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# SAFEGUARDS MEASUREMENT EVALUATION PROGRAM

## URANIUM AND PLUTONIUM SAMPLES EXCHANGE ANNUAL REPORT

NEW BRUNSWICK LABORATORY

## JANUARY–DECEMBER 2007

B. Srinivasan, Kattathu Mathew, Joseph Waggoner,
Usha Narayanan and Jon Neuhoff

U.S. DEPARTMENT OF ENERGY • OFFICE OF SCIENCE • CHICAGO OFFICE • ARGONNE, ILLINOIS

**U.S. DEPARTMENT OF ENERGY**

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**NEW BRUNSWICK LABORATORY**
9800 South Cass Avenue
Argonne, Illinois 60439

**JULY 2008**

NBL Home Page: www.nbl.doe.gov
NBL Internet Address: USDOE.NBL@CH.DOE.GOV
NBL Telephone Number: 630-252-2442
NBL Facsimile Number: 630-252-6256

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## NBL: HISTORY AND MISSION

The New Brunswick Laboratory (NBL) is owned and operated by the United States Department of Energy through the Office of Science (SC). NBL was established in 1949 as an analytical chemistry laboratory in New Brunswick, New Jersey to provide support to the United States Atomic Energy Commission. At that time, it was staffed by scientists from the National Bureau of Standards who had contributed significantly to nuclear material measurement programs in the Manhattan Project. At NBL, they provided the technical expertise and skills to solve problems related to quantitative analyses of uranium-bearing materials. Over the years, these scientists and others following them have expanded the capabilities of the laboratory to include chemical and mass spectrometric analyses of plutonium and other trans-uranium elements, research and development activities in chemical analyses techniques, preparation of certified reference materials, and operation of the nuclear safeguards measurement evaluation program. In 1977, the laboratory moved from New Jersey to its present location at the Argonne National Laboratory site in Illinois.

NBL's major mission is to provide technical assistance to the Department of Energy in the following areas: measurement evaluation program operation, certified (nuclear) reference materials preparation, measurement techniques development, and measurement services to domestic and international customers. In addition to fulfilling these tasks, the laboratory helps the Department in three other areas: conducting technical audits, resolving shipper/receiver differences in material transfers, and assisting in nuclear nonproliferation programs.

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**ACKNOWLEDGEMENTS**

The Safeguards Measurement Evaluation program is administered by the United States Department of Energy, Office of Science (SC). The authors of this annual report thank the following individuals for their contributions to the CY 2007 program: Richard Palczynski (DOE-CH), Ron Kuziel, Kevin Atto, Joel Catausan, Miguelito Domingo, Mark Jilek, Stephen Smith (all from Chickasaw Nation Industries), William Guthrie and Thomas Vetter (both from NIST), and Kimberly Johnson-Miller, Peter Mason, Frank Orlowicz, Glennda Orlowicz, Michael Soriano, Gary Sowell, Alma Stiffin, Albert Thomas, Stephan Vogt, Heidi Williams (all from NBL).

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## SUMMARY

The New Brunswick Laboratory (NBL) has been tasked by the United States Department of Energy, Office of Science (SC) to evaluate the quality of measurement results in nuclear materials accounting at the Department of Energy laboratories. Both destructive and non-destructive methods of analysis come under this purview. The destructive analyses results are evaluated in the Safeguards Measurement Evaluation (SME) Program, and the non-destructive analyses results in the Calorimetric Exchange (CALEX) Program. This report describes the activities in the SME program during calendar year (CY) 2007. A separate report has been prepared and issued for the CY 2007 CALEX program.

**Participants**: The following DOE laboratories participated in the CY 2007 SME program: Idaho National Laboratory, Los Alamos National Laboratory, New Brunswick Laboratory, Savannah River Site, and the Y-12 plant. The ABACC network laboratories (five laboratories in Argentina and four in Brazil), Nuclear Material Control Center in Japan, and URENCO Laboratory in England also participated.

**Test samples**: Four different types of uranium test samples were used in the CY 2007 program; uranyl nitrate solution (UNH), $UO_2$ pellets, $UO_3$ powder and $UF_6$. Note that plutonium test samples could not be sent this year since NBL plutonium laboratories were in "stand down" mode. The test samples were shipped to the participants and an analysis schedule was provided that specified the frequency and number of measurements to be made on each sample type.

All uranium test samples have been characterized earlier at NBL, except $UF_6$, for uranium concentration and uranium isotopes abundance. The $UF_6$ samples were made and characterized at the Portsmouth Gaseous Diffusion Plant. The measurement results were evaluated in comparison to the characterized values.

**Performance evaluation**: The SME program participants analyzed the test samples at the prescribed frequencies and as a part of their routine measurements. The analyses methods are shown in Table A. The measurement results were evaluated for accuracy, precision, bias and day-to-day variations. Performance evaluation reports were issued based on these evaluations.

**Table S1: CY 2007 SME program: Test samples analyzed and analyses techniques.**

| Lab Code | UNH | $UO_2$ | $UO_3$ | $UF_6$ |
|---|---|---|---|---|
| Uranium concentration analysis | | | | |
| A | IDMS, XRF | | | |
| B | D&G, IDMS | | | |
| F | D&G | D&G | D&G | |
| G | D&G | | | |
| T | | D&G | | |
| AB | D&G | | | D&G |
| AC | | D&G | | |
| AD | D&G | D&G | | |
| AE | | D&G | D&G | D&G |
| AW | IDMS | | | |
| BA | D&G | D&G | D&G | |
| BC | D&G | D&G | | |
| BF | | D&G | D&G | |
| EA | | | | D&G |
| | | | | |
| Uranium isotope abundance analysis* | | | | |
| A | TIMS | | | |
| B | TIMS | | | |
| F | TIMS | TIMS | TIMS | |
| T | TIMS | TIMS | | |
| AA | TIMS | TIMS | | TIMS |
| AW | TIMS | | | |
| BC | | TIMS | | GSMS |
| BE | ICPMS | ICPMS | | |
| EA | ICPMS | | | ICPMS |

*Isotopic abundance samples were natural uranium, low enriched or high enriched uranium.

**Safeguards Measurement Evaluation System (SMES):** The uranium measurement results were evaluated using the newly developed Safeguards Measurement Evaluation System **(**SMES) – a database for storing the measurement results and an evaluation system for statistical analysis of the results. Quality assurance to SMES was provided partly through comparison of the outputs of statistical evaluation reports from the new SMES as well as the old FoxPro based system.

**Measurement Evaluation Program Annual Meeting**: The Measurement Evaluation Program Annual Meeting was conducted on July 7, 2007 in Tucson, Arizona, a day prior to the start of INMM annual meeting at the same location. About thirty scientists/technicians attended the NBL meeting and presented seventeen technical papers. The meeting minutes was prepared and mailed to the attendees.

**ABACC workshops**: Two back-to-back workshops were held in August 2007, one in Argentina, and the other in Brazil. The workshops were of one week duration each and attended by about 20 scientists/technicians from each country. Subject matter experts from NBL were instructors. Hands-on training was provided in NBL modified method of Davies-Gray titration for uranium determination. Instructions needed for measurement uncertainty evaluations in Davies-Gray titration and thermal ionization mass spectrometry results were also provided. These instructions included hands-on training in using "Kragten" spread sheets for uncertainty estimations. The spread sheet - a simple and elegant software tool – based on an original work by Kragten was developed further by NIST statisticians to calculate uncertainties according to ISO guidelines. The spread sheets were given to the attendees free of charge. At these workshops, the attendees demonstrated the procedures of uranium analyses currently in use at their facilities using auto titrators and other semi-automated procedures.

**Technical presentations**: The NBL Standards and Evaluation Division staff attended scientific meetings and presented papers related to the measurement evaluation program:

a) Plutonium Metal Exchange Meeting, Los Alamos, New Mexico, June 2007. Two papers were presented; i) "Introducing the New Safeguards Measurement (SME) Program Database", and ii) "New ICPMS Instrumentation at NBL".

b) 48$^{th}$ INMM Annual Meeting, Tucson, Arizona, July 2007. One paper was presented. "New Brunswick Laboratory Measurement Evaluation Program: New Database Development".

c) American Chemical Society Meeting, Boston, Massachusetts, August 2007. One presentation on "Measurement Evaluation in Chronometry and Preparation of Chronometry Test Material Standards".

d) Conference on Nuclear safety and Nuclear Education, Obninsk, Russia, October 2007. One presentation on "Nuclear Material Sample Measurement Comparison and Performance Evaluation in Support of Nonproliferation Programs".

**Papers published:** Two technical papers were published in CY 2007.

a) "New Brunswick Laboratory Measurement Evaluation Program: New Database Development" in the proceedings of the INMM 48$^{th}$ annual meeting (appendix C).

b) "New Brunswick Laboratory Safeguards Measurement Evaluation Program: Operational Features" in the International Journal of Nuclear Knowledge Management (appendix D).

**NBL participation in other measurement evaluation programs**: NBL not only conducted its own SME program but also participated or planning to participate in measurement evaluation programs of other facilities.

a) Los Alamos Laboratory Plutonium Metal Exchange Program: A NBL staff attended the Plutonium Metal Exchange Workshop held in June 2007 in Los Alamos.

b) Brazilian Safeguards Measurement Evaluation Program: NBL will provide help to LASAL (Laboratorio de Salvaguardas in Rio de Janeiro) to set up their Measurement evaluation program for Brazilian laboratories. This work involves characterizing uranium oxide ($UO_2$) pellets of Brazilian origin for use as test samples in that program. Sampling and analyses plans were made and the pellets were analyzed for uranium concentration and uranium isotopic abundances.

c) Atomic Weapons Establishment Uranium Metal Exchange Program: NBL has agreed to participate in AWE uranium metal exchange program in CY 2008. Uranium metal samples of different levels of $^{235}U$ enrichments will be analyzed.

## A. INTRODUCTION

The New Brunswick Laboratory (NBL) is a nuclear material measurement laboratory of the U.S. Department of Energy (DOE) in the Office of Science (SC). An important aspect of NBL's mission is to conduct the measurement evaluation program, a program designed to provide independent verification of internal analytical quality control as practiced by DOE facilities in nuclear material accountability measurements.

The measurement evaluation program consists of two parts: the Safeguards Measurement Evaluation (SME) program for evaluating destructive analyses measurement results (e.g., titration, mass spectrometry) of uranium and plutonium bearing materials, and the Calorimetry Exchange (CALEX) program for evaluating non-destructive analyses measurement results (e.g., calorimetry and gamma ray spectrometry) of plutonium. This annual report describes the SME program activities in CY 2007. A separate report has been prepared and issued for the CALEX program.

## B. SAFEGUARDS MEASUREMENT EVALUATION PROGRAM

Material control and accountability measurements are essential elements of nuclear material safeguards. The accountability measurements are carried out either by destructive or non-destructive analyses. The methods must be capable of providing quantitative results within the acceptable limits of accuracy and precision. Large bias and/or poor precision compromise the ability to detect material loss in processing/by theft/by diversion.

In the SME program, the elemental and isotopic-abundance measurement results of uranium and plutonium test samples are evaluated for accuracy, precision, and conformity to method/material specific International Target Values (ITVs)[1]. These measurements are usually made as part of the routine analysis with full cognizance to internal quality control practices. If the results reveal inadequate performance (such as insufficient accuracy, poor precision, bias, day-to-day variation) then the laboratories are advised to make improvements. The usual remedial measures are measurement procedures review, implementing proper instrument calibration procedures, checking the validity of calibration and quality control standards, and re-training analysts.

[1] Aigner H., Binner R., Kuhn E. et al. International Target Values 2000 for Measurement Uncertainties in Safeguarding Nuclear Materials. International Atomic Energy Agency Report STR-327

## C. CY 2007 SAFEGUARDS MEASUREMENT EVALUATION PROGRAM

The activities and accomplishments of the CY 2007 SME program are described below. The information provided in this section is essentially the same as in the Summary section.

a) **Test samples**: Only uranium test samples were sent for analyses. The shipments suffered delays and pointed out the need to streamline NBL shipping procedures (packaging, preparation of shipping documents and finally shipping).

   Plutonium samples could not be sent because NBL plutonium laboratories were in "stand down" mode. The plutonium laboratories are expected to resume operation in CY 2009.

b) **Test samples analyses**: Sixteen laboratories participated in the CY 2007 SME program and analyzed uranium test samples for concentration and/or isotopes abundance (see Table S1 in Summary). Approved methods of analyses were used with full cognizance to internal quality control practices.

c) **Performance evaluation reports**: Measurement results were evaluated in comparison to the respective characterized values and performance evaluation reports were sent to the participants. In a number of cases, unacceptably long delays occurred between the submission of results and generation of evaluation reports, mainly due to insufficient help; part time help provided by two NBL statisticians was lost . Additional help was provided in late 2007 to catch up with the backlog and to operate the program in conformity to performance metrics; two chemists were assigned to the program to work part time in the program. With this help, the CY 2008 program is expected to register significant improvements – smoother shipping operations and shorter "turn-around" time for evaluation reports.

d) **Safeguards Measurement Evaluation System**: A new safeguards Measurement Evaluation System (SMES) - a combination of database and a statistical evaluation system - was developed by Chickasaw Nation Industries computer professionals (under DOE-CH contract). It replaces a similar but less efficient system based on FoxPro. The new SMES is web based and will allow participants to enter their own measurement

results and retrieve evaluation reports. The new system, when it becomes fully functional, is expected to cut down the "turn around" time for evaluation reports to two weeks or less.

Quality assurance tests for the new SMES were completed; privacy statements, risk assessment and security plan documents were submitted to the management for review and approval. Data stored in the FoxPro system were migrated to the new SMES. The new SMES is now ready for routine use.

CY 2007 measurement results were evaluated using the new SMES; data were entered manually by SME program staff and checked for data entry errors manually. In CY 2008 SME program participants in DOE laboratories will have direct access for data entry and retrieval of performance evaluation reports. International laboratories will be provided access at a later date.

e) **Measurement Evaluation Program Annual Meeting**: The Measurement Evaluation Program Annual Meeting was held in Tucson, Arizona on July 7, 2007, a day prior to the start of the 48$^{th}$ INMM Annual Meeting. About thirty scientists/technicians attended the meeting and presented seventeen technical papers. The minutes of the meeting was prepared and sent to the attendees. Holding the NBL meeting at the same location as the INMM meeting is proving to be cost-effective – savings in travel costs and marginal increase only in lodging cost (one more day of lodging).

f) **New test samples**: A new test sample of uranium oxide ($U_3O_8$) was made. This sample will be available for analysis in CY 2008 SME program.

g) **New participants**: Efforts were made to increase the number of participants in the SME program. At least four more laboratories are expected to join; two of these will be NRC laboratories in the U.S., and two others are outside the U.S.

h) **ABACC workshops**: Two back-to-back workshops were held in August 2007, one in Argentina, and the other in Brazil. The workshops were of one week duration each and attended by about 20 scientists/technicians from each country. Subject matter experts from NBL were instructors. Hands-on training was provided in NBL modified method of

Davies-Gray titration for uranium determination. Instructions needed for measurement uncertainty evaluations in Davies-Gray titration and thermal ionization mass spectrometry results were also provided. These instructions included hands-on training in using "Kragten" spread sheets for uncertainty estimations. The spread sheet - a simple and elegant software tool – based on an original work by Kragten was developed further by NIST statisticians to calculate uncertainties according to ISO Guide to The Expression of Uncertainty in Measurements. The spread sheets were given to the attendees free of charge. Note that a large portion of the course material on statistics and uncertainty estimations were obtained from William Guthrie and Thomas Vetter of NIST. The NBL instructors thank them for permission to use the NIST material in the two workshops.

At these workshops, the attendees demonstrated the procedures of uranium analyses currently in use at their facilities using auto titrators and others semi-automated procedures. The close interactions and technical exchanges with the attendees helped NBL to learn about the strengths and weaknesses in nuclear material measurement techniques as practiced in the ABACC network laboratories. The attendees were appreciative of the opportunity given to them to participate in the workshop. These types of assistance and interactions certainly promote goodwill among nations in the international safeguard programs.

i) **Brazilian Safeguards Measurement Evaluation Program**: NBL will provide help to LASAL (Laboratorio de Salvaguardas in Rio de Janeiro) to set up a Measurement Evaluation program for Brazilian laboratories. This collaborative work involves characterizing uranium oxide pellets made in Brazil for use as test samples in that program. The pellets were analyzed at NBL in early 2008. NIST statisticians are now evaluating the measurement results to define the uranium concentration and uranium isotopes abundances.

j) **Atomic Weapons Establishment (AWE) Laboratory Evaluation Program**: NBL has agreed to participate in CY 2008 AWE uranium metal exchange program. Depleted and enriched uranium metal samples will be analyzed for uranium concentration and uranium isotopes abundance.

k) **Los Alamos National Laboratory Plutonium Metal Exchange Program**: This year, NBL was unable to analyze plutonium metal samples of the LANL program. Until 2005, NBL contributed measurement results for plutonium assay by coulometry and plutonium isotopes by TIMS. It is expected that NBL will resume analyses of the exchange samples in CY 2009.

Peter Mason of the Standards and Evaluation Division represented NBL at the Plutonium Metal Exchange Workshop in Los Alamos, Mexico in June 2007. He presented two papers at the workshop: "Introducing the New Safeguards Measurement (SME) Program Database" and "New ICPMS Instrumentation at NBL".

l) **48$^{th}$ INMM Annual Meeting, Tucson, Arizona, July 2007**: Seven members of staff from NBL attended the 48$^{th}$ INMM annual meeting. One paper "New Brunswick Laboratory Measurement Evaluation Program: New Database Development by B. Srinivasan, Michael Soriano, Joseph Waggoner and Ron Kuziel" was presented at the meeting and was also published in the proceedings of the meeting (included as appendix C to this report). Joseph Waggoner (Standards Evaluation Division) made the oral presentation.

m) **American Chemical Society Meeting, Boston, Massachusetts**: An invited paper entitled "Measurement Evaluation in Chronometry and Preparation of Chronometry Test Material Standards by B. Srinivasan, Paul Croatto, Steve Goldberg, Usha Narayanan and Jon Neuhoff" was presented at the American Chemical Society Meeting in August 2007. Stephan Vogt (Standards Evaluation Division) represented NBL and presented the paper.

n) **Conference on Nuclear safety and Nuclear Education (Obninsk, Russia):** A paper on "Nuclear Material Sample Measurement Comparison and Performance Evaluation in Support of Nonproliferation Programs" was presented at the Obninsk meeting in October 2007. Kattathu Mathew (Standards Evaluation Division) represented NBL and presented the paper. The same paper with a modified title "New Brunswick Laboratory Safeguards Measurement Evaluation Program: Operational Features by B. Srinivasan, Kattathu Mathew, Paul Croatto, Usha Narayanan and Jon Neuhoff" was published in the International Journal of Nuclear Knowledge Management (included as appendix D to this report).

### C.1. SME Program Participants

DOE laboratories participation is mandated by the requirement in Chapter II.4.e. (7) of DOE Manual 474.1-1 of November 2000: *"Each facility's measurement control program must include participation in appropriate inter-laboratory control programs to provide independent verification of internal analytical quality control."* In addition to DOE laboratories, facilities outside the U.S. also participate on a voluntary basis with DOE approval. Table 1 lists the CY 2007 program participants.

**Table 1. CY 2007 SME Program Participants in Uranium Sample Analysis**

| |
|---|
| ABACC LABORATORIES (a group of laboratories in Argentina and Brazil) |
| IDAHO NATIONAL LABORATORY (DOE Contractor Laboratory) |
| LOS ALAMOS NATIONAL LABORATORY (DOE Contractor Laboratory) |
| NEW BRUNSWICK LABORATORY (DOE Laboratory) |
| SAVANNAH RIVER SITE (DOE Contractor Laboratory) |
| TOKAI SAFEGUARDS ANALYTICAL LABORATORY (Japan) |
| URENCO (Capenhurst) LTD (U.K.) |
| Y-12 Plant – BWXT LLC. (DOE Contractor Laboratory) |

### C.2. Materials and Measurement Methods

Table 2 shows the test samples used in the program for uranium concentration determinations and the methods of analyses. Table 3 shows the same type of information for uranium isotopes abundance measurements. The participants are identified by code letters to provide confidentiality.

**Table 2. Materials and methods used to evaluate uranium assay. The participating laboratories are identified by code letters only. Numbers next to codes refer to number of times the laboratory participated in the program. For example, B6 means laboratory B participated in the program six times during CY 2007.**

| Method | UNH Solutions | $UO_2$ Pellets | $UF_6$ | $UO_3$ Powder |
|---|---|---|---|---|
| **Dichromate Titration (Davies-Gray)** | AB6 AD1 BA2 BC1 B6 F4 G2 | AC2 AD1 AE1 BA3 BC2 BF1 F2 T2 | AB2 AE3 EA1 | AE2 BA2 BF2 F3 |
| **IDMS** | AW1 A2 B3 | | | |
| **XRF** | A2 | | | |

Notes: UNH, uranyl nitrate solutions. $UO_2$, uranium dioxide pellets. $UF_6$, uranium hexafluoride. $UO_3$, uranium oxide powder. IDMS, isotope dilution mass spectrometry. XRF, X-ray fluorescence.

**Table 3. Materials and methods used to evaluate uranium isotopic abundance measurements. The participant laboratories are identified by code letters only. Numbers next to codes refer to number of times the laboratory participated in the program. For example, BE5 means laboratory BE participated in the program five times during CY 2007.**

| Method | HEU | LEU |
|---|---|---|
| **TIMS** | A1 B3 F1 AW1 | AA6 BC1 A1 AW1 B3 F4 T3 |
| **ICPMS** | | BE5 EA3 |
| **GSMS** | | BC1 |

Notes. HEU is highly-enriched uranium containing ≥ 20 wt % $^{235}U$. LEU is low-enriched uranium containing < 20 wt % $^{235}U$. TIMS, thermal ionization mass spectrometry. ICPMS, inductively coupled plasma mass spectrometry. GSMS, gas source mass spectrometry.

### C.3. Test Materials, Shipping, and Analysis

**Test materials**: The SME Program test samples are made from Certified Reference Materials (CRMs) or Working Reference Materials (WRMs), or custom-made. The test samples are characterized for elemental concentrations and/or isotopic abundances, and the characterized values are used as reference values in evaluating measurement results submitted by SME program participants.

**Shipping test samples and analyses**: Test samples for a particular calendar year are shipped to participants in the last quarter of the previous year. CY 2007 sample shipments were delayed with concomitant reduction in participation frequency. The shipping procedures and operations are expected to be streamlined in CY 2008. NBL has hired a shipping specialist recently who is expected to provide the much needed help for on-time shipment of SME program samples.

### C.4. Database and Statistical Evaluation Programs

The measurement results submitted by the participating laboratories are entered manually into a SMES database and verified manually for data entry errors. The results are evaluated using the statistics application programs. Performance evaluation reports are sent to participant laboratories and their supervisory organizations.

In CY 2007, in a limited number of cases, measurement results were entered and evaluation reports generated using the new SMES and the older FoxPro® database/evaluation system. The double entry/double evaluations were done as a part of quality assurance tests for the new system.

### C.5. Statistical Evaluation of Measurement Results

The measurement results are evaluated using statistical techniques. First, the percent relative difference (% RD) of each experimental result is calculated with respect to the corresponding reference value, the latter obtained from characterization measurements. The % RD is defined as follows:

$$\% \text{ RD} = 100 \text{ X } \{(\text{observed value} - \text{reference value})/\text{reference value}\}.$$

Next, each set of % RDs is examined for outliers using a number of statistical tests. A particular result is identified as a potential outlying value if at least two of the statistical tests show it to be an "outlier" at ≥ 99 % significance level. The outliers are removed only after reviews by the statistician and/or the Measurement Evaluation Program Coordinator. The data set, without outliers, is then tested to identify significant sources of variation (attributable to day-to-day and/or analyst-to-analyst differences) using standard one-factor analysis of variance (ANOVA). If the ANOVA results indicate no significant variation, then the standard uncertainty is the simple standard deviation (σ) of the results divided by the square root of n, where n is the number of measurements. The coverage factor is the Student's 95 % "t" factor with n-1 degrees of freedom. For example, in a set of 8 results showing no day-to-day or analyst-to-analyst variation, the number of degrees of freedom is 7, and the coverage factor is 2.36.

If the ANOVA results indicate significant day-to-day and/or analyst-to-analyst variation (≥ 95 %), then the standard uncertainty in the mean % RD is estimated from a combination of the mean square for the "error" and the mean square for the "model" quantities from the ANOVA, with degrees of freedom determined from Satterthwaite's approximation. For measurements done on two days (or by two analysts), the formula for estimating the standard uncertainty in the mean % RD is reduced to the square root of the mean square for the "model" quantity obtained from ANOVA results. In this case, the coverage factor is 12.71 (i.e., the Student's 95 % "t" factor with one degree of freedom).

The uncertainties shown in the statistical reports are the 95 % confidence limit (C.L.) of means. In the figures accompanying the reports, the 95 % confidence interval (C.I.) of the mean is constructed from the C.L. Note that the C.I. represents the interval containing all values between the mean % RD minus the C.L. and the mean % RD plus the C.L. Thus, the 95 % C.L. of the mean are just the two end points of the C.I.

A measurement is considered to be bias-free if the 95 % C.I. included zero. Otherwise, measurement bias is indicated. The simple standard deviation (σ) of the % RDs represents the precision of the measurement results.

### C.6. Examples of Statistical Evaluation Reports

Two examples of the statistical analysis reports are shown in Figs.1 and 2, the former showing uranium assay results from Davies-Gray titration, and the latter from Isotope Dilution Mass Spectrometry (IDMS) measurements. There are 8 results in each set from analyses of two samples in duplicate and on two different days.

There are no outliers in Fig.1. There is no evidence for significant day-to-day variation; the statistical significance is 44.3 %. Note that variations are considered significant if they exceed 95 %, and marginally significant if the value is between 90 and 95 %. The mean % RD value is -0.154 and the 95 % C.L. uncertainty is 0.070, the latter calculated using a coverage factor of 2.36 corresponding to 7 degrees of freedom. The mean value extended by the confidence limit (-0.154 $\pm$ 0.070) does not include zero, thereby indicating negative bias in the measurements. The standard deviation (a measure of precision) of the results is 0.083.

There are no outliers in Fig. 2. However, there is evidence for significant day-to-day variation (statistical significance of 96.6 %). The mean % RD value is 0.015 and the uncertainty at 95 % C.L. is 1.319, the latter calculated using a coverage factor of 12.7 corresponding to 1 degree of freedom. The mean value extended by the confidence limit (0.015 $\pm$ 1.319) overlaps with zero, indicating no statistically-significant bias. But, this conclusion is not meaningful since the uncertainty is very large. The standard deviation (a measure of precision) of the results is 0.149.

The bias and precision International Target Values (ITVs) are shown at the bottom of the reports. These are referred to as u(s) and u(r) in the April 2000 draft of the “International Target Values 2000 for Measurement Uncertainties in Safeguarding Nuclear Materials”.

In Fig.1, the mean % RD of -0.154 is beyond the bias ITV of 0.1 %; the precision of 0.083 is within the precision ITV of 0.1 %. The measurement suffers from negative bias as seen in the evaluation result of (-0.154 $\pm$ 0.070). In Fig.2, the mean % RD of 0.015 is within the ITV of 0.1 %, and the precision of 0.149 is also within the ITV of 0.15 %. However, no conclusion is possible regarding bias because of the large estimated uncertainty in the measurement results (0.015 $\pm$ 1.319) - a consequence of day-to-day variation.

Statistical reports, similar to those shown in Figures 1 and 2, are generated for each set of results (material/method/analyses date specific reports). The reports are sent to the laboratories and to the supervisory organizations along with a performance evaluation letter stating the conclusions of the statistical reports. For DOE laboratories, the site offices are responsible for initiating action to bring about improvements if bias and/or precision in measurements are not within the respective target values. If needed, NBL will provide assistance through site visits, procedure reviews, and training sessions.

**Figure 1**

**SAMPLE DATA EVALUATION REPORT**

**No statistically significant difference due to analysis day**

U.S. Department of Energy
New Brunswick Laboratory
Safeguards Measurement Evaluation Program
Data Evaluation Report

**Day to Day ANOVA analysis**

Report for Laboratory: XX

U02 Pellet – U Concentration

Davies-Gray Titration

Date of Report: November 30, 2003

| Sample Number | Aliquant Number | Analysis Date | Reported %U | % Relative Difference | Analyst Code |
|---|---|---|---|---|---|
| 95EU0079-1 | 1 | 11/03/03 | 88.126 | -0.0034 | XXX |
| 95EU0079-1 | 2 | 11/03/03 | 87.990 | -0.1577 | XXX |
| 95EU0079-2 | 1 | 11/03/03 | 88.031 | -0.1112 | XXX |
| 95EU0079-2 | 2 | 11/03/03 | 87.892 | -0.2689 | XXX |
| 95EU0079-1 | 3 | 11/04/03 | 88.030 | -0.1123 | XXX |
| 95EU0079-1 | 4 | 11/04/03 | 87.950 | -0.2031 | XXX |
| 95EU0079-2 | 3 | 11/04/03 | 87.922 | -0.2349 | XXX |
| 95EU0079-2 | 4 | 11/04/03 | 88.002 | -0.1441 | XXX |

| | |
|---|---|
| **Number of Results Analyzed** | 8 |
| **Mean % Difference** | -0.154 |
| **Mean Absolute % Difference** | 0.154 |
| **95% C.L. of Mean (df = 7)** | 0.070 |
| **Standard Deviation** | 0.083 |
| **Between-Day Standard Deviation (df = 1)** | 0.054 |
| **Within-Day Standard Deviation (df = 6)** | 0.087 |
| **Statistical Significance of Between-Day Standard Deviation** | 44.3% |

**International target value for bias in Davies-Gray Titration is 0.1%.**

**International target value for precision in Davies-Gray Titration is 0.1%.**

**Figure 1 (cont.)**

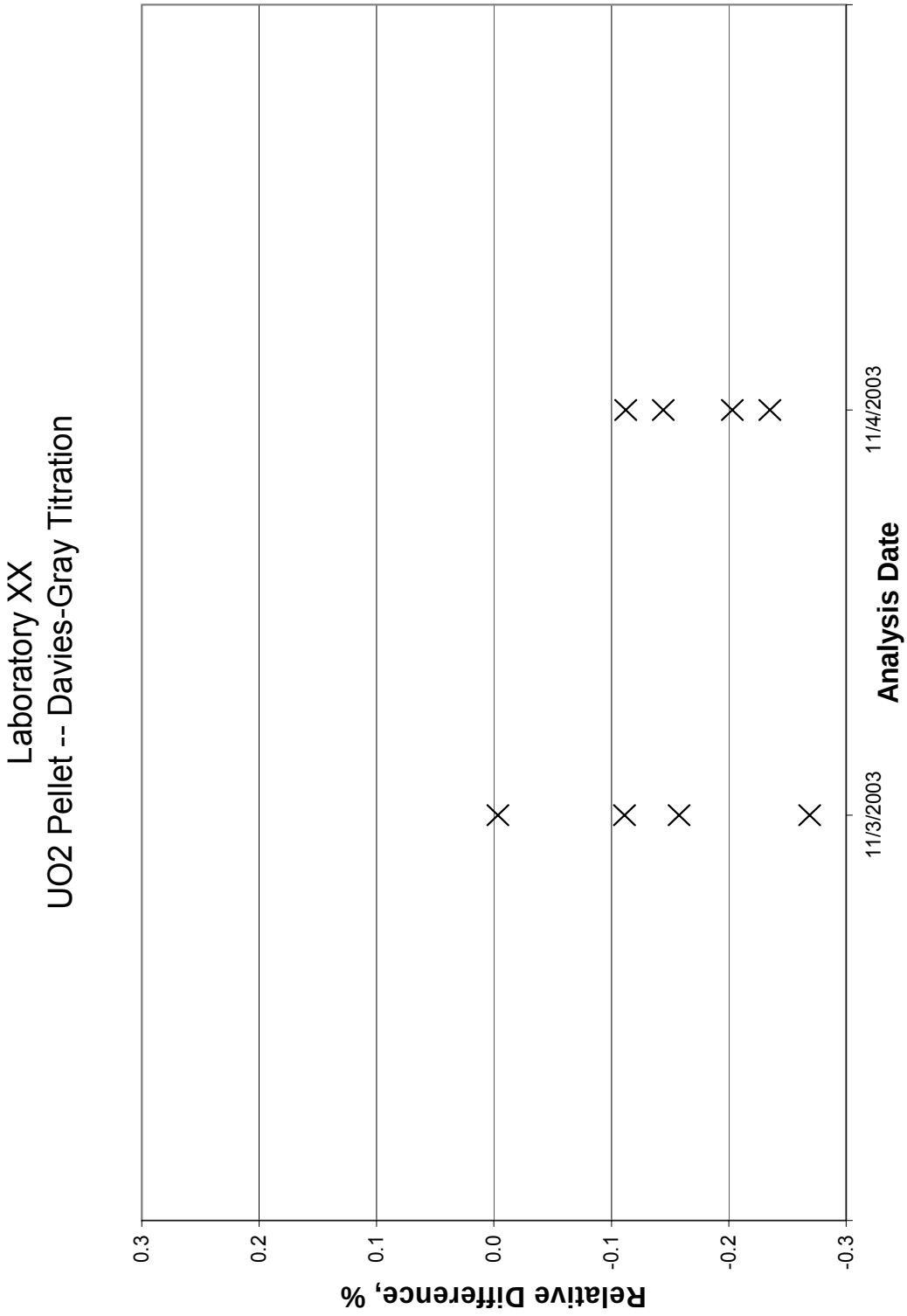


**Figure 2**

**SAMPLE DATA EVALUATION REPORT**

**Statistically significant difference due to analysis day**

U.S. Department of Energy
New Brunswick Laboratory
Safeguards Measurement Evaluation Program
Data Evaluation Report

**Day to Day ANOVA analysis**

Report for Laboratory: XX

UNH Solution – U Concentration

IDMS

Date of Report: November 30, 2003

| Sample Number | Aliquant Number | Analysis Date | Reported %U | % Relative Difference | Analyst Code |
|---|---|---|---|---|---|
| 94NU0021-023 | 1 | 11/03/03 | 1.0000 | -0.0590 | XXX |
| 94NU0021-023 | 2 | 11/03/03 | 1.0003 | -0.0290 | XXX |
| 94NU0023-079 | 1 | 11/03/03 | 0.9991 | -0.0080 | XXX |
| 94NU0023-079 | 2 | 11/03/03 | 0.9996 | -0.2582 | XXX |
| 94NU0021-023 | 3 | 11/04/03 | 1.0022 | 0.1609 | XXX |
| 94NU0021-023 | 4 | 11/04/03 | 1.0004 | -0.0190 | XXX |
| 94NU0023-079 | 3 | 11/04/03 | 1.0004 | 0.1221 | XXX |
| 94NU0023-079 | 4 | 11/04/03 | 1.0013 | 0.2122 | XXX |

| | |
|---|---|
| **Number of Results Analyzed** | 8 |
| **Mean % Difference** | 0.015 |
| **Mean Absolute % Difference** | 0.109 |
| **95% C.L. of Mean (df = 1)** | 1.319 |
| **Standard Deviation** | 0.149 |
| **Between-Day Standard Deviation (df = 1)** | 0.294 |
| **Within-Day Standard Deviation (df = 6)** | 0.107 |
| **Statistical Significance of Between-Day Standard Deviation** | 96.6% |

**International target value for bias in IDMS is 0.1%.**

**International target value for precision in IDMS is 0.15%.**

**Figure 2 (cont.)**

### C.7. SMES: Design Features and Availability to Users

SMES was developed by computer professionals from Chickasaw Nation Industries (contractor to DOE Chicago Office) and it will be maintained by them. The design features are shown in Section C.7.1.

#### C.7.1. SMES Design

- Modern technology: The SMES employs modern web-based technologies and uses a well supported modern database system (SQL).

- Modular programming: The SMES employs modular programming techniques and reusable code, and will be easy to maintain. The design allows for future expansions of the program, such as increase in the number of participants and evaluation of results from new methods of analyses.

- Java enterprise server architecture: SMES is designed around the Java 2 Enterprise Edition (J2EE) architecture. The system uses a dedicated J2EE Application Server.

- SQL database storage: SMES data is securely stored on an SQL database server for quick retrieval and updating of data; data backups are automated.

- Secure platform independent thin client: Laboratories will be able to enter their own measurement results to SMES via the Internet, eliminating the need to mail the data to NBL. SMES will support the most popular current web browsers with Secure Socket Layers (SSL) and will require no special browser add-ons.

- Role-based security: The system provides a number of access roles including those required for data entry, data validation and published report retrieval. SMES will provide access to participating laboratories and oversight agencies (e.g., DOE area office). Note that participant laboratories will have access only to their own data and reports.

- Security through the Web: SMES will provide secure access through the Internet by using User ID/passwords, role-based access and encryption with considerations of confidentiality of data submitted and reports generated.

- Historical Data: All historical data contained in the FoxPro® database will be migrated to SMES.

- Calculation Techniques: The time proven statistical analysis tools (e.g., outlier tests, calculation of mean and standard deviation of %RDs, tests to determine day-to-day and analyst-to-analyst variations, determination of 95% C.I. etc.) originally written for the FoxPro® application will be retained.

- Quality assurance/documentation: The DOE standards for software development, change control and quality assurance are incorporated in design and maintenance.

### C.7.2. SMES Availability

The SMES became available in CY 2007 for evaluating measurement results and generating statistical reports; only SME program staff had access to the system. In late 2007, documents related to privacy, risk assessment and security were prepared and submitted to management for review and approval. The approvals have been obtained. The system will be available in CY 2008 for DOE laboratory personnel to enter data and retrieve performance evaluation reports. Training will be provided by SME program staff.

## D. ANALYSES RESULTS AND REPORTING FORMAT

The uranium measurement results submitted by the participating laboratories in 2005-2007 are shown in Appendices A and B; results evaluated in the first quarter of CY 2008 but belonging to analyses in the last quarter of CY 2007 are also included. The evaluations of uranium concentration measurement results (also referred to as uranium assay results) are discussed in Section E.1 to E.4., and uranium isotopes abundance results in Section E.5. In these discussions, the laboratories are identified by code letters only.

The measurement results were evaluated in terms of mean % RD and the standard deviation of the mean % RD for each material/method/laboratory combination. Tables 4 to 12 show the code letters for the participants, the methods of analyses, the number of results (outliers removed), mean % RDs, standard deviations, bias target values and precision target values.

The % RDs and standard deviations shown in Tables 4 to 12 are also shown graphically in Figures 3 to 20. There are two types of figures: the material-measurement skeletal figures (odd numbers figures between Figure 3 and Figure 20) to evaluate bias, and the material-measurement line figures (even number figures between Figure 4 and Figure 20) to evaluate precision.

In the odd numbered figures, the mean % RDs are shown as diamonds. The vertical line represents the standard deviation. The bias target values are shown as dotted horizontal lines. If the diamonds (extended by the respective standard deviation of the results) fall within the horizontal lines, then the measurements are said to satisfy the bias target values; those falling outside fail. The magnitude of bias (if any) can be estimated only with reference to the mean % RD and its uncertainty as 95 % C.L. No bias is indicated if the mean % RD extended by the 95 % C.L. includes zero. If it fails to include zero, bias is indicated; above zero indicates positive bias and below zero indicates negative bias.

The even number figures between Figure 4 and Figure 20 show precisions achieved in the measurements. The vertical line represents the standard deviation associated with each set of mean % RDs. If the top of the vertical line is below the corresponding precision target value - shown as a dotted horizontal line - then the laboratory has satisfied the precision target value. If the vertical line extends beyond the dotted horizontal line, then the laboratory has failed the precision criterion. In these figures, the diamonds represent the absolute values of the mean % RDs. The measurements are assumed to be bias-free if the diamonds fall on the abscissa or very close to it. The magnitude of bias can be estimated only with reference to % RD taken in conjunction with uncertainty (as 95 % C.L.).

Figures 21 to 76 in Section F show evaluations of uranium assay and uranium isotopes abundance measurement results submitted during 2005-2007. Unlike Figures 3 to 20 where results from all laboratories are shown, the three year evaluation figures are laboratory specific.

## E. PERFORMANCE EVALUATION: MATERIAL BY MATERIAL

The uranium assay evaluations are discussed in Sections E.1 to E.4 and uranium isotopes abundance evaluations in Section E.5.

### E.1. Uranyl Nitrate Solutions

Test samples of uranyl nitrate solutions were made from both enriched uranium (> 0.7 % in $^{235}U$) and natural uranium. Three different types of uranyl nitrate solutions were made: one solution from 50 % enriched material, three solutions from 90 % enriched material, and three solutions from natural uranium. The uranium concentrations of these solutions were in the range of 7 to 10 mg uranium per gram of solution. The uranium contents of the three natural uranium solutions differed from each other by no more than 0.2 %. The uranium contents of the three solutions from 90 % material also differed from each other by not more than 0.2 %. These solutions, with closely-spaced but distinguishably different values for concentrations, are ideal samples to test accuracy and precision in uranium concentration measurements.

#### E.1.1. Preparation and Packaging for Shipment

The uranyl nitrate solutions were sent to participating laboratories in flame-sealed glass ampoules with break-off tips. Each ampoule was packed in a plastic bag. The bag was wrapped in absorbent cushioning material and sealed in another large plastic bag. The large bag was then kept inside a screw-cap fiberboard can for shipping.

#### E.1.2. Reference Value and Uncertainty

NBL used a modified Davies and Gray titration procedure to characterize the uranium concentrations of the test samples in the ampoules. The uncertainties (95 % C.L.) in uranium concentrations were as follows: ± 0.1 % for the 50 % enriched uranium solution, ± 0.02 % for the 90 % enriched uranium solutions, and in the range of ± 0.02 to ± 0.05 % for the natural uranium solutions.

A separate experiment demonstrated that the solutions did not suffer concentration change as a result of flame sealing. Samples withdrawn from sealed ampoules of natural uranium solutions and from the original stock, showed negligible differences between them; the uranium concentrations agreed within a few hundredths of one percent.

### E.1.3. Performance Evaluation

Seven laboratories determined the uranium concentrations of the test samples (uranyl nitrate solutions) using Davies & Gray titration; three laboratories used isotope dilution mass spectrometry (IDMS) and one laboratory used X-ray fluorescence (XRF).

The evaluation results are shown in Table 4, along with the target values for each method. Fig. 3 and Fig. 4 are graphical representation of results in Table 4.

| | |
|---|---|
| D& G results in conformity with bias target value: | Laboratories AB, AD, F, and G |
| D&G results in conformity with precision target value: | Laboratories AB, AD, BC, F, and G |
| D& G results non-conformity with bias target value: | Laboratories BA, BC, and B |
| D& G results non-conformity with precision target value: | Laboratories BA and B |
| | |
| IDMS results in conformity with bias target value: | Laboratories AW and A |
| IDMS results in conformity with precision target value: | Laboratory AW |
| IDMS results non-conformity with bias target value: | Laboratory B |
| IDMS results non-conformity with precision target value: | Laboratories A and B |
| | |
| XRF results in conformity with bias target value: | Laboratory A |
| XRF results in conformity with precision target value: | Laboratory A |

**Table 4. Inter-laboratory performance summary for uranium assay in UNH solutions**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| Davies & Gray Titration | AB | -0.071 | 0.079 | 48 | 0.1 | 0.1 |
| | AD | -0.056 | 0.062 | 12 | 0.1 | 0.1 |
| | BA | -0.433 | 0.443 | 36 | 0.1 | 0.1 |
| | BC | -3.949 | 0.062 | 24 | 0.1 | 0.1 |
| | B | 0.177 | 0.329 | 40 | 0.1 | 0.1 |
| | F | 0.037 | 0.067 | 32 | 0.1 | 0.1 |
| | G | -0.070 | 0.051 | 16 | 0.1 | 0.1 |
| IDMS | AW | -0.031 | 0.090 | 12 | 0.1 | 0.15 |
| | A | 0.059 | 0.357 | 16 | 0.1 | 0.15 |
| | B | -0.666 | 0.557 | 24 | 0.1 | 0.15 |
| X-Ray Fluorescence # | A | 0.235 | 0.268 | 16 | 0.5 | 0.5 |

# ITV's are not available for X-ray Fluorescence and are assumed to be same as DOE target values.

**Figure 3**

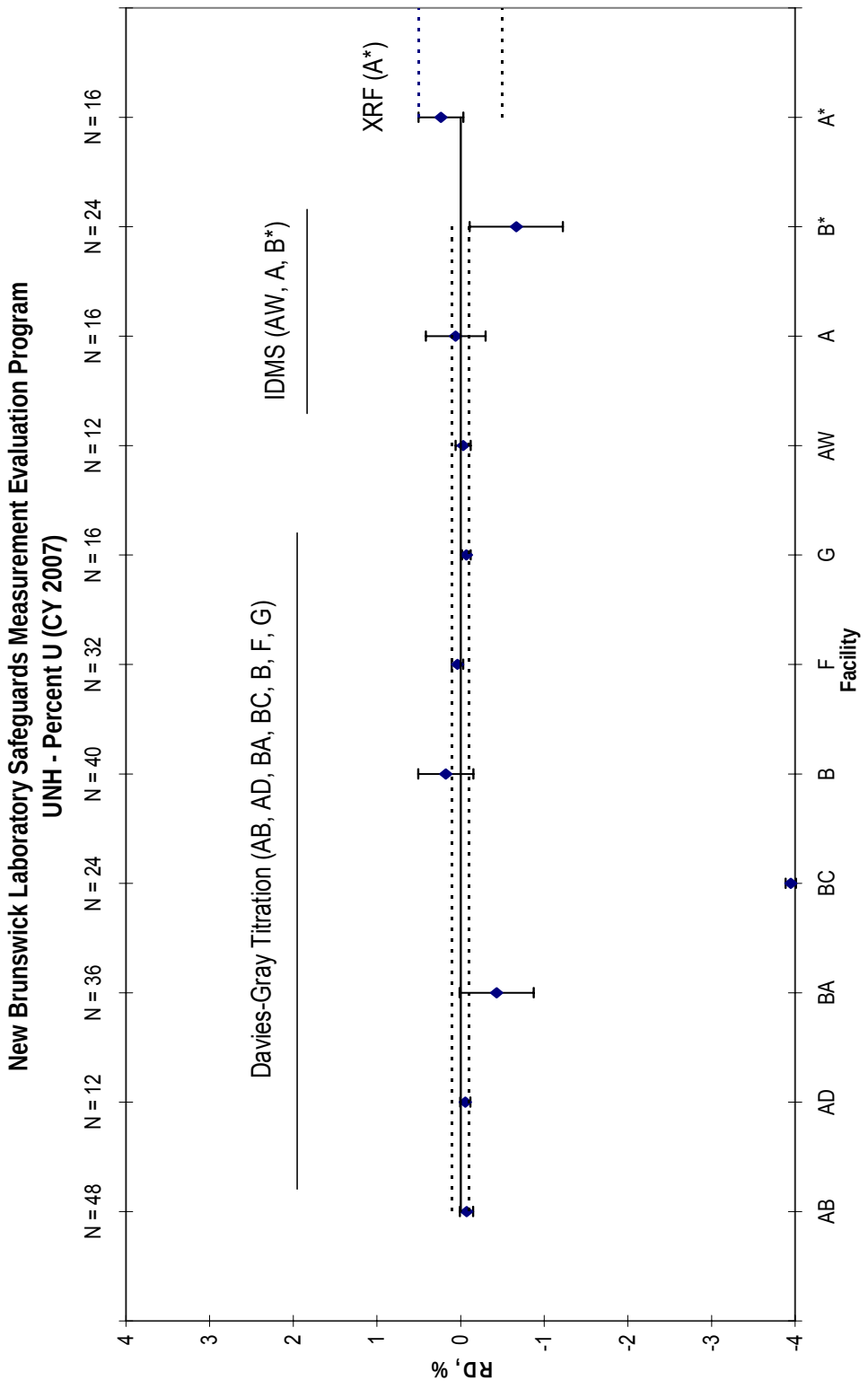
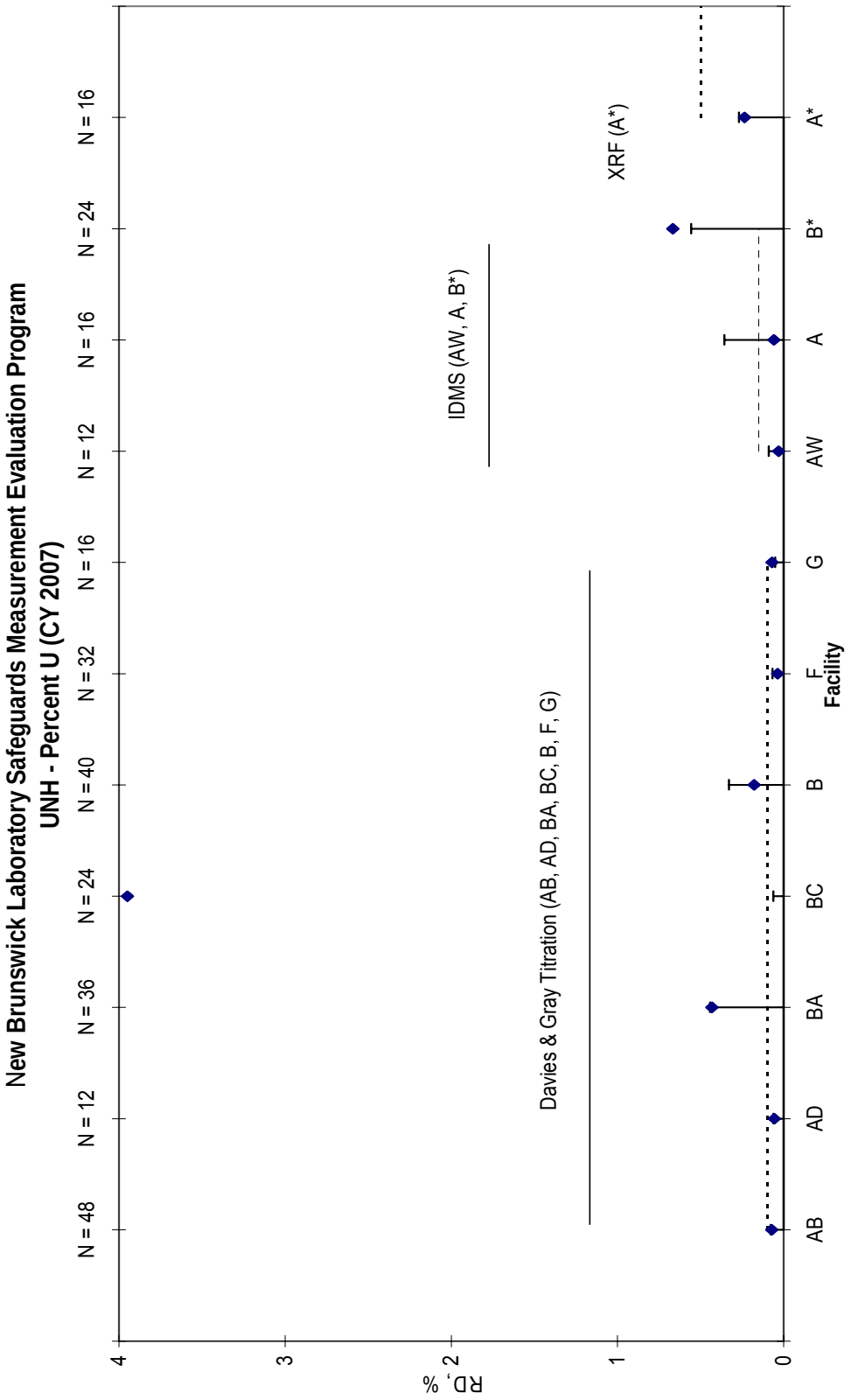

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U (CY 2007)
Davies-Gray Titration (AB, AD, BA, BC, B, F, G)
IDMS (AW, A, B*)
XRF (A*)
RD, %
Facility
N = 48
N = 12
N = 36
N = 24
N = 40
N = 32
N = 16
N = 12
N = 16
N = 24
N = 16
AB
AD
BA
BC
B
F
G
AW
A
B*
A*

**Figure 4**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U (CY 2007)
N = 48
N = 12
N = 36
N = 24
N = 40
N = 32
N = 16
N = 12
N = 16
N = 24
N = 16
RD, %
4
3
2
1
0
Davies & Gray Titration (AB, AD, BA, BC, B, F, G)
IDMS (AW, A, B*)
XRF (A*)
AB
AD
BA
BC
B
F
G
AW
A
B*
A*
Facility

### E.2. Enriched Uranium Dioxide ($UO_2$) Pellet

The uranium dioxide ($UO_2$) pellets were originally made in a single batch at the Westinghouse Commercial Nuclear Fuel Division (a NRC licensee), using a high temperature sintering process at 1700 °C for 20 hours in a reducing atmosphere. The $UO_2$ pellets are known to be stable. They suffer no compositional change on exposure to air and are resistant to moisture uptake. The pellets served as a test material for both uranium assay and uranium isotopic abundance measurements. The $^{235}U$ content is about 4.5 %.

#### E.2.1. Preparation and Packaging for Shipment

The $UO_2$ pellets were wrapped in low-lint tissue to prevent chipping, placed in snap-cap glass bottles, and the bottles sealed in plastic bags. The bottles were shipped in fiberboard cans.

#### E.2.2. Reference Value and Uncertainty

The elemental uranium concentration of the pellets was determined by the NBL high-precision titration method. A uranium metal assay standard was used for quality control and traceability. The uranium concentration was measured with an uncertainty (as 95 % C.L) of about ± 0.02 %.

#### E.2.3. Performance Evaluation

Eight laboratories analyzed the uranium dioxide pellets for uranium concentration using Davies-Gray Titration. The mean of % RDs along with uncertainties are shown in Table 5 along with the target values and also in Figs. 5 & 6.

| | |
|---|---|
| D& G results in conformity with bias target value: | Laboratories AC, AD, AE, BA, BC, BF, F and T |
| D&G results in conformity with precision target value: | Laboratories AC, AD, AE, BA, BF, F and A |
| D& G results non-conformity with bias target value: | None |
| D& G results non-conformity with precision target value: | Laboratory BC |

.

**Table 5. Inter-laboratory performance summary for uranium assay in $UO_2$ Pellets**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| Davies-Gray Titration | AC | -0.011 | 0.024 | 16 | 0.1 | 0.1 |
| | AD | -0.066 | 0.010 | 8 | 0.1 | 0.1 |
| | AE | -0.064 | 0.068 | 8 | 0.1 | 0.1 |
| | BA | -0.096 | 0.077 | 51 | 0.1 | 0.1 |
| | BC | 0.093 | 0.124 | 52 | 0.1 | 0.1 |
| | BF | -0.003 | 0.074 | 18 | 0.1 | 0.1 |
| | F | -0.007 | 0.041 | 27 | 0.1 | 0.1 |
| | T | 0.032 | 0.090 | 16 | 0.1 | 0.1 |

**Figure 5**

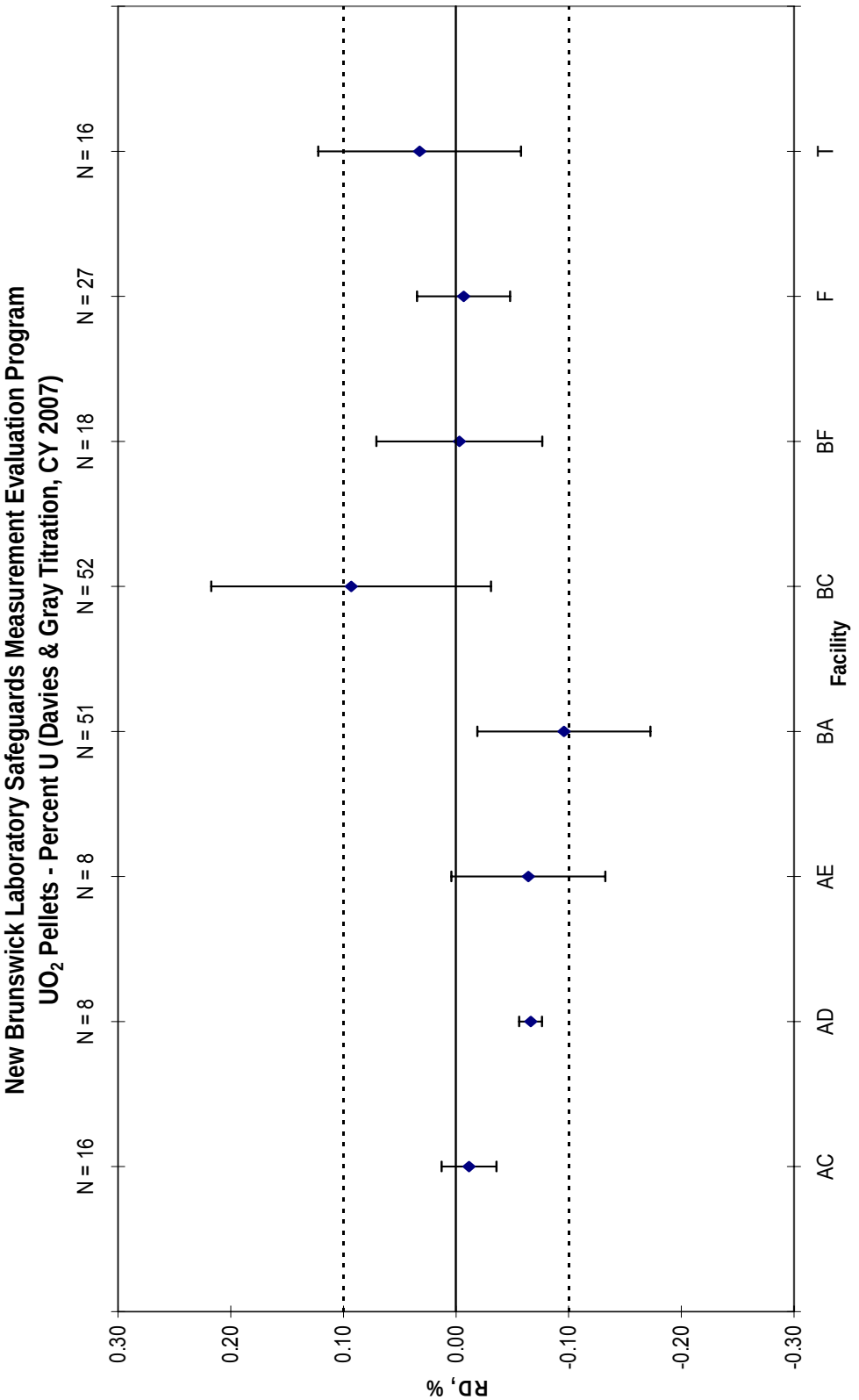
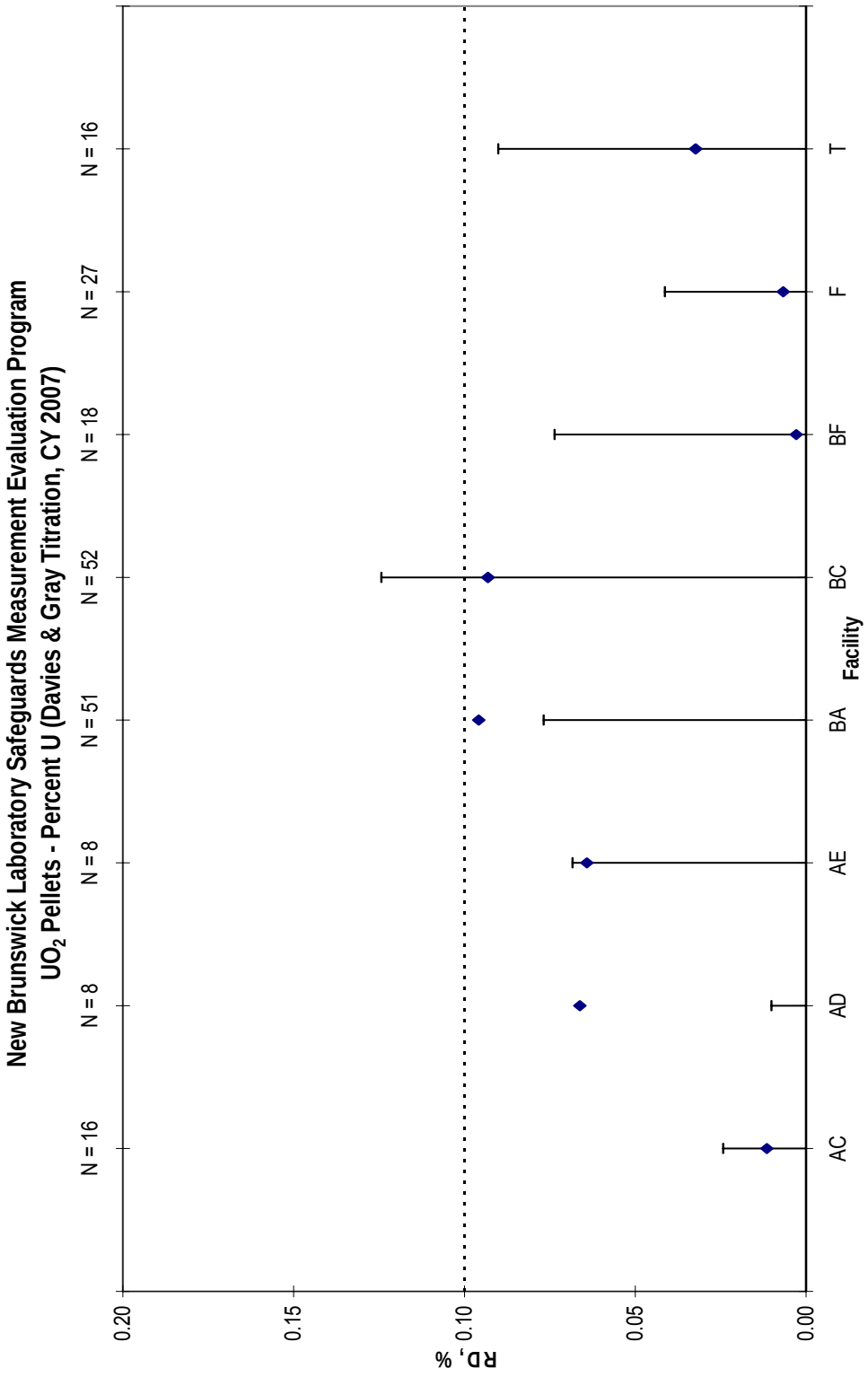

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U (Davies & Gray Titration, CY 2007)
N = 16
N = 8
N = 8
N = 51
N = 52
N = 18
N = 27
N = 16
AC
AD
AE
BA
BC
BF
F
T
Facility
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
RD, %

**Figure 6**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U (Davies & Gray Titration, CY 2007)
N = 16
N = 8
N = 8
N = 51
N = 52
N = 18
N = 27
N = 16
AC
AD
AE
BA
BC
BF
F
T
Facility
RD, %
0.20
0.15
0.10
0.05
0.00

### E.3. Uranium Hexafluoride ($UF_6$)

In FY 1993, Portsmouth Gaseous Diffusion Plant donated two sampling manifolds to NBL for transferring $UF_6$ from 2S cylinders to P-10 tubes. One of the two manifolds was used to transfer natural $UF_6$, and the other for enriched material. These manifolds have been taken out of service. Now, NBL is relying on Portsmouth Gaseous Diffusion facility for the preparation of SME test samples. The $UF_6$ samples analyzed this year were made by Portsmouth.

