February 21, 2001

Mr. Mike Reandeau
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SUBJECT: SIGNIFICANCE DETERMINATION PROCESS - SITE-SPECIFIC WORKSHEETS (TAC NO. MA6544)

Dear Mr. Reandeau:

Enclosed is 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 is also publically available through the U.S. Nuclear Regulatory Commission (NRC), ADAMS system.

The 1999 Pilot Plant review effort clearly indicated that significant site-specific design and risk information was not captured in the previous worksheets forwarded to you. 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 that visit.

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

Contact me if you have any questions.

Sincerely,

/RA/

Jon B. Hopkins, Senior Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-461

Enclosure: As stated

cc w/encl: See next page

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RISK-INFORMED INSPECTION NOTEBOOK FOR

CLINTON POWER STATION

UNIT 1

BWR-6, GE, WITH MARK III CONTAINMENT

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Prepared for

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Enclosure

NOTICE

This notebook was developed for the NRC's inspection teams to support risk-informed inspections. The "Reactor Oversight Process Improvement," SECY-99-007A, March 1999 discusses the activities involved in these inspections. 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. It will be periodically updated with new or replacement pages incorporating additional information on this plant. All recommendations for improvement of this document should be forwarded to the Chief, Probabilistic Safety Assessment Branch, NRR, with a copy to the Chief, Inspection Program Branch, NRR.

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ABSTRACT

This notebook contains summary information to support the Significance Determination Process (SDP) in risk-informed inspections for the Clinton Power Station, Unit 1.

The information includes the following: Categories of Initiating Events Table, Initiators and System Dependency Table, SDP Worksheets, and SDP Event Trees. This information is used by the NRC's inspectors to identify the significance of their findings, i.e., in screening risk-significant findings, consistent with Phase-2 screening in SECY-99-007A. The Categories of Initiating Event Table is used to determine the likelihood rating for the applicable initiating events. The SDP worksheets are used to assess the remaining mitigation capability rating for the applicable initiating event likelihood ratings in identifying the significance of the inspector's findings. The Initiators and System Dependency Table and the SDP Event Trees (the simplified event trees developed in preparing the SDP worksheets) provide additional information supporting the use of SDP worksheets.

The information contained herein is based on the licensee's Individual Plant Examination (IPE) submittal, the updated Probabilistic Risk Assessment (PRA), and system information obtained from the licensee during site visits as part of the review of earlier versions of this notebook. Approaches used to maintain consistency within the SDP, specifically within similar plant types, resulted in sacrificing some plant-specific modeling approaches and details. Such generic considerations, along with changes made in response to plant-specific comments, are summarized.

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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 consistent with the specifics of the inspection findings. To aid in this process, this notebook provides the following information:

1. Estimated Likelihood Rating for Initiating Events Categories
2. Initiator and System Dependency Table
3. Significance Determination Process (SDP) Worksheets
4. SDP Event Trees.

Table 1, Categories of Initiating Events, is used to obtain the estimated likelihood rating for applicable initiating events for the plant for different exposures times for degraded conditions. This Table follows the format of the Table 1 contained in SECY-99-007A. Initiating events are grouped in frequency bins covering one order of magnitude. The table includes the initiating events that should be considered for the plant and for which SDP worksheets are provided. Categorization of the following initiating events is based on industry-average frequency: transients (Reactor Trip) (TRANS); transients without power conversion system (TPCS); large, medium, and small loss of coolant accidents (LLOCA, MLOCA, and SLOCA); inadvertent or stuck open relief valve (IORV or SORV); anticipated transients without scram (ATWS); interfacing systems LOCA (ISLOCA) and LOCA outside containment (LOC). The frequency of the remaining initiating events vary

significantly from plant to plant, and accordingly, they are categorized using the plant-specific frequency obtained from the licensee. These initiating events include loss of offsite power (LOOP) and special initiators caused by loss of support systems.

The Initiator and System Dependency Table shows the major dependencies between frontline and support systems, and identifies their involvement in different types of initiators. This table identifies the most risk-significant systems; it is not an exhaustive nor comprehensive compilation of the dependency matrix, as shown in Probabilistic Risk Assessments (PRAs). This table is used to identify the SDP worksheets to be evaluated, corresponding to inspection findings on systems and components.

To evaluate the impact of an inspection finding on the core-damage scenarios, we developed the SDP worksheets. They contain two parts. The first part identifies the functions, the systems, and the combinations thereof that can perform mitigating functions, the number of trains in each system, and the number of trains required (success criteria) for each the initiator. It also characterizes the mitigation capability in terms of the available hardware (e.g., 1 train, 1 multi-train system) and the operator action involved. The second part of the SDP worksheet contains the core-damage accident sequences associated with each initiator; these sequences are based on SDP event trees. In the parentheses next to each of the sequences 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.

SDP worksheets are developed for each initiating event, including "Special Initiators," which are typically caused by complete or partial loss of support

systems. A special initiator typically leads to a reactor scram and degrades some front-line or support systems (e.g., Loss of Service water in BWRs). The SDP worksheets for initiating events that directly lead to core damage are different. Of this type of initiating events, only the interfacing system LOCA (ISLOCA) and LOCA outside containment (LOC) are included. This worksheet identifies the major consequential leak paths and the number of barriers that may fail to cause the initiator to occur.

For the special initiators, we considered those plant-specific initiators whose contribution to the plant's core damage frequency (CDF) is non-negligible and/or have the potential to be a significant contributor to CDF given an inspection finding on system trains and components. We defined a set of criteria for their inclusion to maintain some consistency across the plants. These conditions are as follows:

1. The special initiator should degrade at least one of the mitigating safety functions changing its mitigation capability in the worksheet. For example, a safety function with two redundant trains, classified as a multi-train system, degrades to an one-train system, to be classified as 1 Train, due to the loss of one of the trains as a result of the special initiator.

