June 3, 2008

L-MT-08-041
10 CFR 50.90

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

Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License
License No. DPR-22

Monticello Extended Power Uprate (USNRC TAC MD8398): Acceptance Review Supplemental Information Package 4

References:

1) NMC Letter to USNRC, "License Amendment Request: Extended Power Uprate," dated March 31, 2008

2) NMC Letter to USNRC, "Monticello Extended Power Uprate (USNRC TAC MD8398): Acceptance Review Supplement Regarding Radiological Analysis," dated May 20, 2008

3) NMC Letter to USNRC, "Monticello Extended Power Uprate (USNRC TAC MD8398): Acceptance Review Supplemental Information," dated May 28, 2008

4) NMC Letter to USNRC, "Monticello Extended Power Uprate (USNRC TAC MD8398): Acceptance Review Supplemental Information Package 3," dated May 30, 2008

Pursuant to 10 CFR 50.90, Nuclear Management Company, LLC (NMC), requested in Reference 1 approval of amendments to the Monticello Nuclear Generating Plant (MNGP) Renewed Operating License (OL) and Technical Specifications (TS) to increase the maximum power level authorized from 1775 megawatts thermal (MWt) to 1870 MWt, an approximate five percent increase in the current licensed thermal power (CLTP). The proposed request for Extended Power Uprate (EPU) represents an increase of approximately 12 percent above the Original Licensed Thermal Power (OLTP). The Monticello EPU application was supplemented on May 20, 2008, May 28, 2008, and May 30, 2008 by References 2, 3, and 4.

In a teleconference held May 19, 2008, the NRC staff indicated that additional information would be necessary for the Reactor Inspection Branch to complete the acceptance review of the Monticello EPU license amendment request (LAR). The questions were formalized and emailed to NMC on May 20, 2008.

Enclosure 1 contains the questions and responses to the Reactor Inspection Branch. NMC has reviewed the No Significant Hazards Consideration and the Environmental Consideration submitted with Reference 1 relative to the enclosed supplemental information. NMC has determined that there are no changes required to either of these sections of Reference 1.

Additionally, NMC received the following question from the Instrument and Control Branch (EICB) by email on May 22, 2008:

> "Based on this review, I find that licensee need to supplement information in their submittal for instrument setpoint methodology in accordance with the staff guidance provided in RIS 2006-17. Licensee in their submittal has been using the information which was previously approved by the staff. However, the staff has issued additional guidance on meeting 10CFR50.36 in RIS 2006-17 and no longer relying on TSTF -493."

Following a clarifying call on May 27, 2008, NMC committed to respond to the above EICB question within 30 days of the clarifying teleconference (by June 26, 2008).

Commitment Summary

This letter makes one new commitment:

> *NMC commits to respond to the EICB question above regarding RIS 2006-017 by June 26, 2008.*

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

Executed on June 3, 2008.

Timothy J. O'Connor
Site Vice President, Monticello Nuclear Generating Plant
Nuclear Management Company, LLC

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
Resident Inspector, Monticello, USNRC
Minnesota Department of Commerce

Enclosure

Enclosure 1 to L-MT-08-041

Reactor Inspection Branch
Questions and Responses

Enclosure 1

NRC Statement: Section 2.10, Health Physics of the PUSAR describes the onsite and off-site radiation levels, normal and post-operation radiation levels. To evaluate Section 2.10, the acceptance criteria for occupational and public radiation doses are based on 10 CFR Part 20, GDC 19, and 40 CFR Part 190. To perform the health physics review of the EPU application, the following supplemental information is needed.

Onsite Radiation Levels

NRC Question 1)
Provide the radiation levels prior to EPU and at EPU for the areas described in Table 2.10-1 and 2.10-2. Describe the methodology used to determine EPU radiation levels.

Tables 2.10-1 and 2.10-2 of the PUSAR summarize the changes in area radiation levels at EPU. Further details are provided in this enclosure.

Definitions of Radiation Zones used in the following tables can be interpreted as follows:

Radiation Zone Designation	Design Dose Rate (mRem/hr)	Occupancy (hours/week)
A	≤0.5	Continuous
B	≤1.0	40
C	≤6.0	10
D	≤12.0	5
E	≤100.0	1
F	≥100.0	Normally Inaccessible[1]

[1] Access to this area is limited, but can be obtained through controlled doors.

Enclosure 1

Table 1- Reactor Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
1	I/1B	B.1.4	RHR and Core Spray Pump Room, Division I	2 - 35 120 - 160 Near HX	C	Not surveyed	Increase by 13%	Increase by 13%
2	I/1B	B.1.4	RHR and Core Spray Pump Room, Division I Stairway	Not surveyed	C	Not surveyed	Increase by 13%	Increase by 13%
3	II/1A	B.1.4	RHR and Core Spray Pump Room, Division II	5 - 40 20 - 50 Near HX	C	Not surveyed	Increase by 13%	Increase by 13%
4	II/1A	B.1.4	RHR and Core Spray Pump Room, Division II Stairway	Not surveyed	C	Not surveyed	Increase by 13%	Increase by 13%
5	III/1C	B.1.3	RCIC Room	Not surveyed	C	Not surveyed	Increase by up to a factor of 11.3 (1130% when system shutdown. No change during system operation.	Increase by up to a factor of 11.3 (1130%)

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6	II/1D	B.1.2	Reactor Bldg Elevation 896' Equipment and Floor Drain Tank	0.5 - 20 40 - 100 Near Tanks	F	Not surveyed	Increase by 13%	Increase by 13%
7	II/2C	B.1.10	CRD Pump Room	Not surveyed	C	Not surveyed	Increase by 13%	Increase by 13%
8	II/1E	B.1.2	HPCI Room	0.5 – 3	D	Not surveyed	Increase by up to a factor of 11.3 (1130%) when system shutdown. No change during system operation.	Increase by up to a factor of 11.3 (1130%)
9	IV/1F	B.1.6	Suppression Pool Area - Northeast	5 – 50	F	Not surveyed	Increase by 13%	Increase by 13%
10	IV/1F	B.1.6	Suppression Pool Area - Southeast	5 – 30	F	Not surveyed	Increase by 13%	Increase by 13%
11	IV/1F	B.1.6	Suppression Pool Area - Southwest	5 - 60	F	Not surveyed	Increase by 13%	Increase by 13%

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12	IV/1F	B.1.6	Suppression Pool Area - Northwest	5 - 30	F	Not surveyed	Increase by 13%	Increase by 13%
13	I/2G	B.1.8	East Shutdown Cooling Room	0.5 - 20	D, E	Not surveyed	Increase by 13%	Increase by 13%
14	I/2B	B.1.11	B.1.9 CRD Hydraulic Control Unit Area - East 935′ Elevation	1 - 6 3 - 60	B	Not surveyed	Increase by 13%	Increase by 13%
15	I/2E	B.1.9	TIP Room	1 - 50	F	Not surveyed	Increase by 13%	Increase by 13%
16	II/2F	B.1.7	Steam Chase	500 - 2000 In steam chase 25 - 800 in airlock	F	1-2	No change	
17	III/2A	B.1.9	TIP Drive Room	1 - 4	B	Not surveyed	Increase by 13%	Increase by 13%
18	II/2C	B.1.10	CRD Hydraulic Control Unit Area and HVAC Areas - NW 935' El	1 - 55	B	Not surveyed	Increase by 13%	Increase by 13%
19	II/2C	B.1.10 B.1.12	CST Pump Transfer DW Equip Hatch Entrance Areas - SW 935′ El	1 - 4	B	Not surveyed	Increase by 13%	Increase by 13%

