UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 31, 2000

Mr. Michael B. Roche
Vice President and Director
GPU Nuclear, Inc.
Oyster Creek Nuclear Generating Station
Post Office Box 388
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SUBJECT: SITE-SPECIFIC WORKSHEETS FOR USE IN THE NUCLEAR REGULATORY COMMISSION'S SIGNIFICANCE DETERMINATION PROCESS (TAC NO. MA6544)

Dear Mr. Roche:

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 Oyster Creek Nuclear Generating Station on April 2, 2000. Included in the enclosed Risk-Informed Inspection Notebook is 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 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 301-415-1261.

Sincerely,

Helen N. Pastis, Sr. Project Manager, Section I
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure: As Stated

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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 301-415-1261.

Sincerely,

/RA/

Helen N. Pastis, Sr. Project Manager, Section I
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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RISK-INFORMED INSPECTION NOTEBOOK FOR

OYSTER CREEK NUCLEAR GENERATING STATION

BWR-2, GE, WITH MARK I CONTAINMENT

Prepared by

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Enclosure

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 Oyster Creek Nuclear Generating 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). 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; both Rx Trip and without PCS, 2) Small Loss of Coolant Accident (LOCA), 3) Medium LOCA, 4) Large LOCA, 5) Loss of Offsite Power (LOOP), and 6) 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. 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 an 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 Oyster Creek Nuclear Generating 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 involvement in different initiating events are noted in the last column.

Table 1 Initiators and System Dependency for Oyster Creek Nuclear Generating Station

Affected System	Major Components	Support Systems	Initiating Event Scenarios
Power Conversion System (PCS)	3 MDMFW pumps and 3 MD condensate pumps	AC , DC , TBCCW, IA, CT	Transient, ATWS
Condensate Transfer System (CT)	2 pumps	AC, IA	Transient, TPCS, LOOP, ATWS
HPCI mode of Feedwater System	3 MDMFW pumps and 3 MD condensate pumps	AC , DC , TBCCW, IA	Transient, TPCS, SLOCA, SORV, LOOP, ATWS
Turbine Bypass Valves (TBVs)	9 TBVs with 40% capacity	DC	Transient, ATWS
Electromatic Relief Valves (EMRVs) (Automatic Depressurization System) and Safety Valves	5 EMRVs, 9 SVs	DC (EMRVs) , ESFAS, CS (permissive signal)	Transient, TPCS, SLOCA, SORV, LOOP, ATWS
Shutdown Cooling System (SDC)	3 MDPs, 3 Heat Exchangers	AC, DC, RBCCW	Transient, TPCS, SLOCA, SORV, LOOP, ATWS
Core Spray System (CS)	2 Systems each with 2 two main pumps and two booster pump 2	AC, DC, FP(backup water supply)	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP
Containment Spray System	2 loops each with 2 100% capacity pumps and 2 50% capacity heat exchangers	AC, DC, ESW, ESFAS	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
AC Power (non-EDG)	Breakers, transformers	DC, ESFAS	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
EDGs	2 EDGs	DC	LOOP
DC power	2 Batteries with 3 hour capacity	None	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS

Table 1 (Continued)

Affected System	Major Components	Support Systems	Initiating Event Scenarios
Control Rod Drive	2 150 gpm MDPs	AC, DC, IA(flow control valve), CT, IC (CRD makeup)	Transient, TPCS, LOOP, ATWS
Instrument Air	3 Air compressors	AC, TBCCW, FP (backup cooling)	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Isolation Condenser (IC)	2 ICs	DC, CT, FP (backup makeup), RPT, ESFAS	Transient, TPCS, LOOP, ATWS
Standby Liquid Control (SLC)	2 pumps	AC, DC	ATWS
Reactor Building Closed Cooling Water (RBCCW)	MDPs, MOVs, Heat exchangers	AC , DC , SW	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Recirculation Pump Trip	Signal	AC, DC	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Turbine Building Closed Cooling Water (TBCCW)	3 MDPs, 2 Heat exchangers	AC , DC , SW, CW	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Circulating Water System (CW)	4 MDPs	AC, DC	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Emergency Service Water (ESW)	2 Pumps and 2 Heat exchangers	AC, DC, SW, ESFAS	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Service Water (SW)	2 MDPs	AC , DC	Transient, TPCS, SLOCA, SORV, LLOCA, LOOP, ATWS
Torus Venting	Hardened vent	DC, IA (with dedicated accumulators)	
Fire Protection Pumps (FP)	2 MDPs, 2 Diesel-driven pump 2	AC , DC, CS (flow path)	

Notes:

Table 1 (Continued)

(1) The CDF from internal events is 3.69E-6 per year. The CDF of internal floods is 2.08E-7.

1.2 SDP WORKSHEETS

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

1. Transients (Rx Trip)
2. Transients with Loss of PCS (TPCS)
3. Small LOCA
4. SORV
5. Large LOCA
6. LOOP
7. Anticipated Transients Without Scram (ATWS)

Oyster Creek does not model medium LOCA. Accordingly, a medium LOCA worksheet is not provided. A large LOCA worksheet can be used to model the medium LOCA scenarios.

