

## Shielding Integral Benchmark Archive and Database (SINBAD)

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### Abstract

The Shielding Integral Benchmark Archive and Database (SINBAD) was initiated in the early 1990's. SINBAD is an international collaboration between the Organization for Economic Cooperation and Development's Nuclear Energy Agency Data Bank (OECD/NEA DB) and the Radiation Safety Information Computational Center (RSICC) at Oak Ridge National Laboratory (ORNL). SINBAD is a major attempt to compile experiments and corresponding computational models with the goal of preserving institutional knowledge and expertise that needs to be handed down to future scientists. SINBAD is also a learning tool for university students and scientists who need to design experiments or gain expertise in modeling and simulation.

The SINBAD database is currently divided into three categories – fission, fusion and accelerator benchmarks. Each experiment is described and analyzed using radiation transport software such as SCALE and MCNP. The current SINBAD experimental benchmarks are listed below.

#### **FISSION BENCHMARKS**

Winfrith Iron Benchmark (ASPIS)  
Winfrith Iron 88 Benchmark (ASPIS)  
Winfrith Graphite Benchmark (ASPIS)  
Winfrith Water/Iron Benchmark (ASPIS-PCA REPLICA)  
Winfrith Water Benchmark  
Winfrith Neutron-Gamma Ray Transport through Water/Steel Arrays (ASPIS)  
NESDIP-2 Benchmark (ASPIS)  
NESDIP-3 Benchmark (ASPIS)  
JANUS Phase I (Neutron Transport Through Mild and Stainless Steel)  
JANUS Phase VIII (Neutron Transport Through Sodium Mild Steel)  
Ispra Sodium Benchmark (EURACOS)  
Ispra Iron Benchmark (EURACOS)  
Cadarache Sodium (HARMONIE)  
Karlsruhe Iron Sphere  
Wuerenlingen Iron Benchmark (PROTEUS)  
Neutron Leakage from Water Spheres (NIST)  
Streaming Through Ducts (IRI-TUB)  
Gamma-ray Production Cross Sections from Thermal Neutron Capture in 14 elements and SS  
Averaged Gamma-ray Production Cross Sections from Fast Neutron Capture in 14 ele. & SS  
JASPER Advanced Reactor Axial Shield Measurements  
JASPER Advanced Reactor Intermediate Heat Exchanger Measurements  
JASPER Advanced Reactor Radial Shield Measurements  
ORNL TSF Iron Broomstick  
ORNL TSF Oxygen Broomstick  
ORNL TSF Nitrogen Broomstick  
ORNL TSF Sodium Broomstick  
ORNL TSF Stainless Steel Broomstick  
ORNL Neutron Transport Through Iron and SS - Part I  
ORNL Neutron Transport in Thick Sodium  
Pool Critical Assembly-Pressure Vessel Facility Benchmark  
University of Illinois Iron Sphere (CF-252)  
University of Tokyo-YAYOI Iron Slab  
Radiation field parameters for pressure vessel monitoring in NRI LR-0 VVER-440 reactor  
Radiation field parameters for pressure vessel monitoring in NRI LR-0 VVER-1000 reactor  
Balakovo-3 VVER-1000 Ex-vessel Neutron Dosimetry Benchmark  
VENUS-3 LWR-PVS Benchmark  
H.B. Robinson-2 Pressure Vessel  
Photon Leakage Spectra from Al, Ti, Fe, Cu, Zr, Pb, U238 Spheres  
Photon Spectra from H<sub>2</sub>O, SiO<sub>2</sub> and NaCl  
IPPE Th shell with 14 MeV and Cf-252 source neutrons  
Baikal-1 Skyshine Benchmark Experiment  
NAÏADE 1 Graphite Benchmark (60cm)  
NAÏADE 1 Iron Benchmark (60cm)  
NAÏADE 1 Light Water Benchmark (60cm)  
SNL Polyethylene-Reflected Plutonium Metal Spheres: Subcritical Neutron and Gamma Measurements

<b>FUSION BENCHMARKS</b>	<b>ACCELERATORS</b>
<p>Osaka Nickel Sphere (OKTAVIAN)  Osaka Iron Sphere (OKTAVIAN)  Osaka Aluminium Sphere (OKTAVIAN)  Osaka Silicon Sphere (OKTAVIAN)  Osaka Tungsten Sphere (OKTAVIAN)  FNS Experimental data for fusion neutronics benchmark  FNS Clean Experiment on Graphite Cylindrical Assembly  FNS Liquid Oxygen  FNS Vanadium Cube  FNS Tungsten  FNS Skyshine  FNS Dogleg Duct Streaming  FNG-SS Shield (integral measurements)  FNG-ITER Blanket Bulk Shield (integral measurements)  FNG/TUD ITER Blanket Bulk Shield (spectra measurements)  FNG-ITER Neutron Streaming (integral measurements)  FNG-ITER Dose Rate Experiment  FNG Silicon Carbide (integral measurements)  FNG/TUD Silicon Carbide (spectra measurements)  FNG Tungsten (integral measurements)  FNG/TUD Tungsten (spectra measurements)  TUD Iron Slab Experiment  IPPE Vanadium Shells  IPPE Iron Shells  ORNL 14-MeV Neutron SS/Borated Poly Slab  University of Illinois Iron Sphere (D-T)  KANT Spherical Beryllium Shells  MEPhI empty slits streaming experiment  Juelich Li Metal Blanket Experiment</p>	<p>Transmission Through Shielding Materials of Neutrons and Photons  Generated by 52 MeV Protons  Transmission Through Shielding Materials of Neutrons and Photons  Generated by 65 MeV Protons  Transmission of Medium Energy Neutrons Through Concrete Shields  Neutron Production from Thick Targets of Carbon, Iron, Copper, and  Lead by 30- and 52-MeV Protons  TIARA 40 and 65 MeV Neutron Transmission Through Iron, Concrete  and Polyethylene  Radioactivity induced by GeV-Protons and Spallation Neutrons using  AGS accelerator  Intermediate and High-Energy Accelerator Shielding Benchmarks  ROESTI I, II and III (CERN)  CERF Bonner Sphere Spectrometer Response to Charged Hadrons  CERF Radionuclide Production  CERF Residual Dose Rates  CERF Neutron Energy Spectra behind Shielding of a 120 GeV/c  Hadron Beam Facility  CERN 200 and 400 GeV/c protons activation experiments  RIKEN Quasi-monoenergetic Neutron Field in 70-210 MeV Energy  Range  KENS p-500 MeV shielding experiment using 4m Concrete at KEK  HIMAC experiments with He, C, Ne, Ar, Fe, Xe and Si ions on C, Al,  Cu &amp; Pb targets  HIMAC High energy Neutron (&lt;800 MeV) Measurements in Iron  HIMAC High energy Neutron (&lt;800 MeV) Measurements in Concrete  BEVALAC Experiment with Nb Ions on Nb &amp; Al Targets  MSU experiment with He &amp; C ions on Al target  Neutron Spectra Generated by 590-MeV Protons on Thick Pb Target  ISIS Deep-Penetration Neutrons through Concrete and Iron Shields  using p-800 MeV  Simulation of the lineal energy distribution of the energy deposition in  biological cells, TEPC-FLUKA Comparison</p>