#### E.3.1. Preparation and Packaging for Shipment

The Portsmouth Gaseous Diffusion facility prepared and packaged $UF_6$ test samples in P-10 tubes Each test sample contained 7 to 12 g of $UF_6$.

#### E.3.2. Reference Value and Uncertainty

The $UF_6$ test samples used in the SME Program since October 2004 were not characterized for assay because of the "stand down" of laboratory activities at NBL. Calculated values (based upon the assumption of 100 % purity) were used instead. Characterized isotopic values were based upon Portsmouth data which were verified at NBL using gas source mass spectrometry (GSMS).

#### E.3.3. Performance Evaluation

Three laboratories reported results for uranium assay in $UF_6$ using Davies-Gray Titration. The mean of % RDs along with uncertainties are shown in Table 6 and also in Figs.7 & 8. Laboratories AB and EA were in conformity with both bias and precision target values. Laboratory AE was in conformity with precision target value but missed the bias target value.

**Table 6. Performance summary for uranium assay in $UF_6$**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| Davies-Gray Titration | AB | -0.050 | 0.048 | 12 | 0.1 | 0.1 |
| | AE | -0.152 | 0.094 | 16 | 0.1 | 0.1 |
| | EA | -0.079 | 0.036 | 8 | 0.1 | 0.1 |

**Figure 7**

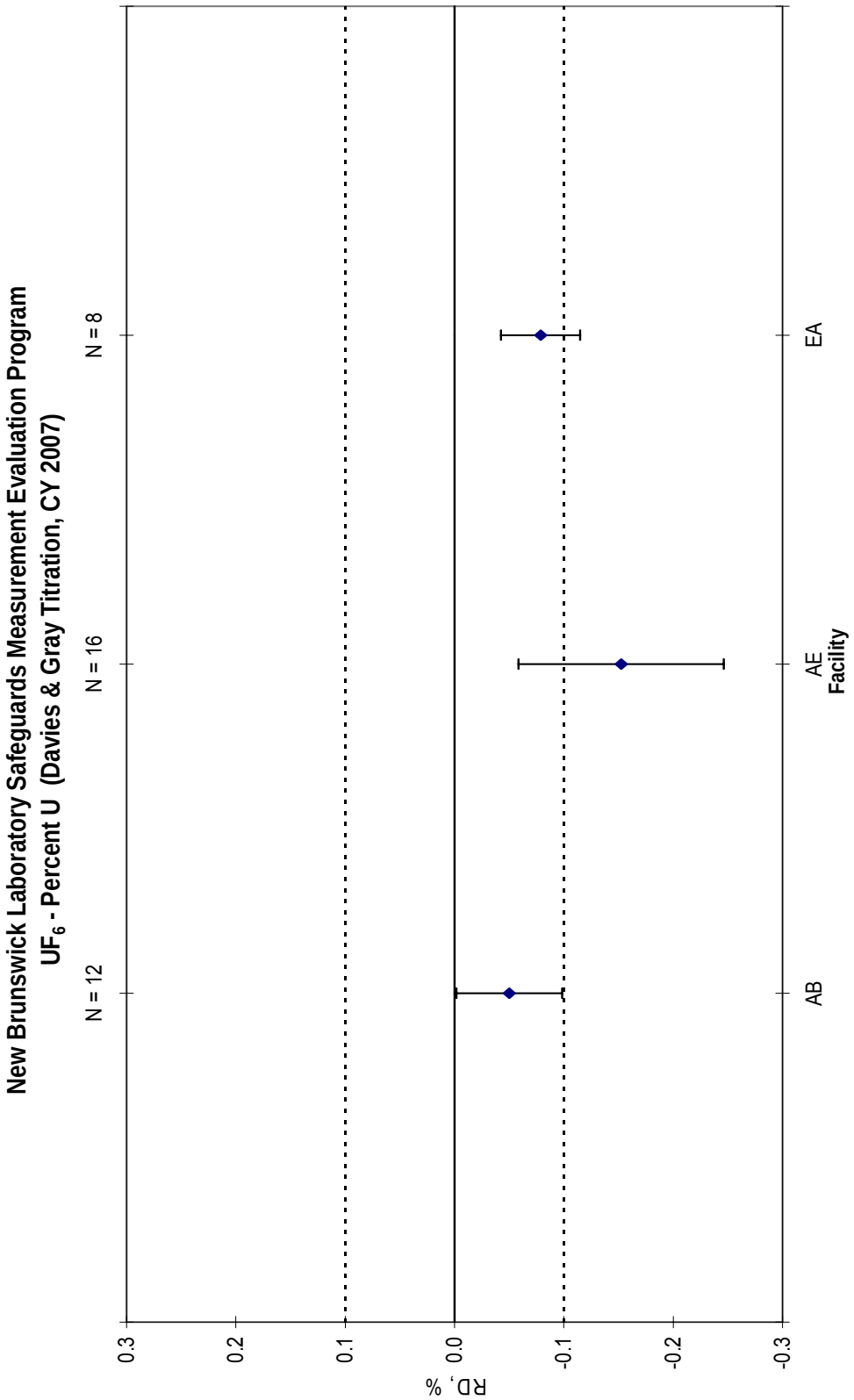
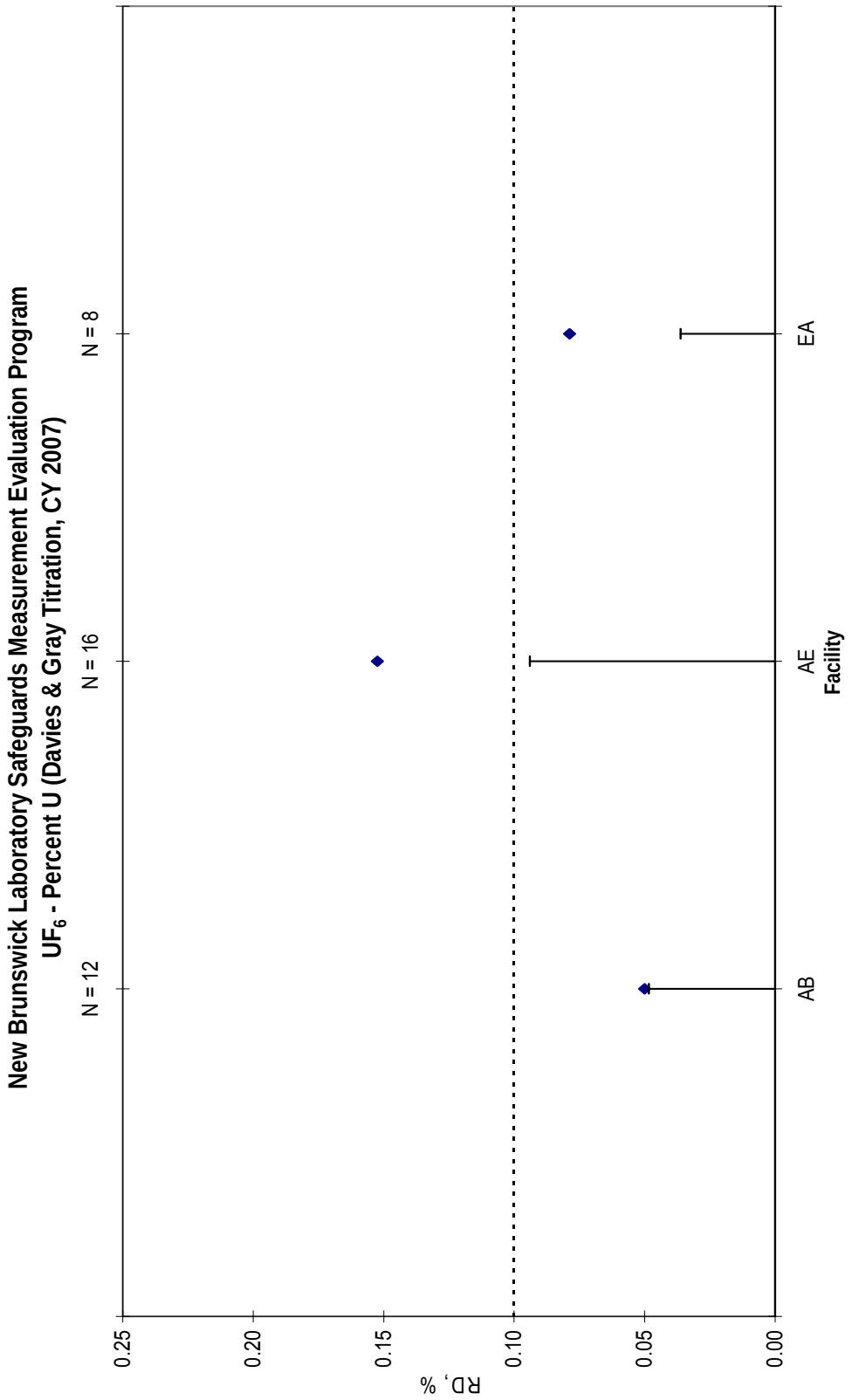

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U (Davies & Gray Titration, CY 2007)
N = 12
N = 16
N = 8
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
RD, %
AB
AE
EA
Facility

**Figure 8**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U (Davies & Gray Titration, CY 2007)
N = 12
N = 16
N = 8
0.25
0.20
0.15
0.10
0.05
0.00
RD, %
AB
AE
EA
Facility

### E.4. Uranium Oxide ($UO_3$) Powder

$UO_3$ powder is an ideal test material to monitor the capability of a laboratory in analyzing hygroscopic materials. It was used as a test material several years ago, but was discontinued for sometime in between because of a perceived lack of interest in this material. A few years ago, it was re-introduced as a test material at the request of a participant laboratory. Four different laboratories analyzed $UO_3$ powder in CY 2007.

#### E.4.1. Preparation and Packaging for Shipment

The test samples come from preparations done several years ago; they were packaged under dry nitrogen atmosphere into pharmaceutical vials with Teflon-lined stoppers. The vials were crimp sealed, then sealed in plastic, and packaged in cardboard tubes for shipping.

#### E.4.2. Reference Value and Uncertainty

The elemental concentration of uranium in $UO_3$ material was characterized through analysis of 8 different samples using the NBL-modified Davies and Gray titration method. Quality control and traceability were provided through analysis of CRM 112-A (a uranium metal assay standard). The uranium content of the test samples differed from the original value by about 0.064 %, the new value being lower. The uncertainty (95 % C.L.) in the new measurements was 0.012 %. Apparently, the concentration of uranium in the $UO_3$ material was not altered to a significant extent.

#### E.4.3. Performance Evaluation

Four laboratories analyzed the $UO_3$ test samples for uranium concentration using Davies & Gray method. The mean % RDs along with uncertainties are shown in Table 7 and also in Figs.9 & 10. Laboratories AE, BF and F were in conformity with both bias and precision target values; laboratory BA met the precision target value but missed the bias target value.

A fifth laboratory reported difficulties in analyzing the $UO_3$ samples. They suspected that moisture uptake might have compromised the integrity of the test samples. They requested NBL to redo the characterization experiments and provide a procedure for analyzing the samples for uranium concentration on a moisture-free basis. These experiments were done at NBL in CY 2007 with inconclusive results (see Section F).

**Table 7. Inter-laboratory performance summary of uranium assay in $UO_3$**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| Davies-Gray Titration | AE | -0.047 | 0.049 | 16 | 0.1 | 0.1 |
| | BA | -0.165 | 0.098 | 44 | 0.1 | 0.1 |
| | BF | -0.009 | 0.097 | 16 | 0.1 | 0.1 |
| | F | -0.082 | 0.070 | 80 | 0.1 | 0.1 |

**Figure 9**

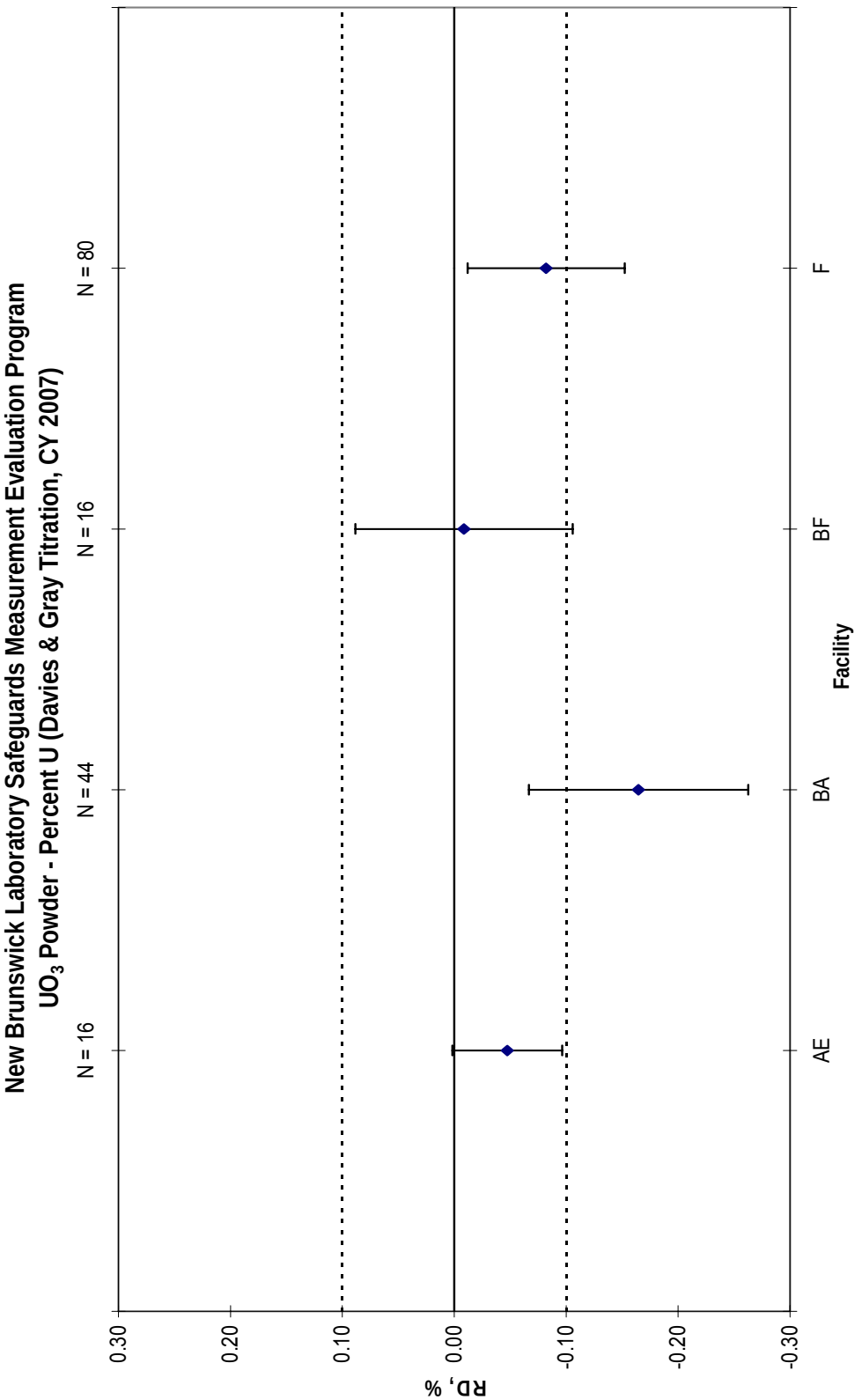
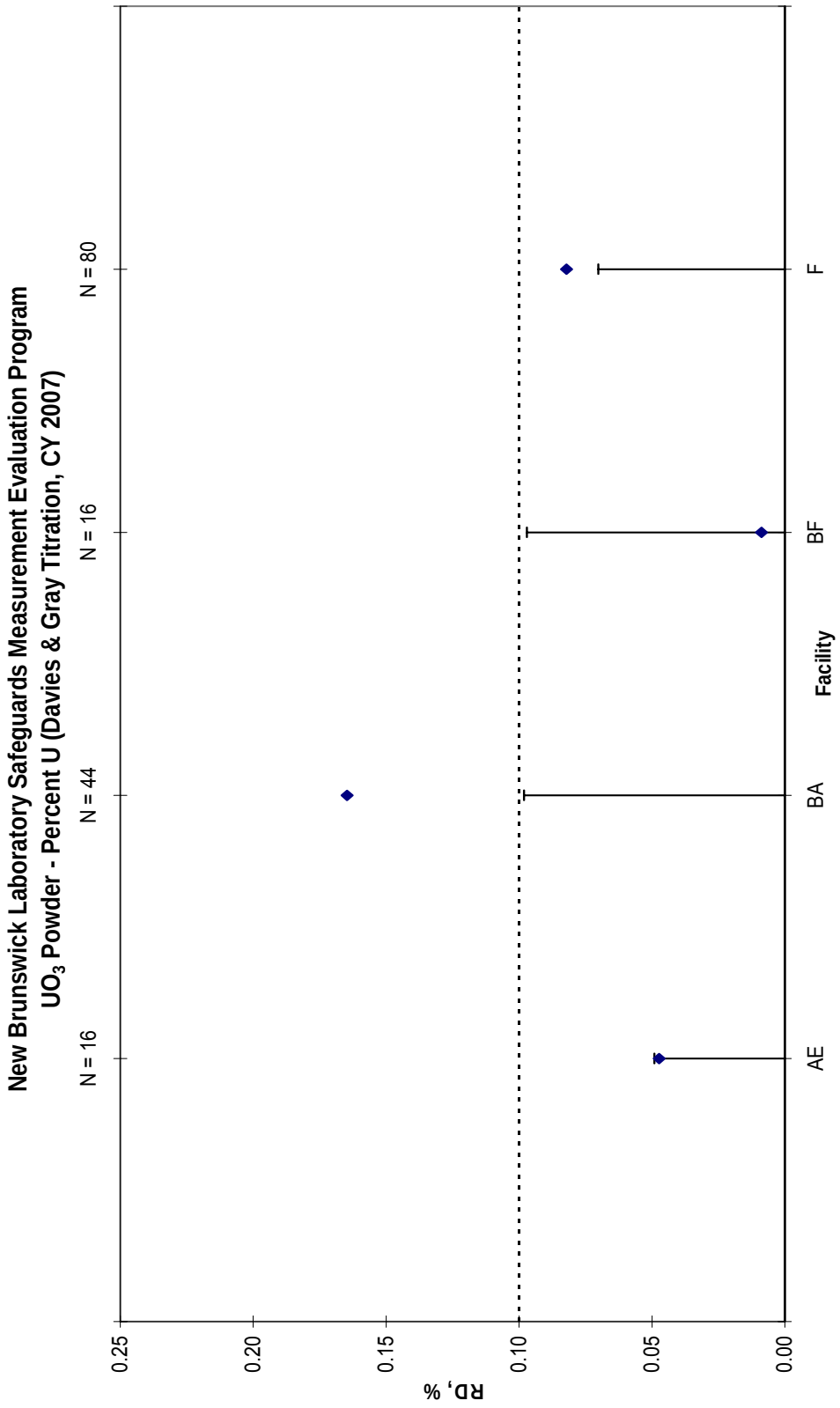

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U (Davies & Gray Titration, CY 2007)
N = 16
N = 44
N = 16
N = 80
AE
BA
BF
F
Facility
RD, %
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30

**Figure 10**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U (Davies & Gray Titration, CY 2007)
RD, %
0.25
0.20
0.15
0.10
0.05
0.00
N = 16
N = 44
N = 16
N = 80
AE
BA
BF
F
Facility

### E.5. $^{235}$U Enrichment

Both high and low enriched uranium test samples are available for evaluating isotopic abundance results. Highly-enriched Uranium (HEU) test samples include three uranyl nitrate solutions with 90 % enrichment, and one uranyl nitrate solution with 50 % enrichment. Low-Enriched Uranium (LEU) samples comprise one uranyl nitrate solution with 4 % enrichment, solid $UO_2$ pellets of about 4 % enrichment, hydrolyzed $UF_6$ of about 4.5 % enrichment, $UO_3$ powder of about 0.9% enrichment, and several $UF_6$ samples with varying levels of enrichment.

#### E.5.1. Preparation and Packaging for Shipment

The uranyl nitrate solutions were packaged in flame-sealed glass ampoules with a break-off tip. The ampoules were sealed in plastic, wrapped in absorbent cushioning, sealed in plastic again, and packaged in cardboard tubes for shipping. Each solution contained 5 to 10 mg uranium/g solution.

The $UO_2$ pellets were packaged in a snap-cap glass bottle with a low-lint tissue for cushioning to prevent chipping. The glass bottles are sealed in plastic, and packaged in cardboard tubes for shipping.

The $UO_3$ powder samples were packaged under dry nitrogen atmosphere in pharmaceutical vials with Teflon-lined stoppers. The vials were crimp sealed, then sealed in plastic, and packaged in cardboard tubes for shipping.

The $UF_6$ test samples in P-10 tubes were packed in sealed plastic bags and shipped in cardboard containers with screw caps.

#### E.5.2. Reference Value and Uncertainty

The uranium isotopic abundances in the UNH, $UO_2$, and $UO_3$ test materials were characterized by thermal ionization mass spectrometry (TIMS). The experimental results were corrected for mass fractionation effects. The correction factors were determined through analyses of appropriate Certified Reference Materials performed under the same conditions as the test materials.

$UF_6$ material was characterized by TIMS and/or gas source mass spectrometry (GSMS). The TIMS measurements required hydrolyzed $UF_6$ samples, and GSMS measurements were made on $UF_6$ itself.

The uncertainties (95 % C.L.) in $^{235}U$ abundance by TIMS were as follows: 0.02 % for the 4 % enriched uranyl nitrate solution; < 0.01 % for the 50 % and 90 % enriched solutions; 0.07 % for $UO_2$ pellets; and 0.053 % for $UF_6$. The uncertainties for the uranyl nitrate solutions did not include the uncertainties in determining the mass fractionation correction factors, whereas the uncertainties in $UO_2$ and $UF_6$ included mass fractionation correction factor uncertainties.

### E.5.3. Performance Evaluation

**Low enriched UNH solutions**: Six laboratories analyzed the UNH solutions (LEU) via thermal ionization mass spectrometry (TIMS) and two laboratories analyzed via ICPMS. The % RDs along with uncertainties are shown in Table 8 and also in Figs. 11 & 12. Note that international target values are available for TIMS measurements only; the ICPMS target values are assumed to be the same as TIMS.

| | |
|---|---|
| TIMS/ICPMS results in conformity with bias target value: | Laboratories A, F, T and EA |
| TIMS/ICPMS results in conformity with precision target value: | Laboratories A, F, T and EA |
| TIMS/ICPMS results non-conformity with bias target value: | Laboratories AA, AW, B, and BE |
| TIMS/ICPMS results non-conformity with precision target value: | Laboratories AA, AW, B, and BE |

**Table 8. Inter-laboratory performance summary for $^{235}U$ enrichment in LEU materials**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| TIMS | AA | -0.119 | 0.131 | 20 | 0.1 | 0.1 |
| | A | 0.026 | 0.068 | 8 | 0.1 | 0.1 |
| | AW | 0.113 | 0.137 | 3 | 0.1 | 0.1 |
| | B | 0.102 | 0.152 | 20 | 0.1 | 0.1 |
| | F | -0.005 | 0.026 | 12 | 0.1 | 0.1 |
| | T | 0.029 | 0.019 | 8 | 0.1 | 0.1 |
| ICPMS # | BE | -1.009 | 1.230 | 32 | 0.1 | 0.1 |
| | EA | -0.009 | 0.023 | 8 | 0.1 | 0.1 |

# ITV's are not available for ICPMS and are assumed to be the same as those for TIMS.

**Figure 11**

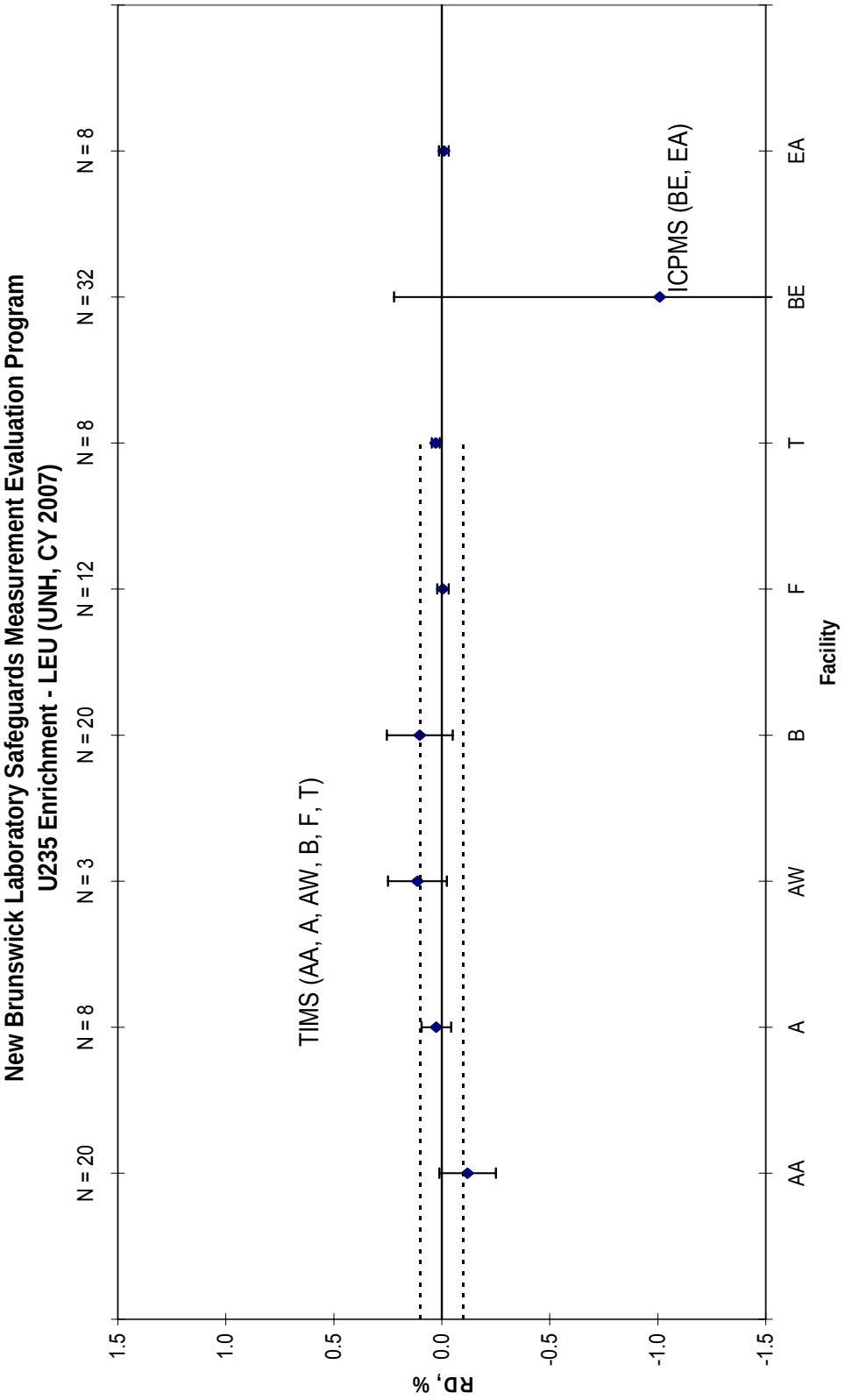
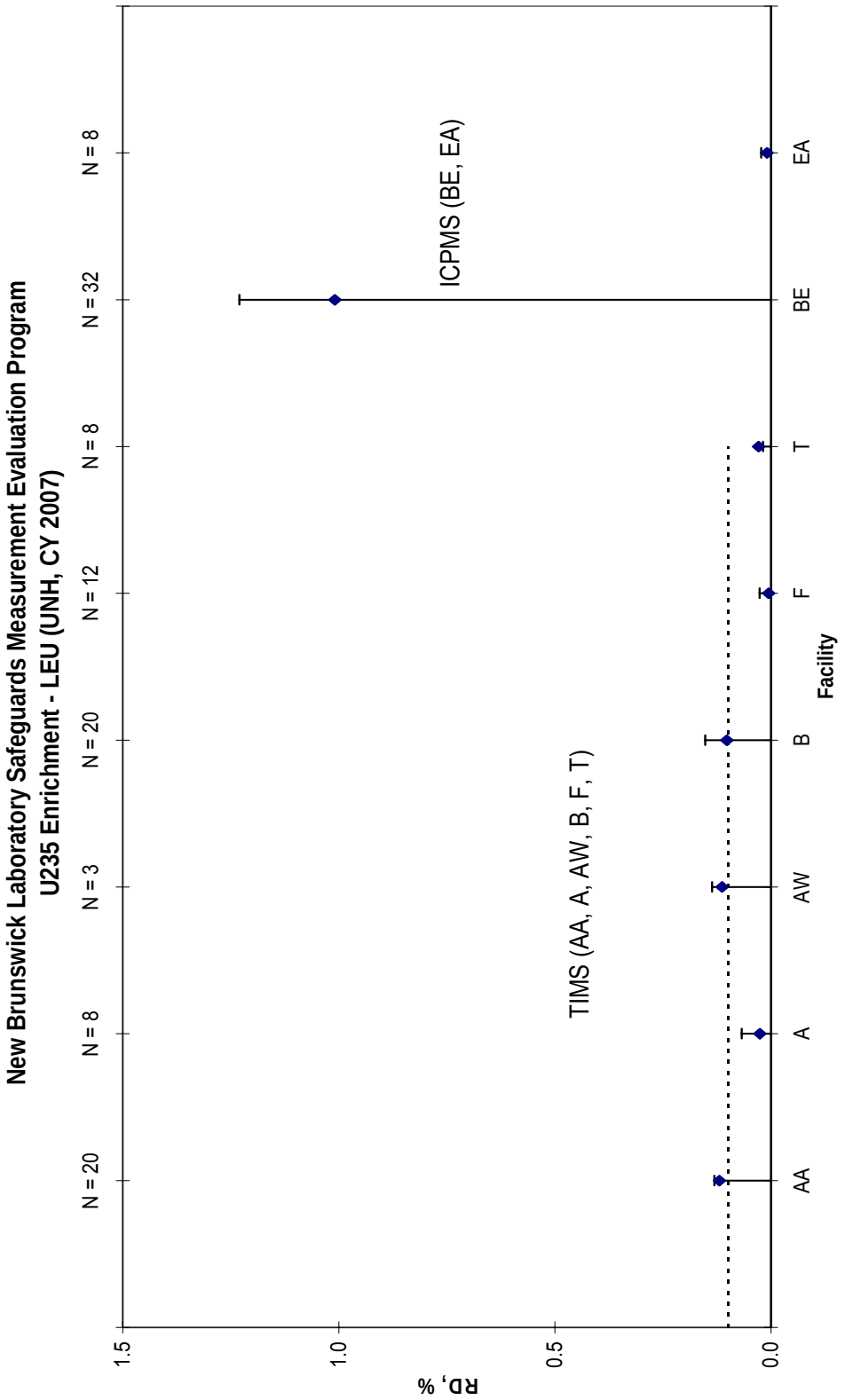

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU (UNH, CY 2007)
N = 20
N = 8
N = 3
N = 20
N = 12
N = 8
N = 32
N = 8
AA
A
AW
B
F
T
BE
EA
Facility
RD, %
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
TIMS (AA, A, AW, B, F, T)
ICPMS (BE, EA)

**Figure 12**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU (UNH, CY 2007)
RD, %
1.5
1.0
0.5
0.0
N = 20
N = 8
N = 3
N = 20
N = 12
N = 8
N = 32
N = 8
AA
A
AW
B
F
T
BE
EA
Facility
ICPMS (BE, EA)
TIMS (AA, A, AW, B, F, T)

**Low enriched $UF_6$**: Three laboratories analyzed the $UF_6$ samples, using three different types of instruments: TIMS, ICPMS and GSMS. The % RDs along with uncertainties are shown in Table 9 and also in Figs. 13 & 14. The target values for GSMS are lower than TIMS/ICPMS target values. Note that target values are available only for TIMS; ICPMS target values are assumed to be the same as TIMS.

TIMS/ICPMS results in conformity with bias target value: Laboratories AA and EA
TIMS/ICPMS results in conformity with precision target value: Laboratory EA
TIMS/ICPMS results non-conformity with bias target value: None
TIMS/ICPMS results non-conformity with precision target value: Laboratory AA

GSMS results in conformity with bias target value: Laboratory BC
GSMS results in conformity with precision target value: None
GSMS results non-conformity with bias target value: None
GSMS results non-conformity with precision target value: Laboratory BC

**Table 9. Inter-laboratory performance summary for $^{235}U$ enrichment in $UF_6$**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| TIMS | AA | 0.080 | 0.112 | 28 | 0.1 | 0.1 |
| GSMS | BC | 0.017 | 0.250 | 12 | 0.05 | 0.05 |
| ICPMS # | EA | 0.008 | 0.065 | 24 | 0.1 | 0.1 |

# ITV's are not available for ICPMS and are assumed to be the same as those for TIMS.

**Figure 13**

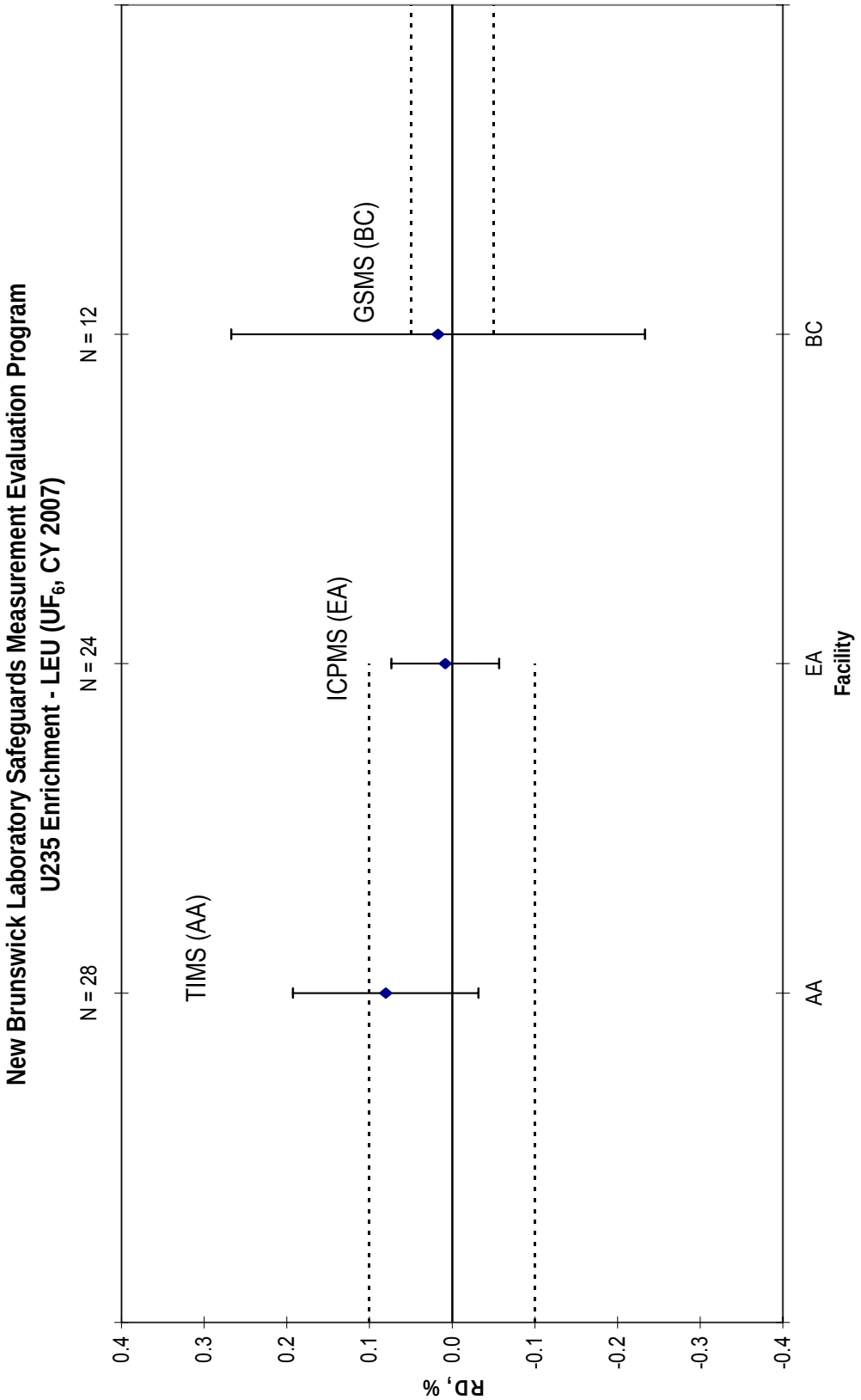
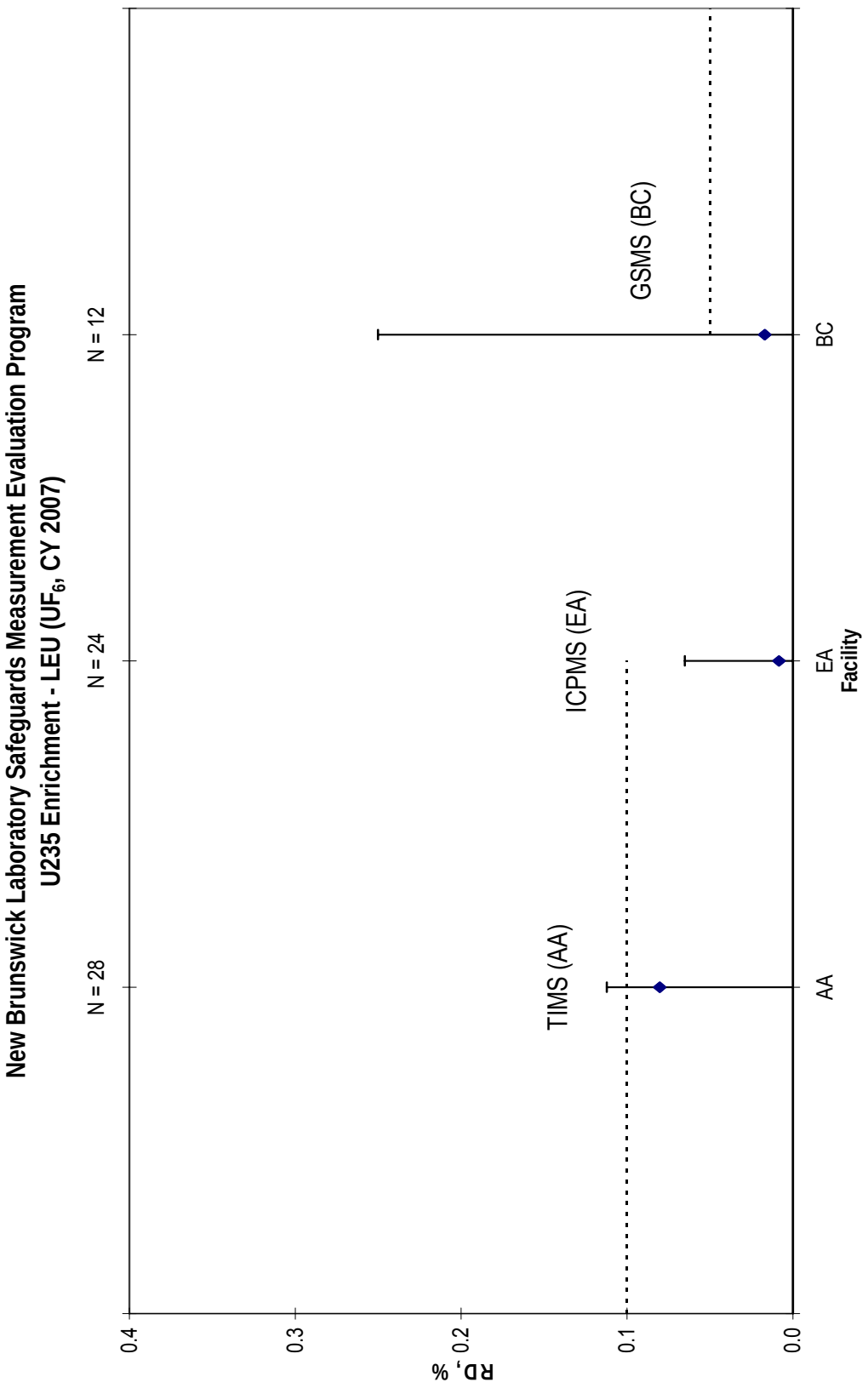

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UF_6$, CY 2007)
TIMS (AA)
ICPMS (EA)
GSMS (BC)
N = 28
N = 24
N = 12
AA
EA
BC
Facility
RD, %
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4

**Figure 14**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UF_6$, CY 2007)
N = 28
N = 24
N = 12
TIMS (AA)
ICPMS (EA)
GSMS (BC)
AA
EA
BC
Facility
RD, %
0.4
0.3
0.2
0.1
0.0

**Low enriched $UO_2$ pellet**: Six laboratories analyzed the $UO_2$ pellets. Four of the six laboratories used thermal ionization mass spectrometry (TIMS) and one laboratory used ICPMS. The % RDs along with uncertainties are shown in Table 10 and also in Figs. 15 & 16. Note that international target values are available for TIMS measurements only; the ICPMS target values are assumed to be the same as TIMS.

| | |
|---|---|
| TIMS/ICPMS results in conformity with bias target value: | Laboratories BC, F and T |
| TIMS/ICPMS results in conformity with precision target value: | Laboratories AA, BC, F and T |
| TIMS/ICPMS results non-conformity with bias target value: | Laboratories AA and BE |
| TIMS/ICPMS results non-conformity with precision target value: | Laboratory BE |

**Table 10. Inter-laboratory performance summary for $^{235}U$ enrichment in $UO_2$**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| TIMS | AA | -0.128 | 0.044 | 8 | 0.1 | 0.1 |
| | BC | 0.029 | 0.092 | 8 | 0.1 | 0.1 |
| | F | -0.018 | 0.021 | 16 | 0.1 | 0.1 |
| | T | 0.027 | 0.027 | 16 | 0.1 | 0.1 |
| ICPMS # | BE | -0.975 | 1.142 | 48 | 0.1 | 0.1 |

# ITV's are not available for ICPMS and are assumed to be the same as those for TIMS.

**Figure 15**

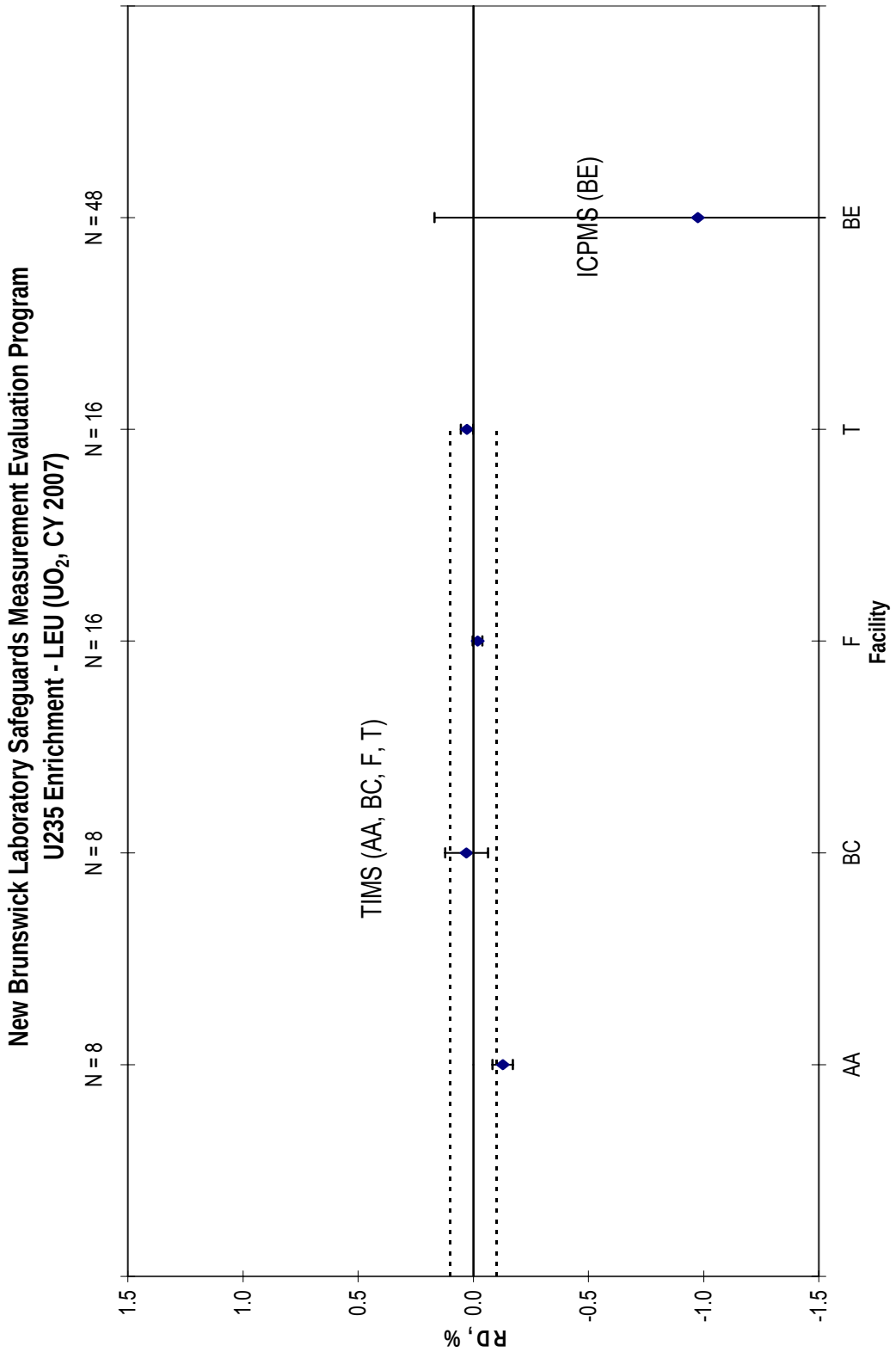
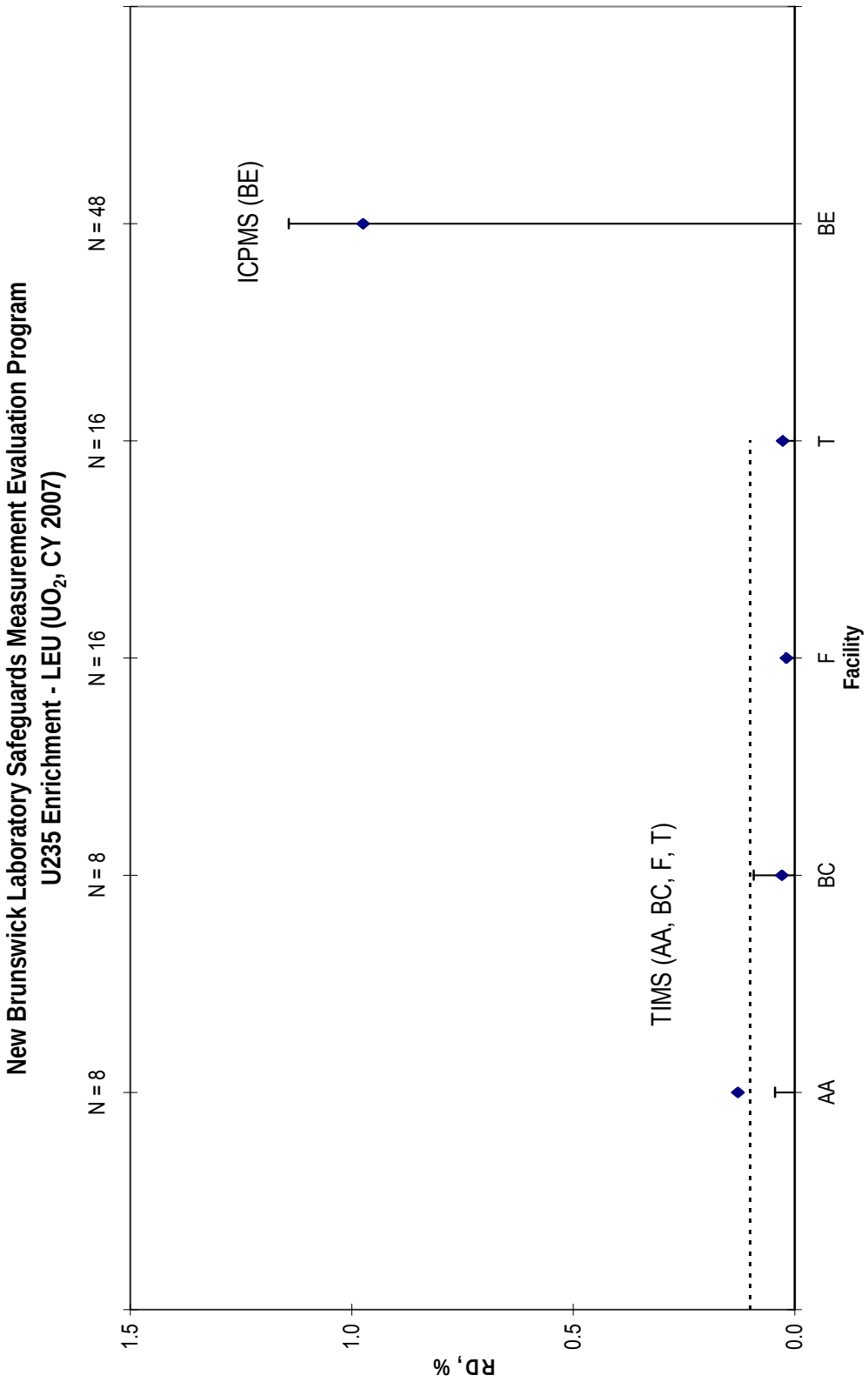

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UO_2$, CY 2007)
N = 8
N = 8
N = 16
N = 16
N = 48
TIMS (AA, BC, F, T)
ICPMS (BE)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
RD, %
AA
BC
F
T
BE
Facility

**Figure 16**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UO_2$, CY 2007)
ICPMS (BE)
TIMS (AA, BC, F, T)
N = 8
N = 8
N = 16
N = 16
N = 48
AA
BC
F
T
BE
Facility
RD, %
1.5
1.0
0.5
0.0

**$UO_3$ powder**: Only one laboratory analyzed the $UO_3$ samples via thermal ionization mass spectrometry (TIMS). The % RD and the uncertainty are shown in Table 11 and in Figs. 17 & 18. The results are in conformity to both bias and precision target values.

**Table 11. Inter-laboratory performance summary for $^{235}U$ enrichment in $UO_3$**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| TIMS | F | -0.071 | 0.033 | 8 | 0.1 | 0.1 |

**Figure 17**

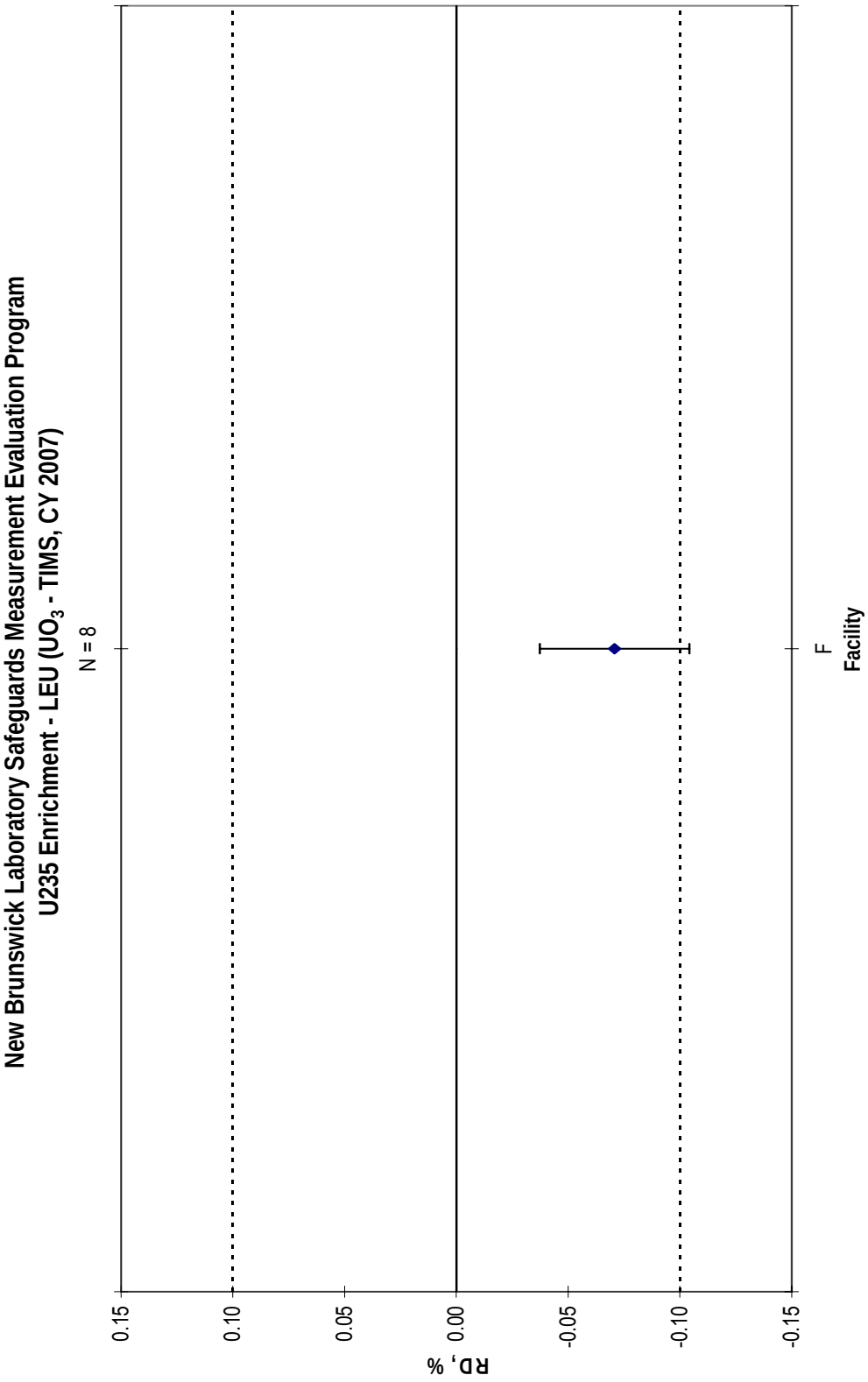
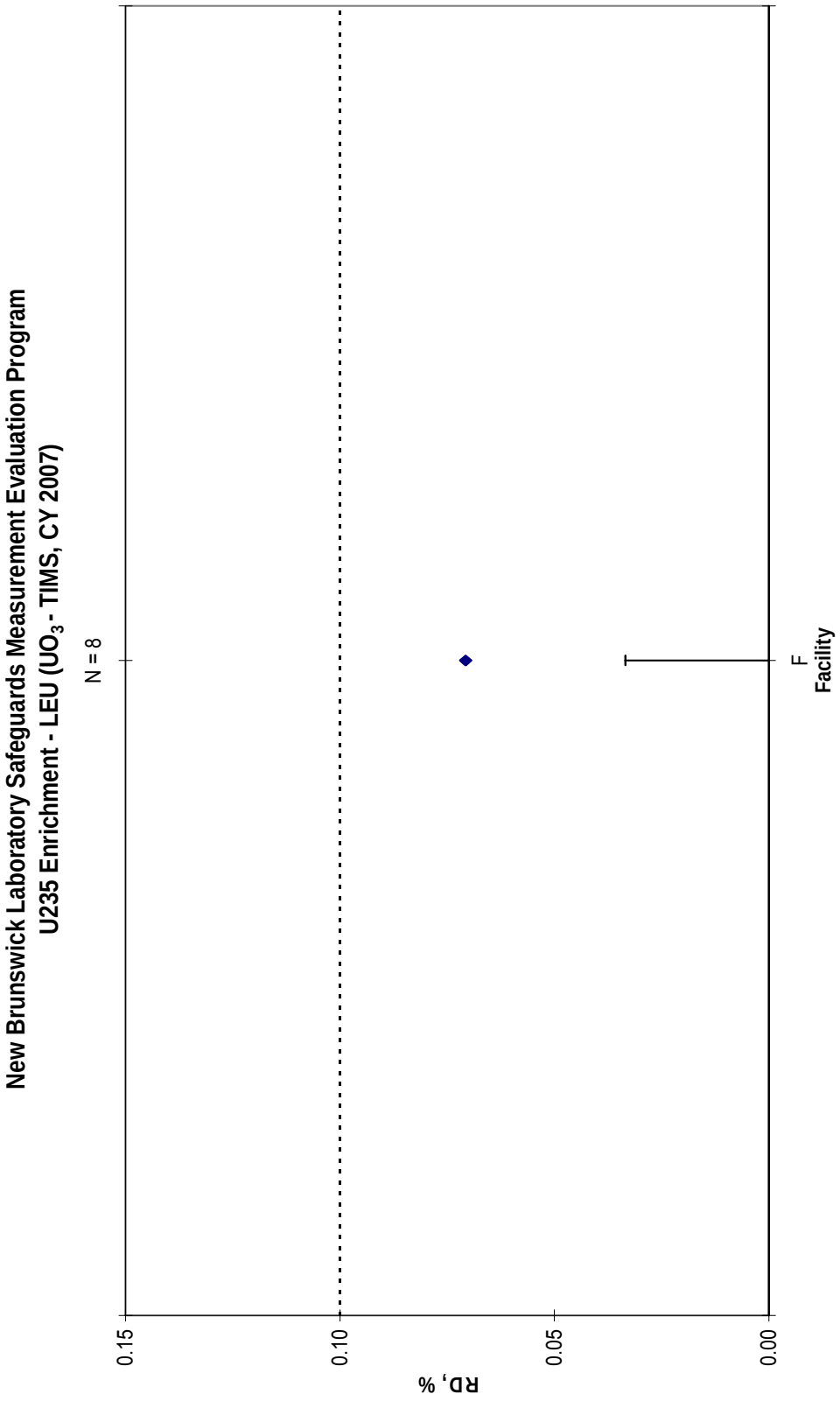

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UO_3$ - TIMS, CY 2007)
N = 8
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
RD, %
F
Facility

**Figure 18**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU ($UO_3$ - TIMS, CY 2007)
N = 8
F
Facility
RD, %
0.15
0.10
0.05
0.00

**High enriched UNH solution**: Four laboratories analyzed the UNH solutions using thermal ionization mass spectrometry (TIMS). The % RDs along with uncertainties are shown in Table 12 and in Figs. 19 & 20. All laboratories were able to measure $^{235}U$ abundance within the bias and precision target values.

