DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT

OVERVIEW

ADVANCED NEUTRON SOURCE (ANS)

Neutrons are extremely useful to study the structure and dynamics of materials, to produce certain isotopes, to understand radiation effects, and for other research. Because they are uncharged, neutrons can penetrate deeply into materials, and interact with the nuclei of atoms; thus, they afford a unique capability to study materials. From neutron scattering experiments, it is possible to obtain detailed information on a microscopic scale of the position of atoms in a material, and the manner in which these atoms move as the result of thermal excitations. Because the neutron possesses a magnetic moment, the location of atomic-scale magnetic moments can be obtained. The structural and magnetic information obtained by neutron experiments is essential to the understanding of materials and has been instrumental in the creation of new materials. Of particular importance is the impact made by neutron research on polymers and biological materials. The use of neutron scattering to investigate the microscopic characteristics and structures of polymers has increased exponentially in the past decade, and this trend continues at the present time. Neutrons, by virtue of their capability to determine accurately the position of hydrogen in macromolecular structures, provide unique methods to study the structure and function of, for example, receptor molecules in biological systems. These latter studies are, in turn, vital to the understanding of disease and human genetics. Neutrons are also needed to make transuranic and other isotopes which find important uses in such diverse areas as medical applications, aircraft radiography, residual stress analysis, the study of impurities and dopants in semiconductors, and the inspection of a variety of components of industrial equipment. Neutrons are also used for irradiation studies of materials for fusion and fission reactors, materials analysis, and nondestructive evaluation of materials.

Over the past two decades, a considerable erosion in the strength of the U.S. neutron capability has occurred relative to other industrialized countries. The two major U.S. high-flux reactors, the High Flux Beam Reactor at Brookhaven National Laboratory and the High Flux Isotope Reactor at Oak Ridge National Laboratory, were both constructed in the 1960's. The High Flux Beam Reactor was optimized for neutron scattering. The High Flux Isotope Reactor was optimized for isotope production; however, it also provides several scattering beamlines and facilities for materials irradiation. Both of these reactors will approach the end of their useful lifetimes in the next decade. Since the 1960's, no new high-flux beam research reactor has been constructed in the U.S. In Europe, the situation is different. Major reactor facilities were constructed in 1971 and 1980 in France, and in 1982 and 1991 in Germany.

The strategy for the development of new, advanced research reactor facilities, which serve a broad scientific community in the investigation of the structure of matter, resulted from an evaluation by the National Research Council's Major Materials Facilities Committee. In 1984, this Committee recommended an advanced steady-state neutron facility. This recommendation was reaffirmed in 1985 by the Energy Research Advisory Board; in 1987 by the National Research Council's Physics Review Panel, the Energy Research Advisory Board's Physics Review Panel, and the Basic Energy Sciences Advisory Committee; in 1989 by the National Research Council's Materials Science and Engineering Committee; and in 1990 again by the Basic Energy Sciences Advisory Committee. More recently, in 1993, the Basic Energy Sciences Advisory Committee's Panel on Neutron Sources provided the following recommendation:

"Recommendation 1: Complete the design and construction of the Advanced Neutron Source according to the schedule proposed by the project."

The Advanced Neutron Source is an experimental facility designed to meet the Nation's need for an intense steady-state source of neutrons, as described above. The facility will be based on a new research reactor that will have the most intense neutron beams in the world,

exceeding its closest competitor by a factor of 5 to 10. The Advanced Neutron Source would replace both the High Flux Beam Reactor and the High Flux Isotope Reactor, provide increased research capability, and provide increased assurance of worker and public safety. The Advanced Neutron Source is designed to meet the programmatic needs of the Department of Energy in condensed matter physics, chemistry, biological sciences, materials science, polymer science, isotope production, and materials irradiation. In addition, it will function as a national facility open to researchers from universities, national laboratories, and industry. Based on the experience in Europe, it is anticipated that the Advanced Neutron Source will serve over 1,000 researchers per year.

The Advanced Neutron Source is a Presidential investment initiative for the Department of Energy.

The FY 1995 request provides $12,300,000 for continued research and development of the Advanced Neutron Source, as well as $1,000,000 for capital equipment. Construction funding of $26,700,000 is requested to initiate Title I design.

