QF-0545 (FP-E-MOD-11) Rev. 0

NMC Committed to Nuclear Excellence
Fleet Modification Process

Design Information Transmittal (DIT)

From: Charles Nelson

To : Greg Rainey - Sargent & Lundy

Mod or Tracking Number: CA-95-075 Date: 03/20/08 DIT No: EPU-0258

Mod Title: Main Steam Line High Flow Setpoint

Plant: Monticello Unit 1 ☒ Unit 2 ☐ Common ☐ Quality Classification: Safety Related

SUBJECT:High Main Steam Flow Analytical Limit and Tech Spec Limit

Check if applicable:

☒ **This DIT confirms information previously transmitted orally on 3/20/2008 by C. Nelson.**

☐ **This information is preliminary. See explanation below.**

SOURCE OF INFORMATION (Source documents should be uniquely identified)

The EPU Tech Spec limit and Analytical Limit will remain the same as prior to EPU in terms of absolute steam pressure; 151.95 psid and 160.63 psid, respectively. Based on the increase in rated flow from 7.259x10^6 lbs/hr to 8.335x10^6 lbs/hr, these limits correspond to 123.64% of EPU rated flow and 127.124% of EPU rated flow, respectively.

DESCRIPTION OF INFORMATION (Write the information being transmitted or list each document being transmitted)

The Tech Spec limit will be established at 123.64% of EPU rated steam flow (151.95 psid) and the Analytical Limit will be established at 127.124% of EPU rated flow (160.63 psid).

DISTRIBUTION (Recipients should receive all attachments unless otherwise indicated. All attachments are uncontrolled unless otherwise indicated)

C. Nelson - NMC
S. Malak - S&L
R. Dhiman - S&L
G. Rainey - S&L

PREPARED BY (The Preparer and Approver may be the same person.)

Preparer Name	Position	Signature	Date
C. Nelson	EPU Project	C Nelson	3/20/08

APPROVED BY (The cognizant Engineering Supervisor has release authority. Consult the Design Interface Agreement or local procedures to determine who else has release authority.)

Approver Name	Position	Signature	Date
S. Hammer	EPU Project	S Hammer	3/20/08

QF-0545 (FP-E-MOD-11) Rev. 0

NMC Committed to Nuclear Excellence Fleet Modification Process	**Design Information Transmittal (DIT)**

A copy of the DIT (along with any attachments not on file) should be sent to the modification fille

QF-0545 (FP-E-MOD-11) Rev. 0

NMC Committed to Nuclear Excellence
Fleet Modification Process

Design Information Transmittal (DIT)

From: Charles Nelson

To : Greg Rainey - Sargent & Lundy

Mod or Tracking Number: CA-95-075 Date: 03/21/08 DIT No: EPU-0259

Mod Title: Main Steam Line High Flow Setpoint

Plant: Monticello Unit 1 ☒ Unit 2 ☐ Common ☐ Quality Classification: Safety Related

SUBJECT:High Main Steam Flow Current Flow Relationship

Check if applicable:

☒ **This DIT confirms information previously transmitted orally on 3/21/2008 by C. Nelson.**

☐ **This information is preliminary. See explanation below.**

SOURCE OF INFORMATION (Source documents should be uniquely identified)

CA-95-075, Revision 0

DESCRIPTION OF INFORMATION (Write the information being transmitted or list each document being transmitted)

The current revision of CA-95-075 establishes that 140% of the current rated flow corresponds to 147.7 psid. This relationship is used to determine the relationship between percent of EPU rated flow and pressure.

DISTRIBUTION (Recipients should receive all attachments unless otherwise indicated. All attachments are uncontrolled unless otherwise indicated)

C. Nelson - NMC
S. Malak - S&L
R. Dhiman - S&L
G. Rainey - S&L

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C. Nelson	EPU Project	CNelson	3/21/08
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S. Hammer	EPU Project	S Hammer	3/21/08
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QF-0545 (FP-E-MOD-11) Rev. 0

NMC Committed to Nuclear Excellence Fleet Modification Process	Design Information Transmittal (DIT)

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BARTON

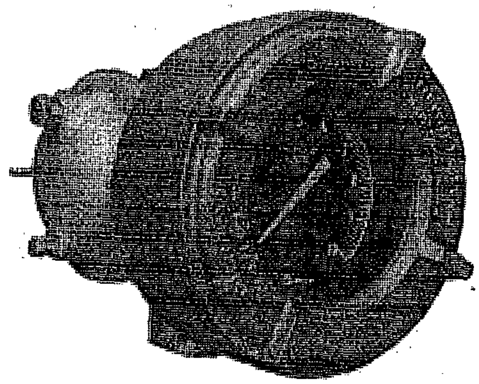
PRODUCT BULLETIN 288A/289A-6

Differential Pressure Indicating Switches

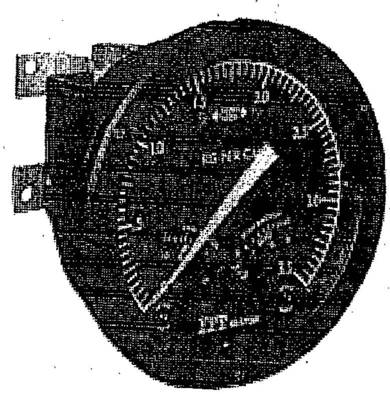
LIQUID LEVEL · DIFFERENTIAL PRESSURE · FLOW RATE

PRODUCT DESCRIPTION

The differential pressure indicating switches described in this bulletin are responsive to relatively low magnitudes of pressure differences at high static pressures.



MODEL 291B



MODEL 288A

These units are employed to energize alarm or control circuits at predetermined limits of flow through pipelines, liquid level in pressurized vessels or pressure loss across devices, such as filters. For monitoring flow rates, they are used in conjunction with a primary element, such as an orifice in the line.

These switches will withstand overranges equal to their rated safe working pressure. They are offered in a wide range of differential and pressure ratings with either snap-action mechanical contacts or magnetically operated mercury contacts in either a NEMA 4 watertight or an explosion-proof case.

Actuation of these switches is either by a Barton Model 199 or Model 224 Rupture-Proof Differential Pressure Unit. Accuracy, stability of calibration, negligible static pressure shift, and minimum maintenance are inherent features of these units.

Switches are supplied with the Model 199 unit where maximum sensitivity is required in the lower differential pressure ranges, where a field range change is anticipated or when a built-in pulsation dampener is desired to control response time of the instrument.

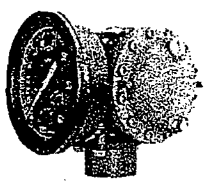
On the other hand, the Model 224 unit is employed to actuate the switch where the differential range specified exceeds that available with the 199 unit or where size and weight are prime consideration.

BARTON ITT

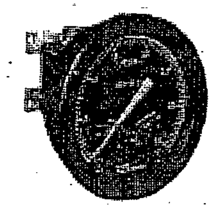
TYPICAL MODELS AVAILABLE

Switch Model No.	Actuator Model No.	Contacts	Type Contact	Integral Relays Available	Case With 6" Dial
277	199	Mercury	SPST	No	Weather-Proof
278	224	Mercury	SPST	No	Weather-Proof
279	199	Mercury	SPST	No	Explosion-Proof
280	224	Mercury	SPST	No	Explosion-Proof
288A	224	Snap-Acting	SPDT	Yes	Weather-Proof
289A	199	Snap-Acting	SPDT	Yes	Weather-Proof
290A	224	Snap-Acting	SPDT	Yes	Explosion-Proof
291A	199	Snap-Acting	SPDT	Yes	Explosion-Proof
290B	224	Snap-Acting	SPDT	Yes	Explosion-Proof, Group B; NEMA-4
291B	199	Snap-Acting	SPDT	Yes	Explosion-Proof, Group B; NEMA-4

GENERAL INFORMATION



SWITCH ACTUATED BY MODEL 199 DIFFERENTIAL PRESSURE UNIT



SWITCH ACTUATED BY MODEL 224 DIFFERENTIAL PRESSURE UNIT

GENERAL
Selection of the proper instrument for a particular application will depend upon the pressure rating required, the materials of construction that are suitable for contact with the measured fluid, the required differential pressure range, and desired weight and volume displacement for the actuating unit. Selection will also depend upon the type of contacts wanted and if the indicating mechanism and contacts should be housed in a NEMA 4 watertight or explosion-proof case.

CASE — NEMA 4 WATERTIGHT
The case is die-cast aluminum and is finished with a weather-resistant black epoxy resin paint. The cover glass is secured in the bezel with an elastomer ring, thus reducing the possibility of accidental glass breakage. This ring also acts as a seal between the bezel and the case and insures a moisture, fume and dust-free atmosphere for the indicator and switch mechanism.

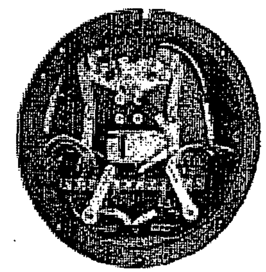
CASE — EXPLOSION-PROOF
This case is certified for Class I, Division 1, Groups C & D, explosion-proof service. The large cover glass allows maximum readability of the indicating pointer. Switches and all adjustments are readily accessible when the bolted cover is removed.

SCALES
The 6" diameter indicating scale can be graduated uniformly for measurement of differential pressure or liquid level or square root for direct reading of flow rate. Special scales can be furnished for indicating the quantity of liquid in tanks.

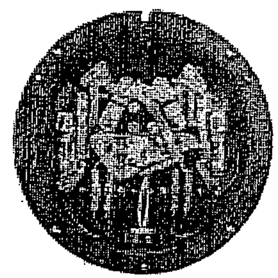
INDICATING MECHANISM
The indicating pointer traverses a 270° arc, providing excellent readability. It is driven by a precision-made jewelled rotary movement that employs a thermally stable Ni-Span-C hair spring. The movement has micrometer screws for convenient zero and range adjustments. Zero and range adjustments may be made without removing the scale plate or the pointer. Linear adjustments are readily accessible after the removal of the scale plate. The rotary movement and the pointer are fully protected from overrange in either direction.

SWITCH ACTION
Barton indicating switches are available with either one or two fully adjustable contacts. They can be set for high or low, or both high and low when two contacts are furnished. Accuracy of indication, narrow deadband and repeatability of switch action at set point are outstanding features.

SWITCH CONTACTS



INTERIOR VIEW
(SNAP-ACTING SWITCHES)



INTERIOR VIEW
(MERCURY SWITCHES)

OPERATION
The switch contacts are adjustable over the entire scale. Setting of the switch set points is accomplished by merely adjusting the control screw located flush with the scale. The contact setting is indicated by a small scale on the face of the scale plate.

SNAP-ACTING CONTACTS
The mechanically actuated snap-acting type contacts are chosen for their reliability under severe shock and vibration conditions. Maximum flexibility is provided, since either contact can be set to open or close the circuit with increasing or decreasing differential pressure. This is accomplished by simply reversing the external lead wires at the terminal block.

SPECIFICATIONS — SNAP-ACTING

Type .... SPDT
AC Rating .... 5 Amps up to 125V
2.5 Amps up to 250V
DC Rating:
Inductive .... 2.5 Amps up to 30V
Resistive .... 4.0 Amps up to 30V

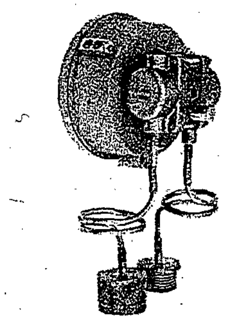
Electrical Connections:
Standard .... ½" NPT Female
Optional .... Up to 8' long flexible conduit terminating with ½" NPT connector

MERCURY CONTACTS
These contacts are operated by magnetic attraction through a glass container. Electrical contact is made by capillary action in an inert atmosphere and therefore is not as subject to breakdown from current arcing.

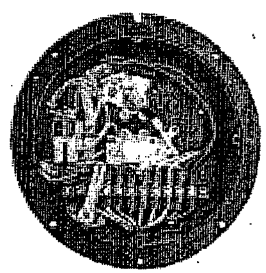
SPECIFICATIONS — MERCURY

Type .... SPST
AC Rating .... 1 Amp up to 125V
0.5 Amp up to 240V
DC Rating .... 0.25 Amp up to 125V to 230V
Electrical Connections:
Standard .... ½" NPT Female
Optional .... Up to 8' long flexible conduit terminating with ½" NPT male connector

SPECIAL APPLICATION SWITCHES



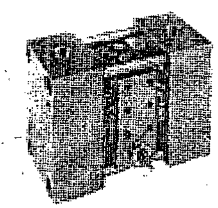
SWITCH WITH EXTERNAL BELLOWS SENSING ELEMENT
The system illustrated is a standard instrument with a length of tubing and sealed bellows connected to the high and low pressure housings. The bellows, tubing and housings are evacuated and liquid-filled at the factory. Measurement or control of corrosive, high temperature or dangerous fluids are typical applications for a filled system. In liquid level applications, the need for a reference leg is eliminated. Installation where gage lines are subject to freezing, clogging, condensate formation, gas entrapment, hydrate formation, etc., are also applications for the filled system.



SWITCH WITH INTERNAL RELAYS
All models employing snap-acting switches may be furnished with one or two relays mounted within the case. The addition of a relay allows greater flexibility of switching action and increased current handling capacity without the need for external mounting and wiring. This feature is often of considerable importance where explosion-proof housings are required.

SPECIFICATIONS — OPTIONAL RELAYS

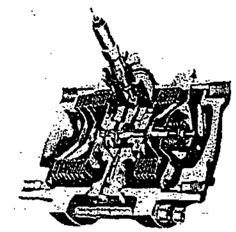
Type .... DPDT
AC Rating:
Contact:
Inductive .... 5 Amps up to 115V
Resistive .... 10 Amps up to 115V
Coil:
6V, 12V, 24V,
115V .... 5 VA Max.
DC Rating:
Contact:
Inductive .... 5 Amps up to 26.5V
Resistive .... 10 Amps up to 26.5V
Coil:
6V, 12V, 24V,
120V .... 2 W Max.



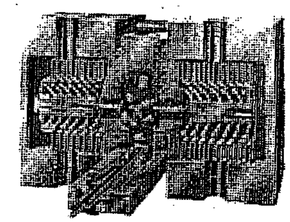
SWITCH WITH SEAL WELDED ACTUATOR
Special applications exist for a switch actuated by a positive leak-proof differential pressure unit. For such applications, the housings and gage lines are seal-welded at the factory. Welds may be certified to comply with applicable specifications by testing with a helium mass spectrometer. A typical specification allows 0.01 micron cubic feet per hour helium leak rate.

The measurement of corrosive, toxic, radioactive, or very expensive materials are usual applications for a seal-welded unit. These applications include liquid rocket propellants, hydrozene, nitrogen, tetroxide, UDMH, helium and hydrogen.

DIFFERENTIAL PRESSURE UNITS



MODEL 199 DPU CUTAWAY



MODEL 224 DPU CUTAWAY

DESCRIPTION
The Model 199 and Model 224 Rupture-Proof Differential Pressure Units both consist of a Bellows Unit Assembly and removable pressure housings; although they differ in details of construction, they incorporate the same basic features.

In both models flexible bellows are secured to a center plate. The movable bellows are rigidly connected by a dual valve stem that passes through the center plate. Valve seats in the passage through the center plate form a seal with the valves spaced on the stem. Contacting the valve stem in the center plate is a drive arm pivoted on the end of a sealed torque tube. The interior of the bellows and center plate is filled with a clean, non-corrosive, low freezing point liquid. A free-floating bellows is attached to the high pressure bellows to allow for expansion or contraction of the fill liquid, thus providing positive temperature compensation. The strength of the springs shown in the illustrations determines the differential pressure range of the unit.

OPERATION
In operation, pressure is applied to the high and low chambers surrounding the bellows. Any difference in pressure causes the bellows to move until the spring effect of the unit balances out for force thus generated. The linear motion of the bellows, which is proportional to the differential pressure, is transmitted as a rotary motion through the torque tube assembly. If the bellows are subjected to a pressure difference greater than the differential pressure range of the unit, a valve mounted on the center stem seals against its corresponding valve seat. As the valve closes, it "traps" the fill liquid in the bellows; thus the bellows are fully supported and cannot be ruptured regardless of the over pressure applied. Since opposed valves are provided, full protection is afforded against an "overrange" in either direction.

FEATURES OF THE ACTUATING UNITS
Bellows Construction — Individual diaphragms, stamped and formed from 316 stainless steel or beryllium copper, are assembled by highly specialized techniques. Bellows thus formed have exacting linearity characteristics, as well as long cycle life, free from the effects of work hardening commonly encountered with the hydraulically formed or mechanically rolled types.

Torque Tube — The torque tube employed in the units eliminates the possibility of leakage and required no lubrication. The needle bearing that supports the inboard end of the torque tube, and the ball bearing that is attached to the follower drive arm, operate with a minimum of friction. As a result the initial high degree of sensitivity is maintained for the life of the instrument.

Temperature Compensator — The auxiliary free-floating bellows attached to the high pressure bellows automatically protect the unit from zero and calibration drift when the instrument is subjected to a change in ambient temperature.

Pulsation Dampener (available only on Model 199) — The pulsation dampener in the Model 199 is externally adjustable and provides for direct control of response time of the instrument from approximately one second to several minutes for full-scale travel of the bellows.

Calibration Springs — Select materials and refined specifications are employed in the calibration springs. They have an extremely low hysteresis characteristic and exceptional temperature stability.

Self-Draining or Venting — Connection on the top and bottom of the housing provide automatic draining of liquids or venting of gases.

GENERAL SPECIFICATIONS

MODEL 199

Meter Body		Available Differential Pressure Ranges	
SWP-psi	Housing Material	3¾" O.D.	2½" O.D.
1,000	*Cast Aluminum 356T6*	Stainless Steel Bellows 0-10" to 0-400" w.c. *Inconel Bellows* 0-20" to 0-400" w.c.	Stainless Steel or *Inconel Bellows* 0-15 psi to *0-75 psi*
1,000	Forged Stainless Steel 316		
2,500	Forged Steel A.I.S.I. C1018		
3,000	Forged Stainless Steel 316		
3,000	Forged Monel K-500		
4,500	Forged Alloy Steel 4142		
6,000	Forged Alloy Steel 4142		
6,000	Forged Stainless Steel 329		
Net Volume in cu. in.	L.P. Head	30	35
	H.P. Head	26	31
Displacement in cu. in. for full-scale travel.		1.5	0.5

NOTES:
Zero center or split ranges are available on special order. For example, a 0-60" w.c. range may be ordered 30-0-30" w.c. or 15-0-45" w.c. Absolute pressure ranges are available from 100" w.c. to 600 psi.

Other sizes and types of connections (welding stubs, MS, A.N.D., etc.) are available upon request.

Special bellows and housing materials can be made available upon request (e.g. Inconel 625).

Outline dimensional drawings are available upon request.

MODEL 224

Meter Body		Available Differential Pressure Ranges				Pressure Connections	
		Stainless Steel Bellows		Beryllium Copper Bellows			
SWP-psi	Housing Material	1⅜" O.D.	¾" O.D.	1⅜" O.D.	¾" O.D.	Top	Bottom
500	Forged Brass (ASTM-B124#2)			0-30" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	¼" NPT	¼" NPT
500	Stainless Steel (316)	0-30" w.c. to 0-55 psi	0-60 psi to 0-500 psi			¼" NPT	¼" NPT
1,000	*Brass* (Fed. Spec. QQ-B-637 Comp.2)			0-60" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	¼" NPT	¼" NPT
1,000	Copper Nickel (70-30) MIL-C-15726			0-60" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	MS16142-4	MS16142-4
1,500	Cold Rolled Steel (C1018) Stainless Steel (316)	0-60" w.c. to 0-55 psi	0-60 psi to 0-600 psi	0-60" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	¼" NPT	¼" NPT
3,000	Cold Rolled Steel (C1018) Stainless Steel (316)	0-60" w.c. to 0-55 psi	0-60 psi to 0-600 psi	0-60" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	½" NPT	¼" NPT
6,000	Cold Rolled Steel (C1018) Stainless Steel (316)	0-70" w.c. to 0-55 psi	0-60 psi to 0-600 psi	0-70" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	½" NPT AMINCO ¼" ODT	¼" NPT AMINCO ¼" ODT
10,000	Alloy Steel (4140)	0-100" w.c. to 0-55 psi	0-60 psi to 0-600 psi	0-100" w.c. to 0-24.5 psi	0-25 psi to 0-400 psi	AMINCO ¼" ODT	AMINCO ¼" ODT
Net Volume in cu. in.	L.P. Head	1.66	2.51	1.86	2.51		
	H.P. Head	1.55	2.42	1.55	2.42		
Displacement in cu. in. for full-scale travel		.14	.03	.14	.03		

NOTES:
Zero center or split ranges are available on special order. For example, a 0-60" w.c. range may be ordered 30-0-30" w.c. or 15-0-45" w.c. Absolute pressure ranges are available from 100" w.c. to 600 psi.

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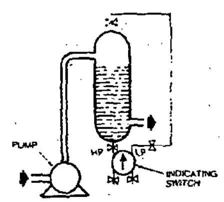
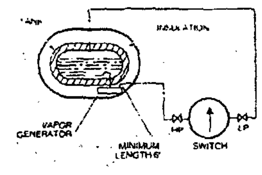
Special bellows and housing materials can be made available upon request (e.g. Inconel 625).

Outline dimensional drawings are available upon request.

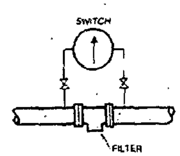
BARTON ITT



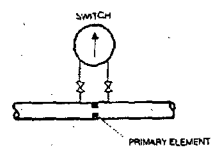
ON-OFF PUMP CONTROL



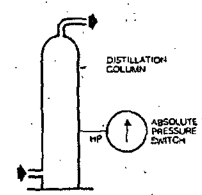
CRYOGENIC LIQUID LEVEL



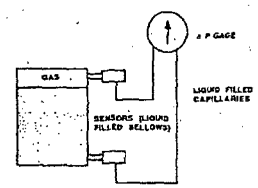
PRESSURE DROP ACROSS A FILTER



HI-LO FLOW ALARM



ABSOLUTE PRESSURE MEASUREMENT



REMOTE LEVEL CONTROL

BARTON ITT

MONTICELLO NUCLEAR GENERATING PLANT

TITLE: Main Steam Line High Flow Setpoint

CA-95-075

Attachment 6

PERFORMANCE SPECIFICATIONS

ACCURACY OF INDICATION
±1% of full-scale differential pressure

At Point of Switch Actuation .... ±1½% of full scale differential pressure
Switch Deadband .... 5% maximum of full scale differential pressure
Temperature Limits .... -60° F to +200° F
Accuracy of Repeatability .... ±0.2% of full scale

SPECIAL INSTRUMENTS

(Suppressed-Ranges, Reverse-Rotation, DPDT Switches, Sealed Systems, Reduced Ranges)

Low DP Ranges, less than 150" w.c.:

Pointer Accuracy .... 2% (3% at set point)
Pointer Repeatability .... ½%
Switch Deadband .... 7% maximum
Switch Repeatability .... ½%

High DP Ranges, 151" w.c. and higher:

Pointer Accuracy .... 1½% (2½% at set point)
Pointer Repeatability .... ½%
Switch Deadband .... 6% maximum
Switch Repeatability .... ½%

DIMENSIONS

Specify model number and housing rating. A certified dimensional drawing will be furnished on request.

INDICATING SWITCHES ORDERING INFORMATION

Model Number
Housing pressure rating (SWP)
Housing material
Bellows material
Material contacting bellows
Differential pressure range
Type of scale (square root) (uniform)
Scale graduations

Mounting:* (pipe) (wall) (flush panel)
Number of contacts (single) or (double)
Low contact (close) (open) at (w.c.) (psi) on (increasing) (decreasing) pressure
High contact (close) (open) at (w.c.) (psi) on (increasing) (decreasing) pressure
Relay (if required:) Coil voltage, contact rating

*Explosion-proof models — pipe mounting only.

The ITT Barton standard warranty is available for inspection upon request.

YOUR LOCAL REPRESENTATIVE

ITT Barton
900 S. Turnbull Canyon Road
City of Industry, CA 91749-1882
Tele. (818) 961-2547 Telex: 67-7475

DI 7M Litho in U.S.A.

ITT Barton
ITT Fluid Technology Corporation

NEDO-10544
72 NED 29
CLASS I
April 1972

MODIFIED STEAMLINE FLOW-LIMITING VENTURI TEST RESULTS

E. L. Strickland

Approved: [signature]
D. McDaniel, Manager
Startup and Training

ATOMIC POWER EQUIPMENT DEPARTMENT • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95114

GENERAL ELECTRIC

18/65 S&T
wjh 4-72

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

ABSTRACT

Differential pressure versus steam-flow rates were obtained at the Monticello Nuclear Power Station for up to 120% of rated steamline flow using modified steamline flow-limiting venturis. The experimental data were least squares fit to an exponential function and compared with predicted performance.

1. INTRODUCTION

Between February 1 and February 24, 1972 the Monticello Nuclear Power Station (MNPS) of the Northern States Power Company was returned to power after an extended outage. During this outage the main steamline flow limiters, venturi tubes supplied by the Permutit Company, had been modified to remove some manufacturing defects. These defects did not affect the ability of the devices to limit maximum steam flow to 200% of rated steam flow, but by degrading the measurable pressure differential did affect the ability of the devices to measure the steamline flow rate. This document discusses the performance of the modified venturi tubes for flow measurements as determined from data recorded during the February 1 to February 24 startup. Differential pressure data recorded on March 10 and 11 are also included.

2. SUMMARY AND CONCLUSIONS

The modified steamline flow limiters installed in the Monticello Station respond to steam flow in a consistent manner that correlates well with the theoretically expected performance. Assuming no errors in measuring either differential pressure across the flow limiters or reactor feedwater, the flow limiters have an effective discharge coefficient of 0.97 compared to a predicted value of 1.0. This is equivalent to an error in differential pressure of 2.5 psid (4%), or in total feedwater flow rate of 200,000 lb/h (3%), or some combination of both. It is recognized that the reported feedwater flow rate may be low by 0.5% to 1.0% since the control rod drive water flow rate was not ɔrded. Whether the measured discharge coefficient or the predicted discharge coefficient is correct is not known at .s time, but the difference is not large enough for concern. This performance satisfies all reasonable expectations for the equipment.

3. DISCUSSION

3.1 BACKGROUND

The Monticello Nuclear Power Station, owned and operated by the Northern States Power Company, is equipped with steamline flow restrictors supplied by the Permutit Company. One function of these devices is to limit the maximum possible steam flow through each of the four steamlines to no more than 200% of the design steam-flow rate. A second function is to provide a measurement of the steam flow rate through each steamline. During the startup testing of the station, September 8, 1970, to July 5, 1971, it was observed that the differential pressure measured at any steam-flow rate was approximately a factor of 3 less than the expected value supplied by the vendor. It was noted that while lower than expected the measured differential pressure behaved in a repeatable manner and plotted parallel to the predicted Δp versus flow curve.

