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Revision 9

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OVERALL PLANT DESIGN SPECIFICATION MODULAR HIGH TEMPERATURE GAS-COOLED REACTOR

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LIST OF ABBREVIATIONS AND ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BOL	Beginning of Life
BSDD	Building and Structures Design Description
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CWS	Circulating Water System
DOE	Department of Energy
EACS	Essential AC Electrical System
ECA	Energy Conversion Area
ECA CWS	Energy Conversion Area Cooling Water System
EDCS	Essential DC Electrical System
EFOH	Effective Forced Outage Hours
EOL	End of Life
FHSS	Fuel Handling and Storage System
HEPA	High Efficiency Particulate Air
HP	Helium Purification
HSS	Helium Services System
HTGR	High Temperature Gas-cooled Reactor
HTS	Heat Transport System
HVAC	Heating, Ventilating, and Air-Conditioning
IA	Integrated Approach
ICD	Interface Control Document
IPS	Investment Protection System
ISI	In-Service Inspection
LOSP	Loss of Offsite Power
LP	Low Pressure
LSPS	Lighting and Service Power Supply

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LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

MHTGR	Modular HTGR
MOL	Middle of Life
NE	Nuclear Energy
NI	Nuclear Island
NICWS	Nuclear Island Cooling Water System
NRC	Nuclear Regulatory Commission
OBE	Operating Basis Earthquake
OPDS	Overall Plant Design Specification
OSHA	Occupational Safety and Health Administration
PACS	Plant AC Electrical System
PAG	Protective Action Guidelines
PCDIS	Plant Control, Data, and Instrumentation System

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PDCS	Plant DC Electrical System
PFPS	Plant Fire Protection System
PHWHS	Plant Hot Water Heating System
PMS	Plant Monitoring System
QA	Quality Assurance
RCCS	Reactor Cavity Cooling System
RPS	Reactor Protection System
RC	Reactor Complex
RS	Reactor System
SCHE	Shutdown Cooling Heat Exchanger
SCS	Shutdown Cooling System
SCWS	Shutdown Cooling Water System
SDD	System Design Description
SDTS	Sanitary Drainage and Treatment System
SFCWS	Spent Fuel Cooling Water System
SRDC	Safety-Related Design Condition
SSCs	Structures, Systems, and Components
SSE	Safe Shutdown Earthquake
SWDS	Steam and Water Dump System

LIST OF DEFINITIONS

Activity: An identifiable set of human actions undertaken to accomplish a particular task within one of the more general industry activities of Design, Construction, Operation, Maintenance, and Decommissioning.

Building or Structure: A collection of structural and associated mechanical and/or electrical components treated as a unit for technical, administrative, or contractual purposes. The primary function of a building or structure, as opposed to a system, is to support plant systems and to protect the systems and their operating and maintenance personnel against certain environmental effects.

Design Criterion: A basis for judging the acceptability of a particular quantity, action, procedure, or design solution.

Design Value: The nominal value of a plant or system operating parameter plus an appropriate margin.

Energy Conversion Area: That portion of the plant not included within the Nuclear Island.

Equilibrium Plant: A commercial plant that incorporates a design that has matured through construction of replicate facilities and has accrued the benefits of standardization, learning, and optimal use of associated manufacturing facilities.

Equivalent Availability: Equivalent availability is mathematically defined as:

$$A_e = \int_0^{T_p} \frac{P_a(t)}{T_p} dt$$

LIST OF DEFINITIONS (Continued)

where: $P_a(t)$ = available net electrical power expressed as a percentage of design power as a function of time (t)

t = time

T_p = time period (operational lifetime)

Function: A statement of what is to be achieved.

Functional Analysis: A systems engineering technique or method used to develop (1) functions required to meet established goals, (2) the relationship between functions and related requirements, and (3) the basis and justification for design selections through which the prescribed goals are met. [Functional analysis is one part of the Integrated Approach.]

Functional Requirement: A bounding quantification that is derived from a functional need versus being imposed by an institutional standard.

Functional Tree: A diagram which displays the interrelationships between functions. The MHTGR functional tree commences with the top level goal, then continues with subordinate goals and plant states.

Goal: An endpoint or accomplishment towards which an effort is directed. The Integrated Approach has identified the following specific goals supporting the overall objective:

1. Safe, economical power (top level - Goal 0).
2. Maintain plant operation (Goal 1).
3. Maintain plant protection (Goal 2).
4. Maintain control of radionuclide release (Goal 3).
5. Maintain emergency preparedness (Goal 4).