**Table 12. Inter-laboratory performance summary for $^{235}U$ enrichment in UNH (HEU)**

| Method | Lab Code | Mean % RD | Standard deviation | N | ITV | |
|---|---|---|---|---|---|---|
| | | | | | Bias | Precision |
| TIMS | A | 0.010 | 0.023 | 8 | 0.05 | 0.05 |
| | B | 0.028 | 0.028 | 20 | 0.05 | 0.05 |
| | F | 0.008 | 0.010 | 19 | 0.05 | 0.05 |
| | AW | 0.013 | 0.022 | 12 | 0.05 | 0.05 |

**Figure 19**

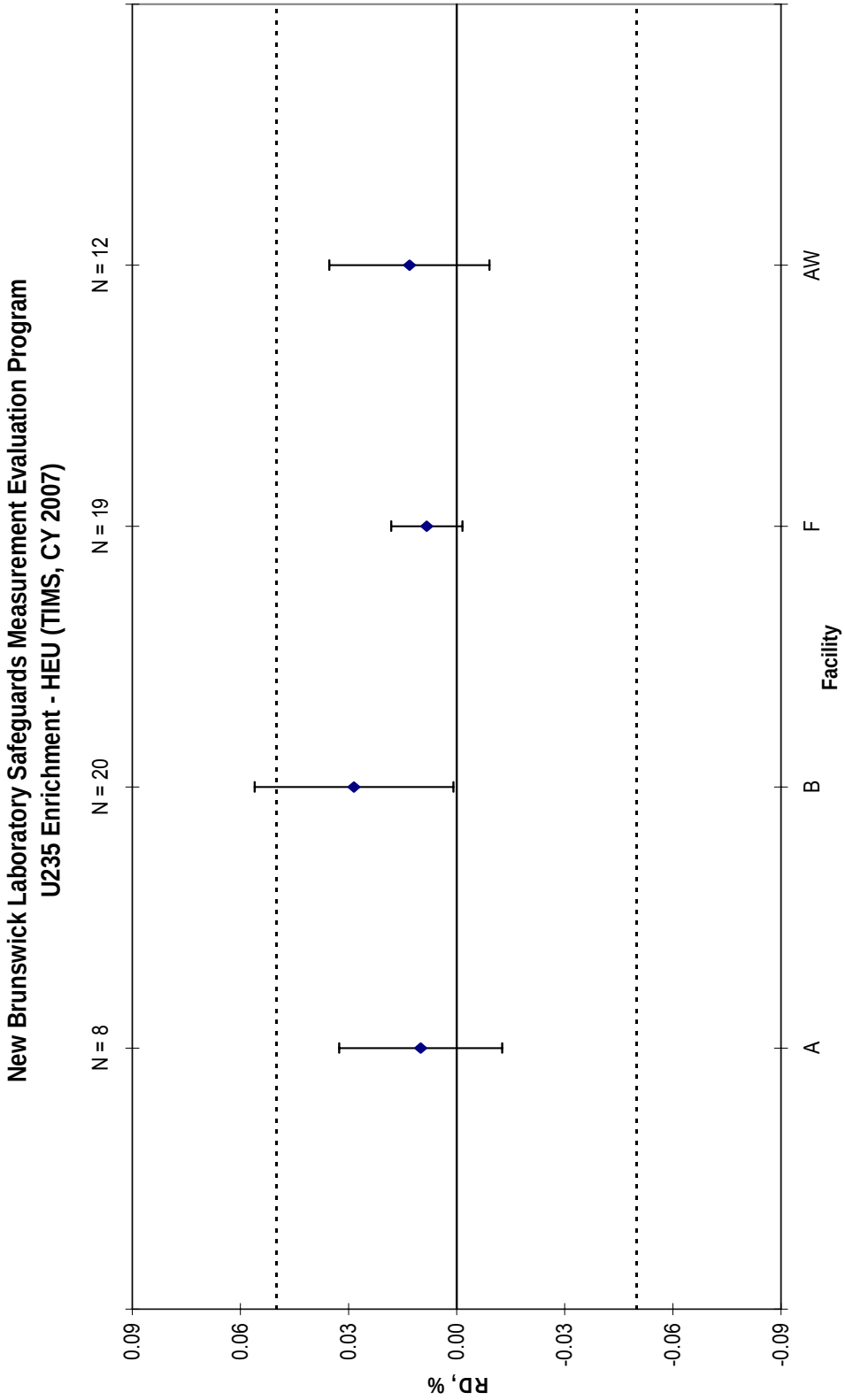
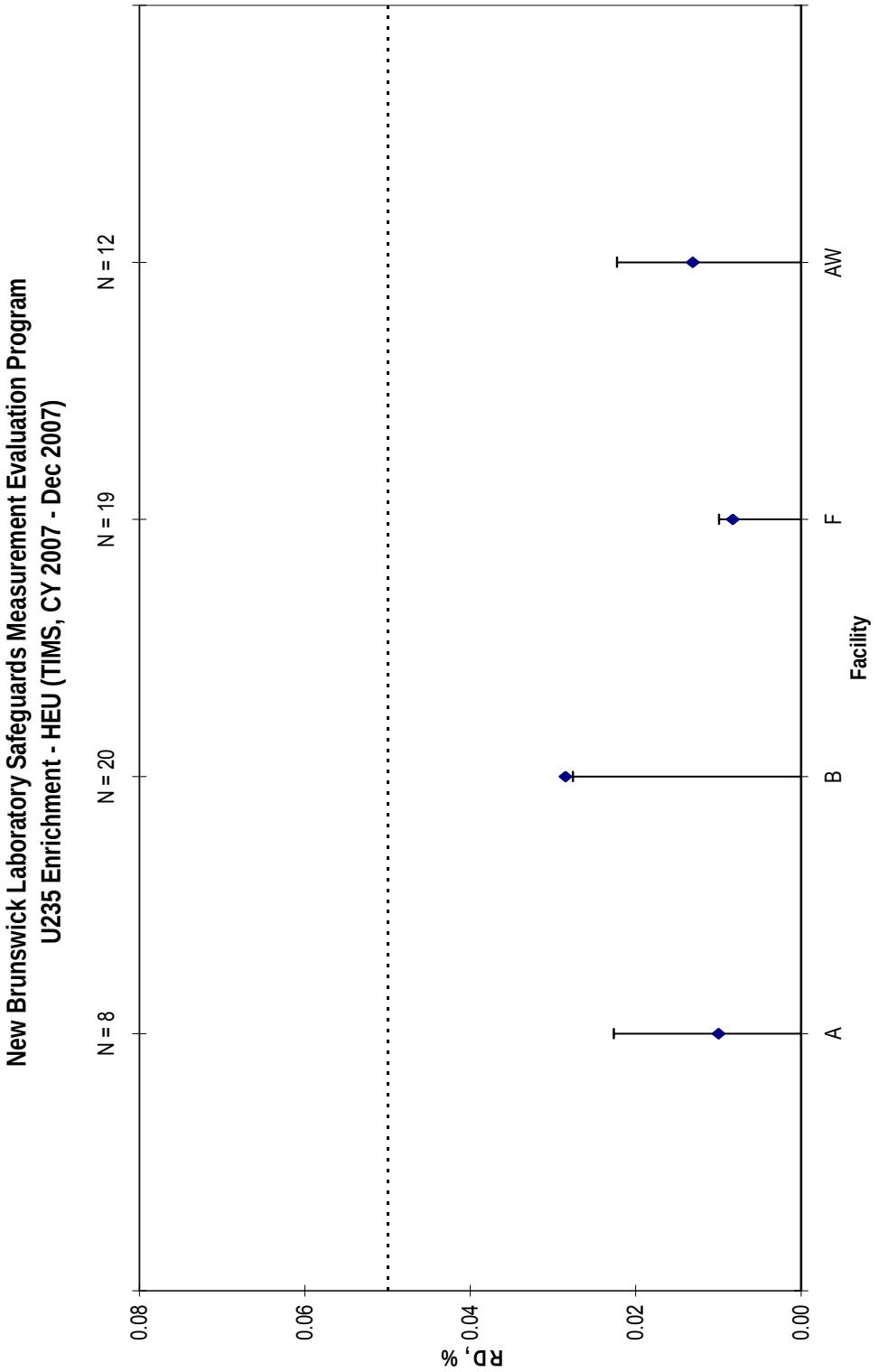

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU (TIMS, CY 2007)
N = 8
N = 20
N = 19
N = 12
0.09
0.06
0.03
0.00
-0.03
-0.06
-0.09
RD, %
A
B
F
AW
Facility

**Figure 20**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU (TIMS, CY 2007 - Dec 2007)
N = 8
N = 20
N = 19
N = 12
0.08
0.06
0.04
0.02
0.00
RD, %
A
B
F
AW
Facility

### E.6. Plutonium Assay and Isotopic Abundance

Plutonium test samples could not be sent to participants because of the “stand down” of plutonium laboratory operations.

## F. SPECIAL STUDY: MOISTURE IN $UO_3$ TEST SAMPLES

One of the laboratories in the SME program (laboratory A) suspected that the integrity of the $UO_3$ powder test samples might have been compromised by moisture uptake. They wanted NBL to verify whether there are any differences between samples analyzed as received and samples analyzed after drying to remove the moisture. NBL analyzed eight $UO_3$ sample but with no definite conclusions. NBL will repeat the analysis in CY 2008 this time using a well defined statistical sampling and analysis plan to determine whether moisture uptake is significant. If found to be significant, analysis procedure for these samples will be modified – sample drying before weighing samples for analysis. If simple drying procedures do not yield reproducible uranium assay results, then this particular set of test samples will be withdrawn.

## G. LONG TERM EVALUTION OF URANIUM MEASUREMENTS

The uranium assay and isotopic results submitted by the participating laboratories during the years 2005 to 2007 are evaluated to provide long-term trends. The evaluation results are shown in Figs. 21 to 76. The % RDs calculated from the submitted results are shown in Figs. 21 to 76. Each figure represents results from one laboratory only for a specific material/method combination. For example, Fig. 21 shows results from laboratory AB for uranyl nitrate solution analysis by D&G titration.

**Figure 21**

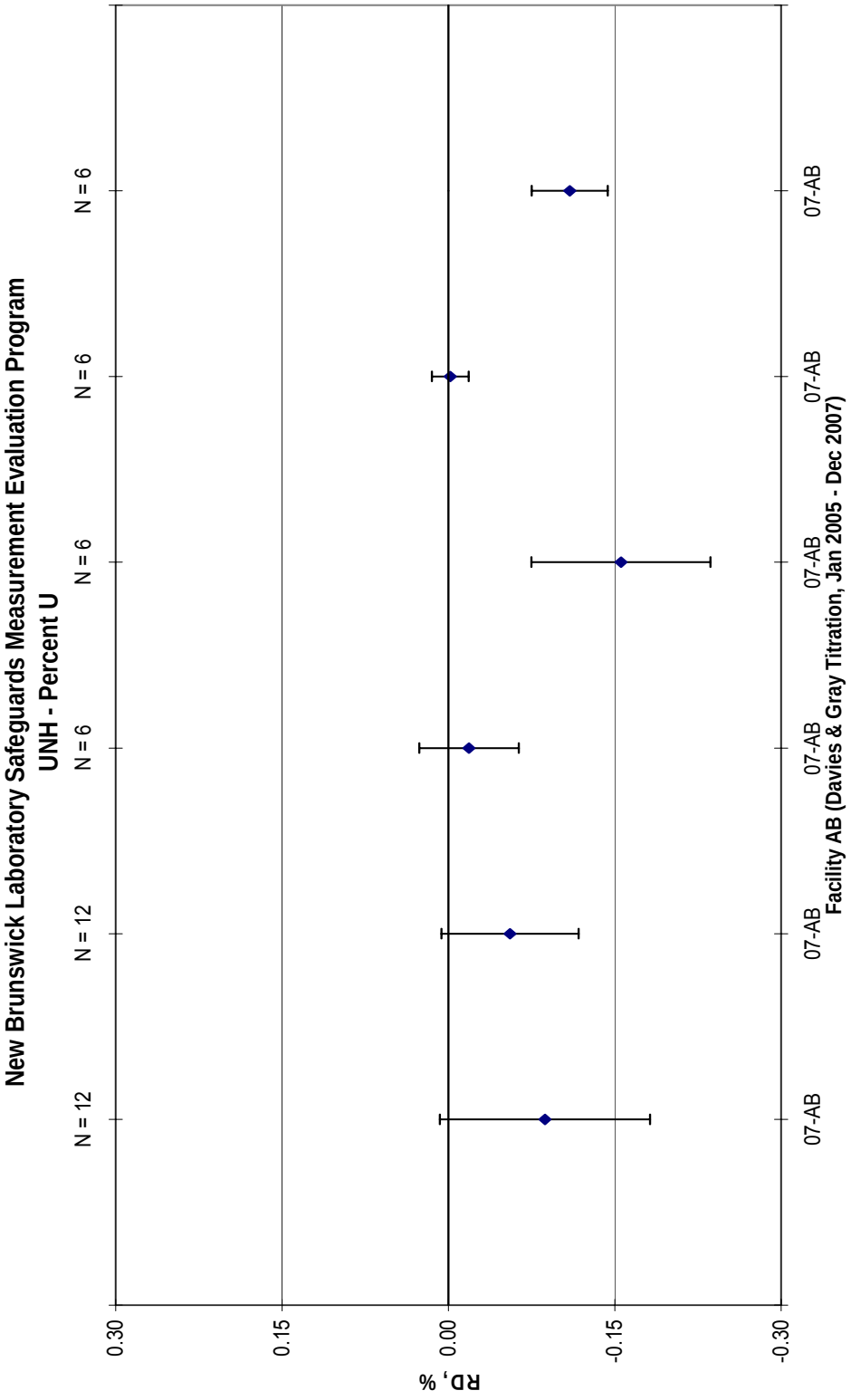

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
RD, %
0.30
0.15
0.00
-0.15
-0.30
N = 12
N = 12
N = 6
N = 6
N = 6
N = 6
07-AB
07-AB
07-AB
07-AB
07-AB
07-AB
Facility AB (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 22**

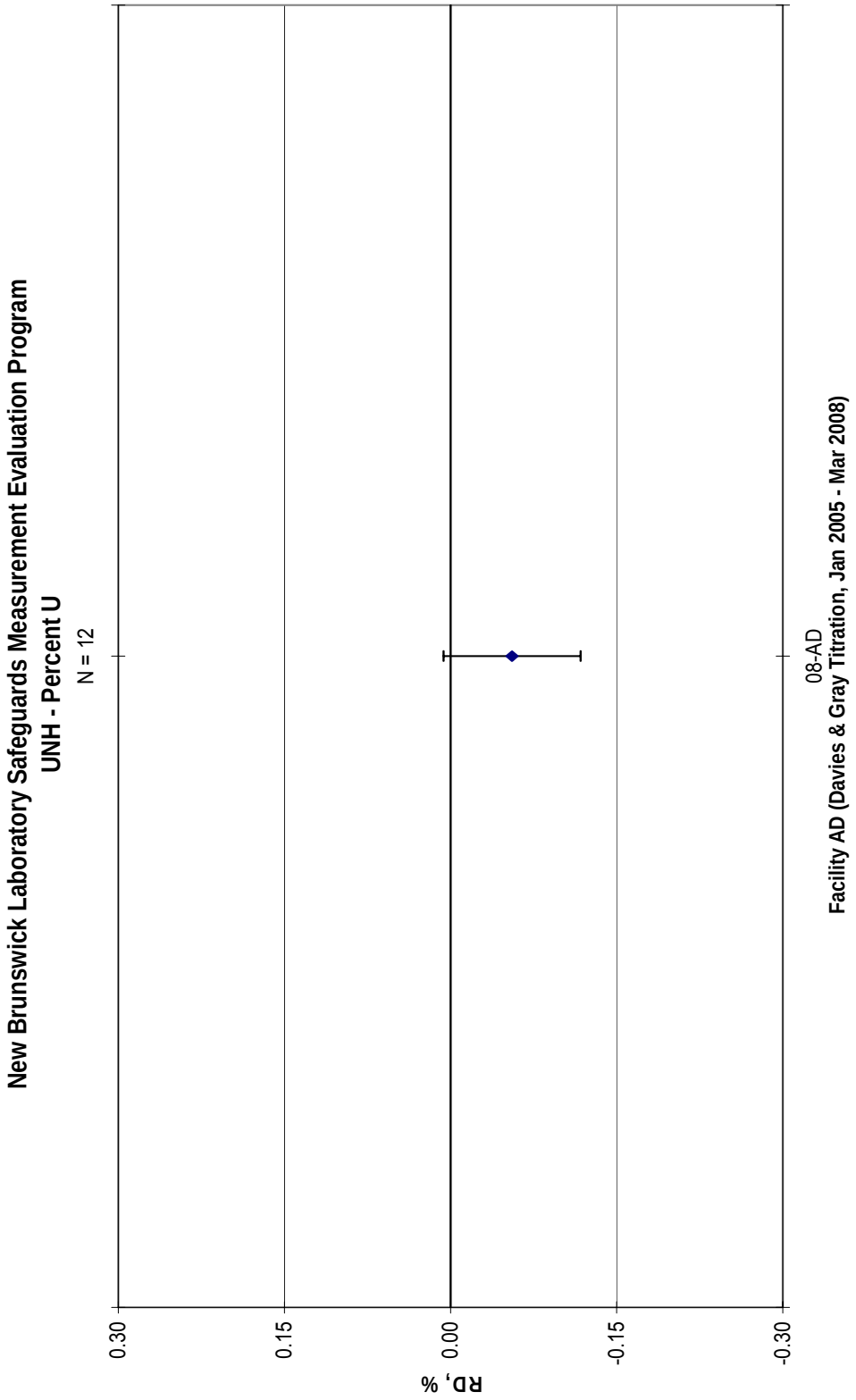

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 12
RD, %
0.30
0.15
0.00
-0.15
-0.30
08-AD
Facility AD (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 23**

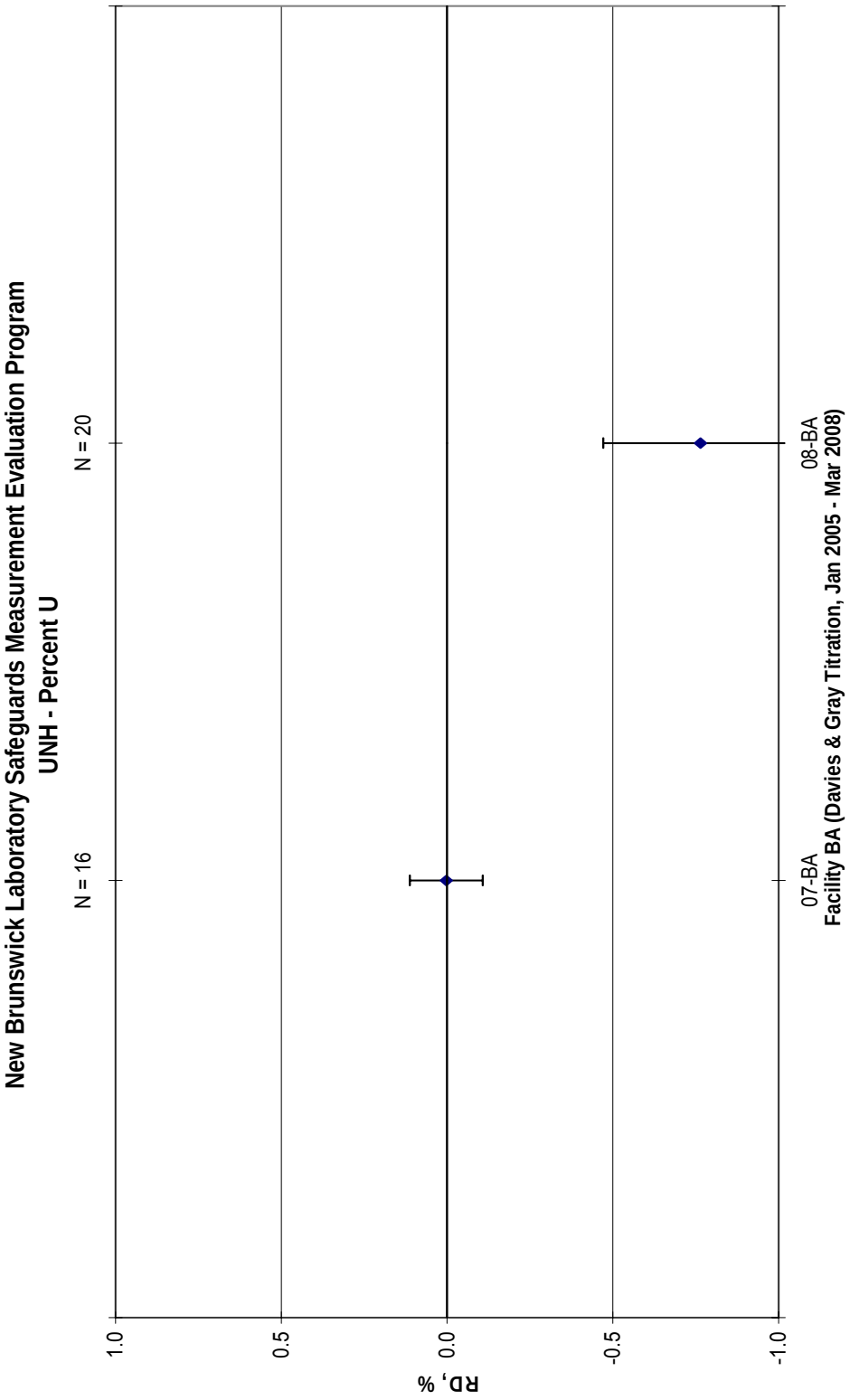

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 16
N = 20
1.0
0.5
0.0
-0.5
-1.0
RD, %
07-BA
08-BA
Facility BA (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 24**

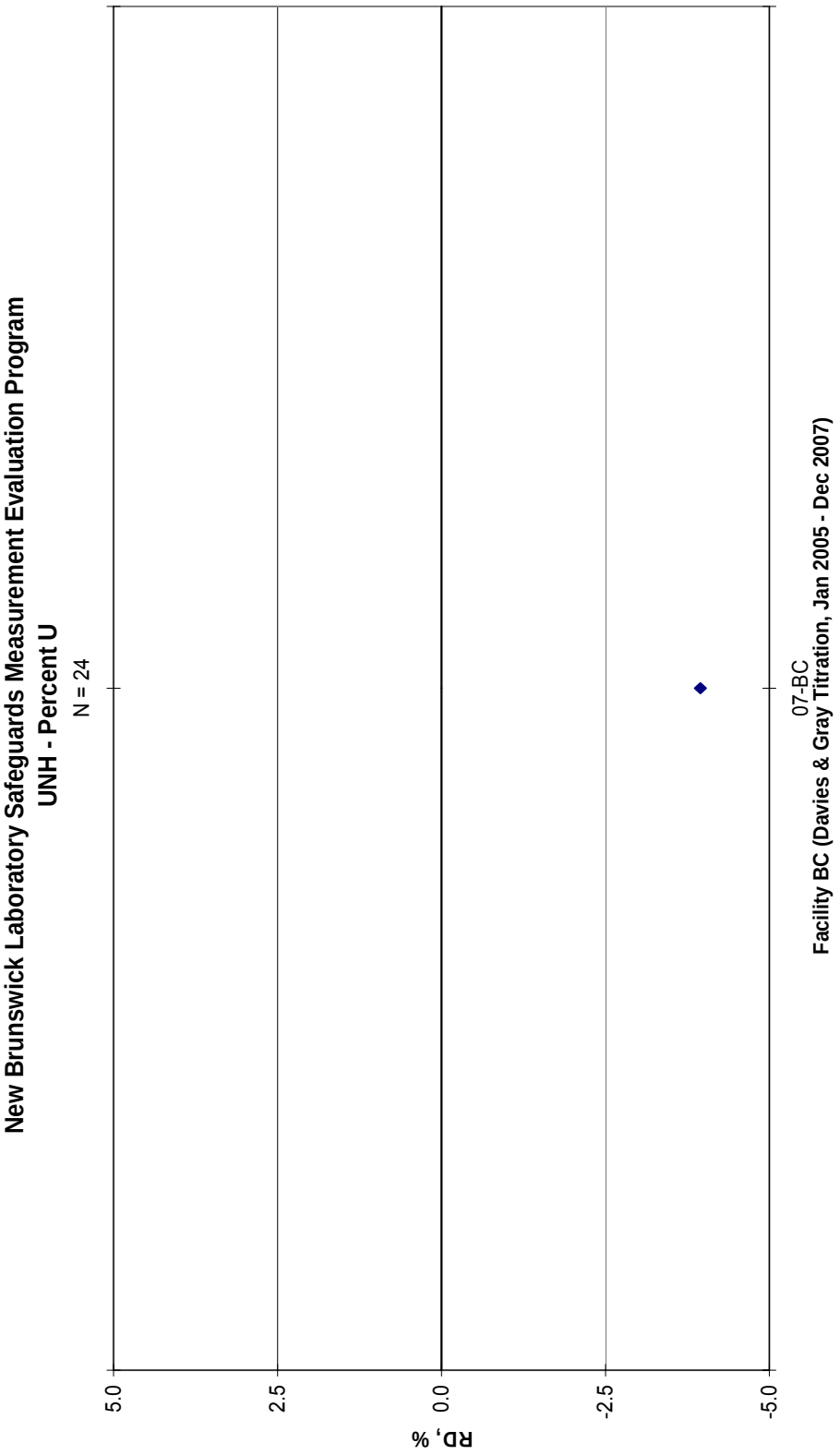

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 24
RD, %
5.0
2.5
0.0
-2.5
-5.0
07-BC
Facility BC (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 25**

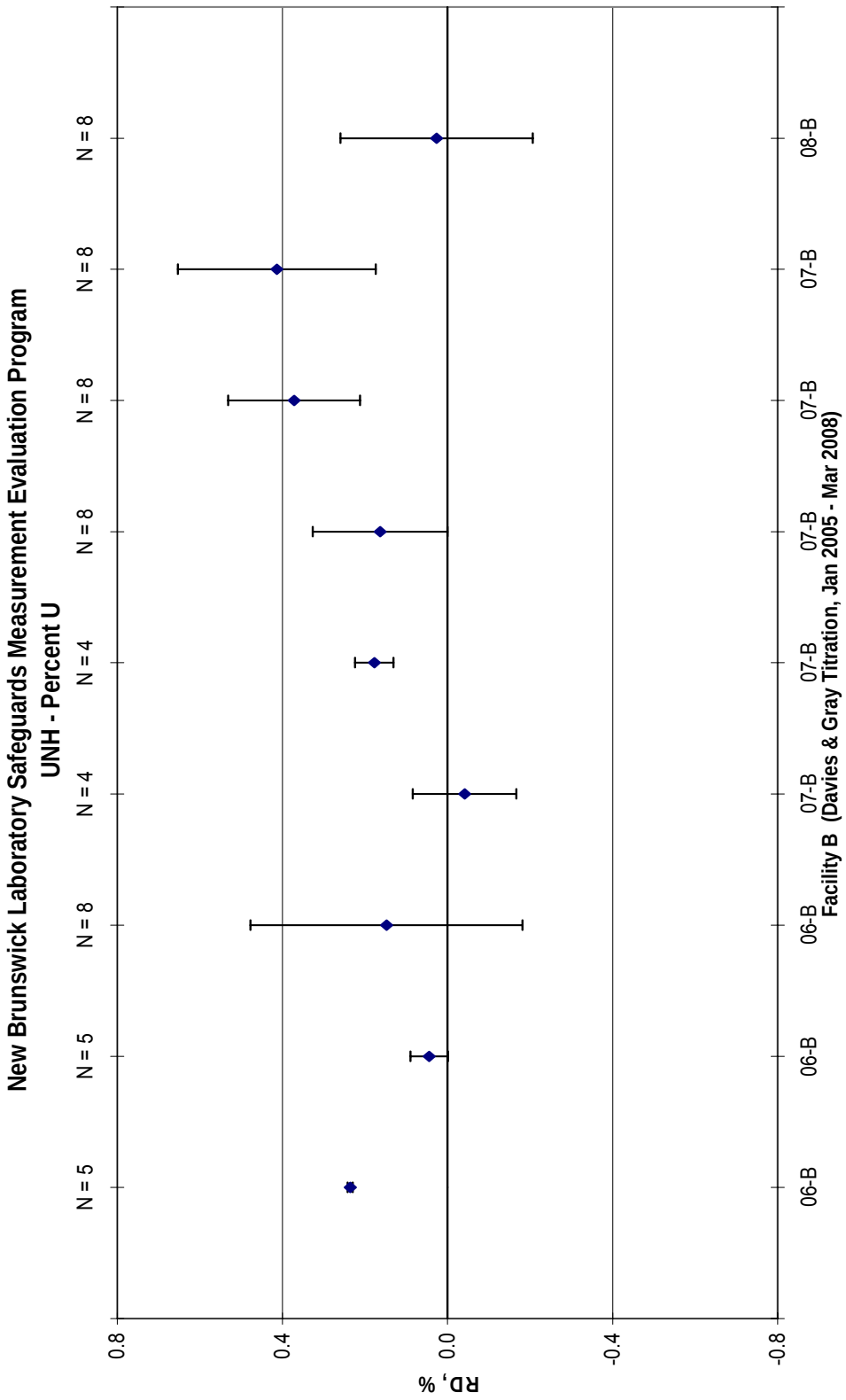

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
RD, %
0.8
0.4
0.0
-0.4
-0.8
N = 5
N = 8
N = 4
N = 8
N = 8
N = 8
N = 5
N = 8
N = 4
N = 8
N = 8
N = 8
06-B
06-B
06-B
07-B
07-B
07-B
07-B
07-B
07-B
08-B
Facility B (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 26**

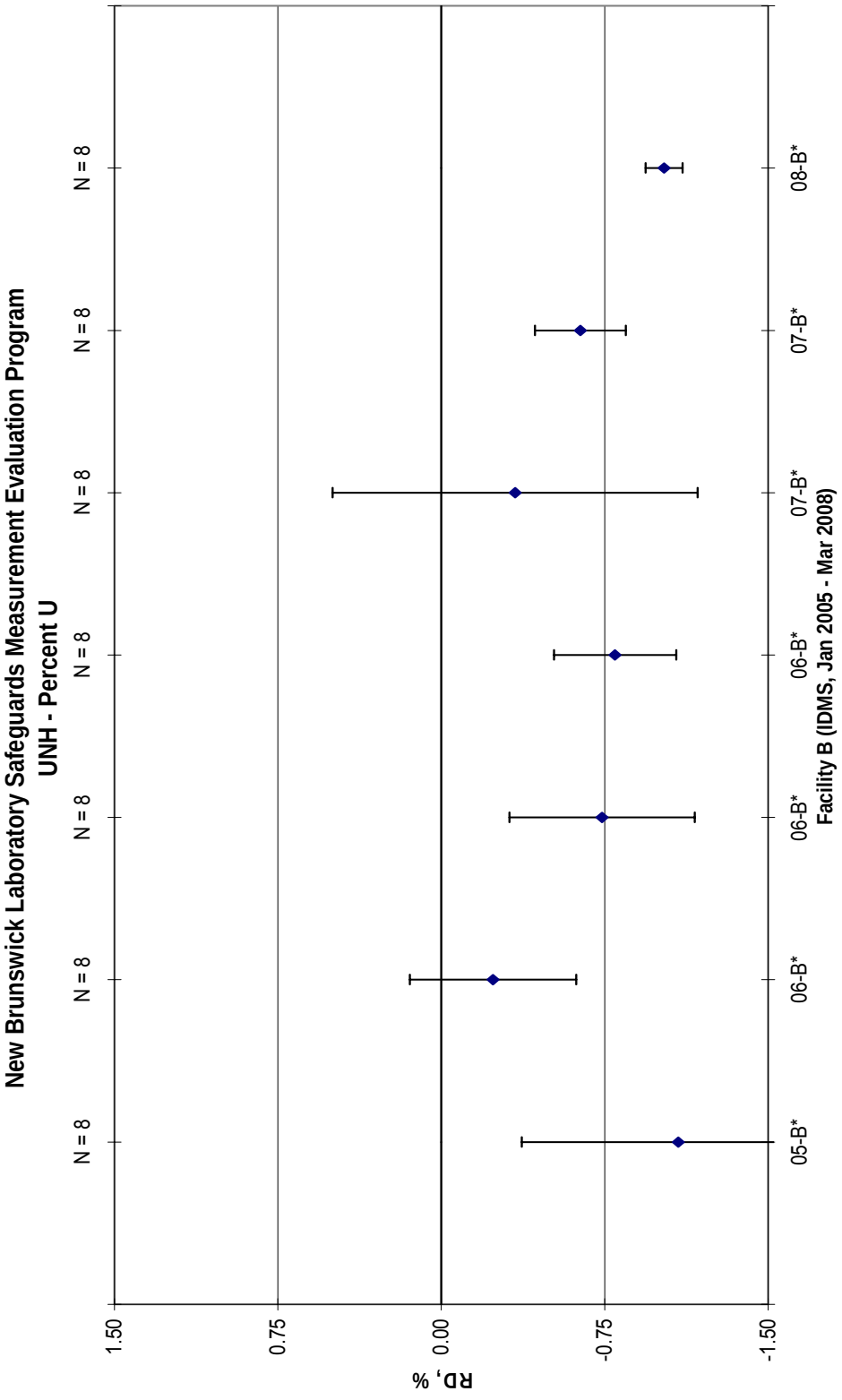

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
RD, %
1.50
0.75
0.00
-0.75
-1.50
N = 8
05-B*
06-B*
06-B*
06-B*
07-B*
07-B*
08-B*
Facility B (IDMS, Jan 2005 - Mar 2008)

**Figure 27**

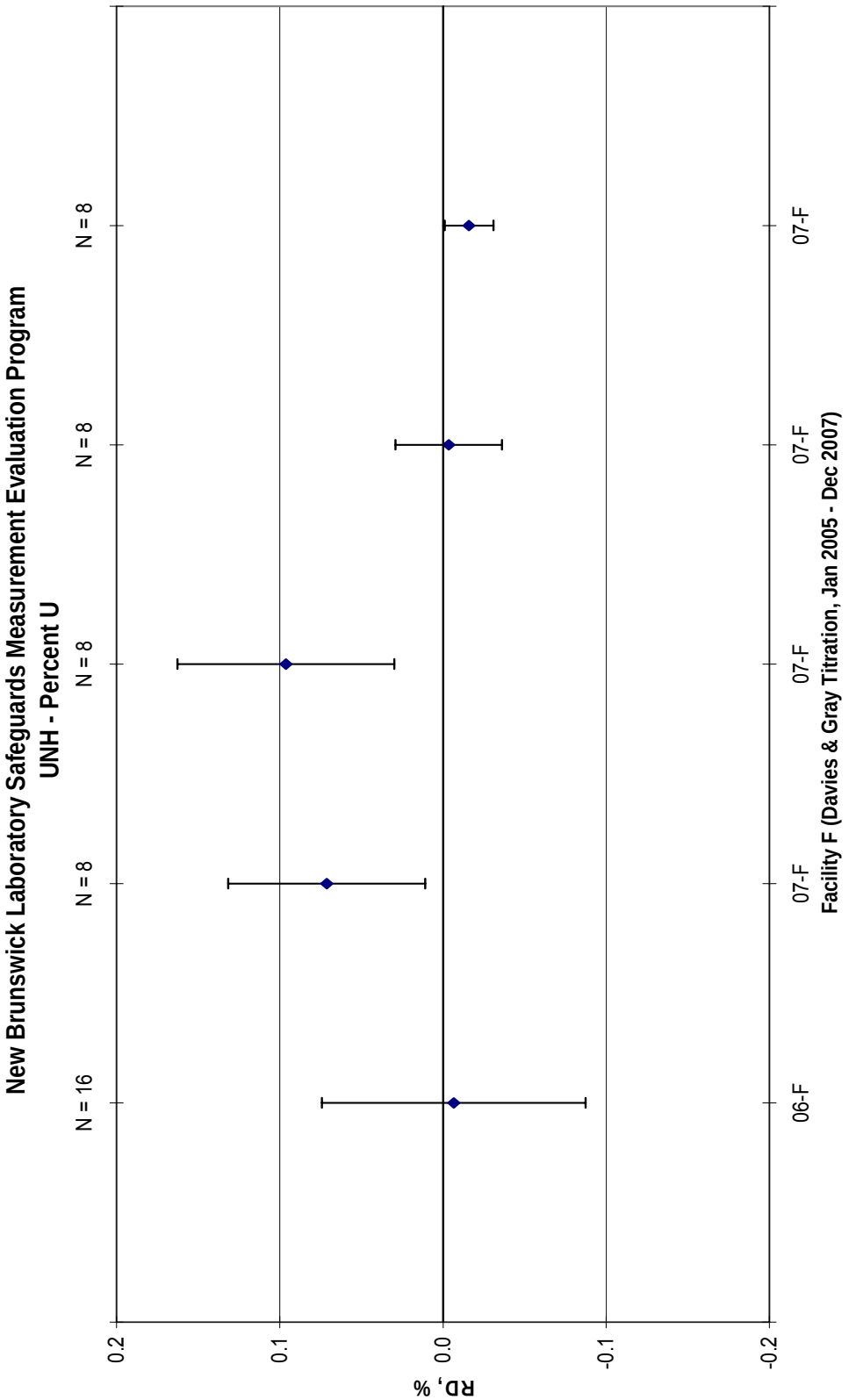

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
RD, %
0.2
0.1
0.0
-0.1
-0.2
N = 16
N = 8
N = 8
N = 8
06-F
07-F
07-F
07-F
Facility F (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 28**

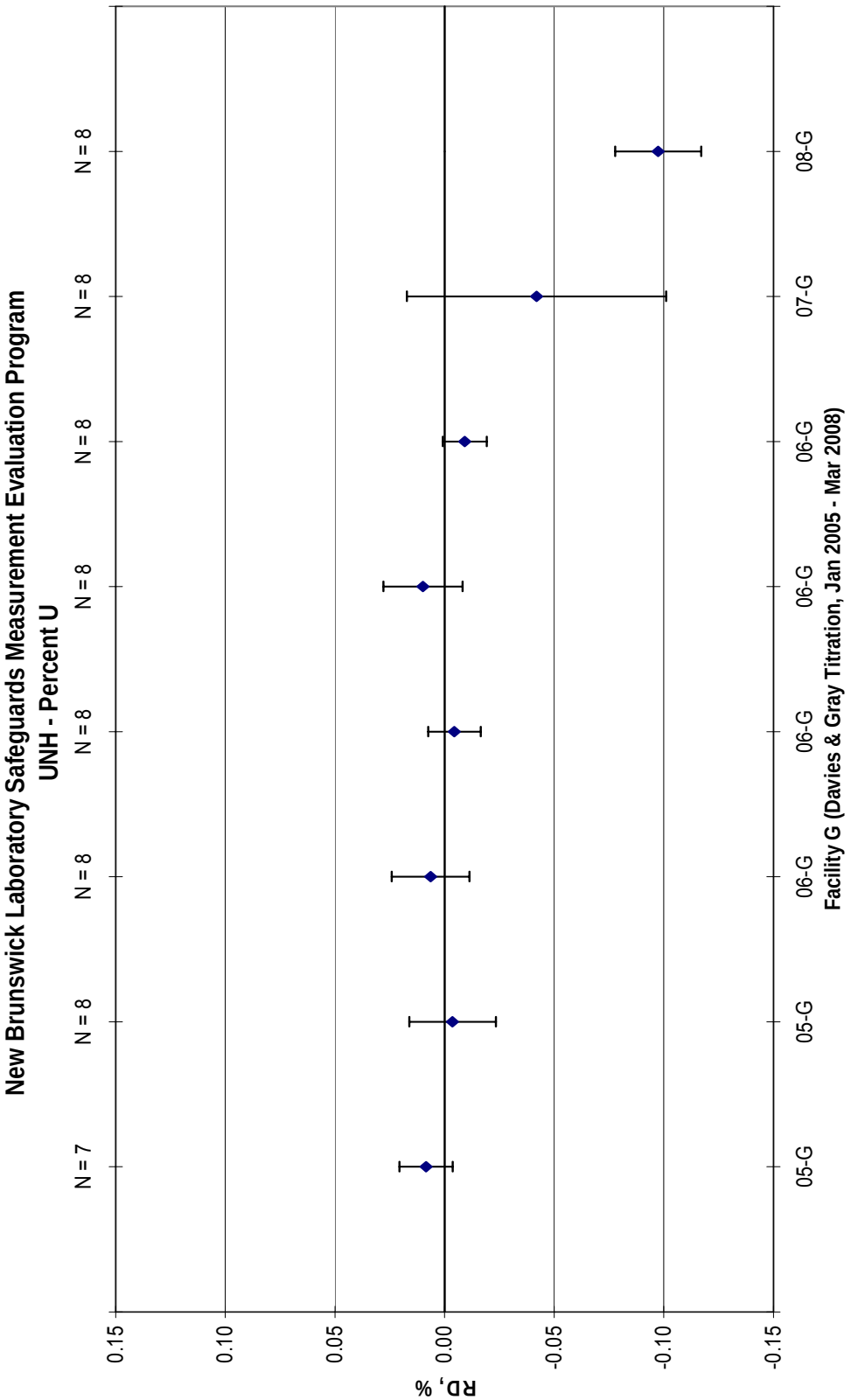

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
RD, %
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
N = 7
N = 8
N = 8
N = 8
N = 8
N = 8
N = 8
05-G
05-G
06-G
06-G
06-G
06-G
07-G
08-G
Facility G (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 29**

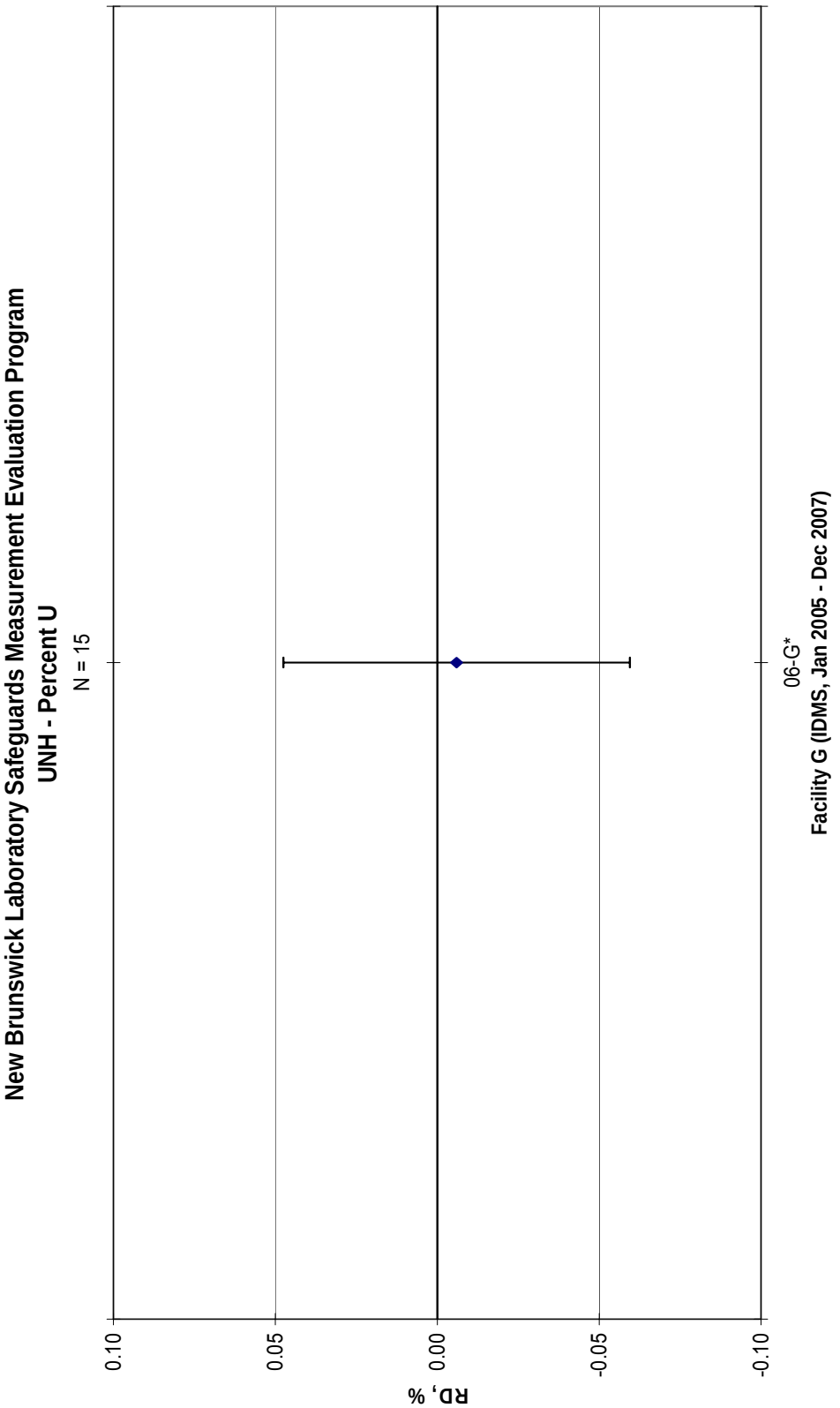

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 15
06-G*
Facility G (IDMS, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 30**

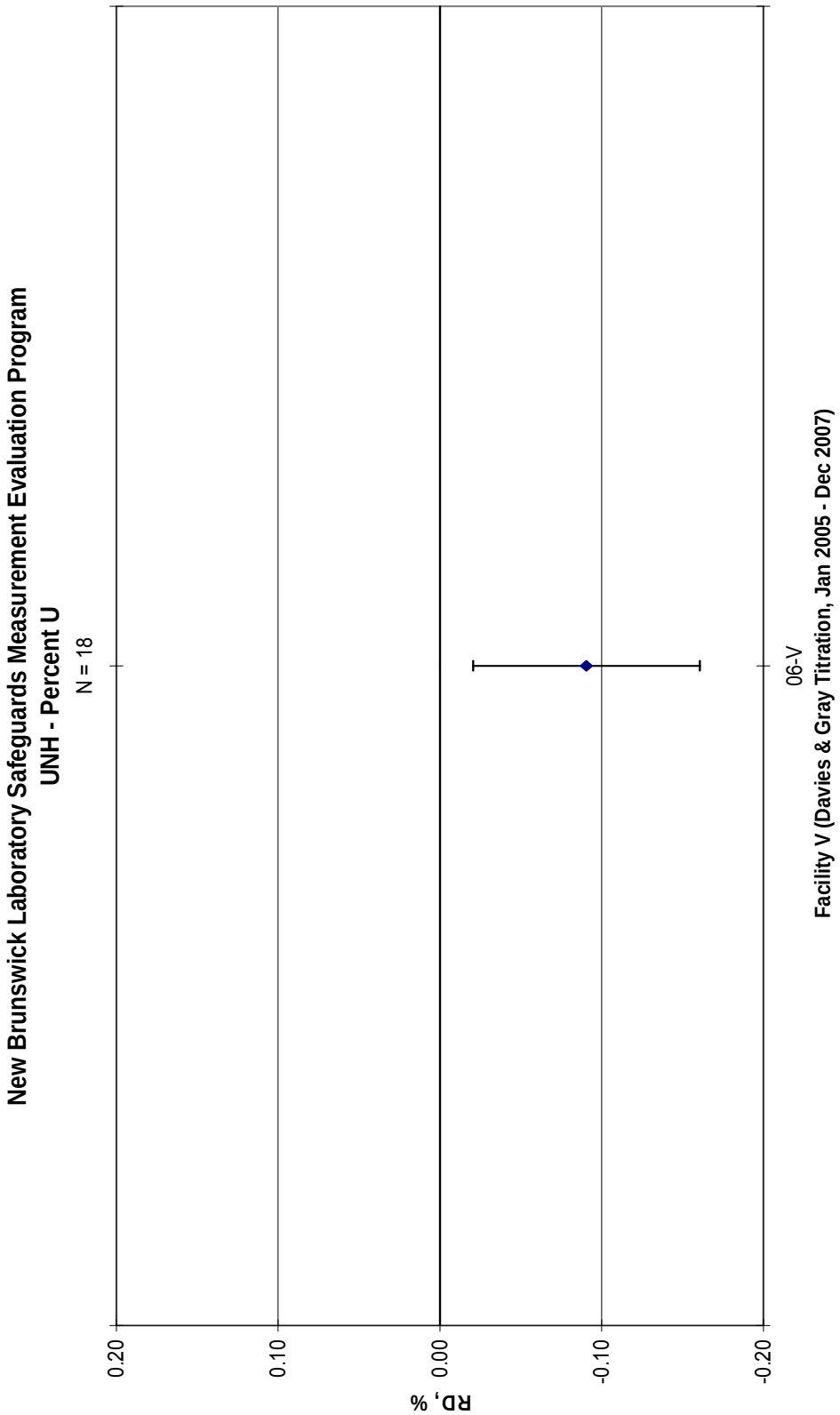

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 18
RD, %
0.20
0.10
0.00
-0.10
-0.20
06-V
Facility V (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 31**

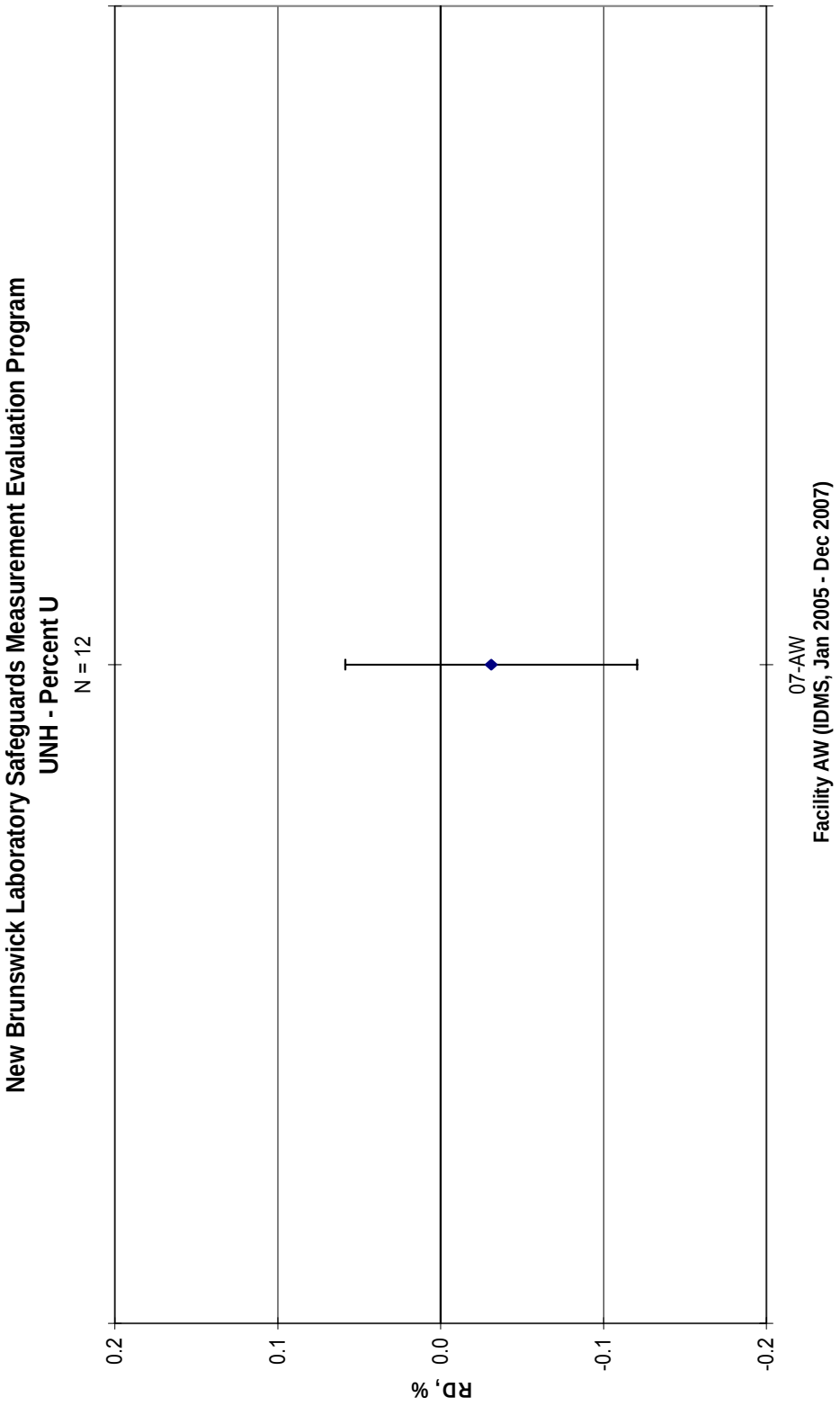

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 12
RD, %
0.2
0.1
0.0
-0.1
-0.2
07-AW
Facility AW (IDMS, Jan 2005 - Dec 2007)

**Figure 32**

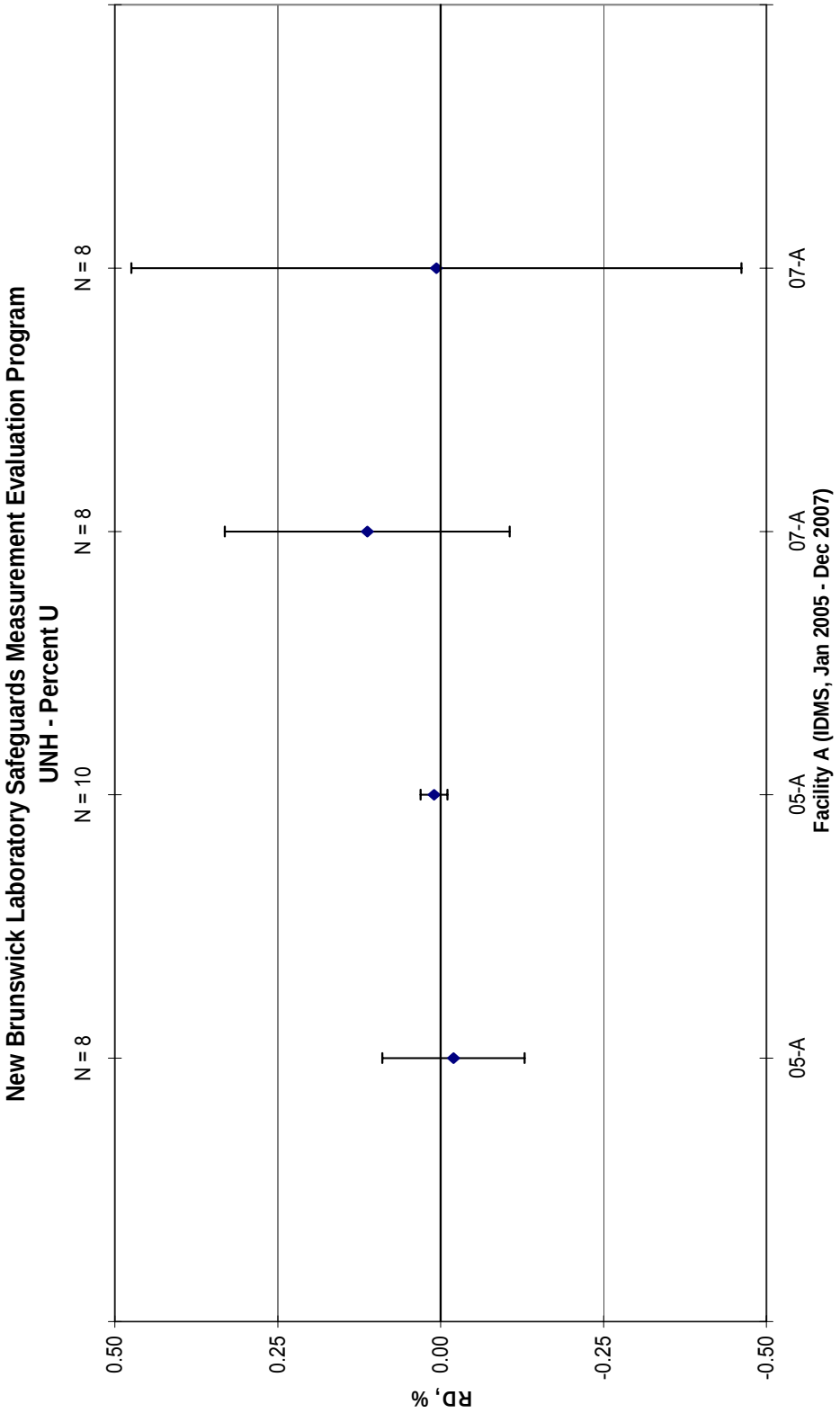

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 8
N = 10
N = 8
N = 8
0.50
0.25
0.00
-0.25
-0.50
RD, %
05-A
05-A
07-A
07-A
Facility A (IDMS, Jan 2005 - Dec 2007)

**Figure 33**

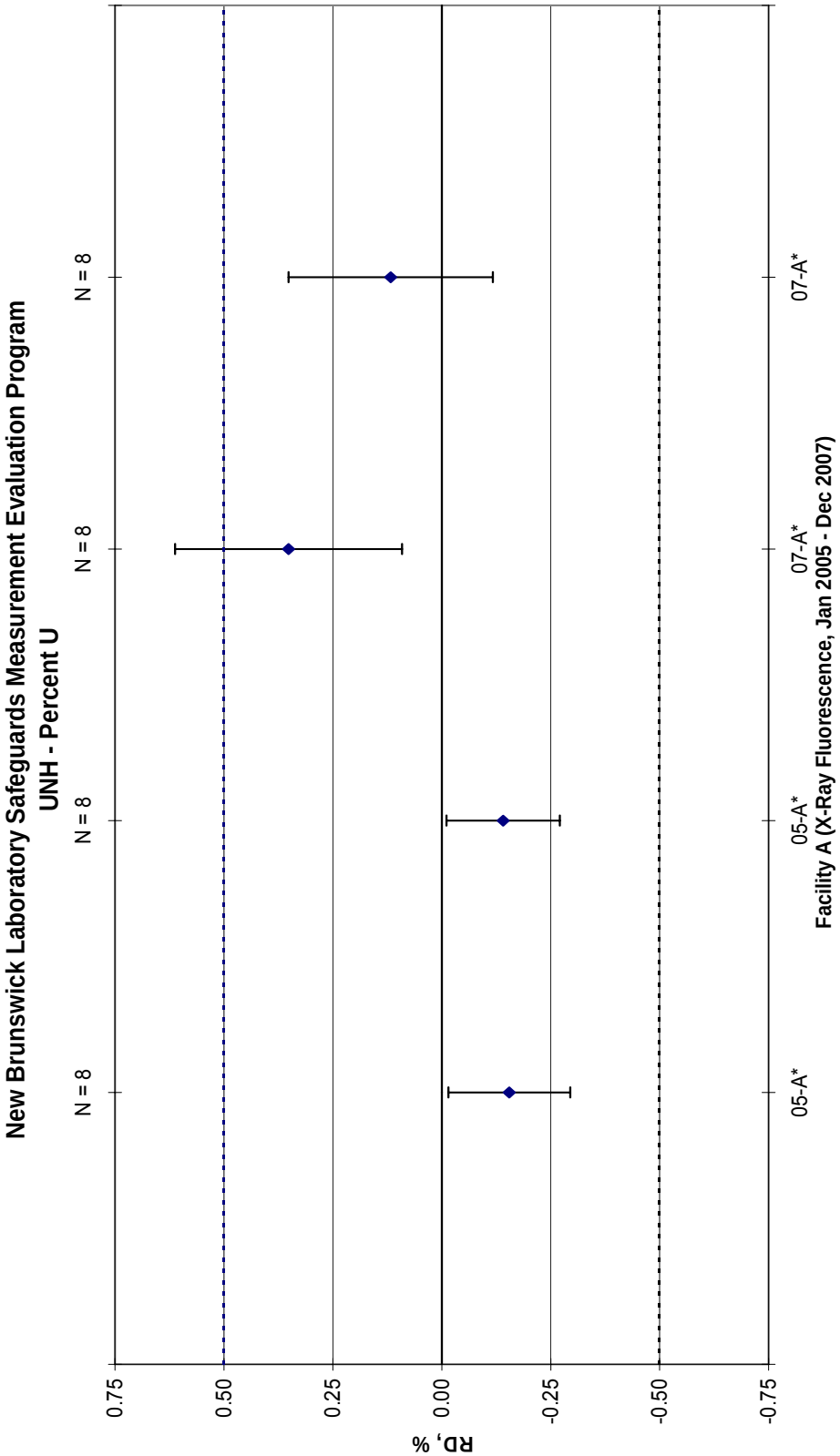

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UNH - Percent U
N = 8
N = 8
N = 8
05-A*
05-A*
07-A*
07-A*
Facility A (X-Ray Fluorescence, Jan 2005 - Dec 2007)
RD, %
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75

**Figure 34**

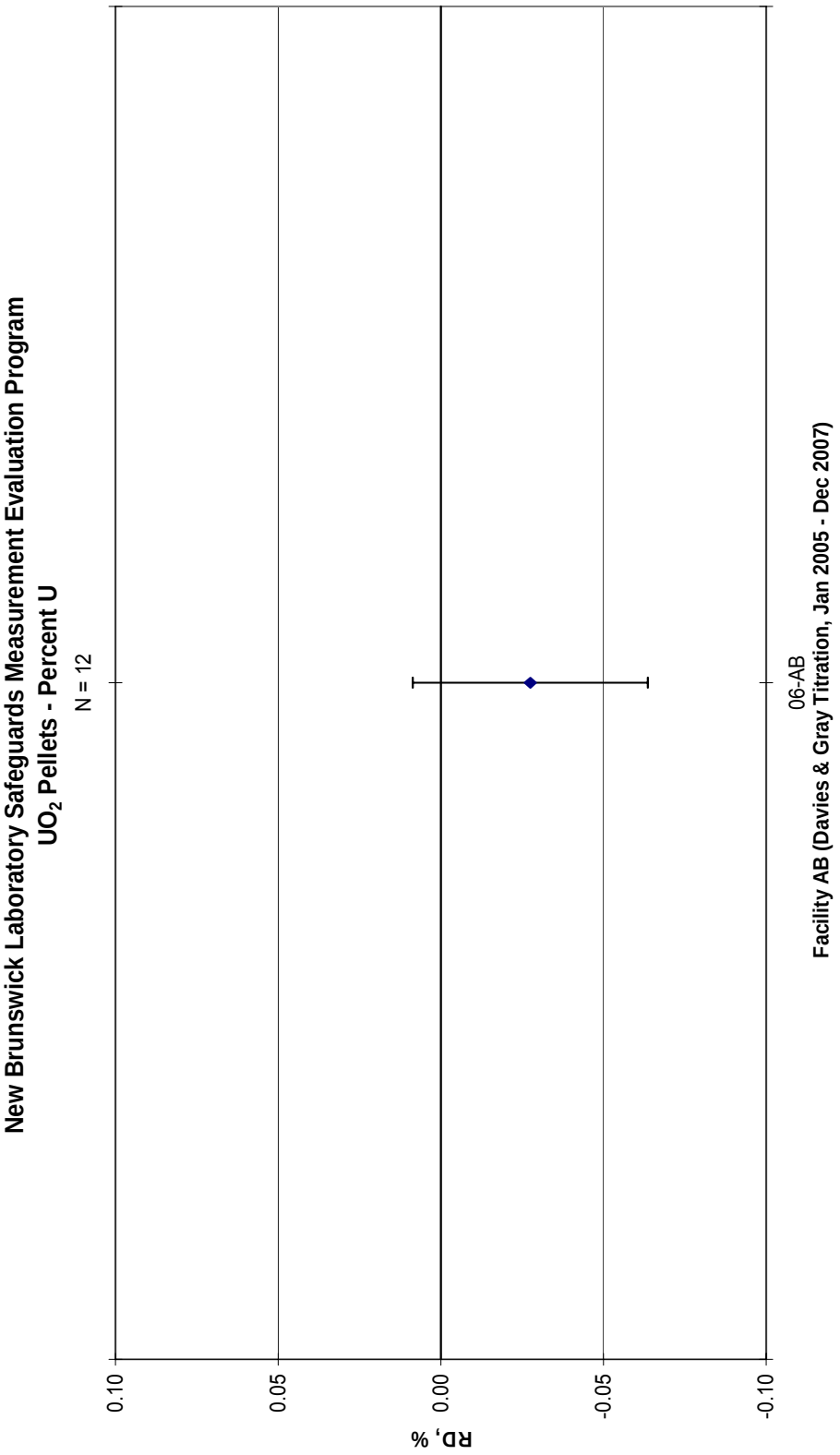

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 12
0.10
0.05
0.00
-0.05
-0.10
RD, %
06-AB
Facility AB (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 35**