2. The special initiators, which degrade the mitigation capability of the accident sequences associated with the initiator from comparable transient sequences by two and higher orders of magnitude, must be considered.

Following the above considerations, the classes of initiators that we consider in this notebook are:

1. Transients with power conversion system (PCS)available, called

Transients (Reactor trip) (TRANS),
2. Transients without PCS available, called Transients w/o PCS (TPCS),
3. Small Loss of Coolant Accident (SLOCA),
4. Inadvertent or Stuck-open Power Operated Relief Valve (IORV or SORV),
5. Medium LOCA (MLOCA),
6. Large LOCA (LLOCA),
7. Loss of Offsite Power (LOOP)
8. Anticipated Transients Without Scram (ATWS).

Section 1.3 lists the plant-specific special initiators addressed in this notebook. Examples of special initiators are as follows:

1. LOOP with failure of 1 Emergency AC (LEAC) bus or associated EDG (LEAC),
2. LOOP with stuck open SORV (LORV),
3. Loss of 1 DC Bus (LDC),
4. Loss of component cooling water (LCCW),
5. Loss of instrument air (LOIA),
6. Loss of service water (LSW).

The worksheet for the LOOP may include LOOP with emergency AC power (EAC) available and LOOP without EAC, i.e., Station Blackout (SBO). LOOP with partial availability of EAC, i.e., LOOP with loss of a bus of EAC, is covered in a separate worksheet to avoid making the LOOP worksheet too large. LOOP with stuck open SORV is also covered in a separate worksheet, when applicable. In some plants, LOOP with failure of 1 EAC bus and LOOP with stuck-open SORV are large contributors to the plant's core damage frequency (CDF).

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. For special initiators whose event tree closely corresponds to another event tree (typically, the Transient(Reactor trip) or Transients w/o PCS event tree) with one or more functions eliminated or degraded, a separate event tree may not be drawn.

We considered the following items in establishing the SDP event trees and the core-damage sequences in the SDP worksheets; Section 2.1 gives additional guidelines and assumptions.

1. Event trees and sequences were developed such that the worksheet contains all the major accident sequences identified by the plant-specific IPEs or PRAs. The special initiators modeled for a plant is based on a review of the special initiators included in the plant IPE/PRA and the information provided by the licensee.

2. The event trees and sequences for each plant took into account the IPE/PRA 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 or more 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 consolidation of transient event tree may also be done besides defining the special initiators following the criteria defined above.

5. Major actions by the operator during accident scenarios are credited using four categories of Human Error Probabilities (HEPs). They are termed operator action =1 (representing an error probability of 5E-2 to 0.5), operator action=2 (error probability of 5E-3 to 5E-2), operator action=3 (error probability of 5E-4 to 5E-3), and operator action=4 (error probability of 5E-5 to 5E-4). An human action is assigned to a category bin, based on a generic grouping of similar actions among a class of plants. This approach resulted in designation of some actions to a higher bin, even though the IPE/PRA HEP value may have been indicative of a lower category. In such cases, it is noted at the end of the worksheet. On the other hand, if the IPE/PRA HEP value suggests a higher category than that generically assumed, the HEP is assigned to a bin consistent with the IPE/PRA value in recognition of potential plant-specific design; a note is also given in these situations. Operator's actions belonging to category 4, i.e., operator action=4, may only be noted at the bottom of worksheet because, in those cases, equipment failures may have the dominating influence in determining the significance of the findings.

The four sections that follow include the Categories of Initiating Events Table, Initiators and System Dependency Table, SDP Worksheets, and the SDP Event Trees for the Clinton Power Station, Unit 1.

1.1 INITIATING EVENT LIKELIHOOD RATINGS

Table 1 presents the applicable initiating events for this plant and their estimated likelihood ratings corresponding to the exposure time for degraded conditions. The initiating events are grouped into rows based on their frequency. As mentioned earlier, loss of offsite power and special initiators are assigned to rows using the plant-specific frequency obtained from individual licensees. For other initiating events, industry-average values are used, as per SECY-99-007A.

Table 1 Categories of Initiating Events for Clinton Power Station, Unit 1

Row	Approximate Frequency	Example Event Type	Estimated Likelihood Rating		
I	> 1 per 1-10 yr	Reactor Trip (TRANS), Loss of Power Conversion System (TPCS) including Loss of condenser, Closure of MSIVs, Loss of feedwater, etc.	**A**	**B**	**C**
II	1 per 10-10^{2} yr	Loss of offsite power (LOOP), Inadvertent or stuck open SRVs (IORV), Loss of non-safety DC power (LDC)	**B**	**C**	**D**
III	1 per 10^{2} - 10^{3} yr	Loss of non-safety Service Water (LSW), Loss of Instrument Air (LIA)	**C**	**D**	**E**
IV	1 per 10^{3} - 10^{4} yr	Small LOCA (RCS rupture), Medium LOCA (RCS rupture),	**D**	**E**	**F**
V	1 per 10^{4} - 10^{5} yr	Large LOCA (RCS rupture), ATWS	**E**	**F**	**G**
VI	less than 1 per 10^{5} yr	ISLOCA, Vessel rupture	**F**	**G**	**H**
			> 30 days	**3-30 days**	**< 3 days**
			Exposure Time for Degraded Condition		

Note:

1. The SDP worksheets for ATWS core damage sequences assume that the ATWS is not recoverable by manual actuation of the reactor trip function or by ARI (for BWRs). Thus, the ATWS frequency to be used by these worksheets must represent the ATWS condition that can only be mitigated by the systems shown in the worksheet .

