RSIC Newsletter

No. 336   *November 1992*

*Tolerance is the positive and cordial effort to understand another's beliefs,
practices and habits without necessarily sharing or accepting them.—Joshua L.
Liebman*

Session on Early Test Facilities and Analytic Methods
for Radiation Shielding to be Published by RSIC

The Radiation Protection and Shielding Division has organized a special session to be presented at the 1992 American Nuclear Society/European Nuclear Society International Meeting which will be held in Chicago, Illinois, on November 15-20, 1992. The meeting commemorates the 50th anniversary of the first controlled nuclear chain reaction, which occurred, not coincidentally, in Chicago. The papers contained in this report are in keeping with the historical theme of the meeting. **Those who wish to request a copy of the report may complete and return the form at the end of this newsletter.** Dan Ingersoll, head of the Nuclear Analysis & Shielding Section at Oak Ridge National Laboratory, describes the contents of compilation as follows:

"They are individuals who helped to form the foundations of the discipline of radiation shielding, and have all been appropriately honored by widespread recognition for their accomplishments. In their papers, they present a collage of facts and personal remembrances, which I find delightfully entertaining, fascinating and even inspiring.

The first paper, authored by Lorraine Abbott, could have opened with: "In the beginning..." She describes the earliest activities in radiation shielding research, which began immediately following the Chicago pile test. Frontiering programs grew from the insight and efforts of three key individuals: Everitt Blizard, Theodore Rockwell, and Charles Clifford. Abbott goes on to describe the major influence that Adm. Hyman Rickover had over those early programs and directions. The first shielding experiments at the Oak Ridge X-10 pile were in support of the Hanford production reactors, which later spawned shielding research at that site, as described by **Wilbur Bunch** in the second paper. Bunch provides a thorough description of their development and testing program, which focused primarily on iron/masonite shields and a vast range of special concretes. In an interesting aside, Bunch notes that not everything from those days survived, such as the "vigor" unit, which never gained the same level of acceptance as did the related "lethargy" unit.

The third paper, written by **Norm Schaeffer**, describes a fascinating test program for the Aircraft Nuclear Propulsion Project. The unique challenge of these tests is best reflected in the fact that nuclear engineers participating in the test had to first be trained in parachute jumping. The limitations of the ground tests and the awkwardness of the flight tests led to a compromise solution: experiments conducted at the Oak Ridge Tower Shielding Facility, which allowed the reactor and shield to be suspended 200 ft. above the ground. The design, construction and operation of the TSF is described in the fourth paper, authored by **Buzz Muckenthaler**. The TSF, which must be the longest surviving shield test facility, has supported a vast array of national programs, many of which are highlighted in Muckenthaler's paper.

Switching from early shield test facilities to early shielding design methods, **Dave Trubey** describes in the fifth paper the original development and evolution of buildup factors. Point-kernel codes employing buildup factors were some of the first successful computational methods, and are still in frequent use today. The method exemplifies the artistic nature of shielding design anlysis due to the need to constantly balance speed and accuracy, a problem which persists even today. In the sixth paper, **Kal Shure** describes the early methods used at Bettis Laboratory for the Naval Reactor program. Cloaked by secrecy, many of the developments at Bettis paralleled work at other laboratories. Shure wittily places in perspective the "worthiness" of results computed with these early codes, and makes reference to "user-tolerable" codes — a term which unfortunately applies to even modern computing software.

The seventh paper, authored by **John Butler**, provides a thoughtful description of radiation shielding research as it began in the United Kingdom. With a primary focus on kernel and Monte Carlo methods, much of the U.K. development complemented U.S. activities. The same was true of benchmark testing activities in the U.K., which centered around the NESTOR/ASPIS facility.

In the eighth and final paper, **Herb Goldstein** begins by stating that: "The title tells it all." In classic Goldstein style, he presents a wise and delightfully personal review of early computation methods, nuclear data, and even the early computers. He does well to point out the project-driven nature of shielding development, but goes on to describe some of those rare nuggets of fundamental theoretical research which have managed to "trickle" along the way. Goldstein provides a fitting conclusion to the session by stating that: "Now we have the tools...if anyone still wants to ask the questions, and is willing to pay for the answers."

Unlike most meeting proceedings, which are meant to be studied one paper at a time, this collection of historical perspectives is meant to be taken as a whole, and is best suited for a quiet evening and a soft armchair."

