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USNRC

May 5, 2008 (4:00pm)

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May 1, 2008

Lawrence G. McDade, Chair
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Atomic Safety and Licensing Board Panel
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Dr. Richard E. Wardwell
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Atomic Safety and Licensing Board Panel
Mail Stop - T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

In the Matter of
Entergy Nuclear Operations, Inc.
(Indian Point Nuclear Generating Units 2 and 3)
Docket Nos. 50-247-LR/50-286-LR

Dear Administrative Judges:

The purpose of this letter is to inform the Licensing Board that, on April 30, 2008, Entergy Nuclear Operations, Inc. submitted Amendment No. 4 to the License Renewal Application ("LRA") for Indian Point Energy Center ("IPEC"). As stated in the associated transmittal letter (NL-08-074), LRA Amendment No. 4 involves changes to the LRA resulting from the completion of the installation of the new Station Blackout (SBO)/Appendix R diesel

TEMPLATE = SECY-043

DS-03

generator for IPEC Unit 2. A copy of LRA Amendment No. 4 is enclosed for your information. Copies of the amendment also have been sent by e-mail and first class mail to those parties identified in the service list for this proceeding.

Sincerely,

Martin J. O'Neill

Kathryn M. Sutton
Paul M. Bessette
Martin J. O'Neill

Counsel for Entergy Nuclear Operations, Inc.

Enclosure: As stated
cc w/ encl.: Service List
William Dennis, Assistant General Counsel
Entergy Nuclear Operations, Inc.

1-WA/2968004.1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
Lawrence G. McDade, Chair
Dr. Richard E. Wardwell
Dr. Kaye D. Lathrop

In the Matter of)	Docket Nos. 50-247-LR and 50-286-LR
)	
ENTERGY NUCLEAR OPERATIONS, INC.)	ASLBP No. 07-858-03-LR-BD01
)	
(Indian Point Nuclear Generating Units 2 and 3))	May 1, 2008
)	

CERTIFICATE OF SERVICE

I hereby certify that copies of a letter from counsel for Entergy Nuclear Operations, Inc. to the Atomic Safety and Licensing Board, dated May 1, 2008, was served this 1st day of May 2008 upon the persons listed below, by first class mail and e-mail as shown below. The letter forwards a copy of Amendment No. 4 to the License Renewal Application for Indian Point Energy Center, dated April 30, 2008 (NL-08-074).

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Fred Dacimo
Vice President
License Renewal

April 30, 2008

Re: Indian Point Unit Nos. 2 & 3
Docket Nos. 50-247 & 50-286
NL-08-074

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Entergy Nuclear Operations, Inc.
Indian Point Nuclear Generating Unit Nos. 2 & 3
Docket Nos. 50-247 and 50-286
Amendment 4 to License Renewal Application (LRA)

REFERENCES:

1. Entergy Letter dated April 23, 2007, F. R. Dacimo to Document Control Desk, "License Renewal Application" (NL-07-039)

2. Entergy Letter dated April 23, 2007, F. R. Dacimo to Document Control Desk, "License Renewal Application Boundary Drawings" (NL-07-040)

3. Entergy Letter dated April 23, 2007, F. R. Dacimo to Document Control Desk, "License Renewal Application Environmental Report References" (NL-07-041)

4. Entergy Letter dated June 21, 2007, F. R. Dacimo to Document Control Desk, "Station Blackout (SBO) / Appendix R Diesel Generator Commitment for Indian Point Nuclear Generating Unit No. 2 in Response to NRC Review Status of License Renewal Application" (NL-07-078)

5. Entergy Letter dated October 11, 2007, F. R. Dacimo to Document Control Desk, "Supplement to License Renewal Application (LRA)" (NL-07-124)

6. Entergy Letter dated November 14, 2007, F. R. Dacimo to Document Control Desk, "Supplement to License Renewal Application (LRA) Environmental Report References" (NL-07-133)

Dear Sir or Madam:

In the referenced letters, Entergy Nuclear Operations, Inc. applied for renewal of the Indian Point Energy Center operating license.

In Reference 4, Entergy committed to install and make operational a new Station Blackout (SBO) / Appendix R diesel generator for Indian Point Nuclear Generating Unit No. 2 (IP2) by April 30, 2008. This commitment has been met and Attachment 1 to this letter contains Amendment 4 of the License Renewal Application (LRA), consisting of LRA changes resulting from the completion of the installation of the diesel generator for IP2. Drawings LRA-400881-0 and LRA-400882-0 are discussed on page 2 of Attachment 1 and they are included as Enclosures 1 and 2, respectively.

Enclosure 3 to this letter contains the UFSAR changes associated with the SBO / Appendix R diesel generator installation, which will be incorporated into the IP2 and IP3 UFSARs at the next scheduled updates. Although this is not part of Amendment 4 of the LRA, it is being provided as supplemental information to facilitate NRC review.

Entergy Nuclear Operations, Inc. is making no new commitments in this letter.

If you have any questions, or require additional information, please contact Mr. Robert Walpole, Licensing Manager, at 914-734-6710.

I declare under penalty of perjury that the foregoing is true and correct. Executed on

4\30\08

Sincerely,

Fred R. Dacimo
Vice President
License Renewal

Attachments:

1. Station Blackout (SBO) / Appendix R Diesel Generator for IP2, LRA Amendment 4

Enclosures:

1. Drawing LRA-400881-0
2. Drawing LRA-400882-0
3. IP2 and IP3 UFSAR License Basis Document Changes (supplemental information)

cc: Mr. Samuel J. Collins, Regional Administrator, NRC Region I
Mr. Sherwin E. Turk, NRC Office of General Counsel, Special Counsel
Mr. Kenneth Chang, NRC Branch Chief, Engineering Review Branch I
Mr. Bo M. Pham, NRC Environmental Project Manager
Mr. John Boska, NRR Senior Project Manager
Mr. Paul Eddy, New York State Department of Public Service
NRC Resident Inspector's Office, Indian Point Energy Center
Mr. Paul D. Tonko, President, New York State Energy, Research, & Development Authority

ATTACHMENT 1 TO NL-08-074

Station Blackout / Appendix R Diesel Generator for IP2
LRA Amendment 4

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 & 3
DOCKET NOS. 50-247 AND 50-286

Station Blackout / Appendix R Diesel
License Renewal Application
Amendment 4

(Changes are shown as strikethroughs for ~~deletions~~ and underlines for <u>additions</u>)

2.1.1.3.5, Commission's Regulations for Station Blackout (10 CFR 50.63), third paragraph, is changed to read as follows

~~Upon completion of its installation and testing, a~~ The new diesel generator, the SBO/Appendix R diesel generator (SBO/ARDG), ~~will be~~<u>is</u> the source of alternate AC power credited for IP2 compliance with 10 CFR 50.63~~. The SBO/ARDG will be the source of alternate AC power continuing through the period of extended operation. The SBO/ARDG will be installed and operational prior to completion of NRC review of this application.~~ The SBO/ARDG ~~will replace the gas turbines to~~ provide<u>s</u> power for Appendix R and station blackout events. The integrated plant assessment for license renewal includes review of the SBO/ARDG. Specifically, the results of that review are included in Section 2.3.3.16 for scoping and screening, and in Table 3.3.2-16-IP2 for the aging management review.

Table 2.2-3, line item is changed to read as follows.

Gas Turbine Substation Switchgear Structures and Foundation ~~(IP3)~~	Section 2.4.3, Turbine Buildings, Auxiliary Buildings, and Other Structures

2.3.3.8, Heating, Ventilation and Air Conditioning, SBO/Appendix R Diesel Generator Ventilation is changed to read as follows.

~~Before entering the period of extended operation, IP2 will have completed the installation of a new station blackout (SBO) and Appendix R diesel.~~ The IP2 SBO/Appendix R diesel generator is credited with providing backup power to the plant to assist in safe shutdown following a fire ~~and~~or following <u>a</u> station blackout and its associated ventilation equipment is required for this equipment to function. The IP2 SBO/Appendix R diesel ~~will~~ utilize<u>s</u> louvers~~, fire dampers,~~ an exhaust fan, and outlet ductwork. The fan will operate when the diesel is in operation.

Section 2.3.3.13 System Description is revised as follows:

Gas Turbine System

The gas turbine system description is included in the fuel oil section because its only intended function for license renewal is performed by its fuel oil subsystem.

~~The purpose of the gas turbine (GT) system is to provide an alternate source of standby power for the site. Gas turbine Unit 1 is located adjacent to the Unit 1 turbine building. Gas turbine Units 2 and 3 are located at the Buchanan substation. The gas turbines have been credited as an alternate power supply for the Appendix R and station blackout events;~~

~~however, these functions will be assumed by the IP2 SBO/Appendix R diesel generator (SBO/ARDG) prior to the period of extended operation.~~

2.3.3.16, Appendix R Diesel Generators, the second and third paragraphs are changed to read as follows.

The SBO/Appendix R diesel generator (SBO/ARDG) ~~will be~~ is the source of alternate AC power credited for IP2 compliance with 10 CFR 50.63. ~~continuing through the period of extended operation.~~ The SBO/ARDG ~~replace the gas turbines to~~ provides power for Appendix R and station blackout events. The integrated plant assessment for license renewal identified the SBO/ ARDG as within the scope of license renewal.

The SBO/ARDG~~Appendix R diesel will be~~ is located inside the Unit 1 turbine building. The SBO/ARDG~~Appendix R diesel generator installation will be a self-contained package that~~ is designed to operate upon a complete loss of power. The ~~package contains~~ SBO/ARDG includes batteries, a battery charger, jacket water heater and cooler, turbochargers, aftercoolers, aftercooler coolers, jacket water pump, lube oil ~~heater and~~ cooler, lube oil pump, and necessary filters and piping.~~strainers~~. The SBO/ARDG~~Appendix R diesel generator~~ can supply the safe shutdown loads through the 6.9 kV distribution and the emergency 480 V buses and motor control centers or the turbine building switchgear and motor control centers.

2.3.3.16, License Renewal Drawings, Unit 2, is changed to read as follows.

LRA-40088~~2~~1
LRA-40088~~5~~2

2.3.3.19, Components Subject to Aging Management Review table on page 2.3-171 is changed to read as follows.

IP2 System Code	Area or Components Excluded
ARDG (SBO/Appendix R Diesel Generator)	The SBO/Appendix R diesel generator is ~~not yet~~ installed ~~for IP2; however, it will be~~ in the IP1 turbine hall. The SBO/ARDG system was not reviewed for 54.4(a)(2) for spatial interaction because all of its ~~the~~ passive mechanical components were already included for ~~the~~ its ~~(a)(1) or the~~ (a)(3) functions.

Table 2.3.3-16-IP2 is changed to read as follows.

Table 2.3.3-16-IP2
SBO/Appendix R Diesel Generator System
Components Subject to Aging Management
Review

Component Type	**Intended Function**
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flexible connection	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (fins)	Heat transfer
Heat exchanger (housing)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Silencer	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Turbocharger housing	~~Heat transfer~~ Pressure boundary
Valve body	Pressure boundary

2.4.3, Turbine Buildings, Auxiliary Buildings, and Other Structures, Description, *Gas Turbine Generator No. 1, 2 and 3 Enclosure and Fuel Tank Foundation*, is changed to read as follows.