1.2 INITIATORS AND SYSTEM DEPENDENCY

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

Affected Systems	Major Components	Support Systems	Initiating Event Scenarios
Power Conversion System / Feedwater Delivery	Two TD & one MD Feedwater Pumps, Four MD Condensate Booster Pumps, Four MD Condensate Pumps, Feedwater Control (Condensate Storage Tank)	BOP Auxiliary AC Power, BOP DC Power, Plant Service Water (WS), Turbine Oil (TO), Turbine Building Closed Cooling Water (WT), Instrument Air (IA)	TRANS, SLOCA, IORV, ATWS, LIA
High Pressure Core Spray (HPCS)	MD Pump with Dedicated Standby Diesel Generator and dedicated DC and Service Water	Div III Aux. AC Power, Div III DC Power, Div IV DC Power, Div III SDSW (SX), PSSW (WS), ECCS Initiation Logic	All
Low Pressure Core Spray (LPCS)	MD Pump	Div I Aux. AC Power, Div I DC Power, Div I SDSW (SX), ECCS Initiation Logic	All
Main Steam (MS)	Four Main Steam lines, 16 SRVs, 35% Capacity TBP, Main Condenser, Condenser Air Removal, Circulating Water	BOP AC Power, BOP DC Power, IA/SA	TRANS, SLOCA, IORV, ATWS, LIA
Automatic Depressurization System (ADS)	Nine[5] (of above 16) Safety Relief Valves (SRVs), Air Accumulators Back-up Air Bottles	Divs I and II AC and DC Power, IA/SA, ECCS Initiation Logic	All except LLOCA
Residual Heat Removal (RHR) / Low Pressure Coolant Injection (LPCI)	Three MD pumps Trains A, B, C, MOVs	Div I AC and DC Power (Train A), Div II AC and DC Power (Trains B and C), Div I SX (Train A), Div II SX (Trains B and C), ECCS Initiation Logic	All
RHR/ Suppression Pool Cooling (SPC)	Two MD pumps Trains A and B, MOVs, Heat Exchanger	Same as LPCI Trains A and B	TRANS, TPCS, SLOCA, IORV, LOOP, ATWS, LDC, LSW, LIA

Table 2 (Continued)

Affected Systems	**Major Components**	**Support Systems**	**Initiating Event Scenarios**
Reactor Core Isolation Cooling (RCIC)	One TD pump, MOVs	Divs I Aux Power, Div I DC Power, Div I SX, ECCS Initiation Logic	All except MLOCA, LLOCA, ATWS
Emergency Core Cooling System (ECCS) Initiation Logic	Initiation logic for HPCS, LPCS, RHR, RCIC, and EDGs	Divs I, II, III, DC, NSPS Power	SLOCA, IORV, MLOCA, LLOCA, LOOP, ATWS
Standby Liquid Control (SLC)	Two MD pumps, explosive valves, neutron absorber storage tank	Divs I and II AC Aux Power, Division I & II DC Power	ATWS
Fire Protection System (as RPV injection source)	Three DD pumps, Cross-tie to WS system	Div II AC Aux Power, Div II SX	All except MLOCA, LLOCA , LSW
Control Rod Drive (as RPV injection source)	Two MD pumps (140 GPM total capacity)	BOP Aux AC Power, WS, WT	TRANS, TPCS, LOOP, LIA
Containment Venting (CV)	One flow path thru RHR to spent fuel pool One flow path thru FC to spent fuel pool One flow path thru CCP to atmosphere	Divs I and II Aux AC Power, BOP Aux AC Power, IA/SA, Fuel Pool Cooling and Cleanup (FC), Continuous Containment Purge(CCP or VR), RHR "A" to Containment Spray Sparger	Not used in event tree see Note 6
Auxiliary AC Power (Divisional and BOP AC power)	Two offsite sources, switchyard, Three diesel generators, diesel oil, diesel ventilation	Offsite power, unit auxiliary transformers (UAT), reserve auxiliary transformer (RAT), emergency reserve auxiliary transformer (ERAT), Divs I, II, and III emergency diesel generators (EDGs), diesel oil, diesel ventilation HVAC, SX, Divs I, II, and III DC power, BOP AC & DC busses	All

Table 2 (Continued)

Affected Systems	Major Components	Support Systems	Initiating Event Scenarios
Direct Current Power	Inverters, Nuclear System Protection System (NSPS) Power Supplies, Switchgear Heat Removal, six batteries and battery chargers	Six 125 V-DC batteries and chargers, motor control centers, auxiliaries, DC buses, eight 120 V Aux AC power buses, inverters, power supplies, inverter cooling systems	All
Instrument Air (IA) (excluding ADS air supplies)	Three centrifugal compressors, three service air dryers, IA ring headers	Compressor lube oil cooling water (Component Cooling - CC)	LIA
Shutdown Service Water (SX) System (includes Emergency Core Cooling System (ECCS) Heat Removal)	Three MD pumps, strainers, three independent subsystem headers, three SX heat exchangers	Divs I, II, and III Aux AC Power, Divs I, II, and III DC Power	All
Plant Service Water System (WS)	Three MD pumps, two strainers, two WS seal water pumps	BOP Aux AC Power, BOP DC Power	TRANS, TPCS, SLOCA, IORV, ATWS, LOOP, LIA
Turbine Building Closed Cooling Water System (WT)	Two MD pumps, two heat exchangers	BOP Aux AC Power, BOP DC Power, WS	TRANS, SLOCA, IORV MLOCA, LLOCA, ATWS, LIA
Component Cooling Water System (CC)	Three MD pumps, two heat exchangers	BOP Aux AC Power, BOP DC Power, WS	TRANS, TPCS, LIA, SLOCA, IORV, ATWS

Notes:

1. The above information is based upon the Clinton Power Station Response to Generic Letter 88-20, “Individual Plant Examination for Severe Accident Vulnerabilities” submitted to the NRC by letter dated September 23, 1992, and the licensee comments provided during site visit based on updated IPE.

