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PRESSURIZER HEATUP/COOLDOWN LIMITS

LIMITING CONDITION FOR OPERATION

3.4.8.2 The pressurizer temperature shall be limited to:

a. A maximum heatup rate of 200°F per hour, and

b. A maximum cooldown rate of 200°F per hour.

APPLICABILITY: At all times.

ACTION:

With the pressurizer temperature limits in excess of any of the above limits, restore the temperature to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the structural integrity of the pressurizer; determine that the pressurizer remains acceptable for continued operation or be in at least HOT STANDBY within the next 6 hours and reduce the pressurizer pressure to less than 500 psig within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.8.2.1 The pressurizer temperatures shall be determined to be within the limits at least once per 30 minutes during system heatup or cooldown.

4.4.8.2.2 The spray water temperature differential shall be determined for use ~~in Table 5.7-2~~ for each cycle of main spray with less than four reactor coolant pumps operating and for each cycle of auxiliary spray operation.

delete

5.0 DESIGN FEATURES

5.1 SITE LOCATION

see new write up

SITE AND EXCLUSION BOUNDARIES

5.1.1 The site and exclusion boundaries shall be as shown in Figure 5.1-1.

LOW POPULATION ZONE

5.1.2 The low population zone shall be as shown in Figure 5.1-2.

GASEOUS RELEASE POINTS

5.1.3 The gaseous release points shall be as shown in Figure 5.1-3.

5.2 CONTAINMENT

CONFIGURATION

5.2.1 The reactor containment building is a steel lined, prestressed concrete building of cylindrical shape, with a dome roof and having the following design features:

a. Nominal inside diameter = 146 feet.

b. Nominal inside height = 206.5 feet.

c. Minimum thickness of concrete walls = 3 feet, 8 inches.

d. Minimum thickness of concrete roof = 3 feet, 8 inches.

e. Minimum thickness of concrete floor pad = 10.5 feet.

f. Nominal thickness of steel liner = 0.25 inch.

g. Net free volume = 2.6×10^6 cubic feet.

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for a maximum internal pressure of 60 psig and a temperature of 300°F.

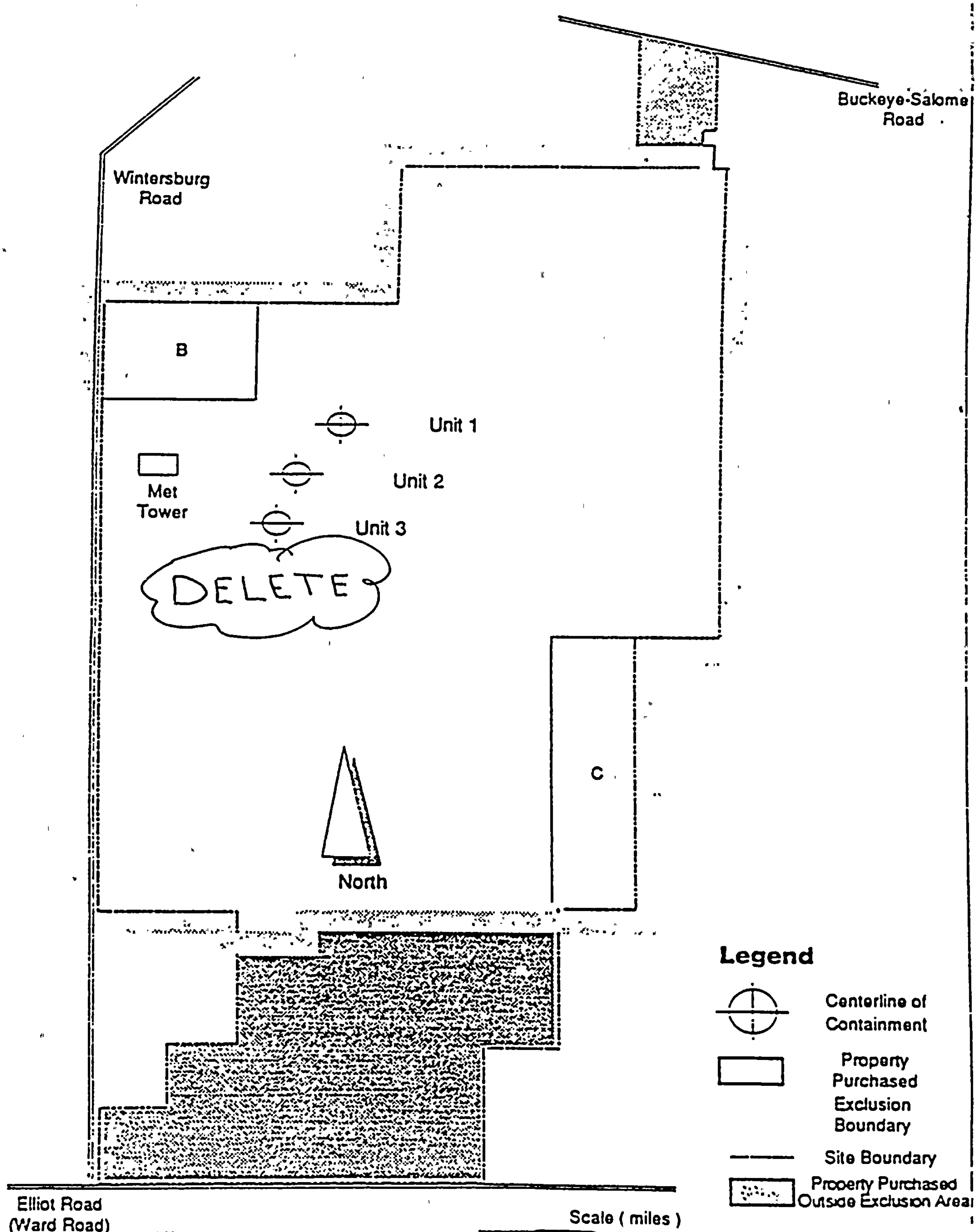

Figure 5.1-1
Site and Exclusion Boundaries

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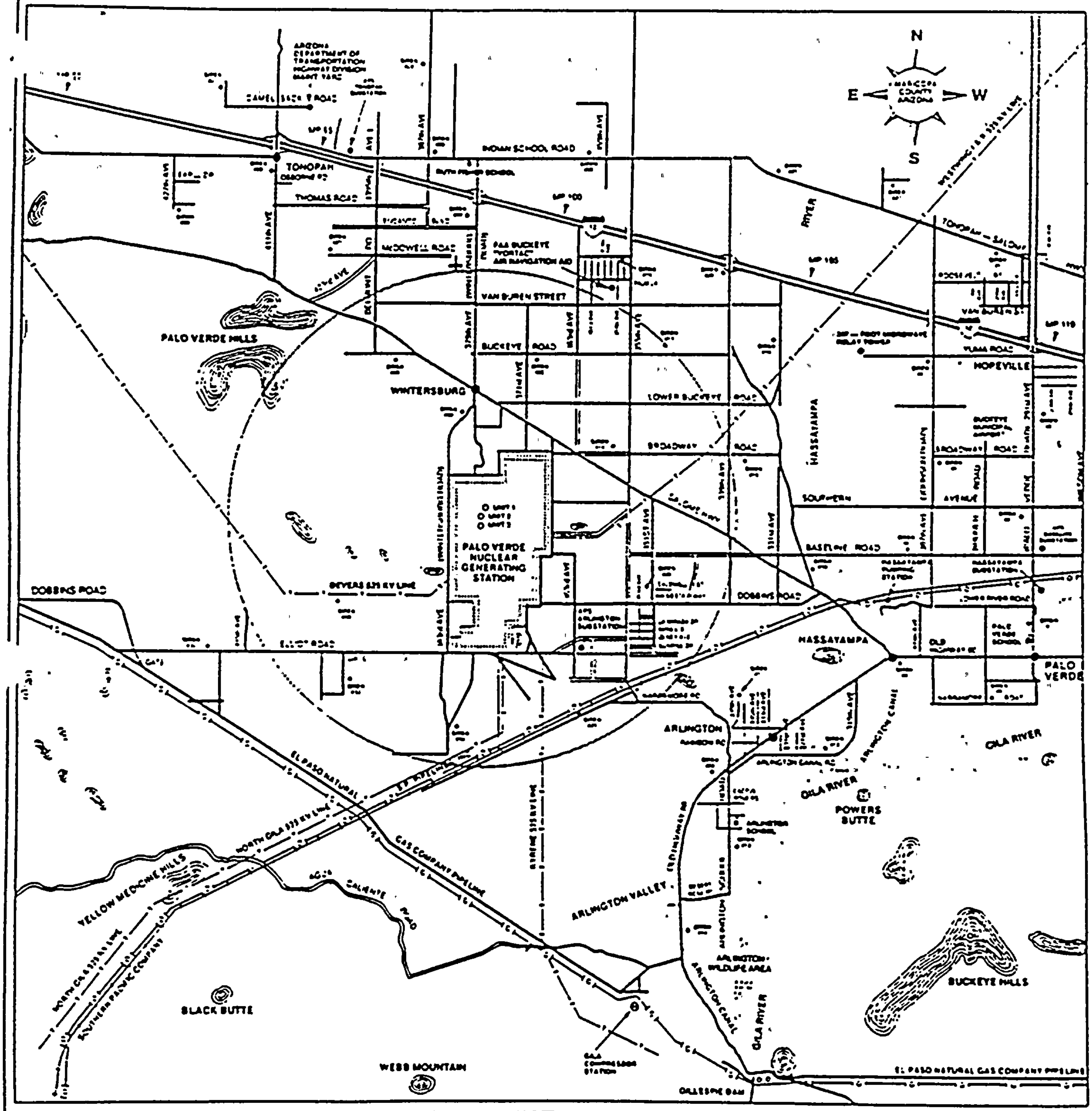
Graphic Scale in Miles 0 1 2 3 4 5



KEY TO MAP

- Paved Road
- Unpaved Road
- 4WD Road
- Gas Pipeline
- Oil Pipeline
- Power Line
- Railroad
- Airstrip
- Palo Verde Nuclear Generating Station Boundary
- School
- Siren
- Milepost

