March 21, 2000

Mr. S. E. Scace - Director
Nuclear Oversight and Regulatory Affairs
c/o Mr. David A. Smith
Northeast Nuclear Energy Company
P. O. Box 128
Waterford, CT 06385-0128

SUBJECT: SITE-SPECIFIC WORKSHEETS FOR USE IN THE NUCLEAR REGULATORY COMMISSION'S SIGNIFICANCE DETERMINATION PROCESS (TAC NO. MA6544)

Dear Mr. Scace:

The purpose of this letter is to provide you with one of the key implementation tools to be used by the Nuclear Regulatory Commission (NRC) in the revised reactor oversight process, which is currently expected to be implemented at Millstone Nuclear Power Station, Unit 2 in April 2000. Included in the enclosed Risk-Informed Inspection Notebook are the Significance Determination Process (SDP) worksheets that inspectors will be using to risk-characterize inspection findings. The SDP is discussed in more detail below.

On January 8, 1999, the NRC staff described to the Commission's plans and recommendations to improve the reactor oversight process in SECY-99-007, "Recommendations for Reactor Oversight Process Improvements." SECY-99-007 is available on the NRC's web site at www.nrc.gov/NRC/COMMISSION/SECYS/index.html. The new process, developed with stakeholder involvement, is designed around a risk-informed framework, which is intended to focus both the NRC's and licensee's attention and resources on those issues of more risk significance.

The performance assessment portion of the new process involves the use of both licensee-submitted performance indicator data and inspection findings that have been appropriately categorized based on their risk significance. In order to properly categorize an inspection finding, the NRC has developed the SDP. This process was described to the Commission in SECY-99-007A, "Recommendations for Reactor Oversight Process Improvements (Follow-up to SECY-99-007)," dated March 22, 1999, also available at the same NRC web site noted above.

The SDP for power operations involves evaluating an inspection finding's impact on the plant's capability to limit the frequency of initiating events; ensure the availability, reliability, and capability of mitigating systems; and ensure the integrity of the fuel cladding, reactor coolant system, and containment barriers. As described in SECY-99-007A, the SDP involves the use of three tables: Table 1 is the estimated likelihood for initiating event occurrence during the degraded period, Table 2 describes how the significance is determined based on remaining mitigation system capabilities, and Table 3 provides the bases for the failure probabilities associated with the remaining mitigation equipment and strategies.

As a result of the recently concluded Pilot Plant review effort, the NRC has determined that site-specific risk data is needed in order to provide a repeatable determination of the significance of an issue. Therefore, the NRC has contracted with Brookhaven National Lab (BNL) to develop site-specific worksheets to be used in the SDP review. These enclosed worksheets were developed based on your Individual Plant Examination (IPE) submittals that were requested by Generic Letter 88-20. The NRC plans to use this site-specific information in evaluating the significance of issues identified at your facility when the revised reactor oversight process is implemented industry wide. It is recognized that the IPE utilized during this effort may not contain current information. Therefore, the NRC or its contractor will conduct a site visit to discuss with your staff any changes that may be appropriate. Specific dates for the site visit have not been determined, but will be communicated to you in the near future. All site visits should be accomplished by June 2000. The NRC is not requesting a written response or comments on the enclosed worksheets developed by BNL.

We will coordinate our efforts through your licensing or risk organizations as appropriate. If you have any questions, please contact me at 301-415-2426.

Sincerely,

/RA/

Jacob I. Zimmerman, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-336

Enclosure: As Stated

cc w/encl: See next page

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RISK-INFORMED INSPECTION NOTEBOOK FOR

MILLSTONE NUCLEAR POWER STATION

UNIT 2

PWR, COMBUSTION ENGINEERING, TWO-LOOP PLANT WITH LARGE DRY CONTAINMENT

Prepared by

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Prepared for

U. S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
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NOTICE

This notebook was developed for the NRC's inspection teams to support risk-informed inspections. The activities involved in these inspections are discussed in "Reactor Oversight Process Improvement," SECY-99-007A, March 1999. The user of this notebook is assumed to be an inspector with an extensive understanding of plant-specific design features and operation. Therefore, the notebook is not a stand-alone document, and may not be suitable for use by non-specialists. This notebook will be periodically updated with new or replacement pages incorporating additional information on this plant. Technical errors in, and recommended updates to, this document should be brought to the attention of the following person:

Mr. Jose G. Ibarra
U. S. Nuclear Regulatory
Commission
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TWFN T10 E46
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ABSTRACT

This notebook contains summary information to support the Significance Determination Process (SDP) in risk-informed inspections for the Millstone 2 Nuclear Power Station.

SDP worksheets support the significance determination process in risk-informed inspections and are intended to be used by the NRC's inspectors in identifying the significance of their findings, i.e., in screening risk-significant findings, consistent with Phase-2 screening in SECY-99-007A. To support the SDP, additional information is given in an Initiators and System Dependency table, and as simplified event-trees, called SDP event-trees, developed in preparing the SDP worksheets.

The information contained herein is based on the licensee's IPE submittal. The information is revised based on IPE updates or other licensee or review comments providing updated information and/or additional details.

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1. INFORMATION SUPPORTING SIGNIFICANCE DETERMINATION PROCESS (SDP)

SECY-99-007A (NRC, March 1999) describes the process for making a Phase-2 evaluation of the inspection findings. In Phase 2, the first step is to identify the pertinent core damage scenarios that require further evaluation based on the specifics of the inspection findings. To aid in this process, this notebook provides the following information:

1. Initiator and System Dependency Table
2. Significance Determination Process (SDP) Worksheets
3. SDP Event Trees

The initiator and system dependency table shows the major dependencies between front-line- and support-systems, and identifies their involvement in different types of initiators. The information in this table identifies the most risk-significant front-line- and support-systems; it is not an exhaustive nor comprehensive compilation of the dependency matrix as known in Probabilistic Risk Assessments (PRAs). For pressurized water reactors (PWRs), the support systems for Reactor Coolant Pump (RCP) seals are explicitly denoted to assure that the inspection findings on them are properly accounted for. This table is used to identify the SDP worksheets to be evaluated, corresponding to the inspection's findings on systems and components.

To evaluate the impact of the inspection's finding on the core-damage scenarios, the SDP worksheets are developed and provided. They contain two parts. The first part identifies the functions, the systems, or combinations thereof that can perform mitigating functions, the number of trains in each system, and the number of trains required (success criteria) for each class of initiators. The second part of the SDP worksheet contains the core-damage accident sequences associated with each initiator class; these sequences are based on SDP event trees. In the parenthesis next to each of the sequence the corresponding event tree branch number(s) representing the sequence is included. Multiple branch numbers indicate that the different accident sequences identified by the event tree are merged into one through the boolean reduction. The classes of initiators that are considered in this notebook are 1) Transients, 2) Small Loss of Coolant Accident (LOCA), 3) Stuck-open Power Operated Relief Valve (PORV), 4) Medium LOCA, 5) Large LOCA, 6) Loss of Offsite Power (LOOP), 7) Steam Generator Tube Rupture (SGTR), and 8) Anticipated Transients Without Scram (ATWS). Main Steam Line Break (MSLB) events are included separately if they are treated as such in the licensee's Individual Plant Examination (IPE) submittal.

Following the SDP worksheets, the SDP event trees corresponding to each of the worksheets are presented. The SDP event trees are simplified event trees developed to define the accident sequences identified in the SDP worksheets.

The following items were considered in establishing the SDP event trees and the core-damage sequences in the SDP worksheets:

1. Event trees and sequences were developed such that the worksheet contains all the major accident sequences identified by the plant-specific IPEs. In cases where a plant-specific feature introduced a sequence that is not fully captured by our existing set of initiators and event trees, then a separate worksheet is included.

2. The event trees and sequences for each plant took into account the IPE models and event trees for all similar plants. Any major deviations in one plant from similar plants typically are noted at the end of the worksheet.

3. The event trees and the sequences were designed to capture core-damage scenarios, without including containment-failure probabilities and consequences. Therefore, branches of event trees that are only for the purpose of a Level II PRA analysis are not considered. The resulting sequences are merged using Boolean logic.

