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HTGR

CONDENSATE POLISHING SUBSYSTEM DESIGN DESCRIPTION

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ISSUED BY STONE & WEBSTER ENGINEERING CORP.
UNDER SUBCONTRACT TO GAS-COOLED REACTOR ASSOCIATES
FOR THE DEPARTMENT OF ENERGY
CONTRACT DE-AC03-78SF02034

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CONDENSATE POLISHING SUBSYSTEM DESIGN DESCRIPTION

4 x 350 MW(t) MODULAR HTGR PLANT

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Issued By:
Stone & Webster Engineering Corporation
Under Subcontract To Gas-Cooled Reactor Associates
For The Department Of Energy
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LIST OF ACRONYMS

OPDS	Overall Plant Design Specification
PCG	Power Conversion Group
SDD	System Design Description
SSDD	Subsystem Design Description
TB	Turbine Building
TBD	To be Determined

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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 event 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 lower 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 Condensate Polishing System is a subsystem within the Power Conversion Group (PCG).

The system removes suspended and dissolved impurities from the condensate resulting from condenser inleakage and condensate and feedwater system corrosion.

Two systems are included, one for each of the two turbine generator arrangements. Each system consists of three 50 percent polisher vessels and regeneration equipment and is designed to treat 100 percent of the condensate flow.

SECTION 1

SUBSYSTEM FUNCTIONS AND DESIGN REQUIREMENTS

1.1 SUBSYSTEM FUNCTIONS

The functions of the Condensate Polishing Subsystem are as follows:

- Remove suspended impurities from the condensate system.
- Remove dissolved impurities from the condensate system.
- Maintain the highest quality feedwater and steam purity conditions.

SECTION 4

SUBSYSTEM AND COMPONENT INTERFACES

4.1 SUBSYSTEM INTERFACE REQUIREMENTS

4.1.1 Interface Requirements Imposed on Other Systems

Interface requirements, at the system level, are presented in Table 4.1-1 showing the system on which the requirements are imposed, and a brief description of the interface.

4.1.2 Interface Requirements Imposed on Subsystems Within the System

Interface requirements, at the subsystem level, are presented in Table 4.1-2 showing the subsystem within the system on which the requirements are imposed, and a brief description of the interface.

TABLE 4.1-1

(CONDENSATE POLISHING)
INTERFACE REQUIREMENTS IMPOSED ON OTHER SYSTEMS

Interfacing Systems (with Subsystem/Identification)	Nature of Interface	Interfacing Component	Interface Requirements
1. Reactor System (10)	No Interface		
2. Vessel System (11)	No Interface		
3. Reactor Services Group (20)	No Interface		
4. Heat Transport System (21)			
(Steam Generator)	Maintains Feedwater Chemistry Within Specified Limits	Feedwater & Condensate Subsystem Piping	-Maintain feedwater chemistry per limits stated in Ref.3 Table 26-1. (07.0401.040)
5. Miscellaneous Control and Instrumentation Group (30)	No Interface		
6. Plant Protection and Instrumentation System (32)	No Interface		
7. Fuel Handling, Storage and Shipping System (34)	No Interface		

TABLE 4.1-1 (cont)

(CONDENSATE POLISHING)

Interfacing Systems (with Subsystem/Identification)	Nature of Interface	Interfacing Component	Interface Requirements
8. Plant Control, Data and Instrumentation System (37)			
(Plant Supervisory Control)	Measures System Parameters for System Control	At Various Sensors in the Condensate Polishing Subsystem	4 to 20 ma at 24 V dc required. (07.0401.080)
9. Power Conversion Group (50)	See Table 4.1-2 for interface requirements imposed on subsystems within the Power Conversion Group		
10. Heat Rejection Group (52)	No Interface		
11. Reactor Cavity Cooling System (56)	No Interface		
12. Shutdown Cooling System (57)	No Interface		
13. Buildings Structures, and Building Services Group (70)			
(Turbine Building)	Provide Space	Inside the TB	Provide [2 ft pheripheral] space for maintenance, separation, support, and placement of piping and equipment. (07.0401.130)