Table 2.1 SDP Worksheet for Oyster Creek Nuclear Generating Station —— Transients (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:**
Power Conversion System (PCS)	1/3 condensate pumps, 1/3 motor-driven FW pumps, vessel level control, turbine bypass valves, and condenser (operator action) (1)
Isolation Condenser (IC)	1/2 Isolation condenser trains with RCS closed (1 multi-train system)
Isolation Condenser Makeup (ICMU)	1/ 2 condensate transfer pumps or 1/4 fire pumps (operator action) (2)
Control Rod Pumps (CRD)	1 / 2 CRD pumps providing makeup to vessel (operator action) (3)
Depressurization (DEP)	3/5 EMRVs open (1 multi-train system)
Low Pressure Injection (LPI)	1/2 Core Spray systems with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) or 1/3 condensate pumps (operator action) (4)
Containment Heat Removal (CHR)	1/3 Shutdown Cooling (SDC) trains (operator action) (5) or 1/2 containment spray loops with 1/2 pumps and 2/2 heat exchanger (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) (6)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining* Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 Trans - PCS - ICMU - CHR - CV (5, 8)			
2 Trans - PCS - ICMU - CRD - LPI (9)			
3 Trans - PCS - ICMU - CRD - DEP (10)			

4 Trans - PCS - IC - CHR - CV (13)			
5 Trans - PCS - IC - LPI (14)			
6 Trans - PCS - IC - DEP (15)			

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 HEP for operator failure to main vessel level is 5.0E-3 (event ZHERF1 in table C.3-1).

(2) The HEP for operator failure to establish makeup to shell side of isolation condenser is 4.0E-4 (event ZHEMU1 in table C.3-1).

(3) The HEP for operator failure to use CRD to provide makeup is 5.0E-3 (event ZHECD1 in table 3.C-1)

(4) The HEP for operator failure to use condensate pumps to provide makeup is not documented in the IPE.

(5) The HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1). Note that the IPE des not have detailed description of the shutdown cooling system.

(6) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.2 SDP Worksheet for Oyster Creek Nuclear Generating Station — 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:	***Full* Creditable Mitigation Capability for Each Safety Function:**
Isolation Condenser (IC)	1/2 Isolation condenser trains with RCS closed (1 multi-train system)
Isolation Condenser Makeup (ICMU)	1/ 2 condensate transfer pumps or 1/4 fire pumps (operator action) [1]
Control Rod Pumps (CRD)	1 / 2 CRD pumps providing makeup to vessel (operator action) [2]
Depressurization (DEP)	3/5 EMRVs open (1 multi-train system)
Low Pressure Injection (LPI)	1/2 Core Spray systems with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) or 1/3 condensate pumps (operator action) [3]
Containment Heat Removal (CHR)	1/3 Shutdown Cooling (SDC) trains (operator action) [4] or 1/2 containment spray loops with 1/2 pumps and 2/2 heat exchangers (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) [5]

Circle Affected Functions	**Recovery of Failed Train**	***Remaining* Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 TPCS - ICMU - CHR - CV (5, 8)			
2 TPCS - ICMU - CRD - LPI (9)			
3 TPCS - ICMU - CRD - DEP (10)			

4 TPCS - IC - CHR - CV (13)			
5 TPCS - IC - LPI (14)			
6 TPCS - IC - DEP (15)			

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 HEP for operator failure to establish makeup to shell side of isolation condenser is 4.0E-4 (event ZHEMU1 in table C.3-1).

(2) The HEP for operator failure to use CRD to provide makeup is 5.0E-3 (event ZHECD1 in table 3.C-1)

(3) The HEP for operator failure to use condensate pumps to provide makeup is not documented in the IPE.

(4) The HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1).

(5) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.3 SDP Worksheet for Oyster Creek Nuclear Generating Station —— 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:**
Condensate Pumps (CNDP)	1/3 condensate pumps (1 multi-train system)
High Pressure Injection (HPI)	1/3 motor-driven MFW pumps (1 -multi-train system) with CNDP successful
Depressurization (DEP)	3/5 EMRVs open (1 multi-train system)
Low Pressure Injection (LPI)	CNDP successful: 1/2 Core Spray trains with 1/2 main pumps and 1/2 booster pumps (1 multi-train system) or 1/4 fire pumps (1 multi-train system) or 1/3 condensate pumps (1multi-train system) CNDP failed: 1/2 Core Spray trains with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) or 1/4 fire pumps (1 multi-train system)
Shutdown Cooling (SDC)	1/3 Shutdown Cooling (SDC) trains (operator action) (1)
Containment Heat Removal (CHR)	1/2 containment spray loops with 1/2 pumps and 2/2 heat exchangers (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) (2)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 SLOCA - SDC - CHR - CV (4, 7)			
2 SLOCA - HPI - LPI (8)			
3 SLOCA - HPI - DEP (9)			
4 SLOCA - CNDP - CHR - CV (12)			

5 SLOCA - CNDP - LPI (13)			
6 SLOCA -CNDP - DEP (14)			

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 HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1).

