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Work Performed Under Contract DE-AC09-79 ET 47921

ALLIED-GENERAL NUCLEAR SERVICES
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**AFR/DESIGN AND LICENSING
INFORMATION/BNFP AS A MODEL**

TECHNICAL PROGRESS REPORT

October 1979 - December 1979

January 25, 1980

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

**PREPARED FOR THE
DEPARTMENT OF ENERGY
FUEL CYCLE PROGRAM OFFICE
UNDER CONTRACT DE-AC09-79ET47921**

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ABSTRACT

AFR SPENT FUEL STORAGE PROGRAM

Work on this project is focused on developing design and licensing information for the model facility. To date, the design effort is proceeding on schedule. A subcontract for soils and structural design of the fuel transfers canal is ready for DOE review. Proposals for high-density rack design to bring the model facility up to a nominal 1750 MTU capacity have been received and are being reviewed internally. This subcontract should be available for DOE review in early February. A security subcontract has been awarded to International Energy Associates Limited and the preliminary design effort is underway.

Licensing activities are progressing satisfactorily. Review of the governing local, state, and federal regulations has been completed. Format and schedule for the safety analysis report and the environmental report have been established.

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	4
Principal Areas of Investigation	4
Status Summary	4
Technical Progress	4
Implementation Concepts	4
Progress to Date	5
SUB-TASK 1.4 - LICENSING DOCUMENTATION	5
Principal Areas of Investigation	5
Status Summary	5
Technical Progress	6
Implementation Concepts	6
Progress to Date	6
TABLE 1 - HIGH-DENSITY RACK/SPENT FUEL INTERFACE	7

TECHNICAL PROGRESS REPORT
October 1979 - December 1979

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 period was directed at identifying modifications to the existing facility required for operation as a spent fuel storing facility. Design has been completed on 5 items and is proceeding on 8 of approximately 63 remaining jobs. A contractor has been selected for the design of structural and soils work related to the fuel transfer canal for the expansion pools.

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

Of the 32 items in this portion of the sub-task, the T&D platforms, breathing air systems, and leaker can designs have been completed.

Cost estimates, procurement, and construction information are being prepared for these items.

Design is proceeding on the following six items:

- Filter Blowdown/Waste Accumulator
- Air Supply to Yoke
- Caustic Supply to Deionizing Systems
- Receiver for Cask Drain
- FTP Gate Handling System
- HVAC Design Study.

Sub-Task 1.1.2 - Subsystem Designs within FRSS

Of the 36 items in this portion of the sub-task, the designs of crane accessories and pool water control have been completed. Cost estimates, procurement, and construction information are being prepared for these items.

Design is proceeding on the following two items:

- Crane Anticollision System
- Liquid Waste Handling.

Sub-Task 1.1.3 - FRSS Structure Modifications

Proposals were received from Catalytic and Bechtel covering the engineering and studies for modifications to FRSS structures and canal extension required for future expansion capabilities. Bechtel was selected for the soils studies and structural design. The contract is being submitted to DOE for approval.

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:

- Determination of technical criteria for fuel and rack interfaces.

- Preparation of a detailed procurement specification for the design of the rack and auxiliary equipment.
- Review of qualified vendors' proposals from the standpoint of the adequacy of the technical submittal and the vendors' quality assurance (QA) plans.

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

Fuel criterion was developed to assure that the spent fuel racks were compatible with a wide variety of current and past design fuels of both boiling water (BWR) and pressurized water (PWR) reactor types. Table 1 is a summary of the most important fuel characteristics. The racks will be designed to accommodate in excess of 95% of the applicable fuel in use or in storage within the United States.

The design specification was prepared to assure that only vendors with considerable experience in the design, fabrication, and installation of high-density racks were considered. Previous estimates of BNFP capacity have verified that from 1,600 to 1,800 MTU of fuel could be stored in a single level of the fuel storage pool, one cask unloading pool, and selected portions of the fuel transfer pool. These estimates were reverified by several qualified vendors. Two design rack types are to be examined for the BNFP application:

- Movable racks to be employed in the 32-foot deep fuel storage pool.
- Fixed (permanent) racks to be employed in the 60-foot deep cask unloading and fuel transfer pools.