Fifth paragraph: The gas turbine generators No. 2 and 3 enclosure is a seismic Class III structure providing shelter and protection from the elements for ~~the gas turbines and their associated~~ equipment. The gas turbine No. 2 and 3 enclosure is located at the Buchanan substation. The enclosure houses gas turbine generators No. 2 and 3 and associated switchgear equipment. The switchgear and associated components within the structure support offsite power recovery following station blackout. ~~the site's Appendix R safe shutdown analysis.~~ Gas turbine 2 and 3 fuel tank foundation supports the fuel tank, which provides an alternate source of fuel for the emergency diesel generators. These fuel tanks are shared by IP2 and IP3 and credited with providing minimum fuel oil inventory for the emergency diesel generators. If the EDGs require the reserves in these tanks, the contents can be transported by tanker truck.

Ninth Paragraph bullet:

Provide support, shelter and protection for equipment needed for offsite power recovery following ~~credited for~~ station blackout. ~~(10 CFR 50.63) and Appendix R safe shutdown (10 CFR 50.48).~~ Components required to restore offsite power following a station blackout (SBO) were conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

Tenth paragraph:

The gas turbine substation switchgear structures and foundation provides support equipment required to support offsite power recovery following station blackout. ~~achieve and maintain hot shutdown in the event a fire prevents control from the central control room.~~

Thirteenth paragraph bullet:

Provide support for equipment needed for offsite power recovery following ~~credited in support of Appendix R safe shutdown analysis (10 CFR 50.48) and~~ station blackout. ~~(10 CFR 50.63).~~ Components required to restore offsite power following a station blackout (SBO) were conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

3.2.2.2.4 Reduction of Heat Transfer due to Fouling

1. Reduction of heat transfer due to fouling for copper alloy heat exchanger tubes exposed to lubricating oil in ESF systems is managed by the Oil Analysis Program. There are no stainless steel or steel heat exchanger tubes exposed to lubricating oil in the ESF systems; however, this item is applicable to heat exchanger tubes of the SBO/Appendix R diesel generator. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to fouling. The One-Time Inspection Program will use visual inspections or non-destructive examinations of representative samples to confirm that the Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.3.2.1.16 Appendix R Diesel Generators, Materials, is changed to add "plastic"

Table 3.2.1 line item is changed to read as follows.

Table 3.2.1
Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801

Table 3.2.1: Engineered Safety Features, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-9	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	The Oil Analysis Program manages reduction of heat transfer in copper alloy *and stainless steel* heat exchanger tubes. The One-Time Inspection Program will be used to confirm the effectiveness of the Oil Analysis Program. ~~There are no stainless steel or steel heat exchanger tubes exposed to lube oil in the ESF systems.~~ See Section 3.2.2.2.4 item 1.

Table 3.3.2-16-IP2 is changed to read as follows.

Table 3.3.2-16-IP2
SBO/ Appendix R Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	Bolting integrity	VII.I-4 (AP-27)	3.3.1-43	A
Bolting	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
Filter housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
~~Filter housing~~	~~Pressure boundary~~	~~Carbon steel~~	~~Air – indoor (int)~~	~~Loss of material~~	~~External surfaces monitoring~~	~~V.A-19 (E-29)~~	~~3.2.1-32~~	~~E~~
Filter housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-20 (AP-30)	3.3.1-14	B, 316
Filter housing	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Filter housing	Pressure boundary	Plastic	Air – indoor (int)	None	None	--	--	F
Flexible connection	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
~~Flexible connection~~	~~Pressure boundary~~	~~Stainless steel~~	~~Exhaust gas (int)~~	~~Cracking – fatigue~~	~~TLAA – metal fatigue~~	~~—~~	~~—~~	~~H~~
Flexible connection	Pressure boundary	Stainless steel	Exhaust gas (int)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2-2 (A-27)	3.3.1-18	E

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flexible connection	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-17 (AP-59)	3.3.1-33	B, 316
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Periodic surveillance and preventive maintenance	--	--	G, 305
~~Heat exchanger (bonnet)~~	~~Pressure boundary~~	~~Carbon steel~~	~~Treated water (int)~~	~~Loss of material~~	~~Water chemistry control – closed cooling water~~	~~VII.C2-1 (A-63)~~	~~3.3.1-48~~	~~D~~
Heat exchanger (fins)	Heat transfer	~~Aluminum~~ Carbon steel	Air – indoor (ext)	Fouling	Periodic surveillance and preventive maintenance	--	--	H
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (housing)	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External surfaces monitoring	V.A-19 (E-29)	3.2.1-32	E
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.H2-3 (AP-41)	3.3.1-59	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-5 (AP-39)	3.3.1-21	B, 316
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Periodic surveillance and preventive maintenance	--	--	G, 305
Heat exchanger (shell)	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.C2-1 (A-63)	3.3.1-48	D

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	~~Copper alloy~~ <u>Stainless steel</u>	Air – indoor (ext)	Fouling	Periodic surveillance and preventive maintenance	--	--	G
Heat exchanger (tubes)	Heat transfer	~~Copper alloy~~ <u>Stainless steel</u>	Lube oil (ext)	Fouling	Oil analysis	V.A-1~~2~~<u>4</u> (EP-~~47~~<u>50</u>)	3.2.1-9	D, 316
Heat exchanger (tubes)	Heat transfer	~~Copper alloy~~ <u>Stainless steel</u>	Treated water (int)	Fouling	Water chemistry control – closed cooling water	VII.C2-~~2~~<u>3</u> (AP-~~80~~<u>63</u>)	3.3.1-52	D
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water (int)	Fouling	Periodic surveillance and preventive maintenance	--	--	G, 305
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated water > 140°F (~~in~~<u>ext</u>)	Fouling	Water chemistry control – closed cooling water	VII.C2-3 (AP-63)	3.3.1-52	D
Heat exchanger (tubes)	Pressure boundary	<u>Stainless steel</u>	Air – indoor (ext)	None	None	<u>VII.J-15 (AP-17)</u>	3.3.1-94	C
<u>Heat exchanger (tubes)</u>	<u>Pressure boundary</u>	<u>Stainless steel</u>	<u>Lube oil (ext)</u>	<u>Cracking</u>	<u>Oil analysis</u>	<u>--</u>	<u>--</u>	<u>H</u>
Heat exchanger (tubes)	Pressure boundary	~~Copper alloy~~ <u>Stainless steel</u>	Lube oil (ext)	Loss of material	Oil analysis	VII.H2-~~10~~<u>17</u> (AP-~~47~~<u>59</u>)	3.3.1-~~26~~<u>33</u>	D, 316
Heat exchanger (tubes)	Pressure boundary	~~Copper alloy~~ <u>Stainless steel</u>	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.~~E1-2~~<u>C2-10</u> (~~AP-34~~<u>A-52</u>)	3.3.1-~~51~~<u>50</u>	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water (int)	Loss of material	Periodic surveillance and preventive maintenance	--	--	G, 305

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (~~in~~ext)	Cracking	Water chemistry control – closed cooling water	VII.E3-2 (A-68)	3.3.1-46	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (~~in~~ext)	Loss of material	Water chemistry control – closed cooling water	VII.E3-1 (A-67)	3.3.1-49	D
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (~~in~~ext)	Loss of material – wear	Heat exchanger monitoring	--	--	H
Heat exchanger (tubes)	Pressure boundary	Stainless steel	Treated water > 140°F (int)	Cracking	Periodic surveillance and preventive maintenance	--	--	G, 305
Heater housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Heater housing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Piping	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Piping	Pressure boundary	Carbon steel	Air – outdoor (ext)	Loss of material	External surfaces monitoring	VII.I-9 (A-78)	3.3.1-58	A
~~Piping~~	~~Pressure boundary~~	~~Carbon steel~~	~~Condensation (int)~~	~~Loss of material~~	~~Periodic surveillance and preventive maintenance~~	~~VII.H2-21 (A-23)~~	~~3.3.1-71~~	~~E~~
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Piping	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2-2 (A-27)	3.3.1-18	E

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Piping~~	~~Pressure boundary~~	~~Carbon steel~~	~~Lube oil (int)~~	~~Loss of material~~	~~Oil analysis~~	~~VII.H2-20 (AP-30)~~	~~3.3.1-14~~	~~B, 316~~
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Piping	Pressure boundary	Plastic	Air – indoor (ext)	None	None	--	--	F
Piping	Pressure boundary	Plastic	Air – indoor (int)	None	None	--	--	F
Pump casing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Pump casing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-20 (AP-30)	3.3.1-14	B, 316
Pump casing	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Sight glass	Pressure boundary	Copper alloy > 15% Zn	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Sight glass	Pressure boundary	Copper alloy > 15% Zn	Lube oil (int)	Loss of material	Oil analysis	VII.H2-10 (AP-47)	3.3.1-26	B, 316
Sight glass	Pressure boundary	Copper alloy > 15% Zn	Treated water (int)	Loss of material	Selective leaching	VII.H2-12 (AP-43)	3.3.1-84	A, 307
Sight glass	Pressure boundary	Copper alloy > 15% Zn	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-8 (AP-12)	3.3.1-51	B
Sight glass	Pressure boundary	Glass	Air – indoor (ext)	None	None	VII.J-8 (AP-14)	3.3.1-93	A

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Sight glass	Pressure boundary	Glass	Lube oil (int)	None	None	VII.J-10 (AP-15)	3.3.1-93	A
Sight glass	Pressure boundary	Glass	Treated water (int)	None	None	VII.J-11 (AP-50)	3.3.1-93	A, 303
Silencer	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Silencer	Pressure boundary	Carbon steel	Exhaust gas (int)	Cracking – fatigue	TLAA – metal fatigue	--	--	H
Silencer	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2-2 (A-27)	3.3.1-18	E
Tank	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Tank	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-20 (AP-30)	3.3.1-14	B, 316
Tank	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Thermowell	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
Thermowell	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Tubing	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Tubing	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-17 (AP-59)	3.3.1-33	B, 316

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Turbocharger housing	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
~~Turbocharger housing~~	~~Pressure boundary~~	~~Carbon steel~~	~~Air – indoor (int)~~	~~Loss of material~~	~~External surfaces monitoring~~	~~V.A-19 (E-29)~~	~~3.2.1-32~~	~~E~~
Turbocharger housing	Pressure boundary	Carbon steel	Exhaust gas (int)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2-2 (A-27)	3.3.1-18	E
Turbocharger housing	Pressure boundary	Carbon steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-20 (AP-30)	3.3.1-14	B, 316
~~Turbocharger housing~~	~~Heat transfer~~	~~Carbon steel~~	~~Air – indoor (int)~~	~~Fouling~~	~~Periodic surveillance and preventive maintenance~~	~~—~~	~~—~~	~~G~~
~~Turbocharger housing~~	~~Heat transfer~~	~~Carbon steel~~	~~Treated water (int)~~	~~Fouling~~	~~Water chemistry control – closed cooling water~~	~~VII.H2-23 (A-25)~~	~~3.3.1-47~~	~~B~~
~~Turbocharger housing~~	~~Pressure boundary~~	~~Carbon steel~~	~~Air – indoor (ext)~~	~~Loss of material~~	~~External surfaces monitoring~~	~~VII.I-8 (A-77)~~	~~3.3.1-58~~	~~A~~
Turbocharger housing	Pressure boundary	Carbon steel	Air – indoor (int)	Loss of material	External surfaces monitoring	V.A-19 (E-29)	3.2.1-32	E
~~Turbocharger housing~~	~~Pressure boundary~~	~~Carbon steel~~	~~Treated water (int)~~	~~Loss of material~~	~~Water chemistry control – closed cooling water~~	~~VII.H2-23 (A-25)~~	~~3.3.1-47~~	~~B~~
Valve body	Pressure boundary	Carbon steel	Air – indoor (ext)	Loss of material	External surfaces monitoring	VII.I-8 (A-77)	3.3.1-58	A
~~Valve body~~	~~Pressure boundary~~	~~Carbon steel~~	~~Condensation (int)~~	~~Loss of material~~	~~Periodic surveillance and preventive maintenance~~	~~VII.H2-21 (A-23)~~	~~3.3.1-71~~	~~E~~

Table 3.3.2-16-IP2: SBO/ Appendix R Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
~~Valve body~~	~~Pressure boundary~~	~~Carbon steel~~	~~Lube oil (int)~~	~~Loss of material~~	~~Oil analysis~~	~~VII.H2-20 (AP-30)~~	~~3.3.1-14~~	~~B, 316~~
Valve body	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-23 (A-25)	3.3.1-47	B
Valve body	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil analysis	VII.H2-10 (AP-47)	3.3.1-26	B, 316
Valve body	Pressure boundary	Copper alloy	Treated water (int)	Loss of material	Water chemistry control – closed cooling water	VII.H2-8 (AP-12)	3.3.1-51	B
Valve body	Pressure boundary	Copper alloy > 15% Zn	Air – indoor (ext)	None	None	V.F-3 (EP-10)	3.2.1-53	C
Valve body	Pressure boundary	Copper alloy > 15% Zn	Lube oil (int)	Loss of material	Oil analysis	VII.H2-10 (AP-47)	3.3.1-26	B, 316
Valve body	Pressure boundary	Stainless steel	Air – indoor (ext)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Valve body	Pressure boundary	Stainless steel	Lube oil (int)	Loss of material	Oil analysis	VII.H2-17 (AP-59)	3.3.1-33	B, 316

A.2.1.16, last item of the first bullet is changed to read as follows.