Palo Verde Nuclear Generating Station
LOW POPULATION ZONE

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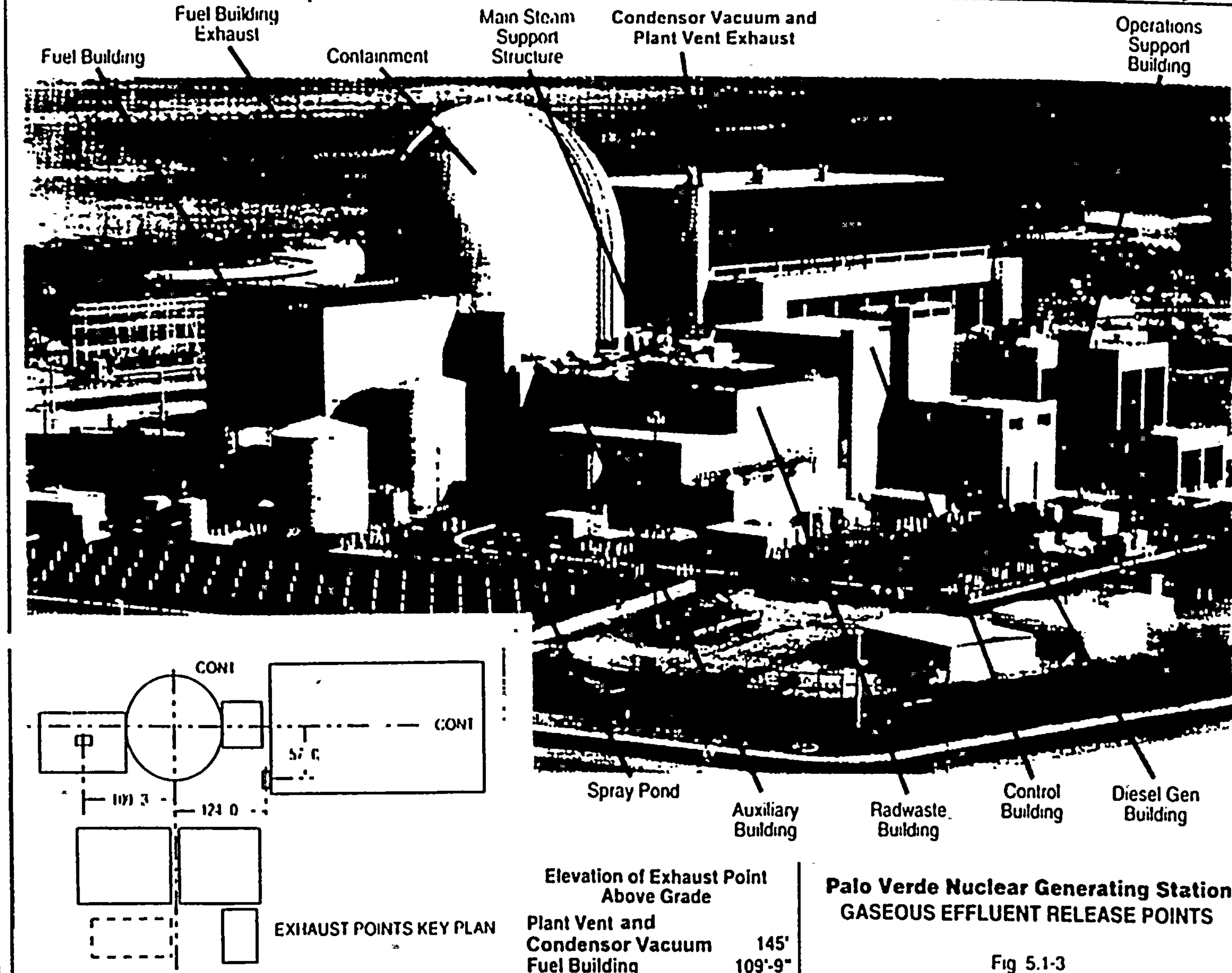
0–5 Miles

Figure 5.1-2



Elevation of Exhaust Point Above Grade	
Plant Vent and Condensor Vacuum	145'
Fuel Building	109'-9"

Palo Verde Nuclear Generating Station
GASEOUS EFFLUENT RELEASE POINTS

Fig 5.1-3

PALO VERDE - UNIT 1

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5.2 REACTOR CORE

FUEL ASSEMBLIES

(See new write-up)

5.2.1 The reactor core shall contain 241 fuel assemblies with each fuel assembly normally containing 236 fuel rods or burnable poison rods clad with Zircaloy-4 except that limited substitution of fuel rods by filler rods consisting of Zircaloy-4 or stainless steel may be made if justified by a cycle specific reload analysis. Each fuel rod shall have a nominal active fuel length of 150 inches and contain a maximum total weight of approximately 1950 grams uranium. Each burnable poison rod shall have a nominal active poison length of 136 inches. The initial core loading shall have a maximum enrichment of 3.35 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum radially averaged enrichment of 4.30 weight percent U-235 at any axial location.

CONTROL ELEMENT ASSEMBLIES

5.2.2 The reactor core shall contain 76 full-length and 13 part-length control element assemblies.

~~5.4 REACTOR COOLANT SYSTEM~~

~~DESIGN PRESSURE AND TEMPERATURE~~

~~5.4.1 The Reactor Coolant System is designed and shall be maintained:~~

~~a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant of the applicable surveillance requirements,~~

~~b. For a pressure of 2500 psia, and~~

~~c. For a temperature of 650°F, except for the pressurizer which is 700°F.~~

~~VOLUME~~

~~5.4.2 The total water and steam volume of the Reactor Coolant System is 13,900 + 300/-0 cubic feet at a nominal T_{avg} of 593°F.~~

~~5.5 METEOROLOGICAL TOWER LOCATION~~

~~5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.~~

5.6 FUEL STORAGE

5.6.1 CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. The maximum calculated k_{eff} value, including margin for uncertainty in calculational method and mechanical tolerances, less than or equal to 0.95 with a 95% probability at a 95% confidence level when flooded with unborated water.

b. A nominal 9.5 inches center-to-center distance between adjacent storage cell locations.

5.6.1.2 The k_{eff} for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

5.6.1.3 The spent fuel storage pool is organized into three regions for spent fuel storage. Fuel shall be placed in the appropriate region based on appropriate initial enrichment and existing burnup as designated in Figure 5.6-1:

a. Region 1: Fuel shall be stored in a checkerboard (two-out-of-four) storage pattern. Fuel that qualifies to be stored in Regions 1, 2, or 3, in accordance with Figure 5.6-1, may be stored in Region 1.

b. Region 2: Fuel shall be stored in a three-out-of-four storage pattern. Fuel that qualifies to be stored in Regions 2 or 3, in accordance with Figure 5.6-1, may be stored in Region 2.

c. Region 3: Fuel shall be stored in a four-out-of-four storage pattern. Only fuel that qualifies to be stored in Region 3, in accordance with Figure 5.6-1, shall be stored in Region 3.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 137 feet - 6 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1329 fuel assemblies.

~~5.7 COMPONENT CYCLIC OR TRANSIENT LIMITS~~

~~5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Tables 5.7-1 and 5.7-2.~~

