August 15, 2001

Mr. W. R. McCollum, Jr
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7800 Rochester Highway
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SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2 AND 3 RE: SITE-SPECIFIC WORKSHEETS FOR USE IN THE NUCLEAR REGULATORY COMMISSION'S SIGNIFICANCE DETERMINATION PROCESS (TAC NO. MA6544)

Mr. McCollum:

Enclosed please find the Risk-Informed Inspection Notebook which incorporates the updated Significance Determination Process (SDP) Phase 2 Worksheets that inspectors will be using to characterize and risk-inform inspection findings. This document is one of the key implementation tools of the reactor safety SDP in the reactor oversight process and will also be publicly available through the Nuclear Regulatory Commission (NRC) external website at http://www.nrc.gov/NRC/IM/index.html.

The 1999 Pilot Plant review effort clearly indicated that significant site-specific design and risk information was not captured in the Phase 2 worksheets forwarded to you last spring. Subsequently a site visit was conducted by the NRC to verify and update plant equipment configuration data and to collect site-specific risk information from your staff. The enclosed document reflects the results of this visit.

The enclosed Phase 2 Worksheets have incorporated much of the information we obtained during our site visits. The staff encourages further licensee comments where it is identified that the Worksheets give inaccurately low significance determinations. Any comments should be provided to the Document Control Desk, with a copy to the Chief, Probabilistic Safety Assessment Branch, Nuclear Reactor Regulation. We will continue to assess SDP accuracy and update the document based on continuing experience.

While the enclosed Phase 2 Worksheets have been verified by our staff to include the site specific data, we will continue to assess its accuracy throughout implementation and update the document based on comments by our inspectors and your staff.

Sincerely,

/RA/

David E. LaBarge, Senior Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosure: Risk-Informed Inspection Notebook

cc w/encl: See next page

While the enclosed Phase 2 Worksheets have been verified by our staff to include the site specific data, we will continue to assess its accuracy throughout implementation and update the document based on comments by our inspectors and your staff.

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RISK-INFORMED INSPECTION NOTEBOOK FOR

OCONEE NUCLEAR STATION

UNITS 1, 2, AND 3

PWR, B&W, TWO-LOOP PLANT WITH LARGE DRY CONTAINMENT

Prepared by

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Prepared for

U. S. Nuclear Regulatory Commission
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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:

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ABSTRACT

This notebook contains summary information to support the Significance Determination Process (SDP) in risk-informed inspections for the Oconee Nuclear Station, Units 1, 2, and 3.

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.

CONTENTS

FIGURES

Page

TABLES

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 Oconee Nuclear Station, Units 1, 2, and 3.

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 Oconee Nuclear Stations[1]

Affected Systems	Major Components	Support Systems	Initiating Event
Accumulators (CFTs)	Two Accumulators (Core flood tanks)	None	LLOCA
AC Power System	AC Power Distribution and AC Instrument Power	HVAC, DC	LOOP
EFW	Twp MDPs , each feeding one SG	Air System (IA, or Aux. Air), LPSW, 4160 V-AC, 600 V-AC, 208 V-AC, 125 V-DC	Transient, SLOCA, SORV, LOOP, SGTR, ATWS
	One TDP, capable of feeding both SGs	Air System (IA, or Aux. Air), LPSW or HPSW, 125 V-DC (but could continue operation upon loss of DC)	
	UST (Upper Surge Tank)	Make up from: Demineralized, CST, or Condenser hotwell Air System (IA, or Auxiliary Air)	
ASW	One ASW pump share between three units for decay heat removal	Lake water through the two (2/4) CCW (Condenser Circulating Water) Pumps Manual Operation from Switchgear Panel Opening of ADVs to depressurize, AC, DC	Transient, SLOCA, SORV, LOOP, SGTR
LPSW	Two Pumps in two trains for lake suction (Note units 1 and 2 share a three train pump system) Three pumps in three trains for lake discharge	IA, CCW, 4160 V-AC, 600 V-AC, 208 V-AC, 120 V-AC, 125 V-DC	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, RCP seal LOCA

Table 1 (Continued)

Affected Systems	Major Components	Support Systems	Initiating Event
Component Cooling Water (CC)	Two pump trains [(2)]	LPSW,600 V-AC, 208 V-AC, 125 V-DC	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, RCP seal LOCA
HPSW	Two 6000 gpm pumps and one 500 gpm Jocky Pump	CCW, 4160 V-AC, 600 V-AC, 208 V-AC, 120 V-AC, 125 V-DC	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, RCP seal LOCA
Condensate / MFW	Three 50% Condensate pumps Two 100% TDMFW Pumps	IA, Aux. IA, RCW, 4160 V-AC, 600 V-AC, 208 V-AC, 250 V-DC, 125 V-DC	Transient, SGTR
Containment Fan Coolers	Three Parallel Cooling Trains	AC, DC, ESFAS, LPSW	LLOCA
Cont / RB Spray System	Two Subsystems, each with one pump	4160 V-AC, 208 V-AC, LPSW, ESAS	LLOCA
HPI/CVCS	Three HPI pumps	IA or Aux. IA, LPSW or HPSW, 4160 V-AC, 600 V-AC, 208 V-AC, 125 V-DC, ESAS, BWST	Transient, SLOCA, SORV, MLOCA, LOOP, SGTR, ATWS, RCP seal LOCA
DC Power System	Buses, Three battery chargers (two in operation normally), and two batteries (1850 amp-hour, each could provide loads for one hour)	HVAC; Loss of HVAC in equipment room could cause CCF of inverters, chargers, and breakers. This is treated as a special initiator in IPE	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, RCP seal LOCA
Emergency AC	Two main feeder bus provide power to three redundant eng. safeguard switchgear bus. 1/2 Keowee Hydro Unit either through under ground or overhead path	DC, ESAS	LOOP

Table 1 (Continued)