- SBO/Appendix R diesel ~~jacket~~ cooling water heat exchangers

A.2.1.28, seventeenth and eighteenth bullets are changed to read as follows.

- SBO/Appendix R diesel turbochargers and aftercoolers
- SBO/Appendix R diesel~~jacket~~ cooling water heat exchangers

B.1.9, DIESEL FUEL MONITORING, Enhancement 5 is changed to read as follows.

Attributes Affected	Enhancements
5. Monitoring and Trending	IP2: Revise appropriate procedures to change the GT1 gas turbine fuel oil storage tanks, SBO/Appendix R diesel generator day tank, and diesel fire pump fuel oil storage tank analysis for water and particulates to a quarterly frequency. IP3: Revise appropriate procedures to change the Appendix R diesel generator fuel oil day tank and diesel fire pump fuel oil storage tank analysis for water and particulates to a quarterly frequency.

B.1.17, HEAT EXCHANGER MONITORING, Scope of Program, Enhancement, last bullet, is changed to read as followings.

- SBO/Appendix R diesel ~~jacket~~ cooling water heat exchangers (IP2 only)

B.1.17, HEAT EXCHANGER MONITORING, Enhancement. 1. Scope of Program, last bullet, is changed to read as follows.

- SBO/Appendix R diesel ~~jacket~~ cooling water heat exchangers (IP2 only)

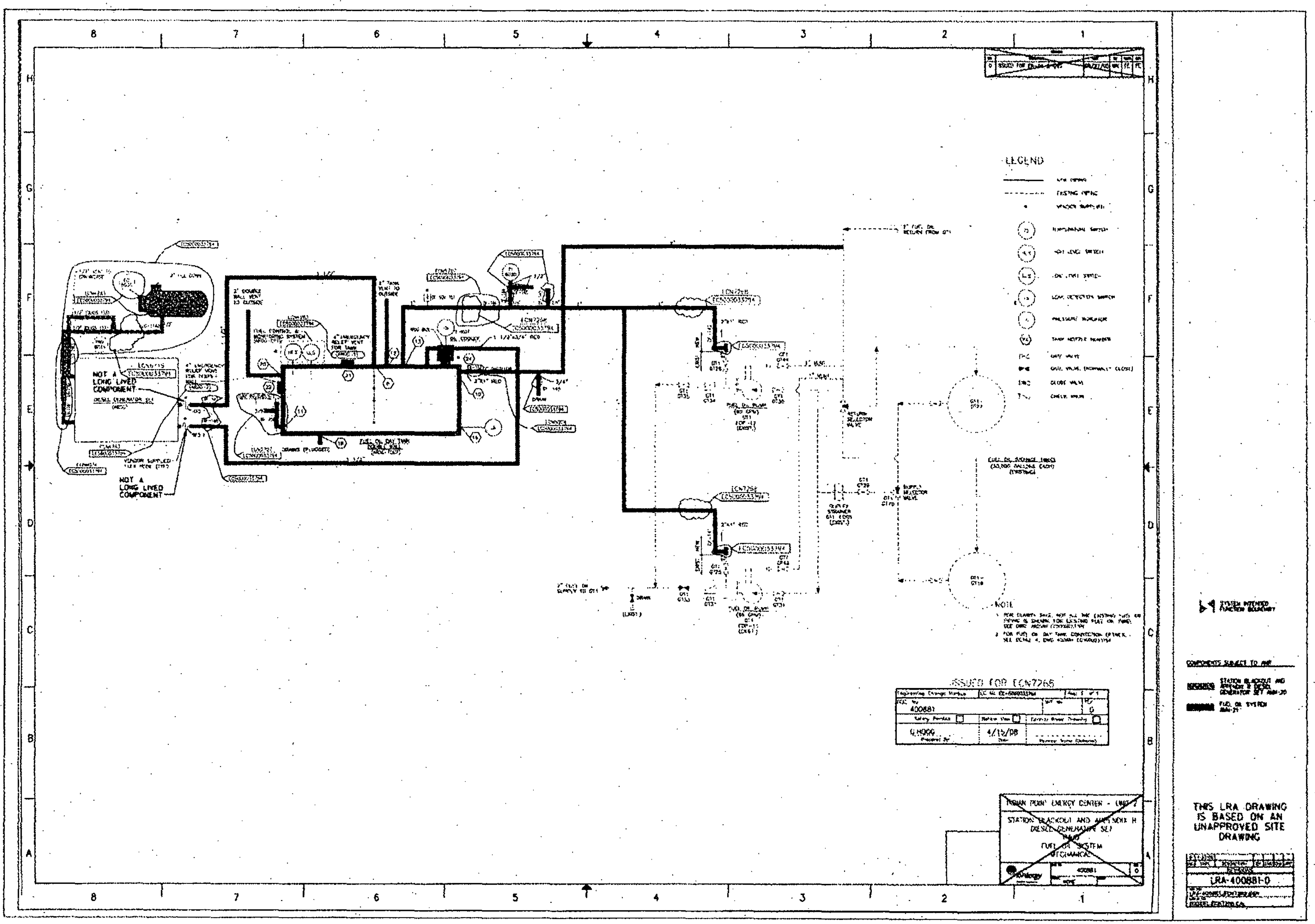
B.1.29, PERIODIC SURVEILANCE AND PREVENTIVE MAINTENANCE, Program Description, IP2 SBO/Appendix R Diesel Generator, is changed to read as follows.

IP2 SBO/Appendix R Diesel Generator	Use visual or other NDE techniques to inspect internal surfaces of a representative sample of diesel exhaust gas piping, piping elements, and components to manage cracking and loss of material on internal surfaces. Use visual or other NDE techniques to inspect the internal surface condition of the engine turbocharger and aftercooler housing including external surfaces of tubes and fins to manage loss of material and fouling. Use visual or other NDE techniques to inspect the internal surfaces of the diesel ~~jacket~~ cooling water heat exchangers carbon steel bonnets and stainless steel tubes exposed to treated water (city water).

ENCLOSURE 1 TO NL-08-074

Drawing LRA-400881-0

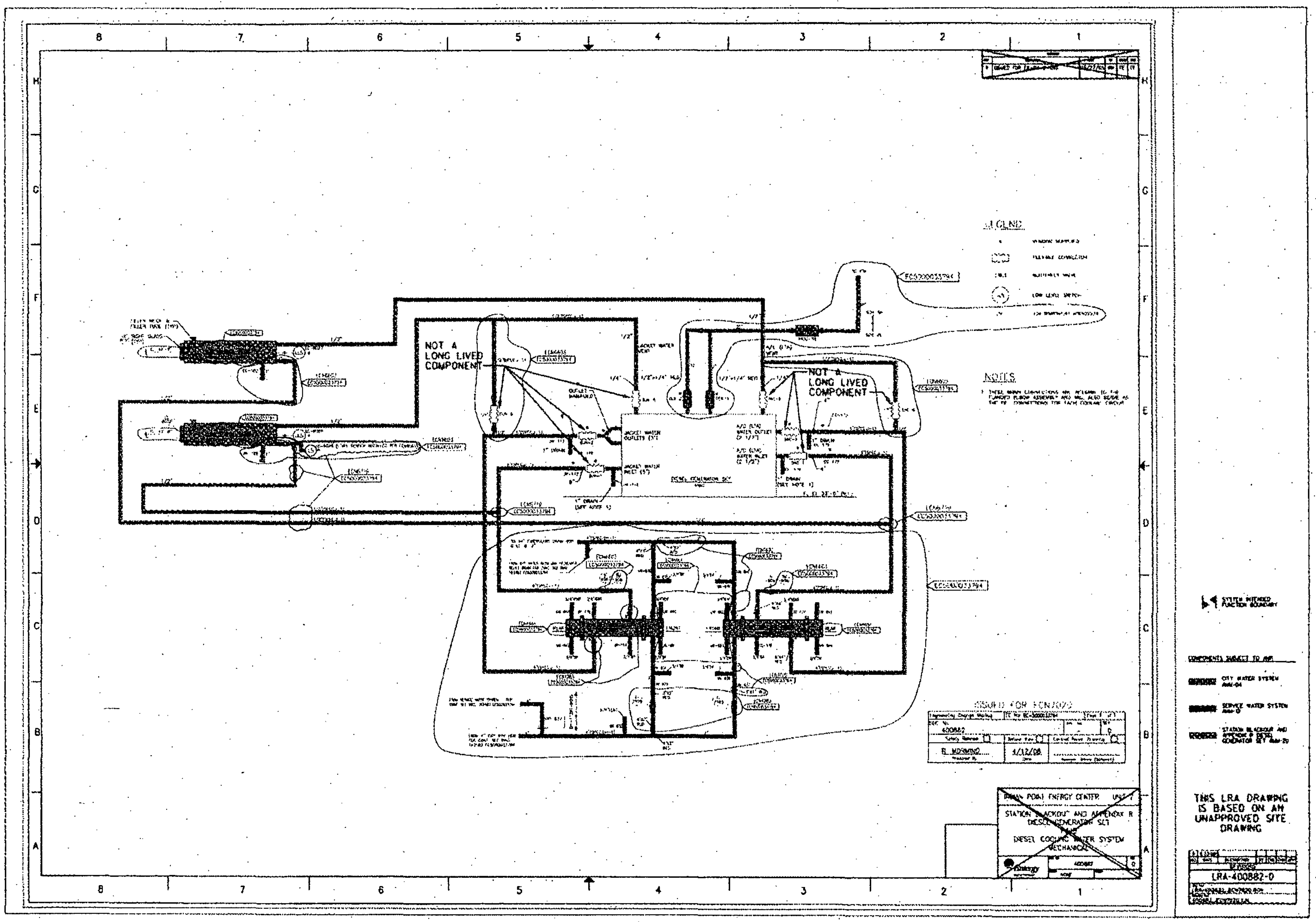
ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 & 3
DOCKET NOS. 50-247 & 50-286


