DOE/HTGR--87-051

HFD-47017

MAKEUP WATER TREATMENT AND AUXILIARY BOILER BUILDING
STRUCTURAL DESIGN DESCRIPTION

4 x 350 MW(t) MODULAR HTGR PLANT

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LIST OF ABBREVIATIONS AND ACRONYMS

ACI	American Concrete Institute
ACWS	Auxiliary Cooling Water Subsystem
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BOP	Balance of Plant
CDS	Component Design Specification
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
DCS	Distributed Control System
ECA	Energy Conversion Area
FM	Factory Mutual
HVAC	Heating, Ventilation and Air Conditioning
ICD	Interface Control Document
IEEE	Institute of Electrical and Electronic Engineers
MCC	Motor Control Center
MWABB	Makeup Water Treatment and Auxiliary Boiler Building
MW(e)	Megawatt, electric
MW(t)	Megawatt, thermal
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
O/M	Operation and Maintenance
OPDS	Overall Plant Design Specification
OSHA	Occupational Safety and Health Act
QA	Quality Assurance
QAL	Quality Assurance Level
SDD	Structure Design Description
SSDD	Subsystem Design Description
SWEC	Stone & Webster Engineering Corporation
SWGR	Switchgear
TB	Turbine Building
TBD	To Be Determined
UHS	Ultimate Heat Sink
UL	Underwriters Laboratory

PREFACE

The objectives of the HTGR plant project are to produce safe, economical power. Supporting these objectives are four major goals and their associated plant states, identified as follows:

1. Maintain Safe Plant Operation
 - 1.1 Maintain Safe Energy Production
 - 1.2 Maintain Safe Plant Shutdown
 - 1.3 Maintain Safe Plant Refueling
 - 1.4 Maintain Safe Plant Startup/Shutdown
2. Maintain Plant Protection (in the event that plant operation cannot be maintained in the normal operating envelope)
 - 2.1 Protect the Capability to Maintain Safe Energy Production
 - 2.2 Protect the Capability to Maintain Safe Plant Shutdown
 - 2.3 Protect the Capability to Maintain Safe Plant Refueling
 - 2.4 Protect the Capability to Maintain Safe Plant Startup/Shutdown
3. Maintain Control of Radionuclide Release (in the low probability event of failure to maintain plant protection)
 - 3.1 Control Radiation
 - 3.2 Control Personnel Access
4. Maintain Emergency Preparedness (in the extremely low probability of failure to maintain control of release of radionuclides)

The Overall Plant Design Specification (OPDS) is the top-level technical document for the HTGR plant. The OPDS (based on owner requirements and regulatory requirements) establishes the overall performance, functional, institutional, interface, operational, safety, maintenance, inspection, and decommissioning requirements for design of the plant.

In response to the OPDS, a series of low tier documents, System Design Descriptions (SDDs), Subsystem Design Descriptions (SSDDs), Component Design Specifications (CDSs), and Interface Control Documents (ICDs), describe and control the individual designs. Traceability from plant-level requirements to equipment-level requirements is maintained throughout this hierarchy of design documents.

SUMMARY

The Makeup Water Treatment and Auxiliary Boiler Building (MWABB) is a grade-founded, single-story, steel-framed structure with insulated sheet metal exterior walls and roof decking. It houses the electrically-heated auxiliary boiler and related equipment, and the Raw Water Treatment System. The Makeup Water Treatment and Auxiliary Boiler Building is located adjacent to the Maintenance Building in the Energy Conversion Area of the plant.

SECTION 1

FUNCTIONS AND DESIGN REQUIREMENTS

1.1 FUNCTIONS

The following lists the Integrated Approach structure functions for the Makeup Water Treatment and Auxiliary Boiler Building (MWABB).

Function

Provide facilities

Afford space in the MWABB

Support elements structurally in the MWABB

Enable access in the MWABB

Lift, handle, and/or transport design selection in the MWABB

Isolate plant environment and enclose the MWABB space envelope

In addition to these functions, the following requirements for the MWABB are provided by the Utility/User Requirements (Reference 1, Section 9).