Dan Ingersoll
Nuclear Analysis & Shielding Section
Oak Ridge National Laboratory

ORNL MAKES ORGANIZATIONAL CHANGES

A new division was formed at ORNL from the former Technical Applications organization of the Computing and Telecommunications Division of Martin Marietta Energy Systems. G. Elliott Whitesides is the director of the new Computing Applications Division (CAD). The addition of CAD and it's 150 professional staff members will complement the computing capabilities of the many divisions involved in scientific

computing at ORNL. The selection of ORNL as one of two High-Performance Computing Research Centers by the DOE was a leading reason for the decision to form the new division.

RSIC looks forward to continued collaboration with the personnel in the new Computing Applications Division.

CHANGES TO THE COMPUTER CODE COLLECTION

Two changes were made to the Computer Code Collection. One new code system was packaged and added to the collection and an existing code package was extended to include an additional hardware version.

CCC-547/TWODANT-SYS

Experimental and Mathematical Physics Consultants, Gaithersburg, Maryland, contributed a personal computer version of TWODANT-SYS, a one- and two-dimensional multigroup, discrete-ordinates transport code system. TWODANT-SYS was developed at Los Alamos National Laboratory, New Mexico, and includes ONEDANT, TWODANT, and TWOHEX. The new release runs on personal computers and uses 8 Mbytes of memory. The Lahey F77L-EM/32 compiler was used to create the executable included in the package, which runs under DOS and WINDOWS. This package is distributed on 2 DS/HD (1.2 MB) diskettes. References: LA-9184-M (Dec. 1989), LA-10258-M (Dec. 1989), LA-10049-M (Feb. 1990), and informal notes (Feb. 1990 and Sept 1992). Fortran 77; Cray (A), Vax (B), Sun Sparcstation (C), and PC 486 (D).

PSR-321/GRPANL

Lawrence Livermore National Laboratory, Livermore, California, through the DOE ESTSC, Oak Ridge, Tennessee, contributed this code system for analyzing germanium and alpha-particle detector pulse-height spectra. The package consists of a suite of programs called GRPANL. GRPANL is also the name of the main peak-fitting program which is particularly useful for accurately deconvoluting and interpreting complex clusters of peaks in a spectrum. GRPANL determines the gamma-

SCALE Workshop Planned for '93

The week of July 11, 1993, is the tentative date set for a SCALE workshop to be held in the Oak Ridge, Tennessee area. Additional details will be publicized in the *RSIC Newsletter* as

ray energies and intensities of the peaks and also identifies and measures isotopes in a sample. Other programs included are EDIGRP, LIBRY, and GEVAL. The system is operational on the Vax family of computers running VMS. One DS/HD (1.2 MB) diskette is required for transmittal. References: UCRL-53861, Vol. 1 and 2 (May 1988). Vax; Fortran 77.

CHANGES TO THE DATA LIBRARY COLLECTION

Four changes were made to the data library collection during the month. One new data library was packaged and added to the collection, two existing data libraries were updated, and one data library was replaced with a newly frozen version. One change resulted from a contribution from Japan.

DLC-75/BUGLE-80

This ENDF/B-IV derived, 47 neutron, 20 gamma-ray group, P3 data package was updated with the addition of data for bismuth, deuterium and cadmium. The new data were collapsed from the DLC-113/VITAMIN-E library which is based on ENDF/B-V and added to versions (B) and (C). Version B consists of the entire BUGLE-80 package and is distributed on 2 DS/HD (1.2 MB) diskettes. Version C contains data from files 1 and 2 (48 coupled materials and mixtures) from the original pack-

ages plus H-2, Cd, and Bi-209. These data are in individual files in ANISN fixed-fido format and are distributed on one DS/HD diskette. Reference: Informal Notes (June 1980).

DLC-96/PEFPYD

Los Alamos National Laboratory, New Mexico, added the FITPULS retrieval code to this package of aggregate fission-product decay data based on ENDF/B-V. FITPULS can be used to retrieve data from a library containing aggregate fine-group spectra from fission products, collapse the data to a few groups, and fit the resulting spectra along the cooling time axis with a linear combination of exponential functions. This version of FITPULS has run on Cray computers under the CTSS operating system. Modifications will be required to run on other computers. The package is transmitted on 2 DS/HD (1.2 MB) diskettes. References: LA-8365-MS (May 1980) and LA-8277-MS (March 1980). Fortran; Cray.