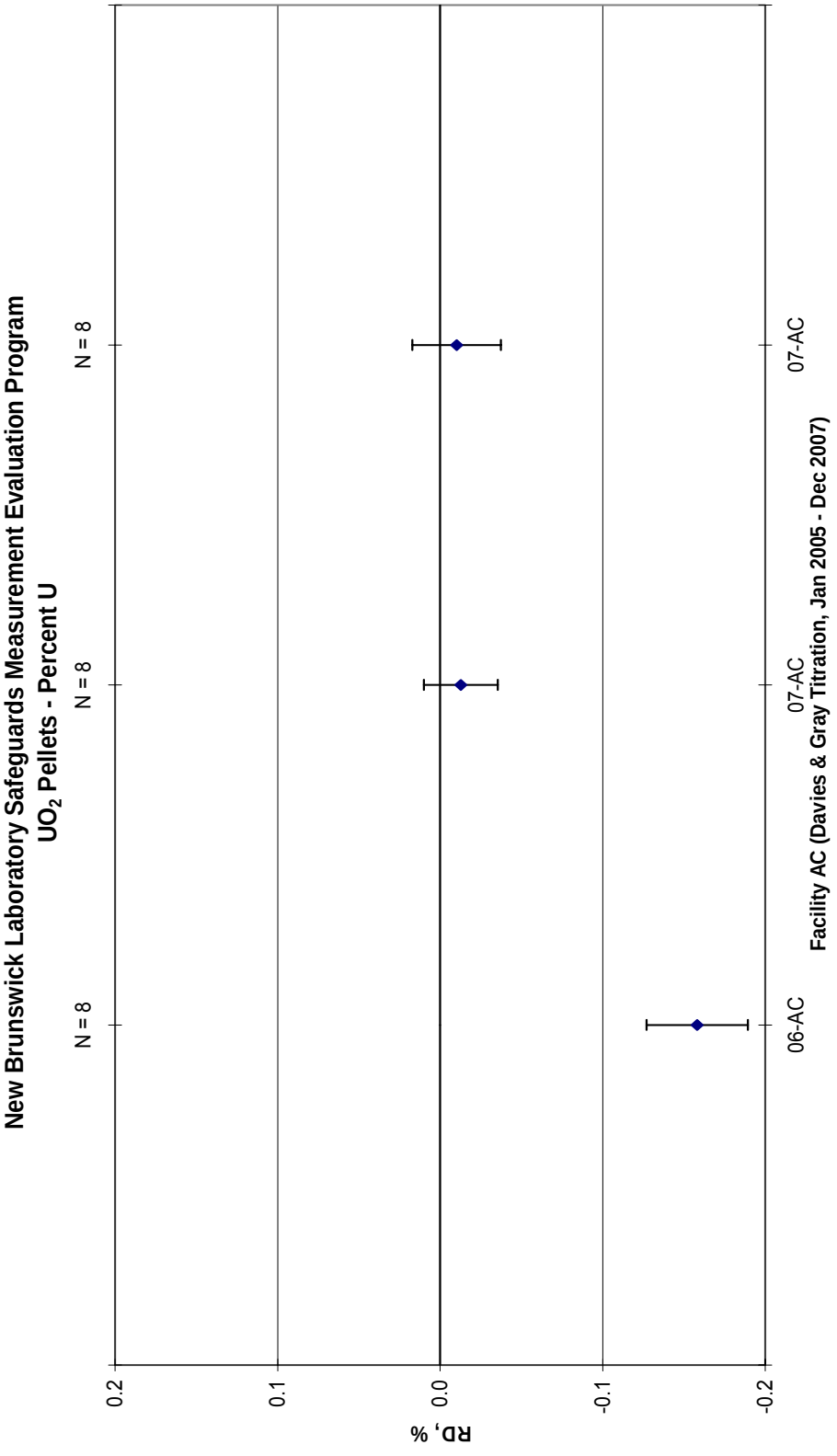

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 8
N = 8
N = 8
06-AC
07-AC
07-AC
Facility AC (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.2
0.1
0.0
-0.1
-0.2

**Figure 36**

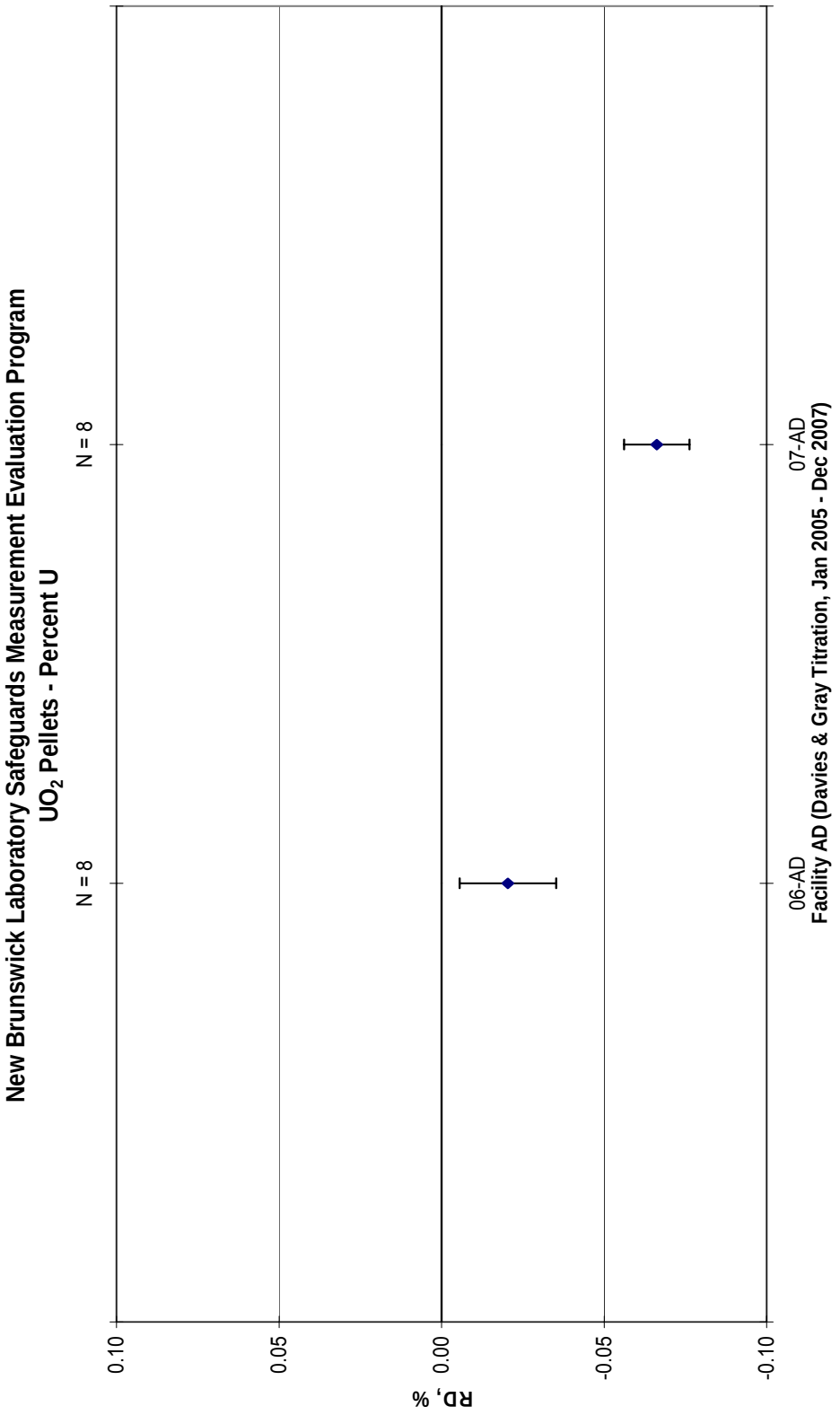

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 8
N = 8
0.10
0.05
0.00
-0.05
-0.10
RD, %
06-AD
07-AD
Facility AD (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 37**

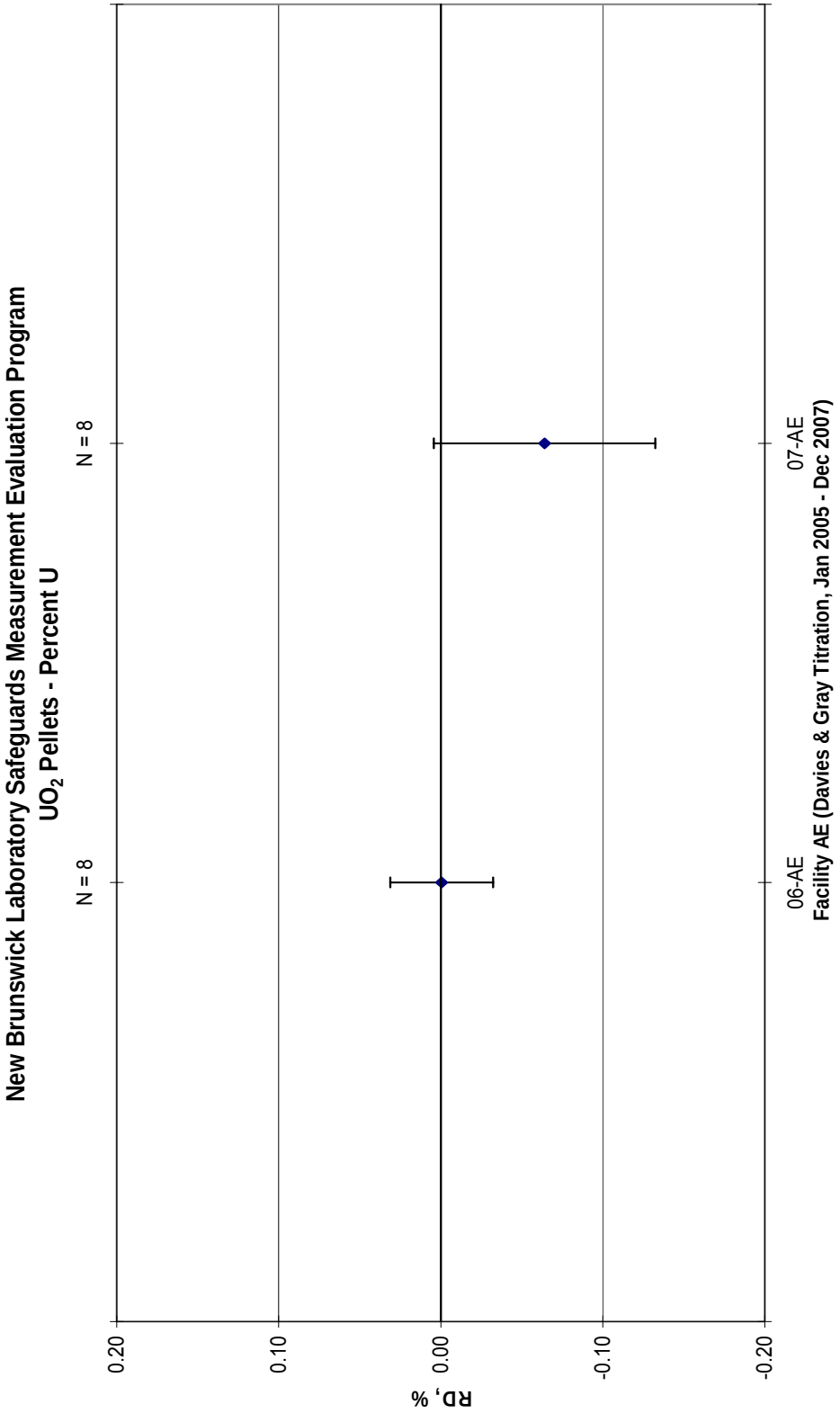

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 8
N = 8
0.20
0.10
0.00
-0.10
-0.20
RD, %
06-AE
07-AE
Facility AE (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 38**

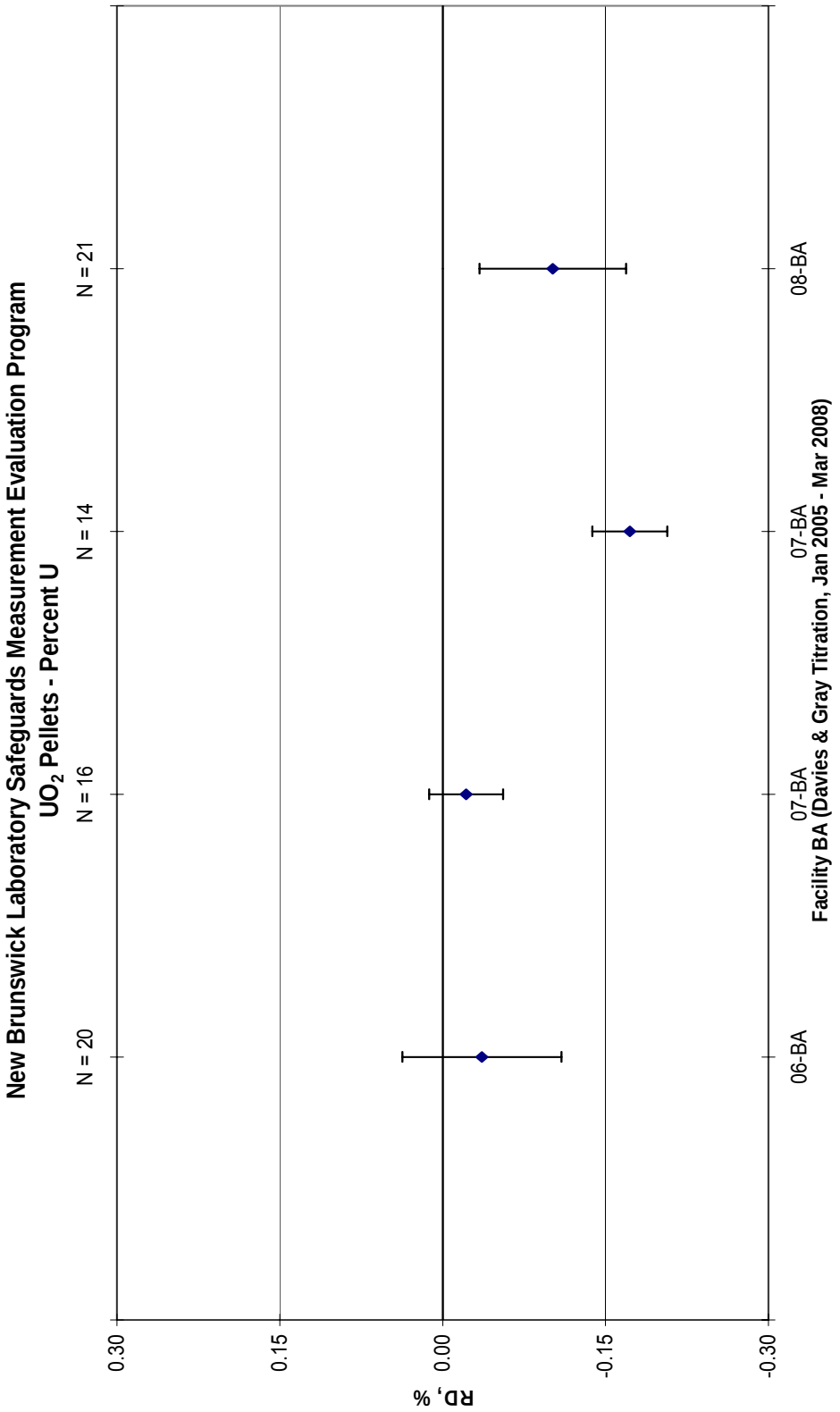

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
Facility BA (Davies & Gray Titration, Jan 2005 - Mar 2008)
RD, %
0.30
0.15
0.00
-0.15
-0.30
N = 20
N = 16
N = 14
N = 21
06-BA
07-BA
07-BA
08-BA

**Figure 39**

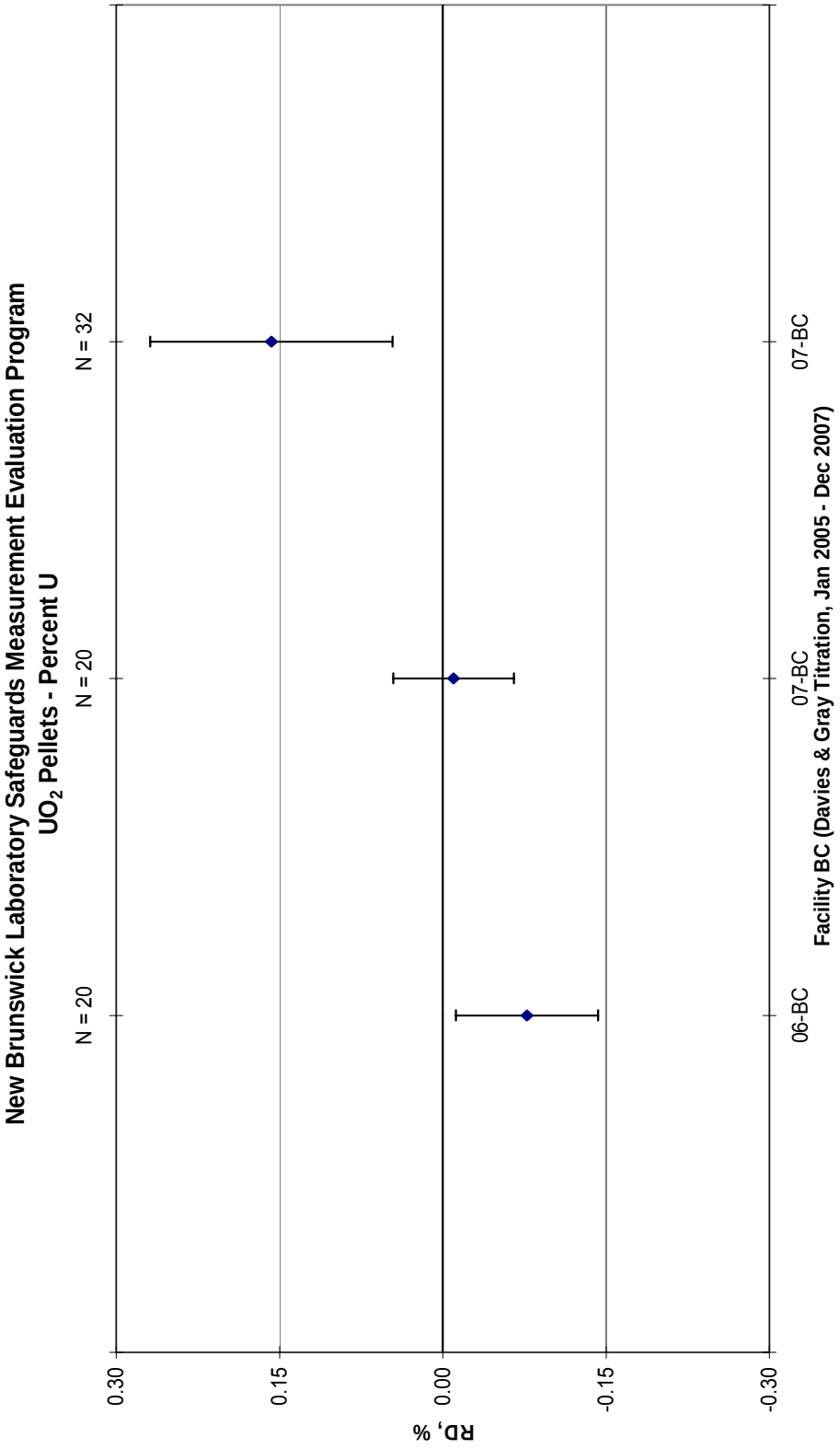

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 20
N = 20
N = 32
06-BC
07-BC
07-BC
Facility BC (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.30
0.15
0.00
-0.15
-0.30

**Figure 40**

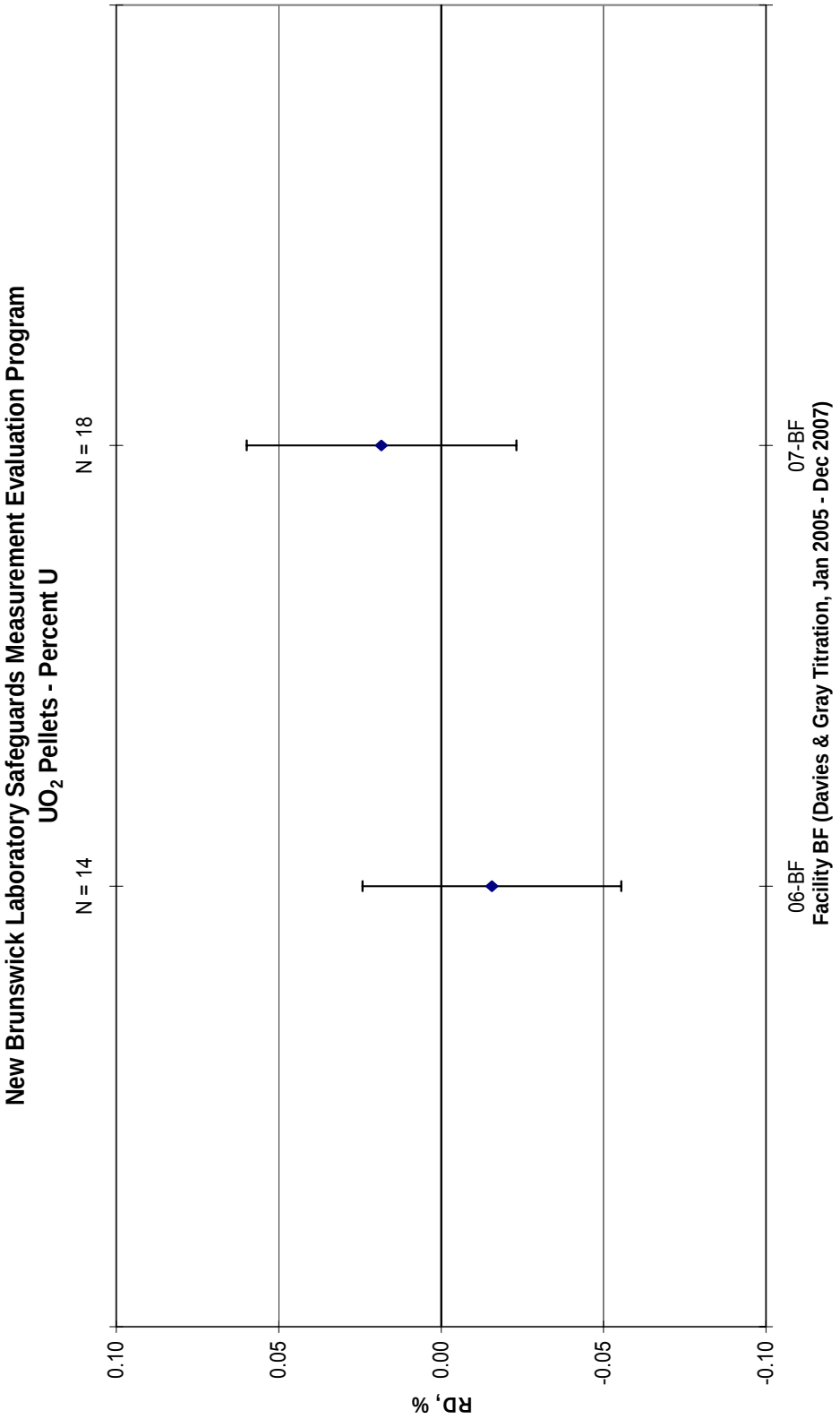

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 14
N = 18
06-BF
07-BF
Facility BF (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 41**

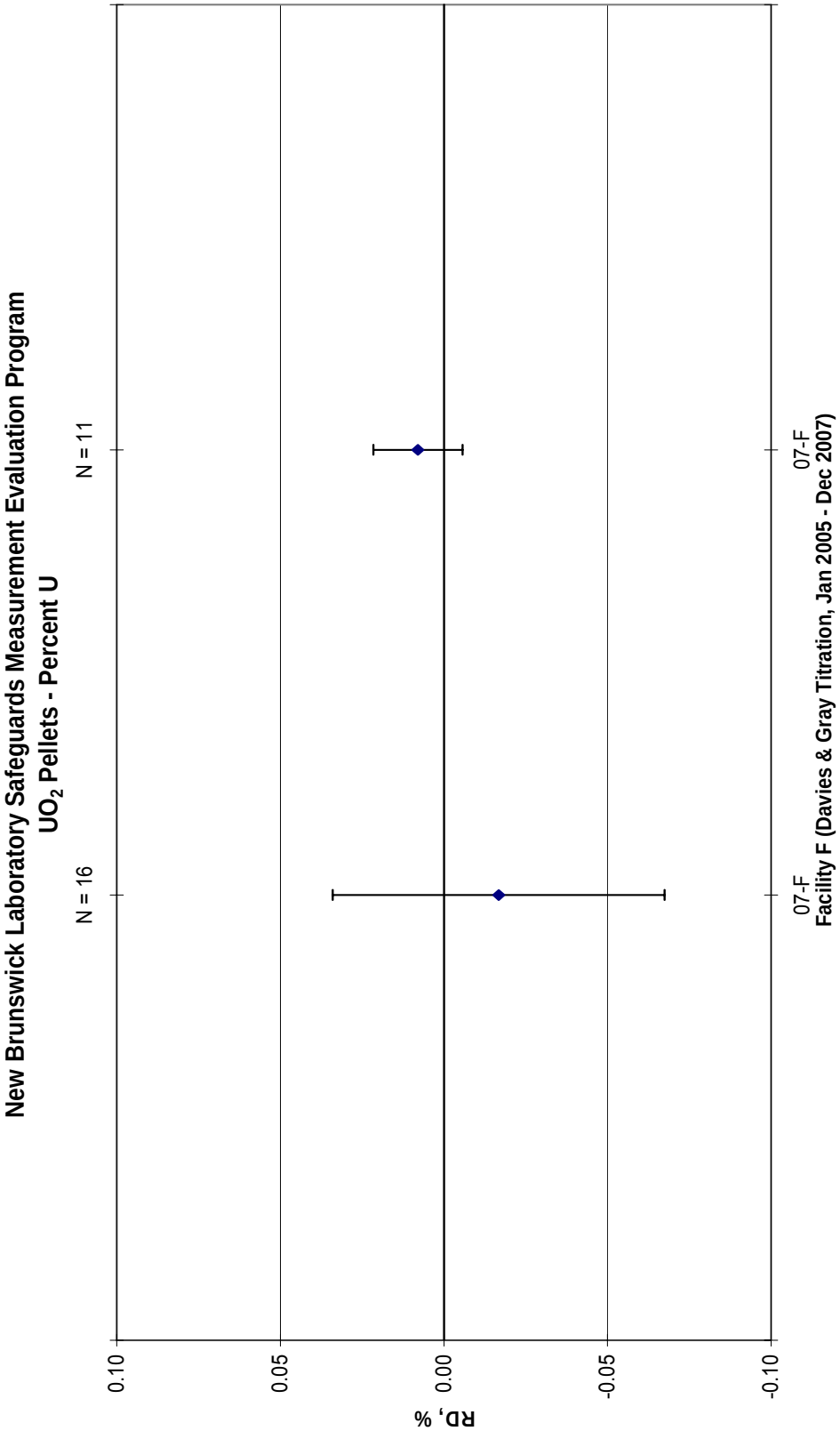

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 16
N = 11
07-F
07-F
Facility F (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 42**

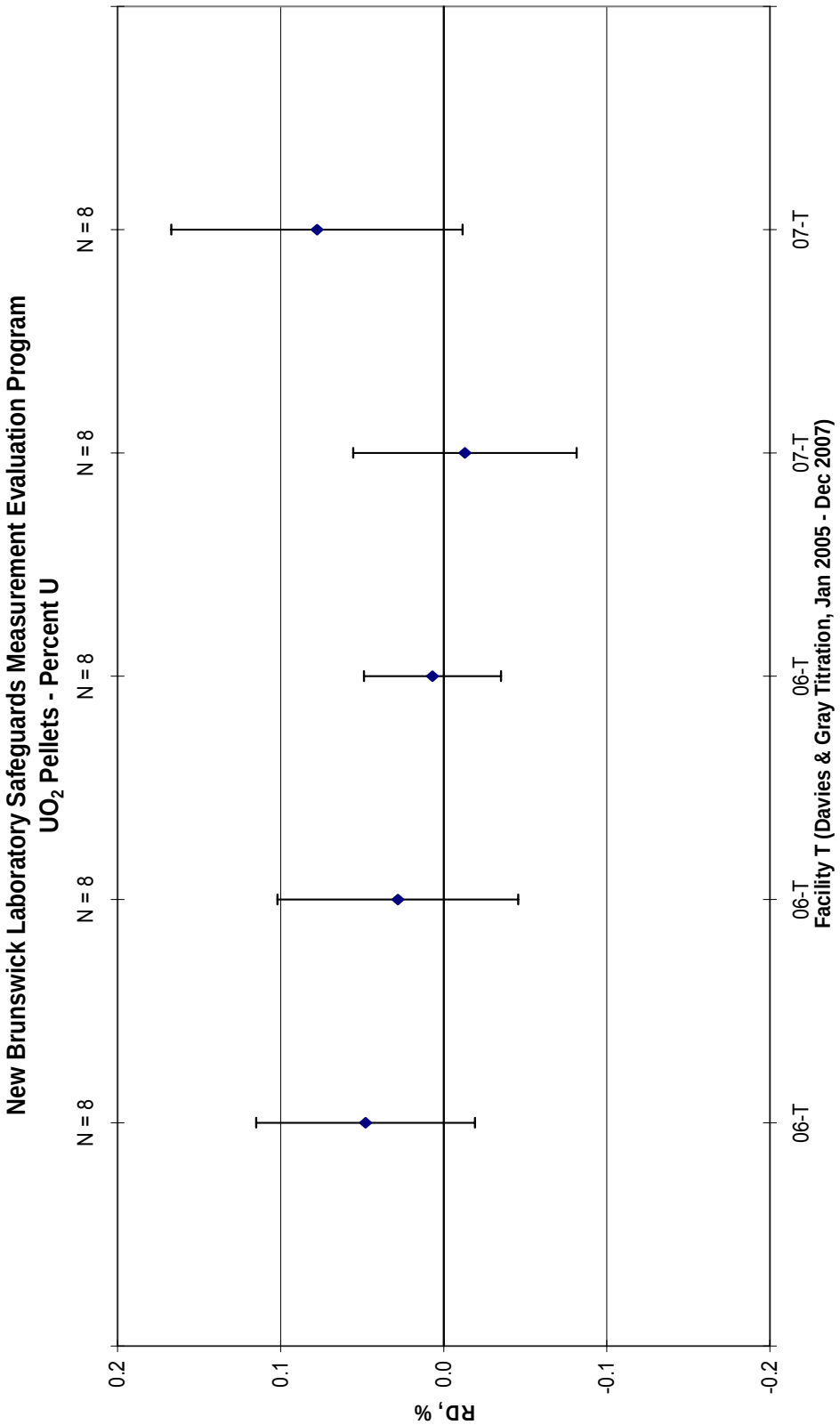

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 8
N = 8
N = 8
N = 8
06-T
06-T
06-T
07-T
07-T
Facility T (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.2
0.1
0.0
-0.1
-0.2

**Figure 43**

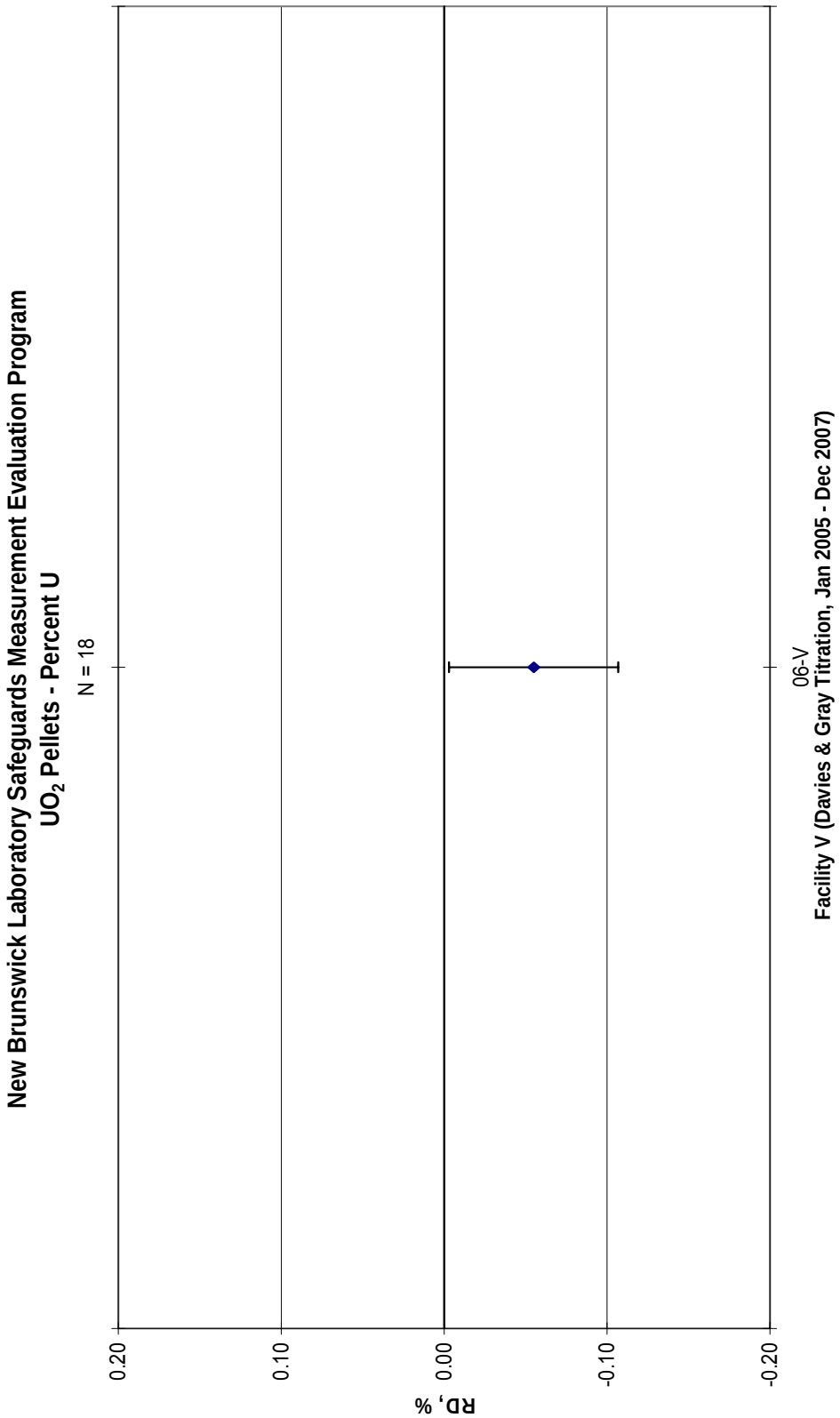

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO2 Pellets - Percent U
N = 18
06-V
Facility V (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.20
0.10
0.00
-0.10
-0.20

**Figure 44**

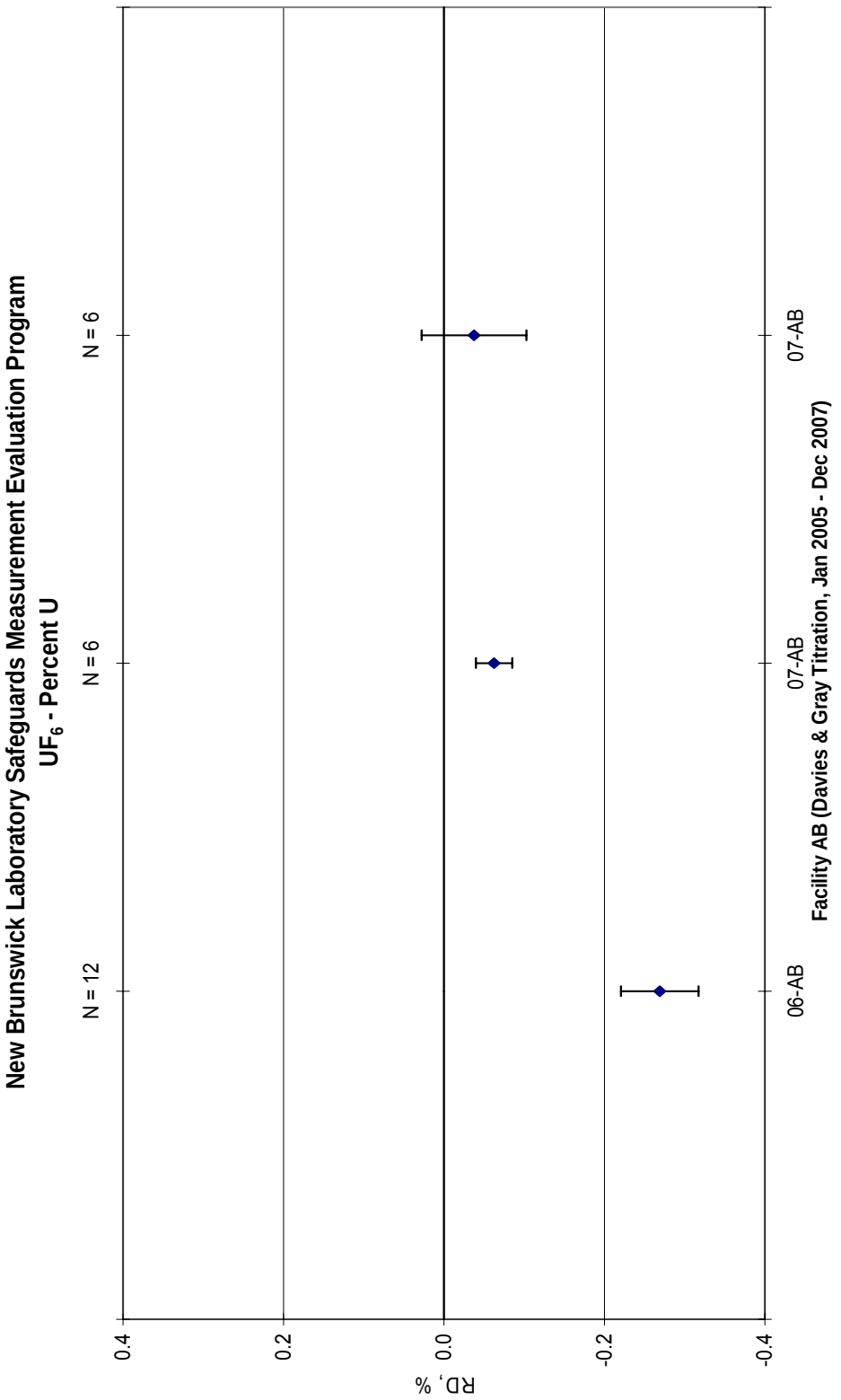

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U
N = 12
N = 6
N = 6
06-AB
07-AB
07-AB
Facility AB (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.4
0.2
0.0
-0.2
-0.4

**Figure 45**

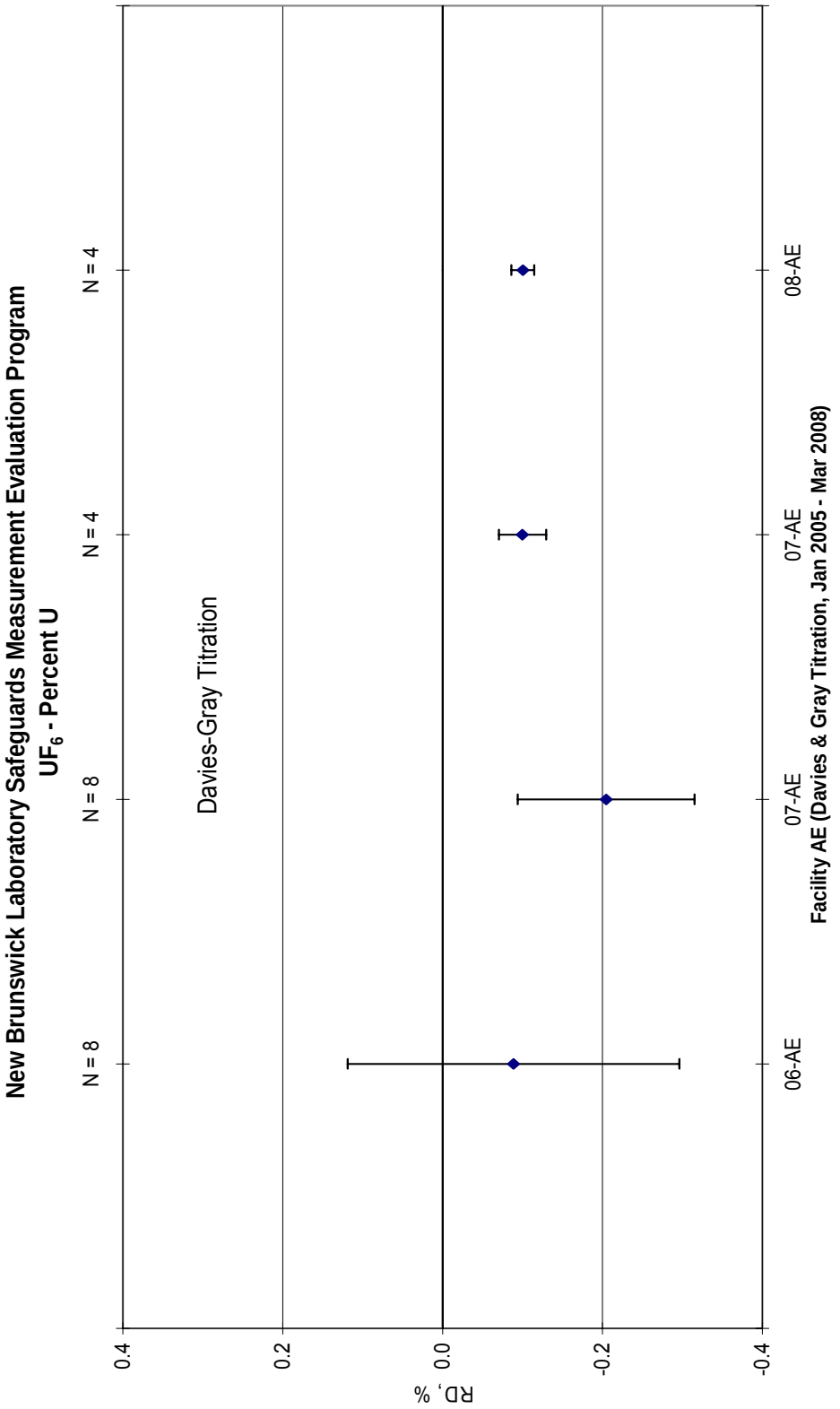

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U
Davies-Gray Titration
N = 8
N = 4
N = 8
N = 4
0.4
0.2
0.0
-0.2
-0.4
RD, %
06-AE
07-AE
07-AE
08-AE
Facility AE (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 46**

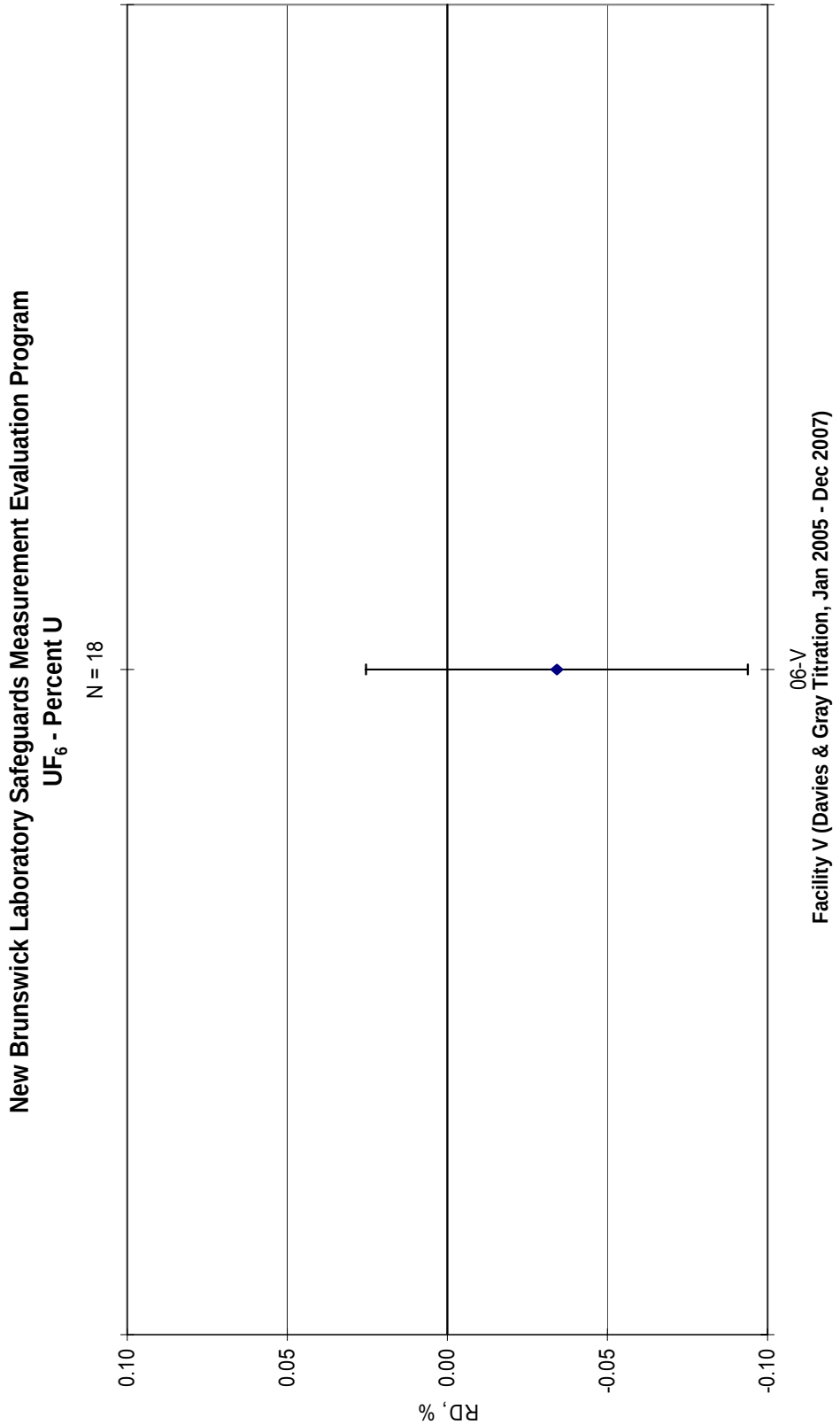

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U
N = 18
06-V
Facility V (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 47**

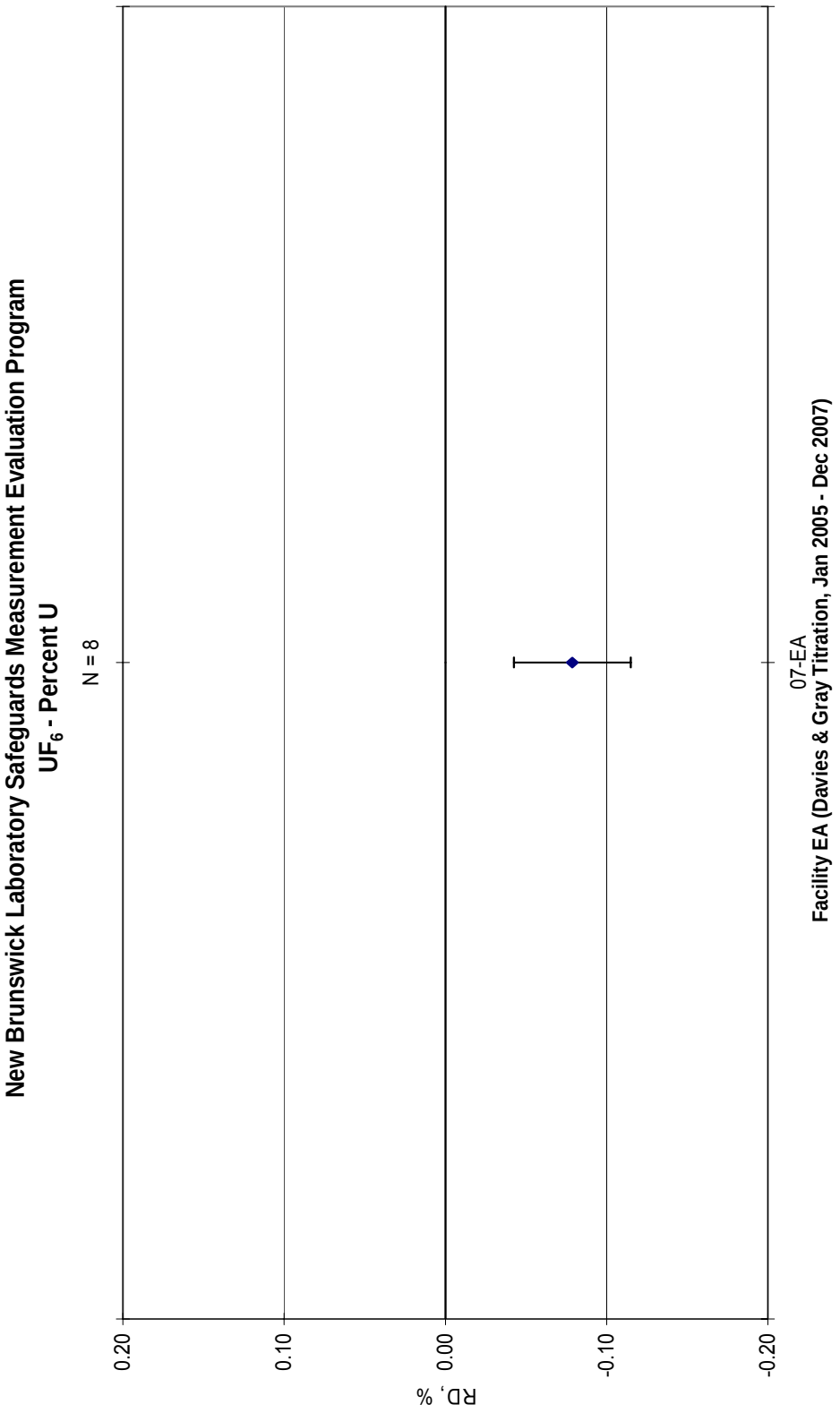

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UF6 - Percent U
N = 8
07-EA
Facility EA (Davies & Gray Titration, Jan 2005 - Dec 2007)
RD, %
0.20
0.10
0.00
-0.10
-0.20

**Figure 48**

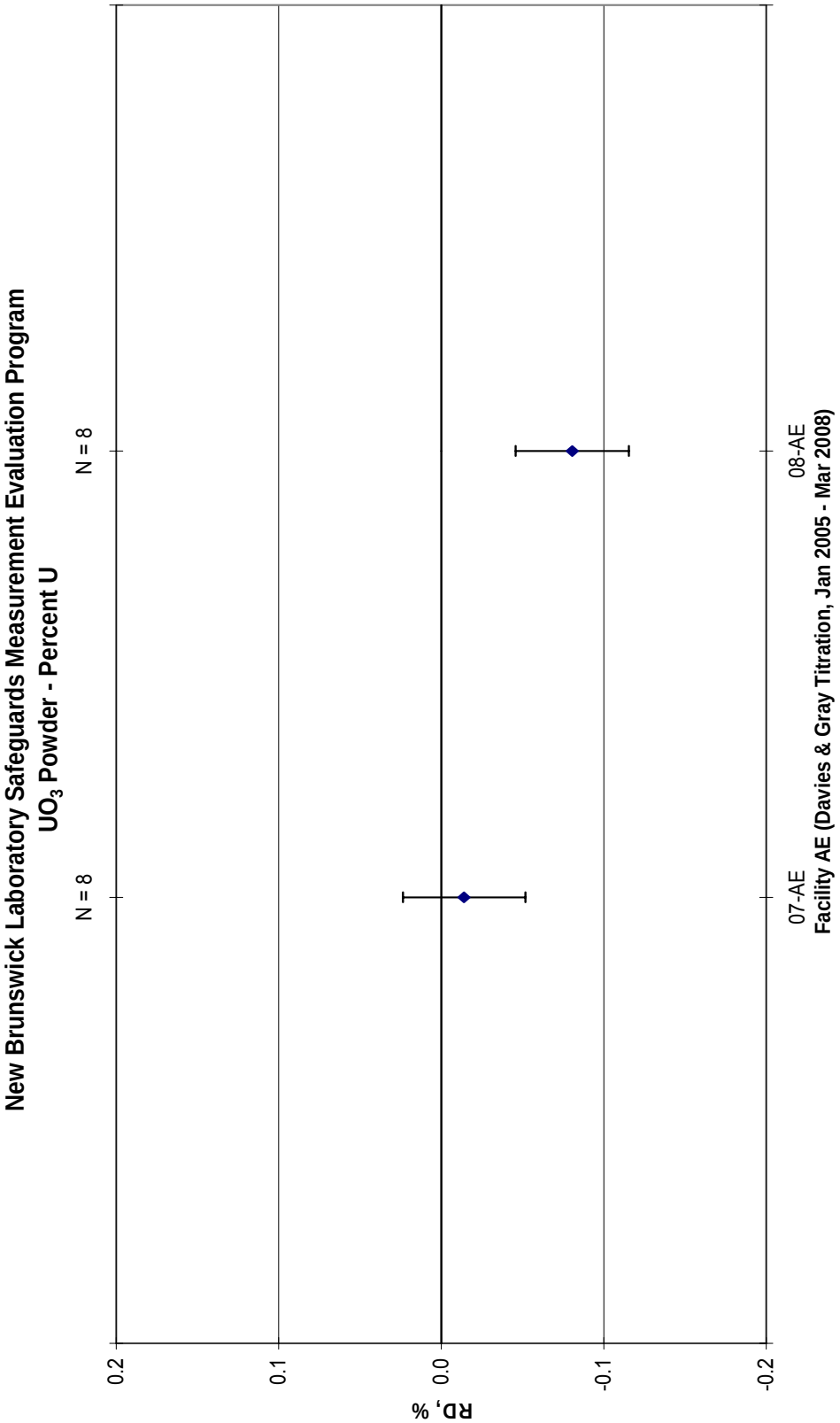

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 8
N = 8
07-AE
08-AE
Facility AE (Davies & Gray Titration, Jan 2005 - Mar 2008)
RD, %
0.2
0.1
0.0
-0.1
-0.2

**Figure 49**

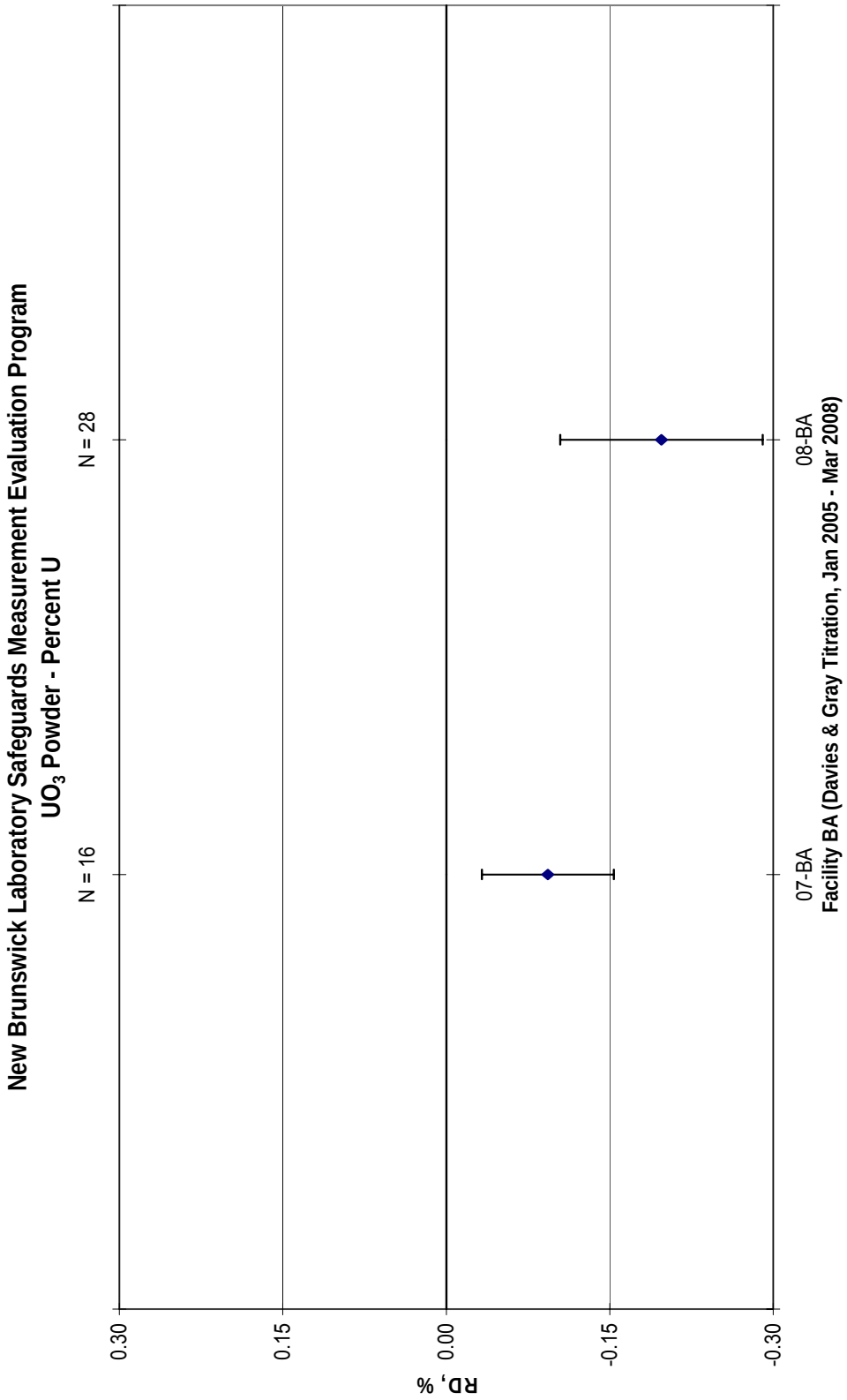

New Brunswick Laboratory Safeguards Measurement Evaluation Program
$UO_3$ Powder - Percent U
N = 16
N = 28
0.30
0.15
0.00
-0.15
-0.30
RD, %
07-BA
08-BA
Facility BA (Davies & Gray Titration, Jan 2005 - Mar 2008)

**Figure 50**

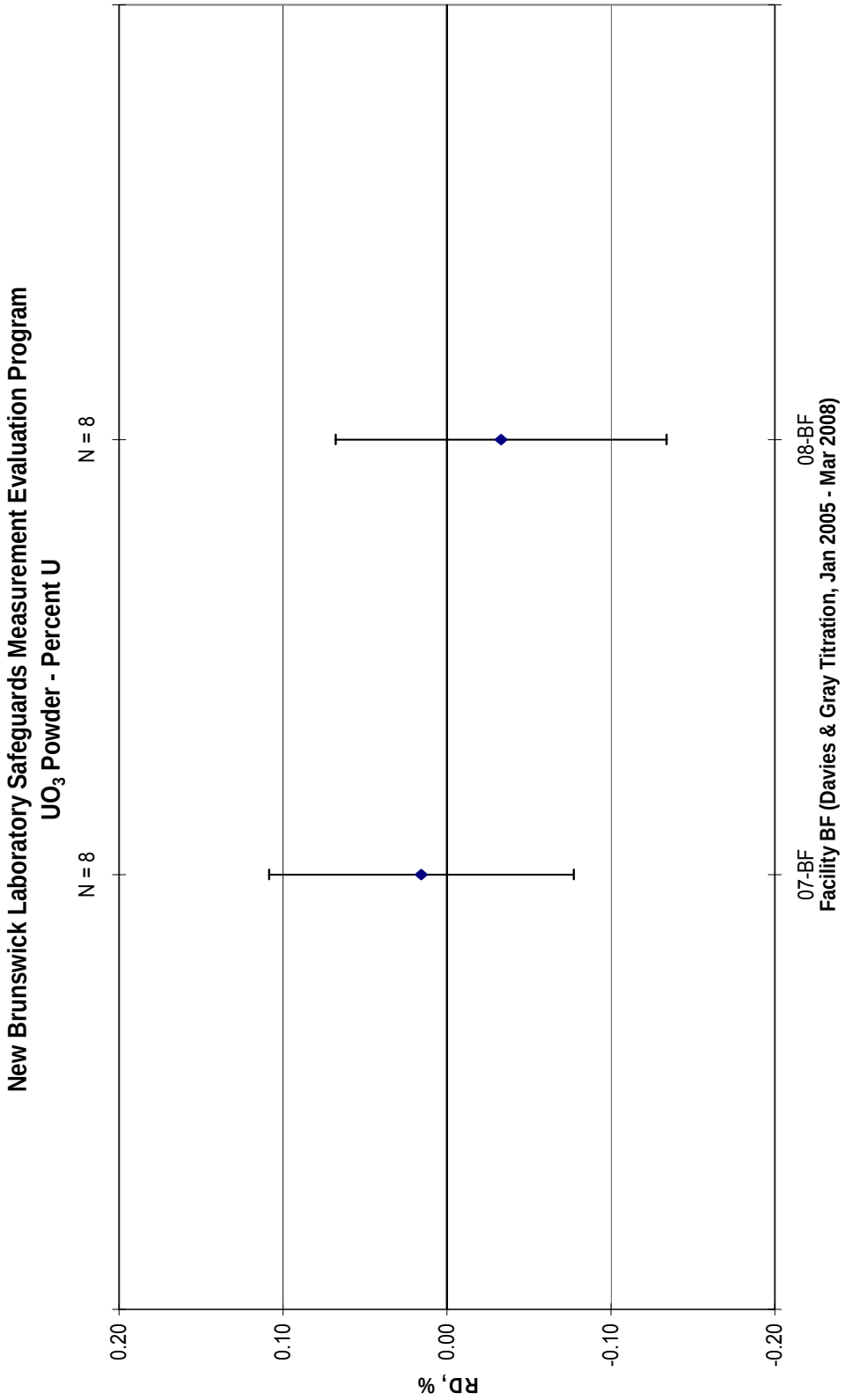

New Brunswick Laboratory Safeguards Measurement Evaluation Program
$UO_3$ Powder - Percent U
N = 8
N = 8
07-BF
08-BF
Facility BF (Davies & Gray Titration, Jan 2005 - Mar 2008)
RD, %
0.20
0.10
0.00
-0.10
-0.20