Another potential means of increasing fuel storage capacity is to "double-tier" spent fuel racks in the deep pool areas. Several vendors have confirmed the general feasibility of this approach. A potential application is currently being licensed. The incremental fuel increase at the BNFP for the "double-tiering" is in excess of 400 to 500 MTU.

Responsive proposals to the procurement specification were received from five highly experienced suppliers of spent fuel racks and engineering services. These proposals are currently being evaluated. The following design factors were developed from the proposals:

- Fuel slot "center-to-center" spacing
PWR: 10 to 10 3/4 inches
BWR: 6 to 6 3/4 inches
- Rack construction - stainless steel honeycomb
- Poison - boron alloys
 - typically B₄C
 - both permanent and replaceable designs
- Structural design - computerized analysis using pool dynamic response spectra
- Criticality - computerized analysis.

SUB-TASK 1.3 - SECURITY SYSTEM

Principal Areas of Investigation

Preparation of a design package for a security system for spent fuel storage activities.

Status Summary

The major effort this period was directed at selecting and placing a contract with an outside security consultant. Additional work has been done in the areas of identifying the government regulations applicable to an AFR security system and developing design criteria for an AFR security system.

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

A consulting firm was selected and a subcontract awarded during this period. The firm selected was International Energy Associates Limited. IEAL has a number of excellent technical people and considerable experience in the area of security licensing. These attributes will help us greatly in any involvement with the NRC.

Identifying government regulations applicable to an AFR security system; this work has been mostly a study and evaluation of existing and proposed government regulations. Additional input was provided by knowledgeable industry and consulting sources.

After evaluating all present and proposed regulations to an AFR security system, we have reached the conclusion that a system may be licensed under proposed rule 10 CFR, Part 72.

We have also concluded that there will be no additional requirements imposed by either DOE or the IEAL.

Develop design criteria for an AFR security system; work on this task is just beginning to get underway at this time. Development of criteria is still at the discussion stage and there have not been any firm criteria formulated.

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

Work is proceeding satisfactorily. The formats for the Safety Analysis and Environmental Report have been identified and responsibilities for the preparation of each major section have been assigned. Decommissioning policy and criteria for the facility modifications have been prepared.

Technical Progress

Implementation Concepts

Identify and report on federal, state, and local regulations and guidelines which are applicable to AFR spent fuel storage facility construction, modification, and operation.

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

All existing Change Authorizations (CA's) for the FRSS have been tabulated and reviewed for possible impact on licensing documents.

The characteristics of the design basis fuel have been prepared, reviewed, and approved, thus providing the basis for development of normal and accident condition radioactive source terms.

Format for the SAR has been established as per draft Regulatory Guide 3.44 and 10 CFR 72. Due dates and responsibilities for the preparation of each section have been assigned.

Format for the Environmental Report will be as per Regulatory Guide 4.2, issued for light water reactors, modified as appropriate for an AFR.

The new NRC Dose to Man computer program (GASPAR) has been loaded with BNFP site specific data. It has been checked out with sample problems and can now be used to perform the environmental dose calculations for the AFR Project.

The decommissioning policy and criteria to be applied to the design of modifications have been prepared and issued.

TABLE 1

HIGH-DENSITY RACK/SPENT FUEL INTERFACE

<u>FUEL CHARACTERISTICS</u>	<u>PWR</u>	<u>BWR</u>
• Enrichment, Initial (Max.), Percent	4.1	3.2
• Cross Section, Inches	8.55	5.26
• Active Length, Maximum, Inches	150	150
• Overall Length, Maximum, Inches	180	180
• Fuel Content, KgU	480	190
• Assembly Weight, Maximum, Pounds	1600	700

MISCELLANEOUS

- No provision will be made for non-fuel components such as control rods, spiders, BWR channels, etc.
- Minimum fuel age is one year at a maximum burnup of 33,000 MWD/MTU.

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