Radiation Facilities at Sandia National Laboratories

Sally Seidel
Department of Physics and Astronomy
University of New Mexico

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1 Introduction

Sandia National Laboratories (SNL) is a U.S. Department of Energy facility located in Albuquerque, New Mexico, USA. The laboratory operates several radiation facilities on which time may be purchased by RD50 and other scientific collaborations.

2 Gamma Irradiation

Gamma irradiations are available with Co-60 (at three facilities) and Cs-138.

Cobalt Cell 1 locates the sample external to a 10 kCurie Co-60 source array of height 27″ and provides a uniform 100 rad/sec in an area $6'' \times 6''$.

Cobalt Cell 2 locates the sample in the center of a 100 kCurie array of height 18″. This cell provides 550 rad/sec in an area of diameter 7.75″.

Cobalt Cell 3 locates the sample external to a 20 kCurie array of height 12″. This cell provides an approximately uniform 70 rad/sec over an area $4'' \times 4''$. The benefit to use of Cell 3 relative to Cell 1 is that the total volume available is very large (on the order of cubic meters) although the exposure is non-uniform.

Samples may also be placed external to an 8.8 Curie cesium point source. The maximum dose rate available is 17 rad/hour.

3 Neutron Irradiation

The Annular Core Research Reactor (ACRR) may be operated in pulsed or steady state mode. This is a pool-type reactor with a core formed of BeO-UO_2 fuel elements arranged around a 9″ diameter dry central cavity. The neutron spectra may be seen in Figure 1. The fluence in neutrons/cm^2/MJ is summarized in Table 1. The spectrum may be altered by insertion of various shields. In particular, use of a standard Pb-B_4C liner hardens the spectrum, with the benefit that activation is diminished so the waiting time to access irradiated samples is decreased.

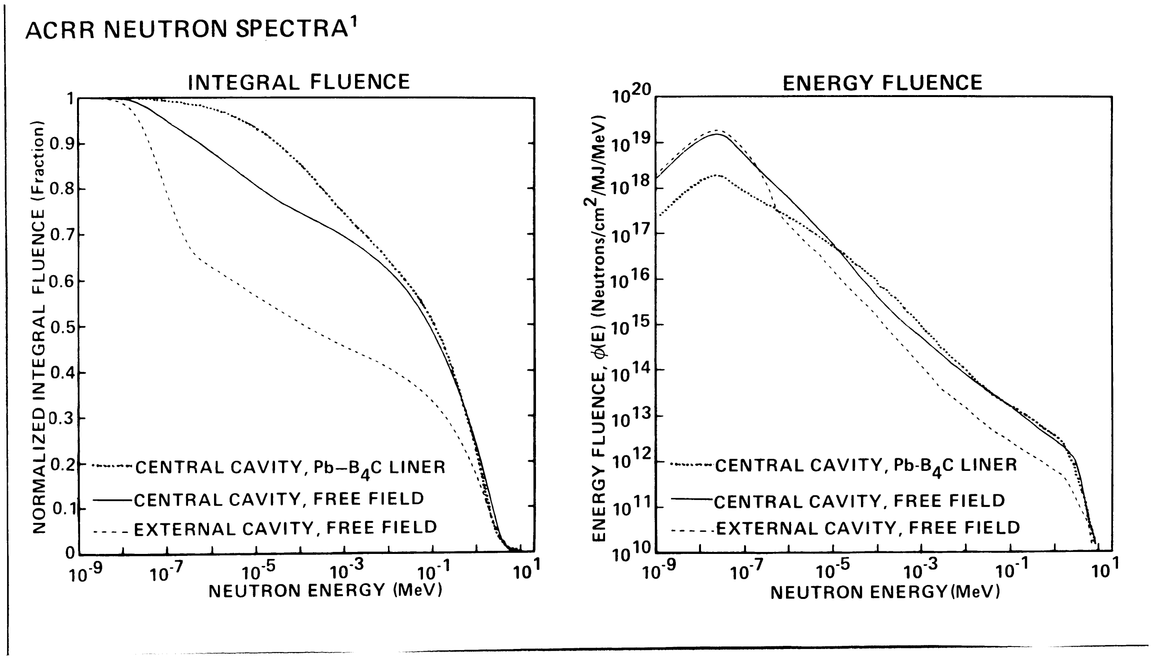

Figure 1: The integral fluence (left) and energy fluence (right) for neutrons at the ACRR cavities.

The temperature in the cavity depends upon the reactor power. Standard reactor power in continuous steady-state operation is 2.0 MW. Reduction of the power to 600 kW, combined with forced air cooling in the chamber at a flow rate of 10 cubic feet per minute, has been demonstrated to keep the chamber temperature at or below 80°C. Without forced air, the temperature can be maintained around 80°C if the power is cut to 300 kW. A thermocouple can be provided for temperature monitoring. The user should note that charges for reactor use (see below) are based upon running time, so temperature control via power reduction is achieved at the cost of a longer running period.

Energy Range	Neutron fluence (n/cm^2/MJ)
All Energies	1.9×10^{13}
< 1 eV	2.3×10^{12}
> 10 keV	1.2×10^{13}
> 3 MeV	1.0×10^{12}
1 MeV Si Equiv.	8.9×10^{12}

Table 1: Fluence per MJ of ACRR operation.

4 Other Services

Alinene-based and standard thermoluminescent dosimetry are available for gamma irradiations, and nickel-foil activation dosimetry is used for high fluence neutron irradiation. Dosimetry is provided without additional charge. If RD50 would like to store activated materials below room temperature during the waiting period for radioactive cooldown, the collaboration may provide SNL with a freezer for that purpose.

5 Costs

Use of the cesium source is \$100/day. Use of the cobalt arrays is \$175/hour. If a user purchases 8 sequential hours (\$1400) of manned time on the cobalt arrays, the subsequent 16 unmanned overnight hours are free of charge.

The official fee rate for use of the reactor is \$1750/hour. The official length of a day of use is 8 hours, although 10 hour runs may be negotiated. Use of the reactor for any part of a day requires approximately 1 hour of setup time, the cost of which is also \$1750/hour. Discussions with the Facilities Manager and the Facilities Supervisor indicate that it may be possible to negotiate a substantially lower cost per hour if the user anticipates a long-term irradiation program. In order to determine the fee rate in that case, the user must provide SNL with a well defined statement of the purpose, scope, and time frame for the irradiation program to be undertaken.