Affected Systems	Major Components	Support Systems	Initiating Event
	One SSF DG dedicated to SSF ASW pump.	125 V-DC	
ESAS	Instrumentations, relay and actuation logics	120 V-AC	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR, ATWS, RCP seal LOCA
Instrument Air (IA) and Auxiliary Instrument Air (AIA)	IA: Four air compressors, one primary and three backup AIA: Three air compressors	HPSW, LPSW, RCW, 4160 V-AC, 600 V-AC, 120 V-AC	Transient, SLOCA, SORV, LOOP, SGTR, ATWS
Main Steam	Per SG: Two ADVs, eight safety valves MSIVs and four turbine bypass valves (air operated)	125 V-DC, IA, AIA	SGTR
Pressurizer Pressure Relief	Two Safety valves and one PORVs with associated block valves	600 V-AC (block valve), 125 V-DC (PORV), IA (needed for the auxiliary prizer spray valve)	Transient, SLOCA, SORV, LOOP, SGTR, ATWS
RCP	Seals (Bingham)	1 / 2 HPI pumps or 1/1 SSF RCM pump for seal injection or 1 / 2 CC train for seal cooling	LOOP, RCP seal LOCA
LPI/RHR	2 RHR/LPSI pumps and heat exchanger are normally aligned with the third pump valved out and load shed	LPSW, 4160V-AC, 600 V-AC, 208 V-AC, 125 V-DC, ESAS	Transient, SLOCA, SORV, MLOCA, LLOCA, LOOP, SGTR

Notes:

(1) Plant internal event CDF = 1.8 E-5/yr, Fire 2.2E-5/yr, and Seismic 5.0E-5/yr. The information provided in this document are from Oconee unit 3 but they could be used for Units 1 and 2.

(2) The information on the system was not directly available from the IPE document.

1.2 SDP WORKSHEETS

This section presents the SDP worksheets to be used in the Phase 2 evaluation of the inspection findings for the Oconee Nuclear Station, Units 1, 2, and 3. The SDP worksheets are presented for the following initiating event categories:

1. Transients
2. Transients with Loss of PCS
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. SDP Worksheet — Main Steam/Feedwater Line Break (MS/FLB)
11. Loss of Instrument Air (IA)
12. Loss of LPSW (LLPSW)

Table 2.1 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Transients

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:**
Power Conversion System (CS)	½ MFW trains and 2/3 Condensate pumps to ½ SG (Operator action)
Secondary Heat Removal (EFW)	½ MDEFW trains (1 multi-train system) or 1 TDEFW train (1 ASD train)
Alternate Sec. Heat Removal (ASW)	1/1 SSF ASW pump (operator action)(1)
Primary bleed (FB)	½ SRVS to open (1 multi-train system) or 1/1 PORV open (operator action)
Early Inventory, HPI Injection (EIHP)	2/3 HPI pumps injecting to 2 out of 4 RCS from BWST (1 multi-train system)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from ½ LPI trains (Operator action)(2)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1. TRA - PCS - EFW - ASW - HPR (5)			
2 TRA - PCS - EFW - ASW - EIHP (6)			.
3 TRA - PCS - EFW - ASW - FB (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.

Notes:

(1) The value used in the IPE is 3.1E-2 for the failure of the operator to manually align the ASW pump. The use of operator action (0.01) is non-conservative for this case.

(2) The human error probability (HEP) assessed in the IPE for switch over to recirculation is 2.2E-03.

Table 2.2 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Transients with Loss of PCS

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 (EFW)	1 / 2 MDEFW trains (one multi-train system) or one TDEFW train (one ASD train)
Alternate Sec. Heat Removal (ASW)	1 / 1 SSF ASW pump (operator action)(1)
Primary bleed (FB)	1 / 2 SRVS to open (one multi-train system) or 1/1 PORV open (operator action)
Early Inventory, HPI Injection (EIHP)	2/3 HPI pumps injecting to 2 out of 4 RCS from BWST (one multi-train system)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Operator action)(2)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1. TRAN - EFW - ASW - HPR (5)			
2 TRAN - EFW - ASW - EIHP (6)			
3 TRAN - EFW - ASW - FB (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.

Notes:

(1) The value used in the IPE is 3.1E-2 for the failure of the operator to manually align the ASW pump. The use of operator action (0.01) is non-conservative for this case.

(2) The human error probability (HEP) assessed in the IPE for switch over to recirculation is 2.2E-03.

Table 2.3 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Small LOCA <1.5"

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)	1/3 HPI pumps injecting to 2 out of 4 RCS from BWST (one multi-train system)
Secondary Heat Removal or Primary Depressurization (SHR/DEP)	1/2 MDEFW trains (one multi-train system) or one TDEFW train (one ASD train),or 1/1 SSF ASW pump (operator action)(1) or 1/1 SRVs to open (one multi-train system), or 1/1 PORV to open (one Train)(2)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Operator action)(3)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SLOCA - HPR (2)			
2 SLOCA - EIHP (3)			
3 SLOCA - SHR/DEP (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.

Notes:

(1) The value used in the IPE is 3.1E-2 for the failure of the operator to manually align the ASW pump. The use of operator action (0.01) is non-conservative for this case.

(2) The IPE analysis shows that SRV and PORV will be demanded by the pressure in Reactor Building upon failure of secondary heat removal. There fore the function SHR/DEP has a high probability of success.

(3) The human error probability (HEP) assessed in the IPE for switch over to recirculation is 2.2E-03.

Table 2.4 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Stuck Open PORV or SRV (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:**
Early Inventory, HP Injection (EIHP)	1/3 HPI pumps injecting to two out of four RCS from BWST (one multi-train system)
Isolation of Small LOCA (BLK)	Closure of the block valve if open (operator action)(1)
Secondary Heat Removal or Primary Depressurization (SHR/DEP)	1/2 MDEFW trains (one multi-train system) or one TDEFW train (one ASD train),or 1/1 SSF ASW pump (operator action)(2) or 1/2 SRVs to open (one multi-train system), or 1/1 PORV to open (one Train)(3)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Operator action)(4)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SORV - BLK - HPR (2)			
2 SORV - BLK - EIHP (3)			
3 SORV - BLK - SHR/DEP (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.

Notes:

(1) The stuck open SRV can not be isolated however the stuck open PORV can be isolated. The associated human error probability assigned in the IPE is 0.1 (the same as conservative screening value).

(2) The value used in the IPE is 3.1E-2 for the failure of the operator to manually align the ASW pump. The use of operator action (0.01) is non-conservative for this case.

(3) The IPE analysis shows that SRV and PORV will be demanded by the pressure in Reactor Building upon failure of secondary heat removal. There fore the function SHR/DEP has a high probability of success.

(4) The human error probability (HEP) assessed in the IPE for switch over to recirculation is 2.2E-03.

