INTERNATIONAL URANIUM (USA) CORPORATION

File: IUC Cell 4A Rnd 1 Interrog. Resp.

May 26, 2006

**VIA E-MAIL AND OVERNIGHT DELIVERY**

Mr. Dane L. Finerfrock
Director
Division of Radiation Control
Department of Environmental Quality
168 North 1950 West
P.O Box 144850
Salt Lake City, UT 84114-4850



Re: Cell 4A Lining System Design Report, Response to DRC Request for Additional Information – Round 1 Interrogatory, Cell 4A Design.

Dear Mr. Finerfrock:

We are responding to your May 17, 2006 letter, requesting additional information following on the Cell 4A Lining System Design.

For ease of review, the Division of Radiation Control's ("DRC's") questions are repeated below in italics with International Uranium (USA) Corporation's ("IUSA's") responses following each question. In order to avoid confusion in the review of this response, the attachments are designated in sequence with the attachments to the previous response.

1. *Radiation Survey Report and Demonstration – needs to be submitted to demonstrate and justify that the uranium concentrations found in soils below the existing subgrade under Cell 4A are acceptable. Although the engineering design for re-lining may continue forward, please be advised that the Construction Permit will not be issued until this matter is fully resolved.*

IUSA is finalizing the revisions to the Final Cleanup Monitoring Plan and will submit the Plan under separate cover.

2. *Revised Construction Quality Assurance/Quality Control (CQA/QC) Plan – the proposed CQA/QC Plan needs to be revised to clarify responsibilities and criteria for acceptance of work and procedures, required actions, and timelines to remediate material specification or construction errors when identifying and responding to non-conformances.*

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*Please revise the CQAP so it includes:*

*Sufficient detail to indicate who is responsible (between the Construction Manager, CQA Officer, and others) for, or when acceptance of the liner system construction work identified will occur.*

Section 9.4.6 of the CQA Plan states the following:

> "The Geosynthetic Installer and the Manufacturer(s) will retain all responsibility for the geosynthetic materials in the liner system until acceptance by the Construction Manager.
>
> The geosynthetic liner system will be accepted by the Construction Manager when:
>
> - The installation is finished;
> - Verification of the adequacy of all seams and repairs, including associated testing, is complete;
> - All documentation of installation is completed including the CQA Site Manager's acceptance report and appropriate warranties; and
> - CQA report, including 'as-built' drawing(s), sealed by a registered professional engineer has been received by the Construction Manager."

Section 2.2 of the CQA Plan states the following:

> "The Construction Manger is selected/appointed by the Owner."

Section 02770, Part 3.06 of the Technical Specifications states the following:

> A. "The Geosynthetic Installer shall retain all ownership and responsibility for the geomembrane until accepted by the Owner.
> B. The geomembrane will not be accepted by the Owner before:
>  1. The installation is complete;
>  2. All documentation is submitted;
>  3. Verification of all field seams and repairs, including associated testing, is complete; and
>  4. All warranties are submitted."

We believe that this information is sufficient to define liner system acceptance.

*So it clearly identifies responsibility assignments or procedures for when there is non-conformance, how they are addressed and corrected, and the timely implementation and documentation of the corrective measure.*



IUC

Section 3.4 of the CQA Plan discusses the responsibilities of the CQA Site Manager, including notification of the Construction Manager of "...deviations from the CQA Plan, Drawings, and Technical Specifications..." Section 4.1.3 of the CQA Plan discusses problem or work deficiency meetings, including implementation and documentation issues. Specific sections of the CQA Plan identify non-conformance reporting (e.g. Section 9.2.3, third paragraph; Section 9.4.2.1, fourth paragraph; Section 10.2, fifth paragraph; etc.). The Technical Specifications identify procedures for non-conformance (e.g. Section 02772, Part 2.02.C. through E.; etc.).

We believe that the CQA Plan and the Technical Specifications sufficiently define the roles, responsibilities, corrective measures, and documentation of non-conformance.

*So it clearly states that the engineer of record (licensed in the State of Utah) is an independent party who will certify the CQA report by both direct field observations and document review.*

Section 2.8 of the CQA Plan states the following:

> "The CQA Consultant is a party, independent from the Contractor, Manufacturer, and Geosynthetic Installer, who is responsible for ...
> The CQA report will be signed and sealed by the CQA Officer who will be a Professional Engineer registered in the State of Utah."

Sections 3.2 and 3.3 of the CQA Plan further defines the responsibilities of the CQA Officer.

We believe that this information is sufficient to define the engineer of record roles and responsibilities.

3. *Tailings Wastewater Characterization Data – including additional characterization information on the current and anticipated tailings cell wastewater quality.*

Analytical results for the tailings cell solution were previously sent to the DRC on September 4, 2003 in support of the preparation of the Ground Water Discharge Permit for the White Mesa Mill. Copies of the data are included as Attachment H.

4. *Additional GCL Test Data –for the bentonite layer found in the Geo Composite Liner (GCL) that demonstrates the thin bentonite layer is able to resist damage and degradation under long-term contact with the tailings cell wastewater.*

The performance of the bentonite clay component of the GCL is derived from the ability of the bentonite to hydrate (absorb water). Bentonite clays have been shown to absorb

water from adjacent soils with moisture contents as low as 1% (Koerner 1999). This absorption occurs over a short period of time (5 to 15 days) and allows the bentonite component of the GCL to hydrate (Koerner 1999). The hydraulic conductivity of hydrated bentonite clay to acidic liquids is much lower (better) than unhydrated GCLs (Ruhl 1997). Based on the proposed installation of the GCL overlying the soil subgrade, the GCL is anticipated to hydrate long before the cell liner system begins operation, thereby allowing the GCL to perform as a hydraulic barrier to the acidic liquids contained within the Cell 4A.

Based on the Action Leakage Rate calculation package, the quantity of liquids passing through the primary geomembrane into the leak detection system will result in a very small head (0.17 mm) on the secondary geomembrane. Conservatively assuming that the secondary geomembrane is non-existant and the liquid can not drain laterally, the small head would act to drive the liquid vertically down into the GCL.

Hydraulic conductivity of pre-hydrated bentonite is conservatively accepted as $1 \times 10^{-9}$ cm/sec. After 2.5 pore volumes of hydrochloric (HCl) acid with a pH of 1.0 are permeated through sodium bentonite, the resulting hydraulic conductivity is $3 \times 10^{-10}$ cm/sec (Ruhl, 1997). According to Ruhl, et. al. (Ruhl, 1997), approximately 15 pore volumes of acidic permeant is required to exhaust the buffering capacity of the bentonite, at which time the hydraulic conductivity will begin to slowly increase. Based on the very small head developed overlying the secondary geomembrane and the GCL, the time to get one pore volume of liquid through the bentonite portion of the GCL is well over 100 years. Therefore, the 15 pore volumes of permeant are not likely to flow through the GCL during the life of the facility.

According to Ruhl, et. al., approximately 30 pore volumes of calcium rich liquid would be required to saturate the exchange sites of the bentonite. Based on the above, this level of cation exchange is not likely.

According to Podgornery, et. al. (Podgornery, 2006), long-term exposure of GCLs to freeze thaw cycles resulted in no appreciable increases in the hydraulic conductivity.

5. <u>*Detailed FML Installation and Cell Operation Procedures*</u> *– that will minimize stress on the Flexible Membrane Liner (FML) during both installation and tailings cell operation.*

   *Although the applicant provided some calculations in the design report, they are incomplete and should include stresses from installation, operations (including tailings placement), interface stability, and varying environmental conditions. However, procedures to be used during liner installation and tailings placement were discussed in IUC's May 8, 2006 response to URS Completeness Review that addressed concerns over stress from installation and operations as well as from varying environmental conditions. If IUC follows the procedures as discussed in the May 8, 2006 response, limited or no added stress on the liner system during installation and operations that could compromise it's integrity should result. The*

*information provided also addressed concerns over varying environmental conditions.*

This question does not appear to need any additional response. Information on installation stresses was provided in the May 8, 2006 Response to URS Completeness Review, and IUSA committed to include the cell startup procedure details in the Cell 4A Operations and Maintenance Procedures and Plan, and Best Available Technology Monitoring Plan.

6. *Settlement Evaluation – to evaluate anticipated settlement of the liner at the cell bottom and sideslopes under static conditions of the final cover system.*

Cell 4A was constructed by removal of natural overburden soils and approximately 10 to 20 feet of undisturbed Dakota Sandstone upstream of the compacted fill creating the dikes. The majority of the Cell 4A tailings and cap material will be supported by the Dakota Sandstone formation, except for the small vertical component on the dike slopes. Published values (Atwell and Farmer, 1976) for unconfined compressive strengths of weekly cemented to competent sedimentary rocks indicates compressive strengths in the range of 20 to 80 MPa (1 MPa = 145 psi), or 2,900 to 11,600 psi. Assuming a tailings thickness of 40 feet and a cover thickness of 8 feet at an average density of 125 pounds per cubic foot (pcf), yields a loading on the rock foundation of approximately 42 psi. This is well below the expected minimum allowable bearing pressure of 2,900 psi of the rock foundation.

The anticipated loading from the Cell 4A tailings and final cover will be relatively uniform across the base of the cell. Based on the relative uniformity of the loading and the nature of the underlying rock, settlement is anticipated to be uniform and minimal.

As stated in the original Cell 4A design documents, Section 3.4 (Attachment G to IUSA response to URS Completeness Review Response) foundation settlement of the soils underlying the 40-foot high dike was anticipated to be in the range of 1 to 2 inches, with approximately 90 percent occurring during construction. In order to monitor the dike settlement, survey monuments were installed along the dike crest after construction. The monuments are surveyed on an annual basis by a Utah Registered Surveyor and reported as a part of the Annual Technical Evaluation of the White Mesa Mill Tailings Management System, conducted by a Utah Registered Professional Engineer. After original construction in 1989, the monuments indicated only slight vertical movement.

As discussed previously, the dikes are constructed overlying natural overburden soils, while the base of Cell 4A is constructed overlying a relatively thin layer of compacted clay and the underlying sandstone formation. The dike has been in place for more than 16 years and has experienced very minor settlement. The base liner system of Cell 4A is anticipated to settle less than the dikes due to the nature of the underlying soils/rock, which will experience very similar loading conditions.

With respect to the current condition of the dikes, after original construction of the Cell 4A dikes, the outside slopes were left with approximately 1 to 3 feet of additional loose fill material (loose material outside of the compaction zone) to provide protection for the

compacted fill and a medium for growth of protective vegetation. Since construction, the condition of the dike slopes has been monitored during the routine daily inspection of the tailings area by White Mesa Mill personnel and evaluated during the Annual Technical Evaluation. Recommendations are made, if necessary, for maintenance items as needed. Vegetation has been allowed to grow on the outside slopes to help stabilize the soils. High vegetation or densities of vegetation that could hinder the routine inspection of the dike slopes is removed. The top of the dikes are maintained to prevent retention or ponding of water and any erosion of the dike slopes is immediately repaired. Burrowing animals, such as prairie dogs, are discouraged from residing in the area of the cell dikes. The Annual Technical Evaluation has not raised any issues that would suggest that the structural integrity of the dikes has been compromised.

7. *Dike Stability – including evaluation of the stability of 2H:1V sideslope, found on the western margin of Cell 4A, under the critical condition of partial or total liner system failure.*

IUSA contacted the original consulting engineers retained by Umetco Minerals for the Cell 4A design, Western Engineers, Inc. They were unable to offer assistance in evaluation of the 2H:1V slope, therefore IUSA has contracted with MFG, Inc. to provide the slope stability analysis. They are currently working on the analysis, based on the as-built soils and construction information, and the results will be forwarded to DRC by June 2, 2006.

8. *Basis for Assumed Ground Acceleration – including submittal of the basis for the 0.10 g seismic loading used in the current dike stability analysis for the 3H:1V sideslopes.*

The original Cell 4A Design documents provided a Seismic Risk Analysis for the dike design of Cell 4A. A copy of the Seismic Risk Analysis is included as Attachment I. Section 1.3.4, "Potential Earthquake Hazards to Project" details the justification for the 0.10 g seismic loading.

9. *GCL Panel Overlap Demonstration – including additional demonstration to show that the proposed 1-foot GCL panel overlap is sufficient.*

Current industry standard of practice is to install adjacent geosynthetic clay liner (GCL) panels on side slopes with a minimum 6-inch overlap. When the liner system is to remain exposed, the industry is moving towards a 12-inch overlap, as recommended by Thiel, et. al., 2005. In addition, for the following reasons, the amount of GCL separation is not expected to be greater than 12 inches:

- The GCL to be used in the Cell 4A project will have a woven geotextile component that will minimize the potential for tension developed necking in the GCL.

- A white surfaced geomembrane will be installed to limit temperature changes within the exposed liner system components.
- Two geomembrane layers and one geonet layer installed overlying the GCL will provide some temperature insulation for the underlying GCL.
- The side slopes are not considered steep (greater than 2H:1V) and will therefore have less tension developed necking in the GCL.

10. *LCS and LDS Flow Rates – including anticipated and maximum flow rates in both the leachate collection system (LCS) and leak detection system (LDS) proposed for the new Cell 4A design.*

The evaluation of the Action Leakage Rate Through the Leak Detection System was submitted to DRC on May 24, 2006.

11. *LDS Action Leakage Rate – including a determination of the maximum design daily flow rate allowable in the LDS, under rapid reporting conditions, where the LDS fluid head is equal to or less than 1-foot.*

The evaluation of the Action Leakage Rate Through the Leak Detection System was submitted to DRC on May 24, 2006.

12. *Drawing Clarifications*

The slimes drain system is installed in a manner that provides drainage of the low point of the cell and is design to aid in dewatering of the slimes fraction of the tailings solids. The tailings will be placed into the Cell along the north, northwest and northeast sides of the Cell. The sand fraction will settle out first near the point of discharge and the finer grained material will eventually settle in the pool area of the Cell. The sand fraction of the tailings solids will drain faster than the slimes fraction, therefore extending the drain in to those areas will provide little or no additional benefit. The slimes drain layout proposed for Cell 4A is approximately three (3) times larger than the systems installed in the other cells.

The slimes drain and LDS piping can be cleaned from the sump riser piping. Typical clean out equipment can extend up to 1,000 feet into a pipe. LDS pipe cleanouts will be added to the ends of the laterals and header pipe. Solution in the LDS piping will most likely be low pH with high dissolved solids. Flushing the pipe with fresh water would most likely neutralize the solution and cause dissolved solids to precipitate out and plug the piping system.

Sections F and G on Sheet 6 will have the aggregate hatch pattern removed from beneath the pipe.

A brochure for the strip drain, along with pictures of the end connector, is provided as Attachment J.

Construction level drawings will be prepared that include horizontal and vertical control points.

If you need any additional clarification on any of the above responses please feel free to contact me at (303) 389-4160.

Very truly yours,

Harold R. Roberts
Vice President – Corporate Development

cc: Ron F. Hochstein, IUSA
Gregory T. Corcoran, GeoSyntec Consultants

Attachments

References

Koerner, Robert M, Designing with Geosynthetics, 1999, 4th Edition, Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Podgornery, R.K. and Bennett, J.E., "Evaluating the Long-Term Performance of Geosynthetic Clay Liners Exposed to Freeze-Thaw", Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 2, February 2006.

Ruhl, Janice L., Daniel, David E., "Geosynthetic Clay Liners Permeated with Chemical Solutions and Leachate", Journal of Geotechnical and Geoenvironmental Engineering, Vol. 123, No. 4, April 1997

Thiel, Richard; Criley, Ken; Bryk, Jakub, "Practical Guidelines for specifying GCL Overlaps", Geotechnical Fabrics Report, October/November 2005, volume 23, number 8.

