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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	Docket No. 70-3103-ML
Louisiana Energy Services, L.P.	)	
	)	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	)	

PREFILED REBUTTAL TESTIMONY OF GEORGE A. HARPER AND ROGER L. PEERY ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. ON CONTENTION NIRS/PC EC-1 ("IMPACTS UPON GROUND AND SURFACE WATER")

I. WITNESS BACKGROUND

Q1. Please state your name, occupation, employer, and responsibilities relative to the licensing of Louisiana Energy Services, L.P.'s ("LES") proposed National Enrichment Facility ("NEF").

A1. I, George H. Harper ("GAH"), am the Manager of Regulatory Compliance Programs at Framatome ANP in Marlborough, Massachusetts, where I managed a team of scientists and engineers involved in preparing the NEF Environmental Report. I also contributed to the preparation of specific portions of the NEF license application and related state permit applications, including LES's New Mexico Groundwater Discharge Permit application. A full statement of my professional qualifications was included with LES's initial prefiled testimony in this proceeding, submitted on January 7, 2005. *See* "Prefiled Testimony of George A. Harper and Roger L. Peery on Behalf of Louisiana Services, L.P. Concerning Contention NIRS/PC EC-1 ("Impacts Upon Ground and Surface Water")" (hereinafter "Harper-Peery Direct Testimony").

Template = SECY-035

SECY-02

I, Roger L. Peery ("RLP"), am employed as Chief Executive Officer and Senior Hydrogeologist at John Shomaker & Associates, Inc. in Albuquerque, New Mexico, where I am responsible for managing a variety of hydrogeological and water resources evaluations. I was hired by LES to serve as an expert witness on hydrogeological and water resources issues in this proceeding. A full statement of my professional qualifications was included with LES's initial prefiled testimony in this proceeding, submitted on January 7, 2005. *See* Harper-Peery Testimony.

Q2. What is the purpose of this rebuttal testimony?

A2. (GAH, RLP) The purpose of this rebuttal testimony is to specifically address the written direct testimony of George Rice regarding Contention NIRS/PC EC-1 in this proceeding. We have reviewed Mr. Rice's testimony, which was submitted on behalf of Nuclear Information and Resource Service and Public Citizen ("NIRS/PC") on January 7, 2005, in its entirety. We show how the issues raised by Mr. Rice were previously addressed in our initial direct testimony in this proceeding. *See* "Direct Testimony of George Rice on Behalf of Nuclear Information and Resource Service and Public Citizen" ("Rice Direct Testimony"). We also provide some additional responses to those issues in view of certain additional claims made by Mr. Rice. In general, as we concluded previously, LES and the NRC Staff have performed a complete and adequate assessment of the potential environmental impacts of the proposed NEF on site surface and ground water.

II. RESPONSE TO SPECIFIC CLAIMS MADE IN THE PREFILED DIRECT TESTIMONY OF NIRS/PC WITNESS GEORGE RICE

Q3. Please summarize the major opinions and conclusions stated by NIRS/PC witness George Rice in his prefiled direct testimony relative to Contention NIRS/PC EC-1.

A3. (GAH, RLP) In the final answer of his testimony, Mr. Rice summarizes his "major points" relative to Contention NIRS/PC EC-1. Mr. Rice concludes that "[t]he work performed by LES and the NRC Staff is deficient," insofar as they have neither "performed investigations necessary properly to characterize existing groundwater conditions," nor "performed investigations necessary to determine how the proposed facility will affect groundwater in the future." Rice Direct Testimony, at 25. He suggests that LES and the NRC Staff should be required to:

1. Measure the hydraulic properties of the shallow materials.

2. Investigate the possibility that fractures capable of acting as preferred flow paths may exist at the proposed site.

3. Estimate the amount of water that would leak from:

    a. The Treated Effluent Evaporative Basin ("TEEB")
    b. The Uranium Byproduct Cylinder ("UBC") Storage Pad Stormwater Retention Basin
    c. The Site Stormwater Detention Basin.
    d. The septic leach fields.

4. Determine where water that leaked from the facility would go, *i.e.*, identify discharge areas.

5. Estimate the time it would take for water from the NEF to reach discharge areas.

6. Develop a groundwater monitoring plan that clearly identifies all units to be monitored.

7. Monitor stormwater runoff for all contaminants that the proposed plant is expected to generate.

Q4. Do you agree with any of Mr. Rice's conclusions or opinions, as summarized above?

A4. (GAH, RLP) No. We strongly disagree with the conclusions and opinions expressed by Mr. Rice. In fact, we believe that each of the "major points" identified by Mr. Rice

in his direct testimony already has been adequately addressed by LES and the NRC Staff in those parties': (1) respective environmental review documents [*i.e.*, the NEF Environmental Report ("ER") and the NRC Draft Environmental Impact Statement ("DEIS")], and (2) prefiled direct testimony. Notwithstanding, we believe that a number of the assertions made by Mr. Rice in his direct testimony warrant clarification or additional explanation because they are inaccurate, irrelevant, and/or unsubstantiated.

A. <u>Claims Regarding the Hydraulic Properties of the "Shallow Materials"</u>

Q5. In his prefiled direct testimony, George Rice concedes that "[g]roundwater has not been found in the alluvium at the proposed site." Rice Direct Testimony, at 4. He states, however, that "groundwater is known to exist in the alluvium at three places near the site: 1) about ½ mile north at the Wallach sand and gravel quarry, 2) about ½ mile northeast at Baker Spring and 3) about 2/3 mile east at the WCS site." Rice Direct Testimony, at 4. Do you believe that this observation supports Mr. Rice's view that LES has not adequately evaluated the alluvium beneath the proposed NEF site for the presence of groundwater?

A5. (GAH, RLP) No. We fully addressed this issue in our prefiled direct testimony. *See* Harper-Peery Testimony (Answers 38, 39, and 60), at 30-34, 50-51. As stated therein, the zones of saturation observed in the alluvium at three places to the north and east of the NEF site (*i.e.*, Wallach Quarry, Baker Spring, and the WCS site) are limited and intermittent, and are attributable to very localized infiltration mechanisms, such as infiltration from "buffalo wallow" depressions that pond surface water and man-made features (*e.g.*, excavations). These localized conditions, however, do not exist at the NEF site. Moreover, based on review of the data collected at the NEF site and that obtained from the nearby sites, none of these shallow saturated unit occurrences appears to be: (1) laterally continuous (*i.e.*, they do not extend to the NEF site),

or (2) hydrologically connected to any deeper water-bearing units (*e.g.*, the thin saturated zone present at approximately 220 feet below ground surface).

Q6. Mr. Rice also states that "groundwater in the alluvium and the Dockum Group (Chinle Formation or the Santa Rosa Aquifer) has been used in the vicinity of the site." Rice Direct Testimony, at 5. Does this statement support his view that LES has not adequately characterized site groundwater conditions in general, or evaluated the "shallow" alluvium beneath the proposed NEF site in particular?

