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JUL 11 2011

L-PI-11-068
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Prairie Island Nuclear Generating Plant Units 1 and 2
Dockets 50-282 and 50-306
Renewed License Nos. DPR-42 and DPR-60

Response to Requests for Additional Information (RAI) Associated with Adoption of the Alternative Source Term (AST) Methodology (TAC Nos. ME2609 and ME2610)

In a letter to the U. S. Nuclear Regulatory Commission (NRC) dated October 27, 2009 (Agencywide Documents and Management System (ADAMS) Accession No. ML093160583), the Northern States Power Company, a Minnesota corporation doing business as Xcel Energy (hereafter "NSPM"), requested an amendment to the Technical Specifications (TS) for Prairie Island Nuclear Generating Plant (PINGP). The proposed amendment requested adoption of the Alternative Source Term (AST) methodology, in addition to TS changes supported by AST design basis accident radiological consequence analyses.

The NRC Staff sent draft requests for additional information (RAIs) via electronic mail on September 21, 2010 to support their review of the submittal. In a letter to the NRC dated December 17, 2010 (ADAMS Accession No. ML103510322), NSPM provided a response to the Containment and Ventilation Systems Branch (SCVB) RAI, SCVB-1. The NRC Staff sent a clarification question via electronic mail on April 1, 2011, which was discussed during a subsequent teleconference held on April 5, 2011.

The enclosure to this letter provides the response to the SCVB clarification question discussed during the April 5, 2011 teleconference. The response was discussed during a May 31, 2011 teleconference and provides the additional information requested by the NRC during the teleconference.

NSPM submits this supplement in accordance with the provisions of 10 CFR 50.90.

1717 Wakonade Drive East • Welch, Minnesota 55089-9642
Telephone: 651.388.1121

The supplemental information provided in this letter does not impact the conclusions of the Determination of No Significant Hazards Consideration and Environmental Assessment presented in the October 27, 2009 submittal, supplemented by letters dated April 29, 2010 (ADAMS Accession No. ML101200083), May 25, 2010 (ADAMS Accession No. ML101460064), June 23, 2010 (ADAMS Accession No. ML101760017), August 12, 2010 (ADAMS Accession No. ML102300295), December 17, 2010 (ADAMS Accession No. ML103510322) and June 22, 2011 (ADAMS Accession No.ML111740145).

In accordance with 10 CFR 50.91, NSPM is notifying the State of Minnesota of this LAR supplement by transmitting a copy of this letter to the designated State Official.

If there are any questions or if additional information is needed, please contact Mr. Gregory Myers, P.E., at 651-267-7263.

Summary of Commitments

This letter contains no new commitments or revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on JUL 11 2011

Mark A. Schimmel
Site Vice President, Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, PINGP, USNRC
Resident Inspector, PINGP, USNRC
State of Minnesota

ENCLOSURE
TO
L-PI-11-068

Response to SCVB Clarification Question

10 pages follow

ENCLOSURE

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CONTAINMENT AND VENTILATION SYSTEMS BRANCH (SCVB)

Draft NRC RAI – SCVB-1

Calculation No. GEN-PI-079, "post-LOCA EAB, LPZ and CR Doses – AST" (Attachment 6 to Enclosure to the October 27, 2009 application), assumes a specific Shield Building leakage rate as shown on Table 2 (Page 64 of 257 of the calculation). This leakage rate helps determine the recirculation and holdup time of any source term leaking into the Shield Building annulus.

Describe the periodic verification performed to assure that the Shield Building leakage rate remains within the values assumed in the accident analyses.

NRC Clarification Question – sent via email dated 4/1/2011

The NRC staff has reviewed the subject RAI response and has the following clarification question:

Ref: Table 2 on Page 64 of 257 of Attachment 6 to the Enclosure to the October 27th, 2009 application.

In this table we are focusing on two columns: (1) [shield building ventilation system] SBVS Filtered Venting (cfm) and (2) Shield Building Leakage (cfm). In accordance with Table 2, the SBVS vents at a specific rate (cfm) at various times following a LOCA, and the Shield Building leaks at a specific rate (cfm) following a LOCA.