Attachment H

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-001
**Client Sample ID:** Cell #1 (a)

**Report Date:** 04/28/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 343 | mg/L | D | 4.4 | | E200.7 | 04/14/03 09:56 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:23 / slb |
| Chloride | 7690 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 14:52 / jl |
| Fluoride | 1780 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:03 / slb |
| Magnesium | 6800 | mg/L | D | 5.7 | | E200.7 | 04/14/03 09:56 / ts |
| Nitrogen, Ammonia as N | 3510 | mg/L | D | 200 | | A4500-NH3 G | 03/31/03 10:29 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 47.0 | mg/L | D | 0.8 | | E353.2 | 03/25/03 15:18 / rwk |
| Phosphorus | 353 | mg/L | | 0.10 | | E200.7 | 04/14/03 09:53 / ts |
| Potassium | 828 | mg/L | D | 4.6 | | E200.7 | 04/14/03 09:56 / ts |
| Sodium | 9950 | mg/L | D | 6.9 | | E200.7 | 04/14/03 09:56 / ts |
| Sulfate | 72900 | mg/L | D | 6.1 | | E200.7 | 04/14/03 09:56 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 1.80 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:23 / slb |
| Solids, Total Dissolved TDS @ 180 C | 110000 | mg/L | H | 10 | | A2540 C | 03/26/03 12:37 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 2460 | mg/L | D | 0.13 | | E200.7 | 04/14/03 09:56 / ts |
| Arsenic | 146 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:35 / smd |
| Barium | 0.036 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:35 / smd |
| Beryllium | 0.499 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:35 / smd |
| Boron | 8.04 | mg/L | | 0.10 | | E200.7 | 04/14/03 09:29 / ts |
| Cadmium | 4.41 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:35 / smd |
| Chromium | 7.07 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:35 / smd |
| Copper | 227 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:35 / smd |
| Iron | 3220 | mg/L | D | 0.48 | | E200.7 | 04/14/03 09:56 / ts |
| Lead | 3.17 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:35 / smd |
| Manganese | 179 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:35 / smd |
| Molybdenum | 56.6 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:35 / smd |
| Nickel | 42.7 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:35 / smd |
| Selenium | 2.24 | mg/L | D | 0.05 | | E200.8 | 04/11/03 13:35 / smd |
| Titanium | 33.2 | mg/L | D | 0.01 | | E200.8 | 04/11/03 13:35 / smd |
| Uranium | 154 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:35 / smd |
| Vanadium | 393 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:35 / smd |
| Zirconium | 38.5 | mg/L | | 0.001 | | E200.8 | 04/11/03 13:35 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-001
**Client Sample ID:** Cell #1 (a)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 185000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1540 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 114000 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 898 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 4700 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 43 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1690 | pCi/L | | 0.2 | | E903.0 | 04/06/03 09:45 / es |
| Radium 226 precision (±) | 60.7 | pCi/L | | | | E903.0 | 04/06/03 09:45 / es |
| Thorium 230 | 23700 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 480 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 109 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 32.9 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:** RL - Analyte reporting limit.
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ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-002
**Client Sample ID:** Cell #1 (b)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 291 | mg/L | | 1.0 | | E200.7 | 04/14/03 09:59 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:25 / slb |
| Chloride | 5420 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 14:54 / jl |
| Fluoride | 2330 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:06 / slb |
| Magnesium | 4940 | mg/L | D | 5.7 | | E200.7 | 04/14/03 10:02 / ts |
| Nitrogen, Ammonia as N | 2350 | mg/L | D | 80 | | A4500-NH3 G | 03/31/03 10:30 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 35.5 | mg/L | D | 0.8 | | E353.2 | 03/25/03 15:20 / rwk |
| Phosphorus | 246 | mg/L | | 0.10 | | E200.7 | 04/14/03 09:59 / ts |
| Potassium | 522 | mg/L | | 1.0 | | E200.7 | 04/14/03 09:59 / ts |
| Sodium | 7160 | mg/L | D | 6.9 | | E200.7 | 04/14/03 10:02 / ts |
| Sulfate | 52000 | mg/L | D | 6.1 | | E200.7 | 04/14/03 10:02 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 1.94 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:25 / slb |
| Solids, Total Dissolved TDS @ 180 C | 76600 | mg/L | H | 10 | | A2540 C | 03/26/03 15:57 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1790 | mg/L | D | 0.13 | | E200.7 | 04/14/03 10:02 / ts |
| Arsenic | 104 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:52 / smd |
| Barium | 0.055 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:52 / smd |
| Beryllium | 0.402 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:52 / smd |
| Boron | 8.33 | mg/L | D | 0.22 | | E200.7 | 04/14/03 09:59 / ts |
| Cadmium | 3.27 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:52 / smd |
| Chromium | 5.46 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:52 / smd |
| Copper | 168 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:52 / smd |
| Iron | 2300 | mg/L | D | 0.48 | | E200.7 | 04/14/03 10:02 / ts |
| Lead | 3.42 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:52 / smd |
| Manganese | 139 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:52 / smd |
| Molybdenum | 41.1 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:52 / smd |
| Nickel | 31.4 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:52 / smd |
| Selenium | 1.65 | mg/L | D | 0.05 | | E200.8 | 04/11/03 13:52 / smd |
| Titanium | 25.7 | mg/L | D | 0.01 | | E200.8 | 04/11/03 13:52 / smd |
| Uranium | 112 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:52 / smd |
| Vanadium | 301 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:52 / smd |
| Zirconium | 21.2 | mg/L | | 0.001 | | E200.8 | 04/11/03 13:52 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-002
**Client Sample ID:** Cell #1 (b)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 135000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1100 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 89700 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 664 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 3800 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 39 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1210 | pCi/L | | 0.2 | | E903.0 | 04/06/03 10:32 / es |
| Radium 226 precision (±) | 43.5 | pCi/L | | | | E903.0 | 04/06/03 10:32 / es |
| Thorium 230 | 21800 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 475 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 105 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 33.4 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-003
**Client Sample ID:** Cell #1 c

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 285 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:05 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:27 / slb |
| Chloride | 4630 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 14:55 / jl |
| Fluoride | 2240 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:09 / slb |
| Magnesium | 4220 | mg/L | D | 5.7 | | E200.7 | 04/14/03 10:08 / ts |
| Nitrogen, Ammonia as N | 2140 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 10:33 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 29.8 | mg/L | D | 0.8 | | E353.2 | 03/25/03 15:23 / rwk |
| Phosphorus | 200 | mg/L | | 0.10 | | E200.7 | 04/14/03 10:05 / ts |
| Potassium | 441 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:05 / ts |
| Sodium | 6150 | mg/L | D | 6.9 | | E200.7 | 04/14/03 10:08 / ts |
| Sulfate | 44900 | mg/L | D | 6.1 | | E200.7 | 04/14/03 10:08 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.00 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:27 / slb |
| Solids, Total Dissolved TDS @ 180 C | 64700 | mg/L | H | 10 | | A2540 C | 03/26/03 15:58 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1560 | mg/L | D | 0.13 | | E200.7 | 04/14/03 10:08 / ts |
| Arsenic | 83.6 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:57 / smd |
| Barium | 0.093 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:57 / smd |
| Beryllium | 0.347 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:57 / smd |
| Boron | 6.93 | mg/L | D | 0.22 | | E200.7 | 04/14/03 10:05 / ts |
| Cadmium | 2.66 | mg/L | D | 0.008 | | E200.8 | 04/11/03 13:57 / smd |
| Chromium | 4.77 | mg/L | D | 0.02 | | E200.8 | 04/11/03 13:57 / smd |
| Copper | 140 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:57 / smd |
| Iron | 1940 | mg/L | D | 0.48 | | E200.7 | 04/14/03 10:08 / ts |
| Lead | 3.60 | mg/L | D | 0.003 | | E200.8 | 04/11/03 13:57 / smd |
| Manganese | 126 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:57 / smd |
| Molybdenum | 34.2 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:57 / smd |
| Nickel | 26.7 | mg/L | D | 0.005 | | E200.8 | 04/11/03 13:57 / smd |
| Selenium | 1.39 | mg/L | D | 0.05 | | E200.8 | 04/11/03 13:57 / smd |
| Titanium | 20.9 | mg/L | D | 0.01 | | E200.8 | 04/11/03 13:57 / smd |
| Uranium | 95.1 | mg/L | D | 0.004 | | E200.8 | 04/11/03 13:57 / smd |
| Vanadium | 257 | mg/L | D | 0.006 | | E200.8 | 04/11/03 13:57 / smd |
| Zirconium | 13.5 | mg/L | | 0.001 | | E200.8 | 04/11/03 13:57 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-003
**Client Sample ID:** Cell #1 c

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 142000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1160 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 78200 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 630 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 2900 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 34 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1070 | pCi/L | | 0.2 | | E903.0 | 04/06/03 11:22 / es |
| Radium 226 precision (±) | 38.4 | pCi/L | | | | E903.0 | 04/06/03 11:22 / es |
| Thorium 230 | 15900 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 399 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 62.5 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 25.5 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-004
**Client Sample ID:** Cell #1 (d)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | MCL/ RL QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | |
| Calcium | 308 | mg/L | | 1.0 | E200.7 | 04/14/03 10:11 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | A2320 B | 03/27/03 11:43 / slb |
| Chloride | 7720 | mg/L | | 1.0 | A4500-Cl B | 03/27/03 14:57 / jl |
| Fluoride | 4440 | mg/L | | 0.1 | A4500-F C | 03/31/03 14:13 / slb |
| Magnesium | 6950 | mg/L | D | 5.7 | E200.7 | 04/14/03 10:14 / ts |
| Nitrogen, Ammonia as N | 4520 | mg/L | D | 200 | A4500-NH3 G | 03/31/03 10:35 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 46.6 | mg/L | D | 0.8 | E353.2 | 03/25/03 15:25 / rwk |
| Phosphorus | 344 | mg/L | | 0.10 | E200.7 | 04/14/03 10:11 / ts |
| Potassium | 718 | mg/L | | 1.0 | E200.7 | 04/14/03 10:11 / ts |
| Sodium | 9910 | mg/L | D | 6.9 | E200.7 | 04/14/03 10:14 / ts |
| Sulfate | 73700 | mg/L | D | 6.1 | E200.7 | 04/14/03 10:14 / ts |
| **PHYSICAL PROPERTIES** | | | | | | |
| pH | 1.81 | s.u. | | 0.010 | A2320 B | 03/27/03 11:43 / slb |
| Solids, Total Dissolved TDS @ 180 C | 109000 | mg/L | H | 10 | A2540 C | 03/26/03 15:58 / sp |
| **METALS - TOTAL** | | | | | | |
| Aluminum | 2530 | mg/L | D | 0.13 | E200.7 | 04/14/03 10:14 / ts |
| Arsenic | 142 | mg/L | D | 0.02 | E200.8 | 04/11/03 14:18 / smd |
| Barium | 0.035 | mg/L | D | 0.008 | E200.8 | 04/11/03 14:18 / smd |
| Beryllium | 0.532 | mg/L | D | 0.003 | E200.8 | 04/11/03 14:18 / smd |
| Boron | 11.3 | mg/L | D | 0.22 | E200.7 | 04/14/03 10:11 / ts |
| Cadmium | 4.40 | mg/L | D | 0.008 | E200.8 | 04/11/03 14:18 / smd |
| Chromium | 7.13 | mg/L | D | 0.02 | E200.8 | 04/11/03 14:18 / smd |
| Copper | 233 | mg/L | D | 0.006 | E200.8 | 04/11/03 14:18 / smd |
| Iron | 3290 | mg/L | D | 0.48 | E200.7 | 04/14/03 10:14 / ts |
| Lead | 3.21 | mg/L | D | 0.003 | E200.8 | 04/11/03 14:18 / smd |
| Manganese | 178 | mg/L | D | 0.004 | E200.8 | 04/11/03 14:18 / smd |
| Molybdenum | 58.4 | mg/L | D | 0.005 | E200.8 | 04/11/03 14:18 / smd |
| Nickel | 43.5 | mg/L | D | 0.005 | E200.8 | 04/11/03 14:18 / smd |
| Selenium | 2.10 | mg/L | D | 0.05 | E200.8 | 04/11/03 14:18 / smd |
| Titanium | 33.2 | mg/L | D | 0.01 | E200.8 | 04/11/03 14:18 / smd |
| Uranium | 151 | mg/L | D | 0.004 | E200.8 | 04/11/03 14:18 / smd |
| Vanadium | 392 | mg/L | D | 0.006 | E200.8 | 04/11/03 14:18 / smd |
| Zirconium | 25.7 | mg/L | | 0.001 | E200.8 | 04/11/03 14:18 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-004
**Client Sample ID:** Cell #1 (d)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 189000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1570 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 110000 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 884 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 3500 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 37 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1590 | pCi/L | | 0.2 | | E903.0 | 04/06/03 12:00 / es |
| Radium 226 precision (±) | 56.9 | pCi/L | | | | E903.0 | 04/06/03 12:00 / es |
| Thorium 230 | 27500 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 620 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 113 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 40.4 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-005
**Client Sample ID:** Cell #1 (e)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | MCL/ RL QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | |
| Calcium | 297 | mg/L | | 1.0 | E200.7 | 04/14/03 10:34 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | A2320 B | 03/27/03 11:45 / slb |
| Chloride | 8000 | mg/L | | 1.0 | A4500-Cl B | 03/27/03 14:58 / jl |
| Fluoride | 4010 | mg/L | | 0.1 | A4500-F C | 03/31/03 14:20 / slb |
| Magnesium | 6720 | mg/L | D | 5.7 | E200.7 | 04/14/03 10:37 / ts |
| Nitrogen, Ammonia as N | 3410 | mg/L | D | 200 | A4500-NH3 G | 03/31/03 10:36 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 49.2 | mg/L | D | 0.8 | E353.2 | 03/25/03 16:07 / rwk |
| Phosphorus | 341 | mg/L | | 0.10 | E200.7 | 04/14/03 10:34 / ts |
| Potassium | 712 | mg/L | | 1.0 | E200.7 | 04/14/03 10:34 / ts |
| Sodium | 9630 | mg/L | D | 6.9 | E200.7 | 04/14/03 10:37 / ts |
| Sulfate | 71300 | mg/L | D | 6.1 | E200.7 | 04/14/03 10:37 / ts |
| **PHYSICAL PROPERTIES** | | | | | | |
| pH | 1.83 | s.u. | | 0.010 | A2320 B | 03/27/03 11:45 / slb |
| Solids, Total Dissolved TDS @ 180 C | 109000 | mg/L | H | 10 | A2540 C | 03/26/03 15:59 / sp |
| **METALS - TOTAL** | | | | | | |
| Aluminum | 2480 | mg/L | D | 0.13 | E200.7 | 04/14/03 10:37 / ts |
| Arsenic | 141 | mg/L | D | 0.02 | E200.8 | 04/11/03 14:29 / smd |
| Barium | 0.039 | mg/L | D | 0.008 | E200.8 | 04/11/03 14:29 / smd |
| Beryllium | 0.545 | mg/L | D | 0.003 | E200.8 | 04/11/03 14:29 / smd |
| Boron | 11.3 | mg/L | D | 0.22 | E200.7 | 04/14/03 10:34 / ts |
| Cadmium | 4.48 | mg/L | D | 0.008 | E200.8 | 04/11/03 14:29 / smd |
| Chromium | 7.17 | mg/L | D | 0.02 | E200.8 | 04/11/03 14:29 / smd |
| Copper | 237 | mg/L | D | 0.006 | E200.8 | 04/11/03 14:29 / smd |
| Iron | 3190 | mg/L | D | 0.48 | E200.7 | 04/14/03 10:37 / ts |
| Lead | 3.15 | mg/L | D | 0.003 | E200.8 | 04/11/03 14:29 / smd |
| Manganese | 181 | mg/L | D | 0.004 | E200.8 | 04/11/03 14:29 / smd |
| Molybdenum | 59.2 | mg/L | D | 0.005 | E200.8 | 04/11/03 14:29 / smd |
| Nickel | 44.4 | mg/L | D | 0.005 | E200.8 | 04/11/03 14:29 / smd |
| Selenium | 2.03 | mg/L | D | 0.05 | E200.8 | 04/11/03 14:29 / smd |
| Titanium | 33.3 | mg/L | D | 0.01 | E200.8 | 04/11/03 14:29 / smd |
| Uranium | 151 | mg/L | D | 0.004 | E200.8 | 04/11/03 14:29 / smd |
| Vanadium | 389 | mg/L | D | 0.006 | E200.8 | 04/11/03 14:29 / smd |
| Zirconium | 22.9 | mg/L | | 0.001 | E200.8 | 04/11/03 14:29 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-005
**Client Sample ID:** Cell #1 (e)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 188000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1550 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 116000 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 903 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 4000 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 40 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1620 | pCi/L | | 0.2 | | E903.0 | 04/06/03 12:36 / es |
| Radium 226 precision (±) | 58.2 | pCi/L | | | | E903.0 | 04/06/03 12:36 / es |
| Thorium 230 | 26500 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 599 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 116 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 40.2 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-006
**Client Sample ID:** Cell #1 (f)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 320 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:40 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:47 / slb |
| Chloride | 6910 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:00 / jl |
| Fluoride | 3230 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:23 / slb |
| Magnesium | 6300 | mg/L | D | 5.7 | | E200.7 | 04/14/03 10:43 / ts |
| Nitrogen, Ammonia as N | 4190 | mg/L | D | 200 | | A4500-NH3 G | 03/31/03 10:44 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 42.7 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:09 / rwk |
| Phosphorus | 318 | mg/L | | 0.10 | | E200.7 | 04/14/03 10:40 / ts |
| Potassium | 661 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:40 / ts |
| Sodium | 9030 | mg/L | D | 6.9 | | E200.7 | 04/14/03 10:43 / ts |
| Sulfate | 67200 | mg/L | D | 6.1 | | E200.7 | 04/14/03 10:43 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 1.87 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:47 / slb |
| Solids, Total Dissolved TDS @ 180 C | 98900 | mg/L | H | 10 | | A2540 C | 03/26/03 15:59 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 2340 | mg/L | D | 0.13 | | E200.7 | 04/14/03 10:43 / ts |
| Arsenic | 111 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:23 / smd |
| Barium | 0.070 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:23 / smd |
| Beryllium | 0.527 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:23 / smd |
| Boron | 10.4 | mg/L | D | 0.22 | | E200.7 | 04/14/03 10:40 / ts |
| Cadmium | 4.72 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:23 / smd |
| Chromium | 6.59 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:23 / smd |
| Copper | 175 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:23 / smd |
| Iron | 2980 | mg/L | D | 0.48 | | E200.7 | 04/14/03 10:43 / ts |
| Lead | 3.81 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:23 / smd |
| Manganese | 172 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:23 / smd |
| Molybdenum | 53.8 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:23 / smd |
| Nickel | 33.0 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:23 / smd |
| Selenium | 1.76 | mg/L | D | 0.05 | | E200.8 | 04/11/03 20:23 / smd |
| Titanium | 31.9 | mg/L | D | 0.01 | | E200.8 | 04/11/03 20:23 / smd |
| Uranium | 144 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:23 / smd |
| Vanadium | 356 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:23 / smd |
| Zirconium | 23.9 | mg/L | | 0.001 | | E200.8 | 04/11/03 20:23 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-006
**Client Sample ID:** Cell #1 (f)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 177000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1540 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 105000 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 870 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 4000 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 40 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1470 | pCi/L | | 0.2 | | E903.0 | 04/06/03 13:16 / es |
| Radium 226 precision (±) | 52.8 | pCi/L | | | | E903.0 | 04/06/03 13:16 / es |
| Thorium 230 | 25500 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 573 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 121 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 40.0 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:** RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-007
**Client Sample ID:** Cell #3 (a)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 406 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:46 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:49 / slb |
| Chloride | 2770 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:01 / jl |
| Fluoride | 709 | mg/L | | 0.1 | | A4500-F C | 03/31/03 15:32 / slb |
| Magnesium | 3850 | mg/L | D | 5.7 | | E200.7 | 04/14/03 10:49 / ts |
| Nitrogen, Ammonia as N | 1390 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 10:46 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 21.0 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:12 / rwk |
| Phosphorus | 124 | mg/L | | 0.10 | | E200.7 | 04/14/03 10:46 / ts |
| Potassium | 285 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:46 / ts |
| Sodium | 3820 | mg/L | D | 6.9 | | E200.7 | 04/14/03 10:49 / ts |
| Sulfate | 37100 | mg/L | D | 6.1 | | E200.7 | 04/14/03 10:49 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.26 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:49 / slb |
| Solids, Total Dissolved TDS @ 180 C | 57800 | mg/L | H | 10 | | A2540 C | 03/26/03 15:59 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1640 | mg/L | D | 0.13 | | E200.7 | 04/14/03 10:49 / ts |
| Arsenic | 38.4 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:28 / smd |
| Barium | 0.021 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:28 / smd |
| Beryllium | 0.462 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:28 / smd |
| Boron | 5.24 | mg/L | D | 0.22 | | E200.7 | 04/14/03 10:46 / ts |
| Cadmium | 2.24 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:28 / smd |
| Chromium | 4.12 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:28 / smd |
| Copper | 97.8 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:28 / smd |
| Iron | 1440 | mg/L | D | 0.48 | | E200.7 | 04/14/03 10:49 / ts |
| Lead | 2.03 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:28 / smd |
| Manganese | 152 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:28 / smd |
| Molybdenum | 14.3 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:28 / smd |
| Nickel | 23.3 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:28 / smd |
| Selenium | 1.12 | mg/L | D | 0.05 | | E200.8 | 04/11/03 20:28 / smd |
| Titanium | 9.64 | mg/L | D | 0.01 | | E200.8 | 04/11/03 20:28 / smd |
| Uranium | 78.3 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:28 / smd |
| Vanadium | 174 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:28 / smd |
| Zirconium | 4.13 | mg/L | | 0.001 | | E200.8 | 04/11/03 20:28 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-007
**Client Sample ID:** Cell #3 (a)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | MCL/ RL QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | |
| Gross Alpha | 105000 | pCi/L | | 1.0 | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1000 | pCi/L | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 63600 | pCi/L | | 2.0 | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 572 | pCi/L | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 880 | pCi/L | | 2.7 | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 21 | pCi/L | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 970 | pCi/L | | 0.2 | E903.0 | 04/06/03 14:08 / es |
| Radium 226 precision (±) | 34.9 | pCi/L | | | E903.0 | 04/06/03 14:08 / es |
| Thorium 230 | 13700 | pCi/L | | 0.2 | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 457 | pCi/L | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 91.0 | pCi/L | | 0.2 | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 38.0 | pCi/L | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-008
**Client Sample ID:** Cell #3 (b)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 429 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:52 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:51 / slb |
| Chloride | 2670 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:06 / jl |
| Fluoride | 759 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:29 / slb |
| Magnesium | 3830 | mg/L | D | 5.7 | | E200.7 | 04/14/03 10:55 / ts |
| Nitrogen, Ammonia as N | 1480 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 10:49 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 20.9 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:14 / rwk |
| Phosphorus | 120 | mg/L | | 0.10 | | E200.7 | 04/14/03 10:52 / ts |
| Potassium | 283 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:52 / ts |
| Sodium | 3770 | mg/L | D | 6.9 | | E200.7 | 04/14/03 10:55 / ts |
| Sulfate | 37300 | mg/L | D | 6.1 | | E200.7 | 04/14/03 10:55 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.26 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:51 / slb |
| Solids, Total Dissolved TDS @ 180 C | 57300 | mg/L | H | 10 | | A2540 C | 03/26/03 16:00 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1640 | mg/L | D | 0.13 | | E200.7 | 04/14/03 10:55 / ts |
| Arsenic | 38.5 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:33 / smd |
| Barium | 0.035 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:33 / smd |
| Beryllium | 0.464 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:33 / smd |
| Boron | 5.23 | mg/L | D | 0.22 | | E200.7 | 04/14/03 10:52 / ts |
| Cadmium | 2.13 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:33 / smd |
| Chromium | 4.12 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:33 / smd |
| Copper | 99.9 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:33 / smd |
| Iron | 1430 | mg/L | D | 0.48 | | E200.7 | 04/14/03 10:55 / ts |
| Lead | 2.27 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:33 / smd |
| Manganese | 156 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:33 / smd |
| Molybdenum | 14.0 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:33 / smd |
| Nickel | 23.6 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:33 / smd |
| Selenium | 0.98 | mg/L | D | 0.05 | | E200.8 | 04/11/03 20:33 / smd |
| Titanium | 9.64 | mg/L | D | 0.01 | | E200.8 | 04/11/03 20:33 / smd |
| Uranium | 77.0 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:33 / smd |
| Vanadium | 173 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:33 / smd |
| Zirconium | 3.06 | mg/L | | 0.001 | | E200.8 | 04/11/03 20:33 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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## LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-008
**Client Sample ID:** Cell #3 (b)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 107000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1010 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 60000 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 557 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 870 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 20 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1190 | pCi/L | | 0.2 | | E903.0 | 04/06/03 14:52 / es |
| Radium 226 precision (±) | 42.8 | pCi/L | | | | E903.0 | 04/06/03 14:52 / es |
| Thorium 230 | 15100 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 501 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 64.6 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 33.8 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:** RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-009
**Client Sample ID:** Cell #3 c