Because of the differences between predicted and observed Δp versus flow performance for the Permutit flow restrictors an experimental program was undertaken by GE-APED at the San Jose facility to determine the cause of the differences, and how the flow restrictors could be modified to make them respond more nearly as originally designed. This program determined that the low differential pressure readings were caused by a leakage path from a high pressure region into the throat tap piezometer ring. This leakage path in no way affected the ability of the flow restrictor to limit the maximum steam-flow rate to the intended value. A modification to the throat tap was defined which was expected to make the measured Δp versus flow rate close to the predicted performance. This experimental program is reported in detail in Reference 1.

The Monticello Station was the first unit to return to power following modification of the steam-flow limiters as ...scribed in Reference 1. The data discussed in this report were taken during and following the return to power of the Monticello Station.

3.2 DATA RECORDING

The differential pressure across each steamline flow limiter at Monticello is measured by four Barton Differential Pressure Indicator Switches (dPIS). These are in addition to any GE/MAC sensors which are part of the feedwater control circuits. Figure 1 is a schematic drawing of the installation. The Barton dPIS are spanned to read 0–200 psid. The calibration, zero shift with pressure, and hysteresis of the 16 Barton dPIS (4 on each of 4 steamlines) were checked before the station was returned to power and again during an interruption in the power increase for turbine repairs. All differential pressure readings discussed here are based upon these Barton dPIS.

The total steam flow rate from the reactor is determined by a mass balance drawn around the reactor pressure vessel. The only term in this mass balance of significance is the reactor feedwater. (Control rod drive water flow is 0.5% to 1.0% of the value of the feedwater flow.) The feedwater measurement instrumentation was calibrated during the outage when the steam nozzles were being modified. The output of the feedwater nozzle differential pressure device is read by the process computer and converted numerically to feedwater flow rate. It is also read by station instrumentation and converted electrically to become the value of feedwater flow rate displayed in the control room. All values of total steam flow rate reported here are equivalent to the feedwater flow rate displayed in the control room with the exception of the data recorded on 10 March and 11 March, 1972, when only the computer output was recorded. When both were recorded the computer value for feedwater is up to 2% lower than the control room recorder value.

The reported values of reactor pressure and electrical output are those recorded by station personnel using normal plant instrumentation.

3.3 DATA REDUCTION

There are two physical effects which can not be measured directly but which directly affect the validity and usefulness of the results. One of these is the presence of a zero offset, possibly caused by a water leg between the steamline tap and the condensing chambers or a temperature difference in the instrument lines between the condensing chambers and the instrument rack. The second is the steam flow rate mismatch between the steamlines caused by small differences in line geometries.

The presence of a zero offset can be checked by closing a single main steam isolation valve (MSIV) when the reactor is operating near 50% power and then recording the readings of all dPIS. This was done at Monticello and average offsets were found for each line. These average offsets were used to correct the measured differential pressures in the calculations presented here. The zero offset values do change with time and are between 0.4 psid and 2.5 psid. The effect of the offset is to give a larger than actual differential pressure indication. The magnitude of the offset is small relative to the differential pressure values measured at significant flow rates.

The steam-flow mismatch can be estimated from calculations if these calculations include in sufficient detail the as-built steamline geometries. A more straightforward method is to apportion the steam flow between the steamlines on the basis of the measured differential pressures. The relative flow values should be accurate since all Δp instrumentation was recalibrated using a common method. The second method is the one used to determine individual steamline flow rates.

The complete data-reduction method used can be illustrated best using an actual set of plant data. This is done in Table 1. All the data recorded during this startup of the Monticello plant were reduced in this manner and are plotted on Figure 2. The data recorded on 10 March and 11 March were not used in finding the "best-fit" curve because the feedwater data were recorded only from the computer.

It is of interest to compare the observed after-modification differential pressure versus flow behavior with that which would be predicted using the ASME expression for flow of a compressible fluid through a venturi. Section 7 of Reference 2 gives the following expression:

$$W_h = 359\,CFd^2F_aY_a\sqrt{h_w/v_1} \qquad (1)$$

Table 1

Date .... February 15, 1972
Time 0945
Station Output .... 400 MWe
Reactor Pressure (P_R) .... 982 psig
Total Feedwater Flow Rate (W) $4.70 \cdot 10^6$ lb/h

dPIS Readings Instrument Number	Reading (psid)	Average dp	Measured Correction Factor (Zero Offset)	Corrected Average dp (Δp_i)	$(\Delta p_i)^{1/2}$	Line Steam-Flow Rate (lb/h) (W_i)
116A	29.8					
116B	31.4	30.75	−1.51	29.24	5.41	$1.1795 \cdot 10^6$
116C	29.3					
116D	32.5					
117A	29.6					
117B	33.2	31.40	−2.5	28.90	5.38	$1.1729 \cdot 10^6$
117C	32.0					
117D	30.8					
118A	31.2					
118B	28.5	29.025	−0.475	28.55	5.34	$1.1642 \cdot 10^6$
118C	28.0					
118D	28.4					
119A	32.9					
119B	31.7	31.625	−2.125	29.50	5.43	$1.1838 \cdot 10^6$
119C	29.5					
119D	32.4					

NOTE: $$W_i = (\Delta p_i)^{1/2} \cdot \frac{W/4}{\frac{1}{4}\sum_i (\Delta p_i)^{1/2}} = \frac{(\Delta p_i)^{1/2}}{\sum_i (\Delta p_i)^{1/2}} \cdot W$$

For the Monticello Steam-Flow Limiters this can be reduced to:

$$\Delta p = (4.273 \cdot 10^{-11})\, \upsilon_1 \frac{W^2}{Y_a^2} \qquad (2)$$

Where

Δp = psid
υ_1 = ft^3/lb
W = lb/h
Y_a = dimensionless

Note that in equation (2) both υ_1 and Y_a are functions of the inlet pressure to the venturi. Figure 3 is a plot of υ_1 versus pressure. Figure 4 is a plot of Y_a^2 versus r, the ratio of throat to inlet pressures for a venturi. In order to make a meaningful comparison of analytical and experimental values it is necessary for the analytical prediction of Δp to be based upon pressures similar to those existing when the measurements were taken. Figure 5 is the intended operating reactor pressure versus reactor power map for the Monticello reactor. Note that the operating pressure data on Figure 5 are plotted against electrical power and hence are subject to changes in turbine-generator performance. Figure 6 is a plot of the calculated Δp based upon equation 2, Figures 3, 4 and 5 and the design pressure drop from the reactor pressure vessel to the inlet to the steam flow limiters. At full power this design pressure drop is 11 psi. Also shown on Figure 6 is the calculated Δp assuming a constant 1015 psia inlet pressure and the "best fit" line to the data taken between 1 February and 24 February, 1972.

4. RESULTS

The data recorded by Northern States Power Company personnel at Monticello and reduced as described in Section 3.3 are plotted in Figure 2 along with the best "least squares" fit to the data. Also, these data were fit separately for each individual steam-flow limiter. The complete set of data were refit including only Δp versus flow data for line flows greater than 40%, 45%, and 50% of rated. The coefficients of these fit curves are listed in Table 2. Included in Table 2 is the standard error of estimate, sometimes called the root-mean-square difference between the data points and the fit curve. The experimental data were compared with the curve calculated for a nozzle discharge coefficient of unity. The standard error of estimate for this comparison is shown in Table 2. The calculated curve of differential pressure does not plot as the square of the flow because of the changing pressure with changing flow and the accuracy of the calculations. It is not known why the corrected experimental data do not behave as the square of the flow. Possible reasons include unaccounted-for pressure effects, feedwater flow measurement errors, and small instrumentation errors. All fitting of the experimental data is based upon the assumption that the measured values are exactly correct. In this case the effective average nozzle discharge coefficient can be calculated to be 0.97. Note that this effective C = 0.97 includes the effects of all measurement errors including those in the feedwater flow rate. As can be seen from Figure 7 the feedwater flow rate can not be accurately confirmed by secondary plant measurements such as turbine-generator output. A difference of 1 psid (1.7% of the rated flow differential pressure) is equivalent to a difference of 10,000 lb/h, 0.58% of the rated steam flow rate.

Table 2
FIT DATA

$$\Delta p_j = A(W_j * 10^{-6})^B$$

All Lines	A	B	σ	$\sigma_{1.0}$
All data	21.49	2.068	0.816	2.12
Power >40%	21.59	2.034	0.798	2.20
Power >45%	21.69	2.017	0.796	2.41
Power >50%	21.66	2.021	0.864	2.70
Single Lines Power >45%				
Line 116	21.47	2.031	0.773	2.22
Line 117	21.70	2.020	0.799	2.53
Line 118	21.72	2.018	0.791	2.51
Line 119	21.86	1.993	0.862	2.53
Theoretical Curve C = 1.0	20.32	2.009	0.0789	–––

σ is the "standard error of the estimate" for the best fit curve

$$\sigma = \left[\frac{\sum_i (\Delta p_j \text{ (data)} - \Delta p_j \text{ (calc from fit)})^2}{N-1}\right]^{1/2}$$

$\sigma_{1.0}$ is the "standard error of the estimate" where the calculated Δp_j values are based upon an assumed venturi discharge coefficient of 1.0.

The units of σ are psid.

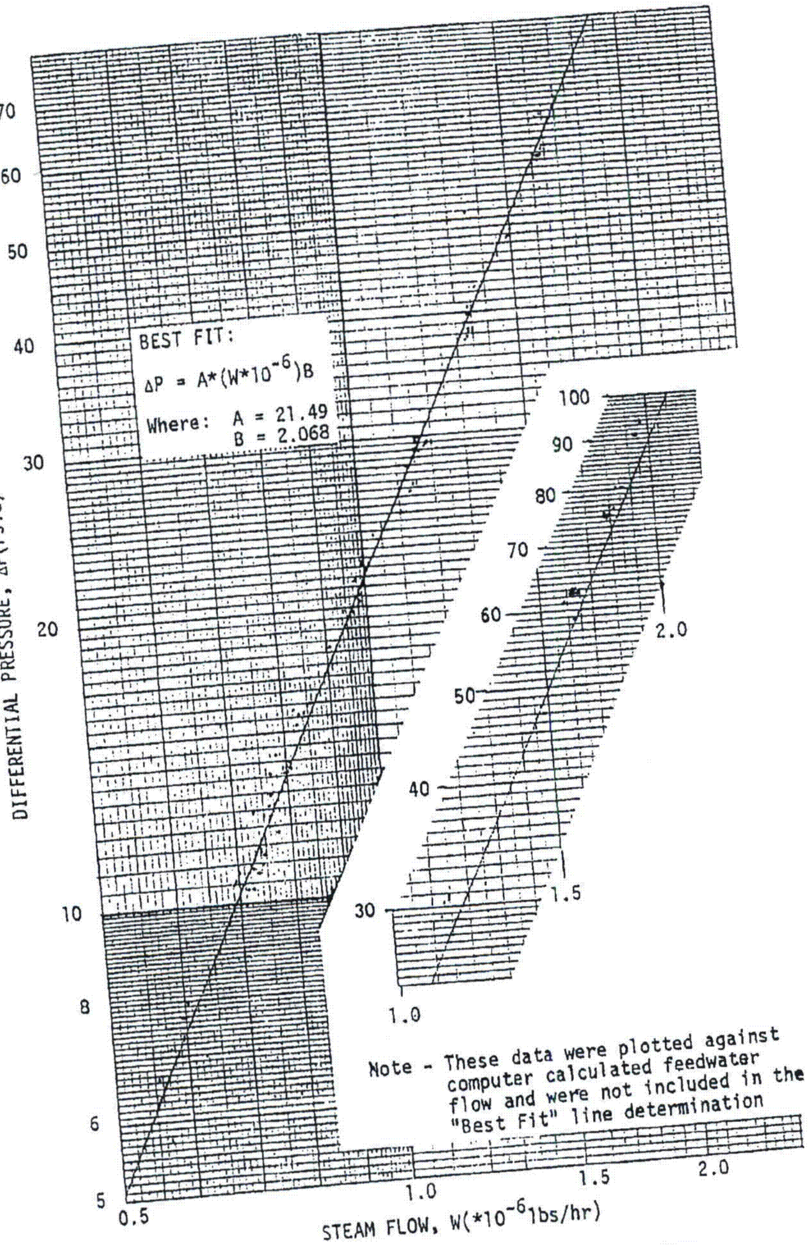


Figure 2. Measured Differential Pressure versus Steam Flow

RECORD OF TELEPHONE CONVERSATION

(818) 961-2547

DATE: 7-4-90

TIME:

TO BE CONFIRMED: ☐ YES ☐ NO

FROM: Warren S. Monson (NAME) — Bechtel Power - Setpoint Group (COMPANY OR DEPARTMENT)

TO: Sam Kumemoto (NAME) — ITT Barton Model 288A Eng. (COMPANY OR DEPARTMENT)

SUBJECT(S) DISCUSSED: Model 288A Pressure Switch

REMARKS:

Mr. Kumemoto stated that the error for static pressure is .25% F.S. per 1000 lb. overrange pressure.

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Calculation Signature Sheet

Document Information

NSPM Calculation (Doc) No: CA-95-075	Revision: 1
Title Main Steam Line High Flow Setpoint	
Facility: ☒ MT ☐ PI	Unit: ☒ 1 ☐ 2
Safety Class: ☒ SR ☐ Aug Q ☐ Non SR	
Special Codes: ☐ Safeguards ☐ Proprietary	
Type: **Calc** Sub-Type:	

NOTE:	Print and sign name in signature blocks, as required.

Major Revisions 3-26-12

EC Number: ~~13614~~ 13638 3/10/10	☒ Vendor Calc
Vendor Name or Code Sargent & Lundy	Vendor Doc No: 11972-049
Description of Revision Considers effects of EPU and new Analytical Limit.	
Prepared by Vendor	Date12/18/08
Reviewed by: James Bowlby [signature]	Date: 3/12/09
Type of Review: ☐ Design Verification ☐ Tech Review ☒ Vendor Acceptance	
Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test	
Approved by: [signature]	Date: 3/18/09

Minor Revisions

EC No:	☐ Vendor Calc:
Minor Rev. No:	
Description of Change:	
Pages Affected:	
Prepared by:	Date:
Reviewed by:	Date:
Type of Review: ☐ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test	
Approved by:	Date:

(continued on next page) Rev. 3 of QF-0549 is acceptable for use with no adverse impact.

NTM 3-22-12 3-26-12

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Calculation Signature Sheet

EC No:	☐ Vendor Calc:
Minor Rev. No:	
Description of Change:	
Pages Affected:	
Prepared by:	Date:
Reviewed by:	Date:
Type of Review: ☐ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test	
Approved by:	Date:

EC No:	☐ Vendor Calc:
Minor Rev. No:	
Description of Change:	
Pages Affected:	
Prepared by:	Date:
Reviewed by:	Date:
Type of Review: ☐ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test	
Approved by:	Date:

EC No:	☐ Vendor Calc:
Minor Rev. No:	
Description of Change:	
Pages Affected:	
Prepared by:	Date:
Reviewed by:	Date:
Type of Review: ☐ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
Method Used (For DV Only): ☐ Review ☐ Alternate Calc ☐ Test	
Approved by:	Date:

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Xcel Energy — **Calculation Signature Sheet**

NOTE:	This reference table is used for data entry into the PassPort Controlled Documents Module, reference tables (C012 Panel). It may also be used as the reference section of the calculation. The input documents, output documents and other references should all be listed here. Add additional lines as needed.

Reference Documents (PassPort C012 Panel from C020)

#	Controlled* Doc? + Type	Document Name	Document Number	Doc Rev.	Ref Type** (If known)
1	☒ CALC	MNGP EPU Task Report: Transient Analysis	T0900, ~~EC 11850~~ 11-250	Rev. 0	☒Input ☐Output
2	☐	DIT: High Main Steam Flow Analytical Limit and Tech Spec Limit	EPU-0258, Attachment 4		☒Input ☐Output
3	☐	DIT: High Main Steam Line High Flow Setpoint	EPU-0259, Attachment 5		☒Input ☐Output
4	☐	MNGP EPU Task Report: Environmental Qualification	T1004, EC 11836	1-0	☒Input ☐Output
5	~~☒ VTM~~ ☐	Ashcroft Digital Test Gauge Operating Instructions	~~NX-63620~~		☒Input ☐Output
6	☒ VTM	Mansfield and Green Pneumatic Dead Weight Tester	NX-17448	0	☒Input ☐Output
7	☒ CALC	MNGP EPU Task Report: Moisture Carryover in MSL	T2005, ~~EC 11845~~ 11-256	0	☒Input ☐Output
8	☐				☐Input ☐Output
10	☐				☐Input ☐Output
11	☐				☐Input ☐Output
12	☐				☐Input ☐Output
13	☐				☐Input ☐Output
14	☐				☐Input ☐Output
15	☐				☐Input ☐Output

*Controlled Doc checkmark means the reference can be entered on the C012 panel in black. Unchecked lines will be yellow. If checked, also list the Doc Type, e.g., CALC, DRAW, VTM, PROC, etc.)

**Corresponds to these PassPort "Ref Type" codes: Inputs/Both = ICALC, Outputs = OCALC, Other/Unknown = blank)

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GL 3/10/10 Note: See Attached Pages for additional references

GL 3/10/10

VTM 3-26-12 JMW 3-26-12

QF-0549 for 95-075 (Reference Documents Continued)

8	☐	"General Electric Setpoint Methodology", September 1996	NEDC 31336P-A (Roll 1454)		☐Input ☐Output
9	☐	"Setpoint Calculation Guidelines for the Monticello Nuclear Generating Plant", DRF A-00-01932-1	GE-NE-901-021-0492 (RRMO3264-0144)		☐Input ☐Output
10	☒ PROC	Engineering Standards Manual ESM 03.02 "Design Requirements, Practices, & Topics (Instrumentation & Controls)" Rev. 9	ESM-03.02	~~9~~ 10+	☐Input ☐Output
11	☐	ANSI/ISA Standard ISA-S67.04 – Part I "Setpoints for Nuclear Safety-Related Instrumentation" 1994	ISA-S67.04		☐Input ☐Output
12	☐	ISA Recommended Practice RP67.04 – Part II "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation" 1994	RP67.04 (RRMO3176-1546)		☐Input ☐Output
13	☐	EPRI report TR-103335, "Guidelines for Instrument Calibration Extension/Reduction Programs" 3/94	TR-103335 (Roll 9102)		☐Input ☐Output
14	☐	Monticello Plant Component Master List (CML) Database			☒Input ☒Output
15	☐	BARTON product bulletin 288A/289A-7, "Differential Pressure Indicating Switches"	Attachment 6		☐Input ☐Output
16	☒ PROC	ESM-03.02-APP-I, GE Methodology Instrumentation and Controls	ESM-03.02-APP-I	4+	☐Input ☐Output
17	☒ DRAW	NX-7829-67-1, Rack (25-26) C-126, Rev. B	NX-7829-67-1	~~B~~ 76+	☐Input ☐Output
18	☒ SPEC	Purchase Spec 21A1058, Controlled Specification Data Sheet Steam Flow Restrictor	MPS-0165	4+	☐Input ☐Output
19	☒ CALC	"Calculation to Determine Discharge Coefficient Changes for the Main Steam Line Flow Restrictors"	97-216	0	☐Input ☐Output
20	☒ CALC	"Determine of Instrument Service Conditions for Input into Setpoint Calculations"	95-027	1	☐Input ☐Output

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QF-0549 for 95-075 (Reference Documents Continued)

21	☒ PROC	"GE Methodology Instrumentation and Controls"	ESM-03.02-APP-III	5+	☐Input ☐Output
22	☐	NEDO-10544, April 1972, "Modified Steam Line Flow Limiting Venturi Test Results"	Attachment 7		☐Input ☐Output
23	☐	Telephone conversation record from Bechtel Power Setpoint Group to ITT Barton	Attachment 8		☐Input ☐Output
24	☒ CALC	"Environmental Qualification of Barton Pressure Switches Models 278, 288, 288A and 289A"	98-011	8+	☐Input ☐Output
25	☐	Generic Letter 91-04, Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle	91-04 (RRMO2751-1048)		☐Input ☐Output
26	☒ PROC	OPERATIONS DAILY LOG - PART J OUTPLANT	0000-J	105++	☐Input ☒Output
27	☒ PROC	MAIN STEAM LINE HIGH FLOW GROUP I INSTRUMENT TEST	0051	30++	☐Input ☒Output

\+ The current revisions of the references have been reviewed as of 3-22-12 and the changes due to the revisions were found to have no technical impact on this calculation.

++ The latest revisions of the output impacted documents have been listed. As outputs, changes due to revisions have no technical impact on this calculation.

NTM 3-26-12

[illegible] 3-26-12

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Calculation Signature Sheet

Other PassPort Data

Associated System (PassPort C011, first three columns) **OR** **Equipment References** (PassPort C025, all five columns):

Facility	Unit	System	Equipment Type	Equipment Number
MT	1	MST	INDREC	DPIS-2-116 A, B, C, D
MT	1	MST	INDREC	DPIS-2-117 A, B, C, D
MT	1	MST	INDREC	DPIS-2-118 A, B, C, D
MT	1	MST	INDREC	DPIS-2-119 A, B, C, D

Superseded Calculations (PassPort C019):

Facility	Calc Document Number	Title
MT	CA-95-075 REV. 0	MAIN STEAM LINE HIGH FLOW SETPOINT DRIFT ANALYSIS

Description Codes - Optional (PassPort C018):

Code	Description (optional)	Code	Description (optional)

Notes (Nts) - Optional (PassPort X283 from C020):

Topic Notes	Text
☐ Calc Introduction	☐ Copy directly from the calculation Intro Paragraph or ☐ See write-up below
☐ (Specify)	

Record Retention: Retain this form with the associated calculation for the life of the plant.

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Xcel Energy	Calculation Signature Sheet

Monticello Specific Information

☒ DBD Topic Code(s) (See MT Form 3805): ______
☐ DBD Structural Code(s) (See MT Form 3805):______

Does the Calculation:
☐ YES ☒ No Affect the Fire Protection Program? (If Yes, Attach MT Form 3765)
☐ YES ☒ No Affect piping or supports? (If Yes, Attach MT Form 3544)
☐ YES ☒ No Affect IST Program Valve or Pump Reference Values, and/or Acceptance Criteria? (If Yes, inform IST Coordinator and provide copy of calculation)

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CA-95-075
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HITACHI

GE Hitachi Nuclear Energy

Douglas C. Crawford
Manager, Systems Engineering

3901 Castle Hayne Road
P.O. Box 780
Wilmington, NC 28402
USA

T 910-819-6680
F 910-362-6680
douglas.crawford@ge.com

DRF Section 0000-0156-8601

Mr. Steven J. Hammer
Monticello Nuclear Generating Plant
Xcel Energy
2807 West County Road 75
Monticello, MN 55362

January 17, 2013

Dear Mr. Hammer:

[redacted]

[redacted]

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[redacted]

CA-95-075
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January 17, 2013 eDRF Section 0000-0156-8601

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[redacted]

Please call me at 910-819-6680 or Larry King at 910-616-6003 with any questions.

Regards,

DC Crawford

Douglas C. Crawford
Manager, Systems Engineering

Verified by: Yogi Dayal
Principal Engineer

[redacted]

CA-95-075 Rev. 1 AH. 11 1/2

Summary of Change to Main Steam Line High Flow Allowable Value in accordance with GE Hitachi DRF Section 0000-0156-8601, dated January 17, 2013.

Rhon Sanderson, 02-01-13

General Electric DRF 0156-8601 provided new main steam line flow element choked flow and differential pressure information specifically relevant to Monticello. This DRF is a Monticello plant-specific follow up to a GE Part 21 communication. An improved modelling methodology was used by GE to revise the previously assumed values for choked flow and the relationship between break flow and the corresponding flow element differential pressure.

Per the DRF the existing setpoint Allowable Value and Analytical Limits are actually more conservative with respect to ensuring a trip well below choked flow considering the results from the new methodology. These setpoint values, expressed as differential pressures, are not being changed for EPU. However, L-MT-09-047, Supplement to EPU LAR dated 08-31-09, defines the EPU Allowable value for the Main Steam Line High Flow MSIV isolation function as a percent of flow, vs. a differential pressure. This is consistent with existing (pre-EPU) Technical Specifications. Due to the revised data from GE regarding the flow element differential pressure vs. mass flow relationship, the <= 123.6% of EPU flow Allowable Value submitted is no longer correct. Per the DRF, the instrument Allowable Value of <= 151.95 psid corresponds to <= 116.9% of rated EPU flow. Therefore a new license ammendment request supplement will be required to change the Allowable Value for the Main Steam Line High Flow trip function from <= 123.6% to <= 116.9% of rated EPU steam flow.

A change to the applicable setpoint calculation, CA-95-075 has been performed to reflect the new Allowable Value expressed as a percent of rated flow.
The changes per the GE DRF to this calculation do not result in a change to the previously submitted Analytical Limit, Allowable Value, or Nominal Setpoint, defined as differential pressures across the flow element(s). The As-Left and As-Found tolerances are being increased slightly to bring them in line with practical I&C calibration capabilities. These increased setting tolerance values leave considerable margin with respect to protection of the defined Analytical Limit and Allowable Value differential pressures. The EPU licensing (Tech Specs) Allowable Value was re-calculated as this value was expressed as a percent of rated (100% EPU power) steam flow. Per GE the retention of the previously evaluated Analytical Limit and Allowable Value expressed as a differential pressure ensures conservative margin for operation of the main steam line high flow trip instruments vs. the differential pressure modelled for break (choked) flow.

AH. 11 (2/2)

Following is a relevant excerpt from the DRF:

CA-95-075
AH. 10 (3/5)

[redacted]

January 17, 2013 eDRF Section 0000-0156-8601

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Because the current values of the MSL Flow – High Instrument Analytical Limit and Allowable Value as expressed in psid are conservative with respect to the revised choked flow rate, those setpoint values in psid can optionally be retained as they are. But because the revised calculation method now results in lower values of flow rate corresponding to a given flow-instrument pressure drop (in psid), MNGP documentation would need updating with revised values of associated flow rate. This would include an update to the Allowable Value as it appears in the MNGP Technical Specifications. An advantage to this option is retaining the existing flow-instrument setpoints values (in psid), and the MSL Flow – High Instrument trip function would continue to operate as it did previously. Because the calculated flow corresponding to this setpoint is lower than previously assumed, this would ensure the mass releases for a MSLB of the type evaluated in "Revised Mass and Energy Release Rates for Power Rerate HELB Analysis (Task 27)", GLN-96-086, DRF L12-00834 Index 4, December 10, 1996 remain bounding.

Recommendation is to retain existing flow element differential pressure values for the Main Steam Line High Flow trip Analytical Limit and Allowable Value. The nominal setpoint differential pressure also remains unchanged. This is in line with the above GE guidance.