2.1.1.5 Decommissioning

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(01.0201.051)

2.1.1.6 Radiation Exposure Control

The number of inaccessible areas due to high radiation levels during reactor operation shall be minimized to facilitate routine operational and maintenance activities.

(01.0201.061)

Materials shall be selected to minimize the production of radioactive materials due to activation and the generation of products of corrosion.

(01.0201.062)

Building configuration, access route designation, and shielding design shall be responsive to the requirement to control personnel radiation exposure.

(01.0201.063)

2.1.1.7 Economics

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(01.0201.091)

A goal shall be the development of a design that has an economic advantage of at least 10% in the levelized (30 year) busbar cost of electricity relative to a comparably sized, state-of-the-art coal plant alternative while requiring equivalent institutional resources⁽¹⁾ and posing equivalent financial risks.⁽²⁾

(01.0201.092)

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(1)The term "equivalent institutional resources" means that approximately the same level of qualified personnel and organizational capability, functioning within similar corporate cultures, is required to successfully procure, license, operate, maintain, and decommission the plants.

(2)The term "equivalent financial risks" means that approximately the same level of uncertainty exists for receiving return of investment at an equivalent return on investment, such that investors will be equally likely to invest in the MHTGR or coal plants.

2.1.2 Design Requirements

2.1.2.1 Overall Design Requirements

Availability Requirements

The design Equivalent Availability averaged over the lifetime of the plant shall be at least 80% for electrical generation when modeled using equipment mean time to failure and mean time to repair data for like type or similar systems and/or components. (01.0201.101)

The equivalent unavailability averaged over the lifetime of the plant owing to scheduled outages shall not exceed 10% (average of 876 h/year). (01.0201.102)

Design modifications and improvements to achieve or surpass the above availability requirements shall be considered for incorporation in the design, if a one percentage increase in the total capital investment produces, at a minimum, a seven-tenths percentage improvement in the equivalent availability factor. For example, if the total capital investment of an HTGR plant is \$1 billion with an evaluated equivalent availability of 80%, then an additional plant investment of \$10 million would be justified if the evaluated equivalent availability is increased from 80% to 80.56% or higher. (01.0201.103)

Plant Investment Protection Requirements

Outages of 6 months or greater shall not contribute more than 10% of the total equivalent unavailability from forced outages, including those not expected to occur in an individual plant's lifetime. (01.0201.111)

The calculated annual value for risk (i.e., the sum of event frequency times consequence over all events) to plant equipment or property, when averaged over plant lifetime, shall not exceed the annual property damage

2.3.2 Programmatic Requirements

The standard reactor module shall be configured to achieve the program objective to develop HTGRs for a broad range of applications in support of commercial/user interests in the safety and higher temperature characteristics of these plants. (01.0203.011)

The preparation of program design documentation shall follow the RDT Standards (RDT F1-2T) as modified by HTGR program procedures (Ref. 2-2). (01.0203.012)

The design shall be conducted in accordance with QA standards and procedures to be approved by the Director of the HTGR Program at DOE. (01.0203.013)

Applicable state and local government regulations, codes, and standards shall be identified and documented subsequent to the time a specific site is identified. Use of all codes and standards shall be justified in appropriate lower level design documents. (01.0203.014)

2.3.3 Design Objectives and Goals

Materials, configurations, and features that minimize the volume of activated and contaminated materials, that minimize radiation levels and radiation exposure and that minimize the time and cost of decommissioning shall be included in the design. (01.0203.021)

A design goal shall be the development of a design that has an economic advantage of at least 10% in the levelized (30-year) busbar cost of electricity relative to a comparably sized, state-of-the-art coal plant alternative. (01.0203.022)

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2.4 STATE (LOCAL) REQUIREMENTS

[TBD]

REFERENCES

- 2-1. "Top Level Regulatory Criteria for the Standard HTGR," HTGR-85002.
- 2-2. "Design Description Document Preparation," HP-10402, Rev. 0.

The plant is composed of the following Systems, Buildings, and Structures.
System number designators are indicated in parentheses.