FIGURE 5.~~6~~3-1
ASSEMBLY BURNUP VERSUS INITIAL ENRICHMENT

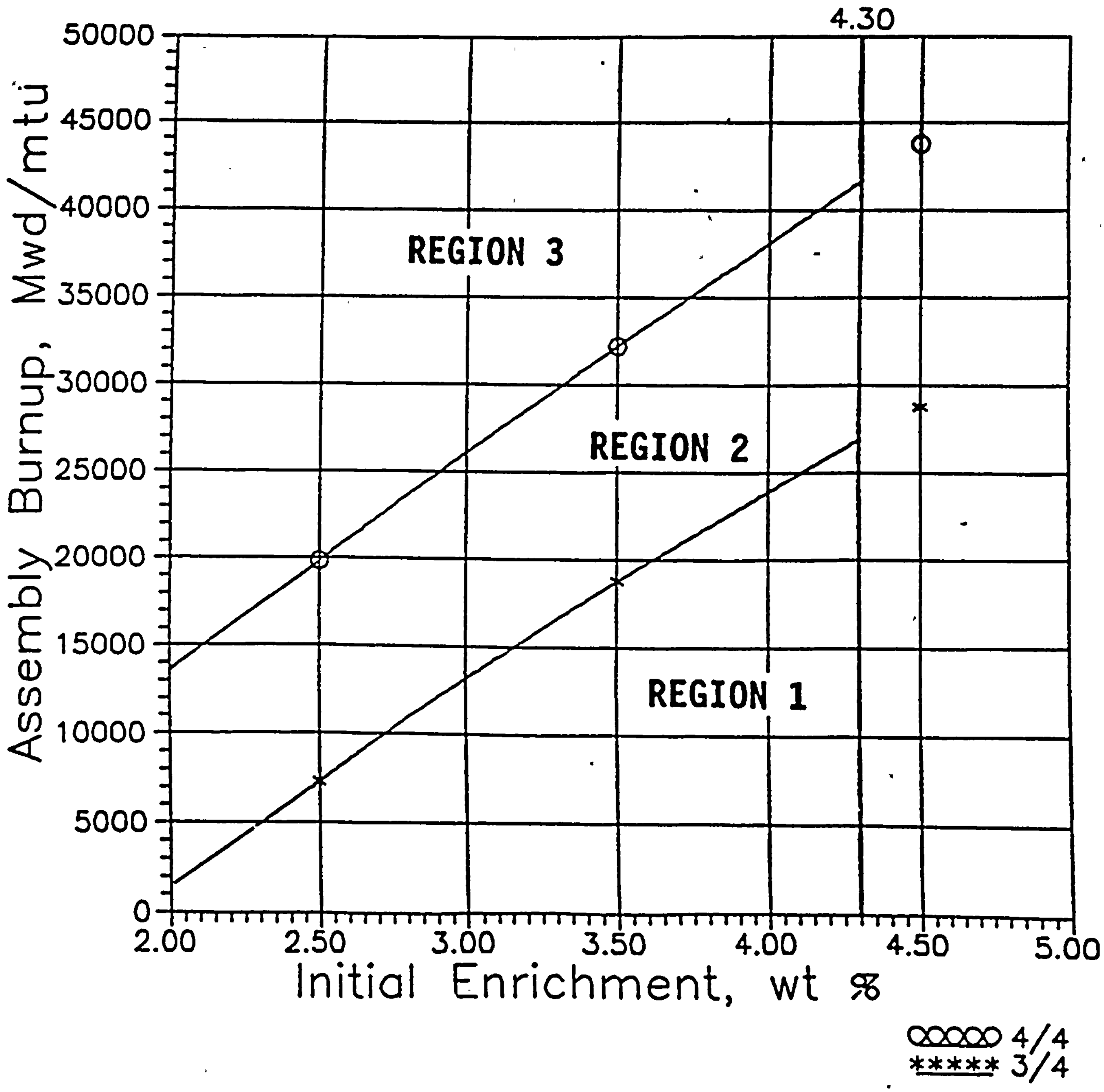

TABLE 5.7-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	500 system heatup and cooldown cycles at rates ≤ 100°F/hr.	Heatup cycle - Temperature from ≤ 70°F to ≥ 565°F; cooldown cycle - Temperature from ≥ 565°F to ≤ 70°F.
	500 pressurizer heatup and cooldown cycles at rates ≤ 200°F/hr.	Heatup cycle - Pressurizer temperature from ≤ 70°F to ≥ 653°F; cooldown cycle - Pressurizer temperature from ≥ 653°F to ≤ 70°F.
	10 hydrostatic testing cycles.	RCS pressurized to 3125 psia with RCS temperature between 120°F and 400°F.
	480 reactor trip cycles, turbine trip cycles, and loss of reactor coolant flow.	Includes combinations of reactor trips due to operator errors, equipment malfunctions, and total loss of reactor coolant flow.
	200 seismic stress cycles.	Subjection to a seismic event equal to one-half the design basis earthquake (DBE).
	1 complete loss of secondary pressure cycle.	Loss of secondary pressure from either steam generator due to a complete double-ended break of a steam generator steam or feedwater nozzle.

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TABLE 5.7-1 (Continued)

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
	200 primary system leak test cycles	Leak test primary system at a pressure of 2250 psia at a temperature from 120°F to 400°F.
Pressurizer Spray Nozzle	Calculate usage factor per Table 5.7-2.	Main spray (less than four RCP operating) with fluid ΔT_m > 200°F. Auxiliary spray with fluid ΔT_a > 200°F.

ΔT_m = The difference in temperature between the pressurizer and main spray water as adjusted by the instrument correction factor.

ΔT_a = The difference in temperature between the pressurizer and Auxiliary spray water as adjusted by the instrument correction factor.

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TABLE 5.7-2

PRESSURIZER SPRAY NOZZLE USAGE FACTOR

Main Spray				Auxiliary Spray			
ΔT_m	N_A	N	N/N_A	ΔT_a	N_A	N	N/N_A
201-250	7900			201-250	50000		
251-300	4500			251-300	2200		
301-350	2900			301-350	1300		
351-400	1900			351-400	850		
401-450	1200			401-450	550		
451-500	850			451-500	375		
501-550	555			501-550	225		
				551-600	150		
		$\Sigma N/N_A$ =	______			$\Sigma N/N_A$ =	______

Cumulative Usage Factor

$\Sigma N/N_A$ (Main Spray) ____________

$\Sigma N/N_A$ (Aux. Spray) ____________

Total ____________ = Cumulative Usage Factor

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TABLE 5.7-2 (Continued)

Where:

$\Delta T_a = (T_{101} - T_{229}) + 60$

$\Delta T_m = (T_{101} - T_{103*} \text{ or } {}_{104*}) + 70$

NA = Allowable number of spray cycles

N = Number of cycles in ΔT range indicated

Calculational Method:

1. The spray cycle is defined as any initiation and termination of main or auxiliary spray flow throughout the pressurizer spray nozzle.

2. If the difference between pressurizer water temperature and the spray water temperature exceeds 200°F each spray cycle and the corresponding temperature difference is logged.

3. The spray nozzle usage factor shall be calculated as follows:

   A. Fill in Column "N" above.

   B. Calculate "N/N_A" (Divide N by N_A).

   C. Add Column "N/N_A" to find $\Sigma N/N_A$.

   $\Sigma N/N_A$ is the cumulative spray nozzle usage factor. If the cumulative usage factor is equal to or less than 0.65 no further action is required.

4. If the cumulative usage factor exceeds 0.65, subsequent pressurizer spray operation shall continue to be monitored and an engineering evaluation of nozzle fatigue shall be performed within 90 days. The evaluation shall determine that the nozzle remains acceptable for additional service beyond the 90 day period or subsequent spray operation shall be restricted so that the difference between the pressurizer water temperature and the spray water temperature shall be limited to less than or equal to 200°F when spray is operated.

*Use lower of two temperatures.

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~~5.1.3~~	~~GASEOUS RELEASE POINTS~~	~~5-1~~
~~5.2 CONTAINMENT~~		
~~5.2.1~~	~~CONFIGURATION~~	~~5-1~~
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5.~~3~~ 2.2	CONTROL ELEMENT ASSEMBLIES	5-~~5~~ 1
~~5.4 REACTOR COOLANT SYSTEM~~		
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~~5.4.2~~	~~VOLUME~~	~~5-5~~
~~5.5 METEORLOGICAL TOWER LOCATION~~		~~5-6~~
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5.~~6~~ 3.1	CRITICALITY	~~5-6~~ 5-1
5.~~6~~ 3.2	DRAINAGE	~~5-6~~ 5-2
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REACTOR COOLANT SYSTEM

PRESSURIZER HEATUP/COOLDOWN LIMITS

LIMITING CONDITION FOR OPERATION

3.4.8.2 The pressurizer temperature shall be limited to:

a. A maximum heatup rate of 200°F per hour, and

b. A maximum cooldown rate of 200°F per hour.

APPLICABILITY: At all times.

ACTION:

With the pressurizer temperature limits in excess of any of the above limits, restore the temperature to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the structural integrity of the pressurizer; determine that the pressurizer remains acceptable for continued operation or be in at least HOT STANDBY within the next 6 hours and reduce the pressurizer pressure to less than 500 psig within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.8.2.1 The pressurizer temperatures shall be determined to be within the limits at least once per 30 minutes during system heatup or cooldown.

4.4.8.2.2 The spray water temperature differential shall be determined for use ~~in Table 5.7-2~~ for each cycle of main spray with less than four reactor coolant pumps operating and for each cycle of auxiliary spray operation.

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5.0 DESIGN FEATURES

5.1 SITE LOCATION (see new write-up)

~~SITE AND EXCLUSION BOUNDARIES~~

~~5.1.1 The site and exclusion boundaries shall be as shown in Figure 5.1-1.~~

~~LOW POPULATION ZONE~~

~~5.1.2 The low population zone shall be as shown in Figure 5.1-2.~~

~~GASEOUS RELEASE POINTS~~

~~5.1.3 The gaseous release points shall be as shown in Figure 5.1-3.~~

~~5.2 CONTAINMENT~~

~~CONFIGURATION~~

5.2.1 The reactor containment building is a steel lined, prestressed concrete building of cylindrical shape, with a dome roof and having the following design features:

a. Nominal inside diameter = 146 feet.

b. Nominal inside height = 206.5 feet.

c. Minimum thickness of concrete walls = 3 feet, 8 inches.

d. Minimum thickness of concrete roof = 3 feet, 8 inches.

e. Minimum thickness of concrete floor pad = 10.5 feet.

f. Nominal thickness of steel liner = 0.25 inch.

g. Net free volume = 2.6×10^6 cubic feet.

DELETE

~~DESIGN PRESSURE AND TEMPERATURE~~

~~5.2.2 The reactor containment building is designed and shall be maintained for a maximum internal pressure of 60 psig and a temperature of 300°F.~~

LOCATION (See reverse side-up)