DLC-134/RADDECAY 4.01

Grove Engineering, Inc, Rockville, Maryland, contributed a newly frozen version of this radioactive decay data package. RADDECAY is an interactive, microcomputer-based program for displaying radioactive decay information for any of the 497 radionuclides in the library. Data displayed includes the half-lives, radioactive daughter nuclides, prob-abilities per decay, and decay product energies for alphas, betas, positrons, electrons, X-rays, and gamma rays. Given an initial activity and decay time by the user, RADDECAY will calculate the remaining activity of a nuclide and the activity of its progeny. The decay chain is calculated for as many as 20 generations. The program is written in TrueBasic and compiled. It appears to be compatible with computers using Intel 8088, 80286, 80386, or 80486 microprocessors, Disk Operating System 2.1 or later, and standard graphics display adapters. The executable program and coded data files are distributed on 1 DS/HD (1.2 MB) diskette. Reference: Grove 91-1 (November 1991). IBM PC.

DLC-165/FSXLIB-J3

The Japan Atomic Energy Research Institute, Tokai-mura, Japan, contributed this library produced from the newly evaluated nuclear data file JENDL-3 for fusion neutronics application. The FSXLIB-J3 library was produced by the modified version of the nuclear data processing system NJOY (83/6) and the library compiling and checking code for the MCNP library called MACROS. It may be used as a continuous energy cross section table of neutron interaction for the MCNP code. This package is transmitted either on two 6250 BPI tapes or on one quarter-inch cartridge tape or one 8 mm data cartridge written with the tar utility. References: Informal information (1992).

PERSONAL ITEMS

In serving a specialized area of scientific endeavor, it seems important that we note significant changes in the activities of people concerned with radiation protection, transport, and shielding in the nuclear industry. We, therefore, continue to carry personal items as they are brought to our attention.

Akira Shono, who has spent two years at ORNL working on the joint Japan-U.S. JASPER program of shield experiment measurement and analysis at the Tower Shielding Facility (TSF), has completed his assignment and returned to Japan. He will be located at the Oarai Engineering Center of the Power Reactor and Nuclear Fuel Development Corporation (PNC). The U.S. participation in the JASPER program is managed within the Nuclear Analysis and Shielding Section of the Engineering Physics and Mathematics Division at ORNL.

Visitors to RSIC

During the month the following persons came for an orientation visit and/or to use RSIC facilities: *Vonach Herbert*, University of Vienna, Austria; *S. Ganesan*, International Atomic Energy Agency Nuclear Data Section, Vienna; and *Enrico Sartori*, NEA Data Bank, France.

Calendar

Your attention is directed to the following events of interest.

December 1992
Radioactive Waste Management, Dec. 7–11, 1992, Charlotte, North Carolina. Contact: Linda S. Woodson, Woodson Associates, Inc., P.O. Box 2665, Gaithersburg, MD 20886 (phone 301-990-0751; fax 301-990-6153).

January 1993
Managing Nuclear Emergencies, Jan. 11–15, 1993, Phoenix, Arizona. Contact: Linda S. Woodson, Woodson Associates, Inc., P.O. Box 2665, Gaithersburg, MD 20886 (phone 301-990-0751; fax 301-990-6153).

Groundwater Contaminant Transport Modelling Course, 9th Annual, Jan. 13–15, 1993, sponsored by the University of Vermont. Contact: College of Engineering & Mathematics, 109 Votey Bldg., Burlington, VT 05405 (phone: 802-656-1941; Fax 802-656-8802).

February 1993
HEART, Feb. 1–5, 1993, Naval Training Center, Orlando, Florida, sponsored by the Department of Defense and the Department of Energy. Contact: Arne Kalma, S-Cubed, 3020 Callen Road, San Diego, CA 92121 (phone 619-450-2439).

Practical Radiation Shielding, Feb. 1–5, 1993, Atlanta, Georgia, a course sponsored by Shonka Research Associates, Inc. Contact: Shonka Research Assoc., 4939 Lower Roswell Road, Suite 106, Marietta, GA 30068 (phone 404-509-7606).

Maintenance/Repair of Oil Filled Lead Glass Shielding Windows, Feb. 9–11, 1993, Kent, Washington, sponsored by Hot Cell Services. Contact: Ronald A. Campbell, Hot Cell Services Corp., 22626 85th Place South, Kent, WA 98031 (phone 206-854-4945; fax 206-854-4947).