TABLE 4.1-1 (cont)

(CONDENSATE POLISHING)

Interfacing Systems (with Subsystem/Identification)	Nature of Interface	Interfacing Component	Interface Requirements
14. Mechanical Service Group (90)			
(Waste Water Treatment)	Treatment of Regeneration Wastes	TBD	TBD
(Instrument and Service Air)	Provide Air to Service and Operate Equipment	Misc. Components	Provide [TBD] SCFM at [100] psig air for maintenance and operation of components. (07.0401.145)
(Plant Drains)	Provide Capability to Drain Piping and Components	TBD	TBD
15. Electrical Group (92)			
(Non-Class 1E AC Distribution)	Power Supply	Valves and pumps	-Provide [15] kW of 480 V AC power for pumps. -[5] kw of 120 VAC power for valves (07.0401.150)
(Non-Class 1E Uninterruptable Power Supply)	Power Supply	Misc Controls and Instrumentation	-Provide [5] kW of ac power. (07.0401.155)

TABLE 4.1-2

(CONDENSATE POLISHING)
INTERFACE REQUIREMENTS IMPOSED ON SUBSYSTEMS
WITHIN THE SYSTEM

Interfacing Systems (with Subsystem/Identification)	Nature of Interface	Interfacing Component	Interface Requirements
Power Conversion Systems (50)			
(Feedwater and Condensate)	Maintain Process Chemistry of Feedwater	Subsystem piping connection	Meet design feedwater chemistry requirements stated in Ref. 3 Table 26-1. (07.0401.500)
(Demineralized Water Makeup)	Provide Water During Regeneration	Subsystem piping connection	Provide [50] gpm at a [10 mins/24 hrs] intermittent basis. (07.0401.510)
(Chemical Feed)	No Interface		
(Turbine Plant Sampling)	Provide Local Sample Points	Subsystem piping connection	-Provide [3] local sample points throughout the system. (07.0401.520)
(Turbine Building Closed Cooling Water)	No Interface		
(Turbine Generator and Auxiliaries)	No Interface		

TABLE 4.1-2 (cont)

(CONDENSATE POLISHING)

Interfacing Systems (with Subsystem/Identification)	Nature of Interface	Interfacing Component	Interface Requirements
(Main and Bypass Steam)	No Interface		
(Extraction and Auxiliary Steam)	No Interface		
(Heater Drains and Condensate Returns)	No Interface		
(Steam Vents and Drain)	No Interface		
(Start-up and Shutdown)	No Interface		
(Steam and Water Dump)	No Interface		

SECTION 9

REFERENCES

1. GA Technologies, Inc. (GA), et al Overall Plant Design Specification 4 x 350 MW(t) Modular HTGR Plant, HTGR - 86-004, Rev. 1. GA, San Diego, CA, February 1986.