LEGEND
NOT A LONG LIVED COMPONENT
DIESEL GENERATOR SET
VENDOR SUPPLIED
FUEL OIL DAY TANK
DRAINS (PLUGGED)
2" DOUBLE WALL VENT TO OUTSIDE
4" EMERGENCY RELIEF VENT
ECN7265
NOTE
ISSUED FOR ECN7265
400881
G.HOGG
4/15/08
INDIAN POINT ENERGY CENTER - UNIT 2
STATION BLACKOUT AND APPENDIX R
DIESEL GENERATOR SET
FUEL OIL SYSTEM
MECHANICAL
COMPONENTS SUBJECT TO AMR
STATION BLACKOUT AND APPENDIX R DIESEL GENERATOR SET
FUEL OIL SYSTEM
SYSTEM INTENDED FUNCTION BOUNDARY
THIS LRA DRAWING IS BASED ON AN UNAPPROVED SITE DRAWING
LRA-400881-0

ENCLOSURE 2 TO NL-08-074

Drawing LRA-400882-0

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 & 3
DOCKET NOS. 50-247 & 50-286



NOT A LONG LIVED COMPONENT
NOT A LONG LIVED COMPONENT
LEGEND
NOTES
DIESEL GENERATOR SET
ISSUED FOR ECN2070
400882
4/12/08
COMPONENTS SUBJECT TO AMR
CITY WATER SYSTEM
SERVICE WATER SYSTEM
STATION BLACKOUT AND APPENDIX R DIESEL GENERATOR SET
INDIAN POINT ENERGY CENTER UNIT 2
STATION BLACKOUT AND APPENDIX R DIESEL GENERATOR SET
DIESEL COOLING WATER SYSTEM MECHANICAL
Entergy
THIS LRA DRAWING IS BASED ON AN UNAPPROVED SITE DRAWING
LRA-400882-0

ENCLOSURE 3 TO NL-08-074

IP2 and IP3 UFSAR License Basis Document Changes (supplemental information)

IP2 UFSAR - 11 pages

IP3 UFSAR - 11 pages

Changes are shown as strikethroughs for ~~deletions~~ and bold underlines for **additions**

ENTERGY NUCLEAR OPERATIONS, INC.
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DOCKET NOS. 50-247 & 50-286

Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits shall be designed to be available within a few seconds following a loss-of-coolant accident to assure that the core cooling, containment integrity, and other vital safety functions are maintained.

Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

Independent alternate power systems are provided with adequate capacity and testability to supply the required engineered safety features and protection systems.

The plant is supplied with normal, standby, and emergency power sources as follows:

1. The normal source of auxiliary power for 6.9-kV buses 1, 2, 3, and 4 during plant operation is the unit auxiliary transformer, which is connected to the main generator via the iso-phase bus.

2. The normal source of auxiliary power for 6.9-kV buses 5 and 6 and standby power required during plant startup, shutdown, and after reactor trip is the station auxiliary transformer, which is supplied from the Con Edison 138-kV system by either of two separate overhead lines from the Buchanan substation approximately 0.5 mile from the plant. Alternate feeds from the Buchanan 13.8-kV system are also available for immediate manual connection to the auxiliary buses. ~~In addition, three gas turbines with blackstart (no auxiliary power) capability are available. These gas turbines may also be used to "bootstrap" the unit back to power operation following a loss of the Con Edison grid. The capacities of these gas turbine generators require that the station load be reduced to a minimum during startup.~~

3. Three diesel-generator sets supply emergency power to the engineered safety features buses in the event of a loss of AC auxiliary power. There are no automatic bus ties associated with these buses. ~~The three gas turbines discussed in item 2 may also serve to supply emergency shutdown power.~~**<u>The SBO / Appendix R emergency diesel-generator is installed in Unit 1 Turbine Building and is used to supply power for Appendix R fires and a Station Blackout.</u>**

4. Power for vital instrumentation and controls and for emergency lighting is supplied from the four 125-V DC systems. The station batteries supply

Failure of a single inverter or its static transfer to switch will not cause the loss of a basic protective system or prevent the actuation of the minimum safeguards devices.

Several sources of offsite power are available to Indian Point Unit 2. These consist of two 138-kV overhead supplies from the Buchanan 138-kV substation, **and** three separate underground feeders from the Buchanan 13.8-kV substation~~, and three 13.8-kV gas turbines (one of which is located on-site)~~. The 13.8-kV line is rated 19.8 MVA at 13-kV. The 13.8/6.9-kV transformer is rated 20 MVA. The maximum engineered safety feature and safe shutdown loads are 9.2 MVA. No safety or emergency power is required from these sources for the retired Indian Point Unit 1.

The Buchanan 138-kV substation supply to Indian Point Unit 2 has two connections to the Millwood 138-kV substation, a connection to the Peekskill Refuse Burning Generating Station and a connection via auto-transformer to the Buchanan North 345-kV substation. The Indian Point Unit 2 345-kV connection to the system goes to the Buchanan North 345-kV substation, which has connections to Ramapo and Eastview 345-kV substations. System stability studies show that the system is stable for the loss of any generating unit including Indian Point Unit 2.

Each 138-kV overhead tie line can provide offsite power to Indian Point 2 via the station auxiliary transformer. The loss of this transformer would interrupt the 138-kV supply to the station. For this reason, an alternate 13.8/6.9-kV supply is provided.

A**n** **a**dditional sources of offsite power from the 13.8-kV distribution system at Buchanan ~~and an independent power supply from the onsite gas turbine (Unit 1) installation are~~ **is** available to 6.9-kV buses 5 and 6 through supply breakers GT-25 and GT-26. The transfer from the normal to the reserve supply (or vice versa) must be accomplished manually.

~~Three (3) gas turbine generators are directly available to the Indian Point site. One gas turbine generator is more than adequate to provide an additional contingency of backup electrical power for maintaining the plant in a safe shutdown condition.~~

~~Gas turbine Unit 1 is located adjacent to the Unit 1 turbine building. The position indication and controls for breakers GT-25 and GT-26 are located on a panel in the Central Control Room.~~

~~Gas turbine Units 2 and 3 are located at the Buchanan substation. Either of these gas turbines can supply power to the Unit 2 auxiliary electrical system through the Buchanan 13.8-kV distribution system connections or through the 138-kV tie lines.~~

Each of these circuits is designed to be available in sufficient time following a loss of all onsite AC power supplies and other offsite electric power circuits, to ensure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. The 138-kV system is designed to be available instantaneously following a loss-of-coolant accident to ensure that core cooling, containment integrity, and other vital safety functions are maintained. This is accomplished by a "dead-fast" transfer scheme that uses stored energy breakers to transfer the auxiliaries on the four 6.9-kV buses supplied by the unit auxiliary transformer to the station auxiliary transformer, which is supplied from the 138-kV system. However, when buses 5 and 6 are supplied from the alternate 13.8-kV supply, the "dead fast" transfer scheme is defeated by manual action to protect the 13.8-kV-6.9-kV transformer.

The diversity and redundancy inherent in the combination of ~~onsite/~~offsite electrical systems minimize the probability of losing electric power from any of the remaining sources as a result

4. Letter from Con Edison to the Nuclear Regulatory Commission, Subject: Station Blackout Rule, dated April 14,1989.

5. Letter from Con Edison to the Nuclear Regulatory Commission, Subject: Station Blackout Rule, dated March 27,1990.

6. Letter from Con Edison to the Nuclear Regulatory Commission, Subject: Station Blackout Rule, dated October 22, 1993.

7. Letter from Con Edison to the Nuclear Regulatory Commission, Subject: Station Blackout Rule, dated November 30,1993.

8. Letter from Francis J. Williams, U.S. Nuclear Regulatory Commission, to Stephen B. Bram, Con Edison, Subject: Safety Evaluation of the Indian Point Nuclear Generating Unit No.2, Response to the Station Blackout Rule (TAC No. M68556), dated November 21, 1991.

9. Letter from Con Edison to the Nuclear Regulatory Commission, Subject: Station Blackout Rule, dated December 23, 1991.

8.2 ELECTRICAL SYSTEM DESIGN

8.2.1 Network Interconnections

Con Edison's external transmission system provides two basic functions for the nuclear generating station: (1) it provides auxiliary power as required for startup and normal shutdown and (2) it transmits the output power of the station.

Electrical energy generated at 22-kV is raised to 345-kV by the two main transformers. Power is delivered to the system via a 345-kV overhead tie line routed between the main transformers and the 345-kV North Ring Bus at Buchanan Substation. The North Ring Bus is configured with three circuit breakers rated 362-kV, 3000A, 40/63kA. Two of these breakers have synchronizing capability to connect the main generator to the system. The North Ring Bus is also connected to Ramapo and Eastview Substations via overhead transmission circuits and to the Buchanan 138-kV Substation via a 335/138-kV auto-transformer.

The electrical one-line diagram for the Indian Point Station is presented in Plant Drawing 250907 [Formerly UFSAR Figure 8.2-1]. Standby power is supplied to the station from the Buchanan 138-kV Substation, which has two connections to the Millwood 138-kV Substation, one connection to the Peekskill Refuse Burner, and one connection to the Buchanan 345-kV Substation via an auto-transformer. ~~In addition, gas turbine power can be provided to Indian Point Unit 2 from any of the three gas turbines.~~ Several power flow paths exist to connect ~~gas turbine power to the plant, either thru various switching arrangements of 13.8-kV and 6.9-kV underground feeders, or thru combinations of 13.8-kV underground feeders, transformations up through the Buchanan 138-kV, and thru either of the two 138-kV overhead feeders. Maximum flexibility of routing is provided by inter-ties at the Buchanan substation (138-kV and~~ 13.8-kV buses~~) and at the Indian Point site (138-kV site switchyard and gas turbine substation 6.9-kV bus tie). One of these gas turbine-generators is located at the Indian Point site and two are located at the Buchanan Substation.~~ through 13.8/6.9 kV autotransformers to Buses 1 and 6.

A single-line diagram showing the connections of the main generator to the power system grid and standby power source is shown in Plant Drawing 250007 [Formerly UFSAR Figure 8.2-2].

8.2.1.1 Reliability Assurance

T**wo**~~hree~~ external sources of standby power are available to Indian Point Unit 2. They are the 138-kV tie from the Buchanan 345-kV substation, **and** the 138-kV Buchanan-Millwood ties~~, and the gas turbine generators.~~ Loss of any ~~two~~ of these sources will not affect the **other** ~~third~~. Substantial flexibility and alternate paths exist within each source.

The 138-kV supply from the Buchanan substation with its connections to the Con Edison 345-kV system provides a dependable source of station auxiliary power. Upon loss of 345/138-kV auto-transformer supply at Buchanan, two 138-kV ties are designed to provide additional auxiliary power from the Millwood 138-kV substation. A further guarantee of reliable auxiliary power, independent of transmission system connections, is provided by the ~~three gas turbine generators, one installed at the plant site and two (2) at Buchanan.~~ **SBO / Appendix R Diesel for the Appendix R fire or a loss of all AC (station blackout).** [redacted] **The SBO / Appendix R diesel, associated switchgear and breakers minimum operating requirements are specified in the TRM. The minimum quantity of fuel for the SBO / Appendix R Diesel to operate for 72 hours shall be available at all times the SBO / Appendix R Diesel is considered operable. Support systems for cooling include the City Water Storage Tank and the Service Water System (first the city water and then a switch to SW). If these requirements cannot be met, then the diesel is considered inoperable and the TRM requirments are followed.** ~~The gas turbines can provide an alternate backup power source in case of loss of onsite emergency power and concurrent loss of offsite power as well as required auxiliary power for alternate safe shutdown equipment. Minimum operating conditions for the gas turbines are specified in the Unit 2 Technical Requirements Manual.[TRM].~~

The fuel supply ~~for gas turbines~~ consists of two onsite 30,000-gal fuel oil tanks and a 200,000-gal storage tank located at the Buchanan substation site. A minimum amount ~~of 94,870 gal~~ of fuel is maintained available and dedicated for the **SBO / Appendix R Diesel** ~~required gas turbine~~. This minimum fuel inventory ensures that ~~one gas turbine~~ **the SBO / Appendix R Diesel** will be capable of supplying the maximum electrical load for the Indian Point Unit 2 alternate safe shutdown power supply system (i.e., 1600kW) for at least 3 days. Commercial oil supplies and trucking facilities exist to ensure deliveries of additional fuel within one day's notice.

