2

MASTER

Work Performed Under Contract DE-AC09-79 ET 47921

ALLIED-GENERAL NUCLEAR SERVICES
P.O. BOX 847
BARNWELL, SC 29812

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Printed in the United States of America
Available from
National Technical Information Service, U. S. Department of Commerce
5825 Port Royal Road, Springfield, Virginia 22151

Price: Printed Copy \$ 4.00 ; Microfiche \$3.00

AGNS
Allied-General Nuclear Services

DISCLAIMER

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

AGNS-47921-TPR-4

Distribution
Category UC-85

AFR SPENT FUEL STORAGE PROGRAM

TECHNICAL PROGRESS REPORT

April 1980 - June 1980

July 25, 1980

ALLIED-GENERAL NUCLEAR SERVICES
POST OFFICE BOX 847
BARNWELL, SOUTH CAROLINA 29812

PREPARED FOR THE
DEPARTMENT OF ENERGY
WASTE AND FUEL CYCLE TECHNOLOGY OFFICE
UNDER CONTRACT DE-AC09-79ET47921

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

fy

ABSTRACT

AFR SPENT FUEL STORAGE PROGRAM

Work on this project is focused on developing design and licensing information for the model facility. The three major subcontracts for soils and structural design, rack design, and the security system design are progressing satisfactorily. Design modification work at AGNS is near completion.

Licensing documentation is approximately 50% complete and progressing at a satisfactory pace to meet scheduled projections.

FOREWORD

This Quarterly Report describes the technical status of work performed by Allied-General Nuclear Services (AGNS) in providing design and licensing information preparatory to conversion of a nuclear fuel reprocessing plant's fuel receiving and storage facility to an away-from-reactor (AFR) spent fuel storage facility using the Barnwell Nuclear Fuel Plant as a model.

TABLE OF CONTENTS

	<u>Page No.</u>
ABSTRACT	
FOREWORD	
TASK OBJECTIVES	1
SUB-TASK 1.1 - FACILITY MODIFICATIONS	1
Principal Areas of Investigation	1
Status Summary	1
Technical Progress	1
Implementation Concepts	1
Progress to Date	2
Sub-Task 1.1.1 - Modifications to Model Facility	2
Sub-Task 1.1.2 - Subsystem Designs within FRSS	2
Sub-Task 1.1.3 - FRSS Structure Modifications	2
SUB-TASK 1.2 - HIGH-DENSITY FUEL STORAGE RACKS	2
Principal Areas of Investigation	2
Status Summary	2
Technical Progress	3
Implementation Concepts	3
Progress to Date	3
SUB-TASK 1.3 - SECURITY SYSTEM	5
Principal Areas of Investigation	5
Status Summary	5
Technical Progress	5
Implementation Concepts	5
Progress to Date	5
SUB-TASK 1.4 - LICENSING DOCUMENTATION	6
Principal Areas of Investigation	6
Status Summary	6
Technical Progress	6
Implementation Concepts	6
Progress to Date	6

TECHNICAL PROGRESS REPORT
April 1980 - June 1980

TASK OBJECTIVES

The contractor shall furnish design and licensing information preparatory to conversion of a nuclear fuel reprocessing plant's fuel receiving and storage facility to an away-from-reactor (AFR) spent fuel storage facility using the Barnwell Nuclear Fuel Plant as a model.

SUB-TASK 1.1 - FACILITY MODIFICATIONS

Principal Areas of Investigation

Preparation of a design package for fuel receiving modifications to the model facility.

Status Summary

The major effort this report period was directed at preparing engineering designs for the various facility modifications. A total of 35 designs have been completed and 17 are in progress. The structural modification and seismic study with Bechtel are 90% complete. Work should be completed at Bechtel by August 15, 1980.

Technical Progress

Implementation Concepts

- Provide detail design packages for modifications to the existing FRSS Facility which are required to adapt the model facility to an AFR mode and/or improve the operation of the existing facility.
- Engineering studies and designs will be developed for the building extension structure, crane extension, transfer canal connections, and soils studies required for proposed expansion pools.
- Other major design jobs will involve the crane systems, cask working platform, leaker can handling system, HVAC, pool water, and waste handling systems.
- A report will be provided summarizing the jobs included, documents developed, estimated cost, construction approach, major procurement required, and the schedule for material delivery and installation.

