ACTION SHEET (40)

between
The United States Department of Energy (DOE)
and
The Japan Nuclear Cycle Development Institute (JNC)
So r
Joint Research and Development Study of the Metrology of the Isotope Dilution Gamma-Ray Spectrometry (IDGS)

1. Introduction

Under Article II (Area of Cooperation) of the Agreement between JNC and DOE for Cooperation in Research and Development Concerning Nuclear Material Control and Accounting Measures for Safeguards and Nonproliferation (herein called the "Agreement"), dated September 15, 1993, DOE and JNC undertake to carry out a cooperative effort on a joint research and development study of the metrology of isotope dilution gamma-ray spectrometry (IDGS). The intent of the study is to determine the metrological potential and limits of IDGS and use this information to improve the accuracy and precision of IDGS. The study will be also include performing proof-of-principle experiments for dissolver solutions using the developed IDGS metrology and further testing of the IDGS technique with high burnup input accountability tank dissolver solutions like those at RETF.

2. Scone of Work

This Action Sheet (AS) provides for a cooperative effort on a joint research and development study of the metrology of isotope dilution gamma-ray spectrometry (IDGS). The AS is an extension of SMA #12, "Study of Concentration and Isotopic Composition Measurement for Uranium and Plutonium in Chemical Processing Plant Input Accountability Tank Solutions by Gamma Measurement of Resin Bead Samples."

Results of SMA#12 which used IDGS methodology to simultaneously measure concentrations of $^{235}U$ and plutonium solutions and determine isotopic composition are very encouraging. Proof-of-principle experiments should be continued for developing simultaneous plutonium and uranium measurements that can be used to determine concentrations and isotopic compositions in various spent-fuel dissolver solutions; especially high burnup solutions typical in RETF and/or a large reprocessing plant. In order to improve precision and accuracy, it is important to study the metrology of IDGS.

The work performed under this Action Sheet shall be performed at the Los Alamos National Laboratory (LANL) and Tokai Reprocessing Centert (TRC/JNC) in accordance with the terms and conditions of the Agreement.

3. Program Management

LANL is responsible for developing the measurement technique, analysis method, and the metrology for simultaneous uranium and plutonium concentration and isotopic composition IDGS measurements of input accountability tank solutions, including high-burnup solutions at RETF. The work to be done is identified in Appendix I and is limited to development of equipment and techniques for nuclear safeguards applications.

JNC is responsible for studies related to implementing the task, for assisting in the development of the metrology, for improving sample preparation techniques, for providing spent-fuel dissolver solutions, and for supplying other information required to complete the joint studies.

Appendix II identifies key personnel associated with this project.

DOE and LANL shall work directly with JNC in planning tasks and resolving programmatic and technical questions. LANL shall start by developing and circulating a work plan with projected milestones and update the work plan with JNC concurrence as work progresses.

LANL shall prepare brief semiannual letter progress reports on activities of the Action Sheet and circulate them to JNC, DOE, and other pertinent organizations as requested by JNC.

LANL and JNC shall prepare and present written and oral reports at meetings of the Permanent Coordinating Group (PCG).

4. Fiscal Management

JNC shall make a cash contribution with the sum of $120,000 in United States dollars to conduct the activities related to the completion of the joint studies of IDGS safeguards techniques as defined in Appendix I of this Action Sheet in the following manner:

A contribution of $120,000 in United States dollars shall be due and payable upon receipt of an invoice to be issued in Japanese Fiscal Year (JFY) 1998 after the date of signature of the Action Sheet.

All contributions by JNC shall be due and payable within thirty days of receipt by JNC of an invoice from DOE, subject to availability of appropriated funds to JNC.

DOE shall be responsible for the budget planning and financial management and shall make best efforts to complete the JNC-funded activities in Appendix I satisfactorily and within the cash contribution by JNC. DOE costs are determined in accordance with DOE's policy for costing work it performs for others as set forth in 10 CFR Part 1009. The total cost to JNC for DOE's performance of work under this Action Sheet shall not, without JNC's prior consent, exceed the contributions set forth above.

DOE shall not begin or carry out work prior to entry into force of the Agreement and Action Sheet and receipt of the required payment in advance. Work shall not be continued after Funds from JNC have been depleted.

Throughout the duration of work under this Action Sheet, JNC shall provide sufficient funds in advance to reimburse DOE for causing LANL to perform the work described in this Action Sheet, and DOE shall have no obligation to perform in the absence of adequate advance funds. Payment in advance from JNC shall be sufficient to cover the expected obligation and cash requirements of the work until a subsequent request for payment in advance can be made,

collected and recorded. In this regard, sufficient advance funds shall be provided to maintain: at a minimum, a continuous 90-days advance of funds for expected DOE fund requirements during the life of this Action Sheet. Advances shall be sufficient to cover expected termination costs that DOE would incur on behalf of JNC.