DEC 18

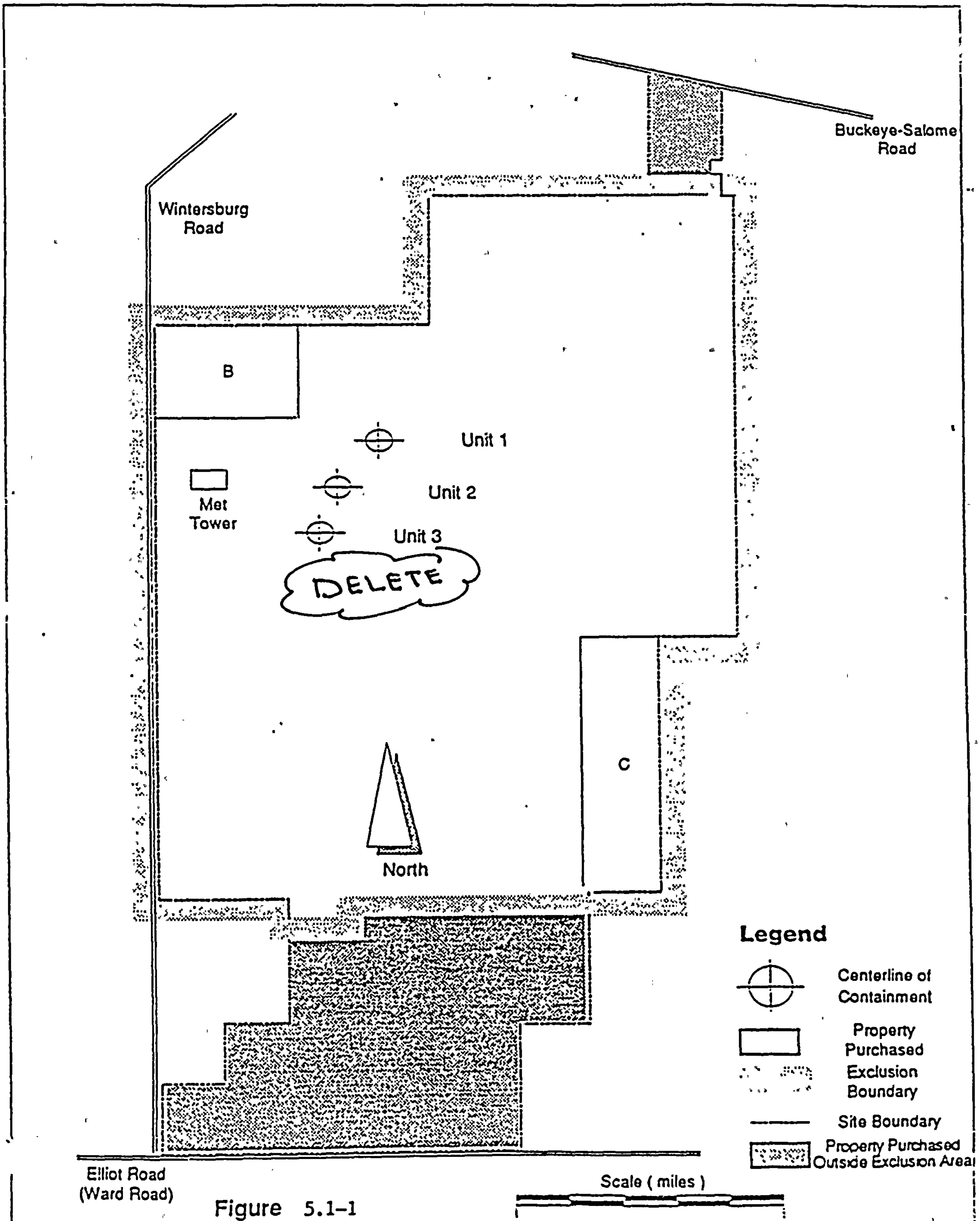

Figure 5.1-1
Site and Exclusion Boundaries

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FOR INFORMATION ONLY

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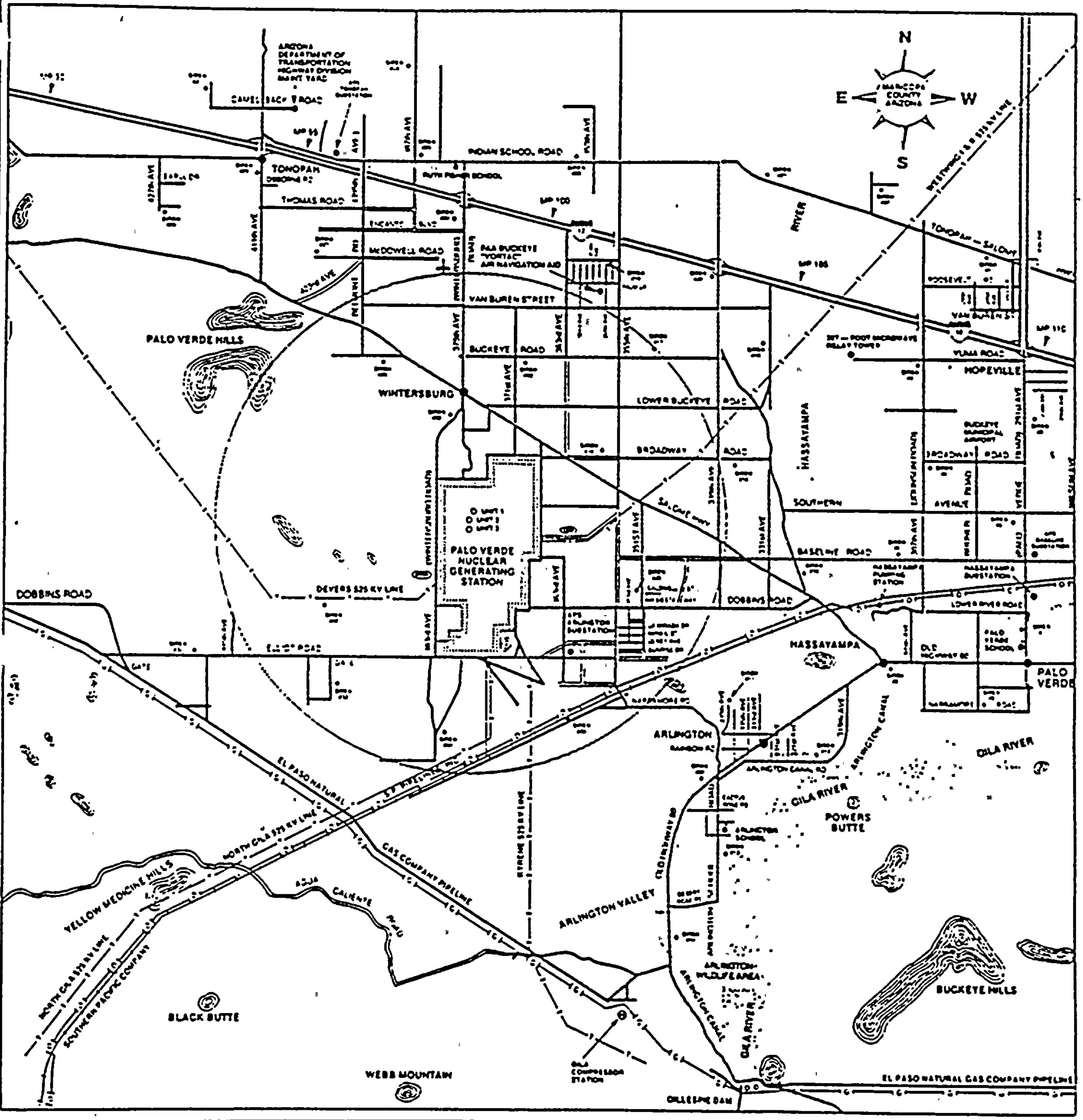
Graphic Scale in Miles
0 1 2 3 4 5



KEY TO MAP

- Paved Road
- Unpaved Road
- 4WD Road
- Gas Pipeline
- Oil Pipeline
- Power Line
- Railroad
- Airstrip
- Palo Verde Nuclear Generating Station Boundary
- School
- Siren
- Milepost

Palo Verde Nuclear Generating Station
LOW POPULATION ZONE

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0–5 Miles

Figure 5.1-2

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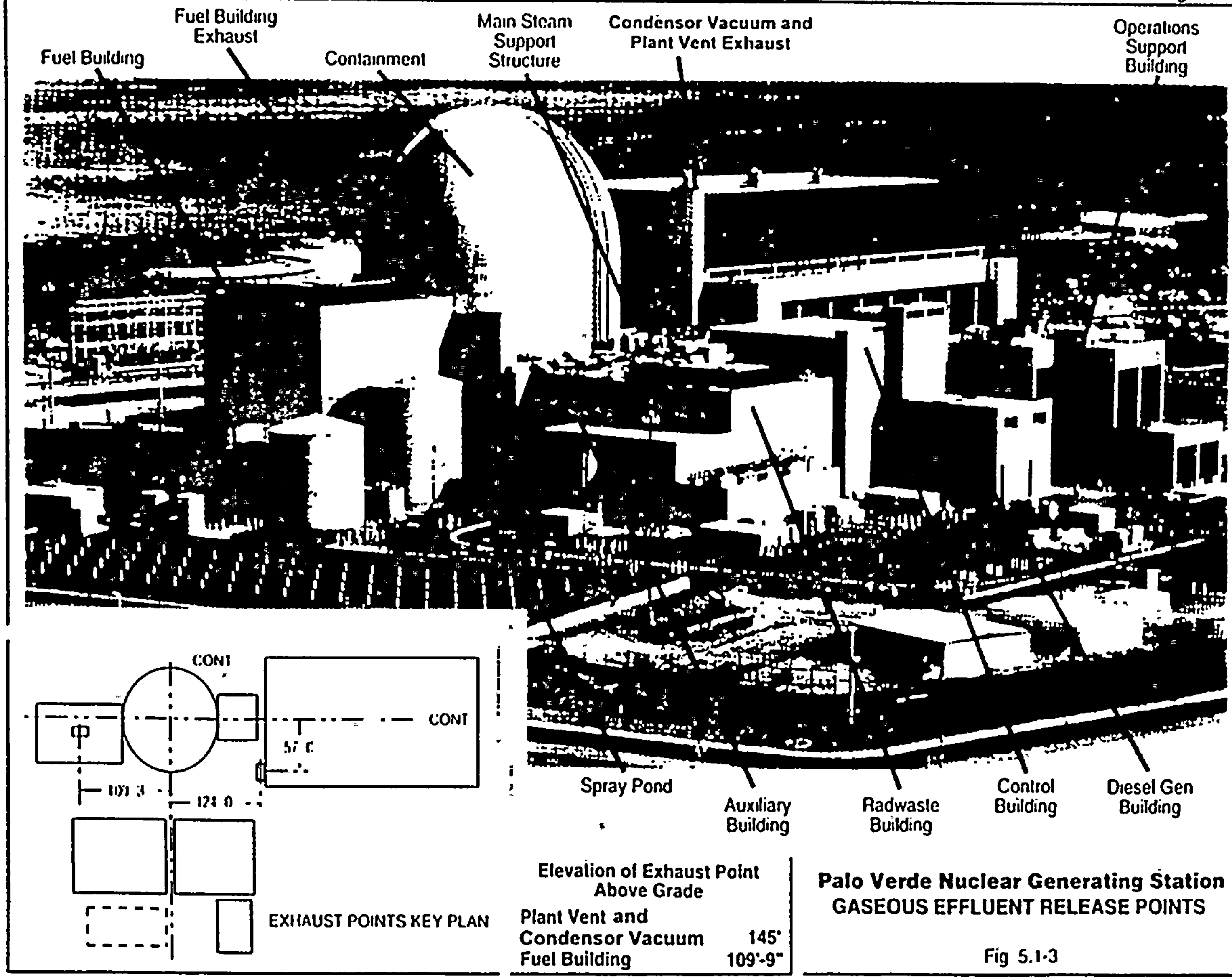

Elevation of Exhaust Point Above Grade	
Plant Vent and Condensor Vacuum	145'
Fuel Building	109'-9"

Palo Verde Nuclear Generating Station
GASEOUS EFFLUENT RELEASE POINTS

Fig 5.1-3

DELETE

5.~~3~~ 2 REACTOR CORE

FUEL ASSEMBLIES

(see new write-up)

5.~~3~~ 2.1 The reactor core shall contain 241 fuel assemblies with each fuel assembly normally containing 236 fuel rods or burnable poison rods clad with Zircaloy-4 except that limited substitution of fuel rods by filler rods consisting of Zircaloy-4 or stainless steel may be made if justified by a cycle specific reload analysis. Each fuel rod shall have a nominal active fuel length of 150 inches and contain a maximum total weight of approximately 1950 grams uranium. Each burnable poison rod shall have a nominal active poison length of 136 inches. The initial core loading shall have a maximum enrichment of 3.35 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum radially averaged enrichment of 4.30 weight percent U-235 at any axial location.