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 397 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:58 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:53 / slb |
| Chloride | 2670 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:08 / jl |
| Fluoride | 733 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:32 / slb |
| Magnesium | 3640 | mg/L | D | 5.7 | | E200.7 | 04/14/03 11:01 / ts |
| Nitrogen, Ammonia as N | 1420 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 10:51 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 21.5 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:17 / rwk |
| Phosphorus | 120 | mg/L | | 0.10 | | E200.7 | 04/14/03 10:58 / ts |
| Potassium | 268 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:58 / ts |
| Sodium | 3270 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:58 / ts |
| Sulfate | 32800 | mg/L | | 1.0 | | E200.7 | 04/14/03 10:58 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.26 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:53 / slb |
| Solids, Total Dissolved TDS @ 180 C | 56400 | mg/L | H | 10 | | A2540 C | 03/26/03 16:00 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1570 | mg/L | D | 0.13 | | E200.7 | 04/14/03 11:01 / ts |
| Arsenic | 36.2 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:39 / smd |
| Barium | 0.032 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:39 / smd |
| Beryllium | 0.461 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:39 / smd |
| Boron | 4.94 | mg/L | D | 0.22 | | E200.7 | 04/14/03 10:58 / ts |
| Cadmium | 2.04 | mg/L | D | 0.008 | | E200.8 | 04/11/03 20:39 / smd |
| Chromium | 3.90 | mg/L | D | 0.02 | | E200.8 | 04/11/03 20:39 / smd |
| Copper | 95.5 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:39 / smd |
| Iron | 1360 | mg/L | D | 0.48 | | E200.7 | 04/14/03 11:01 / ts |
| Lead | 2.01 | mg/L | D | 0.003 | | E200.8 | 04/11/03 20:39 / smd |
| Manganese | 149 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:39 / smd |
| Molybdenum | 13.0 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:39 / smd |
| Nickel | 22.4 | mg/L | D | 0.005 | | E200.8 | 04/11/03 20:39 / smd |
| Selenium | 0.95 | mg/L | D | 0.05 | | E200.8 | 04/11/03 20:39 / smd |
| Titanium | 8.97 | mg/L | D | 0.01 | | E200.8 | 04/11/03 20:39 / smd |
| Uranium | 70.3 | mg/L | D | 0.004 | | E200.8 | 04/11/03 20:39 / smd |
| Vanadium | 165 | mg/L | D | 0.006 | | E200.8 | 04/11/03 20:39 / smd |
| Zirconium | 3.01 | mg/L | | 0.001 | | E200.8 | 04/11/03 20:39 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-009
**Client Sample ID:** Cell #3 c

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 111000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 1030 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 59800 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 556 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 990 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 22 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1200 | pCi/L | | 0.2 | | E903.0 | 04/06/03 15:40 / es |
| Radium 226 precision (±) | 43.0 | pCi/L | | | | E903.0 | 04/06/03 15:40 / es |
| Thorium 230 | 14100 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 501 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 102 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 43.6 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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030680R0018

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-010
**Client Sample ID:** Cell #3 (d)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 413 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:15 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 11:54 / slb |
| Chloride | 2110 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:09 / jl |
| Fluoride | 615 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:34 / slb |
| Magnesium | 3100 | mg/L | D | 5.7 | | E200.7 | 04/14/03 11:18 / ts |
| Nitrogen, Ammonia as N | 1160 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 10:52 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 17.0 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:27 / rwk |
| Phosphorus | 89.4 | mg/L | | 0.10 | | E200.7 | 04/14/03 11:15 / ts |
| Potassium | 219 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:15 / ts |
| Sodium | 2620 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:15 / ts |
| Sulfate | 29800 | mg/L | D | 6.1 | | E200.7 | 04/14/03 11:18 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.33 | s.u. | | 0.010 | | A2320 B | 03/27/03 11:54 / slb |
| Solids, Total Dissolved TDS @ 180 C | 43100 | mg/L | H | 10 | | A2540 C | 03/26/03 16:02 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1330 | mg/L | D | 0.13 | | E200.7 | 04/14/03 11:18 / ts |
| Arsenic | 25.8 | mg/L | D | 0.02 | | E200.8 | 04/11/03 21:00 / smd |
| Barium | 0.028 | mg/L | D | 0.008 | | E200.8 | 04/11/03 21:00 / smd |
| Beryllium | 0.373 | mg/L | D | 0.003 | | E200.8 | 04/11/03 21:00 / smd |
| Boron | 3.95 | mg/L | D | 0.22 | | E200.7 | 04/14/03 11:15 / ts |
| Cadmium | 1.64 | mg/L | D | 0.008 | | E200.8 | 04/11/03 21:00 / smd |
| Chromium | 3.20 | mg/L | D | 0.02 | | E200.8 | 04/11/03 21:00 / smd |
| Copper | 72.2 | mg/L | D | 0.006 | | E200.8 | 04/11/03 21:00 / smd |
| Iron | 1080 | mg/L | D | 0.48 | | E200.7 | 04/14/03 11:18 / ts |
| Lead | 2.81 | mg/L | D | 0.003 | | E200.8 | 04/11/03 21:00 / smd |
| Manganese | 131 | mg/L | D | 0.004 | | E200.8 | 04/11/03 21:00 / smd |
| Molybdenum | 9.64 | mg/L | D | 0.005 | | E200.8 | 04/11/03 21:00 / smd |
| Nickel | 17.8 | mg/L | D | 0.005 | | E200.8 | 04/11/03 21:00 / smd |
| Selenium | 0.81 | mg/L | D | 0.05 | | E200.8 | 04/11/03 21:00 / smd |
| Titanium | 6.47 | mg/L | D | 0.01 | | E200.8 | 04/11/03 21:00 / smd |
| Uranium | 56.1 | mg/L | D | 0.004 | | E200.8 | 04/11/03 21:00 / smd |
| Vanadium | 136 | mg/L | D | 0.006 | | E200.8 | 04/11/03 21:00 / smd |
| Zirconium | 2.28 | mg/L | | 0.001 | | E200.8 | 04/11/03 21:00 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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030680R0019

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-010
**Client Sample ID:** Cell #3 (d)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 96500 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 983 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 46900 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 504 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 750 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 19 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 818 | pCi/L | | 0.2 | | E903.0 | 04/06/03 16:36 / es |
| Radium 226 precision (±) | 29.4 | pCi/L | | | | E903.0 | 04/06/03 16:36 / es |
| Thorium 230 | 8980 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 358 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 51.8 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 28.1 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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030680R0020

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-011
**Client Sample ID:** Cell #3 (e)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | | |
| Calcium | 432 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:21 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | | A2320 B | 03/27/03 13:14 / slb |
| Chloride | 2140 | mg/L | | 1.0 | | A4500-Cl B | 03/27/03 15:13 / jl |
| Fluoride | 580 | mg/L | | 0.1 | | A4500-F C | 03/31/03 14:37 / slb |
| Magnesium | 2500 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:21 / ts |
| Nitrogen, Ammonia as N | 1110 | mg/L | D | 30 | | A4500-NH3 G | 03/31/03 11:03 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 19.1 | mg/L | D | 0.8 | | E353.2 | 03/25/03 16:29 / rwk |
| Phosphorus | 88.1 | mg/L | | 0.10 | | E200.7 | 04/14/03 11:21 / ts |
| Potassium | 221 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:21 / ts |
| Sodium | 2660 | mg/L | | 1.0 | | E200.7 | 04/14/03 11:21 / ts |
| Sulfate | 29800 | mg/L | D | 6.1 | | E200.7 | 04/14/03 11:24 / ts |
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 2.29 | s.u. | | 0.010 | | A2320 B | 03/27/03 13:14 / slb |
| Solids, Total Dissolved TDS @ 180 C | 44400 | mg/L | H | 10 | | A2540 C | 03/26/03 16:03 / sp |
| **METALS - TOTAL** | | | | | | | |
| Aluminum | 1330 | mg/L | D | 0.13 | | E200.7 | 04/14/03 11:24 / ts |
| Arsenic | 26.1 | mg/L | D | 0.02 | | E200.8 | 04/11/03 21:16 / smd |
| Barium | 0.046 | mg/L | D | 0.008 | | E200.8 | 04/11/03 21:16 / smd |
| Beryllium | 0.386 | mg/L | D | 0.003 | | E200.8 | 04/11/03 21:16 / smd |
| Boron | 4.00 | mg/L | D | 0.22 | | E200.7 | 04/14/03 11:21 / ts |
| Cadmium | 1.64 | mg/L | D | 0.008 | | E200.8 | 04/11/03 21:16 / smd |
| Chromium | 3.28 | mg/L | D | 0.02 | | E200.8 | 04/11/03 21:16 / smd |
| Copper | 72.7 | mg/L | D | 0.006 | | E200.8 | 04/11/03 21:16 / smd |
| Iron | 1100 | mg/L | D | 0.48 | | E200.7 | 04/14/03 11:24 / ts |
| Lead | 2.94 | mg/L | D | 0.003 | | E200.8 | 04/11/03 21:16 / smd |
| Manganese | 130 | mg/L | D | 0.004 | | E200.8 | 04/11/03 21:16 / smd |
| Molybdenum | 10.0 | mg/L | D | 0.005 | | E200.8 | 04/11/03 21:16 / smd |
| Nickel | 17.9 | mg/L | D | 0.005 | | E200.8 | 04/11/03 21:16 / smd |
| Selenium | 0.65 | mg/L | D | 0.05 | | E200.8 | 04/11/03 21:16 / smd |
| Titanium | 7.05 | mg/L | D | 0.01 | | E200.8 | 04/11/03 21:16 / smd |
| Uranium | 56.7 | mg/L | D | 0.004 | | E200.8 | 04/11/03 21:16 / smd |
| Vanadium | 140 | mg/L | D | 0.006 | | E200.8 | 04/11/03 21:16 / smd |
| Zirconium | 4.89 | mg/L | | 0.001 | | E200.8 | 04/11/03 21:16 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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030680R0021

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-011
**Client Sample ID:** Cell #3 (e)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | | |
| Gross Alpha | 96000 | pCi/L | | 1.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 983 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 47500 | pCi/L | | 2.0 | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 507 | pCi/L | | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 680 | pCi/L | | 2.7 | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 19 | pCi/L | | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 751 | pCi/L | | 0.2 | | E903.0 | 04/06/03 17:33 / es |
| Radium 226 precision (±) | 27.0 | pCi/L | | | | E903.0 | 04/06/03 17:33 / es |
| Thorium 230 | 10400 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 408 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 54.0 | pCi/L | | 0.2 | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 30.5 | pCi/L | | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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030680R0022