Following is a markup of L-MT-09-047 showing the recommended change:

L-MT-09-047
Enclosure 1
Page 2 of 6

3.0 ANALYSIS OF THE PROPOSED CHANGES

3.1 <u>Main Steam Line Flow – High (Function 1.c) of TS Table 3.3.6.1-1</u>

This change revises the Allowable Value in TS Table 3.3.6.1-1, Primary Containment Isolation Instrumentation, for the Main Steam Line Flow – High (Function 1.c), from ≤ 142 % rated steam flow to ≤ ~~123.6~~ % rated steam flow.
116.9%

Note also that the new version of CA-95-075 reflecting the GE DRF guidance should be submitted.

ENCLOSURE 5

UPDATED ENVIRONMENTAL ASSESSMENT

75 pages follow

Enclosure 5 to L-MT-13-020

MNGP Extended Power Uprate Environmental Assessment Update

ENCLOSURE 5

MNGP EXTENDED POWER UPRATE ENVIRONMENTAL ASSESSMENT UPDATE

JANUARY 2013

NORTHERN STATES POWER COMPANY, A MINNESOTA CORPORATION (NSPM)

MONTICELLO NUCLEAR GENERATING PLANT

MONTICELLO, MINNESOTA

RENEWED LICENSE NO. DPR-22

DOCKET NO. 50-263

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EXECUTIVE SUMMARY

This document presents an update to the Environmental Assessment (EA) submitted as part of a request for a license amendment on November 5, 2008 and the information submitted to the NRC to supplement the EA on January 29, 2009 (Refs. 47 and 48). The 2008 EA and its 2009 supplement evaluated the environmental impacts of the proposed Monticello extended power uprate from 1775 MWth to 2004 MWth. The intent of this document is to provide updated information for the NRC Staff to evaluate the environmental impacts of extended power uprate in accordance with the requirements of 10 CFR Part 51.

The environmental impacts of extended power uprate are identified and compared against the environmental impacts associated with the present power level which have been previously evaluated by the NRC Staff in the 1998 Monticello Nuclear Generating Plant (MNGP) Power Rerate Environmental Evaluation (Refs. 17 and 18) as part of the MNGP Power Rerate Project and associated license amendment (Amendment 102) as well as the MNGP Operating License Renewal Environmental Evaluation, NUREG-1437 Supplement 26 (Refs. 19 and 20). The original licensed power level environmental impacts have been previously evaluated by the NRC Staff in the Final Environmental Statement (Ref. 2) associated with the issuance of the Monticello full term operating license.

The environmental impacts identified by the NRC Staff in the Final Environmental Statement are based on conservative assumptions for source terms and other environmental parameters. Since initial operation, a variety of systematic environmental improvements have been implemented at Monticello that have further increased the margin of conservatism associated with these assumptions. By adjusting actual plant operating parameters for extended power uprate effects, it can be demonstrated that the previous assumptions and conclusions concerning the environmental impact of Monticello operation at present power levels continue to bound plant operation at extended power uprate conditions with significant margin.

In a few cases, the Final Environmental Statement and its associated documentation does not contain sufficient information necessary for a detailed comparison of the extended power uprate environmental impacts with previously evaluated impacts. In these instances, comparisons and conclusions are made using other appropriate environmental criteria established by the NRC. Where other environmental authorities govern Monticello operation such as in the matter of state water appropriation limits, comparisons and conclusions are made using the appropriate environmental permits and regulations.

The Monticello extended power uprate is being implemented without consequential changes to the plant systems that directly or indirectly interface with the environment. No environmental permits are adversely affected by extended power uprate. The NRC recently evaluated the environmental impacts of the proposed extended power uprate in an EA and Finding of No Significant Impact (FONSI) dated January 11, 2010 (Ref. 49). In that EA and FONSI the NRC concluded that the proposed action (extended power uprate) will not have a significant effect on the environment. This EA demonstrates that the environmental impacts of extended power uprate remain well-bounded or encompassed by previously evaluated criteria established by the NRC Staff in the FES, Rerate Environmental Evaluation and License Renewal Environmental Evaluation, NUREG-1437 Supplement 26, the NRC's EA and FONSI for extended power uprate, or remain well-bounded by other appropriate regulatory criteria.

ENCLOSURE 5

1.0 INTRODUCTION

The Northern States Power Company, a Minnesota corporation (NSPM) is committed to operating the Monticello Nuclear Generating Plant (MNGP) in an environmentally sound manner. All plant activities, including design, construction, maintenance, and operation, are conducted in a manner that involves strict compliance with environmental regulations and deliberate consideration of environmental practices and consequences. Numerous controls and modifications have been implemented to prevent and reduce impacts to the environment, and extensive environmental monitoring programs have been instituted at MNGP. In keeping with this important obligation and in accordance with regulatory requirements, NSPM conducted a comprehensive environmental evaluation of the proposed MNGP extended power uprate from 1775 MWth to 2004 MWth and submitted this information in an Environmental Assessment (EA) on November 5, 2008 (Ref. 47). NSPM then supplemented the EA in a January 29, 2009 submittal (Ref. 48). NSPM has reviewed the 2008 EA and 2009 supplement and has updated the 2008 EA where more recent information exists.

This environmental evaluation is provided pursuant to 10 CFR 51.41 and is intended to fully support the Commission in complying with the requirements of Section 102(2) of the National Environmental Policy Act (NEPA), as amended, for the proposed change to the MNGP operating power level. The scope of the evaluation is limited to that information necessary and sufficient to determine the environmental impact of those particular changes associated with the proposed extended power uprate at MNGP from 1775 MWth to 2004 MWth. This evaluation is not specifically intended to reestablish the current environmental licensing basis or to justify the environmental impacts of operating at the present power level.

The environmental impact of operation at the current licensed power level has been reviewed and determined to be acceptable by the NRC Staff. In 1971-1972, the Company provided an Environmental Report (Ref.1 & 3) to the Atomic Energy Commission (AEC) as part of NSP's application for a full term operating license. The Environmental Report addressed the environmental impacts of construction and operation of MNGP. The report was utilized by the AEC in preparing a Final Environmental Statement or FES (Ref. 2) in fulfillment of the requirements of the National Environmental Policy Act of 1969. The NRC subsequently issued a full term operating license to MNGP (Ref. 12). This license authorized a maximum power level of 1670 MWth. By the Notice of Issuance included as Enclosure 2 to Ref. 12, the Commission stated that "...issuance of this license will not result in any environmental impacts other than those evaluated in the Final Environmental Statement since the activity authorized by the license is encompassed by the overall action evaluated in the Final Environmental Statement." In September 1998, the Commission approved an increase in the maximum power level of MNGP from 1670 MWth to 1775 MWth (Ref. 18). This approval was supported by an "Environmental Assessment and Final Finding of No Significant Impact" that was transmitted to NSP in August 1998 (Ref. 17). The MNGP Facility Operating License was renewed in November 2006. This renewed operating license was supported by an Environmental Impact Statement, NUREG-1437 Supplement 26, prepared for MNGP (Ref. 19). The NRC recently evaluated the environmental impacts of the proposed extended power uprate in an EA and Finding of No Significant Impact (FONSI) dated January 11, 2010 (Ref. 49). In that EA and FONSI the NRC concluded that the proposed action (extended power uprate) will not have a significant effect on the environment.

This evaluation demonstrates that the environmental impacts of extended power uprate remain well-bounded or encompassed by previously evaluated criteria established by the

NRC Staff in the FES, Rerate Evaluation, License Renewal Evaluation, the NRC's EA and FONSI for extended power uprate, or remain well-bounded by other appropriate regulatory criteria.

2.0 OVERVIEW OF OPERATIONAL AND EQUIPMENT CHANGES

Monticello is a Boiling Water Reactor (BWR) that operates in a direct thermodynamic cycle between the reactor and the turbine. At extended power uprate conditions, thermodynamic processes are changed to extract additional work from the turbine. Simply put, extended power uprate involves an increase in the heat output of the reactor to support increased turbine inlet steam flow requirements and an increase in the heat dissipated by the condenser to support increased turbine exhaust steam flow requirements. In order to support an extended power uprate to 2004 MWth, the reactor core operating range will be expanded by increasing reactor power within existing rod and core flow control lines. No changes in operating pressure are necessary to support extended power uprate. In the turbine portion of the heat cycle, increases in steam flow will result in a slight increase in the heat rejected to the Mississippi River. The environmental impacts of these operational changes are discussed herein.

Several plant modifications are required to support operation at the extended power uprate power level. Item 19 in L-MT-12-114 updates the list of modifications required to support EPU. In summary, modifications are required to some systems to generate and/or accommodate the increased feedwater and steam flow rates to achieve EPU power levels. A number of these modifications were made during outages in 2009 and 2011. The remaining modifications are planned for installation in the spring 2013 outage (Ref. 50). However, these other modifications are not specifically required to support EPU and many are planned to address life cycle management improvements.

3.0 PROPOSED ACTION AND NEED

3.1 Proposed Action

With the operational goal of increasing electrical generating capacity, NSPM, in conjunction with the plant designer, General Electric, has comprehensively evaluated the effects of an extended power uprate at Monticello. This evaluation concluded that sufficient safety and design margins exist such that a prudent increase in the rated core thermal power from 1775 to 2004 MWth can be accomplished without any adverse impact on the health and safety of the public and without any significant impact on the environment. Accordingly, NSPM is proposing an amendment to the MNGP Operating License to allow for an increase in the licensed core thermal power level to 2004 MWth.

The maximum licensed thermal power level of 2004 MWth will be implemented following startup from the refueling outage in 2013 (Ref. 50). The maximum power level proposed by this action and evaluated for environmental impact herein is 2004 MWth.

3.2 Need for Proposed Action

The Company filed a fifteen-year resource plan for the period 2008-2022 with the State of Minnesota (Ref. 21) which included an evaluation of extended power uprate at MNGP. This Resource Plan includes a forecasted average annual increase in expected customer peak demand of 1.2 percent through the 2008-2022 planning period. To meet this projected demand, generating capacity must have a net increase of 598 MWe to 11,314 MWe by 2012[1].

This Resource Plan forecast is first produced with a 50 percent probability that the energy or demand will be less than the forecast and a 50 percent probability it could be higher. These forecasts are referred to as the median forecasts. From these forecasts, the 90/10 probability forecasts are developed for both energy and demand. The forecasts include the impacts of past and future demand-side management ("DSM") programs[2]. These forecasts include a "business as usual" assumption in which there is no basic change in the relationship between the regional and national economies. The Company plans to the 50 percent energy forecast and the 90 percent demand forecast. The 90 percent forecast is used for capacity planning due to the significant financial penalties associated with not maintaining the 15 percent Mid-Continent Area Power Pool ("MAPP") reserve sharing requirement and the increasingly tight market for short-term purchases seen in recent years.

The Company has determined the need for additional generation resources through a comparison of the projected resource needs (Obligations) to the resources available to the Company (Committed Resources). The Company's resource obligations include forecasted summer peak net demand, MAPP minimum reserve requirements, and other contracted obligations. Committed resources include existing capacity, committed capacity additions, and committed capacity purchases. The results of this comparison are shown in Table 3.2-1 below.

Table 3.2-1
Company Total Resource Needs (MWe)

	2008	2012	2016	2020
Net Forecasted Obligations	10,716	11,314	11,892	12,465
Committed Resources	10,818	11,086	10,113	10,103

Included in Table 3.2-1 above is 2,400 MW of wind capacity that will be added between 2010 and 2022 to comply with the 2007 Renewable Energy Standard legislation requiring the Company to provide 25 percent of its retail sales through wind resource by 2025[3]. The proposed increase in electrical generating capacity due to the Monticello extended power uprate is not included in the Committed Resource values displayed above. As shown in Table 3.2-1, the Company expects to require increasing additional capacity through 2020. The effects of existing and new DSM programs necessary to

[1] Net peak forecast after load management programs and including a 15 percent reserve margin as required by MAPP.
[2] DSM savings of 1.1 percent assumed to comply with 2007 Next Generation Act.
[3] The committed resources assumes Prairie Island Units 1 and 2 are both relicensed to operate an additional 20 years past their current licenses which expire in 2013 and 2014.

assume a 1.1 percent reduction in retail sales has already been factored into the energy and demand forecasts. Additionally, the net forecasted demand obligations have already been reduced by the expected peak savings due to load management programs.

NSPM received a Certificate of Need (CON) from the Minnesota Public Utilities Commission (MPUC) for the Monticello extended power uprate on January 8, 2009, as modified by the Change of Circumstance (COC) issued on January 6, 2012. Issuance of these orders confirms the continued need for the proposed action (Refs. 51 and 52).

4.0 SOCIOECONOMIC EFFECTS

This section addresses the effect of extended power uprate on the social and economic conditions of communities affected by MNGP operation. The Company, as a matter of policy, factors in environmental costs in determining its selection of generation resources, but does not quantify socioeconomic effects of new generation. Therefore, the following discussions include the environmental costs prepared as part of the 2008-2022 Resource Plan and presented in Table 4.0-1. As discussed in section 3.2, the MPUC granted NSPM the CON for the extended power uprate on January 8, 2009 (as modified by the January 6, 2012 COC), thereby accepting these environmental cost values.

Table 4.0-1
Environmental Cost Values

Effluent	
SO2	$776.54/ton based on the current cost of permits under title IV of the Clean Air Act. This value increases significantly in 2010 with the implementation of the Clean Air Interstate Rule (CAIR)
NOx	$591.54/ton based on the current cost of permits under title IV of the Clean Air Act. This value increases significantly in 2009 with the implementation of the Clean Air Interstate Rule (CAIR)
Mercury	$18,432/ton starting in 2010 with the implementation of the Clean Air Mercury Rule (CAMR)
CO2	$20/ton starting in 2010. This value is meant to be an estimate of the costs from future carbon regulation.
PM10	$7,094-$923/ton depending on location, based on externality values established by the Minnesota Public Utilities Commission.
CO	$2.17-$0.40/ton depending on location, based on externality values established by the Minnesota Public Utilities Commission.
Pb	$2.17-$0.40/ton depending on location, based on externality values established by the Minnesota Public Utilities Commission.

The Company (including the employees of NSPM) is a major employer in the community (second behind the school district) and the largest single contributor, by far, to the local tax base. MNGP personnel have higher incomes than the area on average and contribute significantly to the local tax base by payment of sales taxes and property taxes. Many MNGP personnel are actively involved in volunteer work within the local community and contribute to local service agencies. All these activities have a positive impact on the local and regional economies.

4.1 Economic Structure

On January 29, 2009 NSPM provided a response to NRC's Request for Additional Information (RAI) Item 3, regarding additional workers and equipment and material deliveries to support EPU-related plant modifications during the 2009 and 2011 outages (Ref. 48). NSPM's response presented worker and material delivery estimates for the 2009 and 2011 outages, which are now outdated. NSPM estimates that an average of 700 additional workers will be needed to complete the 2013 outage to support EPU. Planned modifications in 2013 will require 50 additional deliveries of materials to the site by tractor trailer or rail. These values will vary based on final planning, manufacturing schedules, and other similar factors. The remainder of the text in the RAI response remains valid. Extended power uprate does not significantly affect the size of the MNGP work force and does not have a material effect on the labor force required for future plant outages.

In 2012, the Company (including the employees of NSPM) employed approximately 502 full-time workers at MNGP. These workers have a disproportionate influence on the economics of the region because of higher than average incomes. Estimated per capita and median household income from 2007-2011 for Monticello, St. Cloud, Sherburne County, and Wright County are presented in Table 4.1-1 (Ref. 53). The U.S. Census Bureau's 2007-2011 American Community Survey (ACS) contains the most recent information for all categories in Table 4.1-1 below. The 2006 estimated average annual wage of MNGP employees was $64,200. The 2012 estimated average annual salary is $93,623.

Table 4.1-1
2007-2011 Per Capita and Median Household Income Estimates (2011 dollars)

Jurisdiction	Per Capita Income	Median Household Income
Communities		
Monticello	$27,052	$66,748
St. Cloud	$22,871	$40,687
Counties		
Sherburne	$27,444	$71,819
Wright	$29,231	$69,674
Two-County Average	$28,338	$70,747
Minnesota	$30,310	$58,476

4.2 Economic Benefits of Extended Power Uprate Equipment on Service Suppliers

Although the amount of plant modification and new equipment required to implement the extended power uprate is relatively small[1], there is a significant positive economic benefit to local and national businesses derived from extended power uprate at MNGP. There is a direct impact on the economy due to contracts awarded for project implementation. General Electric – Hitachi (GEH) was awarded the contract for the major engineering services associated with extended power uprate. Other local engineering firms, equipment suppliers, and service industries are receiving payments for extended power uprate related activities. This direct impact of these revenues from the Company will eventually cease within a few years of extended power uprate implementation. Successful implementation of extended power uprate at MNGP could result in additional follow-on revenue for equipment and service suppliers as other nuclear plant owners similarly decide to implement extended power uprate projects.

4.3 Tax Benefits of Extended Power Uprate

It is expected that the extended power uprate project will contribute additional property and sales taxes above that associated with the continued operation of the plant without the extended power uprate project. In addition, the extended power uprate project will result in an increase in state and federal income taxes being paid by workers during uprate implementation and by the Company over the project life.

The ability of the local community to provide public services at a reasonable tax rate is largely due to Company payments to local taxing jurisdictions. Public services, including law enforcement, fire protection, public education, and health services, receive a substantial amount of economic support through tax revenues generated by MNGP. The Company paid a total of $7,264,203 in local taxes to the City of Monticello, Wright County, School District 882, and Monticello/Big Lake Community Hospital in 2011. A significant reduction in the Company contribution from MNGP operations will result in economic penalties and/or loss of services to businesses, farmers, and homeowners as the Company tax contribution differential is apportioned to the remaining tax revenue sources.

Market values and tax disbursements for selected years can be found in Table 4.3-1 and Table 4.3-2 below.

Table 4.3-1
Assessed Market Values of MNGP

	1995	2000	2005	2007
Assessed Value	$262,339,700	$260,934,300	$232,574,300	$244,145,500

Table 4.3-2
Company Tax Disbursements

[1] The reactor system will require few modifications, but a number of balance-of-plant improvements and a new steam turbine will be necessary to take advantage of the increased steam flow.

Taxing Jurisdiction	Taxes Paid			
	2000	2005	2010	2011
State of Minnesota	0	$567,703	$722,695	$823,827
City of Monticello	$3,166,500	$2,727,683	$2,288,515	$2,706,348
Wright County	$2,834,800	$1,600,493	$1,788,931	$2,276,440
School District 882	$5,425,700	$1,353,213	$1,766,158	$2,194,483
Hospital District	$201,300	$124,034	$87,601	$86,932
Total	$11,628,300	$6,373,126	$6,653,900	$8,088,030

4.4 Economic Competitiveness of MNGP Under Extended Power Uprate Conditions

The socioeconomic effects of extended power uprate are, in part, dependent on whether extended power uprate is economically competitive. Although implementation of extended power uprate is not the sole factor affecting the future economic competitiveness of MNGP, it is a real and material factor. While MNGP is not the least cost provider among the Company's generation assets, it is a low cost provider as compared to other base load generation. Additionally, the base load operation of a non-carbon emitting plant provides a significant hedge against future carbon regulation due to the increasing concern over the effect of carbon emissions has on climate change. The economic impact of that potential carbon hedge is estimated to be a savings of between $158 million and $295 million over the life of the plant - based on a hypothetical carbon tax of between $9/ton and $40/ton.

4.5 Environmental Justice Information

Minority and Low Income Populations

In the environmental justice analyses for previous license renewal applications, NRC used a 50-mile plant radius as the overall area that could contain environmental impact sites, and the state as the geographic area for comparative analysis. NSPM adopts a similar approach in order to identify and analyze the minority and low-income populations that could be affected by operation at extended power uprate conditions at MNGP.

Minority Populations

Minority populations were identified using the Year 2010 Census demographic data to the block group level for the following racial minority categories: Non-Hispanic or Latino

Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Other Single Race, and Two or More Races; and Hispanic or Latino (Ref. 54). In addition to these groups, the minority population as a whole (an aggregate minority category) was included in the analysis, in accordance with NRC guidance. NRC guidance specifies that a minority population exists in either of the following cases:

Exceeds 50 Percent – the minority population of the environmental impact site exceeds 50 percent; or

More than 20 Percentage Points Greater – the minority population percentage of the impact site is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

The area within a 50-mile radius of MNGP was used in this analysis to define the area of potential environmental impact. A census block group was included in the analysis if its boundaries were fully contained in the area, or if any part of the census block group was present in the area. The 50-mile radius of MNGP is located entirely within the State of Minnesota and encompasses all or part of 23 counties (see Figure 4.5-1). The geographic area chosen for comparative analysis consisted of the State of Minnesota. The population demographic data from the State comprises average numbers for both the minority population as a whole and each minority category for comparison (see Table 4.5-2). The percentage of each minority group in an individual census block group was calculated as a percentage using the following:

$$[(\text{minority group population})_{\text{block group}} / \text{total population}] * 100$$

To calculate the aggregate minority population in an individual census block group, the populations of each of the minority groups (Non-Hispanic or Latino Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Other Single Race, and Two or More Races; and Hispanic or Latino) were added together and used in the above equation.

The 50-mile radius includes 2,265 census block groups. Table 4.5-2 shows the number of census blocks groups in each county with a minority population, and the threshold values for determining if a minority population exists.

There are no census block groups within a 50-mile radius that have a minority population in the following categories: Native Hawaiian and Other Pacific Islander, Other Single Race, or Two or More Races. There were 440 census block groups with an aggregate minority population (see Figure 4.5-1 and Table 4.5-2). For the individual minority categories:

- 181 census block groups had a minority population of Black or African Americans (see Figure 4.5-2 and Table 4.5-2),
- 2 census block groups had a minority population of American Indian or Native Alaskan (see Figure 4.5-3 and Table 4.5-2),

- 83 census block groups had a minority population of Asians (see Figure 4.5-4 and Table 4.5-2); and

- 70 census block groups had a minority population of Hispanics or Latinos (see Figure 4.5-5 and Table 4.5-2).

Hennepin County has 140 block groups with a Black or African American minority population, Ramsey County has 38, Stearns County has 2, and Anoka County has one block group (see Table 4.5-2). Both Hennepin and Mille Lacs counties have one block group with an American Indian or Native Alaskan minority population. Hennepin and Ramsey counties were the only two counties within the 50-mile radius to have block groups with an Asian minority. Hennepin, Ramsey, Dakota, Carver, and Scott counties have block groups with Hispanic or Latino minorities.

The majority of the block groups with minority populations (729 of 776) were located in Hennepin and Ramsey counties, part of the Minneapolis-St. Paul metropolitan area. In conclusion, the minority populations in the 50-mile radius of MNGP are concentrated near an urban center with a high population density approximately 30 or more miles from the plant. The closest minority population to MNGP is an aggregate minority population in Sherburne County, located 19.5 miles northwest of the facility.

Low-Income Populations

The 2010 decennial census did not survey participants for income characteristics; therefore, 2010 decennial census income level information at the block group level was not available for this update. The analysis in the 2008 EA remains the most recent decennial census (2000) income data available at the block group level.

More recent information about the percentage of low-income households within the 50-mile radius of MNGP was compiled using U.S. Census Bureau Data statistics for poverty from the American Community Survey (ACS) 2011 5-Year Estimates (at the census tract level) (see Ref. 53). NRC guidance specifies that a low-income population exists in either of the following cases:

> Exceeds 50 Percent – the percentage of households below the poverty level in the census block group or environmental impact site (in this case, the census tract level) exceeds 50 percent; or
>
> More than 20 Percentage Points Greater – the percentage of households below the poverty level in the census block group or environmental impact site (in this case, the census tract level) is significantly greater (typically at least 20 percentage points) than the percentage of households below the poverty level in the geographic area chosen for comparative analysis.

The environmental impact area and geographic area for comparative analysis used to identify low-income populations are similar to those described above for identifying minority populations (except census tract data was used versus census block group data). Data for both the total number of households and the number of households with an income below the poverty level was obtained for each census tract within the 50-mile

radius of MNGP. The number of households below poverty in each census tract was then calculated as a percentage using the following:

$$[(\text{households below poverty})_{\text{census tract}} / \text{total households}] * 100$$

The percentage of households below poverty level in the State of Minnesota served as the average regional number for comparison. Any census tract with a percentage of households below the poverty level greater than 31.0 percent (11.0 percent for the state of Minnesota, plus 20 percent, see Table 4.5-2) was considered a low-income population in this assessment.

A total of 65 census tracts within the 50-mile radius of MNGP meet the criteria for low-income populations. The majority of the census tracts with a low-income population were located in Hennepin County (38 tracts) and Ramsey County (20 tracts) 35 miles or more from the plant. The two other counties with census tracts that have low-income populations are Dakota, Scott, Sherburne, and Stearns counties (1, 3, 1, and 2 census tracts, respectively; see Table 4.5-2).

The NRC reviewed similar Environmental Justice information for the MNGP License Renewal (Ref. 19) and concluded for that licensing action that the offsite impacts to minority and low-income populations were small and no mitigation actions were warranted. The NRC also concluded in their 2010 EA and FONSI that the proposed action would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of MNGP (Ref. 49).