A6. (RLP) No. Citing a reference that is over 40 years old, Mr. Rice states that "[a]lluvial wells approximately three miles west of the proposed site have been used for domestic purposes," and that "[t]he City of Eunice had an old public supply well in the Dockum . . . about six miles west of the [NEF] site." Rice Direct Testimony, at 5. As I explained previously, the extensive hydrogeological data (including numerous boring logs) collected at and near the NEF site do not suggest that saturated conditions exist in the alluvium beneath the NEF site. The existence of small, discontinuous zones of saturation in the alluvium (including "alluvial wells" that tap such zones) within several miles of the NEF site does not alter this conclusion, especially given the typically localized and intermittent nature of such occurrences. Furthermore, as Mr. Rice himself acknowledges, there are no downgradient groundwater users within two miles of the proposed NEF site. The particular wells identified by Mr. Rice, to the extent they even still exist, are located upgradient of, and substantially far from, the NEF site. Therefore, any postulated releases from the proposed NEF would not affect these facilities.

Citing a more recent reference, Mr. Rice states that "[t]he Town of Oil Center, about 12 miles northwest of the site, obtains water from the Dockum Group," and that "deeper aquifers such as the Dockum Group may be developed for future water supplies." Rice Direct

Testimony, at 5-6. He adds that the *Lea County Regional Water Plan* "recommends investigating areas where faulting may have fractured those aquifers." LES has concluded that NEF operations will not adversely impact any saturated zones beneath the site, the shallowest of which occurs at approximately 220 feet below ground surface. Specifically, the thick, low-permeable red beds, with vertical permeabilities on the order of 2×10^{-8} cm/sec, act as a natural barrier to the downward migration of groundwater, and hence, preclude natural recharge of the water-bearing units by waters originating on the surface of the NEF site, as well as hydraulic connection among those units. *See* Harper-Perry Direct Testimony (Answers 22-23), at 14-15.

Notably, the *Lea County Regional Water Plan* specifically states that development of Dockum Group groundwater is "limited specifically to the Santa Rosa sandstone unit" in large part due to "high cost of producing the deep Dockum waters" (*see* LES Exhibit 26, at 6-12). The plan further states that "[t]he Dockum Group, Rustler, Capitan Reef, and other deeper aquifers in Lea County will need to be characterized in more detail, before the feasibility of using these deposits can be known and before large-scale water production can begin" (*see* LES Exhibit 26, at 6-12). In short, the existence of these deeper aquifers (or postulated fractures within those aquifers) – which are located below the Santa Rosa Aquifer – has no bearing on whether LES has adequately characterized site groundwater conditions in general.

Q7. In his direct testimony, Mr. Rice maintains that "LES and NRC have not performed any tests to determine the hydraulic properties of the alluvium or other shallow materials underlying the site," and that "at a minimum, the range of hydraulic conductivities should be determined." In particular, he suggests that they be measured by "infiltrometer tests" and/or the "reverse auger method." Rice Direct Testimony, at 6-7. Do you agree with these assertions?

A7. (RLP) No. LES does not believe that there is a need to measure specifically the hydraulic properties of the "alluvium or other shallow materials underlying the site," whether by field methods or laboratory measurements. As set forth in my direct testimony, no groundwater was encountered in these soils beneath the NEF site when Cook-Joyce, Inc. ("CJI") and MACTEC Engineering and Consulting, Inc. ("MACTEC") installed a total of 14 borings. *See also Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico,* prepared by Cook-Joyce, Inc. (Nov. 19, 2003) (LES Exhibit 3, Tab L); *Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico,* prepared by MACTEC Engineering and Consulting, Inc. (Oct. 17, 2003) (LES Exhibit 3, Tab N). Additionally, given its considerable thickness and low permeability, the Chinle Formation sediments (*i.e.*, red beds) that lie beneath the alluvium are more important from a hydrogeologic standpoint insofar as they inhibit potential downward migration of groundwater, as well as hydraulic connection among the known water-bearing units below the NEF site. Furthermore, as indicated in the Walvoord et al. (*see* LES Exhibit 5) analysis of thick desert vadose zones, and discussed further below, the net moisture fluxes (flow or movement) below desert root zones are generally upward.

Based on the hydrogeologic and geotechnical investigation borings installed by CJI and MACTEC at the NEF site, it is clear that the alluvium or shallow soils overlying the Chinle Formation red beds consist mainly of fine sand and silt, with some gravel in certain areas. Further, based on these characterization efforts, LES has reasonably estimated the porosity of these soils to be about 25 to 50 percent, and the saturated hydraulic conductivity of these soils to range from 10^{-5} to 10^{-1} centimeters per second. *See* Freeze, R. and Cherry, J., *Groundwater* (1979), at 29, 37.

Q8. Citing the observation of "moisture" in cuttings from two borings drilled at the NEF site, Mr. Rice asserts that "LES does not explain how the water came to be trapped, how long it has been trapped, or whether the moisture will dissipate (*i.e.*, will it flow in response to hydraulic gradients?)." Rice Direct Testimony, at 7. Do you agree with this assertion?

A8. (GAH, RLP) No. We fully addressed this issue in our direct testimony. *See* Harper-Peery Testimony (Answers 38, 60), at 30-31, 50-51. As discussed therein, CJI and MACTEC installed a total of 14 borings (nine groundwater exploration and five geotechnical borings, respectively) at the NEF site. The associated boring logs confirm that the soils encountered by CJI and MACTEC were almost invariably very dry. The "slightly moist" and "moist" soil descriptions cited by Mr. Rice were used only twice (*i.e.*, in CJI boring B-9 at a depth between 6 and 14 feet below ground and in MACTEC boring B-2 at a depth between 35 and 41.4 feet below ground, respectively). *See New Mexico Groundwater Discharge Permit Application for the National Enrichment Facility* (Apr. 2, 2004) (Attachment C to LES Exhibit 4). The limited moisture observed in these two soil samples likely represented some "residual" moisture, possibly infiltrated precipitation that had yet to evapotranspire, attributable to the moisture storage capacity of the soil in the vadose or unsaturated zone (*i.e.*, the space in soil voids or pores are only partially filled with water). It did <u>not</u> reflect the existence of saturated conditions, as specifically confirmed by the CJI and MACTEC employees who logged the two borings at issue.

Any moisture present in the vadose zone is held in the soil pores under surface-tension forces. As explained in Section 3.4.1.1 of the NEF Environmental Report (*see* LES Exhibit 1) and the Walvoord study cited therein (*see* LES Exhibit 5), the movement of soil water within <u>thick</u> (greater than 25 meters) semi-arid to arid vadose zones (such as is present at the

NEF site) is dominated largely by an upward hydraulic potential gradient. To the extent such moisture is able to make its way downward to the alluvium/Chinle contact, any further downward movement of that would be further inhibited by the low-permeability Chinle clay. Thus, the limited moisture observed in the two soil samples described above is in no way indicative of saturated conditions.

Q9. So you do not agree with Mr. Rice's assertion that "[t]he most straightforward explanation for the presence of this moisture is that it represents residual water from episodic recharge events"? Rice Direct Testimony, at 7.