The performance measure for the Advanced Neutron Source will be milestones completed against approved project baselines for cost, schedule and performance.

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative in whole dollars).

LEAD TABLE

Advanced Neutron Source

Activity	FY 1993 Estimate a/	FY 1994 Request	FY 1994 Adjustment	FY 1995 Request
Operating Expenses	$0	$17,000	$0	$12,300
Capital Equipment	0	0	0	1,000
Construction	0	0	0	26,700
Total	$0	$17,000	$0	$40,000
Summary				
Operating Expenses	0	17,000	0	12,300
Capital Equipment	0	0	0	1,000
Construction	0	0	0	26,700
Total Program	$0	$17,000	$0	$40,000
Staffing (FTE's)	(Included in Basic Energy Sciences Program Direction)			

Authorization: Section 209, P.L. 95-91, "Department of Energy Organization Act"

a/ ANS was budgeted as part of the Basic Energy Sciences program in FY 1993 ($21,419,000).

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(dollars in thousands)

SUMMARY OF CHANGES

Advanced Neutron Source

FY 1994 Appropriation	$ 17,000
Operating Expenses	- 4,700

Supports continuing research and development to provide the technical foundation for the Advanced Neutron Source, the development of an Environmental Impact Statement and safety and regulatory compliance.

Capital Equipment	+ 1,000

Provides funds for equipment associated with the natural circulation test facility, the safety test facility, vessel fracture tests, and circulation loop tests.

Construction	+ 26,700

Construction funds are being requested to initiate Title I design.

FY 1995 Congressional Budget Request	$ 40,000

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

ADVANCED NEUTRON SOURCE RESEARCH, DEVELOPMENT AND OPERATIONS

I. Preface: Advanced Neutron Source Research, Development and Operations

The Advanced Neutron Source research and development (R&D) program provides support for research and development to further the design and provide the technical foundation for the ANS and its technical systems. The program currently has a strong focus on the design, fabrication, and testing of the fuel elements for the reactor. Also included are corrosion testing and analyses of potential fuel elements, the neutronic and thermal hydraulic design of the reactor core, and reactor kinetics studies. Specific experiments will be carried out such as the irradiation of aluminum in the High Flux Isotope Reactor and the development of a materials data base for reactor system components. Continued modelling and testing of components and concepts for sources of cold (long wavelength) neutron beams will be undertaken. Efforts to refine designs and concepts for scientific instruments and beam guides will be continued. Shielding calculations, design of reactor protection systems and sensor development will be carried out. Various activities such as thermal hydraulics testing, materials certification, and blockage to support the safety analysis will also be carried out.

This budget supports essential research and development, the development of an environmental impact statement, activities necessary for reactor safety and regulatory compliance, a study of low-enriched uranium fuel options for the ANS, advanced conceptual design studies, and activities necessary to update the baseline documentation.

II. A. Summary Table: Advanced Neutron Source Research, Development and Operations

Program Activity	FY 1993 Enacted	FY 1994 Enacted	FY 1995 Request	% Change
Advanced Neutron Source Research, Development and Operations	$ 0	$ 17,000	$ 12,300	- 28
Total, Advanced Neutron Source Research, Development and Operations	$ 0	$ 17,000	$ 12,300	- 28

II. B. Major Laboratory and Facility Funding

OAK RIDGE NATIONAL LAB	$ 0	$ 14,792	$ 12,300	- 17
ARGONNE NATIONAL LAB (EAST)	$ 0	$ 960	$ 0	-100
BROOKHAVEN NATIONAL LAB	$ 0	$ 200	$ 0	-100