**Figure 51**

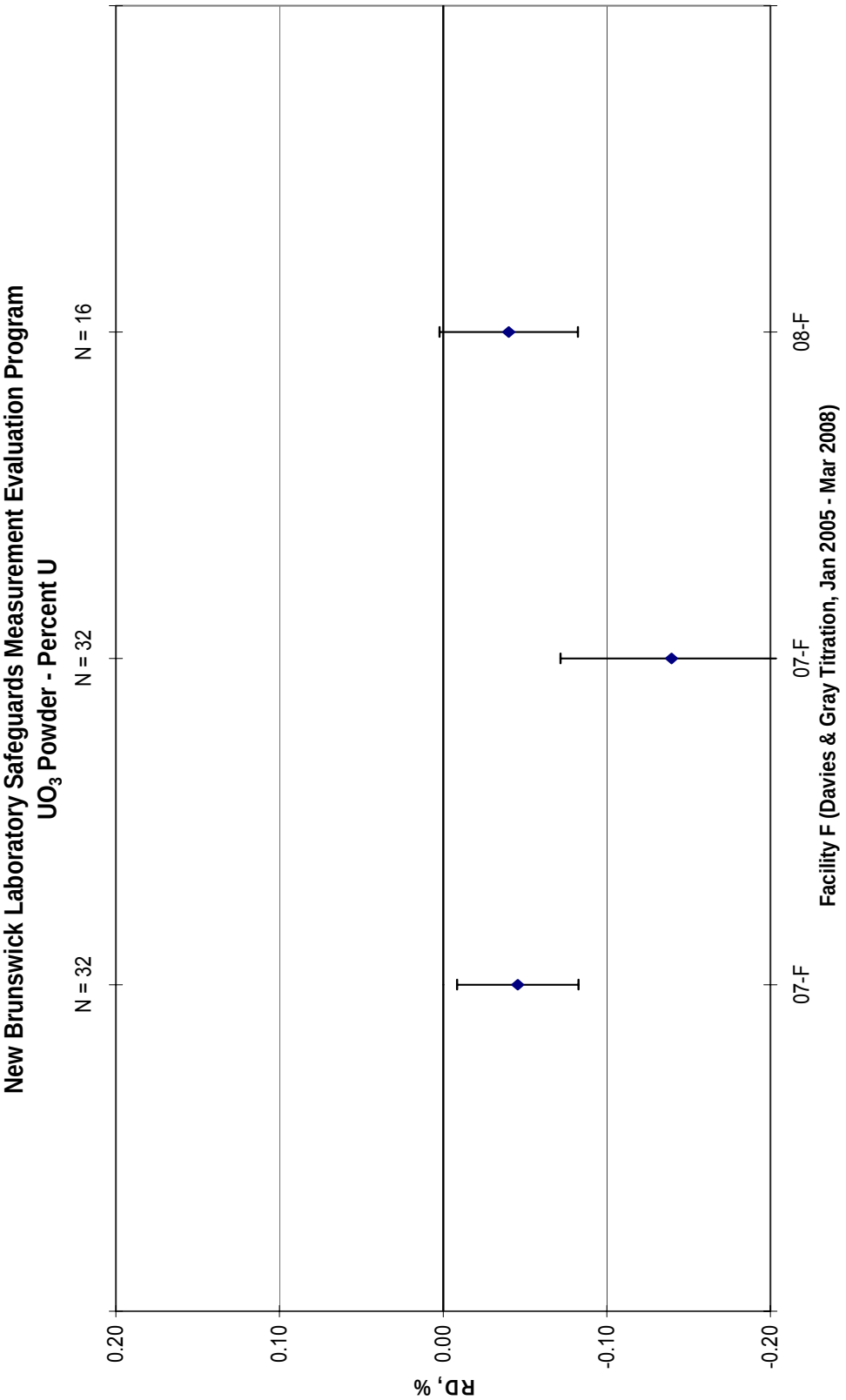

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 32
N = 32
N = 16
07-F
07-F
08-F
Facility F (Davies & Gray Titration, Jan 2005 - Mar 2008)
RD, %
0.20
0.10
0.00
-0.10
-0.20

**Figure 52**

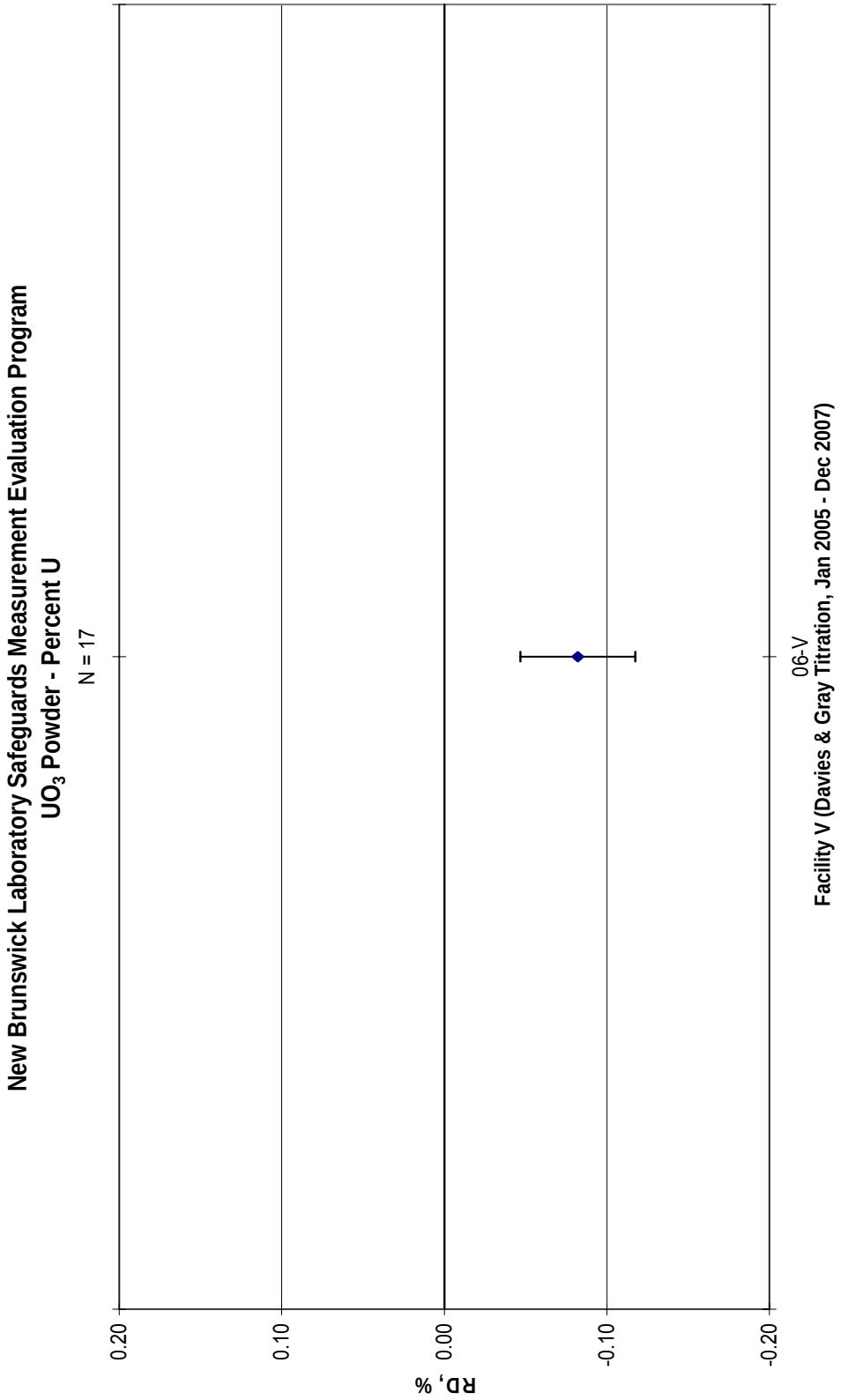

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 17
RD, %
0.20
0.10
0.00
-0.10
-0.20
06-V
Facility V (Davies & Gray Titration, Jan 2005 - Dec 2007)

**Figure 53**

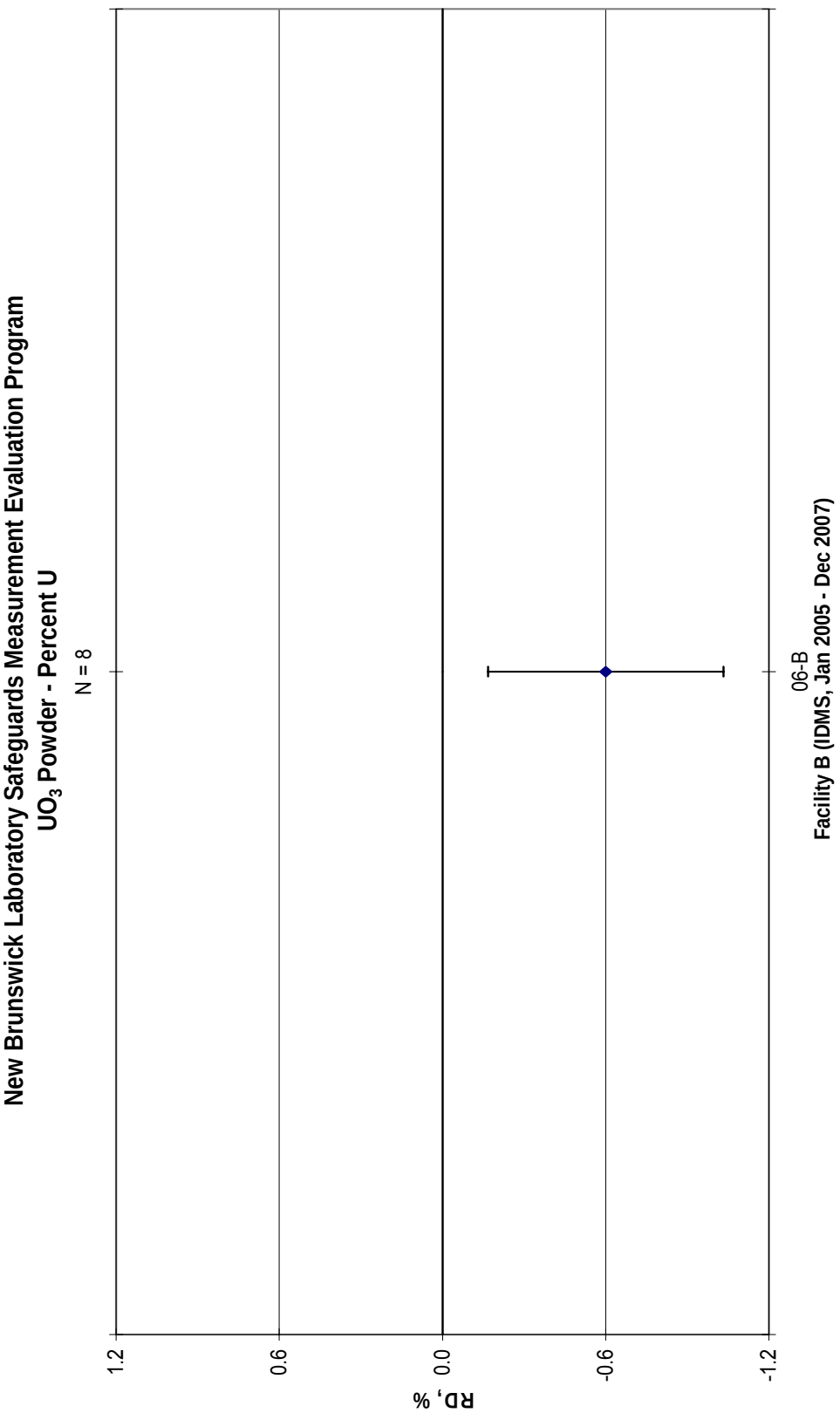

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 8
RD, %
1.2
0.6
0.0
-0.6
-1.2
06-B
Facility B (IDMS, Jan 2005 - Dec 2007)

**Figure 54**

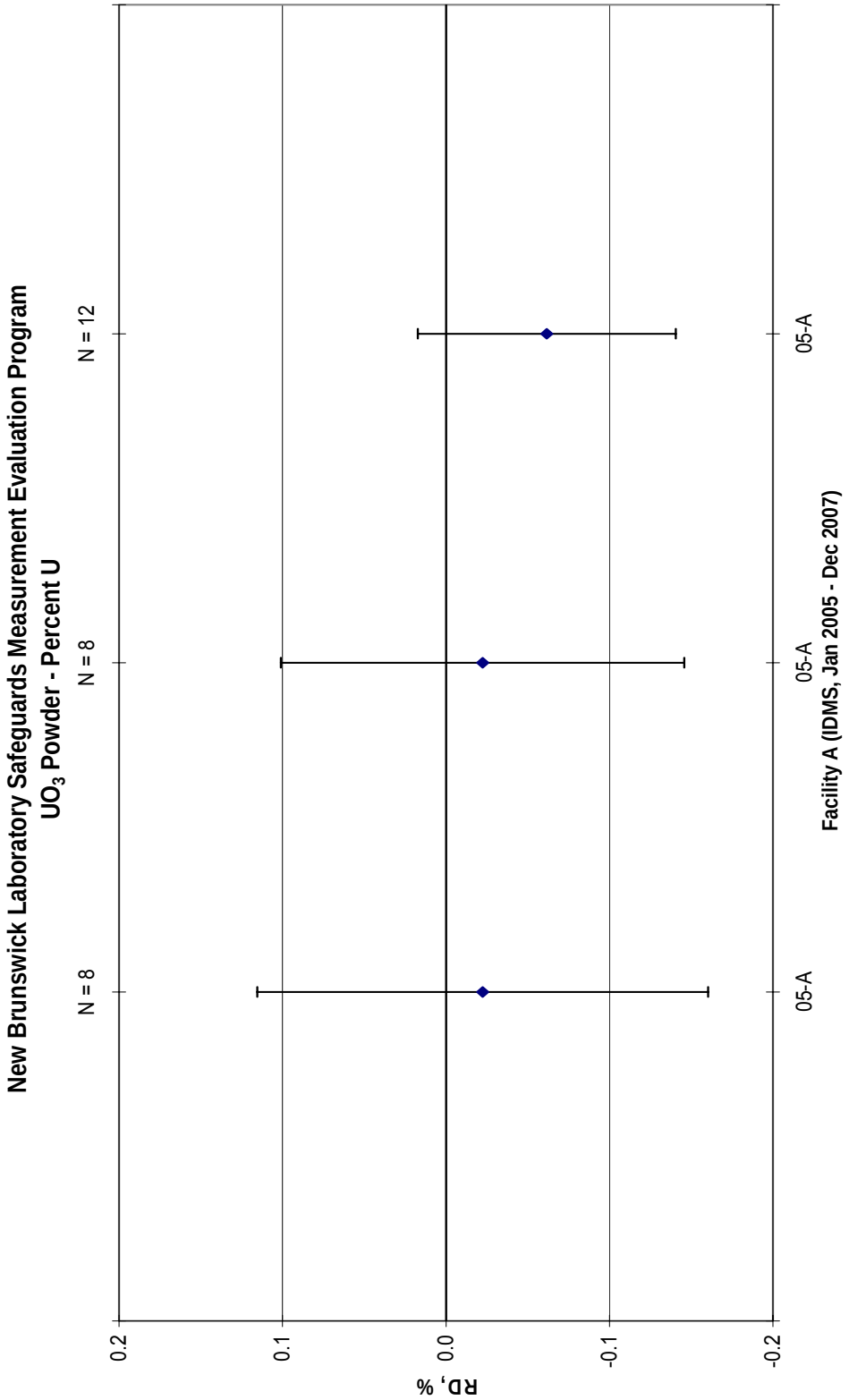

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 8
N = 8
N = 12
05-A
05-A
05-A
Facility A (IDMS, Jan 2005 - Dec 2007)
RD, %
0.2
0.1
0.0
-0.1
-0.2

**Figure 55**

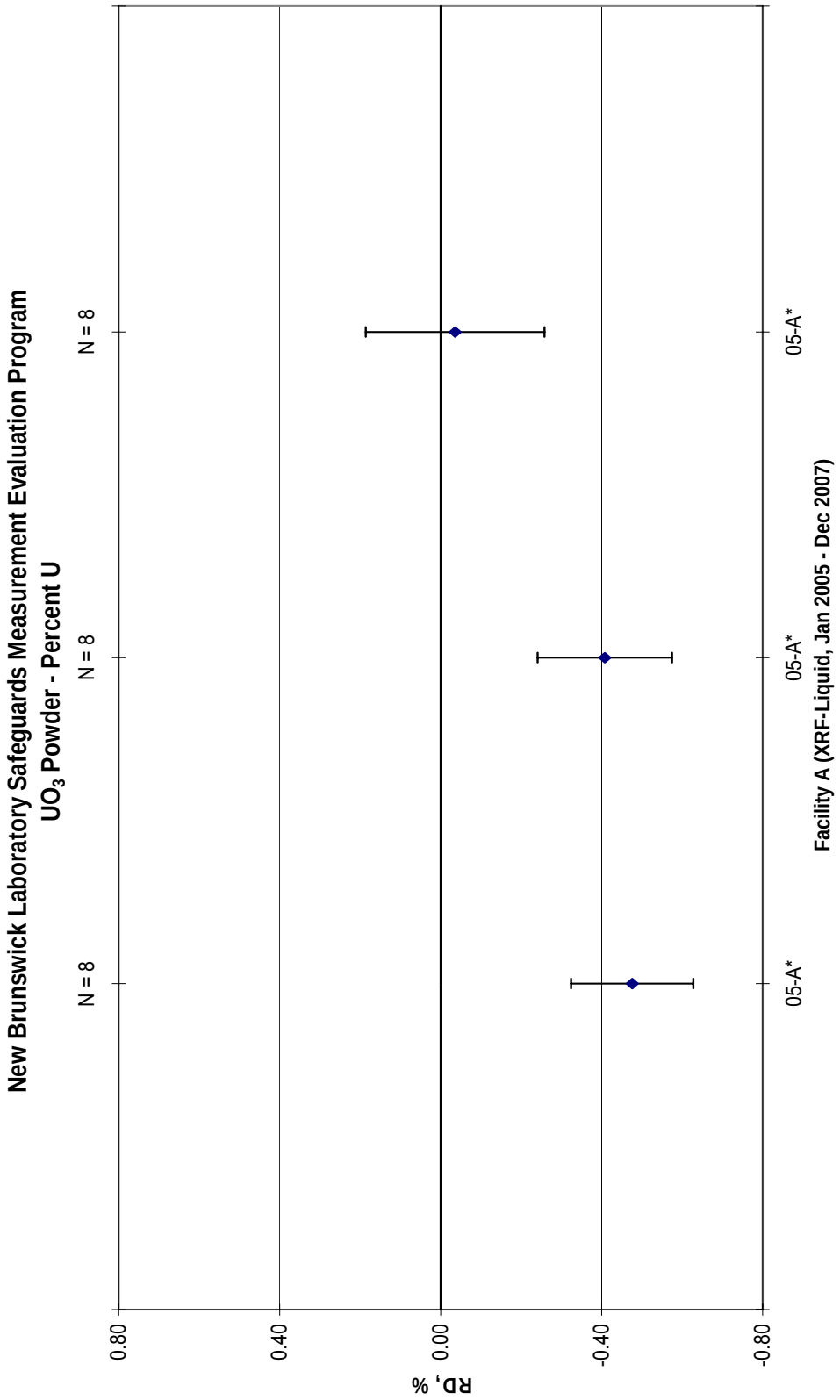

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
Facility A (XRF-Liquid, Jan 2005 - Dec 2007)
RD, %
0.80
0.40
0.00
-0.40
-0.80
N = 8
N = 8
N = 8
05-A*
05-A*
05-A*

**Figure 56**

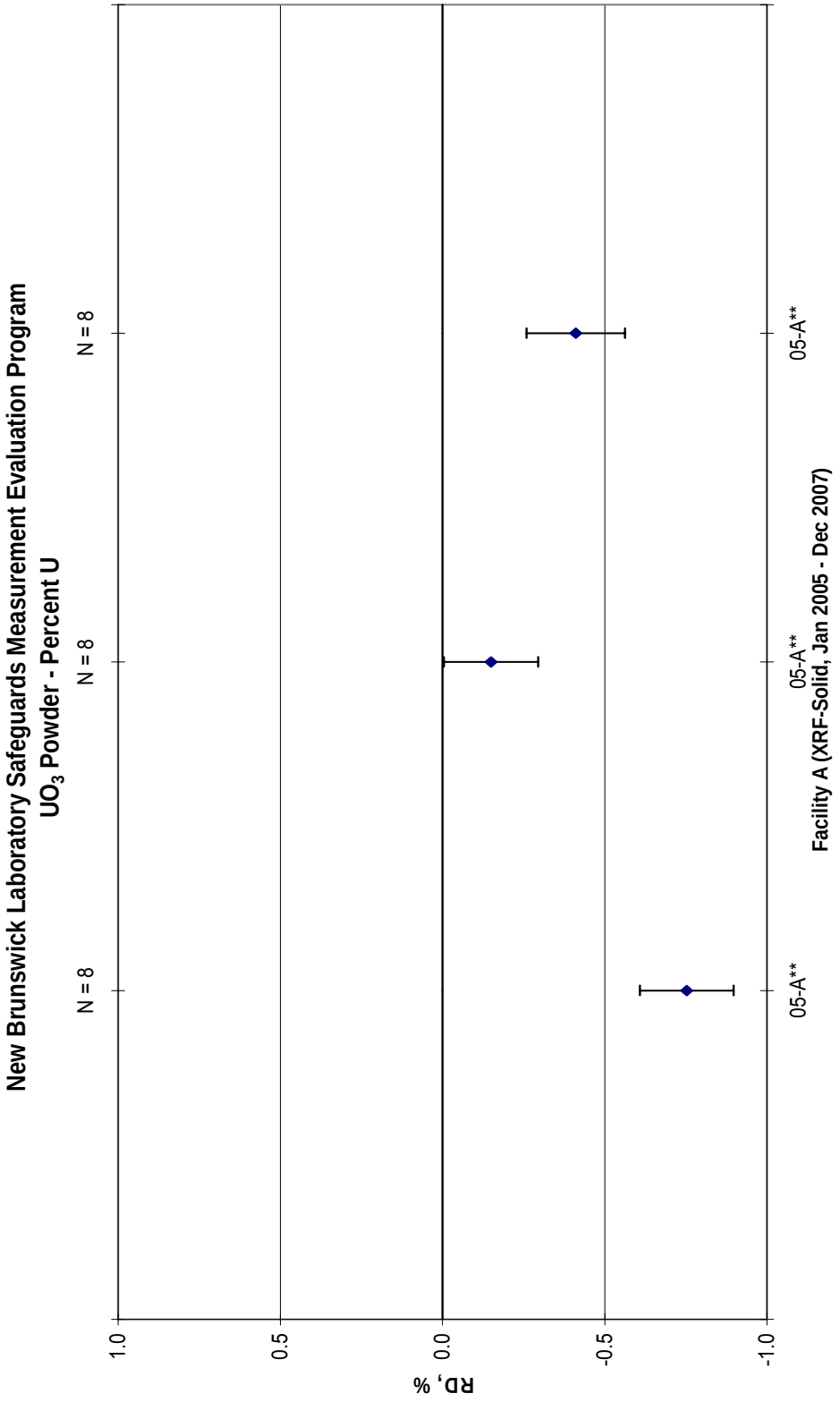

New Brunswick Laboratory Safeguards Measurement Evaluation Program
UO3 Powder - Percent U
N = 8
N = 8
N = 8
05-A**
05-A**
05-A**
Facility A (XRF-Solid, Jan 2005 - Dec 2007)
RD, %
1.0
0.5
0.0
-0.5
-1.0

**Figure 57**

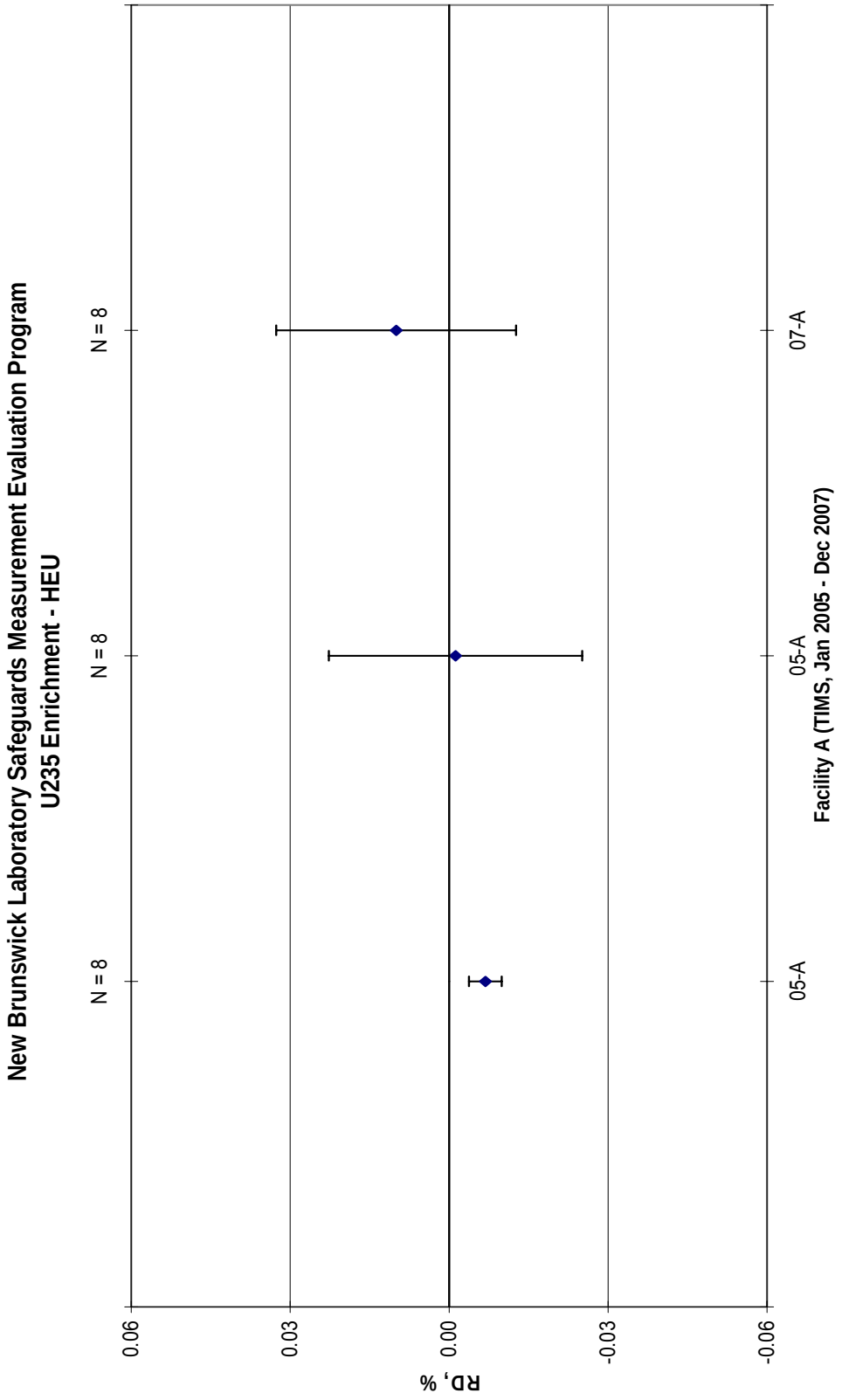

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
RD, %
0.06
0.03
0.00
-0.03
-0.06
N = 8
N = 8
N = 8
05-A
05-A
07-A
Facility A (TIMS, Jan 2005 - Dec 2007)

**Figure 58**

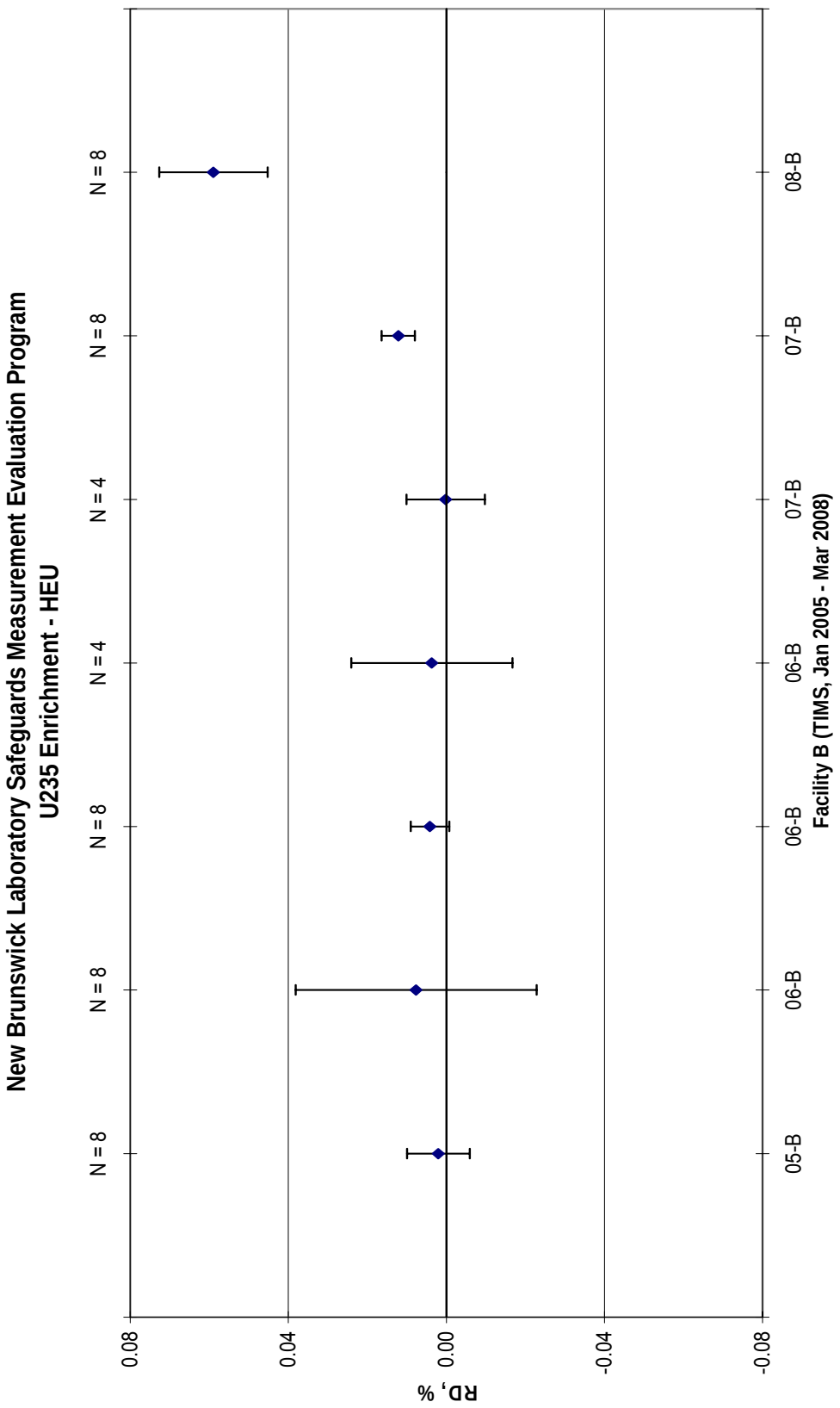

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
RD, %
0.08
0.04
0.00
-0.04
-0.08
N = 8
N = 8
N = 4
N = 8
N = 4
N = 8
05-B
06-B
06-B
06-B
07-B
07-B
08-B
Facility B (TIMS, Jan 2005 - Mar 2008)

**Figure 59**

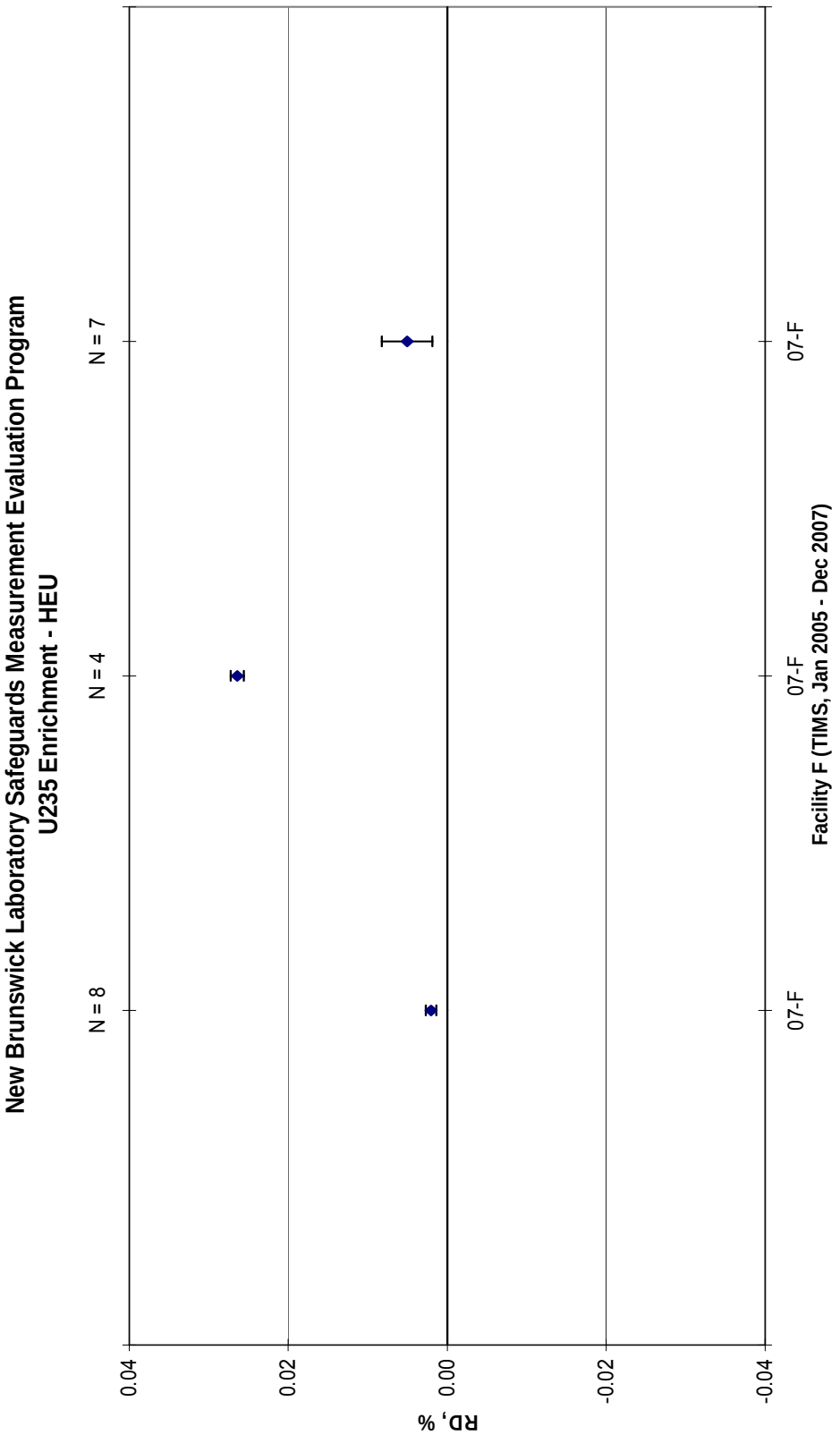

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
RD, %
0.04
0.02
0.00
-0.02
-0.04
N = 8
N = 4
N = 7
07-F
07-F
07-F
Facility F (TIMS, Jan 2005 - Dec 2007)

**Figure 60**

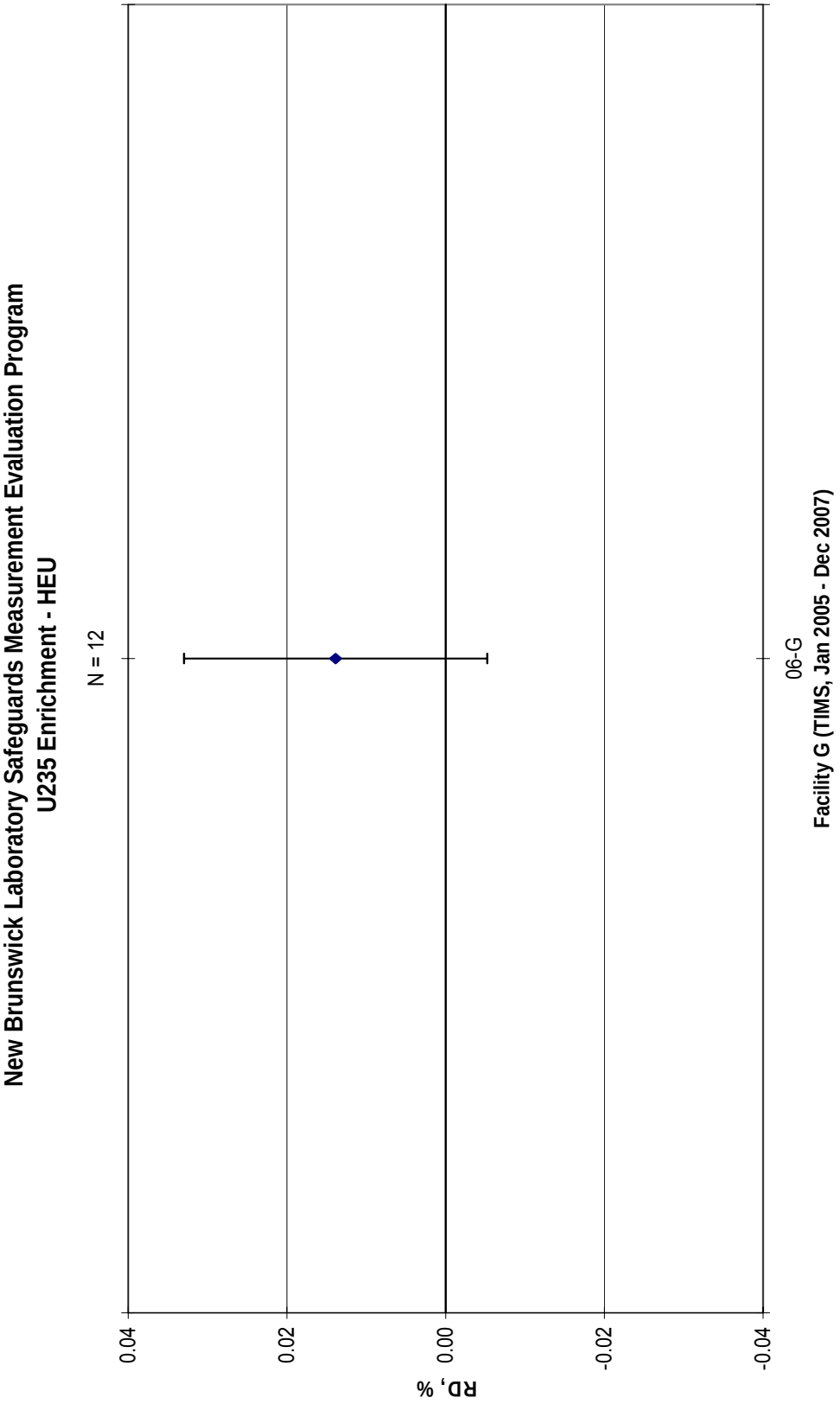

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
N = 12
06-G
Facility G (TIMS, Jan 2005 - Dec 2007)
RD, %
0.04
0.02
0.00
-0.02
-0.04

**Figure 61**

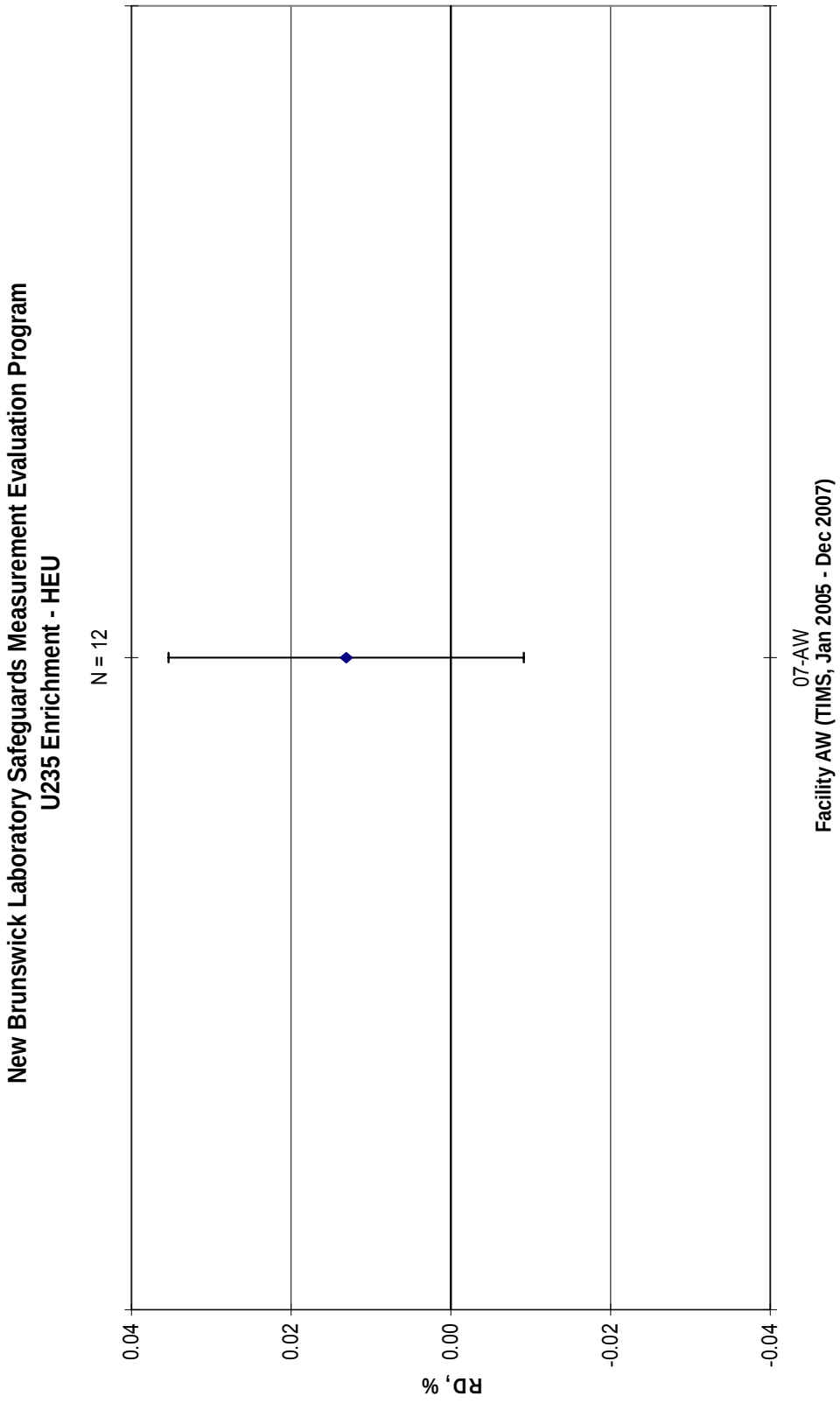

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
N = 12
0.04
0.02
0.00
-0.02
-0.04
RD, %
07-AW
Facility AW (TIMS, Jan 2005 - Dec 2007)

**Figure 62**

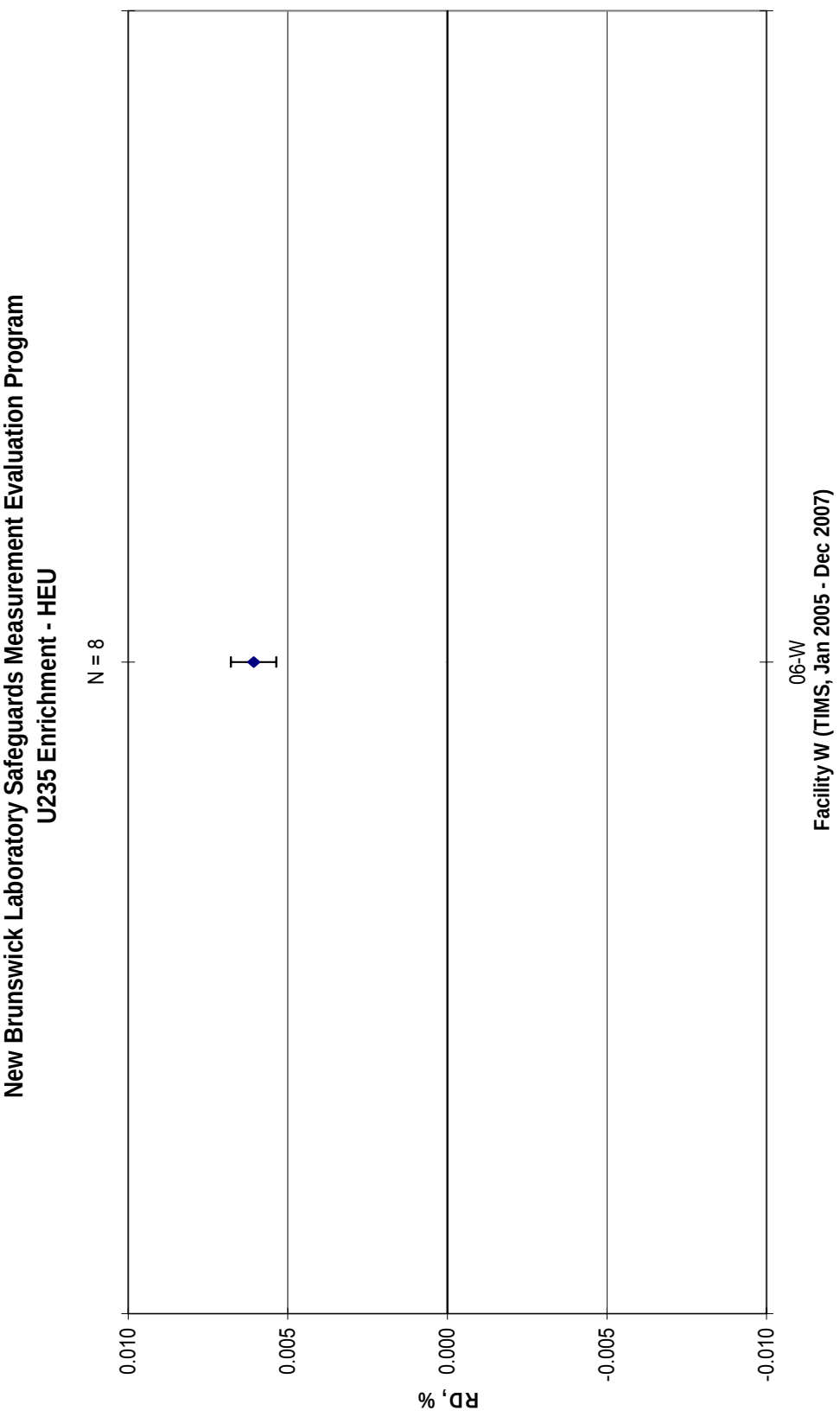

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - HEU
N = 8
RD, %
0.010
0.005
0.000
-0.005
-0.010
06-W
Facility W (TIMS, Jan 2005 - Dec 2007)

**Figure 63**

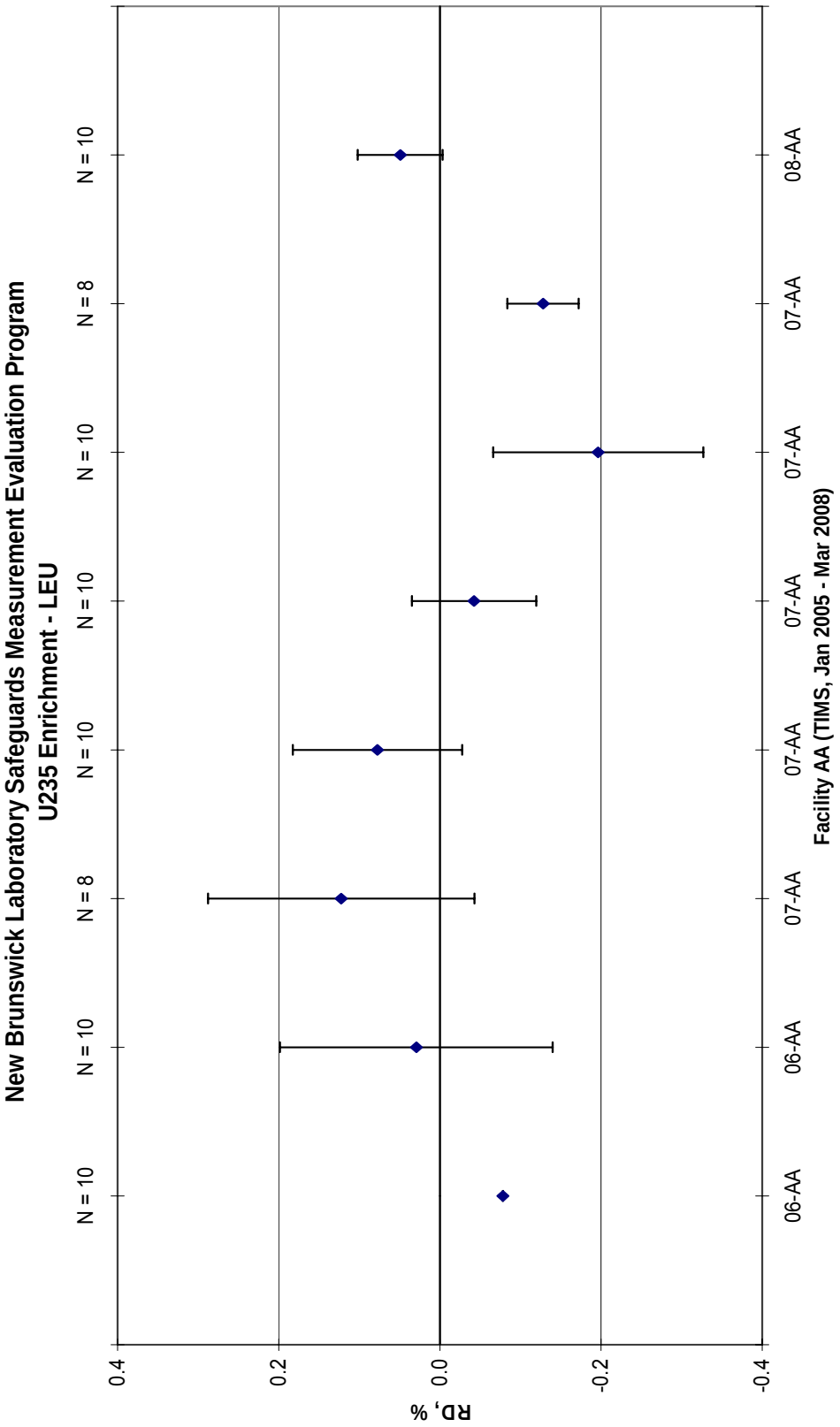

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
RD, %
0.4
0.2
0.0
-0.2
-0.4
N = 10
N = 10
N = 8
N = 10
N = 10
N = 8
N = 10
06-AA
06-AA
07-AA
07-AA
07-AA
07-AA
07-AA
08-AA
Facility AA (TIMS, Jan 2005 - Mar 2008)

**Figure 64**

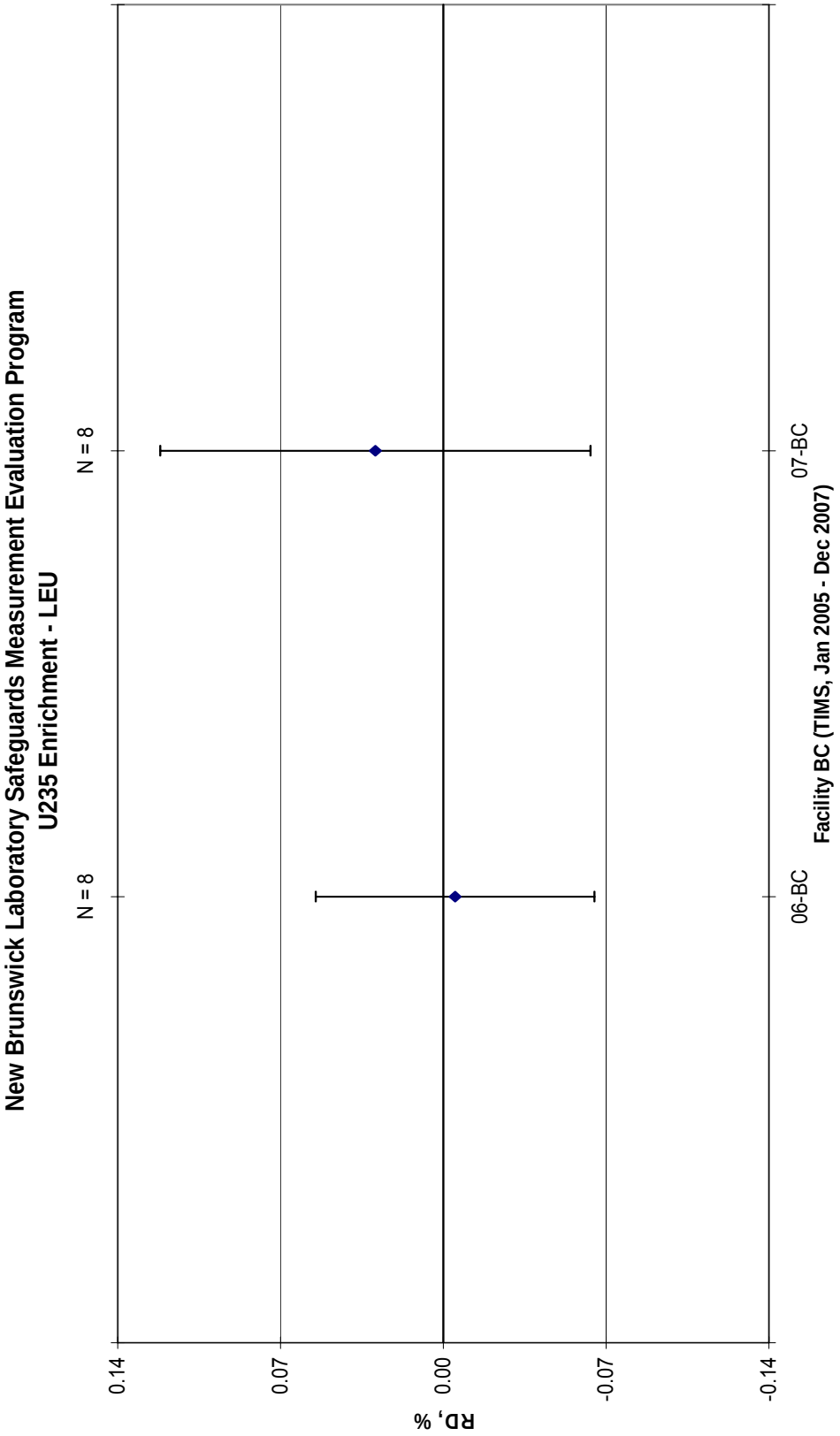

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 8
N = 8
06-BC
07-BC
Facility BC (TIMS, Jan 2005 - Dec 2007)
RD, %
0.14
0.07
0.00
-0.07
-0.14

**Figure 65**

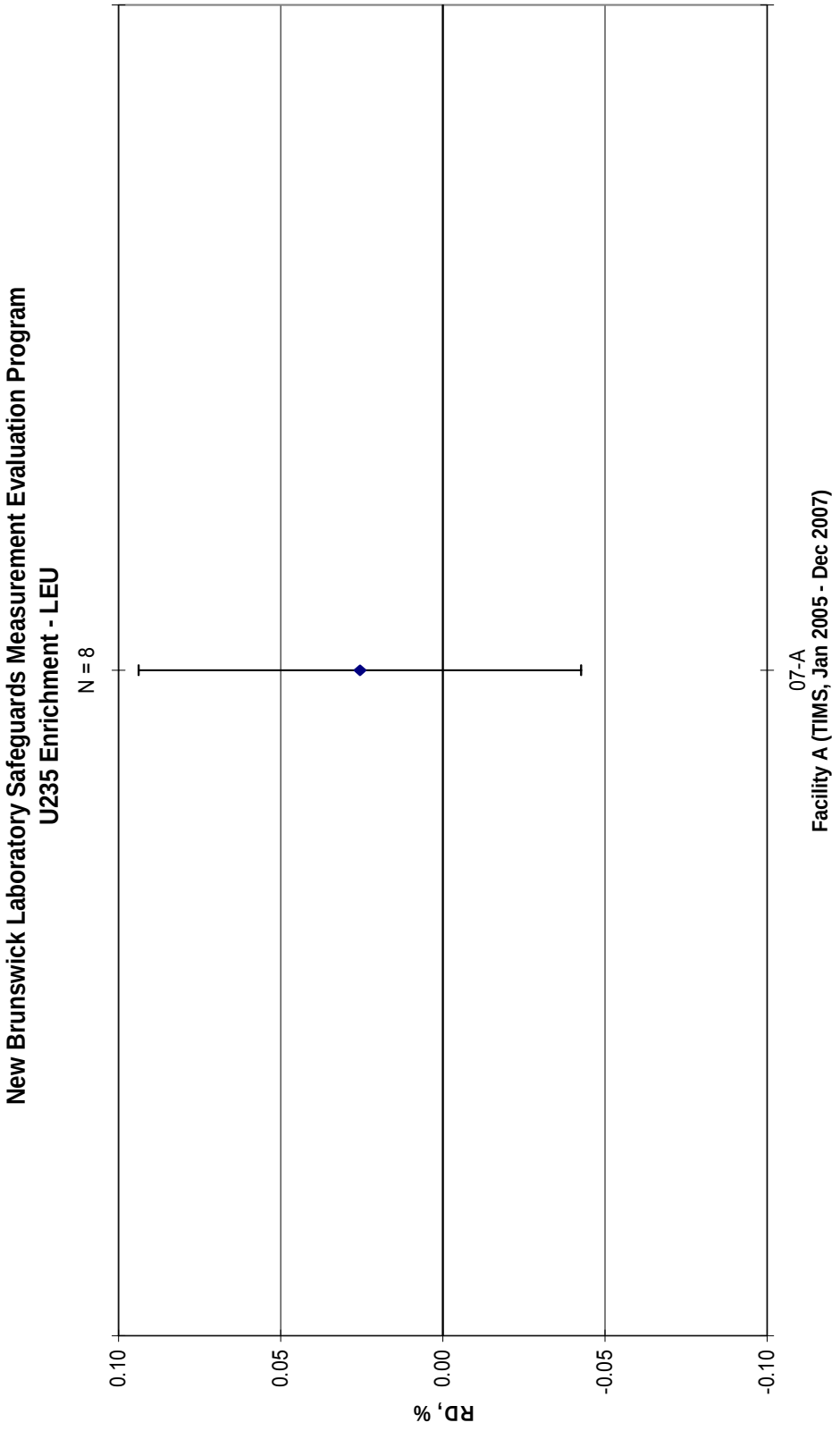

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 8
07-A
Facility A (TIMS, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 66**

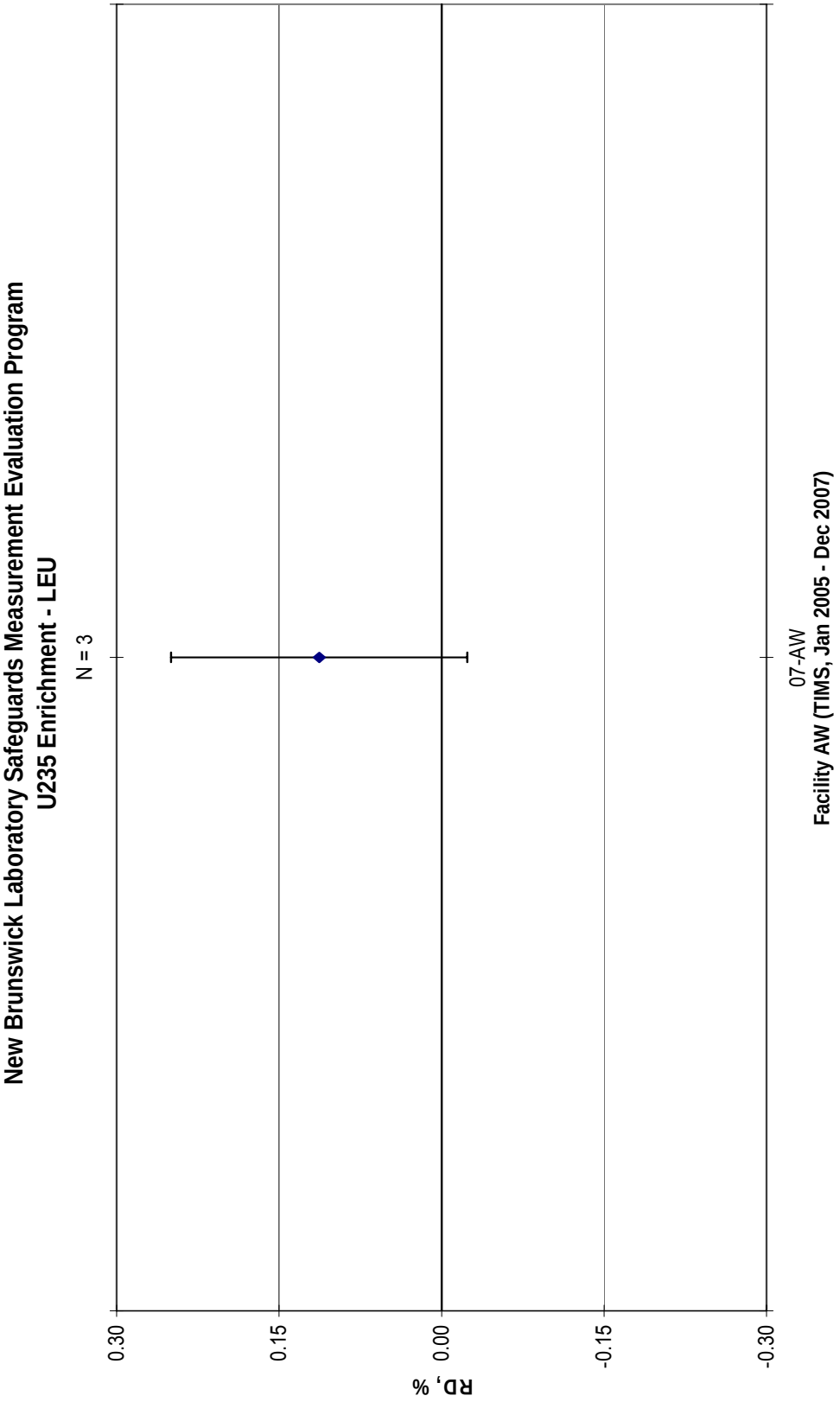

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 3
RD, %
0.30
0.15
0.00
-0.15
-0.30
07-AW
Facility AW (TIMS, Jan 2005 - Dec 2007)