Progress to Date

Sub-Task 1.1.1 - Modifications to Model Facility

- Seventeen items in this portion of the modifications have been designed.
- Eight cost estimates, procurement and construction packages are completed.
- Design is proceeding on seven other items.

Sub-Task 1.1.2 - Subsystem Designs within FRSS

- Eighteen items in this portion of the modifications have been designed.
- Five cost estimates, procurement and construction packages are completed.
- Design is proceeding on ten other items.

Sub-Task 1.1.3 - FRSS Structure Modifications

- Bechtel has completed 90% of the seismic analysis work.
- Law Engineering has completed three test hole borings at the plant site.
- Preliminary canal extension drawings were received and reviewed.
- A review meeting is planned at Bechtel's office the week of July 28, 1980.

SUB-TASK 1.2 - HIGH-DENSITY FUEL STORAGE RACKS

Principal Areas of Investigation

Preparation of a design package for high-density fuel storage rack configuration for the model storage facility.

Status Summary

The work performed during this quarter included:

- Completed layout drawings of fuel storage areas (fuel storage pool, cask unloading pool No. 2, fuel transfer pool) to determine rack locations and floor mounting arrangements.
- Continuing design and development of movable racks for PWR and BWR fuel.

- Conceptual design of movable rack floor mounting technique and design completed.
- Poison material for spent fuel racks evaluated and material selected.
- Rack nuclear criticality studies initiated. PWR and BWR fuel nuclear and geometry bases established.
- Design and analysis of movable racks for handling accidents completed.
- Continued discussions and preliminary evaluations between NES and AGNS of movable PWR racks to accommodate disassembled/canned fuel and possibly double-tiering in deep pool areas. A proposal to continue development studies in this area was submitted to DOE.
- Preliminary structural evaluations performed to examine seismic loadings on movable rack and mounting structure.

Technical Progress

Implementation Concepts

- Prepare a specification package for high-density storage racks.
- Evaluate vendor-provided data on specific high-density storage rack designs and configurations.
- Develop engineering data on high-density storage racks suitable for Nuclear Regulatory Commission (NRC) licensing actions.
- Identify, develop, and report on a design for existing pool modifications required to accommodate high-density racks using currently licensed technology.
- Develop a planning schedule for high-density storage rack utilization.
- Submit final report to the Savannah River Spent Fuel Project Office.

Progress to Date

- (1) Conceptual designs of the movable BWR and PWR spent fuel racks and mounting structure were prepared. These racks have an identical outer envelope and are interchangeable on the floor-mounting structure. The PWR rack is sized to contain nine assemblies on a square (34-inch) array. In like manner, the BWR rack will accommodate 25 assemblies.

The movable racks are mounted on a box-beam structure positioned on the pool floor. The mounting structure, based on a four-sector symmetry of the pool floor, utilizes the stub location of the "old"

suspended canister concept previously utilized for the fuel pool. An additional 14 to 16 mounting anchor locations will be required to lower the floor mounting/rack load to acceptable limits. The box-beam structure can be prefabricated in eight sectors and mounted in the pool when required.

The movable racks are transported from the cask unloading pool using the canister crane and a redesigned yoke/cap arrangement. Floor attachments will be remote and interlocked with the crane controls for a fail-safe handling operation. The rack/floor mounting latch device is external to the rectangular cross section of the rack to permit visibility during latching operations. The design of the handling tools is currently in progress.

- (2) An evaluation was made of a number of possible neutron poison materials. The material selected was Boral which has the following advantages:

- (a) Greatest operational experience -- 20⁺ years in a pool environment
- (b) Good radiation stability
- (c) Excellent structural strength after high radiation levels.

Disadvantages include higher first cost of the fabricated material and possible material problems. Work is continuing in evaluating the latter area. These material considerations are currently being examined as the design evolves.