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FIGURE 4.5-1

AGGREGATE MINORITY POPULATION

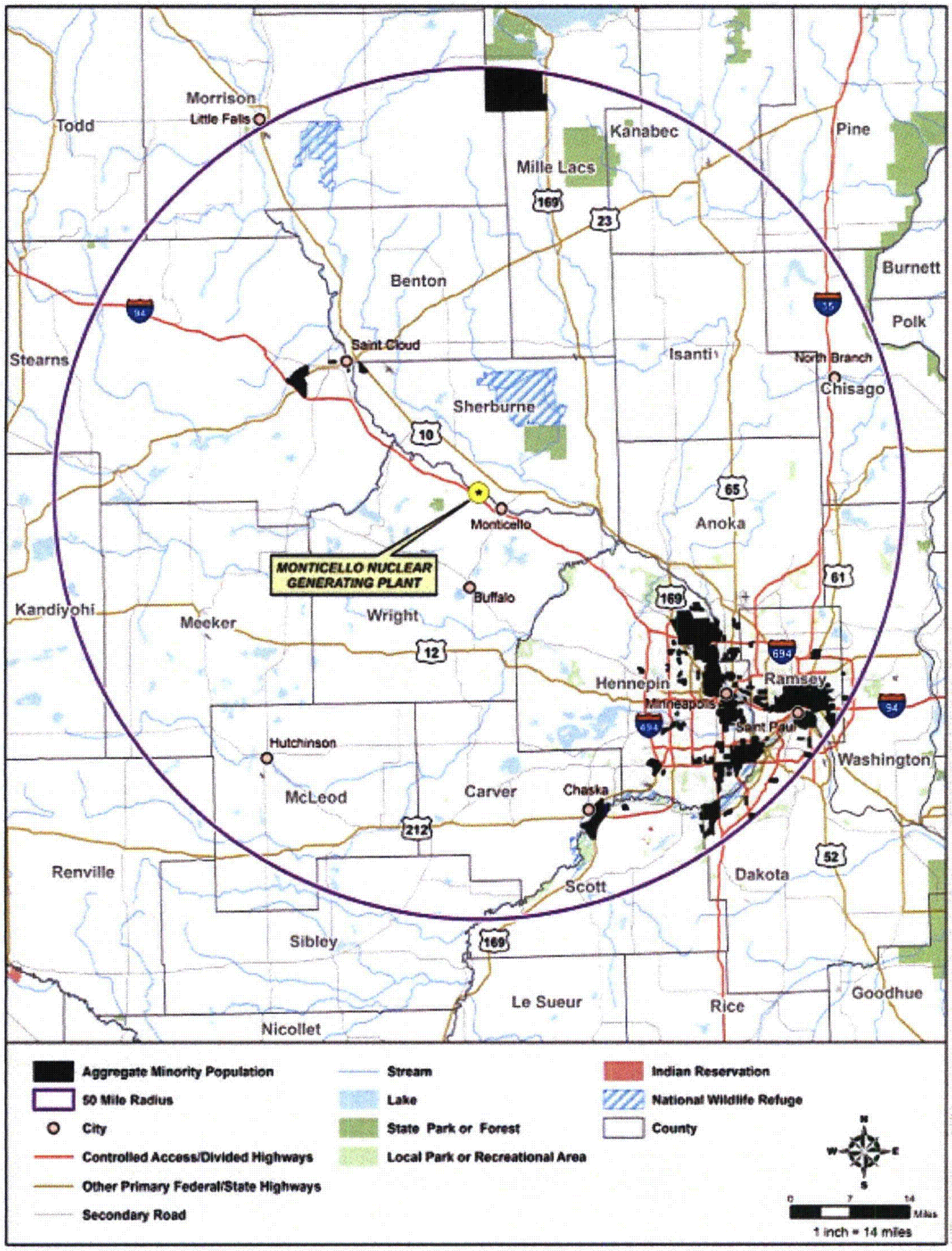

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FIGURE 4.5-2

BLACK OR AFRICAN AMERICAN MINORITY POPULATION

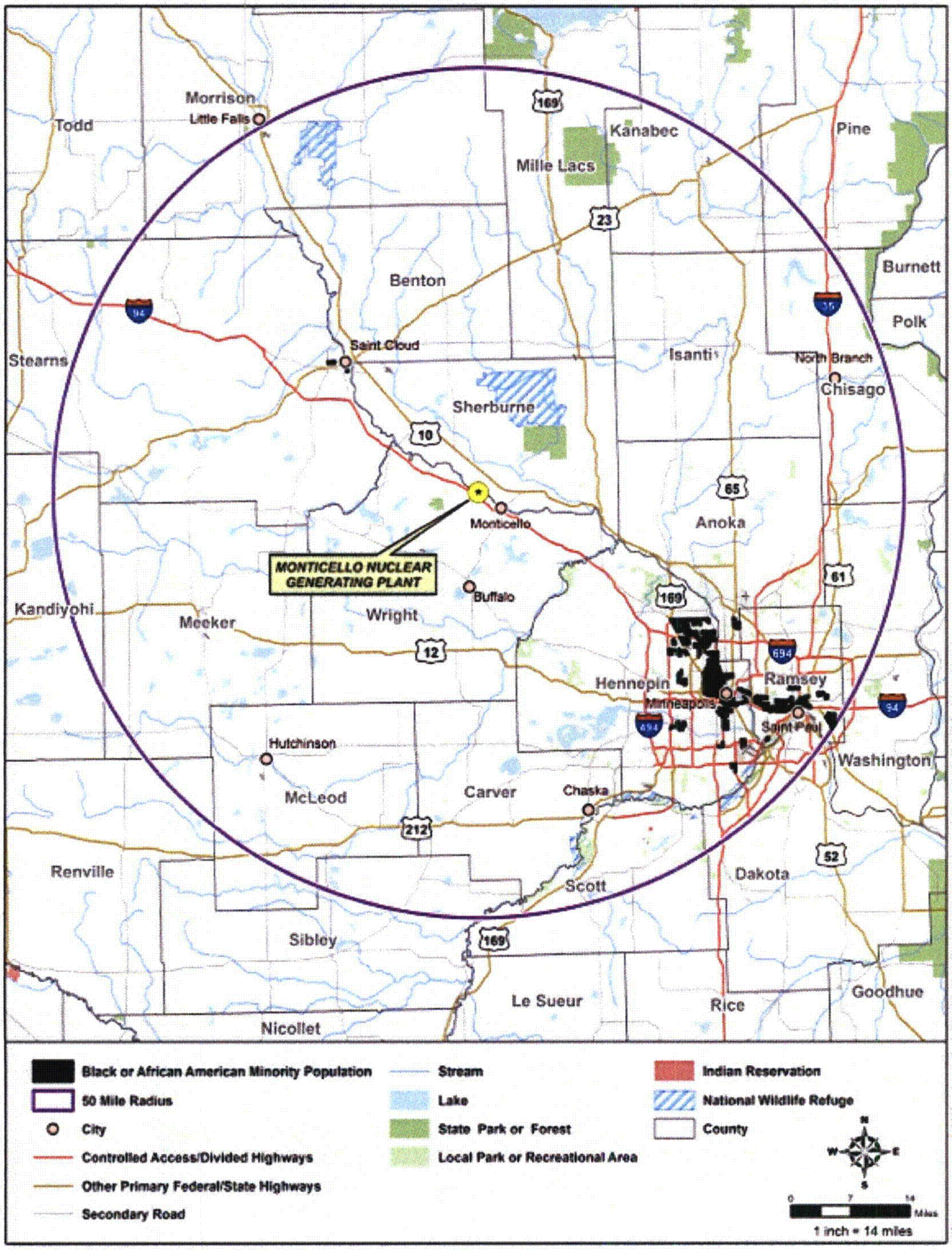

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FIGURE 4.5-3

NATIVE AMERICAN MINORITY POPULATION

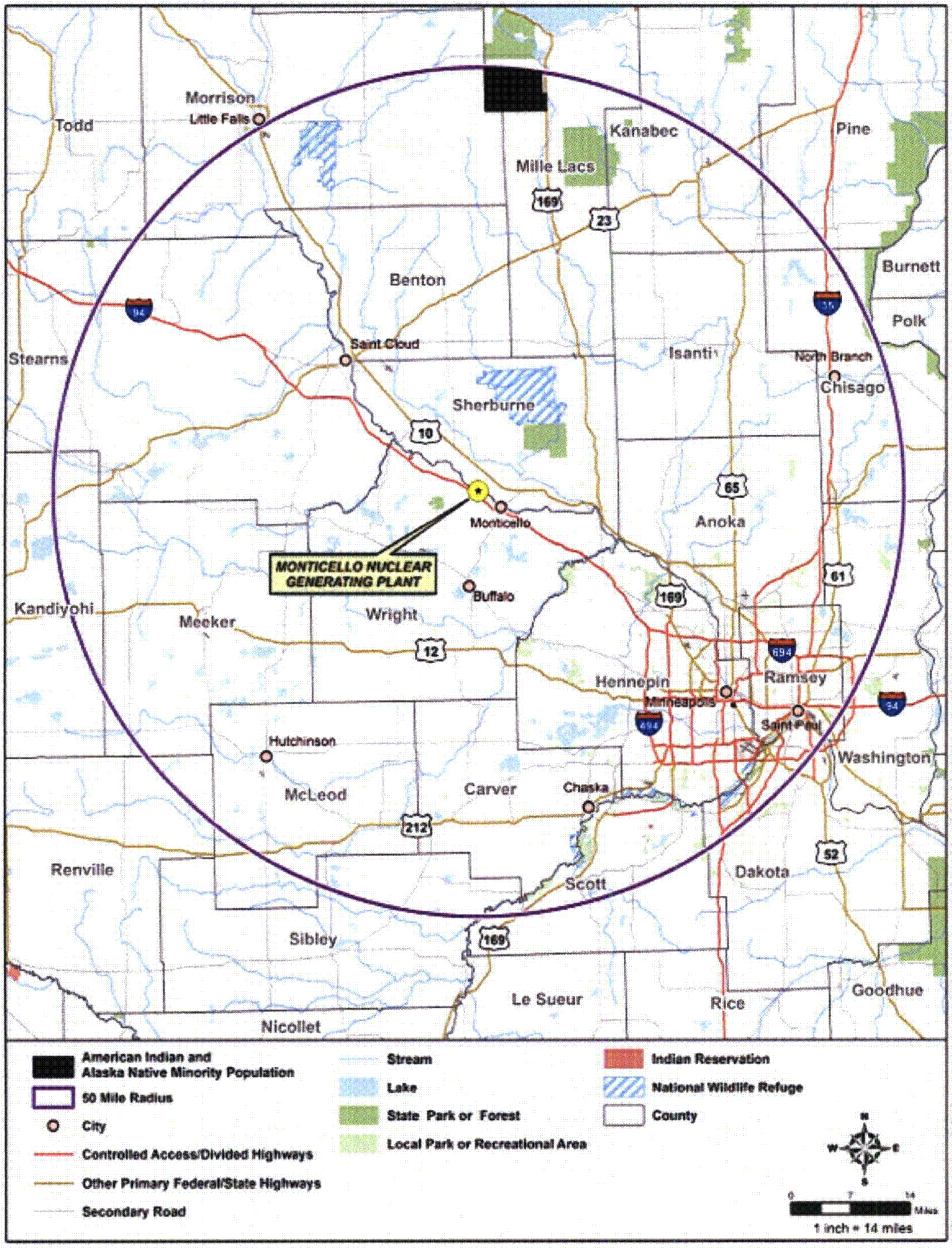

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FIGURE 4.5-4

ASIAN MINORITY POPULATION

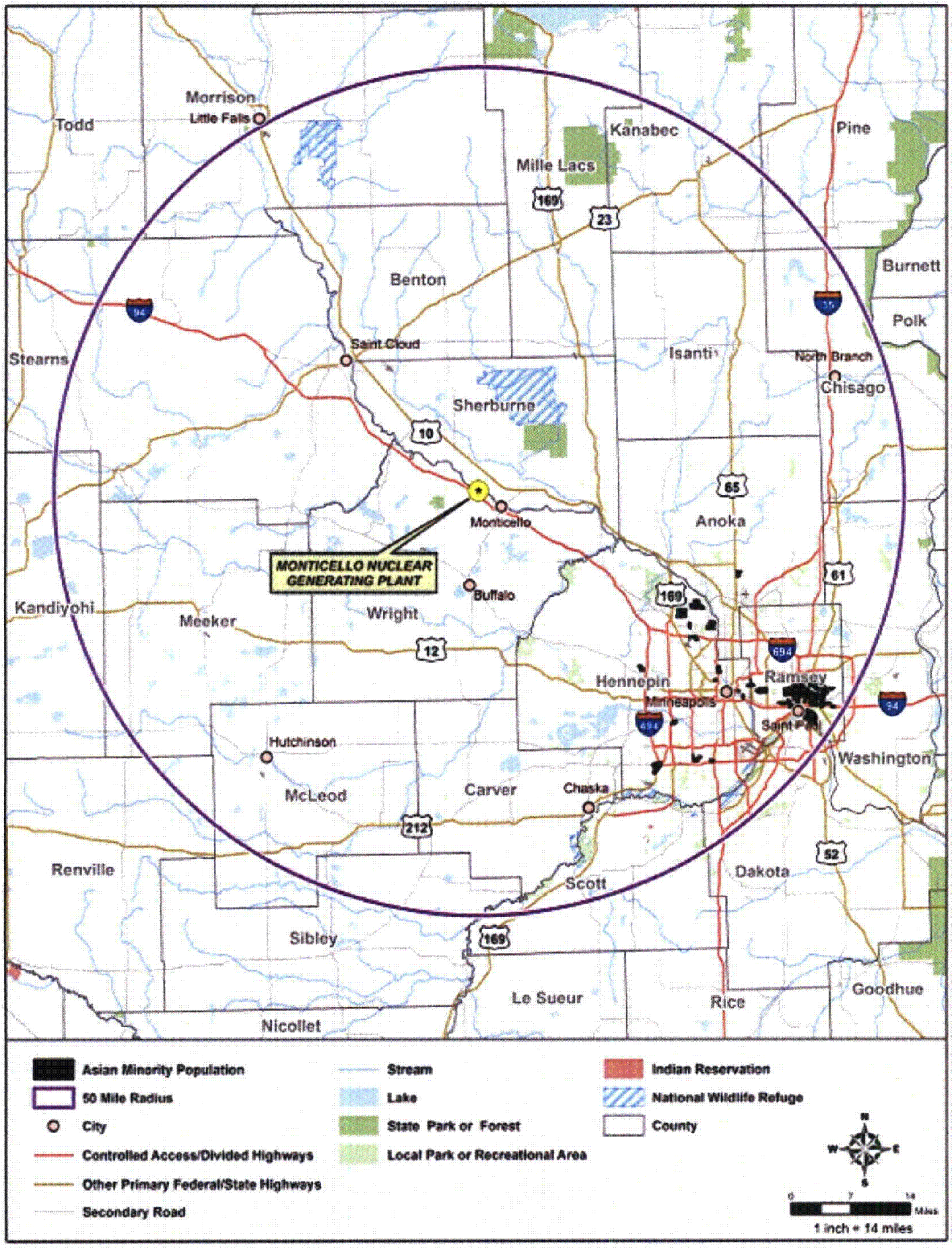

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FIGURE 4.5-5

HISPANIC OR LATINO MINORITY POPULATION

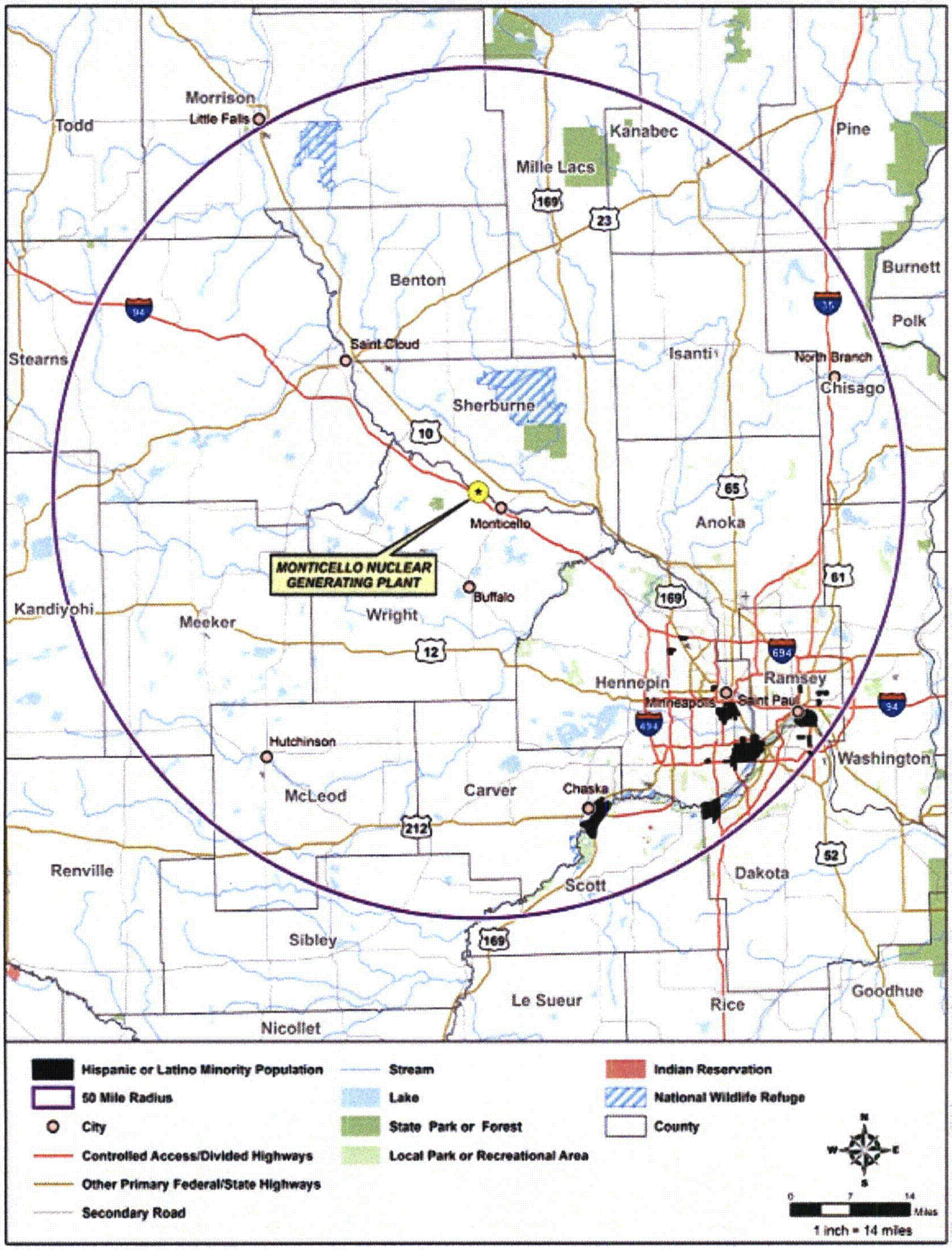

TABLE 4.5-1
ESTIMATED POPULATIONS AND ANNUAL GROWTH RATES IN WRIGHT AND SHERBURNE COUNTIES FROM 1970 TO 2040

	Wright		Sherburne	
Year	Population[a]	Percent[b]	Population[a]	Percent[b]
1970	38,933	--	18,344	--
1980	58,681	4.19	29,908	5.01
1990	68,710	1.59	41,945	3.44
2000	89,986	2.73	64,417	4.38
2010	124,700	3.32	88,499	3.22
2020	126,420	1.43	105,620	2.04
2030	139,020	0.95	121,920	1.45
2040	152,876	0.95	140,736	1.45

a. Source: Reference 27, except 2010 data from Reference 54.
b. Annual percent growth rate calculated using the equation N[t] = N[o] (1+r)t where N is population, t is time in years, and r is the annual growth rate expressed as a decimal.

TABLE 4.5-2
NUMBER OF CENSUS BLOCKS WITH MINORITY AND LOW-INCOME POPULATIONS WITHIN THE 50-MILE RADIUS OF MNGP

State	County	Black or African American[a]	American Indian and Alaska Native[a]	Asian[a]	Native Hawaiian and Other Pacific Islander[a]	Other Single Minority[a]	Two or More Races[a]	Hispanic or Latino	Aggregate Minority	Low Income[c]
	State of Minnesota	5.1	1.0	4.0	<0.1	0.1	1.9	4.7	16.9	11.0
	Threshold for Minority Population[b]	25.1	21.0	24.0	20.0	20.1	21.9	24.7	36.9	31.0
MN	Anoka	1	0	1	0	0	0	0	11	0
MN	Benton	0	0	0	0	0	0	0	0	0
MN	Carver	0	0	0	0	0	0	1	1	0
MN	Chisago	0	0	0	0	0	0	0	0	0
MN	Dakota	0	0	0	0	0	0	4	13	1
MN	Hennepin	140	1	20	0	0	0	50	272	38
MN	Isanti	0	0	0	0	0	0	0	0	0
MN	Kanabec	0	0	0	0	0	0	0	0	0
MN	Kandiyohi	0	0	0	0	0	0	0	0	0
MN	McLeod	0	0	0	0	0	0	0	0	0
MN	Meeker	0	0	0	0	0	0	0	0	0
MN	Mille Lacs	0	1	0	0	0	0	0	1	0
MN	Morrison	0	0	0	0	0	0	0	0	0
MN	Pine	0	0	0	0	0	0	0	0	0
MN	Ramsey	38	0	62	0	0	0	14	132	20
MN	Renville	0	0	0	0	0	0	0	0	0

TABLE 4.5-2 (CONTINUED)
NUMBER OF CENSUS BLOCKS WITH MINORITY AND LOW-INCOME POPULATIONS WITHIN THE 50-MILE RADIUS OF MNGP

State	County	Black or African American[a]	American Indian and Alaska Native[a]	Asian[a]	Native Hawaiian and Other Pacific Islander[a]	Other Single Minority[a]	Two or More Races[a]	Hispanic or Latino	Aggregate Minority	Low Income[c]
	State of Minnesota	5.1	1.0	4.0	<0.1	0.1	1.9	4.7	16.9	11.0
	Threshold for Minority Population[b]	25.1	21.0	24.0	20.0	20.1	21.9	24.7	36.9	31.0
MN	Scott	0	0	0	0	0	0	1	4	3
MN	Sherburne	0	0	0	0	0	0	0	1	1
MN	Sibley	0	0	0	0	0	0	0	0	0
MN	Stearns	2	0	0	0	0	0	0	3	2
MN	Todd	0	0	0	0	0	0	0	0	0
MN	Washington	0	0	0	0	0	0	0	2	0
MN	Wright	0	0	0	0	0	0	0	0	0
	Total	181	2	83	0	0	0	70	440	65

Source: Reference 54

a. Non-Hispanic or Latino

b. At least 20 percentage points greater than the state-wide percentage for Minnesota

c. Census tract data

ENCLOSURE 5

5.0 COST - BENEFIT ANALYSIS

As part of the 2008-2022 Resource Plan, the Company estimated that the MNGP extended power uprate project will result in a net present value savings of $200 to $540 million over the remaining life of the plant. The required capital investment costs will be more than offset by fuel and emission savings, and by the avoided cost of additional capacity. These savings will be directly passed on to the Company's ratepayers.

The Company used the resource planning software Strategist to evaluate the uprate project in comparison to other capacity alternatives. The model performs detailed simulations of the NSP system to estimate operational cost impacts and performs rigorous accounting calculations to forecast the cost recovery of capital projects. Strategist is widely used throughout the energy industry and has been used by the Company in numerous resource plans, certificates of need, and all source solicitations.

The MNGP uprate project was compared to coal, biomass, and natural gas based alternatives as part of the Company's 2007 Integrated Resource Plan. The 71MW uprate project was the least cost option followed by natural gas, then coal, and the biomass based alternative was estimated to be the most expensive.

The costs and benefit of the various alternatives can be categorized into three groups.

1. Capital and Fixed Costs
2. Operating Costs
3. Emission Costs

In general, the capital cost for the uprate project is lower than the expected capital costs for either new biomass or new coal based generation. However, in comparison to natural gas, the uprate project has a higher capital cost. The impact on annual fixed O&M costs is expected to be negligible. The Net Present Value (NPV) of ratepayer benefit from the MNGP uprate project for capital and fixed costs is estimated to be in the range of $151 to $188 million.

Operating cost savings are primarily due to decreased fuel costs. Other elements include variable O&M and the avoided cost of additional purchased power. The operating costs of the natural gas option were very high and canceled out its lower capital cost. The NPV of ratepayer benefit from the MNGP uprate project for operating cost is estimated to be in the range of $77 to $267 million.

Emission costs were decidedly lowest for the uprate project in comparison to the alternatives. While the Company imputed costs to many air emissions as detailed in Table 4.0-1, the total cost was primarily driven by CO_2. The Company encountered varying opinions regarding the appropriate CO_2 emission rate to be applied to the biomass alternative. While some argue that biomass fuel is carbon neutral, the fact remains that emissions from biomass plants are roughly twice that from coal, and that alternative uses for biomass fuel may likely keep the CO_2 from entering the atmosphere. The Company took the conservative approach of applying the full cost of CO_2 emissions to the biomass alternative. The NPV of ratepayer benefit from the MNGP uprate project for emissions is estimated to be in the range of $81 to $277 million.

Finally, the MNGP uprate project maintains the Company's fuel diversity and provides a natural hedge against fuel cost volatility in the coal and natural gas markets. The Company tested this benefit by varying the fuel cost assumptions used in Strategist. One result was

that when natural gas prices were increased by 20 percent the NPV of the MNGP uprate project increased by $70 million.

In summary, all modeling results indicate that the uprate project is in the best interest of ratepayers by lowering total forecasted revenue requirements, reducing exposure to future CO2 regulation, and by maintaining fuel diversity. As discussed in section 3.2, the MPUC granted NSPM the CON for the extended power uprate on January 8, 2009 (as modified by the January 6, 2012 COC), thereby confirming this cost-benefit analysis.

6.0 NON-RADIOLOGICAL ENVIRONMENTAL IMPACT

6.1 Terrestrial Effects

6.1.1 Land Use

The MNGP extended power uprate does not result in any activity which will change or otherwise modify the present requirements for land use at the plant site. There are no plans to build facilities or modify access roads, parking areas, or laydown areas. No transmission/distribution equipment will need to be replaced or modified to support extended power uprate activities at MNGP. Except for transportation of equipment and routine disposal of waste, extended power uprate maintenance activities are confined to the inner-plant security fenced area. Extended power uprate does not affect the storage requirements for above ground or below ground tanks. Other lands located outside the inner security fence will not be modified or changed to support extended power uprate activities. Extended power uprate does not involve changes to any aesthetic resources and does not involve any impacts to lands with historical or archaeological significance.

NSPM does not anticipate the need to construct additional or new low-level radioactive waste storage buildings to support present or extended power uprate activities. The replaced turbine components will be decontaminated as necessary, and recycled to the extent possible, or transferred to an approved disposal facility.

6.1.2 Transmission Facilities

A. Transmission Design and Equipment

A feasibility study for the MNGP EPU was performed in a manner consistent with the MAPP Design Review Standards (DRS) and Midwest Independent System Operator (MISO) practices for interconnection and transmission studies. Further analysis indicates that no transmission system improvements will be required to support the MNGP generation increase for EPU. The Midwest Independent System Operator (MISO) recently commissioned a stability analysis for projects known to occur prior August 2012 (including the MNGP EPU). The results of the stability analysis indicated that there would be no adverse impacts to grid stability due to the addition of any of the known projects (Ref. 55). Transmission modifications will be completed as directed by MISO.

B. Shock Hazards

Two 345-kV transmission lines (Monticello to Coon Creek and Monticello to Parkers Lake circuits) were originally constructed to connect MNGP to the transmission system and were evaluated in the Final Environmental Statement (FES) for initial operations. However, changes to the 345-kV transmission system and to these lines have fully integrated the Company's Monticello Substation into the 345-kV system. Based on these considerations, the Company's Monticello Substation now constitutes the transmission interconnection for MNGP.

All lines emanating from the Company's Monticello Substation were designed, constructed and are operated in compliance with the applicable sections of the National Electrical Safety Code (NESC®). Specifically, these lines meet the requirement in effect since the 1990 edition of the Code for lines exceeding 98kV alternating current to ground, which limits "the steady state current due to electrostatic effects to 5 milliamp if the largest anticipated truck, vehicle or equipment under the line were short-circuited to ground," (Section 232.C.1.c. and 232.D.3.c.). This current is induced in vehicles by the transmission line electric field, which is proportional to the voltage of the line and inversely proportional to the distance from the line. The Electric Power Research Institute (EPRI) has performed measurements on objects beneath lines to determine the level of electric field that will induce current in various objects. Results indicate that an electric field of 7.8 kV per meter at 1 meter above ground is required to induce a 5 milliamp current through a large tractor trailer. The 345-kV lines associated with MNGP produce a maximum electric field at 1 meter above ground of 6.0 kV per meter. The unloaded sag at 120°F is limited by the NESC® to a minimum distance to ground of 30 feet in order to meet the minimum clearance required for operation at 212°F, which is the highest temperature that Xcel Energy operates the lines (NESC® Section 232). For a large vehicle, the electric field values indicated above could potentially generate an induced current of 3.84 milliamp, which is below the NESC® code criteria of 5 milliamp.