Enclosure 1

Table 1- Reactor Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
20	II/2H	B.1.8	West Shutdown Cooling Room 21 I/3B B.1.14 PIPE Chase 974'	1 - 30	D, E	Not surveyed	Increase by 13%	Increase by 13%
21	I/3B	B.1.14	Pipe Chase 974'	1 - 30	B	Not surveyed	Increase by 13%	Increase by 13%
22	I/3B	B.1.14	MCC and Standby Liquid Control System Area - East 962' El	1	B	Not surveyed	Increase by 13%	Increase by 13%
23	I/3B	B.1.14	Contaminated Tool Storage - East 962' El	1	D	Not surveyed	Increase by 13%	Increase by 13%
24	I/3B	Recirc	MG Set Airlock	Not surveyed	B	Not surveyed	Increase by 13%	Increase by 13%
25	I/3B		962' North of Reactor Shield Wall	1	B	Not surveyed	Increase by 13%	Increase by 13%
26	V/3A		Reactor Recirculation Pumps MG Set Room	1 - 4	B	Not surveyed	Increase by 13%	Increase by 13%
27	II/3D	B.1.15 and B.1.13	Cooling Water Pump and Chiller Area - West 962' El	1 - 5 2 - 30	B	Not surveyed	Increase by 13%	Increase by 13%

Table 1- Reactor Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
28	II/3D	B.1.5	RWCU Pump Room B and Hallway	40	E	Not surveyed	Increase by 13%[2]	Increase by 13%
29	II/3D	B.1.5	RWCU Pump Room A	20	F	Not surveyed	Increase by 13%[3]	Increase by 13%
30	II/3D	B.1.5	RWCU Heat Exchanger Area	80	F	Not surveyed	Increase by 13%[4]	Increase by 13%
31	II/3D	B.1.5	RWCU Area Behind Hx Exchanger	2200	F	Not surveyed	Increase by 13%[5]	Increase by 13%
32	II/3D	B.1.5	RWCU Isolation Valve Room	1600	F	Not surveyed	Increase by 13%[6]	Increase by 13%
33	II/3C	B.1.13	MCC and Instrument Rack C-55 Area	1 - 3	B	Not surveyed	Increase by 13%	Increase by 13%
34	I/4A	B.1.18	CGCS-A Recombiner Area	1 - 6	B	Not surveyed	Increase by 13%	Increase by 13%

[2] Values expected to remain bounded by 2.78E+04 Rad TID at locations of EQ equipment
[3] Values expected to remain bounded by 1.39E+04 Rad TID at locations of EQ equipment
[4] Values expected to remain bounded by 5.55E+05 Rad TID at locations of EQ equipment
[5] Values expected to remain bounded by 1.53E+06 Rad TID at locations of EQ equipment
[6] Values expected to remain bounded by 1.11E+06 Rad TID at locations of EQ equipment

Enclosure 1

Table 1- Reactor Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
35	I/4B	B.1.17	Cooling Water Heat Exchanger and CGCS–B Recombiner Area	1 - 4	B	Not surveyed	Increase by 13%	Increase by 13%
36	I/4D	B.1.21	Standby Gas Treatment System B - Train Room	1	F	Not surveyed	Increase by 13%	Increase by 13%
37	I/4D	B.1.21	Standby Gas Treatment System Fan Room	1	F	Not surveyed	Increase by 13%	Increase by 13%
38	I/4D	B.1.21	Standby Gas Treatment System Airlock	1	D	Not surveyed	Increase by 13%	Increase by 13%
39	I/4D	B.1.21	Standby Gas Treatment System A - Train Area	1	F	Not surveyed	Increase by 13%	Increase by 13%
40	I/4E	B.1.16	Reactor Plenum Room	1	C	Not surveyed	Increase by 13%	Increase by 13%
41	V/3A	B.1.16	Reactor Recirculation MG Set Fan Room	1	A	Not surveyed	Increase by 13%	Increase by 13%
42	I/4C	B.1.16	Corridor Outside Main Exhaust Plenum	1	B	Not surveyed	Increase by 13%	Increase by 13%

Table 1- Reactor Building								
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43	I/5C	B.1.19	Skimmer Surge Tank and Fuel Pool Pumps Area	10 - 500	C	Not surveyed	Increase by 13%	Increase by 13%
44	I/5A	B.1.20	Snubber Rebuild and Decontaminatio n Area	1 - 5	B	Not surveyed	Increase by 13%	Increase by 13%
45	I/5B	B.1.19	Northeast Stairway 1001′ El	1 - 2	B	Not surveyed	Increase by 13%	Increase by 13%
46	I/5B	B.1.19	Contaminated Equipment Storage Area	1 - 6	C	Not surveyed	Increase by 13%	Increase by 13%
47	I/5B	B.1.19	Northwest Stairway 1001′ El	Not surveyed	C	Not surveyed	Increase by 13%	Increase by 13%
48	I/6		Refueling Floor 1027′ El	0.2 - 7	B	Not surveyed	Increase by 13%	Increase by 13%
49	DRYWEL L	B.1.1	Drywell	Not surveyed	F	Not surveyed	Increase by 13%	Increase by 13%

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
1	IX/13C	B.1.24	Motor Control Center B-33A & B, and B-12	1	A	Not surveyed	No change	No change
2	IX/13C	B.1.24	Turbine Building Southeast Corner near MCC B-33	1	A	Not surveyed	Increase by up to factor of 11.3 (1130%)	Increase by up to factor of 11.3 (1130%)
3	IX/13B	B.1.24	Lube Oil Reservoir and Reactor Feed Pump Area	1	A	Not surveyed	Increase by up to factor of 11.3 (1130%)	Increase by up to factor of 11.3 (1130%)
4	IX/13A	B.1.24	Lube Oil Storage Tank Room	1	A	Not surveyed	No change	No change
5	IX/16	B.1.24	Turbine Building Corridor Northeast 911' El	1 - 2	A	Not surveyed	No change	No change
6	IX/16	B.1.24	Water Box Scavenging System Area	1	A	Not surveyed	No change	No change

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
7	IX/12A	B.1.24	Turbine Building Sump & MCC B-31 Area	1	A	Not surveyed	No change	No change
8	IX/12A	B.1.24	4 KV and Load Center Division A East	1	A	Not surveyed	No change	No change
9	IX/12A	B.1.24	4 KV and Load Center Division A West	1	A	Not surveyed	No change	No change
10	X/12B	B.1.24	Hydrogen Seal Oil Unit and Condensate Pump Area	1 1 - 5	B	Not surveyed	No change	No change
11	X/12D	B.1.24	Mechanical Vacuum Pump Area	1 - 10 30	E	Not surveyed	No change	No change
12	X/12D	B.1.24	Condensate Backwash – Receiving Tank Area	5 - 30	F	Not surveyed	No change	No change
13	X/12E	B.1.24	Air Ejector Room	2 - 1500	F	0.2 – 3	Increase by 25% to 33%	Increase by up to a factor of 11.3 (1130%)