A9. (RLP) I do not agree with Mr. Rice's assertion. He misapplies the term "recharge." Contrary to Mr. Rice's suggestion, the NEF Environmental Report does not define "recharge" as mere "infiltration of water beneath the base of the root zone." Recharge is traditionally defined as the "the entry into the saturated zone of water made available at the water-table surface, together with the associated flow away from the water table within the saturated zone." Freeze, R. and Cherry, J., *Groundwater*, at 211 (1979). The saturated zone refers to permeable geologic materials in which the pore spaces are completely filled with water, such as the saturated sediments below the water table. The root zone is the depth to which plant roots extend below the ground surface

It is conceivable that some infiltrating water may make its way past the base of the root zone; however, this does not mean that it will enter underlying saturated zones located at great depths, as at the NEF site. The first occurrence of a continuous saturated water-bearing unit beneath the NEF is within the low-permeable Chinle red bed clay at a depth of about 220 feet below ground surface. The presence of very limited moisture within the alluvium above or at the alluvium/Chinle interface is not tantamount to "recharge," as Mr. Rice wrongly suggests

by describing such moisture as "residual water from episodic recharge events" and "recharge that ponded along interface between the alluvial materials and the relatively impermeable Chinle." Rice Direct Testimony, at 7-8. Indeed, the authors of the Walvoord study concluded that their modeling results "suggest that current net moisture fluxes below desert root zones are generally upward, groundwater recharge is extremely small, and the net moisture flux below the root zone is not equivalent in magnitude or direction to the flux across the water table." Michelle A. Walvoord, Mitchell A. Plummer, and Fred M. Phillips, "Deep Arid System Hydrodynamics Part 1: Equilibrium States and Response Times in Thick Desert Vadose Zones," Water Resources Research, Vol. 38 No. 12 (2002), at 44-13 (*see* LES Exhibit 5).

Q10. Mr. Rice appears to suggest that the conclusions reached in the Walvoord study are inapplicable because the authors "state that their method of assessing flow in the vadose zone assumes that preferential flow paths do not affect the system." Rice Direct Testimony, at 8 n.28. He adds that such flow paths "may also result from variations in the permeability of the shallow materials underlying the site." Rice Direct Testimony, at 8. Do you agree with these assertions?

A10. (RLP) No. The authors of the Walvoord study do state that they assumed that "fractures, macropores, or other preferential flow paths do not affect the system." However, as we explained in our direct testimony, in view of the abundant data available for the NEF and nearby WCS site, there do not appear to be any subsurface fractures or "fast flow" pathways that would allow water to flow rapidly from the alluvium to the Chinle Formation, or from the Chinle Formation to the Santa Rosa Formation. Certainly, variations in permeability can occur laterally and with depth. Notably, as part of their work, the Walvoord team performed a sensitivity analysis by systematically varying parameters and comparing results to their base case solution. Specifically, they accounted for significant variations in soil type (by considering sand, silt, and

silty clay), saturated permeability, porosity, geothermal gradient, water table depth, fixed root zone matric potential, and vapor diffusion rate. They concluded that their model applies to a broad range of thick, unconsolidated vadose zones in semi-arid to arid regions (*see* LES Exhibit 5, at 44-11). In this regard, we believe that the model adequately accounts for potential anisotropies and heterogeneities (*i.e.*, directional and spatial variations in permeability/hydraulic conductivity) of the type that reasonably might be expected to occur at the NEF site.

Q11. Mr. Rice states that "[m]oist clay at the alluvial/Chinle contact also occurs at the WCS site." Specifically he claims that "in the early 1990s, moist clay was found in most of the borings that penetrated the contact." Rice Direct Testimony, at 8. Does the claimed presence of "moisture" in the WCS borings in any way alter your conclusions regarding the adequacy of LES's groundwater characterization efforts or the potential for recharge by waters originating at the NEF site surface?

A11. (RLP) No, not at all. I have revisited the WCS boring logs referred to by Mr. Rice. It is correct that many of the boring logs describe certain soil samples, including clay samples taken near the Chinle contact, as containing "moisture." However, with only one exception, the moisture content descriptions are "slightly moist," "moist," or "damp." Moreover, several of the "moist" samples occurred at depths approaching or exceeding 200 feet below ground surface, where one might expect to find groundwater associated with the so-called "220-foot" groundwater zone. Indeed, the monitoring wells installed in these borings were screened from 185 to 215 feet and 211 to 221 feet, respectively (*see* LES Exhibit 3, Tab G).

As with the two samples from the NEF site discussed earlier, the "slightly moist" and "moist" clay/silty clay samples taken at or near the Chinle contact beneath the NEF site are <u>not</u> indicative of saturated conditions or active recharge of underlying saturated zones. Rather,

the moisture in these samples is likely "residual" moisture that did not yet fully evapotranspire (*see* Borings B-9 and B-2) and that, in the case of Boring B-2, may have worked its way down, over long periods of time, to the low-permeable Chinle clays, which have a higher moisture storage capacity than the overlying "alluvial" soils. Notably, the vast majority of the boring log descriptions reflect very dry conditions – indeed, many of the samples were described as being hard, brittle, and crumbly, in addition to dry – both above and below those discrete intervals near the Chinle contact where "moisture" was observed. In fact, the very limited extent of this moisture further confirms that groundwater is not moving through "fast flow paths" and reaching the saturated zones that exist at great depths below the NEF and WCS sites. As such, I disagree with Mr. Rice's conclusion that the moisture found in the WCS borings "indicates that some recharge currently occurs at the site." Rice Direct Testimony, at 8. Again, Mr. Rice misapplies the term "recharge." Furthermore, Walvoord et al. (*see* LES Exhibit 5, at 44-1) indicate "that water transport in thick desert vadose zones at steady state is usually dominated by upward vapor flow and that long response times, of the order of $10^4 - 10^5$ years, are required to equilibrate to existing arid surface conditions."

Q12. Do you believe that it is necessary to use "radioisotopes to date the moisture found in the vadose zone" (Rice Direct Testimony, 8), as Mr. Rice suggests in this direct testimony?

A12. (RLP) No. Mr. Rice suggests using this approach to answer "this question about recent recharge." As I just explained, I do not believe that "recent recharge" is occurring at the NEF site. Published data obtained from geochemical analyses of groundwater samples taken from the Lower Dockum Group in the region indicate that recent recharge has not occurred. *See* Dutton, A. and Simpkins, W., "Hydrogeochemistry and Water Resources of the Triassic Lower

Dockum Group in the Texas Panhandle and Eastern New Mexico," Report of Investigations No. 161, Bureau of economic Geology, University of Texas at Austin (1986) (LES Exhibit 6). Therefore, radioisotopic dating is unnecessary.

In addition, the use of radioisotopes for hydrogeologic characterizations of the type at issue here is not standard or customary. To my knowledge, none of the numerous hydrogeologic investigations conducted to date in the site vicinity (at WCS in particular) involved or required the conduct of radioistopic analysis of site groundwater. In general, the specific age of the water in an aquifer beneath a site is not the concern, though the presence of groundwater that is tens of thousands of years old suggests that recent recharge has not occurred. Rather, the potential for the site-specific hydrogeologic setting to limit the downward migration of water (in this case, the low permeability red beds), and the site-specific plans to preclude subsurface contamination, are the primary concerns when assessing the potential for contamination of ground water.