Transmission line compliance with the provisions of the NESC® code discussed above is verified by periodic air patrols (monthly), which monitor construction activities beneath and near the lines that could alter corridor terrain and clearances. Based on these considerations, NSPM concludes that the Monticello 345-kV transmission lines meet the NESC® recommendations for preventing shock from induced currents.

C. Electromagnetic Fields (EMF)

The increased electrical output under EPU conditions will cause a corresponding current rise on the transmission system and this will result in an increased magnetic field. However, according to the NRC Staff, the chronic effects of EMF on humans are unquantified at this time, and no significant impacts to terrestrial biota have been identified (Sections 4.5.4.2.3 and 4.5.6.3.4 of Ref. 5). According to the National Institute of Environmental Health Sciences, the overall scientific evidence for human health risk from EMF exposure is weak and there is no consistent pattern of biological effects (Ref. 8). The chronic effects from EMF exposure have not been conclusively established and scientists are still debating whether EMF is a hazard to health.

6.1.3 Miscellaneous Wastes

Sanitary wastes from MNGP are discharged directly to the Monticello Wastewater Treatment Plant in accordance with a permit issued by the City of Monticello. Acid drains are processed in a retention basin in accordance with NPDES permit requirements. Other waste sources include hazardous waste generation from routine plant operations and air emissions from the plant heating boiler and diesel generators. Effluents from these pathways are controlled as required by state and federal permits. Extended power uprate does not have any significant impact on the quality or quantity of effluents from these sources, and operation under extended power uprate conditions will not significantly reduce the margin to the limits established by the appropriate permits. See Section 6.2.5 herein for additional information on water quality.

6.1.4 Cooling Tower Drift, Icing, and Fog

In Reference 19, the NRC Staff concluded that:

> "Impacts from salt drift, icing, fogging, or increased humidity with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal period."

Drift, icing, and fog from the MNGP cooling towers have been negligible and have had no discernible impacts on vegetation, agriculture, recreational activities, highway safety, air traffic, or river traffic. The Mississippi River does not contain the salt content of other water sources, and sufficient rainfall is available to prevent undesirable chemical concentrations in the soil from trace chemicals in the drift.

Extended power uprate may involve an estimated extra 20 days of cooling tower operation (see Section 6.2.2 herein). These changes will not have a significant effect on the environment. Assuming cooling tower operation from April to October (seven months), the NRC Staff conservatively estimated a total fogging time of 45 hr/yr in Reference 2. The fogging rate associated with an estimated 150 days of cooling tower operation at extended power uprate conditions is bounded by the fogging rate associated with an estimated 210 days of cooling tower operation (April to October assumed in Reference 2).

6.1.5 Noise

In Reference 19, the NRC Staff concluded that:

> "Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term."

Extended power uprate does not result in any significant changes to the character, sources, or energy of noise generated at MNGP. The new equipment necessary to implement extended power uprate will be primarily installed within existing plant buildings. This includes the upgraded HP turbine which will operate at the same speed as the original equipment. The effect of the additional period of cooling tower operation on ambient noise levels is not significant. No new significant noise-generating equipment will be installed outside the plant. No significant increases in ambient noise levels are expected within the plant.

ENCLOSURE 5

6.1.6 Terrestrial Biota

6.1.6.1 Threatened and Endangered Species

The United States Fish and Wildlife Service (FWS) has designated 15 species known to occur in Minnesota as threatened or endangered at the federal level and four species known to occur in the state as candidates for such listing (Ref. 25). However, only one of these species, the Higgins' eye pearlymussel (*Lampsilis higginsii*) is indicated by the Minnesota Department of Natural Resources (MNDNR) as occurring in the vicinity of MNGP (Ref. 33). Similarly, threatened and endangered species have been designated at the state level under programs administered by the MNDNR as implemented by Minnesota Rule 6134.0150. Five bird species, one reptile species, two mollusk species, one insect species, and six plant species designated as endangered or threatened at the state level in Minnesota have been documented by MNDNR as occurring in the vicinity of MNGP or the transmission corridors of interest. Pertinent information related to the status of these species is provided in the following sections (see Table 6.1.6.1-1). Note that the bulk of the information provided in the Section 6.1.6.1 subsections is retained from Reference 27 unless otherwise referenced. NSPM updated the information in this section by conducting a web-based survey of publicly available data from government agencies and other credible sources. No consultation with federal, state, or local agencies occurred during this analysis.

TABLE 6.1.6.1-1
THREATENED AND ENDANGERED SPECIES OCCURRING IN THE VICINITY OF MNGP AND THE ASSOCIATED TRANSMISSION CORRIDORS[a]

Common Name	Scientific Name	Status[b] Minnesota	U.S.
Birds			
Common tern	*Sterna hirundo*	T	
Horned grebe	*Podiceps auritus*	T	
Loggerhead Shrike	*Lanius ludovicianus*	T	
Peregrine Falcon	*Falco peregrinus*	T	
Trumpeter Swan	*Cygnus buccinator*	T	
Reptile			
Blanding's turtle	*Emydoidea blandingii*	T	
Mollusks			
Elktoe	*Alasmidonta marginata*	T	
Higgins' eye pearlymussel	*Lampsilis higginsii*	E	E
Insects			
Uncas Skipper	*Hesperia uncas*	E	
Plants			
Ram's-head lady's-slipper	*Cypripedium arietinum*	T	
St. Lawrence grapefern	*Botrychium rugulosum*	T	
Tall Nut-rush	*Scleria triglomerata*	E	
Annual skeletonweed	*Shinnersoseris rostrata*	T	
Tubercled rein-orchid	*Platanthera flava* var. *herbiola*	E	
Cross-leaved milkwort	*Polygala cruciate*	E	

a. Based on occurrences reported by MNDNR Ref. 29 and 33) and FWS (Ref.. 25).
b. E = Endangered, T = Threatened

6.1.6.1.1 Fauna

The bald eagle was originally included in the above table for the MNGP License Renewal Environmental Report (Ref. 27). The bald eagle is known to occur in the vicinity of the MNGP site. Originally listed as endangered by the FWS in 1967, the bald eagle was down-listed to threatened in 1995, and was de-listed in 2007 (Ref. 22). Several factors aided in the recovery of this species including a national ban on

DDT and other organochlorine pesticides by the EPA in mid-1970's and the reduced use of lead shot for waterfowl hunting. These efforts have considerably benefited bald eagle populations in the State of Minnesota. The state's first bald eagle survey in 1973 found 115 active nests; by 1995 the survey found over 600. In 2000, MNDNR surveyed over 1,300 known breeding areas and identified 681 occupied nests in the state, 76.5 percent of which included young. In 2005, MNDNR surveyed over 1,900 known breeding areas and identified 872 occupied nests (Ref. 34). Based on the continuing recovery of the species indicated in these surveys, MNDNR will no longer conduct future surveys as bald eagle populations are gradually reaching a healthy level (Ref. 35). Bald eagles are typically found near forested rivers and lakes where there is ready access to preferred nest sites and food. Preferred nesting habitat includes tall trees or cliffs. Bald eagles primarily prey on fish and ducks. Bald eagles are known to nest in the vicinity of the MNGP site.

Five bird species listed as threatened by the State of Minnesota are known to occur either on or in the vicinity of MNGP and associated transmission corridors of interest: common tern (Sterna hirundo), horned grebe (Podiceps auritus), loggerhead shrike (*Lanius ludovicianus*), peregrine falcon (*Falco peregrinus*), and trumpeter swan (*Cygnus buccinator*).

MNDNR surveys document common terns occurring in Wright County and five other counties in Minnesota. Populations nesting in the Great Lakes region have declined in the last 30 years due to predation, human disturbance, and competition with other bird species for breeding sites. Minnesota had over 2,000 breeding pairs in 1900; however, populations declined to 880 pairs by 1984, earning the common tern classification as a species of special concern until reclassification as a threatened species in 1996. In 1999, there were five nesting colony sites and a statewide population of fewer than 900 nesting pairs. Common terns nest on isolated, sparsely vegetated islands in large lakes or on open edges of sandy or gravelly beaches (Ref. 36).

Although horned grebes nested throughout Minnesota in the early 1900s, breeding populations have since declined rapidly and the species' range has contracted to a handful of counties, including Wright County, in the central and northwestern parts of the state. The horned grebe was classified as a species of special concern in 1984, but was reclassified as a threatened species in 1996 when surveys identified populations in the single digits. Breeding season bird inventories conducted from 1992 to 2008 observed horned grebes only in the Roseau River, Twin Lakes, and Thief Lake Wildlife Management Areas, despite suitable habitat existing elsewhere. Horned grebes prefer marshes and areas of lakes protected from wind and waves, where they can build floating nests in shallow water, usually in emergent vegetation (Ref. 37).

Loggerhead shrikes are known to occur in Wright, Anoka, and Sherburne Counties. Few were identified in surveys in 2008 and 2009,

although populations are typically found in the Anoka Sand Plain in Wright and Sherburne Counties. Preferring open country and dry upland prairie with hedgerows, shrubs, and small trees, the birds can also be found around planted shelterbelts of trees, old orchards, pastures, cemeteries, grassy roadsides, and farmsteads. The scattered trees, shrubs, and fencerows in these areas provide places for the shrikes to hunt and rest. Power lines are used as perches from which to hunt as well. Red cedar, hawthorn and plum (*Prunus americana*) trees are often used for nesting (Ref. 38).

Though peregrine falcon populations were greatly reduced in the 1950's and 60's by the effects of pesticide poisoning, reintroduction programs are having success in Minnesota. Peregrine falcons prefer open wetlands where there is access to nesting sites on cliffs, such as those along the Mississippi River Valley and Lake Superior. This species also demands a ready supply of prey such as ducks, shorebirds, and seabirds. However, they have proven to be adaptable. MNDNR reported that in 2007, 52 pairs successfully fledged 94 young at traditional cliff sites and new man-made habitats which include power plant stacks, skyscraper balconies and rooftops, and bridges. With the installation of a nest box on the MNGP Off-Gas Stack in 1992, peregrine falcons have been successfully nesting at the site since 1995. Since 1993, peregrine falcons have also been successfully nesting at the Sherco site, which is five miles upstream from MNGP (Ref. 39).

In recent years, wintering trumpeter swans have been observed in increasing numbers on the Mississippi River downstream from MNGP. The swans in this area are drawn to the open water in the winter months, which results from MNGP's discharge of warm water to the River, and to food supplied by a local resident at the City of Monticello's Mississippi Drive Park. Having disappeared from Minnesota in the 1880's, the trumpeter swan has been successfully restored to the state with a 2002 MNDNR and FWS surveys showing more than 75 nesting pairs and nearly 900 year round residents. A 2011 survey observed more than 5,300 trumpeter swans in 14 Minnesota counties (Ref. 40).

One reptile species, the Blanding's turtle (*Emydoidea blandingii*) is listed by the State of Minnesota as a threatened species and is documented by MNDNR as occurring in the vicinity of the transmission corridors in Anoka and Sherburne Counties. The turtles require both wetland and upland habitats to complete their life cycle. In Minnesota, the turtles are primarily marsh and pond inhabitants. Calm, shallow water bodies with mud bottoms and abundant aquatic vegetation, such as cattails, and water lilies are preferred, though extensive marshes bordering rivers are also suitable habitat for the turtles. Nesting occurs in open (grassy and brushy) sandy uplands.

The Higgins' eye pearlymussel (*Lampsilis higginsii*), a mollusk species, is listed by both the U.S. Fish and Wildlife Service and the MNDNR as an endangered species and occurring in the vicinity of MNGP (Ref. 25, Ref. 28). The Higgins' eye is a medium-sized (reaching approximately

100 mm in length) freshwater mussel with a smooth, yellow, yellowish green, or brown with green rays that are obscure on some individuals. Like other freshwater mussels, the Higgins' eye feeds by filtering food particles from the water column. The specific food habits of the species are unknown, but other juvenile and adult freshwater mussels have been documented to feed on detritus, diatoms, phytoplankton, and zooplankton. The diet of Higgins' eye glochidia, like other freshwater mussels, comprises water (until encysted on a fish host) and fish body fluids (once encysted). Higgins' eye has been characterized as a large river mussel species. No correlation was found between overall mussel density and substrate size in the Wisconsin River where Higgins' eye was found. It was found that burrowing times for Higgins' eye were similar in clay, silt and sand, but longer in pebble-gravel substrate. The species is not associated with firmly packed clay, flocculent silt, organic material, bedrock, concrete, or unstable moving sand. It has been indicated that Higgins' eye were most common in sand/gravel substrate. Substratum that was free of plants and consisted of stable, gravelly sand was considered as suitable. It was also noted that immediately downstream of wingdams, mussel diversity was high and new species were found at a more rapid rate on the wingdam than in gravelly sand. The species was found immediately below the wingdam at McMillan Island and has been collected on wingdams near Prairie du Chien. Higgins' eye may be primarily adapted to large river habitats with moderate current, such as the East channel of the Mississippi River near Prairie du Chien, Wisconsin. Water velocities less than 1 meter per second during periods of low discharge are considered ideal for this species. (Higgins' Eye information from Ref. 26)

The MNDNR listed the elktoe mussel (*Lampsilis higginsii*) as a threatened species in 1996 after populations had died out in many of Minnesota's rivers. The elktoe occasionally occurs in the Mississippi River, but is more commonly found in the St. Croix River. MNDNR conducted a ten-year statewide mussel survey starting in 1999 that revealed elktoe mussel populations are still dwindling in Minnesota. Alterations to waterways, sedimentation, and invasive zebra mussels all threaten the elkoe's habitat (Ref. 41).

One insect species, the Uncas skipper (*Hesperia uncas*), a state-listed endangered species, is documented by MNDNR as occurring in the vicinity of the transmission corridor in Sherburne County. Preferred habitat for the Uncas skipper includes short-grass prairie and open woodlands. Adults feed on flower nectar, and the plant hosts for the caterpillar stage are blue grama grass (*Bouteloua gracilis*) and needlegrass (*Stipa sp.*). Though found in many areas of the western North America, where arid environments are common, the Uncas skipper is listed as endangered in Minnesota because of habitat scarcity. With fire no longer a natural part of the regional ecosystem, forestation of former savanna has occurred and reduced the available habitat.

6.1.6.1.2 Flora

Ram's-head lady's-slipper (*Cypripedium arietinum*), a rare orchid, is found primarily in northern Minnesota, but can occur as far south as Wright County. MNDNR first classified this species as endangered in 1984, but reclassified it as threatened in 1996. Ram's-head lady's slipper grow in a variety of coniferous forest habitats, including bogs, swamps, lowland forests, and drier upland forests. Changes in land use and clear-cutting have contributed to the decline of this species as well as illegal collection by poachers (Ref. 42).

St. Lawrence grapefern (*Botrychium rugulosum*) is also rare in Minnesota, but has been documented by MNDNR as occurring in Sherburne County. St. Lawrence grapefern prefers open pine forests or moist, grassy areas within pine or oak groves and is often confused with the common leathery grapefern (*B. multifidum*). The species was listed as threatened in 1996 due to habitat alteration, land development, herbicides, and changes in water levels (Ref. 43).

Tall nut-rush (*Scleria triglomerata)* is a state-listed endangered species documented by MNDNR as occurring in the vicinity of the transmission corridor. Tall nut-rush can be found in dry or moist sandy ground and tolerates open to shaded light conditions. It is found in prairies and in the borders of marshes. Common or indicator plant associates in dry sand prairie habitats include bluejoint grass, cordgrass, rush, sedges, twig-rush, and shrubby cinquefoil. In wet-mesic prairie habitats common or indicator plant associates include big bluestem, little blue stem, cord grass, prairie dropseed, and bee-balm.

Annual skeletonweed (*Shinnersoseris rostrata*) is predominantly confined to sand dunes in the Great Plains region of the United States and has been found in Norman, Polk, and Sherburne Counties in Minnesota. It has only been found on open sand dunes in a prairie landscape where conditions are sunny and dry. MNDNR listed the species as threatened in 1984. Skeletonweed occurs with the rare Indian ricegrass (*Oryzopis hymenoides*) as well as more common species such as sand dropseed (*Sporobolus cryptandrus*), umbrella sedges (*Cyperus spp*), Junegrass (*Koeleria pyramidata*), and hairy golden aster (*Chrysopsis villosa*) (Ref. 44).

Tubercled rein-orchid (*Platanthera flava* var. *herbiola*) can be found throughout the northeastern United States and is known to occur in Sherburne County. The species was listed as endangered by MNDNR in 1984 due to habitat loss as a result of road construction and urban expansion. Tubercled rein-orchid prefers wet prairies and meadows, swales in mesic prairies, or sandy or peaty areas along the edges of marshes, swamps, and lakeshores. It can be found in areas of full sun or in the partial shade created by willow (*Salix* spp.) and dogwood (*Cornus* spp.) shrubs (Ref. 45).

Cross-leaved milkwort (*Polygala cruciata*) grows primarily in the Atlantic and Gulf coastal planes, but an isolated range exists in the Great Lakes region. After a well-documented decline, MN DNR listed

the species as endangered in 1984. Cross-leaved milkwort typically occurs on wet, sandy shores of shallow lakes in the Anoka Sand Plain in Sherburne County and in sandy or peaty meadows and swales. Rare species occurring in these habitats include tooth-cup (*Rotala ramosior*), tall nut-rush (*Scleria triglomerata)*, and twisted yellow-eyed grass (*Xyris torta*) (Ref. 46).

6.1.6.1.3 Terrestrial Biota Conclusion

The EPU project does not involve land disturbance or a measurable increase in noise levels outside the plant. The project also does not increase the size of the MNGP workforce or change right-of-way maintenance practices. As a result, there will be no impacts to terrestrial biota (including threatened or endangered species) beyond those described in the FES for operation and the Generic Environmental Impact Statement for MNGP License Renewal.

6.1.7 Air Quality

On January 29, 2009 NSPM provided a response to NRC's Request for Additional Information (RAI) Item 4, regarding Wright County's attainment status for carbon monoxide (CO) and how construction activities associated with extended power uprate might affect the air quality in Wright County and nearby counties (Ref. 51). NSPM's response discussed Wright County's attainment status and conducted a bounding analysis for traffic count and a screening analysis for CO emissions. This information was based on outages in 2009 and 2011 and used information that is now outdated. The following paragraphs update information in NSPM's RAI Item 4 response.

Part of Wright County was designated non-attainment for the CO National Ambient Air Quality Standard (NAAQS) on March 3, 1978. A State Implementation Plan (SIP) was written to document the plan for attainment and maintenance of the NAAQS. The area was designated as in attainment effective November 29, 1999, and is now considered a maintenance area. Maintenance areas retain that classification for 20 years after they are designated as attainment.[5] Therefore, Wright County's partial maintenance designation will remain until 2019. Amendments to the SIP were approved on November 29, 1999 and January 2005. The 2005 amendment revised the motor vehicle emission budget (MVEB) for CO to 1,961 tons per day (Ref. 57). However, in 2010, EPA approved an MPCA request for a Limited Maintenance Plan for the area. Under the limited maintenance plan, the EPA has determined that there is no requirement to project emissions over the maintenance period. Several aspects of the SIP remain in place and must continue to be followed until SIP revisions are made and approved by EPA. The CO concentrations measured in 2011 in the area were less than 15% of the existing standard.[6]

Bounding Analysis -Traffic Count

The Minnesota Department of Transportation (MnDOT) maintains an Automatic Traffic Recorder (ATR) on Interstate 94 about 10 miles northwest of MNGP. This

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5 Per EPA at http://www.epa.gov/oar/genconform/training/01_mod_1_Sec_1-3.html.

6 Based on highest second high (H2H) 2011 CO concentrations measured at the Hennepin County monitoring station (as reported in the EPA Airdata database (http://www.epa.gov/airdata/). The H2H concentrations were 1.8 ppm for 1-hour and 1 ppm for 8-hour.

site is labeled ATR# 200. Annual average daily traffic (AADT) measured at that site for 2011 was 42,000 vehicles per day (Ref. 56). For the Monticello EPU, assuming an additional 1,400 vehicles per day (700 additional workers each driving solo, times 2 trips per day), the AADT increases by approximately 3 percent. This count estimate is conservative because it assumes that there will be a one-for-one increase in the number of workers during the outage, and it assumes that each worker will drive their own vehicle. The average daily truck volume for ATR# 200 is 7,900 trucks per day. The Monticello EPU would add approximately 100 trucks per year (50 deliveries times 2 trips).

Based on the small increase in the traffic count in the area, and the current low CO concentrations (<20% of the NAAQS), vehicle emissions during the construction phase of the Monticello EPU will not have an impact on the maintenance area status of Wright County for CO.

Screening Analysis- CO Emissions

NSPM performed a screening analysis of CO impacts. For the 2013 outage, it was assumed 700 additional workers would be necessary during the outage. Assuming each worker drives their own vehicle, and workers drive 40 miles each way to and from the plant, the project will add 56,000 vehicle miles traveled per day. Using a fleet average CO emission rate of 15.072 grams per vehicle mile traveled (g/VMT) (Metropolitan Council) results in CO emissions of 0.9 tons per day. This is equal to 0.05% of the MVEB.

The current schedule for the 2013 refueling outage is assumed to have a duration of 85 days for this analysis. The total CO emissions as a result of the project are 79.1 tons in 2013. These emission estimates are below the general conformity applicability threshold of 100 tons per year, found in 40 CFR 51.853(b)(2).

6.2 Hydrology

6.2.1 Groundwater

Extended power uprate does not affect groundwater resources and does not involve significant increases in the consumptive use of these resources at MNGP. Station groundwater use is governed by water appropriation limits of the MNDNR. The domestic water supply is obtained from six wells located on the plant property. No dewatering or collector-type wells (Ranney wells) are used at MNGP. The Domestic Water System, which is serviced by two 100 gpm wells, provides domestic water to lavatories, showers, and laundries and provides raw water to the reverse-osmosis system and seal water to certain pumps located at the plant intake structure. Groundwater appropriation permit number 670083 (issued by MNDNR) establishes limits associated with two 100 gpm wells. Extended power uprate does not affect compliance with these limits. The annual appropriation limit is 20 million gallons and average annual usage over the last five years (2007-2011) was less than 13 million gallons. Any increases in makeup to plant systems under extended power uprate from these sources are expected to be minor, and operation within the allowable limit will continue. Four smaller capacity wells (that are not required to be addressed via a groundwater appropriation permit) provide water to office, warehouse, and security facilities not serviced by the Domestic Water System. The wells are of standard vertical construction. Extended power uprate has no effect on these sources.

6.2.2 Surface Water Appropriation

Surface water use at MNGP is in accordance with the water appropriation limits of the MNDNR. Under surface water appropriation permit number PA 66-1172-S, the Company may withdraw a maximum of 645 cubic feet per second (cfs) of water from the Mississippi River at MNGP. Special operating restrictions apply at lower than average river flows of 860 cfs and 240 cfs. Extended power uprate does not introduce any significant changes to the screen wash, service water, or circulating water flow requirements. Extended power uprate does not involve any changes to the water appropriation requirements of this permit.

Currently, the surface water consumption due to open cycle evaporative losses and cooling tower evaporation and drift is estimated at approximately 6,800 acre-ft/year assuming 130 days of cooling tower operation, 235 days of open-cycle operation and nominal values of cooling tower flow (approximately 509 cubic feet/second). Using the maximum surface water appropriation limit of 645 cubic feet/second as the cooling tower flow value results in an estimated total consumption of 7,800 acre-ft/year.

For extended power uprate, assuming an increase in open cycle consumption of 20 percent, an increase in days of cooling tower operation to 150 days/year, and nominal values of cooling tower flow, results in an estimated consumption of 7,700 acre-ft/year. Using the maximum surface water appropriation limit of 645 cubic feet/second as the cooling tower flow value results in an estimated total consumption of approximately 8,700 acre-ft/year. Note that using the appropriation limit for cooling tower flow is very conservative because the cooling towers are typically operated in "Helper" mode (i.e., not all circulating water flow is passed over the cooling towers).

Even the most conservative estimate (i.e., 8,700 acre-ft/year) of consumption is below the value of 9,000 acre-ft/year that has been previously evaluated by the NRC in the MNGP FES (Ref. 2) for a combined consumption of open cycle and cooling tower operations. This estimate is also well below the 13,000 acre-ft/year the NRC evaluated in Ref. 19 and concluded that "the consumptive loss due to evaporation from the cooling towers represents four percent of the river flow, which is not considered significant." The NRC further concluded that "the staff expects that the existing State restrictions on water withdrawal during low-flow conditions in the Mississippi River are appropriate and no additional mitigation measures are warranted." The nominal value of 7,700 acre-ft/year, which is most representative of actual cooling tower operating flow rates, is well below the 9,000 acre-ft/year value used in the FES (Ref. 2) and the 13,000 acre-ft/year referenced in Ref. 19.

Additionally, cooling tower operation at power uprate conditions is estimated at 150 days per year which is less than the FES assumption of approximately 210 days per year (April through October).

In conclusion, the estimated additional consumption due to extended power uprate is bounded by values previously evaluated by the NRC and is not considered to be significant.

6.2.3 Discharges

Surface water and wastewater discharges are regulated by the State of Minnesota. The National Pollutant Discharge Elimination System (NPDES) permit is periodically reviewed and re-issued by the Minnesota Pollution Control Agency (MPCA). The present NPDES permit for MNGP, permit number MN0000868, authorizes discharges from five stations[7]. The stations and their effluent limits are listed in Table 6.2.3-1 herein. None of the limits listed in this table will require modification to implement extended power uprate. Additionally, Attachment A contains a summary of the environmental authorizations for current plant operations.

6.2.4 Increase in Circulating Water Discharge Temperature

At extended power uprate conditions, the heat rejected by the condenser increases. This results in a corresponding increase in the circulating water outlet temperature for a given system flow rate. The steam cycle heat dissipation is provided by the Circulating Water System and the Cooling Tower System. The heat dissipation system at MNGP is the source of thermal discharges from the plant. No physical modifications or operational changes are required for these systems to implement extended power uprate.

The NPDES permit issued by the MPCA limits maximum average daily discharge temperatures at the end of the discharge canal (Note ‘a’ to Table 6.2.3-1). Extended power uprate will not involve any changes to the MPCA discharge temperature limits. The slight discharge canal temperature increase will not result in one half of the surface width of the river temperature exceeding the 90°F maximum as delineated in the FES. Extensive field studies have been performed to confirm that the limits imposed by the NPDES permit are conservative and assure no significant adverse impact on the environment. These temperature studies ended in 1988 when the MPCA determined that 20 years of temperature monitoring had adequately characterized the thermal impacts of MNGP operation. Based on studies that evaluate the MNGP impact on the river ecosystem, cooling tower operation during the summer months has adequately prevented detrimental environmental effects and water temperatures downstream are not high enough to harm aquatic species or impede fish migration even in summer months. Temperature monitoring of outfall SD001 (discharge canal) is continuous, and NSP has consistently operated MNGP in conformance with the permit's thermal discharge requirements.