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1993	FY 1994	FY 1995
Advanced Neutron Source Research, Development and Operations	This activity was funded in the Basic Energy Sciences program.	The FY 1994 research and development (R&D) program will be a continuation of designs, tests, and modelling of ANS components to provide further results prior to ANS construction. Activities in FY 1994 will include fuel element R&D such as the irradiation of the second miniplate in the reflector region of the High Flux Isotope Reactor facility. Upper and lower fuel elements without uranium in fuel plates will be fabricated for use in core flow tests. Dynamic tests of some reactor core elements, the control rods, and the reflector shutdown rods will be carried out. A study will be undertaken to examine the impact on the ANS performance goals if low or medium-enriched fuel is used rather than the highly enriched fuel used for the design. The study will build on existing information using currently developed fuels and focus on low (20%) and medium (35%) enriched fuel. Continue work on Environmental Impact Statement.	Continue research and development leading to the construction of the Advanced Neutron Source. Complete corrosion tests under irradiation conditions at the High Flux Isotope Reactor. Fabricate dummy prototype core for flow tests. Begin operation of a natural circulation core facility. Continue effort on preliminary safety analysis report, Phase 2 of the Level 1 Probabilistic Risk Assessment and Phase 1 of the Level 2 Probabilistic Risk Assessment. Continue work on safety analysis report. Continue work on Environmental Impact Statement. Continue work on the fabrication of fuel elements for use in ANS critical experiments. Cold source tests will be performed. The current ANS design is based on a core fueled with highly enriched (93%) uranium fuel. Modification of the core design to incorporate low enriched uranium fuel will be considered based on: the results of the FY 1994 study on the feasibility of fueling with medium or low enriched uranium; and the cost effectiveness of such a modification. If fueling the reactor with existing low enriched uranium fuel would result in an unacceptable degradation of performance, the DOE will consider initiating a research program to attempt to develop a low enriched uranium fuel option that would meet necessary performance standards. It is recognized that changing the current design could result in an increase to the total project cost. The cost to develop a new fuel has not been incorporated into the current estimate.

III. Advanced Neutron Source Research, Development and Operations (Cont'd):

Program Activity	FY 1993	FY 1994	FY 1995
Advanced Neutron Source Research, Development and Operations (Cont'd)	EPACT:	EPACT:	EPACT:
	EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis":	EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis":	EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis":
	This activity was funded in the Basic Energy Sciences program in FY 1993.	Provides funds to further develop the design and provide the technical foundation for the Advanced Neutron Source.	Provides funds to further develop the design and provide the technical foundation for the Advanced Neutron Source.
	This activity was funded in the Basic Energy Sciences program.	Funding in the amount of $251,000 has been budgeted for the SBIR program.	Funding in the amount of $246,000 has been budgeted for the SBIR program.
	$ 0	$ 17,000	$ 12,300
Advanced Neutron Source Research, Development and Operations	**$ 0**	**$ 17,000**	**$ 12,300**

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

CAPITAL EQUIPMENT

I. Preface: Capital Equipment

The ANS has specific capital equipment requirements in support of the research and development efforts on the many technical system components and for the engineering design of scientific instruments and systems which will exploit the neutron beams. Included are equipment to support control rod element testing and evaluation, the design and cold source component and loop tests, natural circulation test, transient low flow testing, and reactor component tests.

II. A. Summary Table: Capital Equipment

Program Activity	FY 1993 Enacted	FY 1994 Enacted	FY 1995 Request	% Change
Capital Equipment.....	$ 0	$ 0	$ 1,000	>999
Total, Capital Equipment	$ 0	$ 0	$ 1,000	>999

II. B. Major Laboratory and Facility Funding

OAK RIDGE NATIONAL LAB	$ 0	$ 0	$ 1,000	>999

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1993	FY 1994	FY 1995
Capital Equipment	This activity was funded in the Basic Energy Sciences program.	No activity.	Funds are for equipment associated with the natural circulation test facility, the safety test facility, vessel fracture tests, and circulation loop tests. Other equipment supports the research and development on components and engineering design of instruments and systems of the Advanced Neutron Source.
	EPACT:	EPACT:	EPACT:
	EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis":	No activity.	EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis":
	This activity was funded in the Basic Energy Sciences program in FY 1993.		Provides funds to equipment needs associated with the design of the Advanced Neutron Source. ($1,000)
	$ 0	$ 0	$ 1,000
Capital Equipment	$ 0	$ 0	$ 1,000

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(dollars in thousands)

KEY ACTIVITY SUMMARY

CONSTRUCTION

I. Preface: Construction

The Advanced Neutron Source will be designed and constructed to meet national experimental needs for an intense, steady-state source of neutrons. The Advanced Neutron Source research complex will be built around a new reactor with a fission power of approximately 330 megawatts.