Table 2.5 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Medium LOCA <4"

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)	1/3 HPI pumps injecting to two out of four RCS from BWST (one multi-train system)
High Pressure Recirculation (LPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Operator action)

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

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 Oconee Nuclear Station, Units 1, 2, and 3 —— Large LOCA >4"

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:**
Core Flood Tank (CFT)	1/2 CFT inject to vessel, assuming one train affected by LOCA (one train system; high reliability)
Early Inventory, LP Injection (EILP)	1/2 LPI trains inject to vessel (one multi-train system)(1)
Low Pressure Recirculation (LPR)	1/2 LPI trains in recirculation mode (operator action)(2)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LLOCA - LPR (2)			
2 LLOCA - EILP (3)			
3 LLOCA - CFT (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.

Notes:

(1) On loss of LPI there are possibilities for recovery actions if the HPI pumps is operating these are: alignment of the spare LPI pump in 15 minutes, or to perform manual valve operation from the control room if the loss of LPI is due to failure of the needed valves to open. These recovery actions even though discussed have not been credited in the IPE.

(2) Operator has to do switch over in 30 minutes. The value of HEP used in IPE is 1.0E-3.

(3) The containment heat removal function is assumed to be performed by the LPR and the associated heat exchanger. Failure of LPR therefore indicates failure of containment heat removal as well.

Table 2.7 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— 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 Keowee Hydro Units through either underground or overhead path (one multi-train system)
Availability of SSF Systems (SSF)	Availability of SSF DG , SSF ASW pump, and SSF RCM RCP injection (High stress operator action)(1)
Turbine-driven EFW P Pump (TDEFW)	1/1 TDEFW train (one ASD train)
Secondary Heat Removal (AFW)	1/2 MDEFW train after AC recovered-Excluding TDEFW credited earlier (one multi-train system)
Recovery of AC Power in < 1 hrs (REC1)	Recovery of an AC source including the closure of 4.16 KV breakers (high stress operator action) (2)
Recovery of AC Power in < 5 hrs (REC5)	Recovery of an AC source including the closure of 4.16 KV breakers (Operator action)(3)
Early Inventory, HP Injection (EIHP)	2/3 HPI pumps injecting into 2 of RCS injection nozzles (one multi-train system)
Primary Heat Removal (FB)	1/2 SRVS to open (one multi-train system) or 1/1 PORV open (operator action)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (operator action)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LOOP - EAC - SSF - REC1 - HPR (5)			
2 LOOP - EAC - SSF - REC1 - EIHP (6)			
3 LOOP - EAC - SSF - REC5 (7)			

4 LOOP - EAC - SSF - TDEFW - REC1 (13) (AC recovered within 5 hours)			
5 LOOP - EAC - SSF - TDEFW - AFW - EIHP (12) (AC recovered in one hour similar to tran.)			
6 LOOP - EAC - SSF - TDEFW - AFW - FB (11) (AC recovered in one hour similar to tran.)			
7 LOOP - EAC - SSF - TDEFW - AFW - HPR (11) (AC recovered in one hour similar to tran.)			
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 availability of SSF systems the DG, RCM pump, and ASW pump could provide a means to go to safe shutdown. For the sake of simplicity for the SDP sheets, these function are all combined under SSF heading. The combined required operator actions therefore is assigned a probability of 0.1. This may not exactly reflect the plant risk profile but is considered sufficient for the purpose of screening.

(2) The heading on Recovery of AC Power in < 1 hrs (REC1) is assumed to reflect the core damage with RCP seal LOCA and failure of secondary heat removal.

(3) The heading on Recovery of AC Power in < 5 hrs (REC5) is assumed to reflect the core damage with RCP seal LOCA but availability of secondary heat removal. The leak rate in this case is assumed to be about 100 GPM.

(4) The human error probability (HEP) assessed in the IPE (page 3-129) for establishing bleed and feed cooling is 7.05E-2 (event OAB).

Table 2.8 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— 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:**
Secondary Heat Removal/Main Feed Water (MFW)	1/2 MFW trains and 2/3 Condensate pumps to 1/2 (Operator action)
Secondary Heat Removal (EFW)	1/2 MDEFW trains (one multi-train system) or one TDEFW train (one ASD train)
Early Inventory, HP Injection (EIHP)	1/3 HPI pumps injecting into 2/4 RCS injection nozzles (one multi-train system)
Pressure Equalization (EQ)	RCS cooldown and depressurization using pressurizer spray (operator action)(1) or RCS depressurization through the 2/2 turbine bypass valves in the affected SG (Operator action)(2)
Primary Depressurization (DEP)	1/1 PORV open (Operator action)(3)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (operator action)(4)
Decay Heat Removal (DHR)	1/2 LPI trains in DHR mode (operator action)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SGTR - EIHP (14)			
2 SGTR - EQ - HPR (4,9)			
3 SGTR - EQ - DEP (5,10)			
4 SGTR - MFW - EFW - DEP (13)			
5 SGTR - MFW - EFW - HPR (12)			

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:

General Comment: Sequences 2 and 7 in the event tree are not included in the SDP sheets. These sequences do not usually end up to core damage, and they are shown on the event tree to reflect normal procedure in dealing with SGTR.

(1) The human error probability used in IPE was 2.0E-4.

(2) The human error probability used in IPE was 2.0E-4. However both human actions in equalization are assumed to be coupled.

(3) The human error probability for this operator action could not be found in IPE.

(4) The human error probability (HEP) assessed in the IPE for switch over to recirculation is 2.2E-03.

Table 2.9 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— ATWS[(1)]

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 Boration (HPI)	1/3 HPI pumps injecting to two out of four RCS injection nozzles (one multi-train system)
Turbine Trip (TTP)	2/2 AMSAC channels (one train)
Primary Relief (SRV)	2/2 SRVs (one train)
Secondary Heat Removal (EFW)	1/2 MDEFW trains (one multi-train system) or one TDEFW train (one ASD train)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 ATWS - HPI (2)			
2 ATWS - EFW (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.

Notes:

(1) The MTC for these sequences were assumed to be favorable. Unfavorable MTC would directly lead to core damage.