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
14	X/12C	B.1.24	Turbine Basement Condenser Area	5 - 1800	F	0.2 – 2	Steam areas increase by 9% Condensate areas increase by up to 11.3 (1130%) times	Increase by up to a factor of 11.3 (1130%)
15	IX/16	B.1.24	Pipe Tunnel to Intake	1	A	Not surveyed	No change	No change
16	IX/23A	B.1.24	Intake Entry Area	1	A	Not surveyed	No change	No change
17	IX/23A & XXIII/24	B.1.24	Intake Structure Pump Room	1	A	Not surveyed	No change	No change
18	IX/23A	B.1.24	Circ Water Pump Area	1	A	Not surveyed	No change	No change
19	IX/13C	B.1.23	Turbine Building Southeast Stairway from 911′ to 931′ El	1	A	Not surveyed	No change	No change
20	IX/13B	B.1.23	Turbine Building 931′ El Vent Chase	Not surveyed	A	Not surveyed	No change	No change
21	IX/16	B.1.23	Turbine Building Corridor Northwest 931′ El	1	B	Not surveyed	No change	No change

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
22	IX/12A	B.1.23	Turbine Building Northwest Stairway from 931′ to 951′ El	1	B	Not surveyed	No change	No change
23	X/14B	B.1.23	Valve Operating Gallery and Condensate Demin Panels Area	1-2	B	Not surveyed	No change	No change
24	XII/19B	B.1.23	Motor Control Center B-42 A&B, and B-43 A&B	1	A	Not surveyed	No change	No change
25	IX/19C	B.1.23	FW Pipe & Cable Tray Penetration Room	1	A	Not surveyed	Increase by up to a factor of 11.3 (1130%)	Increase by up to a factor of 11.3 (1130%)
26	XII/19A	B.1.23	Water Treatment Area South	1	A	Not surveyed	No change	No change
27	XII/19A	B.1.23	Water Treatment Area North	1	A	Not surveyed	No change	No change
28	XII/20	B.1.23	Auxiliary Boiler Room	1	A	Not surveyed	No change	No change

Enclosure 1

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
29	XII/34	B.1.23	East Electrical Equipment Room and 13 EDG	1	A	Not surveyed	No change	No change
30	XII/18A	B.1.23	Hot Machine Shop	1	A	Not surveyed	No change	No change
31	XII/18B	B.1.23	Oil Storage Room	1	A	Not surveyed	No change	No change
32	IX/16	B.1.23	Turbine Building Corridor Southeast Corner 931′ El	1	A	Not surveyed	No change	No change
33	IX/16	B.1.23	Cable Chase 941′ El	1	A	Not surveyed	No change	No change
34	XIV/15B	B.1.23	No. 11 Diesel Generator Room	1	A	Not surveyed	No change	No change
35	XIV/15B	B.1.23	No. 11 Diesel Generator Room Entry Area	1	A	Not surveyed	No change	No change
36	XIII/15A	B.1.23	No. 12 Diesel Generator Room	1	A	Not surveyed	No change	No change
37	XII/14A	B.1.23	Stator Water Cooling Area	1	A	Not surveyed	No change	No change

Table 2 - Turbine Building								
Volume	**Fire Zone**	**Environmental Specification**	**Volume Description**	**CLTP Operating Mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
38	XII/14A	B.1.23	4KV and Load Center Division B East	1	A	Not surveyed	No change	No change
39	XII/14A	B.1.23	4KV and Load Center Division B West	1	A	Not surveyed	No change	No change
40	X/14C	B.1.23	Turbine Building Railroad Car Shelter	1 – 2	B	Not surveyed	No change	No change
41	X/30	B.1.22	Pass System Area	1 – 3	C	Not surveyed	No change	No change
42	X/30	B.1.22	Turbine Volume from 951′ to 961′ El	1 – 1000 10 - 3000	F	1-5	Increase by 2% to 9%	Increase by up to a factor of 11.3 (1130%)
43	IX/16	B.1.23	Hallway to No. 11 Diesel Generator Entry Area	Not surveyed	A	Not surveyed	No change	No change
44	X/30	B.1.22	Turbine Volume from 961′ El to 1004′ El	1 – 1000 10 - 3000	F	1-5	Increase by 2% to 9%	Increase by up to a factor of 11.3 (1130%)

Table 3 - Control Room					
Area Description	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
Control Room	<0.2	A	<0.2	No change	No change

Table 4 - Protected Area and Building Roofs					
Area Description	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
Recombiner Building Roof	1 – 1.8	C	Not surveyed	Increase by 10%	No change
Diesel Generator Building Roof	1.2 – 8	D	Not surveyed	Increase by 10%	No change
Breaker Room Roof	0.4 – 4	C	Not surveyed	Increase by 10%	No change
Turbine Building Addition Roof	6 – 60	E	Not surveyed	Increase by 10%	No change
Hot Shop Roof	8 – 42	E	Not surveyed	Increase by 10%	No change
Turbine Building Roof	16 – 180	F	Not surveyed	Increase by 10%	No change
Non-1E Elec Room Roof	1.6 – 3.2	C	Not surveyed	Increase by 10%	No change
Heating Boiler Bldg Roof	1.6 – 1.8	C	Not surveyed	Increase by 10%	No change
EFT Roof	0.6 – 8	D	Not surveyed	Increase by 10%	No change
Admin Building Roof	0.2 – 60	E	Not surveyed	Increase by 13%	No change
Reactor Building Roof	0.2 – 14	E	Not surveyed	Increase by 13%	No change

Table 4 - Protected Area and Building Roofs					
Area Description	**CLTP Operating mrem/hr**	**Radiation Zone**	**CLTP Shutdown Dose rate from annual survey**	**Predicted EPU Radiation Effect at Power**	**Predicted EPU Shutdown Dose Effect**
Protected Area South of Radwaste Building	<0.2 – 0.4	A	Not surveyed	No change	No change
Protected Area West of Reactor Building	<0.2 – 0.3	A	Not surveyed	No change	No change
Protected Area East of Admin Building	<0.2 – 0.2	A	Not surveyed	No change	No change
Protected Area Northeast of Turbine Building	< 0.2 – 1.3	C	Not surveyed	No change	No change
Protected Area North of Turbine Building	<0.2 – 3.4	C	Not surveyed	No change	No change
Protected Area Northwest of Turbine Building	<0.2 – 1.4	C	Not surveyed	Increase by 10%	No change

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
1	**Plant Shielding Design** Plant shielding design was based on conservative specifications of radioactivity concentrations in coolant.	USAR 12.3.1.6 described the design bases for shielding. "The offgas system shielding is based on a stack release rate of 260,000 μCi/sec. Reactor water fission product concentrations and activated corrosion products were assumed to be the maximum values expected: 8.0 μCi/cc, and 0.07 μCi/cc, respectively." These design criteria are not approached during normal plant operation and will remain very conservative at EPU.
2	**Operating Dose – Reactor Building** Dose rates in the reactor building are estimated to increase by 13% during power operation at EPU. Dose rates close to the steam chase are estimated to be unchanged at EPU.	The primary source of operating radiation dose in the reactor building is due to core gamma and neutron radiation from the reactor. This source increases at EPU in direct proportion to the increase in thermal power production. EPU power is 2004 MWt, and CLTP power is 1775 MWt, therefore dose rates were estimated by scaling existing dose rates by 13%. Areas near the steam chase receive dose due to the N-16 source in steam piping. The production rate of N-16 increases in proportion to the increase in thermal power. However, the increase in steam flow rate also increases in proportion to the increase in thermal power. As a result the concentration of N-16 in steam is essentially unchanged at EPU conditions. Steam velocity also increases, but since the steam chase is close to the reactor there is no significant change in transit time for decay so dose rates in the vicinity of the steam chase will remain about the same as at current operating conditions. The TIP system area will likely experience an increase in observed radiation levels due to an increase in the activation of the detector's head and cable as a result of the increase in