The core is comprised of two right circular cylindrical elements which are coaxially aligned, separated on the vertical axis, and offset in radius such that unheated coolant enters each element. The core volume is approximately 67 liters. The core is positioned in a replaceable core pressure boundary tube which constitutes a section of the primary coolant loop piping. Surrounding the core pressure boundary tube is a reflector tank of heavy water, approximately 3 meters in diameter, which serves as a neutron reflector and moderator for the reactor and experimental systems. Materials irradiation and transuranic production targets are located inside the core pressure boundary tube near the core while beam tubes and other irradiation facilities are located in the reflector tank. For further moderation of neutrons to very low energies, the reflector tank will also contain two "cold sources." Each cold source is a helium-cooled cryostat containing a liquid deuterium moderator and serves as a source of cold neutrons.

There are four major buildings planned for the Advanced Neutron Source complex. The central structure is an approximately 60-meter-diameter cylindrical, domed reactor containment building. This building houses the reactor itself, with the first floor dedicated to beam and irradiation experiments, the second floor divided between experimental facilities and reactor operations, and a high bay floor dedicated to reactor operations. Adjacent to the reactor building is a reactor support building. This structure houses other large reactor equipment and the general support equipment which need not be located in the reactor building. Also connected to the reactor building is the guide hall. This structure, outside of the reactor containment, is dedicated to beam experiments and will be equipped with an initial complement of advanced instruments for neutron scattering. The fourth building in the complex is an office building, serving both the extensive user community and the reactor operations staff. A number of state-of-the-art experimental systems will be provided to make use of the intense neutron beams from the Advanced Neutron Source. These would include beam transport systems, monochrometers, sample chambers, detectors, and the necessary electronics.

II. A. Summary Table: Construction

Program Activity	FY 1993 Enacted	FY 1994 Enacted	FY 1995 Request	% Change
Construction	$ 0	$ 0	$ 26,700	>999
Total, Construction	$ 0	$ 0	$ 26,700	>999

II. B. Major Laboratory and Facility Funding

OAK RIDGE NATIONAL LAB	$ 0	$ 0	$ 26,700	>999

III. Activity Descriptions: (New BA in thousands of dollars)

Program Activity	FY 1993	FY 1994	FY 1995
Construction	No activity.	No activity.	Provides necessary funds to begin Title I design of the Advanced Neutron Source.
	INVESTMENT/EPACT: EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis": No activity.	No activity.	INVESTMENT/EPACT: EPACT Section 2203(a)(2)(d) "Supporting Research and Technical Analysis": Provides funds to begin Title I design of the Advanced Neutron Source ($26,700).
	$ 0	$ 0	$ 26,700
Construction	$ 0	$ 0	$ 26,700

ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative dollars in whole dollars.)

IV. A. Construction Project Summary

Project No.	Project Title	Previous Obligations	FY 1993 Adjusted	FY 1994 Request	FY 1995 Request	Unappropriated Balance	TEC
94-E-308	Advanced Neutron Source	$ 0	$ 0	$ 0	$ 26,700	$ 2,191,973	$ 2,218,673
Total, Advanced Neutron Source		$ 0	$ 0	$ 0	$ 26,700	$ 2,191,973	$ 2,218,673

IV. B. Construction Funded Project Descriptive Summary

1. Project Title and Location: Project 94-E-308 Advanced Neutron Source
Oak Ridge National Laboratory
Oak Ridge, Tennessee

TEC: $2,218,673
TPC: $2,883,263

Start Date: 3rd Qtr. FY 1997 Completion Date: 4th Qtr. FY 2003

2. Financial Schedule (Federal Funds):

Fiscal Year	Appropriated	Obligations	Costs
1995	$ 26,700	$ 26,700	$ 26,700
1996	97,000	97,000	82,950
1997	202,060	202,060	146,707
1998	358,700	358,700	287,965
1999	512,790	512,790	482,820
2000	515,540	515,540	556,055
2001	338,030	338,030	402,614
2002	145,400	145,400	201,687
2003	22,453	22,453	31,175

3. Narrative: The Advanced Neutron Source will be a new reactor facility planned to meet national experimental needs for an intense, steady-state source of neutrons. It will be open for use by scientists from universities, industry, and other Federal laboratories. The Advanced Neutron Source research complex will be built around a new reactor with a fission power of approximately 330 megawatts.