4. The simplified event-trees focus on classes of initiators, as defined above. In so doing, many separate event trees in the IPEs often are represented by a single tree. For example, some IPEs define four classes of LOCAs rather than the three classes considered here. The sizes of LOCAs for which high-pressure injection is not required are some times divided into two classes, the only difference between them being the need for reactor scram in the smaller break size. Some IPEs also may define several classes of transients, depending on the initiator's impact on the systems. Such differentiations generally are not considered in the SDP worksheets unless they could not be accounted for by the Initiator and System Dependency table.

5. Major operator actions during accident scenarios are assigned as high stress operator action or an operator action using simple, standard criteria among a class of plants. This approach resulted in the designation of some actions as high-stress operator actions, even though the PRA may have assumed a (routine) operator action; hence, they have been assigned an error probability less than 5E-2 in the IPE. In such cases, a note is given at the end of the worksheet.

The three sections that follow include the initiators and dependency table, SDP worksheets, and the SDP event-trees for the Millstone 2 Nuclear Power Station.

1.1 INITIATORS AND SYSTEM DEPENDENCY

Table 1 provides the list of the systems included in the SDP worksheets, the major components in the systems, and the support system dependencies. The system involvements in different initiating events are noted in the last column.

Table 1 Initiators and System Dependency for Millstone Nuclear Power Station, Unit 2

Affected Systems[1, 2]	Major Components	Support Systems	Initiating Event
Atmospheric Dump Valves (ADVs)	Two ADVs, one for each SG	Instrument Air, 120V Vital AC	SGTR
AC Power System	6.9 kV AC Power	DC Pwr	TRAN, TPCS, SGTR
	4.16 kV AC System: Two emergency buses	ESFAS, DC Pwr	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
	Two Emergency diesel generators (EDGs)	ESFAS, DC Pwr, Service Water	LOOP
	120V Vital AC Power: Four 120 V Vital AC Panels	125 V-DC, DC Switchgear Room Cooling	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
	120 V IAC	4.16 kV AC, DC Switchgear Room Cooling	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
Auxiliary Feedwater (AFW)	2 MDPs	DC Pwr, 120V Vital AC[3]	TRAN, TPCS, SLOCA, SORV, LOOP, SGTR, ATWS, MSLB
	1 SDP	DC Pwr, 120V Vital AC[4]	TRAN, TPCS, SLOCA, SORV, LOOP, SGTR
Circulating Water	Not found in “3.2 Systems Analysis” of IPE	DC Pwr, 4.16 kV AC	TRAN, TPCS, SGTR
Condensate pumps	Three pumps	Instrument Air, 6.9 kV AC	TRAN, TPCS, SGTR
Containment Heat Removal (CHR)	Containment Air Recirculation (CAR) System: Two trains, each with two fan units	ESFAS, 4.16 kV AC, RBCCW	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB

Table 1 (Continued)

Affected Systems[1, 2]	Major Components	Support Systems	Initiating Event
	Containment Spray (CS) System: Two trains, each a pump	ESFAS, DC Pwr, 4.16 kV AC, 480 V-AC, RBCCW, ESF Rm Cool, Sump Recirculation, RWST	
125 V DC Power System	Two buses, each with one battery, and one battery charger. IPE assumes battery life is 8 hours.	480 V AC, DC Switchgear Room Cooling	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
DC Switchgear Room Cooling	Two trains, each with one fan, one pump, and one chiller	4.16 kV AC, 120 V IAC, 125 V DC, Service Water, ESAS, Instrument Air, Chilled Water, TBCCW	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
Emergency Boration / Charging	Three charging pumps, each with a capacity of 44 gpm[5]	ESFAS, 4.16 kV AC	ATWS
	Two boric acid pumps, each with a capacity of 143 gpm[5, 6]		
Engineered Safeguards Actuation System (ESAS)	Four sensor channels and two actuation channels	120 V Vital AC	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
Engineered Safety Features (ESF) Room Cooling System	Two trains, each with a fan	ESFAS, 4.16 kV AC, RBCCW, Service Water	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB
High Pressure Safety Injection (HPSI)	Three pumps[7], each with a design flow of 315 gpm and a design head of 2500 feet	ESFAS, DC Pwr, 4.16 kV AC, RBCCW, ESF Rm Cool, Sump Recirculation, RWST	TRAN, TPCS, SLOCA, SORV, MLOCA, LOOP, SGTR, MSLB
Instrument Air System	3 Air compressors	4.16 kV AC, TBCCW	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB

Table 1 (Continued)

Affected Systems[1, 2]	Major Components	Support Systems	Initiating Event
Low Pressure Safety Injection (LPSI)	Two pumps, each with a design flow of 3000 gpm and a design head of 350 ft.	ESFAS, DC Pwr, 4.16 kV AC, Vital AC panels[8], ESF Rm Cool, Sump Recirculation, RWST	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB
Main Feedwater (MFW)	Two 55% capacity, turbine-driven steam generator feed pumps (SGFPs)	Main Steam, DC Pwr, 4.16 kV AC,[9] Instrument Air, 120 V IAC, Circulating Water, Condensate pumps, TBCCW	TRAN, TPCS, SGTR
Power Operated Relief Valves (PORVs)	Two PORVs	Vital 125 V DC power	TRAN, TPCS, LOOP, SGTR, ATWS, MSLB
	Two motor-operated block valves	Vital 125 V DC power[10]	TRAN, TPCS, SORV, LOOP, SGTR, ATWS, MSLB
Primary Depressurization	Pressurizer Spray, and Auxiliary Pressurizer Spray	DC Pwr, Instrument Air, 6.9 kV AC	SGTR
Primary Relief	Two safety relief valves (SRVs)	None	ATWS
Reactor Building Closed Cooling Water System (RBCCW)	Two trains, each with one pump and one heat exchanger[11]	ESFAS, DC Pwr, 4.16 kV AC, Service Water	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB
Reactor Coolant Pumps (RCP)	Seals	On a typical CE RCP, controlled reactor coolant leakage is cooled by 1 / 2 pumps of CCW (RBCCW)[12]	LOOP, RCP seal LOCA
Refueling Water Storage Tank (RWST)	RWST, two check valves, and two MOVs	Not found in IPE's Dependency Matrix (page 3-133)	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB
Safety Injection Tanks (SIT)	Four ECCS safety injection tanks	None	LLOCA

Table 1 (Continued)

Affected Systems[1, 2]	Major Components	Support Systems	Initiating Event
Service Water System (SW)	Three Pumps	ESFAS, DC Pwr, 4.16 kV AC	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB
Steamline Isolation	One Main Steam Isolation Valve (MSIV) and one Non-Return Valve (NRV) per SG	ESAS	MSLB
Sump Recirculation	Containment sump, and two MOVs	ESFAS, 4.16 kV AC, 120 V Vital AC	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, MSLB
TBCCW	Not found in “3.2 Systems Analysis” of IPE	ESFAS, 4.16 kV AC, SW	TRAN, TPCS, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, MSLB

Notes:

1. The following systems were not found in “3.2 Systems Analysis” of IPE: 480V AC, Chilled Water, and Main Steam.

2. Table 3.2-1, “MP2 Dependency Matrix”, of the IPE (page 3-133) shows that several systems depend on ESFAS. However, ESFAS is not described in “3.2 Systems Analysis” of IPE. It appears that references to ESFAS are really meant to ESAS.

3. It appears that the motive power of the MDPs of AFW is not included in the AFW’s support systems shown in the IPE’s Dependency Matrix, page 3-133.

4. Table 3.2-1, “MP2 Dependency Matrix”, of the IPE (page 3-133) does not separate the support systems for the MDPs and the SDP of AFW. It is not clear that the SDP requires AC power to operate.

5. The shutoff head of these pumps was not found in subsection 3.2.1, “Emergency Boration / Charging”, of the IPE.

6. If the boric acid pumps are not operable, boric acid will flow by gravity from the boric acid tanks to the charging pumps suction header (IPE, page 3-7).

Table 1 (Continued)

7. Pump P41B is a swing pump (IPE, page 3-22).

8. The IPE (page 3-15) states that both LPSI pumps are assumed to fail due to the loss of 2 vital AC panels. The IPE does not provide the identification of these panels, or their voltage.