Finally, the approach suggested by Mr. Rice himself would appear to yield potentially inconclusive results. Specifically, he states that even if "high concentrations" of tritium, chlorine-36, or carbon-14 were determined to be present in vadose zone moisture, their presence at such levels "would not necessarily indicate that moisture was recent . . . because water in the vadose zone may exchange water vapor and other gases in the atmosphere." Rice Direct Testimony, at 8.

B. <u>Claims Regarding the Potential for Fractures to Act as Fast Flow Paths</u>

Q13. Mr. Rice claims that LES has not adequately investigated the possibility that fractures may act as fast flow paths, and that "[s]uch fractures could allow water to rapidly flow

from the alluvium to the saturated zones in the Chinle, or from the Chinle to the Santa Rosa Aquifer." Rice Direct Testimony, at 10. Do you agree with these assertions?

A13. (RLP) No. I fully addressed this issue in my prefiled direct testimony. *See* Harper-Peery Testimony (Answers 24, 36 and 61), at 16-18, 28-29, 51. NRC Staff witness Alan Toblin also has thoroughly addressed this issue in his direct testimony. *See* Toblin Testimony (Answers 40-52), at 20-24. In summary, extensive permeability and hydraulic conductivity data obtained from the WCS, Lea County Municipal Landfill, and NEF sites confirm that the Chinle Formation sediments underlying the site are not highly transmissive. *See, e.g., Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc. (Feb. 2004), at 5-16; Table 6.5-2 (*see* LES Exhibit 3, Tab O). The confined nature of the various water-bearing zones beneath the NEF site, and the very large hydraulic head differences (differences in water level elevations) between these zones (which indicate a lack of hydraulic communication), strongly suggest that there are no fracture zones that act as fast flow paths. Furthermore, it is unlikely that any fractures beneath the NEF site would form interconnected or continuous zones that extend hundreds of feet vertically downward. As Mr. Toblin correctly pointed out, the lack of interconnectivity, the lack of proper fracture orientation, and/or the filling in of fracture apertures by clay or mineralization tend to limit the existence of "fast" or "preferential" flow paths. *See* Toblin Direct Testimony (Answer 43), at 20. Mr. Rice's view that angled borings should have been drilled appears to be based on the premise that any fractures that might exist at or near the NEF site would be vertically oriented. In fact, such fractures are more likely to be obliquely oriented, making the vertical borings drilled at the NEF site, and at the nearby WCS and Lea County Landfill sites, a better method for detecting the presence of

fractures because they are generally present at oblique angles, as indicated in the investigation of faulting at the WCS site.

Q14. In his direct testimony, Staff witness Alan Toblin referred to an August 2004 geology report, in which CJI and Intera, Inc. evaluated faulting observed in the Chinle Formation red beds at the WCS site and its relationship to the overlying Antlers Formation. *See* Toblin Direct Testimony (Answer 51) at 22. Are you familiar with this report?

A14. (RLP) Yes, I have reviewed this report. *See Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc. (Aug. 2004) (*see* LES Exhibit 73).

Q15. What was the purpose of this report?

A15. (RLP) In February 2004, investigators discovered ancient (approximately 135 million-year-old) faulting in the Triassic-aged Chinle red beds at the WCS site. To further investigate the faulting, WCS extended the southeast wall of the Resource Conservation Act and Recovery ("RCRA") landfill about 200 feet southwest, exposing the geology of the site over about 60 vertical feet and 400 horizontal feet. The excavation extended between 30 and 40 feet into the red beds. CJI and Intera then performed detailed geologic mapping of the excavation that "focused on geologic contacts and distinguishable geologic features, including faults, joints, slickensides, bedding planes, partings, channels, alteration and weathering zones." LES Exhibit 73, at 4-6.

Q16. Do you agree with Mr. Toblin that the WCS evaluation "found no evidence of a fast flow path resulting from the faulting at the WCS site?"

A16. (RLP) Yes. Faulting in the Triassic-aged Dockum Group sediments at the WCS site clearly did not create joints or fractures that increased the permeability of the sediments. CJI and Intera reached the following conclusions:

> . . . [T]here are no indications that the Cretaceous-aged Antlers Formation was affected by the faulting in the Triassic red beds. There are clearly no geologic Formations present in the excavation younger than Triassic that are affected by faulting and there are no regulatory issues related to faulting at the WCS site. Additionally, there are no issues with respect to potential migration pathways resulting from the faulting at the WCS site. The uppermost faulting occurred completely within the Triassic red beds; which have great capacity for healing and closing fault planes and joints to fluid migration as indicated by the limited penetration of the alteration front in the red beds. (*see* LES Exhibit 73, at 4-11).

Q17. Mr. Rice notes that "[f]ractures were found at various depths, from the alluvial/Chinle contact to more than 200 feet below ground surface," in core samples taken by Terra Dynamics at the WCS site from 1992 to 1993. Rice Direct Testimony, at 11. Does this observation alter your conclusion regarding the absence of fracture-related "fast flow paths" beneath the NEF site?

A17. (RLP) No. I have re-examined the boring logs identified by Mr. Rice in his direct testimony (*see* LES Exhibit 3, Tab G). The fractures described in these boring logs are by no means indicative of the presence of large-scale, continuous interconnected fracture systems that extend to great depths within the Chinle Formation. The presence of small fractures in desiccated or very dry clays is certainly not unusual. Most of the Chinle samples in which fractures were observed were described as dry, hard, crumbly, and/or brittle, and as exhibiting "conchoidal" or "blocky" fracture. In other words, the fractures may reflect the natural mineralogical composition/structure of the sediments, very low moisture content, and the effects of sampling itself. As confirmed by the August 2004 WCS fault investigation, to the extent that larger joints and fractures are present in the Chinle red beds, they have not increased the

permeability of those sediments, which have a capacity for "self-healing." Any fluid migration is matrix-dominated.

In fact, in a 1996 follow-up report to the 1993 Holt report cited by Mr. Rice, the author, Ken Rainwater, Ph.D., P.E., stated as follows:

> On October 4, 1993, Dr. Rainwater visited the office of Jack H. Holt, Ph.D. and Associates. Inc. (JHA) with Mr. Witteveld to visually examine core samples from selected borings. Cores 6-B and 9-G . . . represent locations in which almost all of the different lithological [units] were penetrated. Of particular concern in this examination was the condition of the red claystone. In the samples from both cores, the red claystone was typically continuous (few fracture planes not attributable to the sampling process), solid, and tight. As indicated by the results of the laboratory hydraulic conductivity tests, the claystone was probably naturally compacted by the weight of overburden during deposition. *See Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas*, prepared by Ken Rainwater (Dec. 1996), at 8-9 (LES Exhibit 3, Tab H).

Essentially, Dr. Rainwater's observations were that Chinle red beds have few fractures, and that the sampling process contributed, to some degree, to the fracturing observed in the core samples. Also, he observed that the claystone was naturally compacted over time, making it more solid, which, in turn, would decrease its permeability. In fact, two of Dr. Rainwater's major conclusions were that: (1) the presence of a thick Triassic clay layer (i.e., the Chinle Formation) near the ground surface at the site makes it an excellent location for a properly designed and constructed landfill; and (2) if properly constructed and operated, the landfill should have no impact on usable groundwater in Andrews County (*see* Executive Summary of LES Exhibit 3, Tab H).