Table 2.10 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Main Steam/ Feedwater Line Break[1]

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 Break (ISO)	Closure of MSIV or manual isolation for breaks outside containment (operator action)
SRV Fail to Re-close (SRVO)	Failure of the PORV or SRV to re-close (one train)
Secondary Heat Removal (EFW)	1/2 MDEFW trains or one TDEFW train to unaffected SG (one train)
Alternate Secondary Heat Removal (ASW)	1/1 SSF ASW pump (operator action)[1]
Primary Bleed (FB)	1/2 SRVS to open (one multi-train system) or 1/1 PORV open (operator action)
Early Inventory, HPI Injection (EIHP)	2/3 HPI pumps injecting to 2 out of 4 RCS from BWST (one multi-train system)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Operator action)[2]

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1. MSLB/FLB - ISO - SRVO-EIHP			
2. MSLB/FLB - ISO - SRVO -HPR			
3. MSLB/FLB - ISO - EFW - ASW - HPR			
4. MSLB/FLB - ISO - EFW - ASW - FB			

5. MSLB/FLB - ISO - EFW - ASW - EIHP			
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 MSLB/FLB initiator was considered in IPE but no event tree was provided. The dominant sequences are given in this sheet however the underlying event tree is not provided.

Table 2.11 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Loss of Instrument Air: IA[(1)]

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:**
Alternate Sec. Heat Removal (ASW)	1/1 SSF ASW pump (High stress operator action)
Primary Bleed (FB)	1/1 PORV open (operator action)
Early Inventory, HPI Injection (EIHP)	2/3 HPI pumps injecting to two out of four RCS from BWST (operator action)
High Pressure Recirculation (HPR)	1/3 HPI pumps taking suction from 1/2 LPI trains (Recovery action)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1. IA - ASW -HPR			
2. IA - ASW - EIHP			
3. IA - ASW - FB			

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) Loss of Instrument air Frequency in Oconee IPE is estimated to be 1.4 E-3 per year. The major impact is on loss of MFW, loss of long term operation of EFW (failure of makeup to UST), and valve manipulation for HPR.

Table 2.12 SDP Worksheet for Oconee Nuclear Station, Units 1, 2, and 3 —— Loss of LPSW (LLPSW)[1]

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:**
Power Conversion System (PCS)	1/2 MFW trains and 2/3 Condensate pumps to 1/2 SG (Operator action)
Secondary Heat Removal (EFW)	One TDEFW train (one ASD train)
Alternate Secondary Heat Removal (ASW)	1/1 SSF ASW pump (operator action)[1]
High Pressure SW (HPSW)	1/2 6000 gpm pump train (one multi-train system)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1. LLPSW - PCS - EFW - ASW			
2. LLPSW - HPSW			

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:

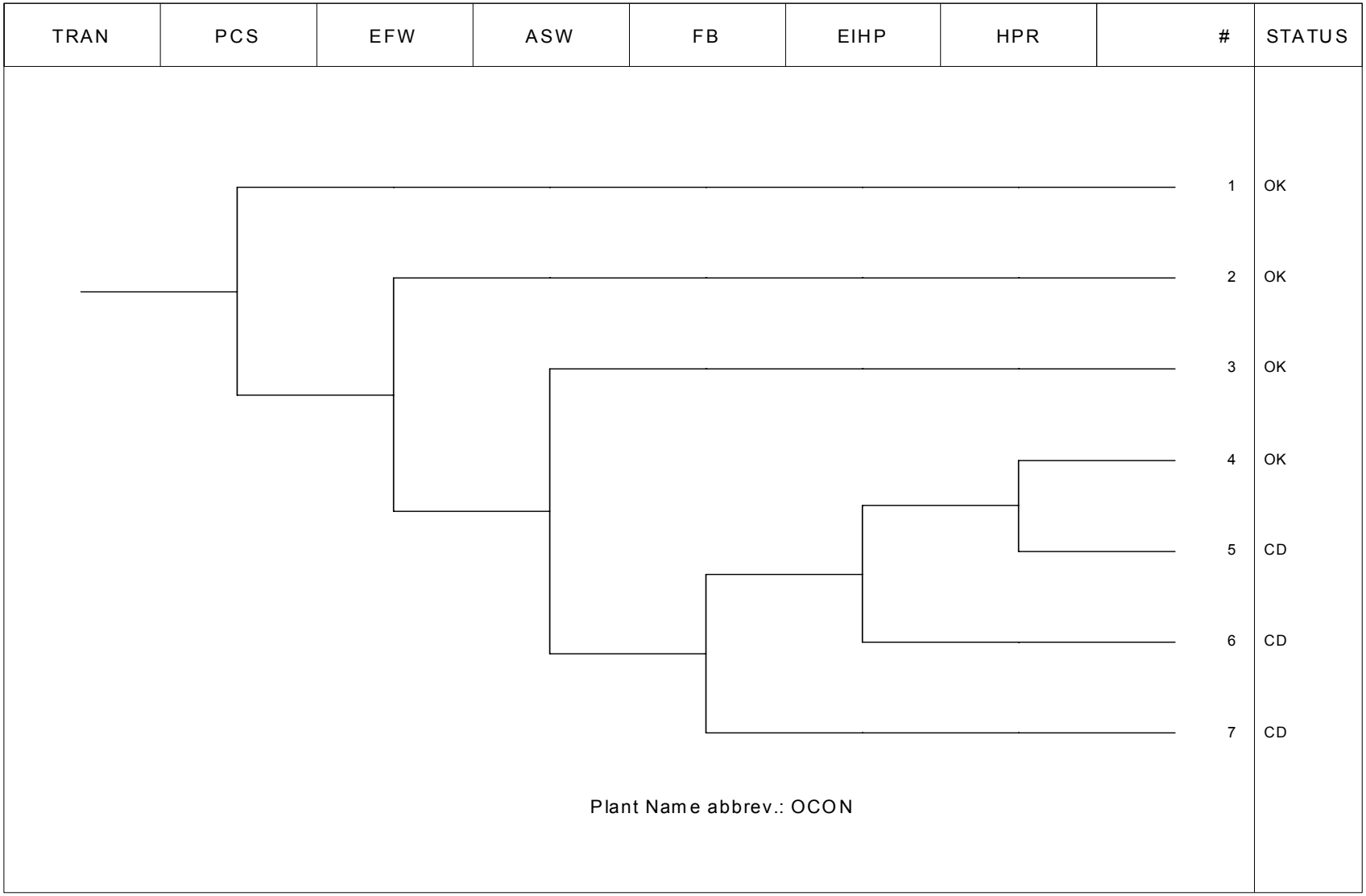
(1) Loss of LPSW is estimated to be 4.3E-3 in the Oconee IPE. It will cause a reactor trip , loss of MDEFW pump cooling, and LPI coolers (No FB and HPR would be available). The back up system is the HPSW system for remaining capabilities.