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		reactor power. This area is designated as a Radiation Zone F (> 100 mrem/hr) and is normally inaccessible. Since this area is normally inaccessible, the increase in observed normal radiation levels does not impact plant personnel normal activities and the zone's normal radiation zoning designation is deemed acceptable for EPU implementation.
3	**Reactor Building – Drywell Operating and Shutdown Dose**	The Drywell area is designated as a Radiation Zone F (> 100 mrem/hr) and is normally inaccessible during power operations. As a result of the EPU, the Drywell radiation levels increase due to a 13% increase in reactor core operating sources. Since this area is normally inaccessible, the increase in observed normal radiation levels does not impact plant personnel normal activities and the zone's normal radiation zoning designation is deemed acceptable for EPU implementation. Following reactor shutdown the Drywell dose rate is primarily a result of the core fission product source term in the reactor and activation and corrosion products deposited in various plant piping systems and components. Both of these sources will change in proportion to the increase in power level and are estimated to increase by about 13%
4	**Shutdown Dose – Reactor Building** Shutdown dose rates in the reactor building are estimated to increase by 13% following shutdown from EPU conditions.	The primary source of radiation adjacent to the primary containment and inside the drywell is due to the core source term inventory at the time of shutdown. Following reactor shutdown, components activated by neutron radiation, fission products, and activated corrosion and wear products also become significant sources, especially when deposited in piping and equipment outside of the RPV. Both of these sources (core source term and activation products) will

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		increase in direct proportion to the increase in thermal power. Shutdown dose rates from these sources are estimated to increase by 13% compared to CLTP.
5	**Operating Dose – BOP Areas** Dose rates in areas that are dominated by the N-16 source term are affected by changes in transit and residence time for steam transport. A Microsoft Excel spreadsheet was used to estimate these changes. Dose rates in areas where N-16 has substantially decayed will be governed by increased deposition of coolant fission and activation products. In areas such as heater drains and condensate this is driven by up to a ten-fold increase in moisture carryover (MCO) and by up to a 13% increase in activation due to neutron flux increase in the core. Some areas could increase by up to a factor of 11.3 (1130%). These areas currently have very low dose rates during plant operation so the impact of this increase on radiation dose to workers can be minimized by monitoring radiation levels and controlling access to areas. This is sort of dose management approach is driven by the ALARA principle and is already in use at MNGP. See Tables 1, 2, 3 and 4 above for estimates of changes to specific plant areas.	Dose rates during normal plant operation in areas exposed to reactor coolant and steam are primarily a function of N-16 concentration. N-16 concentration in reactor steam is essentially unchanged as power increases due to dilution in the associated increased steam flow. Increased steam flow rates reduce the transit time in steam piping. The reduction in transit time also reduces the time for decay of the N-16 source at any specific location. The result is increased dose rates in areas further downstream. A series of evaluations were performed for various plant areas based on the effect of steam transit time and N-16. The estimates were made by scaling OLTP transit times to various components, first to CLTP and then to EPU conditions and then computing the difference in N-16 decay time to compute a change in radiation level. The results show that areas closest to the reactor have little or no change in N-16 dose rate. Steam areas of the plant show dose rate increase of up to 14% at the exit of the #14 FWH. Radiation levels are expected to increase by 31% to 34% in the SJAE and Offgas system steam piping. The dose rate due to N-16 entering the condenser increases by

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		about 9%. N-16 dose in the condensate leaving the hotwell shows an increase of a factor of about 10, but since most of the N-16 will have decayed, this will not result in a significant increase in radiation levels. Due to significant holdup time in the condenser hotwell, nearly all N-16 will decay before it moves on to the condensate piping, demineralizers, and feedwater system. The net holdup time in the condenser hotwell at current hotwell control levels is a minimum of 21.5 half-lives of N-16. The dose rate in condensate and feedwater piping areas is more a result of deposition of activation and corrosion products than a result of N-16. As a result, radiation levels in these areas are predicted to be unaffected by N-16 changes at EPU. Dose rates in BOP areas where the N-16 source has decayed result from deposition of fission products, and activated corrosion and wear products. These areas will see radiation dose increases determined by the increase in moisture carryover (up to a factor of 11.3or 1130%). The results are summarized in Table 6 of this enclosure. The evaluation used the steam concentration of N-16 from the transit time scaling mentioned earlier in this item. However, since the final result is the ratio of the results of two different results based on the assumed steam concentration, the assumed concentration cancels out.
6	**Shutdown Dose – BOP Areas** Shutdown dose rates due to activation and corrosion products will increase proportional to the power uprate –	Shutdown dose rates in the balance of plant are a result of activation of corrosion and wear products and fission products with longer half-lives that are deposited in BOP piping and

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
	approximately 13%. Shutdown dose rates will increase proportional to the assumed increase in moisture carryover. Typical MCO at CLTP is 0.05%. Performance Assumption for MCO at EPU is 0.5%. Shutdown dose rates will increase by up to a factor of 10 as a result of moisture carryover. The net change in shutdown dose rates in plant areas due to moisture carryover and deposition could be up to 10*1.13 or an increase by a factor of 11.3 (1130%). See Tables 1, 2, 3, and 4 of this enclosure for predictions of changes in BOP areas.	equipment during plant operation. Short lived radioactivity decays before it can become significant shutdown dose concern. The biggest impact in radioactivity deposition in balance of plant piping will be a result of the carryover of fission products and activated corrosion and wear products in reactor steam. Carryover allows soluble and non-soluble radioactive isotopes to reach BOP piping systems and equipment where it can build up over time until its decay rate matches its deposition rate. The time to achieve 95% of its maximum possible concentration for a given isotope is on the order of 4.5 half-lives. Most isotopes evaluated in ANSI/ANS 18.1 will reach equilibrium in less than an operating cycle, but some long lived isotopes will take many years (e.g., Mn-54, Fe-55, Co-60, Ni-63, Sr-90, Ru-106, and Ce-144). **Fission Product Generation Rate** Fission product generation rate will increase in proportion to reactor neutron flux which is proportional to the increase in EPU thermal power. Fission product Noble Gases will pass through the system and be exhausted through the Steam Jet Air Ejectors and Offgas system. Undecayed, gaseous fission product iodine will likewise be exhausted as a gas. Fission product solids and decay products will also increase in proportion to thermal power but as solids these products tend to remain in the reactor vessel. **Corrosion Product Generation Rate** Zinc injection, hydrogen water chemistry systems and coolant chemistry controls will continue to work to minimize

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		corrosion. Corrosion rates are not expected to change significantly at EPU conditions. **Erosion and Wear Products Generation Rate** Generation of erosion or wear products is a function of flow velocity. While flow rates in power cycle systems increase at EPU conditions, the rates of erosion and wear are expected to remain low. Operation of Condensate demineralizers and Reactor Water Cleanup demineralizers will act to reduce the changes in the concentration of corrosion and wear products in the coolant. As a result, equilibrium concentration of erosion and wear products are assumed to remain about the same at EPU conditions. **Erosion/Corrosion Product Activation Rate** The rate of activation of corrosion and wear products is therefore expected to increase proportionally to the increase in core neutron flux which will be proportional to the thermal power increase (about 13%). **Deposition Rate** The rate of deposition of radioactivity is a function of reactor power and fluid temperature and velocity. Increased steam, condensate and feedwater flow rates would be expected to reduce deposition rates roughly in proportion to the increase in flow rates. This will roughly offset the increased production rate of radioactivity.