In the event of the loss of the Indian Point Unit 2 138-kV supply (the primary preferred offsite supply), the Indian Point Unit 2 13.8/6.9-kV supply is manually connected to 6.9-kV buses 5 and 6. The capacity of this supply is limited and is not capable of supplying full plant load. However, the 13.8-6.9-kV supply is capable of supplying the normal load on buses 5 and 6 and is also capable of supplying all 480-V safeguards and safe shutdown loads. The "dead-fast" transfer of 6.9-kV buses 1, 2, 3, and 4 is prevented by manual action when buses 5 and 6 are supplied from the 13.8/6.9-kV supply.

8.2.2 Station Distribution System

The auxiliary electrical system is designed to provide a simple arrangement of buses requiring a minimum of switching to restore power to a bus in the event that the normal supply is lost.

In 1989, the NRC approved changes to the design basis with respect to dynamic effects of postulated primary loop ruptures, as discussed in Section 4.1.2.4.

In those areas where the compressed instrument air system is near the essential 480-V switchgear, the following provisions have been incorporated to shield this essential switchgear and cabling from potential missiles or pipe whip:

1. The compressed instrument air lines in the vicinity of the switchgear are supported at the piping bends. This will resist any step loading of PA (which could occur in the event of an instantaneous circumferential rupture) without occurrence of a "plastic hinge." The possibility of pipe whip is eliminated.

2. A guard cover is supplied around the air compressor flywheel. This cover is designed to absorb the translational kinetic energy associated with a compressor flywheel missile.

3. A guard barrier is supplied adjacent to the compression chamber of the air compressor. This barrier is designed to absorb the kinetic energy associated with a compression chamber segment.

These provisions ensure that no missile or whipping pipe originating from postulated failures in the compressed instrument air system will strike the essential switchgear.

8.2.3 Emergency Power

8.2.3.1 Source Descriptions

The ~~three~~ sources of offsite emergency power are: (1) the Con Edison 345-kV system and (2) Con Edison's 138-kV system ~~and (3) the licensee's gas turbines~~. The emergency diesel-generator sets provide three sources of onsite emergency power. Each set is an Alco Model 16-251-E engine coupled to a Westinghouse 900 rpm, 3-phase, 60-cycle, 480-V generator. The units have a capability of 1750 kW (continuous), 2300 kW for 1/2 hour in any 24 hour period, and 2100 kW for 2 hours in any 24 hour period. There is a sequential limitation whereby it is unacceptable to operate EDG's for two hours at 2100 kW followed by operating at 2300 kW for a half hour. Any other combination of the above ratings is acceptable.

Any two units, backups to the normal standby AC power supply, are capable of sequentially starting and supplying the power requirement of at least one complete set of safeguards equipment. The units are installed in a seismic Class I structure located near the Primary Auxiliary Building.

Each emergency diesel is automatically started by two redundant air motors, each unit having a complete 53-ft^3 air storage tank and compressor system powered by a 480-V motor. The piping and the electrical services are arranged so that manual transfer between units is possible. The capability exists to cross-connect a single EDG air compressor to more than one (1) EDG air receiver, via manual air tie valves. However, to ensure that the operability of two (2) of the three (3) EDGs is maintained for minimum safeguards in the event of a single failure, administrative controls are in-place to require an operator to be stationed within the EDG Building, whenever any of the starting air tie valves are opened. Each air receiver has sufficient storage for four normal starts. However, the diesel will consume only enough air for one automatic start during manner, transfer pump 22 receives an automatic starting signal on low level in the day tank for diesel 22 and is backed up by transfer pump 23. Transfer pump 23 starts on low level in the day tank for diesel generator 23 and is backed up by transfer pump 21.

Each diesel oil transfer pump stops automatically when 15.5-in. of oil remains in the associated underground tank which equates to a maximum of approximately 7000-gal of available fuel oil per tank. A minimum fuel storage of 19,000 gal (i.e., approximately 6340 gal per tank) is maintained in the three underground storage tanks.

The 19,000 gal of storage ensures that two diesels can operate for at least 73 hours at the maximum load profile permitted by the diesels' ratings. If one of the three storage tanks is not available, there is sufficient fuel oil to run two diesels at the maximum load profile for at least 45 hours. *Similarly, if three diesels are available, there is sufficient fuel oil in the three storage* tanks for at least 45 hours of operation at the maximum load profile. These values are based on the use of No. 2 diesel fuel oil at the lowest density of 6.87 lb/gal and engine fuel oil consumption rates based on operating at each load rating. For heavier oil, the time would be increased proportionally to the ratio of 6.87 lb/gal and the actual fuel density. An upper limit of 7.39 lb/gal is common for No. 2 diesel oil.

Additional fuel oil suitable for the diesel engines is stored on the site ~~for gas turbine GT-1~~ and at Buchanan substation. ~~for gas turbines GT-2 and GT-3.~~ A minimum additional storage of 29,000 gal is maintained in the storage tanks dedicated for diesel-generator use. This storage is sufficient for operation of two diesels for at least 111 hours at the maximum load profile permitted by the diesels' ratings. As previously mentioned (Section 8.2.1), commercial oil supplies and trucking facilities exist to ensure deliveries on one day's notice.

The basis for the minimum total required fuel oil quantity of 48,000 gallons is to provide for operation of two diesel generators for 7 days. The specified minimum quantity of fuel oil is based on operation of two diesel generators for 7 days at the maximum load profile permitted by the diesel generator rating. Each diesel is rated for operation for 0.5 hours of operation out of any 24 hours at 2300 kW plus 2.0 hours of operation out of any 24 hours at 2100 kW with the remaining 21.5 hours of operation of any twenty four hours at 1750 kW. Operation of the diesel generators at the maximum load profile ratings bounds the postulated accident load profile. If one EDG storage tank or transfer pump is unavailable, the remaining tanks or pumps with the additional 29,000 gallons of fuel oil can operate two diesels at the maximum load profile permitted by the diesel generator rating for at least 160 hours.

8.2.3.3 Emergency Diesel Generator Separation

The emergency diesel generators are located in a sheet metal, steel-framed building immediately South of the Primary Auxiliary Building. The diesel generators are arranged parallel to each other on 13-ft centers, with approximately 10 ft of clear space between engine components. The engine foundations are surrounded by a 1 foot-high concrete curb containing sufficient volume to hold all the lube-oil or fuel released from a single engine in the event of an inadvertent spill or line break.

Diesel generator separation and fire protection features necessary to meet the criteria of 10 CFR 50.48 are described in the document under separate cover entitled, "IP2 Fire Hazards Analysis." A control panel, which contains relays and metering equipment for all three diesel generators is located on the west end of the building. The panels are compartmentalized with controls for each engine separated from each other. The compartmentalized design minimizes

Figure 8.2-10	Single Line Diagram - 480-V Motor Control Centers 28A and 211, Replaced with Plant Drawing 208241
Figure 8.2-11	Single Line Diagram - 480-V Motor Control Centers 26A and 26B, Replaced with Plant Drawing 9321-3006
Figure 8.2-11a	Single Line Diagram - 480-V Motor Control Center 26C, Replaced with Plant Drawing 248513
Figure 8.2-12	Single Line Diagram - 480-V Motor Control Centers 26AA and 26BB and 120-V AC Panels No. 1 and 2, Replaced with Plant Drawing 208500
Figure 8.2-13	Single Line Diagram - 118-VAC Instrument Buses No. 21 thru 24, Replaced with Plant Drawing 208502
Figure 8.2-14	Single Line Diagram - 118-VAC Instrument Buses No. 21A thru 24A, Replaced with Plant Drawing 208503
Figure 8.2-15	Single Line Diagram - DC System Distribution Panels No. 21, 21A, 21B, 22, and 22A, Replaced with Plant Drawing 208501
Figure 8.2-16	Single Line Diagram - DC System Power Panels No. 21 thru 24, Replaced with Plant Drawing 9321-3008
Figure 8.2-17	Single Line Diagram of Unit Safeguard Channeling and Control Train Development, Replaced with Plant Drawing 208376
Figure 8.2-18	Cable Tray Separations, Functions, and Routing, Replaced with Plant Drawing 208761

8.3 ALTERNATE SHUTDOWN SYSTEM

The Indian Point Unit 2 alternate safe shutdown system provides the necessary functions to maintain the plant in a safe shutdown condition following a fire that damages the capability to power and control essential equipment from normal and emergency Indian Point Unit 2 sources.

In the unlikely event of a major fire or other external event affecting redundant cabling or equipment in certain areas, electrical power could be disrupted to safe shutdown components and systems. However, following the unlikely loss of normal and preferred alternate power, additional independent and separate power supplies from the Indian Point Unit 1 440-V switchgear are provided for a number of safe shutdown components. **An independent SBO/APP. R diesel-generator is provided to power the Unit 1 440-V switchgear in the unlikely event of loss of offsite power to Unit 1 switchgear. In addition, there is provision to cross-connect the Unit 3 SBO / Appendix R DG to the Unit 2 alternative shutdown loads; and Unit 2 SBO/APP. R DG to Unit 3 alternative shutdown loads. The Indian Point 2 SBO/App. R diesel generator set is manufactured by Cummins Power Generation, with a rating of 2700 kW (Standby Rating), 13.8 kV, 3 Phase, 60 Hertz, 1800 RPM, for operation on diesel fuel. The output of the generator is connected to SBO/APP. R 13.8 kV Switchgear bus via circuit breaker SBO/ASS, located at DG Breaker Switchgear. The SBO/APP. R 13.8 kV Switchgear section has two feeder circuit breakers, ASS and SBOH. The ASS breaker feeds the existing Unit No. 1, 13.8 kV L&P Bus Section 3 in order to provide power to Alternate Safe Shutdown System loads. The SBOH breaker feeds a 13.8 kV - 6.9 kV, 3750 KVA SBO transformer, that in turn feeds the 6.9 kV section of the SBO/APP Switchgear via circuit breaker SBOL. This breaker then feeds power to the plant 6.9 kV electrical distribution system via breakers GT-25 and GT-26. In addition, there is provision to cross-connect the Unit 3 SBO / Appendix R DG to the Unit 2 alternative shutdown loads; and Unit 2 SBO/APP. R DG to Unit 3 alternative shutdown loads.**

The SBO/App. R diesel generator and associated switchgear, fuel supply and breakers shall be operable and tested in accordance with the TRM.

A detailed description of the alternate safe shutdown system including its functions, components, and operation is provided in the document under separate cover entitled, "IP2 10 CFR 50, Appendix R Safe Shutdown Separation Analysis."