9. Table 3.2-1, “MP2 Dependency Matrix”, of the IPE (page 3-133) indicates that Main Feedwater (MFW) is supported by 4.16 kV AC. However, it is not clear that the turbine-driven steam generator feed pumps require AC power to operate.

10. From Table 3.2-1, “MP2 Dependency Matrix”, of the IPE (page 3-133), the support system of the motor-operated block valves appears to be DC Power.

11. A third pump and heat exchanger serve as an installed spare to either train of RBCCW.

12. The success criteria for cooling of RCP seals was not found in “3.2 Systems Analysis” of IPE.

13. Plant internal event CDF = 3.4 E-5/reactor year (the contribution of internal flooding is 2.0E-7/reactor year).

1.2 SDP WORKSHEETS

This section presents the SDP worksheets to be used in the Phase 2 evaluation of the inspection findings for the Millstone 2 Nuclear Power Station. The SDP worksheets are presented for the following initiating event categories:

1. Transients with PCS Available (TRAN)
2. Transients with Loss of PCS (TPCS)
3. Small LOCA
4. Stuck-open PORV
5. Medium LOCA
6. Large LOCA
7. LOOP
8. Steam Generator Tube Rupture (SGTR)
9. Anticipated Transients Without Scram (ATWS)
10. Main Steam Line Break

Table 2.1 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 — Transients with PCS Available (TRAN) (Reactor Trip)

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Secondary Heat Removal (AFW)	1 / 2 MDAFW pumps (1 multi-train system) or 1 / 1 SDAFW pump (1 ASD train)
Secondary Heat Removal (MFW)	1 / 2 SGFPs (1 multi-train system)
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Primary Heat Removal, Feed/Bleed (FB)	Operator establishes feed and bleed using 2 / 2 PORVs (operator action under high stress)(1)
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 TRAN - AFW - MFW - CONT (4)			
2 TRAN - AFW - MFW - HPR (5)			
3 TRAN - AFW - MFW - FB (6)			
4 TRAN - AFW - MFW - EIHP (7)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event: If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Note:

(1) In the IPE, failure of Bleed and Feed operation has a probability = 0.2 (IPE, page A-46, event BAF2).

Table 2.2 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Transients with Loss of PCS (TPCS)

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:[1, 2]	***Full* Creditable Mitigation Capability for Each Safety Function**:
Secondary Heat Removal (AFW)	1 / 2 MDAFW pumps (1 multi-train system) or 1 / 1 SDAFW pump (1 ASD train)
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Primary Heat Removal, Feed/Bleed (FB)	Operator establishes feed and bleed using 2 / 2 PORVs (operator action under high stress)[3]
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 TPCS - AFW - CONT (3)			
2 TPCS - AFW - HPR (4)			
3 TPCS - AFW - FB (5)			
4 TPCS - AFW - EIHP (6)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Notes:

(1) IPE's most dominant accident sequence includes the event "CCFs (common cause failure) of the common injection header valves". IPE's list of dominant accident sequences (Table 3.4.1-2, page 3-149) does not give the identification of these valves.

(2) The IPE gives credit to the recovery of Main Feedwater with a failure probability = 0.145 (IPE, page A-46, event MFWREC)..

(3) In the IPE, failure of Bleed and Feed operation has a probability = 0.2 (IPE, page A-46, event BAF2).

Table 2.3 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Small LOCA

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Rapid Secondary Depressurization (RAPDEP)	Operator depressurize to allow use of LPSI (operator action)
Secondary Heat Removal (AFW)	2 / 2 MDAFW pumps (1 train) or 1 / 1 SDAFW pump (1 ASD train) (1)
Low Pressure Injection (LPI)	1 / 2 LPSI pump trains (1 multi-train system)
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Low Pressure Recirculation (LPR)	Recirculation using 1 / 2 LPSI pump trains (operator action) (2)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SLOCA - CONT (2, 7)			
2 SLOCA - LPR (3, 8)			
3 SLOCA - HPR (4)			
4 SLOCA - AFW (5, 10)			
5 SLOCA - EIHP - LPI (9)			

6 SLOCA - EIHP - RAPDEP (11)			
Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event: If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.			

Notes:

(1) For those sequences (3, 4, and 5 of this worksheet) that do not require Rapid Secondary Depressurization (RAPDEP), the success criteria of AFW is 1 / 2 MDAFW pumps (1 multi-train system) or 1 / 1 SDAFW pump (1 ASD train) (IPE, page 3-31).

(2) Manual initiation of LPSI pumps is required for sump recirculation (IPE, page A-43).

Table 2.4 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Stuck Open PORV (SORV)

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Isolation of Small LOCA (BLK)	The closure of the block valve associated with stuck open PORV (recovery action)
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Rapid Secondary Depressurization (RAPDEP)	Operator depressurize to allow use of LPSI (operator action)
Secondary Heat Removal (AFW)	2 / 2 MDAFW pumps (1 train) or 1 / 1 SDAFW pump (1 ASD train)(1)
Low Pressure Injection (LPI)	1 / 2 LPSI pump trains (1 multi-train system)
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Low Pressure Recirculation (LPR)	Recirculation using 1 / 2 LPSI pump trains (operator action)(2)
Containment Press/Temp Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SORV - BLK - CONT (2, 7)			
2 SORV - BLK - LPR (3, 8)			
3 SORV - BLK - HPR (4)			
4 SORV - BLK - AFW (5, 10)			
5 SORV - BLK - EIHP - LPI (9)			

6 SORV - BLK - EIHP - RAPDEP (11)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Notes:

(1) For those sequences (3, 4, and 5 of this worksheet) that do not require Rapid Secondary Depressurization (RAPDEP), the success criteria of AFW is 1 / 2 MDAFW pumps (1 multi-train system) or 1 / 1 SDAFW pump (1 ASD train) (IPE, page 3-31).

(2) Manual initiation of LPSI pumps is required for sump recirculation (IPE, page A-43).

Table 2.5 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Medium LOCA

Estimated Frequency (Table 1 Row) _________ Exposure Time _________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Low Pressure Recirculation (LPR)	1 / 2 LPSI pump trains (1 multi-train system)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 MLOCA - CONT (2)			
2 MLOCA - LPR (3)			
3 MLOCA - EIHP (4)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Table 2.6 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Large LOCA

Estimated Frequency (Table 1 Row) __________	Exposure Time __________	Table 1 Result (circle): A B C D E F G H	
Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**		
Early Inventory, SITs (EISIT)	2 / 3 SITs (1 multi-train system)		
Early Inventory, LP Injection (EILP)	1 / 2 LPSI pump trains (1 multi-train system)		
Low Pressure Recirculation (LPR)	1 / 2 LPSI pump trains (1 multi-train system)		
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)		
Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LLOCA - CONT (2)			
2 LLOCA - LPR (3)			
3 LLOCA - EILP (4)			
4 LLOCA - EISIT (5)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Table 2.7 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— LOOP

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Emergency AC Power (EAC)	1 / 2 Emergency Diesel Generators (1 train) (1)
Turbine-driven AFW Pump (TDAFW)	1 / 1 SDAFW pump (1 ASD train)
Secondary Heat Removal (AFW)	2 / 2 MDAFW pumps (1 train) or 1 / 1 SDAFW pump (1 ASD train)
Recovery of AC Power in < 1 hr (REC1)	SBO procedures implemented (operator action under high stress)(2)
Recovery of AC Power in < 13 hrs (REC13)	SBO procedures implemented (operator action)(3)
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Feed-and-Bleed (FB)	Operator establishes feed and bleed using 2 / 2 PORVs (operator action under high stress) (4)
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LOOP - AFW - CONT (3)			
2 LOOP - AFW - HPR (4)			
3 LOOP - AFW - FB (5)			
4 LOOP - AFW - EIHP (6)			

5 LOOP - EAC - CONT (8, 13) (AC recovered)			
6 LOOP - EAC - HPR (9, 14) (AC recovered)			
7 LOOP - EAC - EIHP (10, 16) (AC recovered)			
8 LOOP - EAC - REC13 (11)			
9 LOOP - EAC - TDAFW - FB (15) (AC recovered)			
10 LOOP - EAC - TDAFW - REC1 (17)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Notes:

(1) The value assessed by the IPE (page A-47) for the failure of 2 of 2 EDGs is 1.06E-2.