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
2. Small LOCA
3. Medium LOCA
4. Large LOCA
5. LOOP
6. Steam Generator Tube Rupture (SGTR)
7. Anticipated Transients Without Scram (ATWS)


TRAN
PCS
EFW
ASW
FB
EIHP
HPR
#
STATUS
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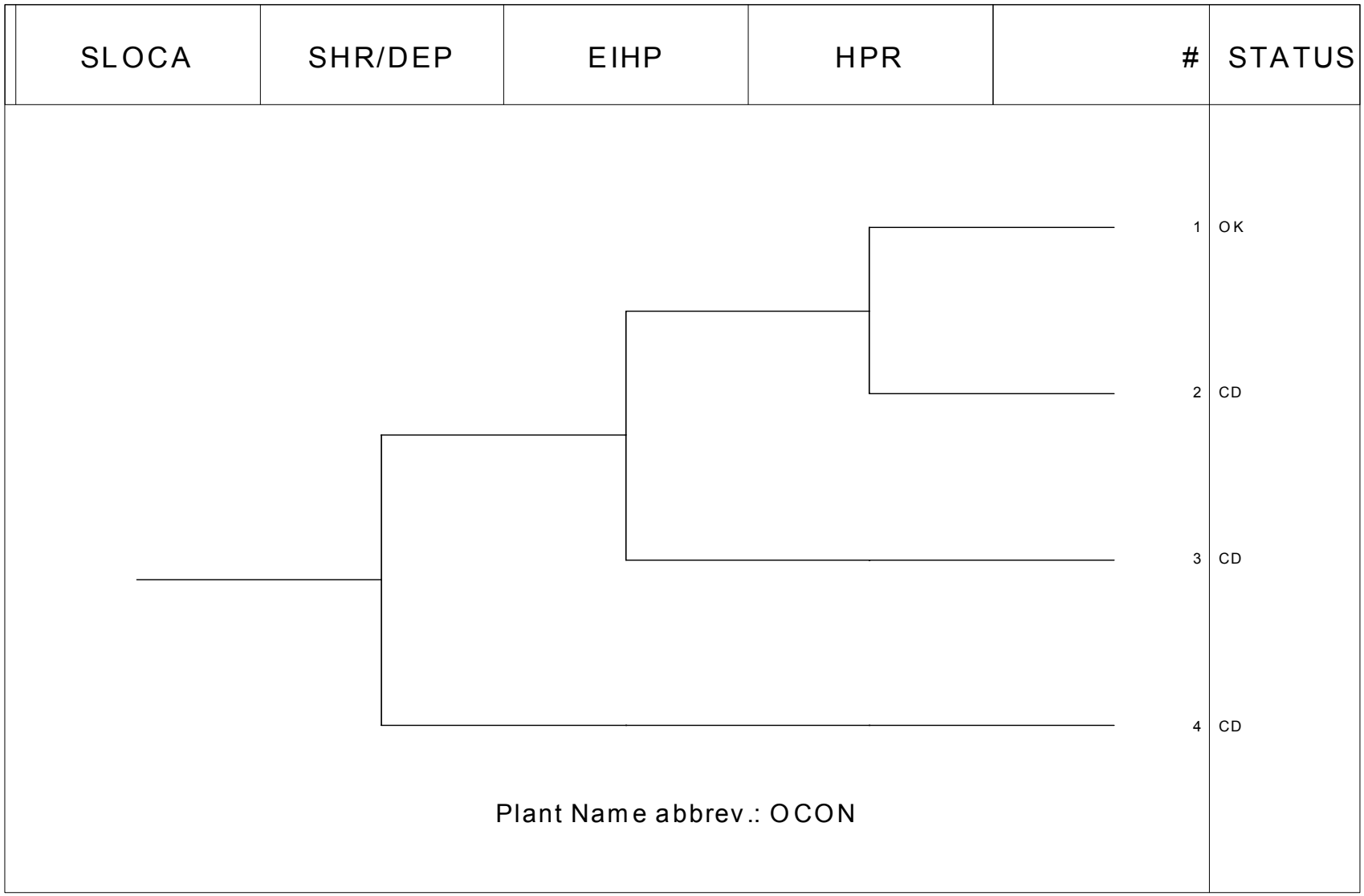
OK
2
OK
3
OK
4
OK
5
CD
6
CD
7
CD
Plant Name abbrev.: OCON


