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Lindsay A. Lovejoy, Jr.

attorney-at-law

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7 January 2005

G. Paul Bollwerk, III
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dr. Paul B. Abramson
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dr. Charles N. Kelber
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

James Curtiss, Esq.
David A. Repka, Esq.
Winston & Strawn
1400 L St., N.W.
Washington, D.C. 20005-3502

John W. Lawrence, Esq.
Louisiana Energy Services, L.P.
2600 Virginia Ave., N.W.
Suite 610
Washington, D.C. 20037

Office of the General Counsel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Associate General Counsel for Hearings, Enforcement, and Administration

Office of Commission Appellate Adjudication
Mail Stop O-16C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Tannis L. Fox, Esq.
Deputy General Counsel
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87502-1031

618 Paseo de Peralta, Unit B • Santa Fe, NM 87501 • 505-983-1800
505-983-0036 fax • lindsay@lindsaylovejoy.com

Template = SECY-028

SECY-02

Glenn R. Smith, Esq.
Christopher D. Coppin, Esq.
Stephen R. Farris, Esq.
David M. Pato, Esq.
Assistant Attorneys General
P.O. Drawer 1508
Santa Fe, NM 87504-1508

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications Staff

Greetings:

Enclosed is an additional exhibit to be offered at the forthcoming hearing on behalf of Nuclear Information and Resource Service and Public Citizen. I regret that this exhibit is delivered after the date for filing exhibits set by the Board, although it is identified on that date. I request that the brief delay be excused in light of the fact that the document was recently produced by the Applicant and, thus, is already in the Applicant's possession.

The item is a water balance study performed with regard to the NEF basins by Areva. It is dated September 9, 2004 and bears the document numbers LES-05129 through LES-05188. It may be given the exhibit number NIRS/PC Exhibit 56.

Respectfully,

Lindsay A. Lovejoy, Jr.

Lindsay A. Lovejoy, Jr.
Counsel for NIRS/PC

enc.

AREVA

CALCULATION SUMMARY SHEET (CSS)

Document Identifier 32 - 5047375 - 00

Title WATER BALANCE TABLES FOR NATIONAL ENRICHMENT FACILITY BASINS

PREPARED BY:				REVIEWED BY: METHOD: ☒ DETAILED CHECK ☐ INDEPENDENT CALCULATION			
NAME	STACY T. THOMSON			NAME	FRANCIS X. BELLINI		
SIGNATURE	Stacy T. Thomson			SIGNATURE	Francis X. Bellini		
TITLE	PRINCIPAL ENG.	DATE	9-1-04	TITLE	SCI CHEMIST IV	DATE	9/8/04
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PURPOSE AND SUMMARY OF RESULTS:

The purpose of this calculation is to determine monthly water balances for the National Enrichment Facility (NEF)'s three basins in response to the Nuclear Regulatory Commission (NRC)'s Request for Additional Information (RAI) No. 4-2, Water Resource Impacts (Part A), pursuant to the NEF Environmental Report (ER).

The results for the Treated Effluent Evaporative Basin (TEEB) show that basin outflow due to evaporation will exceed all inflows on a monthly basis for the minimum discharge scenario with the exception of the winter months. Under the maximum discharge scenario, the basin would have standing water in it for most of the year.

The results for the Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis under the minimum discharge scenario. Under the maximum discharge scenario, the basin would have standing water for ten months of the year.

The results for the Site Stormwater Detention Basin (SSDB) show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios.

THE FOLLOWING COMPUTER CODES HAVE BEEN USED IN THIS DOCUMENT:

CODE/VERSION/REV	CODE/VERSION/REV
NOT APPLICABLE	

THE DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK

☒ YES ☐ NO

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1.0 PURPOSE and OBJECTIVE

Referring to Reference 1 (Appendix B), Part A of Environmental Report (ER) Request for Additional Information (RAI) 4-2, Water Resource Impacts, for the National Enrichment Facility (NEF) states:

Provide a complete water balance table identifying the estimated flow rates (maximum and minimum) discharged to each of the wastewater basins identified in Section 4.4.7 and the anticipated evaporation, soil adsorption, or evapotranspiration on a monthly basis.

Per Reference 2, Section 4.4.7 of the NEF ER (Reference 2, Section 4.4.7 - Appendix C), there are three on-site basins as follow:

- The Treated Effluent Evaporative Basin (TEEB) – for the discharge of operations-generated potentially contaminated wastewater;
- The Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin – for the discharge of water from the UBC Storage Pad and cooling tower, and;
- The Site Stormwater Detention Basin (SSDB) – for the controlled release of site runoff.

In response to the Nuclear Regulatory Commission (NRC)'s RAI noted above, the purpose of this calculation is to determine the monthly water balances for the NEF's three basins.

2.0 INPUTS and ASSUMPTIONS

1. The minimum and maximum monthly precipitation values are based on data from Hobbs, New Mexico (References 3 and 4 – Appendix D). The annual minimum and maximum precipitation amounts were distributed by month using the average annual distribution by month. Use of the minimum precipitation amounts provides a minimum discharge scenario. Use of the maximum precipitation amounts provides a maximum discharge scenario.

2. Annual evaporation at the site is 80 inches per year (Reference 5 – Appendix E, p. 13 of 36). Average monthly evaporation values for the site were determined by applying a factor equivalent to the annual evaporation at the site divided by that for Roswell, New Mexico, to the average monthly evaporation values for Roswell (Reference 6 – Appendix F).

3. TEEB design input:
   - The basin collects operations-generated potentially contaminated waste water (Reference 2, Section 4.4.7 – Appendix C). Annual discharge effluent from the Liquid Effluent Collection and Treatment System is 669,844 gallons per year (Reference 5 – Appendix E, p. 12 of 36) or 55,824 gallons per month.
   - The basin will have two synthetic liners (Reference 5 – Appendix E, p. 15 of 36). Therefore, there will be no soil infiltration or evapotranspiration. Outflow will be by evaporation.
   - The surface area at the top of the basin is 1.84 acres (Reference 7 – Appendix G). Conservatively, use 2 acres in determining the volume of precipitation for the basin (i.e., yields larger volume of water). The basin's bottom surface area will be between 0.75 acres (Reference 5 – Appendix E, p. 12 of 36 and Reference 9, pp. 3 and 4) to 1.39 acres (Reference 7 – Appendix G). Therefore, conservatively, use 0.75 acres in determining the volume of evaporation for the basin (i.e., yields less evaporation).

4. UBC Storage Pad Stormwater Retention Basin design input:
   - The basin collects stormwater runoff from the UBC Storage Pad (22.8 acres in size – conservatively 23 acres) (Reference 5 – Appendix E, p. 15 of 36) and cooling tower (5,050,000 gallons per year) (Reference 5 – Appendix E, p. 15 of 36) and boiler blowdown (100 gallons per day) (Reference 8 – Appendix G, Action Item Resolution C).

- The basin will have a single liner (Reference 5 – Appendix E, p. 15 of 36). Therefore, there will be no soil infiltration or evapotranspiration. Outflow will be by evaporation.
- The surface area at the top of the basin is 19.5 acres (conservatively use 20 acres) (Reference 7 – Appendix G) and will be used to determine the volume of precipitation into the basin. The basin's bottom surface area is 18 acres (Reference 7 – Appendix G) and will be used in determining the volume of evaporation for the basin.

5. SSDB design input:
   - The basin collects stormwater runoff. The runoff area served is 96 acres (Reference 5 – Appendix E, p. 15 of 36).
   - The basin will be unlined (Reference 5 – Appendix E, p. 11 of 36). Therefore, outflow will be by soil infiltration and evaporation. 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.
   - The surface area at the top of the basin is 19.2 acres (Reference 7 – Appendix G). Conservatively, use 20 acres in determining the volume of precipitation for the basin (i.e., yields larger volume of water). The basin's bottom surface area is 18.2 acres (Reference 7 – Appendix G). Conservatively, use 18 acres in determining the volume of evaporation for the basin (i.e., yields less evaporation).
   - No credit is taken for outflows from the SSDB through the discharge outlet. Any such flows will eventually infiltrate, evaporate or evapotranspirate.
   - The soil infiltration rate is 1 millimeter per hour (0.04 inches per hour = 350 inches per year = 29.2 inches per month) (Reference 10 – Appendix H). However, monthly infiltration capacity in the SSDB is conservatively assumed as 24 inches.

	Key Assumptions and Related Limitations
1.	Basin size is based on preliminary design information.
2.	Discharge from the Liquid Effluent Collection and Treatment Systems for the TEEB was based on the expected average monthly flow.
3.	Cooling tower blowdown discharge to the UBC Storage Pad Stormwater Retention Basin was based on the expected average annual discharge.
4.	Heating boiler blowdown discharge to the UBC Storage Pad Stormwater Retention Basin was based on the expected average daily discharge and is not expected to vary significantly month by month.
5.	Infiltration and evaporation are based on preliminary design information.

3.0 CALCULATION

3.1 Monthly Precipitation Determination

Precipitation depths are determined based on SI units and converted to metric units for consistency with the RAI response.

Table 3-1: Precipitation

Month	Average Precipitation[1] cm (in)	Minimum Precipitation[2] cm (in)	Maximum Precipitation[3] cm (in)
January	1.3 (0.5)	0.5 (0.194)	2.0 (0.796)
February	1.8 (0.7)	0.7 (0.271)	2.8 (1.114)
March	1.3 (0.5)	0.5 (0.194)	2.0 (0.796)
April	2.0 (0.8)	0.8 (0.310)	3.2 (1.273)
May	6.6 (2.6)	2.6 (1.006)	10.5 (4.137)
June	5.1 (2.0)	2.0 (0.774)	8.1 (3.180)
July	6.1 (2.4)	2.4 (0.929)	9.7 (3.812)
August	6.4 (2.5)	2.5 (0.968)	10.1 (3.978)
September	7.9 (3.1)	3.0 (1.199)	12.5 (4.932)
October	3.6 (1.4)	1.4 (0.542)	5.7 (2.227)
November	2.3 (0.9)	0.9 (0.348)	3.6 (1.432)
December	1.8 (0.7)	0.7 (0.271)	2.8 (1.114)
Total:	46 (18.1)	17.8 (7.0)	73 (28.8)

Key:
cm – centimeters in - inches

Notes:
1. Based on the 1971-2000 monthly normal mean precipitation for Hobbs, New Mexico (Reference 3 – Appendix D). The precipitation data for Hobbs, New Mexico was used due to the proximity of Hobbs to the proposed NEF site (32 kilometers (20 miles)) (Reference 2, Section 1.2.1 – Appendix C). Average precipitation values were rounded.
2. The minimum annual total precipitation for Hobbs, New Mexico is about 17.8 cm (7 in) based on the years 1971-2000 (Reference 4 - Appendix D) (i.e., for 1998). The monthly totals were determined by a scale factor of 7/18.1 = .387. Monthly precipitation values (SI units) have been carried out to several significant digits for input into the water balance tables below.
3. The maximum annual precipitation for Hobbs, New Mexico is 73.2 cm (28.8 in) (i.e., for 1992) (Reference 4 – Appendix D). The monthly totals were determined by a scale factor of 28.8/18.1 = 1.591.

3.2 Monthly Evaporation Determination

The amounts of evaporation are determined based on SI units and converted to metric units for consistency with the RAI response.

Table 3-2: Evaporation

Month	Average Evaporation for Roswell, New Mexico[1] cm (in)	Evaporation for the NEF[2,3] cm (in)
January	3.38 (1.33)	4.2 (1.653)
February	8.18 (3.22)	10.1 (4.002)
March	17.98 (7.08)	22.4 (8.800)
April	22.53 (8.87)	28.0 (11.025)
May	19.69 (7.75)	24.5 (9.633)
June	18.82 (7.41)	23.4 (9.211)
July	17.75 (6.99)	22.1 (8.689)
August	16.66 (6.56)	20.7 (8.154)
September	16.03 (6.31)	19.9 (7.843)
October	9.83 (3.87)	12.2 (4.810)
November	7.09 (2.79)	8.8 (3.468)
December	5.54 (2.18)	6.9 (2.709)
Total:	163.48 (64.36)	203.2 (80.0)

Key: cm – centimeter in - inches

Notes:
1. Based on evaporation data (1948-1950) for Roswell, New Mexico (i.e., Hobbs data not available) (Reference 6 – Appendix F). For June, no data was available, therefore, the evaporation data for June and August were averaged to determine an evaporation value for July. For November, the maximum evaporation value of 10.91 inches appeared to be an error. Therefore, the October and December maximum evaporation values were averaged to determine that for November.
2. 80 inches is the annual evaporation for the NEF site (Reference 5 - Appendix E, p. 13 of 36).
3. Using the average monthly evaporation values for Roswell, the average monthly evaporation values for the NEF site were determined by applying a scale factor of 80/64.36 = 1.243 to Roswell's values.

3.3 Monthly Water Balance Basin Determination

Water balance values will be determined based on SI units. However, for consistency with the RAI response (see Appendix B), both SI units and metric units are provided in the tables below.

3.3.1 Treated Effluent Evaporative Basin

Table 3-3.1a Water Balance for TEEB
(Minimum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m^3 (gal)	Treated Effluent Inflow to Basin[3] m^3 (gal)	Total Inflow to Basin[4] m^3 (gal)	Evaporation per Month[5] cm (in)	Potential Evaporation Outflow from Basin[6] m^3 (gal)	Balance Inflow-Outflow[7] m^3 (gal)	Net in Basin[8] m^3 (gal)
JAN	0.5 (0.194)	40 (10,508)	211 (55,824)	251 (66,332)	4.2 (1.653)	128 (33,694)	124 (32,638)	124 (32,638)
FEB	0.7 (0.271)	56 (14,711)	211 (55,824)	267 (70,535)	10.1 (4.002)	307 (81,069)	-40 (-10,534)	84 (22,104)
MAR	0.5 (0.194)	40 (10,508)	211 (55,824)	251 (66,332)	22.4 (8.800)	679 (179,292)	-428 (-11,296)	0 (0)
APR	0.8 (0.310)	64 (16,813)	211 (55,824)	275 (72,636)	28.0 (11.025)	850 (224,625)	-575 (-151,989)	0 (0)
MAY	2.6 (1.006)	207 (54,641)	211 (55,824)	418 (110,465)	24.5 (9.633)	743 (196,241)	-325 (-85,775)	0 (0)
JUN	2.0 (0.774)	159 (42,032)	211 (55,824)	370 (97,856)	23.4 (9.211)	710 (187,664)	-340 (-89,808)	0 (0)
JUL	2.4 (0.929)	191 (50,438)	211 (55,824)	402 (106,262)	22.1 (8.689)	670 (177,045)	-268 (-70,783)	0 (0)
AUG	2.5 (0.968)	199 (52,540)	211 (55,824)	410 (108,364)	20.7 (8.154)	628 (166,018)	-218 (-57,655)	0 (0)
SEP	3.0 (1.199)	247 (65,149)	211 (55,824)	458 (120,973)	19.9 (7.843)	604 (159,688)	-147 (-38,715)	0 (0)
OCT	1.4 (0.542)	111 (29,422)	211 (55,824)	323 (85,246)	12.2 (4.810)	371 (98,018)	-48 (-12,772)	0 (0)
NOV	0.9 (0.348)	72 (18,914)	211 (55,824)	283 (74,738)	8.8 (3.468)	267 (70,655)	15 (4,083)	15 (4,083)
DEC	0.7 (0.271)	56 (14,711)	211 (55,824)	267 (70,535)	6.9 (2.709)	209 (55,135)	58 (15,400)	73 (19,483)
TOTAL	17.8 (7.0)	1,440 (380,389)	2,536 (669,884)	3,975 (1,050,273)	203.2 (80.0)	6,167 (1,629,144)		

Units:
cm – centimeter in – inches m^3 – cubic meters gal – gallons

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total Precipitation Inflow to Basin = [Surface area at basin top] x [precipitation value from column 2]. Example: JAN: [(2 acres) x (43,560 ft^2/acre)] x [(0.194 in) x (1 ft/12 in)] = 1408.4 ft^3 x 7.48 gal/ft^3 = 10,535 gal ≈ 10,508 gal (i.e., table value). The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of water in the basin based on the anticipated monthly precipitation.
3. Annual treated effluent discharge to the TEEB is 669,884 gal/yr (Reference 5 – Appendix E, p. 12 of 36). Therefore, the monthly effluent discharge is 669,884 ÷ 12 = 55,824 gal/month.
4. Total Inflow = Total Precipitation Inflow + Treated Effluent Inflow
5. Evaporation values are from Table 3-2 above.
6. Potential Evaporation outflow from Basin = [Surface area at basin bottom] x [evaporation value from column 6]. Example: JAN: [0.75 acres) x 43,560 ft^2/acre)] x [(1.653 in) x (1 ft/12 in)] = 4,500.3 ft^3 x 7.48 gal/ft^3 =33,662 gal ≈ 33,694 gal (i.e., table value). Similar to note 2 above, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
7. Balance = Total Inflow (column 5) – Outflow (column 7).
8. Net in Basin (current month) = 'Balance' for current month (column 8) + 'Net in Basin' for previous month (column 9). For January, the 'Net in Basin' for the previous month was taken to be zero (i.e., to represent the time when basin is placed in operation). Negative 'Net in Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).