(2) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.4 SDP Worksheet for Oyster Creek Nuclear Generating Station —— SORV

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

<u>**Safety Functions Needed**</u>:	<u>***Full* Creditable Mitigation Capability for Each Safety Function**</u>:
Condensate Pumps (CNDP)	11/3 condensate pumps (1 multi-train system)
High Pressure Injection (HPI)	1/3 motor-driven MFW pumps (1 -multi-train system) with CNDP successful
Depressurization (DEP)	3/5 EMRVs open (1 multi-train system)
Low Pressure Injection (LPI)	CNDP successful: 1/2 Core Spray trains with 1/2 main pumps and 1/2 booster pumps (1 multi-train system) or 1/4 fire pumps (1 multi-train system) or 1/3 condensate pumps (1multi-train system) CNDP failed: 1/2 Core Spray trains with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) or 1/4 fire pumps (1 multi-train system)
Shutdown Cooling (SDC)	1/3 Shutdown Cooling (SDC) trains (operator action) [1]
Containment Heat Removal (CHR)	1/2 containment spray loops with 1/2 pumps and 2/2 heat exchangers (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) [2]

<u>**Circle Affected Functions**</u>	<u>**Recovery of Failed Train**</u>	<u>***Remaining Mitigation Capability Rating for Each Affected Sequence***</u>	<u>**Sequence Color**</u>
1 SORV - SDC - CHR - CV (4, 7)			
2 SORV - HPI - LPI (8)			
3 SORV - HPI - DEP (9)			
4 SORV - CNDP - CHR - CV (12)			

5 SORV - CNDP - LPI (13)			
6 SORV -CNDP - DEP (14)			
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 HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1).

(2) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.5 SDP Worksheet for Oyster Creek Nuclear Generating Station —— Large LOCA [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:**
Early Inventory (LPI)	1/2 Core Spray systems with 1/2 main pumps and 2/2 booster pumps (1 multi-train system)
Condensate Storage Tank (CST)	Operator align CS to CST to provide makeup (operator action) [2] or 1/4 fire pumps (operator action) [3]
Containment Heat Removal (CHR)	1/2 containment spray loops with 1/2 pumps and 2/2 heat exchangers (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) [4]

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LLOCA - CHR -CV (3)			
2 LLOCA - CST (4)			
3 LLOCA - LPI (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) This event tree applies to an LLOCA below the core inside the containment which is the most dominant LLOCA scenario. For LLOCAs above the core, condensate pumps can be used. For LLOCAs outside the containment, containment heat removal is not needed and core spray alignment to CST is not adequate to provide makeup.

(2) The HEP for operator failure to align CS to CST is 0.01 (event ZHEOS1 in table C.3-1).

(3) The HEP for operator failure to use fire pumps in a large LOCA is 7E-3 (event ZHEFS1 in table C.3-1)

(4) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.6 SDP Worksheet for Oyster Creek Nuclear Generating Station —— 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 Power (EAC)	1/2 EDGs (1 multi-train system)
Stuck Open EMRV (SORV)	at least one EMRV sticks open (1 train)
Recovery of LOOP (R30MIN)	Restoration of offsite power in 30 minutes (high stress operator action) (1)
Isolation Condenser (IC)	1/2 Isolation condenser trains with RCS closed (1 multi-train system)
Recovery of LOOP (R1HR)	Restoration of offsite power in 1 hour (operator action) (2)
Isolation Condenser Makeup (ICMU)	LOOP: 1 / 2 diesel driven fire pumps (operator action) (3) LOOP recovered: 1/ 2 condensate transfer pumps or 1/4 fire pumps (operator action) (4)
Recovery of LOOP (R3HR)	Restoration of offsite power in 3 hours before battery depletion (operator action) (5)
Control Rod Pumps (CRD)	1 / 2 CRD pumps providing makeup to vessel (operator action) (6)
Depressurization (DEP)	3/5 EMRVs open (1 multi-train system)
Low Pressure Injection (LPI)	LOOP: 1/2 Core Spray systems with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) LOOP recovered: 1/2 Core Spray systems with 1/2 main pumps and 1/2 booster pumps(1 multi-train system) or 1/3 condensate pumps (operator action) (7)
Containment Heat Removal (CHR)	1/3 Shutdown Cooling (SDC) trains (operator action) (8) or 1/2 containment spray loops with 1/2 pumps and 2/2 heat exchangers (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) (9)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 LOOP - ICMU - CHR - CV (1,5,8)			
2 LOOP - ICMU - CRD - LPI (1,9)			
3 LOOP - ICMU - CRD - DEP (1,10)			