Internal Dosimetry, Feb. 9–12, 1993, Las Vegas, Nevada. Contact: Linda S. Woodson, Woodson Associates, Inc., P.O. Box 2665, Gaithersburg, MD 20886 (phone 301-990-0751; fax 301-990-6153).

March 1993
Occupational and Environmental Radiation Protection, Mar. 22–26, 1993, Boston, Massachusetts, a short course offered by Harvard School of Public Health. Contact: Mary F. McPeak, Assoc. Dean for Continuing Education, 677 Huntington Ave., Boston, MA 02115 (phone 617-432-1171; Fax 617-432-1969).

April 1993
29th Annual Meeting of the National Council on Radiation Protection and Measurements, Apr. 7–8, 1993, Arlington, Virginia. Contact: NCRP, 7910 Woodmont Avenue, Suite 800, Bethesda, MD 20814.

Joint International Conference on Mathematical Methods and Supercomputing in

Nuclear Applications, Apr. 19–23, 1993, Karlsruhe, Germany. Contact: H. Kuesters, KFK/INR, Postfach 3640 D-W-7500 Karlsruhe 1, Germany, or W. Werner, GRS, D-W-8046 Garching, Germany.

International High-Level Radioactive Waste Management Conference, Apr. 25–29, 1993, Las Vegas, Nevada, sponsored by the ANS, the U.S. Dept. of Energy, and the American Society of Civil Engineers. Contact: Billy Cole, E. R. Johnson Assoc., 10461 White Granite Drive, Suite 204, Oakton, VA 22124 (phone 703-359-8355; Fax 703-359-0842).

4th Topical Symposium on Emergency Preparedness and Response, to be held April 26–29, 1993, in Long Island, New York. Contact: Brant Aidikoff, Technical Program Chairman, LIANS, Box 436, Upton, New York 11973 (phone 516-436-4256).

May 1993

Advanced Workshop on Occupational and Environmental Radiation Protection, May 10–14, 1993, Boston, Massachusetts, a short course offered by Harvard School of Public Health. Contact: Mary F. McPeak, Assoc. Dean for Continuing Education, 677 Huntington Ave., Boston, MA 02115 (phone 617-432-1171; Fax 617-432-1969).

International Symposium on the Measurement Assurance in Dosimetry, May 24–27, 1993, Vienna, sponsored by the International Atomic Energy Agency. Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria (Fax 43 1234564).

Management and Disposal of Radioactive Waste, May 24–28, 1993, Boston, Massachusetts, a short course offered by Harvard School of Public Health. Contact: Mary F. McPeak, Assoc. Dean for Continuing Education, 677 Huntington Ave., Boston, MA 02115 (phone 617-432-1171; Fax 617-432-1969).

June 1993

Conference and International Symposium on Radionuclide Metrology and Its Applications, June 7–11, 1993, Teddington, United Kingdom. Contact: Dr. P. Christmas, National Physical Laboratory, Div. of Radiation Science and Acoustics, Teddington, Middlesex TW11 OLW, UK (Fax 4481 943 6317).

Safewaste '93: The Final Disposal of Nuclear Waste, June 14–18, 1993, Avignon, France, sponsored by the ANS and the European Nuclear Society. Contact: Pierre Tanguy, EDF, Direction Generale 32, Rue de Monceau, 75384 Paris Cedex 08, France.

July 1993

Nuclear and Space Radiation Effects Conference, July 19–23, 1993, Snowbird, Utah. Contact: P. V. Dressendorfer, Sandia National Laboratories, Division 2535, P.O. Box 5800, Albuquerque, NM 87185.

August 1993

SMiRT 12, Structural Mechanics in Reactor Technology, Aug. 15–20, 1993, Stuttgart, Germany. Contact: Prof. Karl Kussmaul, SMiRT 12, Stätliche Materialprüfungsanstalt (MPA), University of Stuttgart, Pfaffenwaldring 32, 7000 Stuttgart 80 Germany (phone 49-711-685-3582; Fax 49-711-685-3144 or 2635).

Topical Meeting on Environmental Transport and Dosimetry, Aug. 31–Sept. 3, 1993, Charleston, South Carolina, sponsored by the ANS. Contact: Robert Addis, Savannah River Laboratory, Environmental Transport Group, Bldg. 773-A, Box 616, Aiken, SC 29808 (phone 803-725-3325).