How often does the licensee verify the venting and/or leakage rate(s) represented in Table 2?

NSPM Response

System Operation

As described on Pages 8 and 9 of the Enclosure to the Reference 1 LAR:

> The shield building ventilation system (SBVS) operates in the event of a loss of coolant accident to draw and maintain a negative pressure in the shield building. In addition, the system recirculates and filters the air prior to release. The system is shown on Figure 3.0-1. This system consists of two independent and redundant filter trains, with the exception that some of the ducting is common to both trains (e.g. return header in the shield building and the shield building vent stack are common). Each train consists of a heater, a prefilter, a high efficiency particulate air (HEPA) filter, and an activated charcoal adsorber section for removal of gaseous activity (principally iodines). Two 100-percent-capacity exhaust and recirculation fans serve the redundant trains. Heaters, ductwork, dampers, and instrumentation also form part of the system. The heaters function to reduce the relative humidity of the air stream. When initiated the SBVS exhausts to draw a negative pressure in the shield building annulus area outside of the reactor containment vessel. After a pre-set negative pressure is established a recirculation damper opens to allow the system to recirculate a portion of the total air flow while exhausting to maintain a negative pressure. The SBVS returns the recirculation flow to a ring header near the bottom of the shield building annulus. The SBVS draws flow from near the top of the reactor containment vessel. The configuration and orientation of the return air ring header relative to the SBVS intake points promote mixing.

Figure 3.0-1 in the Enclosure to the Reference 1 LAR provides a simplified figure of the SBVS.

Radiological Consequence Analysis with Alternative Source Term – SBVS Model

For modeling SBVS performance, the radiological consequence analysis considers two time frames; (1) initial drawdown, and (2) equilibrium operation. These two time frames are modeled as follows (specific design inputs used in the post-LOCA radiological consequence analysis are shown in Table 3.3-8 of the Enclosure to the Reference 1 LAR):

(1) Drawdown – The drawdown time period is the initial 22 minutes. As described above, during this time period the SBVS fans are drawing a negative pressure in the shield building annulus. The dose analysis takes no credit for holdup or filtration during this time period by assuming that containment leakage to the annulus is released directly to the environment through the shield building vent stack.

(2) Equilibrium – After the initial 22 minutes, the SBVS is operating in an equilibrium condition where the ventilation system exhaust is equal to inleakage and a negative pressure is maintained in the annulus. It is noted that the dampers are open and do not modulate to maintain a set negative pressure. The negative pressure is a function of the inleakage. That is, the higher the inleakage, the less negative the pressure that will be maintained. As shown in Table 3.3-8 of the Enclosure of the LAR, the dose analysis assumes an exhaust flow rate of 2000 cfm. The flow rate of 2000 cfm is based on an exhaust flow rate of 1000 cfm, which is doubled to simulate 50% mixing in the annulus.

SBVS Testing

Periodic verification of the capability of the SBVS is performed per Technical Specification Surveillance Requirements. Specifically, the capability for the shield building ventilation system to produce and maintain a negative pressure in the shield building annulus is verified every 31 days per Technical Specification Surveillance Requirement (SR) 3.6.10.2. The Bases for SR 3.6.10.2 states:

> The SBVS produces a negative pressure to prevent leakage from the building. SR 3.6.10.2 verifies that the shield building can be rapidly drawn down to -2.00 inch water gauge and maintains a pressure equal to or more negative than -1.82 inches of water gauge in the annulus after the recirculation dampers open and equilibrium is established. Equilibrium negative pressure equal to or more negative than -1.82 inches water gage is that predicted for non-accident conditions and leakage equal to 75% of the maximum allowable shield building inleakage (Reference 2).

Establishment of this pressure is confirmed by SR 3.6.10.2, which demonstrates that the shield building can be drawn down to ≤ -2.0 inches of vacuum water gauge in the annulus using one SBVS train.