- (i) Building design, equipment layout, and design features including cranes, hoists, and monorails shall be provided to facilitate removal and replacement of major equipment items (Ref. 1-3.4.3).
- (ii) Headroom, pullspace, laydown, and work space for component and equipment maintenance shall be provided (Abridged requirement, Ref. 1-3.4.4).
- (iii) Equipment and components shall be accessible from normally provided floors and platforms, to the greatest degree practicable (Abridged requirement, Ref. 1-3.4.5).
- (iv) Overhead cranes shall be sized to lift the heaviest piece of equipment or heaviest component part that would have to be handled to facilitate planned operations, maintenance, and inspection activities (Ref. 1-3.4.16).

SECTION 4
INTERFACE REQUIREMENTS

4.1 FUNCTIONAL INTERFACES

Functional interfaces between the Makeup Water Treatment and Auxiliary Boiler Building are presented below.

<u>System</u>	<u>Interface</u>
• Auxiliary Boiler System (90-06)	Enclose, structurally support, provide access and lifting/handling capability for the Auxiliary Boiler, one deaerator, two condensate transfer pumps, two boiler feedwater pumps, one blowdown tank and one condenser. Support and enclose the non-Class 1E power supply for the Auxiliary Boiler.
• Raw Water Treatment (90-07)	Enclose, structurally support, provide access and lifting/handling capability for pumps, piping and valves, filters, tanks, and chemical treatment equipment. Provide concrete cubicles for acid and caustic tanks.

SECTION 9

REFERENCES

1. Gas-Cooled Reactor Associates (GCRA). Utility/User Design Requirements for Modular High Temperature Gas Cooled Reactors, GCRA 86-002, Rev. 1. GCRA, San Diego, CA, March 1986.
2. GA Technologies, Inc. (GA) et al. Overall Plant Design Specification Modular High Temperature Gas-Cooled Reactor, HTGR-86-004, Rev. 1. GA, San Diego, CA, February 1986.

APPENDIX B

DRAWINGS

Drawing No.

Title

14884-FM-223A

General Arrangement - Auxiliary Boiler and Makeup
Water Treatment Building

ISSUES	DESCRIPTION	CHECKED	ISSUE 4	DESCRIPTION	CHECKED	ISSUE 5
		CORRECT			CORRECT	
		DATE			DATE

EQUIPMENT LIST

1. FILTER A
2. FILTER B
3. FILTER C
4. FILTER BACKWASH PUMPS
5. DEMINERALIZER FEED PUMPS
6. SODIUM ALUMINATE FEED SYSTEM
7. ALUM FEED SYSTEM
8. SODIUM SULFITE FEED SYSTEM
9. SODIUM HYPOCHLORITE FEED SYSTEM
10. POLYELECTROLYTE FEED SYSTEM
11. POLYELECTROLYTE FEED SYSTEM
12. BACKWASH WASTE SUMP & PUMPS
13. THICKENER
14. FILTER PRESS
15. DUMPSTER
16. CATION A
17. CATION B
18. CAUSTIC DILUTION WATER HEATER
19. MIXED BED A
20. MIXED BED B
21. DEAERATOR
22. ANION A
23. ANION B
24. ACID FEED
25. ACID STORAGE
26. CAUSTIC FEED
27. CAUSTIC STORAGE
28. CLARIFIER/FILTER CONTROL PANEL
29. DEMINERALIZER CONTROL PANEL
30. OFFICE & LABORATORY
31. FLOOR SUMP
32. ELECTRIC AUXILIARY BOILER
33. AUXILIARY BOILER DEAERATOR
34. AUXILIARY BOILER BLOWDOWN TANK
35. AUXILIARY BOILER FEEDWATER PUMP
36. AUXILIARY BOILER CONDENSATE TRANSFER PUMP
37. AUXILIARY BOILER BLOWDOWN CONDENSER
38. AUXILIARY BOILER CONTROL PANEL
39. AUXILIARY BOILER ELECTRICAL PANEL
40. AMMONIA FEED SYSTEM
41. HYDRAZINE FEED SYSTEM

NOTES

1. SCALE: $\frac{1}{8}'' = 1'-0''$

REFERENCE DRAWING

1. PLOT PLAN DM-201E

NOT TO BE USED FOR CONSTRUCTION

GENERAL ARRANGEMENT
MAKEUP WATER TREATMENT &
AUXILIARY BOILER BUILDING

SMALL HTGR PROGRAM
GAS-COOLED REACTOR ASSOCIATES

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASS.

DRAWING NUMBER 4884-FM-2234-1

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	APPROV			APPROV			
	DATE			DATE			

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