation, Regulatory Compliance Negotiation, , Executive Management, Major Program Management.

EDUCATION

University of New Mexico, 1980
M.S. Cum Laude, Geology - Specializing in Hydrogeology/Geomorphology/Remote Sensing

University of Maryland, 1977
B.S. Magna cum Laude, Geomorphology, Phi Beta Kappa, Phi Kappa Phi

McGill University, 1973-1975
Geomorphology, Remote Sensing, Land Use

PROFESSIONAL CERTIFICATIONS AND REGISTRATIONS

AIPG Certified Professional Geologist #6421
Registered Professional Geologist – State of Alabama #1023
Registered Professional Geologist - State of Alaska #421
Registered Professional Geologist - State of Arizona #18002
Registered Professional Geologist - State of California #4373
Registered Professional Geologist - State of Georgia #1305
Registered Professional Geologist - State of Idaho #933
Registered Professional Geologist - State of Illinois #196-001051
Registered Professional Geologist - State of Kansas #544
Registered Professional Geologist - State of Kentucky #2476
Registered Professional Geologist - State of Louisiana #136
Registered Professional Geologist - State of Minnesota #30196
Registered Professional Geologist - State of Mississippi #0648
Registered Professional Geologist - State of Missouri #RG 0527
Registered Professional Geologist - State of North Carolina #1561
Registered Professional Geologist - State of South Carolina #525
Registered Professional Geologist - State of Tennessee #TN4038
Registered Professional Geologist - State of Texas (#113)
Registered Professional Geologist - State of Utah #5218722-2250
Registered Professional Geologist - State of Virginia #PG-1023
Registered Professional Geologist - State of Wyoming #PG-1391

HONORS AND AWARDS

CEO of GCL on INC 500's List of America's Fastest Growing Private Companies 1988 and 1989
Graduated cum Laude, M.S. Geology, University of New Mexico, May 1980.
Flesch Award and Scholarship for outstanding performance in sedimentology and soft rock geology, Department of Geology, University of New Mexico, January 1979
Sigma Gamma Epsilon Geology Honorary Society and Sigma Xi, January 1979
Phi Beta Kappa, University of Maryland 1977
Phi Kappa Phi, University of Maryland, 1977
Graduated Magna cum Laude B.S. Geomorphology, University of Maryland, May 1977
Academic Scholarship awarded by McGill University, April 1975
Honors Geography/Geomorphology Program at McGill University in Montreal, Canada, GPA3.9/4.0

OFFICES HELD

President, CEO and Director, Geolex, Inc., 1996-Present
Director, UNM Science and Technology Corporation, 1994-2004
Director, Albuquerque Museum Foundation 2005-Present
Director, Caswell Silver Foundation, 1995-Present
Director, Frank C. Hibben Foundation, 1999-Present
Director, New Mexico Natural History Museum Foundation, 1988-2007
Commissioner, Interstate Oil and Gas Compact Commission, 1989-2004
Member & Chairman, Clinical Operations Board, University of New Mexico Hospital, 2001-2004
Commissioner, New Mexico Water Quality Control Commission, 1995-2000
Director, University of New Mexico Foundation, 1992-1999
President, CEO and Director, Geoscience Consultants, Ltd. and H+GCL, 1981-1996
Member, American Geological Institute, Minority Scholarship Committee, 1988-1998
Albuquerque Petroleum Association - Board of Directors, Past President, 1986-1989
Chairman, New Mexico Environmental Improvement Board, 1987-1990

ORGANIZATIONS

American Association of Petroleum Geologists-DEG
American Institute of Professional Geologists
Association of Ground Water Scientists and Engineers
Hazardous Materials Control Research Institute
New Mexico Hazardous Waste Society
Albuquerque Geological Society
New Mexico Geological Society
Geological Society of America - Hydrogeology Division
American Geological Institute
Albuquerque Petroleum Association
Texas Professional Geologists Association

EMPLOYMENT

November 1996 - Present
President, CEO
Geolex, Inc.
500 Marquette Avenue NW, Suite 1350
Albuquerque, New Mexico 87102

Duties, Accomplishments, Responsibilities:

1. Founder. Overall corporate and executive management of Geolex, Inc.

2. Expert witness testimony for private clients in Federal and state courts and regulatory agencies in EPA Regions I, II, III, IV, V, VI, VII, VIII, IX and X on fate and transport of organic and inorganic compounds, environmental liability valuation, CERCLA cost allocation, plume differentiation, fate and transport analysis of air, surface water, and groundwater contamination, hazardous waste and petroleum industry practices, forensic geochemistry, remote sensing, insurance recovery, hydrogeology and regulatory compliance cases. Evaluation of soil and groundwater transport of MGP wastes including coal tar, PAHs and other organic compounds.