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[7] MN0000868 expired on September 30, 2012. NSPM submitted a timely permit renewal application on March 31, 2012 and the current permit remains valid until the MPCA takes action.

ENCLOSURE 5

Table 6.2.3-1. NPDES Discharge Limit Summary

Discharge Station No.	Description	Parameter	Limit
SD001	Plant Cooling Water	Flow (mgd) Phosphorus Total (as P) Bromine (as Br) Chlorination Chlorine Rate Oxidants, Total Residual Plant Capacity Factor, Percent of Capacity Temperature, Water	Monitor Only Monitor Only Monitor Only 2.0 hr/day Monitor Only 0.2 mg/l (instantaneous maximum) Monitor Only Seasonal[a]
SD003	Holdup Pond Effluent	Flow (mgd) Total Suspended Solids pH Phosphorus Total (as P)	Monitor Only 9.9 kg/day monthly average 30 mg/l monthly average 33.2 kg/day daily maximum 100 mg/l daily maximum pH (6.0 to 9.0) Monitor Only
SD004	Turbine Building Sump & Misc Discharge	Flow (mgd) Total Suspended Solids pH Oil and Grease, Total Recoverable (Hexane Extractions)	Monitor Only 12.7 kg/day monthly average 30 mg/l monthly average 42.3 kg/day daily maximum 100 mg/l daily maximum pH (6.0 to 9.0) 4.2 kg/day monthly average 10 mg/l monthly average 15 mg/l daily maximum 6.3 kg/day maximum calendar week average
SD005	Screen Backwash	Flow (mgd)	Monitor Only
SD006	Roof/Yard Drains and Screen Backwash	Flow (mgd)	Monitor Only
SW001	Water intake	Phosphorus Total (as P) Temperature, Water	Monitor Only Monitor Only
WS001	Mid-downstream discharge canal	Oxidants, Total Residual	0.05 mg/L daily maximum

[a] In no case shall the maximum daily average temperature at the end of the discharge canal exceed the following limits:
(i) During the months of April through October: 95 °F
(ii) During the months of November and March: 85 °F
(iii) During the months of December through February: 80 °F

The temperature increase across the intake and plant discharge is highest in fall and winter, when once-through cooling is employed. The temperature increase is lowest in summer and during periods of low river flow, when NPDES permit limits associated with upstream average river temperature necessitate cooling tower use. During open cycle operation at rated circulating water system flow, it is conservatively estimated that extended power uprate will result in an increase in temperature of water entering the discharge canal by approximately 4.5°F. During other modes of operation, the water temperature increase will be less due to tempering from partial or full cooling tower operation. The calculated temperature increase of 4.5°F at the discharge canal inlet would be experienced during those months where cooling tower operation is not required to meet NPDES permit temperature requirements. This resultant discharge canal temperature increase is well bounded by seasonal variations. During combinations of high river temperature and high atmospheric temperatures, discharge canal temperatures have approached the NPDES permit limits with cooling tower operation. During such periods NSP has reduced power at MNGP to maintain compliance with the NPDES permit. This practice will continue under extended power uprate conditions.

A 4.5°F inlet temperature increase would not involve any significant increase in harmful thermophilic organisms in the discharge canal. MNGP daily average discharge canal temperatures range from 66 to 95°F when the plant is operating and rarely average more than 90°F over a month. Thermophilic bacteria generally occur at temperatures of 25 to 80°C (77-176°F), with maximum growth at 50 to 60°C (122-140°F). Pathogenic forms have evolved to survive in the digestive tract of mammals and, accordingly, have optimum temperatures of around 37°C (99°F). Similarly, pathogenic protozoans such as *Naegleria fowleri* have maximum growth and reproduction at temperatures ranging from 35 to 45°C (95-113°F) and are rarely found in water cooler than 35°C (95°F).

Because of NPDES permit requirements, MNGP discharge canal temperatures are below those optimal for growth and reproduction of pathogenic microorganisms because of NPDES permit requirements, but could permit limited survival of these organisms in summer months. The heated effluent flows over a weir at the end of the discharge canal which promotes atmospheric mixing and cooling before entry into the Mississippi River. Temperatures in the Mississippi River immediately downstream of MNGP are consistently several degrees cooler than those in the discharge canal and under normal extended power uprate conditions would not accelerate the propagation of these pathogenic organisms. Another factor limiting concentrations of pathogenic microorganisms in the MNGP discharge is the absence of a seed source or inoculant. Wastewater, whether municipal sewage, industrial wastewater, or agricultural runoff, is usually the source of pathogens in natural waters. Since October 1983, MNGP has pumped its sanitary wastes to the City of Monticello's wastewater treatment plant. Consequently, the extended power uprate does not involve significant discharges of pathogenic microorganisms to the discharge canal and the Mississippi River. Pathogenic organisms in the Mississippi River downstream of MNGP would typically come from upstream anthropogenic sources or animal wastes.

MNGP operation at the extended power uprate power level is not expected to stimulate growth and reproduction of pathogenic microorganisms in the Mississippi River downstream of the plant. Under certain circumstances these organisms may be present in the discharge canal but not in sufficient concentrations to pose a threat

to downstream water users. It should be noted that many of these pathogenic microorganisms (e.g., *Pseudomonas*, *Salmonella*, and *Shigella*) are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds, but are usually only a problem when the host is immunologically compromised.

Given the above, the slight increases in circulating water outlet temperature due to extended power uprate will not involve any changes to NSPM's compliance with the present discharge temperature limits established by the Minnesota Pollution Control Agency (MPCA) and will not result in any significant impacts to the environment.

6.2.5 Water Quality

The Mississippi River at the point of discharge for MNGP is classified as Class 1C, 2Bd, and 3C by the State of Minnesota according to Minnesota Administrative Rule (Minn R.) 7050.0470 and 4A, 4B, 5, and 6 according to Minn. R. 7050.0410. Class 1C waters, treated or otherwise, must meet the primary and secondary drinking water standards issued by the US Environmental Protection Agency (EPA). Class 2Bd water quality is sufficient to allow for water sports, fishing, and aquatic recreation. Class 3C waters are allowed for use in industrial cooling and materials transport applications as long as a high degree of treatment is not required to prevent substandard water quality conditions. Class 4A and 4B waters are to be used for agricultural purposes, such as irrigation, or by waterfowl and other wildlife. Class 5 waters quality must allow for aesthetic enjoyment, navigation, or use in fire protection. Class 6 waters include all waters of the state that serve the uses of Classes 1 to 5 or are considered beneficial by the state.

Based on 20 years of water quality monitoring at MNGP, the Company submitted a report for review by the MPCA in 1987. In 1988, the MPCA determined that MNGP operation had not adversely affected the water quality of the Mississippi River downstream of the plant and allowed the Company to reduce the monitoring program. There is no indication that chemical discharges from MNGP have caused any detrimental effects to the aquatic biota. The MPCA determined that water temperature was the only physicochemical parameter significantly affected by plant operation.

Effluent limitations and monitoring requirements for the plant discharges are an integral part of the NPDES permit. Each outfall identified in the permit requires continuous flowrate monitoring. Modifications of the non-radiological drain systems or the retention basin system are not required due to extended power uprate, and biocide/chemical discharges will be consistent with existing permit limits. Extended power uprate will not introduce any new contaminants or pollutants and will not significantly increase the amount of those potential contaminants presently allowed for release by the MPCA other than noted below.

NSPM has determined that approximately 20 additional days of cooling tower operation may be required to support extended power uprate. This is due to the present MPCA permit limit of 95 deg F for the Daily Maximum plant cooling water discharge temperature between April and October. Bromine and sodium hypochlorite are injected into plant water systems at various concentrations to minimize microbiological fouling. The additional 20 days of operation may require a very slight increase in normal bromine and sodium hypochlorite injection. The discharge of any additional residual halogens attributable to the extra 20 days of

cooling tower operation is expected to be insignificant, and effluent concentrations would continue to be well below the NPDES daily discharge limits.

6.2.6 Mississippi River Thermal Plume

The results of the Section 316(a) demonstration (Ref. 6) for MNGP determined that MNGP operation has had subtle alterations in the structure of some aquatic communities, but these impacts have been limited to a small area directly downstream of the plant. Biological diversity has not suffered and may have been enhanced by thermal inputs during certain times of the year. Based on available information, the minor increase in thermal output to the river due to extended power uprate is not expected to result in any impacts on aquatic biota that are different in kind or greater in magnitude than those identified over the past years of plant operation and will not alter the previous 316(a) demonstration.

In addition to the 316(a) demonstration, the Company conducted thermal plume studies following the construction of the discharge canal weir. These studies showed that even in the worst case year the thermal plume disperses rapidly, is largely restricted to the near side of the river and is not a barrier to fish movement. In addition, depending on the ambient conditions and the distance downstream from the plant, roughly 30 to 70 percent of the river is unaffected by the heated discharge. Extended power uprate does not alter the water volume requirements for the heat dissipation system, the physical construction of the discharge canal terminus, or the temperature limits established by the NPDES permit. Therefore, extended power uprate conditions do not change the findings of the thermal gradient and plume studies.

6.2.7 Cold Shock

MNGP is equipped with once-through cooling system coupled with cooling towers that can operate in various modes to meet permit requirements for water appropriations and thermal discharge. The use of the system in a once-through capacity requires evaluation of the effects of the heated discharge on biological resources of the Mississippi River.

Cooling water is withdrawn from the Mississippi River using two, 140,000 gallons per minute (gpm) circulating water pumps. The water is circulated through the condenser and then routed, along with service water, to the discharge structure. During open cycle operation, i.e., when ambient river water temperature is less than 68 degrees Fahrenheit (°F) (and river flow is adequate), the condenser effluent is routed to an open canal and discharged directly to the river. Open-cycle operation is typical from about mid-September to mid-May. When river water temperatures exceed 68°F and river flow is adequate, condenser effluent from the discharge structure is pumped into two, induced-draft cooling towers, and then to the river via the discharge canal. Under high temperature and/or low flow conditions, MNGP can also be operated in a partial recycle mode or closed-cycle mode. These alternative operating modes are used to comply with MNDNR water appropriation restrictions and MPCA thermal discharge limits established in the NPDES permit.

The 316(a) demonstration for MNGP (Ref. 6) summarized the extent and behavior of the thermal discharge plume under various conditions. The author's observations were based on 34 plume-mapping surveys conducted between

1971 and 1973. Compliance with State water quality standards and draft NPDES permit conditions was not always achieved, and compliance was dependent primarily on plant operating mode and river flow. Particularly under extreme summer low flows, compliance was not possible with or without cooling towers. Occasional non-compliance was documented during the fall through spring period. Notwithstanding some periods of non-compliance with draft NPDES permit conditions and water quality standards, the 316(a) demonstration (Ref. 6) concluded, based on a review of pertinent ecological studies, that there had been no "indication of prior appreciable harm to the biota of the Mississippi River within the area of influence of MNGP." This evaluation included all major biotic groups including phytoplankton, periphyton, macrophytes, zooplankton, benthic macroinvertebrates, and fish. The Company notes that when river conditions (i.e., flow and temperature) limit the ability for MNGP thermal discharge to meet the State water quality standards, plant procedures call for a reduction in power output to maintain current NPDES permit compliance.

One aspect of the thermal plume evaluation discussed in the 316(a) demonstration was the attraction of fish to the discharge canal in winter, and their vulnerability to cold shock mortality in the event of a plant shutdown. This may occur when fish enter the warm effluent during fall/winter and become acclimated, and then are subjected to a near instantaneous drop to ambient temperature when the plant shuts down. There were eight winter shutdown events between 1975 and 1979 resulting in the cold shock death of numerous fish. Concerns about this phenomenon resulted in the construction of a fish barrier-weir at the mouth of the discharge canal in 1980. This weir prevents fish from entering the warmest part of the discharge, and has reduced the frequency and severity of cold shock kills. Since 1980, there have been 15 events with a total loss of 5,637 fish. In 2007, there were two events that resulted in fish kills. There were 3,559 fish killed related to the plant scram on January 10, 2007 and there were 27 fish killed as the plant dropped power for the refueling outage. In March 2009 and March 2011 a total of 170 and 68 fish were killed, respectively, as the plant dropped power for a refueling outage. Even before installation of the fish barrier-weir, the 316(a) demonstration (Ref. 6) concluded that cold shock mortality did not appear to adversely affect the fish community near the MNGP.

Installation of the fish barrier-weir in 1980 was assumed to have altered the configuration of the thermal plume. Consequently, from 1982 through 1987, temperature surveys were conducted over a six-kilometer reach below MNGP and at upstream control areas on a seasonal basis. During the worst-case year of 1983, the plume reached approximately six kilometers downstream. Excess temperatures (above ambient) during winter in the main body of the plume ranged from 26°F just below the discharge to 12°F six kilometers downstream at the State Highway 25 Bridge. However, the main body of the plume was confined to the right (south) bank of the river and rarely spanned the entire river. Depending on conditions and location, from 30 to 70 percent of the river was always generally unaffected by the thermal plume.

One of the most valuable tools for assessing the effects of the MNGP thermal plume on the river is the fishery monitoring database compiled by NSP since the mid-1970s. This database contains a more than 30-year annual record of electrofishing and seining results both up- and downstream of the MNGP site. Electrofishing catches from 2004 through 2007 (Ref. 23) were dominated by

shorthead redhorse, silver redhorse, common carp and smallmouth bass with lesser numbers of channel catfish, and other species. Minnows dominated the seine catches, primarily spotfin shiner and sand shiner. Changes noted in the fish community have been unrelated to the MNGP thermal discharge, such as the invasion of channel catfish in the late 1980s and subsequent growth of the population. Electrofishing catches from 2010 – 2011 show a similar species composition (Ref. 32). Examination of the annual fish monitoring data confirms that a "balanced, indigenous community" of fish has been maintained in the river throughout the operational period of MNGP.

Cold shock can be caused by plant shutdown in the winter, and the probability of a plant shutdown is independent of extended power uprate. The projected increase in discharge canal inlet temperature of 4.5°F at extended power uprate conditions will not result in a significant increase in the overall discharge canal temperature, and the magnitude of the temperature decrease in a cold shock situation is not significantly changed. The cold shock concerns of aquatic river species have been reduced by the construction of a weir at the end of the discharge canal. The weir and the traveling screens limit the amount of aquatic species in the discharge canal and reduce the effects of cold shock on aquatic species in the discharge canal. In addition, administrative procedures for controlled temperature reduction of the discharge canal are in place to minimize thermal shock to the aquatic biota. The consequences of a cold shock event have been reduced at present and these practices will be continued under extended power uprate operating conditions.

6.2.8 Impingement and Entrainment

MNGP uses a once-through cooling water system in combination with two mechanical draft cooling towers, enabling the plant to operate in various modes. Operating experience indicates that historically MNGP operates in open or helper cycle approximately 98 percent of the time.

Section 316(b) of the Clean Water Act requires any standard established pursuant to 301 or 306 shall require the location, design, construction, and capacity of cooling water intake structures to reflect the best technology available for minimizing adverse environmental impacts [33 USC 1326 (b)]. Entrainment of fish and shellfish in the early life stages through the condenser cooling system is one of the potential adverse environmental impacts that can be minimized by the use of the best available technology.

A 316(b) demonstration was developed and submitted to the MPCA (Ref. 4). The demonstration was ultimately accepted and approved by the MPCA in September 1979, with the conclusion that entrainment at MNGP "... offers no substantial detriment to the fisheries population." Electrofishing surveys to assess relative abundance and seasonal distribution of fish in response to MNGP's thermal discharge have been conducted from 1976 to the present. Areas of the River sampled extended about 1.5 kilometers both up and downstream from the discharge structure, with the thermal plume generally covering less than one-half of the downstream flow of the study area. Results show similar, persistent, and stable species assemblages both up and downstream of the discharge (Ref. 23). Based on these studies and the fact that water appropriation will not increase under EPU, NSPM concludes that impacts to fish populations as a result of entrainment is not altered under EPU conditions.

Upon review of the 316(b) demonstration, the MPCA concurred that impingement at MNGP "... offer no substantial detriment to the fisheries population". Based upon the same studies discussed above for entrainment, and the fact that water appropriation will not increase under EPU, NSPM concludes that impacts to fish populations as a result of impingement is not impacted by operation at extended power uprate conditions.

The current MNGP NPDES Permit addresses 316(b) compliance. It states that MNGP "shall operate the intake structures consistent with Section 316(b) of the Clean Water Act and consistent with the MPCA-approved 1978 report "Section 316(b) demonstration for the Monticello Nuclear Generating Plant..." The reissued permit has a requirement that MNGP submit the results of an impingement mortality and entrainment sampling effort to the MPCA within one year of permit reissuance. The NPDES Permit further states that "If MPCA review of the evaluation data leads to the conclusion that the facility needs to install technology or modify operations to reduce impingement mortality and/or entrainment the permit may be reopened to include a compliance schedule developed using best professional judgment."

Extended power uprate does not effect the impingement and entrainment of organisms and will not cause effects that have not been previously evaluated. The circulating water and service water system flow rates are not being changed for EPU. Therefore, no increase in entrainment of organisms or impingement of fish is anticipated at extended power uprate conditions above that for present operating conditions. Since initial operation, the Company has modified the MNGP intake structure to reduce impingement impacts. These modifications include a dedicated sluiceway for the traveling screen backwash system to allow aquatic species impinged on the screens to be returned to the river during backwash cycles to minimize impingement mortality. The practice of backwashing of the traveling screens to the river when river temperature is above 50°F has also reduced the potential for organism impingement mortality.

The NRC Staff estimated that operation of MNGP at average river flows and intake flows of 640 cfs may entail a possible mortality rate of up to 15 percent of passing drift organisms through entrainment (Summary and Conclusions, Ref. 2). Studies at MNGP, conducted during low flow conditions before the modifications above were implemented, indicate an entrainment rate of 19 percent of the total drift organisms. Because of the study year bias due to low flow conditions, the NRC Staff's estimate on mortality is consistent with plant operating data. Because there will be no increase in river water appropriation, extended power uprate has no effect on the entrainment rate associated with present operating conditions.

7.0 RADIOLOGICAL ENVIRONMENTAL IMPACT

7.1 Radioactive Waste Streams

The radioactive waste systems at MNGP are designed to collect, process, and dispose of radioactive wastes in a controlled and safe manner. The design bases for these systems during normal operation is to limit discharges in accordance with 10 CFR 20 and to satisfy the design objectives of Appendix I to 10 CFR 50 (Section 9 of Ref. 7). These limits and objectives will continue to be adhered to under extended power uprate.

In addition, operation at extended power uprate conditions does not result in any changes in the operation or design of equipment in the solid waste, liquid waste, or gaseous waste systems. The safety and reliability of these systems is unaffected by extended power uprate. Extended power uprate does not affect the environmental monitoring of any of these waste streams, and the radiological monitoring requirements of the MNGP Technical Specifications will not be affected. Extended power uprate does not introduce any new or different radiological release pathways and does not increase the probability of an operator error or equipment malfunction that would result in an uncontrolled radioactive release. The specific effects of extended power uprate on each of the radioactive waste systems are evaluated below.

7.1.1 Solid Waste

NSPM continually tracks the volume of solid radwaste generated at MNGP. Significant volume reductions have occurred over the years. In the 1994-95 timeframe, approximately 50 cubic meters/year was shipped. For calendar years 2001 through 2006, the average volume of solid radwaste (spent resin, filter sludge, evaporator bottoms, etc.) shipped per year was less than 20 cubic meters. From 2007 to 2011, the average volume of solid radwaste shipped per year was approximately 16.6 cubic meters. The increased volume of resins due to power uprate (estimated at approximately 3 cubic meters/year) could be accommodated in one additional truck shipment per year.

The bulk volume of total solid radwaste shipped from MNGP (in addition to the spent resin, filter sludge, evaporator bottoms, etc.) consists of dry compacted waste, contaminated equipment, etc. This portion of the solid radwaste volume is not directly impacted by power uprate on an ongoing basis but is a factor of the amount and types of housekeeping, maintenance and modification activities performed in the plant. There will likely be a temporary increase in these volumes due to the modifications and equipment replacements in support of power uprate. However, MNGP procedures and practices remain committed to a goal of minimizing the volume of solid radwaste that is created and ultimately requires shipment.

Equipment wastes from operational and maintenance activities, chemical wastes, and reactor system wastes also contribute to solid waste generation. Power uprate does not significantly affect the production or type of equipment and chemical wastes. The effect of power uprate on process wastes and reactor system wastes is evaluated below.

A. Process Wastes

Power uprate conditions will involve small increases in the process wastes generated from operation of the Reactor Water Cleanup (RWCU) filter/demineralizers and the condensate demineralizers.

The changeout limits for the RWCU filter/demineralizers are based on differential pressure and effluent chemistry. It is expected that more frequent RWCU backwashes will occur at power uprate conditions due to chemistry limits. Power uprate will not involve changes in RWCU filter performance. NSPM determined that the increase in backwashes for RWCU would likely be less than or equal to 5 total backwashes per year. RWCU flow rate has been increased by 12.5%.

The changeout limits for condensate demineralizer operation are based on differential pressure and conductivity. The principal power uprate effect on the Condensate Demineralizer System is increased condensate flow. A consequent result of increased condensate flow is that the vessel differential pressure changeout limit will be reached more frequently. Without modification, it is expected that the spent resin generation from condensate demineralizers will increase. It is estimated that the Condensate Demineralizers will require approximately 15 additional backwashes per year.

The slight increases in solid wastes from the processes above (estimated at approximately 3 cubic meters/year) will not result in waste volumes substantially above present levels.

B. Reactor System Wastes

Reactor system wastes will increase slightly due to operation at power uprate conditions. These wastes are currently stored in the spent fuel pool and are not shipped offsite. An Independent Spent Fuel Storage Installation (ISFSI) has been constructed onsite at MNGP and spent fuel was first stored there on September 9, 2008. It is estimated that the number of irradiated fuel assemblies discharged from the reactor will increase from a nominal 150 assemblies/cycle to approximately 170 assemblies/cycle under power uprate conditions. These additional assemblies will be stored in the existing spent fuel pool and ISFSI facility and therefore the environmental impact will be insignificant.

The volume and activity of waste generated from spent control blades and in-core ion chambers may increase slightly under the higher flux conditions associated with power uprate conditions.

The annual environmental impact of low and high level solid wastes has been generically evaluated by the NRC Staff for a 1000 MWe reference reactor. The estimated activity content of these wastes is given by Table S-3 in 10 CFR 51.52. The evaluation with respect to this table is included in Section 8.1 of this report.

Given the arguments above, the environmental impact due to generation of solid radwaste from power uprate conditions is insignificant.

7.1.2 Liquid Radwaste

Although the Company is authorized to discharge liquid radwaste at MNGP per the FES and the Technical Specifications, the Company has administratively operated Monticello as a zero radioactive liquid release plant since 1972. No change is expected in the zero release policy as a result of power uprate.

The annual liquid volume processed by the Liquid Radwaste System is estimated to increase from approximately 11,000 gals/day to 11,250 gals/day partially due to the increased frequency of RWCU filter/demineralizer and Condensate Demineralizer backwashes as a result of power uprate. This increased frequency is estimated to add approximately 91,000 gallons/year, or about 250 gallons/day. This increase is less than two percent of overall system capacity

and brings the total useage to about 55 percent of system capacity. In addition, because of the zero liquid radwaste discharge at MNGP, this slight increase in input to the liquid radwaste system will be recycled, not discharged, and therefore will not produce any environmental impact.

Power uprate conditions will not result in significant increases in the volume of fluid from other sources to the Liquid Radwaste System. The reactor will continue to be operated within its present pressure control band. Valve packing leakage volume into the liquid radwaste system is not expected to increase. There will be no changes in reactor recirculation pump seal flow or any other normal equipment drain path. In addition, there will be no impact to the Dirty Radwaste, Chemical Waste, or Laundry Waste subsystems of the Liquid Radwaste System as a result of power uprate since the operating modes and the inputs to these subsystems are independent of power uprate.

With the current low waste generation rate at MNGP and the insignificant effect of power uprate on liquid radwaste generation, it is reasonable to conclude that power uprate will not increase liquid radwastes above presently allowed limits. In addition, power uprate will not affect compliance with the limits of 10 CFR 20 or the guidelines of Appendix I to 10 CFR 50 for liquid effluents at MNGP.

7.1.3 Gaseous Wastes

During normal operation, radioactive gaseous effluents are released through the Reactor Building Ventilation System and the Off-Gas System pathways. These effluents include small quantities of noble gases, halogens, particulates, and tritium. The dose to individuals from normal gaseous effluent releases at MNGP at the current licensed thermal power level are well within the guidelines of 10 CFR 50 Appendix I and the limits of 10 CFR 20 for all airborne radioactive nuclides. The effluent radioactivity, in curies, of noble gases, iodine, and particulates discharged from MNGP has been reduced steadily and is significantly below discharges during initial operating conditions. Power uprate is expected to increase the production and activity of gaseous effluents approximately 13 percent. This increase is well within regulatory limits.

The gaseous radioactivity of the reactor coolant system is, in part, a function of the extent of fuel defects; the causes of which are independent of power uprate. MNGP has had a good history with respect to nuclear fuel performance. During the past 40 years of plant operation only five fuel rod defects have occurred. One defect was identified in 1989 and was attributed to a manufacturing problem. Three end-of-cycle defects were identified in 1987 and 1989. Since these failures were found during ISFSI activities and the fuel designs are obsolete, there was no additional investigation of the cause of failure.

The other defect was detected in late 2007 and was managed through applicable core management and power suppression techniques. This defect was removed in the 2009 refueling outage and inspection narrowed down the cause to foreign material or a manufacturing defect.

Table 7.1.3-1 presents the gaseous releases from MNGP for the years 2001 through 2011. Table 7.1.3-2 presents the resulting radiation dose assessments for the same time period.

Given the above, it is reasonable to conclude that the effect of power uprate (approximate 13 percent increase) on gaseous radioactive effluents is negligible, and that continued compliance with the release limits of 10 CFR 20 and the design objectives of Appendix I to 10 CFR 50 is maintained with significant margin.

7.2 Radiation Levels and Offsite Dose

7.2.1 Operating and Shutdown In-Plant Radiation

The cycle annual average dose at Monticello has ranged between 107 rem and 146 rem over the last five cycles (from approximately January 2002 to June 2011). Extended power uprate will involve an increase in radiation levels.

MNGP was conservatively designed with respect to shielding and radiation sources. In the shielding analysis, the analytical assumptions for reactor water fission product concentrations and corrosion products are 8 μCi/cc and 0.07 μCi/cc respectively. The plant's administrative limit on total reactor water gamma activity for corrosion products is 0.5 μCi/ml. The gross alpha activity limit is 1E-6 μCi/ml. With expected operating increases in operating activity proportional to the proposed power increase, the design shielding assumptions remain bounding with significant margin at extended power uprate conditions.

Table 7.2.1-1 summarizes the exposure history for MNGP from 1990 through 2011.