Note: Reference 2 in the Bases for SR 3.6.10.2 is Reference 2 of this Enclosure.

The monthly surveillance test of the SBVS, also known as a drawdown test, confirms that the following acceptance criteria are satisfied:

- Minimum pressure equal to or more negative than 2.0" H_2O (vacuum condition) in the annulus.

- Equilibrium minimum pressure in the annulus equal to or more negative than 1.82" H_2O.

Bases for SBVS Testing Acceptance Criteria

The maximum allowable shield building leakage rate was depicted by Technical Specification (TS) Figure 4.4-1. TS Figure 4.4-1 was removed by License Amendments 158 and 149, for Units 1 and 2, respectively.

Leakage at an equilibrium pressure of 1.82" H_2O corresponds to 75% of the maximum allowable shield building in-leakage as cited in the Bases for SR 3.6.10.2. Figure 1 on Page 7 (Reference 2, Figure 5) provides two curves; one showing the maximum allowable leakage rate (former TS Figure 4.4-1) and the other showing the acceptable shield building leakage test results. As shown, the acceptable shield building leakage test results are 75% of the maximum allowable leakage rate. Furthermore, Figure 1 shows that at 1.82" H_2O the maximum allowable leakage rate is 1000 cfm. Figure 2 on Page 8 (Reference 2, Figure 4), shows the SBVS pull-down transient with the Technical Specification maximum leakage rate (i.e., the acceptable shield building leakage test results from Figure 1). As shown on Figure 2, the SBVS pull-down transient curve, the equilibrium differential pressure corresponding to an inleakage rate of 75% of Figure 5 is 1.82" H_2O.

Reference 3 provided the results of Unit 1 initial testing program for the SBVS. An objective of the testing was to verify that the system performance confirmed the SBVS pull-down transient computer model prediction. This was accomplished by a comparison of the curves generated by the computer model using the measured leakage rate of the shield building. For this testing, the shield building leakage rate was determined by measuring the steady state SBVS exhaust flow rate. As described in the conclusion on page 12 of Reference 3, the computer model predictions were conservative compared to the actual drawdown testing. Furthermore, an additional comparison of computer model prediction vs actual system performance is shown on Figure 3 on page 9 (Figure 7 of Reference 2). The computer model input parameters shown on

Figure 3 are identical to those of the noted measured drawdown test (e.g., the test results at a leakage rate of 369 cfm at 2.6" H_2O were predicted by the computer model). As shown on Figure 3, the computer model provides an accurate prediction of the SBVS drawdown transient.

The pre-operational testing demonstrated that the resultant negative pressure in the annulus is directly related to the leakage rate and the leakage rate is the same as the exhaust flow rate at equilibrium conditions. With the system operating in an equilibrium condition an increase in the leakage rate will result in a decrease in the negative pressure condition. For example, if the leakage rate is greater than 75% of the maximum allowable leakage rate the equilibrium acceptance criteria would not be satisfied. USAR Appendix G, Section G.3 provides a description of the SBVS analytical model. This same model is referred to in the initial testing reports provided to the Atomic Energy Commission. As described in Section G.3.7, sensitivity studies were included as part of the analysis performed using this model. One of the parameters considered as part of these sensitivity studies was the shield building leakage. The results from the studies of varying shield building leakage are shown on Figure G.3-11 and G.3-12. As shown on Figure G.3-11 increasing the shield building leak rate results in a less negative pressure condition. This sensitivity of pressure in the annulus to the inleakage rate is consistent with the design and operation of the system. The dampers do not modulate to maintain a set pressure, i.e., SBVS is in equilibrium (Reference 3, Page 3). This is consistent with USAR Appendix G, Page G.3-8, which shows that the pressure drop across the dampers is independent of damper position since they do not modulate.