3. Computer modeling and fate and transport analysis of saturated and unsaturated flow and contaminant transport in soil and groundwater. Analysis of fingerprints of multiple sources of contamination and and associated remedial cost allocation. Reservoir analysis for liquid and acid gas injection evaluations.

4. Evaluation and development of oil and gas waste disposal options for H_2S acid gas and CO_2 sequestration projects. Reservoir identification, characterization, and feasibility evaluation. These evaluations include land status analysis and UIC and acid gas pipeline permitting on private and public lands. Development, permitting, installation, testing, and completion oversight for AGI and CO_2 sequestration projects.

5. Extensive experience as a Dispute Resolution Officer, mediator, binding arbitrator, and expert in cases involving multiple parties including government entities, multinational corporations, insurance companies, and commercial clients. For example, Mr. Gutierrez has mediated a large environmental case involving tens of millions of dollars between two parties over the remediation of an 1800-acre portion of a downtown site in a metropolitan area. This analysis involved multiple elements, including groundwater modeling, Superfund cost allocation, and forensic accounting.

6. Manage and conduct large multi-site environmental due diligence for entire company or facility acquisitions. Develop valuations of actual and potential environmental liabilities. Consulting on strategies for limiting assumption of environmental liability associated with acquisitions. Estimate compliance and remedial costs and evaluate options for remediation of a wide variety of oil and gas, industrial, commercial, and mining sites.

7. Strategic consulting in areas of environmental regulatory compliance and contamination assessment/remedial action in soil and groundwater. Management of major geohydrologic investigations for private and Federal

clients in RCRA and CERCLA enforcement cases. Serves as an expert for U.S. DOJ and numerous industrial companies in cases involving multiple torts and CERCLA cost recovery actions.

8. Preparation, reviews, submittal and obtaining approval of environmental permit documents for Federal and private clients with respect to multiple media, including air, water, solid, hazardous waste, and UIC.

9. Determination and negotiation of final cleanup standards for implementation of soil, groundwater, and indoor remedial actions at RCRA and CERCLA sites including risk assessments for natural attenuation and containment zones.

November 1981 - October 1996
President, CEO
Geoscience Consultants, Ltd. (GCL)
505 Marquette Avenue NW, Suite 1100
Albuquerque, New Mexico 87102

Duties, Accomplishments, Responsibilities:

1. Founder. Overall corporate and executive management including profit/loss and growth responsibilities for GCL including merger with Hygienetics (1991) and sale to BDM (1994). Total number of employees at time of merger was 450 with overall annual revenues and a budget of over $40 million.

2. Development of oil and gas prospects in the Permian Basin of Southeast New Mexico and West Texas. Evaluation of tight gas reservoirs and oil and gas prospects in New Mexico, Texas, Oklahoma, Colorado, and Wyoming. Land and lease status analysis. Nomination and acquisition of oil and gas and mineral leases on Federal and State lands.

3. Overall technical review and supervision of vice president-level staff and multimillion dollar multi-year, multi-task projects.

4. Expert witness testimony for private clients in Federal and state courts and regulatory agencies in all EPA Regions on environmental liability valuation, CERCLA cost allocation, plume differentiation, forensic geochemistry, fate and transport analysis and RCRA hydrogeological and regulatory compliance cases.

5. Management of major geohydrologic investigations for private and Federal clients in RCRA and CERCLA enforcement cases. Includes large federal GOCO sites in EPA Regions III, IV, VI, VII, VIII and IX.