- (3) The movable racks utilize a heavy outer stainless steel casing and "tension" straps to accommodate possible handling accidents. The outer stainless steel wall also serves to augment the neutron poison material. The rack has been examined for a 32-foot drop accident in the cask unloading pool and rack-to-rack, or rack-to-pool wall collisions. It can successfully accommodate these situations. In the rack drop condition, the interaction of the loading on the exterior wall and the resultant strain on the tension strap precludes any major loading to the fuel or storage cell structure.
- (4) Nuclear criticality studies, currently being initiated, are based on utilizing generalized "worst" case parameters. This approach will conservatively assure that a variety of fuel geometries, materials, etc., can be accommodated without specific revisions to the operating license.
- (5) Conceptual studies have been performed which examine the use of the PWR movable rack for handling canistered and disassembled fuel (both PWR and BWR). The "broad-based" use of this modified rack design is promulgated on increasing the cross-sectional dimension of the fuel slot from 9 inches to about 9.5 to 9.65 inches. The

design could be universally utilized in all pool areas of the FRSS if suitable mounting structures were developed. The rack can accommodate both leaked fuel and disassembled fuel. DOE is currently evaluating an AGNS proposal to perform further detailed studies on this rack and the resulting pool loadings.

SUB-TASK 1.3 - SECURITY SYSTEM

Principal Areas of Investigation

Preparation of a security system design package for a model AFR Facility.

Status Summary

The major effort this period has been directed at the preparation of the final system design and the three plans required for license submittal. Work is nearing completion in all areas.

Technical Progress

Implementation Concepts

- Identify governmental regulations applicable to security system requirements for AFR spent fuel storage.
- Develop design criteria for an AFR security system that conforms to the governmental regulations identified above.
- Prepare a design of an AFR security system that meets the design criteria specified above.
- Provide a report covering preliminary plans and programs for safeguards contingency, site security, and security personnel training. These items are presently required for licensing action by NRC.

Progress to Date

The final system design has been received from IEAL and is under final review by AGNS.

The safeguards contingency plan has been completed by IEAL and is being prepared for final review by AGNS.

The preliminary training and qualification plan has been reviewed by AGNS and is now being revised by IEAL.

The physical protection plan is nearing completion and remains on schedule.

SUB-TASK 1.4 - LICENSING DOCUMENTATION

Principal Areas of Investigation

Preparation of licensing-related documents required by the NRC for a spent fuel storage application.

Status Summary

Approximately 50% of the ASAR and 50% of the ER have been drafted.

Technical Progress

Implementation Concepts

- Prepare and refine basic licensing-related documentation required by NRC for an AFR Spent Fuel Storage Facility. Five major subsystems will be evaluated:
 - (a) Application for Licensing
 - (b) Technical Description
 - (c) Environmental Report
 - (d) Emergency Plan
 - (e) Decommissioning Plan.
- Provide a report incorporating all of the above documents to the Savannah River Spent Fuel Project Office.

Progress to Date

Approximately 50% of the Environmental Report has been drafted.

Approximately 50% of the ASAR has been drafted.

Off-site accident doses have been calculated. The maximum whole body dose is approximately 2 mrem.

The maximum annual whole body dose from normal operations was calculated to be approximately 0.04 mrem.

DISTRIBUTION LIST FOR AFR TECHNICAL PROGRESS REPORT

REPORT NO. AGNS-47921-TPR-4

AGNS Internal Distribution:

R. T. Anderson (1)
J. A. Buckham (1)
K. J. Bambas (1)
R. J. Cholister (1)
M. Hawkins (1)
R. B. Holden (1)
E. P. Maddux (1)
E. L. Musselwhite (1)
R. C. Ravasz (1)
J. C. Smith (1)
G. T. Stribling (1)
G. Wiedemann (1)
A. K. Williams (1)
Records Management (1)

DOE Distribution:

Mr. J. W. Geiger, Project Engineer (2)
Waste and Fuel Cycle Technology Office
DOE Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29801

Dr. L. H. Meyer (2)
Savannah River Plant
E. I. du Pont de Nemours and Company
Aiken, South Carolina 29801

Mr. S. W. O'Rear, TIC (2)
Savannah River Laboratory
E. I. du Pont de Nemours and Company
Aiken, South Carolina 29801

Mr. A. F. Westerdahl (1)
Patent Counsel
DOE Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29801

Contracting Officer (1)
DOE Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29801
Attention: R. D. Simpson

Mr. J. M. Bauer, Jr. (1)
Classification Officer
DOE Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29801

Mrs. M. P. McGahee (5)
AFR-SFS Information Services
Savannah River Plant
E. I. du Pont de Nemours and Company
Aiken, South Carolina 29801

TIC Distribution:

DOE Technical Information Center (2)
Post Office Box 62
Oak Ridge, Tennessee 37830