SLOCA
SHR/DEP
EIHP
HPR
#
STATUS
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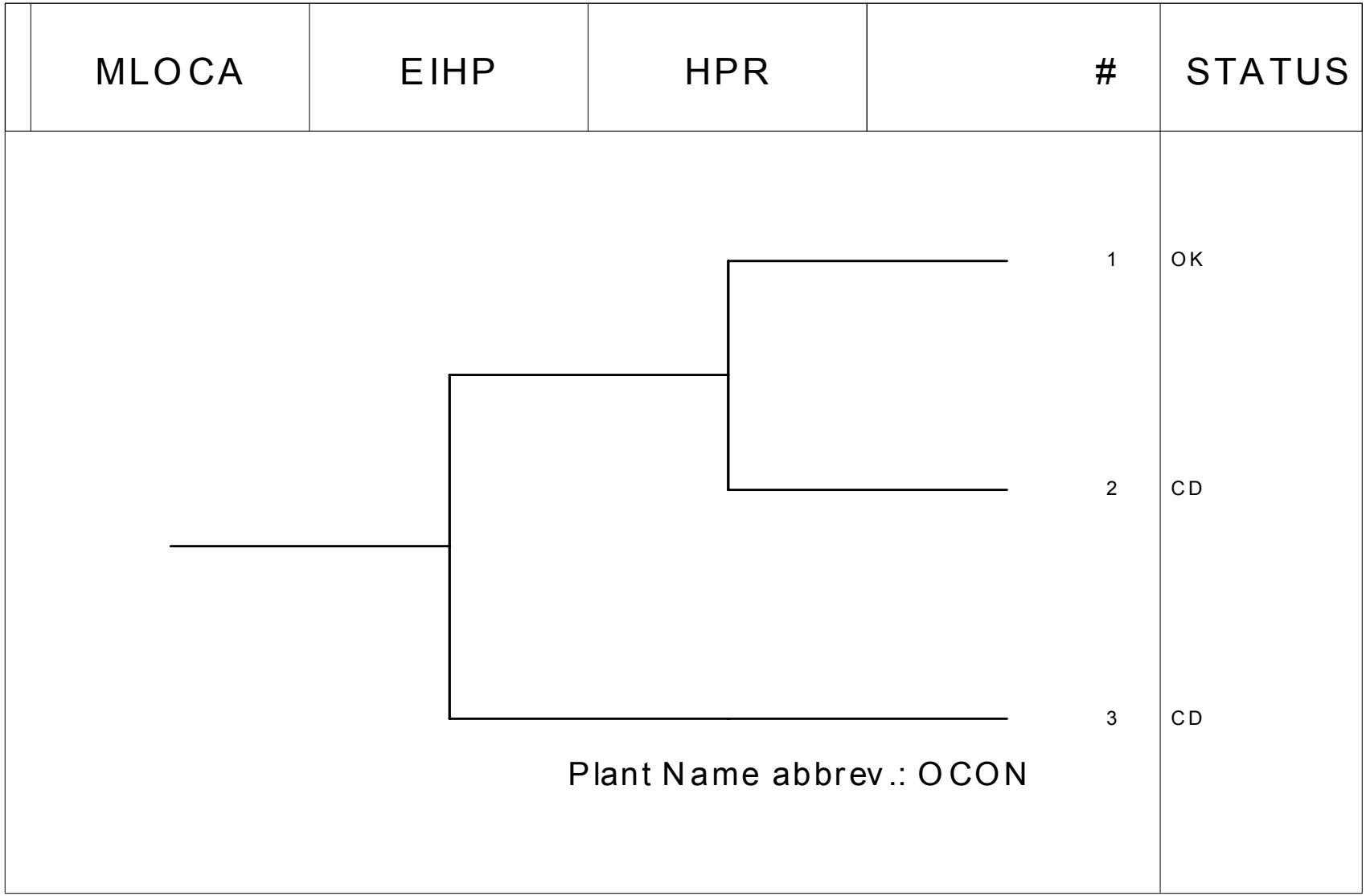
OK
2
CD
3
CD
4
CD
Plant Name abbrev.: OCON


