The United States Department of Energy (DOE)
and
The European Atomic Energy Community
represented by
The Commission of European Communities (EURATOM)
for

Development of a glass fibre optic measurement system

1. Introduction

Pursuant to Article 3.1 of the Agreement between EURATOM and DOE for Cooperation in Nuclear Material Safeguards Research and Development (hereafter called the "Agreement") signed on January 6, 1996, DOE and EURATOM undertake to carry out a cooperative effort in the design and development of a glass fibre optic measurement system.

2. Scope of Work

This Action Sheet provides for the design and development of a glass fibre optic measurement system.

The work under this Action Sheet shall be performed at the EURATOM Safeguards Directorate and Pacific Northwest National Laboratory (PNNL) in accordance with the terms and conditions of the agreement.

3. Program Management

PNNL is responsible for providing the design details and the appropriate advice in the development of a glass fibre optic measurement system and analysis software. EURATOM is responsible for field testing the subsequent design and for providing feedback to the developers with respect to suitability, and technical content. Work to be done jointly is identified in Appendix I and is limited to that statement. Appendix II identifies coordinator and key personnel working on this project

DOE and EURATOM shall carry out this work interactively, exchanging information on the system as the project progresses. At the conclusion of this work, EURATOM will provide a final report on the activities, and any recommendations for additional requirements and, or suggestions that may be identified for further development of this technique in future.

4. Fiscal Management

DOE and EURATOM shall bear their own expenses for this work.

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5. Duration and Termination

This Action Sheet shall enter into force upon the latter date of signature, and shall continue in force for a two year period, or until mutually agreed by the parties that all activities under this Action Sheet are judged to be completed.

For the United States Department of Energy	For the European Atomic Energy Community Represented by the Commission of European Communities
Signature:	Signature :
Printed Name: Kenneth E. SANDERS	Printed Name: Winfried KLOECKNER
Title: Director International Safeguards Division	Title: Head of Division Commission of the European Communities EURATOM Safeguards
Date: April 16, 1998	Date:

Statement of Work
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1. Background

Among the safeguards activities performed by EURATOM staff are measurements of neutron and gamma activities in a variety of environments using a number of different detectors. For in-situ measurements there are often constraints for both linear and volumetric measurements and compromises have to be found to adapt to the realities of the conditions in the plant.

PNNL have developed a specialised glass fibre optic technology for the measurement of neutron and gamma rays in high radiation environment. This technique offers a potential for use in a number of areas, These include qualitative measurements, e.g. on spent fuel, as well as quantitative applications where the amount of fissionable material is determined, e.g. fresh fuel or plutonium or uranium in various chemical forms,

For spent fuel the instrument normally used is the 'Ion Fork'. The usage of this instrument is sometimes restricted due to space limitations or safety considerations.

For the non-quantative measurements of fuel there is a need to identify the contents of a spent fuel or a spent fuel package. The possibility of the use of fibre optics to reverify large spent fuel containers either in air or underwater could be envisaged. A 'fingerprint technique' approach should be investigated to determine whether the fibre optic approach offers sufficient potential for the measurement of intensity distribution maps including ratios of neutron/gamma intensities either on the surface of spent fuel or on the spent fuel packages.

Neutron coincidence counting technique is usually applied to determine the amount of fissionable material in assemblies and Pu powders in storage cans. The detectors are normally bulky and heavy and the use of fibre optic technology would provide a possibility to reduce the size and weight as well as savings on transport and installation costs. Furthermore, if higher efficiencies can be reached , the measurement of neutron multiplicities might be interesting avenue for further investigation.

An additional area of interest could be the application for the fibre optics in a containment and surveillance mode where the fibre is placed in such a way to monitor material movement through openings or doors. If localised information is available, the potential to track material transports with a single detection system could be investigated.

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2. Objective and Scope

The overall objectives of this work are:

- to describe the potential of glass fibre optic detector systems in detail for both gamma and neutron measurements.
- to select (an) application(s)
- design a glass fibre optic detector system for this application
- prepare a workplan and schedule for implementation
- install and test the detector system(s)
- carry out a series of measurements
- evaluate measurement results
- prepare a report together with recommendations.

Appendix I

Action Sheet 9

Statement of Work
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1. Schedule and Milestones

Task Id.	Description	Starting Date	Ending Date	Duration (Weeks)
1	PNNL provide practical details of the glass fibre system and any further information for in-field applications	98.03.02	98.03.06	1
2	EURATOM and PNNL meet to discuss the proposed application and design the detector configuration including data acquisition and evaluation.	98.03.16	98.03.20	1
3	EURATOM prepare workplan and schedule for installation of glass fibre detectors.	98.03.23	98.03.28	1
4	PNNL design and produce the detector	98.03.30	98.07.24	16
5	EURATOM install and field test the detectors for measurement suitability and data acquisition.	98.07.27	99.01.15	25
5	EURATOM evaluates the measurement results	99.01.18	99.01.29	2
6	EURATOM prepares draft final report and recommendations for PNNL.	99.02.01	99.02.26	4
7	EURATOM submits report to PNNL	99.03.01	99.03.05	1
8	PNNL and EURATOM jointly agree on final report	99.03.08	99.03.12	1
9	Final report issued	99.03.15	99.03.15	-

Key Personnel
for
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