6. Over 30 years of experience in evaluating fate and transport and risk assessment of organic solvents and heavy metals including lead, mercury, arsenic and chromium in soils, groundwater, surface water and air. Direct management and oversight of investigation and remediation of over 50 mercury spill sites for a major gas company throughout the southwestern US.

8. Preparation, reviews, submittal and obtaining approval of environmental permit documents for Federal and private clients. Preparation and negotiation of RCRA Part B Permits for complex NASA and DoD facilities and in the petroleum production, refining and marketing , chemical and bio-medical industries.

9. Design and implementation of remedial actions for contaminated soil and

groundwater at RCRA and CERCLA sites for private and Federal clients including determination and negotiation of cleanup standards.

May 1980 - November 1981
Hydrogeologist/Program Manager
Radian Corporation
13595 Dulles Technology Drive
Herndon, VA 22071

Duties, Accomplishments, Responsibilities:

1. Development and Management of several programs including hazardous waste site selection, groundwater monitoring, well design and installation, photogeology and remote sensing. Development of computer models for hazardous waste disposal site screening and evaluation for US Department of Energy. Management of programs for solid and hazardous waste permit assistance to various industrial clients in the petroleum and alcohol fuels industry.

2. Field studies and sampling of hazardous wastes and groundwater at various sites in Texas, Washington, California, Maryland and Virginia. Sampling of wastes done with complete impermeable suits with respirator or self-contained air supply.

3. Computer modeling of contaminated groundwater by finite difference and finite element methods in shallow unconfined aquifers. Leachate plume definition at contaminated hazardous waste disposal sites. Coordination of groundwater monitoring design, sampling and data preparation for modeling.

4. Business development and marketing in the areas of hydrogeological studies for hazardous waste disposal, groundwater monitoring, and risk assessment for Environmental Impairment Liability insurance.

5. Management of program to provide industrial clients with complete risk assessment services relating to the risks of long-term gradual environmental impairment arising from their operations. Development of system to evaluate environmental risk for EIL insurers to develop products and pricing for RCRA compliance EIL insurance. These risk assessments are used in obtaining EIL insurance in response to financial liability requirements.

April 1979 - May 1980
Geologist GS-9
National Park Service, Remote Sensing Division, SWCRC
Albuquerque, NM 87125

Duties, Accomplishments, Responsibilities:

1. Interpret and analyze geologic and geomorphic environments on aerial photography and Landsat imagery to determine characteristics associated with natural and cultural resources and waste disposal sites.

2. Predict location of cultural and mineral resources through remote sensing and computer analyses of vegetation, geomorphic, pedologic, and geologic data in Shenandoah National Park.

3. Geohydrologic investigations of shallow groundwater in Chaco Canyon National Park. Relationship of shallow groundwater geochemistry to cultural resource preservation.

4. Identification of geomorphic management problems and recommendations for mitigation on NPS lands based on imagery interpretation and subsequent field investigations.

May 1978 - May 1980
Co-Coordinator
Research Grant from New Mexico Energy and Minerals Department (at University of New Mexico)

Duties, Accomplishments, Responsibilities:

1. Research design and instrumentation of three experimental water sheds to examine fluvial geomorphology and sedimentology of the strippable coal belt of the San Juan Basin, NM. Geohydrologic investigation of shallow groundwater in San Juan Basin arroyo systems

2. Field geology and geomorphic mapping of study area and surrounding larger drainage systems.

3. Photogeologic interpretation and mapping of stratigraphy, reclamation potential and surficial processes in study areas.

September 1977 – December 1978
Private Consulting Geologist
BIA San Juan Basin Regional Uranium Study

Duties, Accomplishments, Responsibilities:

1. Examine hydrogeology and shallow groundwater regime in Ambrosia Lake and Church Rock mining districts. Geochemical studies of leachate from uranium mine tailings disposal. Modeling of groundwater movement in shallow alluvial aquifers near tailings disposal areas.

2. Define dominant geomorphic processes operating in districts of present or predicted high level activity, i.e., Crownpoint, Ambrosia Lake, etc.

3. Analyze impacts of exploration, mining, and milling on geomorphic and surface hydrology variables of selected districts.