Q18. Mr. Rice further posits that "the generally dry conditions found in the Chinle do not mean that fracture flow does not occur." Rice Direct Testimony, at 11. Do agree with this assertion?

A18. (RLP) No. Mr. Rice states that moisture contents of materials like the Chinle red beds can be difficult to judge in the field, and that one cannot assume that an interval of the Chinle is dry merely because it was logged as dry in the field. He cites two examples in support of this proposition. Specifically, he states that, according to the boring logs and well construction diagrams for WCS boring/monitor wells B-20 (11-D) and B-21 (9-G(3)), no water was encountered within the screened intervals, yet these wells were later found to contain more than 100 feet and 6 feet of standing water, respectively. *See* Rice Direct Testimony, at 11 & n.49; 12 & n.50.

Again, I must disagree with Mr. Rice's interpretation of the relevant data. As here, when a boring/well installed in a low-permeability unit, particularly using the air rotary drilling method (which generates heat and pressure that can inhibit groundwater flow from the formation into the boring), it is not unusual for there to be a delay in the entry of groundwater into the boring/well. In fact, in "developing" such wells, it is often necessary to add distilled water and to repeatedly bail or pump the well to induce formation flow into the well.

WCS boring/monitoring well B-20 (11-D) is screened in a clay to silty clay zone located approximately 232 to 257 feet below ground surface. This may be the same water-bearing unit as the 220-foot zone to which I have referred previously. Based on data from both the NEF site (the MW-2 slug test) and WCS site, this unit is known to have a very low hydraulic conductivity. WCS boring/monitoring well B-21 (9-G(3)) was screened in a very silty clay zone located between 263 to 273 feet below ground surface, which also is likely to have a very low hydraulic conductivity. This water bearing zone is present under confined conditions at each of these wells. If fast flow paths were present at these locations, then it would be expected that this

saturated zone would not be present under confined conditions, and the hydraulic conductivity would be higher.

In the 1996 "Rainwater" report cited by Mr. Rice, Dr. Rainwater made several important observations with respect to the WCS wells (including 11-D and 9-G(3)) installed by Terra Dynamics in the 1992-1993 timeframe. *See Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas*, prepared by Ken Rainwater (Dec. 1996), at 6 (*see* LES Exhibit 3, Tab H). First, he pointed out that, when bailed to dryness, the water levels in the wells typically took several weeks to return to static levels," indicating that "either low local permeability, little water volume in storage, or both controlled the return of water to the screened interval." Second, he stated that the equilibrated water surface elevations at most of the monitoring wells with similar depths of screen were not close enough to imply hydraulic continuity." Finally, Dr. Rainwater noted that in certain wells, including well 11-D, the height of the water columns above the top of the screens "indicate that the water in the siltstones at those locations was under pressurized confined conditions, yet the permeability or discontinuity still restricted the flow." To sum it up, the delayed or slow entry of groundwater into WCS boring/monitor wells B-20 (11-D) and B-21 (9-G(3)) is <u>not</u> indicative of "episodic" groundwater flow "along fractures." Rather, it reflects groundwater flow under low-permeable, confined conditions.

Q19. Mr. Rice also suggests that the presence of "mineral deposits" in some of the 1993 WCS core samples "indicate that the fractures have acted as groundwater flow paths." Rice Direct Testimony, at 11. What is your view with respect to this statement?

A19. (RLP) It is not uncommon for minerals (*e.g.*, quartz, calcite, and metal oxides) to precipitate from ions in solution within a fracture. However, it is misleading to suggest that the

mere presence of such mineralized veins, particularly on a small or localized scale, is an indication that "the fractures have acted as groundwater flow paths." First, it is probable that the mineral deposits observed by Jack H. Holt and Associates were deposited when climatic and geologic conditions were very different from those which exist at the site today (*i.e.*, on the order of thousands to perhaps millions of years ago). In should be understood that the red bed sediments were deposited millions of years ago as the sediments were transported by ancient rivers. Second, the mineral deposits may have precipitated from a very modest quantity of water that was trapped in the fracture, or as the sediments dried out after their initial deposition. In short, I do not believe that it is credible to infer the existence of "fast" flow paths from the presence of mineral veins in the low-permeability Chinle red beds.

Q20. With respect to the issue of permeability, Mr. Rice asserts that "limited permeability measurements that were performed at the proposed site and the nearby WCS site are not likely to reveal the presence of fractures that may be spaced at intervals of five feet, ten feet, or more." Rice Direct Testimony, at 12. Do you agree with this assertion?

A20. (RLP) No. First, as I have testified previously, the permeability and hydraulic conductivity values obtained from the NEF, Lea County Landfill, and WCS site investigations constitute a substantial and adequate body of data; these data are not "limited" or "restricted," as Mr. Rice suggests. These data are summarized in Answer 24 of my prefiled direct testimony. *See* Harper-Peery Direct Testimony, at 16-18. These data confirm that the Chinle Formation consists of very low-permeability materials at and near the NEF site. Again, absent the "right" orientation, degree of interconnectivity, and continuity with depth (over hundreds of feet at the NEF site), even limited numbers of open (unfilled) fractures will <u>not</u> act as "fast flow paths." It is not reasonable or customary to drill boreholes for site investigations at spacing of 5 to 10 feet.

In fact, attempting to evaluate the subsurface conditions by drilling boreholes at this spacing would be likely to damage the formation and create fast flow paths. Based on my review of the available and ample hydrogeologic data, I do not believe that such fast flow paths exist beneath the NEF site.

Q21. Mr. Rice questions the reliability of laboratory measurements of permeability, maintaining that they "often underestimate the bulk permeability of a unit, because they do not account for fractures and other features that may act as preferential flow paths." Rice Direct Testimony, at 12. Do you agree with this assertion?

A21. (RLP) No. I disagree with this assertion for the reasons set forth in detail in Answers 24, 47, and 61 of my prefiled direct testimony. *See* Harper-Peery Direct Testimony, at 16-18, 39-40, 51. Also, as indicated by Dr. Rainwater's observations of cores from 6-B and 9-G, the sampling process can create some degree of fracturing. The fractures associated with the sampling techniques would lead to laboratory permeability values which overestimate the in-situ permeability of the sediments.

Q22. In support of this assertion, Mr. Rice states that "[p]ermeabilities measured in the field may be more than a thousand times greater than the corresponding laboratory measurement." Rice Direct Testimony, at 12. What is your view relative to this statement?

A22. (RLP) This statement is unsubstantiated. Mr. Rice purports to base this conclusion on data extracted from a technical report and plotted in Figure 2 of his testimony. *See* Olson, R.E., D.E. Daniel, 1981, *Measurement of the Hydraulic Conductivity of Fine-Grained Soils*, in "Permeability and Groundwater Contaminant Transport", Zimmie and Riggs, editors, ASTM Special Technical Publication 746 ("Olson and Daniel"). I have reviewed the Olson and Daniel report and reach a very different conclusion. First, the authors of the report specifically

acknowledge that there are uncertainties associated with the data upon which they based their comparison of field and laboratory-measured hydraulic conductivities "*k*"):

> In many cases it was necessary to simplify the data by reporting average values when there was significant scatter or by reporting data at only one effective stress. It was often unclear how certain measurements were made, and inferences were drawn from general discussions in some cases. Olson and Daniel, at 54.