There are five major buildings for the Advanced Neutron Source complex. The central structure is an approximately 60-meter-diameter cylindrical, domed reactor containment building. This building houses the reactor itself, with lower floors dedicated to beam and irradiation experiments and a high bay floor dedicated to reactor operations. The second floor is divided between experimental facilities and reactor operations. Adjacent to the reactor building is a reactor support building. This structure houses other large reactor equipment and the general support equipment which need not be located in the reactor building. Also connected to the reactor containment building is the guide hall. This structure, outside of reactor containment, is dedicated to cold neutron beam experiment use. The fourth building in the complex is an office building, serving both the extensive user community and the reactor operations staff. The fifth building is dedicated to operations support functions with other ancillary structures associated with facility operations located in proximity to the basic five building complex. A number of state-of-the-art experimental systems will be provided to make use of the intense neutron beams from the Advanced Neutron Source. These would include beam transport systems, monochrometers, sample chambers, detectors, and the necessary electronics.

4. Total Project Funding (BA):

	Prior Years	FY 1993	FY 1994	FY 1995 Request	To Complete
Construction	$ 0	$ 0	$ 0	$26,700	$2,191,973
Capital Equipment	4,500	860	0	1,000	25,266
Operating Expenses	60,376	20,559	17,000	12,300	522,729

DEPARTMENT OF ENERGY
FY 1995 CONGRESSIONAL BUDGET REQUEST
(Changes from FY 1994 Congressional Budget Request are denoted with a vertical line in left margin.)

ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Advanced Neutron Source

1. Title and Location of Project:	Advanced Neutron Source Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

SIGNIFICANT CHANGES

- TEC increased from $2,139,329,000 to $2,218,673,000 primarily because of a one year delay in the project's start date and the application of full overhead burdened rates as directed by the DOE Chief Financial Officer for FY 1995 construction projects. Other cost changes have also been incorporated to reflect the results of value engineering studies, responses to review committee recommendations on thermal-hydraulics and reactor safety topics, incorporation of modifications arising from inputs from the positron users community, and updated escalation factors.

- TPC increased from $2,748,900,000 to $2,883,263 primarily because of a one year delay in the project's start date, the application of full overhead burdened rates as directed by the DOE Chief Financial Officer for FY 1995 construction projects, and reevaluation of the R&D program to reflect incorporation of review committee recommendations on thermal-hydraulics and reactor safety topics. The basic change within the TPC is a redistribution of "Other Project Costs." That redistribution reflects the modified costs and schedule estimates associated primarily with R&D tasks, especially those associated with reactor safety topics.

DEPARTMENT OF ENERGY
FY 1995 INTERNAL REVIEW BUDGET

ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

Advanced Neutron Source 1/

1. Title and Location of Project: Advanced Neutron Source (ANS)
Oak Ridge National Laboratory (ORNL)
Oak Ridge, Tennessee

2a. Project No. 94-E-308
2b. Construction Funded

3a. Date A-E Work Initiated, (Title I Design Start Scheduled): 1st Qtr. FY 1995

3b. A-E Work (Title I, II, III) Duration: 104 months

5. Previous Cost Estimate:
Total Estimated Cost (TEC) -- $2,139,329
Total Project Cost (TPC) -- $2,748,900

4a. Date Physical Construction Starts: 3rd Qtr. FY 1997

4b. Date Construction Ends. 4th Qtr. FY 2003

6. Current Cost Estimates:
TEC: $2,218,673
TPC: $2,883,263

7. Financial Schedule (Federal Funds):

Fiscal Year	Appropriations	Obligations	Costs
1995	26,700	26,700	26,700
1996	97,000	97,000	82,950
1997	202,060	202,060	146,707
1998	358,700	358,700	287,965
1999	512,790	512,790	482,820
2000	515,540	515,540	556,055
2001	338,030	338,030	402,614
2002	145,400	145,400	201,687
2003	22,453	22,453	31,175