8.3 FIGURES

Figure No.	Title
Figure 8.3-1	Deleted

8.4 MINIMUM OPERATING CONDITIONS

The electrical system is designed such that no single contingency can inactivate enough safeguards equipment to jeopardize plant safety. The minimum operating conditions define those conditions of electrical power availability necessary (1) to provide for safe reactor operation and (2) to provide for the continuing availability of engineered safety features. The facility Technical Specifications, Section 3.8, include minimum operating conditions covering the following plant conditions:

1. Minimum electrical conditions for reactor criticality.
2. Minimum electrical conditions during power operation.

8.5 TESTS AND INSPECTIONS

Emergency Diesel generators are tested in accordance with technical specification requirements. The tests specified are designed to demonstrate that the emergency diesel generators will provide power for the operation of equipment. They also ensure that the emergency generator system controls and the control systems for safeguards equipment will function automatically in the event of a loss of all normal 480-V AC station service power.

The testing frequency specified is often enough to identify and correct deficiencies in systems under test before they can result in a system failure. The fuel supply and starting circuits and controls are continuously monitored and any faults are alarm indicated. An abnormal condition in these systems would be signaled without having to place the emergency diesel generators on test.

The Emergency Diesel Generators will be inspected in accordance with a licensee controlled maintenance program. The maintenance program will require inspection in accordance with the manufacturer's recommendation for this class of standby service. Changes to the maintenance program will be controlled under [redacted]

Station batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide an indication of a cell becoming unserviceable long before it fails. The periodic [redacted] will ensure that the ampere-hour capability of the batteries is maintained.

The 'refueling interval' load test for each battery, together with the visual inspection of the plates, will assure the continued integrity of the batteries. The batteries are of the type that can be visually inspected, and this method of assuring the continued integrity of the battery is proven standard power plant practice.

~~At monthly intervals, at least one gas turbine~~ **The SBO / Appendix R Diesel and support systems** shall be tested and have surveillances in accordance with the TRM. ~~started and synchronized to the power distribution system for a minimum of thirty (30) minutes with a minimum electric output of 2000kW. At weekly intervals, the minimum gas turbine fuel volume 94,870 gallons shall be verified to be available and shall be documented in the plant log.~~ These tests and surveillances are designed to assure that the **SBO / Appendix R diesel** ~~at least one gas turbine~~ will be available to provide power for operation of equipment, if required. ~~Since the Indian Point 2 alternate safe shutdown power supply system demands a maximum electrical load of approximately 1600 kW, the required minimum test load will demonstrate adequate capability.~~

~~In addition, the required minimum gas turbine fuel oil storage volume of 94,870 gallons will conservatively assure at least three (3) days of operation of a gas turbine generator.~~

~~The specified test frequencies for the gas turbine generator(s) and associated fuel supply will be adequate to identify and correct any mechanical or electrical deficiency before it can result in a component malfunction or failure.~~

leak to the outside atmosphere. Pump leakage is piped to the drain header for disposal. The pump design prevents lubricating oil from contaminating the charging flow, and the integral discharge valves act as check valves.

Each pump is designed to provide the normal charging flow and the reactor coolant pump seal water supply during normal seal leakage. Each pump is designed to provide flow against a pressure equal to the sum of the reactor coolant system normal maximum pressure (existing when the pressurizer power-operated relief valve is operating) and the piping, valve and equipment pressure losses at the charging flows. During normal operation, 8 gpm seal injection enters each reactor coolant pump in the thermal barrier region where the flow splits, with 3 gpm flowing upward through the controlled leakage seal package and returning to the chemical and volume control system. The remaining 5 gpm passes through the thermal barrier heat exchanger and into the reactor coolant system where it constitutes a portion of the reactor coolant system water makeup. In the event that normal seal cooling is lost, the component cooling water system provides adequate seal cooling by supplying flow to the thermal barrier heat exchanger.

Seal injection flow is indicated locally and in the central control room.

An alternate power supply is provided for one of the charging pumps from the 13.8-kV normal offsite power through Unit 1 switchgear. If normal offsite power is not available, this pump can be energized using ~~any of the three available gas turbines~~**the SBO / Appendix R diesel**.

Any one of the three charging pumps can be used to hydrotest the reactor coolant system.

A low-pressure tank (dampener) is installed in the suction line, and a high-pressure tank is installed in the discharge line on each charging pump in order to eliminate pulsation that could potentially cause cavitation at the charging pump suction or root weld cracks on the discharge piping.

9.2.2.4.10 Chemical Mixing Tank

The primary use of the stainless steel chemical mixing tank is to prepare caustic solutions for pH control and hydrazine for oxygen scavenging. The capacity of the chemical mixing tank is more than sufficient to prepare a solution of pH control chemical for the reactor coolant system.

9.2.2.4.11 Excess Letdown Heat Exchanger

The excess letdown heat exchanger cools reactor coolant letdown flow if letdown through the normal letdown path is blocked. The letdown stream flows through the tube side and component cooling water is circulated through the shell side. All surfaces in contact with reactor coolant are austenitic stainless steel and the shell is carbon steel. All tube joints are welded. The unit is designed to withstand 2000 step changes in the tube fluid temperature from 80°F to the cold-leg temperature.

9.2.2.4.12 Seal-Water Heat Exchanger

The seal-water heat exchanger removes heat from two sources; reactor coolant pump seal-water returning to the volume control tank and reactor coolant discharge from the excess letdown heat exchanger. Reactor coolant flows through the tubes and component cooling water

An alternate power supply is also provided for one of the component cooling water pumps from the 13.8-kV normal offsite power through Unit 1 switchgear. If normal offsite power is not available, this pump can be energized using ~~any of the three available gas turbines~~**the SBO / Appendix R diesel**. During the recirculation phase following a loss-of-coolant accident, one of the three component cooling water pumps is required to deliver flow to the shell side of one of the residual heat exchangers.

9.3.3.1.2 Residual Heat Removal Loop

Two pumps and two heat exchangers are utilized to remove residual and sensible heat during plant cooldown. If one of the pumps and/or one of the heat exchangers is not operable, safe operation is governed by Technical Specifications and safe shutdown of the plant is not affected; however, the time for cooldown is extended. The function of this equipment following a loss-of-coolant accident is discussed in Section 6.2.

Alternate power can be supplied to one residual heat removal pump from the 13.8-kV normal outside power through Unit 1 switchgear.

The time to cool down using the [redacted] safe shutdown components (1 RHR pump and heat exchanger, 1 component cooling pump, and 1 service water pump supplying flow to non-essential header) has been determined [redacted]. Conditions assumed were an initial core power of 102% of 3216 MW and service water temperature of 95°F. The analysis shows that the RCS can be brought to the cold shutdown mode (temperature less than 200°F) within 72 hours.

9.3.3.1.3 Spent Fuel Pit Cooling Loop

This manually controlled loop may be shut down safely for time periods, as shown in Section 9.3.3.2.3, for maintenance or replacement of malfunctioning components.

9.3.3.2 Leakage Provisions

9.3.3.2.1 Component Cooling Loop

Water leakage from piping, valves, and equipment in the system inside the containment is not considered to be generally detrimental unless the leakage exceeds the makeup capability. With respect to water leakage from piping, valves, and equipment outside the containment, welded construction is used where possible to minimize the possibility of leakage. The component cooling water could become contaminated with radioactive water due to a leak in any heat exchanger tube in the chemical and volume control, the sampling, or the auxiliary coolant systems, or a leak in the thermal barrier cooling coil for the reactor coolant pumps.

Tube or coil leaks in components being cooled would be detected during normal plant operations by the leak detection system described in Sections 4.2.7 and 6.7. Such leaks are also detected at any time by a radiation monitor that samples the component cooling pump discharge downstream of the component cooling heat exchangers.

Leakage from the component cooling loop can be detected by a falling level in the component cooling surge tank. The rate of water level fall and the area of the water surface in the tank permit determination of the leakage rate. To assure accurate determinations, the operator would check that temperatures are stable.

Sharing of Structures, Systems and Components (Criterion 5)

Criterion: Structures, systems and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

The only structure important to safety that is shared by the nuclear units at the site is the cooling water discharge canal which carries the safety related Service Water System discharge to the river. Since this channel is of sufficient capacity to handle the discharge flow from both operating units, sharing of this structure will in no way impair the ability of safety related systems in either of the nuclear units to perform their safety functions.

There are no safety related systems shared by the nuclear units at the site. ~~However, there are three gas turbine generators provided which are shared by the two operating units and which can be used to supply the safeguard power requirements. Two of these are located near the Buchanan Substation, while the third is at the Indian Point site. The gas turbines are connected to the distribution system at 13.8kV. The 13.8 kV feeders and the gas turbines are connected to the 6.9 kV buses via autotransformers. While each of the 13.8 kV feeders is normally assigned to one unit, interties at the substation permit the cross feeding from any line to any unit. (See Sections 8.1 and 8.2)~~

The city water supply system provides a backup source of water to the Condensate Water Storage Tank for the Auxiliary Feedwater System of Indian Point 3.

The Fire Protection Systems formerly shared between Indian Point 1, 2 and 3 have been separated to provide independent fire protection capability. Details of the system modification are addressed in Section 9.6.

The only components important to safety that are shared by the two operating nuclear units (Indian Point 2 and 3) are the backup fuel oil storage tanks for the emergency diesel generators. The fuel oil storage tanks dedicated to Indian Point 3 have a capacity sufficient to assure continuous operation of two of the three Indian Point 3 diesels at minimum safeguards load for a total of 48 hours. The additional fuel oil required for continuous operation for a minimum of seven days can be transported by truck from the 200,000 gallon fuel oil storage tank at the Buchanan Substation located immediately across Broadway and/or from other local oil supplies (Section 8.2).

1.3.2 Protection by Multiple Fission Product Barriers (Criteria 10 to 19)

Reactor Design (Criterion 10)

Criterion: The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

> Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limit and design limit and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits shall be designed to be available within a few seconds following a Loss-of-Coolant Accident to assure that the core cooling, containment integrity, and other vital safety functions are maintained.
>
> Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

Independent alternate power systems are provided with adequate capacity and testability to supply the required Engineered Safety Features and protection systems. The plant is supplied with normal, standby (offsite) and emergency (onsite) power sources as follows:

1. The normal source of auxiliary power during plant operation is supplied from both the plant's generator and offsite power.

2. Offsite power is supplied from Buchanan Substation (approximately ¾ mile from the plant) by 138kV and 345 kV feeders, and two underground 13.8 kV feeders. The Buchanan Substation has two 345kV and two 138 kV circuits to Millwood Substation and a 345kV circuit to Ladentown Substation which interconnects with the PJM system. Millwood Substation has ties to Pleasant Valley Substation which is the interconnection point between Consolidated Edison Co. and Niagara Mohawk and Connecticut Light and Power system. ~~In addition, there is 1-25.4 MW and 1-16.9 MW combustion turbine generator at Buchanan Substation connected to the 13.8kV feeders from Buchanan Substation and a 21 MW combustion turbine generator located at the Indian Point site.~~ The 138kV feeders are connected to the 6.9 kV buses through the station auxiliary transformer, the 13.8 kV feeders ~~and combustion turbines~~ are connected to the 6.9 kV buses through autotransformers. The 480 volt engineered safety features buses are connected to the 6.9 kV buses through station auxiliary transformers.

3. Three diesel generators are each connected to their respective engineered safety features buses to supply emergency shutdown power in the event of loss of all other AC auxiliary power. There are no automatic ties between the buses associated with each diesel generator. Each diesel will be started automatically on a safety injection signal or upon the occurrence of under voltage on its associated 480 volt bus. Any two diesels have adequate capacity to supply the engineered safety features for the hypothetical accident concurrent with loss of outside power. This capacity is adequate to provide a safe and orderly plant shutdown in the event of loss of outside electrical power. The

consideration of the most severe of these natural phenomena that have been officially recorded for the site and the surrounding area and (b) an appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design. (GDC 2 of 7/11/67)

All electrical systems and components vital to plant safety, including the emergency diesel generators, are designed as Class I so that their integrity is not impaired by the maximum potential earthquake, wind, storms, floods or disturbances on the external electrical system. Power, control and instrument cabling, motors and other electrical equipment required for operation of the engineered safety features are suitably protected against the effects of either a nuclear system accident or of severe external environment phenomena in order to assure a high degree of confidence in the operability of such components in the event that their use is required.