Prior Approval History

As described in Reference 2, in addition to the acceptance criteria for equilibrium pressure in the shield building annulus, there was also an acceptance criteria to confirm the actual shield building leakage rate by measuring the SBVS exhaust flow. At that time, Technical Specification 4.4.A.3 required leak testing of the shield building and Technical Specification 4.4.B.1 required a drawdown test of the shield building. In a letter dated December 3, 1982, Northern States Power proposed to delete the leak testing for the shield building (Reference 5). The NRC approved this deletion in a letter dated February 23, 1983 (Reference 4). The NRC Safety Evaluation Report (starting on Page 10) concludes the following:

- Specifications 4.4.B.1 and 4.4.B.2 meet the provision of Appendix J Section IV B since operability is demonstrated by meeting the drawdown performance specified in the TS 4.4.B.1 for the shield building and when a measureable negative pressure is achieved within 6 minutes specified for the auxiliary building in TS 4.4.B.2.

- Results of a special functional test of the shield building and the auxiliary building special ventilation system performed in accordance with TS 4.4.A.3c were provided during the plant initial start period in a report dated April 9, 1976. The results were reviewed and were found to be acceptable.

- The requirements of TS 4.4.A.3, 4.4.A.3a, 4.4.A.3b and 4.4.A.3c do not serve a meaningful purpose and therefore are no longer necessary since their functions are adequately addressed in the existing TS 4.4.B.1 and 4.4.B.2 and therefore may be deleted.

Therefore, based on this NRC approval, the leak testing of the shield building by measurement of the SVBS exhaust flow was not required as it was adequately covered by the drawdown testing. This same drawdown testing is currently performed by the monthly surveillance test of the SBVS.

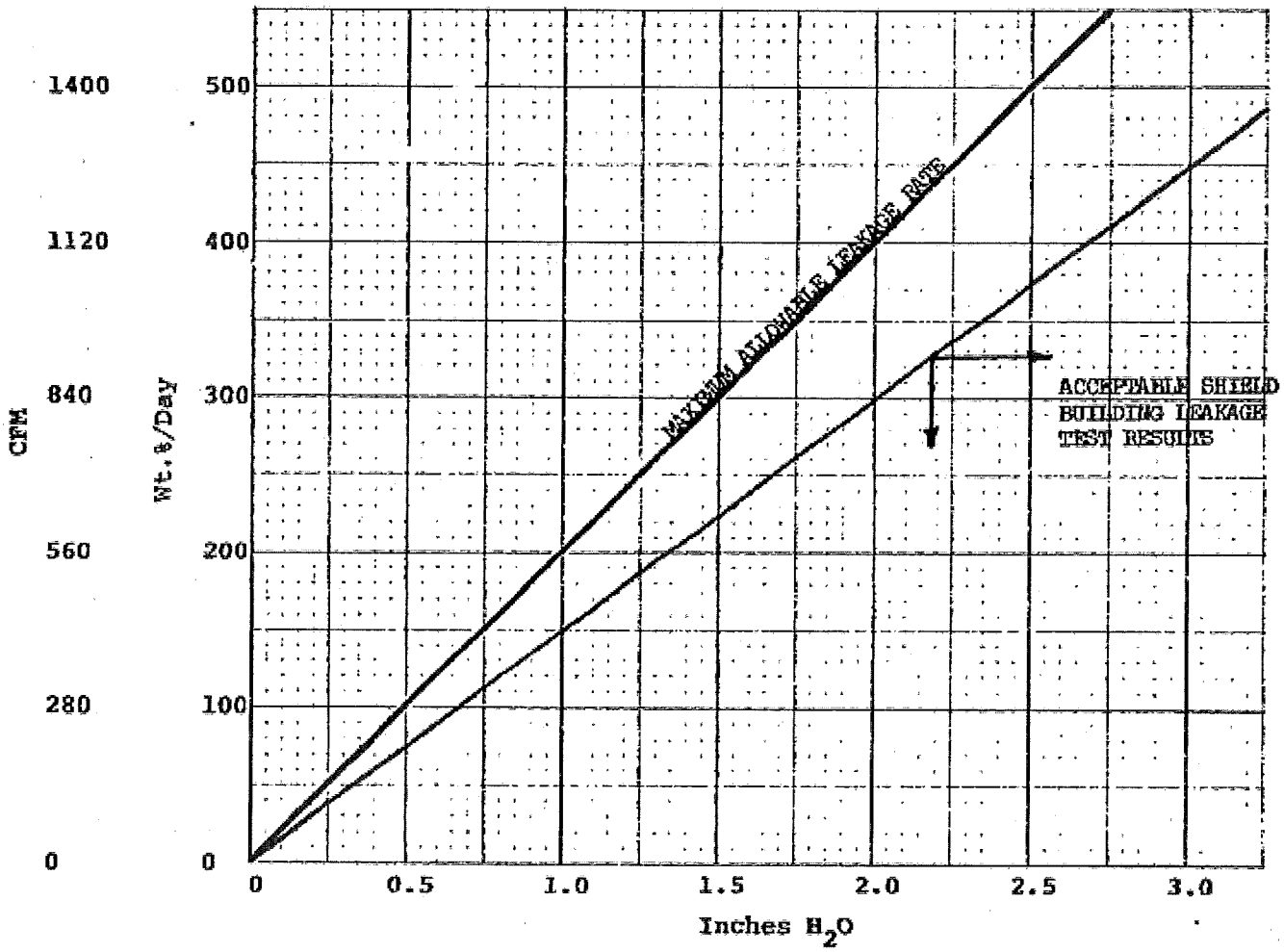
Impacts from Alternative Source Term (AST)
Implementation of a new source term has no impact on the operation of the SBVS. The source term is independent of the operation of the SBVS. It is noted that reduced credit is taken for the SBVS. In the current dose analysis, both the HEPA filter and the charcoal adsorber are credited. In the AST dose analysis, only the HEPA filter is credited.