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-012
**Client Sample ID:** Cell #3 (f)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | MCL/ RL QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|
| **MAJOR IONS** | | | | | | |
| Calcium | 433 | mg/L | | 1.0 | E200.7 | 04/14/03 11:27 / ts |
| Carbonate as CO3 | ND | mg/L | | 1.0 | A2320 B | 03/27/03 13:19 / slb |
| Chloride | 2400 | mg/L | | 1.0 | A4500-Cl B | 03/27/03 15:15 / jl |
| Fluoride | 605 | mg/L | | 0.1 | A4500-F C | 03/31/03 15:36 / slb |
| Magnesium | 3400 | mg/L | D | 5.7 | E200.7 | 04/14/03 11:30 / ts |
| Nitrogen, Ammonia as N | 1250 | mg/L | D | 30 | A4500-NH3 G | 03/31/03 11:05 / rwk |
| Nitrogen, Nitrate+Nitrite as N | 20.6 | mg/L | D | 0.8 | E353.2 | 03/25/03 16:32 / rwk |
| Phosphorus | 108 | mg/L | | 0.10 | E200.7 | 04/14/03 11:27 / ts |
| Potassium | 250 | mg/L | | 1.0 | E200.7 | 04/14/03 11:27 / ts |
| Sodium | 3050 | mg/L | | 1.0 | E200.7 | 04/14/03 11:27 / ts |
| Sulfate | 33600 | mg/L | D | 6.1 | E200.7 | 04/14/03 11:30 / ts |
| **PHYSICAL PROPERTIES** | | | | | | |
| pH | 2.24 | s.u. | | 0.010 | A2320 B | 03/27/03 13:19 / slb |
| Solids, Total Dissolved TDS @ 180 C | 50800 | mg/L | H | 10 | A2540 C | 03/26/03 16:03 / sp |
| **METALS - TOTAL** | | | | | | |
| Aluminum | 1480 | mg/L | D | 0.13 | E200.7 | 04/14/03 11:30 / ts |
| Arsenic | 31.8 | mg/L | D | 0.02 | E200.8 | 04/11/03 21:21 / smd |
| Barium | 0.039 | mg/L | D | 0.008 | E200.8 | 04/11/03 21:21 / smd |
| Beryllium | 0.435 | mg/L | D | 0.003 | E200.8 | 04/11/03 21:21 / smd |
| Boron | 4.61 | mg/L | D | 0.22 | E200.7 | 04/14/03 11:27 / ts |
| Cadmium | 2.06 | mg/L | D | 0.008 | E200.8 | 04/11/03 21:21 / smd |
| Chromium | 3.83 | mg/L | D | 0.02 | E200.8 | 04/11/03 21:21 / smd |
| Copper | 84.6 | mg/L | D | 0.006 | E200.8 | 04/11/03 21:21 / smd |
| Iron | 1260 | mg/L | D | 0.48 | E200.7 | 04/14/03 11:30 / ts |
| Lead | 2.98 | mg/L | D | 0.003 | E200.8 | 04/11/03 21:21 / smd |
| Manganese | 146 | mg/L | D | 0.004 | E200.8 | 04/11/03 21:21 / smd |
| Molybdenum | 12.6 | mg/L | D | 0.005 | E200.8 | 04/11/03 21:21 / smd |
| Nickel | 20.5 | mg/L | D | 0.005 | E200.8 | 04/11/03 21:21 / smd |
| Selenium | 0.95 | mg/L | D | 0.05 | E200.8 | 04/11/03 21:21 / smd |
| Titanium | 8.68 | mg/L | D | 0.01 | E200.8 | 04/11/03 21:21 / smd |
| Uranium | 68.9 | mg/L | D | 0.004 | E200.8 | 04/11/03 21:21 / smd |
| Vanadium | 162 | mg/L | D | 0.006 | E200.8 | 04/11/03 21:21 / smd |
| Zirconium | 2.84 | mg/L | | 0.001 | E200.8 | 04/11/03 21:21 / smd |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

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030680R0023

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# LABORATORY ANALYTICAL REPORT

**Client:** International Uranium (USA) Corp
**Project:** Cell Sampling
**Lab ID:** C03030680-012
**Client Sample ID:** Cell #3 (f)

**Report Date:** 04/25/03
**Collection Date:** 03/17/03
**Date Received:** 03/24/03
**Matrix:** Aqueous

| Analyses | Result | Units | Qual | MCL/ RL QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|
| **RADIONUCLIDES - TOTAL** | | | | | | |
| Gross Alpha | 94000 | pCi/L | | 1.0 | E900.0 | 03/31/03 12:00 / rs |
| Gross Alpha precision (±) | 961 | pCi/L | | | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta | 52800 | pCi/L | | 2.0 | E900.0 | 03/31/03 12:00 / rs |
| Gross Beta precision (±) | 529 | pCi/L | | | E900.0 | 03/31/03 12:00 / rs |
| Lead 210 | 780 | pCi/L | | 2.7 | NERHL-65-4 | 12/30/99 18:00 / ph |
| Lead 210 precision (±) | 20 | pCi/L | | | NERHL-65-4 | 12/30/99 18:00 / ph |
| Radium 226 | 1070 | pCi/L | | 0.2 | E903.0 | 04/06/03 18:22 / es |
| Radium 226 precision (±) | 38.6 | pCi/L | | | E903.0 | 04/06/03 18:22 / es |
| Thorium 230 | 12000 | pCi/L | | 0.2 | E907.0 | 04/08/03 10:30 / ph |
| Thorium 230 precision (±) | 436 | pCi/L | | | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 | 49.4 | pCi/L | | 0.2 | E907.0 | 04/08/03 10:30 / ph |
| Thorium 232 precision (±) | 29.1 | pCi/L | | | E907.0 | 04/08/03 10:30 / ph |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

TRACKING NO. PAGE NO.
030680R0024

# Chain of Custody and Analytical Request Record



**PLEASE PRINT**, provide as much information as possible.
Refer to corresponding notes on reverse side.

ENERGY LABORATORIES

Company Name: International Uranium Corporation

Report Address: Harold Roberts, 1650 17th Street Suite 950 Independence Plaza, Denver, [redacted] Colorado 80265

Project Name, PWS #, Permit #, Etc.: Cell Sampling

Contact Name, Phone, Fax, E-mail: Harold Roberts (303) 389-4160

Sampler Name if other than Contact: David Turk

Invoice Address: -Same-

Invoice Contact & Phone #: -Same-

Purchase Order #:

ELI Quote #:

Report Required For: POTW/WWTP ☐ DW ☐
Other ____

Special Report Formats – ELI must be notified prior to sample submittal for the following:
NELAC ☐ A2LA ☐ Level IV ☐
Other ____
EDD/EDT ☐ Format ____

Notify ELI prior to RUSH sample submittal for additional charges and scheduling

Comments:

Receipt Temp ____ °C
Cooler ID(s) N/A
Custody Seal (Y) (N)
Intact (Y) N
Signature Match (Y) N

| | SAMPLE IDENTIFICATION (Name, Location, Interval, etc.) | Collection Date | Collection Time | Number of Containers / Sample Type: A W S V U O / Air Water Solls/Solids Vegetation Urine Other / MATRIX | SEE ATTACHED | Normal Turnaround (TAT) | RUSH Turnaround (TAT) | Lab ID |
|---|---|---|---|---|---|---|---|---|
| 1 | Cell # 1 (a) | 3/17/03 | | 1-W | ✓ | | | C0303068 |
| 2 | Cell # 1 (b) | | | 1-W | ✓ | | | |
| 3 | Cell # 1 (c) | | | 1-W | ✓ | | | |
| 4 | Cell # 1 (d) | | | 1-W | ✓ | | | |
| 5 | Cell # 1 (e) | | | 1-W | ✓ | | | |
| 6 | Cell # 1 (f) | | | 1-W | ✓ | | | |
| 7 | Cell # 3 (a) | | | 1-W | ✓ | | | |
| 8 | Cell # 3 (b) | | | 1-W | ✓ | | | |
| 9 | Cell # 3 (c) | | | 1-W | ✓ | | | |
| 10 | Cell # 3 (d) | 3/17/03 | | 1-W | ✓ | | | |

TRACKING NO. PAGE NO. 0303068R0025

**Custody Record MUST be Signed**

Relinquished by: [signature] Date/Time: 3/18/03 1100
Shipped by: UPS

Relinquished by: Date/Time:
Shipped by:

Received by: [signature] Date/Time: 3/24/03 0800

Received by: Date/Time:

Sample Disposal: Return to client: ____ Lab Disposal: ____

LABORATORY USE ONLY
Sample Type: ____ # of fractions ____

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# Chain of Custody and Analytical Request Record



**PLEASE PRINT**, provide as much information as possible.
Refer to corresponding notes on reverse side.

ENERGY LABORATORIES

| | |
|---|---|
| Company Name: International Uranium Corporation | Project Name, PWS #, Permit #, Etc.: Cell Sampling |
| Report Address: 1050 17th Street, Suite 950, Independence Plaza, Denver, Colorado 80265 | Contact Name, Phone, Fax, E-mail: Haroldo Roberts (303) 389-4160 |
| | Sampler Name if other than Contact: David Turk |
| Invoice Address: -Same- | Invoice Contact & Phone #: -Same- |
| | Purchase Order #: |
| | ELI Quote #: |

Report Required For: POTW/WWTP ☐ DW ☐
Other _____

Special Report Formats – ELI must be notified prior to sample submittal for the following:
NELAC ☐ A2LA ☐ Level IV ☐
Other _____
EDD/EDT ☐ Format _____

Notify ELI prior to RUSH sample submittal for additional charges and scheduling

Comments:

Receipt Temp _____ °C
Cooler ID(s) _____
Custody Seal Y N
Intact Y N
Signature Match Y N
Lab ID

| | SAMPLE IDENTIFICATION (Name, Location, Interval, etc.) | Collection Date | Collection Time | Number of Containers / Sample Type: A W S V U O / Air Water Soils/Solids Vegetation Urine Other / MATRIX | SEE ATTACHED | Normal Turnaround (TAT) | RUSH Turnaround (TAT) | Lab ID |
|---|---|---|---|---|---|---|---|---|
| 1 | Cell #3 (e) | 3/17/03 | | 1-W | / | | | C030306801 |
| 2 | Cell #3 (f) | 3/17/03 | | 1-W | / | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

LABORATORY USE ONLY

TRACKING NO. 030680R0026

PAGE NO.

**Custody Record MUST be Signed**

| | | | |
|---|---|---|---|
| Relinquished by: | Date/Time: 3/19/03 1100 | Shipped by: UPS | Received by: Date/Time: 3/20/03 10:00 |
| Relinquished by: | Date/Time: | Shipped by: | Received by: Date/Time: |

Sample Disposal: Return to client: _____ Lab Disposal: _____

**LABORATORY USE ONLY**
Sample Type: _____ # of fractions _____

Visit our web site at ***www.energylab.com*** for additional information, downloadable fee schedule, forms, & links.

| |
|---|
| PH |
| Aluminum |
| Ammonia |
| Arsenic |
| Barium |
| Boron |
| Calcium |
| Carbonate |
| Cadmium |
| Chloride |
| Chromium |
| Beryllium |
| Copper |
| Fluoride |
| Iron |
| Lead |
| Magnesium |
| Manganese |
| |
| Molybdenum |
| Nickel |
| Nitrate – Nitrite |
| |
| Phosphorus |
| Potassium |
| Selenium |
| |
| |
| |
| Sodium |
| |
| Sulfate |
| |
| Titanium |
| Vanadium |
| |

| |
|---|
| Zirconium |
| Total Dissolved Solids |
| U nat, mg/L |
| Ra-226, pCi/l |
| |
| Th-230, pCi/l |
| Th-232, mg/L |
| Pb-210, pCi/l |
| |
| |
| Gross Alpha |
| Gross Beta |
| |
| VOC |
| SVOC |
| |
| |
| |
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| |
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| |

## Energy Laboratories Inc.

### Sample Receipt Checklist

Client Name **INTRNTNL-URNM-CRP-DNR** Date and Time Received: **3/24/2003 10:00:00**

Work Order Number **C03030680** Received by **sh**

Checklist completed by _____ 3/24/03 Reviewed by _____ _____

Signature Date Initials Date

Carrier name UPS

| | | | |
|---|---|---|---|
| Shipping container/cooler in good condition? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on shipping container/cooler? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on sample bottles? | Yes ☑ | No ☐ | Not Present ☐ |
| Chain of custody present? | Yes ☑ | No ☐ | |
| Chain of custody signed when relinquished and received? | Yes ☑ | No ☐ | |
| Chain of custody agrees with sample labels? | Yes ☑ | No ☐ | |
| Samples in proper container/bottle? | Yes ☐ | No ☑ | |
| Sample containers intact? | Yes ☑ | No ☐ | |
| Sufficient sample volume for indicated test? | Yes ☑ | No ☐ | |
| All samples received within holding time? | Yes ☐ | No ☑ | |
| Container/Temp Blank temperature in compliance? | Yes ☑ | No ☐ | 6 °C |
| Water - VOA vials have zero headspace? | Yes ☐ | No ☐ | No VOA vials submitted ☑ |
| Water - pH acceptable upon receipt? | Yes ☑ | No ☐ | Not Applicable ☐ |

Adjusted? _____ Checked by _____

Any No and/or NA (not applicable) response must be detailed in the comments section below.

Client contacted Date contacted: _____ Person contacted _____

Contacted by: Regarding: _____

Comments:

**Samples split and preserved by lab. We did not receive any bottles for VOC & SVOC, and the TDS was rc'd out of holding. Called client 3-24-03 per Harold Roberts he doesn't really need VOC or SVOC and we can run the TDS out of holding.**

Corrective Action

TRACKING NO. PAGE NO.

030680R0028

ENERGY LABORATORIES, INC. • 2393 Salt Creek Highway (82601) • P[illegible]x 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

# ANALYTICAL SUMMARY REPORT

April 25, 2003

Harold Roberts
International Uranium (USA) Corp
1050 17th St
Ste 950
Denver, CO 80265

Workorder No.: C03030680

Project Name: Cell Sampling

Energy Laboratories Inc. received the following 12 samples from International Uranium (USA) Corp on 3/24/2003 for analysis.

| Sample ID | Client Sample ID | Collect Date | Receive Date | Matrix | Test |
|---|---|---|---|---|---|
| C03030680-001 | Cell #1 (a) | 03/17/03 0:00 | 03/24/03 | Aqueous | Alkalinity<br>Chloride<br>Fluoride<br>Metals by ICP, Total<br>Metals by ICP-MS, Total<br>Nitrogen, Ammonia<br>Nitrogen, Nitrate + Nitrite<br>Metals Digestion by EPA 200.2<br>Gross Alpha, Gross Beta<br>Lead 210, Total<br>Radium 226, Total<br>Thorium, Isotopic<br>Solids, Total Dissolved |
| C03030680-002 | Cell #1 (b) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-003 | Cell #1 c | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-004 | Cell #1 (d) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-005 | Cell #1 (e) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-006 | Cell #1 (f) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-007 | Cell #3 (a) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-008 | Cell #3 (b) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-009 | Cell #3 c | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-010 | Cell #3 (d) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-011 | Cell #3 (e) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |
| C03030680-012 | Cell #3 (f) | 03/17/03 0:00 | 03/24/03 | Aqueous | Same As Above |

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative or Report.

If you have any questions regarding these tests results, please call.

**Report Approved By:** R. A. Gearheart
ROGER A. GEARHEART
LABORATORY SUPERVISOR

TRACKING NO. PAGE NO.
030680R0029

Attachment I

## 1.3 Seismic Risk Assessment

### 1.3.1 General

This review utilized the environmental assessment completed in 1978 for the White Mesa Uranium Project by Dames & Moore (1978b). Information has been updated and procedures have been modified to conform to current requirements.

### 1.3.2 Seismic History of Region

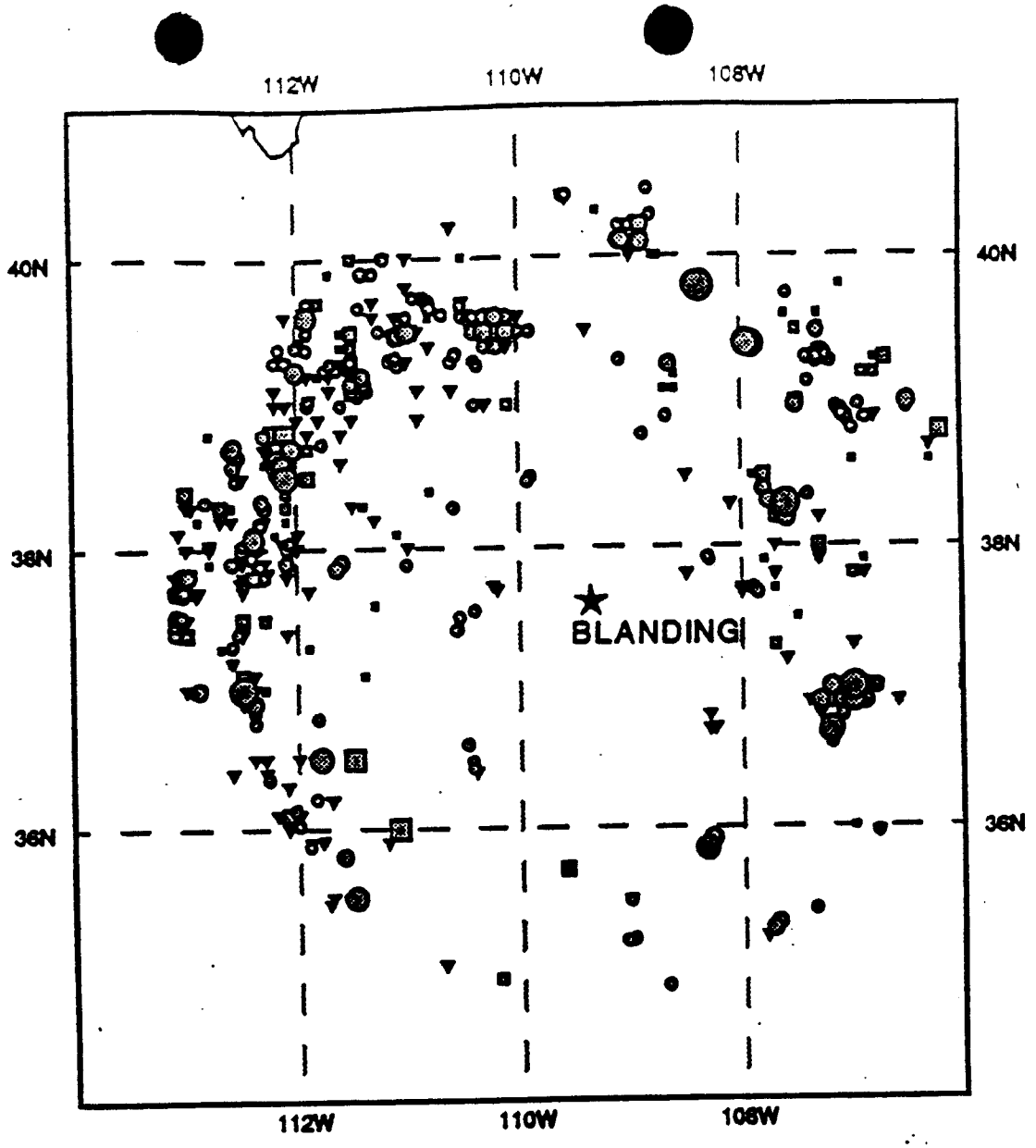
Because of the region's late settlement, the record of earthquake occurrences in the Colorado Plateau and surrounding regions dates back only 135 years. Documentation of the earlier events was based solely on newspaper reports that frequently recorded effects only in the more populated areas which may have been some distance from the epicenters. Not until the late 1950's was a seismograph network developed to properly locate and evaluate seismic events in this region (Simon, 1972).