Emergency Power

Criterion: An emergency power source shall be provided and designed with adequate independency, redundancy, capacity, and testability to permit the functioning of the engineered safety features and protection systems required to avoid undue risk to the health and safety of the public. This power source shall provide this capacity assuming a failure of a single component. (GDC 39 and GDC 24 of 7/11/67)

Independent alternate power systems are provided with adequate capacity and testability to supply the required engineered safety features and protection systems.

The plant is supplied with normal, standby and emergency power sources as follows:

1) The normal sources of auxiliary power during plant operation are both the generator and offsite power.

2) Offsite power is supplied from Buchanan Substation (approximately ¾ mile from the plant) by 138kV and 345kV feeders, and two underground 13.8kV feeders. The Buchanan Substation has two 345kV and two 138kV circuits to Millwood Substation and a 345Kv circuit to Ladentown Substation which interconnects with the PJM system. Millwood Substation has ties to Pleasant Valley Substation which is the interconnection point between Consolidated Edison Company, Niagara Mohawk and Connecticut Light and Power systems. ~~In addition, there are 1-26.4 MW and 1-16.9 MW combustion turbine generators at Buchanan Substation and a 21MW combustion turbine generator located at the Indian Point site.~~ 138Kv feeders are connected to the 6.9 KV buses through the station auxiliary transformer, **and** 13.8 kV feeders ~~and combustion turbines~~ are connected to the 6.9kV buses through autotransformers. 480 volt engineered safety features are connected to the 6.9kV buses through station auxiliary transformers.

3) Three diesel generators are each connected to their respective engineered safety features buses to supply emergency shutdown power in the event of loss of all other AC auxiliary power. There are no automatic ties between the buses associated with each diesel generator.

   Each diesel will be started automatically on a safety injection signal or upon the occurrence of under voltage on its associated 480 volt bus. Any two diesels have adequate capacity to supply the engineered safety features for the hypothetical accident concurrent with loss of outside power. This capacity is adequate to provide a sage and orderly plant shutdown in the event of loss of outside electrical power. The diesel generator units are capable of being started and sequence load begun within 10 seconds after the initial signal.

The three diesel-generators are located adjacent to the control building and are connected to three (3) of the four (4) separate 480 volt auxiliary system buses. The fourth 480 volt bus is automatically connected to the third bus during diesel generator operation, and the two buses are operated as a unit from a single diesel generator for this mode of operation only.

4) Emergency power supply for vital instruments, control, and emergency lighting is from the four 125 volt DC station batteries.

5) A 2500 KW diesel generator capable of providing on-site power for safe shutdown loads has been installed in compliance with 10 CFR 50 Appendix "R"; also support compliance with SBO requirements.

8.2 ELECTRICAL SYSTEM DESIGN

8.2.1 Network Interconnection

The offsite transmission system provides two basic functions for the station; namely, it provides auxiliary power as required for startup and normal shutdown and transmits the output of the station.

Electrical energy generated at 22 kV is raised to 345 kV by the two main generator transformers and delivered to the Buchanan 345 kV Switching Station via 345 kV, 3000 Amp, 25,000 MVA synchronizing circuit breakers. The Buchanan Substation has two 345 kV and two 138 kV circuits to Millwood Substation and a 345 kV circuit to Ladentown Substation which interconnects with the PMJ system. Millwood Substation has ties to Pleasant Valley Substation which is the interconnection point between Consolidated Edison Company and Niagara Mohawk and Connecticut Light and Power System. The Buchanan 138 kV Substation has connections to Lovett Station.

Offsite (standby) power is supplied from Buchanan Substation (approximately ¾ mile from the plant) by 138 kV and 345 kV feeders, and two underground 13.8 kV feeders. ~~In addition, there is 1-25.4 MW and 1-16.9 MW combustion turbine generators at Buchanan substation connected to the 13.8 kV feeders and a 21 MW combustion turbine generator located at the Indian Point Site.~~ The 13.8 kV feeders are connected to the 6.9 kV buses through autotransformers. The 480 volt engineered safety feature buses are connected to the 6.9 kV buses through station auxiliary transformers.

Single-Line Diagram

A single-line diagram, showing the connections of the main generator to the power system grid and to standby power source is shown on Plant Drawing 9321-F-33853 [Formerly Figure 8.2-1].

Reliability Insurance

There are four independent sources of emergency power available to Indian Point 3. They are the 138 kV and 345 kV ties from Buchanan and the two 13.8 kV feeders from Buchanan. ~~In addition, there are three combustion turbine generators, one located on the Indian Point site and the others connected to 13.8 kV feeders at Buchanan, providing a completely independent supply from the rest of the offsite transmission system.~~ The 138 kV supply from the Buchanan bus with its connections to the Consolidated Edison Company system and Orange & Rockland County provide a dependable source of station auxiliary power.

An analysis of the 1971 system demonstrated that the interconnected power system remained stable for the loss of the largest unit, Ravenswood No. 3 (1000 Mwe). Since the transmission system is as strong after the installation of Indian Point 3, and since Indian Point 3 is not as large capacity wise, this analysis can be applied to confirm the stability of the interconnected system for the sudden loss of the largest unit. In addition, a 2500 kw self-contained diesel generator is available to provide on-site power for safe shutdown loads having alternate feed capability.

8.2.2 Station Distribution System

The Auxiliary Electrical System was designed to provide a simple arrangement of buses requiring the minimum of switching to restore power to a bus in the event that the normal supply to that bus is lost.

The relays that are used for bus clearing and sequencing of safeguards components on the four 480 volt buses have been physically located in the 480 volt switchgear and the circuitry has been developed on an individual, independent bus scheme. That is, each bus has its own set of bus clearing and load sequencing relays physically located within its own line-up, independent of the other bus sections. Diesel generator No. 31 is connected to bus No. 2A and bus No. 2A is then connected to bus No. 3A in the event of a diesel requirement. Buses No. 2A and 3A together form one of the three 480 volt safeguards power trains with buses No. 5A and 6A used for the remaining two power trains.

In addition, Indian Point 3 has a five-battery DC System. Each of the three 480 volt safeguards power trains and associated circuitry receives its DC control power from its own individual battery (Nos. 31, 32 and 33). Battery No. 36 feeds power panel No. 36. Battery No. 34 feeds instrument bus No. 34.

Batteries 31, 32, 33, and 34 are safety batteries which supply DC power to safe shutdown systems. Battery 36 is a non-safety battery which supplies DC power to non-essential loads.

Single Line Diagrams

The basic components of the station's electrical system are shown on the electrical one line diagrams, Plant Drawings 617F645, 617F643, 617F644, 9321-F-30063, -30083, 9321-H-36933, and 9321-F-39893 [Formerly Figures 8.2-2 through 8.2-6, 8.2-8 and 8.2-9], which include the 6900 volt, the 480 volt, the 120 volt AC instrument, and the 125 volt DC bus systems.

Unit Auxiliary, Station Auxiliary and Station Service Transformers

Unit Auxiliary Transformer

The unit auxiliary transformer is a three phase, two winding, forced oil/air type. During unit operation, it transforms 22 kV power from the main generator bus to 6.9 kV and, through appropriate switching, supplies four of the six 6900 volt auxiliary buses. These four buses supply virtually all of the unit 6900 volt auxiliaries and approximately 50% of the 480 volt auxiliaries.

Station Auxiliary Transformer

The station auxiliary transformer is a three phase, two winding forced oil/air type. It transforms 138 kV power from the offsite network to 6.9 kV and, through appropriate switching, supplies the remaining two of the six 6900 volt auxiliary buses. During unit operation it supplies the 6900 and 480 volt auxiliary loads that are not supplied by the Unit Auxiliary Transformer.

When the Unit Auxiliary Transformer is not available, such as during unit trip, unit downtime, or startup, the four buses normally supplied by this transformer are reconnected to the two remaining buses, and the Station Auxiliary Transformer supplies all auxiliary loads.

Station Service Transformers

The seven station service transformers are three phase, two winding, air insulated, dry type. Insulation material is fire resistant and non-explosive. Solid insulation in the transformers consists of inorganic materials such as porcelain, mica, glass or asbestos, in combination with a sufficient quantity of high temperature binder to impart the necessary mechanical strength to the insulation structure. This insulation is defined by ASA standards as Group III material. The Station Service Transformers transform 6.9 kV power form the 6900 volt buses to 480 volts to supply low voltage auxiliary loads.

The above transformers were designed and constructed in accordance with the applicable standards of ASA, IEE and NEMA. During normal operation and auto engineered safeguards loading, these transformers will not be loaded beyond their rating. However, during peak accident loading scenarios, these transformers are allowed to be loaded up to 3600 amps, for up to 4 hours. This short time overload capability is necessary to support the 480V buses 2A, 3A, 5A, and 6A loading requirements during the manual recovery phase of a design basis accident. Manufacturer shop tests of the transformers were conducted in accordance with the latest revision of American Standard Test Code C 57.12.90. This series of tests consisted of the following:

1) Resistance measurements of all windings,
2) Ratio tests,
3) Polarity and phase relation tests,
4) No-load losses,
5) Exciting current,
6) Impedance and load loss,
7) Temperature test,
8) Applied potential tests, and
9) Induced potential tests.

6900 Volt System

The 6900 volt system is divided into seven buses. These buses supply 6900 volt auxiliaries directly and 480 volt auxiliaries via the station service transformers. Two buses, numbers 5 and 6, are connected to the 138 kV system via bus main breakers and the Station Auxiliary Transformer. An alternate connection is available to the 13.8 kV **IP2 SBO / Appendix R**

diesel~~gas turbine~~ and/or the 13.8 kV off-site power network via a step-down auto transformer. Buses No. 1, 2, 3, and 4 are connected to the generator leads via bus main breakers and the Unit Auxiliary Transformer. Buses No. 1 and 2 can be tied to Bus No. 5 and Buses No. 3 and 4 can be tied to Bus No. 6 via bus tie breakers to provide auxiliary power during unit down time. These bus tie connections are automatically initiated, in the event of unit trip, to assist continuity of service. BUS 3NBY01 is connected to the 13.8 kV off-site power network via a step-down auto transformer.

480 Volt System

The 480 volt system consists of seven buses, each supplied from a 6900 volt bus via a station service transformer. Four of these Buses, No. 2A, 3A, 5A and 6A, supplied from Buses No. 2, 3, 5, and 6 respectively, comprise the safety related 480 volt system. The required safeguards equipment circuits are dispersed among these buses. These buses are provided with diesel generator back-up in the event of voltage failure, and are protected against a sustained undervoltage condition, which could cause mis-operation of, or damage to, safeguards equipment. 480V Buses 2A, 3A, 5A and 6A are each rated 3200 amps continuous. However, during peak accident loading scenarios, these buses can be loaded up to 3600 amps for up to 4 hours, based on a maximum ambient switchgear room temperature of 40°C. For Buses 2A and 3A, this short time limit applies to the combined loading, when these buses are tied together and powered from a single station service transformer. (Buses 2A and 3A are considered a single safeguards bus.)

480 Buses 2A, 3A, 5A and 6A load breakers are rated to interrupt up to 50kA short circuit current. Maximum short circuit current at the 480V load breakers during emergency diesel generator testing parallel to the system, was initially and conservatively calculated to be slightly greater than 50kA. However, taking into account cable and raceway construction, and establishment of "safe zone" areas during diesel testing (CAT I areas), the maximum fault current was analyzed to be less than the 50kA rating which would allow the breaker to safely interrupt a fault if it occurs.