- Reactor System (11)
- Vessel System (12)
- Heat Transport System (13)
- Shutdown Cooling System (14)
- Shutdown Cooling Water System (15)
- Reactor Cavity Cooling System (16)
- Fuel Handling and Storage System (21)
- Spent Fuel Cooling Water System (22)
- Nuclear Island Cooling Water System (23)
- Helium Services System (24)
- Radwaste and Decontamination System (25)
- Reactor Protection System (31)
- Steam and Water Dump System (32)
- Investment Protection System (33)
- Plant Control, Data, and Instrumentation System (34)
- Plant Monitoring System (35)
- Turbine Generator and Auxiliaries System (41)
- Main & Auxiliary Steam System (42)
- Feedwater and Condensate System (43)
- Startup and Shutdown System (44)
- Reactor Complex (51)
- Helium Service Building (52)
- Helium Storage Structure (53)
- Remote Shutdown Building (54)
- Nuclear Island Warehouse (55)
- Operations Center (61)
- Turbine Complex (62)
- Circulating Water Pump House (63)
- Makeup Water Pump House and Discharge Structure (64)
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- Grounding, Lightning Protection, Heat Tracing and Cathodic Protection System (93)
- Essential DC Electrical System (94)
- Plant DC Electrical System (95)
- Communication System (96)
- Plant Security System (97)

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4.2 OVERALL PLANT ARRANGEMENT

The MHTGR plant is divided into two major areas; the Nuclear Island (NI) containing the four reactor modules, and the Energy Conversion Area (ECA) containing the two turbine generators (Ref. 4-3 and Ref. 4-4). The NI is physically separated from the ECA and is surrounded by a doubly fenced security boundary.

4.2.1 Nuclear Island

The Nuclear Island (NI) consists of four reactor modules and support facilities. The four modules, each of which produces a thermal output of

The core refueling equipment is used to perform the periodic remote replacement of core fuel and reflector elements in a safe and efficient manner. The equipment, which is operated in the upper core plenum during refueling, is installed and removed through one of the penetrations in the reactor vessel top head.

Fuel handling operations external to the reactor vessel are performed in the Reactor Service Building. Equipment and facilities needed to handle the fuel and reflector blocks interface with the core refueling equipment to transfer fuel elements between the spent fuel storage facility, and the fuel sealing and inspection facility.

The decay heat generated by the spent fuel elements is removed until their heat generation rate has decreased sufficiently to allow shipment to permanent storage offsite. It is assumed that the actual shipment of spent fuel from the plant site will be the responsibility of the DOE (or its agent) in accordance with the provisions of the Civilian Waste Repository Act and that the DOE will provide empty shipping casks to the site on a predetermined schedule.

4.7.8 Spent Fuel Cooling Water System (22)

Cooling water circulating around each storage well removes the decay heat generated by the spent fuel. Heat from the cooling water is transferred to the atmosphere through air blast heat exchangers.

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The SFCS is designed to function continuously. To provide spent fuel cooling at all times, a passive backup cooling mode is provided. In this mode, the large water inventory in the storage pools provides a large thermal capacitance and ultimately heat is removed by boiling. Water loss through boiling is replaced from a makeup water supply.

4.7.9 Nuclear Island Cooling Water System (23)

The Nuclear Island Cooling Water System removes heat from the following reactor plant components:

- Helium purification (HP) system components
- Main helium circulator motor
- Nitrogen recondenser(s)
- Miscellaneous Nuclear Island HVAC air handlers
- Reactor building HVAC air handlers

Rev. 9

The Nuclear Island Cooling Water System consists of multiple closed chilled water cooling loops which serve these components for all four reactor modules. The system consists of pumps, water chillers, a surge/head tank, a water chemistry package (filter-demineralizer train) and associated piping. The system is also equipped with the required instrumentation and control. The chemistry package maintains the purity of the water in the system. The heat removed by the Nuclear Island Cooling Water System is rejected directly to the atmosphere at the chillers.

Rev. 9

Rev. 9

4.7.10 Helium Services System (24)

The Helium Services System consists of components and structures which purify, transfer, and store helium and the liquid nitrogen for cooling purification equipment and analytical instruments.

The system contains helium purification trains and regeneration equipment, helium storage and transfer trains, and liquid nitrogen trains.

The helium purification trains consist of a specific sequence of gas processing components, plus related piping, valves, controls, and instrumentation designed to purify helium for each reactor module during normal full-power operation. The helium purification trains remove chemical impurities

4.7.27.4 Maintenance Building

The Maintenance Building houses the mechanical/machine, welding, electrical, instrument, and electronic maintenance shops and related activities.