**Figure 67**

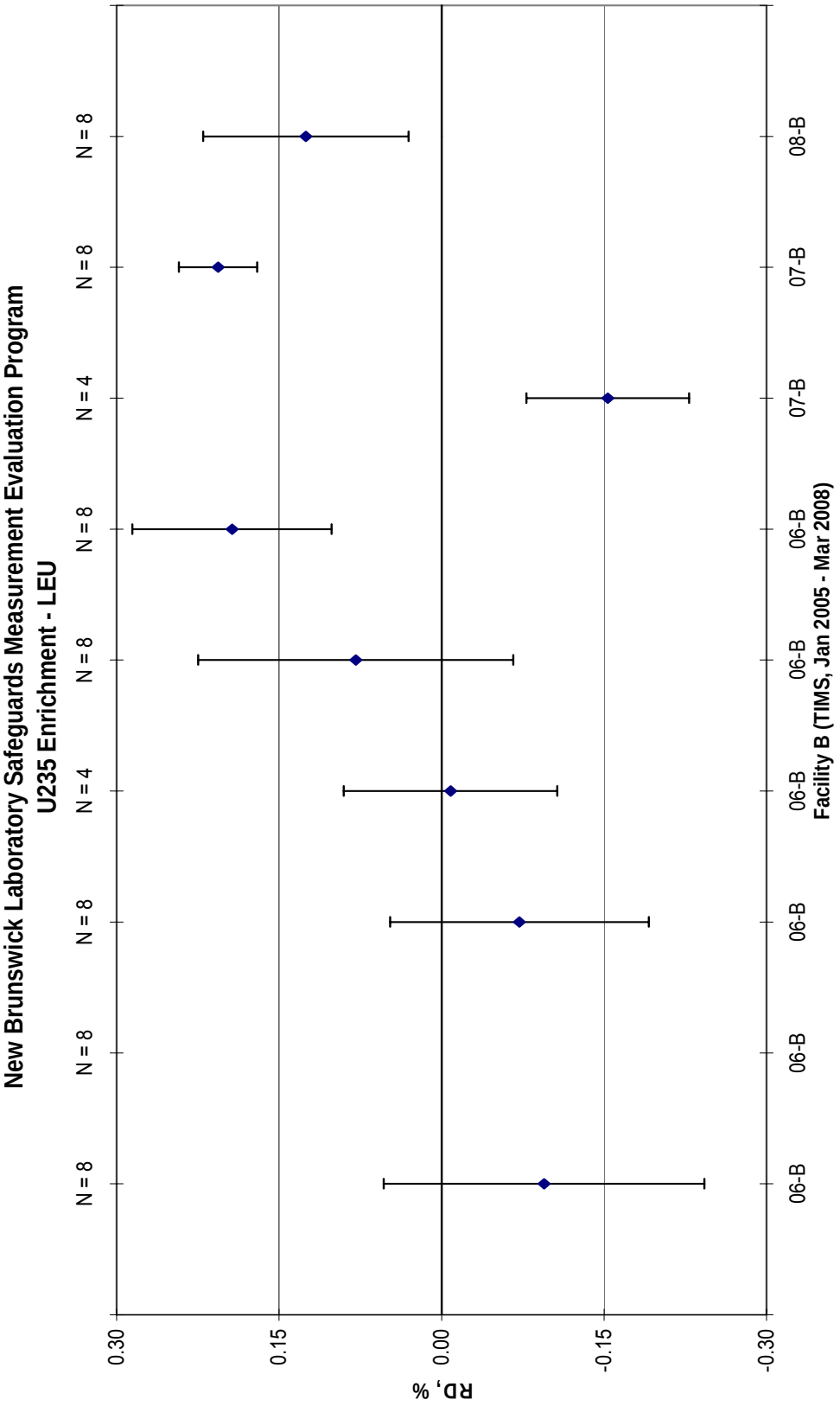

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
RD, %
0.30
0.15
0.00
-0.15
-0.30
N = 8
N = 8
N = 8
N = 4
N = 8
N = 4
N = 8
N = 8
06-B
06-B
06-B
06-B
06-B
06-B
07-B
07-B
08-B
Facility B (TIMS, Jan 2005 - Mar 2008)

**Figure 68**

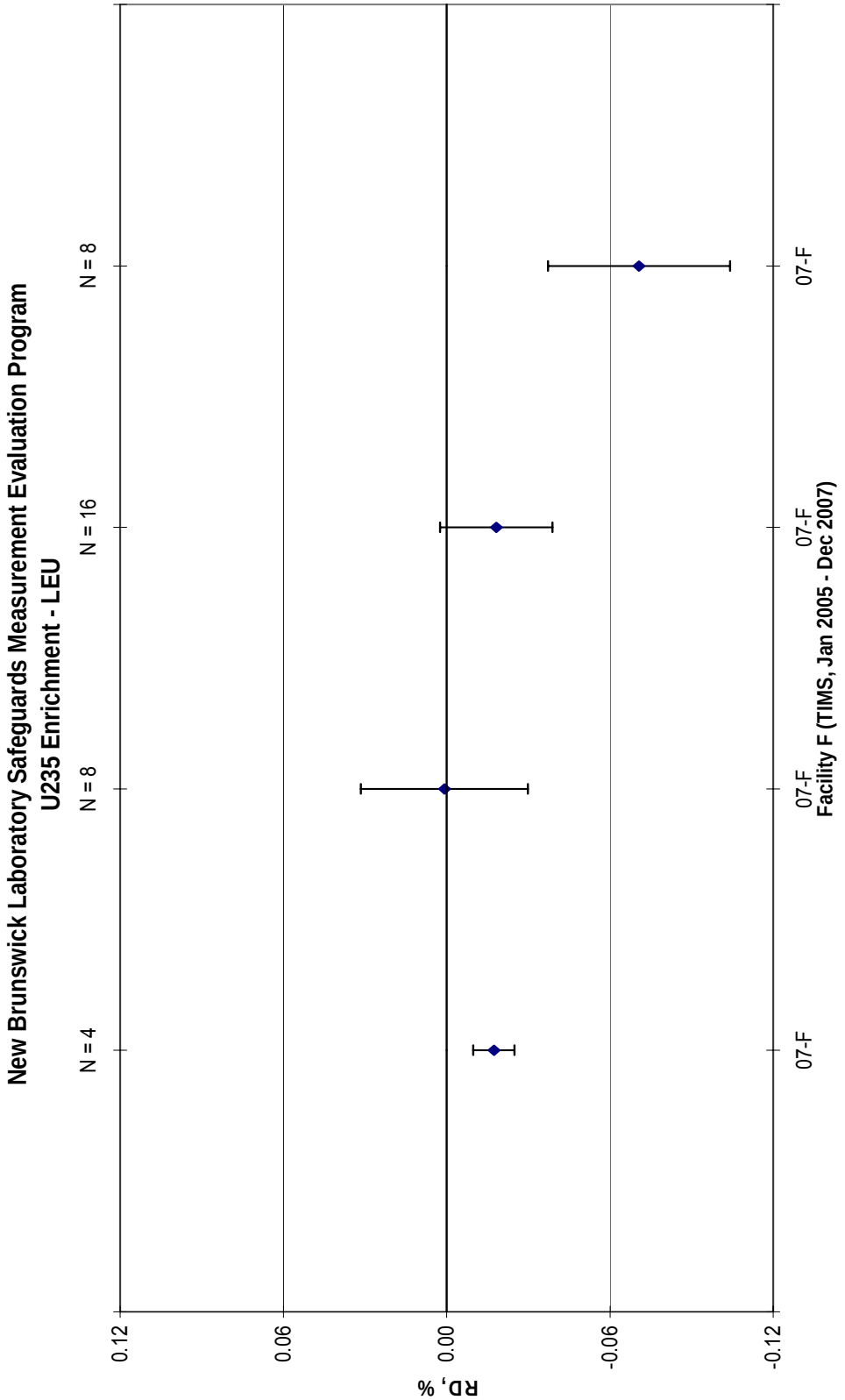

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
RD, %
0.12
0.06
0.00
-0.06
-0.12
N = 4
N = 8
N = 16
N = 8
07-F
07-F
07-F
07-F
Facility F (TIMS, Jan 2005 - Dec 2007)

**Figure 69**

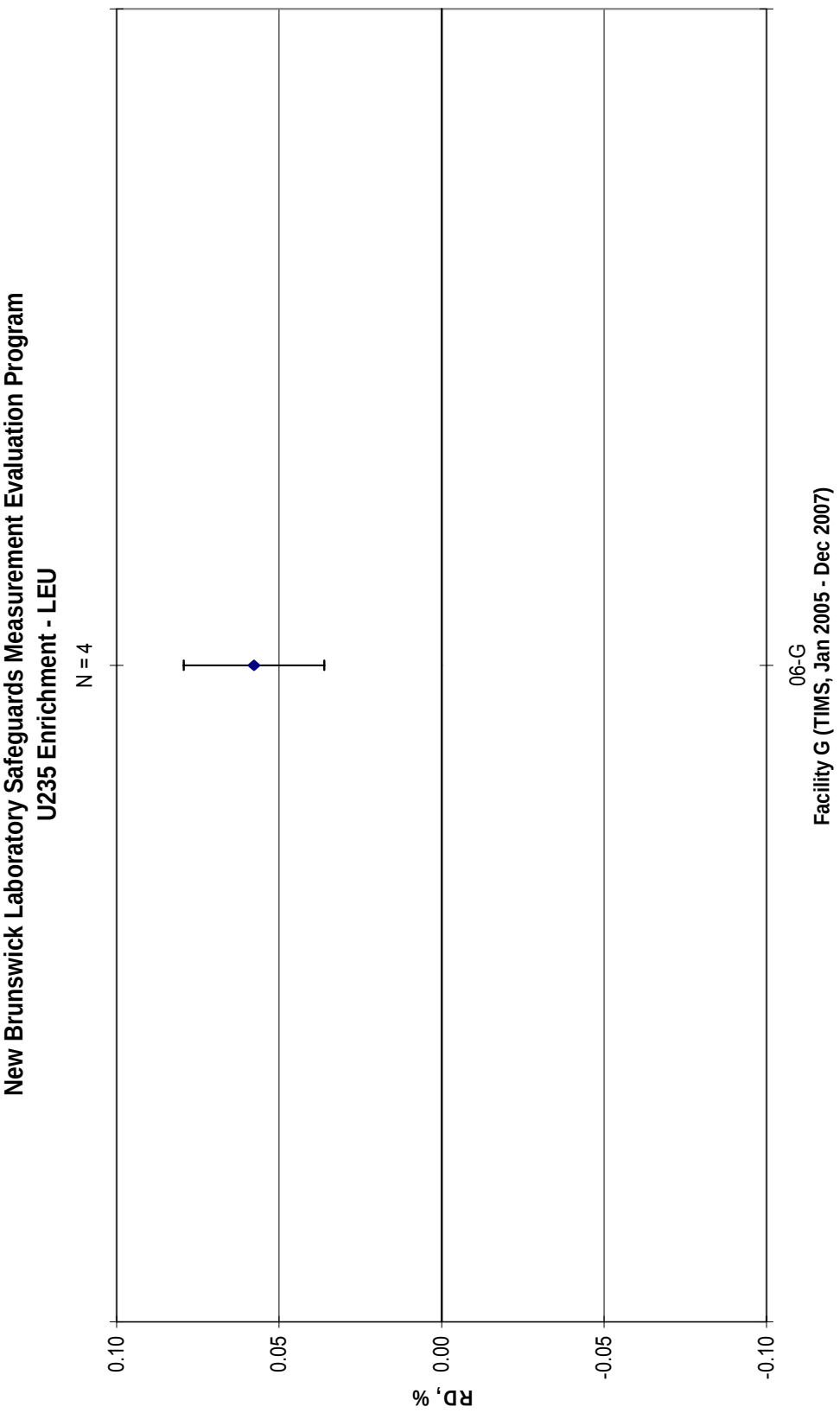

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 4
06-G
Facility G (TIMS, Jan 2005 - Dec 2007)
RD, %
0.10
0.05
0.00
-0.05
-0.10

**Figure 70**

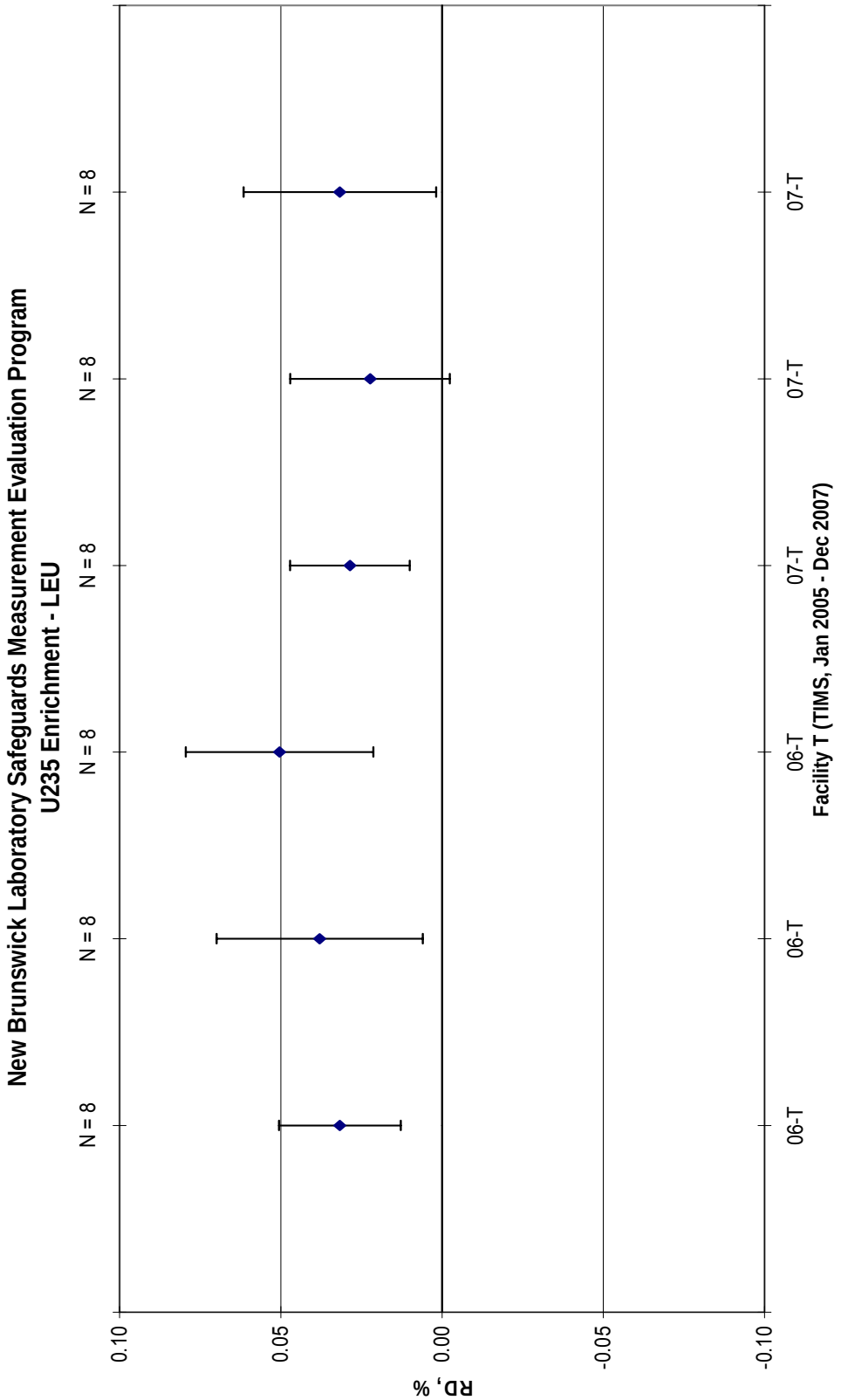

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
RD, %
0.10
0.05
0.00
-0.05
-0.10
N = 8
N = 8
N = 8
N = 8
N = 8
06-T
06-T
06-T
07-T
07-T
07-T
Facility T (TIMS, Jan 2005 - Dec 2007)

**Figure 71**

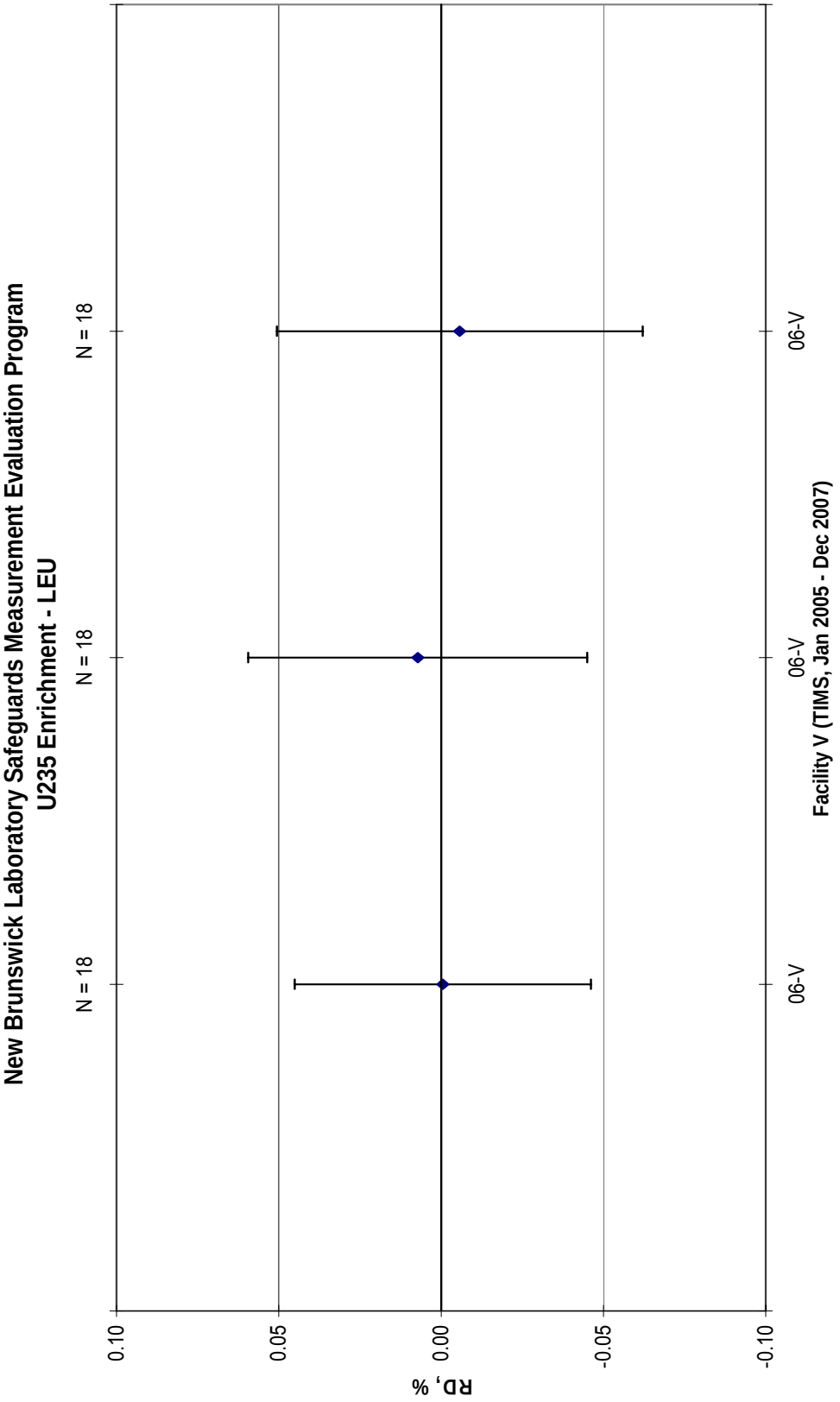

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 18
N = 18
N = 18
06-V
06-V
06-V
Facility V (TIMS, Jan 2005 - Dec 2007)
0.10
0.05
0.00
-0.05
-0.10
RD, %

**Figure 72**

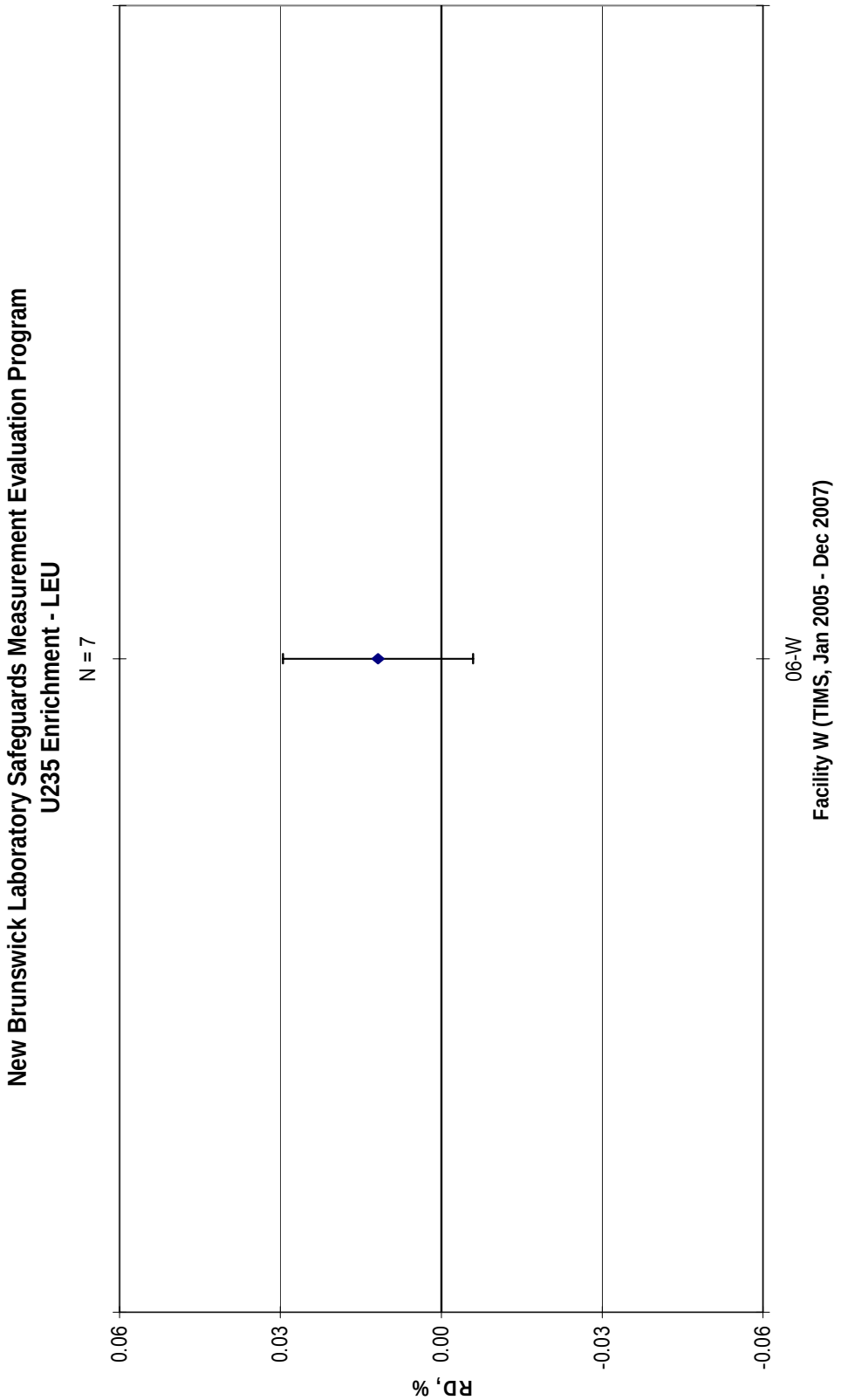

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 7
RD, %
0.06
0.03
0.00
-0.03
-0.06
06-W
Facility W (TIMS, Jan 2005 - Dec 2007)

**Figure 73**

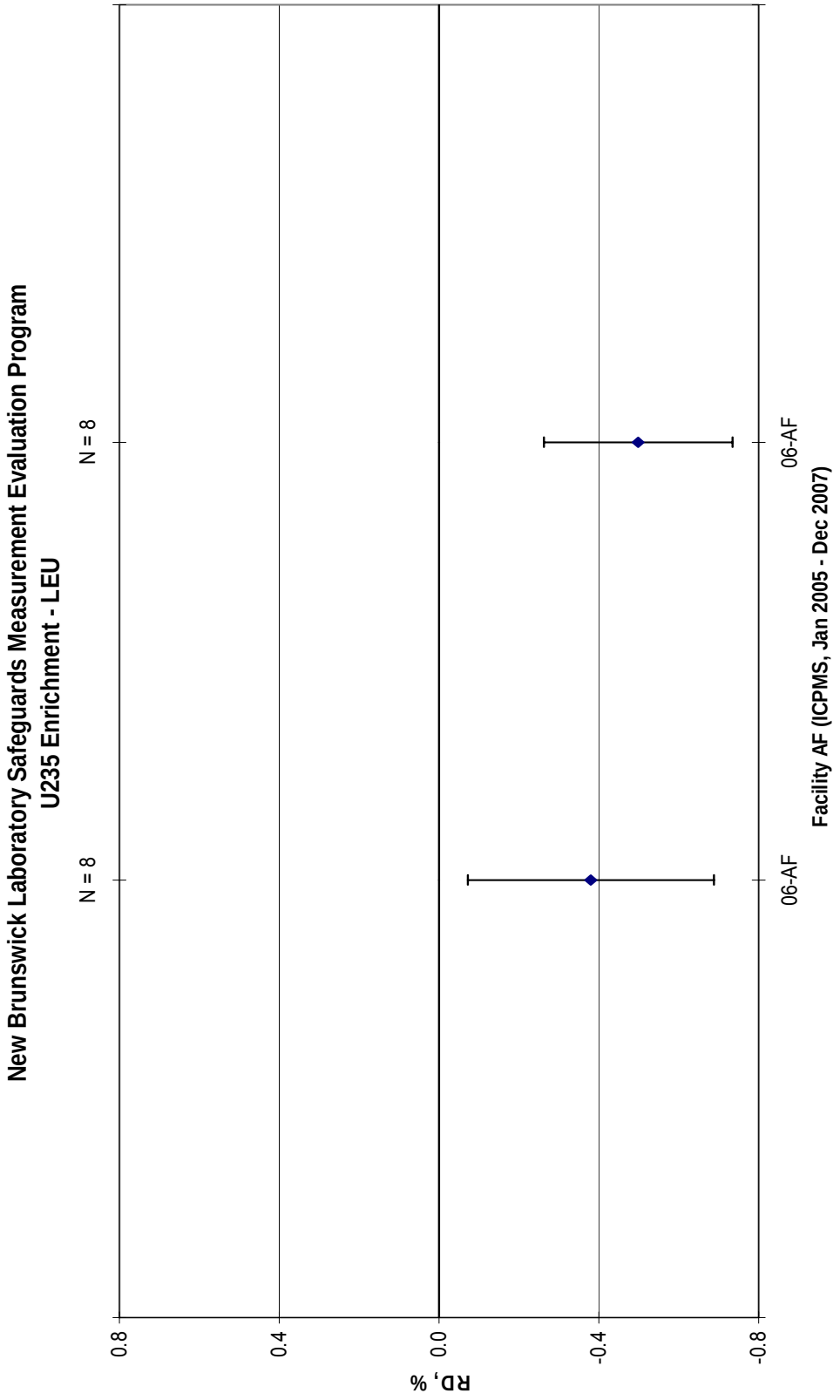

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 8
N = 8
06-AF
06-AF
Facility AF (ICPMS, Jan 2005 - Dec 2007)
RD, %
0.8
0.4
0.0
-0.4
-0.8

**Figure 74**

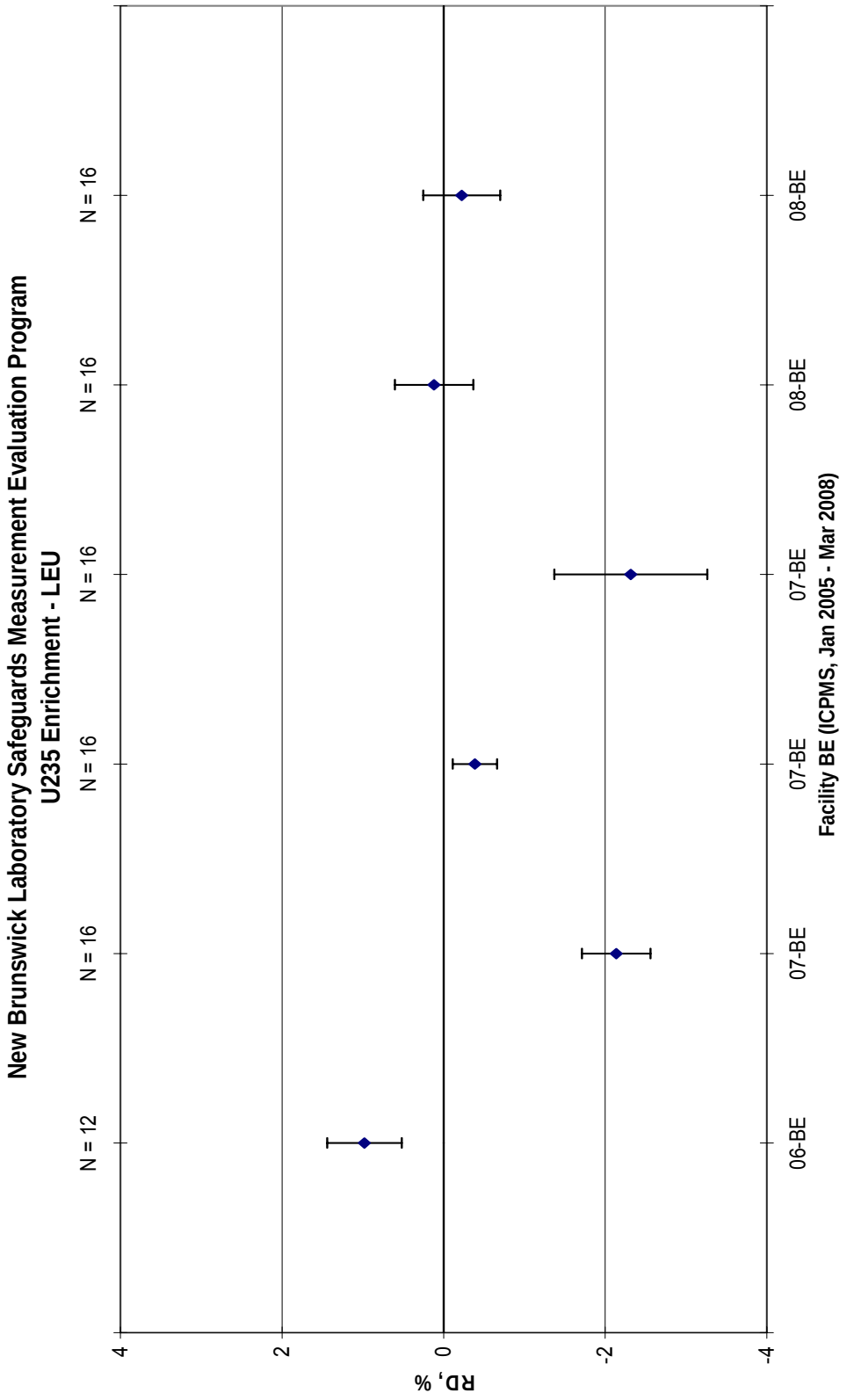

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
RD, %
4
2
0
-2
-4
N = 12
N = 16
N = 16
N = 16
N = 16
06-BE
07-BE
07-BE
07-BE
08-BE
08-BE
Facility BE (ICPMS, Jan 2005 - Mar 2008)

**Figure 75**

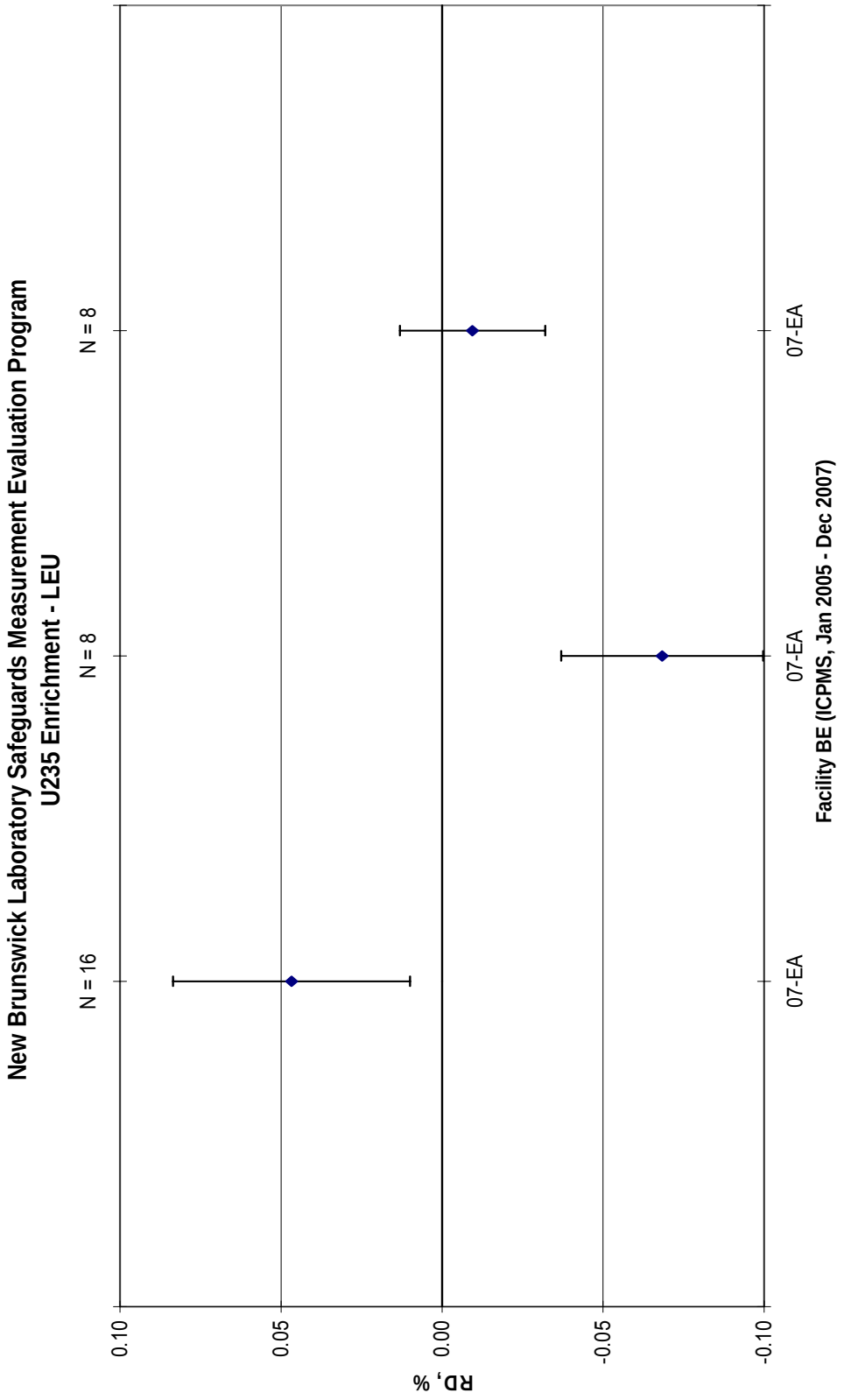
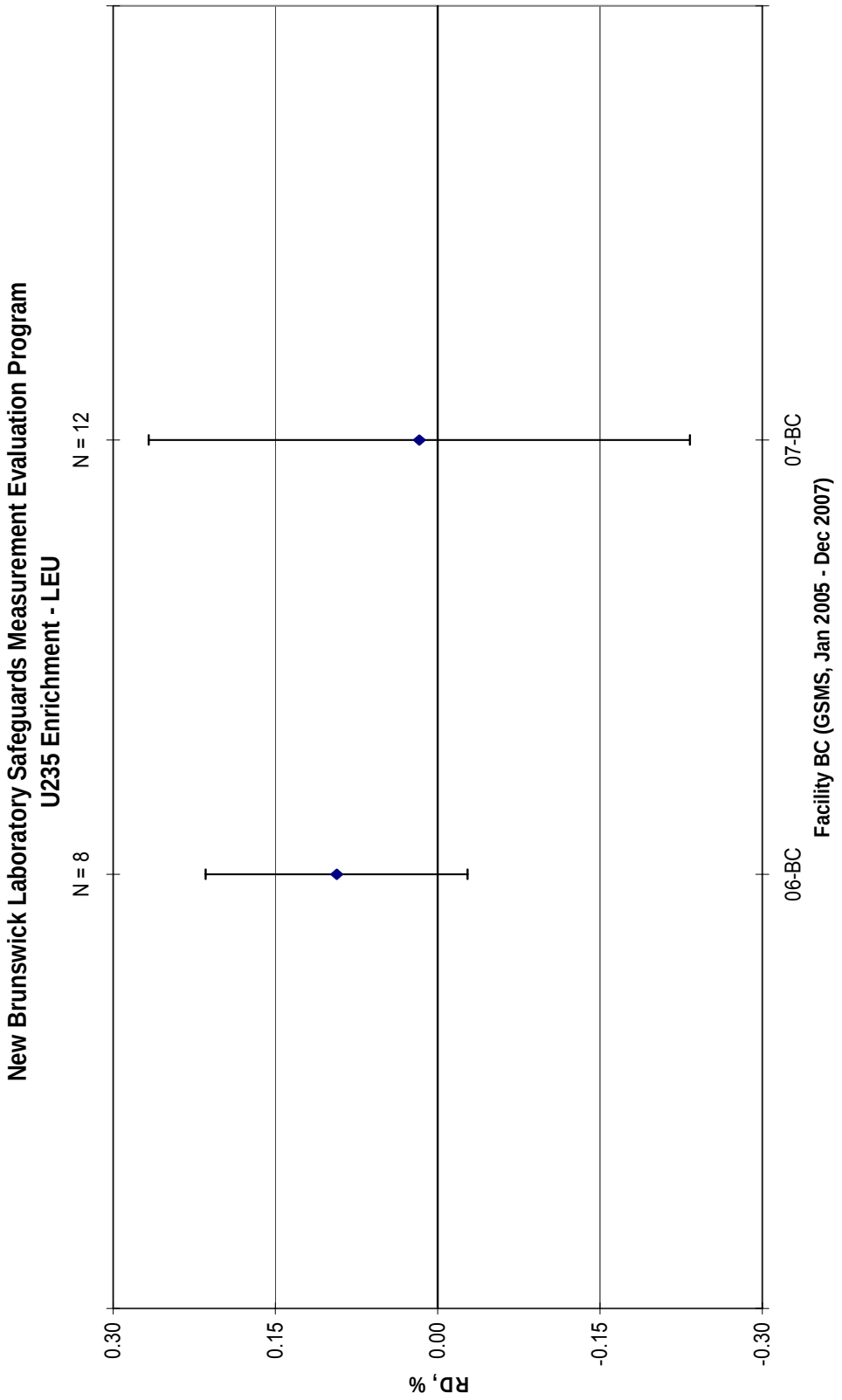

New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 16
N = 8
N = 8
07-EA
07-EA
07-EA
0.10
0.05
0.00
-0.05
-0.10
RD, %
Facility BE (ICPMS, Jan 2005 - Dec 2007)

**Figure 76**


New Brunswick Laboratory Safeguards Measurement Evaluation Program
U235 Enrichment - LEU
N = 8
N = 12
06-BC
07-BC
Facility BC (GSMS, Jan 2005 - Dec 2007)
RD, %
0.30
0.15
0.00
-0.15
-0.30

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# APPENDICES



## Key to symbols in the tables in the appendices

Material Symbols

| | |
|---|---|
| UNH | Uranyl Nitrate Solution |
| $UO_2$ | Uranium Dioxide Pellet |
| $UF_6$ | Uranium Hexafluoride |
| $UO_3$ | Uranium Trioxide Powder |
| HEU | Highly Enriched Uranium |
| LEU | Low Enriched Uranium |

Method Type Symbols

| | |
|---|---|
| DG | Davies-Gray Titration |
| IDMS | Isotope Dilution Mass Spectrometry |
| XRFL | X-Ray Fluorescence - Liquid |
| XRFS | X-Ray Fluorescence - Solid |
| TIMS | Thermal Ionization Mass Spectrometry |
| GSMS | Gas Source Mass Spectrometry |
| ICPMS | Inductively Coupled Plasma Mass Spectrometry |

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# Appendix A: Uranium Assay Results