5. Duration and Termination

This Action Sheet shall enter into force upon the later date of signature and shall continue in force for a three-year period or until mutually agreed by the parties that all activities under this Action Sheet are completed.

For the Japan Nuclear Cycle Development Institute

Signature: Masayuki Iwanaga

Printed Name: Masayuki Iwanaga

Title: Director, International Cooperation and Nuclear Material Control Division

Date: March 18, 1999

For the United States Department of Energy

Signature: Ernest Kusse for

Printed Name: Kenneth E. Sanders

Title: Director. International Safeguards Division

Date: 3-22-99

ACTION SHEET (40)

APPENDIX I

Joint Research and Development Study of the Metrology of the Isotope Dilution Gamma-Ray Spectrometry (IDGS)

1. Study Outline

This program involves a joint research and development study of the metrology of isotope dilution gamma-ray spectrometry (IDGS). The study outline is as follows:

A. LANL will obtain research and development specifications and information on constraints from JNC.
B. LANL and JNC will evaluate all possible separation methods for improving sample preparation techniques.
C. LANL will continue to evaluate simultaneous plutonium and uranium measurements that can be used to determine concentrations and isotopic compositions in various spent-fuel dissolver solutions; especially high burnup solutions typical in RETF and/or a large reprocessing plant
D. LANL will perform error analysis on results of simultaneous $^{235}U$ and plutonium measurements.
E. LANL will document results of the study and provide JNC with a final report.
F. LANL and JNC will jointly participate in technical meetings as required.

As more detailed program plans are developed, specific responsibilities will be better defined and delineated.

2. Sites

This work will be conducted at:

| | | |
|---|---|---|
| Los Alamos National Laboratory<br>Los Alamos, New Mexico, USA | and | Japan Nuclear Cycle Development Institute<br>Tokai, Japan |

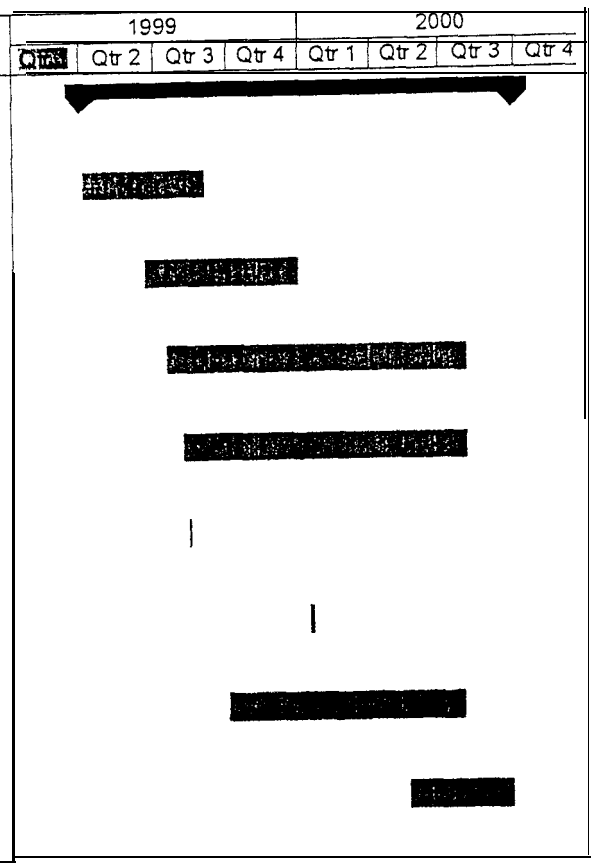
3. Programmatic Responsibilities

A. LANL will be responsible for providing best efforts within the funding and schedule for the feasibility study.
B. JNC will be responsible for facility specific specifications and information on any constraints.
C. JNC and LANL will jointly participate in the experiments for the plutonium and uranium measurements of dissolver solutions.
D. JNC and LANL will jointly participate in technical review meetings and the final evaluation.

4. Schedule

The schedule will be followed on a best-effort basis commencing on receipt of funding-and availability of parts.

| ID | Task Name |
|---|---|
| 1 | **R&D Study of the Metrology of the Isotope Dilution Gamma-Ray Spectrometry (IDGS) - LANL/JNC** |
| 2 | R&D specifications and constraints - JNC |
| 3 | Evaluate all possible separation methods for improving sample preparation techniques-JNC/LANL |
| 4 | Fundamental experiments and analysis - LANUJNC |
| 5 | Perform error analysis on results of simultaneous U-235 and plutonium measurements - LANL |
| 6 | Technical meeting - LANL/JNC |
| 7 | Technical meeting - LANL/JNC |
| 8 | RETF high burnup input solution analysis - LANL |
| 9 | Final report - LANL |



ACTION SHEET (40)
APPENDIX II

**Joint Research and Development Study of the Metrology of the Isotope Dilution Gamma-Ray Spectrometry (IDGS)**

## Japan Nuclear Cycle Development Institute

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