4 LOOP - IC - CHR - CV (1)			
5 LOOP - IC - LPI (1)			
6 LOOP - IC - DEP (1)			
7 LOOP - EAC - R3HR (12) (LOOP recovered)			
8 LOOP - EAC - R45MIN - ICMU (13)			
9 LOOP - EAC - IC (14)			
10 LOOP - EAC - SORV - CHR - CV (17) (LOOP recovered)			
11 LOOP - EAC - SORV - LPI (18) (LOOP recovered)			
12 LOOP EAC - SORV - DEP (19) (LOOP recovered)			
13 LOOP - EAC - SORV - R30MIN (20)			
14 LOOP - EAC - SORV - IC (21)			

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 HEP{ for operator failure to restore offsite power in 1 hour is 0.258 (event ZHERE2 in table C.3-1).

(2) The HEP{ for operator failure to restore offsite power in 1 hour is 6.94E-2 (event ZHERE1 in table C.3-1).

(3) The HEP for operator failure to establish makeup to shell side of isolation condenser is 4.0E-4 (event ZHEMU2 in table C.3-1).

(4) The HEP for operator failure to establish makeup to shell side of isolation condenser is 4.0E-4 (event ZHEMU1 in table C.3-1).

(5) The HEP for operator failure to restore offsite power in 3 hour is not documented. It is assumed that after battery depletion, core damage would result, probably due to loss of DC to the makeup valves of the isolation condensers.

(6) The HEP for operator failure to use CRD to provide makeup is 5.0E-3 (event ZHECD1 in table 3.C-1)

(7) The HEP for operator failure to use condensate pumps to provide makeup is not documented in the IPE.

(8) The HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1).

(9) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

Table 2.7 SDP Worksheet for Oyster Creek Nuclear Generating Station —— ATWS

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:**
Overpressure Protection (OVERP)	4/5 EMRVs or 8/9 SVs open (1 multi-train system)
Recirculation Pump Trip (RPT)	Automatic trip of recirculation pumps (1 multi-train system)
Reactivity Control (SLC)	Manual initiation of 1/2 SLC pumps (operator action) (1)
Inhibit ADS	Operator inhibits ADS (operator action) (2)
Feedwater Injection (FW)	1/3 condensate pumps and 1/3 motor-driven FW pumps, condenser hotwell, and CST (1 multi-train system)
Turbine Bypass Valves (TBV)	No MSIV closure and 2/9 TBVs operate successfully (1 train)
Isolation Condenser (IC)	FW successful: 1/2 Isolation condenser trains with RCS closed (1 multi-train system) FW failed: 1/2 Isolation condenser trains with RCS closed (1 multi-train system) and 1 / 2 CRD pumps (1 multi-train system)
Isolation Condenser Makeup (ICMU)	1/2 condensate transfer pumps or 1/4 fire pumps (operator action) (3)
Containment Heat Removal (CHR)	1/2 containment spray loops with 1/2 pumps and 2/2 heat exchanger (1 multi-train system)
Containment Venting (CV)	Containment venting (operator action) (4)
Shutdown Cooling (SDC)	1/3 Shutdown Cooling (SDC) trains (operator action) (5)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining Mitigation Capability Rating for Each Affected Sequence***	**Sequence Color**
1 ATWS - OVERP (16)			
2 ATWS - RPT (15)			
3 ATWS - INH (14)			

4 ATWS - SLC (13)			
5 ATWS - FW - IC (12)			
6 ATWS - FW - ICMU (11)			
7 ATWS - FW - SDC (10)			
8 ATWS - TBV - IC - CHR -CV (8)			
9 ATWS - TBV - ICMU -CHR - CV (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 HEP for operator failure to initiate SLC is 1.7E-2 (event ZHEBI4 in table C.3-1).

(2) The HEP for operator failure to inhibit ADS is 2.6E-2 (event ZHEOL2 in table C.3-1).

(3) The HEP for operator failure to establish makeup to shell side of isolation condenser is 4.0E-4 (event ZHEMU1 in table C.3-1)..

(4) The HEP for operator failure to vent the containment is 1.2E-2 (event ZHEOV1 in table 3.C-1).

(5) The HEP for operator failure to establish shutdown cooling is 4.0E-3 (event ZHESD1 in table 3.C-1). Note that the IPE des not have detailed description of the shutdown cooling system