2. The overall core damage frequency for internal events is 5.8E-6 , and for flooding is 4.4E-7 events per reactor-year based on the updated PRA information submitted by the Licensee.

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Table 2 (Continued)

3. According to the CLNT IPE, pages 3-28 and 3-29: "Loss of the steam (vapor) suppression system, i.e., bypassing the suppression pool, is postulated to occur only after drywell temperature reaches 700°F because of potential penetration failure. This temperature occurs only after core damage. Loss of steam suppression could also be postulated to occur either by bypassing the suppression pool or by a loss of pool inventory. Bypass of the drywell at lower temperatures is not considered feasible because two vacuum breakers in series which are used to vent into the drywell would have to fail. Loss of suppression pool inventory, such that the weir vents become uncovered, is only expected to occur if containment pressure reaches 93.75 psig. Failure of emergency core cooling system (ECCS) suction piping which penetrates below the suppression pool water is not considered credible because this piping is exposed to low pressure conditions and is seismically qualified. The treatment of suppression pool capability is consistent with the assumption made for Grand Gulf in NUREG/CR-4500.
4. Upper pool dump is not required for maintaining net positive suction head for the ECCS pumps in the event of various LOCAs. A conservative calculation was performed to determine the minimum suppression pool inventory following a LOCA. This calculation assumed that the drywell volume to the top of the weir wall was completely filled with water from the suppression pool following a LOCA. Additionally, the suppression pool inventory was assumed to be further reduced by ECCS system operation to restore reactor vessel inventory. This calculation proved that suppression pool inventory is sufficient to provide adequate NPSH for all ECCS pumps and maintain adequate weir vent coverage." Incorporating the results from this calculations does result in different event tree for Clinton than other BWR6-Mark III plants (e.g. Grand Gulf)

5. Clinton Power Station has a total of sixteen (16) Safety Relief Valves (SRVs). There are seven (7) ADS SRVs, and two (2) low-low set SRVs that have backup air supply. There are seven (7) other power operated SRVs that would be isolated from their normal source of instrument air (IA) on a low reactor water level signal. CLNT RAI response to Question 13a dated November 22, 1995: "ADS was the only means of depressurization modeled. Depressurizing through the bypass valves using the pressure regulator or bypass valve jack was not modeled in the CLNT PRA although these actions are allowed in the emergency operating procedures....Note: alternate depressurization methods have been included in PRA updates subsequent to IPE submittal, but failure to initiate ADS is still very important...."

6. According to CLNT IPE pages 3-221 and 3-28: "Analysis has shown that the ECCS pumps can take suction from the suppression pool even under saturation conditions. Low pressure core spray (LPCS), high pressure core spray (HPCS), and residual heat removal (RHR) pumps (in the low pressure coolant injection, LPCI, mode) do not lose suction after loss of containment heat removal or depressurization following containment venting or containment failure unless the failure is in the suppression pool. If the suppression pool were at saturation conditions, analysis (USAR 6.3.1.1.3) shows that sufficient net positive suction head remains available." Also, CLNT Response to RAI Question 15a, dated November 22, 1995: "CLNT has a Mark III containment with a large suppression pool and net free air volume. For sequences in which the reactor is shut down and core damage is averted (ECCS systems running), the containment would not fail during the 24 hour mission time of the IPE, even if containment heat removal systems were unavailable. Note this makes containment venting not an issue for mitigation of core damage. The decay heat energy added to the containment is insufficient to cause enough of the suppression pool inventory to boil to exceed the ultimate strength capacity of the containment....For non-ATWS sequences in which core damage occurs, there may be sufficient hydrogen generated to cause containment failure due to hydrogen burns. However these sequences already involved core damage (ECCS and other injection systems failed) and containment failure so the sequence determination has already been made."

7. If the SRVs are used to depressurize the reactor, or if the RCIC system is operating, then at least one loop of the RHR system is aligned in the

suppression pool cooling mode to remove heat from the containment. (If there is a large break LOCA and pressure is increasing inside containment, the RHR system can be aligned to the containment spray (CS) mode. Only the suppression pool cooling mode of RHR is modeled in the CLNT Level 1 PRA and only as a support for successful RCIC operation. The shutdown cooling (SDC) mode of RHR is not included in the model because it is not needed to prevent core damage during the 24 hour mission time of the IPE. The CS mode of RHR is modeled in the containment analysis (Level 2) because its primary function is to maintain containment integrity. Success for containment heat removal is successful operation of one train of RHR in the suppression pool cooling mode. (CLNT IPE, pages 3-21 and 3-22).

8. Because the ECCS systems would not be affected by containment performance during the mission time of the Level 1 analysis, no credit for containment venting was required in the Level 1 analysis. (CLNT RAI response to Question 15b dated November 22, 1995).