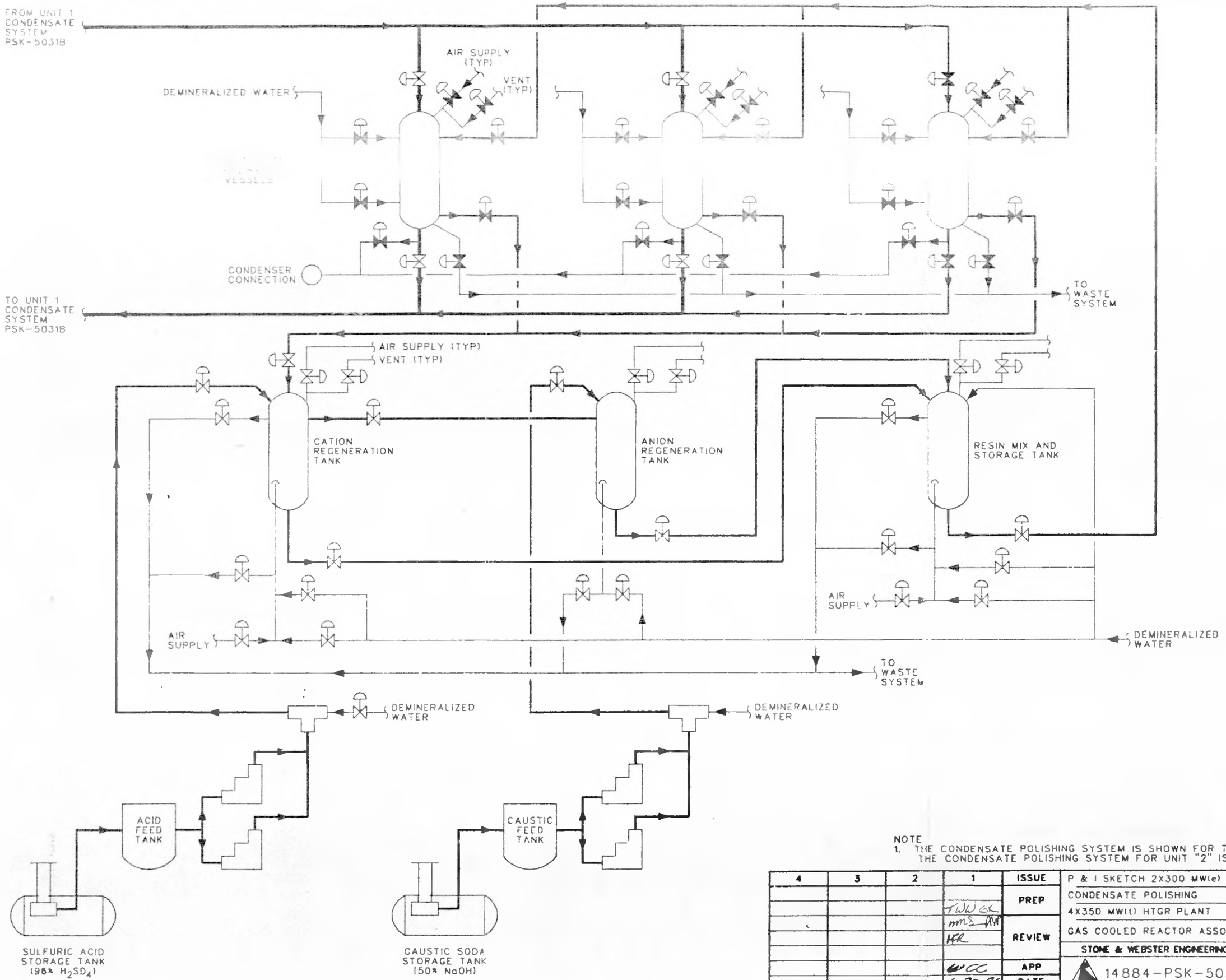
2. Bechtel Group, Inc. (BGI) et al Preliminary Concept Description Report 4 x 350 MW(t) HTGR Plant Side-By-Side Steel Vessel Prismatic Core Concept, HTGR-85-142. BGI, San Francisco, CA, October 1985.

3. GA Technologies, Inc. (GA). NSSS/BOP Interface Requirements; for the Modular HTGR Plant, HTGR-86-007. GA, San Diego, CA, April 1986.

APPENDIX B

DRAWINGS

Drawing No.	Title
14884-PSK-5033	Condensate Polishing



NOTE
1. THE CONDENSATE POLISHING SYSTEM IS SHOWN FOR TG UNIT "1", THE CONDENSATE POLISHING SYSTEM FOR UNIT "2" IS SIMILAR.

4	3	2	1	ISSUE	P & I SKETCH 2X300 MW(e)
				PREP	CONDENSATE POLISHING
			TWW GK		4X350 MW(t) HTGR PLANT
			mms MM	REVIEW	GAS COOLED REACTOR ASSOCIATES
			HFR		STONE & WEBSTER ENGINEERING CORPORATION
			WCC	APP	14884-PSK-5033
			6-20-86	DATE	