Table 3-3.1b Water Balance for TEEB (Maximum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m^3 (gal)	Treated Effluent Inflow to Basin[3] m^3 (gal)	Total Inflow to Basin[4] m^3 (gal)	Evaporation per Month[5] cm (in)	Potential Evaporation Outflow from Basin[6] m^3 (gal)	Balance Inflow-Outflow[7] m^3 (gal)	Net in Basin[8] m^3 (gal)
JAN	2.0 (0.796)	163 (43,174)	211 (55,824)	375 (98,998)	4.2 (1.653)	128 (33,694)	247 (65,304)	247 (65,304)
FEB	2.8 (1.114)	229 (60,444)	211 (55,824)	440 (116,268)	10.1 (4.002)	307 (81,069)	133 (35,199)	380 (100,503)
MAR	2.0 (0.796)	163 (43,174)	211 (55,824)	375 (98,998)	22.4 (8.800)	679 (179,292)	-304 (-80,294)	76 (20,209)
APR	3.2 (1.273)	261 (69,079)	211 (55,824)	473 (124,903)	28.0 (11.025)	850 (224,625)	-377 (-99,722)	0 (0)
MAY	10.5 (4.137)	850 (224,507)	211 (55,824)	1,061 (280,331)	24.5 (9.633)	743 (196,241)	318 (84,090)	318 (84,090)
JUN	8.1 (3.180)	654 (172,698)	211 (55,824)	865 (228,521)	23.4 (9.211)	710 (187,664)	155 (40,857)	473 (124,947)
JUL	9.7 (3.812)	784 (207,237)	211 (55,824)	996 (263,061)	22.1 (8.689)	670 (177,045)	326 (86,016)	799 (210,963)
AUG	10.1 (3.978)	817 (215,872)	211 (55,824)	1,028 (271,696)	20.7 (8.154)	628 (166,018)	400 (105,677)	1,199 (316,640)
SEP	12.5 (4.932)	1,013 (267,681)	211 (55,824)	1,225 (323,505)	19.9 (7.843)	604 (159,688)	620 (163,817)	1,819 (480,458)
OCT	5.7 (2.227)	458 (120,888)	211 (55,824)	669 (176,712)	12.2 (4.810)	371 (98,018)	298 (78,694)	2,116 (559,151)
NOV	3.6 (1.432)	294 (77,714)	211 (55,824)	505 (133,538)	8.8 (3.468)	267 (70,655)	238 (62,883)	2,354 (622,034)
DEC	2.8 (1.114)	229 (60,444)	211 (55,824)	440 (116,268)	6.9 (2.709)	209 (55,135)	231 (61,133)	2,586 (683,167)
TOTAL	73.1 (28.8)	5,916 (1,562,914)	2,536 (669,884)	8,451 (2,232,798)	203.2 (80.0)	6,167 (1,629,144)		

Units:
cm – centimeter   in – inches m^3 – cubic meters   gal – gallons

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total Precipitation Inflow to Basin = [Surface area at basin top] x [precipitation value from column 2]. Example: JAN: [(2 acres) x (43,560 ft^2/acre)] x [(0.796 in) x (1 ft/12 in)] = 5779 ft^3 x 7.48 gal/ft^3 = 43,227 gal ≈ 43,174 gal (i.e., table value). The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is insignificant considering that the table value is an approximation of water in the basin based on the anticipated monthly precipitation.
3. Annual treated effluent discharge to the TEEB is 669,884 gal/yr (Reference 5 – Appendix E, p. 12 of 36). Therefore, the monthly effluent discharge is 669,884 ÷ 12 = 55,824 gal/month.
4. Total Inflow = Total Precipitation Inflow + Treated Effluent Inflow
5. Evaporation values are from Table 3-2 above.
6. Potential Evaporation outflow from Basin = [Surface area at basin bottom] x [evaporation value from column 6]. Example: JAN: [0.75 acres) x 43,560 ft^2/acre)] x [(1.653 in) x (1 ft/12 in)] = 4,500.3 ft^3 x 7.48 gal/ft^3 = 33,662 gal ≈ 33,694 gal (i.e., table value). Similar to note 2 above, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
7. Balance = Total Inflow (column 5) – Outflow (column 7).
8. Net in Basin (current month) = 'Balance' of current month (column 8) + 'Net in Basin' of previous month (column 9). For January, the 'Net in Basin' of the previous month was taken to be zero (i.e., to represent the time when basin is placed in operation). Negative 'Net in Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).

3.3.2 UBC Storage Pad Stormwater Retention Basin

Table 3-3.2a Water Balance for UBC Storage Pad Stormwater Retention Basin (Minimum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m^3 (gal)	Blowdown Inflow to Basin[3] m^3 (gal)	Total Inflow to Basin[4] m^3 (gal)	Evaporation per Month[5] cm (in)	Potential Evaporation Outflow from Basin[6] m^3 (gal)	Balance Inflow-Outflow[7] m^3 (gal)	Net In Basin[8] m^3 (gal)
JAN	0.5 (0.194)	857 (226,505)	1,604 (423,875)	2,462 (650,380)	4.2 (1.653)	3,061 (808,650)	-599 (-158,270)	0 (0)
FEB	0.7 (0.271)	1,198 (316,407)	1,604 (423,875)	2,802 (740,282)	10.1 (4.002)	7,365 (1,945,661)	-4,563 (-1,205,379)	0 (0)
MAR	0.5 (0.194)	857 (226,505)	1,604 (423,875)	2,462 (650,380)	22.4 (8.800)	16,287 (4,302,999)	-13,827 (-3,652,619)	0 (0)
APR	0.8 (0.310)	1,370 (361,941)	1,604 (423,875)	2,975 (785,816)	28.0 (11.025)	20,406 (5,391,000)	-17,433 (-4,605,184)	0 (0)
MAY	2.6 (1.006)	4,446 (1,174,559)	1,604 (423,875)	6,051 (1,598,434)	24.5 (9.633)	17,827 (4,709,774)	-11,778 (-3,111,340)	0 (0)
JUN	2.0 (0.774)	3,421 (903,686)	1,604 (423,875)	5,025 (1,327,561)	23.4 (9.211)	17,048 (4,503,936)	-12,024 (-3,176,375)	0 (0)
JUL	2.4 (0.929)	4,106 (1,084,657)	1,604 (423,875)	5,710 (1,508,532)	22.1 (8.689)	16,083 (4,249,089)	-10,374 (-2,740,557)	0 (0)
AUG	2.5 (0.968)	4,278 (1,130,191)	1,604 (423,875)	5,883 (1,554,066)	20.7 (8.154)	15,082 (3,984,439)	-9,200 (-2,430,373)	0 (0)
SEP	3.0 (1.199)	5,300 (1,399,896)	1,604 (423,875)	6,904 (1,823,771)	19.9 (7.843)	14,507 (3,832,511)	-7,604 (-2,008,740)	0 (0)
OCT	1.4 (0.542)	2,395 (632,814)	1,604 (423,875)	4,000 (1,056,689)	12.2 (4.810)	8,904 (2,352,437)	-4,905 (-1,295,748)	0 (0)
NOV	0.9 (0.348)	1,538 (406,309)	1,604 (423,875)	3,143 (830,184)	8.8 (3.468)	6,418 (1,695,715)	-3,276 (-865,531)	0 (0)
DEC	0.7 (0.271)	1,198 (316,407)	1,604 (423,875)	2,802 (740,282)	6.9 (2.709)	5,009 (1,323,246)	-2,207 (-582,964)	0 (0)
TOTAL	17.8 (7.0)	30,964 (8,179,877)	19,253 (5,086,500)	50,219 (13,266,377)	203.2 (80.0)	147,996 (39,099,456)		

Units:

cm – centimeter in – inches m^3 – cubic meters gal – gallons

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total *Precipitation Inflow to Basin* = [Surface area at basin top + UBC storage pad surface area] x [precipitation value from column 2]. Example: JAN: [(20 acres + 23 acres) x (43,560 ft^2/acre)] x [(0.194 in) x (1 ft/12 in)] = 29,788.5 ft^3 x 7.48 gal/ft^3 = 226,505 gal. The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I) based on the surface area at the basin top only. Runoff from the UBC Storage Pad was not included. For example, referring to Appendix I, 'UBC Minimum' spreadsheet, note that for January, the 'Direct Precipitation Inflow to Basin' was determined to be 105,080 gallons (i.e, about half of that indicated in the table above).
3. Cooling tower blowdown and boiler blowdown are discharged to the UBC Storage Pad Stormwater Retention Basin. The annual cooling tower blowdown is 5,050,000 gal/year (Reference 5 – Appendix E, p. 15 of 36) or 420,833 gal/month. Boiler blowdown is 100 gal/day (Reference 8 – Appendix G, Action Item Resolution C) = 36,500 gal/year = 3,042 gal/month. Therefore, blowdown inflow into the basin per month is 420,833 + 3,042 = 423,875 gal.
4. Total Inflow = Total Precipitation Inflow + Blowdown Inflow
5. Evaporation values are from Table 3-2 above.
6. Potential Evaporation outflow from Basin = [Surface area at basin bottom] x [evaporation value from column 6]. Example: JAN: [18 acres) x 43,560 ft^2/acre)] x [(1.653 in) x (1 ft/12 in)] = 108,007.02 ft^3 x 7.48 gal/ft^3 =807,893 gal ≈ 808,650 gal (i.e., table value). The 'Potential Evaporation Outflow' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
7. Balance = Total Inflow (column 5) – Outflow (column 7).
8. Net In Basin (current month) = 'Balance' for current month (column 8) + 'Net In Basin' for previous month (column 9). For January, the 'Net In Basin' for the previous month was taken to be zero (i.e., to represent the time when basin is placed in operation). Negative 'Net In Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).

Table 3-3.2b Water Balance for UBC Storage Pad Stormwater Retention Basin (Maximum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m^3 (gal)	Blowdown Inflow to Basin[3] m^3 (gal)	Total Inflow to Basin[4] m^3 (gal)	Evaporation per Month[5] cm (in)	Potential Evaporation Outflow from Basin[6] m^3 (gal)	Balance Inflow-Outflow[7] m^3 (gal)	Net In Basin[8] m^3 (gal)
JAN	2.0 (0.796)	3,518 (929,372)	1,604 (423,875)	5,123 (1,353,247)	4.2 (1.653)	3,061 (808,650)	2,062 (544,597)	2,062 (544,597)
FEB	2.8 (1.114)	4,924 (1,300,654)	1,604 (423,875)	6,528 (1,724,529)	10.1 (4.002)	7,365 (1,945,661)	-837 (-221,132)	1,225 (323,465)
MAR	2.0 (0.796)	3,518 (929,372)	1,604 (423,875)	5,123 (1,353,247)	22.4 (8.800)	16,287 (4,302,999)	-11,166 (-2,949,752)	0 (0)
APR	3.2 (1.273)	5,626 (1,486,295)	1,604 (423,875)	7,231 (1,910,170)	28.0 (11.025)	20,406 (5,391,000)	-13,176 (-3,480,830)	0 (0)
MAY	10.5 (4.137)	18,284 (4,830,168)	1,604 (423,875)	19,889 (5,254,043)	24.5 (9.633)	17,827 (4,709,774)	2,060 (544,269)	2,060 (544,269)
JUN	8.1 (3.180)	14,055 (3,712,819)	1,604 (423,875)	15,659 (4,136,694)	23.4 (9.211)	17,048 (4,503,936)	-1,390 (-367,242)	670 (177,027)
JUL	9.7 (3.812)	16,848 (4,450,713)	1,604 (423,875)	18,452 (4,874,588)	22.1 (8.689)	16,083 (4,249,089)	2,368 (625,499)	3,038 (802,526)
AUG	10.1 (3.978)	17,581 (4,644,527)	1,604 (423,875)	19,186 (5,068,402)	20.7 (8.154)	15,082 (3,984,439)	4,103 (1,083,963)	7,141 (1,886,489)
SEP	12.5 (4.932)	21,798 (5,758,372)	1,604 (423,875)	23,402 (6,182,247)	19.9 (7.843)	14,507 (3,832,511)	8,895 (2,349,736)	16,036 (4,236,225)
OCT	5.7 (2.227)	9,843 (2,600,141)	1,604 (423,875)	11,447 (3,024,016)	12.2 (4.810)	8,904 (2,352,437)	2,542 (671,579)	18,578 (4,907,804)
NOV	3.6 (1.432)	6,329 (1,671,936)	1,604 (423,875)	7,934 (2,095,811)	8.8 (3.468)	6,418 (1,695,715)	1,515 (400,096)	20,093 (5,307,900)
DEC	2.8 (1.114)	4,924 (1,300,654)	1,604 (423,875)	6,528 (1,724,529)	6.9 (2.709)	5,009 (1,323,246)	1,519 (401,283)	21,612 (5,709,183)
TOTAL	73.1 (28.8)	127,248 (33,615,023)	19,253 (5,086,500)	146,502 (38,701,523)	203.2 (80.0)	147,996 (39,099,456)		

Units:
cm – centimeter in – inches m^3 – cubic meters gal – gallons

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total Precipitation Inflow to Basin = [Surface area at basin top + UBC storage pad surface area] x [precipitation value from column 2]. Example: JAN: [(20 acres + 23 acres) x (43,560 ft^2/acre)] x [(0.796 in) x (1 ft/12 in)] = 124,247.6 ft^3 x 7.48 gal/ft^3 = 929,372 gal. The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I) based on the surface area at the basin top only. Runoff from the UBC Storage Pad was not included. For example, referring to Appendix I, 'UBC Maximum' spreadsheet, note that for January, the 'Direct Precipitation Inflow to Basin' was determined to be 431,723 gallons (i.e., about half of that indicated in the table above).
3. Cooling tower blowdown and boiler blowdown are discharged to the UBC Storage Pad Stormwater Retention Basin. The annual cooling tower blowdown is 5,050,000 gal/year (Reference 5 – Appendix E, p. 15 of 36) or 420,833 gal/month. Boiler blowdown is 100 gal/day (Reference 8 – Appendix G, Action Item Resolution C) = 36,500 gal/year = 3,042 gal/month. Therefore, blowdown inflow into the basin per month is 420,833 + 3,042 = 423,875 gal.
4. Total Inflow = Total Precipitation Inflow + Blowdown Inflow
5. Evaporation values are from Table 3-2 above.
6. Potential Evaporation outflow from Basin = [Surface area at basin bottom] x [evaporation value from column 6]. Example: JAN: [18 acres) x 43,560 ft^2/acre)] x [(1.653 in) x (1 ft/12 in)] = 108,007.02 ft^3 x 7.48 gal/ft^3 = 807,893 gal ≈ 808,650 gal (i.e., table value). The 'Potential Evaporation Outflow' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
7. Balance = Total Inflow (column 5) – Outflow (column 7).
8. Net In Basin (current month) = 'Balance' of current month (column 8) + 'Net In Basin' of previous month (column 9). For January, the 'Net In Basin' of the previous month was taken to be zero (i.e., represents when basin is placed in operation). Negative 'Net In Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).