1.3 SDP WORKSHEETS

This section presents the SDP worksheets to be used in the Phase 2 evaluation of the inspection findings for the Clinton Power Station, Unit 1. The SDP worksheets are presented for the following initiating event categories:

1. Transients (Reactor Trip) (TRANS)
2. Transients with Loss of PCS (TPCS)
3. Small LOCA (SLOCA)
4. Intermittent Opening of SRVs (IORV)
5. Medium LOCA (MLOCA)
6. Large LOCA (LLOCA)
7. Loss of Offsite Power (LOOP)
8. Anticipated Transients Without Scram (ATWS)
9. Loss of Non-Safety DC Power (LDC)
10. Loss of Non-Safety Service Water (LSW)
11. Loss of Instrument Air (LIA)
12. Interfacing System LOCA (ISLOCA)

Table 3.1 SDP Worksheet for Clinton Power Station, Unit 1 — Transients (Reactor Trip) (TRANS)

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>**
Power Conversion System (PCS)	{[1/2 TD or 1/1 MD Feedwater pumps] and 2/4 condensate pumps and 2/4 condensate booster pumps with turbine bypass (TB) and operable condenser} (operator action = 2) (1)
High Pressure Core Spray (HPCS)	HPCS pump (1 train)
Reactor Core Isolation Cooling (RCIC)	Turbine Driven RCIC pump (1 ASD train)
Control Rod Drive Pumps (CRD)	1/2 CRD pumps (2) (1multi-train system)
Depressurization (DEP)	1/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 3) (3)
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pump] (1 train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	{[1/2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3) (4)
Late Depressurization and Makeup (LDEP)	3/16 SRVs with [1/4 condensate (CD) pumps and 1/4 condensate booster (CB) pumps if RX pressure < 725 psi] or [1/4 condensate pumps if RX pressure <250 psi]} or [1/2 fire pumps (all diesel-driven) at RX pressure <= 73 psi] (5) (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 TRANS - PCS - HPCS - RHRSPC - CRD - LDEP (6)			
2 TRANS - PCS - HPCS - RCIC - LPI - LDEP (9)			
3 TRANS - PCS - HPCS - RCIC - DEP (10)			

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 updated PRA has a HEP value of 5.0E-4 for restoring tripped feedwater system (FOPERCCSWW). A HEP value with credit 2 is assigned to manual action for PCS function based on generic data.

2. After a reactor scram at rated pressure, if the operators took no action to increase control rod drive (CRD) flow, CRD flow would increase automatically to 140 GPM. If the second CRD pump were to be used, it would have to be manually initiated and the total flow rate would be only 150 gpm. This is due to high pressure drop in the lines. The Clinton IPE PRA model assumed only the 140 gpm flow rate of one CRD pump after 1 hour. (See CLNT IPE pages 3-30, 3-32, and 3-80.) This is assuming that in the first hour RCIC was running and the operator had to trip RCIC due to high suppression pool temperature.

3. 1/16 SRVs is sufficient for LPI but for LDEP function 3/16 is required. Since LDEP function is independent from the RHRSPC and has different success criteria for depressurization, it is separated from LPI. This is a deviation from the plant IPE and the licensee's comment. The failure of the operator to manually initiate ADS is assigned a probability of 5E-4 in the updated IPE. An operator action credit of 3 is given based on generic data.

4. A HEP value of 1.6E-3 is assigned to operator failure to initiate RHR in the suppression pool cooling mode in the updated IPE. A HEP credit of 3, therefore, is assigned to the action.

5. Use of the fire protection system requires that a check valve between the WS and FP systems to be disassembled. The fire pumps require several hours to align before injection into the reactor pressure vessel can begin. As an injection source, the fire pumps are not modeled as a frontline system but are used as a recovery upon delayed failure of other systems. (CLNT IPE pages 3-20, 3-32 and 3-89). All manual actions involved in late depressurization and makeup are combined to one operator action reflecting the dependency of human errors.

Table 3.2 SDP Worksheet for Clinton Power Station, Unit 1 — 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:**
High Pressure Core Spray (HPCS)	HPCS pump (1 train)
Reactor Core Isolation Cooling (RCIC)	Turbine Driven RCIC pump (1 ASD train)
Control Rod Drive Pumps (CRD)	1/2 CRD pumps [1] (1multi-train system)
Depressurization (DEP)	1/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 3)[2]
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pump] (1 train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	{[1/2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3) [3]
Late Depressurization and Makeup (LDEP)	3/16 SRVs with [1/4 condensate (CD) pumps and 1/4 condensate booster (CB) pumps if RX pressure < 725 psi] or [1/4 condensate pumps if RX pressure <250 psi]} or [1/2 fire pumps (all diesel-driven) at RX pressure <= 73 psi] [4] (operator action = 2)

Circle Affected Functions	**Recovery of Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 TPCS - HPCS - RHRSPC - CRD - LDEP (6)			
2 TPCS - HPCS - RCIC - LPI - LDEP (9)			
3 TPCS - HPCS - RCIC - DEP (10)			

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 transient event tree is used for this SDP worksheet. After a reactor scram at rated pressure, if the operators took no action to increase control rod drive (CRD) flow, CRD flow would increase automatically to 140 GPM. If the second CRD pump were to be used, it would have to be manually initiated and the total flow rate would be only 150 gpm. This is due to high pressure drop in the lines. The Clinton IPE PRA model assumed only the 140 gpm flow rate of one CRD pump after 1 hour. (See CLNT IPE pages 3-30, 3-32, and 3-80.) This is assuming that in the first hour RCIC was running and the operator had to trip RCIC due to high suppression pool temperature.

2. 1/16 SRVs is sufficient for LPI but for LDEP function 3/16 is required. Since LDEP function is independent from the RHRSPC and has different success criteria for depressurization, it is separated from LPI. This is a deviation from the plant IPE and the licensee's comment. The failure of the operator to manually initiate ADS is assigned a probability of 5E-4 in the updated IPE. An operator action credit of 3 is given based on generic data.