The project area is within a relatively tectonically stable portion of the Colorado Plateau noted for its scarcity of historical seismic events. Conversely, the border between the Colorado Plateau and the Basin and Range Province and Middle Rocky Mountain Province some 155 to 240 miles (249 to 386 km) west and northwest, respectively, from the site is one of the most active seismic belts in the western United States.

The epicenters of historical earthquakes from 1853 through 1986 within a 200-mile (320-km) radius of the site are shown in Figure A-3. More than 1146 events have occurred in the area, of which at least 45 were damaging; that is, having an intensity of VI or greater on the Modified Mercalli Scale. A description of the Modified Mercalli Scale is given in Table A-3. All intensities mentioned herein refer to this table. Table A-3 also shows a generalized relationship between Mercalli intensities and other parameters to which this review will refer. Since these relationships are frequently site specific, the table values should be used only for approximation and understanding.

Only 63 non-duplicative epicenters have been recorded within a 120 mile (200 km) radius of the project area (Figure A-4). Of these, 50 had an intensity IV or less (or unrecorded) and two were recorded as intensity VI. The nearest event occurred in the Glen Canyon National Recreation Area approximately 38 miles (63 km) west-northwest of the project area. The next closest event occurred approximately 53 miles (88 km) to the northeast. Just east of Durango, Colorado, approximately 99 miles (159 km) due east of the project area, an event having local intensity of V was recorded on August 29, 1941 (Hadsell, 1968). It is very doubtful that these events would have been felt in the vicinity of Blanding.

Three of the most damaging earthquakes associated with the seismic belt along the Colorado Plateau's western border have occurred in the Elsinore-Richfield area about 168 miles (270 km) northwest of the project site. All were of intensity VIII. On November 13, 1901, a strong shock caused extensive damage from Richfield to Parowan. Many brick structures were damaged; rockslides were reported near Beaver. Earth cracks with the ejection of sand and water were reported, and some creeks increased their flow. Aftershocks continued for several weeks (von Hake, 1977). Following several weeks of small foreshocks, a strong earthquake caused major damage in the Monroe-Elsinore-Richfield area on September 29, 1921. Scores of chimneys were thrown down, plaster fell from ceilings, and a section of a new two-story brick wall




1146 EARTHQUAKES PLOTTED

MAGNITUDES
<4.0
5.0
6.0
7.0

NO INTENSITY OR MAGNITUDE ▼

INTENSITIES
I-IV
V
VII
IX

NATIONAL GEOPHYSICAL DATA CENTER / NOAA BOULDER, CO 80303

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT
SEISMICITY
320KM AROUND
BLANDING UTAH
JUNE, 1988 FIGURE A-3

## TABLE A-3

### MODIFIED MERCALLI SCALE: 1958 VERSION*

| Intensity | | Effects | v, † cm/s | a‡ |
|---|---|---|---|---|
| M§ | I. | Not felt. Marginal and long-period effects of large earthquakes (for details see text). | | |
| 3 | II. | Felt by persons at rest, on upper floors, or favorably placed. | | |
| | III. | Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake. | | 0.0035–0.007 |
| 4 | IV. | Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV wooden walls and frame creak. | | 0.007–0.015 |
| | V. | Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate. | 1–3 | 0.015–0.035 |
| 5 | VI. | Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle—CFR). | 3–7 | 0.035–0.07 |
| 6 | VII. | Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments—CFR). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged. | 7–20 | 0.07–0.15 |
| | VIII. | Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. | 20–60 | 0.15–0.35 |
| 7 | IX. | General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations—CFR.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, earthquake fountains, sand craters. | 60–200 | 0.35–0.7 |
| 8 | X. | Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly. | 200–500 | 0.7–1.2 |
| | XI. | Rails bent greatly. Underground pipelines completely out of service. | | >1.2 |
| | XII. | Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air. | From Fig. 11.14 | |

NOTE: Masonry A, B, C, D. To avoid ambiguity of language, the quality of masonry, brick or otherwise, is specified by the following lettering (which has no connection with the conventional Class A, B, C construction).

a Masonry A: Good workmanship, mortar, and design reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.

a Masonry B: Good workmanship and mortar reinforced, but not designed to resist lateral forces.

a Masonry C: Ordinary workmanship and mortar; no extreme weaknesses such as non-tied-in corners, but masonry is neither reinforced nor designed against horizontal forces.

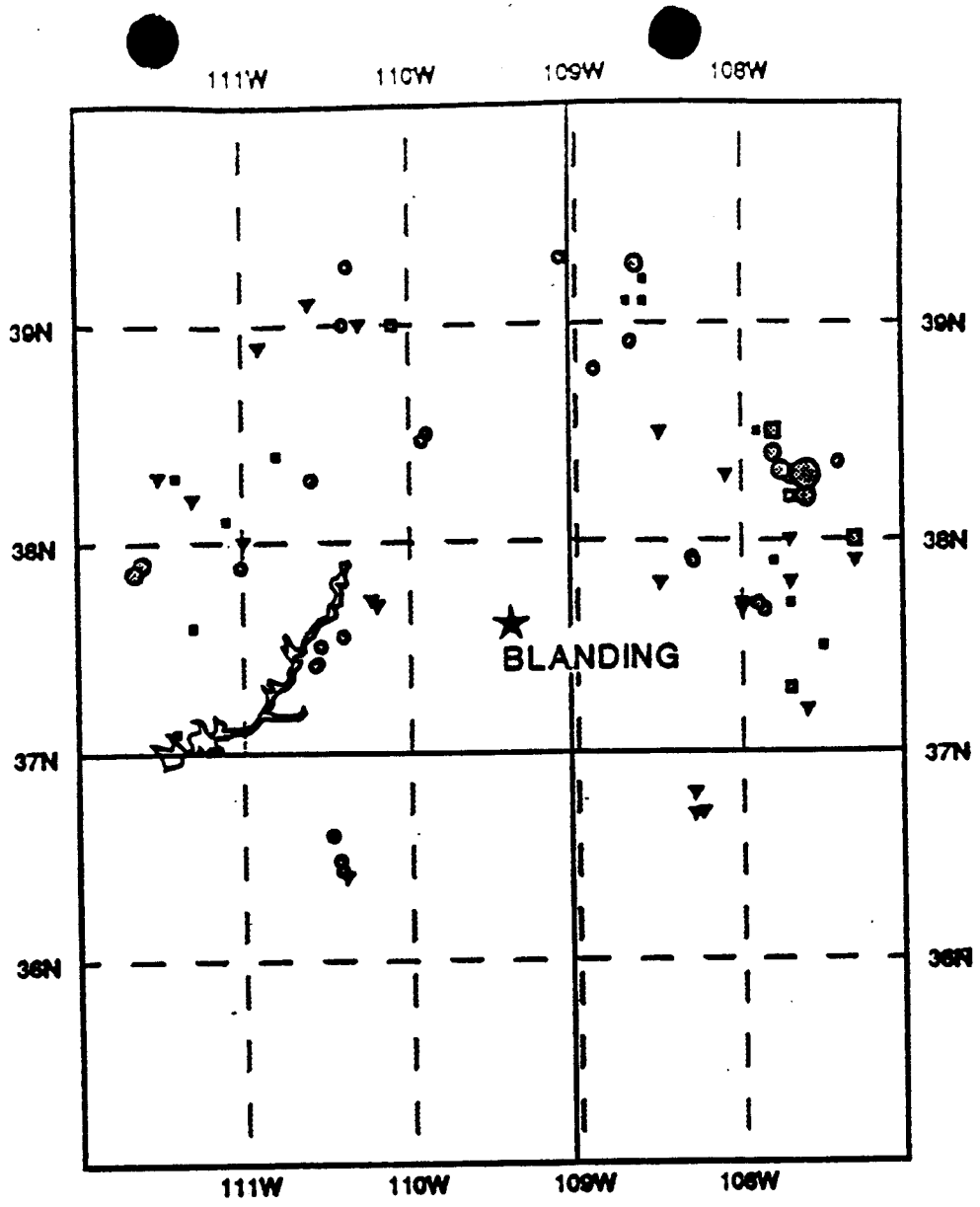
a Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

*From Richter (1958).[1] Adapted with permission of W. H. Freeman and Company. by Hunt (1984).

†Average peak ground velocity, cm/s.

‡Average peak acceleration (g=acc from gravity).

§Magnitude correlation.




103 EARTHQUAKES PLOTTED

MAGNITUDES
<4.0
5.0
6.0
7.0

NO INTENSITY OR MAGNITUDE

INTENSITIES
I-IV
V
VII
IX

NATIONAL GEOPHYSICAL DATA CENTER / NOAA BOULDER, CO 80303

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT
**SEISMICITY**
**200KM AROUND**
**BLANDING UTAH**
JUNE, 1988 FIGURE A-4

collapsed at Elsinore's schoolhouse. Two days later, on October 1, 1921, another strong tremor caused additional damage to the area's structures. Large rockfalls occurred along both sides of the Sevier Valley and hot springs were discolored by iron oxides (von Hake, 1977). It is probable that these shocks may have been perceptible at the project site but they certainly would not have caused any damage.

Seven events of intensity VII have been reported in the area shown in Figure A-3. Of these, only two are considered to have any significance with respect to the project site. On August 18, 1912, an intensity VII shock damaged houses in northern Arizona and was felt in Gallup, New Mexico, and southern Utah. Rock slides occurred near the epicenter in the San Francisco Mountains and a 50-mile (80 km) earth crack was reported north of the San Francisco Range (U. S. Geological Survey, 1970). Nearly every building in Dulce, New Mexico, was damaged to some degree when shook by a strong earthquake on January 22, 1966. Rockfalls and landslides occurred 10 to 15 miles (16 to 24 km) west of Dulce along Highway 17 where cracks in the pavement were reported (Hermann et al., 1980). Both of these events may have been felt at the project site but, again, would certainly not have caused any damage.

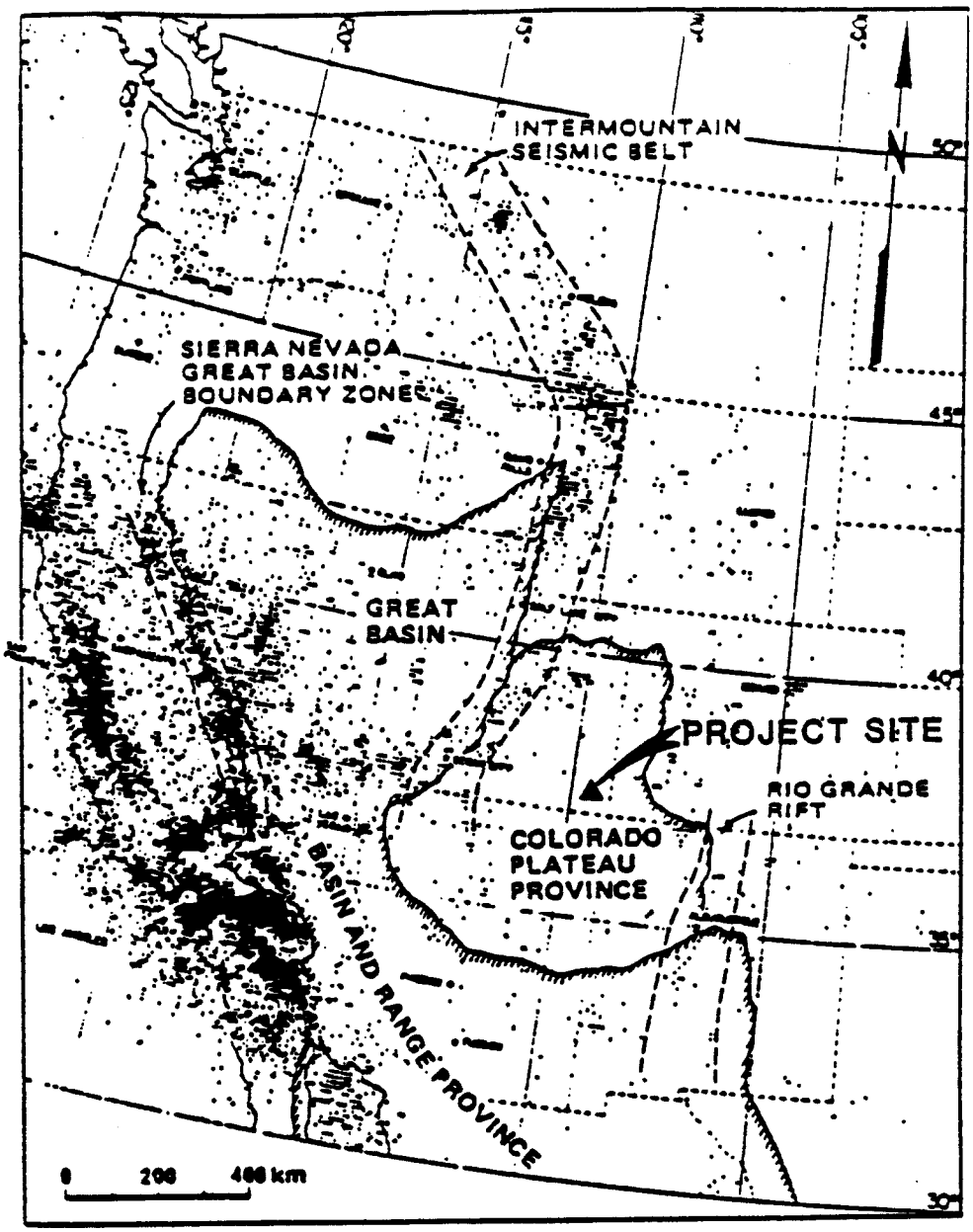
### 1.3.3 Relationship of Earthquakes to Tectonic Structures

The majority of recorded earthquakes in Utah have occurred along an active belt of seismicity that extends from the Gulf of California, through western Arizona, central Utah, and northward into western British Columbia. The seismic belt is possibly a branch of the active rift system associated with the landward extension of the East Pacific Rise (Cook and Smith, 1967). This belt is the Intermountain Seismic Belt shown in Figure A-5 (Smith, 1978).

It is significant to note that the seismic belt forms the boundary zone between the Basin and Range - Great Basin Provinces and the Colorado Plateau - Middle Rocky Mountain Provinces. This block-faulted zone is about 47 to 62 miles (75 to 100 km) wide and forms a tectonic transition zone between the relatively simple structures of the Colorado Plateau and the complex fault-controlled structures of the Basin and Range Province (Cook and Smith, 1967).

Another zone of seismic activity is in the vicinity of Dulce, New Mexico, near the Colorado border. This zone, which coincides with an extensive series of Tertiary intrusives, may also be related to the northern end of the Rio Grande Rift. This rift is a series of fault-controlled structural depressions extending southward from southern Colorado through central New Mexico and into Mexico. The rift is shown on Figure A-5 trending north-south to the east of the project area.

Most of the events south of the Utah border of intensity V and greater are located within 50 miles (80 km) of post-Oligocene extrusives. This relationship is not surprising because it has been observed in many other parts of the world (Hadsell, 1968).




Modified from Smith, 1978

**SHOWS RELATIONSHIP OF THE COLORADO PLATEAU PROVINCE TO MARCANAL BELTS**

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT

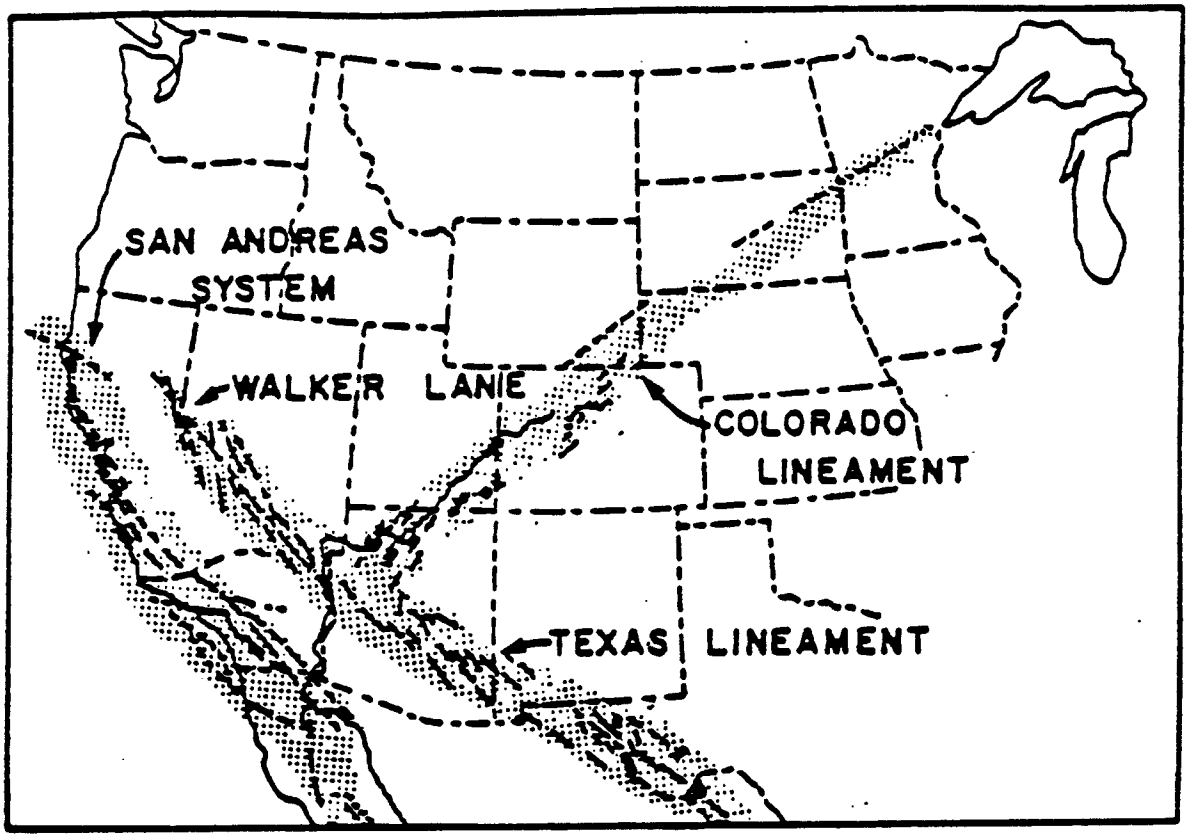
**SEISMICITY OF THE WESTERN UNITED STATES, 1950 TO 1976**

JUNE, 1988 FIGURE A-5

In Colorado, the Rio Grande Rift zone is one of three seismotectonic provinces that may contribute energy to the study area. Prominent physiographic expression of the rift includes the San Luis Valley in southern Colorado. The valley is a half-graben structure with major faulting on the eastern flank. Extensional tectonics is dominant in the area and very large earthquakes with recurrence intervals of several thousand years have been projected (Kirkham and Rodgers, 1981). Mountainous areas to the west of the Rio Grande rift province include the San Juan Mountains. These mountains are a complex domical uplift with extensive Oligocene and Miocene volcanic cover. Many faults are associated with the collapse of the calderas and apparently have not moved since. Faults of Neogene age exist in the eastern San Juan Mountains that may be related to the extension of the Rio Grande rift. Numerous small earthquakes have been felt or recorded in the western mountainous province despite an absence of major Neogene tectonic faults (Kirkham and Rodgers, 1981).