3.3.3 Site Stormwater Detention Basin

Table 3-3.3a Water Balance for Site Stormwater Detention Basin (Minimum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m^3 (gal)	Evaporation per Month[3] cm (in)	Evaporation + Infiltration per Month[4] cm (in)	Potential Evaporation + Infiltration Outflow from Basin[5] m^3 (gal)	Balance Inflow-Outflow[6] m^3 (gal)	Net In Basin[7] m^3 (gal)
JAN	0.5 (0.194)	2,376 (627,763)	4.2 (1.653)	65.2 (25.653)	47,460 (12,538,487)	-45,084 (-11,910,723)	0 (0)
FEB	0.7 (0.271)	3,564 (941,645)	10.1 (4.002)	71.1 (28.002)	51,763 (13,675,498)	-48,199 (-12,733,853)	0 (0)
MAR	0.5 (0.194)	2,376 (627,763)	22.4 (8.800)	83.3 (32.800)	60,686 (16,032,835)	-58,310 (-15,405,072)	0 (0)
APR	0.8 (0.310)	3,564 (941,645)	28.0 (11.025)	89.0 (35.025)	64,804 (17,120,837)	-61,240 (-16,179,192)	0 (0)
MAY	2.6 (1.006)	11,881 (3,138,817)	24.5 (9.633)	85.4 (33.633)	62,226 (16,439,611)	-50,345 (-13,300,793)	0 (0)
JUN	2.0 (0.774)	9,505 (2,511,054)	23.4 (9.211)	84.4 (33.211)	61,447 (16,233,773)	-51,942 (-13,722,719)	0 (0)
JUL	2.4 (0.929)	10,693 (2,824,936)	22.1 (8.689)	83.0 (32.689)	60,482 (15,978,925)	-49,789 (-13,153,990)	0 (0)
AUG	2.5 (0.968)	11,881 (3,138,817)	20.7 (8.154)	81.7 (32.154)	59,480 (15,714,276)	-47,600 (-12,575,459)	0 (0)
SEP	3.0 (1.199)	14,257 (3,766,581)	19.9 (7.843)	80.9 (31.843)	58,905 (15,562,348)	-44,648 (-11,795,767)	0 (0)
OCT	1.4 (0.542)	5,940 (1,569,409)	12.2 (4.810)	73.2 (28.810)	53,303 (14,082,273)	-47,363 (-12,512,865)	0 (0)
NOV	0.9 (0.348)	3,564 (941,645)	8.8 (3.468)	69.8 (27.468)	50,817 (13,425,551)	-47,253 (-12,483,906)	0 (0)
DEC	0.7 (0.271)	3,564 (941,645)	6.9 (2.709)	67.8 (26.709)	49,407 (13,053,082)	-45,843 (-12,111,437)	0 (0)
TOTAL	17.8 (7.0)	83,166 (21,971,722)	203.2 (80.0)	934.7 (368.0)	680,782 (179,857,498)		

Units:
cm – centimeter *in – inches* *m^3 – cubic meters* *gal – gallons*

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total Precipitation Inflow to Basin = [Surface area at basin top + Runoff area served] x [precipitation value from column 2]. **Example:** JAN: [(20 + 96 acres) x (43,560 ft²/acre)] x [(0.194 in) x (1 ft/12 in)] = 81,689.5 ft³ x 7.48 gal/ft³ = 611,038 gal ≈ 627,763 gal (i.e., table value). The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of water in the basin based on the anticipated monthly precipitation.
3. Evaporation values are from Table 3-2 above.
4. Minimum infiltration rate = 1 millimeter/hour (approx 0.04 in /hr) (Ref. 10, *Figure 3.24 – Appendix H*). From this figure, at 30 minutes, the infiltration rate is about 2 millimeters. Based on a ratio of 60 minutes to 30 minutes, the infiltration rate is about 1 millimeter at 60 minutes which equates to 0.04 inches per hour. Infiltration of 0.04in/hr ≈ 350 in/year = 29.2 in/month. Conservatively, assume soil infiltration is 24 in/month (i.e., more water retained in basin).
5. Potential Evaporation + Infiltration outflow from Basin = [Surface area at basin bottom] x [evaporation/infiltration value from column 5]. **Example:** JAN: [18 acres) x 43,560 ft²/acre)] x [(25.653 in) x (1 ft/12 in)] = 1,676,167 ft³ x 7.48 gal/ft³ = 12,537,729 gal ≈ 12,538,487 gal (i.e., table value). Similar to note 2 above, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
6. Balance = Total inflow (column 3) – Outflow (column 6).
7. Net in Basin (current month) = 'Balance' of current month (column 7) + 'Net in Basin' of previous month (column 8). For January, the 'Net in Basin' of the previous month was taken to be zero (i.e., represents when basin is placed in operation). *Negative 'Net in Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).*

Table 3-3.3b Water Balance for Site Stormwater Detention Basin (Maximum Scenario)

Month	Precipitation[1] cm (in)	Total Precipitation Inflow to Basin[2] m³ (gal)	Evaporation per Month[3] cm (in)	Evaporation + Infiltration per Month[4] cm (in)	Potential Evaporation + Infiltration Outflow from Basin[5] m³ (gal)	Balance Inflow-Outflow[6] m³ (gal)	Net In Basin[7] m³ (gal)
JAN	2.0 (0.796)	9,445 (2,495,360)	4.2 (1.653)	65.2 (25.653)	47,460 (12,538,487)	-38,014 (-10,043,127)	0 (0)
FEB	2.8 (1.114)	13,223 (3,493,504)	10.1 (4.002)	71.1 (28.002)	51,763 (13,675,498)	-38,540 (-10,181,994)	0 (0)
MAR	2.0 (0.796)	9,445 (2,495,360)	22.4 (8.800)	83.3 (32.800)	60,686 (16,032,835)	-51,241 (-13,537,475)	0 (0)
APR	3.2 (1.273)	15,112 (3,992,576)	28.0 (11.025)	89.0 (35.025)	64,804 (17,120,837)	-49,692 (-13,128,261)	0 (0)
MAY	10.5 (4.137)	49,115 (12,975,871)	24.5 (9.633)	85.4 (33.633)	62,226 (16,439,611)	-13,111 (-3,463,740)	0 (0)
JUN	8.1 (3.180)	37,781 (9,981,439)	23.4 (9.211)	84.4 (33.211)	61,447 (16,233,773)	-23,666 (-6,252,333)	0 (0)
JUL	9.7 (3.812)	45,337 (11,977,727)	22.1 (8.689)	83.0 (32.689)	60,482 (15,978,925)	-15,145 (-4,001,198)	0 (0)
AUG	10.1 (3.978)	47,226 (12,476,799)	20.7 (8.154)	81.7 (32.154)	59,480 (15,714,276)	-12,254 (-3,237,477)	0 (0)
SEP	12.5 (4.932)	58,560 (15,471,231)	19.9 (7.843)	80.9 (31.843)	58,905 (15,562,348)	-345 (-91,117)	0 (0)
OCT	5.7 (2.227)	26,447 (6,987,008)	12.2 (4.810)	73.2 (28.810)	53,303 (14,082,273)	-26,856 (-7,095,266)	0 (0)
NOV	3.6 (1.432)	17,001 (4,491,648)	8.8 (3.468)	69.8 (27.468)	50,817 (13,425,551)	-33,816 (-8,933,904)	0 (0)
DEC	2.8 (1.114)	13,223 (3,493,504)	6.9 (2.709)	67.8 (26.709)	49,407 (13,053,082)	-36,184 (-9,559,579)	0 (0)
TOTAL	73.1 (28.8)	341,918 (90,332,027)	203.2 (80.0)	934.7 (368.0)	680,782 (179,857,498)		

Units:
cm – centimeter in – inches m³ – cubic meters gal – gallons

Notes:

1. Precipitation values are from Table 3-1 above.
2. Total Precipitation Inflow to Basin = [Surface area at basin top + Runoff area served] x [precipitation value from column 2]. Example: JAN: [(20 + 96 acres) x (43,560 ft²/acre)] x [(0.796 in) x (1 ft/12 in)] = 335,180 ft³ x 7.48 gal/ft³ = 2,507,146 gal = 2,495,360 gal (i.e., table value). The 'Total Precipitation Inflow to Basin' values were initially determined using an Excel spreadsheet (Appendix I). Therefore, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of water in the basin based on the anticipated monthly precipitation.
3. Evaporation values are from Table 3-2 above.
4. Minimum infiltration rate = 1 millimeter/hour (Ref. 10, Figure 3.24, – Appendix H). From this figure, at 30 minutes, the infiltration rate is about 2 millimeters. Based on a ratio of 60 minutes to 30 minutes, the infiltration rate is about 1 millimeter at 60 minutes which equates to 0.04 inches per hour. Infiltration of 0.04in/hr = 350 in/year = 29.2 in/month. Conservatively, assume soil infiltration is 24 in/month (i.e., more water retained in basin).
5. Potential Evaporation + Infiltration outflow from Basin = [Surface area at basin bottom] x [evaporation/infiltration value from column 5]. Example: JAN: [18 acres) x 43,560 ft²/acre)] x [(25.653 in) x (1 ft/12 in)] = 1,676,167 ft³ x 7.48 gal/ft³ = 12,537,729 gal = 12,538,487 gal (i.e., table value). Similar to note 2 above, due to rounding by the spreadsheet, the manual calculation varies slightly; however, the difference is considered insignificant considering that the table value is an approximation of the monthly evaporation.
6. Balance = Total inflow (column 3) – Outflow (column 6).
7. Net in Basin (current month) = 'Balance' of current month (column 7) + 'Net in Basin' of previous month (column 8). For January, the 'Net in Basin' of the previous month was taken to be zero (i.e., represents when basin is placed in operation). Negative 'Net in Basin' values are denoted as '0', indicating that there is no standing water in the basin (i.e., outflow exceeds inflow).

4.0 RESULTS and CONCLUSIONS

The results for the TEEB show that basin outflow due to evaporation will exceed all inflows on a monthly basis for the minimum discharge scenario with the exception of the winter months. Under the maximum discharge scenario, the basin would have standing water in it for most of the year.

The results for the UBC Storage Pad Stormwater Retention Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis under the minimum discharge scenario. Under the maximum discharge scenario, the basin would have standing water for ten months of the year. Referring to Note 2 in Tables 3.3-2a and 3.3-2b, if runoff from the UBC Storage Pad is not included (see Appendix I), basin outflow due to evaporation will exceed all inflows on a monthly basis under both scenarios, except for one winter month under the maximum discharge scenario.

The results for the SSDB show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios.

5.0 REFERENCES

1. Letter NEF#04-019 dated May 20, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Response to NRC Request for Additional Information Regarding National Enrichment Facility Environmental Report". Excerpts are provided in Appendix B.

2. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic Licensing of Special Nuclear Material, 10 CFR 40, Domestic Licensing of Source Material, and 10 CFR 30, Rules of General Applicability to Domestic Licensing of Byproduct Material, and for a Facility Clearance Under 10 CFR 95, Facility Security Clearance and Safeguarding of National Security Information and Restricted Data". Attachment – National Enrichment Facility Environmental Report. Excerpts are provided in Appendix C.

3. Hobbs, New Mexico, NCDC 1971-2000 Monthly Normals, Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliNORMNCDC2000.pl?nmhobb, (Appendix D).

4. Hobbs, New Mexico, Monthly Total Precipitation, Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMONtpre.pl?nmhobb, last updated June 24, 2004 (Appendix D)

5. Roswell Evaporation, Station ID 7604, 01/1948 to 03/1950, http://weather-mirror.nmsu.edu/Pan_Evaporation/roswell_evap.htm, (Appendix F).

6. Ground Water Discharge Permit Application, National Enrichment Facility, submitted by Louisiana Energy Services, LP, dated April 26, 2004 (Appendix E)

7. Electronic message dated March 9, 2004 from D.E. Mickanen (Lockwood Greene) to G. A Harper (Framatome ANP), regarding "Groundwater Permit Open Items" (Appendix G).

8. Lockwood Greene Response Letter dated May 13, 2004, from J. L. Shaw (Lockwood Greene) to Rod Krich regarding "LG Response to NEF Action Item – ER RAI 4-2A" (Appendix G).

9. Framatome ANP Document 32-5036255-01, "National Enrichment Facility, Treated Effluent Evaporative Basin Size".

10. Hydrology Handbook, Second Edition, American Society of Civil Engineers (Appendix H)

Note: References 1, 2, 6, 7 and 8 above are customer documents that are not available for entering into Records Management. In accordance with Framatome-ANP Administrative Procedure 0402-01, these documents have been used for design information in preparation of this calculation with the Project Manager's written approval as indicated below. Further note that although no client identification number is associated with Reference 6, excerpts from this document are provided in Appendix E. Similarly, copies of References 7 and 8 are provided in Appendix G.

George A. Harper
Project Manager Name

George A. Harper 10/4/04
Project Manager Signature and Date

Appendix A

Design Verification Checklist

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AREVA

DESIGN VERIFICATION CHECKLIST

Document Identifier 32 - 5047375 - 00

Title WATER BALANCE TABLES FOR NATIONAL ENRICHMENT FACILITY BASINS

		Y	N	N/A
1.	Were the inputs correctly selected and incorporated into design or analysis?	☒ Y	☐ N	☐ N/A
2.	Are assumptions necessary to perform the design or analysis activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities are completed?	☒ Y	☐ N	☐ N/A
3.	Are the appropriate quality and quality assurance requirements specified? Or, for documents prepared per FANP procedures, have the procedural requirements been met?	☒ Y	☐ N	☐ N/A
4.	If the design or analysis cites or is required to cite requirements or criteria based upon applicable codes, standards, specific regulatory requirements, including issue and addenda, are these properly identified, and are the requirements/criteria for design or analysis met?	☐ Y	☐ N	☒ N/A
5.	Have applicable construction and operating experience been considered?	☐ Y	☐ N	☒ N/A
6.	Have the design interface requirements been satisfied?	☐ Y	☐ N	☒ N/A
7.	Was an appropriate design or analytical method used?	☒ Y	☐ N	☐ N/A
8.	Is the output reasonable compared to inputs?	☒ Y	☐ N	☐ N/A
9.	Are the specified parts, equipment and processes suitable for the required application?	☐ Y	☐ N	☒ N/A
10.	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?	☐ Y	☐ N	☒ N/A
11.	Have adequate maintenance features and requirements been specified?	☐ Y	☐ N	☒ N/A
12.	Are accessibility and other design provisions adequate for performance of needed maintenance and repair?	☐ Y	☐ N	☒ N/A
13.	Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?	☐ Y	☐ N	☒ N/A
14.	Has the design properly considered radiation exposure to the public and plant personnel?	☐ Y	☐ N	☒ N/A
15.	Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?	☐ Y	☐ N	☒ N/A
16.	Have adequate pre-operational and subsequent periodic test requirements been appropriately specified?	☐ Y	☐ N	☒ N/A
17.	Are adequate handling, storage, cleaning and shipping requirements specified?	☐ Y	☐ N	☒ N/A
18.	Are adequate identification requirements specified?	☐ Y	☐ N	☒ N/A
19.	Is the document prepared and being released under the FANP Quality Assurance Program? If not, are requirements for record preparation review, approval, retention, etc., adequately specified?	☒ Y	☐ N	☐ N/A

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AREVA

DESIGN VERIFICATION CHECKLIST

Document Identifier			
Comments:			
Verified By: (First, MI, Last)	Francis X. Bellini Printed / Typed Name	Francis X. Bellini Signature	9/9/04 Date

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Appendix B

Excerpts from LES ER RAI Response 4-2A

4-2 Water Resources Impacts:

A. Provide a complete water balance table identifying the estimated flow rates (maximum and minimum) discharged to each of the wastewater basins identified in Section 4.4.7 and the anticipated evaporation, soil adsorption, or evapotranspiration on a monthly basis.

B. Provide the basis for assuming that the sand and gravel layer at the surface is laterally and wholly indurated across the entire proposed NEF site.

- In Section 3.3, it appears there is an assumption being made that the sand and gravel layer at the surface is laterally and wholly indurated across the entire proposed NEF site. The limited information from the geotechnical borings does not support this assumption.

C. Discuss the contaminant pathways in a lateral direction to a groundwater source within the subsurface (i.e., contaminant migration beyond the bounds of the proposed NEF within the sand and gravel layer above the Chinle formation).

- Section 4.4.2 includes discussions on contaminant pathways only in a vertical direction to a groundwater source and not in a lateral direction within the subsurface.

D. Discuss the potential for water or other liquids from spills or pipeline leaks to migrate and flow along the base of the Chinle Formation.

- In the construction of the proposed NEF, the site would be subject to borrow and fill from onsite. The sand and gravel "fill" could be a pathway for water or other liquids from spills or pipeline leaks. The water or liquids may flow along the base of the fill area in an apparent southwesterly direction based on the slope of the Chinle Formation.

E. Provide any impacts to the surrounding land if the site stormwater retention basin overflows.

LES Response

A. Complete water balances for each of the basins identified in ER Section 4.4.7 are provided in Table ER RAI 4-2A.1a, "Water Balance for Treated Effluent Evaporative Basin (Minimum Scenario)," Table ER RAI 4-2A.1b, "Water Balance for Treated Effluent Evaporative Basin (Maximum Scenario)," Table ER RAI 4-2A.2a, "Water Balance for UBC Storage Pad Stormwater Retention Basin (Minimum Scenario)," Table ER RAI 4-2A.2b, "Water Balance for UBC Storage Pad Stormwater Retention Basin (Maximum Scenario)," Table ER RAI 4-2A.3a, "Water Balance for Site Stormwater Detention Basin (Minimum Scenario)," and Table ER RAI 4-2A.3b, "Water Balance for Site Stormwater Detention Basin (Maximum Scenario)," in Attachment 2 to this submittal.