February 1976 - July 1977
Geologist, GS-5
U.S. Geological Survey, National Center, Reston, VA
Environmental Impact Analysis Program

Duties, Accomplishments, Responsibilities:

1. Research innovative methods of analyzing and quantifying geomorphic and hydrologic impacts of surface coal mining in semiarid western states. Analysis of environmental systems for use as baseline data to analyze impacts of surface mining.

2. Designed and executed research projects to establish processes operating in, and rates of natural reclamation on unreclaimed surface coal mines in southeastern Wyoming. Ecosystem modeling for EIS preparation.

3. Monitoring of geomorphic variables in surface mine reclamation through use of high-altitude photography and Landsat imagery. Research, development, writing and completion of a manual for the preparation of environmental impact statements on surface mining and oil and gas development.

TEACHING EXPERIENCE

University of New Mexico Geology and Geography Department - Fall 1977-Spring 1980 - Teaching Assistant for Courses in Geomorphology, Quantitative Geomorphology, Geomorphology Lab and Field Courses, Photogeology and Remote Sensing, Physical Geography, Hydrogeology and Environmental Geology

PUBLICATIONS

Gutierrez, Alberto A. and James C. Hunter 2013, Control and Prevention of Hydrate Formation and Accumulation in Acid Gas Injection Systems During Transient Pressure/Temperature Conditions; Proceedings of the Fourth International Symposium on Acid Gas Injection; September 24-27, Calgary, Alberta Canada; 23pp.

Ali, Liaqat, Russell E. Bentley, Alberto A. Gutierrez and Yosmar Gonzales, 2013, Using Distributed Temperature Sensing Technology in Acid Gas Injection Design, Acta Geotechnica; Online ISSN 1861-1133, July 2013, Springer Berlin Heidelberg, 12pp

Gutiérrez, Alberto, A.; 2011 Acid Gas Injection in the Permian Basin: New Developments and Recent Case Studies from New Mexico; Presented at Permian Basin Gas Processor's Association Technical Meeting, May 3, Midland TX.

Lescinsky Dr. David T, ; Alberto A. Gutierrez, RG; James C. Hunter, RG; Julie W. Gutierrez; and Russell E. Bentley, PE, 2010, Acid Gas Injection in the Permian and San Juan Basins: Recent Case Studies from New Mexico; Proceedings of the Second International Symposium on Acid Gas Injection; September 27-30 Calgary, Alberta Canada; 29pp.

Gutierrez, Alberto A., 2009, Benzene Vapor Transport: Measurement and Modeling to Evaluate Remedial Systems and Benzene Exposure in Ambient Air; Proceedings of the 2009 Groundwater Summit, National Groundwater Association April 19-23 Tucson AZ; 24pp.

Gutierrez, Alberto A., 2008, Hydrocarbon Vapor Transport Measurement and Modeling to Evaluate Remedial System Performance and Benzene Exposure in Ambient Air; Proceedings of the Innovative Remedial Technology Conference; American Institute of Professional Geologists; November 6-7, 2008; 22 pp.

Gutierrez, Alberto A., 2004, MTBE in Groundwater; Current Scientific Regulatory and Litigation Trends; Proceedings of the 33rd Annual Conference on Environmental Law; March 11-14, 2004; pp. 449-454

Gutierrez, Alberto A. 1997, Chemical Fingerprinting: A Useful Tool for Source Identification, Differentiation and Remedial Cost Allocation, Hazardous Waste Strategies Update, Volume 8, Number 2, Winter 1997

Gutierrez, Alberto A. and Martin Chandler, 1996, Use of Chemical Fingerprinting in Plume Differentiation and Cost Allocation, The Military Engineer, October/November, 1996

Gutierrez, Alberto A., 1996, Use of Chemical Fingerprints for Source Differentiation at Military Sites, Paper presented at Third International Symposium on Environmental Contamination in Central and Eastern Europe on 12 September in Warsaw, Poland.