1/ The Office of Energy Research is the sponsoring (funding) office while the Office of Nuclear Energy will be responsible for project management and execution.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

8. Brief Physical Description of Project

The Advanced Neutron Source (ANS) is a new experimental facility planned to meet the national need for an intense, steady-state source of neutrons. It will be open to use by scientists from universities, from industry, and from other federal laboratories. The ANS will be equipped with an initial complement of advanced instruments for neutron scattering and nuclear physics research, with isotope production facilities, and ~~materials irradiation~~ with facilities for the study of materials in high radiation fields.

The facility will be built around a new research reactor of unprecedented flux [2/] that will have the most intense beams of steady-state neutrons in the world--a minimum of five to ten times higher than the current world leader at the Institute Laue-Langevin (ILL) in Grenoble, France. Combining the higher source flux with ~~and~~ improved experimental instruments ~~and detectors~~ will create a useful neutron flux that is at least ten times and, for certain experiments, more than one hundred times, higher than is now available in the United States. ~~When fully instrumented~~ There will be three times as many scattering instruments as there are at either of the present high-flux reactors so that the scientific output can be much more than 10 times greater than that at the High Flux Isotope Reactor (HFIR) at Oak Ridge and the High Flux Beam Reactor (HFBR) at Brookhaven together. The potential also exists for the development of entirely new lines of scientific research based on the advanced capabilities that will be available in the ANS facilities.

In addition to meeting the DOE programmatic needs, this will be a national facility with an open user policy attractive to scientists from universities, other national laboratories, and industry. It is anticipated that the ANS would be used by approximately 1000 different individuals each year for neutron scattering experiments in solid state physics, chemistry, metallurgy, ceramics, polymers, colloids, biology, and nuclear physics. In addition, a wide community of isotope and materials irradiation users will also be supported both on-site and throughout the world.

The primary objectives in the design of the site and buildings for the ANS are to provide a protective containment structure for the reactor, to provide the optimal ~~instruments~~ facilities for utilization of neutron beams and irradiation facilities ~~studies~~, and to address the mix of needs associated with the user community, the operations staff, security, contamination control, noise, etc.

[2/] The conceptual design reactor core is based on high enriched (93%) uranium fuel.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

8. Brief Physical Description of Project (Continued)

The objectives stated above are being met with a ~~four~~ five major building concept. The central structure is an approximately 60 m (200 ft.) diameter cylindrical, domed, reactor containment building. This building houses the reactor itself, with lower floors dedicated to beam and irradiation experiments, and a high bay floor dedicated to reactor operations. The entire primary cooling circuits are located in cell banks in reactor containment. Adjacent to the containment building is a reactor support building. This structure houses other large reactor and general support equipment which need not be located in containment.

Also connected to the reactor containment building ~~dome~~ is the guide hall. This structure, outside of reactor containment, is dedicated to cold neutron beam experiment use. The fourth building in this complex is an office building, serving both the extensive user community and the permanent staff. The fifth building is dedicated to operations support functions with other ancillary structures associated with facility operations ~~will be~~ located in proximity to the basic ~~four~~ five building complex.

9. Purpose, Justification of Need for, and Scope of Project

All studies of U. S. facilities used for conducting research in neutron scattering and other fields of materials science have shown the facilities do not have state-of-the-art capabilities. The most significant studies supporting this finding were the Seitz/Eastman committee of the National Academy on Major Materials Facilities (1984) and the DOE Energy Research Advisory Board (1985). Both recommended an immediate start on development and design work for a new advanced steady state neutron source. More recently (1993) the Basic Energy Sciences Advisory Commission (BESAC) Panel on Neutron Sources concluded the ANS was the Panel's highest priority for rapid construction.