4.7.28 Circulating Water Pump House (63)

The Circulating Water Pump House houses the pumps, valves, and piping which are part of the Circulating Water System.

Rev. 9

4.7.29 Makeup Water Pump House and Discharge Structure (64)

The Makeup Water Pump House and Discharge Structure houses and supports the pumps, valves, and piping which are a portion of the Circulating Water System.

Rev. 9

4.7.30 Fire Pump House (65)

The Fire Pump House provides an enclosure for the firewater pumps and related equipment which form part of the Plant Fire Protection System.

4.7.31 Energy Conversion Area Warehouse (66)

The Energy Conversion Area (ECA) Warehouse Building stocks the spare parts inventory required for equipment, components, and systems in the Energy Conversion Area.

4.7.32 Miscellaneous Site Improvements (67)

(TBD)

4.7.33 Energy Conversion Area Cooling Water System (71)

The Energy Conversion Area (ECA) Cooling Water System removes waste heat from the turbine-generator auxiliary equipment located in the Turbine

Building and conveys the waste heat through the component cooling water heat exchangers to the Circulating Water System.

Rev. 9

The ECA Cooling Water System consists of independent closed flow paths which serve equipment associated with each turbine-generator unit. Separate pumps and heat exchangers are provided for each path. A surge tank is located at the high point of each flow path to provide the required net positive suction head for proper operation of the pumps and to allow for thermal expansion and contraction. In addition, a component chemical addition tank is furnished to maintain proper water chemistry.

4.7.34 Circulating Water System (72)

This system removes waste heat from the condensers, and the ECA Cooling Water System.

Rev. 9

The waste heat is conveyed to the plant cooling tower.

The circulating water system consists of two independent loops. In normal plant operation, circulating water is pumped from the cooling tower basin through the condensers and heat exchangers, and back to the cooling tower where the waste heat is released to the atmosphere via mechanical draft cooling towers where the cooled water is returned to the basin.

Rev. 9

Rev. 9

The makeup and blowdown components provide inventory and water chemistry control for the system.

Rev. 9

The plant cooling tower basin supports the cooling tower and is a part of this system.

4.7.35 Water Supply and Treatment System (73)

The Water Supply and Treatment System provides clarified and filtered water for domestic use, and demineralized water for steam generator makeup, demineralizer regeneration, condensate polisher regeneration, and for makeup during flushing activities associated with plant systems and processes. It also supplies demineralized water to various hose connections located throughout the plant.

Potable water is supplied and distributed to plant plumbing fixtures, safety showers, drinking water coolers, and ventilation evaporative coolers for makeup. Potable water is fed from the raw water treatment components through a pumping system that automatically fills a potable water storage tank. Potable water pumps then take suction from the potable water storage tank and supply water to a hydropneumatic tank which, in turn, distributes water to the users. This water is free of pathogenic and other deleterious materials, taste, and odor.

The demineralized water storage and distribution network receives demineralized water from the Raw Water Treatment components and distributes it to various users throughout the plant. Equipment items include a demineralized water storage tank, demineralized water transfer pumps, plus associated piping, valves, and hose connections.

4.7.36 Plant Hot Water Heating System (74)

The Plant Hot Water Heating System provides hot water to unit heaters and air-handling unit heating coils located throughout the plant, and maintains ambient environments above minimum design temperature requirements.

4.7.37 ECA Chilled Water System (75)

Rev. 9

The ECA Chilled Water System is a conventionally designed cooling water system utilizing packaged refrigerant chillers and an associated closed loop supply system to furnish the Energy Conversion Area HVAC air handlers with chilled water.

Rev. 9

4.7.38 Plant Fire Protection System (76)

The Plant Fire Protection System provides for rapidly detecting, containing, and extinguishing fires in selected key plant areas should they occur, and provides protection for structures, systems, and components, such that a fire that starts in spite of the fire prevention program does not prevent essential plant safety functions from being performed.

The fire detection and alarm functions are designed for reliable error-free operation achieved through redundant design. Once a fire is detected, the Plant Fire Protection System contains and extinguishes it automatically or provides the means for containing and extinguishing it manually.

The Plant Fire Protection System consists of three major sections: water, carbon dioxide, and halon.

The water section of this system consists of firewater storage tanks, fire pumps (electric motor and diesel) and their respective controls, pressure maintenance equipment, yard hydrant and hose houses, distribution piping to an underground yard piping loop, and piping to the several fire protection areas within the plant's structures.