Second, notwithstanding this fact, the authors state that "[t]he range in the ratio of field *k*/laboratory *k* is from 0.3 to 46,000, but nearly 90 percent of the observations lie in the range from 0.38 to 64." Olson and Daniel, at 54. In other words, laboratory-measured hydraulic conductivity values were, in fact, in numerous cases greater than the field-measured values. In any case, field values that exceeded laboratory values by more than a ratio of 10 to 1 were rare (*i.e.*, outliers), and appear to reflect the use of laboratory values back-calculated from consolidation (*i.e.*, Terzagh's) theory, as opposed to the use of directly measured values. Indeed, the authors cited this fact as one of the major causes of higher values of field hydraulic conductivity. Olson and Daniel, at 54 & Table 4. It warrants mention that the WCS and Lea County Municipal Landfill permeability values discussed in my testimony involved direct laboratory measurements of permeability using ASTM-prescribed methods, not back-calculations.

Q23. The authors of the report also note that higher field conductivity values could result from "the presence of sand seams, fissures, and other macrostructures in the field which are not represented properly in the laboratory." Olson and Daniel, at 54. In your view, is this cause for concern?

A23. (RLP) No. The permeability measurements taken on samples in the site vicinity, over 50 in number, consistently indicate that Chinle Formation consists of low-permeability

sediments. Moreover, to the extent that "sand seams, fissures, and other macrostructures" might exist within the Chinle and cause slightly larger permeabilities, such structures should not confused with vast, transmissive, interconnected fracture zones that would have the potential to act fast flow paths. I do not believe the latter exist beneath the NEF site in view of the substantial hydrogeologic data available to me.

Additionally, while Mr. Rice recommends using field techniques to measure hydraulic conductivities, he neglects to mention their limitations, as acknowledged by Olson and Daniel. Specifically, the report authors note that field tests are preferred for saturated soils, which, at the NEF site, are not present until 220 feet below ground surface. In this regard, the infiltrometer and reverse auger tests mentioned by Mr. Rice appear to be impractical. Indeed, Olson and Daniel state that field testing for measurement of conductivity in unsaturated soils is at a "rudimentary stage of development." Olson and Daniel, at 55.

Q24. In his direct testimony, Mr. Rice states that groundwater can flow between the Dockum Group and overlying units, as "this is the conclusion of investigators who have studied this issue." Rice Direct Testimony, at 13. Do you agree with Mr. Rice on this point?

A24. (RLP) I disagree with Mr. Rice to the extent he suggests that such cross-formational flow is occurring in the vicinity of the NEF site. As Mr. Rice himself concedes, the potential for groundwater flow between the water-bearing strata of concern depends on local conditions. *See* Rice Direct Testimony, at 13. Based on my review of the pertinent hydrogeologic data, I conclude that conditions conducive to cross-formational flow are not present at the NEF site at rates greater than the documented permeabilities for the red beds in the area. Two of the three references cited by Mr. Rice involve different hydrogeologic settings and are unsuitable for that reason. The third reference, which I have previously cited in my own

testimony, actually undermines Mr. Rice's position relative to the potential for cross-formational flow at the NEF site.

The first two references identified by Mr. Rice indicate that there may be some hydraulic communication between the Ogallala Formation and the Dockum Group (which includes the Chinle and Santa Rosa Formations). However, as I testified previously, the Ogallala Formation has not been found at the NEF site. According to a recent WCS report prepared in large part by CJI, the southern limit of the Ogallala Aquifer is north of the red bed ridge at approximately the northern and eastern boundaries of the WCS permitted area (and hence, to the north and east of the NEF site). *See Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc. (Feb. 2004), at 3-1 (*see* LES Exhibit 3, Tab O). The hydrogeologic environments discussed in Langman *et al.* and Mehta *et al.* are located substantially far north and northeast of the NEF site, about 110 miles and 270 miles respectively, in areas where the Ogallala Formation overlies the Dockum Group. The conclusions reached in those reports relative to cross-formational flow thus are not applicable to the NEF site vicinity.

Mr. Rice relies on a third reference, Dutton and Simpkins (1986), for the proposition that "in some portions of the Southern High Plains, the Dockum Formation receives recharge from overlying aquifers." Rice Direct Testimony, at 13. This is not the case, however, in the vicinity of the NEF site. As I explained in my direct testimony, based on their analysis of hydrogeochemical data, the authors reached a different conclusion. Specifically, they concluded that erosion of the Pecos and Canadian River valleys during the Pleistocene created groundwater basin divides along the western and northern limits of the Southern High Plains, thereby preventing modern recharge in the Dockum Group outcrops from reaching confined parts of the Dockum Group aquifers.

CJI agrees with this conclusion. *See Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc (Feb. 2004), at 3-3 to 3-4 (LES Exhibit 3, Tab O). CJI has stated that the relative difference in hydraulic head between the lower Dockum aquifer and the overlying Ogallala aquifer throughout much of the region (though the Ogallala aquifer is not present at the NEF site) suggests that the lower Dockum aquifer is receiving essentially no recharge from cross-formational flow (*see* LES Exhibit 3, Tab O, at 3-4). Notably, CJI has concluded that "the primary limiting factors on recharge to the Dockum Group aquifer include the low-permeability aquitard characteristics of the upper Dockum Group and the cut-off by the Pecos River Valley of historical recharge areas in eastern New Mexico" (*see* LES Exhibit 3, Tab O, at 3-4). In other words, the areas in which historical recharge to the Dockum Group aquifer occurred no longer exist, and, therefore, modern recharge to the confined portions of the Dockum Group is not occurring.

Q25. In view of the above, do you believe that it is necessary to collect additional information of the type suggested by Mr. Rice (*i.e.*, to perform fracture studies and to measure the stable isotope ratios and ages of the groundwaters beneath the site)?

A25. (RLP) No. I would add that Mr. Rice has provided no compelling basis for his opinion that "fractures could allow water to rapidly flow from the alluvium to the saturated zones in the Chinle, or from the Chinle to the Santa Rosa Aquifer." Rice Direct Testimony, at 10. In this regard, I would emphasize that Figures 1 and 3 of his direct testimony, which depict continuous fractures extending from the alluvium/Chinle contact downward through the Dockum Formation – for hundreds to over 1,000 feet – are purely hypothetical, lack any scientific basis, and ignore all data available from the NEF, WCS, and Lea County Landfill sites.

C. Claims Regarding "Leakage" from the NEF Site Engineered Basins and Septic Leach Fields

Q26. NIRS/PC claim that LES and the NRC Staff have not adequately evaluated how "discharges" from the proposed NEF will affect groundwater in the future. Do you agree with this assertion?