Conclusion
In conclusion, the current methods used to test the SBVS are acceptable and additional exhaust flow or leakage testing is not required, as described in more detail above. Every 31 days, SBVS surveillance testing of differential pressure confirms that the shield building in-leakage (equal to exhaust flow) is less than or equal to 750 cfm, which is 75% of the maximum allowable shield building in-leakage. This confirms that the SBVS leakage and exhaust do not exceed the values used in the dose analysis.

In summary:

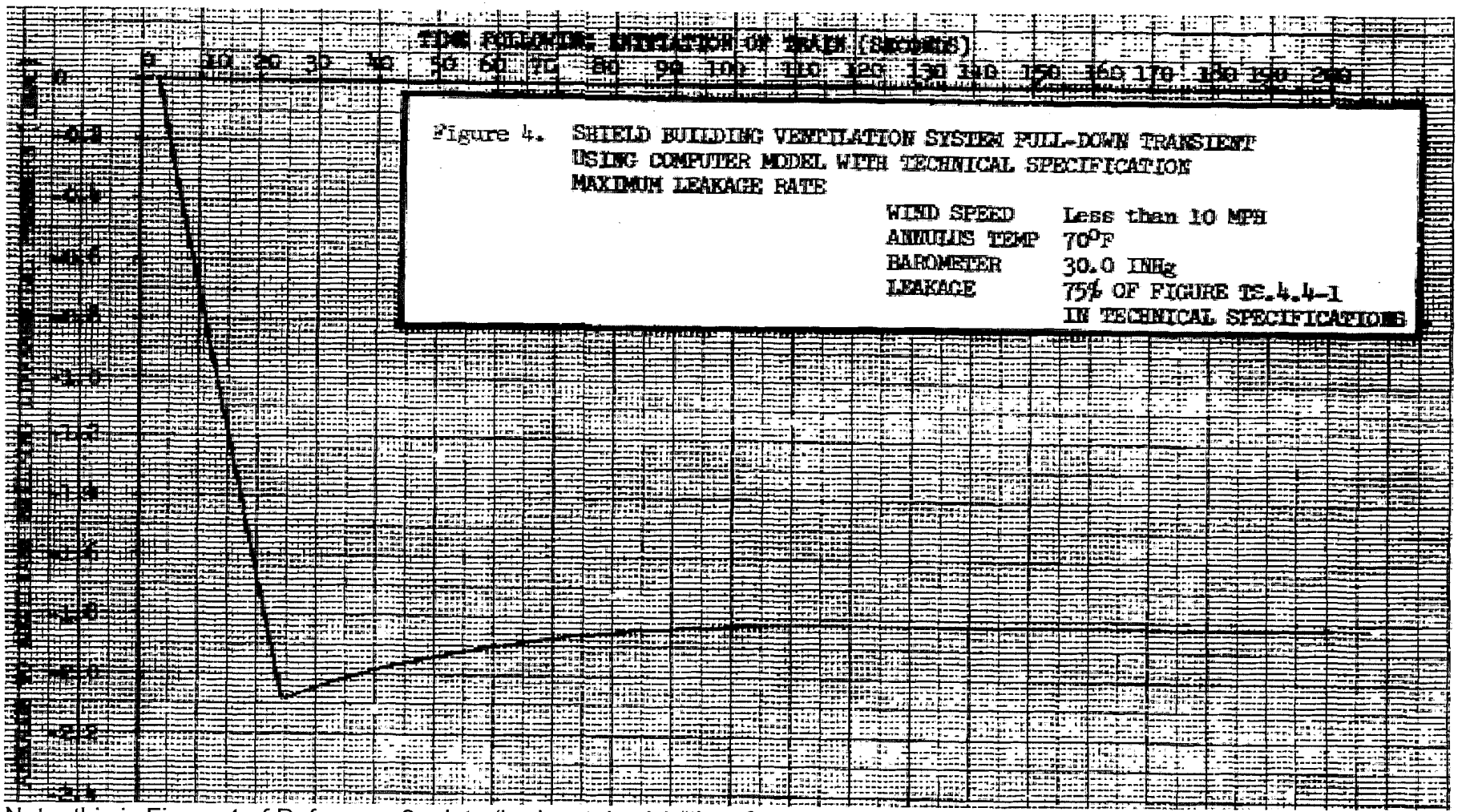
- SBVS drawdown testing performed in accordance with SR 3.6.10.2 confirms that the shield building in-leakage (equal to exhaust flow) is less than or equal to 750 cfm, which is 75% of the maximum allowable shield building in-leakage.
- This drawdown testing confirms that leakage and exhaust do not exceed values used in the dose analysis.
- The NRC has previously approved the acceptability of drawdown testing and concluded that leak rate testing is not necessary; i.e., it does not serve any meaningful purpose.