The three remaining 480 volt buses, Buses No. 312, 313, and 3NGY01 are supplied from 6900 volt Buses No. 1, 3 and 3NBY01 respectively, and supply auxiliary power to additional plant facilities installed subsequent to the initial installation. A tie breaker between Buses 312 and 313 permit one bus to serve as a backup for the other. Interlocking prevents the cross connecting of the two 6.9 kV sources to Buses 312 and 313 through the 480 volt system. The interlock can be defeated temporarily for performing a live transfer of 480 volt buses 312 and 313 when both 6.9 kV supply buses are fed from the same 6.9 kV power source.

The 480 volt feeders for the Fire Protection System are from the 480 Volt Buses No. 312 and 313 to the 480 volt Motor Control Center G and H, respectively. Buses No. 312 and 313 are located in the Turbine Hall and Motor Control Centers G and H are located in the Fire Pump House. The motor driven fire pump normal feed is Bus No. 312 and the emergency feed is 480 volt Bus No. 5A. These feeders run through the manual transfer switch which is used to manually transfer the feeders to the motor driven fire pump from the normal feed to the emergency feed and from the emergency feed to normal feed. The electrical feeds to the remaining equipment installed as part of the additional facilities program are supplied through individual breakers. **A provision also exists to cross-connect the Unit 2 SBO/App. R DG to the Unit 3 alternative shutdown loads; and the Unit 3 Appendix R DG to the Unit 2 alternative shutdown loads.**

runs, PVC heavy wall conduit encased in a concrete envelope provides maximum protection. When cable is run in a tray, peaked covers are used in areas where physical damage to cables may result from falling objects or liquids. In addition, covers are provided on horizontal cable trays which are exposed to the sun.

Fire protection measures to prevent propagation of flame are discussed in Section 9.6-2. Fire detection is provided for areas where there are large groupings of cables in stacked cable trays. The plant has a protective signaling system that transmits fire alarm and supervisory signals to the Control Room where audible and visual alarms are provided. The system includes signals for actuation of fire detectors, and automatic sprinkler, water spray, foam and CO2 systems. Electrical supervisory signals are received from tamper switches on fire water system control valves.

Cables and wireways are marked by means of metal tags attached at each end. These tags are embossed to conform with the identification given in the Conduit and Cable Schedule. At each multiple conductor cable termination, a plastic covering is attached which as been premarked to indicate the terminal designation of each conductor. In addition, cable trays are marked at frequent intervals to indicate the channel number and voltage level of the tray. Color coding is discussed in Section 7.2.

In areas where missile protection could not be provided (such as near the Reactor Coolant System) redundant instrument impulse lines and cables were run by separate routes. These lines were kept as far apart as physically possible, or were protected by heavy (1/4") metal plates interposed where inherent missile protection could not be provided by spacing.

8.2.3 Emergency Power

Sources Description

Standby power required during plant startup, shutdown and after turbine trip is supplied from one 345kV feeder and one 138 kV feeder from the Buchanan Substation (approximately 3/4 mile from the plant) which as connections to the Millwood Substation and the Lovett Station of the Orange and Rockland system. These connections are made through the station auxiliary transformer.

In addition, there are two underground 13.8 kV feeders from the Buchanan Substation. ~~There is also 1-25.4 MW and 1-16.9 MW combustion turbine generator at Buchanan connected to these 13.8 kV underground feeders, and a 21 MW combustion turbine generator located on the Indian Point site.~~ The 13.8 kV feeders are connected to the 6.9 kV buses via autotransformers. If these sources should fail, the on-site sources of emergency power are three emergency diesel generator sets, each consisting of an Alco model 16-251-E engine coupled to a Westinghouse 2188 KVA, 0.8 power factor, 900 rpm, 3 phase, 60 cycle, 480 volt generator. Each unit has a 2000 hour and a 2 hour rating of 1950 kW and a 1750 kW continuous rating. There is also a vendor stated maximum ½ hour rating of 2000 kW. This is not an operational limit but an area of additional margin for handling power surges and spikes which may occur during testing. In addition, an alternate on-site source of power for safe shutdown loads is available from the Appendix "R" Diesel Generator which consists of an ALCO model 251 engine coupled to a KATO model 8P103600 3125 KVA, 0.8 power factor, 900 rpm, 3 phase, 60 cycle, 6900 volt Generator.

immediately across Broadway. These tanks contain fuel oil for operation of ~~combustion turbines that is compatible for use with the diesels~~**the Unit 2 SBO / Appendix R diesel**. Each tank has a level indicator and a capacity check is made weekly. **The maximum consumption of the IP2 SBO / Appendix R diesel generator over a three day operating period is 12,500 gallons.**~~When the combustion turbines are being operated, the dispatcher will be notified to start oil deliveries and to keep the tanks filled. The gas turbines consume approximately 2000 gallons per turbine per hour.~~ A truck with hose connections compatible with the underground storage tanks will be provided. If the diesels require the reserves in these tanks, the contents of these tanks would be transported by truck to the underground diesel storage tanks. Additional supplies of diesel oil are available locally. Under normal conditions, 25,000 gallons can be delivered on a one or two-day notice. Additional supplies are also maintained in the region (about 40 miles from the plant) and are available for use during emergencies, subject to extreme cold weather conditions (increased domestic heating usage) and available transportation.

All components of the emergency diesel fuel oil supply system are seismic Class I and as such were designed in accordance with the criteria of Section 16.1. In addition, all components of the diesel fuel oil supply system are tornado protected and as such are able to withstand the design tornado and the tornado driven missiles delineated in Section 16.2. These components are also protected against the turbine missiles described in Appendix 14A of Chapter 14. The power supply and control system for the diesel fuel oil transfer system were designed in accordance with IEEE-279, meeting fully the single failure criteria specified therein.

Fuel oil for the emergency diesel generators is stored in three buried storage tanks. Each tank is equipped with a single vertical fuel oil transfer pump that discharges oil into either of two headers according to the manual valving arrangement selected. Both of these headers connect to a 175-gallon day tank mounted on each of the three diesel engines.

Decrease in level in any one of the three day tanks to the 65 percent level automatically starts its associated fuel oil transfer pump (local manual controls are also available). The fuel oil transfer pumps are powered from motor control centers 36C, 36D, and 36E. Since each pump is capable of supplying fuel oil to all three diesels, this arrangement assures the availability of fuel oil to each diesel.

Each day tank is provided with AC normal level and low level indicating lights. In addition, each day tank has a DC low-low alarm on its respective diesel generator control panel which also annunciates a common Diesel Generator Trouble Alarm on the supervisory panels in the Control Room.

Diesel-Generator Separation

The emergency diesel generators are located in a tornado-proof reinforced concrete building immediately adjacent to the Control Building. The diesel generators are arranged on 13'-0" centers, parallel to each other with approximately 10'-0" between engine components. The structure is provided with internal walls to separate the three diesel generators and their associated cabling and control panels from each other for fire protection. Fire protection and detection systems for the diesel generators are discussed in Section 9.6.2.

Each control panel contains relays and metering equipment for its diesel generator. In the event of an electrical fire the event is annunciated in the main control room. With the compartmentalized diesel generator separation design, and the fire protection systems

Charging pumps and volume control tank with associate piping. Boric Acid transfer pumps and tanks and associated piping. Letdown station. Non-regenerative heat exchanger and associated equipment. Component Cooling and Service Water Systems. Periodic operation of one reactor coolant pump for pressurizer homogenization; the auxiliary spray/heaters could be used if necessary. Compressed air for valve operation – manual could be adopted if necessary.

The vital items of this equipment are housed within the containment and the reinforced concrete auxiliary building. The Service Water System is protected by means of redundancy. In order to guarantee the operation of the system the 480 volt system must again be assured.

It is worthy of note that with the reactor held at hot shutdown conditions, boration of the plant is not required immediately after shutdown. The xenon transient does not decay to the equilibrium level until at least 9 hours after shutdown and a further period would elapse before the reactivity shutdown margin provided by the full length control rods have been cancelled. This delay would provide useful time for emergency measures although the essential systems are considered to be adequately protected within the auxiliary building and Containment Building. For loss of CCW due to a missile strike in the Fuel Storage Building, city water is available for hook-up (IPN-02-040).

c) Pressurizer Pressure Level Control

Following a reactor trip, the primary coolant temperature will automatically reduce to the no load temperature condition as dictated by the steam generator conditions. This reduction in the primary water temperature reduces the primary water volume and if continued pressure control is to be maintained primary water makeup is required. The pressurizer pressure level is controlled in normal circumstances by the Chemical and Volume Control System. This requirement implies the charging pump duty referred to for boration plus a guaranteed borated water supply. The facility for boration is safety protected within the Primary Auxiliary Building; it is only necessary to supply water for makeup. Water may readily be obtained from separate sources: that in the volume control tank, boric acid tanks, monitor tanks, primary storage tank, and refueling water storage tank.

Similarly to the two previous service requirements, the 480 volt system must be assured with the additional electrical load of the pressurizer heaters. Vital instruments and controls are provided both locally and in the Control Room.

d) Ventilation

The most essential ventilation requirements apply to the containment since in order to guarantee the satisfactory operation of the instrumentation and control systems the containment air temperature must be controlled to a tolerable level. This system again requires the satisfactory operation of the Service Water and Electrical Systems.

e) Electrical Systems

Protection from tornado is provided for the 480 volt switchgear and supply redundancy is provided by the diesel generators, ~~gas turbine generator,~~ the two above-ground incoming lines and the one below ground incoming line. The 6.9kV is fed ~~by either the gas turbine generator or~~ by an underground 13.8 kV feeder from the Buchanan substation. The Buchanan substation consists of four buses.

Shutdown to Cold Condition

Plant cooldown is not an immediate requirement following major damage due to a tornado. For a cooldown, the basic services required are:

a) Residual Heat Removal
b) Reactivity Control
c) Pressurizer Pressure Level Control
d) Ventilation
e) Electrical Systems

A cooldown would not be attempted until full equipment facilities had been guaranteed.

Tornado missile damage to a small bore pipe in the Containment Cooling Loop in the Fuel Storage Building (FSB) would require isolation and repair or isolation of piping. Prior to establishing Residual Heat Removal during plant cooldown the CCW System would have to be refilled using operator action. The Primary Water Storage Tank is available to replace lost water inventory.

Criterion III

Following a Loss-of-Coolant Accident the residual heat is removed through internal recirculation conditions with the facility for external recirculation if required. The duty implies the continued operation of the Auxiliary Feedwater System together with the associated electrical and service water supplies. The recirculation systems are protected by the tornado proof containment and auxiliary buildings. The Electrical and Service Water Systems are assured by redundancy as previously discussed.

References:

(1) "Design of Protective Structures" by Arsham Amirikian, Navy Docks P-51, Bureau of Yards and Docks Department of the Navy, Washington, D.C., August 1950.

(2) TM5-855-1, Department of the Army Technical Manual, "Fundamentals of Protective Design (Non-Nuclear)," 1965.

16.3 DEMONSTRATION OF ADEQUACY OF SELECTED SEISMIC CLASS I ITEMS

16.3.1 Design of Seismic Class I Structures

A multi degree-of-freedom modal analysis was performed on all Class I building structures for Indian Point 3. The results indicate that all except the containment structure are rigid.

16.3.2 Analysis of Seismic Class I Equipment Other Than Reactor Coolant Pressure Boundary*