8th ASTM-EURATOM Symposium on Reactor Dosimetry, Aug. 29–Sept. 3, 1993, Vail, Colorado. Contact: Patrick J. Griffin, Div. 6522, Sandia National Laboratories, Albuquerque, New Mexico 87185 (phone 505-

845-9121). See call for papers in September 1992 *RSIC Newsletter*.

March 1994
11th International Conference on the Use of Computers in Radiotherapy, Mar. 20–24, 1994, Manchester, United Kingdom. Contact: J. M. Wilkinson, Christie Hospital, Withington, Manchester M20 9BX, GB.

April 1994
Topical Meeting on Advances in Reactor Physics, Apr. 11–14, 1994, Knoxville, Tennessee, sponsored by the American Nuclear Society. Contact: B. A. Worley, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6363 USA (phone 615-574-6106).

May 1994
9th Pacific Basin Nuclear Conference, May

1–5, 1994, Sydney, Australia. Contact: Australian Nuclear Association, P.O. Box 445, Sutherland, NSW 2232, Australia.

International Conference on Nuclear Data for Science and Technology, May 9–13, 1994, Gatlinburg, Tennessee, USA. Contact: J. K. Dickens, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6356 USA (phone 615-574-6115).

March 1995
5th Topical Meeting on Tritium Technology in Fission, Fusion, and Isotopic Applications, Mar. 26–31, 1995, Augusta, Georgia, sponsored by the ANS. Contact: C. E. Murphy, Westinghouse SRC, Savannah River Lab., Aiken, SC 29808.

OCTOBER ACCESSION OF LITERATURE

The following literature cited has been ordered for review, and that selected as suitable will be placed in the RSIC Information Storage and Retrieval Information System (SARIS). This early announcement is made as a service to the shielding community. Copies of the literature are not distributed by RSIC. They may generally be obtained from the author or from a documentation center such as the National Technical Information Service (NTIS), Department of Commerce, Springfield, Virginia 22161.

RSIC maintains a microfiche file of the literature entered into SARIS, and duplicate copies of out-of-print reports may be available on request. Naturally, we cannot fill requests for literature which is copyrighted (such as books or journal articles) or whose distribution is restricted.

This literature is on order. It is not in our system. Please order from NTIS or other available source as indicated.

RADIATION SHIELDING LITERATURE

Health Phys., 63, 421-426. . *Neutron Discrepancies in the DS86 Hiroshima Dosimetry System.* . Straume, T.; Egbert, S.D.; Woolson, W.A.; Finkel, R.C.; Kubik, P.W.;Gove, H.E.; Sharma, P.; Hoshi, M. . October 1992
Health Phys., 63, 443-448. . *Absorbed Doses to Skin From Radionuclide Sources on the Body Surface.* . Faw, R.E. . October 1992
Nucl. Sci. Eng. 112, 1-15. . *An Extended First Collision Source Method for Electron Beam Source Problems.* . Filippone, W.L.; Morel, J.E.; Walters, W.F. . September 1992
Nucl. Sci. Eng. 112, 159-169. . *Analytic Monte Carlo Score Distributions for Future Statistical Confidence Interval Studies.* . Booth, T.E. . September 1992
Nucl. Sci. Eng. 112, 16-31. . *HELIOS: Angularly Dependent Collision Probabilities.* . Villarino, E.A.; Stamm'ler, R.J.J.; Ferri, A.A.; Casal, J.J. . September 1992
Nucl. Sci. Eng. 112, 32-42. . *Iterative Methods for Solving x-y Geometry SN Problems on Parallel Architecture Computers.* . Yavuz, M.; Larsen, E.W. .