The water balances consider the following components:

- Direct precipitation falling within the basin berms for all 3 basins.

- Stormwater runoff for the UBC Storage Pad Stormwater Retention Basin and the Site Stormwater Detention Basin.

- Other inflows (i.e., discharge from Liquid Effluent Collection and Treatment System for the Treated Effluent Evaporative Basin and cooling tower and heating boiler blowdown for the UBC Storage Pad Stormwater Retention Basin).

- Evaporation for all 3 basins.

- Infiltration for the Site Stormwater Detention Basin. The Treated Effluent Evaporative Basin and the UBC Storage Pad Stormwater Retention Basin are lined. Therefore, infiltration is not considered for these basins.

The water balances include the following inputs and assumptions:

- The minimum and maximum monthly precipitation values are based on data from Hobbs, New Mexico. The annual minimum and maximum precipitation amounts were distributed by month using the average annual distribution by month. Use of the minimum precipitation amounts provides a minimum discharge scenario. Use of the maximum precipitation amounts provides a maximum discharge scenario. These data were used in lieu of ER Table 3.6-1B which provides the extreme maximums and minimums for each month at Hobbs over a 30-year period of record. The information in ER Table 3.6-1B is not representative of what would occur over a very dry or very wet calendar year.

- The discharge from the Liquid Effluent Collection and Treatment System for the Treated Effluent Evaporative Basin was based on the expected average monthly flow.

- The cooling tower blowdown was based on the expected average annual discharge. Monthly distribution will not be available until final design.

- The heating boiler blowdown was based on the expected average annual discharge. This component is relatively small and is not expected to vary significantly month by month.

- Annual evaporation at the site is 203.2 cm (80 in) per year. Monthly distribution was based on information from Roswell, New Mexico.

- Monthly infiltration capacity in the Site Stormwater Detention Basin was conservatively assumed as 61 cm (24 in).

- No credit is taken for outflows from the Site Stormwater Detention Basin through the discharge outlet. Any such flows will eventually infiltrate, evaporate or evapotranspirate.

The tables provide the monthly balance (inflow minus outflow). A positive value indicates that the inflow components exceed the outflow components for the respective basin. A negative value indicates that outflow components will dispose of the entire monthly inflow for the respective basin. The tables also provide the monthly net in the basin. A non-zero value indicates that the basin will contain standing water.

The results for the Treated Effluent Evaporative Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis for the minimum discharge scenario with the exception of the winter months. Under the maximum discharge scenario, the basin would have standing water in it for most of the year.

The results for the UBC Storage Pad Stormwater Retention Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis under both discharge scenarios, except for one winter month under the maximum discharge scenario.

The results for the Site Stormwater Detention Basin show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios. Prior to final design of the basin, it is not possible to accurately estimate the distribution of infiltration and evaporation. At this stage in the design, it is reasonable to assume that the basin outflow will be 50 % by infiltration and 50 % by evaporation. 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. As shown in Table ER RAI 4-2A.3, the combination of both potential infiltration and potential evaporation are more than sufficient to dispose of basin inflows on a monthly basis.

B. The five borings are not sufficient to adequately define subsurface conditions for final design purposes, but they are acceptable for judging the feasibility of developing the site. Assuming that the borings are generally representative of subsurface conditions, the site is considered acceptable for the facility structures supported on a system of shallow foundations.

During final design, additional geotechnical investigations will be undertaken to collect more information on the sand and gravel layer.

C. As discussed in ER Section 3.4.15, the nine groundwater exploration borings were performed in the sand and gravel layer above the Chinle Formation and no groundwater was detected. During drilling, only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Based on this, it is concluded that a continuous groundwater aquifer does not exist in this layer under the NEF site. Since there is no consistent groundwater in this layer, it does not provide a likely contaminant pathway in the lateral direction.

Due to the lack of groundwater in this layer, potential contamination would travel laterally at very small rates, if at all. The travel time to downstream users through a lateral contaminant pathway would be significant. The lack of ground water in this layer is supported by information from the adjacent Waste Control Specialists (WCS) ground water investigations.

Table ER RAI 4-2A.1a Water Balance for Treated Effluent Evaporative Basin (Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow - Outflow m^3 (gal)	Net In Basin m^3 (gal)
JAN	0.5 (0.2)	40 (10,508)	211 (55,824)	251 (66,332)	4.2 (1.7)	128 (33,894)	124 (32,638)	124 (32,638)
FEB	0.7 (0.3)	56 (14,711)	211 (55,824)	267 (70,535)	10.1 (4.0)	307 (81,069)	-40 (-10,534)	84 (22,104)
MAR	0.5 (0.2)	40 (10,508)	211 (55,824)	251 (66,332)	22.4 (8.8)	679 (179,292)	-428 (-112,96)	0 (0)
APR	0.8 (0.3)	64 (16,813)	211 (55,824)	275 (72,636)	28.0 (11.0)	850 (224,625)	-575 (-151,989)	0 (0)
MAY	2.6 (1.0)	207 (54,641)	211 (55,824)	418 (110,465)	24.5 (9.6)	743 (196,241)	-325 (-85,775)	0 (0)
JUN	2.0 (0.8)	159 (42,032)	211 (55,824)	370 (97,856)	23.4 (9.2)	710 (187,664)	-340 (-89,808)	0 (0)
JUL	2.4 (0.9)	191 (50,438)	211 (55,824)	402 (106,262)	22.1 (8.7)	670 (177,045)	-268 (-70,783)	0 (0)
AUG	2.5 (1.0)	199 (52,540)	211 (55,824)	410 (108,364)	20.7 (8.2)	628 (166,018)	-218 (-57,655)	0 (0)
SEP	3.0 (1.2)	247 (65,149)	211 (55,824)	458 (120,973)	19.9 (7.8)	604 (159,688)	-147 (-38,715)	0 (0)
OCT	1.4 (0.5)	111 (29,422)	211 (55,824)	323 (85,246)	12.2 (4.8)	371 (98,018)	-48 (-12,772)	0 (0)
NOV	0.9 (0.3)	72 (18,914)	211 (55,824)	283 (74,738)	8.8 (3.5)	267 (70,655)	15 (4,083)	15 (4,083)
DEC	0.7 (0.3)	56 (14,711)	211 (55,824)	267 (70,535)	6.9 (2.7)	209 (55,135)	58 (15,400)	74 (19,483)
Totals	17.8 (7.0)	1,440 (380,389)	2,536 (669,884)	3,975 (1,050,273)	203.2 (80.0)	6,167 (1,629,144)		

Table ER RAI 4-2A.1b Water Balance for Treated Effluent Evaporative Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance (Inflow – Outflow) m^3 (gal)	Net In Basin m^3 (gal)
JAN	2.0 (0.8)	163 (43,174)	211 (55,824)	375 (98,998)	4.2 (1.7)	128 (33,694)	247 (65,304)	247 (65,304)
FEB	2.8 (1.1)	229 (60,444)	211 (55,824)	440 (116,268)	10.1 (4.0)	307 (81,069)	133 (35,199)	380 (100,503)
MAR	2.0 (0.8)	163 (43,174)	211 (55,824)	375 (98,998)	22.4 (8.8)	679 (179,292)	-304 (-80,294)	76 (20,209)
APR	3.2 (1.3)	261 (69,079)	211 (55,824)	473 (124,903)	28.0 (11.0)	850 (224,625)	-377 (-99,722)	0 (0)
MAY	10.5 (4.1)	850 (224,507)	211 (55,824)	1,061 (280,331)	24.5 (9.6)	743 (196,241)	318 (84,090)	318 (84,090)
JUN	8.1 (3.2)	654 (172,698)	211 (55,824)	865 (228,521)	23.4 (9.2)	710 (187,664)	155 (40,857)	473 (124,947)
JUL	9.7 (3.8)	784 (207,237)	211 (55,824)	996 (263,061)	22.1 (8.7)	670 (177,045)	326 (86,016)	799 (210,963)
AUG	10.1 (4.0)	817 (215,872)	211 (55,824)	1,028 (271,696)	20.7 (8.2)	628 (166,018)	400 (105,677)	1,199 (316,640)
SEP	12.5 (4.9)	1,013 (267,681)	211 (55,824)	1,225 (323,505)	19.9 (7.8)	604 (159,688)	620 (163,817)	1,819 (480,458)
OCT	5.7 (2.2)	458 (120,888)	211 (55,824)	669 (176,712)	12.2 (4.8)	371 (98,018)	298 (78,694)	2,116 (559,151)
NOV	3.6 (1.4)	294 (77,714)	211 (55,824)	505 (133,538)	8.8 (3.5)	267 (70,655)	238 (62,883)	2,354 (622,034)
DEC	2.8 (1.1)	229 (60,444)	211 (55,824)	440 (116,268)	6.9 (2.7)	209 (55,135)	231 (61,133)	2,588 (683,167)
Totals	73.1 (28.8)	5,916 (1,562,914)	2,536 (669,884)	8,451 (2,232,798)	203.2 (80.0)	6,167 (1,629,144)		

Table ER RAI 4-2A.2a Water Balance for UBC Storage Pad Stormwater Retention Basin (Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Blowdown Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow – Outflow m^3 (gal)	Net In Basin m^3 (gal)
JAN	0.5 (0.2)	398 (105,080)	1,604 (423,875)	2,002 (528,955)	4.2 (1.7)	3,061 (808,650)	-1,059 (-279,695)	0 (0)
FEB	0.7 (0.3)	557 (147,112)	1,604 (423,875)	2,161 (570,987)	10.1 (4.0)	7,365 (1,945,661)	-5,203 (-1,374,674)	0 (0)
MAR	0.5 (0.2)	398 (105,080)	1,604 (423,875)	2,002 (528,955)	22.4 (8.8)	16,287 (4,302,999)	-14,285 (-3,774,044)	0 (0)
APR	0.8 (0.3)	636 (168,128)	1,604 (423,875)	2,241 (592,003)	28.0 (11.0)	20,406 (5,391,000)	-18,165 (-4,798,998)	0 (0)
MAY	2.6 (1.0)	2,068 (546,415)	1,604 (423,875)	3,673 (970,290)	24.5 (9.6)	17,827 (4,709,774)	-14,154 (-3,739,484)	0 (0)
JUN	2.0 (0.8)	1,591 (420,319)	1,604 (423,875)	3,195 (844,194)	23.4 (9.2)	17,048 (4,503,936)	-13,853 (-3,659,742)	0 (0)
JUL	2.4 (0.9)	1,909 (504,383	1,604 (423,875)	3,514 (928,258)	22.1 (8.7)	16,083 (4,249,089)	-12,570 (-3,320,831)	0 (0)
AUG	2.5 (1.0)	1,989 (525,399)	1,604 (423,875)	3,593 (949,274)	20.7 (8.2)	15,082 (3,984,439	-11,488 (-3,035,165)	0 (0)
SEP	3.0 (1.2)	2,466 (651,495)	1,604 (423,875)	4,070 (1,075,370)	19.9 (7.8)	14,507 (3,832,511)	-10,436 (-2,757,142)	0 (0)
OCT	1.4 (0.5)	1,114 (294,223)	1,604 (423,875)	2,718 (718,098)	12.2 (4.8)	8,904 (2,352,437)	-6,186 (-1,634,338)	0 (0)
NOV	0.9 (0.3)	716 (189,144)	1,604 (423,875)	2,320 (613,019)	8.8 (3.5)	6,418 (1,695,715)	-4,098 (-1,082,696)	0 (0)
DEC	0.7 (0.3)	557 (147,112)	1,604 (423,875)	2,161 (570,987)	6.9 (2.7)	5,009 (1,323,246)	-2,847 (-752,259)	0 (0)
Totals	17.8 (7.0)	14,398 (3,803,888)	19,253 (5,086,500)	33,651 (8,890,388)	203.2 (80.0)	147,996 (39,099,456)		

Table ER RAI 4-2A.2b Water Balance for UBC Storage Pad Stormwater Retention Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Blowdown Inflow to Basin m³ (gal)	Total Inflow to Basin m³ (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow – Outflow m³ (gal)	Net in Basin m³ (gal)
JAN	2.0 (0.8)	1,634 (431,723)	1,604 (423,875)	3,239 (855,598)	4.2 (1.7)	3,061 (808,650)	178 (46,948)	178 (46,948)
FEB	2.8 (1.1)	2,288 (604,412)	1,604 (423,875)	3,892 (1,028,287)	10.1 (4.0)	7,365 (1,945,661)	-3,472 (-917,374)	0 (0)
MAR	2.0 (0.8)	1,634 (431,723)	1,604 (423,875)	3,239 (855,598)	22.4 (8.8)	16,287 (4,302,999)	-13,049 (-3,447,400)	0 (0)
APR	3.2 (1.3)	2,615 (690,757)	1,604 (423,875)	4,219 (1,114,632)	28.0 (11.0)	20,406 (5,391,000)	-16,187 (-4,276,368)	0 (0)
MAY	10.5 (4.1)	8,497 (2,244,960)	1,604 (423,875)	10,102 (2,668,835)	24.5 (9.6)	17,827 (4,709,774)	-7,725 (-2,040,939)	0 (0)
JUN	8.1 (3.2)	6,536 (1,726,893)	1,604 (423,875)	8,141 (2,150,768)	23.4 (9.2)	17,048 (4,503,936)	-8,907 (-2,353,168)	0 (0)
JUL	9.7 (3.8)	7,844 (2,072,271)	1,604 (423,875)	9,448 (2,496,146)	22.1 (8.7)	16,083 (4,249,089)	-6,635 (-1,752,942)	0 (0)
AUG	10.1 (4.0)	8,171 (2,158,616)	1,604 (423,875)	9,775 (2,582,491)	20.7 (8.2)	15,082 (3,984,439)	-5,307 (-1,401,949)	0 (0)
SEP	12.5 (4.9)	10,132 (2,676,684)	1,604 (423,875)	11,736 (3,100,559)	19.9 (7.8)	14,507 (3,832,511)	-2,771 (-731,953)	0 (0)
OCT	5.7 (2.2)	4,576 (1,208,825)	1,604 (423,875)	6,180 (1,632,700)	12.2 (4.8)	8,904 (2,352,437)	-2,724 (-719,737)	0 (0)
NOV	3.6 (1.4)	2,941 (777,102)	1,604 (423,875)	4,546 (1,200,977)	8.8 (3.5)	6,418 (1,695,715)	-1,873 (-494,738)	0 (0)
DEC	2.8 (1.1)	2,288 (604,412)	1,604 (423,875)	3,892 (1,028,287)	6.9 (2.7)	5,009 (1,323,246)	-1,116 (-294,958)	0 (0)
Totals	73.1 (28.8)	59,155 (15,628,378)	19,253 (5,086,500)	78,408 (20,714,878)	203.2 (80.0)	147,996 (39,099,456)		

Table ER RAI 4-2A.3a Water Balance for the Site Stormwater Detention Basin (Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow – Outflow m³ (gal)	Net in Basin m³ (gal)
JAN	0.5 (0.2)	2,376 (627,763)	65.2 (25.7)	47,460 (12,538,487)	-45,084 (-11,910,723)	0 (0)
FEB	0.8 (0.3)	3,564 (941,645)	71.1 (28.0)	51,763 (13,675,498)	-48,199 (-12,733,853)	0 (0)
MAR	0.5 (0.2)	2,376 (627,763)	83.3 (32.8)	60,686 (16,032,835)	-58,310 (-15,405,072)	0 (0)
APR	0.8 (0.3)	3,564 (941,645)	89.0 (35.0)	64,804 (17,120,837)	-61,240 (-16,179,192)	0 (0)
MAY	2.5 (1.0)	11,881 (3,138,817)	85.4 (33.6)	62,226 (16,439,611)	-50,345 (-13,300,793)	0 (0)
JUN	2.0 (0.8)	9,505 (2,511,054)	84.4 (33.2)	61,447 (16,233,773)	-51,942 (-13,722,719)	0 (0)
JUL	2.3 (0.9)	10,693 (2,824,936)	83.0 (32.7)	60,482 (15,978,925)	-49,789 (-13,153,990)	0 (0)
AUG	2.5 (1.0)	11,881 (3,138,817)	81.7 (32.2)	59,480 (15,714,276)	-47,600 (-12,575,459)	0 (0)
SEP	3.0 (1.2)	14,257 (3,766,581)	80.9 (31.8)	58,905 (15,562,348)	-44,648 (-11,795,767)	0 (0)
OCT	1.3 (0.5)	5,940 (1,569,409)	73.2 (28.8)	53,303 (14,082,273)	-47,363 (-12,512,865)	0 (0)
NOV	0.8 (0.3)	3,564 (941,645)	69.8 (27.5	50,817 (13,425,551)	-47,253 (-12,483,906)	0 (0)
DEC	0.8 (0.3)	3,564 (941,645)	67.8 (26.7)	49,407 (13,053,082)	-45,843 (-12,111,437)	0 (0)
Totals	17.8 (7.0)	83,166 (21,971,722)	934.7 (368.0)	680,782 (179,857,498)		