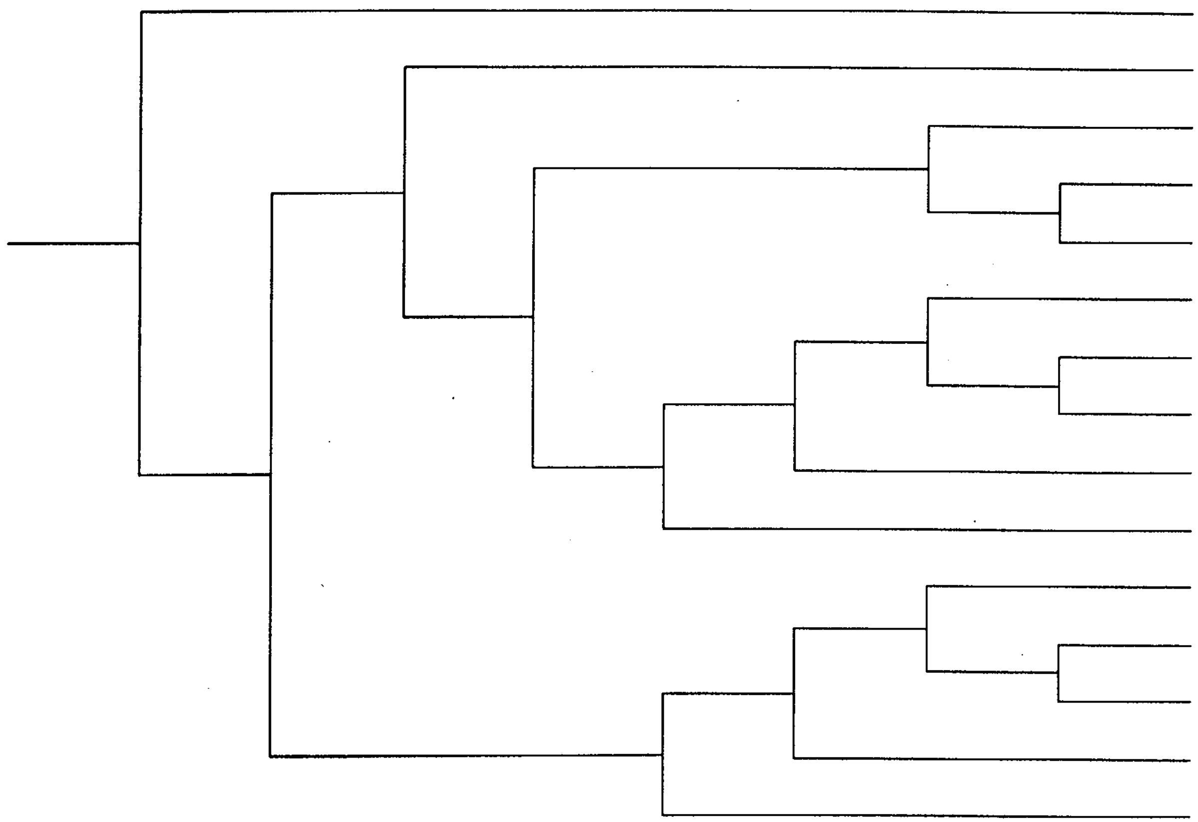
1.3 SDP EVENT TREES

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. The event tree headings are defined in the corresponding SDP worksheets.

The following event trees are included:

1. Transients (Reactor Trip)
2. Small LOCA
3. Large LOCA
4. LOOP
5. Anticipated Transients Without Scram (ATWS)

TRAN	PCS	IC	ICMU	CRD	DEP	LPI	CHR	CV	#	STATUS



#	STATUS
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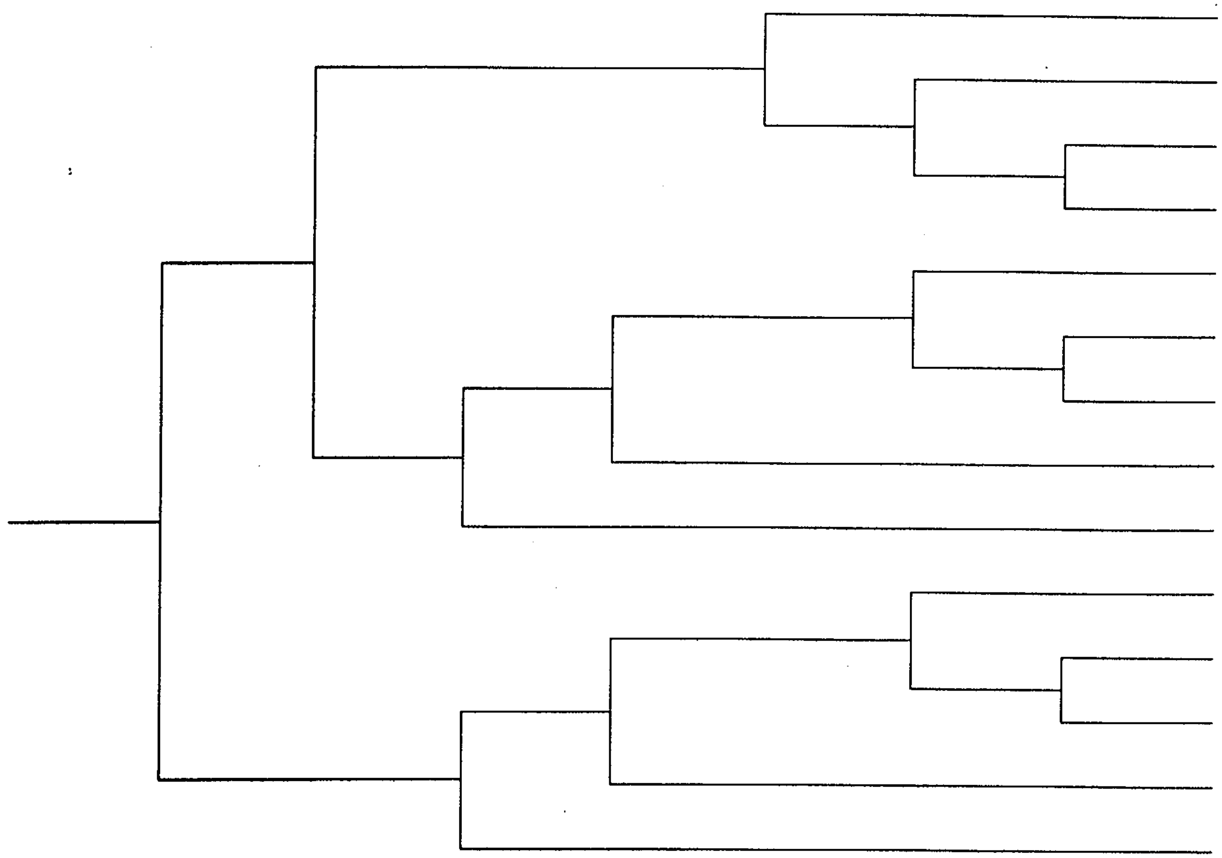
2	OK
3	OK
4	OK
5	CD
6	OK
7	OK
8	CD
9	CD
10	CD
11	OK
12	OK
13	CD
14	CD
15	CD