CONTROL ELEMENT ASSEMBLIES

5.~~3~~ 2.2 The reactor core shall contain 76 full-length and 13 part-length control element assemblies.

~~5.4 REACTOR COOLANT SYSTEM~~

~~DESIGN PRESSURE AND TEMPERATURE~~

5.4.1 The Reactor Coolant System is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant of the applicable surveillance requirements,

b. For a pressure of 2500 psia, and

c. For a temperature of 650°F, except for the pressurizer which is 700°F.

DELETE

VOLUME

~~5.4.2 The total water and steam volume of the Reactor Coolant System is~~ 13,900 + 300/-0 cubic feet at a nominal T_{avg} of 593°F.

~~5.5 METEOROLOGICAL TOWER LOCATION~~

~~5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.~~

5.6 FUEL STORAGE

5.6.1 CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with:

(see new write up)

a. The maximum calculated k_{eff} value, including margin for uncertainty in calculational method and mechanical tolerances, less than or equal to 0.95 with a 95% probability at a 95% confidence level when flooded with unborated water.

b. A nominal 9.5 inches center-to-center distance between adjacent storage cell locations.

5.6.1.2 The k_{eff} for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

5.6.1.3 The spent fuel storage pool is organized into three regions for spent fuel storage. Fuel shall be placed in the appropriate region based on appropriate initial enrichment and existing burnup as designated in Figure 5.6-1:

a. Region 1: Fuel shall be stored in a checkerboard (two-out-of-four) storage pattern. Fuel that qualifies to be stored in Regions 1, 2, or 3, in accordance with Figure 5.6-1, may be stored in Region 1.

b. Region 2: Fuel shall be stored in a three-out-of-four storage pattern. Fuel that qualifies to be stored in Regions 2 or 3, in accordance with Figure 5.6-1, may be stored in Region 2.

c. Region 3: Fuel shall be stored in a four-out-of-four storage pattern. Only fuel that qualifies to be stored in Region 3, in accordance with Figure 5.6-1, shall be stored in Region 3.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 137 feet - 6 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1329 fuel assemblies.

~~5.7 COMPONENT CYCLIC OR TRANSIENT LIMITS~~

~~5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Tables 5.7-1 and 5.7-2.~~

FIGURE 5.3-1
ASSEMBLY BURNUP VERSUS INITIAL ENRICHMENT

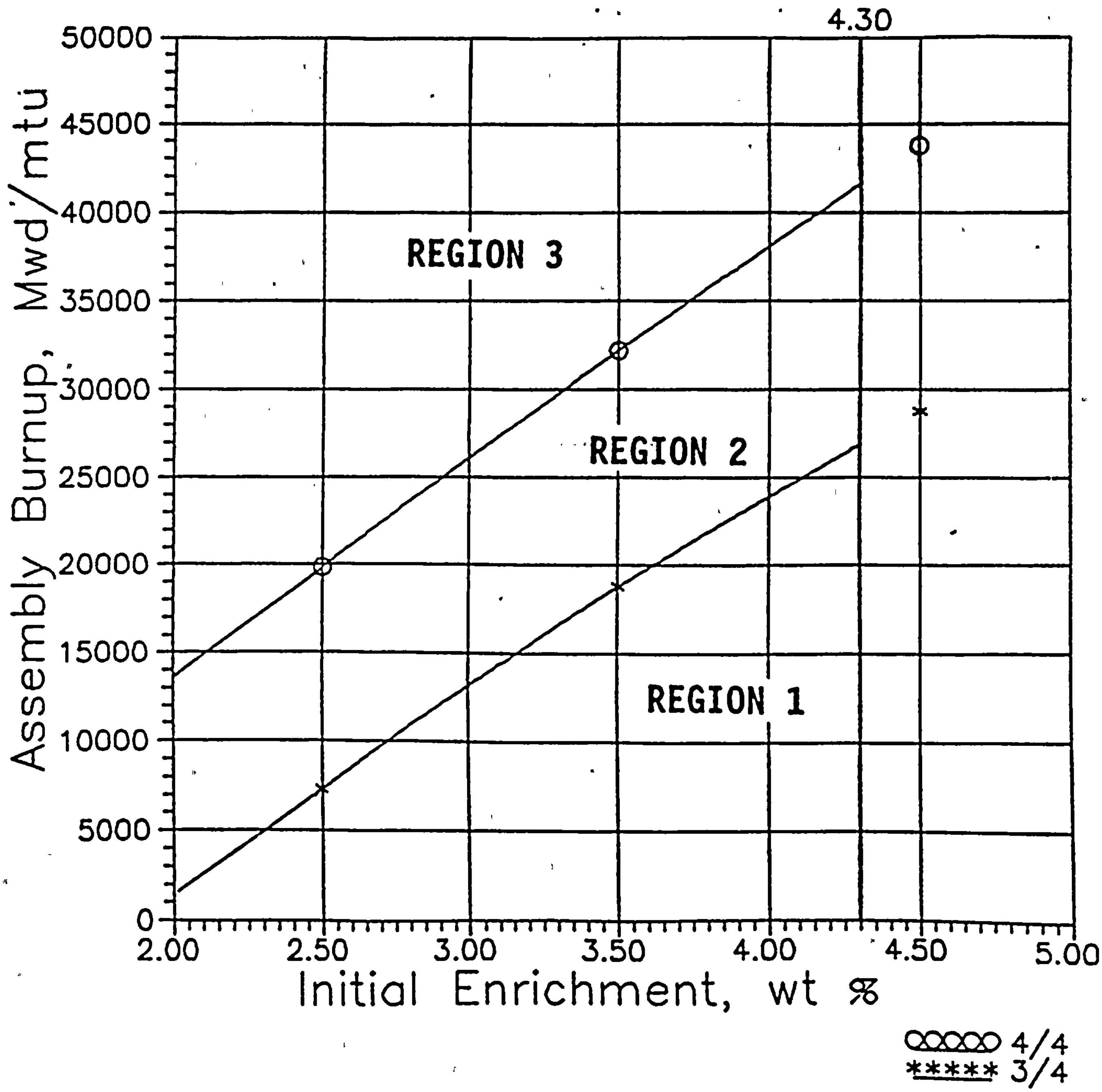

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TABLE 5.7-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	500 system heatup and cooldown cycles at rates ≤ 100°F/hr.	Heatup cycle - Temperature from ≤ 70°F to ≥ 565°F; cooldown cycle - Temperature from ≥ 565°F to ≤ 70°F.
	500 pressurizer heatup and cooldown cycles at rates ≤ 200°F/hr.	Heatup cycle - Pressurizer temperature from ≤ 70°F to ≥ 653°F; cooldown cycle - Pressurizer temperature from ≥ 653°F to ≤ 70°F.
	10 hydrostatic testing cycles.	RCS pressurized to 3125 psia with RCS temperature between 120°F and 400°F.
	480 reactor trip cycles, turbine trip cycles, and loss of reactor coolant flow.	Includes combinations of reactor trips due to operator errors, equipment malfunctions, and total loss of reactor coolant flow.
	200 seismic stress cycles.	Subjection to a seismic event equal to one-half the design basis earthquake (DBE).
	1 complete loss of secondary pressure cycle.	Loss of secondary pressure from either steam generator due to a complete double-ended break of a steam generator steam or feedwater nozzle.

DELETE

TABLE 5.7-1 (Continued)

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
	200 primary system leak test cycles	leak test primary system at a pressure of 2250 psia at a temperature from 120°F to 400°F.
Pressurizer Spray Nozzle	Calculate usage factor per Table 5.7-2.	Main spray (less than four RCP operating) with fluid $\Delta T_m > 200°F$. Auxiliary spray with fluid $\Delta T_a > 200°F$.

ΔT_m = The difference in temperature between the pressurizer and main spray water as adjusted by the instrument correction factor.

ΔT_a = The difference in temperature between the pressurizer and Auxiliary spray water as adjusted by the instrument correction factor.

DELETE

DELETE

TABLE 5.7-2

PRESSURIZER SPRAY NOZZLE USAGE FACTOR

Main Spray				Auxiliary Spray			
ΔT_m	N_A	N	N/N_A	ΔT_a	N_A	N	N/N_A
201-250	7900			201-250	50000		
251-300	4500			251-300	2200		
301-350	2900			301-350	1300		
351-400	1900			351-400	850		
401-450	1200			401-450	550		
451-500	850			451-500	375		
501-550	555			501-550	225		
				551-600	150		
		$\Sigma N/N_A$ =	________			$\Sigma N/N_A$ =	________

Cumulative Usage Factor

$\Sigma N/N_A$ (Main Spray) ________________

$\Sigma N/N_A$ (Aux. Spray) ________________

Total ________________ = Cumulative Usage Factor

DELETE

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TABLE 5.7-2 (Continued)

Where:

$\Delta T_a = (T_{101} - T_{229}) + 60$

$\Delta T_m = (T_{101} - T_{103*} \text{ or } {}_{104*}) + 70$

NA = Allowable number of spray cycles

N = Number of cycles in ΔT range indicated

Calculational Method:

1. The spray cycle is defined as any initiation and termination of main or auxiliary spray flow throughout the pressurizer spray nozzle.

2. If the difference between pressurizer water temperature and the spray water temperature exceeds 200°F each spray cycle and the corresponding temperature difference is logged.