In general, radiation levels and dose rates are estimated to increase in proportion to the increase in power level (i.e., approximately 13%). Dose reduction programs will continue to address the increases in individual doses due to extended power uprate. The plant radiation protection program will be used to maintain individual doses consistent with ALARA policies and well below the established limits of 10 CFR 20. Routine plant radiation surveys required by the radiation protection program will identify increased radiation levels in accessible areas of the plant and radiation zone postings will be adjusted if necessary. Time within radiation areas is controlled under the radiation protection program. Administrative dose control limits are established well below regulatory criteria and provide significant margin to that allowed by regulatory dose limits. Administrative dose limits are not routinely exceeded under present power conditions.

ENCLOSURE 5

Table 7.1.3-1
Radioactive Effluent Releases from 2001 through 2011

Source: Annual Radioactive Effluent Release Reports for MNGP		Gaseous Effluents				Iodines, Particulates, and Tritium	Liquid Effluents	
		Total Release	Release Rate	Percent Tech Spec Reporting Level		Percent Tech Spec Reporting Level	Percent Tech Spec Reporting Level	
				Gamma	Beta		Whole Body	Organ
Quarter	Year	Ci	micro-Ci/sec	%	%	%	%	%
1Q	2001	2.98E+01	3.84E+00	2.83E-02	1.57E-02	6.14E-02	0.00E+00	0.00E+00
2Q	2001	5.67E+01	7.21E+00	2.71E-02	1.27E-02	7.41E-02	2.13E-04	9.76E-05
3Q	2001	4.09E+01	5.15E+00	9.21E-03	2.83E-03	9.25E-02	0.00E+00	0.00E+00
4Q	2001	1.14E+02	1.43E+01	6.06E-02	7.32E-03	4.90E-02	1.50E-05	1.09E-05
1Q	2002	1.06E+02	1.36E+01	3.76E-02	8.30E-03	6.26E-02	0.00E+00	0.00E+00
2Q	2002	4.78E+01	6.07E+00	1.53E-02	3.58E-03	9.17E-02	0.00E+00	0.00E+00
3Q	2002	3.77E+01	4.74E+00	1.11E-02	2.79E-03	9.49E-02	0.00E+00	0.00E+00
4Q	2002	3.54E+01	4.45E+00	9.63E-03	2.28E-03	6.84E-02	0.00E+00	0.00E+00
1Q	2003	4.93E+01	6.34E+00	4.01E-02	2.62E-02	8.82E-02	0.00E+00	0.00E+00
2Q	2003	3.10E+02	3.94E+01	1.93E-01	2.22E-02	1.03E-01	1.08E-04	3.90E-05
3Q	2003	1.04E+03	1.31E+02	7.00E-01	5.55E-02	7.14E-02	0.00E+00	0.00E+00
4Q	2003	8.87E+02	1.12E+02	6.04E-01	6.18E-02	5.39E-02	0.00E+00	0.00E+00
1Q	2004	8.44E+02	1.08E+02	5.62E-01	5.20E-02	5.68E-02	0.00E+00	0.00E+00
2Q	2004	4.54E+02	5.77E+01	2.92E-01	3.51E-02	6.41E-02	0.00E+00	0.00E+00
3Q	2004	3.54E+01	4.46E+00	1.68E-02	4.90E-03	6.60E-02	0.00E+00	0.00E+00
4Q	2004	3.72E+01	4.68E+00	1.71E-02	8.32E-03	9.54E-02	1.29E-08	3.88E-09
1Q	2005	3.34E+01	4.21E+00	1.96E-02	8.45E-03	2.28E-02	0.00E+00	0.00E+00
2Q	2005	4.21E+01	3.69E+00	2.05E-02	9.03E-03	1.04E-02	0.00E+00	0.00E+00
3Q	2005	3.85E+01	4.95E+00	2.32E-02	9.59E-03	7.70E-02	0.00E+00	0.00E+00

ENCLOSURE 5

Source: Annual Radioactive Effluent Release Reports for MNGP		Gaseous Effluents				Iodines, Particulates, and Tritium	Liquid Effluents	
		Total Release	Release Rate	Percent Tech Spec Reporting Level		Percent Tech Spec Reporting Level	Percent Tech Spec Reporting Level	
				Gamma	Beta		Whole Body	Organ
Quarter	Year	Ci	micro-Ci/sec	%	%	%	%	%
4Q	2005	2.46E+01	3.13E+00	1.20E-02	2.84E-03	2.38E-02	0.00E+00	0.00E+00
1Q	2006	2.60E+01	3.35E+00	9.04E-03	1.64E-03	1.01E-02	0.00E+00	0.00E+00
2Q	2006	3.34E+01	4.25E+00	9.85E-03	1.68E-03	1.21E-02	0.00E+00	0.00E+00
3Q	2006	3.48E+01	4.37E+00	9.99E-03	1.89E-03	1.31E-02	0.00E+00	0.00E+00
4Q	2006	3.70E+01	4.66E+00	1.15E-02	3.97E-03	1.60E-02	0.00E+00	0.00E+00
1Q	2007	3.77E+01	4.85E+00	2.52E-02	5.40E-02	3.22E-2	0.00E+00	0.00E+00
2Q	2007	2.04E+01	2.59E+00	7.99E-03	1.26E-03	1.60E-02	1.16E-03	1.16E-03
3Q	2007	3.05E+01	3.84E+00	9.20E-03	3.01E-03	2.89E-02	0.00E+00	0.00E+00
4Q	2007	1.10E+02	1.38E+01	1.92E-02	5.41E-03	1.79E-02	0.00E+00	0.00E+00
1Q	2008	1.43E+02	1.84E+01	6.43E-02	2.34E-02	1.34E-01	0.00E+00	0.00E+00
2Q	2008	2.54E+02	3.23E+01	1.15E-01	3.89E-02	3.69E-01	0.00E+00	0.00E+00
3Q	2008	2.65E+02	3.34E+01	1.34E-01	3.83E-02	5.35E-01	0.00E+00	0.00E+00
4Q	2008	3.97E+02	5.00E+01	3.07E-01	8.06E-02	1.00E+00	0.00E+00	0.00E+00
1Q	2009	4.35E+02	5.60E+01	1.88E-01	4.56E-02	8.63E-01	0.00E+00	0.00E+00
2Q	2009	3.07E+02	3.90E+01	1.59E-01	4.41E-02	2.30E-01	0.00E+00	0.00E+00
3Q	2009	3.88E+02	4.88E+01	2.12E-01	5.60E-02	2.65E-01	0.00E+00	0.00E+00
4Q	2009	3.73E+02	4.69E+01	2.02E-01	5.38E-02	3.35E-01	2.14E-08	6.42E-09
1Q	2010	3.83E+02	4.93E+01	1.62E-01	4.92E-02	4.20E-01	0.00E+00	0.00E+00
2Q	2010	3.56E+02	4.53E+01	1.47E-01	4.74E-02	5.08E-01	0.00E+00	0.00E+00
3Q	2010	3.98E+02	5.01E+01	1.85E-01	5.35E-02	5.03E-01	0.00E+00	0.00E+00
4Q	2010	3.47E+02	4.36E+01	1.53E-01	4.20E-02	6.61E-01	0.00E+00	0.00E+00
1Q	2011	2.80E+02	3.57E+01	1.13E-01	3.04E-02	8.13E-01	0.00E+00	0.00E+00

ENCLOSURE 5

Source: Annual Radioactive Effluent Release Reports for MNGP		Gaseous Effluents				Iodines, Particulates, and Tritium	Liquid Effluents	
		Total Release	Release Rate	Percent Tech Spec Reporting Level		Percent Tech Spec Reporting Level	Percent Tech Spec Reporting Level	
				Gamma	Beta		Whole Body	Organ
Quarter	Year	Ci	micro-Ci/sec	%	%	%	%	%
2Q	2011	1.82E+02	2.32E+01	1.14E-01	4.89E-02	2.70E-01	0.00E+00	0.00E+00
3Q	2011	2.81E+02	3.53E+01	1.30E-01	1.61E-01	4.57E-01	0.00E+00	0.00E+00
4Q	2011	2.15E+02	2.70E+01	1.08E-01	2.69E-02	4.82E-01	0.00E+00	0.00E+00
Averages		2.18E+02	2.76E+01	1.20E-01	2.87E-02	2.12E-01	3.40E-05	2.97E-05
Tech Spec Reporting Limits				5.00E+00	1.00E+01	7.50E+00	1.50E+00	5.00E+00
				mrad/qtr	mrad/qtr	mrem/qtr to any organ	mrem/qtr	mrem/qtr to any organ

Table 7.1.3-2
Radiation Dose Assessments from 2001 through 2011

Source: Annual Radioactive Effluent Release Reports for MNGP	10 CFR 50 Appendix I Limits								10 CFR 20		
	10	20	15	5	15	15	3	10	100		
	Gaseous Releases						Liquid Releases		Gaseous Releases		
	Max Site Boundary Gamma		Organ	Maximum Dose to Most Likely Exposed Member of General Public			Max Offsite Dose		Max Dose to Individuals due to Activities Inside Site Boundary		
	Gamma	Beta		Whole Body	Skin	Thyroid	Whole Body	Organ	Whole Body	Thyroid	Max Organ (Skin)
	mrad/yr	mrad/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem	mrem	mrem	mrem	mrem
2001	3.00E-03	4.00E-03	1.10E-02	6.00E-03	7.00E-03	1.10E-02	1.61E-05	1.72E-04	1.20E-02	1.40E-02	1.50E-02
2002	1.00E-03	2.00E-03	1.40E-02	6.00E-03	8.00E-03	1.40E-02	0.00E+00	0.00E+00	1.40E-02	1.80E-02	1.60E-02
2003	2.20E-02	1.70E-02	4.70E-02	3.90E-02	7.30E-02	4.70E-02	2.45E-07	5.55E-07	2.00E-02	3.00E-02	3.00E-02
2004	1.30E-02	1.00E-02	3.70E-02	2.20E-02	3.70E-02	3.70E-02	1.94E-10	1.94E-10	9.00E-03	1.10E-02	9.00E-03
2005	3.00E-03	3.00E-03	2.50E-02	1.60E-02	2.50E-02	2.50E-02	0.00E+00	0.00E+00	1.50E-02	1.60E-02	1.90E-02
2006	1.00E-03	1.00E-03	1.40E-02	8.00E-03	6.00E-03	9.00E-03	0.00E+00	0.00E+00	8.00E-03	8.00E-03	1.00E-02
2007	9.00E-04	1.00E-03	1.05E-02	7.00E-03	7.00E-03	1.05E-02	2.90E-03	5.92E-03	1.50E-02	2.30E-02	1.70E-02
2008	1.90E-02	1.80E-02	8.40E-02	3.60E-02	3.50E-03	8.40E-02	0.00E+00	0.00E+00	3.80E-02	6.40E-02	4.80E-02
2009	1.95E-02	2.07E-02	6.24E-02	3.62E-02	2.54E-02	6.24E-02	3.21E-10	3.21E-10	3.57E-02	5.02E-02	4.40E-02
2010	1.53E-02	2.12E-02	1.15E-01	4.46E-02	3.150E-02	1.15E-01	0.00E+00	0.00E+00	1.39E-02	1.78E-02	1.92E-02
2011	1.18E-02	1.24E-02	1.25E-01	3.59E-02	5.30E-02	1.25E-01	0.00E+00	0.00E+00	2.42E-02	3.10E-02	3.00E-02
Averages	9.53E-03	1.00E-02	4.95E-02	2.33E-02	2.80E-02	4.91E-02	2.65E-04	5.54E-04	1.86E-02	2.57E-02	2.34E-02

Table 7.2.1-1
MNGP Exposure History (in REM)

	Operation	Refueling Outage	Total
1990	94	0	94
1991	94	371	465
1992	114	0	114
1993	66	429	496
1994	78	321	395
1995	44	0	44
1996	71	169	240
1997	106	0	106
1998	47	162	209
1999	70	0	70
2000	40	176	216
2001	55	166	221
2002	40	0	40
2003	49	120	169
2004	35	0	35
2005	26	149	175
2006	33	0	33
2007	31	160	191
2008	44	0	44
2009	38	136	174
2010	56	0	56
2011	24	213	237

7.2.2 Offsite Doses at Extended Power Uprate Conditions

For extended power uprate, normal operational gaseous activity levels may increase slightly. The increase in activity levels is generally proportional to the percentage increase in core thermal power. This slight increase does not affect the large margin to the offsite dose limits established by 10 CFR 20. Doses from liquid effluents are currently zero and are expected to remain zero under extended power uprate conditions.

The Monticello Technical Specifications implement the guidelines of 10 CFR 50 Appendix I which are well within the 10 CFR 20 limits.

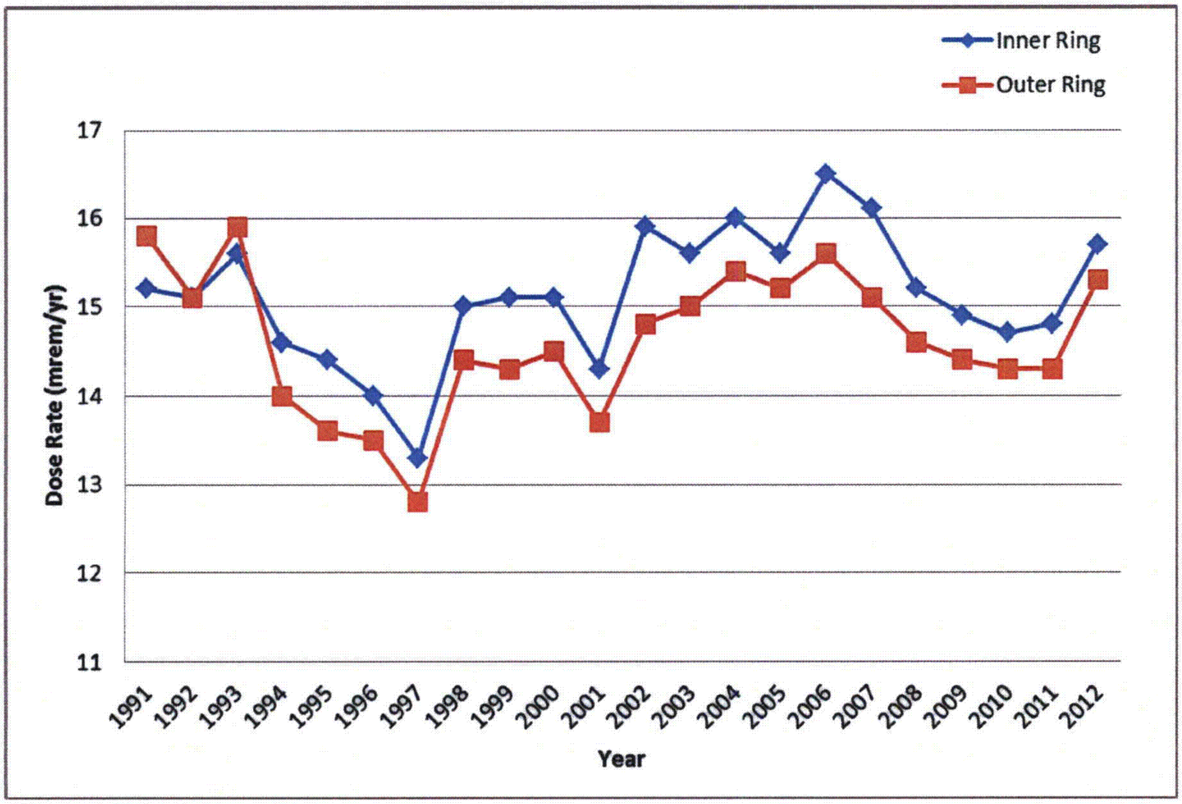
Table 7.1.3-2, previous, contains the results of the dose assessment for 2001-2011. An increase of approximately 13 percent for extended power uprate operation remains a very small fraction of the reporting limits.

Table 7.2.2-1 and Figure 7.2.2-1 present the ambient gamma radiation data for MNGP for the years 1991-2012. The conclusion from that data is that no plant effect on ambient gamma radiation is indicated.

Table 7.2.2-1
Ambient Gamma Radiation as Measured by Thermoluminescent Dosimetry, Average Quarterly Dose Rates, Inner vs. Outer Ring Locations

Year	Inner Ring	Outer Ring
	Dose rate (mRem/qtr)	
1991	15.2	15.8
1992	15.1	15.1
1993	15.6	15.9
1994	14.6	14
1995	14.4	13.6
1996	14	13.5
1997	13.3	12.8
1998	15	14.4
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7
2002	15.9	14.8
2003	15.6	15
2004	16	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1
2008	15.2	14.6
2009	14.9	14.4
2010	14.7	14.3
2011	14.8	14.3
2012	15.7	15.3
Average	15.12	14.62

Figure 7.2.2-1
Ambient Gamma Radiation as Measured by Thermoluminescent Dosimetry, Average Quarterly Dose Rates, Inner vs. Outer Ring Locations



7.2.3 Ground Water Monitoring Program

NSPM implemented a ground water monitoring program as part of the Radiological Environmental Monitoring Program (REMP). Eight on-site monitoring wells are routinely sampled and analyzed to ensure that radioactive contamination is not impacting ground water. Reactor-produced contamination has not been identified in any ground water samples. Operation at EPU power levels is not expected to impact these results.

7.2.4 Radiation Levels and Offsite Doses - Conclusion

Extended power uprate does not involve significant increases in offsite dose from noble gases, airborne particulates, iodine, or tritium. Radioactive liquid effluents are not routinely discharged from MNGP. In addition, radiation from shine from extended power uprate conditions will have only a minimal impact on measured dose rates offsite.

Extended power uprate does not create any new or different sources of offsite dose from MNGP operation, and extended power uprate does not involve

significant increases in present radiation levels. Therefore, it is reasonable to conclude that under extended power uprate conditions, offsite dose will remain well within regulatory criteria with no significant environmental impact.

7.3 Radiological Consequences of Accidents

Section VI of the Final Environmental Statement (FES) identifies nine classes of postulated accidents at MNGP that were evaluated by the NRC Staff to determine the associated environmental impact. "Accidents," in this context, includes those accidents evaluated for environmental consequences by the NRC Staff in addition to design basis accidents contained in the MNGP Final Safety Analysis Report (FSAR).

The NRC Staff used information provided by the Company in Section 10 and Appendix C of the MNGP Environmental Report (Ref. 1) to determine the associated environmental impacts. According to Section 3 of Ref. 1, the radiological effects determination is conducted utilizing reasonable assumptions, justifiable calculation models and techniques, and realistic assessments of environmental effects. The following discussion addresses the impact of extended power uprate on the assumptions and conclusions for the environmental accident classes. Comparisons are made, where applicable, with the accident analyses previously submitted by the Company in the MNGP Environmental Report. Note that MNGP has implemented the full-scope alternative source term methodology (Ref. 24). As such, comparisons are made for the events within the scope of that methodology.

7.3.1 Class 1 - Small Leaks Inside Containment

In accordance with AEC guidance for environmental reports at the time, Class 1 accidents were not considered within the scope. These accidents are initiated by small spills and leaks below the Technical Specification limits inside the primary containment or secondary containment. These leaks are bounded by those analyzed under Class 8 - LOCA Inside or Outside Containment. The NRC Staff considered that an incident of this type would cause releases that are commensurate with routine effluents (Section VI of Ref. 2). EPU evaluations regarding reactor coolant radiation sources indicate that total activity levels are less than 20 percent of the MNGP design basis for reactor water fission products and less than 50 percent of the MNGP design basis for activated corrosion products.

7.3.2 Class 2 - Miscellaneous Small Leaks Outside Containment

The postulated Class 2 accident is a continuous steam leak equivalent to a 7 gpm leak on the turbine building floor that releases through the turbine building roof vent. Extended power uprate does not increase the probability of occurrence or severity of this event. The turbine building vents were permanently secured subsequent to initial operation, and turbine exhaust air is processed through the reactor building ventilation system.

At extended power uprate conditions, the activity concentration of the reactor coolant will not increase above the assumptions used by the NRC Staff in the original analyses. These analyses assumed a coolant activity inventory of 0.2 μCi/cc to determine radiological effects (Section 10.b(2)(b) of Ref. 1). EPU

evaluations regarding reactor coolant radiation sources indicate that total activity levels are less than 20 percent of the MNGP design basis for reactor water fission products and less than 50 percent of the MNGP design basis for activated corrosion products. Specifically, total fission product activity concentration in reactor water is 0.13 μCi/cc and the total non-coolant activation product activity concentration in reactor water is 0.029 μCi/cc at EPU conditions. Consequently, the dose conclusions of Table VI-2 of the FES for Class 2 accidents remain bounding for extended power uprate, and the radiological consequences of these accidents are not increased.

7.3.3 Class 3 - Radwaste System Failures

Class 3 accidents are included in Table VI-2 of the FES. Class 3.1 radwaste system failures are due to a single operator error or single equipment malfunction (Section 2.2 of Appendix C to Ref. 1). The Company selected two events to represent Class 3.1. These are 1) a liquid radwaste discharge-operator error, and 2) a gaseous waste discharge drain line failure. These accidents were chosen because these particular events were considered most probable (Section 7.0 of Appendix C to Ref. 1).

The NRC Staff included a Release of Waste Gas Storage Tank Contents Accident (Class 3.2) and a Release of Liquid Radwaste Storage Tank (Class 3.3) in Class 3. The Company analyzed these events as Class 8 accidents because of low probability (Sections 12.4 and Sections 12.5 of Appendix C to Ref. 1 respectively). These accidents will be addressed as Class 3 accidents herein to conform to the NRC Staff's determination.

A. Class 3.1 Equipment Leakage or Malfunction

1. Liquid Radwaste Discharge

Section 7.1 of Appendix C to the Environmental Report (Ref. 1) describes the assumptions used in postulating this event. The release is the result of an inadvertent pumping of the floor drain sample tank containing 0.7 Ci to the discharge canal for 20 minutes. The event is initiated by one of the following three single operator errors.

The operator commences pumping without taking a batch sample.

A batch sample is incorrectly analyzed prior to discharge.

The operator pumps the wrong tank.

From the above, it can be deduced that this accident was postulated because liquid radwaste discharges were expected to be performed routinely. However, evolutionary changes to the liquid radwaste system and changes in NSP's liquid radwaste discharge policies make this event extremely unlikely for current power and extended power uprate operating conditions. Liquid radwaste discharge is not routinely performed at MNGP. The plant is administratively operated as a zero radioactive liquid discharge plant. Operators have not discharged liquid radwaste to the

canal for 35 years. Inadvertent pumping of liquid radwaste would require an implausible sequence of events involving multiple operator errors and malicious disregard for a variety of administrative controls. A procedure to pump liquid radwaste to the discharge canal, which does not currently exist and would likely be created for a one-time occurrence, would have to be developed and approved by a variety of environmental authorities. Operators are not authorized to perform evolutions without a valid procedure. The liquid radwaste discharge valve in the plant is a manual valve that is maintained shut. A sign at the valve warns the operator that management permission is required for operation. Additional manual valves in the discharge line are shut.

The above accident is initiated by an operator error. The offsite dose consequences of a liquid radwaste equipment failure or operator error are bounded by a tank release. The radiological consequences of discharging the entire contents of the floor drain sample tank have been analyzed and found to be well within the limits of 10 CFR 50 Appendix I. See Section 7.3.3.C below.

Given the above, the probability of this postulated environmental accident under extended power uprate conditions is significantly less than that assumed at initial licensing and would require multiple operator errors to occur.

2. Gaseous Radwaste Discharge

Section 7.2 of Appendix C to the Environmental Report (Ref. 1) describes the assumptions used in postulating this event. The release is the result of a loss of a drain line water seal. A modification to the Offgas System removed these water seals such that gaseous effluents are hard-piped and positively contained within closed drain tanks. Consequently, the probability of a malfunction of this type is significantly reduced at present and extended power uprate conditions because a release of this type would require a passive Offgas System pressure boundary failure instead of a single equipment failure.

Because of modifications made to the MNGP Offgas System since initial operation, it is difficult to directly analyze this postulated accident under extended power uprate conditions. These changes were described to the NRC Staff by several letters. See Section 2.1.1 of Ref. 13. For an updated system description, see Section 9.3 of the MNGP USAR (Ref. 7).

To the extent that a comparison can be made, the activity concentrations at extended power uprate are well bounded by the assumptions used in the original analyses. The original analyses assumed a normal offgas release rate of 25,000 μCi/sec whereas the EPU evaluation is indicating an average gaseous effluent release rate for the years 2001-2011 of 27.6 μCi/sec (which can be expected to increase proportionally to the EPU power increase, i.e., approximately 13 percent). Consequently, the dose conclusions of Table VI-2 of the FES for equipment failures remain

bounding for extended power uprate, and the radiological consequences of this accident are not increased.

Gaseous waste discharges due to operator errors were not specifically analyzed by the Company in the original Environmental Report. Two MNGP technical specification limits incorporated after the issuance of the Final Environmental Statement address this issue. The offgas storage tank gross activity limit of 22,000 Ci (Xe-133 equivalent, MNGP Technical Specification 5.5.7) is based on limiting the offsite dose following an operator error that results in an inadvertent release of one decay tank after 12 hours of decay. A typical value for this parameter at current power levels is about eight (8) Ci. Extended power uprate will not involve significant increases in storage tank activity, and a large margin to the limit will be maintained. A separate technical specification limits the maximum activity at the steam jet air ejector (≤ 260 mCi/sec at 30 minutes, Technical Specification 3.7.6) to limit dose within regulatory criteria due to exposures from inadvertent discharges. From the discussion in the preceding paragraphs it is apparent that operation at extended power uprate will not involve significant increases in offgas activity above present levels, and significant margin to this limit will be maintained.

Gaseous waste accidents initiated by single operator errors or equipment failures are bounded by the multiple tank release analysis. See Section B below.

B. Class 3.2 Release of Waste Gas Storage Contents

Section 12.5 of Appendix C to Ref. 1 describes this accident. The accident is the result of a hydrogen ignition in the holdup volume. The probability of this accident is significantly less likely since NSP has installed offgas recombiners in the Air Ejector Offgas System. See Section 9.3.3.4, Hydrogen Explosion, of the MNGP USAR (Ref. 7) for a description and analysis.

The hydrogen handling design of the augmented offgas system has been reviewed and approved by the NRC Staff (Ref. 15). The offgas system is designed to withstand the pressure from a hydrogen detonation. Loss of dilution steam results in a recombiner train shutdown. In addition, hydrogen is monitored, and automatic shutdowns occur well before potentially explosive hydrogen concentrations are reached. An explosion in the recombiner could cause a release via the recombiner's hydrogen analyzer equipment. This release has been analyzed and was found to be within limits. The analyzer release is bounded by the multiple tank failure accident described below.