Plant Name abbrev.: OYST

SLOCA	CNDP	HPI	DEP	LPI	SDC	CHR	CV	#	STATUS



#	STATUS
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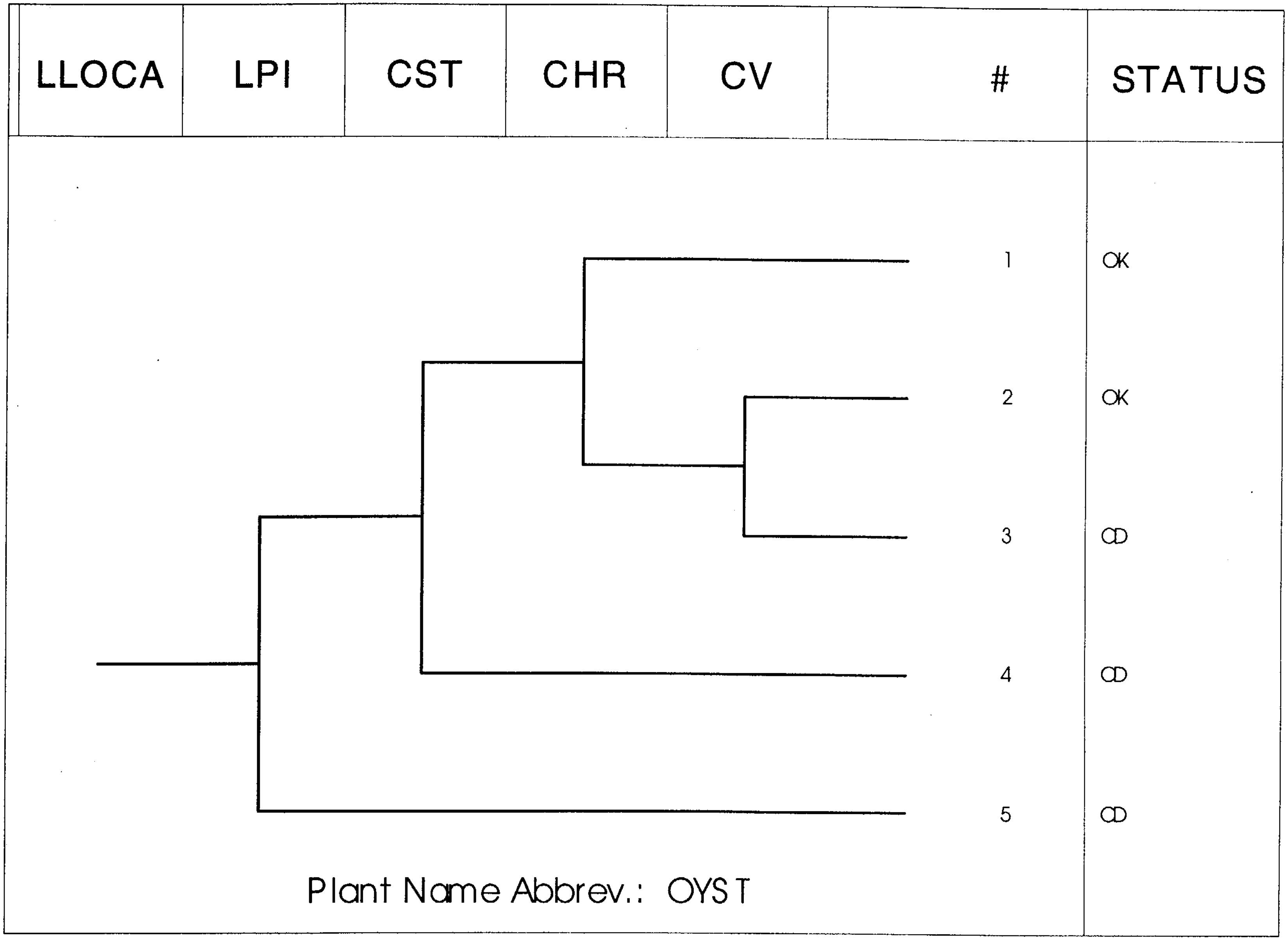
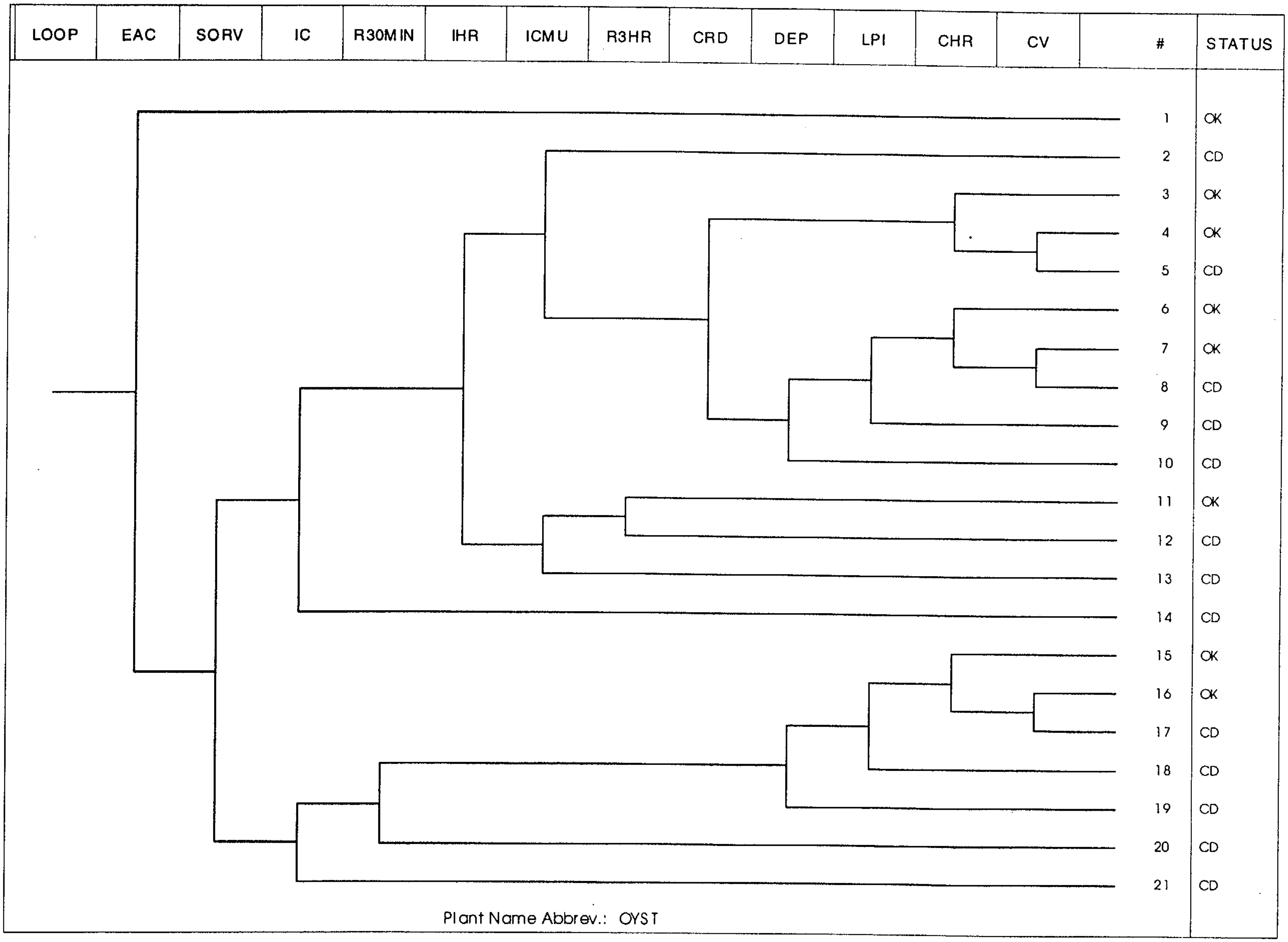
2	OK
3	OK
4	CD
5	OK
6	OK
7	CD
8	CD
9	CD
10	OK
11	OK
12	CD
13	CD
14	CD