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		Impact Summary The biggest impact in radioactivity deposition in balance of plant piping will be a result of the carryover of fission products and activated corrosion and wear products in reactor steam. Carryover allows soluble and non-soluble radioactive isotopes to reach BOP piping systems and equipment where it can build up over time until its decay rate matches its deposition rate. The time to achieve 95% of its maximum possible concentration for a given isotope is on the order of 4.5 half-lives. Most isotopes evaluated in ANSI/ANS 18.1 will reach equilibrium in less than an operating cycle, but some long lived isotopes will take many years (e.g., Mn-54, Fe-55, Co-60, Ni-63, Sr-90, Ru-106, and Ce-144). BOP areas currently have very low dose rates during plant shutdown so the impact of this increase on radiation dose to workers can be minimized by monitoring radiation levels and controlling access to areas. This sort of dose management approach is driven by the ALARA principle and is already in use at MNGP.
7	**Impact of Filter/Demineralizer Systems on Radiation Levels**	Filtration/Demineralizer systems at MNGP include the Reactor Water Cleanup and Condensate Demineralizer systems. These system use mechanical and chemical filtration processes to remove particulates and chemically active contaminants from coolant. The levels of impurities including radioactive in the effluents are significantly reduced from levels in the influents, but neither of these processes removes 100% of the impurities from the fluid. Even though the radioactivity levels in effluents from these systems are significantly decreased they will change by a similar proportion as described for the influents as

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		described in this evaluation. To accommodate increased flowrates, condensate demineralizers at MNGP will be replaced as part of the modifications to support EPU. It is assumed that the new equipment will be selected and sized to support mechanical and chemical removal efficiencies equivalent to the current system performance at CLTP. A conservative RWCU system flowrate that does not maintain the current assumption of 1% of the rated feedwater flowrate was used. This results in conservatively higher estimates of coolant source term concentrations. The results indicate that the assumption that the coolant source terms increase in proportion to the power increase is conservative.
8	**Doses in Radioactive Waste Processing and Storage Areas**	The volume of solid and liquid radwaste processed will increase at EPU conditions. The bulk of this increase will come from condensate demineralizer and RWCU demineralizer resin wastes. Dose rates in radwaste areas are a function of how much waste material is present. This source can be controlled by the use of shielding or frequency of transportation for disposal. Therefore, there is no clear correlation between dose rates in radwaste processing areas and reactor power level.
9	**Control Room**	The Main Control Room is designated as a Radiation Zone A ($\leq$ 0.5 mrem/hr) allowing for uncontrolled access and unlimited occupancy. As reflected in radiation survey data, the normal operating radiation level in the Main Control Room is currently less than 0.2 mrem/hr. This area is well shielded

Table 5 - Evaluations and Methodology		
Item	**Subject**	**Description/Basis**
		from the normal operation radiation sources that would be affected by the EPU. With the implementation of the EPU, the observed area dose rates may increase in proportion to the change in power (approx 13%); however, due to the low radiation levels in the Control Room, this increase is considered to be negligible. EPU will not result in a change to the Main Control Room normal radiation zone designation for personnel access. Equipment in the control room will not have any significant change to the total integrated radiation dose from normal operation that is currently evaluated for the EQ program.
10	**Protected area, Building Roofs, Sky Shine and Site perimeter**	The most significant source of radiation dose rates for these areas is the N-16 source from the turbine building. As described above. The N-16 source concentration in steam leaving the reactor does not change significantly at EPU conditions. Due to shorter transit times, the concentration of N-16 further downstream in steam piping, turbines, and heaters will be higher than at present. This will increase dose rates on the turbine op deck and shine from the turbine building. Based on the estimates of N-16 dose rates in Table 6 below it can be seen that the dose rates at the HP turbine increase about 3%, the LP turbine about 9% and the #15 Feedwater Heater about 17% on average. Therefore, reasonable bounding estimate is that radiation levels driven by shine will increase by about 10%.

Table 6 - Evaluation of N-16 Dose Rates

	TRANSIT Time CA-67-086	Time OLTP sec	N-16 OLTP micro-Ci/gm	Flow OLTP lb/hr	Time CLTP sec	Flow CLTP lb/hr	N-16 CLTP micro-Ci/gm	Time EPU sec	Flow EPU lb/hr	N-16 EPU micro-Ci/gm	% Change EPU %	
Vessel to Steam stop	0	0	6.15E+01	6.78E+06	0.00	7.26E+06	6.11E+01	0.00	8.32E+06	6.00E+01	-1.70%	
	2.05321	2.05321	5.04E+01	6.44E+06	1.95	6.77E+06	5.05E+01	1.59	8.32E+06	5.14E+01	1.84%	
MSL Steam Chase to												
Stop Valves	0.49	2.05321	5.04E+01	6.44E+06	1.95	6.77E+06	5.05E+01	1.59	8.32E+06	5.14E+01	1.84%	
HP Turbine	1.12	2.68321	4.74E+01	6.44E+06	2.55	6.77E+06	4.76E+01	2.08	8.32E+06	4.91E+01	2.95%	
	1.14	2.70321	4.73E+01	6.44E+06	2.57	6.77E+06	4.76E+01	2.09	8.32E+06	4.90E+01	2.99%	
Moisture Separator	1.53	3.09321	4.55E+01	6.04E+06	2.96	6.32E+06	4.58E+01	2.41	7.74E+06	4.75E+01	3.62%	
	3.44	5.00321	3.78E+01	6.04E+06	4.78	6.32E+06	3.84E+01	3.91	7.74E+06	4.11E+01	7.04%	
LP Turbine	4.04	5.60321	3.57E+01	5.40E+06	5.34	5.67E+06	3.63E+01	4.33	7.00E+06	3.94E+01	8.45%	
	4.07	5.63321	3.56E+01	5.40E+06	5.37	5.67E+06	3.62E+01	4.35	7.00E+06	3.93E+01	8.50%	
Condenser	4.07	5.63321	3.56E+01	6.43E+06	5.36	6.76E+06	3.63E+01	4.35	8.34E+06	3.93E+01	8.48%	
	4.11	5.67321	3.54E+01	6.43E+06	5.40	6.76E+06	3.61E+01	4.38	8.34E+06	3.92E+01	8.55%	
#15 FWH	2.18	3.74321	4.28E+01	3.63E+05	3.36	4.05E+05	4.41E+01	2.55	5.33E+05	4.68E+01	6.30%	
	6.81	8.37321	2.73E+01	3.63E+05	7.51	4.05E+05	2.94E+01	5.71	5.33E+05	3.45E+01	17.10%	
#14 FWH	4.88	6.44321	3.29E+01	7.89E+05	6.17	8.25E+05	3.35E+01	5.19	9.79E+05	3.62E+01	8.07%	
	8.48	10.04321	2.32E+01	7.89E+05	9.61	8.25E+05	2.40E+01	8.09	9.79E+05	2.73E+01	13.94%	
SJAE Steam	0	1.56321	5.29E+01	7.00E+03	1.33	8.20E+03	5.36E+01	0.90	1.22E+04	5.50E+01	2.58%	
	9.1	10.66321	2.18E+01	7.00E+03	9.10	8.20E+03	2.52E+01	6.12	1.22E+04	3.31E+01	31.40%	
OG	4.11	5.67321	2.29E+05	8.00E+02	5.67	8.00E+02	2.45E+05	5.67	8.00E+02	3.28E+05	33.76%	0.8 factor described in USAR 12.3.2.2.2
	121	122.56321	2.66E+00	8.00E+02	122.56	8.00E+02	2.45E+05	122.56	8.00E+02	3.28E+05	33.76%	
Hotwell	4.11	5.67321	7.12E+00	6.43E+06	5.40	6.76E+06	7.23E+00	4.38	8.34E+06	7.85E+00	8.55%	0.2 factor described in USAR 12.3.2.2.2
	202.75	25.02	1.08E+00	6.43E+06	182.38	6.76E+06	2.44E-07	158.13	8.34E+06	2.53E-06	938.50%	
				Rerate Heat Balance		Rerate Heat Balance			Heat Balance AA06-291 R0			