The Offgas System has been designed to prevent an explosive mixture from propagating beyond the recombiner system. In 1973, the NRC Staff evaluated the effects of an offgas tank failure for the augmented offgas system. By Section 6.1 of the safety evaluation for the full term operating license (Ref. 13), the NRC Staff analyzed the radiological consequences of a simultaneous failure of five offgas storage tanks. The offgas release rate was

assumed to be equivalent to the prevailing Technical Specification limits. The NRC Staff concluded that the dose at the site boundary was well within the values given in 10 CFR 100. This conclusion remains valid under extended power uprate conditions. Extended power uprate will not increase the probability of this accident and will not involve operation above the release rates assumed by the NRC Staff, and consequently, the previously analyzed dose rates continue to bound operation at extended power uprate conditions.

C. Class 3.3 Release of Liquid Waste Storage Tank Contents

This accident involves a catastrophic failure of a low level radwaste tank which included a simultaneous failure of the tank's containment basin (Section 12.4 of Appendix C to Ref. 1). The activity was released to the discharge canal. The analysis assumed a total radwaste tank activity content based on the prevailing technical specification limits.

Technical specification inventory limits are provided for undiked temporary radwaste tanks. The technical specification limit for undiked temporary tanks is 10 Ci, excluding tritium and dissolved or entrained noble gases. Extended power uprate will not, of itself, involve storage of low level radwaste outside of the radwaste building. If storage does occur, the temporary tank radioactivity limit of Technical Specification 5.5.7 will not be exceeded.

Concerning installed radwaste tanks, the Company analyzed radwaste tank discharges by its Appendix I filing (Section 1.1 of Ref. 16). In this analysis it was assumed that the entire contents of the floor drain sample tank after treatment was discharged to the Circulating Water System with no credit for Mississippi River dilution. Conservative discharges of chemical wastes and laundry wastes were also assumed. Exposures were calculated using the guidance of Regulatory Guide 1.109. The resultant doses were well below the 10 CFR 50 Appendix I limits. Extended power uprate will not have a material impact on the effectiveness of the liquid waste processing system or on the generation and activity level of liquid wastes at MNGP. Consequently, the results of the Appendix I radwaste tank discharge analysis are bounding for extended power uprate conditions.

7.3.4 Class 4 - Events that Release Radioactivity into Primary System

According to Section 2.2 of Appendix C to the Environmental Report (Ref. 1), no Class 4 events were identified for MNGP. Table VI-2 of the FES includes dose estimates for Class 4 events. The assumptions for these dose estimates could not be located. It is reasonable to conclude, however, that these estimates will remain bounding for extended power uprate. According to Table VI-2, Class 4 events include releases due to fuel cladding defects and releases from fuel failures induced from transients. Fuel cladding defects have been significantly reduced since initial operation due to industry improvements. In addition, operational limits are calculated at MNGP for each cycle to prevent transients from inducing fuel damage. These limits involve significant margin to fuel failure. These calculations will continue to be performed, and the appropriate limits will continue to be imposed under extended power uprate conditions.

7.3.5 Class 5 - Events that Release Radioactivity into Secondary System

Class 5 accidents were intended to apply to Pressurized Water Reactors (PWRs). A justification for not including Class 5 accidents was presented in Section 9 of Appendix C of Reference 1. Extended power uprate does not impact this justification.

7.3.6 Class 6 - Refueling Accidents Inside Containment

Class 6 accidents include refueling and fuel handling accidents. The Company chose the design basis refueling accident and a spent fuel cask drop to represent this class. The refueling accident is specifically addressed in the design basis accident section below (Class 8). The following discussion addresses the spent fuel cask drop and fuel damage from heavy loads.

The spent fuel cask drop was analyzed in Section 10.2 of Appendix C to Ref. 1. A cask was assumed to drop from a crane while being lowered to a flatcar. Because of cask design integrity and fuel capability, no fuel damage was postulated. A 1000 Ci release was assumed in accordance with 10 CFR 71 criteria.

Since initial licensing the cask drop accident has been re-evaluated by the Company at the request of the NRC Staff, in part to support actual fuel shipments made from MNGP. These evaluations resulted in a variety of design and administrative improvements in cask handling. By its review of cask handling at MNGP in May 1977 (Ref. 9), the NRC Staff concluded that, "the licensee has proposed adequate measures to preclude the occurrence of a cask drop accident and to mitigate its effect in the very unlikely event that it should occur."

Subsequent to this action, the NRC Staff issued generic letters that requested that licensees determine the extent of compliance with NUREG-0612. The safety concerns of a heavy object drop at MNGP are mitigated by compliance with NUREG-0612. The crane system for lifting casks at MNGP is designed for single failures. Procedural controls and safe load paths are in place to prevent handling of heavy objects above the core and the fuel pool. By SER dated March 19, 1984 (Ref. 10), the NRC Staff concluded that the guidelines of Section 5.1.1 and 5.1.3 of NUREG-0612 had been satisfied. For additional information on cask movement and crane safety at MNGP, see the Company's response to NRC Bulletin 96-02, Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, Or Over Safety Related Equipment (Ref. 14).

Notwithstanding the Company's stated compliance with NUREG-0612, the severity of any heavy load drop involving fuel damage is less at extended power uprate conditions. The FES analysis was based on the fractional activity of 7x7 fuel assemblies. The Company has replaced all the 7x7 fuel at MNGP with 8x8, 9x9, or 10X10 fuel. The effect of this change in fuel design was to lower the fuel pin centerline temperature, which lowered the release of fission product gases from the fuel. This, in turn, lowered the available inventory of gases in the fuel pin cladding gap available for release to the environment. According to Section 14.7.6.3.1 of the MNGP USAR, the relative amount of activity released for 9X9

array fuel is 0.91 times the activity released for a core of 8X8 fuel. Similarly, the relative amount of activity released for 10X10 array fuel is 0.95 times the activity released for a core of 8X8 fuel. Therefore, for those accidents that assume fuel cladding failures caused by a heavy object drop, the radioactivity available for release and the subsequent magnitude of the release to the environment is still bounded by that previously analyzed in the FES.

7.3.7 Class 7 - Accidents to Spent Fuel Outside Containment

Extended power uprate does not significantly impact the probability or consequences of a transportation accident. NSPM has evaluated the conditions and assumptions of Table S-4 of 10 CFR 51.52 for MNGP operation at extended power uprate conditions. These conditions and assumptions are applicable for MNGP operation under extended power uprate conditions. Table S-4 of 10 CFR 51.52 presents a generic evaluation of the environmental impact of fuel and waste transportation accidents. See Section 8.2 below for additional information.

7.3.8 Class 8 - Accident Initiation Events Considered in the Design Basis Evaluation in the SAR

The environmental impact analysis made in the FES for Class 8 accidents was based on information provided by the Company in its Environmental Report (Section II of Ref. 1). These accidents included the Recirculation Line Suction Break, the Main Steam Line Break, and the Control Rod Drop Accident. The radwaste tank failure and the offgas accident, which were originally analyzed as Class 8, are evaluated in Section 7.3.3 above. The design basis refueling accident, which was originally analyzed as Class 6, is included in the Class 8 evaluation.

The methodology used to determine the offsite doses for environmental impacts of Class 8 was based in part on subjective and realistic assumptions, and the FES results were expressed in estimated fractions of 10 CFR 20. It is difficult to recreate this methodology, and the value of recreating it is questionable in light of some non-conservatisms such as the assumed availability of offsite power and because of evolutionary changes in dose calculations. Therefore, for extended power uprate, a comparison is presented between the original full-scope implementation of the alternative source term methodology (Ref. 24) and the same methodology at EPU conditions.

Table 7.3.8-1 summarizes the accident analysis results (Note: The dose values for the 1880 MWth column are consistent with what was developed for the Alternate Source Term amendment, Ref. 24).

The radiological consequences of design basis accidents under extended power uprate conditions are within the acceptance criteria of GDC 19 of Appendix A to 10 CFR 50, 10 CFR 50.67, and RG 1.183 and do not involve any significant impact to the human environment.

7.3.9 Class 9 - Severe Accidents

The environmental effects of severe accidents outside the design basis of protection and engineered safety systems were not evaluated in the MNGP FES. (See Section VI.A of Ref. 2.) The NRC Staff did not evaluate these sequences on the premise that sufficient design conservatism, quality assurance, testing, and multiple physical barriers were in place such that the probability of a severe environmental accident is small, and the environmental risk of a Class 9 accident was extremely low. Extended power uprate will not involve any changes to the NRC Staff's assumptions made in arriving at the above conclusion.

Notwithstanding the above, NMC (now NSPM) conducted an evaluation (Ref. 31) to identify the risk implications due to EPU at MNGP. The scope included the complete risk contribution associated with the EPU. Risk impacts due to internal events were assessed using the MNGP Level 1 and Level 2 PRA Model of Record. External events were evaluated using the analyses of the MNGP Individual Plant Examination of External Events (IPEEE) submittal (Ref. 30). The results indicate that the risk impact due to EPU is low and acceptable. The risk impact is in the "very low" category (i.e., Region III of the Regulatory Guide 1.174 Guidelines) for core damage frequency (CDF) and large early release frequency (LERF).

7.4 Other Potential Environmental Accidents

Extended power uprate does not significantly change the inventory, storage, usage, or control requirements for chemicals, industrial gases, oil, oil products, or other hazardous substances. Extended power uprate will not require the introduction or use of any new hazardous substances. Extended power uprate will not result in a significant increase in the probability or consequences of an oil spill, chemical spill, industrial gas release, or other event involving a non-radioactive hazardous substance.

Table 7.3.8-1 Accident Analysis Results

Parameter	1880 MWth (Current Licensed Thermal Power Level Design Assumption Value)	2004 MWth (Extended Power Uprate Value)	Regulatory Limit (10 CFR 50.67) & (10 CFR 50, App. A, GDC 19)
Post-LOCA Accident Dose:*			
EAB	1.31 Rem TEDE	1.46 Rem TEDE	25 Rem TEDE
LPZ	1.72 Rem TEDE	1.99 Rem TEDE	25 Rem TEDE
CR Operator	3.40 Rem TEDE	3.80 Rem TEDE	5 Rem TEDE
TSC Operator	0.854 Rem TEDE	0.92 Rem TEDE	5 Rem TEDE
FHA Accident Dose:			
EAB	1.61 Rem TEDE	1.74 Rem TEDE	6.3 Rem TEDE
LPZ	0.31 Rem TEDE	0.34 Rem TEDE	6.3 Rem TEDE
CR Operator	4.29 Rem TEDE	4.67 Rem TEDE	5 Rem TEDE
CRDA Accident Dose:			
EAB	1.73 Rem TEDE	2.00 Rem TEDE	6.3 Rem TEDE
LPZ	0.79 Rem TEDE	0.91 Rem TEDE	6.3 Rem TEDE
CR Operator	1.70 Rem TEDE	1.89 Rem TEDE	5 Rem TEDE
MSLBA Accident Dose: Pre-Incident Iodine Spike			
EAB	1.05 Rem TEDE	1.05 Rem TEDE	25 Rem TEDE
LPZ	0.20 Rem TEDE	0.20 Rem TEDE	25 Rem TEDE
CR Operator	3.25 Rem TEDE	3.25 Rem TEDE	5 Rem TEDE
MSLBA Accident Dose: Equilibrium Iodine Conc.			
EAB	0.11 Rem TEDE	0.11 Rem TEDE	2.5 Rem TEDE
LPZ	0.02 Rem TEDE	0.02 Rem TEDE	2.5 Rem TEDE
CR Operator	0.33 Rem TEDE	0.33 Rem TEDE	5 Rem TEDE

* L-MT-13-020, Item 2 increased the EPU LOCA dose by small amounts which do not change the values in this table.

8.0 ENVIRONMENTAL EFFECTS OF URANIUM FUEL CYCLE ACTIVITIES AND FUEL AND RADIOACTIVE WASTE TRANSPORTATION

8.1 Compliance With 10 CFR 51.51, Uranium Fuel Cycle Environmental Data (Table S-3)

Table S-3 of 10 CFR 51.51 was adopted after MNGP received its operating license, therefore, the MNGP FES does not contain a uranium fuel cycle environmental analysis similar to Table S-3. The NRC Staff, however, included the Table S-3 fuel cycle environmental data in its review of the MNGP full term operating license (Enclosure 3 of Ref. 12) and the renewed operating license (Ref. 19). The NRC Staff concluded that the fuel cycle effects of Table S-3 combined with operation of MNGP did not significantly impact the environment. The impact of extended power uprate on the NRC Staff's previous evaluation is increased fuel burnup and U-235 enrichment.

The environmental effects of fuel cycle activities under extended power uprate conditions continue to be bounded by the NRC Staff's evaluation that incorporated Table S-3 into the MNGP licensing basis as described above. The evaluation assumed that the fuel cycle would support a reference reactor of 1000 MWe that operated at 80 percent capacity factor which results in an adjusted daily electricity production of 800 MWe during a reference reactor year (RRY). Under extended power uprate conditions the daily output at 100 percent capacity is less than 700 MWe and MNGP will not exceed the assumptions of the RRY used in the evaluation.

The data presented in Tables S-3 and S-4 are, in part, based on an average burnup assumption of 33,000 MWd/MtU and a U-235 enrichment assumption of 4 wt.percent. Fuel consumption is expected to increase under extended power uprate conditions such that the batch average burnup of the fuel assemblies will be in excess of 33,000 MWd/MtU but less than 60,000 MWd/MtU (MNGP EPU evaluation indicates a maximum assembly exposure of approximately 53,000 MWd/MtU). The U-235 enrichments levels will also increase to greater than 4 wt.percent but less than 5 wt.percent to support extended burnup. The NRC Staff has previously evaluated the environmental impact of increased burnup to 60,000 MWd/MtU with U-235 fuel enrichment to 5 wt.percent on the conclusions of Table S-3. See the GEIS for license renewal (Refs. 5, 19 & 20). Although some radionuclide inventory levels and activity levels are projected to increase, the NRC Staff noted that little or no increase in the amount of radionuclides released to the environment during normal operation was expected. The NRC Staff determined that the incremental environmental effects of increased enrichment and burnup on transportation of fuel, spent fuel, and waste were not significant. In addition, the NRC Staff recognized the salient environmental benefits of extended burnup such as reduced occupational dose, reduced public dose, reduced fuel requirements per unit electricity, and reduced shipments. The NRC Staff concluded that the environmental impacts described by Table S-3 were bounding and were also applicable for burnup levels to 60,000 MWd/MtU and U-235 enrichment levels to 5 wt.percent.

Table S-3 does not include a determination of the environmental effects of the gaseous effluents of Rn-222 and Tc-99. By Enclosure 3 to the issuance of the MNGP full term operating license (Ref. 12) and the license renewal (Ref. 19), the NRC Staff evaluated these effluents and concluded that the environmental impact from radon releases was not significant. In addition, an industry study performed by the Atomic Industry Forum

(Ref. 11) concluded that extending fuel burnup to 60,000 MWd/MtU and increasing U-235 enrichment to 5 wt.percent results in insignificant environmental consequences from Rn-222 and Tc-99.

8.2 Compliance With 10 CFR 51.52, Environmental Effects of Transportation of Fuel and Waste (Table S-4)

The environmental impacts of transporting fuel and waste were analyzed by the NRC Staff in the FES and the license renewal environmental impact statement (Ref. 19). 10 CFR 51.52, Table S-4 presents a generic assessment of the environmental impacts of transporting fuel and waste to and from a reference reactor. For extended power uprate operating conditions, this demonstration supersedes the previous Company submittals concerning environmental effects of transportation of fuel and waste including Sections 11.0 of 13.0 of Appendix C to the Environmental Report (Ref. 1).

Operation of MNGP under extended power uprate conditions meets all the conditions of part (a) of 10 CFR 51.52 with the exception of the enrichment and burnup conditions as described in the succeeding paragraphs. Each subsection of part (a) is addressed below for extended power uprate conditions. The enrichment assumptions of paragraph (a)(2) and the burnup assumptions of paragraph (a)(3) are addressed separately below.

(a)(1) The core thermal power under extended power uprate conditions is less than 3800 MW.

(a)(2) The reactor fuel is in the form of sintered uranium dioxide pellets, and the pellets are encapsulated in zircalloy rods.

(a)(3) No irradiated fuel assembly is shipped until at least 90 days after it is discharged from the reactor.

(a)(4) With the exception of irradiated fuel, all radioactive waste shipped from the reactor is packaged and in a solid form.

(a)(5) Unirradiated fuel is shipped by truck; irradiated fuel is shipped by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped from the reactor by truck or rail.

(a)(6) In accordance with paragraph (a)(6) of 10 CFR 51.52, the environmental impacts of transportation of fuel and waste to and from the reactor at extended power uprate conditions with respect to normal and accident conditions of transport are as set forth in Table S-4 with the exception of fuel enrichment and burnup assumptions. The values in the table represent the contribution of the transportation to the environmental costs of operating at extended power uprate conditions.

NSPM complies with the conditions of Table S-4 for the MNGP extended power uprate except for the U-235 enrichment and fuel burnup assumptions. The conservatism and continued applicability of Table S-4, however, has been previously evaluated by the NRC Staff for enrichment to 5 wt. percent and for average burnup to 62,000 MWd/MtU (Ref. 19).

9.0 DECOMMISSIONING EFFECTS

Other than financial set asides, the environmental effects of decommissioning were not evaluated by the NRC Staff in the Monticello FES (Section XIII, Question 45, and Section VIII.C of Ref. 2). The AEC deferred this review until the submittal of a decommissioning plan. The Company's decommissioning plan for Monticello will be submitted in accordance with regulatory criteria. Extended power uprate does not involve any substantial increases in decommissioning cost estimates and does not affect the Company's ability to maintain sufficient financial reserves for decommissioning.

The potential impact of extended power uprate on decommissioning is due to increases in feedwater flow rate and increased neutron fluence. These effects could increase the amount of activated corrosion products and consequently increase post-shutdown radiation levels.

10.0 CONCLUSIONS

Extended power uprate does not involve any significant impacts to the environment. There are no new significant environmental hazards in addition to those previously evaluated. The environmental impacts and adverse effects identified by the NRC Staff for MNGP operation at 1670 MWth in the Summary and Conclusions Section of the Final Environmental Statement (Ref. 2) continue to bound plant operation at extended power uprate conditions. Conclusions made by the NRC in their 2010 EA for extended power uprate remain valid (Ref. 52). The proposed changes do not, individually or cumulatively, affect the human environment. There is no significant change in the types or amounts of plant effluents. Extended power uprate does not involve significant increases in individual or cumulative occupational radiation exposure.

The effect of extended power uprate on the environment does not prevent continued compliance with any MNGP environmental permit. None of the license conditions for environmental protection will be changed for extended power uprate. No effluent limits will be exceeded, and the present large margins to these limits will not be significantly changed. Extended power uprate does not involve an increase in the discharge of hazardous substances, contaminants, or pollutants and does not involve the use of any new hazardous substances, contaminants, or pollutants.

The additional workers and equipment delivery required to implement extended power uprate modifications during the 2013 outage will result in minor and short-duration air quality impacts. Extended power uprate does not involve any changes to water quality. The proposed action does not result in any changes to land usage and has an insignificant effect on groundwater and surface water usage. The amount of water withdrawn and consumed from the Mississippi River is not significantly increased above that previously evaluated. The slight increase in discharge canal temperature has an insignificant effect on river temperature and will not result in any changes to aquatic biota other than those previously evaluated. Extended power uprate will not involve new or different discharges of contaminants and does not involve changes to any bioaccumulation effects for aquatic organisms. Extended power uprate does not accelerate the introduction of any microbiological organisms into surface water pathways or significantly increase the population of any known pathogens.

Extended power uprate does not involve any changes to wildlife habitat and does not result in any significant changes to aquatic or terrestrial biota. There are no deleterious effects on the diversity of biological systems or the sustainability of species due to extended power

uprate. Extended power uprate does not involve any additional changes to the stability and integrity of ecosystems. Extended power uprate does not affect the previous conclusions on impingement or entrainment. Extended power uprate does not affect NSPM's compliance with Sections 316(a) or 316(b) of the Federal Water Pollution Control Act.

Extended power uprate does not significantly change any doses to the public from radiological effluents, and offsite doses will continue to be well within regulatory limits. By Section 2.1.3 of the Safety Evaluation for the MNGP full term operating license, the NRC Staff concluded that "the release of radioactive material in liquid and gaseous effluents from the Monticello Nuclear Generating Plant will meet the requirements of 10 CFR 50 for keeping such effluent levels to unrestricted areas as low as practicable and will result in doses that are a small percentage of the 10 CFR 20 limits." The NRC Staff based this conclusion on assumptions for effluent releases that bound releases expected for extended power uprate. Occupational dose will be maintained well within regulatory limits, and changes in radiation levels will not significantly increase the dose to the MNGP work force. For accident dose, the methodology for certain design basis accidents was updated. This methodology is consistent with previously approved NRC Staff methods, and the resultant dose is well within the applicable regulatory limits. Extended power uprate does not involve significant increases in the probability or consequences of previously evaluated environmental accidents.

This environmental evaluation has demonstrated that in most cases extended power uprate does not involve any environmental impacts that are different from those previously evaluated for the present power level. Where environmental impacts which differ from those previously evaluated have been identified, these impacts have been shown to be insignificant and well within regulatory environmental acceptance criteria.

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ATTACHMENT A

MONTICELLO NUCLEAR GENERATING PLANT—EXTENDED POWER UPRATE

ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT OPERATIONS/ PERMIT RENEWAL SCHEDULE

Agency	Authority	Requirement	Number	Expiration Date	Renewal Frequency
Minnesota Department of Natural Resources[a]	Minnesota Statutes Chapter 103G.271	Water Appropriations Permit	67-0083	NA	Does not expire
Minnesota Department of Natural Resources[a]	Minnesota Statutes Chapter 103G.271	Water Appropriations Permit	66-1172	NA	Does not expire
Minnesota Department of Natural Resources	Minnesota Statutes Chapter 97A.401	Division of Fish and Wildlife Special Permit	17823	12/31/12	Yearly renewal
Minnesota Department of Natural Resources	Minnesota Statutes Chapter 97A.401	Division of Ecological Services Special Permit REMP mussel collection	273	12/31/15	5-year renewal
Minnesota Pollution Control Agency	Minnesota Statutes Chapters 115 and 116	National Pollutant Discharge Elimination System (NPDES) Permit	MN0000868	9/30/12	5-year renewal(permit renewal submitted 3/31/12 and remains in-process)[8]
Minnesota Pollution Control Agency	Minnesota Statutes Chapters 115 and 116	NPDES (General Stormwater Permit for Industrial Activity)	MN G610000	9/30/12	Incorporated in the NPDES Permit
Minnesota Pollution Control Agency	Minnesota Rules Chapter 7045.0225	Hazardous Waste Generator License	MND000686139	06/30/13	Yearly renewal

[8] Minnesota Rule 7007.0450, Subpart 3, "Continuation of an expiring permit," defines the conditions under which an existing permit does not expire pending reissuance of the permit.

ENCLOSURE 5

Agency	Authority	Requirement	Number	Expiration Date	Renewal Frequency
Minnesota Pollution Control Agency	Minnesota Rules Chapters 7007.0150	Air Emission Permit	17100019-003	08/16/05	5-year renewal (permit renewal submitted 2/17/05 and remains in-process)[9]
City of Monticello	City of Monticello Ordinance Title 14, Chapter 4	Sanitary Sewer Wastewater Discharge Agreement	001	NA	Does not expire
Minnesota Pollution Control Agency	Minnesota Statutes Chapters 115 and 116	NPDES (State Disposal System (SDS) Permit)	MN0058343	9/30/12	Incorporated in the NPDES Permit
Minnesota Department of Natural Resources	Minnesota Statues Chapter 103G.315 Minnesota Rule Chapter 6115.0200	"Work In Waters" Permit (State Dredging Permit)	67-0743	NA[b]	Does not expire; maintenance provision #8 requires written approval for each project
State of Tennessee Department of Environment and Conservation	TDEC 1200-2-10-.30	Radioactive Shipment License	T-MN002-L12	12/31/15	Yearly renewal
Utah Department of Environmental Quality	Utah Code Annotated, Title 19 Chapter 3; UAC R313-21	Generator Site Access Permit	0209 001 562	09/30/13	Yearly renewal
U.S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899; Section 404 of the Clean Water Act	"Work In Waters Permit"	01-02982-GP-GAE; coverage under Department of Army General Permit GP-001-MN	NA[b]	Not applicable; secure determination with each project on the river bed

[9] Minnesota Rule 7007.0450, Subpart 3, "Continuation of an expiring permit," defines the conditions under which an existing permit does not expire pending reissuance of the permit.

ENCLOSURE 5

Agency	Authority	Requirement	Number	Expiration Date	Renewal Frequency
U.S. Department of Transportation	49 USC 5108 (49 CFR 107.601)	Certificate of Registration for Transportation of Hazardous Materials	062707550034P	6/30/13	Yearly renewal
U.S. Fish and Wildlife Service	16 USC 703-712 (50 CFR Part 13 and 50 CFR 21.27)	Special Purpose Permit	MB074020-0	03/31/15	Three-year permit renewal cycle
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.), 10 CFR 50.10	Facility Operating License	Unit 1 – DPR-22	09/08/30	Forty-year original term; 20-year license renewal approved

a. Original permit issued by Minnesota Department of Conservation in 1970. The Department of Conservation was renamed Minnesota Department of Natural Resources in 1971.

b. Expiration date not applicable for the master permit. In addition, there are no actions currently authorized.

CFR = Code of Federal Regulations

NA = Not Applicable

TDEC = Tennessee Department of Environment and Conservation

U.S. = United States

USC = United States Code

ENCLOSURE 6

GENERAL ELECTRIC – HITACHI AFFIDAVIT FOR WITHHOLDING PROPRIETARY INFORMATION

3 pages follow

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Linda C. Dolan, state as follows:

(1) I am the Manager, Regulatory Compliance of GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, GE-MNGP-AEP-3263, "GEH Response to NRC request concerning GEH 10 CFR Part 21 Communication entitled 'Error in Main Steam Line High Flow Calculational Methodology,'" dated February 25, 2013. The GEH proprietary information in Enclosure 1, which is entitled "Effect of GEH 10 CFR Part 21 Communication entitled 'Error in Main Steam Line High Flow Calculational Methodology at Monticello Nuclear Generation Plant,' GEH Proprietary Information - Class III (Confidential)" is identified by a dark red dotted underline inside double square brackets. [[This sentence is an example.{3}]]. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit that provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* (FOIA), 5 U.S.C. Sec. 552(b)(4), and the Trade Secrets Act, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2.d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2.d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over GEH or other companies.

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, that may include potential products of GEH.

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.

(8) The information identified in paragraph (2) above is classified as proprietary because it contains results of analysis performed by GEH to support Monticello's extended power uprate license application. This analysis is part of the GEH extended power uprate methodology. Development of the extended power uprate methodology and the supporting analysis techniques and information and their application to the design, modification and processes were achieved at a significant cost to GEH.

The development of the evaluation methodology along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and

analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 25th day of February, 2013.

Linda C. Dolan

Linda C. Dolan
Manager, Regulatory Compliance
GE-Hitachi Nuclear Energy Americas LLC
3901 Castle Hayne Rd
Wilmington, NC 28401
Linda.dolan@ge.com