A26. (GAH, RLP) No. In raising this issue, NIRS/PC witness George Rice again merely poses a series of questions that LES and the NRC Staff "should answer." Specifically, Mr. Rice asserts that LES and the Staff should determine how much water would infiltrate into the alluvium from the three proposed engineered basins and septic leach fields; where water flowing along the alluvial/Chinle contact would be discharged; how long it would take this water to reach any discharge areas; and whether this water could reach underlying saturated zones via fractures. We have, in fact, fully addressed each of these issues in our direct testimony. *See* Harper-Peery Direct Testimony (Answers 33-36, 51-53), at 26-29, 41-44. In short, given the low precipitation and high evapotranspiration rates in the site vicinity, the low-permeability of the near-surface soils (primarily silts and silty sands), and the tendency of these soils to hold non-evapotranspired moisture in storage, infiltration and migration of water from the Stormwater Detention Basin and septic leach fields is expected to be negligible.

Q27. Do you agree with Mr. Rice's assertion that LES and the NRC "seem to disagree" on the fate of water that would "leak" from the Site Stormwater Detention Basin and septic leach fields? *See* Rice Direct Testimony, at 16.

A27. (GAH, RLP) No. Like LES, the NRC Staff recognizes that any potential infiltration of water from the Site Stormwater Detention Basin and septic leach fields is likely to be limited by high evapotranspiration rates and the moisture storage capacity of the soils. *See* Toblin Direct Testimony (Answers 19, 39), at 10, 18. To the extent that such water does

infiltrate into the alluvium and form perched water bodies along the alluvium/Chinle contact, any downgradient movement of that water would be limited due to these same factors. Mr. Rice criticizes LES and the NRC Staff for having "not quantified either of these limiting factors." As set forth in our direct testimony, and in the direct testimony of NRC Staff witness Alan Toblin, the Staff has, in fact, performed a highly conservative analysis of the potential movement of "perched water bodies" along the alluvium/Chinle interface. This analysis includes calculations – based on very conservative assumptions – of the dimensions of these perched water bodies, their flow rates, and their potential discharge locations. *See* Toblin Testimony (Answers 11 through 21), at 6-11.

Q28. Mr. Rice asserts that the NRC Staff's estimate of the flow rate is too low, and that the Staff has not adequately investigated potential discharge areas. Do you agree with these claims?

A28. (GAH, RLP) No. These are essentially the same unfounded criticisms levied by Mr. Rice in his expert report of November 24, 2004. We have addressed the issues raised by Mr. Rice in Answers 50 through 55 of my direct testimony. *See* Harper-Peery Direct Testimony, at 41-45. Furthermore, Mr. Toblin has addressed these issues in explaining the Staff's analysis of "perched water body" dimensions, flow rates, and potential discharge locations. *See* Toblin Testimony (Answers 11 through 21), at 6-11.

Q29. Mr. Rice also states that, in its comments on the Staff's DEIS, "the New Mexico Environment Department ("NMED") has expressed concern regarding the possibility that leakage from the NEF may transport contaminants offsite and pose a threat of contamination to ephemeral drainages or aquifers." Rice Direct Testimony, at 19. Have you reviewed the NMED's comments?

A29. (GAH, RLP) Yes. We would note that the NMED appears to have taken the Staff's "perched water body" or "plume" analysis at face value, without acknowledging that the assumptions and calculations underlying that analysis are highly conservative. In any event, we believe that the Staff's conservative analysis is more than sufficient for purposes of its NEPA evaluation, and note that the NEF will not be able to commence construction and operation of the NEF until it receives a New Mexico Groundwater Discharge Permit from the NMED. That permit will require LES to conduct appropriate groundwater monitoring in accordance with a plan specifically approved by the NMED. Given the NEF design, the characteristics of the liquid discharges, the hydrogeologic characteristics of the site and the proposed monitoring system, we believe the possibility that leakage from the NEF may transport contaminants offsite and pose a treat of contamination to ephemeral drainages or aquifers is negligible.

Q30. In his direct testimony, Mr. Rice claims that LES and the NRC have not adequately addressed the possibility of leakage from the lined basins, *i.e.*, the Treated Effluent Evaporative Basin ("TEEB") and the Uranium Byproduct Cylinder ("UBC") Storage Pad Stormwater Retention Basin. Rice Direct Testimony, at 19-21. Do you agree with this assertion?

A30. (GAH) No. This claim coincides with Basis B of Contention NIRS/PC EC-1, as amended. The majority of the concerns raised by Mr. Rice in direct testimony relative to this issue were previously raised in his expert report of November 24, 2004. *See* "Expert Reports on Behalf of Nuclear Information and Resource Service and Public Citizen Pursuant to Order Dated October 20, 2004," dated November 24, 2004. Accordingly, both LES and the NRC Staff have thoroughly addressed those concerns in their direct testimony. *See* Harper-Peery Direct Testimony (Answers 26-29, 57-59), at 19-22, 45-50; Toblin Direct Testimony (Answers 22-31),

at 11-16. For the reasons set forth in my direct testimony, I do not believe that it is necessary – or even useful for that matter – to attempt to estimate the probability and frequency of leakage through the liners of the TEEB and the UBC Storage Pad Stormwater Retention Basin. Nor do I believe that it is necessary to provide any additional analysis of the fate of postulated leakage beyond that already provided by LES and the NRC Staff in their respective environmental review documents and prefiled direct testimony.

Q31. So you do not believe that it is necessary for LES to design additional monitoring systems "to detect leakage from both lined basins" and "to detect leakage in the vadose zone, and along the alluvial/Chinle contact," as Mr. Rice proposes?

A31. (GAH) No, I do not believe that additional monitoring devices over those already described in the ER and in the Groundwater Discharge Permit are necessary to adequately monitor the NEF basins and septic systems.

Q32. With regard to the issue of potential "leakage" from the NEF site engineered basins and septic leach fields, Mr. Rice claims that LES has made "contradictory statements" regarding the "fate" of water discharged to the septic leach fields and engineered basins? Specifically, he cites apparent inconsistencies between statements made by LES during discovery and in its New Mexico Groundwater Discharge Permit application. *See* Rice Direct Testimony, at 21-22. Do you agree with this assertion?

A32. (GAH) No, I disagree. I was directly involved in the preparation of the New Mexico Groundwater Discharge Permit application, and I am familiar the discovery-related statements cited by Mr. Rice. The statements of concern are not contradictory when viewed in the proper context.

Q33. What did LES state in the context of discovery?

A33. (GAH) Mr. Rice cites several interrogatory responses and a portion of my deposition testimony. With respect to the septic leach fields, the relevant interrogatory response states: "The treated liquid will be discharged to the leach fields. The ultimate disposal of liquid discharged to the leach fields is expected to be via evapotranspiration, based on geologic and meteorological conditions at the site." *See* "Applicant's Objections and Responses to Interrogatories of Nuclear Information and Resource Service and Public Citizen, dated September 23, 2004, at 3 ("LES Response to Interrogatories"). With respect to the Site Stormwater Detention Basin, the relevant interrogatory states: "As described in ER RAI 4-2A response, dated May 20, 2004, infiltrating water is expected to eventually return to the atmosphere via evapotranspiration." LES Response to Interrogatories, at 5. RAI Response 4-2A, in turn, states: "Of the amount that infiltrates into the ground, most is expected to eventually return to the atmosphere via evapotranspiration by vegetation growing within and in the vicinity of the basin" (*see* LES Exhibit 3, Tab B). Similarly, during my deposition, I stated that "of the amount [of basin water] infiltrated, it essentially would all go back up through evapotranspiration." Harper-Peery September 17, 2004 Dep., Tr. at 35. Finally, in regard to the two lined basins, the pertinent interrogatory response states: "The basins will be designed to preclude water from infiltrating into the subsurface." LES Response to Interrogatories, at 6.