MLOCA
EIHP
HPR
#
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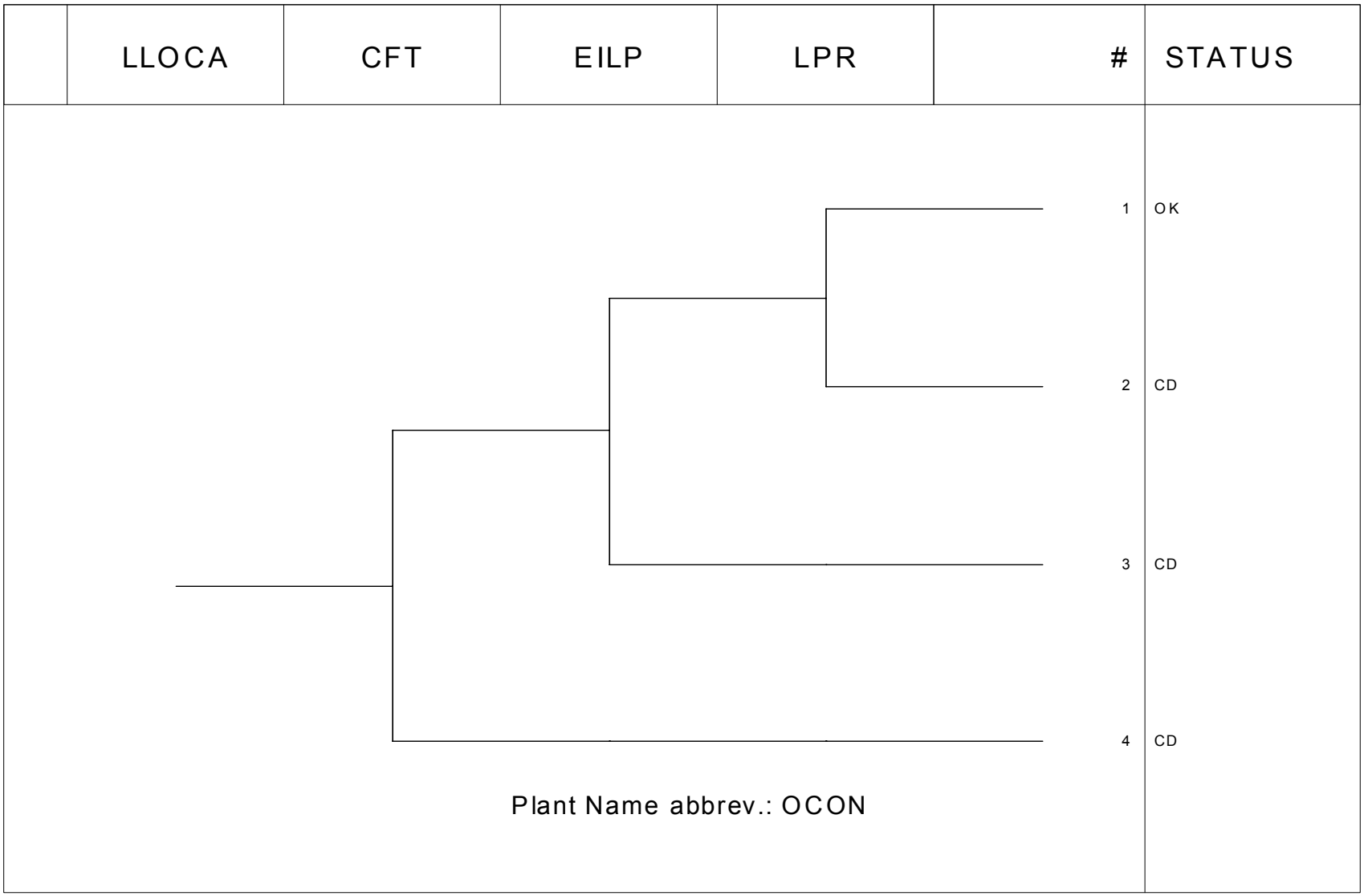
CD
3
CD
Plant Name abbrev.: OCON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CFT
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LPR
#
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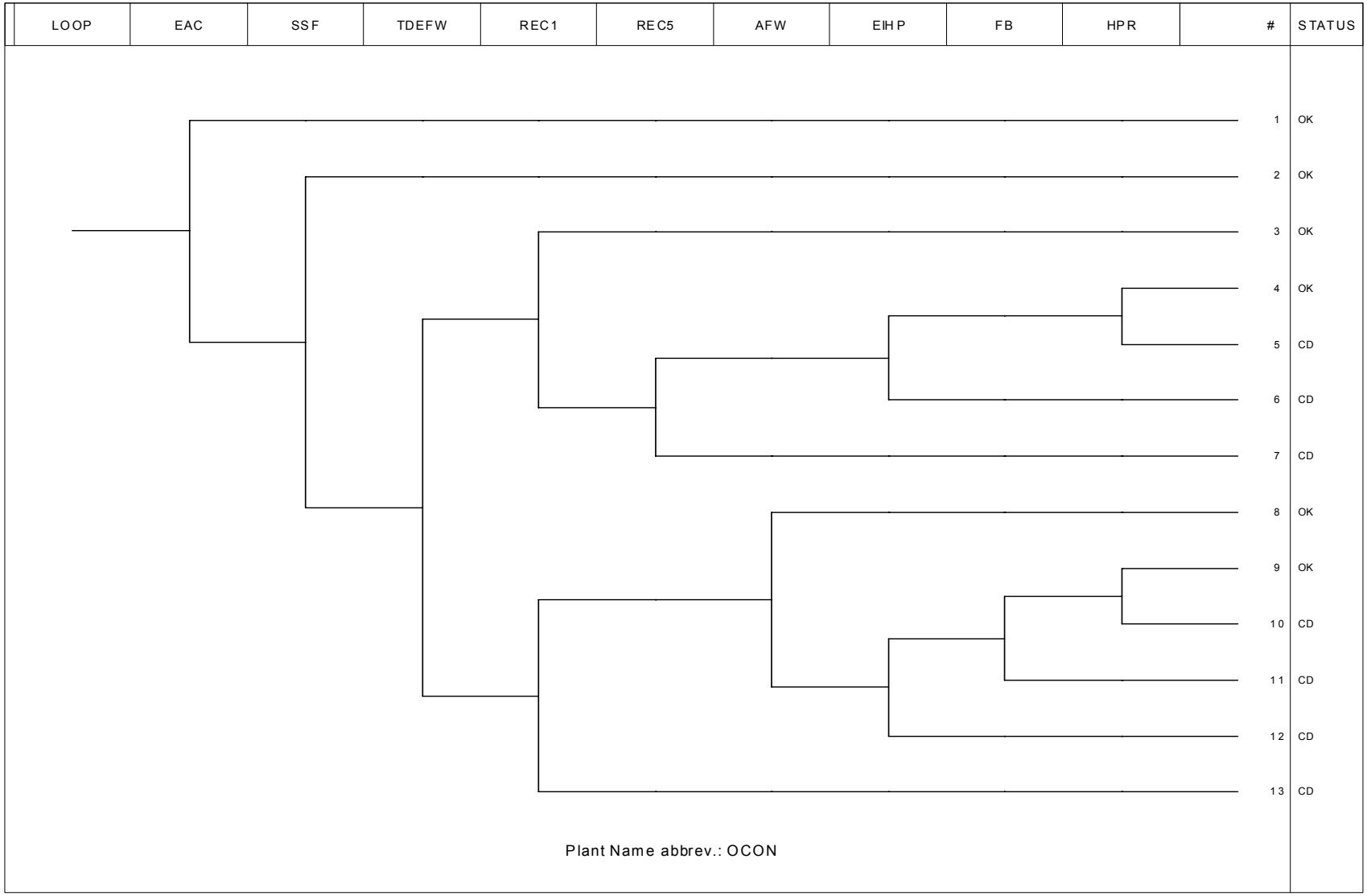
OK
2
CD
3
CD
4
CD
Plant Name abbrev.: OCON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EAC
SSF
TDEFW
REC1
REC5
AFW
EIHP
FB
HPR
#
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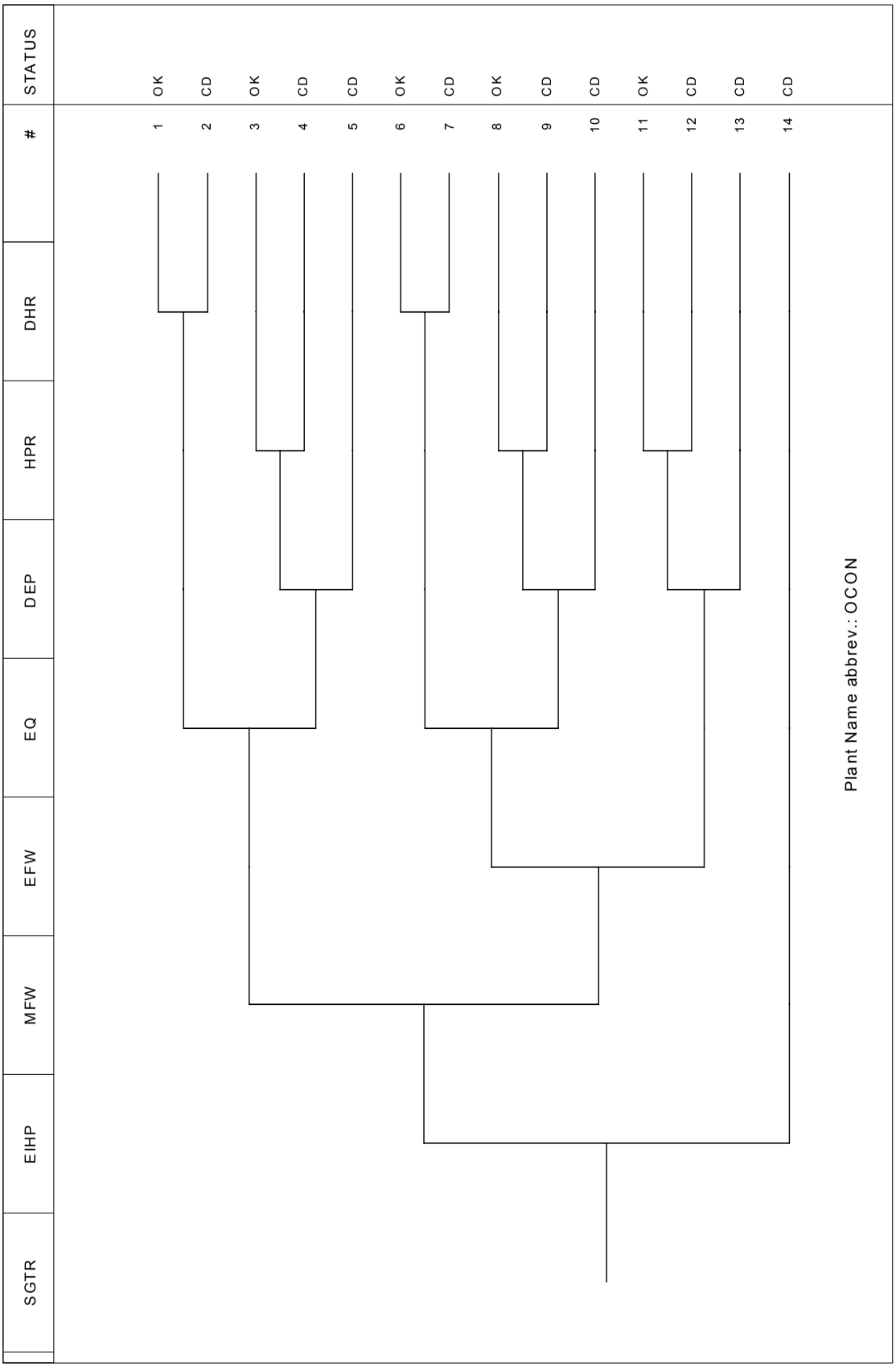
4 OK
5 CD
6 CD
7 CD
8 OK
9 OK
10 CD
11 CD