(2) IPE's Time-Dependent SBO Analysis (subsection 3.2.20.4, page 3-86) states that the steam generators would dry out 54 minutes after SBO's onset. The IPE assesses the failure probability of 9.09E-3 for the recovery of AC power in 54 minutes (IPE, page A-47, event ACREC54).

(3) IPE's Time-Dependent SBO Analysis (subsection 3.2.20.4, page 3-86) assesses a mean coping time for SBO of about 13 hours. IPE's Time-Dependent SBO Analysis does not discuss the timing of RCP seal LOCA scenarios.

(4) In the IPE, failure of Bleed and Feed operation has a probability = 0.329 (IPE, page A-47, event BAF1).

Table 2.8 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— SGTR

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Isolation of Ruptured SG (ISOL)	Operator isolates faulted SG (operator action)
Secondary Heat Removal (SHR)	1 / 2 MDAFW pumps (1 multi-train system) or 1 / 1 SDAFW pump (1 ASD train) or 1 / 2 SGFPs (1 multi-train system)
Primary Depressurization (PRIDEP)	Operator lowers RCS pressure below the SG safety valves' setpoint with pressurizer spray and with 1 / 2 pressurizer PORVs (operator action under high stress)[1]
Stuck open ADV or MSSV (ADV)	1 / 2 ADVs reseat (operator action under high stress)[2]
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Makeup to RWST (RWSTMU)	Operators add makeup to the RWST (operator action)
Long-Term Cooling (LTC)	1 / 2 LPSI pump trains (1 multi-train system)
Feed-and-Bleed (FB)	Operator establishes feed and bleed using 2 / 2 PORVs (operator action under high stress)[3]
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Containment Press/Temp Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SGTR - ADV - RWSTMU - LTC (4)			
2 SGTR - ADV - EIHP (5)			
3 SGTR - PRIDEP - RWSTMU (7, 19)			
4 SGTR - PRIDEP - EIHP (8, 20)			

5 SGTR - SHR - CONT (10, 22)			
6 SGTR - SHR - HPR (11, 23)			
7 SGTR - SHR - FB (12, 24)			
8 SGTR - SHR - EIHP (13, 25)			
9 SGTR - ISOL - RWSTMU - LTC (16)			
10 SGTR - ISOL - EIHP (17)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Notes:

(1) IPE's "failure to depressurize the primary system using pressurizer spray and PORVs" has a failure probability = 3.85E-3(IPE, page A-46). The IPE (Table 3.3.3-1, page 3-137) has two human errors related to this depressurization: OA (human error probability (HEP) = 7.3E-4), and HI (HEP = 3.8E-3).

(2) For sequences with success of “Primary Depressurization (PRIDEP)”, the IPE assesses a value of 3.15E-3 (IPE, page A-44, node ADV) for “Stuck open ADV or MSSV (ADV)”, and thus the mitigating capability for this worksheet is 1 multi-train system (1.0E-3). For sequences with failure of “Primary Depressurization (PRIDEP)”, the IPE assesses a value of 1.0E-1 (IPE, page A-44, node ADV1) for “Stuck open ADV or MSSV (ADV)”, and thus the mitigating capability for this worksheet is operator action under high stress (1.0E-1).

(3) The human error probability (HEP) assessed in the IPE (page A-44) for establishing bleed and feed cooling is 2.05E-1 (event BAF).

Table 2.9 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— ATWS (given loss of MFW)

Estimated Frequency (Table 1 Row) __________ Exposure Time __________ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	**Full Creditable Mitigation Capability for Each Safety Function:**
Turbine Trip (TTP)	Automatic turbine trip (1 train)(1)
Primary Relief (SRV)	2 / 2 SRVs open and 1 / 2 PORVs open (1 train)
Secondary Heat Removal (AFW)	2 / 2 MDAFW pumps (1 multi-train system)
Emergency Boration (EMEBOR)	Operator initiates Emergency Boration using 1 / 3 charging pumps (operator action)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 ATWS - EMEBOR (2)			
2 ATWS - AFW (3)			
3 ATWS - SRV (4)			
4 ATWS - TTP (5)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:
If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

<u>Note</u>:

(1) IPE's event tree "ATWS given a loss of MFW" (IPE, page A-25) does not require turbine trip.

Table 2.10 SDP Worksheet for Millstone Nuclear Power Station, Unit 2 —— Main Steam Line Break Downstream of NRVs (MSLB)

Estimated frequency (Table 1 row) __________ Exposure time __________ Table 1 result (circle): A B C D E F G H

Safety Functions Needed:	***Full* Creditable Mitigation Capability for each Safety Function:**
Both MSIVs Close (MSIV2)	2 / 2 MSIVs close (1 train)
One MSIV Closes (MSIV1)	1 / 2 MSIVs close (1 train)
Secondary Heat Removal (AFW)	1 / 2 MDAFW pumps (1 multi-train system)(1)
Isolation of AFW (ISAFW)	Operator isolates AFW (operator action)(2)
Early Inventory, HP Injection (EIHP)	2 / 2 HPSI pump trains (1 train)
Primary Heat Removal, Feed/Bleed (FB)	2 / 2 PORVs and block valves open for Feed/Bleed (operator action under high stress)(3)
High Pressure Recirculation (HPR)	Recirculation using 2 / 2 HPSI pump trains with 1 / 2 LPSI pump trains (1 train)
Containment Pressure / Temperature Control (CONT)	1 / 2 Containment Spray trains or 1 / 4 CAR fans (2 multi-train systems)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 MSLB - AFW - CONT (3, 10, 15, 21)			
2 MSLB - AFW - HPR (4, 11, 16, 22)			
3 MSLB - AFW - FB (5, 12, 17, 23)			
4 MSLB - AFW -EIHP (6, 13, 18, 24)			

5 MSLB - MSIV2 - ISAFW (8, 19)			
Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event: If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.			

<u>Notes</u>:

(1) The availability of the SDAFW pump depends on the faulted SG. For this reason, we conservatively did not credit this pump in this worksheet.

(2) According to the IPE (page 3-40), if only one of the two MSIVs close, manual isolation of AFW flow to the faulted SG is required (sequences 8 and 9 of SDP event tree). If both MSIVs fail to close, manual isolation of AFW flow to both SGs is recommended to prevent pressurized thermal shock (sequences 16 to 22 of SDP event tree).

(3) In the IPE, failure of Bleed and Feed operation has a probability = 0.249 (IPE, page A-49, event BAF).