The carbon dioxide section of this system consists of a refrigerated storage tank for carbon dioxide, piping, nozzles, and controls for master and selection valves, and detection and audio alarms. Carbon dioxide is delivered to the turbine generator bearing and enclosure areas.

TABLE A-3 (Continued)

<u>System/Building/Structure (No.)</u>	<u>SDD/BSDD (DOE-HTGR-)</u>	<u>ICD (DOE-HTGR-)</u>	
Circulating Water Pump House (63)	88014	88060	Rev. 9
Makeup Water Pump House and Discharge Structure (64)	87048	88061	
Fire Pump House (65)	87046	88062	
ECA Warehouse (66)	88015	88063	
Miscellaneous Site Improvements (67)	88030	88064	
ECA Cooling Water System (71)	87038	88065	
Circulating Water System (72)	88016	88066	Rev. 9
Water Supply and Treatment System (73)	88017	88067	
Plant Hot Water Heating System (74)	88018	88068	
ECA Chilled Water System (75)	88019	88069	Rev. 9
Plant Fire Protection System (76)	88020	88070	
Nuclear Island HVAC System (81)	88021	88071	
ECA HVAC System (82)	87055	88072	
Instrument and Service Air System (83)	88022	88073	
Waste Water System (84)	88023	88074	
Yard Drainage System (85)	88024	88075	
Sanitary Drainage and Treatment System (86)	88025	88076	
Essential AC Electrical System (91)	87059	88077	
Plant AC Electrical System (92)	88026	88078	
Grounding, Lightning, Heat Tracing and Cathodic Protection System (93)	88027	88079	
Essential DC Electrical System (94)	87061	88080	
Plant DC Electrical System (95)	87060	88081	
Communication System (96)	88028	88082	
Plant Security System (97)	88029	88083	

5.37 PLANT HOT WATER HEATING SYSTEM (74)

5.37.1 System Functions

The function of the Plant Hot Water Heating System is to supply hot water to unit heaters and air-handling unit heater coils throughout the plant.

5.37.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.37.2.1 System Configuration and Essential Features Requirements

The Plant Hot Water Heating System (PHWHS) shall maintain ambient environments above minimum design temperature requirements. (01.0537.001)

5.38 ECA CHILLED WATER SYSTEM (75)

Rev. 9

5.38.1 System Functions

The function of the Plant Chilled Water System is to supply chilled water to unit coolers and air-handling unit cooling coils throughout the ECA.

Rev. 9

5.38.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.38.2.1 System Configuration and Essential Features Requirements

The Plant Chilled Water System (PCWS) shall supply chilled water at approximately 7°C (45°F) to users. (01.0538.001)

5.39 PLANT FIRE PROTECTION SYSTEM (76)

5.39.1 System Functions

The functions of the Plant Fire Protection System are to prevent fires from starting, to detect and annunciate rapidly the presence and location of combustion by-products or the presence of fire within the plant, to control and extinguish promptly fires that do occur, and to provide protection for structures, systems, and components such that the performance of safety function is not prevented.

5.39.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.39.2.1 System Configuration and Essential Features Requirements

The plant shall not rely on offsite fire protection capability.

(01.0539.001)

The Plant Fire Protection System (PFPS) shall be comprised of three separate and independent means of fire protection:

- Water
- Carbon Dioxide
- Halon

(01.0539.002)

The Circulating Water System (CWS) shall be designed by | Rev. 9
assuming that local natural water sources are not adequate to support once-
through condenser cooling. (01.0535.004)

Nonbrackish river water shall be used as the reference plant water source.
The reference chemical analysis is contained in Table 2.1-3.
(01.0535.005)

The CWS shall be of an open-loop design. (01.0535.006) | Rev. 9

The cooling tower shall be located within the ECA. (01.0535.007)

The cooling tower basin shall provide inventory for the circulating
water pump house. (01.0535.008) | Rev. 9

The cooling tower basin shall be located below the cooling tower structure
and form the foundation for same. (01.0535.009)

The circulating water return (from the condensers) shall discharge inside
the cooling towers. (01.0535.010)

The towers shall be positioned so that "tower drift" does not routinely
pass over other buildings/structures on the plant site. (01.0535.011)

Deleted Rev. 8. (01.0535.012)

5.35.2.2 Operational Requirements

The CWS design temperature shall be 50.0°C (122°F). (01.0535.021) | Rev. 9

5.36 WATER SUPPLY AND TREATMENT SYSTEM (73)

5.36.1 System Functions

The functions of the Water Supply and Treatment System are to provide water of proper chemical composition for makeup and flushing activities for plant systems and processes and to provide clarified and filtered water for domestic uses.