12 CD
13 CD
Plant Name abbrev.: OCON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HPR
DEP
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EFW
MFW
EIHP
SGTR
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5 CD
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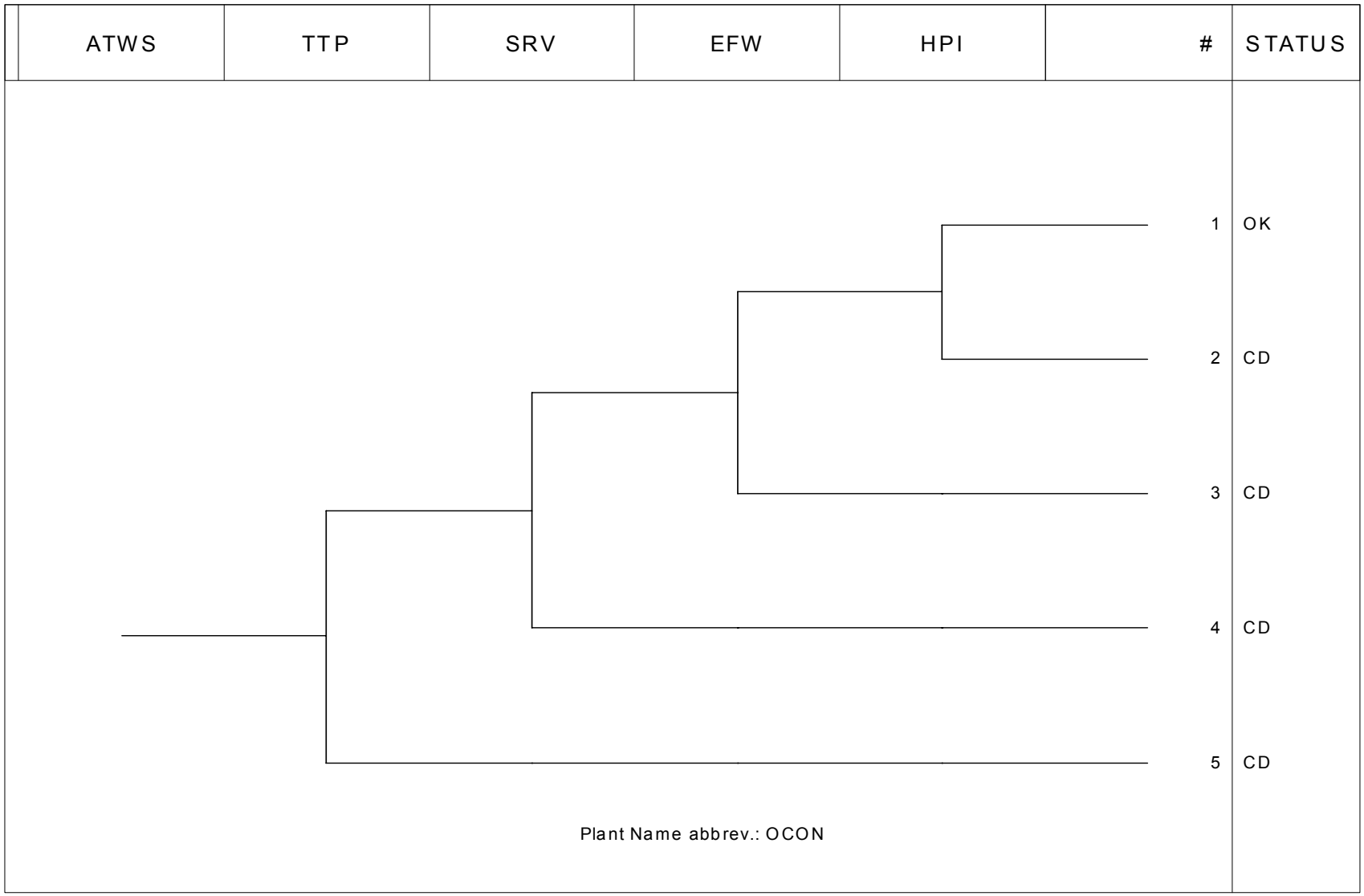
9 CD
10 CD
11 OK
12 CD
13 CD
14 CD
Plant Name abbrev.: OCON


ATWS
TTP
SRV
EFW
HPI
#
STATUS
1
OK
2
CD
3
CD
4
CD
5
CD
Plant Name abbrev.: OCON

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. Duke Power Company, "Oconee Nuclear Station, Unit 3 — Individual Plant Examination Report," November 1990.