September 1992

     Nucl. Sci. Eng. 112, 43-53. . *A WIMS-Based Calculational Route for Pebble-Bed Fuel*. . Segev, M.; Caner, M. . September 1992

     Nucl. Sci. Eng. 112, 54-65. . *Calculations of EURACOS Iron Benchmark Experiment Using the HYBRID Method*. . Chang, B.J.; Liu, Y.W.H.; Wun, C.C.; Rief, H. . September 1992

     Nucl. Technol., 98, 160-170. . *Sensitivity, Uncertainty, and Importance Analysis of a Risk Assessment*. . Andsten, R.S.; Vaurio, J.K. . May 1992

     Nucl. Technol., 98, 196-206. . *Estimate of the Crud Contribution to Shipping Cask Containment Requirements*. . Sandoval, R.P.; Einziger, R.E.; Jordan, H.; Malinauskas, A.P.;Mings, W.J. . May 1992

     Nucl. Technol., 98, 217-223. . *Neutron Autoradiography of Trace Amounts of Gadolinium*. . Shih, J.L.A.; Brugger, R.M. . May 1992

     ORNL/TM-11918. . *Analysis of the Spring-1991 Two-Meter Box Test Bed Experiments Performed at the Army Pulse Radiation Facility (APRF)*. . Johnson, J.O.; Drischler, J.D.; Barnes, J.M. . . September 1992

COMPUTER CODES LITERATURE

ANL-RE-91/2-Vol.2 . . . . LTC
A Fast Reactor Transient Analysis Methodology for PCs.. . . Ott, K.O.. . . Purdue University, School of Nuclear Engineering, Lafayette, IN. . . October 1991. . . INIS mf only; OSTI; NTIS; GPO

CONF-9109407 . . . . BUSCA
Development and Validation of BUSCA Code: A Model to Assess the Aerosol and Fission Product Retention in a Water Pool.. . . Calvo, M.; Guntay, S.; Ramsdale, S.A.. . . Universidad Politecnica de Madrid, Madrid, Spain. . . 1991

EUR-13013/1 . . . . DOSE ASSESSMENT
Optimization of Dose Assessment Models Including the Interface with Environmental Survey, for Use in Case of Accidental Releases.. . . Govaerts, P.; Sohier, A.; Zeevaert, T.. . . Studiecentrum voor Kernenergie (SCK/CEN), Mol, Belgium. . . 1991. . . INIS mf only

INIS-mf-13279 (in Spanish) . . . . WIMSD4, WINTER, AMICO, DOT, CITATION, DIPOBAR, ANISN
Utilities Programs for the WIMSD4 Code.. . . Leszczynski, F.. . . Comision Nacional de Energia Atomica, San Carlos de Bariloche, Argentina. . . 1990. . . INIS mf only

KEK-PROC-91-14 (in Japanese) EGS4
Proceedings of the First EGS4 User's Meeting in Japan.. . . Hirayama, H.; Namito, Y.; Ban, Syuichi; (eds.). . . National Laboratory for High Energy Physics, Tsukuba, Ibaraki, Japan. . . December 1991. . . INIS mf only

KIY-90-7 (in Russian) . . . . MANY
MANY - The Program System of Interactive Processing Data of Nuclear Physics Experiments. 1. Approach and Structure.. . . Zerkin, V.V.. . . AN Ukrainskoj SSR, Kiev, Ukraine. . . 1990. . . INIS mf only

NUREG/CR-4554-Vol.1-Rev.1 . . . . SCANS
SCANS (Shipping Cask ANalysis System): A Microcomputer Based Analysis System for Shipping Cask Design Review.. . . Gerhard, M.A.; Trummer, D.J.; Johnson, G.L.; Mok, G.C.. . . Lawrence Livermore National Laboratory, CA; Nuclear Regulatory Commission, Washington, DC. . . February 1992. . . INIS mf only; OSTI; NTIS; GPO

SAND-91-1826C; CONF-920307-28 . . . . IMPACTS-BRC
Development of IMPACTS-BRC, Version 2.1.. . . Rao, R.R.; Kozak, M.W.; Rollstin, J.A.. . . Nuclear Regulatory Commission, Washington, DC; Sandia National Labs., Albuquerque, NM. . . 1991. . . INIS mf only; OSTI; NTIS; GPO

WSRC-MS-91-178; CONF-9105213-2 . . . . WSRC
WSRC Approach to Validation of Criticality Safety Computer Codes.. . . Finch, D.R.; Mincey, J.F.. . . USDOE, Washington, DC; Westinghouse Savannah River Co., Aiken, SC. . . 1991. . . INIS mf only; OSTI; NTIS; GPO

EARLY TEST FACILITIES AND ANALYTIC METHODS
FOR RADIATION SHIELDING

You may Fax this request to 615-574-6182 if you wish.

Name: _____

Organization: _____

Address: _____

_____

_____

Fold and return this request to:

_____