3. A HEP value of 1.6E-3 is assigned to operator failure to initiate RHR in the suppression pool cooling mode in the updated IPE. A HEP credit of 3, therefore, is assigned to this action.

4. Use of the fire protection system requires that a check valve between the WS and FP systems would need to be disassembled. The fire pumps require several hours to align before injection into the reactor pressure vessel can begin. As an injection source, the fire pumps are not modeled as a frontline system but are used as a recovery upon delayed failure of other systems. (CLNT IPE pages 3-20, 3-32 and 3-89). All manual actions involved in late depressurization and makeup are combined to one operator action reflecting the dependency of human errors.

Table 3.3 SDP Worksheet for Clinton Power Station, Unit 1 — Small LOCA (SLOCA)

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>**
Power Conversion System (PCS)	{[1/2 TD or 1/1 MD Feedwater pumps] and 2/4 condensate pumps and 2/4 condensate booster pumps with turbine bypass (TB) and operable condenser} (operator action = 2)
Early Inventory High Pressure Core Spray (HPCS)	HPCS pump (1 train)
Early Inventory High Pressure RCIC (RCIC)	RCIC pump (1 ASD train)
Depressurization (DEP)	1/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 3) (1)
Low Pressure Injection (LPI)	1/3 RHR pumps in LPCI mode (1 multi-train system) or 1/1 LPCS pump (1 train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	{[1/2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3) (2)
Late Depressurization and Makeup (LDEP)(3,4)	3/16 SRVs and [1/4 condensate (CD) pumps and 1/4 condensate booster pumps if RX pressure < 725 psi] or [1/4 condensate pumps if RX pressure <250 psi] (operator action = 2)

<u>Circle Affected Functions</u>	**<u>Recovery or Failed Train</u>**	**<u>Remaining Mitigation Capability Rating for Each Affected Sequence</u>**	**<u>Sequence Color</u>**
1 SLOCA - PCS - HPCS - RHRSPC - LDEP (5)			
2 SLOCA -PCS - HPCS - RCIC - LPI - LDEP (8)			
3 SLOCA - PCS - HPCS - RCIC - DEP (9)			

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 worksheets consider depressurization (DEP) using SRVs to be a HEP with credit of 3 (1.0E-3 HEP category). The initial screening value in the IPE for the operator failing to manually initiate ADS was 2.8E-3. The final value was 5.0E-4. (See CLNT IPE, Table 3.3-5, page 3-199 and RAI response to Question 31a dated November 22, 1995.)

2. A HEP value of 1.6E-3 is assigned to operator failure to initiate RHR in suppression pool cooling mode in the updated IPE. A HEP credit of 3, therefore, is assigned to this action.

3. In similar plants with Mark III containment, the function of Suppression pool makeup is required to ensure that the lost inventory to the break in the drywell is compensated for. The SPMU function is also required to ensure sufficient NPSH for ECCS pumps. In the Clinton Nuclear Power Plant, however, this function is not required (See comment 4 under Table 2). Therefore, this function is not included in the SDP worksheet.

4. 1/16 SRVs is sufficient for LPI but for LDEP function 3/16 is required. Since LDEP function is independent from the RHRSPC and has different success criteria for depressurization, it is separated from LPI. This is a deviation from the plant IPE and the licensee's comment.

Table 3.4 SDP Worksheet for Clinton Power Station, Unit 1 — Intermittent Opening of SRVs (IORV)[1]

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>**
Power Conversion System (PCS)	{[1/2 TD or 1/1 MD Feedwater pumps] and 2/4 condensate pumps and 2/4 condensate booster pumps with turbine bypass (TB) and operable condenser} (operator action = 2)
Early Inventory High Pressure Core Spray (HPCS)	HPCS pump (1 train)
Depressurization (DEP)	Assumed Success as a result of the initiator. Not included in the sequences [1]
Low Pressure Injection (LPI)	1/3 RHR pumps in LPCI mode (1 multi-train system) or 1/1 LPCS pumps (1 train)
Late Depressurization and Makeup (LDEP)[2,3]	2/16 SRVs and [1/4 condensate (CD) pumps and 1/4 condensate booster pumps if RX pressure < 725 psi] or [1/4 condensate pumps if RX pressure <250 psi] (operator action = 2)

<u>Circle Affected Functions</u>	**<u>Recovery or Failed Train</u>**	**<u>Remaining Mitigation Capability Rating for Each Affected Sequence</u>**	**<u>Sequence Color</u>**
1 IORV - PCS - HPCS - LPI - LDEP (5)			
2 IORV -PCS - HPCS - DEP (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.

<u>Notes</u>:

1. Licensee's definition of Small LOCA is based on RCIC capacity. IORV is larger than small LOCA and therefore RCIC capacity is not sufficient for makeup. A new event tree therefore is developed and used for this SDP worksheet. The worksheets consider depressurization (DEP) to be successful as a result of the initiator. Sequence 9 of the Small LOCA event tree, therefore, does not apply.

2. In similar plants with Mark III containment, the function of Suppression pool makeup is required to ensure that the lost inventory to the break in the drywell is compensated for. The SPMU function is also required to ensure sufficient NPSH for ECCS pumps. Neither the IPE nor the licensee's comments refer to SPMU function. Therefore, it is not currently included in the SDP worksheet.

3. The SDP worksheet is valid for one SORV opening. For one IORV, the SLOCA SDP worksheet is used. 1/16 SRVs is sufficient for LPI but for LDEP function 2/16 is required. Since the LDEP function is independent from the RHRSPC and has different success criteria for depressurization, it is separated from LPI. This is a deviation from the plant IPE and the licensee's comment.