The third seismotectonic province in Colorado, that of the Colorado Plateau, extends into the surrounding states to the west and south. In Colorado, the major tectonic element that has been recurrently active in the Quaternary is the Uncompahgre uplift. Both flanks are faulted and earthquakes have been felt in the area. The faults associated with the Salt Anticlines are collapsed features produced by evaporite solution and flowage (Cater, 1970). Their non-tectonic origin and the plastic deformation of the salt reduces their potential for generating even moderate-sized earthquakes (Kirkham and Rodgers, 1981).

Case and Joesting (1972) have called attention to the fact that regional seismicity of the Colorado Plateau includes a component added by basement faulting. They inferred a basement fault trending northeast along the axis of the Colorado River through Canyonlands. This basement faulting may be part of the much larger structure that Hite (1975) examined and Warner (1978) named the Colorado lineament (Figure A-6). This 1300-mile (2100-km) long lineament that extends from northern Arizona to Minnesota is suggested to be a Precambrian wrench-fault system formed some 2.0 to 1.7 billion years before present. While it has been suggested that the Colorado lineament is a source zone for larger earthquakes (m = 4 to 6) in the west-central United States, the observed spatial relationship between epicenters and the trace of the lineament does not prove a causal relation (Brill and Nuttli, 1983). In terms of contemporary seismicity, the lineament does not act as a uniform earthquake generator. Only specific portions of the proposed structure can presently be considered seismic source zones and each segment exhibits seismicity of distinctive activity and character (Wong, 1981). This is a reflection of the different orientations and magnitudes of the stress fields along the lineament. The interior of the Colorado Plateau forms a tectonic stress province, as defined by Zoback and Zoback (1980), that is characterized by generally east-west tectonic compression. Only where extensional stresses from the Basin and Range province of the Rio Grande rift extend into the Colorado Plateau would the Colorado lineament in the local area be suspected of having the capability of generating a large magnitude earthquake (Wong, 1984). At the present time, the well defined surface expression of regional extension is far to the west and far to the east of the project area.




SOURCE: WARNER, 1978

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT

COLORADO LINEAMENT

JUNE, 1988 FIGURE A-6

Recent work by Wong (1984) has helped define the seismicity of the Colorado Plateau. He called attention to the low level (less than 1 but high number (30) of earthquakes in the Capitol Reef area from 1978 to 1980 that were associated with the Waterpocket fold and the Cainville monocline, two other major tectonic features of the Colorado Plateau. Only five earthquakes in the sequence were of $M_L$ greater than 3, and fault plane solutions suggest the swarm was produced by normal faulting along northwest-trending Precambrian basement structures (Wong, 1984). The significance of the Capitol Reef seismicity is its relatively isolated occurrence within the Colorado Plateau and its location at a geometric barrier in the regional stress field (Aki, 1979). Stress concentration that produces earthquakes at bends or junctures of basement faults as indicated by this swarm may be expected to occur at other locations in the Colorado Plateau Province. No inference that earthquakes such as those at Capitol Reef are precursors for larger subsequent events is implied.

### 1.3.4 Potential Earthquake Hazards to Project

The project site is located in a region known for its scarcity of recorded seismic events. Althought the seismic history for this region is barely 135 years old, the epicentral pattern, or fabric, is basically set and appreciable changes are not expected to occur. Most of the larger seismic events in the Colorado Plateau have occurred along its margins rather than in the interior central region. Based on the region's seismic history, the probability of a major damaging earthquake occurring at or near the project site is very remote. Studies by Algermissen and Perkins (1976) indicate that southeastern Utah, including the site, is in an area where there is a 90 per cent probability that a horizontal acceleration of four per cent gravity (0.04g) would not be exceeded within 50 years.

Minor earthquakes, not associated with any seismic-tectonic trends, can presumably occur randomly at almost any location. Even if such an event with an intensity as high as VI should occur at or near the project site, horizontal ground accelerations would not exceed 0.10g but would probably range between 0.05 an 0.09g (Coulter et al., 1973; Trifunac and Brady, 1975). These magnitudes of ground motion would not pose significant hazards to the existing and proposed facilities at the Project Site.

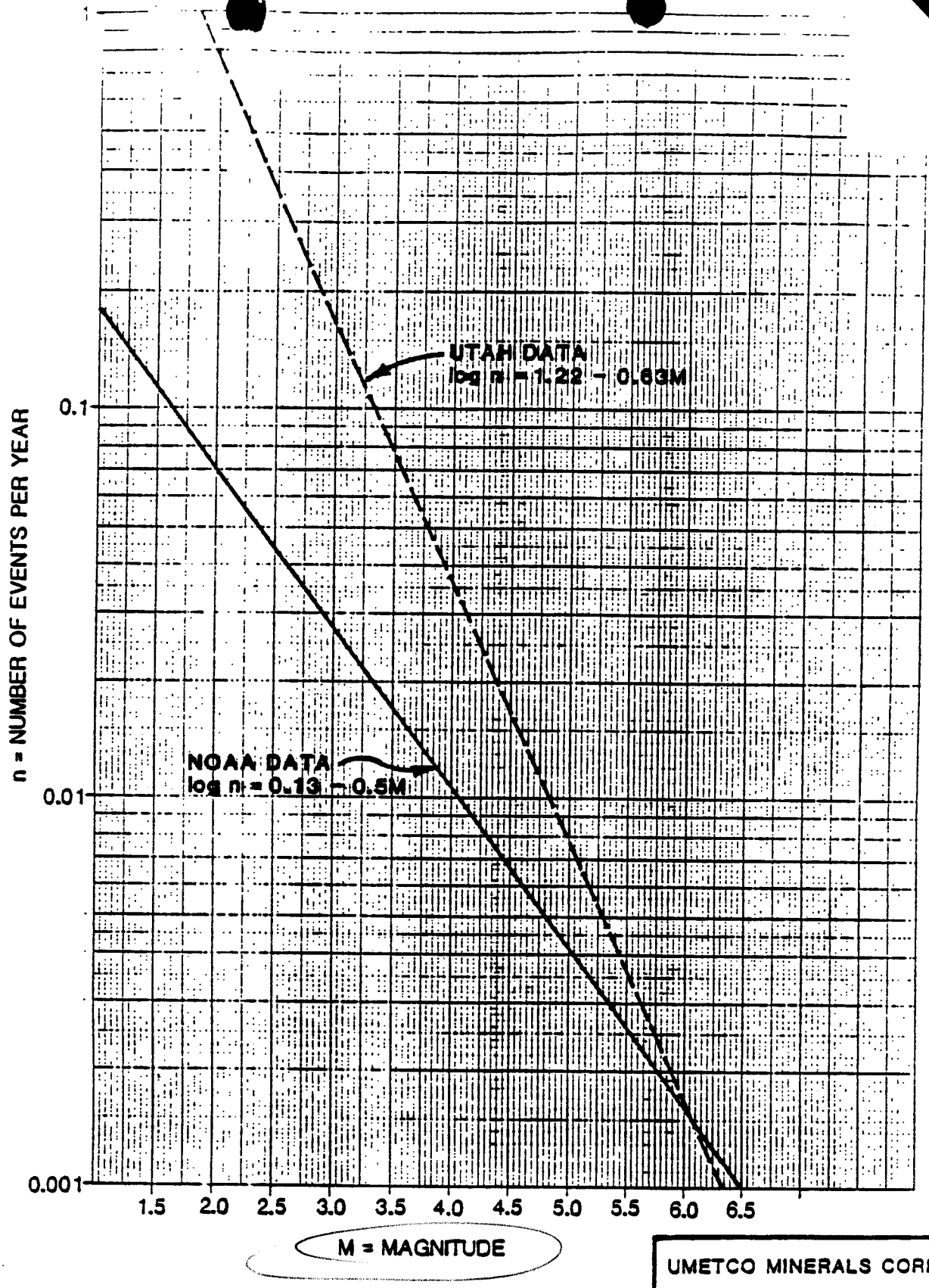
In addition to general estimates of earthquake hazards, such as those offered by Dames and Moore (1978b), a more detailed analysis of the relationship between the project area and regional seismicity was performed. As can be seen in Figure A-3, a map based on the seismologic data base from the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (NOAA 1988), many events occur within the Intermountain Seismic Belt and within the Rio Grande rift. Since the Colorado Plateau Province, and particularly the Blanding basin portion, in which the project site lies, is a distinctly different tectonic province, the historical sample chosen for magnitude/frequency estimates was limited to a radius of about 120 miles (200 km) from the project. This sample included a region which is more representative of the seismicity of the Colorado Plateau.

The map in Figure A-4 shows a plot of earthquake epicenters within 124 miles (200 km) of Blanding. In comparing this map with Figure A-3, it is apparent that the project site is located in an area of very low seismic flux compared to the marginal areas to both east and west. Using a sample of 46 events ranging in magnitude from 2 to 5.5 and covering a time span of 135 years, the calculated yearly rates for each magnitude range were normalized to an area of 6,823 square miles (17,671 $km^2$) [47-mile (75-km) radius]. A Poisson distribution was assumed and a linear regression produced the best fit line of magnitude vs. frequency shown in Figure A-7. The form of log (n) = b + aM (where n is the expected number of events per year of magnitude M) was used. The sample of 46 events included all non-duplicative epicenters with reported magnitude or intensity. Intensities were converted to magnitudes where necessary using the equation M = 2.1 + 0.5I as recommended by Krinitsky and Chang (1975). The resulting recurrence intervals of events of a specific magnitude are considerably longer than for the same size event in the more active zones to the east and west but are more realistic of the Blanding area (Arabasz, Smith and Richins, 1979; Kirkham and Rodgers, 1981). The magnitude/frequency relationship determined is not intended to represent true rates but is only a conservative estimate based on samples which are representative of only the area near the White Mesa project site.

The historical records from both NOAA and Utah data sources list only five events which have occurred within 62 miles (100 km) of the study site. The largest of these relatively near events was a magnitude 4.0 event on July 22, 1986, that occurred 61.5 miles (99 km) west of the site. In the 124 miles (200 km) radius data set the largest event is one of magnitude 5.5 on October 11, 1960, at a distance of 112 miles (180 km) from the project.

The nearest fault to the site identified on maps by Andersen and Miller (1979) as youthful and therefore presumably potentially active is 25 miles (57 km) north of the project site (Figure A-8). The fault, as mapped, has a well defined length of about 1.9 miles (3 km) and a possible total length of 6.8 miles (11 km). The fault is identified by Anderson and Miller as a suspected Quaternary fault, but may not be the result of tectonic activity. The evidence for Quaternary movement on this fault is not strong and it appears to be a discrete extension of the South fault of the Shay graben. No other part of the surface expression of the Shay graben structure gives any indication that the fault's traces are anything other than erosionally produced fault-line scarps. Nevertheless, it is appropriate to use this mapped suspected Quaternary fault for estimates for seismic design criteria since it is the nearest fault or fault segment to the project area that has been mapped as young. Additional discussion of the faulting in the Shay and Verdure grabens (Figure A-8) is included below.

Estimates of the maximum credible earthquake from this fault 35 miles (57 km) north of the project assuming rupture of 1.9 miles (3 km) and 6.7 miles (11 km), as well as a one-half total length ruture 3.4 miles (5.5 km) have been made using the relationships discussed in Slemmons (1977). These are summarized in Tables A-4 and A-5. Determinative assumptions included the expected length of surface rupture, type of fault movement, and regional location. This least squares approach to the regression analysis was well validated by the studies of Bonilla et al. (1984).




COVERS AREA WITHIN A 75 KM RADIUS OF THE PROJECT SITE

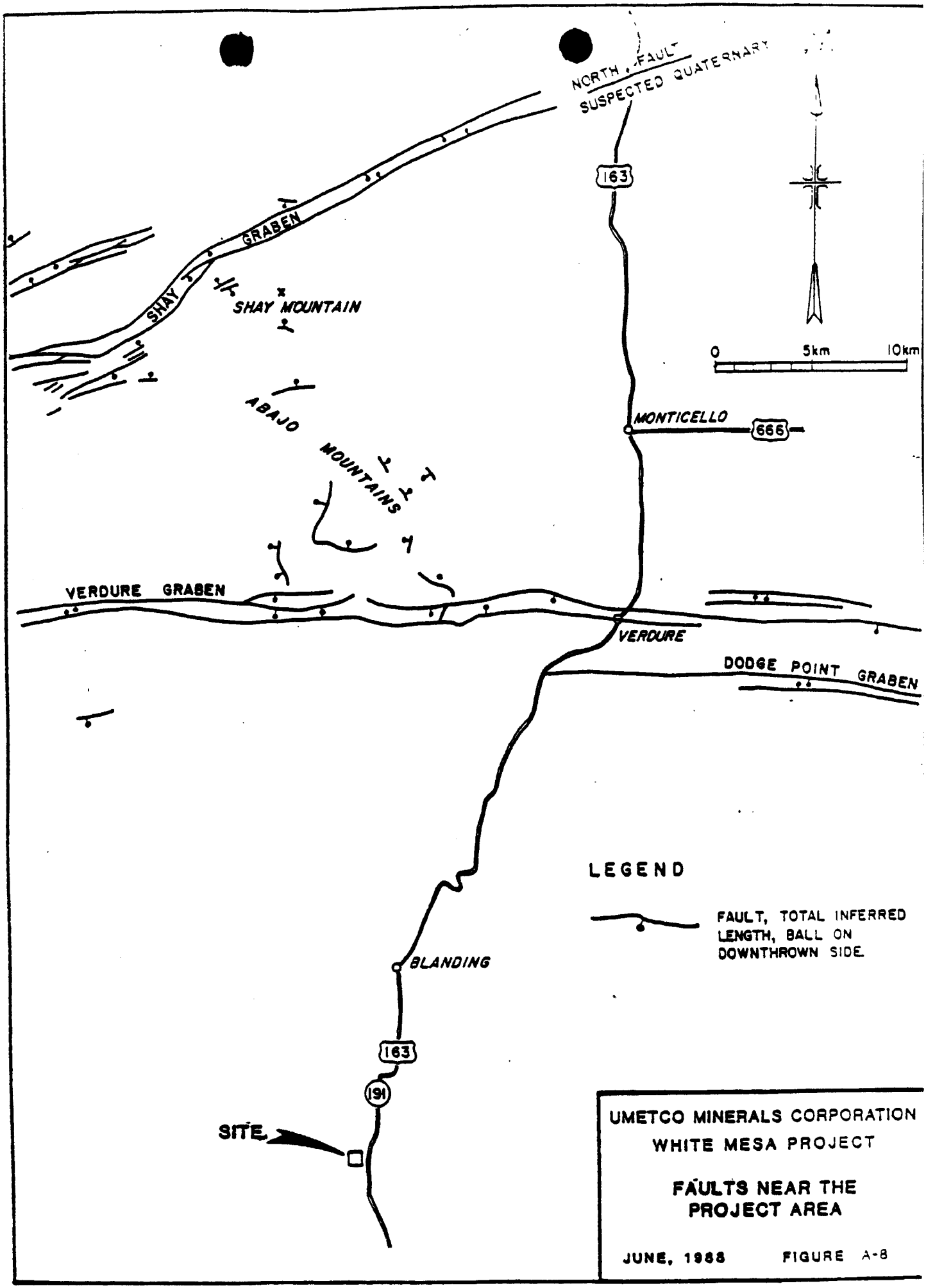
what about $10^{-4}$?