Q34. What did LES state in the New Mexico Groundwater Discharge Permit application for the NEF?

A34. (GAH) Mr. Rice cites three statements from LES's Ground Water Discharge Permit application to support his claim. These paragraphs pertain to the septic leach fields, the Site Stormwater Detention Basin, and the UBC Storage Pad Stormwater Retention Basin. As discussed below, Mr. Rice takes these statements out of context.

By way of background, the New Mexico Water Quality Board requires that facilities that discharge an aggregate wastewater of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan, respectively. This requirement is based on the assumption that the discharges have the potential to affect groundwater. *See* NEF Environmental Report at 4.4-1 (citing Section 20.6.2.3104 of New Mexico Water Quality Control Commission Regulations) (*see* LES Exhibit 1). The section of the Ground Water Permit Application containing the text cited by Mr. Rice is entitled "20.6.2.3109.C Approval Demonstration." *See* New Mexico Groundwater Discharge Permit Application for the National Enrichment Facility (April 2, 2004, as revised on October 14, 2004) (*see* LES Exhibit 4). The purpose of this section is to demonstrate that, under any conditions, the NEF would be in compliance with applicable New Mexico ground water standards. Therefore, LES structured its demonstration to be highly conservative by considering the possibility – however unlikely – that infiltrating water would reach the first groundwater zone at roughly 220 feet below ground surface.

Relative to the septic leach fields and the Site Stormwater Detention Basin, the permit application thus states: "The infiltrated waters are expected to potentially recharge the limited ground water system at the 214 to 222 foot depth or return to the atmosphere via evapotranspiration." (*see* LES Exhibit 4, at 17). Mr. Rice focuses on this statement, ignoring the underlying conclusion in both cases, as stated several sentences later: "Therefore, based on the above, even if any of the infiltrated waters reach the ground water, the applicable ground water standards in 20.6.2.3103 NMAC will be met" (*see* LES Exhibit 4, at 17). Likewise, with respect to the UBC Storage Pad Stormwater Retention Basin, LES conservatively posited that: "Any minor leakage past the liner will infiltrate into the ground under the basin. The infiltrated waters

are potentially expected to recharge the limited ground water system at the 214 to 222 foot depth or return to atmosphere via evapotranspiration." (*see* LES Exhibit 4, at 18). Several sentences later, the permit application states: "Therefore, based on the above, it is concluded that even if any of the basin waters infiltrated into the ground, the applicable ground water standards in 20.6.2.3103 NMAC will be met." (*see* LES Exhibit 4, at 18). Again, Mr. Rice chooses to ignore this fact.

These sentences clearly convey the fact that migration of infiltrating water to a depth of approximately 220 feet below ground surface is not the expected outcome. This possibility was included as a conservatism for purposes of LES's approval demonstration. As reflected in the NEF Environmental Report, LES's discovery responses, and LES's prefiled testimony, I expect the evapotranspiration process to inhibit any potential for "recharge" of the 220-foot saturated zone by infiltrating surface waters. In summary, there are no "apparent inconsistencies" between statements made by LES in this proceeding and statements made in the Ground Water Discharge Permit Application.

D. Claims Regarding the Adequacy of LES's Groundwater Monitoring Plan

Q35. Mr. Rice alleges that LES has not presented a "clear groundwater monitoring plan." In particular, he claims that "[a]ll groundwater zones beneath the site, from the Santa Rosa Aquifer to the surface, should be monitored," and that LES has "not explained how [it] will distinguish between groundwater contamination caused by the NEF and contamination caused by other potential sources." Rice Direct Testimony, at 22. What is your view with regard to these assertions?

A35. (GAH) These concerns are addressed in our direct testimony. *See* Harper-Peery Direct Testimony (Answers 41-42, 44), at 35-38. I would like to make one additional point. Mr.

Rice notes that "the NMED has stated that it will probably require LES to install additional wells to monitor any leakage from the basins or septic systems that perches on the alluvial/Chinle contact." Importantly, this statement was contained in the NMED's comments on the Staff's DEIS. As I stated above, it appears that the NMED has taken the Staff's "perched water body" or "plume" analysis at face value, without acknowledging that the assumptions and calculations underlying that analysis are highly conservative. In any event, if the NMED chooses to impose such a requirement in LES's groundwater discharge permit, then LES will be required to comply with it. This possibility does not change my conclusions relative to the adequacy of LES's and the Staff's environmental evaluations.

E. <u>Claims Regarding the Adequacy of LES's Stormwater Monitoring Program</u>

Q36. On a related note, Mr. Rice also asserts that LES's proposed Stormwater Monitoring Program for Detention and Retention Basins is inadequate. What is your response to this claim?

A36. (GAH) With one exception, I have already responded to the claims made by Mr. Rice in his direct testimony relative to stormwater monitoring at the NEF site, which relate to Basis E of Contention NIRS/PC EC-1, as amended. *See* Harper-Peery Testimony (Answers 62-64), at 52-53). I would note that Staff witness Alan Toblin also has addressed these claims at length in his direct testimony. *See* Toblin Direct Testimony (Answers 53-61), at 26-30.

Q37. What is the exception to which you alluded in your previous answer?

A37. (GAH) In his direct testimony, Mr. Rice states that the Regional Environmental Officer of the United States Department of the Interior has expressed a concern that wastewater in the UBC Storage Pad Stormwater Retention Basin may contain nutrients, heavy metals,

organic chemicals, petroleum, solvents, or pesticides, and that these contaminants may pose a risk to migratory birds and other wildlife.

Q38. What is your view relative to this statement?

A38. (GAH) For the reasons set forth in Answer 29 of my prefiled direct testimony, I do not believe that the UBC Storage Pad Stormwater Retention Basin poses such a risk. In particular, LES's environmental monitoring program will allow LES to adequately monitor the basin waters and ensure the risk to migratory birds and other wildlife is minimized.

Q39. Does this conclude your testimony?

A39. (GAH) Yes.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 70-3103-ML
	)	
Louisiana Energy Services, L.P.	)	ASLBP No. 04-826-01-ML
	)	
(National Enrichment Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "PREFILED REBUTTAL TESTIMONY OF GEORGE A. HARPER AND ROGER L. PEERY ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. ON CONTENTION NIRS/PC EC-1 ("IMPACTS UPON GROUND AND SURFACE WATER")" in the captioned proceeding have been served on the following by e-mail service, designated by **, on January 28, 2005 as shown below. Additional service has been made by deposit in the United States mail, first class, this 28th day of January 2005.

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