<u>NRC Question</u>

2) Describe the radiation surveys to be performed as part of the startup testing plan.

<u>NMC Response</u>

Table 7 - Radiation Surveys		
Item	**Subject**	**Recommendations from Evaluation**
1	Radiation Surveys	1 Perform plant radiation surveys during power ascension testing and at EPU to confirm predicted radiation dose rates. 2 Perform post-shutdown plant radiation surveys following operation at increased power levels to confirm predicted shutdown dose rates.
2	Site Boundary and Protected Area Radiation Surveys	As part of power ascension testing perform detailed radiation surveys at protected area and site boundaries to identify any areas with radiation level increases due to possible radiation streaming. This monitoring will help prevent potential issues with offsite dose rates before regulatory limits could be exceeded.
3	Office Areas and Facilities Radiation Surveys	As part of power ascension testing perform detailed radiation surveys at site office areas and facilities that can be occupied by members of the public or workers not subject to occupational exposure limits to identify any areas with radiation level increases due to possible radiation streaming . This monitoring will help prevent potential issues with dose rates before regulatory limits could be exceeded.

The radiation surveys will be performed as part of STP-5, which is described in Tables 1 and 2 of the Monticello EPU LAR, Enclosure 9, Startup Test Plan. EPU Test 2 (Table 8 on next page) will be the control for Radiation Surveys.

Table 8 - Test Number 2, Radiation Measurements		
Item	**Subject**	**Description**
1	Purpose	Monitor radiation at the EPU conditions to assure that personnel exposures are maintained ALARA, radiation survey maps are accurate, and radiation zones are properly posted.
2	Applicability	Applies to both mid-cycle on-line and post-refueling outage EPU implementation phases.
3	Description	At selected EPU power levels, gamma dose rate measurements and, where appropriate, neutron dose rate measurements will be made at specific limiting locations throughout the plant to assess the impact of the uprate on actual plant area dose rates. USAR radiation zones will be monitored for any required changes.
4	Test Data Acquisition	Within the EPU power ascension test procedure or the governing test schedule, add steps, at selected EPU power levels, to conduct radiation surveys of those areas expected to experience an increase in radiation dose rates.
5	Test and Test Conditions	Test: 1. Measure radiation levels at selected locations throughout the plant Test Conditions: A. ≥100% CLTP up to maximum EPU power.
6	Acceptance Criteria	The radiation doses of plant origin and the occupancy times of personnel in radiation zones shall be controlled consistent with the guidelines of the standards for protection against radiation as outlined in 10CFR20, "Standards for Protection Against Radiation".

NRC Question 3)
Describe the contribution and effects of hydrogen water chemistry (HWC) (N-16) to the radiation doses (both pre-EPU and post-EPU) to members of the public onsite.

NMC Response

Table 9 - Effects of HWC

Item	Assumption	Ref./Basis
1	The increase in skyshine dose rate at EPU conditions is driven by N-16.	N-16 is the predominant radiation source in BWRs, especially in plants with HWC. N-16 production rate increases in proportion to the increase in thermal power (approximately 13%). At a constant HWC injection rate the feedwater hydrogen concentration entering the reactor would decrease slightly. However, this effect is offset by the increase of radiolysis which produces free hydrogen from the reactor coolant. The increase in steam flow at EPU (14.8%) offsets this increased N-16 production by dilution. So N-16 concentration in steam exiting the RPV at EPU (without an increase in HWC Injection rate) would remain constant. Increased steam flow rates decrease transit time for N-16 in steam to various points in the BOP. This reduction in transit time allows less time for decay of N-16 and results in increased radiation levels further downstream in steam piping and steam systems.
2	HWC injection rate will be increased by approximately 14.8% (the EPU increase in feedwater flow rate) to maintain feedwater hydrogen concentration at current levels.	Reasonable assumption, based on design basis for HWC. No actual increase has been planned or identified at present.
3	The dose rate due to N-16 increases linearly with the increase in hydrogen injection rate.	EPRI Report NP-4621 (See Figure 1 below) shows the typical characteristic response of steam radiation levels with increasing hydrogen injection rate. MNGP radiation operating hydrogen injection levels place the plant in the upper region of this curve where it is conservative to predict a linear increase in radiation levels with increasing injection rate.

Enclosure 1

Figure 1 - Dose Rate as a Function of HWC Injection Rate (Typical)