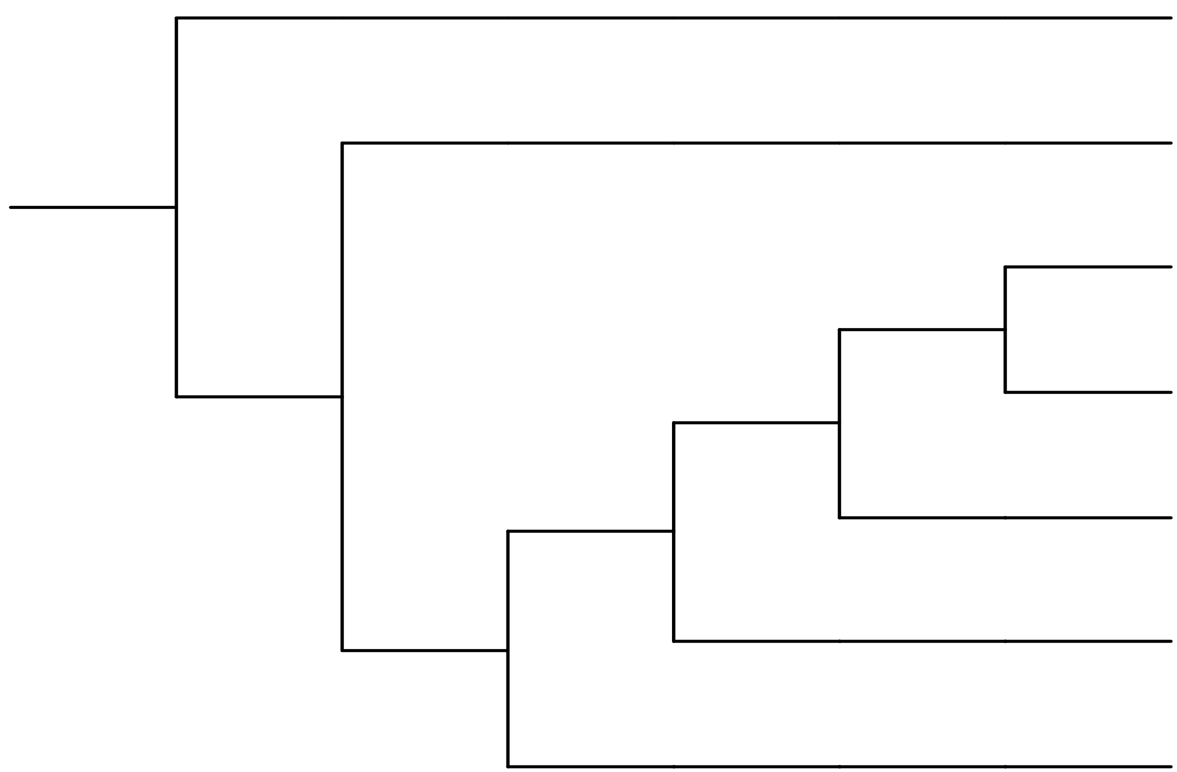
1.3 SDP EVENT TREES

This section provides the simplified event trees called SDP event trees used to define the accident sequences identified in the SDP worksheets in the previous section. An event tree for the stuck-open PORV is not included since it is similar to the small LOCA event tree. The event tree headings are defined in the corresponding SDP worksheets.

The following event trees are included:

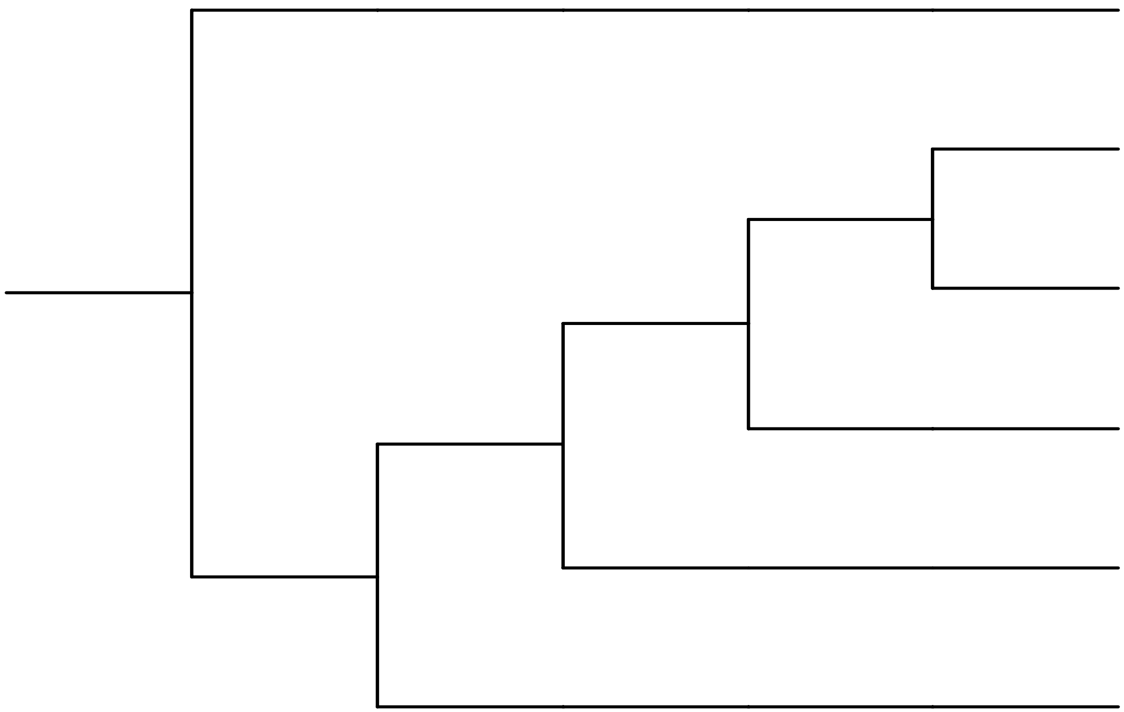
1. Transients with PCS Available (TRAN)
2. Transients with Loss of PCS (TPCS)
3. Small LOCA
4. Medium LOCA
5. Large LOCA
6. LOOP
7. Steam Generator Tube Rupture (SGTR)
8. Anticipated Transients Without Scram (ATWS)
9. Main Steam Line Break

TRAN	AFW	MFW	EIHP	FB	HPR	CONT	#	STATUS
							1	OK
							2	OK
							3	OK
							4	CD
							5	CD
							6	CD
							7	CD