Plant Name Abbrev.: OYST


LLOCA
LPI
CST
CHR
CV
#
STATUS
1
OK
2
OK
3
CD
4
CD
5
CD
Plant Name Abbrev.: OYST


LOOP
EAC
SORV
IC
R30MIN
IHR
ICMU
R3HR
CRD
DEP
LPI
CHR
CV
#
STATUS
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2 CD
3 OK
4 OK
5 CD
6 OK
7 OK
8 CD
9 CD
10 CD
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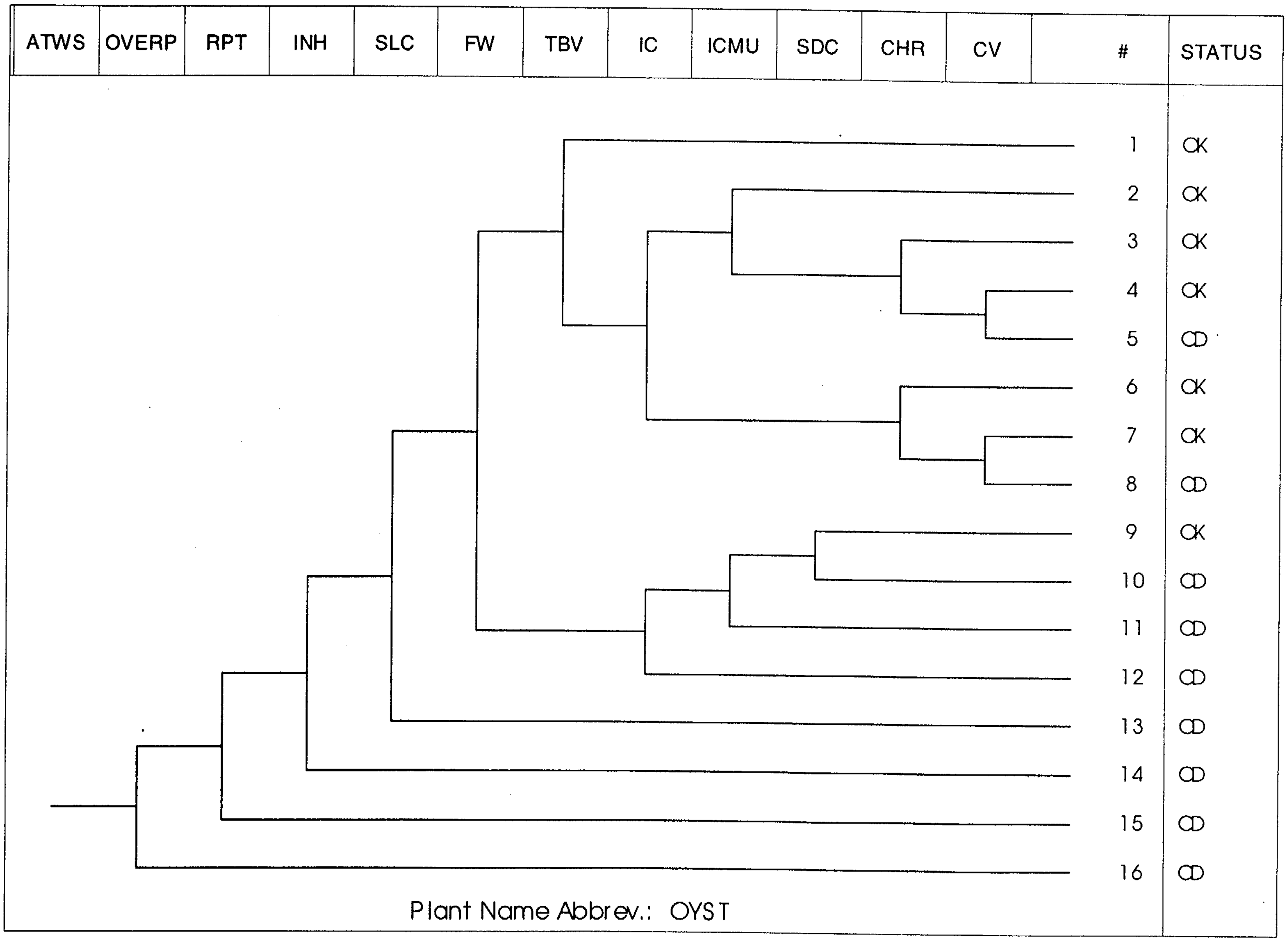
12 CD
13 CD
14 CD
15 OK
16 OK
17 CD
18 CD
19 CD
20 CD
21 CD
Plant Name Abbrev.: OYST


ATWS
OVERP
RPT
INH
SLC
FW
TBV
IC
ICMU
SDC
CHR
CV
#
STATUS
1 OK
2 OK
3 OK
4 OK
5 OD
6 OK
7 OK
8 OD
9 OK
10 OD
11 OD
12 OD
13 OD
14 OD
15 OD
16 OD
Plant Name Abbrev.: OYST