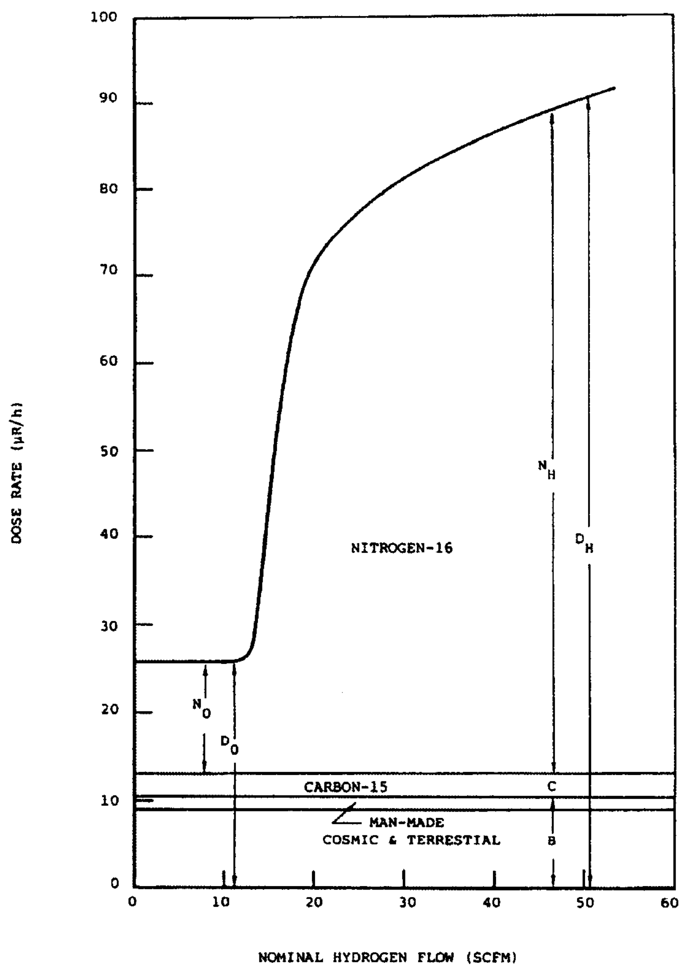

Figure 4-1. Contributions to Dose Rate as a Function of Hydrogen Addition

4-13

Table 9 - Effects of HWC		
Item	**Assumption**	**Ref./Basis**
4	Plant Skyshine from the Turbine	The primary source of skyshine is the N-16 gamma in reactor steam in the turbine building. The shine from piping and components above grade will only be attenuated by equipment materials, shielding and building materials. The skyshine dose for equipment below grade will be also be attenuated by the earth around the turbine building. In general the changes in the equipment above grade will be the most significant factor in skyshine although radiation scatter from other sources may be present. The equipment above grade includes steam piping, turbines, feedwater heaters, the upper portions of moisture separators and the transition between the turbines and condenser. A conservative estimate of the impact of EPU on skyshine is based on the increase in N-16 dose as a function of increased injection rate times the change in dose due to changes in steam transit time. Using 14.8% increase in feedwater flowrate to estimate increased hydrogen injection rate and the effect of transit time at the exit of the #15 FWH (17.1% increase in estimated dose rate) yields a maximum skyshine source dose rate increase of 34.4% (1.148*1.171).

Table 9 - Effects of HWC		
Item	**Assumption**	**Ref./Basis**
		The 2006 Annual Radiological Operating Report for MNGP reported the results of radiation monitoring for the plant. The report stated: "Ambient radiation was measured in the general area of the site boundary, at an outer ring 4 - 5 mi distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (16.5 and 15.6 mRem/91 days, respectively)....The mean for the control locations was 15.7 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1991 through 2005 ...No plant effect on ambient gamma radiation is indicated." Tabular and graphical data is provided in Monticello EPU LAR, Enclosure 4, Table 7.2.2-1 and Figure 7.2.2-1. The conclusion in the report is that there is no plant effect on ambient gamma radiation. This would support an estimate that skyshine changes due to EPU will not have any impact on measured dose rates offsite. The data shows a maximum difference between the inner and outer ring of 1.1 mrem for a quarter. If this is taken as a measure of skyshine it represents a maximum of 4.4 mrem per year at current conditions. Scaling this result by 34.4% is less than 6 mrem /yr. This is considered a conservative upper bound for offsite dose to skyshine at EPU conditions.

Table 9 - Effects of HWC		
Item	**Assumption**	**Ref./Basis**
		The average exposure due to gaseous emissions and liquid effluents to an individual are less than a total of 1 mrem per year. Adding this to the skyshine estimate of 6 mrem/yr is a total of 7 mrem. As a result it is concluded that the maximum potential dose to any member of the public will remain well within the 40 CFR 190 limit of 25 mrem/yr.

Also see the location specific dose information and predictions for onsite areas described for NRC Question 1 above. These results included N-16 effects. A discussion of methods used to predict N-16 changes in plant areas due to the transit time effects is included as Item 5 in the table of evaluations for BOP areas. Table 6 in that response shows the results for specific plant areas.

Off-Site Radiation Levels

NRC Question

4) Provide the dose value contributions for the primary sources of normal operation offsite doses (all effluent releases, gamma shine, storage and transfer of radioactive materials) to a member of the public at EPU. Describe the methodology to determine these doses.

NMC Response:

Plant history from annual reports from 2001 through 2006 can be found in the Monticello EPU LAR Enclosure 4, Tables 7.1.3-1 and 7.1.3-2.

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
1	Plant Gaseous Emissions	The production rate of gaseous fission products and activation products is proportional to the increase in core neutron flux which is proportional to the increase in rated thermal power. This means the generation rate of gaseous waste increases by about 12.9% at EPU conditions. The plant Gaseous Waste Management system was evaluated and concluded that: a. the increased off-gas flow rates at EPU are within the design capacity of the system, and b. fission product holdup times in the compressed gas storage portion of the offgas system are not impacted. There is, in fact, increased radiolysis production of offgas volumetric flow at EPU conditions proportional to the increase in power. There is also an increase in production rate of fission product and activation product gases at EPU proportional to the increase in power. The amount of air in leakage that adds to the offgas flow rate is determined by the physical condition of the condenser and is not impacted by the EPU. In 2003 and 2004, excessive air inleakage to the condenser at MNGP exceeded the capacity of the offgas

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
		system to compress and store the offgas process stream. The plant operated for about a full cycle with the storage portion of the offgas system bypassed (Holdup time was essentially reduced to zero). However, the condition did not require the plant to shutdown and the offsite dose consequences remained a small fraction of regulatory dose limits. This clearly demonstrates that there is significant operational margin to support operation at EPU conditions. To summarize, increased offgas flowrates at EPU will reduce the actual holdup time. However all increases in offgas volume flowrates remain within the design basis capacity of the offgas system and the offgas storage system. Monticello EPU LAR Enclosure 4, Table 7.1.3-1 summarizes data reported by MNGP in the Annual Radioactive Effluent Release Reports and includes the Technical Specifications reporting dose limits for gaseous effluent releases. By examination it is clear that an increase of 12.9% in dose would remain a very small fraction of the reporting limits. Monticello EPU LAR Enclosure 4, Table 7.1.3-2 summarizes data reported by MNGP in the Annual Radioactive Effluent Release Reports and includes the comparison to the regulatory dose limits for gaseous effluent releases from 10 CFR 50 Appendix I and 40 CFR 190. By examination it is clear that an increase of 12.9% in dose would remain a very small fraction of the regulatory limits. Current environmental monitoring and effluent release reporting requirements remain adequate. Any unplanned gaseous release to the environment that exceeds two times the Offsite Dose Calculation Manual limit for 60 minutes or longer will result in declaration of an Unusual Event, activate the emergency planning organization, and initiate actions to protect the health and safety of the public. The ODCM setpoints are based on a release