3. The spray nozzle usage factor shall be calculated as follows:

   A. Fill in Column "N" above.

   B. Calculate "N/N_A" (Divide N by N_A).

   C. Add Column "N/N_A" to find $\Sigma N/N_A$.

   $\Sigma N/N_A$ is the cumulative spray nozzle usage factor. If the cumulative usage factor is equal to or less than 0.65 no further action is required.

4. If the cumulative usage factor exceeds 0.65, subsequent pressurizer spray operation shall continue to be monitored and an engineering evaluation of nozzle fatigue shall be performed within 90 days. The evaluation shall determine that the nozzle remains acceptable for additional service beyond the 90 day period or subsequent spray operation shall be restricted so that the difference between the pressurizer water temperature and the spray water temperature shall be limited to less than or equal to 200°F when spray is operated.

DELETE

*Use lower of two temperatures.

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PRESSURIZER HEATUP/COOLDOWN LIMITS

LIMITING CONDITION FOR OPERATION

3.4.8.2 The pressurizer temperature shall be limited to:

a. A maximum heatup rate of 200°F per hour, and

b. A maximum cooldown rate of 200°F per hour.

APPLICABILITY: At all times.

ACTION:

With the pressurizer temperature limits in excess of any of the above limits, restore the temperature to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the structural integrity of the pressurizer; determine that the pressurizer remains acceptable for continued operation or be in at least HOT STANDBY within the next 6 hours and reduce the pressurizer pressure to less than 500 psig within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.8.2.1 The pressurizer temperatures shall be determined to be within the limits at least once per 30 minutes during system heatup or cooldown.

4.4.8.2.2 The spray water temperature differential shall be determined for use ~~in Table 5.7-2~~ for each cycle of main spray with less than four reactor coolant pumps operating and for each cycle of auxiliary spray operation.

delete

5.0 DESIGN FEATURES

5.1 SITE LOCATION

See new writeup

SITE AND EXCLUSION BOUNDARIES

5.1.1 The site and exclusion boundaries shall be as shown in Figure 5.1-1.

LOW POPULATION ZONE

5.1.2 The low population zone shall be as shown in Figure 5.1-2.

GASEOUS RELEASE POINTS

5.1.3 The gaseous release points shall be as shown in Figure 5.1-3.

5.2 CONTAINMENT

CONFIGURATION

5.2.1 The reactor containment building is a steel lined, prestressed concrete building of cylindrical shape, with a dome roof and having the following design features:

a. Nominal inside diameter = 146 feet.

b. Nominal inside height = 206.5 feet.

c. Minimum thickness of concrete walls = 3 feet, 8 inches.

d. Minimum thickness of concrete roof = 3 feet, 8 inches.

e. Minimum thickness of concrete floor pad = 10.5 feet.

f. Nominal thickness of steel liner = 0.25 inch.

g. Net free volume = 2.6×10^6 cubic feet.

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for a maximum internal pressure of 60 psig and a temperature of 300°F.

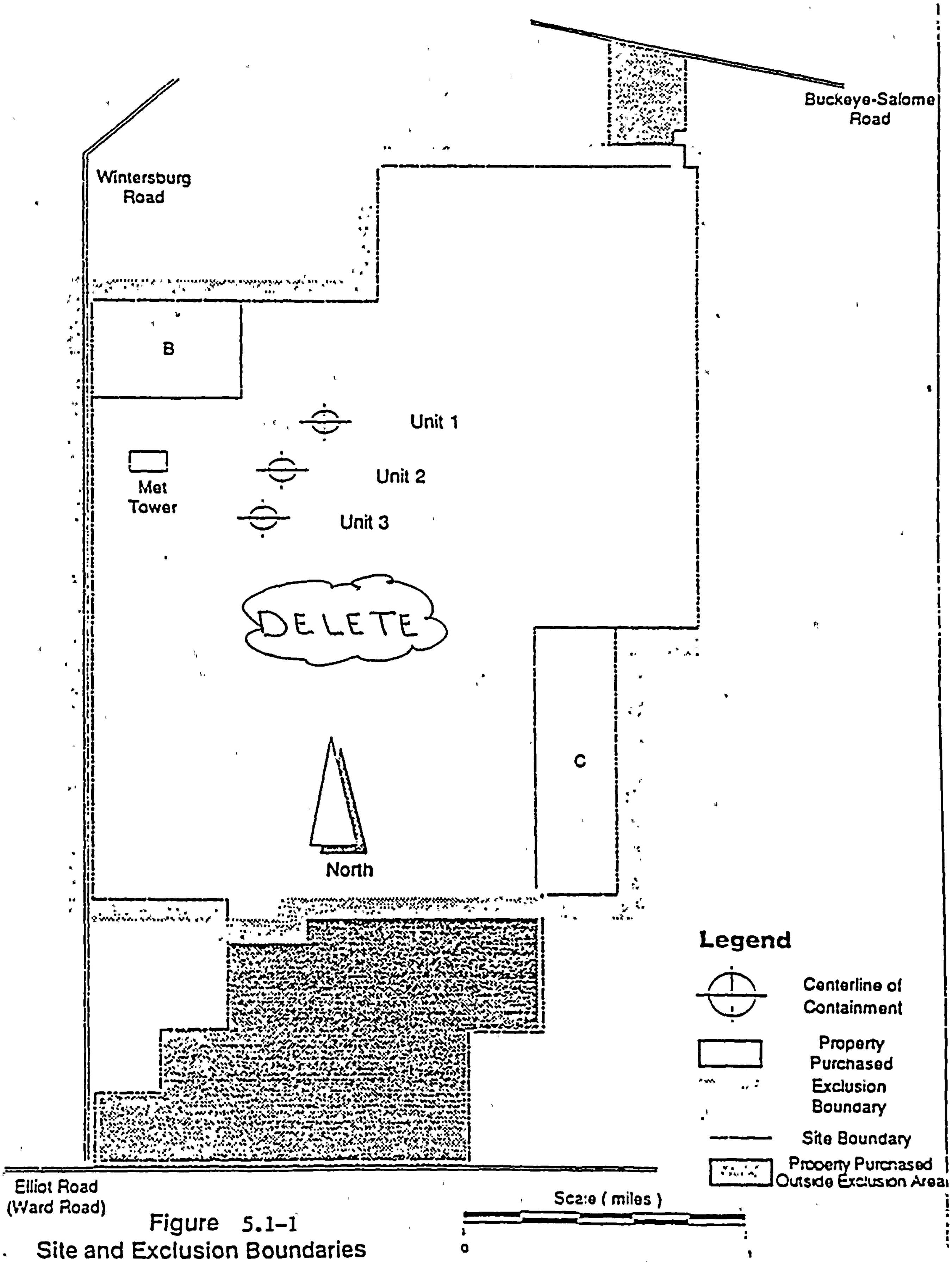
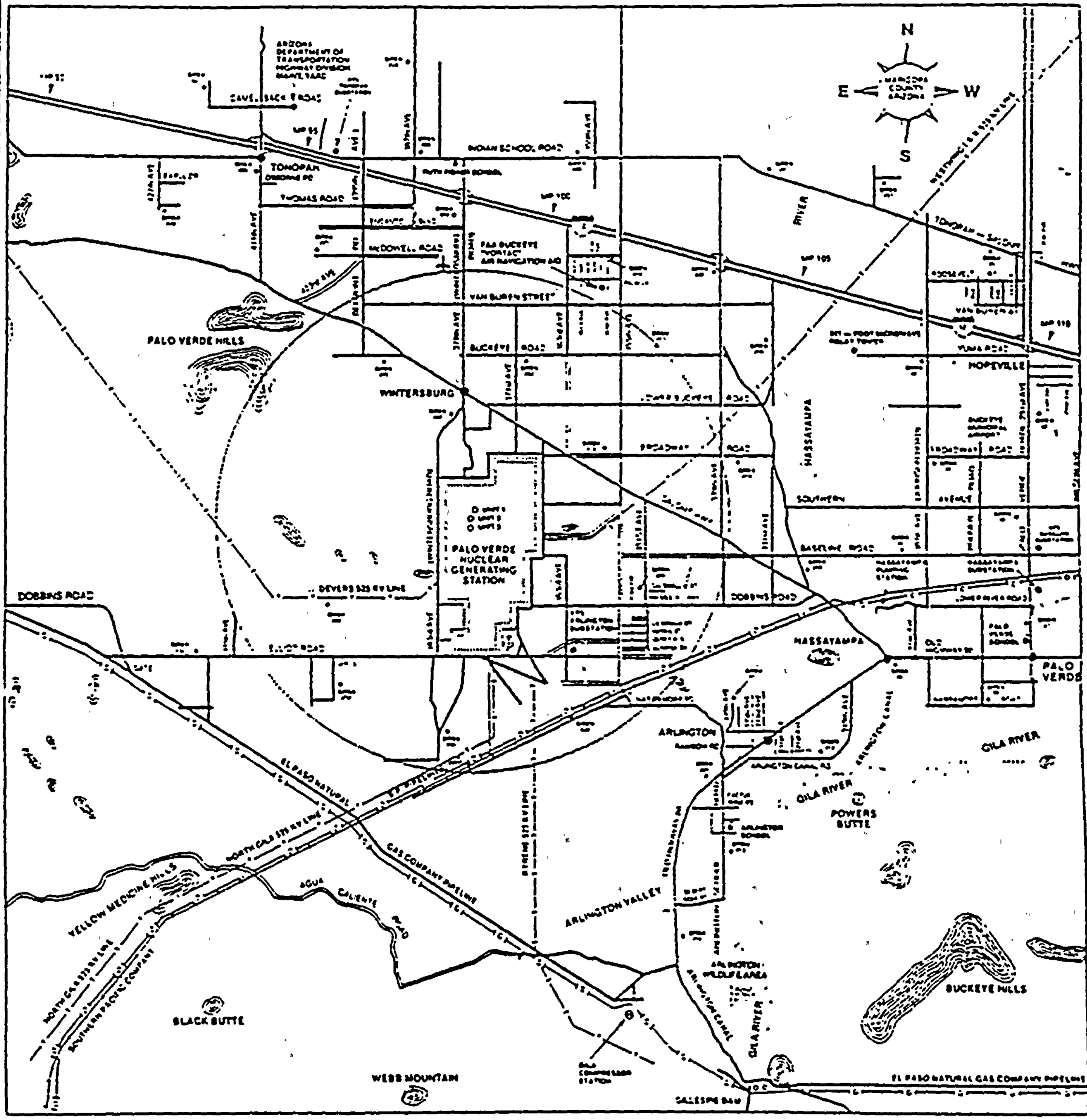