The purpose of the ANS project is to provide a research reactor with unsurpassed facilities ~~capability~~ for scientific experiments. The ANS will provide for very greatly enhanced neutron scattering research in condensed matter physics, chemistry, biology, materials science, and polymer science. It will also replace and enhance the High Flux Isotope Reactor's capabilities for production of transuranium elements, for irradiation test facilities and abundant fast neutrons required for fusion reactor materials research and development.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

9. Purpose, Justification of Need for, and Scope of Project (Continued)

If the proposed facilities are ~~ANS is~~ not supported, the United States will not have facilities capable of performing state-of-the-art research and will fall further behind the Europeans, whose existing reactors are superior to those in the U.S. Further, existing major U.S. reactors (HFIR, HBFR) are expected to be retired in the next decade. The specific impact for not supporting this request is an increase in the likelihood that the U.S. will be without any of these research capabilities and will not be able to preserve a minimum level of U.S. competitiveness in the areas based on this important area of research.

The scope of this project is defined by the requirements for neutron flux and ~~materials~~ irradiation facilities consistent with the recommendations contained in the studies mentioned earlier. This requires the design and construction of a new research reactor and supporting experimental facilities to meet the defined national need for an intense, steady-state source of neutrons.

10. Details of Cost Estimate a/

	Item Cost	Total Cost
a. Design and Management Costs		$ 524,988
1. Engineering, design, and inspection at approximately 20% of items c through f below (Design, Drawings, and Specifications $200,878)	$ 254,339	
2. Construction management at approximately 5% of item c through f below)	62,665	
3. Project management at approximately 9% of items c through f below	112,142	
4. Regulatory Compliance	95,842	
b. Land and land rights		0
c. Construction costs		1,153,077
1. Improvements to land	25,737	
2. Building costs	32,405	
3. Other structures	10,265	
4. Special facilities	1,062,931	
5. Outside utilities	21,739	

a/ The conceptual design report was issued June 1992 and updated in April 1993, Title I design begin October 1994.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

10. Details of Cost Estimate (continued)

	Item Cost	Total Cost
d. Standard equipment		15,448
e. Major computer items		79,217
f. Removal cost less salvage		0
g. Design and project liaison, testing, checkout and acceptance		51,277
Subtotal		1,824,007
h. Contingency at approximately 21.6% of above costs		394,666
i. Total line item cost (Section 12.a.1.(a))		2,218,673
j. Non-Federal Contribution		0
Net Federal total estimated costs (TEC)		$2,218,673

11. Method of Performance

~~The ORNL Management and Operating contractor will subcontract for the services of a Prime Contractor, teamed with an Architect-Engineer for the balance of plant, a Reactor Manufacturer for reactor systems, and a Construction Manager.~~ The ORNL Management and Operating Contractor will provide overall project management, design and procurement of the experiment systems, and will subcontract to the commercial nuclear industry for the services of an Industry Team for design and management integration. The Industry Team will be led by a Prime Contractor teamed with an Architect-Engineer for the balance-of-plant design, a Reactor Manufacturer for reactor systems design, and a Construction Manager for construction, installation, equipment procurement, test and preoperational support. To the extent feasible, construction and procurement will be accomplished by fixed-priced subcontracts awarded on the basis of competitive bidding.

1. Title and Location of Project: Advanced Neutron Source (ANS)
Oak Ridge National Laboratory (ORNL)
Oak Ridge, Tennessee

2a. Project No. 94-E-308
2b. Construction Funded

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
a. Total project funding											
1. Total facility costs											
(a) Line item (Sec. 10).....	0	26,369	82,356	145,843	286,762	481,176	554,101	400,714	200,226	30,308	2,207,855
(b) Expense funded equipment											
(c) Inventories.....							a/				
(d) DOE site office support subcontractors.....	0	331	594	864	1,203	1,644	1,954	1,900	1,461	867	10,818
Total direct cost.....	0	26,700	82,950	146,707	287,965	482,820	556,055	402,614	201,687	31,175	2,218,673
2. Other project costs											
(a) R&D necessary to complete construction.....	43,816	9,869	44,482	40,781	31,884	19,640	7,116	6,020	5,211	5,731	214,550
(b) Conceptual design costs.....	51,881										51,881
(c) Site characterization....	790										790
(d) NEPA documentation.....	1,304	2,365	825								4,494
(e) Other project related costs.....	49	32	1,809	8,121	17,796	19,194	47,576	56,829	89,009	120,323	360,738
(f) DOE site office support subcontracts.....	95	34	52	43	45	48	53	56	59	26	511
(g) Capital equipment not related to construction.	5,360	1,000	4,611	5,397	5,939	3,732	1,863	1,244	1,240	1,240	31,626
Total other project Costs.....	103,295	13,300	51,779	54,342	55,664	42,614	56,608	64,149	95,519	127,320	664,590
Total project cost (TPC).....	103,295	40,000	134,729	201,049	343,629	525,434	612,663	466,763	297,206	158,495	2,883,263

a/ Value of Heavy Water (D_2O) (assumed to be supplied in this year from existing government stocks) not included.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