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | AB | 7/11/07 | 1.0032 | -0.082 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0037 | -0.032 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0035 | -0.052 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0105 | -0.302 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0123 | -0.124 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.012 | -0.154 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0044 | 0.038 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.004 | -0.002 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0042 | 0.018 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0121 | -0.144 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.012 | -0.154 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.013 | -0.055 | FP-AV |
| UNH | DG | AB | 3/4/08 | 1.00376 | -0.026 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.00389 | -0.013 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.00409 | 0.007 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.01232 | -0.122 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.01217 | -0.137 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.0124 | -0.114 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00416 | 0.014 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00418 | 0.016 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00394 | -0.008 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.01314 | -0.041 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.0124 | -0.114 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.01228 | -0.126 | AV-FP |
| UNH | DG | AB | 7/11/07 | 1.0032 | -0.082 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0037 | -0.032 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0035 | -0.052 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0044 | 0.038 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.004 | -0.002 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0042 | 0.018 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0105 | -0.302 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.0123 | -0.124 | FP-AV |
| UNH | DG | AB | 7/11/07 | 1.012 | -0.154 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.0121 | -0.144 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.012 | -0.154 | FP-AV |
| UNH | DG | AB | 7/12/07 | 1.013 | -0.055 | FP-AV |
| UNH | DG | AB | 3/4/08 | 1.00376 | -0.026 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.00389 | -0.013 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.00409 | 0.007 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00416 | 0.014 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00418 | 0.016 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.00394 | -0.008 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.01232 | -0.122 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.01217 | -0.137 | AV-FP |
| UNH | DG | AB | 3/4/08 | 1.0124 | -0.114 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.01314 | -0.041 | AV-FP |
| UNH | DG | AB | 3/5/08 | 1.0124 | -0.114 | AV-FP |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | AB | 3/5/08 | 1.01228 | -0.126 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.00376 | -0.026 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.00389 | -0.013 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.00409 | 0.007 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.01232 | -0.122 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.01217 | -0.137 | AV-FP |
| UNH | DG | AD | 3/4/08 | 1.0124 | -0.114 | AV-FP |
| UNH | DG | AD | 3/5/08 | 1.00416 | 0.014 | AV-EA |
| UNH | DG | AD | 3/5/08 | 1.00418 | 0.016 | AV-EA |
| UNH | DG | AD | 3/5/08 | 1.00394 | -0.008 | AV-EA |
| UNH | DG | AD | 3/5/08 | 1.01314 | -0.041 | AV-EA |
| UNH | DG | AD | 3/5/08 | 1.0124 | -0.114 | AV-EA |
| UNH | DG | AD | 3/5/08 | 1.01228 | -0.126 | AV-EA |
| UNH | DG | BA | 11/26/07 | 1.0139 | 0.034 | |
| UNH | DG | BA | 11/26/07 | 1.015 | 0.142 | |
| UNH | DG | BA | 11/26/07 | 1.0142 | 0.063 | |
| UNH | DG | BA | 11/26/07 | 1.0146 | 0.103 | |
| UNH | DG | BA | 11/26/07 | 1.0135 | -0.006 | |
| UNH | DG | BA | 11/26/07 | 1.0102 | -0.332 | |
| UNH | DG | BA | 11/26/07 | 1.014 | 0.043 | |
| UNH | DG | BA | 11/26/07 | 1.0139 | 0.034 | |
| UNH | DG | BA | 11/27/07 | 1.0133 | -0.026 | |
| UNH | DG | BA | 11/27/07 | 1.0147 | 0.112 | |
| UNH | DG | BA | 11/27/07 | 1.0136 | 0.004 | |
| UNH | DG | BA | 11/27/07 | 1.0138 | 0.024 | |
| UNH | DG | BA | 11/27/07 | 1.0112 | -0.233 | |
| UNH | DG | BA | 11/27/07 | 1.0126 | -0.095 | |
| UNH | DG | BA | 11/27/07 | 1.0113 | -0.223 | |
| UNH | DG | BA | 11/27/07 | 1.0142 | 0.063 | |
| UNH | DG | BA | 3/17/08 | 0.9925 | -1.147 | |
| UNH | DG | BA | 3/17/08 | 0.9877 | -1.625 | |
| UNH | DG | BA | 3/17/08 | 0.9957 | -0.829 | |
| UNH | DG | BA | 3/17/08 | 0.9966 | -0.739 | |
| UNH | DG | BA | 3/17/08 | 0.9959 | -0.809 | |
| UNH | DG | BA | 3/17/08 | 0.9966 | -0.739 | |
| UNH | DG | BA | 3/17/08 | 0.9985 | -0.550 | |
| UNH | DG | BA | 3/17/08 | 0.9951 | -0.888 | |
| UNH | DG | BA | 3/17/08 | 0.9984 | -0.560 | |
| UNH | DG | BA | 3/17/08 | 0.9962 | -0.779 | |
| UNH | DG | BA | 3/17/08 | 0.9987 | -0.530 | |
| UNH | DG | BA | 3/18/08 | 0.9973 | -0.669 | |
| UNH | DG | BA | 3/18/08 | 0.9929 | -1.108 | |
| UNH | DG | BA | 3/18/08 | 0.9956 | -0.839 | |
| UNH | DG | BA | 3/18/08 | 1 | -0.400 | |
| UNH | DG | BA | 3/18/08 | 1.0018 | -0.221 | |
| UNH | DG | BA | 3/18/08 | 0.9969 | -0.709 | |
| UNH | DG | BA | 3/18/08 | 0.9975 | -0.649 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | BA | 3/18/08 | 0.9967 | -0.729 | |
| UNH | DG | BA | 3/18/08 | 0.9963 | -0.769 | |
| UNH | DG | BC | 9/27/07 | 0.9644 | -3.946 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9639 | -3.996 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9643 | -3.956 | ICO |
| UNH | DG | BC | 9/27/07 | 0.964 | -3.986 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9639 | -3.996 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9647 | -3.916 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9743 | -3.873 | ICO |
| UNH | DG | BC | 9/27/07 | 0.974 | -3.903 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9743 | -3.873 | ICO |
| UNH | DG | BC | 9/27/07 | 0.974 | -3.903 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9742 | -3.883 | ICO |
| UNH | DG | BC | 9/27/07 | 0.9741 | -3.893 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9639 | -3.996 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9631 | -4.076 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9637 | -4.016 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9638 | -4.006 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9632 | -4.066 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9638 | -4.006 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9734 | -3.962 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9736 | -3.943 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9745 | -3.854 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9738 | -3.923 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9738 | -3.923 | ICO |
| UNH | DG | BC | 10/2/07 | 0.9742 | -3.883 | ICO |
| UNH | DG | B | 1/26/06 | 1.0063 | 0.227 | 3747 |
| UNH | DG | B | 1/30/06 | 1.0064 | 0.237 | 5011 |
| UNH | DG | B | 1/25/06 | 1.003 | 0.245 | 3747 |
| UNH | DG | B | 1/26/06 | 1.0029 | 0.235 | 3747 |
| UNH | DG | B | 1/30/06 | 1.0029 | 0.235 | 5011 |
| UNH | DG | B | 1/18/06 | 1.0042 | 0.018 | 5011 |
| UNH | DG | B | 1/18/06 | 1.0037 | -0.032 | 5011 |
| UNH | DG | B | 1/18/06 | 1.0015 | 0.095 | 5011 |
| UNH | DG | B | 1/18/06 | 1.001 | 0.045 | 5011 |
| UNH | DG | B | 1/19/06 | 1.0013 | 0.075 | 5011 |
| UNH | DG | B | 1/19/06 | 1.0012 | 0.065 | 5011 |
| UNH | DG | B | 3/29/06 | 1.00182 | -0.048 | 4905 |
| UNH | DG | B | 3/29/06 | 1.00181 | -0.049 | 4905 |
| UNH | DG | B | 4/27/06 | 1.0011 | -0.120 | 3747 |
| UNH | DG | B | 4/27/06 | 0.9991 | -0.319 | 3747 |
| UNH | DG | B | 3/29/06 | 1.00706 | 0.475 | 4905 |
| UNH | DG | B | 3/29/06 | 1.00706 | 0.475 | 4905 |
| UNH | DG | B | 4/27/06 | 1.008 | 0.569 | 3747 |
| UNH | DG | B | 4/27/06 | 1.0043 | 0.200 | 3747 |
| UNH | DG | B | 7/24/06 | 1.00015 | -0.215 | 796 |
| UNH | DG | B | 7/24/06 | 1.00225 | -0.005 | 796 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | B | 7/24/06 | 1.00024 | -0.031 | 796 |
| UNH | DG | B | 7/24/06 | 1.0014 | 0.085 | 796 |
| UNH | DG | B | 10/9/06 | 1.0043 | 0.200 | 374 |
| UNH | DG | B | 10/9/06 | 1.0046 | 0.229 | 374 |
| UNH | DG | B | 10/11/06 | 1.0018 | 0.125 | 374 |
| UNH | DG | B | 10/11/06 | 1.0021 | 0.155 | 374 |
| UNH | DG | B | 7/24/07 | 1.0143 | 0.073 | 5011 |
| UNH | DG | B | 7/24/07 | 1.0176 | 0.399 | 5011 |
| UNH | DG | B | 7/24/07 | 1.0134 | -0.016 | 5011 |
| UNH | DG | B | 7/24/07 | 1.0139 | 0.034 | 5011 |
| UNH | DG | B | 7/25/07 | 1.0137 | 0.014 | 3375 |
| UNH | DG | B | 7/25/07 | 1.0164 | 0.280 | 3375 |
| UNH | DG | B | 7/25/07 | 1.0172 | 0.359 | 3375 |
| UNH | DG | B | 7/25/07 | 1.0152 | 0.162 | 3375 |
| UNH | DG | B | 10/30/07 | 1.0177 | 0.408 | 753 |
| UNH | DG | B | 10/30/07 | 1.0187 | 0.507 | 753 |
| UNH | DG | B | 10/30/07 | 1.0176 | 0.399 | 753 |
| UNH | DG | B | 10/30/07 | 1.0135 | -0.006 | 753 |
| UNH | DG | B | 11/4/07 | 1.0173 | 0.369 | 747 |
| UNH | DG | B | 11/4/07 | 1.0176 | 0.399 | 747 |
| UNH | DG | B | 11/4/07 | 1.0177 | 0.408 | 747 |
| UNH | DG | B | 11/4/07 | 1.0185 | 0.487 | 747 |
| UNH | DG | B | 1/17/08 | 1.0188 | 0.517 | 966 |
| UNH | DG | B | 1/17/08 | 1.0172 | 0.359 | 966 |
| UNH | DG | B | 1/18/08 | 1.0177 | 0.408 | 747 |
| UNH | DG | B | 1/18/08 | 1.018 | 0.438 | 747 |
| UNH | DG | B | 1/18/08 | 1.0177 | 0.408 | 747 |
| UNH | DG | B | 1/18/08 | 1.0173 | 0.369 | 747 |
| UNH | DG | B | 1/19/08 | 1.0132 | -0.036 | 686 |
| UNH | DG | B | 1/19/08 | 1.0221 | 0.843 | 686 |
| UNH | DG | B | 3/27/08 | 1.0155 | 0.191 | 4905 |
| UNH | DG | B | 3/27/08 | 1.0132 | -0.036 | 4905 |
| UNH | DG | B | 4/1/08 | 1.0106 | -0.292 | 4686 |
| UNH | DG | B | 4/1/08 | 1.0141 | 0.053 | 4686 |
| UNH | DG | B | 4/13/08 | 1.0011 | -1.229 | 3747 |
| UNH | DG | B | 4/13/08 | 1.0167 | 0.310 | 3747 |
| UNH | DG | B | 4/13/08 | 1.011 | -0.253 | 3747 |
| UNH | DG | B | 4/13/08 | 1.0157 | 0.211 | 3747 |
| UNH | DG | F | 11/17/05 | 1.0032 | -0.082 | 237 |
| UNH | DG | F | 11/17/05 | 1.0034 | -0.062 | 237 |
| UNH | DG | F | 11/18/05 | 1.0041 | 0.008 | 237 |
| UNH | DG | F | 11/18/05 | 1.004 | -0.002 | 237 |
| UNH | DG | F | 11/21/05 | 1.0043 | 0.028 | 231 |
| UNH | DG | F | 11/21/05 | 1.0044 | 0.038 | 231 |
| UNH | DG | F | 11/22/05 | 1.0043 | 0.028 | 231 |
| UNH | DG | F | 11/22/05 | 1.0049 | 0.088 | 231 |
| UNH | DG | F | 11/17/05 | 0.9999 | -0.065 | 237 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | F | 11/17/05 | 0.9995 | -0.105 | 237 |
| UNH | DG | F | 11/18/05 | 1 | -0.055 | 237 |
| UNH | DG | F | 11/18/05 | 1 | -0.055 | 237 |
| UNH | DG | F | 11/21/05 | 0.9999 | -0.065 | 231 |
| UNH | DG | F | 11/21/05 | 0.9998 | -0.075 | 231 |
| UNH | DG | F | 11/22/05 | 1.0012 | 0.065 | 231 |
| UNH | DG | F | 11/22/05 | 1.0026 | 0.205 | 231 |
| UNH | DG | F | 9/25/07 | 1.005 | 0.098 | GS |
| UNH | DG | F | 9/25/07 | 1.005 | 0.098 | GS |
| UNH | DG | F | 9/25/07 | 1.001 | 0.045 | GS |
| UNH | DG | F | 9/25/07 | 1 | -0.055 | GS |
| UNH | DG | F | 9/26/07 | 1.005 | 0.098 | GS |
| UNH | DG | F | 9/26/07 | 1.005 | 0.098 | GS |
| UNH | DG | F | 9/26/07 | 1.001 | 0.045 | GS |
| UNH | DG | F | 9/26/07 | 1.002 | 0.145 | GS |
| UNH | DG | F | 9/13/07 | 1.005 | 0.098 | MM |
| UNH | DG | F | 9/13/07 | 1.005 | 0.098 | MM |
| UNH | DG | F | 9/13/07 | 1.001 | 0.045 | MM |
| UNH | DG | F | 9/13/07 | 1.001 | 0.045 | MM |
| UNH | DG | F | 9/14/07 | 1.006 | 0.197 | MM |
| UNH | DG | F | 9/14/07 | 1.006 | 0.197 | MM |
| UNH | DG | F | 9/14/07 | 1.001 | 0.045 | MM |
| UNH | DG | F | 9/14/07 | 1.001 | 0.045 | MM |
| UNH | DG | F | 7/25/07 | 1.004 | -0.002 | GS |
| UNH | DG | F | 7/25/07 | 1.004 | -0.002 | GS |
| UNH | DG | F | 7/25/07 | 1.003 | 0.070 | GS |
| UNH | DG | F | 7/25/07 | 1.002 | -0.030 | GS |
| UNH | DG | F | 7/26/07 | 1.004 | -0.002 | GS |
| UNH | DG | F | 7/26/07 | 1.004 | -0.002 | GS |
| UNH | DG | F | 7/26/07 | 1.002 | -0.030 | GS |
| UNH | DG | F | 7/26/07 | 1.002 | -0.030 | GS |
| UNH | DG | F | 7/26/07 | 1.004 | -0.002 | MM |
| UNH | DG | F | 7/26/07 | 1.004 | -0.002 | MM |
| UNH | DG | F | 7/26/07 | 1.002 | -0.030 | MM |
| UNH | DG | F | 7/26/07 | 1.002 | -0.030 | MM |
| UNH | DG | F | 7/26/07 | 1.002 | -0.030 | MM |
| UNH | DG | F | 7/27/07 | 1.004 | -0.002 | MM |
| UNH | DG | F | 7/27/07 | 1.004 | -0.002 | MM |
| UNH | DG | F | 7/27/07 | 1.002 | -0.030 | MM |
| UNH | DG | G | 12/9/04 | 1.00423 | 0.021 | |
| UNH | DG | G | 12/10/04 | 1.00405 | 0.003 | |
| UNH | DG | G | 12/10/04 | 1.00392 | -0.010 | |
| UNH | DG | G | 12/9/04 | 1.00057 | 0.002 | |
| UNH | DG | G | 12/9/04 | 1.00059 | 0.004 | |
| UNH | DG | G | 12/10/04 | 1.0008 | 0.025 | |
| UNH | DG | G | 12/10/04 | 1.00069 | 0.014 | |
| UNH | DG | G | 3/23/05 | 1.00412 | 0.010 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | G | 3/23/05 | 1.00425 | 0.023 | |
| UNH | DG | G | 3/24/05 | 1.00381 | -0.021 | |
| UNH | DG | G | 3/24/05 | 1.00389 | -0.013 | |
| UNH | DG | G | 3/23/05 | 1.00253 | 0.023 | |
| UNH | DG | G | 3/23/05 | 1.00219 | -0.011 | |
| UNH | DG | G | 3/24/05 | 1.00201 | -0.029 | |
| UNH | DG | G | 3/24/05 | 1.00219 | -0.011 | |
| UNH | DG | G | 10/4/05 | 1.00419 | 0.017 | |
| UNH | DG | G | 10/4/05 | 1.00397 | -0.005 | |
| UNH | DG | G | 10/5/05 | 1.00413 | 0.011 | |
| UNH | DG | G | 10/5/05 | 1.00378 | -0.024 | |
| UNH | DG | G | 10/4/05 | 1.00077 | 0.022 | |
| UNH | DG | G | 10/4/05 | 1.00043 | -0.012 | |
| UNH | DG | G | 10/5/05 | 1.00073 | 0.018 | |
| UNH | DG | G | 10/5/05 | 1.00079 | 0.024 | |
| UNH | DG | G | 2/22/06 | 1.00414 | 0.012 | |
| UNH | DG | G | 2/22/06 | 1.00388 | -0.014 | |
| UNH | DG | G | 2/23/06 | 1.00379 | -0.023 | |
| UNH | DG | G | 2/23/06 | 1.00411 | 0.009 | |
| UNH | DG | G | 2/22/06 | 1.00041 | -0.014 | |
| UNH | DG | G | 2/22/06 | 1.00052 | -0.003 | |
| UNH | DG | G | 2/23/06 | 1.00055 | 0.000 | |
| UNH | DG | G | 2/23/06 | 1.00052 | -0.003 | |
| UNH | DG | G | 4/19/06 | 1.00428 | 0.026 | |
| UNH | DG | G | 4/19/06 | 1.00425 | 0.023 | |
| UNH | DG | G | 4/20/06 | 1.00399 | -0.003 | |
| UNH | DG | G | 4/20/06 | 1.00404 | 0.002 | |
| UNH | DG | G | 4/19/06 | 1.00252 | 0.022 | |
| UNH | DG | G | 4/19/06 | 1.00228 | -0.002 | |
| UNH | DG | G | 4/20/06 | 1.00261 | 0.031 | |
| UNH | DG | G | 4/20/06 | 1.0021 | -0.020 | |
| UNH | DG | G | 8/24/06 | 1.00045 | -0.010 | |
| UNH | DG | G | 8/24/06 | 1.00057 | 0.002 | |
| UNH | DG | G | 8/24/06 | 1.00211 | -0.019 | |
| UNH | DG | G | 8/24/06 | 1.00205 | -0.025 | |
| UNH | DG | G | 8/25/06 | 1.00047 | -0.008 | |
| UNH | DG | G | 8/25/06 | 1.0006 | 0.005 | |
| UNH | DG | G | 8/25/06 | 1.00217 | -0.013 | |
| UNH | DG | G | 8/25/06 | 1.00224 | -0.006 | |
| UNH | DG | G | 11/16/07 | 10.1329 | -0.027 | EL,KG |
| UNH | DG | G | 11/16/07 | 10.1375 | 0.019 | EL,KG |
| UNH | DG | G | 11/16/07 | 10.1237 | -0.117 | EL,KG |
| UNH | DG | G | 11/16/07 | 10.1254 | -0.101 | EL,KG |
| UNH | DG | G | 12/6/07 | 10.1353 | -0.003 | EL,KG |
| UNH | DG | G | 12/6/07 | 10.1395 | 0.038 | EL,KG |
| UNH | DG | G | 12/6/07 | 10.1311 | -0.044 | EL,KG |
| UNH | DG | G | 12/6/07 | 10.1254 | -0.101 | EL,KG |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | DG | G | 1/30/08 | 10.1257 | -0.098 | |
| UNH | DG | G | 1/30/08 | 10.1253 | -0.102 | |
| UNH | DG | G | 1/30/08 | 10.1284 | -0.071 | |
| UNH | DG | G | 1/30/08 | 10.1238 | -0.116 | |
| UNH | DG | G | 1/31/08 | 10.1269 | -0.086 | |
| UNH | DG | G | 1/31/08 | 10.1261 | -0.094 | |
| UNH | DG | G | 1/31/08 | 10.1222 | -0.132 | |
| UNH | DG | G | 1/31/08 | 10.1274 | -0.081 | |
| UNH | DG | V | 3/21/06 | 1.00227 | -0.174 | 1 |
| UNH | DG | V | 3/21/06 | 1.00217 | -0.184 | 1 |
| UNH | DG | V | 3/21/06 | 1.00177 | -0.224 | 1 |
| UNH | DG | V | 4/5/06 | 1.00249 | -0.152 | 1 |
| UNH | DG | V | 4/5/06 | 1.00229 | -0.172 | 1 |
| UNH | DG | V | 4/5/06 | 1.00339 | -0.063 | 1 |
| UNH | DG | V | 4/25/06 | 1.00356 | -0.046 | 1 |
| UNH | DG | V | 4/25/06 | 1.00356 | -0.046 | 1 |
| UNH | DG | V | 4/25/06 | 1.00356 | -0.046 | 1 |
| UNH | DG | V | 3/21/06 | 0.99927 | -0.128 | 1 |
| UNH | DG | V | 3/21/06 | 1.00017 | -0.038 | 1 |
| UNH | DG | V | 3/21/06 | 0.99967 | -0.088 | 1 |
| UNH | DG | V | 4/5/06 | 0.99911 | -0.144 | 1 |
| UNH | DG | V | 4/5/06 | 1.00011 | -0.044 | 1 |
| UNH | DG | V | 4/5/06 | 0.99982 | -0.073 | 1 |
| UNH | DG | V | 4/25/06 | 1.00044 | -0.011 | 1 |
| UNH | DG | V | 4/25/06 | 1.0006 | 0.005 | 1 |
| UNH | DG | V | 4/25/06 | 1.00052 | -0.003 | 1 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | IDMS | AW | 5/21/07 | 6.824 | 0.101 | |
| UNH | IDMS | AW | 5/21/07 | 6.8131 | -0.059 | |
| UNH | IDMS | AW | 5/21/07 | 6.8187 | 0.023 | |
| UNH | IDMS | AW | 5/21/07 | 6.8113 | -0.085 | |
| UNH | IDMS | AW | 5/21/07 | 4.6939 | -0.155 | |
| UNH | IDMS | AW | 5/21/07 | 4.6948 | -0.136 | |
| UNH | IDMS | AW | 6/1/07 | 4.6961 | -0.108 | |
| UNH | IDMS | AW | 6/4/07 | 6.8111 | -0.088 | |
| UNH | IDMS | AW | 6/4/07 | 6.821 | 0.057 | |
| UNH | IDMS | AW | 6/4/07 | 4.7053 | 0.087 | |
| UNH | IDMS | AW | 6/4/07 | 4.6985 | -0.057 | |
| UNH | IDMS | AW | 6/4/07 | 4.7034 | 0.047 | |
| UNH | IDMS | A | 11/8/04 | 1.0024 | -0.161 | GPW/JM |
| UNH | IDMS | A | 11/8/04 | 1.0036 | -0.042 | GPW/JM |
| UNH | IDMS | A | 11/10/04 | 1.0037 | -0.032 | DLB/JM |
| UNH | IDMS | A | 11/10/04 | 1.0048 | 0.078 | DLB/JM |
| UNH | IDMS | A | 11/8/04 | 1.0011 | -0.120 | GPW/JM |
| UNH | IDMS | A | 11/8/04 | 1.003 | 0.070 | GPW/JM |
| UNH | IDMS | A | 11/10/04 | 1.0013 | -0.100 | DLB/JM |
| UNH | IDMS | A | 11/10/04 | 1.0038 | 0.150 | DLB/JM |
| UNH | IDMS | A | 9/14/05 | 1.0038 | -0.022 | BLM/GPW |
| UNH | IDMS | A | 9/15/05 | 1.0044 | 0.038 | DLB/GPW |
| UNH | IDMS | A | 9/19/05 | 1.0042 | 0.018 | WS/GPW |
| UNH | IDMS | A | 9/19/05 | 1.0041 | 0.008 | WS/GPW |
| UNH | IDMS | A | 9/14/05 | 1.0004 | -0.015 | BLM/GPW |
| UNH | IDMS | A | 9/14/05 | 1.0004 | -0.015 | BLM/GPW |
| UNH | IDMS | A | 9/15/05 | 1.0008 | 0.025 | DLB/GPW |
| UNH | IDMS | A | 9/15/05 | 1.0008 | 0.025 | DLB/GPW |
| UNH | IDMS | A | 9/19/05 | 1.0008 | 0.025 | WS/GPW |
| UNH | IDMS | A | 9/19/05 | 1.0007 | 0.015 | WS/GPW |
| UNH | IDMS | A | 6/21/07 | 1.0155 | 0.191 | BLM/JM |
| UNH | IDMS | A | 6/21/07 | 1.0118 | -0.174 | BLM/JM |
| UNH | IDMS | A | 6/21/07 | 1.0126 | -0.095 | BLM/JM |
| UNH | IDMS | A | 6/21/07 | 1.0191 | 0.547 | BLM/JM |
| UNH | IDMS | A | 6/25/07 | 1.0151 | 0.152 | PRR/JM |
| UNH | IDMS | A | 6/25/07 | 1.0142 | 0.063 | PRR/JM |
| UNH | IDMS | A | 6/25/07 | 1.0154 | 0.182 | PRR/JM |
| UNH | IDMS | A | 6/25/07 | 1.0139 | 0.034 | PRR/JM |
| UNH | IDMS | A | 9/25/07 | 1.0123 | -0.124 | BLM/JM |
| UNH | IDMS | A | 9/25/07 | 1.0131 | -0.045 | BLM/JM |
| UNH | IDMS | A | 9/25/07 | 1.0126 | -0.095 | BLM/JM |
| UNH | IDMS | A | 9/25/07 | 1.0116 | -0.193 | BLM/JM |
| UNH | IDMS | A | 9/26/07 | 1.0112 | -0.233 | LSB/JM |
| UNH | IDMS | A | 9/26/07 | 1.0252 | 1.148 | LSB/JM |
| UNH | IDMS | A | 9/26/07 | 1.0106 | -0.292 | LSB/JM |
| UNH | IDMS | A | 9/26/07 | 1.0124 | -0.114 | LSB/JM |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | IDMS | B | 1/4/05 | 0.4698 | -0.068 | CDN |
| UNH | IDMS | B | 1/4/05 | 0.4696 | -0.111 | CDN |
| UNH | IDMS | B | 1/8/05 | 0.4654 | -1.004 | JLB |
| UNH | IDMS | B | 1/8/05 | 0.4655 | -0.983 | JLB |
| UNH | IDMS | B | 1/4/05 | 0.4593 | -1.296 | CDN |
| UNH | IDMS | B | 1/4/05 | 0.4591 | -1.339 | CDN |
| UNH | IDMS | B | 1/8/05 | 0.4562 | -1.962 | JLB |
| UNH | IDMS | B | 1/8/05 | 0.4563 | -1.941 | JLB |
| UNH | IDMS | B | 1/9/06 | 0.9978 | -0.620 | PAM |
| UNH | IDMS | B | 1/9/06 | 0.9984 | -0.560 | PAM |
| UNH | IDMS | B | 1/12/06 | 1.0015 | -0.251 | DDN |
| UNH | IDMS | B | 1/12/06 | 1.0006 | -0.341 | DDN |
| UNH | IDMS | B | 1/9/06 | 0.9957 | -0.485 | PAM |
| UNH | IDMS | B | 1/9/06 | 0.9977 | -0.285 | PAM |
| UNH | IDMS | B | 1/12/06 | 1.0057 | 0.515 | DDN |
| UNH | IDMS | B | 1/12/06 | 1.0018 | 0.125 | DDN |
| UNH | IDMS | B | 3/4/06 | 0.9957 | -0.829 | WPB |
| UNH | IDMS | B | 3/4/06 | 0.9962 | -0.779 | WPB |
| UNH | IDMS | B | 3/5/06 | 0.9914 | -1.257 | DDN |
| UNH | IDMS | B | 3/5/06 | 1 | -0.400 | DDN |
| UNH | IDMS | B | 3/4/06 | 0.9962 | -0.435 | WPB |
| UNH | IDMS | B | 3/4/06 | 1.0004 | -0.015 | WPB |
| UNH | IDMS | B | 3/5/06 | 0.9899 | -1.064 | DDN |
| UNH | IDMS | B | 3/5/06 | 0.9893 | -1.124 | DDN |
| UNH | IDMS/U-233 spike | B | 4/12/06 | 1.0007 | -0.331 | JMG |
| UNH | IDMS/U-233 spike | B | 4/12/06 | 0.9982 | -0.580 | JMG |
| UNH | IDMS/U-233 spike | B | 4/13/06 | 0.9916 | -1.237 | CPT |
| UNH | IDMS/U-233 spike | B | 4/13/06 | 0.9932 | -1.078 | CPT |
| UNH | IDMS/U-233 spike | B | 4/12/06 | 0.9958 | -0.819 | JMG |
| UNH | IDMS/U-233 spike | B | 4/12/06 | 0.9956 | -0.839 | JMG |
| UNH | IDMS/U-233 spike | B | 4/13/06 | 0.9959 | -0.809 | CPT |
| UNH | IDMS/U-233 spike | B | 4/13/06 | 0.9971 | -0.689 | CPT |
| UNH | IDMS | B | 7/22/06 | 0.9955 | -0.678 | PWB |
| UNH | IDMS | B | 7/22/06 | 0.9981 | -0.419 | PWB |
| UNH | IDMS | B | 7/22/06 | 0.9975 | -0.305 | PWB |
| UNH | IDMS | B | 7/22/06 | 0.994 | -0.655 | PWB |
| UNH | IDMS | B | 7/31/06 | 1.0167 | 1.437 | DDB |
| UNH | IDMS | B | 7/31/06 | 1.0039 | 0.160 | DDB |
| UNH | IDMS | B | 8/1/06 | 0.9909 | -0.964 | DDB |
| UNH | IDMS | B | 8/1/06 | 0.9877 | -1.284 | DDB |
| UNH | IDMS | B | 1/18/08 | 10.092 | -0.430 | DDN |
| UNH | IDMS | B | 1/18/08 | 10.108 | -0.272 | DDN |
| UNH | IDMS | B | 1/18/08 | 10.053 | -0.815 | DDN |
| UNH | IDMS | B | 1/18/08 | 10.048 | -0.864 | DDN |
| UNH | IDMS | B | 1/26/08 | 10.075 | -0.598 | JCP |
| UNH | IDMS | B | 1/26/08 | 10.053 | -0.815 | JCP |
| UNH | IDMS | B | 1/26/08 | 10.076 | -0.588 | JCP |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | IDMS | B | 1/26/08 | 10.062 | -0.726 | JCP |
| UNH | IDMS | B | 3/25/08 | 10.035 | -0.993 | PAM |
| UNH | IDMS | B | 3/25/08 | 10.029 | -1.052 | PAM |
| UNH | IDMS | B | 3/25/08 | 10.021 | -1.131 | PAM |
| UNH | IDMS | B | 3/25/08 | 10.042 | -0.923 | PAM |
| UNH | IDMS | B | 3/27/08 | 10.031 | -1.032 | LLB |
| UNH | IDMS | B | 3/27/08 | 10.024 | -1.101 | LLB |
| UNH | IDMS | B | 3/27/08 | 10.046 | -0.884 | LLB |
| UNH | IDMS | B | 3/27/08 | 10.028 | -1.062 | LLB |
| UNH | IDMS | G | 5/5/06 | 0.4702 | 0.017 | 3061 |
| UNH | IDMS | G | 5/10/06 | 0.4701 | -0.004 | 3060 |
| UNH | IDMS | G | 5/10/06 | 0.4703 | 0.038 | 3061 |
| UNH | IDMS | G | 5/10/06 | 0.4699 | -0.047 | 3073 |
| UNH | IDMS | G | 5/10/06 | 0.4701 | -0.004 | 3074 |
| UNH | IDMS | G | 5/5/06 | 0.4629 | -0.013 | 3062 |
| UNH | IDMS | G | 5/5/06 | 0.463 | 0.009 | 3063 |
| UNH | IDMS | G | 5/10/06 | 0.4633 | 0.073 | 3075 |
| UNH | IDMS | G | 5/11/06 | 0.4632 | 0.052 | 3076 |
| UNH | IDMS | G | 5/11/06 | 0.4651 | -0.049 | 3064 |
| UNH | IDMS | G | 5/11/06 | 0.4648 | -0.114 | 3065 |
| UNH | IDMS | G | 5/18/06 | 0.4649 | -0.092 | 3081 |
| UNH | IDMS | G | 5/5/06 | 0.4654 | 0.015 | 3066 |
| UNH | IDMS | G | 5/5/06 | 0.4656 | 0.058 | 3067 |
| UNH | IDMS | G | 5/11/06 | 0.4652 | -0.028 | 3080 |
| UNH | XRFL | A | 11/4/04 | 1.002 | -0.030 | MER/SJB |
| UNH | XRFL | A | 11/4/04 | 1.001 | -0.130 | MER/SJB |
| UNH | XRFL | A | 11/30/04 | 0.999 | -0.329 | MER/RBD |
| UNH | XRFL | A | 11/30/04 | 1.003 | 0.070 | MER/RBD |
| UNH | XRFL | A | 11/4/04 | 0.998 | -0.255 | MER/SJB |
| UNH | XRFL | A | 11/4/04 | 1 | -0.055 | MER/SJB |
| UNH | XRFL | A | 11/30/04 | 0.998 | -0.255 | MER/RBD |
| UNH | XRFL | A | 11/30/04 | 0.998 | -0.255 | MER/RBD |
| UNH | XRFL | A | 9/29/05 | 1.002 | -0.201 | ACB |
| UNH | XRFL | A | 9/29/05 | 1.002 | -0.201 | ACB |
| UNH | XRFL | A | 10/3/05 | 1.002 | -0.201 | ACB |
| UNH | XRFL | A | 10/3/05 | 1.004 | -0.002 | ACB |
| UNH | XRFL | A | 9/29/05 | 1 | -0.055 | ACB |
| UNH | XRFL | A | 9/29/05 | 1.001 | 0.045 | ACB |
| UNH | XRFL | A | 10/3/05 | 0.997 | -0.355 | ACB |
| UNH | XRFL | A | 10/3/05 | 0.999 | -0.155 | ACB |
| UNH | XRFL | A | 6/20/07 | 1.014 | 0.043 | MER |
| UNH | XRFL | A | 6/20/07 | 1.015 | 0.142 | MER |
| UNH | XRFL | A | 6/20/07 | 1.014 | 0.043 | MER |
| UNH | XRFL | A | 6/20/07 | 1.019 | 0.537 | MER |
| UNH | XRFL | A | 7/12/07 | 1.02 | 0.635 | MER |
| UNH | XRFL | A | 7/12/07 | 1.016 | 0.241 | MER |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| UNH | XRFL | A | 7/12/07 | 1.019 | 0.537 | MER |
| UNH | XRFL | A | 7/12/07 | 1.02 | 0.635 | MER |
| UNH | XRFL | A | 9/27/07 | 1.017 | 0.339 | MER |
| UNH | XRFL | A | 9/27/07 | 1.015 | 0.142 | MER |
| UNH | XRFL | A | 9/27/07 | 1.014 | 0.043 | MER |
| UNH | XRFL | A | 9/27/07 | 1.011 | -0.253 | MER |
| UNH | XRFL | A | 10/1/07 | 1.012 | -0.154 | MER |
| UNH | XRFL | A | 10/1/07 | 1.016 | 0.241 | MER |
| UNH | XRFL | A | 10/1/07 | 1.018 | 0.438 | MER |
| UNH | XRFL | A | 10/1/07 | 1.015 | 0.142 | MER |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | AB | 3/30/06 | 88.128 | -0.001 | AV |
| $UO_2$ | DG | AB | 3/30/06 | 88.149 | 0.023 | AV |
| $UO_2$ | DG | AB | 3/30/06 | 88.123 | -0.007 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.091 | -0.043 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.143 | 0.016 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.103 | -0.030 | AV |
| $UO_2$ | DG | AB | 3/30/06 | 88.124 | -0.006 | AV |
| $UO_2$ | DG | AB | 3/30/06 | 88.120 | -0.010 | AV |
| $UO_2$ | DG | AB | 3/30/06 | 88.044 | -0.096 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.076 | -0.060 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.071 | -0.066 | AV |
| $UO_2$ | DG | AB | 3/31/06 | 88.085 | -0.050 | AV |
| $UO_2$ | DG | AC | 6/5/06 | 88.028 | -0.115 | AL |
| $UO_2$ | DG | AC | 6/5/06 | 88.037 | -0.104 | AL |
| $UO_2$ | DG | AC | 6/6/06 | 87.970 | -0.180 | NDS |
| $UO_2$ | DG | AC | 6/6/06 | 87.983 | -0.166 | NDS |
| $UO_2$ | DG | AC | 6/5/06 | 87.986 | -0.162 | NDS |
| $UO_2$ | DG | AC | 6/5/06 | 87.977 | -0.172 | NDS |
| $UO_2$ | DG | AC | 6/6/06 | 87.972 | -0.178 | AL |
| $UO_2$ | DG | AC | 6/6/06 | 87.964 | -0.187 | AL |
| $UO_2$ | DG | AC | 11/16/06 | 88.128 | -0.001 | AL |
| $UO_2$ | DG | AC | 11/16/06 | 88.137 | 0.009 | AL |
| $UO_2$ | DG | AC | 11/16/06 | 88.096 | -0.037 | NDS |
| $UO_2$ | DG | AC | 11/16/06 | 88.097 | -0.036 | NDS |
| $UO_2$ | DG | AC | 11/17/06 | 88.129 | 0.000 | NDS |
| $UO_2$ | DG | AC | 11/17/06 | 88.147 | 0.020 | NDS |
| $UO_2$ | DG | AC | 11/17/06 | 88.098 | -0.035 | AL |
| $UO_2$ | DG | AC | 11/17/06 | 88.11 | -0.022 | AL |
| $UO_2$ | DG | AC | 11/20/07 | 88.071 | -0.066 | AL |
| $UO_2$ | DG | AC | 11/20/07 | 88.102 | -0.031 | AL |
| $UO_2$ | DG | AC | 11/21/07 | 88.116 | -0.015 | NDS |
| $UO_2$ | DG | AC | 11/21/07 | 88.128 | -0.001 | NDS |
| $UO_2$ | DG | AC | 11/28/07 | 88.131 | 0.002 | NDS |
| $UO_2$ | DG | AC | 11/28/07 | 88.147 | 0.020 | NDS |
| $UO_2$ | DG | AC | 11/29/07 | 88.138 | 0.010 | AL |
| $UO_2$ | DG | AC | 11/29/07 | 88.127 | -0.002 | AL |
| $UO_2$ | DG | AD | 6/2/06 | 88.097 | -0.036 | EB/CD |
| $UO_2$ | DG | AD | 6/2/06 | 88.126 | -0.003 | EB/CD |
| $UO_2$ | DG | AD | 6/2/06 | 88.115 | -0.016 | EB/CD |
| $UO_2$ | DG | AD | 6/2/06 | 88.087 | -0.048 | EB/CD |
| $UO_2$ | DG | AD | 6/5/06 | 88.113 | -0.018 | EB/CD |
| $UO_2$ | DG | AD | 6/5/06 | 88.121 | -0.009 | EB/CD |
| $UO_2$ | DG | AD | 6/5/06 | 88.120 | -0.010 | EB/CD |
| $UO_2$ | DG | AD | 6/5/06 | 88.109 | -0.023 | EB/CD |
| $UO_2$ | DG | AD | 11/23/06 | 88.059 | -0.079 | EB |
| $UO_2$ | DG | AD | 11/23/06 | 88.069 | -0.068 | CD |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | AD | 11/23/06 | 88.075 | -0.061 | EB |
| $UO_2$ | DG | AD | 11/23/06 | 88.064 | -0.074 | CD |
| $UO_2$ | DG | AD | 11/25/06 | 88.088 | -0.047 | EB |
| $UO_2$ | DG | AD | 11/25/06 | 88.065 | -0.073 | CD |
| $UO_2$ | DG | AD | 11/25/06 | 88.075 | -0.061 | EB |
| $UO_2$ | DG | AD | 11/25/06 | 88.07 | -0.067 | CD |
| $UO_2$ | DG | AE | 4/26/06 | 88.0960 | -0.037 | JR-JM |
| $UO_2$ | DG | AE | 4/26/06 | 88.1055 | -0.027 | JR-JM |
| $UO_2$ | DG | AE | 4/26/06 | 88.1239 | -0.006 | JR-JM |
| $UO_2$ | DG | AE | 4/26/06 | 88.1190 | -0.011 | JR-JM |
| $UO_2$ | DG | AE | 4/27/06 | 88.1469 | 0.020 | JR-JM |
| $UO_2$ | DG | AE | 4/27/06 | 88.1042 | -0.028 | JR-JM |
| $UO_2$ | DG | AE | 4/27/06 | 88.1658 | 0.042 | JR-JM |
| $UO_2$ | DG | AE | 4/27/06 | 88.1668 | 0.043 | JR-JM |
| $UO_2$ | DG | AE | 11/23/06 | 88.122 | -0.008 | JR-EL |
| $UO_2$ | DG | AE | 11/23/06 | 88.164 | 0.040 | JR-EL |
| $UO_2$ | DG | AE | 11/23/06 | 88.091 | -0.043 | JR-EL |
| $UO_2$ | DG | AE | 11/23/06 | 88.095 | -0.039 | JR-EL |
| $UO_2$ | DG | AE | 11/24/06 | 88.065 | -0.073 | JR-EL |
| $UO_2$ | DG | AE | 11/24/06 | 88.006 | -0.140 | JR-EL |
| $UO_2$ | DG | AE | 11/24/06 | 88.06 | -0.078 | JR-EL |
| $UO_2$ | DG | AE | 11/24/06 | 87.977 | -0.172 | JR-EL |
| $UO_2$ | DG | BA | 4/6/06 | 88.152 | 0.092 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.083 | 0.014 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.125 | 0.061 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.052 | -0.022 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.099 | 0.032 | |
| $UO_2$ | DG | BA | 4/7/06 | 88.032 | -0.044 | |
| $UO_2$ | DG | BA | 4/7/06 | 88.005 | -0.075 | |
| $UO_2$ | DG | BA | 4/7/06 | 88.027 | -0.050 | |
| $UO_2$ | DG | BA | 4/7/06 | 87.936 | -0.153 | |
| $UO_2$ | DG | BA | 4/7/06 | 88.025 | -0.052 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.031 | -0.045 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.027 | -0.050 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.058 | -0.015 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.140 | 0.078 | |
| $UO_2$ | DG | BA | 4/6/06 | 88.099 | 0.032 | |
| $UO_2$ | DG | BA | 4/7/06 | 87.951 | -0.136 | |
| $UO_2$ | DG | BA | 4/7/06 | 88.048 | -0.026 | |
| $UO_2$ | DG | BA | 4/7/06 | 87.930 | -0.160 | |
| $UO_2$ | DG | BA | 4/7/06 | 87.997 | -0.084 | |
| $UO_2$ | DG | BA | 4/7/06 | 87.966 | -0.119 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.055 | -0.084 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.15 | 0.024 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.114 | -0.017 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.094 | -0.040 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | BA | 11/23/06 | 88.131 | 0.002 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.099 | -0.034 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.137 | 0.009 | |
| $UO_2$ | DG | BA | 11/23/06 | 88.08 | -0.056 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.102 | -0.031 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.08 | -0.056 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.124 | -0.006 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.136 | 0.008 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.132 | 0.003 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.152 | 0.026 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.062 | -0.076 | |
| $UO_2$ | DG | BA | 11/24/06 | 88.113 | -0.018 | |
| $UO_2$ | DG | BA | 11/26/07 | 88.009 | -0.136 | |
| $UO_2$ | DG | BA | 11/26/07 | 88.001 | -0.145 | |
| $UO_2$ | DG | BA | 11/26/07 | 87.987 | -0.161 | |
| $UO_2$ | DG | BA | 11/26/07 | 88.02 | -0.124 | |
| $UO_2$ | DG | BA | 11/26/07 | 87.97 | -0.180 | |
| $UO_2$ | DG | BA | 11/26/07 | 87.977 | -0.172 | |
| $UO_2$ | DG | BA | 11/26/07 | 87.991 | -0.157 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.972 | -0.178 | |
| $UO_2$ | DG | BA | 11/27/07 | 88.01 | -0.135 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.982 | -0.167 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.928 | -0.228 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.962 | -0.189 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.956 | -0.196 | |
| $UO_2$ | DG | BA | 11/27/07 | 87.914 | -0.244 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.12 | -0.010 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.053 | -0.086 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.105 | -0.027 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.052 | -0.087 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.052 | -0.087 | |
| $UO_2$ | DG | BA | 3/17/08 | 87.961 | -0.191 | |
| $UO_2$ | DG | BA | 3/17/08 | 87.998 | -0.149 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.087 | -0.048 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.087 | -0.048 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.023 | -0.120 | |
| $UO_2$ | DG | BA | 3/17/08 | 88.103 | -0.030 | |
| $UO_2$ | DG | BA | 3/17/08 | 87.961 | -0.191 | |
| $UO_2$ | DG | BA | 3/18/08 | 88.105 | -0.027 | |
| $UO_2$ | DG | BA | 3/18/08 | 87.953 | -0.200 | |
| $UO_2$ | DG | BA | 3/18/08 | 87.977 | -0.172 | |
| $UO_2$ | DG | BA | 3/18/08 | 88.122 | -0.008 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | BA | 3/18/08 | 88.084 | -0.051 | |
| $UO_2$ | DG | BA | 3/18/08 | 87.966 | -0.185 | |
| $UO_2$ | DG | BA | 3/18/08 | 87.958 | -0.194 | |
| $UO_2$ | DG | BA | 3/18/08 | 88.041 | -0.100 | |
| $UO_2$ | DG | BA | 3/18/08 | 88.025 | -0.118 | |
| $UO_2$ | DG | BC | 4/13/06 | 88.06433 | -0.073 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.15492 | 0.029 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.15719 | 0.032 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.08713 | -0.048 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.05359 | -0.086 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.01272 | -0.132 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 87.97265 | -0.177 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.02056 | -0.123 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.00236 | -0.144 | ICO |
| $UO_2$ | DG | BC | 4/13/06 | 88.02031 | -0.123 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.12967 | 0.001 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.10743 | -0.024 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.10258 | -0.030 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.06009 | -0.078 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.16297 | 0.039 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.01585 | -0.128 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.03035 | -0.112 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.01072 | -0.134 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.03399 | -0.108 | ICO |
| $UO_2$ | DG | BC | 4/18/06 | 88.01799 | -0.126 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.07628 | -0.060 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.10536 | -0.027 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.11326 | -0.018 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.09782 | -0.035 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.07518 | -0.061 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.20877 | 0.091 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.13921 | 0.012 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.16356 | 0.039 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.19854 | 0.079 | ICO |
| $UO_2$ | DG | BC | 10/17/06 | 88.15852 | 0.033 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.05198 | -0.087 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.08551 | -0.049 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.05898 | -0.079 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.05865 | -0.080 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.05625 | -0.083 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.1391 | 0.011 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.15435 | 0.029 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.15698 | 0.032 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.16761 | 0.044 | ICO |
| $UO_2$ | DG | BC | 10/19/06 | 88.13891 | 0.011 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.3862 | 0.292 | ICO |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | BC | 10/17/07 | 88.2957 | 0.189 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.3437 | 0.244 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.3748 | 0.279 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.389 | 0.295 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.3956 | 0.303 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.2712 | 0.161 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.2899 | 0.183 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.1584 | 0.033 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.1217 | -0.008 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.0746 | -0.062 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.0775 | -0.058 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.3706 | 0.274 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.364 | 0.267 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.2394 | 0.125 | ICO |
| $UO_2$ | DG | BC | 10/17/07 | 88.2341 | 0.119 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.145 | 0.018 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.1168 | -0.014 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.1436 | 0.017 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.1153 | -0.016 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3143 | 0.210 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3189 | 0.215 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.2798 | 0.171 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.2844 | 0.176 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3438 | 0.244 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3682 | 0.271 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3091 | 0.204 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3335 | 0.232 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.2801 | 0.171 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.3115 | 0.207 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.2435 | 0.130 | ICO |
| $UO_2$ | DG | BC | 10/24/07 | 88.2749 | 0.166 | ICO |
| $UO_2$ | DG | BF | 4/4/06 | 88.061 | -0.077 | ABC |
| $UO_2$ | DG | BF | 4/4/06 | 88.097 | -0.036 | ABC |
| $UO_2$ | DG | BF | 4/4/06 | 88.090 | -0.044 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.122 | -0.008 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.056 | -0.083 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.110 | -0.022 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.138 | 0.010 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.133 | 0.005 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.148 | 0.022 | ABC |
| $UO_2$ | DG | BF | 4/12/06 | 88.147 | 0.020 | ABC |
| $UO_2$ | DG | BF | 4/13/06 | 88.068 | -0.069 | ABC |
| $UO_2$ | DG | BF | 4/13/06 | 88.142 | 0.015 | ABC |
| $UO_2$ | DG | BF | 4/13/06 | 88.160 | 0.035 | ABC |
| $UO_2$ | DG | BF | 4/13/06 | 88.141 | 0.014 | ABC |
| $UO_2$ | DG | BF | 1/15/07 | 88.122 | -0.008 | ABC |
| $UO_2$ | DG | BF | 1/15/07 | 88.121 | -0.009 | ABC |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | BF | 1/15/07 | 87.955 | -0.197 | ABC |
| $UO_2$ | DG | BF | 1/15/07 | 87.998 | -0.149 | ABC |
| $UO_2$ | DG | BF | 1/15/07 | 88.148 | 0.022 | ABC |
| $UO_2$ | DG | BF | 1/15/07 | 88.125 | -0.005 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.127 | -0.002 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.147 | 0.020 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.194 | 0.074 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.204 | 0.085 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.145 | 0.018 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.224 | 0.108 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.105 | -0.027 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.178 | 0.056 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.125 | -0.005 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.126 | -0.003 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.138 | 0.010 | ABC |
| $UO_2$ | DG | BF | 1/16/07 | 88.094 | -0.040 | ABC |
| $UO_2$ | DG | F | 9/14/07 | 88.154 | 0.028 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.098 | -0.035 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.082 | -0.053 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.129 | 0.000 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.108 | -0.024 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.139 | 0.011 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.108 | -0.024 | MM |
| $UO_2$ | DG | F | 9/14/07 | 88.123 | -0.007 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.131 | 0.002 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.049 | -0.091 | MM |
| $UO_2$ | DG | F | 9/25/07 | 87.991 | -0.157 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.148 | 0.022 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.131 | 0.002 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.11 | -0.022 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.158 | 0.033 | MM |
| $UO_2$ | DG | F | 9/25/07 | 88.169 | 0.045 | MM |
| $UO_2$ | DG | F | 10/2/07 | 88.119 | -0.011 | AV |
| $UO_2$ | DG | F | 10/2/07 | 88.14 | 0.012 | AV |
| $UO_2$ | DG | F | 10/2/07 | 88.148 | 0.022 | AV |
| $UO_2$ | DG | F | 10/2/07 | 88.146 | 0.019 | AV |
| $UO_2$ | DG | F | 10/2/07 | 88.131 | 0.002 | AV |
| $UO_2$ | DG | F | 10/2/07 | 88.122 | -0.008 | AV |
| $UO_2$ | DG | F | 10/4/07 | 88.137 | 0.009 | AV |
| $UO_2$ | DG | F | 10/4/07 | 88.135 | 0.007 | AV |
| $UO_2$ | DG | F | 10/4/07 | 88.143 | 0.016 | AV |
| $UO_2$ | DG | F | 10/4/07 | 88.155 | 0.030 | AV |
| $UO_2$ | DG | F | 10/4/07 | 88.12 | -0.010 | AV |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | T | 12/19/05 | 88.20 | 0.081 | |
| $UO_2$ | DG | T | 12/19/05 | 88.26 | 0.149 | |
| $UO_2$ | DG | T | 12/19/05 | 88.24 | 0.126 | |
| $UO_2$ | DG | T | 12/19/05 | 88.15 | 0.024 | |
| $UO_2$ | DG | T | 12/21/05 | 88.13 | 0.001 | |
| $UO_2$ | DG | T | 12/21/05 | 88.18 | 0.058 | |
| $UO_2$ | DG | T | 12/21/05 | 88.10 | -0.033 | |
| $UO_2$ | DG | T | 12/21/05 | 88.11 | -0.022 | |
| $UO_2$ | DG | T | 4/12/06 | 88.23 | 0.115 | |
| $UO_2$ | DG | T | 4/12/06 | 88.20 | 0.081 | |
| $UO_2$ | DG | T | 4/12/06 | 88.17 | 0.047 | |
| $UO_2$ | DG | T | 4/12/06 | 88.22 | 0.103 | |
| $UO_2$ | DG | T | 4/19/06 | 88.04 | -0.101 | |
| $UO_2$ | DG | T | 4/19/06 | 88.12 | -0.010 | |
| $UO_2$ | DG | T | 4/19/06 | 88.15 | 0.024 | |
| $UO_2$ | DG | T | 4/19/06 | 88.10 | -0.033 | |
| $UO_2$ | DG | T | 10/16/06 | 88.15 | 0.024 | |
| $UO_2$ | DG | T | 10/16/06 | 88.15 | 0.024 | |
| $UO_2$ | DG | T | 10/16/06 | 88.1 | -0.033 | |
| $UO_2$ | DG | T | 10/16/06 | 88.12 | -0.010 | |
| $UO_2$ | DG | T | 10/24/06 | 88.03 | -0.112 | |
| $UO_2$ | DG | T | 10/24/06 | 88.18 | 0.058 | |
| $UO_2$ | DG | T | 10/24/06 | 88.03 | -0.112 | |
| $UO_2$ | DG | T | 10/24/06 | 88.18 | 0.058 | |
| $UO_2$ | DG | T | 8/23/06 | 88.09 | -0.044 | |
| $UO_2$ | DG | T | 8/23/06 | 88.16 | 0.035 | |
| $UO_2$ | DG | T | 8/23/06 | 88.16 | 0.035 | |
| $UO_2$ | DG | T | 8/23/06 | 88.1 | -0.033 | |
| $UO_2$ | DG | T | 8/25/06 | 88.1 | -0.033 | |
| $UO_2$ | DG | T | 8/25/06 | 88.12 | -0.010 | |
| $UO_2$ | DG | T | 8/25/06 | 88.19 | 0.069 | |
| $UO_2$ | DG | T | 8/25/06 | 88.16 | 0.035 | |
| $UO_2$ | DG | T | 11/7/07 | 88.13 | 0.001 | |
| $UO_2$ | DG | T | 11/7/07 | 88.09 | -0.044 | |
| $UO_2$ | DG | T | 11/7/07 | 88.1 | -0.033 | |
| $UO_2$ | DG | T | 11/7/07 | 88.21 | 0.092 | |
| $UO_2$ | DG | T | 11/9/07 | 88.25 | 0.137 | |
| $UO_2$ | DG | T | 11/9/07 | 88.27 | 0.160 | |
| $UO_2$ | DG | T | 11/9/07 | 88.25 | 0.137 | |
| $UO_2$ | DG | T | 11/9/07 | 88.28 | 0.171 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_2$ | DG | V | 3/21/06 | 88.031 | -0.111 | 1 |
| $UO_2$ | DG | V | 3/21/06 | 88.038 | -0.103 | 1 |
| $UO_2$ | DG | V | 3/21/06 | 88.032 | -0.110 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 88.085 | -0.050 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 88.089 | -0.045 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 88.136 | 0.008 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.113 | -0.018 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.074 | -0.062 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.145 | 0.018 | 1 |
| $UO_2$ | DG | V | 3/21/06 | 88.070 | -0.067 | 1 |
| $UO_2$ | DG | V | 3/21/06 | 88.092 | -0.042 | 1 |
| $UO_2$ | DG | V | 3/21/06 | 88.034 | -0.108 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 87.990 | -0.158 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 88.108 | -0.024 | 1 |
| $UO_2$ | DG | V | 4/5/06 | 88.038 | -0.103 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.143 | 0.016 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.093 | -0.041 | 1 |
| $UO_2$ | DG | V | 4/25/06 | 88.139 | 0.011 | 1 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | DG | AE | 10/3/07 | 82.697 | 0.031 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/3/07 | 82.665 | -0.007 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/3/07 | 82.675 | 0.005 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/3/07 | 82.669 | -0.002 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/4/07 | 82.667 | -0.005 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/4/07 | 82.59 | -0.098 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/4/07 | 82.663 | -0.010 | JR-JM-EL |
| $UO_3$ | DG | AE | 10/4/07 | 82.649 | -0.027 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/17/08 | 82.586 | -0.103 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/17/08 | 82.571 | -0.121 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/17/08 | 82.589 | -0.099 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/17/08 | 82.624 | -0.057 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/18/08 | 82.66 | -0.013 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/18/08 | 82.602 | -0.083 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/18/08 | 82.619 | -0.063 | JR-JM-EL |
| $UO_3$ | DG | AE | 3/18/08 | 82.584 | -0.105 | JR-JM-EL |
| $UO_3$ | DG | BA | 11/26/07 | 82.599 | -0.087 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.606 | -0.079 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.616 | -0.067 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.608 | -0.076 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.635 | -0.044 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.618 | -0.064 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.581 | -0.109 | |
| $UO_3$ | DG | BA | 11/26/07 | 82.616 | -0.067 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.409 | -0.317 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.479 | -0.232 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.578 | -0.112 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.485 | -0.225 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.59 | -0.098 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.664 | -0.008 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.614 | -0.069 | |
| $UO_3$ | DG | BA | 11/27/07 | 82.62 | -0.062 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.485 | -0.225 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.671 | 0.000 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.592 | -0.096 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.417 | -0.307 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.468 | -0.246 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.557 | -0.138 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.543 | -0.155 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.576 | -0.115 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.421 | -0.302 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.469 | -0.244 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.405 | -0.322 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.431 | -0.290 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.42 | -0.304 | |
| $UO_3$ | DG | BA | 3/19/08 | 82.426 | -0.296 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.528 | -0.173 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | DG | BA | 3/20/08 | 82.582 | -0.108 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.624 | -0.057 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.635 | -0.044 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.529 | -0.172 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.6 | -0.086 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.562 | -0.132 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.488 | -0.221 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.471 | -0.242 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.451 | -0.266 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.43 | -0.292 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.418 | -0.306 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.51 | -0.195 | |
| $UO_3$ | DG | BA | 3/20/08 | 82.507 | -0.198 | |
| $UO_3$ | DG | BF | 7/27/07 | 82.772 | 0.122 | ABC |
| $UO_3$ | DG | BF | 7/27/07 | 82.768 | 0.117 | ABC |
| $UO_3$ | DG | BF | 8/1/07 | 82.732 | 0.074 | ABC |
| $UO_3$ | DG | BF | 8/1/07 | 82.737 | 0.080 | ABC |
| $UO_3$ | DG | BF | 10/3/07 | 82.635 | -0.044 | ABC |
| $UO_3$ | DG | BF | 10/3/07 | 82.646 | -0.030 | ABC |
| $UO_3$ | DG | BF | 10/8/07 | 82.597 | -0.090 | ABC |
| $UO_3$ | DG | BF | 10/8/07 | 82.584 | -0.105 | ABC |
| $UO_3$ | DG | BF | 3/27/08 | 82.767 | 0.116 | ABC |
| $UO_3$ | DG | BF | 3/27/08 | 82.575 | -0.116 | ABC |
| $UO_3$ | DG | BF | 3/27/08 | 82.58 | -0.110 | ABC |
| $UO_3$ | DG | BF | 3/27/08 | 82.569 | -0.123 | ABC |
| $UO_3$ | DG | BF | 3/28/08 | 82.764 | 0.112 | ABC |
| $UO_3$ | DG | BF | 3/28/08 | 82.625 | -0.056 | ABC |
| $UO_3$ | DG | BF | 3/28/08 | 82.589 | -0.099 | ABC |
| $UO_3$ | DG | BF | 3/28/08 | 82.68 | 0.011 | ABC |
| $UO_3$ | DG | F | 9/18/07 | 82.613 | -0.070 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.627 | -0.053 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.663 | -0.010 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.634 | -0.045 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.632 | -0.047 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.65 | -0.025 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.637 | -0.041 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.611 | -0.073 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.616 | -0.067 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.595 | -0.092 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.586 | -0.103 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.635 | -0.044 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.602 | -0.083 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.603 | -0.082 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.592 | -0.096 | NH |
| $UO_3$ | DG | F | 9/19/07 | 82.6 | -0.086 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.624 | -0.057 | NH |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | DG | F | 9/21/07 | 82.647 | -0.029 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.621 | -0.060 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.651 | -0.024 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.603 | -0.082 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.622 | -0.059 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.69 | 0.023 | NH |
| $UO_3$ | DG | F | 9/21/07 | 82.641 | -0.036 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.635 | -0.044 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.663 | -0.010 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.65 | -0.025 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.662 | -0.011 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.641 | -0.036 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.607 | -0.077 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.711 | 0.048 | NH |
| $UO_3$ | DG | F | 9/24/07 | 82.7 | 0.035 | NH |
| $UO_3$ | DG | F | 9/18/07 | 82.617 | -0.065 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.55 | -0.146 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.53 | -0.171 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.605 | -0.080 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.586 | -0.103 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.615 | -0.068 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.474 | -0.238 | MM |
| $UO_3$ | DG | F | 9/18/07 | 82.463 | -0.252 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.597 | -0.090 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.572 | -0.120 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.607 | -0.077 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.573 | -0.119 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.615 | -0.068 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.608 | -0.076 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.52 | -0.183 | MM |
| $UO_3$ | DG | F | 9/19/07 | 82.577 | -0.114 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.569 | -0.123 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.567 | -0.126 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.541 | -0.157 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.51 | -0.195 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.541 | -0.157 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.561 | -0.133 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.443 | -0.276 | MM |
| $UO_3$ | DG | F | 9/21/07 | 82.5 | -0.207 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.62 | -0.062 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.624 | -0.057 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.558 | -0.137 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.606 | -0.079 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.591 | -0.097 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.557 | -0.138 | MM |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | DG | F | 9/24/07 | 82.46 | -0.255 | MM |
| $UO_3$ | DG | F | 9/24/07 | 82.421 | -0.302 | MM |
| $UO_3$ | DG | F | 3/11/08 | 82.68 | 0.011 | MM |
| $UO_3$ | DG | F | 3/11/08 | 82.715 | 0.053 | MM |
| $UO_3$ | DG | F | 3/11/08 | 82.65 | -0.025 | MM |
| $UO_3$ | DG | F | 3/11/08 | 82.598 | -0.088 | MM |
| $UO_3$ | DG | F | 3/13/08 | 82.594 | -0.093 | MM |
| $UO_3$ | DG | F | 3/13/08 | 82.612 | -0.071 | MM |
| $UO_3$ | DG | F | 3/13/08 | 82.633 | -0.046 | MM |
| $UO_3$ | DG | F | 3/13/08 | 82.636 | -0.042 | MM |
| $UO_3$ | DG | F | 3/13/08 | 82.598 | -0.088 | NH |
| $UO_3$ | DG | F | 3/13/08 | 82.669 | -0.002 | NH |
| $UO_3$ | DG | F | 3/13/08 | 82.635 | -0.044 | NH |
| $UO_3$ | DG | F | 3/13/08 | 82.637 | -0.041 | NH |
| $UO_3$ | DG | F | 3/14/08 | 82.682 | 0.013 | NH |
| $UO_3$ | DG | F | 3/14/08 | 82.635 | -0.044 | NH |
| $UO_3$ | DG | F | 3/14/08 | 82.596 | -0.091 | NH |
| $UO_3$ | DG | F | 3/14/08 | 82.636 | -0.042 | NH |
| $UO_3$ | DG | V | 3/21/06 | 82.588 | -0.100 | 1 |
| $UO_3$ | DG | V | 3/21/06 | 82.620 | -0.062 | 1 |
| $UO_3$ | DG | V | 3/21/06 | 82.593 | -0.094 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.577 | -0.114 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.581 | -0.109 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.539 | -0.160 | 1 |
| $UO_3$ | DG | V | 4/25/06 | 82.610 | -0.074 | 1 |
| $UO_3$ | DG | V | 4/25/06 | 82.608 | -0.076 | 1 |
| $UO_3$ | DG | V | 3/21/06 | 82.609 | -0.075 | 1 |
| $UO_3$ | DG | V | 3/21/06 | 82.648 | -0.028 | 1 |
| $UO_3$ | DG | V | 3/21/06 | 82.651 | -0.024 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.586 | -0.103 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.597 | -0.090 | 1 |
| $UO_3$ | DG | V | 4/5/06 | 82.577 | -0.114 | 1 |
| $UO_3$ | DG | V | 4/25/06 | 82.598 | -0.088 | 1 |
| $UO_3$ | DG | V | 4/25/06 | 82.647 | -0.029 | 1 |
| $UO_3$ | DG | V | 4/25/06 | 82.623 | -0.058 | 1 |
| $UO_3$ | IDMS | A | 11/9/04 | 82.78 | 0.132 | BLM/JM |
| $UO_3$ | IDMS | A | 11/9/04 | 82.59 | -0.098 | BLM/JM |
| $UO_3$ | IDMS | A | 12/7/04 | 82.67 | -0.001 | WJS/JM |
| $UO_3$ | IDMS | A | 12/7/04 | 82.77 | 0.120 | WJS/JM |
| $UO_3$ | IDMS | A | 12/7/04 | 82.71 | 0.047 | WJS/JM |
| $UO_3$ | IDMS | A | 12/7/04 | 82.71 | 0.047 | WJS/JM |
| $UO_3$ | IDMS | A | 11/9/04 | 82.48 | -0.231 | BLM/JM |
| $UO_3$ | IDMS | A | 11/9/04 | 82.51 | -0.195 | BLM/JM |
| $UO_3$ | IDMS | A | 3/23/05 | 82.68 | 0.011 | BLM/JM |
| $UO_3$ | IDMS | A | 3/23/05 | 82.69 | 0.023 | BLM/JM |
| $UO_3$ | IDMS | A | 3/24/05 | 82.48 | -0.231 | WJS/JM |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | IDMS | A | 3/24/05 | 82.77 | 0.120 | WJS/JM |
| $UO_3$ | IDMS | A | 3/23/05 | 82.76 | 0.108 | WJS/JM |
| $UO_3$ | IDMS | A | 3/23/05 | 82.64 | -0.037 | WJS/JM |
| $UO_3$ | IDMS | A | 3/24/05 | 82.67 | -0.001 | BLM/JM |
| $UO_3$ | IDMS | A | 3/24/05 | 82.53 | -0.171 | BLM/JM |
| $UO_3$ | IDMS | A | 9/14/05 | 82.58 | -0.110 | BLM/JM |
| $UO_3$ | IDMS | A | 9/14/05 | 82.68 | 0.011 | BLM/JM |
| $UO_3$ | IDMS | A | 9/15/05 | 82.60 | -0.086 | DB/JM |
| $UO_3$ | IDMS | A | 9/15/05 | 82.58 | -0.110 | DB/JM |
| $UO_3$ | IDMS | A | 9/19/05 | 82.53 | -0.171 | WJS/JM |
| $UO_3$ | IDMS | A | 9/19/05 | 82.68 | 0.011 | WJS/JM |
| $UO_3$ | IDMS | A | 9/14/05 | 82.55 | -0.146 | BLM/JM |
| $UO_3$ | IDMS | A | 9/14/05 | 82.61 | -0.074 | BLM/JM |
| $UO_3$ | IDMS | A | 9/15/05 | 82.66 | -0.013 | DB/JM |
| $UO_3$ | IDMS | A | 9/15/05 | 82.76 | 0.108 | DB/JM |
| $UO_3$ | IDMS | A | 9/19/05 | 82.63 | -0.050 | WJS/JM |
| $UO_3$ | IDMS | A | 9/19/05 | 82.58 | -0.110 | WJS/JM |
| $UO_3$ | IDMS | B | 3/2/06 | 82.0 | -0.812 | PAM |
| $UO_3$ | IDMS | B | 3/2/06 | 81.8 | -1.054 | PAM |
| $UO_3$ | IDMS | B | 3/9/06 | 82.0 | -0.812 | DDN |
| $UO_3$ | IDMS | B | 3/9/06 | 82.4 | -0.328 | DDN |
| $UO_3$ | IDMS | B | 3/2/06 | 82.1 | -0.691 | PAM |
| $UO_3$ | IDMS | B | 3/2/06 | 81.8 | -1.054 | PAM |
| $UO_3$ | IDMS | B | 3/9/06 | 82.5 | -0.207 | DDN |
| $UO_3$ | IDMS | B | 3/9/06 | 82.8 | 0.156 | DDN |
| $UO_3$ | XRFL | A | 11/4/04 | 82.35 | -0.388 | MER/SJB |
| $UO_3$ | XRFL | A | 11/4/04 | 82.20 | -0.570 | MER/SJB |
| $UO_3$ | XRFL | A | 11/30/04 | 82.23 | -0.533 | MER/RBD |
| $UO_3$ | XRFL | A | 11/30/04 | 82.15 | -0.630 | MER/RBD |
| $UO_3$ | XRFL | A | 11/4/04 | 82.41 | -0.316 | MER/SJB |
| $UO_3$ | XRFL | A | 11/4/04 | 82.49 | -0.219 | MER/SJB |
| $UO_3$ | XRFL | A | 11/30/04 | 82.15 | -0.630 | MER/RBD |
| $UO_3$ | XRFL | A | 11/30/04 | 82.24 | -0.521 | MER/RBD |
| $UO_3$ | XRFL | A | 4/15/05 | 82.09 | -0.703 | MER/ACB |
| $UO_3$ | XRFL | A | 4/15/05 | 82.39 | -0.340 | MER/ACB |
| $UO_3$ | XRFL | A | 4/18/05 | 82.29 | -0.461 | MER/ACB |
| $UO_3$ | XRFL | A | 4/18/05 | 82.22 | -0.546 | MER/ACB |
| $UO_3$ | XRFL | A | 4/15/05 | 82.33 | -0.412 | MER/ACB |
| $UO_3$ | XRFL | A | 4/15/05 | 82.39 | -0.340 | MER/ACB |
| $UO_3$ | XRFL | A | 4/18/05 | 82.55 | -0.146 | MER/ACB |
| $UO_3$ | XRFL | A | 4/18/05 | 82.41 | -0.316 | MER/ACB |
| $UO_3$ | XRFL | A | 9/15/05 | 82.87 | 0.241 | ACB |
| $UO_3$ | XRFL | A | 9/15/05 | 82.77 | 0.120 | ACB |
| $UO_3$ | XRFL | A | 9/27/05 | 82.51 | -0.195 | ACB |
| $UO_3$ | XRFL | A | 9/27/05 | 82.64 | -0.037 | ACB |
| $UO_3$ | XRFL | A | 9/15/05 | 82.81 | 0.168 | ACB |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UO_3$ | XRFL | A | 9/15/05 | 82.71 | 0.047 | ACB |
| $UO_3$ | XRFL | A | 9/27/05 | 82.48 | -0.231 | ACB |
| $UO_3$ | XRFL | A | 9/27/05 | 82.34 | -0.400 | ACB |
| $UO_3$ | XRFS | A | 11/15/04 | 82.22 | -0.546 | MER/RBD |
| $UO_3$ | XRFS | A | 11/15/04 | 82.16 | -0.618 | MER/RBD |
| $UO_3$ | XRFS | A | 12/1/04 | 81.95 | -0.872 | MER/SJB |
| $UO_3$ | XRFS | A | 12/1/04 | 81.95 | -0.872 | MER/SJB |
| $UO_3$ | XRFS | A | 11/15/04 | 82.06 | -0.739 | MER/RBD |
| $UO_3$ | XRFS | A | 11/15/04 | 81.94 | -0.884 | MER/RBD |
| $UO_3$ | XRFS | A | 12/1/04 | 81.94 | -0.884 | MER/SJB |
| $UO_3$ | XRFS | A | 12/1/04 | 82.17 | -0.606 | MER/SJB |
| $UO_3$ | XRFS | A | 3/9/05 | 82.71 | 0.047 | MER/ACB |
| $UO_3$ | XRFS | A | 3/9/05 | 82.65 | -0.025 | MER/ACB |
| $UO_3$ | XRFS | A | 3/10/05 | 82.56 | -0.134 | MER/ACB |
| $UO_3$ | XRFS | A | 3/10/05 | 82.46 | -0.255 | MER/ACB |
| $UO_3$ | XRFS | A | 3/9/05 | 82.52 | -0.183 | MER/ACB |
| $UO_3$ | XRFS | A | 3/9/05 | 82.42 | -0.304 | MER/ACB |
| $UO_3$ | XRFS | A | 3/10/05 | 82.67 | -0.001 | MER/ACB |
| $UO_3$ | XRFS | A | 3/10/05 | 82.39 | -0.340 | MER/ACB |
| $UO_3$ | XRFS | A | 9/13/05 | 82.28 | -0.473 | ACB |
| $UO_3$ | XRFS | A | 9/13/05 | 82.21 | -0.558 | ACB |
| $UO_3$ | XRFS | A | 9/15/05 | 82.45 | -0.267 | ACB |
| $UO_3$ | XRFS | A | 9/15/05 | 82.38 | -0.352 | ACB |
| $UO_3$ | XRFS | A | 9/13/05 | 82.24 | -0.521 | ACB |
| $UO_3$ | XRFS | A | 9/13/05 | 82.19 | -0.582 | ACB |
| $UO_3$ | XRFS | A | 9/15/05 | 82.35 | -0.388 | ACB |
| $UO_3$ | XRFS | A | 9/15/05 | 82.55 | -0.146 | ACB |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UF_6$ | DG | AB | 4/5/06 | 67.451 | -0.247 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.444 | -0.257 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.413 | -0.303 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.413 | -0.303 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.388 | -0.340 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.396 | -0.328 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.468 | -0.222 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.476 | -0.210 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.496 | -0.181 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.429 | -0.280 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.422 | -0.290 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.439 | -0.265 | FP |
| $UF_6$ | DG | AB | 7/11/07 | 67.575 | -0.064 | FP-AV |
| $UF_6$ | DG | AB | 7/11/07 | 67.602 | -0.024 | FP-AV |
| $UF_6$ | DG | AB | 7/11/07 | 67.558 | -0.089 | FP-AV |
| $UF_6$ | DG | AB | 7/12/07 | 67.573 | -0.067 | FP-AV |
| $UF_6$ | DG | AB | 7/12/07 | 67.565 | -0.079 | FP-AV |
| $UF_6$ | DG | AB | 7/12/07 | 67.582 | -0.053 | FP-AV |
| $UF_6$ | DG | AB | 3/13/08 | 67.577 | -0.061 | AV-FP |
| $UF_6$ | DG | AB | 3/13/08 | 67.605 | -0.019 | AV-FP |
| $UF_6$ | DG | AB | 3/13/08 | 67.556 | -0.092 | AV-FP |
| $UF_6$ | DG | AB | 3/14/08 | 67.669 | 0.075 | AV-FP |
| $UF_6$ | DG | AB | 3/14/08 | 67.547 | -0.105 | AV-FP |
| $UF_6$ | DG | AB | 3/14/08 | 67.602 | -0.024 | AV-FP |
| $UF_6$ | DG | AE | 4/5/06 | 67.431 | -0.277 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.414 | -0.302 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.663 | 0.066 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.700 | 0.121 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.427 | -0.283 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.438 | -0.266 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.694 | 0.112 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.698 | 0.118 | JR-JM |
| $UF_6$ | DG | AE | 11/28/06 | 67.592 | -0.039 | JR-EL |
| $UF_6$ | DG | AE | 11/28/06 | 67.554 | -0.095 | JR-EL |
| $UF_6$ | DG | AE | 11/28/06 | 67.408 | -0.311 | JR-EL |
| $UF_6$ | DG | AE | 11/28/06 | 67.434 | -0.272 | JR-EL |
| $UF_6$ | DG | AE | 11/29/06 | 67.485 | -0.197 | JR-EL |
| $UF_6$ | DG | AE | 11/29/06 | 67.537 | -0.120 | JR-EL |
| $UF_6$ | DG | AE | 11/29/06 | 67.384 | -0.346 | JR-EL |
| $UF_6$ | DG | AE | 11/29/06 | 67.444 | -0.257 | JR-EL |
| $UF_6$ | DG | AE | 10/3/07 | 67.525 | -0.138 | JR-JM-EL |
| $UF_6$ | DG | AE | 10/3/07 | 67.571 | -0.070 | JR-JM-EL |
| $UF_6$ | DG | AE | 10/4/07 | 67.561 | -0.084 | JR-JM-EL |
| $UF_6$ | DG | AE | 10/4/07 | 67.545 | -0.108 | JR-JM-EL |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UF_6$ | DG | AE | 3/17/08 | 67.56 | -0.086 | JR-JM-EL |
| $UF_6$ | DG | AE | 3/17/08 | 67.551 | -0.099 | JR-JM-EL |
| $UF_6$ | DG | AE | 3/18/08 | 67.537 | -0.120 | JR-JM-EL |
| $UF_6$ | DG | AE | 3/18/08 | 67.553 | -0.096 | JR-JM-EL |
| $UF_6$ | DG | V | 3/21/06 | 67.553 | -0.037 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.625 | 0.070 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.592 | 0.021 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.516 | -0.092 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.505 | -0.108 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.538 | -0.059 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.583 | 0.007 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.605 | 0.040 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.607 | 0.043 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.569 | -0.013 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.537 | -0.061 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.564 | -0.021 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.530 | -0.071 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.497 | -0.120 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.480 | -0.145 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.543 | -0.052 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.579 | 0.001 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.565 | -0.019 | 1 |
| $UF_6$ | DG | EA | 6/13/07 | 67.58 | -0.040 | NP2 |
| $UF_6$ | DG | EA | 6/13/07 | 67.58 | -0.040 | NP2 |
| $UF_6$ | DG | EA | 6/13/07 | 67.55 | -0.084 | NP2 |
| $UF_6$ | DG | EA | 6/13/07 | 67.52 | -0.129 | NP2 |
| $UF_6$ | DG | EA | 6/14/07 | 67.57 | -0.055 | NP1 |
| $UF_6$ | DG | EA | 6/14/07 | 67.57 | -0.055 | NP1 |
| $UF_6$ | DG | EA | 6/14/07 | 67.53 | -0.114 | NP1 |
| $UF_6$ | DG | EA | 6/14/07 | 67.53 | -0.114 | NP1 |
| $UF_6$ | DG | AB | 4/5/06 | 67.451 | -0.247 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.444 | -0.257 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.413 | -0.303 | FP |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| $UF_6$ | DG | AB | 4/6/06 | 67.413 | -0.303 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.388 | -0.340 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.396 | -0.328 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.468 | -0.222 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.476 | -0.210 | FP |
| $UF_6$ | DG | AB | 4/5/06 | 67.496 | -0.181 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.429 | -0.280 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.422 | -0.290 | FP |
| $UF_6$ | DG | AB | 4/6/06 | 67.439 | -0.265 | FP |
| $UF_6$ | DG | AE | 4/5/06 | 67.431 | -0.277 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.414 | -0.302 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.663 | 0.066 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.700 | 0.121 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.427 | -0.283 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.438 | -0.266 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.694 | 0.112 | JR-JM |
| $UF_6$ | DG | AE | 4/5/06 | 67.698 | 0.118 | JR-JM |
| $UF_6$ | DG | V | 3/21/06 | 67.553 | -0.037 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.625 | 0.070 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.592 | 0.021 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.516 | -0.092 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.505 | -0.108 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.538 | -0.059 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.583 | 0.007 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.605 | 0.040 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.607 | 0.043 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.569 | -0.013 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.537 | -0.061 | 1 |
| $UF_6$ | DG | V | 3/21/06 | 67.564 | -0.021 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.530 | -0.071 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.497 | -0.120 | 1 |
| $UF_6$ | DG | V | 4/5/06 | 67.480 | -0.145 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.543 | -0.052 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.579 | 0.001 | 1 |
| $UF_6$ | DG | V | 4/25/06 | 67.565 | -0.019 | 1 |

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# Appendix B: Uranium Isotopic Results