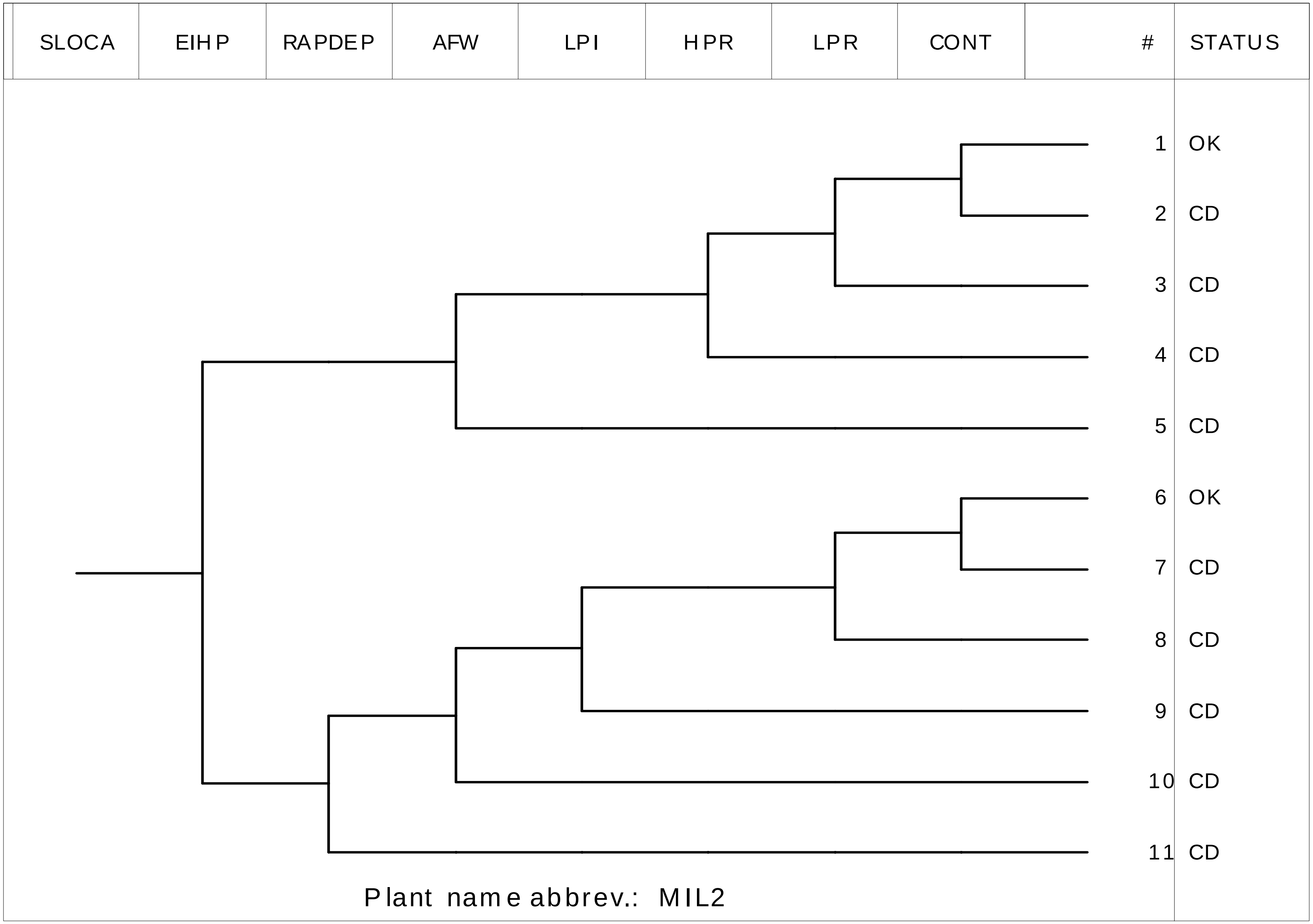
Plant name abbrev.: MIL2

TPCS	AFW	EIHP	FB	HPR	CONT	#	STATUS

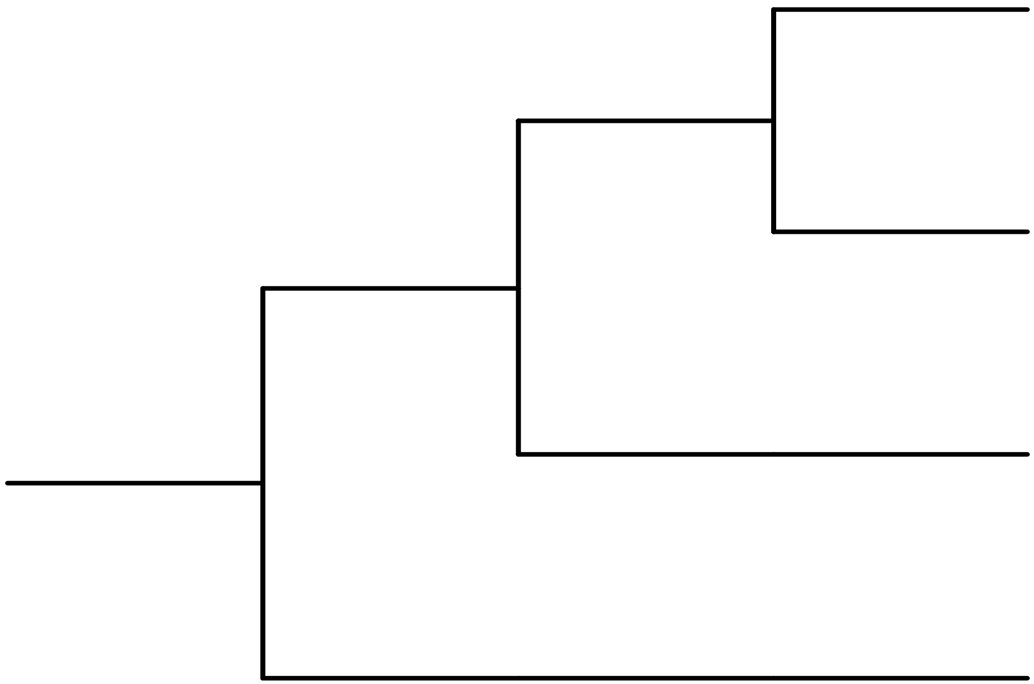


#	STATUS
1	OK
2	OK
3	CD
4	CD
5	CD
6	CD

Plant name abbrev.: MIL2

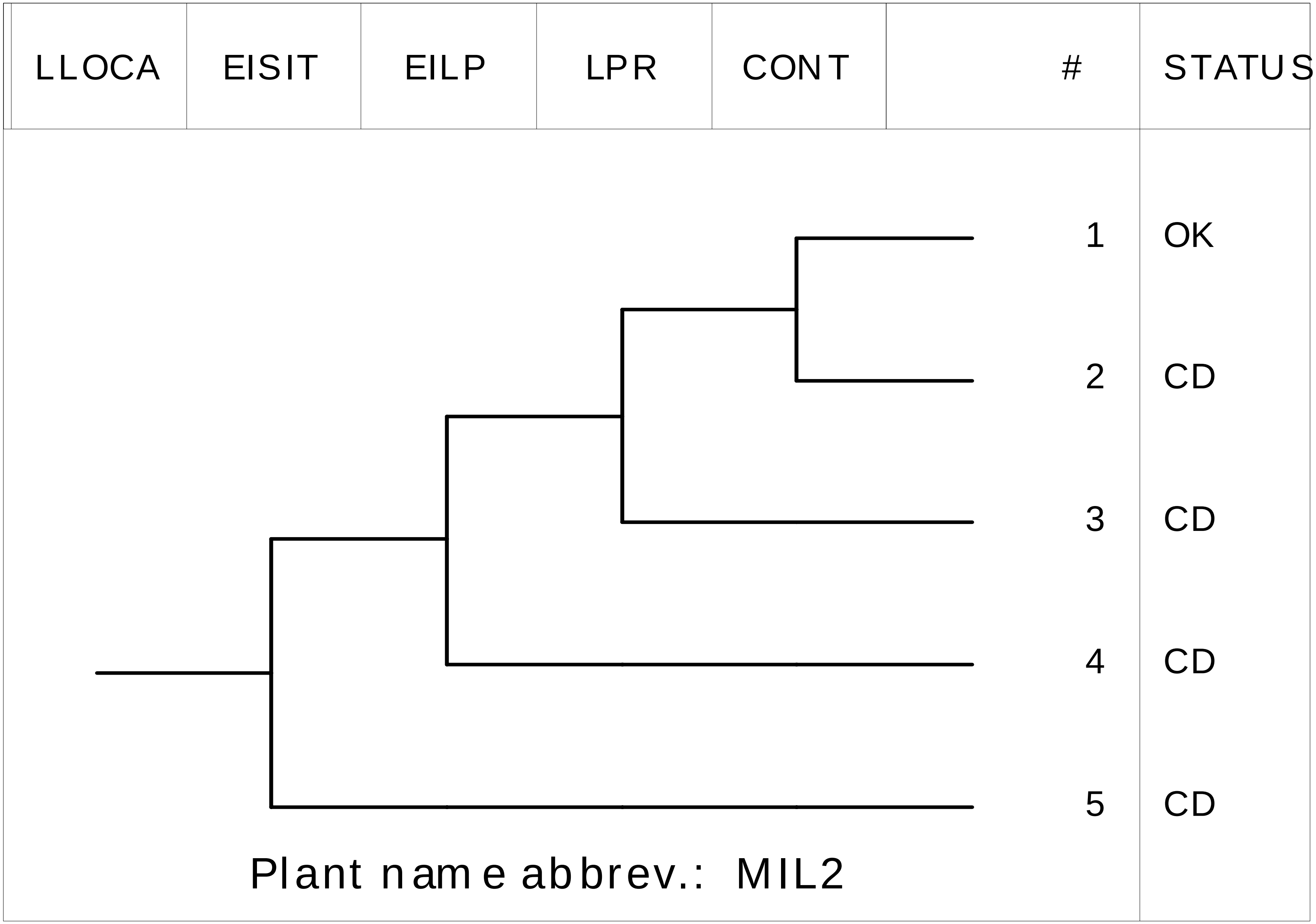

SLOCA
EIHP
RAPDEP
AFW
LPI
HPR
LPR
CONT
#
STATUS
1 OK
2 CD
3 CD
4 CD
5 CD
6 OK
7 CD
8 CD
9 CD
10 CD
11 CD
Plant name abbrev.: MIL2