Table ER RAI 4-2A.3b Water Balance for the Site Stormwater Detention Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow - Outflow m³ (gal)	Net In Basin m³ (gal)
JAN	2.0 (0.8)	9,445 (2,495,360)	65.2 (25.7)	47,460 (12,538,487)	-38,014 (-10,043,127)	0 (0)
FEB	2.8 (1.1)	13,223 (3,493,504)	71.1 (28.0)	51,763 (13,675,498)	-38,540 (-10,181,994)	0 (0)
MAR	2.0 (0.8)	9,445 (2,495,360)	83.3 (32.8)	60,686 (16,032,835)	-51,241 (-13,537,475)	0 (0)
APR	3.2 (1.3)	15,112 (3,992,576)	89.0 (35.0)	64,804 (17,120,837)	-49,692 (-13,128,261)	0 (0)
MAY	10.5 (4.1)	49,115 (12,975,871)	85.4 (33.6)	62,226 (16,439,611)	-13,111 (-3,463,740)	0 (0)
JUN	8.1 (3.2)	37,781 (9,981,439)	84.4 (33.2)	61,447 (16,233,773)	-23,666 (-6,252,333)	0 (0)
JUL	9.7 (3.8)	45,337 (11,977,727)	83.0 (32.7)	60,482 (15,978,925)	-15,145 (-4,001,198)	0 (0)
AUG	10.1 (4.0)	47,226 (12,476,799)	81.7 (32.2)	59,480 (15,714,276)	-12,254 (-3,237,477)	0 (0)
SEP	12.5 (4.9)	58,560 (15,471,231)	80.9 (31.8)	58,905 (15,562,348)	-345 (-91,117)	0 (0)
OCT	5.7 (2.2)	26,447 (6,987,008)	73.2 (28.8)	53,303 (14,082,273)	-26,856 (-7,095,266)	0 (0)
NOV	3.6 (1.4)	17,001 (4,491,648)	69.8 (27.5)	50,817 (13,425,551)	-33,816 (-8,933,904)	0 (0)
DEC	2.8 (1.1)	13,223 (3,493,504)	67.8 (26.7)	49,407 (13,053,082)	-36,184 (-9,559,579)	0 (0)
Totals	73.1 (28.8)	341,918 (90,332,027)	934.7 (368.0)	680,782 (179,857,498)		

Appendix C

Excerpts from Sections 1.2.1 and 4.4.7 of the
NEF Environmental Report

1.2 PROPOSED ACTION

The proposed action is the issuance of an NRC license under 10 CFR 70 (CFR, 2003b) for the construction and operation of a uranium enrichment facility 8 km (5 mi) east of Eunice, New Mexico in Lea County. The NEF will use the gas centrifuge process to separate natural uranium hexafluoride feed material containing approximately 0.71 Uranium-235 (^{235}U) into a product stream enriched up to 5.0 $^{w}/_{o}$ ^{235}U and a depleted UF_6 stream containing approximately 0.2 to 0.34 $^{w}/_{o}$ ^{235}U. Production capacity at design throughput is approximately 3.0 million Separative Work Units (SWU) per year. Facility construction is expected to require eight (8) years. Construction will be conducted in six phases. Operation will commence after the completion of the first cascade in the first Cascade Hall. The facility is licensed for 30 years of operation. Decommissioning and Decontamination (D&D) is projected to take nine (9) years. LES estimates the cost of the plant to be approximately $1.2 billion (in 2002 dollars) excluding escalation, contingency, interest, tails disposition, decommissioning, and any replacement equipment required during the operational life of the facility.

1.2.1 The Proposed Site

The proposed NEF site is located in Southeast New Mexico, approximately 32 km (20 mi) south of Hobbs, New Mexico (population 28,657). The site is located in Lea County, approximately 0.8 km (0.5 mi) west of the Texas state border, 51 km (32 mi) west-north-west of Andrews, Texas (population 10,182) and 523 km (325 mi) southeast of Albuquerque, New Mexico (population 712,728). The nearest large population center (>100,000 population) and commercial airport is the Midland-Odessa, Texas area which is approximately 103 km (64 mi) to the southeast. The approximate center of the NEF is located at latitude 32 degrees, 26 min, 1.74 sec North and longitude 103 degrees, 4 min, 43.47 sec West. Refer to Figure 1.2-1, Location of Proposed Site and Figure 1.2-2, NEF Location Relative to Population Centers Within 80 Kilometers (50 Miles).

Lea County is situated at an average elevation of 1,220 m (4,000 ft) above mean sea level (msl) and is characterized most often by its flat topography. Lea County covers 11,381 km^2 (4,393 mi^2) or approximately 1,138,114 ha (2,822,522 acres) which is three times the size of Rhode Island and only slightly smaller than Connecticut. From north to south, Lea County spans 173 km (108 mi) and 70 km (44 mi) from east to west spans at its widest point.

The proposed NEF site location is Section 32, Township 21S, Range 38E. The site is located approximately 8 km (5 mi) east of the nearest city, which is Eunice, New Mexico (population 2,562). Eunice is located at the crossing junction of New Mexico Highway 207 and New Mexico Highway 234, 32 km (20 mi) south of Hobbs, New Mexico. New Mexico Highway 234 (east-west) and New Mexico Highway 18 (north-south) are the major transportation routes near the site. These two highways intersect about 6.4 km (4 mi) west of the proposed NEF site. An active railroad line operated by the Texas-New Mexico Railroad runs parallels to New Mexico Highway 18 and just east of Eunice within 5.8 km (3.6 mi) of the NEF site. There is also an active railroad spur line that runs from the Texas-New Mexico Railroad, along the North boundary of the NEF site and terminates at the Waste Control Specialists (WCS) facility, just across the New Mexico-Texas border.

4.4.7 Control of Impacts to Water Quality

Site runoff water quality impacts will be controlled during construction by compliance with NPDES General Permit requirements and BMPs will be described in a site Stormwater Pollution Prevention (SWPP) plan.

Wastes generated during site construction will be varied, depending on activities in progress. Any hazardous wastes from construction activities will be handled and disposed of in accordance with applicable state regulations. This includes proper labeling, recycling, controlling and protected storage and shipping offsite to approved disposal sites. Sanitary wastes generated at the site will be handled by portable systems until such time that the site septic system is available for use.

The need to level the site for construction will require some soil excavation as well as soil fill. Fill placed on the site will provide the same characteristics as the existing natural soils thus providing the same runoff characteristics as currently exist due to the presence of natural soils on the site.

During operation, the NEF's stormwater runoff detention/retention system will provide a means to allow controlled release of site runoff from the Site Stormwater Detention Basin only. Stormwater discharge will be periodically monitored in accordance with state and/or federal permits. This system will also be used for routine sampling of runoff as described in ER Section 6.1.1.2, Liquid Effluent Monitoring. A Spill Prevention Control and Countermeasure (SPCC) plan will be implemented for the facility to identify potential spill substances, sources and responsibilities. A SWPP will also be implemented for the NEF to assure that runoff released to the environment will be of suitable quality. These plans are described in ER Section 4.1, Land Use Impacts.

Water discharged to the NEF site septic system will meet required levels for all contaminants stipulated in any permit or license required for that activity, including the 10 CFR 20 (CFR, 2003q) and a Groundwater Discharge Permit/Plan. The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant. The system is fully described in SAR Section 3.2 and ER Section 3.12, and it provides for collection, treatment, analysis, and processing of liquid wastes for disposal. Effluents unsuitable for release to the Treated Effluent Evaporative Basin are processed onsite or disposed of offsite in a suitable manner in conformance with pertinent regulations.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad and cooling tower blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm plus an allowance for cooling tower blowdown. Designed for sampling and radiological testing of the contained water and sediment, this basin has no flow outlet. All discharge is through evaporation.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Mitigation measures will be in place to minimize potential impact on water resources. These include employing BMPs and the control of hazardous materials and fuels. In addition, the following controls will also be implemented:

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- The control of spills during construction will be in conformance with Spill Prevention Control and Countermeasures (SPCC) plan.
- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas (EPA, 2003g). See ER Sections 4.1.1 and 4.2.5 for construction BMPs.
- BMPs will also be used for dust control associated with excavation and fill operations during construction. Water conservation will be considered when deciding how often dust suppression sprays will be applied (EPA, 2003g).
- Silt fencing and/or sediment traps will be used.
- External vehicle washing (no detergents, water only).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All temporary construction and permanent basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention (SWPP) plan.
- A Spill Prevention Control and Countermeasure Plan (SPCC), will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above-ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The NEF Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Control of surface water runoff will be required for activities covered by the EPA Region 6 NPDES General Permit.

The NEF is designed to minimize the use of natural and depletable water resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

4.4.8 Identification of Predicted Cumulative Effects on Water Resources

The NEF will not extract any surface or groundwater from the site or discharge any effluent to the site other than into the engineered basins. As a result, no significant effects on natural water systems are anticipated. Thus no cumulative effects are predicted.

4.4.9 Comparative Water Resources Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

The discussion of alternative scenarios in ER Section 2.0 compares the impacts of NEF with those that could result from expansion of the existing USEC gaseous diffusion plant (GDP) and a proposed centrifuge plant. Plant water usage by the GDP is reported to be 26 million gal/d (USEC, 2003a). NEF water usage is projected to be 87,625 m^3/yr (23.15 million gal/yr), less than 0.5% of the GDP usage.

Significant water usage is also required to generate the electric power needed for GDP operations. NEF will use far less electric power and thus far less water per SWU compared with GDP.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The water resources impact would be greater because of the higher water usage of the GDP and the water use to meet GDP electricity needs.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The water resources impact would be greater in the short term to

Appendix D

Western Regional Climate Center
NCDC 1971-2000 Monthly Normals
and
Monthly Total Precipitation
for
Hobbs, New Mexico

HOBBS, NEW MEXICO

NCDC 1971-2000 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Monthly
Mean Max. Temperature (F)	56.7	62.9	70.7	78.5	86.1	92.8	93.5	91.2	85.4	77.3	65.2	57.9	76.5
Highest Mean Max. Temperature (F)	64.7	71.3	79.1	83.8	94.5	101.5	102.1	96.4	92.6	84.4	73.5	65.4	102.1
Year Highest Occurred	1986	1976	1974	1972	2000	1998	1998	2000	2000	1979	1973	1981	1998
Lowest Mean Max. Temperature (F)	49.0	55.1	63.1	72.2	81.2	87.4	86.6	84.4	77.5	71.8	56.8	50.9	49.0
Year Lowest Occurred	1979	1997	1987	1997	1976	1979	1976	1971	1991	1984	2000	2000	1979
Mean Temperature (F)	42.9	48.0	54.8	62.6	70.9	77.9	80.1	78.3	72.3	63.2	51.3	44.0	62.2
Highest Mean Temperature (F)	47.8	54.6	61.6	67.8	77.9	84.8	86.0	82.0	77.5	66.6	56.4	48.9	86.0
Year Highest Occurred	1986	1976	1974	1986	2000	1990	1998	1999	1998	1979	1981	1977	1998
Lowest Mean Temperature (F)	36.6	42.5	48.7	57.0	66.6	73.7	74.8	72.9	66.0	56.9	44.9	37.6	36.6
Year Lowest Occurred	1985	1978	1987	1983	1976	1979	1976	1971	1974	1976	2000	1983	1985
Mean Min. Temperature (F)	29.1	33.1	38.9	46.6	55.6	63.0	66.6	65.4	59.2	49.1	37.3	30.1	47.8
Highest Mean Min. Temperature (F)	34.0	38.2	44.0	51.9	61.3	69.2	69.8	68.6	63.2	53.7	41.2	36.3	69.8
Year Highest Occurred	1981	1995	1974	1986	2000	1990	1998	1982	1998	1983	1994	1994	1998
Lowest Mean Min. Temperature (F)	22.9	28.5	33.9	41.5	50.5	59.5	62.7	61.1	54.2	41.7	30.8	22.8	22.8
Year Lowest Occurred	1985	1978	1996	1987	1987	1995	1988	1975	1974	1976	1976	1983	1983
Mean Precipitation (in.)	0.51	0.66	0.48	0.78	2.58	2.03	2.42	2.52	3.13	1.45	0.87	0.72	18.15
Highest Precipitation (in.)	2.03	2.21	2.98	2.86	13.83	5.37	9.41	9.06	12.99	8.15	4.33	5.08	13.83
Year Highest Occurred	1993	1973	2000	1981	1992	2000	1988	1984	1995	1985	1978	1986	1992
Lowest Precipitation (in.)	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.11	0.08	0.00	0.00	0.00	0.00
Year Lowest													

Occurred	2000	1999	1996	2000	2000	1990	1980	1994	2000	1989	1999	2000	2000
Heating Degree Days (F)	686.	476.	323.	131.	37.	1.	0.	0.	18.	110.	416.	651.	2849.
Cooling Degree Days (F)	0.	0.	6.	57.	218.	389.	466.	413.	237.	53.	3.	0.	1842.

HOBBS, NEW MEXICO

Monthly Total Precipitation (inches)

(294026)

File last updated on Jun 24, 2004
*** Note *** Provisional Data *** After Year/Month 200403
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR (S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1914	0.03	0.11a	0.08	0.52	2.72	1.92	2.52	3.90	0.87	2.63	0.52	1.59a	17.41
1915	0.25	0.49	1.57	3.80	0.32	4.85	2.82	4.75	6.60	0.26	0.00	1.05	26.76
1916	0.18	0.12	0.59	1.70	0.17	0.03	0.82	4.47a	3.91a	4.08a	0.35	0.10	16.52
1917	0.11	0.00	0.25	0.00	0.40a	0.93	0.04	2.22	0.75	0.00	0.58a	0.00	5.28
1918	0.82a	0.05	0.00	0.07	1.55	5.67	0.66a	0.99	0.22a	1.30	0.82a	0.85a	13.00
1919	0.16a	0.00	2.78	1.59	0.75	1.75	0.13	1.61	10.72b	1.95	0.33a	0.14	21.91
1920	0.96	0.12a	0.05a	0.00	2.50	0.75	1.02	9.17a	0.67	1.30	0.85	0.00	17.39
1921	0.10	1.19	0.43	0.07	0.86	9.30a	3.25a	0.83	1.18b	0.00	0.00	0.17a	17.38
1922	0.37	0.03	0.12	5.17	0.69	2.23	2.01	0.77	1.45	0.39	0.37	0.02	13.62
1923	0.36	2.44	0.75	2.58	0.47	1.37	2.56	1.87	4.80	6.64	0.32	1.55	25.71
1924	0.00	0.22	0.80	0.62	0.28	0.00	0.78	1.08	0.25	0.60	0.06	0.60	5.29
1925	0.12	0.00	0.00	0.67	1.09	1.18	1.65	1.77	0.51	0.88	0.07	0.00	7.94
1926	0.32	0.00	0.74	2.20	1.91	0.30	1.58	2.19	3.97	3.74	0.60	1.60	19.15
1927	0.05	0.22	0.00	0.00	0.23	3.17	3.56	0.40	0.69	0.25	0.00	1.16a	9.73
1928	0.18	0.26a	0.02	0.30	1.71	2.19	4.20	8.28	0.58	0.00z	0.00z	0.00z	17.72
1929	0.00z	0.00z	0.00z	0.00z	0.00z	2.07	1.07	2.53	1.78	4.49	0.40	0.07	12.41
1930	0.24	0.00	0.00	0.03	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.27
1931	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00
1932	0.00z	0.00z	0.00z	0.00z	0.00z	5.25	1.14	5.55	3.99	0.00z	0.00z	0.00z	15.93
1933	0.10	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	1.15	0.00	0.58	0.00	1.83
1934	0.52	0.00	1.15	0.15	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	1.82
1935	0.00z	0.50a	0.75	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	1.25
1936	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00
1937	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.87	0.79	0.67	2.33
1938	0.71	0.40	0.24	0.12	0.00	3.15	1.74	0.04	1.18	0.83	0.09	0.25	8.75
1939	1.10	0.15	0.00	0.10	1.45	1.00	3.61	0.22	0.00	2.42a	1.59	0.28	11.92
1940	0.05	0.56	0.25	1.25	0.63	4.10	0.55	2.80	0.00	3.45	1.09	0.33	15.06
1941	0.22	0.84	2.88	0.69	9.19	3.03	2.32	1.19	6.72	4.66	0.08	0.37	32.19

