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TITLE

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

ORNL/CSD/INF-78/11

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SUBJECT: Quarterly Report on Program for the Standardized Analysis of
Fuel Shipping Containers

TO: Nuclear Regulatory Commission

FROM: G. E. Whitesides

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PROGRAM FOR THE STANDARDIZED ANALYSIS
OF FUEL SHIPPING CONTAINERS

Quarterly Summary

Personnel Time -- 2,631 man hours

Costs

(a) This quarter.....	\$ 86,269
(b) Fiscal year to date.....	198,453
(c) Estimated to completion.....	91,547

Quarterly Report on Program for the Standardized
Analysis of Fuel Shipping Containers
SCALE System Development

During this quarter, effort centered on preparing the SCALE functional modules, control modules and data libraries applied in the criticality safety analytical sequences for transmittal to the Radiation Shielding Information Center (RSIC) for packaging and distribution. The following packages will be included in this series.

SDRI - SCALE System Driver (IBM-360 Version)

SFM1 - NITAWL-S

SFM2 - BONAMI-S

SFM3 - XSDRNPM-S

SFM4 - KENO-IV/S

SCM1 - CSAS1/CSAS2

SDL1 - SCALE Standard Compositions Library

SDL2 - Hansen Roach Bondarenko Library

SDL3 - 123 Group GAM-THERMOS Library

SDL4 - 218 Group ENDF/B-IV Library

SDL5 - 27 Group ENDF/B-IV Library

Progress made on SCALE system development is briefly summarized.

1. Functional Modules

KENO-V has been made ready for operation in SCALE as part of new analytical sequences (control module input) or on a stand-alone basis (user-specified input). Similar work was

performed on the HEATING6 program. This effort is described under the section on thermal analysis support.

2. Data Base

The generation of a 27 neutron group-18 photon group library based upon ENDF/B-IV data is about 85% completed. Considerable effort was expended to assure that the n,γ production cross sections are being weighted in a manner consistent with the production of the original 27 group library. A 123 group data set for boron-11 was added to the GAM-THERMOS library. These cross sections are based on ENDF/B-IV data. The boron-11 data set is to be used when the isotopic composition of boron is specified by the user.

3. Materials Information Processor

A new nuclide, H-X(E)-HR, and a new standard composition, H2O-X(E)-HR, were added to the standard compositions library to provide for the specification of fission-spectrum-weighted Hansen Roach hydrogen cross sections. Several error messages were added to the materials information processor.

4. Control Modules

A new sequence was added to CSAS2 to provide a check of KENO-IV geometry specifications prior to the execution of the problem-dependent cross section processing modules. This capability greatly simplifies the checking of CSAS2 input. Also the capability of running multiple KENO-IV cases from a single CSAS2 input specification has been developed. An algorithm for determining the energy spectrum of ORIGEN-S calculated neutron sources has been added to the SAS2 control

module. This algorithm includes α, n and spontaneous fission reaction rates determined by ORIGEN-S with measured spectral data for the principal isotopes Pu-238, Cm-242 and Cm-244. A 218 group test case has been run for comparison with 27 group analyses of LWR fuel burnup.

5. Geometry Graphic Package

The geometry graphics package is operational for standard combinatorial geometry specifications. Examples of the ability of the package to display complex geometries are attached. Also demonstrated in the examples is the capability to remove "hidden lines" by declaring intervening material regions to be opaque. Presently, effort on this project is directed towards developing the capability of treating nested arrays, e.g., an array of fuel bundles. Eventually the package will be extended to consider KENO mixed box geometry specifications and then be incorporated into SCALE system control modules.

6. BNL-CDC-7600 Implementation

The SCALE system subroutine library, including the machine language direct access routines, is now operational on the INEL-CDC-7600 computer. Work is proceeding on converting the materials information processor and on developing a CDC version of the SCALE system driver. The functional modules, NITAWL-S, XSDRNPM-S, and KENO-IV-S are being transmitted to INEL for conversion.

7. SCALE System Documentation

Various sections of the draft on CSAS1/CSAS2 have been typed. Portions of the drafts for SAS2, COUPLE and ORIGEN-S

have been submitted for report typing. A word-processing terminal to be used in preparing the manuscripts has been acquired.

STANDARDIZED ANALYSIS OF FUEL SHIPPING CONTAINERS THERMAL ANALYSIS SUPPORT

D. C. Elrod
W. D. Turner

The task of incorporating additional features into HEATING5 to render the code more versatile as a tool in the thermal studies associated with the design and safety analysis of spent fuel shipping containers was continued during the past quarter.

HEATING6 Coding Changes

Additional modifications of the input data features were made to the HEATING6 code. Debugging of the code was continued.

Implementation of HEATING6 Into SCALE

Work was initiated on implementing HEATING6 into the SCALE system. As a first step, the code was successfully executed as an independent module in the system. The HEATING6 INPUT PROCESSOR (HIP) has been written and is being debugged. This program will be used by the SCALE system to prepare and read standard interface data files for HEATING6.

H6SIZE - An Aid to HEATING6

The user must allocate the amount of core to be used by the variably dimensioned arrays in order to efficiently use HEATING6 or to override the existing defaults. Since all of the arrays that depend on the input data are variably dimensioned, the calculation of the core size needed can be a cumbersome task. An interactive program, operational on the PDP-10, was written which generates the necessary BLOCK DATA to allocate the core size for efficient execution of the problem.

Monitoring HEATING6 Users

A PROC is being developed to execute HEATING6 independent of the SCALE system. This will allow one to use HEATING6 without going through the SCALE system. An existing system can then be used to monitor the use of HEATING6 and to compile a list of users and the resources accessed.

Documentation

A draft of documentation specifying the use of HEATING6 is being prepared. Thus far, instructions concerning preparation of input data, use of JCL, and creation of the BLOCK DATA to override the default values for the variable dimensioning have been written. It is intended to distribute this draft to potential users of HEATING6 in order to get feedback on their experiences in the use of the code.

PIPE CROSS EXP.





