ADMINISTRATORS' MEMORANDUM OF UNDERSTANDING FOR USNRC-STUDSVIK COOPERATION IN REGARD TO AEROSOL BEHAVIOR AND FILTER SYSTEM PERFORMANCE AS RELATED TO VENTED FILTERED CONTAINMENT SYSTEMS

I. OBJECTIVE

Within the framework of the Technical Exchange and Cooperative Arrangement Between the United States Nuclear Regulatory Commission (USNRC) and the Studsvik Energiteknik AB (STUDSVIK) of Sweden in the Field of Nuclear Safety Research and Development (signed), the USNRC and STUDSVIK Administrators of the Arrangement, in recognition of the common interest of the parties in the area of vented filtered containment systems and of the related studies that each party is carrying out, hereby agree to cooperate in the research studies described herein or as amended, with the purpose of improving the efficiency and speeding up the results of their efforts.

II. STATEMENT OF THE PROBLEM

The assessment of the adequacy of a given design of a filtered, vented containment system, and the establishment of licensing design criteria requires knowledge of the potential radiological source term to be filtered, the rate and form in which that source is delivered to the filters, the loading response of the filters and the filter efficiency.

While the source term is to some extent dependent on the exact accident sequence considered, its general characteristics can be scoped by consideration of whether the fuel has largely melted in a wet or dry atmosphere and whether there has been substantial interaction of the fuel with basemat material. Both the relative composition and the magnitude of the source term are important. The radiological material will be suspended as an aerosol in the containment and the timing of the filtering and venting will determine the fraction of aged aerosol present.

The filter efficiency is dependent not only on the details of the filter design but on the physical and chemical form of the radiological material, and on its magnitude and the rate at which the material is passed through the filter. TL

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Thus, the total assessment of filter, vented containment systems is a typical systems analysis problem, but the basic data can be obtained from two distinct sources: behavior of the radiological source term, and filter efficiency under typical loading conditions.

As described in Section III and IV, respectively, the USNRC is conducting a research program on the release and transport of aerosols in a core melt accident, and STUDSVIK is conducting a test program involving the assessment of filter efficiency for the absorption of aerosols under typical accident condition.

III. USNRC CORE MELT AEROSOL RELEASE AND TRANSPORT PROGRAM

Objectives

An integrated research program at the Oak Ridge National Laboratory is in progress to develop analysis codes and data needed to describe the time dependent aerosol containment source term for a spectrum of degraded-core and core-melt accident sequences, and the transport of the aerosols within containment. The aerosol source is comprised of fission products initially followed by additions of mixtures of aerosols from molten core materials and structural materials released during the interaction of molten fuel with the reactor base mat. The goal of the program is to provide best estimate methods for predicting fission product and aerosol source terms and their disposition within the containment over the entire course of a degraded core or core melt accident sequence for:

- radiological consequence assessment
- assessment of aerosol loads to engineered safety and accident mitigation system, such as filtered, vented containment system.

Program Scope

The major parts of the program to be carried out during the approximate period 1980-1983 are as follows:

1. Aerosol Source Term Experiments and Models
   - fission product release rates from high temperature and molten fuel in reactor vessel and reactor cavity as a function of temperature and environment.
   - rate and composition of fuel and structure materials (steel, concrete) aerosols release from core/concrete interaction tests.
2. Aerosol Transport Modeling
   - code improvements for core melt aerosols
   - core melt aerosol agglomerate properties for modeling

3. Aerosol Transport Code Testing

- tests in ORNL Nuclear Safety Pilot Plant (vessel 3 m. dia x 6 m. tall) using core melt aerosol materials

- possible tests in larger scale facilities.

IV. STUDSVIK FILTER EFFICIENCY MODELLING AND TESTING PROGRAMS

Overview descriptions of Project Filtra, which Studsvik and ASEA-ATOM are performing for the Swedish Nuclear Power Inspectorate, are given in References 1, 2, and 3. The principal task areas for cooperative exchange under this Memorandum of Understanding are as follows:

1. Pressure-Temperature Histories Within the Containment - Detailed descriptions of events inside the containment for a typical PWR and a Swedish BWR Mark II, including steam explosions, hydrogen formation and combustion for various degraded core melt accident sequences and venting strategies.

2. Filter Efficiency Modelling and Verification Experiments - Filtering properties of crushed rock beds, sand beds, and condensation pools.

3. Aerosol Production, Transport, Removal, and Release - Analytical work using the CORRAL and NAUA codes.

4. Molten Core - Ground Interaction - Groundwater contamination and liquid transport exposure pathways to population dose.

5. Containment Pressure Reduction - Pressure reduction within the containment through pressure relief channels with pressure relief valves.

6. Filtration Unit Design Considerations

7. Vented-Filtered Containment Protection Measures

References

1. C. Graslund, "Reactor Containment Modification Project Filtra"; distributed as a contribution to the report of the CSNI Working Group on Research Response to the Accident at Three Mile Island; 1980-04-28.

2. Kjell Johansson and Ingwas Tiren, "Modified Reactor Containment," STUDSVIK/K2-80/266 ASEA-ATOM T80-9; 1980-03-11.

3. C. Graslund, K. Johansson, L. Nilsson and I. Tiren, "FILTRA, Filtered Atmospheric Venting of LWR Containments"; IAEA-CN-39/74; IAEA Stockholm Conference 20-24 October 1980.

V. FORMS OF COOPERATION

Cooperation between the parties will include the following forms:

(a) Exchange of all information developed under the programs included under this Memorandum of Understanding, including the exchange of technical reports, data, results of analyses and codes.

(b) Visits and joint experts meetings.

(c) Temporary assignment of personnel of one party or its contractors to the laboratory or facilities owned by the other party or in which it sponsors research; each such assignment to be considered on a case-by-case basis and be the subject of a separate attachment-of-staff agreement between appropriate representatives of the recipient and assigning organizations.

(d) If either party wishes to visit or assign personnel at facilities owned or operated by entities of other than the parties to this Memorandum of Understanding, the parties recognize that the prior approval of such entities will be required on request to the terms upon which such visit or assignment shall be made.

(e) Any other form agreed between the signatories.

VI. FINAL PROVISIONS

(a) This Memorandum of Understanding shall become effective upon signature by the administrators, and shall extend for a period of 3 years, unless extended for an additional period of time as mutually agreed.

(b) Either party may withdraw from this Memorandum of Understanding after providing written notice to the other party 3 months prior to its intended date of withdrawal.

FOR: STUDSVIK ENERGITEKNIK AB

BY: [signature]

TITLE: Vice President

DATE: February 23, 1981

FOR: U.S. NUCLEAR REGULATORY COMMISSION

BY: [signature]
Robert B. Minogue, Director

TITLE: Office of Nuclear Regulatory Research

DATE: 5 February 1981