UMETCO MINERALS CORPORATION

WHITE MESA PROJECT

**MAGNITUDE / FREQUENCY RELATIONSHIP**

JUNE, 1988 FIGURE A-7

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WHITE MESA PROJECT

**FAULTS NEAR THE PROJECT AREA**

JUNE, 1988 FIGURE A-8

Table A-4

Maximum Fault Displacement (D)
of
North Fault (Figure A-8)

| Parameter | a | b | D = 3 km | D = 5.5 km | D = 11 km |
|---|---|---|---|---|---|
| NA | -4.270 | 1.036 | 0.08 m | 0.14 m | 0.29 m |
| A | -4.375 | 1.014 | 0.14 m | 0.26 m | 0.53 m |
| A+C | -2.898 | 0.705 | 0.36 m | 0.55 m | 0.89 m |

Relationship: Log D = a + b Log L

From: Slemmons (1977)

Table A-5

Maximum Magnitude (M)
of
North Fault (Figure A-8)

| Relationship | Parameter | a | b | M = 3 km | M = 5.5 km | M = 11 km |
|---|---|---|---|---|---|---|
| M = a + b Log L | NA | -0.146 | 1.504 | 5.08 | 5.48 | 5.93 |
| | A | 1.845 | 1.151 | 5.85 | 6.15 | 6.50 |
| | A+C | 2.042 | 1.121 | 5.94 | 6.23 | 6.57 |
| M = a + b Log D | NA | 6.745 | 0.995 | 5.65 | 5.90 | 6.21 |
| | A | 6.827 | 1.050 | 5.93 | 6.21 | 6.54 |
| | A+C | 6.757 | 1.226 | 6.21 | 6.44 | 6.69 |
| M = a + b Log LD | NA | 3.510 | 0.701 | 5.18 | 5.53 | 5.97 |
| | A | 4.551 | 0.530 | 5.94 | 6.22 | 6.55 |
| | A+C | 3.691 | 0.707 | 5.84 | 6.15 | 6.51 |
| M = a + b Log $LD^2$ | NA | 4.808 | 0.420 | 5.35 | 5.66 | 6.05 |
| | A | 5.568 | 0.299 | 6.10 | 6.34 | 6.61 |
| | A+C | 4.752 | 0.459 | 5.94 | 6.23 | 6.56 |
| | | | MEAN | 5.75 | 6.04 | 6.39 |
| MAXIMUM MAGNITUDE (MEAN + S) | | | | 6.11 | 6.37 | 6.66 |

NA = North America
A = Normal Movement
A + C = Combined Normal and Oblique Movement

From: Slemmons (1977)

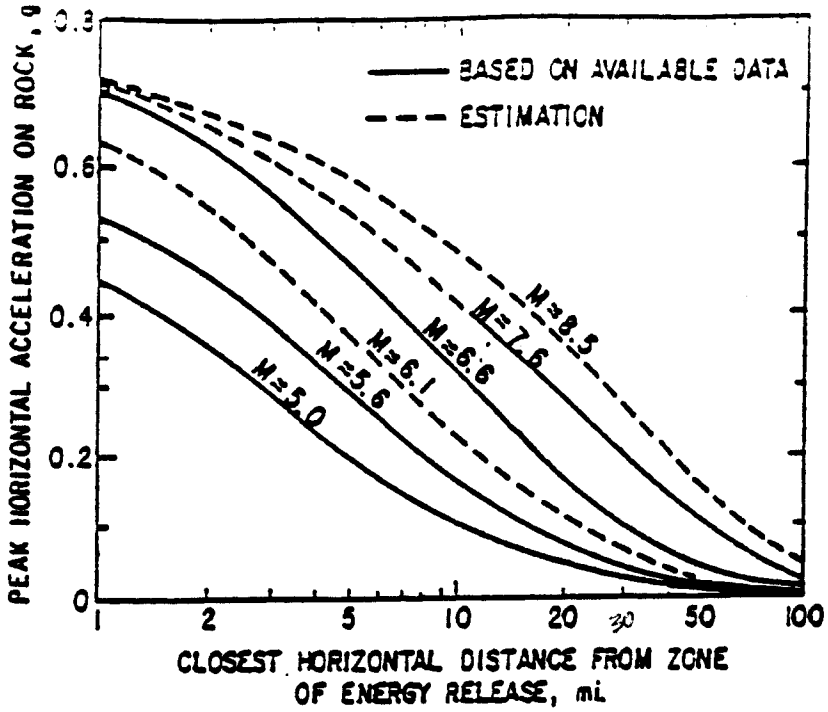
The maximum estimated magnitude of this fault assuming a 3.4 Miles (5.5 km) rupture length is 6.4. This is consistent with estimates of maximum magnitude for the Colorado Plateau by Kirkham and Rodgers (1981) and by Andersen and Miller (1979). Based on the estimated historical magnitude/frequency relationships, this maximum earthquake would have a recurrence interval of about 1000 years. Because the historical magnitude/frequency relationship estimated was not constrained at its upper right limit (say to a value of M 6.5), it is reasonable to deduce that recurrence-intervals determined are shorter (more conservative) than their actual rate of recurrence.

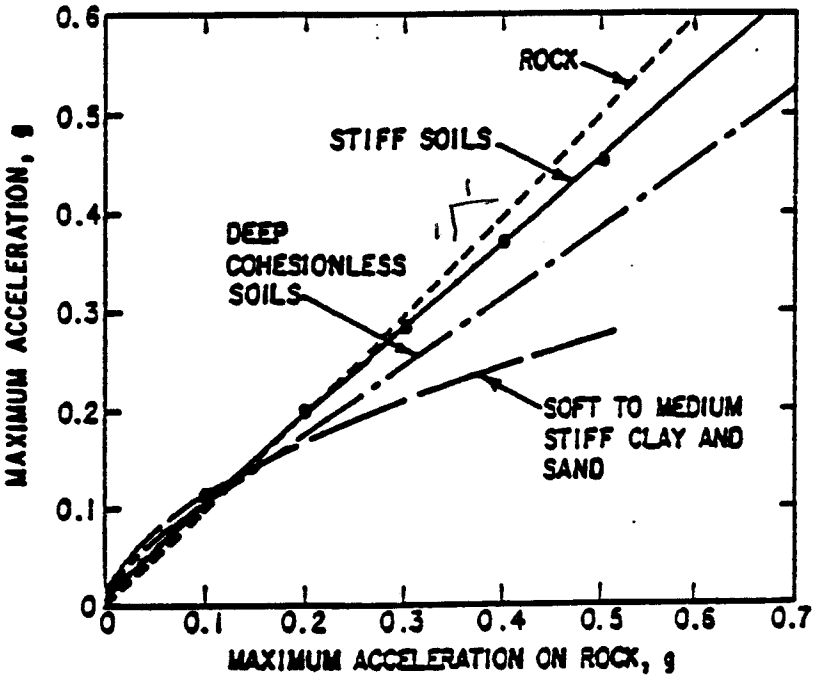
Ground motions at the White Mesa project site resulting from an maximum credible earthquake (MCE) on the fault discussed can be estimated from attenuation curves established by Seed and Idriss (1982). The graph in Figure A-9 indicates an estimated peak horizontal acceleration at a distance of 57 km from the epicenter would be 0.07g.

Note that conservative estimates were used by assuming an estimated magnitude of 6.4 based on the mean plus one standard deviation and assuming the earthquake would initiate at a point on the fault closest 35 miles (57 km) to the project site.

The MCE and possible horizontal acceleration estimate have a very low probability of occurrence but would be used for seismic design parameters for a worst case scenario based on this mapped fault.

Faults associated with the Verdure graben are even closer to the White Mesa Project than the fault discussed above but they show no evidence of recent surface displacement. These faults are shown on the map on Figure A-8 in spite of not being shown on the Quaternary Fault Map of Utah because of their surface expression and similarity in trend and structure to Shay graben to the north (Anderson and Miller, 1979; Woodward-Clyde Consultants, 1982). During micro-seismic monitoring from 1979 through 1982, Wong (1984) recorded only two events associated with these east-west grabens. Both of the micro-earthquakes ($M_L$ 0.6 and $M_L$ 0.7) were in the Abajo Mountains near the western end of the southern fault trace of the Shay graben. Data resolution did not permit these very small events to be assigned to the south fault and they may well be related to the old intrusions. However, this is the only indication found that any of these structures may be active. Detailed field study and mapping of the Verdure graben show Quaternary pediment gravels and alluvium overlying the graben in several places and Witkind (1964) indicated that the south fault was in igneous contact with the Rocky Trail laccolith with no slickensides present (Woodward-Clyde Consultants, 1982). Stream courses cross the faults of the graben with no deflection or gradient change. The implication is that these faults are old and may be of Oligocene age and related to the period of laccolithic intrusion. It is also possible, as many authors believe, that these fault structures are the result of salt flowage in underlying formations and not produced by tectonic stresses (Kirkham and Rodgers, 1981). Since the regional stress field in this area is approximately east-west, it is difficult to see how the normal faulting of the Verdure graben or the Shay graben and its possible extension that forms the small fault north of Monticello could be




( From Seed and Idriss, 1982 )

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT

**GROUND ACCELERATION CURVES**

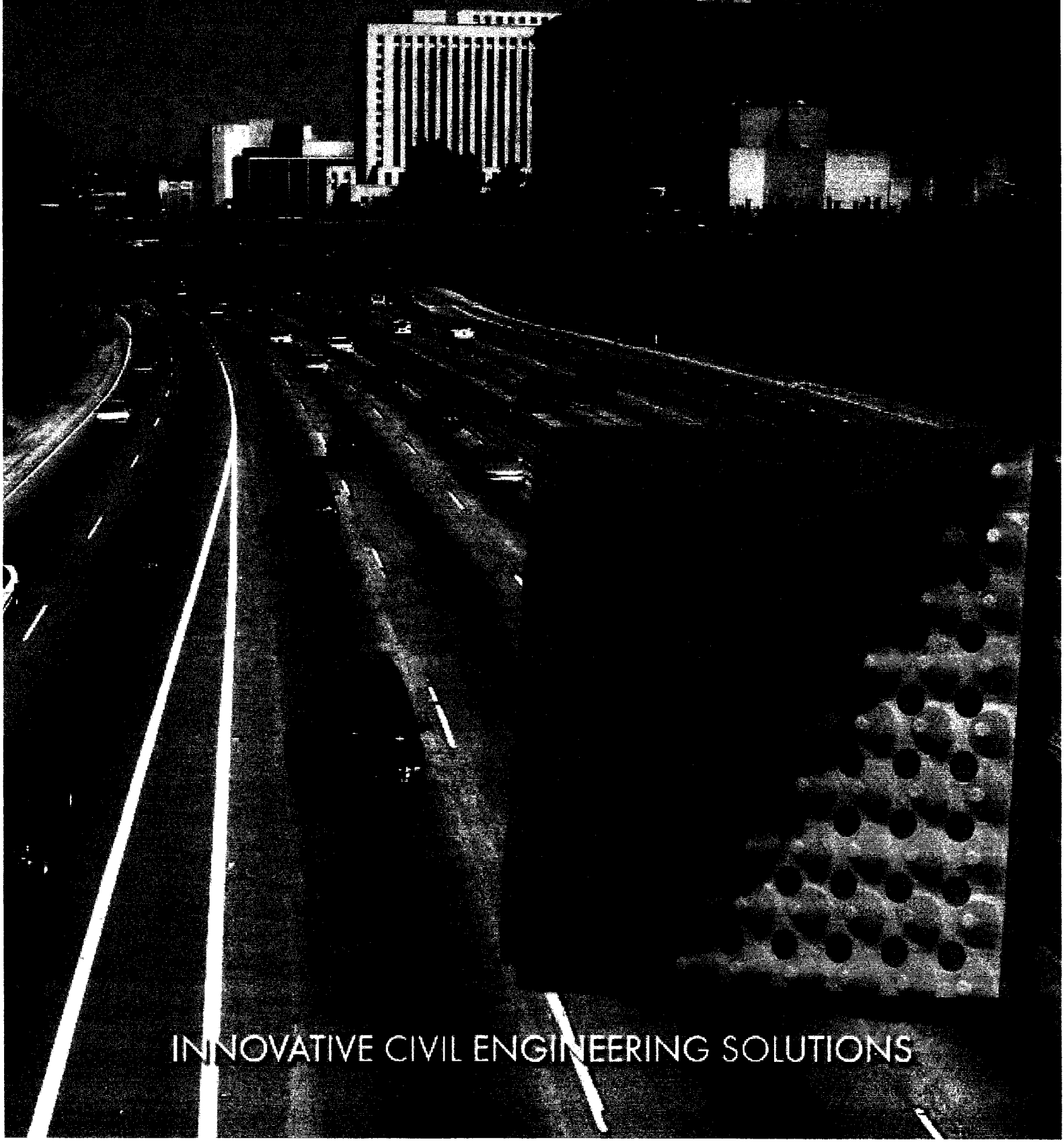
JUNE, 1988 FIGURE A-9

produced by tectonics stresses (Wong, 1984). If the faults are non-tectonic they are not likely to be capable of generating earthquakes larger than magnitude 4 or 5. As mentioned before, probabilistic maps by Algermissen and Perkins (1976) indicate there is a 90 percent probability that horizontal acceleration will not exceed 0.04 g in 50 years in the project area. This is in keeping with the projected MCE from the fault north of Monticello that presents some weak geologic evidence of Quaternary movement. As discussed above, this fault and its MCE should be used for seismic design at the White Mesa Project.

Attachment J

CONTECH
CONSTRUCTION PRODUCTS INC.

# STRIPDRAIN for Highway Pavement Drainage



INNOVATIVE CIVIL ENGINEERING SOLUTIONS

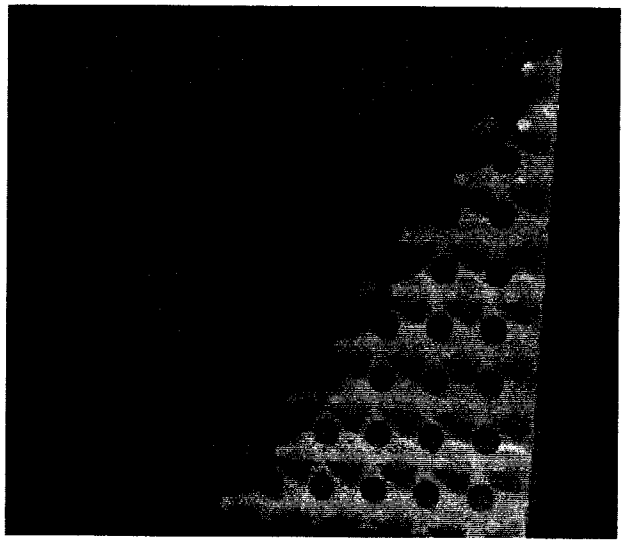
### Superior Subsurface Drainage

STRIPDRAIN™ Geocomposite Pavement Edge Drains combine a unique, high-density polyethylene core with a tight geo-textile wrap to create a self-contained edge drain that has proven itself extremely efficient in removing ground water on highway and runway projects across the United States.

STRIPDRAIN provides an effective alternative to complex aggregate drain and filter systems by providing soil filtration, high-flow capacity, high-compression resistance and long-term durability—in one prefabricated, pre-engineered, easy-to-install system.

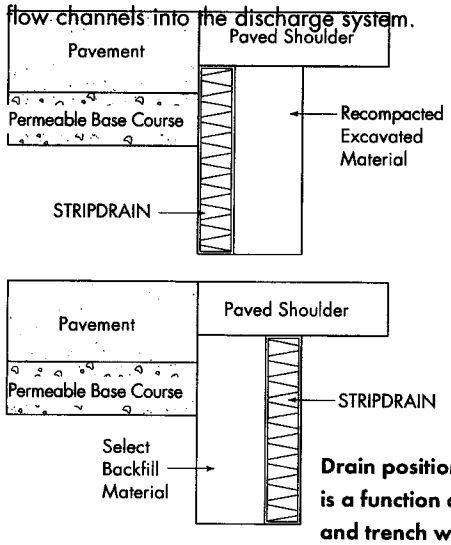
### Economical and productive

STRIPDRAIN installation is considerably faster and lower cost when compared to the commonly used aggregate drain and filter system. In a one-pass operation, a trencher can insert the STRIPDRAIN, backfill and compact the in situ soil. The traditional aggregate drain and filter system, while hydraulically effective, is complex. At the roadway's edge, wide trenches are dug and then lined with geosynthetic material. Next, perforated pipe is bedded within select aggregate. The time-consuming installation and materials can be up to 50% more costly than STRIPDRAIN.

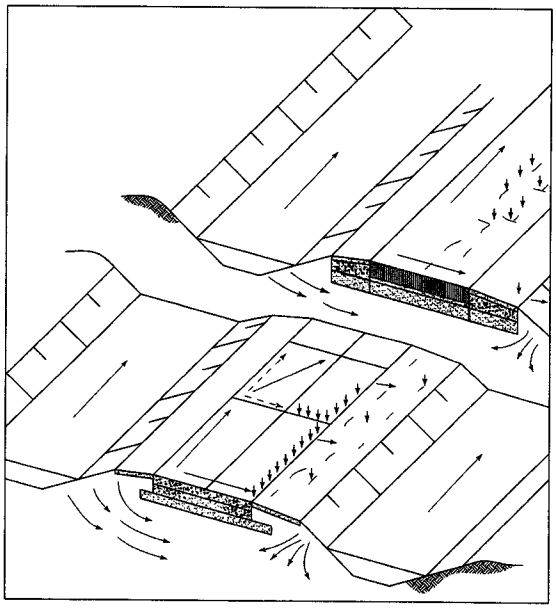


### High strength; high-flow capacity

STRIPDRAIN's high-density polyethylene (HDPE) core has pedestal-like cusps with high lateral stability that support the geotextile. The high strength of the core allows the flow channels to be maintained and provides resistance to deformation under static and dynamic highway loads. The tight geotextile overwrap is nonwoven and needle-punched, resulting in excellent low-head permittivity and effective filtration. It has been specifically engineered to reduce blinding and clogging. Water passes freely from the roadbase or soil through the geotextile and into the molded drain core, allowing gravity to draw the water through the flow channels into the discharge system.




**Drain position within the trench is a function of soil conditions and trench wall stability.**



**Points of water entry into highway pavement structural sections.**

**Research Confirms STRIPDRAIN's Superior Hydraulic Efficiency**

Compared with most geocomposite subdrainage systems, STRIPDRAIN offers a superior combination of quality construction and hydraulic performance. STRIPDRAIN's deep-formed, lightweight, corrosion- and chemical-resistant polymer core provides high strength and excellent in-plane flow capacity. The high-quality geotextile covering has been specifically developed for effective, long-term soil filtration. Together, these materials provide outstanding extended service even in the most difficult soils.