12. Funding Schedule of Project Funding and Other Related Funding Requirements (Continued)

b. Related annual funding (Estimated Life: 40 Years) a/	TOTAL
1. Facility operating costs	$ 89,490
2. Programmatic operating expenses directly related to the facility	39,272
3. Capital equipment not related to construction but related to the programmatic effort in the facility	901
4. GPP or other construction related to the programmatic effort in the facility	0
5. Utility costs	22,785
6. Accelerator reactor improvement modifications (ARIM)	2,680
7. Other costs	0
Total related annual funding	$155,128 b/

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

1. Total facility costs

(a) Line item

The estimated costs for this data sheet are for providing Title I and II design, inspection and construction of the ANS facility.

a/ Estimated costs in thousands escalated to 2004-year dollars.
b/ These costs will be offset by savings from closing down HFIR and HFBR. The annual operating costs of these facilities escalated to 2004 dollars is $74,675,000.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (Continued)

(b) Expense funded equipment

No narrative required.

(c) Inventories

No narrative required.

2. Other Project Costs

(a) R&D necessary to complete construction

A research and development program is needed to confirm several design bases related primarily to the reactor core performance and safety analysis, system control concepts, cold source designs, and neutron guides, beam tubes, and instruments. Several of these development tasks require long time durations to resolve detailed life cycle characteristics and the timely coupling of development results into the design is a major factor in detailed task planning. A detailed R&D plan has been prepared which defines each specific task and the interface requirements and timing relationships to the ANS project.

(b) Conceptual design costs

Costs are included for preparation of the conceptual design documentation and for ~~one~~ two years of advanced conceptual design prior to the start of Title I design in FY ~~1994~~ 1995.

(c) Site Characterization

Preliminary characterization of the reference ANS site on the Oak Ridge Reservation was started in FY 1990 and continued into FY 1994.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (Continued)

(d) NEPA Documentation Costs

Costs shown include preparation of a Phase I Environmental Report and the work required on the Environmental Impact Statement.

(e) Other project related costs

Costs in this category include one-third of the full complement of instruments which are not included in the line item, safety program and management support for the R&D program (item (a) above) and for buildup of the operations staff participation in the design, construction, and test and checkout phases of the project.

(f) DOE site office support

Subcontractor support costs for the DOE-Oak Ridge project office are included in this item.

(g) Capital equipment not related to construction but related to the programmatic effort in the facility

Estimated costs are to provide test facilities for use in development of cold sources, evaluation of core flow blockage, natural convection cooling and flow induced vibration of components. In addition, equipment and facilities supporting structural testing of the fuel elements as well as reactor control components evaluation and major equipment items evaluation is required.

b. Related annual funding:

1. Facility operating costs

The annual facility operating costs expressed in FY ~~2003~~ 2004 dollars include all operations, Quality Assurance and support staff ~~and the annual utility costs~~.

1. Title and Location of Project:	Advanced Neutron Source (ANS) Oak Ridge National Laboratory (ORNL) Oak Ridge, Tennessee	2a. Project No. 94-E-308 2b. Construction Funded

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (Continued)

2. Programmatic operating expenses directly related to the facility

   The costs included in this category are those related to support for the users of the ANS facility.

3. Capital equipment not related to construction but related to the programmatic effort in the facility.

   Costs included are intended to reflect probable replacement parts for capital equipment ~~with moving parts~~.

4. GPP or other construction related to the programmatic effort in the facility

   No narrative required.

5. Utility costs

   Costs shown cover all estimated utility requirements for the facility.

6. Other costs

   No narrative required.