Gutierrez, Alberto A., 1996, Reducing Environmental Liability - A Claims Management Approach, Best's Review / Property Casualty April, 1996

Gutierrez, Alberto A. and Michael W. Selke, 1996 Rapid and Cost-Effective Characterization of Deep Groundwater Contamination, Soil and Groundwater Cleanup, April 1996 Issue

Gutierrez, Alberto A., and Randall T. Hicks, 1992, Risk Assessment of Produced Water Disposal Sites using Field Audits and Aquifer Simulation Modeling, paper presented at and published by 1992 International Produced Water Symposium, San Diego, CA

Gutierrez, Alberto A., and Trent H. Thomas, 1990, Negotiating and Implementing RCRA 3008(h) Orders, Federal Facilities Environmental Journal, Volume 1, No. 3, p 313-323

Gutierrez, Alberto A., and Trent H. Thomas, 1990, The Technical Requirements of an RFI/CMS, paper presented at NASA Environmental Conference, January 17-21, Tucson, Arizona.

Gutierrez, Alberto A., and Trent H. Thomas, 1989, Cost-Effective Assessment and Remediation of Leaking Underground Storage Tanks, paper presented at NASA Environmental Symposium, January 17-20 San Diego, California.

Gutierrez, Alberto A., and Kim H. Bullerdick, 1985, Underground Storage Tanks and Corrective Action: Significant New Additions to RCRA, in "The Environmental Forum", Environmental Law Institute, Washington DC, 16p.

Gutierrez, Alberto A., and James C. Hunter, 1985, Exploring for Groundwater in Fractured Carbonates, East-Central New Mexico, Proceedings of the Western Regional Groundwater Conference, Association of Groundwater Scientists and Engineers, January, 1985, Reno, Nevada p.274-281.

Gutierrez, Alberto A., 1983, Sediment Transport in San Juan Basin Badlands, Proceedings of 2nd International American Geomorphological Association, October 7-10, 1983, Albuquerque, New Mexico.

Gutierrez, Alberto A., 1983, The Abo Formation, a Tight Sandstone Gas Reservoir of Southeastern New Mexico, paper presented at the annual meeting of the American Association of Petroleum Geologists in Dallas, Texas, April 17-20, 1983.

Gutierrez, Alberto A., and J.I. Ebert, 1981, Remote Sensing of Geomorphological Factors Affecting the Visibility of Archaeological Materials, Proceedings American Society of Photogrammetry (ASP-ASCM) 1981 Annual Meeting February 22-27, 1981, Washington, D.C.

Gutierrez, Alberto A., 1981, Geomorphology and Hydrology of the Carlsbad Gypsum Plain, Eddy County, New Mexico, Proceedings Eighth International Congress of Speleology, July 18-24, 1981, Bowling Green, Kentucky, USA.

Wells, S.G. and Alberto A. Gutierrez, 1981, Quaternary Evolution of Badlands in the Southeastern Colorado Plateau, USA in Badland Geomorphology and Pipe Erosion (R. Bryan and A. Yair eds.) Geo-Abstracts, LTD, London, England.

Gutierrez, Alberto A., and W. Pearce, 1980, Hazardous Waste Disposal Options, Costs and Disposal Site Evaluation for Coal Gasification/Liquefaction Facilities, Radian Report for US DOE Office of Major Project Management.

Gutierrez, Alberto A., 1980, Sediment Transport in Badland Watersheds, paper presented at the Geological Society of America (GSA) Annual Meeting (1980) in Atlanta, Georgia, November 17-20. GSA Abstracts (1980) p. 440 - MS Thesis Summary.

Ebert, J.I. and Alberto A. Gutierrez, 1979, Applications of Remote Sensor Data to Prediction and Assessment of Cultural Resources and Geomorphic Environments, NPS, Remote Sensing Division
Report 79-7.

Gutierrez, Alberto A., 1979, Quaternary Landscapes of the San Juan Basin, paper presented at the Museum of Northern Arizona, Symposium on the Geology of the Colorado Plateau, August 31, Flagstaff, Arizona.

Gutierrez, Alberto A. and S.G. Wells, 1979, Geomorphology and Hydrology of the Gypsum Plain Karst, Eddy County, New Mexico, Cave Research Foundation 1978 Annual Report.

Hannaford, K., Alberto A. Gutierrez, et al, Hydrogeology and Dissolution History of Alabaster Cave, North-Central New Mexico, Cave Research Foundation 1978 Annual Report.

