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PREPARATION AND BENCHMARKING OF ANSL-V CROSS SECTIONS  
FOR ADVANCED NEUTRON SOURCE REACTOR STUDIES\*

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Research and development for the Advanced Neutron Source (ANS) Reactor is being funded by the U. S. Department of Energy. The reactor is to provide the world's most intense steady-state source of low-energy neutrons for a national experimental user facility.<sup>1</sup>

Pseudo-problem-independent, multigroup cross-section libraries were generated to support ANS design work. The libraries, designated ANSL-V,<sup>a</sup> are data bases in AMPX<sup>2</sup> master format for subsequent generation of problem-dependent cross sections for use with codes such as KENO,<sup>3</sup> ANISN,<sup>4</sup> XSDRNPM,<sup>5</sup> VENTURE,<sup>6</sup> DOT,<sup>7</sup> and MORSE.<sup>8</sup> Included in ANSL-V are 123-material P<sub>3</sub> neutron, 46-material P<sub>0</sub> or P<sub>6</sub> secondary gamma-ray production (SGRP), and 34-material P<sub>6</sub> gamma-ray interaction (GRI) libraries.

ANSL-V was generated with AMPX<sup>2</sup> and NJOY<sup>9</sup> modules and with evaluated data from various libraries. Hierarchy of such libraries for neutron and SGRP data was: (1) ENDF/B-V General Purpose,<sup>10</sup> (2) LENDL,<sup>11,12</sup> (3) ENDF/B-V Actinide and Fission Product, (4) Japanese Evaluated Nuclear Data.<sup>13,14</sup>

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Experiences gained with CSRL,<sup>15-17</sup> CSRL-V,<sup>18,19</sup> and Hansen-Roach<sup>20</sup> libraries influenced selection of ANSL-V group structures and point-to-multigroup weighting functions. As was done in CSRL and CSRL-V, consideration was given between 3 eV and 20 MeV to resonance structures of prominent nuclei, thresholds of important reactions, and various fission spectra.

Groups were included in the 0.104 to 0.765 and  $4.45 \times 10^{-3}$  to  $10^{-5}$  eV ranges for ANS hot and cold source design needs, respectively.<sup>21</sup> ANSL-V neutron fine- (99 groups) and broad-group (39 groups) structures include 29 and 25 thermal groups, respectively, between 1.00-5 and 3.00 eV.

Thermal bound data for H-1, H-2, Be-9, and graphite were processed from ENDF/B thermal scattering law data and included with appropriate ANSL-V epithermal data. Special data are included to represent kinematics of very low temperature scattering for ortho and para forms of hydrogen and deuterium. Parameters for subsequent Nordheim processing of resolved resonances are included in appropriate data sets; Bondarenko factors are included for unresolved resonance processing. Delayed fission gamma-ray multiplicities are included in U<sup>235</sup> and U<sup>238</sup> SGRP data sets.

Cross sections for the GRI Library (44 groups) were processed from RSIC<sup>b</sup> DLC-99/HUGO data.<sup>22</sup> Kerma factors are included in each GRI data set.

Validity of selected data from the fine-group neutron library was satisfactorily tested in performance parameter calculations for the BAPL-1,<sup>23</sup> TRX-1,<sup>23</sup> and ZEEP-1<sup>24</sup> thermal lattice benchmarks. BAPL-1 is an H<sub>2</sub>O