1942	0.16	0.00	0.50	1.71	1.47	1.51	1.10	2.89	0.67	0.86	0.00	1.88	12.75
1943	0.00	0.08	0.09	0.10	0.72	1.66	3.01	0.30	0.51	0.09	0.50	1.98	9.04
1944	1.23	0.49	0.00	0.42	2.79	1.39	1.42	4.20	5.10	0.28	1.93	0.32	19.57
1945	1.10	0.00	0.00	0.51	0.06	0.36	1.33	1.42	1.30	1.48	0.00	0.16	7.72
1946	1.30	0.03	0.13	0.00	0.46	1.91	1.15	5.59	7.87	3.89	0.00	1.21	23.54
1947	0.73	0.00	0.95a	0.45	7.05	0.10	0.00z	0.47	0.06	0.04	0.70	0.14	10.69
1948	0.84	0.86	0.20	0.56	1.18	0.20	1.90	0.26	1.99	0.39b	0.00	0.13	8.51
1949	2.96b	0.27	0.18	2.46	1.77	1.99	3.96	0.81	8.03	0.45	0.00	0.43	23.31
1950	0.14	0.04	0.02	1.13	0.82	3.85	4.33	1.81	7.86	0.34	0.00	0.00	20.34
1951	0.12	0.05	0.63	0.13	2.56	0.74	0.96	2.54	0.00	0.37	0.04	0.00	8.14
1952	0.00	0.37	0.13	0.40	2.10	0.00	2.36	0.30	1.57	0.00	1.15	0.00	8.38
1953	0.00	0.22	0.49	0.47	0.66	0.27	1.04	1.22	0.78	4.82a	0.03	0.09	10.09
1954	0.00	0.00	0.00	1.93	5.80	0.40	0.00	4.11	0.98	2.76	0.03	0.07	16.08
1955	0.43	0.00	0.11	0.00	3.86	0.23	1.91	0.27	2.71	2.48	0.30	0.00	12.30
1956	0.02	0.80	0.00a	0.14	1.93	0.59	0.15	1.20	0.47	3.05	0.00	0.28	8.63
1957	0.04	0.77	0.36	1.58	4.81	0.99	0.90	3.68	1.51	3.39	1.17	0.00	19.20
1958	1.84	0.99	1.70	0.55	0.87	1.16	0.94	2.15	4.87	3.02	0.89	0.00	18.98
1959	0.00	0.05	0.01	0.74	2.64	2.52	2.68	2.09	0.52	2.25	0.04	1.10	14.64
1960	0.38	0.34	0.19	0.01	0.63	1.35	9.06	2.45	0.37	3.72	0.00	1.91	20.41
1961	1.28	0.11	1.19	0.02	0.85	1.03	2.40	0.63	1.07	0.03	1.03	0.12	9.76
1962	0.48	0.07	0.20	0.28	0.25	3.18	1.94	2.26	3.98	0.94	0.03	0.47	14.08
1963	0.00	0.19	0.00	0.88	4.12	1.86	1.34	2.88	0.63	0.20	0.21	0.29	12.60
1964	0.11	0.12	0.54	0.00	1.40	1.56	0.77	0.37	1.60	0.33	0.14	0.54	7.48
1965	0.00	0.19	0.03	0.64	0.22	1.76	2.04	2.11	0.89	0.28	0.00	0.43	8.59
1966	0.21	0.15	0.85	2.20	0.89	1.65	0.23	6.64	2.40	0.00	0.00	0.02	15.24
1967	0.00	0.03	0.13	0.59	0.07	0.05	2.18	0.96	0.26	0.00	0.48	0.65	5.40
1968	0.93	0.94	0.39c	0.54	1.93	0.88	5.96	3.88	0.11	0.61	1.63	0.27	18.07
1969	0.02	1.09	1.57	0.79	3.23	0.55	1.98	0.66	3.51	6.31	0.15	0.78	20.64
1970	0.00	0.43	1.53	0.60	0.48	2.37	1.03	0.41	3.21	0.54	0.00	0.01	10.61
1971	0.03	0.03	0.07	1.26	1.01	0.05	0.42	8.49	4.89	1.35	0.18	0.93	18.71
1972	0.20	0.04	0.27	0.02	1.13	2.66	2.19	4.20	6.32	3.09	0.56	0.04	20.72
1973	1.28	2.21	0.62	0.07	1.27	1.75	2.44	0.88	0.73	1.02	0.03	0.00	12.30
1974	0.02	0.05	0.31	0.99	1.96	1.62	0.33	6.85	8.46	5.93	0.43	0.39	27.34
1975	0.45	1.19	0.05	0.22	3.72	1.46	7.25	1.76	2.41	0.14	0.00	0.28	18.93
1976	0.20	0.36	0.04	1.52	1.35	0.39	4.44	0.58	1.75	1.57	1.45	0.00	13.65
1977	0.18	0.05	1.10	1.44	2.09	3.41	1.60	0.79	0.53	1.00	0.06	0.01	12.26
1978	0.37	0.65	0.48	0.44	1.95	2.23	0.57	0.75	7.14	1.51	4.33	0.31	20.73
1979	0.29	0.47	0.53	0.32	2.26	4.96	1.59	2.83	0.45	0.11	0.28	0.74	14.83
1980	1.12	0.37	0.02	0.29	4.00	1.31	0.22	3.73	7.05	0.04	1.45	0.09	19.69
1981	0.31	0.42	0.41	2.86	2.27	1.26	7.29	3.07	2.27	2.73	0.26	0.27	23.42
1982	0.35b	0.05	1.25	1.28	4.73	1.55	4.25	0.87	1.67	0.69	1.59	2.26	20.54
1983	1.73	0.41	0.22	0.60	1.87	0.51	0.67	1.12	1.20	2.46	2.91	0.27	13.97
1984	0.08	0.02	0.00	0.11	3.83	2.78	2.53	9.06	1.55	2.34	2.37	2.25a	26.92
1985	0.20a	0.45	0.75	1.20	1.40	4.55	2.78	1.92	3.99	8.15	0.10	0.02	25.51
1986	0.17	0.93	0.10	0.00	1.58	5.09	2.14	2.94	2.77	1.09	1.55	5.08	23.44
1987	0.10	1.80	0.63	0.90	6.01	3.93	0.42	3.59	2.22	0.08	0.36	0.47	20.51

1988	0.45	1.90	0.23	0.63	2.12	0.32	9.41	1.55	1.98	0.00	0.00	0.42	19.01
1989	0.13	1.59	0.79	0.00	0.28	0.40	1.93	3.34	0.90	0.00	0.00	0.55a	9.91
1990	0.44	0.87	0.77	1.11	1.25	0.00	2.85	2.16	2.20	0.37	1.48	0.69	14.19
1991	0.62	0.00	0.00	0.00	0.53	2.70a	4.51	3.10	12.07	0.18	0.96	3.49	28.16
1992	1.50	2.15	0.46	0.49	13.83	2.15	1.50	2.00	1.92	0.02	1.14	1.65	28.81
1993	2.03	0.71	0.18	1.87	0.93	0.17	3.08	0.35	1.12	1.41	0.30	0.00	12.15
1994	0.32	0.00	0.20	0.05	5.33	0.15	1.20	0.11	0.34	0.92	1.44	0.00	10.06
1995	1.31	0.50	0.26	0.09	1.39	2.36	0.32	1.50	12.99	0.38	0.00	0.00c	21.10
1996	0.22	0.00	0.00	0.75	2.37	3.09	3.40	2.80	0.93	0.25	0.76	0.00	14.57
1997	0.62	2.06	0.50	2.77	4.26	2.07	1.11	1.34	1.26	2.00	0.00	1.11a	19.10
1998	0.00	0.20	0.60	0.00	0.00z	0.10	0.24	2.15	0.98	2.19	0.31	0.19	6.96
1999	0.54	0.00	0.67	1.97	2.55	2.61	0.73	1.03a	1.81	0.07	0.00	0.00	11.98
2000	0.00	0.39	2.98	0.00	0.00	5.37	0.00z	0.00z	0.00z	2.38	1.70	0.00	12.82
2001	0.00z	0.00	1.85	0.34b	2.21	1.38b	0.27	1.21	1.84g	0.03	1.04	0.00	8.33
2002	0.57	0.00z	2.70	1.56	0.56	1.40	0.84	0.60	0.00z	0.00z	0.00	0.00z	8.23
2003	0.00z	0.70	0.00	0.00	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.75	0.00z	1.45
2004	0.00z	0.00z	0.93	5.27m	0.00o	0.00t	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.93
Period of Record Statistics													
MEAN	0.45	0.45	0.54	0.80	2.06	1.88	2.11	2.37	2.63	1.57	0.58	0.56	16.10
S.D.	0.56	0.58	0.68	0.95	2.20	1.67	1.91	2.11	2.89	1.79	0.76	0.85	6.35
SKEW	1.95	1.78	2.00	1.95	2.69	1.55	1.86	1.55	1.69	1.48	2.19	2.77	0.32
MAX	2.96	2.44	2.98	5.17	13.83	9.30	9.41	9.17	12.99	8.15	4.33	5.08	32.19
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	5.28
NO YRS	82	83	85	83	79	82	80	81	80	81	83	81	74

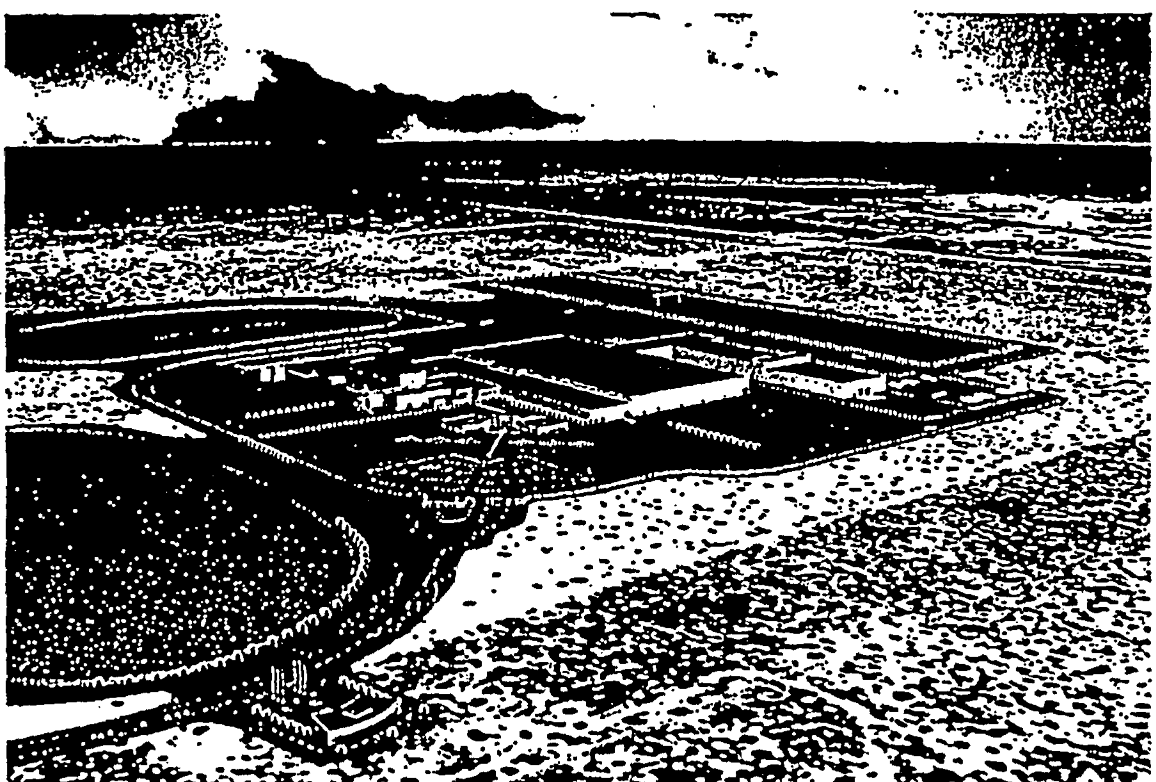
Appendix E

Excerpts from Ground Water Discharge Permit Application
for the NEF

NATIONAL ENRICHMENT FACILITY

LOUISIANA ENERGY SERVICES, LP

GROUND WATER DISCHARGE PERMIT APPLICATION



APRIL 26, 2004

6. **Permit Plans** [20.6.2.3106.C.7, 20.6.2.3107.A, and 20.6.2.3109.C NMAC]:

6.a. **Operational Plan** [20.6.2.3106.C.7 and 20.6.2.3109.C NMAC]:

The operational plan must describe how the system(s) for conveyance, collection, treatment, distribution, and disposal of wastewaters or other discharges will be constructed, operated, inspected, and maintained. The operational plan must demonstrate that ground water standards will not be exceeded.

6.a.i.. In the following table, identify all proposed conveyance, collection, treatment distribution, and disposal units included in the operational plan. Add rows as necessary to include all units.

Treatment/Storage/ or Disposal Unit **Treatment units** (lagoon, mechanical treatment plant, manure separator, clarifier, etc.) **Disposal Units** (land application area, leachfield, evaporative lagoon, leachstockpile, etc.)	**Construction Material**	**Volumetric Capacity*/Area*** (gallons or cubic yards/ acres)
Disposal Unit: Site Storm Water Detention Basin (SSDB) – The ultimate disposal of basin water (site storm water runoff) will be through infiltration to the ground and evaporation.	The basin will be constructed using a combination of excavation below the ground surface and an earth berm above grade. The basin is unlined. The basin will have a minimum of 2 feet of freeboard. The basin will have an outfall. The outfall will consist of a concrete structure with a discharge pipe sized and located to provide the proper flow attenuation. The basin will be maintained free of debris and will be enclosed by a fence to prevent entry by animals and unauthorized personnel.	The basin is sized to contain runoff for a volume equal to that for the 24-hour, 100-year return period storm. The basin will have approximately 23,350 m^3 (100 acre-ft) of storage capacity. Surface Area at High Water Elevation = 19.0 acres.
Disposal Unit: UBC Storage Pad Storm Water Retention Basin (USPSRB) – The ultimate disposal of basin water (UBC Storage Pad storm water runoff, Cooling Tower blowdown and Heating Boiler blowdown) will be through evaporation.	The basin will be constructed using a combination of excavation below the ground surface and an earth berm above grade. The basin is designed with a synthetic membrane lining to minimize any infiltration into the ground and does not have an outlet. The synthetic liner will be used to impose a barrier between the contents of the basin and the underlying soils and potential access to ground water. Access to any ground water is further impeded by the impervious clay layer underlying the liner. The basin liner will be selected and installed in accordance with NMED Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, dated December 11, 1995. To provide adequate chemical resistance to the various liquids, the liner material may consist of High Density Polyethylene (HDPE) or Ethylene Interpolymer Alloy (Coolgard ® XR-5® or Ultra	The basin is sized to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm. The design volume is approximately 77,700 m^3 (63 acre-ft). Surface Area at High Water Elevation = 18.9 acres.