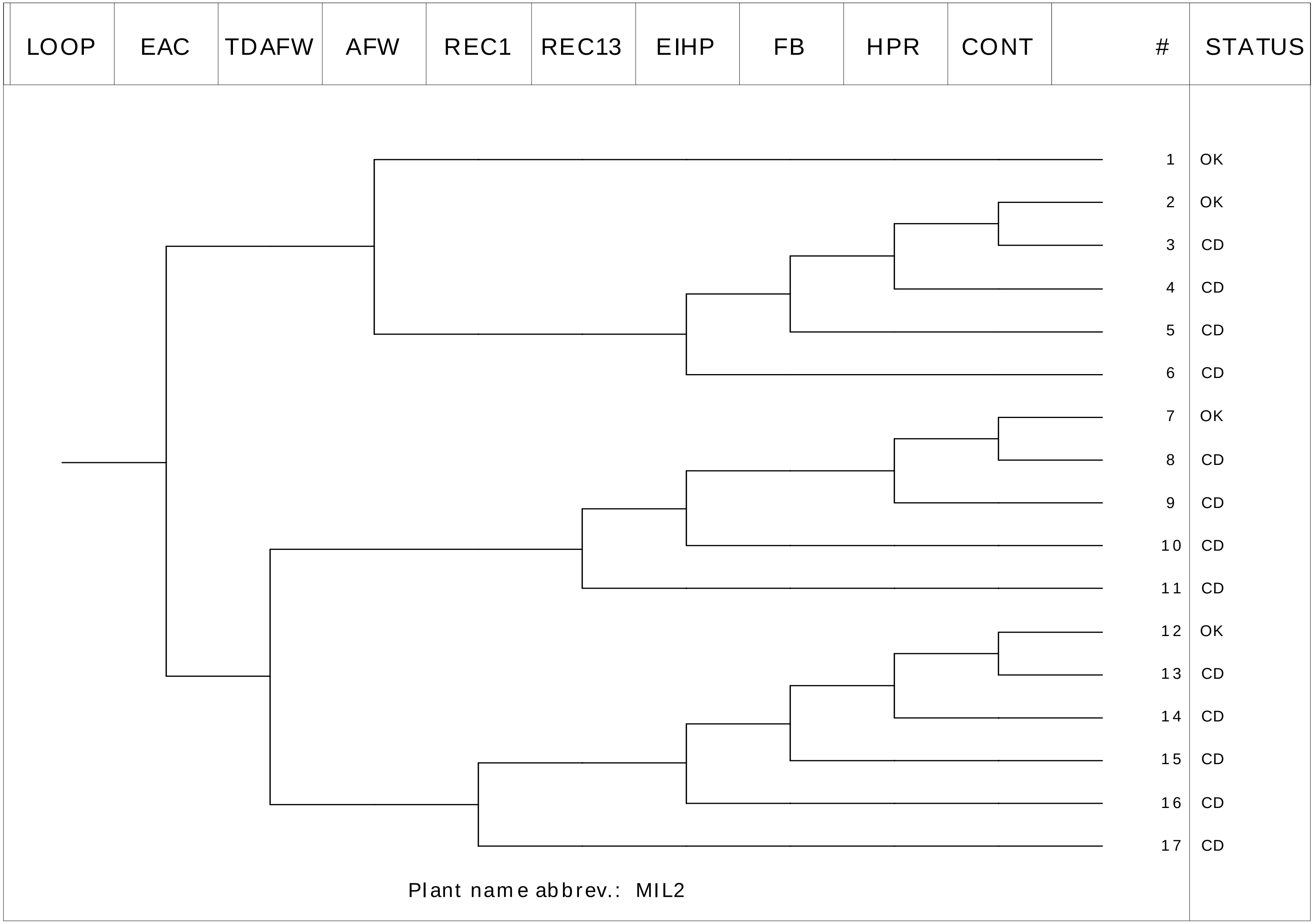
Rev. 0, Mar. 10, 2000

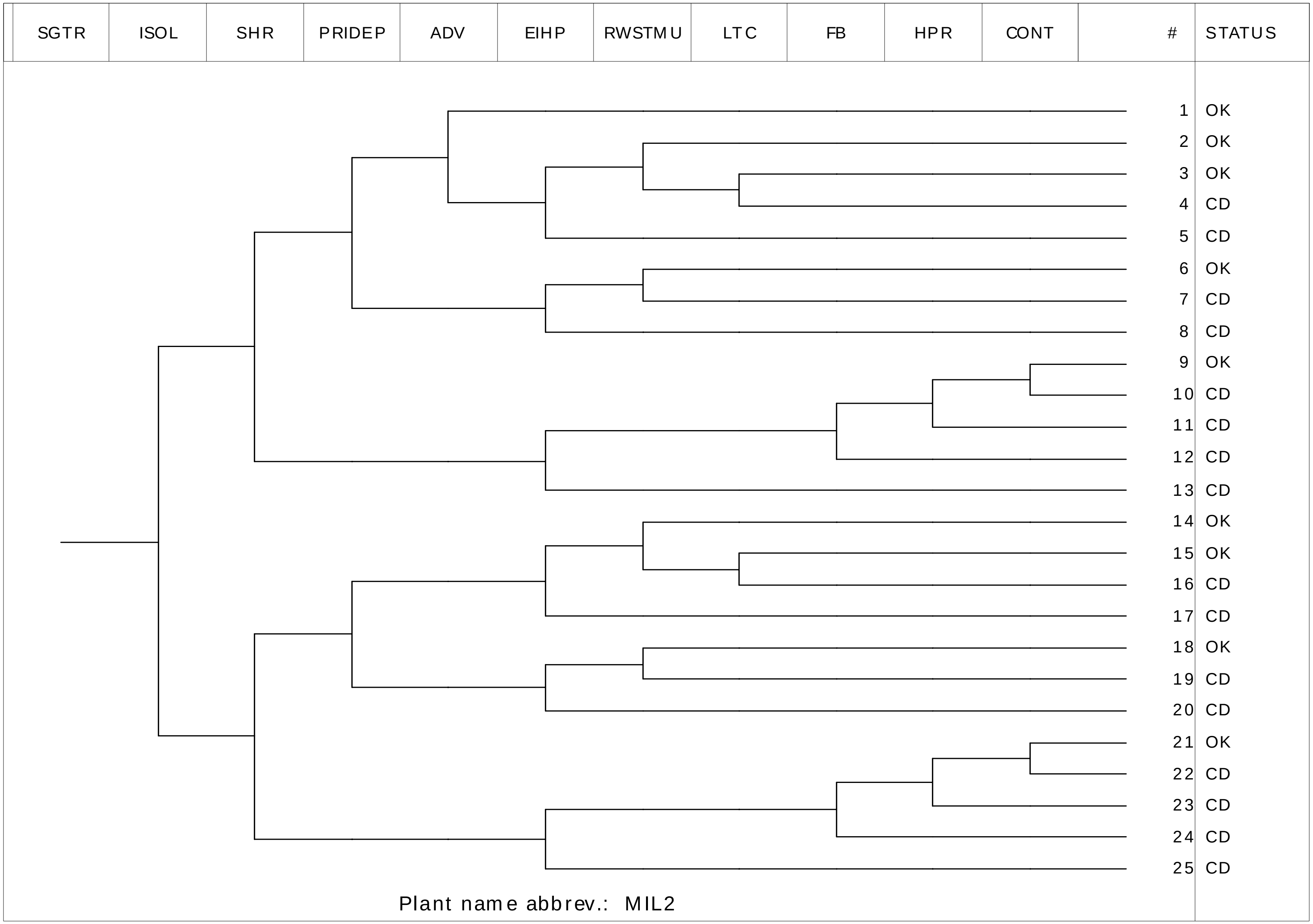


MLOCA	EIHP	LPR	CONT	#	STATUS
				1	OK
				2	CD
				3	CD
				4	CD

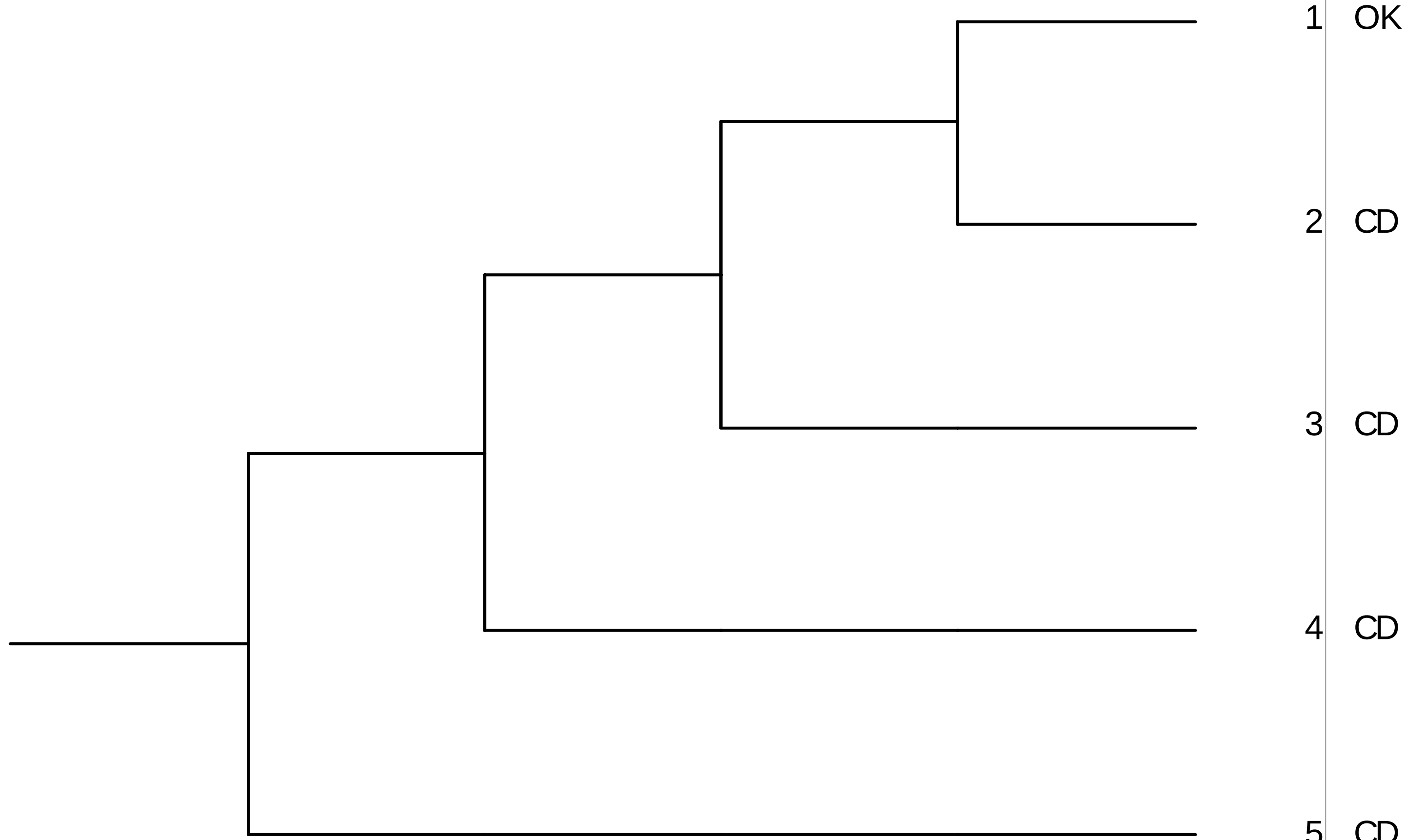
Plant name abbrev.: MIL2


LLOCA
EISIT
EILP
LPR
CONT
#
STATUS
1
OK
2
CD
3
CD
4
CD
5
CD
Plant name abbrev.: MIL2


LOOP
EAC
TDAFW
AFW
REC1
REC13
EIHP
FB
HPR
CONT
#
STATUS
1 OK
2 OK
3 CD
4 CD
5 CD
6 CD
7 OK
8 CD
9 CD
10 CD
11 CD
12 OK
13 CD
14 CD
15 CD
16 CD
17 CD
Plant name abbrev.: MIL2

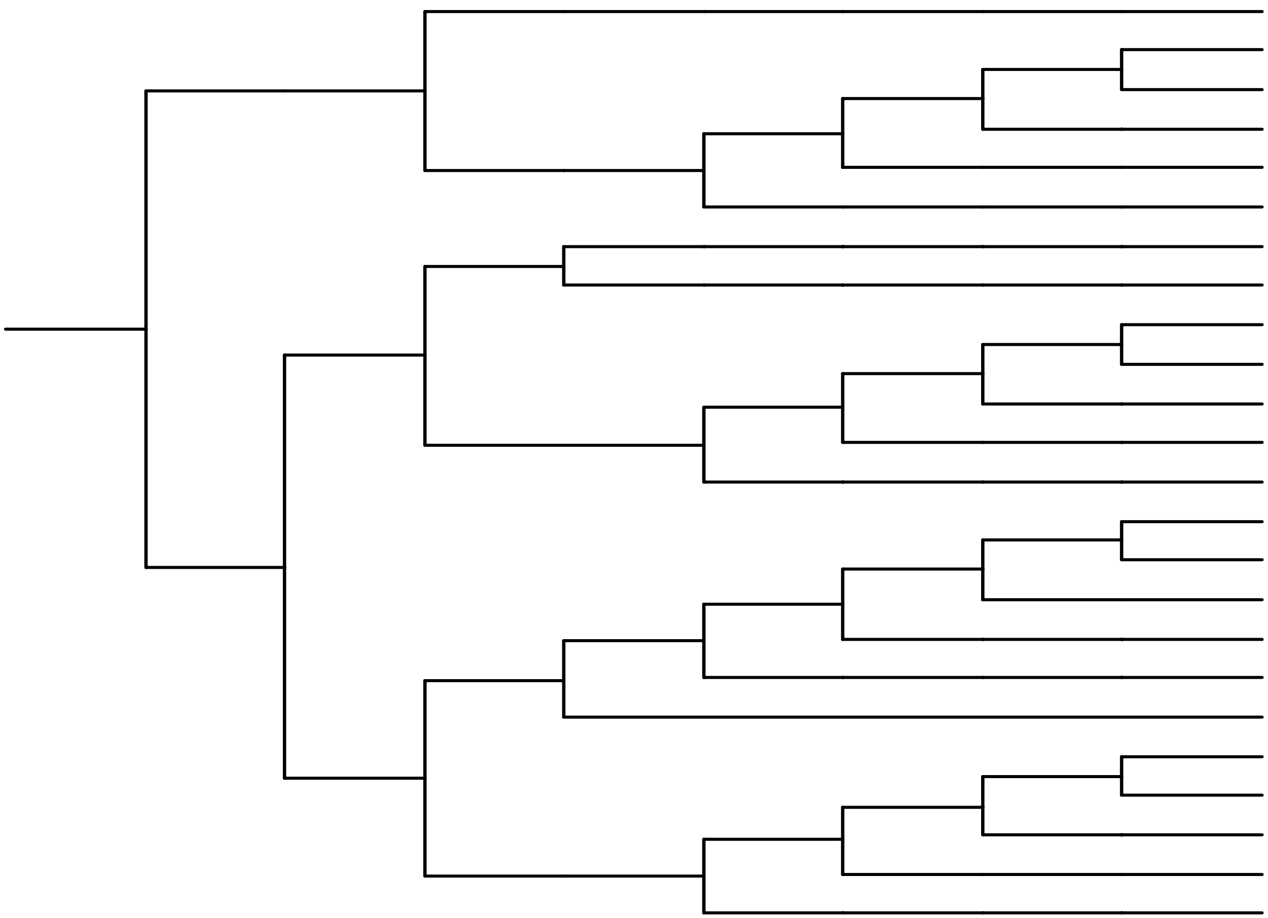

SGTR
ISOL
SHR
PRIDEP
ADV
EIHP
RWSTMU
LTC
FB
HPR
CONT
#
STATUS
1 OK
2 OK
3 OK
4 CD
5 CD
6 OK
7 CD
8 CD
9 OK
10 CD
11 CD
12 CD
13 CD
14 OK
15 OK
16 CD
17 CD
18 OK
19 CD
20 CD
21 OK
22 CD
23 CD
24 CD
25 CD
Plant name abbrev.: MIL2

ATWS	TTP	SRV	AFW	EMEBOR	#	STATUS



Plant name abbrev.: MIL2

MSLB	MSIV2	MSIV1	AFW	ISAFW	EIHP	FB	HPR	CONT	#	STATUS
									1	OK
									2	OK
									3	CD
									4	CD
									5	CD
									6	CD
									7	OK
									8	CD
									9	OK
									10	CD
									11	CD
									12	CD
									13	CD
									14	OK
									15	CD
									16	CD
									17	CD
									18	CD
									19	CD
									20	OK
									21	CD
									22	CD
									23	CD
									24	CD



Plant name abbrev.: MIL2

2. RESOLUTION AND DISPOSITION OF COMMENTS

This section documents the comments received on the material included in this report and their resolution. This section is blank until comments are received and are addressed.

REFERENCES

1. NRC SECY-99-007A, Recommendations for Reactor Oversight Process Improvements (Follow-up to SECY-99-007), March 22, 1999.

2. Northeast Nuclear Energy Company, "Millstone Nuclear Power Station, Unit 2 Individual Plant Examination Submittal Report," December 1993.

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