Figure 1 - As-Built Shield Building Leakage Limit



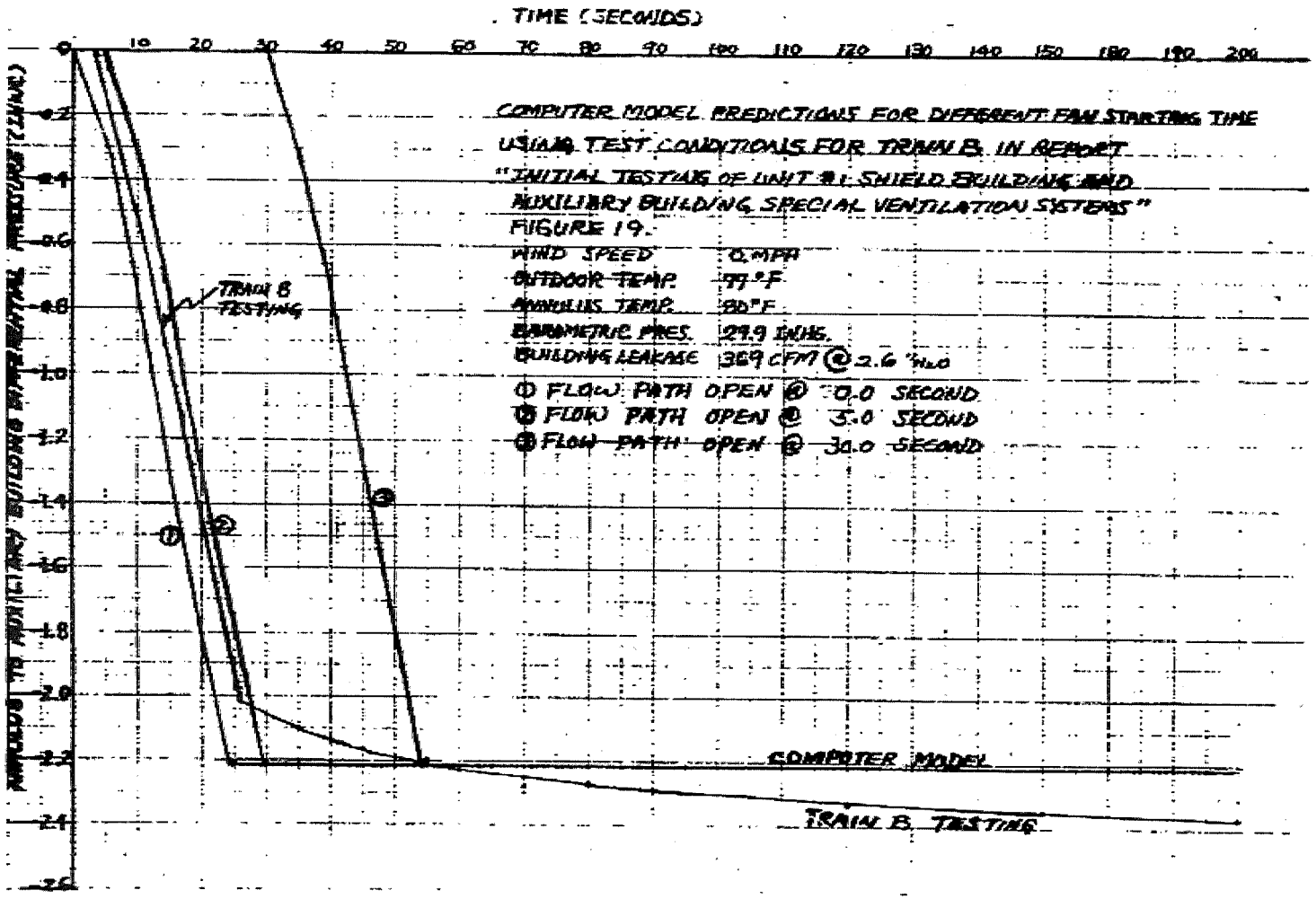
Note: this is Figure 5 of Reference 2.

Figure 2 – Shield Building Pull-Down Transient Computer Model Results



Note: this is Figure 4 of Reference 2: plots (horizontal axis) "time following initiation of train (seconds)" versus (vertical axis) "annulus to auxiliary building differential pressure (in WC)"

Figure 3 – Computer Model Prediction Versus Actual Test Results



Note: this is Figure 7 of Reference 2.

References

1. NSPM Letter to US NRC, "License Amendment Request (LAR) to Adopt the Alternative Source Term Methodology," dated October 27, 2009 (ADAMS Accession No. ML093160583).

2. "Report to the United States Nuclear Regulatory Commission Division of Operating Reactors – Prairie Island Containment Systems Special Analysis," dated April 9, 1976.

3. Northern States Power Company - Prairie Island Nuclear Generating Plant, "Report to the United States Atomic Energy Commission Directorate of Licensing," Dated July 9, 1974.

4. Northern States Power Company, Prairie Island Nuclear Generating Plant Unit 1 and 2 Amendment 62 to Operating License DPR-42 and Amendment 56 to Operating License DPR-60, February 23, 1983 (ADAMS Accession Number ML022180360).

5. Letter from Northern States Power Company, Prairie Island Nuclear Power Plant to Director Office of Nuclear Reactor Regulation, "Revision No. 1 to License Amendment Request dated August 7, 1975 – Containment Leakage Rate Testing Technical Specification Changes," December 3, 1982.