	Tech®). Liner thickness will be specified during final design. From the bottom up the proposed liner system will consist of: • A prepared layer, minimum 2-foot thick, of on site clay-type soils, free from rock, compacted at optimum moisture content to 95% of Standard Proctor ASTM D698. The plastic limit of the clay will be approximately 20 and the material will be compacted to +3% of it's optimum moisture content. • A geosynthetic fabric suitable for the material being retained. • A prepared layer, minimum 1-foot thick, of on site clay, free of rock, and compacted at optimum moisture content • Installation of the liner will be by manufacturer certified installers and will be installed and tested according to project specifications. The basin will be maintained free of debris and will be enclosed by a fence to prevent entry by animals and unauthorized personnel.	
Disposal Unit: Treated Effluent Evaporative Basin (TEEB) – The ultimate disposal of liquid effluent from the Liquid Effluent Collection and Treatment System will be through evaporation.	The basin will be constructed using a combination of excavation below the ground surface and an earth berm above grade. The basin will be double-lined and provided with a leak detection system. The two synthetic liners are used to impose two barriers between the contents of the basin and the underlying soils and potential access to ground water. Access to any ground water is further impeded by the impervious clay layer underlying the liner. These synthetic liners are known as the primary (upper) and secondary (lower) liner. The basin is designed with a synthetic membrane lining to preclude any infiltration into the ground. The basin does not have an outlet. The basin liner will be selected and installed in accordance with NMED Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, dated December 11, 1995. Access to ground water is further impeded by the impervious clay layer which underlies the secondary liner. Active liquid-sensor leak detection will be provided to detect leakage through the upper primary liner. The system is a drain/sump system. The chemical compatibility of the liners has been	Total annual discharge will be approximately 2,535 m^3 per year (669,844 gal/yr). The basin has a surface area of 0.75 acres and a maximum normal operating depth of 1.1 feet above the bottom of the basin. Total basin depth is 4.2 feet. Surface Area at High Water Elevation = 1.75 acres

	verified with the liner manufacturer. To provide adequate chemical resistance to the various liquids, the liner material may consist of High Density Polyethylene (HDPE) or Ethylene Interpolymer Alloy (Coolgard® XR-5® or Ultra Tech®). Liner thickness will be specified during final design. From the bottom up the proposed liner system will consist of: • A prepared layer, minimum 2-foot thick, of on site clay-type soils, free from rock, compacted at optimum moisture content to 95% of Standard Proctor ASTM D698. The plastic limit of the clay will be approximately 20 and the material will be compacted to +3% of it's optimum moisture content. • A geosynthetic fabric suitable for the material being retained. • Leak collection piping, sump, and pumping system to pump any leaks back to the primary liner system. • A geomembrane drainage mat with the imbedded leak collection piping. • A geosynthetic fabric suitable for the material being retained • A prepared layer, minimum 1-foot thick, of on site clay, free of rock, and compacted at optimum moisture content • Installation of the liner will be by manufacturer certified installers and will be installed and tested according to project specifications. The basin does not have an outlet. The basin is designed to retain 30 years of solids accumulation and annual liquid effluent discharge and direct rainfall. The basin is sized to include a safety factor of 200% times the maximum storm water from a single rainfall event. The basin is designed for an annual evaporation of 60 inches per year. The basin is designed with two cells, each designed to evaporate 50% of the annual liquid effluent discharge, allowing for periodic outages of each cell, while maintaining plant operations. Influent flow will be measured and totalized. Pond level gauges will be provided. The basin will be maintained free of debris and will be enclosed by a fence to prevent entry by animals and unauthorized personnel. The basin	

	will be covered by surface netting, or other suitable devices, to exclude waterfowl access to basin water.	
Disposal Unit: Septic Tanks and Leachfields (ST/L) – The ultimate disposal is discharge underground via the leachfields.	Septic tank drain field systems will be constructed in accordance with 20.7.3 NMAC and requirements of the local building officials and health department. During final design the proposed location, length of drain field and orientation of septic systems will be selected by the design engineer and approved in the field by local building officials.	The percolation rate established by actual tests on the site is 8 minutes per inch. Utilizing this rate and allowing for 20-30 gallons per person per day, each person will require approximately 9 linear foot of trench utilizing a 36 inch wide trench filled with 24 inches of open graded crushed stone. The site population during operation is expected to be 210 persons. The building facilities are designed by architectural code analysis to accommodate approximately 420 persons. A total of approximately 3,200 linear feet of percolation drain field will be required. Thus the combined area of the leachfields will be approximately 9,600 ft^2.

*Volumetric Capacity must be provided for all tanks, chambers, and impoundments or other storage units.
*Area must be provided for all land application areas, leachfields or other area features.

6.a.ii. Describe in detail the operational plan, including all conveyance, collection, treatment, distribution and disposal systems. Attach additional pages as necessary:

Site Storm Water Detention Basin

The Site Storm Water Detention Basin collects a portion of general site storm water from plant areas (except for the UBC Storage Pad area). Site runoff will be collected through a series of catch basins and roof drains connected to the site underground storm water system. The runoff will be conveyed to the basin via a system of underground pipes. All runoff will be discharged into the basin.

The NEF also will have a diversion ditch and berm to divert any upstream surface runoff (overland sheet flow) around the facility. The east portion of this diversion ditch also discharges through the Site Storm Water Detention Basin. The storm water from the diversion ditch will be routed through the basin, but will not be changed in either volume or runoff rate. The western portion of the diversion ditch will drain into the natural terrain and will eventually flow into the culvert system under New Mexico Highway 234. This diversion ditch will be designed to divert the 100-year return period storm around the plant structures.

This basin will have an outlet. The basin is designed to cause post-construction peak flow runoff rates to equal or be less than pre-construction release rates for the facility site runoff. The basin will be below 100 acre-feet of storage capacity and less than 15 feet in height. No treatment is provided for in the basin other than some settlement of solids in the runoff.

No plant contaminants are expected to be introduced to this discharge as a result of plant operation. The ultimate disposal of basin water will be through infiltration to the ground and evaporation. The runoff area served includes about 39 ha (96 acres) with the majority of that area being the developed portion of the 220 ha (543 acres) National Enrichment Facility site.

UBC Storage Pad Storm Water Retention Basin

UBC Storage Pad Storm Water Retention Basin is used for the collection of liquid effluent discharges from three sources: 1) storm water runoff from the UBC Storage Pad (8,691,000 gal/yr); 2) the cooling tower blowdown (5,050,000 gal/yr); and 3) the heating boiler blowdown water (36,500 gal/yr). Area served by the basin for storm water runoff includes 9.2 ha (22.8 acres), the total area of the UBC Storage Pad.

Trench drains/catch basins inside the UBC Storage Area will collect storm water within a bermed/sloped area of approximately 22.8 acres. The underground piping system conveying the flow away from the UBC Storage Area will be reinforced concrete pipe with rubber gasketed joints. The underground piping system will discharge into the basin.

The discharge to this basin has a low likelihood of containing trace amounts of uranium washed by rainfall from the exterior of the Uranium Byproduct Cylinders (UBCs) stored on the UBC Storage Pad. Monitoring of the basin will be performed to verify the runoff does not contain uranium.

Blowdown from the Cooling Towers and the Heating Boiler will be routed to the basin via underground piping.

No treatment is provided for in the basin. The basin is designed with a synthetic membrane lining to minimize any infiltration into the ground and does not have an outlet. The synthetic liner will be used to impose a barrier between the contents of the basin and any natural soils and potential access to the underlying soil. The ultimate disposal of basin water will be through evaporation.

Treated Effluent Evaporative Basin

The Treated Effluent Evaporative Basin receives discharge from the Liquid Effluent Collection and Treatment System. A description of the Liquid effluent Collection and Treatment System is provided in Attachment D. This description was adapted from the NEF Safety Analysis Report.

No treatment is provided for in the basin. The basin is designed with a double synthetic membrane lining system to preclude any infiltration into the ground. The basin does not have an outlet. The ultimate disposal of basin water will be through evaporation.

The basin area will be enclosed by a fence to prevent entry by animals and unauthorized personnel and the basin surface will contain a layer of netting or other suitable device to exclude waterfowl.

The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid effluent within the plant including the collection, analysis, and processing of plant liquid effluents for disposal. Numerous types of aqueous and non-aqueous liquid effluents are generated in the NEF. These effluents may contain uranic compounds, may be potentially contaminated with low-levels of uranic compounds, or may be non-contaminated. Table E.1 in Attachment E summarizes the plant sources of potential effluent contamination

Appendix F

Roswell Evaporation
Station ID 7604
01/1948 to 03/1950

Station: ROSWELL
Stn ID: 7604
Years: 01/1948 to 03/1950
Latitude N33:19:00
Longitude W104:26:00
Elevation(m.) 1089.0

Evap (in)

	Jan's	Feb's	Mar's	Apr's	May's	Jun's	Jul's	Aug's	Sep's	Oct's	Nov's	Dec's	Year
Maximum	1.33	3.80	7.08	8.87	7.75	7.41	---	6.56	6.31	4.00	10.91	2.18	-
Minimum	1.33	2.68	7.08	8.87	7.75	7.41	---	6.56	6.31	3.74	2.49	2.18	-
Average	---	3.22	---	---	---	---	---	---	---	3.87	6.70	---	-

Appendix G

Lockwood Greene Electronic Message dated March 9, 2004
and
Lockwood Green Response Letter dated May 13, 2004

MAHER Edward F

From: HARPER George A
Sent: Wednesday, March 10, 2004 9:39 AM
To: MAHER Edward F; BELLINI Francis X
Subject: FW: Groundwater Permit Open Items

George A. Harper, P.E.
Manager, Regulatory Compliance Programs
AREVA
400 Donald Lynch Boulevard
Marlborough, MA 01752
Office: 978.568.2728
Cell: 508.795.9420
Fax: 978.568.3731
Email: george.harper@framatome-anp.com

-----Original Message-----
From: Mickanen, David (LGE-AT) [mailto:dmickanen@lg.com]
Sent: Tuesday, March 09, 2004 11:12 AM
To: George Harper
Cc: Walker, Carroll (LGE-SP)
Subject: RE: Groundwater Permit Open Items

George:

My response to questions 1,2,3, and 7 are below and in *red italic*. If you have any questions, please call me.

Thanks.

David E. Mickanen, PE, REM
Sr. Civil Engineer
LOCKWOOD GREENE
dmickanen@lg.com
(404) 818-8619 ofc
(404) 818-8411 fax
(770) 317-7876 cell

-----Original Message-----
From: HARPER George A [mailto:George.Harper@framatome-anp.com]
Sent: Monday, March 08, 2004 10:26 AM
To: Walker, Carroll (LGE-SP); Campbell, Randy (LGE-SP); Shaw, John (LGE-SP)
Cc: MAHER Edward F; BELLINI Francis X
Subject: Groundwater Permit Open Items

Carroll / Randy / John,

There are a few loose ends on the information we need for the groundwater permit. I have also attached the Information Request we provided to Richard when we there on 2/24. Here they are:

1. Is there a Basis of Design for the Site Stormwater Detention Basin? If not what document captures it's design features? *The design basis can be found in Section 11.5 of the "Civil Design Basis" document no. L4-35-001-BOD, Rev. 1 dated 22-Oct-2003, and in the Stormwater Design Calculations dated 15-Sep-2003.*

2. Verify drainage area to the Site Stormwater Detention basin is 4,164,336 sq. ft. *Yes, this value matches the area used to determine the storage requirements to size the site stormwater detention basis (see Stormwater Design Calculations dated 15-Sep-2003).*

3. Verify drainage area to the UBC Storage Pad Stormwater Retention Basin is 1,746,756 sq. ft. *Yes, this value matches the area used to determine the storage requirements to size the UBC storage pad stormwater retention basis (see Stormwater Design Calculations dated 15-Sep-2003).*

4. See Item #2 on Information Request. We need lat-long for the 3 basins (use middle of basin) and the 6 septic tanks.

5. Is there a potable water analysis available for city water?

6. One page process flow diagram for the Liquid Effluent Collection and Treatment System (Item 6.b on Information Request).

7. Surface area for the three basins (Treated Effluent, UBC and Site Stormwater) *The minimum design surface areas for the three basins can be found in the Stormwater Design Calculations dated 15-Sep-2003. Since I am not 100% sure which specific surface area you need (i.e. bottom of basin, top of basin, or high water surface area), I will list each of them. The surface areas are as follows:*

Treated Effluent:
Surface Area at Top of Basin = 1.84 acres
Surface Area at Bottom of Basin = 1.39 acres
Surface Area at High Water Elevation = 1.75 acres

UBC Storage Pad Stormwater Retention Basin
Surface Area at Top of Basin = 19.5 acres
Surface Area at Bottom of Basin = 18 acres
Surface Area at High Water Elevation = 18.88 acres

Site Stormwater Detention Basin
Surface Area at Top of Basin = 19.2 acres
Surface Area at Bottom of Basin = 18.2 acres
Surface Area at High Water Elevation = 18.95 acres

8. Verify boiler blowdown is discharged to the UBC Storage Pad Stormwater Retention Basin.

Thanks,
George

LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

1500 International Drive
Spartanburg, SC 29303-6745
Telephone 864.578.2000
Facsimile 864.599.6400
www.lg.com

May 13, 2004

RESPONSE TO NEF ACTION ITEM NO. ER RAI 4-2A

To: Rod Krich

CC: Dan Green

Subject: LG Response to NEF Action Item – ER RAI 4-2A

NEF Action Item No. ER RAI 4-2A — Conf. Call Date: Not Applicable

Action Item Description:

2. ER RAI 4-2A*

Need monthly maximum and minimum flows to the three site basins. Please provide the following:

a. Does the liquid effluent system discharge flow to the TEEB vary by month of the year? Or should we assume that the flow is fairly constant throughout the year? Also, is there a maximum and minimum flow for each month? If not, is there a +/- % for maximum/minimum around the average.

b. Does cooling tower blowdown flow to the UBC Storage Pad Stormwater Retention Basin vary by month of the year? If so how does it vary? It likely would vary through the year. Also is there a minimum and maximum flow each month? If not is there a +/-% for maximum/minimum around the average?

c. Does heating boiler blow-down flow to the UBC Storage Pad Stormwater Retention Basin vary by month of the year? If so how does it vary? It likely would vary through the year. Also, is there a maximum and minimum flow each month? If not is there a +/- % for a maximum/minimum around the average?

d. Any guidance on breakdown of evaporation, infiltration, and evapotranpiration in % for the Site Stormwater Detention Basin? Did LG look at this? Did LG look at how the mix would vary month by month?

Action Item Resolution:

a. The flow to the TEEB from the liquid effluent system will vary somewhat dependant on frequency of use. It is made up of flows from floor washings, miscellaneous condensates, lab effluents, degreaser water, citric acid, laundry, and hand wash/ shower water. An average annual daily flow rate of 1835 GPD (see L4-50-05-CALC) and a daily peak flow of 5350 GPD (see PFD 1500-R-1108) were calculated. A calculation to determine the variation of this flow by month has not yet been completed.

b. The blow-down rate from the cooling towers will vary with the evaporation rate on the towers (based on weather conditions), the quality of the incoming water (estimated as an average from the six wells tested that serve Eunice), and the chemical treatment utilized (acid injection will be utilized to maximize cycles of concentration).

For the purpose of the results summarized below, average weather data was utilized, water quality as estimated from the six wells that feed Eunice, and chemical treatment to facilitate 3 cycles of concentration has been utilized. Lockwood Greene calculated water consumption on an annual basis for average yearly conditions. L4-50-05-CALC indicates that the average blow-down rate for the process towers is 5912 GPD, and the average blow-down rate for the HVAC towers is 7929 GPD. A month-by-month calculation based on average weather data and minimum and maximum weather data has not yet been completed.

c. The boiler the blow-down will occur in each month that the boiler is operational. Since the HVAC system is set up to operate with reheat coils that are fed from the boiler, the boilers will be required to run year round. We have estimated the boiler blow down to be 100 gallons a day. The blow down will be automated and should not vary much from month to month.

RESPONSE TO NEF ACTION ITEM NO. ER RAI 4-2A

Page 2 of 2

d. Evaporation was estimated on an annual basis. L4-53-55-CALC states that lake evaporation was estimated from USDA Soil Conservation Service gross annual lake evaporation. The annual number was adjusted for salinity and utilized to size the Stormwater Retention Basin. Since there is a liner, infiltration should essentially be zero. In addition, no credit was taken for plant growth; therefore evapotranspiration was estimated as zero. The variation on a monthly basis was not calculated. However, the 100 year 24 hour storm of 6" was utilized to calculate maximum rainfall from a single rainfall event.

Supporting Discussion (if required):

a. Since the pump that is used to move the water from the liquid effluent collection room to the basin is either on or off, the minimum instantaneous flow to the basin would be zero and the maximum instantaneous flow would be the rating of the pump.

Average Flow: From PFD 1500-R-1108, the yearly discharge from the TSB into the TEEB is 669,853 gallons per year. For one day this averages to 1835 gal per day.

Peak Flow: Because we don't know exactly what days the Laundry Tanks, the Hand Wash and Shower Tanks, and the Treated Effluent Monitor Tanks will discharge to the TEEB, we need to assume all emptying in the same day. Therefore, for the peak discharge per one day-

One Laundry Tank =	1,000 gal
+ One Hand Wash and Shower Tank =	4,000 gal
+ One Treated Effluent Monitor Tank =	350 gal
TOTAL =	5,350 GPD (Max.)