5.36.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.36.2.1 System Configuration and Essential Features Requirements

Nonbrackish river water shall be used as the reference plant water source. The chemical analysis requirements are contained in Table 2.1-3.

(01.0536.001)

The plant shall not rely on offsite municipal water supply or sewer service.

(01.0536.002)

The Water Supply and Treatment System (WSTS) shall be capable of pretreating raw water to produce a suitable water quality for domestic in-plant use.

(01.0536.003)

The WSTS shall process and store demineralized water for distribution to users.

(01.0536.004)

5.33.2 Requirements

5.33.2.1 Configuration and Essential Features Requirements

The site shall be served by road and by rail. (01.0533.001)

5.34 ENERGY CONVERSION AREA COOLING WATER SYSTEM (71)

5.34.1 System Functions

The functions of the ECA Cooling Water System are to remove waste heat from the auxiliary equipment associated with each turbine-generator unit located in the Turbine Complex and to convey waste heat to the Circulating and Service Water System.

5.34.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.34.2.1 System Configuration and Essential Features Requirements

The Energy Conversion Area Cooling Water System (ECA CWS) shall be a closed loop. (01.0534.001)

The ECA CWS shall be designed to transfer waste heat to the Circulating and Service Water System from specified equipment in the turbine building. (01.0534.002)

Each turbine-generator unit and auxiliary equipment shall have an independent ECA Cooling Water System. (01.0534.003)

5.34.2.2 Operational Requirements

The ECA CWS shall be designed for operation during normal plant operation and startup and shutdown modes. (01.0534.011)

5.35 CIRCULATING WATER SYSTEM (72)

5.35.1 System Functions

The functions of the Circulating Water System are to remove waste heat from the main condensers and ECA Cooling Water Systems, and to convey the heat to the cooling tower. The system also controls the chemistry, and provides system water inventory control.

Rev. 9

5.35.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.35.2.1 System Configuration and Essential Features Requirements

Each turbine generator condenser shall have a separate cooling water loop. (01.0535.001)

Waste heat shall be dissipated to the atmosphere via mechanical draft cooling towers. (01.0535.002)

The mechanical draft cooling towers shall provide cooling capacity for both circulating water cooling loops in accordance with Figures 4.1-3 and 4.1-5. (01.0535.003)

5.30.2 Requirements

Requirements which are applicable to multiple systems or buildings or structures have been identified in Section 5.1. For Section 5.1 requirements applicable to this building and structure, see Table 5.1-0.

5.30.2.1 Configuration and Essential Features Requirements

The structure shall be located adjacent to the plant natural water supply.
(01.0530.001)

The water intake structure shall be configured to be partly below grade as required to meet site/source water levels.
(01.0530.002)

The structure shall accommodate portions of the Circulating Water System.
(01.0530.003)

Rev. 9

5.31 FIRE PUMPHOUSE (65)

5.31.1 Functions

The functions of the Fire Pump House are to provide space, structural support for equipment, lifting, handling, and/or transporting of equipment, to isolate the building environment, to permit access control, and to provide miscellaneous facilities.

5.31.2 Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this building and structure, see Table 5.1-0.

5.31.2.1 Configuration and Essential Features Requirements

The structure shall be located within the ECA. (01.0531.001)

5.32 ENERGY CONVERSION AREA WAREHOUSE (66)

5.32.1 Functions

The functions of the ECA Warehouse are to provide space, structural support for equipment, lifting, handling, and/or transporting of equipment, to isolate the building environment, to permit access control, and to provide miscellaneous facilities.

5.32.2 Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this building, see Table 5.1-0.

5.32.2.1 Configuration and Essential Features Requirements

The warehouse shall be located within the Energy Conversion Area (ECA).
(01.0532.001)

The warehouse shall provide storage for plant components and equipment required for special and general maintenance purposes. (01.0532.002)

5.33 MISCELLANEOUS SITE IMPROVEMENTS (67)

5.33.1 Functions

Functions for this section have not yet been determined.

The Turbine Building shall be configured with parallel turbine-generator centerlines that are perpendicular to the common reactor centerline.