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| HEU | TIMS | A | 11/10/04 | 89.882 | -0.010 | BLM/JM |
| HEU | TIMS | A | 11/10/04 | 89.885 | -0.007 | BLM/JM |
| HEU | TIMS | A | 11/9/04 | 89.888 | -0.003 | WJS/GPW |
| HEU | TIMS | A | 11/9/04 | 89.888 | -0.003 | WJS/GPW |
| HEU | TIMS | A | 11/10/04 | 90.328 | -0.010 | BLM/JM |
| HEU | TIMS | A | 11/10/04 | 90.331 | -0.007 | BLM/JM |
| HEU | TIMS | A | 11/9/04 | 90.328 | -0.010 | WJS/GPW |
| HEU | TIMS | A | 11/9/04 | 90.334 | -0.004 | WJS/GPW |
| HEU | TIMS | A | 9/14/05 | 51.334 | 0.019 | WS/JM |
| HEU | TIMS | A | 9/14/05 | 51.330 | 0.011 | WS/JM |
| HEU | TIMS | A | 9/19/05 | 51.303 | -0.042 | WS/JM |
| HEU | TIMS | A | 9/19/05 | 51.313 | -0.022 | WS/JM |
| HEU | TIMS | A | 9/14/05 | 89.702 | 0.026 | WS/JM |
| HEU | TIMS | A | 9/14/05 | 89.697 | 0.020 | WS/JM |
| HEU | TIMS | A | 9/19/05 | 89.670 | -0.010 | WS/JM |
| HEU | TIMS | A | 9/19/05 | 89.669 | -0.011 | WS/JM |
| HEU | TIMS | A | 7/17/07 | 51.333 | 0.017 | BLM/PRR |
| HEU | TIMS | A | 7/18/07 | 51.305 | -0.038 | BLM/PRR |
| HEU | TIMS | A | 7/18/07 | 51.325 | 0.001 | BLM/PRR |
| HEU | TIMS | A | 7/17/07 | 51.333 | 0.017 | BLM/PRR |
| HEU | TIMS | A | 7/17/07 | 51.336 | 0.022 | BLM/PRR |
| HEU | TIMS | A | 7/17/07 | 51.337 | 0.024 | BLM/PRR |
| HEU | TIMS | A | 7/17/07 | 51.325 | 0.001 | BLM/PRR |
| HEU | TIMS | A | 7/17/07 | 51.343 | 0.036 | BLM/PRR |
| HEU | TIMS | B | 1/8/05 | 89.6706 | -0.009 | JLB |
| HEU | TIMS | B | 1/8/05 | 89.6709 | -0.009 | JLB |
| HEU | TIMS | B | 1/10/05 | 89.6868 | 0.009 | MDM |
| HEU | TIMS | B | 1/10/05 | 89.6781 | -0.001 | MDM |
| HEU | TIMS | B | 1/8/05 | 90.3376 | 0.000 | JLB |
| HEU | TIMS | B | 1/8/05 | 90.3453 | 0.009 | JLB |
| HEU | TIMS | B | 1/10/05 | 90.3425 | 0.006 | MDM |
| HEU | TIMS | B | 1/10/05 | 90.3469 | 0.011 | MDM |
| HEU | TIMS | B | 12/14/05 | 51.3445 | 0.039 | PAM |
| HEU | TIMS | B | 12/14/05 | 51.3451 | 0.040 | PAM |
| HEU | TIMS | B | 12/15/05 | 51.3140 | -0.020 | TEB |
| HEU | TIMS | B | 12/15/05 | 51.3449 | 0.040 | TEB |
| HEU | TIMS | B | 12/14/05 | 89.8980 | 0.008 | PAM |
| HEU | TIMS | B | 12/14/05 | 89.8822 | -0.010 | PAM |
| HEU | TIMS | B | 12/15/05 | 89.8965 | 0.006 | TEB |
| HEU | TIMS | B | 12/15/05 | 89.8546 | -0.041 | TEB |
| HEU | TIMS | B | 1/29/06 | 51.3255 | 0.002 | PAM |
| HEU | TIMS | B | 1/29/06 | 51.3245 | 0.000 | PAM |
| HEU | TIMS | B | 3/3/06 | 51.3254 | 0.002 | DDN |
| HEU | TIMS | B | 3/3/06 | 51.3287 | 0.008 | DDN |
| HEU | TIMS | B | 1/29/06 | 89.9017 | 0.012 | PAM |
| HEU | TIMS | B | 1/29/06 | 89.8946 | 0.004 | PAM |
| HEU | TIMS | B | 3/3/06 | 89.8888 | -0.003 | DDN |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| HEU | TIMS | B | 3/3/06 | 89.8987 | 0.008 | DDN |
| HEU | TIMS | B | 3/28/06 | 89.6567 | -0.025 | DDB |
| HEU | TIMS | B | 3/28/06 | 89.6820 | 0.004 | DDB |
| HEU | TIMS | B | 4/5/06 | 89.6910 | 0.014 | DDN |
| HEU | TIMS | B | 4/5/06 | 89.6988 | 0.022 | DDN |
| HEU | TIMS | B | 10/11/06 | 90.3263 | -0.012 | LLB |
| HEU | TIMS | B | 10/11/06 | 90.334 | -0.004 | LLB |
| HEU | TIMS | B | 7/25/06 | 90.346 | 0.010 | PAM |
| HEU | TIMS | B | 7/25/06 | 90.3431 | 0.007 | PAM |
| HEU | TIMS | B | 1/17/08 | 90.3459 | 0.010 | DDN |
| HEU | TIMS | B | 1/17/08 | 90.3436 | 0.007 | DDN |
| HEU | TIMS | B | 1/26/08 | 90.3437 | 0.007 | JCP |
| HEU | TIMS | B | 1/26/08 | 90.3456 | 0.009 | JCP |
| HEU | TIMS | B | 1/17/08 | 90.3518 | 0.016 | DDN |
| HEU | TIMS | B | 1/17/08 | 90.3512 | 0.016 | DDN |
| HEU | TIMS | B | 1/26/08 | 90.3521 | 0.017 | JCP |
| HEU | TIMS | B | 1/26/08 | 90.3514 | 0.016 | JCP |
| HEU | TIMS | B | 3/25/08 | 51.3613 | 0.072 | PAM |
| HEU | TIMS | B | 3/25/08 | 51.3608 | 0.071 | PAM |
| HEU | TIMS | B | 3/27/08 | 51.3613 | 0.072 | LLB |
| HEU | TIMS | B | 3/27/08 | 51.3617 | 0.072 | LLB |
| HEU | TIMS | B | 3/25/08 | 51.3475 | 0.045 | PAM |
| HEU | TIMS | B | 3/25/08 | 51.3471 | 0.044 | PAM |
| HEU | TIMS | B | 3/27/08 | 51.3492 | 0.048 | LLB |
| HEU | TIMS | B | 3/27/08 | 51.3491 | 0.048 | LLB |
| HEU | TIMS | F | 1/12/07 | 89.68024 | 0.002 | RE |
| HEU | TIMS | F | 1/12/07 | 89.68079 | 0.002 | RE |
| HEU | TIMS | F | 1/13/07 | 89.68045 | 0.002 | RE |
| HEU | TIMS | F | 1/13/07 | 89.68072 | 0.002 | RE |
| HEU | TIMS | F | 1/12/07 | 90.33964 | 0.003 | RE |
| HEU | TIMS | F | 1/12/07 | 90.33819 | 0.001 | RE |
| HEU | TIMS | F | 1/13/07 | 90.34 | 0.003 | RE |
| HEU | TIMS | F | 1/13/07 | 90.33858 | 0.002 | RE |
| HEU | TIMS | F | 3/13/07 | 51.3386 | 0.027 | RBT |
| HEU | TIMS | F | 3/13/07 | 51.3376 | 0.026 | RBT |
| HEU | TIMS | F | 3/14/07 | 51.3381 | 0.026 | RBT |
| HEU | TIMS | F | 3/14/07 | 51.3379 | 0.026 | RBT |
| HEU | TIMS | F | 7/11/07 | 89.901 | 0.011 | KJM |
| HEU | TIMS | F | 7/11/07 | 89.894 | 0.003 | KJM |
| HEU | TIMS | F | 7/12/07 | 89.893 | 0.002 | KJM |
| HEU | TIMS | F | 7/12/07 | 89.898 | 0.008 | KJM |
| HEU | TIMS | F | 7/11/07 | 90.3397 | 0.003 | KJM |
| HEU | TIMS | F | 7/12/07 | 90.3406 | 0.004 | KJM |
| HEU | TIMS | F | 7/12/07 | 90.3416 | 0.005 | KJM |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| HEU | TIMS | G | 5/3/06 | 89.6817 | 0.003 | |
| HEU | TIMS | G | 5/3/06 | 89.6811 | 0.003 | |
| HEU | TIMS | G | 5/3/06 | 89.8908 | 0.000 | |
| HEU | TIMS | G | 5/3/06 | 89.8908 | 0.000 | |
| HEU | TIMS | G | 5/3/06 | 90.3402 | 0.003 | |
| HEU | TIMS | G | 5/3/06 | 90.3407 | 0.004 | |
| HEU | TIMS | G | 5/3/06 | 90.3356 | -0.002 | |
| HEU | TIMS | G | 5/3/06 | 90.3351 | -0.002 | |
| HEU | TIMS | G | 5/5/06 | 51.3442 | 0.038 | |
| HEU | TIMS | G | 5/5/06 | 51.3458 | 0.042 | |
| HEU | TIMS | G | 5/8/06 | 51.3435 | 0.037 | |
| HEU | TIMS | G | 5/8/06 | 51.3457 | 0.041 | |
| HEU | TIMS | AW | 5/21/07 | 51.3215 | -0.006 | |
| HEU | TIMS | AW | 5/21/07 | 51.3436 | 0.037 | |
| HEU | TIMS | AW | 6/4/07 | 51.3488 | 0.047 | |
| HEU | TIMS | AW | 5/21/07 | 51.3366 | 0.024 | |
| HEU | TIMS | AW | 5/21/07 | 51.3494 | 0.049 | |
| HEU | TIMS | AW | 6/4/07 | 51.3295 | 0.010 | |
| HEU | TIMS | AW | 5/21/07 | 89.6919 | 0.015 | |
| HEU | TIMS | AW | 6/1/07 | 89.6825 | 0.004 | |
| HEU | TIMS | AW | 6/4/07 | 89.6629 | -0.018 | |
| HEU | TIMS | AW | 5/21/07 | 89.6893 | 0.012 | |
| HEU | TIMS | AW | 6/4/07 | 89.6753 | -0.004 | |
| HEU | TIMS | AW | 6/4/07 | 89.6681 | -0.012 | |
| HEU | TIMS | W | 9/5/06 | 90.3421 | 0.005 | Kuehn |
| HEU | TIMS | W | 9/6/06 | 90.3425 | 0.006 | Kuehn |
| HEU | TIMS | W | 9/7/06 | 90.3431 | 0.007 | Kuehn |
| HEU | TIMS | W | 9/8/06 | 90.343 | 0.006 | Kuehn |
| HEU | TIMS | W | 9/5/06 | 90.3435 | 0.007 | Kuehn |
| HEU | TIMS | W | 9/6/06 | 90.3415 | 0.005 | Kuehn |
| HEU | TIMS | W | 9/7/06 | 90.3425 | 0.006 | Kuehn |
| HEU | TIMS | W | 9/8/06 | 90.3431 | 0.007 | Kuehn |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | AA | 4/5/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/5/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/6/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/6/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/6/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 4.0051 | -0.078 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 0.7100 | -0.125 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 0.7119 | 0.142 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7117 | 0.114 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7127 | 0.254 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7107 | -0.027 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 0.7109 | 0.001 | ALEG |
| LEU | TIMS | AA | 4/20/06 | 0.7109 | 0.001 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7127 | 0.254 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7088 | -0.294 | ALEG |
| LEU | TIMS | AA | 4/21/06 | 0.7107 | -0.027 | ALEG |
| LEU | TIMS | AA | 11/27/06 | 0.7119 | 0.142 | AL/EG |
| LEU | TIMS | AA | 11/27/06 | 0.711 | 0.015 | AL/EG |
| LEU | TIMS | AA | 11/28/06 | 0.7095 | -0.196 | AL/EG |
| LEU | TIMS | AA | 11/28/06 | 0.7111 | 0.029 | AL/EG |
| LEU | TIMS | AA | 11/27/06 | 0.7125 | 0.226 | AL/EG |
| LEU | TIMS | AA | 11/27/06 | 0.7131 | 0.311 | AL/EG |
| LEU | TIMS | AA | 11/28/06 | 0.7123 | 0.198 | AL/EG |
| LEU | TIMS | AA | 11/28/06 | 0.7127 | 0.254 | AL/EG |
| LEU | TIMS | AA | 10/4/07 | 1.3046 | 0.184 | MLG |
| LEU | TIMS | AA | 10/4/07 | 1.3049 | 0.207 | MLG |
| LEU | TIMS | AA | 10/4/07 | 1.3013 | -0.069 | MLG |
| LEU | TIMS | AA | 10/17/07 | 1.3018 | -0.031 | MLG |
| LEU | TIMS | AA | 10/17/07 | 1.3026 | 0.031 | MLG |
| LEU | TIMS | AA | 10/5/07 | 1.3053 | 0.238 | MLG |
| LEU | TIMS | AA | 10/5/07 | 1.302 | -0.015 | MLG |
| LEU | TIMS | AA | 10/5/07 | 1.3036 | 0.108 | MLG |
| LEU | TIMS | AA | 10/17/07 | 1.3029 | 0.054 | MLG |
| LEU | TIMS | AA | 10/17/07 | 1.3031 | 0.069 | MLG |
| LEU | TIMS | AA | 10/5/07 | 4.3968 | 0.120 | MLG |
| LEU | TIMS | AA | 10/5/07 | 4.3902 | -0.031 | MLG |
| LEU | TIMS | AA | 10/17/07 | 4.3875 | -0.092 | MLG |
| LEU | TIMS | AA | 10/17/07 | 4.3868 | -0.108 | MLG |
| LEU | TIMS | AA | 10/17/07 | 4.3867 | -0.110 | MLG |
| LEU | TIMS | AA | 10/8/07 | 4.3904 | -0.026 | MLG |
| LEU | TIMS | AA | 10/8/07 | 4.39 | -0.035 | MLG |
| LEU | TIMS | AA | 10/8/07 | 4.3939 | 0.054 | MLG |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | AA | 10/17/07 | 4.3869 | -0.106 | MLG |
| LEU | TIMS | AA | 10/17/07 | 4.3876 | -0.090 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4514 | -0.190 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4577 | -0.048 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4523 | -0.170 | MLG |
| LEU | TIMS | AA | 12/7/07 | 4.4436 | -0.365 | MLG |
| LEU | TIMS | AA | 12/7/07 | 4.4483 | -0.259 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4575 | -0.053 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4528 | -0.158 | MLG |
| LEU | TIMS | AA | 12/3/07 | 4.4587 | -0.026 | MLG |
| LEU | TIMS | AA | 12/7/07 | 4.4434 | -0.369 | MLG |
| LEU | TIMS | AA | 12/7/07 | 4.4453 | -0.327 | MLG |
| LEU | TIMS | AA | 11/30/06 | 4.0051 | -0.078 | AL/EG |
| LEU | TIMS | AA | 11/30/06 | 4.0027 | -0.138 | AL/EG |
| LEU | TIMS | AA | 12/1/06 | 4.0058 | -0.061 | AL/EG |
| LEU | TIMS | AA | 12/1/06 | 4.0009 | -0.183 | AL/EG |
| LEU | TIMS | AA | 11/30/06 | 4.0026 | -0.140 | AL/EG |
| LEU | TIMS | AA | 11/30/06 | 4.0042 | -0.101 | AL/EG |
| LEU | TIMS | AA | 12/1/06 | 4.0012 | -0.175 | AL/EG |
| LEU | TIMS | AA | 12/1/06 | 4.0023 | -0.148 | AL/EG |
| LEU | TIMS | AA | 3/13/08 | 2.9862 | 0.064 | MLG |
| LEU | TIMS | AA | 3/13/08 | 2.9848 | 0.017 | MLG |
| LEU | TIMS | AA | 3/13/08 | 2.9867 | 0.080 | MLG |
| LEU | TIMS | AA | 3/18/08 | 2.9853 | 0.034 | MLG |
| LEU | TIMS | AA | 3/18/08 | 2.9832 | -0.037 | MLG |
| LEU | TIMS | AA | 3/13/08 | 2.9878 | 0.117 | MLG |
| LEU | TIMS | AA | 3/13/08 | 2.9844 | 0.003 | MLG |
| LEU | TIMS | AA | 3/13/08 | 2.9847 | 0.013 | MLG |
| LEU | TIMS | AA | 3/18/08 | 2.9882 | 0.131 | MLG |
| LEU | TIMS | AA | 3/18/08 | 2.9864 | 0.070 | MLG |
| LEU | TIMS | BC | 4/17/06 | 4.0046 | -0.091 | MRPP |
| LEU | TIMS | BC | 4/17/06 | 4.0090 | 0.019 | MRPP |
| LEU | TIMS | BC | 4/26/06 | 4.0067 | -0.038 | MRPP |
| LEU | TIMS | BC | 4/26/06 | 4.0074 | -0.021 | MRPP |
| LEU | TIMS | BC | 4/17/06 | 4.0066 | -0.041 | MRPP |
| LEU | TIMS | BC | 4/17/06 | 4.0126 | 0.109 | MRPP |
| LEU | TIMS | BC | 4/26/06 | 4.0077 | -0.013 | MRPP |
| LEU | TIMS | BC | 4/26/06 | 4.0096 | 0.034 | MRPP |
| LEU | TIMS | BC | 10/9/06 | 4.0101 | 0.047 | MRPP |
| LEU | TIMS | BC | 10/9/06 | 4.0095 | 0.032 | MRPP |
| LEU | TIMS | BC | 10/16/06 | 4.0122 | 0.099 | MRPP |
| LEU | TIMS | BC | 10/16/06 | 4.0083 | 0.002 | MRPP |
| LEU | TIMS | BC | 10/9/06 | 4.0054 | -0.071 | MRPP |
| LEU | TIMS | BC | 10/9/06 | 4.0138 | 0.139 | MRPP |
| LEU | TIMS | BC | 10/16/06 | 4.0128 | 0.114 | MRPP |
| LEU | TIMS | BC | 10/16/06 | 4.0031 | -0.128 | MRPP |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | A | 9/26/07 | 4.3921 | 0.013 | MB/JM |
| LEU | TIMS | A | 9/27/07 | 4.3913 | -0.005 | MB/JM |
| LEU | TIMS | A | 9/27/07 | 4.3946 | 0.070 | MB/JM |
| LEU | TIMS | A | 9/26/07 | 4.3895 | -0.046 | MB/JM |
| LEU | TIMS | A | 9/12/07 | 4.3916 | 0.001 | MB/JM |
| LEU | TIMS | A | 9/11/07 | 4.3932 | 0.038 | MB/JM |
| LEU | TIMS | A | 9/11/07 | 4.3901 | -0.033 | MB/JM |
| LEU | TIMS | A | 9/12/07 | 4.3989 | 0.168 | MB/JM |
| LEU | TIMS | AW | 5/16/07 | 4.3916 | 0.001 | |
| LEU | TIMS | AW | 5/21/07 | 4.4032 | 0.266 | |
| LEU | TIMS | AW | 6/4/07 | 4.3947 | 0.072 | |
| LEU | TIMS | B | 1/9/06 | 0.7099 | -0.214 | PAM |
| LEU | TIMS | B | 1/9/06 | 0.7110 | -0.060 | PAM |
| LEU | TIMS | B | 1/12/06 | 0.7117 | 0.039 | DDN |
| LEU | TIMS | B | 1/12/06 | 0.7111 | -0.046 | DDN |
| LEU | TIMS | B | 1/9/06 | 0.7111 | -0.046 | PAM |
| LEU | TIMS | B | 1/9/06 | 0.7121 | 0.095 | PAM |
| LEU | TIMS | B | 1/12/06 | 0.7103 | -0.158 | DDN |
| LEU | TIMS | B | 1/12/06 | 0.7088 | -0.369 | DDN |
| LEU | TIMS | B | 3/2/06 | 0.8835 | 1.439 | PAM |
| LEU | TIMS | B | 3/2/06 | 0.8820 | 1.267 | PAM |
| LEU | TIMS | B | 3/9/06 | 0.8811 | 1.164 | DDN |
| LEU | TIMS | B | 3/9/06 | 0.8815 | 1.210 | DDN |
| LEU | TIMS | B | 3/2/06 | 0.8832 | 1.405 | PAM |
| LEU | TIMS | B | 3/2/06 | 0.8823 | 1.302 | PAM |
| LEU | TIMS | B | 3/9/06 | 0.8821 | 1.279 | DDN |
| LEU | TIMS | B | 3/9/06 | 0.8816 | 1.221 | DDN |
| LEU | TIMS | B | 3/4/06 | 0.7094 | -0.285 | WPB |
| LEU | TIMS | B | 3/4/06 | 0.7119 | 0.067 | WPB |
| LEU | TIMS | B | 3/5/06 | 0.7113 | -0.017 | DDN |
| LEU | TIMS | B | 3/5/06 | 0.7114 | -0.003 | DDN |
| LEU | TIMS | B | 3/4/06 | 0.7110 | -0.060 | WPB |
| LEU | TIMS | B | 3/4/06 | 0.7102 | -0.172 | WPB |
| LEU | TIMS | B | 3/5/06 | 0.7117 | 0.039 | DDN |
| LEU | TIMS | B | 3/5/06 | 0.7104 | -0.144 | DDN |
| LEU | TIMS | B | 3/28/06 | 4.3860 | -0.126 | DDB |
| LEU | TIMS | B | 3/28/06 | 4.3904 | -0.026 | DDB |
| LEU | TIMS | B | 4/5/06 | 4.3918 | 0.006 | DDN |
| LEU | TIMS | B | 4/5/06 | 4.3965 | 0.113 | DDN |
| LEU | TIMS | B | 4/12/06 | 0.7137 | 0.320 | JMG |
| LEU | TIMS | B | 4/12/06 | 0.7127 | 0.179 | JMG |
| LEU | TIMS | B | 4/13/06 | 0.7114 | -0.003 | CPT |
| LEU | TIMS | B | 4/13/06 | 0.7116 | 0.025 | CPT |
| LEU | TIMS | B | 4/12/06 | 0.7131 | 0.236 | JMG |
| LEU | TIMS | B | 4/12/06 | 0.7109 | -0.074 | JMG |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | B | 4/13/06 | 0.7114 | -0.003 | CPT |
| LEU | TIMS | B | 4/13/06 | 0.7111 | -0.046 | CPT |
| LEU | TIMS | B | 7/22/06 | 0.7133 | 0.264 | PWB |
| LEU | TIMS | B | 7/22/06 | 0.7122 | 0.109 | PWB |
| LEU | TIMS | B | 7/31/06 | 0.7121 | 0.095 | DDB |
| LEU | TIMS | B | 7/31/06 | 0.7127 | 0.179 | DDB |
| LEU | TIMS | B | 7/22/06 | 0.7122 | 0.109 | PWB |
| LEU | TIMS | B | 7/22/06 | 0.7135 | 0.292 | PWB |
| LEU | TIMS | B | 8/1/06 | 0.7126 | 0.165 | DDB |
| LEU | TIMS | B | 8/1/06 | 0.7138 | 0.334 | DDB |
| LEU | TIMS | B | 7/25/06 | 4.3886 | -0.067 | PAM |
| LEU | TIMS | B | 7/25/06 | 4.3806 | -0.249 | PAM |
| LEU | TIMS | B | 10/11/06 | 4.3845 | -0.160 | LLB |
| LEU | TIMS | B | 10/11/06 | 4.3855 | -0.138 | LLB |
| LEU | TIMS | B | 1/18/08 | 0.7124 | 0.234 | DDN |
| LEU | TIMS | B | 1/18/08 | 0.7121 | 0.192 | DDN |
| LEU | TIMS | B | 1/26/08 | 0.7122 | 0.206 | JCP |
| LEU | TIMS | B | 1/26/08 | 0.7126 | 0.263 | JCP |
| LEU | TIMS | B | 1/18/08 | 0.7124 | 0.234 | DDN |
| LEU | TIMS | B | 1/18/08 | 0.712 | 0.178 | DDN |
| LEU | TIMS | B | 1/26/08 | 0.7118 | 0.150 | JCP |
| LEU | TIMS | B | 1/26/08 | 0.7121 | 0.192 | JCP |
| LEU | TIMS | B | 3/25/08 | 0.7115 | 0.108 | PAM |
| LEU | TIMS | B | 3/25/08 | 0.7122 | 0.206 | PAM |
| LEU | TIMS | B | 3/27/08 | 0.7101 | -0.089 | LLB |
| LEU | TIMS | B | 3/27/08 | 0.7116 | 0.122 | LLB |
| LEU | TIMS | B | 3/25/08 | 0.7118 | 0.150 | PAM |
| LEU | TIMS | B | 3/25/08 | 0.7116 | 0.122 | PAM |
| LEU | TIMS | B | 3/27/08 | 0.7122 | 0.206 | LLB |
| LEU | TIMS | B | 3/27/08 | 0.712 | 0.178 | LLB |
| LEU | TIMS | F | 3/13/07 | 4.39049 | -0.024 | RBT |
| LEU | TIMS | F | 3/13/07 | 4.39055 | -0.023 | RBT |
| LEU | TIMS | F | 3/14/07 | 4.39122 | -0.007 | RBT |
| LEU | TIMS | F | 3/14/07 | 4.39085 | -0.016 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.45874 | -0.025 | RE |
| LEU | TIMS | F | 9/19/07 | 4.46042 | 0.012 | RE |
| LEU | TIMS | F | 9/20/07 | 4.46146 | 0.036 | RBT |
| LEU | TIMS | F | 9/20/07 | 4.461 | 0.025 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.45999 | 0.003 | RE |
| LEU | TIMS | F | 9/19/07 | 4.45923 | -0.014 | RE |
| LEU | TIMS | F | 9/20/07 | 4.45739 | -0.055 | RBT |
| LEU | TIMS | F | 9/20/07 | 4.46096 | 0.025 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.00767 | -0.014 | RE |
| LEU | TIMS | F | 9/19/07 | 4.00685 | -0.034 | RE |
| LEU | TIMS | F | 9/20/07 | 4.00736 | -0.022 | RBT |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | F | 9/20/07 | 4.00782 | -0.010 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.00708 | -0.029 | RE |
| LEU | TIMS | F | 9/19/07 | 4.00727 | -0.024 | RE |
| LEU | TIMS | F | 9/20/07 | 4.00681 | -0.035 | RBT |
| LEU | TIMS | F | 9/20/07 | 4.00692 | -0.033 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.00673 | -0.037 | RE |
| LEU | TIMS | F | 9/19/07 | 4.0067 | -0.038 | RE |
| LEU | TIMS | F | 9/20/07 | 4.0086 | 0.009 | RBT |
| LEU | TIMS | F | 9/20/07 | 4.0081 | -0.003 | RBT |
| LEU | TIMS | F | 9/19/07 | 4.0066 | -0.041 | RE |
| LEU | TIMS | F | 9/19/07 | 4.00743 | -0.020 | RE |
| LEU | TIMS | F | 9/20/07 | 4.00948 | 0.031 | RBT |
| LEU | TIMS | F | 9/20/07 | 4.00857 | 0.008 | RBT |
| LEU | TIMS | F | 11/21/07 | 0.88138 | -0.070 | KJM |
| LEU | TIMS | F | 11/21/07 | 0.88115 | -0.096 | KJM |
| LEU | TIMS | F | 11/23/07 | 0.88135 | -0.074 | KJM |
| LEU | TIMS | F | 11/23/07 | 0.88088 | -0.127 | KJM |
| LEU | TIMS | F | 11/21/07 | 0.88192 | -0.009 | KJM |
| LEU | TIMS | F | 11/21/07 | 0.88144 | -0.063 | KJM |
| LEU | TIMS | F | 11/23/07 | 0.88141 | -0.067 | KJM |
| LEU | TIMS | F | 11/23/07 | 0.88148 | -0.059 | KJM |
| LEU | TIMS | G | 5/8/06 | 4.3939 | 0.054 | |
| LEU | TIMS | G | 5/8/06 | 4.3948 | 0.074 | |
| LEU | TIMS | G | 5/8/06 | 4.3928 | 0.029 | |
| LEU | TIMS | G | 5/8/06 | 4.3948 | 0.074 | |
| LEU | TIMS | T | 1/12/06 | 4.010 | 0.044 | |
| LEU | TIMS | T | 1/12/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 1/12/06 | 4.011 | 0.069 | |
| LEU | TIMS | T | 1/12/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 1/19/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 1/19/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 1/19/06 | 4.010 | 0.044 | |
| LEU | TIMS | T | 1/19/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 4/21/06 | 4.010 | 0.044 | |
| LEU | TIMS | T | 4/21/06 | 4.011 | 0.069 | |
| LEU | TIMS | T | 4/21/06 | 4.010 | 0.044 | |
| LEU | TIMS | T | 4/21/06 | 4.012 | 0.094 | |
| LEU | TIMS | T | 4/24/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 4/24/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 4/24/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 4/24/06 | 4.008 | -0.006 | |
| LEU | TIMS | T | 8/28/06 | 4.012 | 0.094 | |
| LEU | TIMS | T | 8/28/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 8/28/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 8/28/06 | 4.009 | 0.019 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | T | 8/29/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 8/29/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 8/29/06 | 4.012 | 0.094 | |
| LEU | TIMS | T | 8/29/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 10/17/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 10/17/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 10/17/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 10/17/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 10/19/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 10/19/06 | 4.008 | -0.006 | |
| LEU | TIMS | T | 10/19/06 | 4.009 | 0.019 | |
| LEU | TIMS | T | 10/19/06 | 4.01 | 0.044 | |
| LEU | TIMS | T | 4/26/07 | 4.01 | 0.044 | |
| LEU | TIMS | T | 4/26/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 4/26/07 | 4.008 | -0.006 | |
| LEU | TIMS | T | 4/26/07 | 4.008 | -0.006 | |
| LEU | TIMS | T | 5/16/07 | 4.011 | 0.069 | |
| LEU | TIMS | T | 5/16/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 5/16/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 5/16/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 11/29/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 11/29/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 11/29/07 | 4.012 | 0.094 | |
| LEU | TIMS | T | 11/29/07 | 4.008 | -0.006 | |
| LEU | TIMS | T | 12/11/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 12/11/07 | 4.009 | 0.019 | |
| LEU | TIMS | T | 12/11/07 | 4.01 | 0.044 | |
| LEU | TIMS | T | 12/11/07 | 4.01 | 0.044 | |
| LEU | TIMS | V | 3/24/06 | 4.3881 | -0.078 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3943 | 0.063 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3922 | 0.015 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3913 | -0.005 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3920 | 0.010 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3917 | 0.004 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3922 | 0.015 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.3888 | -0.062 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.3898 | -0.040 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.3913 | -0.005 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3937 | 0.049 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3934 | 0.042 | 5 |
| LEU | TIMS | V | 4/3/06 | 4.3938 | 0.051 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3932 | 0.038 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3922 | 0.015 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.3922 | 0.015 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4581 | -0.040 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4567 | -0.071 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4568 | -0.069 | 5 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | TIMS | V | 4/3/06 | 4.4654 | 0.124 | 5 |
| LEU | TIMS | V | 4/4/06 | 4.4630 | 0.070 | 5 |
| LEU | TIMS | V | 4/4/06 | 4.4625 | 0.059 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.4606 | 0.017 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.4612 | 0.030 | 5 |
| LEU | TIMS | V | 4/25/06 | 4.4599 | 0.001 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4580 | -0.042 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4596 | -0.006 | 5 |
| LEU | TIMS | V | 3/24/06 | 4.4611 | 0.028 | 5 |
| LEU | TIMS | V | 4/4/06 | 4.4566 | -0.073 | 5 |
| LEU | TIMS | V | 4/4/06 | 4.4598 | -0.001 | 5 |
| LEU | TIMS | V | 4/4/06 | 4.4604 | 0.012 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.4608 | 0.021 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.4616 | 0.039 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.4612 | 0.030 | 5 |
| LEU | TIMS | V | 3/21/06 | 4.0057 | -0.063 | 5 |
| LEU | TIMS | V | 3/21/06 | 4.0062 | -0.051 | 5 |
| LEU | TIMS | V | 3/21/06 | 4.0064 | -0.046 | 5 |
| LEU | TIMS | V | 4/5/06 | 4.0099 | 0.042 | 5 |
| LEU | TIMS | V | 4/5/06 | 4.0078 | -0.011 | 5 |
| LEU | TIMS | V | 4/5/06 | 4.0080 | -0.006 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0088 | 0.014 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0100 | 0.044 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0091 | 0.022 | 5 |
| LEU | TIMS | V | 3/21/06 | 4.0110 | 0.069 | 5 |
| LEU | TIMS | V | 3/21/06 | 4.0082 | -0.001 | 5 |
| LEU | TIMS | V | 3/23/06 | 4.0040 | -0.106 | 5 |
| LEU | TIMS | V | 4/5/06 | 4.0096 | 0.034 | 5 |
| LEU | TIMS | V | 4/5/06 | 4.0025 | -0.143 | 5 |
| LEU | TIMS | V | 4/7/06 | 4.0079 | -0.008 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0096 | 0.034 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0093 | 0.027 | 5 |
| LEU | TIMS | V | 4/26/06 | 4.0100 | 0.044 | 5 |
| LEU | TIMS | W | 9/1/06 | 4.3933 | 0.040 | Kuehn |
| LEU | TIMS | W | 9/2/06 | 4.3926 | 0.024 | Kuehn |
| LEU | TIMS | W | 9/3/06 | 4.392 | 0.010 | Kuehn |
| LEU | TIMS | W | 9/4/06 | 4.3916 | 0.001 | Kuehn |
| LEU | TIMS | W | 9/1/06 | 4.392 | 0.010 | Kuehn |
| LEU | TIMS | W | 9/2/06 | 4.3908 | -0.017 | Kuehn |
| LEU | TIMS | W | 9/4/06 | 4.3921 | 0.013 | Kuehn |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | ICPMS | AF | 6/5/06 | 3.995 | -0.330 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.997 | -0.280 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.982 | -0.654 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.969 | -0.979 | SR |
| LEU | ICPMS | AF | 6/6/06 | 3.991 | -0.430 | SR |
| LEU | ICPMS | AF | 6/6/06 | 4.007 | -0.031 | SR |
| LEU | ICPMS | AF | 6/6/06 | 4.003 | -0.130 | SR |
| LEU | ICPMS | AF | 6/6/06 | 4.000 | -0.205 | SR |
| LEU | ICPMS | AF | 6/5/06 | 4.005 | -0.081 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.981 | -0.679 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.984 | -0.605 | SR |
| LEU | ICPMS | AF | 6/5/06 | 3.979 | -0.729 | SR |
| LEU | ICPMS | AF | 6/6/06 | 3.985 | -0.580 | SR |
| LEU | ICPMS | AF | 6/6/06 | 3.99 | -0.455 | SR |
| LEU | ICPMS | AF | 6/6/06 | 4 | -0.205 | SR |
| LEU | ICPMS | AF | 6/6/06 | 3.982 | -0.654 | SR |
| LEU | ICPMS | BE | 4/7/06 | 4.067 | 1.466 | MHK |
| LEU | ICPMS | BE | 4/7/06 | 4.072 | 1.591 | MHK |
| LEU | ICPMS | BE | 4/7/06 | 4.069 | 1.516 | MHK |
| LEU | ICPMS | BE | 4/7/06 | 4.063 | 1.366 | MHK |
| LEU | ICPMS | BE | 4/7/06 | 4.059 | 1.267 | MHK |
| LEU | ICPMS | BE | 4/7/06 | 4.058 | 1.242 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.030 | 0.543 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.024 | 0.393 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.030 | 0.543 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.035 | 0.668 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.029 | 0.518 | MHK |
| LEU | ICPMS | BE | 4/20/06 | 4.034 | 0.643 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.372 | -1.970 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.373 | -1.948 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.386 | -1.656 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.373 | -1.948 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.377 | -1.858 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.378 | -1.836 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.377 | -1.858 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 4.365 | -2.127 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.334 | -2.822 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.34 | -2.688 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.328 | -2.957 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.342 | -2.643 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.382 | -1.746 | MHK |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | ICPMS | BE | 10/25/07 | 4.387 | -1.634 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.361 | -2.217 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 4.358 | -2.284 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.989 | -0.480 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.987 | -0.530 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.979 | -0.729 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.983 | -0.629 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.993 | -0.380 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.984 | -0.605 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.98 | -0.704 | MHK |
| LEU | ICPMS | BE | 10/3/06 | 3.99 | -0.455 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 4.021 | 0.319 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 4 | -0.205 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 4.002 | -0.155 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 3.996 | -0.305 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 3.994 | -0.355 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 3.984 | -0.605 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 4.007 | -0.031 | MHK |
| LEU | ICPMS | BE | 10/4/06 | 3.995 | -0.330 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.956 | -1.303 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.95 | -1.453 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.957 | -1.278 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.962 | -1.153 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.937 | -1.777 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.935 | -1.827 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.931 | -1.927 | MHK |
| LEU | ICPMS | BE | 10/25/07 | 3.927 | -2.027 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.91 | -2.451 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.873 | -3.374 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.868 | -3.499 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.872 | -3.399 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.949 | -1.478 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.898 | -2.750 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.874 | -3.349 | MHK |
| LEU | ICPMS | BE | 12/12/07 | 3.848 | -3.998 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.494 | 0.765 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.456 | -0.087 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.481 | 0.474 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.451 | -0.199 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.438 | -0.490 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.427 | -0.737 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.447 | -0.288 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.456 | -0.087 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.461 | 0.025 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.465 | 0.115 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.467 | 0.160 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.495 | 0.788 | MHK |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | ICPMS | BE | 3/4/08 | 4.505 | 1.012 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.48 | 0.452 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.449 | -0.244 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.47 | 0.227 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 3.985 | -0.580 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 3.991 | -0.430 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 3.981 | -0.679 | MHK |
| LEU | ICPMS | BE | 2/4/08 | 4.003 | -0.130 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 3.982 | -0.654 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 3.963 | -1.128 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 3.994 | -0.355 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.015 | 0.169 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.01 | 0.044 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.002 | -0.155 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.032 | 0.593 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.017 | 0.219 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.007 | -0.031 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.005 | -0.081 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 3.975 | -0.829 | MHK |
| LEU | ICPMS | BE | 3/4/08 | 4.027 | 0.468 | MHK |
| LEU | ICPMS | EA | 3/28/07 | 1.292 | 0.008 | |
| LEU | ICPMS | EA | 3/28/07 | 1.292 | 0.008 | |
| LEU | ICPMS | EA | 3/29/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/29/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/28/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/28/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/29/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/29/07 | 1.293 | 0.085 | |
| LEU | ICPMS | EA | 3/28/07 | 2.986 | 0.057 | |
| LEU | ICPMS | EA | 3/28/07 | 2.986 | 0.057 | |
| LEU | ICPMS | EA | 3/29/07 | 2.986 | 0.057 | |
| LEU | ICPMS | EA | 3/29/07 | 2.985 | 0.023 | |
| LEU | ICPMS | EA | 3/31/07 | 2.984 | -0.010 | |
| LEU | ICPMS | EA | 3/31/07 | 2.984 | -0.010 | |
| LEU | ICPMS | EA | 3/29/07 | 2.985 | 0.023 | |
| LEU | ICPMS | EA | 3/29/07 | 2.985 | 0.023 | |
| LEU | ICPMS | EA | 6/14/07 | 4.7874 | -0.104 | NP2 |
| LEU | ICPMS | EA | 6/14/07 | 4.788 | -0.092 | NP2 |
| LEU | ICPMS | EA | 6/21/07 | 4.7895 | -0.061 | NP1 |
| LEU | ICPMS | EA | 6/21/07 | 4.7893 | -0.065 | NP1 |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | ICPMS | EA | 6/14/07 | 4.7876 | -0.100 | NP2 |
| LEU | ICPMS | EA | 6/14/07 | 4.792 | -0.008 | NP2 |
| LEU | ICPMS | EA | 6/21/07 | 4.79 | -0.050 | NP1 |
| LEU | ICPMS | EA | 6/21/07 | 4.7892 | -0.067 | NP1 |
| LEU | ICPMS | EA | 3/31/07 | 4.39 | -0.035 | |
| LEU | ICPMS | EA | 3/31/07 | 4.391 | -0.012 | |
| LEU | ICPMS | EA | 3/29/07 | 4.392 | 0.010 | |
| LEU | ICPMS | EA | 3/29/07 | 4.392 | 0.010 | |
| LEU | ICPMS | EA | 3/31/07 | 4.39 | -0.035 | |
| LEU | ICPMS | EA | 3/31/07 | 4.39 | -0.035 | |
| LEU | ICPMS | EA | 3/29/07 | 4.392 | 0.010 | |
| LEU | ICPMS | EA | 3/29/07 | 4.392 | 0.010 | |

| Material | Method Type | Facility | Analysis Date | Reported Result | % RD | Analyst |
|---|---|---|---|---|---|---|
| LEU | GSMS | BC | 4/12/06 | 3.1885 | -0.011 | ET |
| LEU | GSMS | BC | 4/12/06 | 3.1911 | 0.071 | ET |
| LEU | GSMS | BC | 4/12/06 | 3.1911 | 0.071 | ET |
| LEU | GSMS | BC | 4/12/06 | 3.1929 | 0.127 | ET |
| LEU | GSMS | BC | 4/13/06 | 3.1913 | 0.077 | ET |
| LEU | GSMS | BC | 4/13/06 | 3.1862 | -0.083 | ET |
| LEU | GSMS | BC | 4/13/06 | 3.1943 | 0.171 | ET |
| LEU | GSMS | BC | 4/13/06 | 3.1991 | 0.322 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.1988 | 0.312 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.2008 | 0.375 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.1883 | -0.017 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1816 | -0.227 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1849 | -0.123 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1888 | -0.001 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.1984 | 0.300 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.1978 | 0.281 | ET |
| LEU | GSMS | BC | 10/24/06 | 3.1886 | -0.007 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1873 | -0.048 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1807 | -0.255 | ET |
| LEU | GSMS | BC | 10/27/06 | 3.1765 | -0.387 | ET |

## Appendix C: NBL Measurement Evaluation Program: New Database Development

Srinivasan, B[1], Soriano, Michael[1], Waggoner, Joseph W.[1], and Kuziel, R.[2]
New Brunswick Laboratory, Argonne, Illinois 60439,[1] and
CNI Information Technology LLC, Argonne, Illinois 60439.[2]

**Abstract**

The New Brunswick Laboratory has been tasked by the United States Department of Energy (DOE) to administer an "inter-laboratory" control program to provide independent verification of internal quality control in nuclear materials measurements. DOE facilities performing material control and accountability measurements for nuclear material safeguards participate in the program. This program is open to international laboratories also. The program provides periodic evaluations of results from quantitative measurements of uranium and plutonium bearing materials. Both destructive and non-destructive measurement results are evaluated. One major criterion used in this evaluation is a comparison of measurement bias and precision against the respective international target values (ITVs). Large deviations from ITVs are a matter of concern as they indicate the difficulty and/or inability to detect material loss should they occur in processing, or by theft or by diversion of material. NBL maintains a permanent record of the measurement evaluation results and reports. These archives are ideal sources for analyzing long term trends in analytical performance and also an aid in setting the international target values.

In the inter-laboratory program (also known as the measurement evaluation program), the test samples measurement results are evaluated against the respective characterized values using a database application program internally developed several years ago. This is being replaced by a new database program with certain enhancements and conforming to quality assurance requirements. The new program is a web-based system utilizing Java whose interface is platform independent. Data is stored in an SQL database server providing reliable retrieval, backup and restoration of data, and with multiple layers of security. The system stores data on assay and isotopic abundance measurements, performs outlier tests, compares the measurement results against the respective characterized values, calculates bias and precision of the measurements using statistical methods, and prepares evaluation reports and graphs. The new system when it becomes fully operational will require direct input of measurement results by the participants and will also permit direct electronic retrieval of reports. The main features of the new database program will be presented.

## A. Introduction

The United States Department of Energy (DOE) has charged the New Brunswick Laboratory (NBL) with the responsibility to administer an "inter-laboratory" control program to provide independent verification of internal quality control in nuclear materials measurements. DOE facilities performing accountability measurements of uranium and plutonium bearing materials for nuclear material safeguards are required to participate in the program; non-DOE facilities (e.g., U.S. Nuclear Regulatory Commission facilities and international laboratories) also participate, but on a voluntary basis. The program is divided into two parts: Safeguards Measurement Evaluation (SME) Program and the Calorimetric Exchange Program (CALEX). In the SME program, NBL evaluates measurement results from destructive methods of analyses; in the CALEX program non-destructive analysis results are evaluated.

## B. SME program

The Safeguards Measurement Evaluation program was established in 1986 as a successor to the Safeguards Analytical Laboratory Evaluation (SALE) and General Analytical Evaluation (GAE) programs. In the SME program, NBL sends uranium and plutonium test samples for elemental and isotopic-abundance analyses, and the participants analyze the samples by methods routinely used by them in accountability measurements (e.g., Davies-Gray titration, XRF, IDMS and TIMS). NBL evaluates the results with respect to "characterized" reference values. The accuracy and precision in the measurements are compared against international target values for bias and precision. Measurement evaluation reports are sent to the laboratories and to the oversight offices.

### C. CALEX program

The CALEX program was originally administered by the Mound Laboratory, and it was transferred to NBL in the mid 1990's. In this program, using calorimetry and gamma ray spectrometry methods, participants measure power (i.e., heat output) and isotopic abundance measurements of two different working reference material standards, known as Calex I and Calex II. The standards contain well defined quantities of plutonium oxide of known isotopic compositions. NBL evaluates the measurement results for accuracy and precision. In addition, effective specific power and plutonium mass, quantities derived from the measurement results, are evaluated.

### D. Microsoft FoxPro database and applications

Until recently, the measurement results submitted to the SME and CALEX programs were entered into a FoxPro database, and evaluated using statistical methods. The FoxPro based applications used in the evaluation were developed mainly through the efforts of a NBL physicist. The development work started with the evaluation of uranium assay and uranium isotope abundance results from destructive analysis using an application named as UEx (for uranium exchange). The apparent success of the UEx system led to the development of PuEx (plutonium exchange) for plutonium results from destructive analysis and to CALEX for calorimetry/gamma spectrometry results. The three applications are quite similar, but separate. The SME and CALEX programs relied on these three applications for generating statistical evaluation reports and also the annual reports. The physicist who developed them maintained the system, updated the applications, and in general provided satisfactory service. However, with his departure from NBL in 2003, the responsibility to maintain the three applications was transferred to a NBL statistician who possessed limited knowledge of the FoxPro database and the applications. In collaboration with contracted computer professionals under the auspices of the Office of Science - Chicago Office (SC-CH,) the FoxPro system was maintained in operational status, but several drawbacks in the program design were found; a lack of documentation the absence of quality assurance, subsequent modifications, and outdated and unsupported software exasperated the issues. In early 2006, NBL management recommended development of a new database and application program based on modern programming techniques to replace the outdated FoxPro based system because of extra-ordinary efforts required to maintain the latter. The new system (Safeguards Measurement Evaluation System or SMES) has been under development since then and will be maintained by computer professionals fully cognizant of the need to maintain system documentation and quality assurance measures. The SMES will take advantage of the advances in "web-technology" to facilitate user interface.

### E. SMES: Design features

NBL personnel worked closely with computer professionals of CNI Information Technology LLC, to draw up system and design specifications for the new SMES. The new system is being developed with efficient and reliable data collection capabilities, and to provide timely and accurate analysis of measurement results and reports. Specific features are described below.

- **User self-service**: One of the main objectives of the SMES application is to provide access to participants to enter their own data, validate the entries, and retrieve the evaluation reports. Figures 1 and 2 below are examples of the user self-service report distribution and data entry screens of SMES, respectively. The FoxPro application does not allow direct data entry; NBL personnel entered data sent by the participants via e-mail/postal services, validated the data entry and mailed performance evaluation reports back to participants.

- **Security through the Web**: SMES will provide secure access through the Internet by using User ID/passwords, role-based access and encryption with considerations of confidentiality of data submitted and reports generated. The FoxPro application was only available on the NBL local area network and did not permit remote user access.

- **Quality assurance/documentation**: The SMES application is being developed and tested, and validated by computer professionals (SC-CH contractor) using modern development techniques. The DOE standards for software development, change control and quality assurance are being followed. The FoxPro application was not designed with these standards in mind.

- **Modular programming:** The three separate FoxPro applications (UEx, PuEx and CALEX) are combined into a single application in the SMES. The SMES employs modular programming techniques and reusable code, and will be easy to maintain. The design allows for future expansions of the measurement evaluation programs such as evaluation of measurement results from new techniques. The FoxPro applications were designed with significant code duplication. It meant corrections made in one location in an application required duplication of corrections in the other applications followed by checks and cross-checks to ensure proper working of all applications – a time consuming and inefficient process.

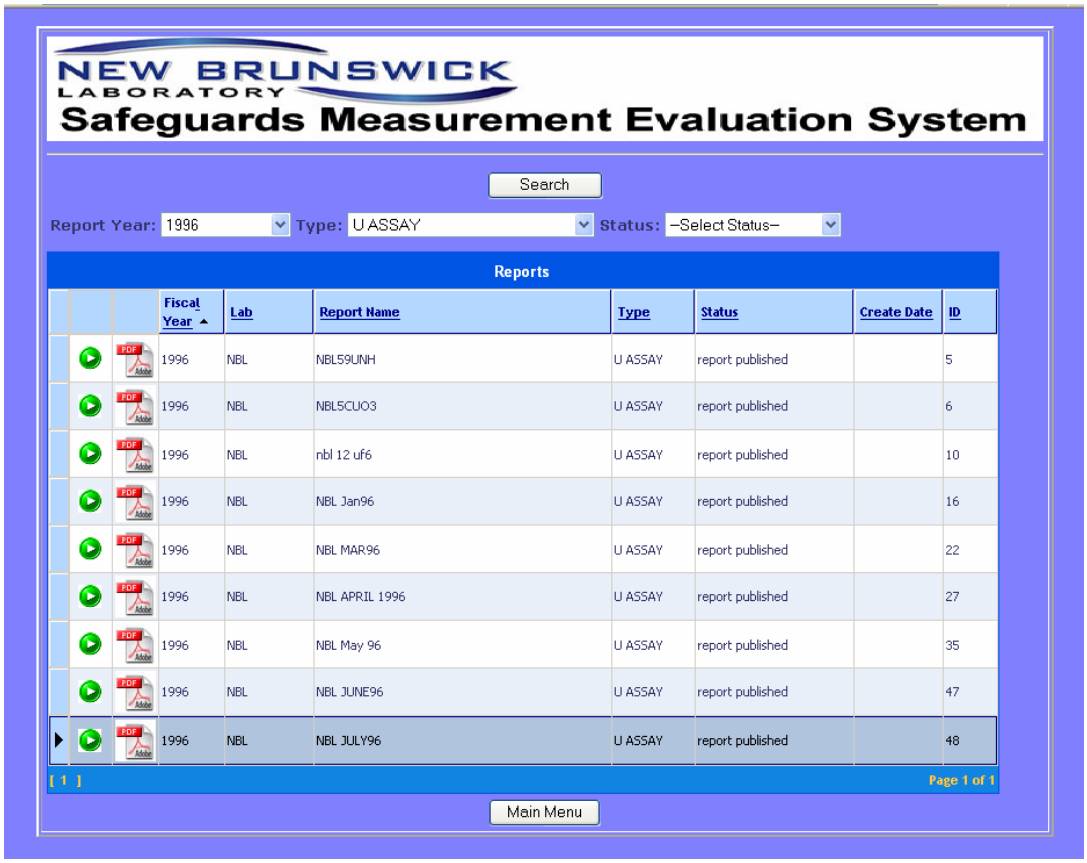


**Figure 1**

- **Modern technology –** The SMES employs modern web-based technologies and uses a well supported modern database system (SQL). The FoxPro database is no longer well supported and lacked the capability needed to migrate to a robust web-based application.


**Figure 2**

## F. SMES Specifications

The SMES leverages the calculation techniques presently found in the FoxPro application. All data presently in the FoxPro application will be migrated into the new system so as to retain historical data. The specifications for SMES are as follows.

- **Java enterprise server architecture**: SMES is designed around the Java 2 Enterprise Edition (J2EE) architecture. The system uses a dedicated J2EE Application Server.

- **SQL database storage**: SMES data is securely stored on an SQL database server for quick retrieval and updating of data; data backups are automated.

- **Secure platform independent thin client**: Laboratories will be able to enter their own measurement results to SMES via the Internet, eliminating the need to mail the data to NBL. SMES will support the most popular current web browsers with Secure Socket Layers (SSL) and will require no special browser add-ons.

- **Role-based security**: The system provides a number of access roles including those required for data entry, data validation and published report retrieval. SMES will provide access to participating laboratories and oversight agencies (e.g., DOE area office). Note that participant laboratories will have access only to their own data and reports.

- **Historical Data:** All historical data contained in the FoxPro database will be migrated to SMES.

- **Calculation Techniques:** The time proven statistical analysis tools (e.g., outlier tests, calculation of mean and standard deviation of %RDs, tests to determine day-to-day and analyst-to-analyst variations, determination of 95% C.I. etc.) originally written for the FoxPro application will be retained.

### G. SMES Development Timeline

The SMES is expected to become operational by the end of the third quarter of CY 2007 with web-based features becoming functional by the end of the year. Access to the SMES system by international laboratories will require additional security measures that are under discussion.

### H. Conclusions

The new Safeguards Measurement Evaluation System (SMES) system replaces three FoxPro programs. It is developed and maintained by computer professionals, is web-based, and will provide users with access to the Internet to enter data and retrieve reports. SMES is designed with full system documentation, quality assurance, security and confidentiality in mind.

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# Appendix D: New Brunswick Laboratory Safeguards Measurement Evaluation Program: Operational Features

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# New Brunswick Laboratory Safeguards Measurement Evaluation Program: Operational Features

**B. Srinivasan, K. J. Mathew, P. Croatto, U. Narayanan & J. Neuhoff**

*U. S. Department of Energy, New Brunswick Laboratory, Argonne, Illinois 60439, USA*

*Corresponding author: B.Srinivasan@ch.doe.gov*

**Abstract:** The Material Control and Accountability plan of nuclear facilities must specify how nuclear material holdings will be accounted for and controlled. This plan includes elements that are designed to (i) deter and detect loss, theft, and diversion of nuclear materials and; (ii) ensure that nuclear material are in their authorized locations and are being used for their intended purposes. In addition, the U.S. Department of Energy facilities performing nuclear material measurements participate in the New Brunswick Laboratory Measurement Evaluation Program to monitor performance and to provide an independent check of the quality control measures used in accountability measurements. In this paper, the operational features of this Measurement Evaluation Program designed to support nuclear safeguards and nuclear non-proliferation programs are described briefly.

**Keywords:** Nuclear Materials; Material Control and Accountability Measurements; Nuclear Safeguards; Non-Proliferation.

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**Biographical notes:** B. Srinivasan received his PhD in Chemistry from the University of Missouri in 1971. He is currently coordinator of the Measurement Evaluation Program at the New Brunswick Laboratory, Argonne, IL, USA. His current research interest topics include analytical chemistry of actinide elements and measurement techniques development efforts at the New Brunswick Laboratory.

K. J. Mathew is a Physical Scientist in the Standards and Evaluation Division of New Brunswick Laboratory, Argonne, IL, USA. He received his PhD in Physics from Physical Research Laboratory, Ahmedabad, India in 1993. His current research interests include Thermal Ionization Mass Spectrometry, Isotopic composition of U and Pu, and actinide measurement method development.

P. Croatto is a Physical Scientist in the Standards and Evaluation Division of New Brunswick Laboratory, Argonne, IL, USA. He received his PhD in Chemistry from the University of Illinois at Chicago in 1990. His current research interests include uranium hexafluoride mass spectrometry, alpha spectrometry, and development of methods for actinide measurement.

U. Narayanan received her PhD in Physical Chemistry from the University of Illinois, Chicago in 1987. She is currently the Director of the Standards and Evaluation Division of

New Brunswick Laboratory, Argonne, IL, USA. Her current research interests include uranium, neptunium, plutonium, and americium measurement method development, certification of reference materials, and sample measurements for safeguards.

J. Neuhoff is the Director of New Brunswick Laboratory, Argonne, IL, USA. He received his M.S. Degree in Nuclear Engineering from University of Illinois at Urbana-Champaign. His research interests are nuclear material packaging and transportation, Safeguards, Non-Proliferation, and nuclear material measurement methods.

## 1 INTRODUCTION

The New Brunswick Laboratory (NBL) serves as the U.S. government's central authority for nuclear material measurements and measurement evaluation, and is the U.S. government's certifying authority for nuclear reference materials. The major mission of the NBL is to provide technical assistance to the Department of Energy (DOE) in the following areas: administering the measurement evaluation program, preparation of certified (nuclear) reference materials, measurement techniques development, and measurement services. In addition, NBL provides help to DOE in three other areas: conducting technical audits, resolving shipper/receiver differences in material transfers, and assisting in nuclear nonproliferation programs. This paper describes the operational aspects of the NBL measurement evaluation program designed to monitor performance in nuclear safeguards measurements. At the discretion of the DOE, this program is open to participation by non-DOE facilities in the U.S. and abroad.

## 2 MEASUREMENT EVALUATION PROGRAM

Accountability measurements of nuclear materials, mainly of uranium and plutonium, are done by either destructive or non-destructive methods. The methods must be capable of providing quantitative results within acceptable limits of accuracy and precision. Large bias and/or poor precision compromise the ability to detect material loss in processing or by theft or by diversion.

The measurements must be made compatible with the national and/or international measurement reference base. In other words, the measurement results remain traceable to higher-level standards. In the U.S., these (reference material) standards are made by NBL and/or by NIST (National Institute of Standards and Technology). In addition, the safeguards measurement laboratories are required to participate in the NBL Measurement Evaluation Program. The program provides an independent verification of the internal analytical quality control practices in nuclear material accountability measurements. Taken together, measurement results traceability and measurement results evaluation form the basis for maintaining a sound and reliable nuclear safeguards material accountability program. In particular, through participation in the performance evaluation program the participants receive timely and periodic evaluations to identify deficiencies in measurement techniques and practices and correct those deficiencies.

The NBL Measurement Evaluation Program has two parts: the Safeguards Measurement Evaluation (SME) program for destructive analyses measurement results and the Calorimetry Exchange (CALEX) program for non-destructive analyses measurement results. This paper describes the essential features of the SME program.

## 3 SME PROGRAM

The SME program is designed to evaluate the accuracy and precision achieved in routine nuclear material accountability measurements. The participating facilities receive well characterized test samples that are closely matched to their routine measurement needs. For example, laboratories involved with uranium fuel cycle material analyses will receive test samples of that type (e.g., $UO_2$ pellets with specific level of $^{235}U$ enrichment). The laboratories analyze the test samples as part of their routine measurements and submit the results to NBL for statistical evaluation. Usually, the laboratories participate in the program on a quarterly basis, performing an adequate number of test samples analyses to permit statistical evaluation of bias, precision, day-to-day variation and/or analyst-to-analyst variation in the measurement results. The bias and precision of each set of measurement results are compared against the method/material specific International Target Values (ITVs)[1]. Results conforming to ITVs signify satisfactory level of performance; non-conformity requires review of laboratory practices, experimental techniques, technicians' training etc. The participant laboratories receive copies of the statistical evaluation reports along with a cover letter commenting upon the performance quality and any need for improvement.

### 3.1 TEST SAMPLES

The test samples used in the SME Program are made by NBL from Certified Reference Materials (CRMs) or Working Reference Materials (WRMs), or custom-made. The test samples are also characterized (for assay and isotopic abundance) at NBL before sending them to participants. Table 1 shows a list of test samples that are available at this time. New test samples will be added to this list to reflect changing needs.

Table 1. Materials and Methods evaluated in SME Program

| Material | Typical Assay Method | Typical Isotopic Method |
|---|---|---|
| UNH Solutions | D&G, HPT, XRFL, IDMS | TIMS, ICPMS |
| UO2 | D&G | ICPMS, TIMS |
| UF6 | D&G | GSMS |
| UO3 | D&G, IDMS, XRFS | |
| LEU | | TIMS, ICPMS, GSMS |
| HEU | | TIMS |
| DU | | TIMS |
| NU | | TIMS |
| Plutonium Sulfate (Low burn-up) | IDMS | TIMS |
| Plutonium Sulfate (High burn-up) | IDMS | TIMS |

UNH Uranyl Nitrate Solution
UO2 Uranium Dioxide Pellet
UF6 Uranium Hexafluoride
UO3 Uranium Trioxide Powder
HEU High Enriched Uranium
LEU Low Enriched Uranium

D&G Davies-Gray Titration
HPT High Precision Titration
IDMS Isotope Dilution Mass Spectrometry
XRFL X-Ray Fluoescence - Liquid
XRFS X-Ray Fluoescence - Solid

TIMS Thermal Ionization Mass Spectrometry
ICPMS Inductively Coupled Plasma Mass Spectrometry
GSMS Gas Source Mass Spectrometry

## 4 STATISTICAL EVALUATION METHODS AND EVALUATION REPORTS

The measurement results are evaluated using statistical methods. First, the percent relative difference (% RD) of each experimental result is calculated with respect to the corresponding reference value, the latter obtained from characterization measurements. The % RD is defined as follows:

% RD = 100 X {(observed value - reference value) / reference value}.

Next, each set of % RDs is examined for outliers using a number of statistical tests. A particular result is identified as a potential outlying value if at least two of the statistical tests show it to be an "outlier" at ≥ 99% significance level. The data set, with outliers removed, is then tested to identify significant sources of variation (e.g., day-to-day and/or analyst-to-analyst) using standard one-factor analysis of variance (ANOVA). If the ANOVA results indicate no significant variation, then the standard uncertainty is the simple standard deviation (σ) of the results divided by the square root of n, where n is the number of measurements. The coverage factor is the Student's 95% "t" factor with n-1 degrees of freedom. For example, in a set of 8 results showing no day-to-day or analyst-to-analyst variation, the number of degrees of freedom is 7, and the coverage factor is 2.36.

If the ANOVA results indicate significant day-to-day and/or analyst-to-analyst variation (≥ 95%), then the standard uncertainty in the mean % RD is estimated from a combination of the mean square for the "error" and the mean square for the "model" quantities from the ANOVA, with degrees of freedom determined from Satterthwaite's approximation. For measurements done on two different days (or by two different analysts), the formula for estimating the standard uncertainty in the mean % RD is reduced to the square root of the mean square for the "model" quantity obtained from ANOVA results. In this case, the coverage factor is 12.71 (i.e., the Student's 95% "t" factor with one degree of freedom).

A typical example of the statistical report for uranium assay by Davies-Gray titration is shown in Table 2; the same results are also displayed in Fig.1.

Table 2: Sample Data Evaluation Report (No statistically significant difference due to analysis day)

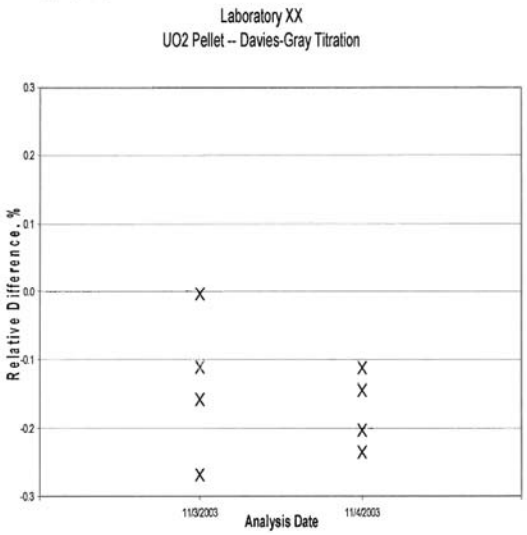
**Day to Day ANOVA analysis**
Report for Laboratory: XX
U02 Pellet – U Concentration
Davies-Gray Titration
Date of Report: November 30, 2003

| Sample Number | Aliquant Number | Analysis Date | Reported %U | % Relative Difference | Analyst Code |
|---|---|---|---|---|---|
| 95EU0079-1 | 1 | 11/03/03 | 88.126 | -0.0034 | XXX |
| 95EU0079-1 | 2 | 11/03/03 | 87.990 | -0.1577 | XXX |
| 95EU0079-2 | 1 | 11/03/03 | 88.031 | -0.1112 | XXX |
| 95EU0079-2 | 2 | 11/03/03 | 87.892 | -0.2689 | XXX |
| 95EU0079-1 | 3 | 11/04/03 | 88.030 | -0.1123 | XXX |
| 95EU00/9-1 | 4 | 11/04/03 | 87.950 | -0.2031 | XXX |
| 95EU0079-2 | 3 | 11/04/03 | 87.922 | -0.2349 | XXX |
| 95EU0079-2 | 4 | 11/04/03 | 88.002 | -0.1441 | XXX |

| | |
|---|---|
| **Number of Results Analyzed** | 8 |
| **Mean % Difference** | -0.154 |
| **Mean Absolute % Difference** | 0.154 |
| **95% C.L. of Mean (df = 7)** | 0.070 |
| **Standard Deviation** | 0.083 |
| **Between-Day Standard Deviation (df = 1)** | 0.054 |
| **Within-Day Standard Deviation (df = 6)** | 0.087 |
| **Statistical Significance of Between-Day Standard Deviation** | 44.3% |

**International target value for bias in Davies-Gray Titration is 0.1%.**
**International target value for precision in Davies-Gray Titration is 0.1%.**

Figure 1: Sample data Evaluation Report (Table 2 results are displayed).



The uncertainties shown in the Table 2 are the 95% confidence limit (C.L.) of means. In the figure, the 95% confidence interval (C.I.) of the mean is constructed from the C.L. Note that the C.I. represents the interval containing all values between the mean % RD minus the C.L. and the mean % RD plus the C.L. Thus, the 95% C.L. of the mean are just the two end points of the C.I.

A measurement is considered to be bias-free if the 95% C.I. included zero. The Table 2 results show that the measurements suffer from a negative bias (-0.154 ± 0.070). Also the result fails to meet the bias ITV of 0.1%.

The Table 2 results show that the standard deviation ($\sigma$) is 0.083 which represents the precision of the measurement results. This is within the precision ITV of 0.1.

## 5 SUMMARY AND CONCLUSIONS

The New Brunswick Laboratory Safeguards Measurement Evaluation Program provides performance evaluation service to the DOE laboratories making nuclear material accountability measurements. The program, at the discretion of the U.S. DOE, is open to non-DOE laboratories in the U.S. and abroad.

The participants derive the following benefits through participation in the SME program:

a) Performance evaluation of nuclear safeguards accountability measurement results of uranium (e.g., fuel cycle materials) and plutonium (e.g., low and high burn-up material).
b) Verification of internal quality control practices.
c) Assistance to correct deficiencies in measurement practices and techniques
d) Assistance in training analysts in measurement techniques
e) Assistance in qualifying new methods of analyses, and in qualifying analysts
f) Resolution of shipper-receiver differences in nuclear commerce
g) Long-term maintenance of performance evaluation records
h) Availability of a wide variety of test samples pertinent to nuclear safeguards and non-proliferation applications.

In addition to the above, NBL organizes an annual meeting of the Measurement Evaluation Program in conjunction with the annual meeting of the Institute of Nuclear Materials and Management (INMM). The participation at this meeting is open to all participants and potential participants in the SME program. The meeting provides opportunities to present papers on nuclear material measurement techniques. It also provides an open forum to discuss issues and concerns in the operation of nuclear safeguards and nuclear nonproliferation programs.

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