A calculation to determine the variation of this flow by month has not been completed. If desired, such a study could be conducted now or at a later date.

b. When the cooling towers are operated in the "dry" mode – there is no evaporation. The dry mode switch point is such that November through January the evaporation and thus blow down is essentially zero. Thus the blow-down flows must be distributed within the remaining nine months with July and August being the highest use rates. A month-by-month calculation based on average weather data and minimum and maximum weather data has not been completed. However, such a study could be conducted now or at a later date.

c. Not Applicable.

d. The current design did not include the use of rainwater for feed to the cooling towers. It is a potential water savings measure to filter the water from the Stormwater Detention Basin for this use.

Source Documents (if required):

L4-50-05-CALC, City Water Consumption, Rev. 2

L4-53-55-CALC, UBC Storage Pad Storm Water Retention Basin Size, Rev. 0

PFD 1500-R-1108, Process Flow Diagram System 680 Treated Effluent Polishing, Rev. 0

* Action Item Description taken from George Harper's "Figures and Inputs for ER RAIs" sheet, dated May 5, 2004.

LG Authorization:

5-13-04	5/13/04	13 May 2004
Chris Funk Date	J. Floyd Sauvé Date	John L. Shaw Date
Mech. Discipline Ld.	Design Coordinator	Project Manager

Attachment(s): Not Applicable

MF FN-20.14

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FN:20.09

Appendix H

American Society of Civil Engineers
Hydrology Handbook
Figure 3.24

ASCE Manuals and Reports on Engineering Practice No. 28

Hydrology Handbook

Second Edition

ASCE

AMERICAN SOCIETY OF CIVIL ENGINEERS

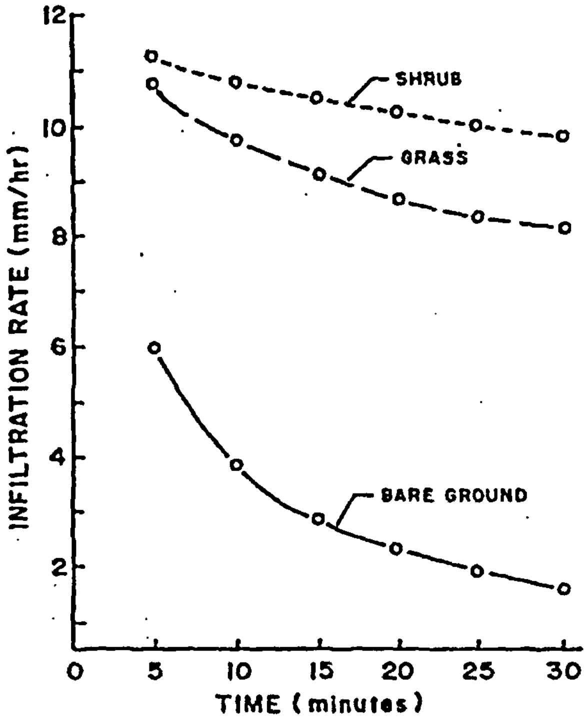

Figure 3.24.—Mean Infiltration Rates for Shrub (GRBI), Grass (CHRO), and Bare Ground (BAGR) (Mbakaya, 1985).

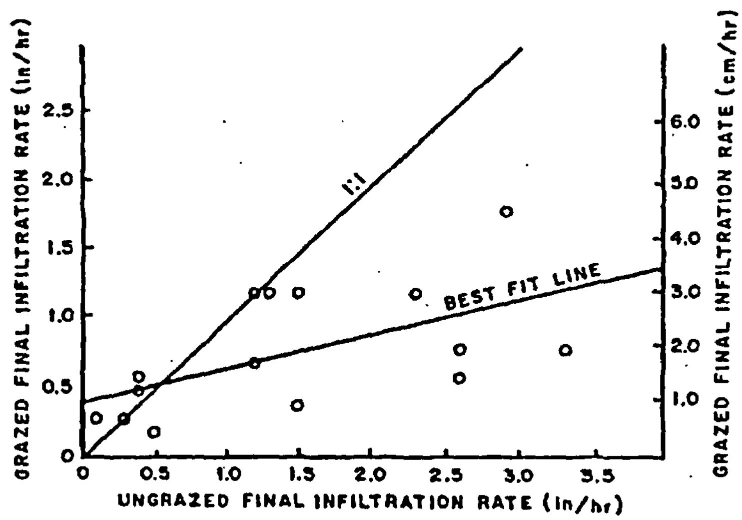

Figure 3.25.—Relationships Between Final Infiltration Rates on Heavily Grazed Areas (Gifford and Hawkins, 1978).

Appendix I

Initial Water Balance Excel Spreadsheets

TEEB
Minimum

Month	Precipitation cm	in	Direct Precipitation Inflow to Basin m-3	gal	Treated Effluent Inflow to Basin m-3	gal	Total Inflow to Basin m-3	gal	Evaporation p cm
January	0.5	0.2	40	10,508	211	55,824	251	66,332	4.2
February	0.7	0.3	56	14,711	211	55,824	267	70,535	10.1
March	0.5	0.2	40	10,508	211	55,824	251	66,332	22.4
April	0.8	0.3	64	16,813	211	55,824	275	72,636	28.0
May	2.6	1.0	207	54,641	211	55,824	418	110,465	24.5
June	2.0	0.8	159	42,032	211	55,824	370	97,856	23.4
July	2.4	0.9	191	50,438	211	55,824	402	106,262	22.1
August	2.5	1.0	199	52,540	211	55,824	410	108,364	20.7
September	3.0	1.2	247	65,149	211	55,824	458	120,973	19.9
October	1.4	0.5	111	29,422	211	55,824	323	85,246	12.2
November	0.9	0.3	72	18,914	211	55,824	283	74,738	8.8
December	0.7	0.3	56	14,711	211	55,824	267	70,535	6.9
Totals	17.8	7.0	1,440	380,389	2,536	669,884	3,975	1,050,273	203.2

Maximum

Month	Precipitation cm	in	Direct Precipitation Inflow to Basin m-3	gal	Treated Effluent Inflow to Basin m-3	gal	Total Inflow to Basin m-3	gal	Evaporation p cm
January	2.0	0.8	163	43,174	211	55,824	375	98,998	4.2
February	2.8	1.1	229	60,444	211	55,824	440	116,268	10.1
March	2.0	0.8	163	43,174	211	55,824	375	98,998	22.4
April	3.2	1.3	261	69,079	211	55,824	473	124,903	28.0
May	10.5	4.1	850	224,507	211	55,824	1,061	280,331	24.5
June	8.1	3.2	654	172,698	211	55,824	865	228,521	23.4
July	9.7	3.8	784	207,237	211	55,824	996	263,061	22.1
August	10.1	4.0	817	215,872	211	55,824	1,028	271,696	20.7
September	12.5	4.9	1,013	267,681	211	55,824	1,225	323,505	19.9
October	5.7	2.2	458	120,888	211	55,824	669	176,712	12.2
November	3.6	1.4	294	77,714	211	55,824	505	133,538	8.8
December	2.8	1.1	229	60,444	211	55,824	440	116,268	6.9

per Month	Potential Evaporation Outflow from Basin		Balance Inflow - Outflow		Net in Basin	
(in)	m-3	gal	m-3	gal	m-3	gal
1.7	128	33,694	124	32,638	124	32,638
4.0	307	81,069	-40	-10,534	84	22,104
8.8	679	179,292	-428	-112,960	0	0
11.0	850	224,625	-575	-151,989	0	0
9.6	743	196,241	-325	-85,775	0	0
9.2	710	187,664	-340	-89,808	0	0
8.7	670	177,045	-268	-70,783	0	0
8.2	628	166,018	-218	-57,655	0	0
7.8	604	159,688	-147	-38,715	0	0
4.8	371	98,018	-48	-12,772	0	0
3.5	267	70,655	15	4,083	15	4,083
2.7	209	55,135	58	15,400	74	19,483
80.0	6,167	1,629,144				

1.7	128	33,694	247	65,304	247	65,304
4.0	307	81,069	133	35,199	380	100,503
8.8	679	179,292	-304	-80,294	76	20,209
11.0	850	224,625	-377	-99,722	0	0
9.6	743	196,241	318	84,090	318	84,090
9.2	710	187,664	155	40,857	473	124,947
8.7	670	177,045	326	86,016	799	210,963
8.2	628	166,018	400	105,677	1,199	316,640
7.8	604	159,688	620	163,817	1,819	480,458
4.8	371	98,018	298	78,694	2,116	559,151
3.5	267	70,655	238	62,883	2,354	622,034
2.7	209	55,135	231	61,133	2,586	683,167

UBC
Minimum

Month	Precipitation		Direct Precipitation Inflow to Basin		Blowdown Inflow to Basin		Total Inflow to Basin*		Evaporation per Month	
	cm	in	m-3	gal	m-3	gal	m-3	gal	cm	(in)
January	0.5	0.2	398	105,080	1,604	423,875	2,002	528,955	4.2	1.7
February	0.7	0.3	557	147,112	1,604	423,875	2,161	570,987	10.1	4.0
March	0.5	0.2	398	105,080	1,604	423,875	2,002	528,955	22.4	8.8
April	0.8	0.3	636	168,128	1,604	423,875	2,241	592,003	28.0	11.0
May	2.6	1.0	2068	546,415	1,604	423,875	3,673	970,290	24.5	9.6
June	2.0	0.8	1591	420,319	1,604	423,875	3,195	844,194	23.4	9.2
July	2.4	0.9	1909	504,383	1,604	423,875	3,514	928,258	22.1	8.7
August	2.5	1.0	1989	525,399	1,604	423,875	3,593	949,274	20.7	8.2
September	3.0	1.2	2466	651,495	1,604	423,875	4,070	1,075,370	19.9	7.8
October	1.4	0.5	1114	294,223	1,604	423,875	2,718	718,098	12.2	4.8
November	0.9	0.3	716	189,144	1,604	423,875	2,320	613,019	8.8	3.5
December	0.7	0.3	557	147,112	1,604	423,875	2,161	570,987	6.9	2.7
Totals	17.8	7.0	14,398	3,803,888	19,253	5,086,500	33,651	8,890,388	203.2	80

Maximum

Month	Precipitation cm	in	Direct Precipitation Inflow to Basin m-3	gal	Blowdown Inflow to Basin m-3	gal	Total Inflow to Basin* m-3	gal	Evaporation per Month cm	(in)
January	2.0	0.8	1634	431,723	1,604	423,875	3,239	855,598	4.2	1.7
February	2.8	1.1	2288	604,412	1,604	423,875	3,892	1,028,287	10.1	4.0
March	2.0	0.8	1634	431,723	1,604	423,875	3,239	855,598	22.4	8.8
April	3.2	1.3	2615	690,757	1,604	423,875	4,219	1,114,632	28.0	11.0
May	10.5	4.1	8497	2,244,960	1,604	423,875	10,102	2,668,835	24.5	9.6
June	8.1	3.2	6536	1,726,893	1,604	423,875	8,141	2,150,768	23.4	9.2
July	9.7	3.8	7844	2,072,271	1,604	423,875	9,448	2,496,146	22.1	8.7
August	10.1	4.0	8171	2,158,616	1,604	423,875	9,775	2,582,491	20.7	8.2
September	12.5	4.9	10132	2,676,684	1,604	423,875	11,736	3,100,559	19.9	7.8
October	5.7	2.2	4576	1,208,825	1,604	423,875	6,180	1,632,700	12.2	4.8
November	3.6	1.4	2941	777,102	1,604	423,875	4,546	1,200,977	8.8	3.5
December	2.8	1.1	2288	604,412	1,604	423,875	3,892	1,028,287	6.9	2.7

Potential Evaporation Outflow from Basin		Balance Inflow - Outflow		Net In Basin	
m-3	gal	m-3	gal	m-3	gal
3,061	808,650	-1,059	-279,695	0	0
7,365	1,945,661	-5,203	-1,374,674	0	0
16,287	4,302,999	-14,285	-3,774,044	0	0
20,406	5,391,000	-18,165	-4,798,998	0	0
17,827	4,709,774	-14,154	-3,739,484	0	0
17,048	4,503,936	-13,853	-3,659,742	0	0
16,083	4,249,089	-12,570	-3,320,831	0	0
15,082	3,984,439	-11,488	-3,035,165	0	0
14,507	3,832,511	-10,436	-2,757,142	0	0
8,904	2,352,437	-6,186	-1,634,338	0	0
6,418	1,695,715	-4,098	-1,082,696	0	0
5,009	1,323,246	-2,847	-752,259	0	0
147,996	39,099,456				

3,061	808,650	178	46,948	178	46,948
7,365	1,945,661	-3,472	-917,374	0	0
16,287	4,302,999	-13,049	-3,447,400	0	0
20,406	5,391,000	-16,187	-4,276,368	0	0
17,827	4,709,774	-7,725	-2,040,939	0	0
17,048	4,503,936	-8,907	-2,353,168	0	0
16,083	4,249,089	-6,635	-1,752,942	0	0
15,082	3,984,439	-5,307	-1,401,949	0	0
14,507	3,832,511	-2,771	-731,953	0	0
8,904	2,352,437	-2,724	-719,737	0	0
6,418	1,695,715	-1,873	-494,738	0	0
5,009	1,323,246	-1,116	-294,958	0	0

SSDB

Minimum

Month	Precipitation cm	in	Direct Precipitation Inflow to Basin m-3	gal	Evapration + Infiltration per Month cm	(in)	Potential Evapration + Infiltration Outflow from Basin m-3	gal	Balance Inflow - Outflow m-3	gal
January	0.5	0.2	2376	627,763	65.2	25.7	47,460	12,538,487	-45,084	-11,910,723
February	0.8	0.3	3,564	941,645	71.1	28.0	51,763	13,675,498	-48,199	-12,733,853
March	0.5	0.2	2,376	627,763	83.3	32.8	60,686	16,032,835	-58,310	-15,405,072
April	0.8	0.3	3,564	941,645	89.0	35.0	64,804	17,120,837	-61,240	-16,179,192
May	2.5	1.0	11,881	3,138,817	85.4	33.6	62,226	16,439,611	-50,345	-13,300,793
June	2.0	0.8	9,505	2,511,054	84.4	33.2	61,447	16,233,773	-51,942	-13,722,719
July	2.3	0.9	10,693	2,824,936	83.0	32.7	60,482	15,978,925	-49,789	-13,153,990
August	2.5	1.0	11,881	3,138,817	81.7	32.2	59,480	15,714,276	-47,600	-12,575,459
September	3.0	1.2	14,257	3,766,581	80.9	31.8	58,905	15,562,348	-44,648	-11,795,767
October	1.3	0.5	5,940	1,569,409	73.2	28.8	53,303	14,082,273	-47,363	-12,512,865
November	0.8	0.3	3,564	941,645	69.8	27.5	50,817	13,425,551	-47,253	-12,483,906
December	0.8	0.3	3,564	941,645	67.8	26.7	49,407	13,053,082	-45,843	-12,111,437
Totals	17.8	7.0	83,166	21,971,722	934.7	368.0	680,782	179,857,498		

Maximum

Month	Precipitation cm	in	Direct Precipitation Inflow to Basin m-3	gal	Evapration + Infiltration per Month cm	(in)	Potential Evapration + Infiltration Outflow from Basin m-3	gal	Balance Inflow - Outflow m-3	gal
January	2.0	0.8	9445	2,495,360	65.2	25.7	47,460	12,538,487	-38,014	-10,043,127
February	2.8	1.1	13,223	3,493,504	71.1	28.0	51,763	13,675,498	-38,540	-10,181,994
March	2.0	0.8	9,445	2,495,360	83.3	32.8	60,686	16,032,835	-51,241	-13,537,475
April	3.2	1.3	15,112	3,992,576	89.0	35.0	64,804	17,120,837	-49,692	-13,128,261
May	10.5	4.1	49,115	12,975,871	85.4	33.6	62,226	16,439,611	-13,111	-3,463,740
June	8.1	3.2	37,781	9,981,439	84.4	33.2	61,447	16,233,773	-23,666	-6,252,333
July	9.7	3.8	45,337	11,977,727	83.0	32.7	60,482	15,978,925	-15,145	-4,001,198
August	10.1	4.0	47,226	12,476,799	81.7	32.2	59,480	15,714,276	-12,254	-3,237,477
September	12.5	4.9	58,560	15,471,231	80.9	31.8	58,905	15,562,348	-345	-91,117
October	5.7	2.2	26,447	6,987,008	73.2	28.8	53,303	14,082,273	-26,856	-7,095,266
November	3.6	1.4	17,001	4,491,648	69.8	27.5	50,817	13,425,551	-33,816	-8,933,904
December	2.8	1.1	13,223	3,493,504	67.8	26.7	49,407	13,053,082	-36,184	-9,559,579

Net In Basin

m-3	gal
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