(01.0528.007)

The Standby Power Building shall accommodate equipment and components comprising the Essential AC Distribution System and power supply.

(01.0528.008)

The Standby Power Building shall be designed to house two standby power generators. Each generator shall be provided with separate and independent services.

(01.0528.009)

The building design shall include features to assure that the standby power area and its contents remain operational under accident conditions.

(01.0528.010)

The Maintenance Building shall provide facilities for the following:

Electrical repair shop

Instrument repair shop

Electronic shop

Equipment handling facilities (cranes, dollies, etc.)

Mechanical repair shop with tool racks, work benches, etc.

Carpentry shop

Pipe shop

Welding shop

Sandblasting and paint shop

Machine shop

Personnel amenities--lockers, toilets, and lunch area

(01.0528.011)

The Makeup Water and Auxiliary Boiler Building shall accommodate the auxiliary boiler and related equipment and components, plus equipment associated with the Water Supply and Treatment System.

(01.0528.012)

5.29 CIRCULATING

WATER PUMP HOUSE (63)

Rev. 9

5.29.1 Functions

The functions of the Circulating Water Pump House are to provide space, structural support for equipment, lifting, handling, and/or transporting of equipment, to isolate the building environment, to permit access control, and to provide miscellaneous facilities.

Rev. 9

5.29.2 Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this building and structure, see Table 5.1-0.

5.29.2.1 Configuration and Essential Features Requirements

The pump house shall be located within the ECA. (01.0529.001)

The circulating water pumps shall take suction from the cooling tower basin. (01.0529.002)

Rev. 9

5.30 MAKEUP WATER PUMPHOUSE AND DISCHARGE STRUCTURE (64)

5.30.1 Functions

The functions of the Makeup Water Pump House and Discharge Structure are to provide space, structural support for equipment, lifting, handling, and/or transporting of equipment, to isolate the building environment, to permit access control, and to provide miscellaneous facilities.

5.9.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.9.2.1 System Configuration and Essential Feature Requirements

The Spent Fuel Cooling Water System (SFCWS) shall include redundant equipment as necessary to ensure continuous operation. (01.0509.001)

5.9.2.2 Operational Requirements

The spent fuel cooling system shall be capable of removing 0.94 MW (3.2×10^6 Btu/h). (01.0509.011) | Rev. 9

Spent fuel cooling shall be operated continuously whenever spent fuel is located in storage. (01.0509.012)

5.10 NUCLEAR ISLAND COOLING WATER SYSTEM (23)

5.10.1 System Functions

The functions of the Nuclear Island Cooling Water System (NICWS) are to remove heat from the reactor plant components by circulating cooling water and to transfer the heat to an ultimate heat sink.

5.10.2 System Requirements

Requirements which are applicable to multiple systems or buildings and structures have been specified in Section 5.1. For Section 5.1 requirements applicable to this system, see Table 5.1-0.

5.10.2.1 System Configuration and Essential Features Requirements

The Nuclear Island Cooling Water System (NICWS) shall serve the simultaneous needs of all four modules under full power operating conditions.

(01.0510.001)

System makeup shall be provided from the plant Feedwater and Condensate System.

(01.0510.002)

Deleted Rev. 9.

(01.0510.003)

Rev. 9

Redundant components shall be provided for continuous operation and on-line maintenance.

(01.0510.004)

5.10.2.2 Operating Requirements

The maximum cold water supply temperature shall not exceed 31.1°C (88°F).

(01.0510.011)

Rev.

The maximum heat load to be rejected under normal plant operating conditions shall be 7.9 MW (27 x 10⁶ Btu/h).

(01.0510.012)

Rev. 9

5.11 HELIUM SERVICES SYSTEM (24)

The Helium Services System (HSS) consists of helium purification trains, helium storage and transfer trains, and a liquid nitrogen train.

5.11.1 System Functions

5.11.1.1 Helium Purification Trains

The primary functions of the helium purification trains are to remove helium from the primary coolant loops, process it to remove its chemical and radioactive impurities and return it to the primary coolant and to meet

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TABLE 5.1 - 0
REMENTS APPLICABLE TO
EMS OR BUILDINGS & STRUCTURES

BUILDING/STRUCTURE DESIGNATOR																																		
53	54	55		61	62	63	64	65	66	67		71	72	73	74	75	76		81	82	83	84	85	86		91	92	93	94	95	96	97		
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