Table 3.5 SDP Worksheet for Clinton Power Station, Unit 1 — Medium LOCA (MLOCA)

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 (HPCS)	HPCS (1 train)
Depressurization (DEP)	3/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 2) [1]
Low Pressure Injection (LPI)	1/3 RHR pumps in LPCI mode (1 multi-train system) or 1/1 LPCS pump (1 train)

Circle Affected Functions	**Recovery or Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 MLOCA - HPCS - LPI (3)			
2 MLOCA - HPCS - 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. A medium break LOCA does not depressurize the reactor to the point at which low pressure injection systems can provide makeup. The reactor must be manually depressurized for the low pressure injection systems to succeed. RCIC does not have sufficient capacity to maintain coverage of the core. Feedwater is not available because makeup to the condenser may be insufficient. MLOCA is similar to SLOCA except that FW,

RCIC, and suppression pool cooling (following RCIC operation) are not included. Furthermore, operation of suppression pool makeup is not required for the Clinton Nuclear Power Plant.

Table 3.6 SDP Worksheet for Clinton Power Station, Unit 1 — Large LOCA (LLOCA)

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 Containment Control (EC)	{Vapor suppression system passive operation of suppression pool and vacuum breakers} (1 multi-train system) (1)		
Early Inventory Control (HPCS)	HPCS (1 train)		
Low Pressure Injection (LPI)	1/3 RHR pumps (A, B, or C) in LPCI mode (1 multi-train system) (2), or 1/1 LPCS pump (1 train) (3)		
Circle Affected Functions	**Recovery or Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 LLOCA - HPCS-LPI (3)			
2 LLOCA - EC (4)			

Notes:

1. Early containment failure (EC) is considered very unlikely in the Clinton Updated IPE, therefore, it is not modeled in IPE. However, consistent with other BWR Mark III is modeled here.

2. If there is a large break LOCA and pressure is increasing inside containment, the RHR system can be aligned to the containment spray (CS) mode. Only the suppression pool cooling mode of RHR is modeled in the CLNT Level 1 PRA and only as a support for successful RCIC operation. RCIC operation is not applicable to LLOCA. The shutdown cooling (SDC) mode of RHR is not included in the model because it is not needed to prevent core damage during the 24 hour mission time of the IPE. The CS mode of RHR is modeled in the containment analysis (Level 2) because its primary function is to maintain containment integrity. Success for containment heat removal is successful operation of one train of RHR in the suppression pool cooling mode. (See CLNT IPE, pages 3-21 and 3-22.)

3. A large break LOCA depressurizes the reactor to a point at which low pressure injection systems can provide makeup. HPCS can also provide

makeup. The LLOCA is similar to an MLOCA except that manual depressurization of the reactor is not required. (See CLNT IPE pages 3-25 and 3-26.)

Table 3.7 SDP Worksheet for Clinton Power Station, Unit 1 — Loss of Offsite Power (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 Div 1 or Div 2 DGs (EAC)	1/2 EDGs (1 multi-train system) [1]
Recovery of Offsite Power within 30 minutes (0.5 Hours) (REC0.5)	(operator action = 0) [1]
High Pressure Core Spray (HPCS)	HPCS pump (1 train) [1, 2, 4]
Reactor Core Isolation Cooling (RCIC)	RCIC pump (1 ASD train) [1, 2, 4]
Recovery of Offsite Power within 4 hours (REC4)	Recovery of AC power including the DC load shed (operator action = 2) [1, 3, 4]
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	1/2 RHR pumps in SPC mode (operator action = 3)
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pumps] (1 train)
Control Rod Drive Pumps (CRD)	1/ 2 CRD pumps (1 multi-train system)
Late Depressurization and Makeup (LDEP)	3/16 SRVs with [1/ 4 condensate (CD) pumps and 1/ 4 condensate booster (CB) pumps if RX pressure < 725 psi] or [1/4 condensate pumps if RX pressure <250 psi]} or [1/3 fire pumps (all diesel-driven) at RX pressure <= 73 psi](operator action = 2)

Circle Affected Functions	**Recovery or Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 LOOP - EAC - HPCS - REC4 (6)			
2 LOOP - EAC - REC0.5 - HPCS - RHRSPC (5)			
3 LOOP - EAC - REC0.5 - HPCS - RCIC (7)			

4 LOOP - HPCS - RHRSPC - CRD - LDEP (1,2) (Transient Sequence)			
5 LOOP - HPCS - RCIC - LPI - LDEP (1,2) (Transient Sequence)			
6 LOOP - HPCS - RCIC - DEP (1,2) (Transient Sequence)			
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. If in a SBO scenario, failure of HPCS and RCIC occurs early in the event, then level would reach top of active fuel in approximately 25 minutes after the initiating event. The batteries are assumed to be available for four (4) hours if load shedding is performed by the operators in one hour. Therefore, included in recovery of offsite power in 4 hours is the load shedding of the DC bus within the first hour. The HEP value in the IPE for this task is 3.0E-2. Also, CLNT RAI Response to Question 7b dated November 22, 1995: (Submit basis that injection systems can operate up to 4 hours without HVAC): “Safety-related components located in the ECCS or RCIC rooms including the pumps have been environmentally qualified for severe temperature conditions including a High Energy Line Break (HELB). A heatup analysis was performed using the methodology contained in NUMARC 87-00 for the Low Pressure Core Spray Room. Similar results are expected for the other ECCS rooms. Because the room temperature rise for the first three hours was substantially below the HELB equipment qualification temperature envelope and only slightly above for the period from three to six hours, the assumption was made that the pumps would remain operable for four hours after room cooling was lost.