Ebert, J.I. and Alberto A. Gutierrez, 1979, Relationships Between Landscapes and Archaeological Sites in Shenandoah National Park: A Remote Sensing Approach, APT Bulletin, Vol. XI, No. 4.

Wells, S.G., and Alberto A. Gutierrez, 1979, Geomorphic Adjustments of Fluvial Systems to Ground-water Hydrology in Semiarid and Humid Karst, Cave Research Foundation 1978 Annual Report.

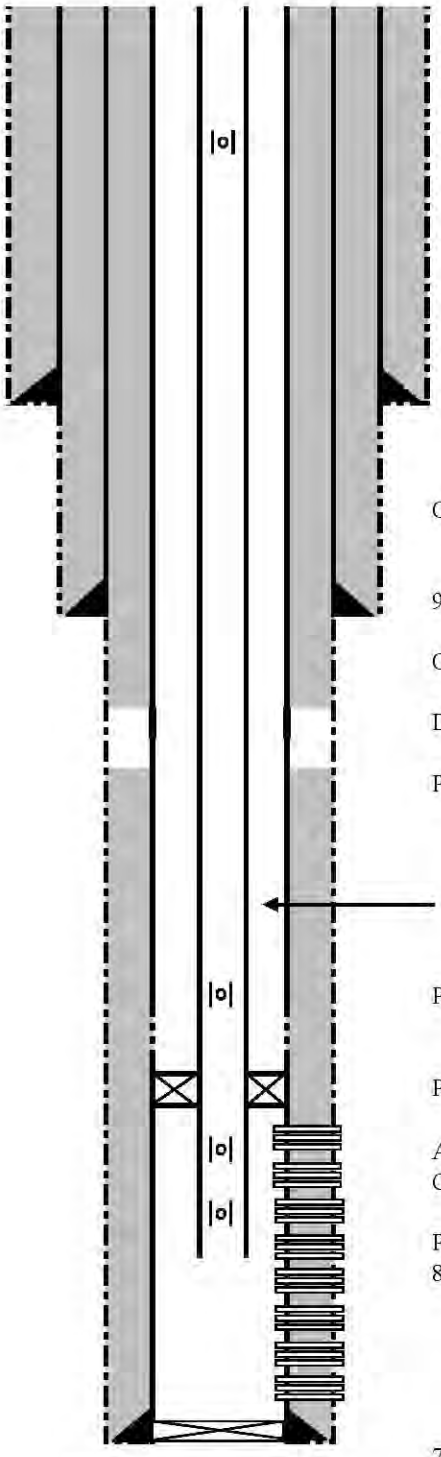
Gutierrez, Alberto A., et al, National Park Service of Canada Bulletin "Archaeology and Prehistoric Land Use of the Proposed Site of Baffin Island National Park, Baffin Island, NWT, Canada," 1975 (end product of research in McGill University Geography Department).

Exhibit B Typical Design of Injection Well Showing Multiple Casing/Cement Strings to Protect Ground Water

Figure 7

DCP LINAM AGI #1
WELLBORE SCHEMATIC

Location: 1980' FSL, 1980' FWL
STR 30-T18S-R37E
County, St.: LEA, NEW MEXICO



SURFACE CASING:
13 3/8", 48.00#/ft, H40, STC at 530'

INTERMEDIATE CASING:
9 5/8", 40.00#/ft, J55, LTC at 4212'

PRODUCTION CASING:
7", 26.00#/ft, L80, STC at 9200'
PBTD = 9137'

TUBING:
Subsurface Safety Valve at 250 ft

3 1/2", 9.2#/ft, L80, Hunting SLF at 8650'

PACKER:
Permanent Production Packer
Adjustable Choke
Check valve

PACKER FLUID (CORROSION INHIBITED):
Diesel w/ Cortron R-2525 (Corrosion inhibitor and oxygen scavenger)

PERFORATIONS:

Primary Target	Secondary Target
Lower Bone Springs	Brushy Canyon
8710' - 8730'	5000' to 5300'
8755' - 8765'	(Not perforated)
8780' - 8795'	
8780' - 8890'	
8925' - 8930'	
8945' - 8975'	
8985' - 9000'	
9045' - 9085'	