Figure 5.1-1
Site and Exclusion Boundaries

FOR INFORMATION ONLY

Graphic Scale in Miles

0 1 2 3 4 5



KEY TO MAP

- Paved Road
- Unpaved Road
- 4WD Road
- Gas Pipeline
- Oil Pipeline
- Power Line
- Railroad
- Airstrip
- Palo Verde Nuclear Generating Station Boundary
- School
- Siren
- Milepost

Palo Verde Nuclear Generating Station
LOW POPULATION ZONE

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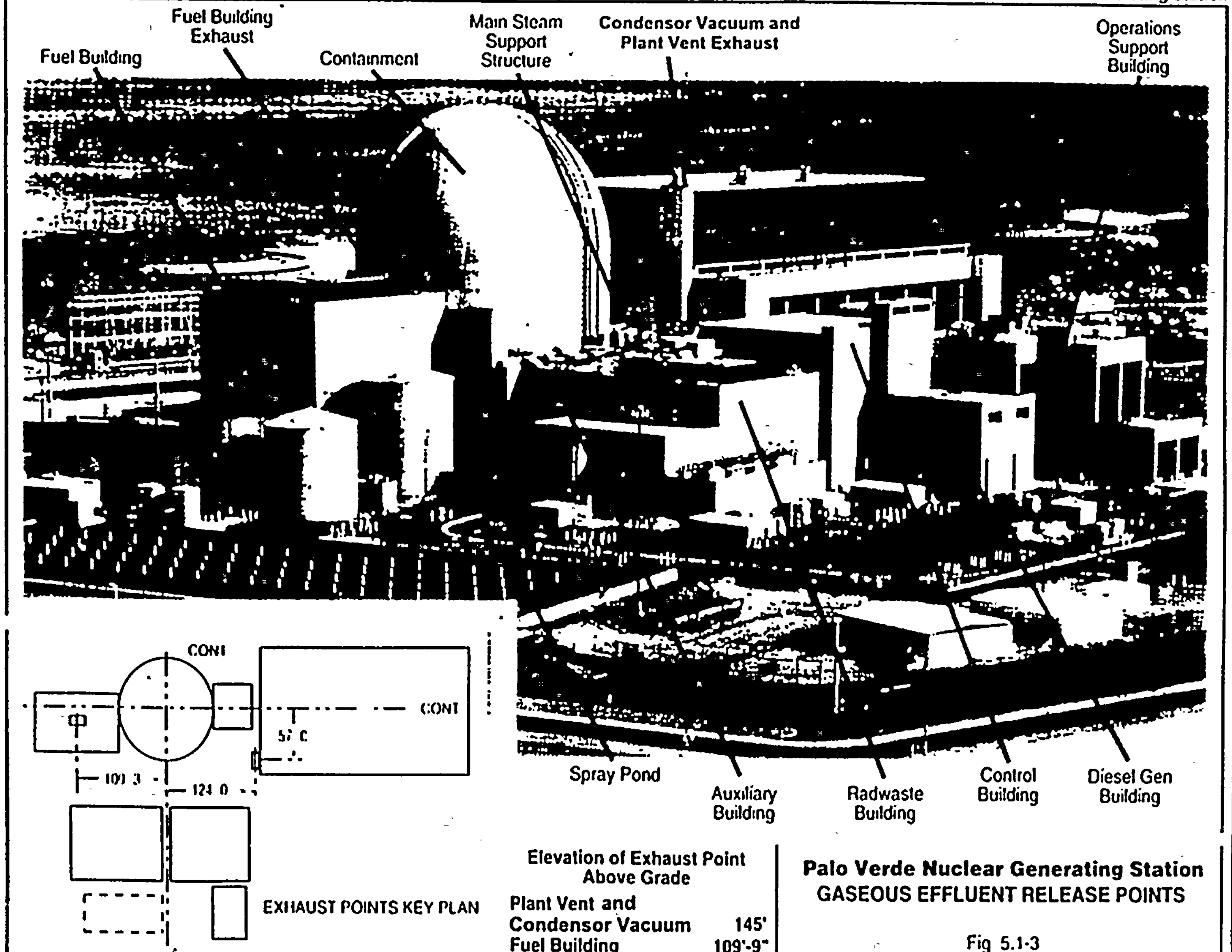
0–5 Miles

Figure 5.1-2



Elevation of Exhaust Point Above Grade	
Plant Vent and Condensor Vacuum	145'
Fuel Building	109'-9"

Palo Verde Nuclear Generating Station
GASEOUS EFFLUENT RELEASE POINTS

Fig 5.1-3

PALO VERDE - UNIT 3

DELETE

Amendment 34, 62

5.3 2 REACTOR CORE

FUEL ASSEMBLIES (see new writeup)

5.3.1 2 The reactor core shall contain 241 fuel assemblies with each fuel assembly normally containing 236 fuel rods or burnable poison rods clad with Zircaloy-4 except that limited substitution of fuel rods by filler rods consisting of Zircaloy-4 or stainless steel may be made if justified by a cycle specific reload analysis. Substitution of up to a total of 80 fuel rods clad with zirconium-based alloys other than Zircaloy-4 may also be made in two fuel assemblies for in-reactor performance evaluation purposes during Cycles 4, 5 and 6. Each fuel rod shall have a nominal active fuel length of 150 inches and contain a maximum total weight of approximately 1950 grams uranium. Each burnable poison rod shall have a nominal active poison length of 136 inches. The initial core loading shall have a maximum enrichment of 3.35 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum radially averaged enrichment of 4.30 weight percent U-235 at any axial location.

CONTROL ELEMENT ASSEMBLIES

5.3.2 2 The reactor core shall contain 76 full-length and 13 part-length control element assemblies.

~~5.4 REACTOR COOLANT SYSTEM~~

~~DESIGN PRESSURE AND TEMPERATURE~~

~~5.4.1 The Reactor Coolant System is designed and shall be maintained:~~

~~a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant of the applicable surveillance requirements,~~

~~b. For a pressure of 2500 psia, and~~

~~c. For a temperature of 650°F, except for the pressurizer which is 700°F.~~

~~VOLUME~~

~~5.4.2 The total water and steam volume of the Reactor Coolant System is 13,900 + 300/-0 cubic feet at a nominal T_{avg} of 593°F.~~

~~5.5 METEOROLOGICAL TOWER LOCATION~~

~~5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.~~

5.6 FUEL STORAGE

5.6.1 CRITICALITY

5.6.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. The maximum calculated k_{eff} value, including margin for uncertainty in calculational method and mechanical tolerances, less than or equal to 0.95 with a 95% probability at a 95% confidence level when flooded with unborated water.

b. A nominal 9.5 inches center-to-center distance between adjacent storage cell locations.

5.6.1.2 The k_{eff} for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

5.6.1.3 The spent fuel storage pool is organized into three regions for spent fuel storage. Fuel shall be placed in the appropriate region based on appropriate initial enrichment and existing burnup as designated in Figure 5.6-1:

a. Region 1: Fuel shall be stored in a checkerboard (two-out-of-four) storage pattern. Fuel that qualifies to be stored in Regions 1, 2, or 3, in accordance with Figure 5.6-1, may be stored in Region 1.

b. Region 2: Fuel shall be stored in a three-out-of-four storage pattern. Fuel that qualifies to be stored in Regions 2 or 3, in accordance with Figure 5.6-1, may be stored in Region 2.

c. Region 3: Fuel shall be stored in a four-out-of-four storage pattern. Only fuel that qualifies to be stored in Region 3, in accordance with Figure 5.6-1, shall be stored in Region 3.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 137 feet - 6 inches.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1329 fuel assemblies.

~~5.7 COMPONENT CYCLIC OR TRANSIENT LIMITS~~

~~5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Tables 5.7-1 and 5.7-2.~~