STRIPDRAIN 100 and STRIPDRAIN 80 have been thoroughly tested to provide satisfactory performance in a wide range of in-service conditions. STRIPDRAIN 100 with a minimum 8,000 psf (ASTM D1621) compressive strength provides a higher factor of safety for long-term performance under typical conditions, as well as the ability to perform satisfactorily under higher static and dynamic loads. It is suitable for critical installations such as **airport construction, heavy industrial applications** and wherever long-term performance under high in-service loads are desired.

STRIPDRAIN 80 with its minimum 6,000 psf (ASTM D1621) compressive strength provides the designer with an adequate factor of safety for long-term structural and in-plane flow performance under typical in-service highway loads (3,000 psf).

**Testing methods**

| Property | STRIPDRAIN 100 | STRIPDRAIN 80 | Test Method |
|---|---|---|---|
| **CORE** | | | |
| Composition | High-density polyethylene | High-density polyethylene | |
| Thickness | 1.0" | 1.0" | ASTM D5199 |
| Compressive strength at maximum 10% deflection | 8,000 psf | 6,000 psf | ASTM D1621 |
| Flow capacity (geotextile-wrapped core in soil environment) at 10 psi, i=0.10 | 15 gal./min./ft. width (min.) | 15 gal./min./ft. width (min.) | ASTM D4716 |
| Fungus resistance | No growth | No growth | ASTM G21 |
| Moisture absorption | <.05% | <.05% | ASTM D570 |
| **Geotextile (min. average roll values)** | | | |
| Grab tensile strength | 95 lbs. | 95 lbs. | ASTM D4632 |
| Grab elongation | 50% | 45% | ASTM D4632 |
| Trapezoidal tear | 40 lbs. | 40 lbs. | ASTM D4533 |
| Mullen burst | 180 psi | 180 psi | ASTM D3786 |
| Puncture | 45 lbs. | 45lbs. | ASTM D4833 |
| A.O.S. | 70-100 | 70-100 | ASTM D4751 |
| Water flow rate | 170 gal./min. per sq. foot | 170 gal./min. per sq. foot | ASTM D4491 |
| Coefficient of permeability | .20 cm/sec. | .20 cm/sec. | ASTM D4491 |
| **Standard roll dimensions** | | | |
| Widths | 12", 18", 24", 30" & 36" | 12", 18", 24", 30" & 36" | |
| Lengths | 150' & 400' | 150' & 475' | |

**Notes:**

(1) Flow data shown is based on laboratory tests conducted by the Georgia Institute of Technology and University and the University of Illinois.
(2) Flow tests conditions were in accordance with ASTM D4716.
(3) Minimum compressive strengths shown are the results of tests conducted in accordance with ASTM D1621. These recommended high compressive strengths (short-term test) are intended to provide adequate safety margins against the effects of long-term creep deformation and subsequent flow capacity reductions that my occur due to in-service highway loading conditions not covered by ASTM D1621 testing.
(4) Additional information is available from your CONTECH representative.

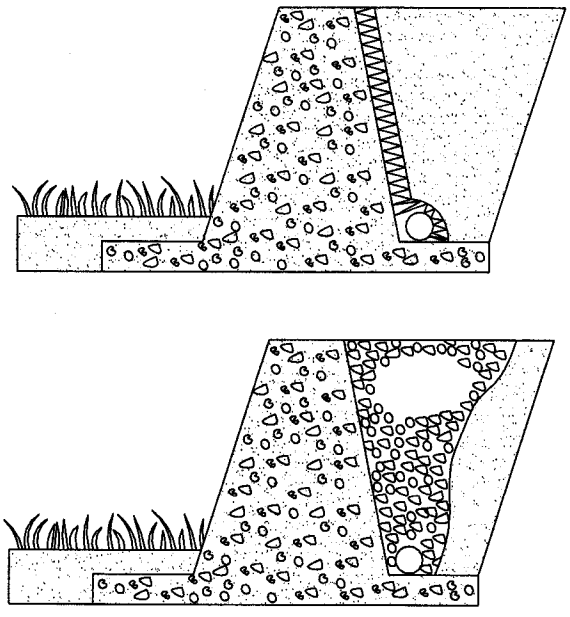
## STRIPDRAIN 75 for Retaining Walls, Bridge Abutments and Box Culverts

CONTECH's STRIPDRAIN 75 is designed especially for groundwater collection and seepage pressure relief on retaining walls, bridge abutments, box culverts and other subsurface structures constructed in soils prone to high water tables and/or high pore water pressure caused by insufficient natural drainage.

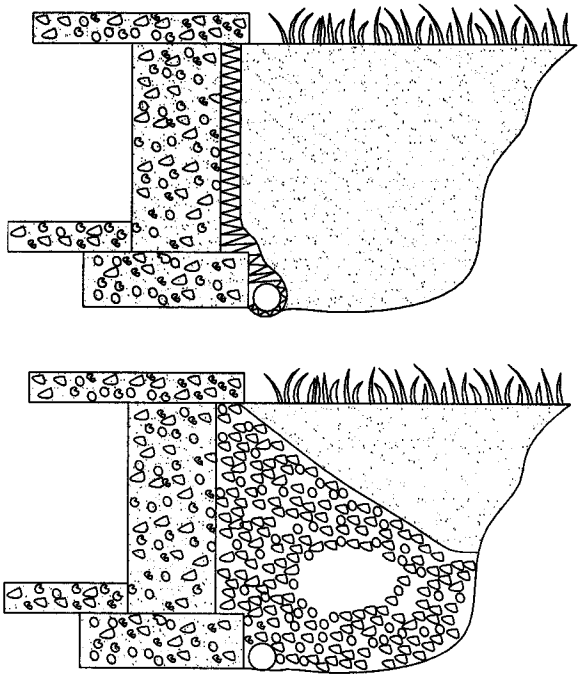
STRIPDRAIN 75 lets the water pass feely from the soil through the geotextile into the core channels, allowing gravity to draw the water through the flow channels to the outlet discharge point.

| Property | STRIPDRAIN 75 | Test Method |
|---|---|---|
| **CORE** | | |
| Composition | High-density polyethylene | |
| Thickness | .75" | ASTM D1777 |
| Compressive strength at maximum 10% deflection | 5,760 psf | ASTM D1621 |
| Flow capacity (geotextile-laminated core in soil environment) at 200 psf, i=1.0 | 13 gal./min./ft. width (min.) | ASTM D4716 |
| Fungus resistance | No growth | ASTM G21 |
| Moisture absorption | <.05% | ASTM D570 |
| **Geotextile (min. average roll values)** | | |
| Grab tensile strength | 95 lbs. | ASTM D4632 |
| Grab elongation | 50% | ASTM D4632 |
| Trapezoidal tear | 40 lbs. | ASTM D4533 |
| Mullen burst | 180 psi | ASTM D3786 |
| Puncture | 45lbs. | ASTM D4833 |
| A.O.S. | 70-100 | ASTM D4551 |
| Water flow rate | 170 gal./min. per sq. foot | ASTM D4491 |
| Coefficient of permeability | .20 cm/sec. | ASTM D4491 |
| **Standard roll dimensions** | | |
| Widths | 22" & 44" | |
| Lengths | 180' | |

**Note:** STRIPDRAIN 75 is available with a full geotextile overwrap (roll length equals 125 linear feet).



**Retaining Wall**



**Foundation**

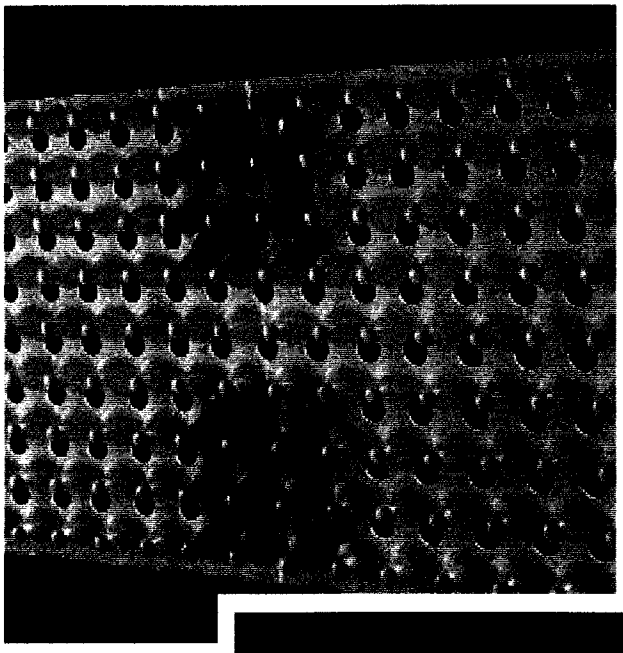
## The Complete Drainage System

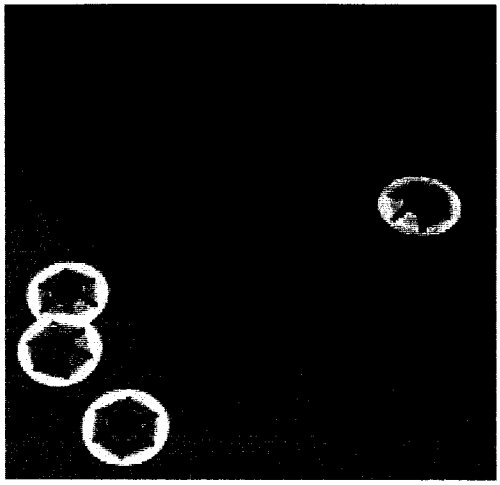
### Full line of dependable fittings

STRIPDRAIN Geocomposite Pavement Edge Drains have a full complement of fittings: End outlets for discharging the drain at the end of a run. And, side outlet fittings to maximize flow efficiency and system performance.

The snap-lock coupling creates a positive connection between sections—providing high resistance to joint pull-apart and planar alignment—to ensure efficient flow characteristics and soil-tight connections.

End outlet and side outlet fitting are molded with nominal four-inch-diameter plastic pipe outlet stubs for easy connection of the underdrain to the outlet pipe. The tapered design of the outlet fittings provide for more efficient discharge of water collected by STRIPDRAIN.





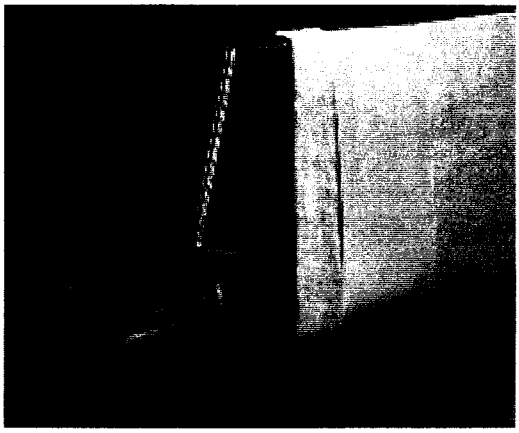
**The snap-lock coupling provides a smooth and positive joint to connect rolls of STRIPDRAIN Geocomposite Pavement Edge Drains for increased flow efficiency.**

### Outlet pipe design

A critical component of your pavement edge drain system is the outlet pipe. All outlet pipes must provide the following functions:

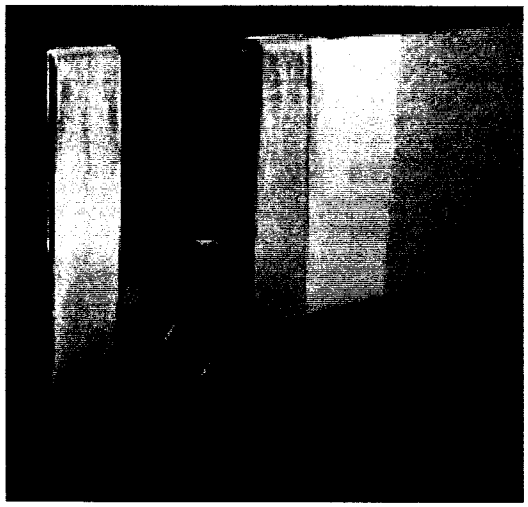
- Positive grade
- Soil-tight joint
- Resistance to deformation from installation and construction loads.

The "stiffness" of an outlet pipe will determine its ability to perform these functions. Pipe stiffness is measured by ASTM D2412. Field testing, simulation, and experience show that solvent welded plastic pipe with a pipe stiffness of 150 psi has the performance characteristics to perform these required functions.



**Standard End Outlet.**

**Side outlet tee fitting with tapered design doubles outlet flow efficiency.**



**Fast, Economical Installation**

STRIPDRAIN Geocomposite Pavement Edge Drains are self-contained, prefabricated systems that can be installed much faster than conventional trench/geotextile/aggregate/pipe subsurface drainage systems. Installation of up to 25,000 linear feet per day is possible with proper equipment because STRIPDRAIN greatly minimizes excavation, backfill and labor requirements.

Wheel-type trenchers are suitable for excavation and placement of STRIPDRAIN in pavement edge drain applications (trench width and depth varies by job condition). It is furnished in rolls that are unrolled along the open trench, placed in a vertical position against the pavement edge and then backfilled.

Some contractors install it with excellent results using modified trenching, backfilling and compacting equipment. For example, trenchers equipped with outriggers pick up the unrolled STRIPDRAIN, turn it vertically and feed it into the trench directly behind the trencher. A drag-type backfill blade can be attached to automatically backfill the trench in preparation for compaction. Ordinary vibratory compactors can be equipped with special shoes designed to fit the trench.

**Drain position within the trench**

The drain position within the trench is primarily dictated by the stability of the trench sidewalls. The vertical orientation of the drain should be maintained within the trench so that STRIPDRAIN can effectively function as both a collector and a conduit. The drain can be placed against either the pavement edge trench sidewall or the outside trench wall.

If sloughing of the pavement edge trench wall is occurring and would affect the vertical orientation of the drain, the drain should be placed against the outside trench wall, provided the verticality of the drain can be adequately maintained before and during backfill. In either case, the tips of the cuspations should face the trench wall and the backfill should be placed against the flat back of the drain.

STRIPDRAIN can be installed in the center of the trench, but care must be taken to maintain the verticality of the drain during backfill.

**Backfill practices**

Granular, well-graded materials are the most suitable backfill for STRIPDRAIN installations. The backfill must provide sufficient groundwater flow towards the STRIPDRAIN geocomposite drain yet restrict the movement of fine soil particles. Excessive movement of fine soil grains can result in particle accumulations on the STRIPDRAIN geotextile exterior and/or within its interior flow area, reducing drainage performance.

Consequently, backfill materials should be evaluated for suitability in a drainage role and for compatibility with the geotextile overwrap. Often, the excavated site soil is satisfactory backfill. In cases where select backfill material is required, STRIPDRAIN Geocomposite Pavement Edge Drains can still offer installation savings over conventional aggregate drain systems.

The backfill material (in situ or select) should be placed in a maximum of six-inch lifts and compacted to a minimum of 90 percent Proctor density. The backfill should be placed against the flat back of the drain and the verticality of the drain should be maintained during backfill.

The compaction equipment should be shielded from the drain and not be allowed to operate upon or come into contact with the drain. Excessive compaction efforts should be avoided so that the resulting drag-down forces do not damage or deform the drain.

**Performance and durability**

As with any product, proper installation is a must to ensure long-term performance. When installing STRIPDRAIN, correct alignment of the drain with the pavement profile, sufficient backfill compaction, proper coupling procedures to ensure pull-apart resistance and soil-tight fitting installation are essential.

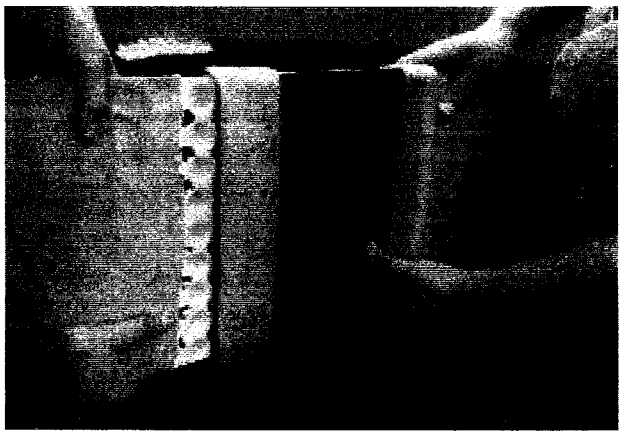
STRIPDRAIN Geocomposite Pavement Edge Drains are remarkably rugged and require no special handling at the jobsite. Although, certain common sense precautions should be observed when handling it. Avoid dragging rolls across rough surfaces to prevent geotextile damage. Avoid walking on STRIPDRAIN or placing heavy objects on it. Keep rolls wrapped until ready to install and do not expose to direct sunlight for more than 90 days.

If the geotextile is torn or damaged, it can be easily repaired. Simply tape over small areas or patch larger ones with the geotextile having a four-inch overlap.

Conventional trenching equipment with placement boot makes installation fast and economical.

Automated trenching equipment can quickly and effectively install STRIPDRAIN Geocomposite Pavement Edge Drains.

Easy assembly of fitting and use of waterproof tape help ensure long-term performance.



Soil-tight end outlet and side outlet fittings provide efficient discharge of ground water.
Back Page

**For more information, call one of CONTECH's Regional Offices:**

| | |
|---|---|
| Arkansas (North Little Rock) 72113 | 501-758-1985 |
| California (San Bernardino) 92408 | 909-885-8800 |
| Colorado (Denver) 80033 | 303-431-8999 |
| Georgia (Atlanta) 30071 | 770-409-0814 |
| Illinois (Chicago) 60523 | 630-573-1110 |
| Indiana (Indianapolis) 46250 | 317-842-7766 |
| Kansas (Kansas City) 66210 | 913-906-9200 |
| Massachusetts (Palmer) 01069 | 413-283-7611 |
| North Carolina (Raleigh) 27609 | 919-781-8540 |
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