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
		rate that would result in a dose of 500 mrem in one year of continuous exposure. ODCM-03-01 section 2.1 requires " With the dose rate exceeding the ODCM limit (500 mrem/yr), the ODCM requires immediate action to decrease the release rate." This supports a conclusion that EPU will have no significant impact on offsite dose from gaseous effluents.
2	Liquid Effluents	No radioactive liquid effluent has been intentionally released from the Monticello Plant since January 1972 (USAR 9.2.3.1). The Liquid Radwaste Processing Systems will have an excess processing margin of about 45% at EPU conditions. Therefore the plant capability of maintaining a zero-discharge liquid effluent release policy is not impacted by operation at EPU. The small volume and radioactivity of unplanned discharges is clearly demonstrated by the plant historical trends summarized in Attachment 1 Table 1. The potential dose consequences of these unplanned discharges are summarized in the historical trends in Attachment 1 Tables 1 and 2. These tables include the Technical Specifications Reporting dose limits and the 10 CFR 50 Appendix I and 40 CFR 190 regulatory dose limits. By examination it is clear that the potential exposures to the public from liquid effluent releases have been a minute fraction of the regulatory limits. Future unplanned releases could reflect the greater production rate of fission products and activation products at EPU. Current environmental monitoring and effluent release reporting requirements remain adequate. Any unplanned liquid release to the environment that exceeds two times the Offsite Dose Calculation Manual limit for 60 minutes or longer will result in declaration of an Unusual Event, activate the emergency planning organization, and initiate actions to protect the health and safety of the public. The ODCM setpoints are based on radioactivity concentrations that would result in a total dose of 500 mrem in one year if ingested continuously. ODCM-03-01 section 2.1

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
		requires" With the dose rate exceeding the ODCM limit (500 mrem/yr), the ODCM requires immediate action to decrease the release rate. "This supports a conclusion that EPU will have no significant impact on offsite dose from liquid effluents.
3	Plant Skyshine from the Turbine	The primary source of skyshine is the N-16 gamma in reactor steam in the turbine building. The shine from piping and components above grade will only be attenuated by equipment materials, shielding and building materials. The skyshine dose for equipment below grade will be also be attenuated by the earth around the turbine building. In general the changes in the equipment above grade will be the most significant factor in skyshine although radiation scatter from other sources may be present. The equipment above grade includes steam piping, turbines, feedwater heaters, the upper portions of moisture separators and the transition between the turbines and condenser. Based on Assumptions Items 1 through 3, a conservative estimate of the impact of EPU on skyshine is based on the increase in N-16 dose as a function of increased injection rate times the change in dose due to changes in steam transit time. Using 14.8% increase in feedwater flowrate to estimate increased hydrogen injection rate and the effect of transit time at the exit of the #15 FWH (17.1% increase in estimated dose rate) yields a maximum skyshine source dose rate increase of 34.4% (1.148*1.171). The 2006 Annual Radiological Operating Report for MNGP reported the results of radiation monitoring for the plant. The report stated: "Ambient radiation was measured in the general area of the site boundary, at an outer ring 4 - 5 mi distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (16.5 and 15.6 mRem/91 days, respectively)....The mean for the control locations was 15.7 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
		to those observed from 1991 through 2005 …No plant effect on ambient gamma radiation is indicated." The conclusion in the report is that there is no plant effect on ambient gamma radiation. This would support an estimate that skyshine changes due to EPU will not have any impact on measured dose rates offsite. The data shows a maximum difference between the inner and outer ring of 1.1 mrem for a quarter. If this is taken as a measure of skyshine it represents a maximum of 4.4 mrem per year at current conditions. Scaling this result by 34.4% is less than 6 mrem /yr. This is considered a conservative upper bound for offsite dose to skyshine at EPU conditions. The average exposure due to gaseous emissions and liquid effluents to an individual are less than a total of 1 mrem per year. Adding this to the skyshine estimate of 6 mrem/yr is a total of 7 mrem. As a result it is concluded that the maximum potential dose to any member of the public will remain well within the 40 CFR 190 limit of 25 mrem/yr.
4	Offsite Dose Rate and Exposure Compliance with 10 CFR 20 § 20.1301, and 10 CFR 20 § 20.1302	10 CFR 20 § 20.1301, and 10 CFR 20 § 20.1302 establish a maximum dose rate in unrestricted areas of 2 mrem/hr (0.02 mSv in one hour) and a maximum annual dose of 100 mrem (0.1 mSv). Based on the evaluations of doses due to gaseous emissions, liquid effluents, and skyshine in 3.3.2 Items 1, 2, and 3, implementation of EPU is not expected to approach these limits.
5	Offsite Doses and Exposure Due to Storage, Transportation and Disposal of Radioactive Materials.	Operation at EPU conditions will increase the need for truck transportation for disposal of solid radwaste by one truck per year. The solid radwaste system is designed to process, package, store, monitor, and provide shielded storage facilities for solid wastes to allow for radioactive decay and/or temporary storage prior to shipment from the plant for off-site disposal. The solid radioactive wastes are shipped off-site in vehicles equipped with adequate shielding to comply with Department of Transportation (DOT) regulations. Code of Federal Regulations Title 10, Parts 20, 61, 70 and 71 also apply. Based on this,

Table 11 - Dose Contributions		
Item	**Subject**	**Description/Basis**
		implementation of EPU is not expected to result in any significant increase in offsite doses or exposures due to the storage, transportation, and disposal of radioactive materials and waste.
6	Operation of MNGP in combination with licensing of an Independent Spent Fuel Storage Facility	Preliminary radiological valuations of the ISFSI being built at MNGP predict a bounding offsite dose consequence of 8.9 mrem/yr at the closest site boundary. The evaluation assumed a fully occupied ISFSI loaded with fuel containing the design basis source inventory, no shielding berm, and continuous exposure to an individual at the closest site boundary. Adding this to the EPU estimate for operation of the plant (7 mrem/yr) gives a conservative total estimate of 15.9 mrem/yr. This meets the 25 mrem/yr limit of 40 CFR 190. ISFSI loading will occur over a period of years. Continued environmental monitoring will provide ample opportunity to detect problems and take action if dose rates from either source exceed expectations.

Enclosure 1

General

NRC Question

5) For all percentages used to describe the changes in dose and radiation levels at EPU described in Section 2.10, provide actual radiation and dose values.

NMC Response

Responses to NRC Questions 1 through 4 above provide this information.

Acronym List for Enclosure 1

Short Form	Description
ALARA	As Low as Reasonably Achievable
BOP	Balance of Plant
BWR	Boiling Water Reactor
Ci	Curie
CFR	Code of Federal Regulations
CGCS	Combustible Gas Control System
CLTP	Current Licensed Thermal Power
CLTR	CPPU Licensing Topical Report
CPPU	Constant Pressure Power Uprate
CR	Control Room
CRD	Control Rod Drive System
CST	Condensate Storage Tank
DOT	Department of Transportation
EDG	Emergency Diesel Generator
EPU	Extended Power Uprate
EQ	Environmental Qualification
GDC	General Design Criteria
HP	High Pressure
HPCI	High Pressure Coolant Injection System
hr	Hour
HWC	Hydrogen Water Chemistry
HVAC	Heating, Ventilation and Air Conditioning System
HX	Heat Exchanger
lbm	Pounds mass
MCC	Motor Control Center
MCO	Moisture Carryover
MNGP	Monticello Nuclear Generating Plant
mrad	Millirad
mrem	MilliRem
MWt	Mega-watt - thermal
N-16	Radioisotope of Nitrogen that is a major contributor to BOP dose rate.
NMC	Nuclear Management Company, LCC

NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OLTP	Original Licensed Thermal Power
RCIC	Reactor Core Isolation Cooling System
RG	Regulatory Guide
RHR	Residual Heat Removal System
RPV	Reactor Pressure Vessel
sec	Second
SJAE	Steam Jet Air Ejector
TIP	Traversing In-Core Probe System
RTP	Reactor Thermal Power
RWCU	Reactor Water Cleanup System
USAR	Updated Safety Analysis Report
yr	Year