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FIGURE 5.6-1
ASSEMBLY BURNUP VERSUS INITIAL ENRICHMENT

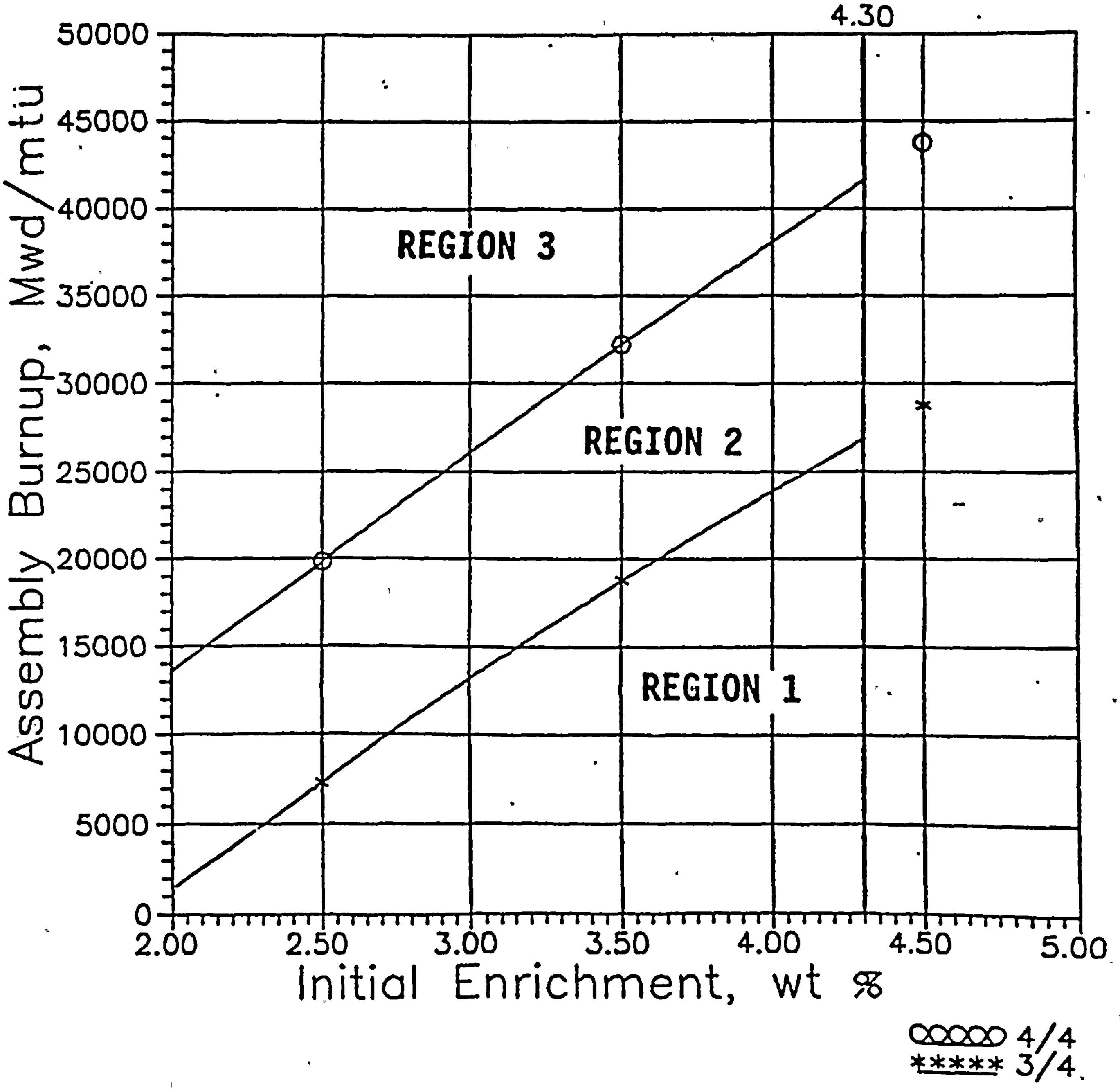

TABLE 5.7-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	500 system heatup and cooldown cycles at rates $\leq$ 100°F/hr.	Heatup cycle - Temperature from $\leq$ 70°F to $\geq$ 565°F; cooldown cycle - Temperature from $\geq$ 565°F to $\leq$ 70°F.
	500 pressurizer heatup and cooldown cycles at rates $\leq$ 200°F/hr.	Heatup cycle - Pressurizer temperature from $\leq$ 70°F to $\geq$ 653°F; cooldown cycle - Pressurizer temperature from $\geq$ 653°F to $\leq$ 70°F.
	10 hydrostatic testing cycles.	RCS pressurized to 3125 psia with RCS temperature between 120°F and 400°F.
	480 reactor trip cycles, turbine trip cycles, and loss of reactor coolant flow.	Includes combinations of reactor trips due to operator errors, equipment malfunctions, and total loss of reactor coolant flow.
	200 seismic stress cycles.	Subjection to a seismic event equal to one-half the design basis earthquake (DBE).
	1 complete loss of secondary pressure cycle.	Loss of secondary pressure from either steam generator due to a complete double-ended break of a steam generator steam or feedwater nozzle.

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TABLE 5.7-1 (Continued)

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
	200 primary system leak test cycles	Leak test primary system at a pressure of 2250 psia at a temperature from 120°F to 400°F.
Pressurizer Spray Nozzle	Calculate usage factor per Table 5.7-2.	Main spray (less than four RCP operating) with fluid ΔT_m > 200°F. Auxiliary spray with fluid ΔT_a > 200°F.

ΔT_m = The difference in temperature between the pressurizer and main spray water as adjusted by the instrument correction factor.

ΔT_a = The difference in temperature between the pressurizer and Auxiliary spray water as adjusted by the instrument correction factor.

DELETE

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TABLE 5.7-2

PRESSURIZER SPRAY NOZZLE USAGE FACTOR

Main Spray				Auxiliary Spray			
ΔT_m	N_A	N	N/N_A	ΔT_a	N_A	N	N/N_A
201-250	7900			201-250	50000		
251-300	4500			251-300	2200		
301-350	2900			301-350	1300		
351-400	1900			351-400	850		
401-450	1200			401-450	550		
451-500	850			451-500	375		
501-550	555			501-550	225		
				551-600	150		
		$\Sigma N/N_A$ =	________			$\Sigma N/N_A$ =	________

Cumulative Usage Factor

$\Sigma N/N_A$ (Main Spray) ________________

$\Sigma N/N_A$ (Aux. Spray) ________________

Total ________________ = Cumulative Usage Factor

DELETE

FOR INFORMATION ONLY

TABLE 5.7-2 (Continued)

Where:

$\Delta T_a = (T_{101} - T_{229}) + 60$

$\Delta T_m = (T_{101} - T_{103*} \text{ or } _{104*}) + 70$

NA = Allowable number of spray cycles

N = Number of cycles in ΔT range indicated

Calculational Method:

1. The spray cycle is defined as any initiation and termination of main or auxiliary spray flow throughout the pressurizer spray nozzle.

2. If the difference between pressurizer water temperature and the spray water temperature exceeds 200°F each spray cycle and the corresponding temperature difference is logged.

3. The spray nozzle usage factor shall be calculated as follows:

   A. Fill in Column "N" above.

   B. Calculate "N/N_A" (Divide N by N_A).

   C. Add Column "N/N_A" to find $\Sigma N/N_A$.

   $\Sigma N/N_A$ is the cumulative spray nozzle usage factor. If the cumulative usage factor is equal to or less than 0.65 no further action is required.

4. If the cumulative usage factor exceeds 0.65, subsequent pressurizer spray operation shall continue to be monitored and an engineering evaluation of nozzle fatigue shall be performed within 90 days. The evaluation shall determine that the nozzle remains acceptable for additional service beyond the 90 day period of subsequent spray operation shall be restricted so that the difference between the pressurizer water temperature and the spray water temperature shall be limited to less than or equal to 200°F when spray is operated.

DELETE

*Use lower of two temperatures.

5.1 SITE LOCATION The Palo Verde Nuclear Generating Station is located in Maricopa County, Arizona, approximately 50 miles west of the Phoenix metropolitan area. The site is comprised of approximately 4,050 acres. Site elevations range from 890 feet above mean sea level at the southern boundary to 1,030 feet above mean sea level at the northern boundary.. The minimum distance from a containment building to the exclusion area boundary is 871 meters.

5.2 REACTOR CORE

FUEL ASSEMBLIES

5.2.1 The reactor core shall contain 241 fuel assemblies. Each assembly shall consist of a matrix of Zircaloy or ZIRLO fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of Zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in non-limiting core regions. Other cladding material may be used with an approved exemption.

CONTROL ELEMENT ASSEMBLIES

5.2.2 The reactor core shall contain 76 full-length and 13 part-length control element assemblies.

5.3 FUEL STORAGE

5.3.1 CRITICALITY

5.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum radially averaged U-235 enrichment of 4.30 weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1.2 of the UFSAR.

c. A nominal 9.5 inch center-to-center distance between adjacent storage cell locations.

5.3.1.2 The spent fuel storage pool is organized into three regions for spent fuel storage. Fuel shall be placed in the appropriate region based on appropriate initial enrichment and existing burnup as designated in Figure 5.3-1:

a. Region 1: Fuel shall be stored in a checkerboard (two-out-of- four) storage pattern. Fuel that qualifies to be stored in Regions 1, 2, or 3 in accordance with Figure 5.3-1, may be stored in Region 1.

b. Region 2: Fuel shall be stored in a three-out-of-four storage pattern. Fuel that qualifies to be stored in Regions 2 or 3, in accordance with Figure 5.3-1, may be stored in Region 2.

c. Region 3: Fuel shall be stored in a four-out-of-four storage pattern. Only fuel that qualifies to be stored in Region 3, in accordance with Figure 5.3-1, shall be stored in Region 3.

5.3.1.3 The new fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum radially averaged U-235 enrichment of 4.30 weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1.1 of the UFSAR;

c. $k_{eff} \leq 0.98$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.1.1 of the UFSAR; and

d. A nominal 17 inch center-to-center distance between fuel assemblies placed in the storage racks.

<u>DRAINAGE</u>

5.3.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 137 feet 6 inches.

<u>CAPACITY</u>

5.3.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1329 fuel assemblies.

4.0 DESIGN FEATURES

4.1 Site Location [Text description of the site location.] Plant specific information

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain [~~217~~ 241] fuel assemblies. Each assembly shall consist of a matrix of [Zircalloy or ZIRLO] fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions. Other cladding material may be used with an approved exemption.

4.2.2 [Control Rod] Assemblies

The reactor core shall contain [~~91~~ 76 full-length and 13 part-length] control element assemblies (CEAs). ~~The control material shall be [silver indium cadmium, boron carbide, or hafnium metal] as approved by the NRC.~~ [not applicable to PVNGS]

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of [~~4.5~~ 4.30] weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in [Section ~~9.1~~ 9.1.2 of the ~~FSAR~~ UFSAR];

(continued)

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

[c. A nominal [~~9~~] 9.5 inch center to center distance between ~~fuel assemblies placed in [the high density fuel storage racks]:]~~ adjacent storage cell locations.

[d. A nominal [10.4] inch center to center distance between fuel assemblies placed in [the low density fuel storage racks]:]

PVNGS plant specific information Section 5.3.1.2, including Figure 5.3-1.

[e. New or partially spent fuel assemblies with a discharge burnup in the "acceptable range" of Figure [3.7.17-1] may be allowed unrestricted storage in [either] fuel storage rack(s); and]

[f. New or partially spent fuel assemblies with a discharge burnup in the "unacceptable range" of Figure [3.7.17-1] will be stored in compliance with the NRC approved [specified document containing the analytical methods, title, date, or specific configuration or figure].]

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of [~~4.5~~] 4.30 weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in [Section ~~9.1~~ 9.1.1 of the ~~FSAR~~ UFSAR];

c. $k_{eff} \leq 0.98$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in [Section ~~9.1~~ 9.1.1 of the ~~FSAR~~ UFSAR]; and

d. A nominal [~~10~~] 17 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation [~~23~~ 137 ft 6 inches].

(continued)

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than [~~1542~~] fuel assemblies. 1329