2. Low pressure injection systems are not available unless the offsite power or Division 1 or Division 2 diesel generators are recovered, because air supplies for opening the SRVs to depressurize the reactor vessel would be depleted. (See CLNT IPE, page 3-219.)

3. The diesel driven fire pumps could be used as a low pressure injection source. However, since it takes several hours to align for reactor injection,

it is not modeled for this SBO scenario. (See CLNT IPE, page 3-219.)

Table 3.8 SDP Worksheet for Clinton Power Station, Unit 1 — Anticipated Transients Without Scram (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)	14/16 SRVs (1 multi-train system) (1)
Recirculation Pump Trip (RPT)	Manual or automatic trip of recirculation pumps (1 train system)
Power Conversion System (PCS)(1)	{[1/2 TD or 1/1 MD Feedwater pumps] and 2/4 condensate pumps and 2/4 condensate booster pumps with turbine bypass (TB) and operable condenser} (operator action = 2)
Reactivity Control (SLC)	1/2 SLC pumps and valves, operator action= 4 but limited by hardware failure (1 multi-train System) (2)
Inhibit ADS (INH)	Operator inhibits ADS (operator action - 3) (2)
Depressurization (DEP)	4/16 SRVs manually open (operator action = 3)
Low Pressure Injection (LPI)	1/3 RHR pumps (A, B, or C) in LPCI mode (1 multi-train system) or 1/1 LPCS pump (1 train)(3)
Containment Heat Removal Suppression Pool Cooling (CHR)	1/2 RHR pumps in SPC mode (operator action = 3)

Circle Affected Functions	**Recovery or Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 ATWS - SLC (2, 8)			
2 ATWS - PCS - CHR (4)			
3 ATWS - PCS - LPI (5)			
4 ATWS - PCS - DEP (6)			

0 00 0 0000 00 00n0 000 0001

5 ATWS - PCS - INH (7)			
6 ATWS - RPT (9)			
7 ATWS - OVERP (10)			

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 ATWS, at least fourteen SRVs must function to protect against early overpressurization. The licensee also has requested that the PCS function be credited. PCS is not usually credited in the SDP for all spectrum of ATWS, however, the licensee’s comment has been incorporated.

2. Important post accident operator actions (human error probabilities) from the Updated Clinton IPE per the Licensee’s comments are as follows:
    a. Operator fails to manually initiate ADS - 5.0E-4
    b. Operator fails to initiate SLC A & B - 4.0E-4.

   Most of the HEP credits in this worksheet therefore are assigned generically.

3. The use of HPCS for inventory make up following successful SLC and depressurization is not a preferred path in Clinton. It therefore is not credited in this SDP worksheet consistent to other BWR-6 plants. However, HPCS could be used if LPI is degraded.

Table 3.9 SDP Worksheet for Clinton Power Station, Unit 1 — Loss of Non-Safety DC Power (LDC) [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:**
High Pressure Core Spray (HPCS)	1/1 HPCS pump (1 train) with dedicated support
Reactor Core Isolation Cooling (RCIC)	1/1 RCIC pump (1 ASD train)
Depressurization (DEP)	1/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 3)
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pumps] (1 train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	{[1/ 2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3)
Late Inventory Makeup (LDEP)	Depressurization (3/16 SRVs) and use of [1/3 firepumps (diesel driven) at RX pressure ≤ 73 psi] [2] (operator action = 1)

Circle Affected Functions	**Recovery of Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 LDC - HPCS - RHRSPC - LDEP (4)			
2 LDC - HPCS - RCIC - LPI (6)			
3 LDC - HPCS - RCIC - DEP (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.

<u>Notes</u>:

1. Loss of non-safety DC power causes loss of PCS (all feedwater and condensate systems), MSIV closure and loss of CRD systems, as well as a loss of non-safety service water (WS) system. The reactor trip comes about due to loss of feedwater and MSIV closure. Fire protection system is credited here, even though a loss of WS (non-safety service water) will ensue, because WS piping will maintain its integrity.

   Initiating Event Frequency: 9.9E-3.

2. Use of the fire protection system requires that a check valve between WS and FP systems would need to be disassembled. The fire pumps require several hours to align before injection into the reactor pressure vessel can begin. As an injection source, the fire pumps are not modeled as a front line system but are used as a recovery upon delayed failure of other systems. (CLNT IPE pages 3-20, 3-32 and 3-89). A HEP credit of 1, therefore, is given for the LDEP function.

Table 3.10 SDP Worksheet for Clinton Power Station, Unit 1 — Loss of Non-Safety Service Water (LSW) [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:**
High Pressure Core Spray (HPCS)	1/1 HPCS pump (1 train) with dedicated EDG
Reactor Core Isolation Cooling (RCIC)	1/1 RCIC pump (1 ASD train)
Depressurization (DEP)	1/16 safety relief valves (SRVs)(auto ADS is inhibited) (operator action = 3)
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pumps] (single train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	[1/2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3)

Circle Affected Functions	**Recovery of Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 LSW - HPCS - RHRSPC (3)			
2 LSW - HPCS - RCIC - LPI (5)			
3 LSW - HPCS - RCIC - DEP (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.

<u>Notes</u>:

1. Loss of non-safety service water (WS) causes loss of PCS (all feedwater and condensate systems) and loss of CRD system. In addition, it is assumed that the fire protection system cannot be used in recovery since it uses a portion of WS piping for injection (and WS loss could be caused by rupture in WS piping).

   Loss of PCS causes reactor trip.

   Initiating Event Frequency: 1.75E-3/yr.

Table 3.11 SDP Worksheet for Clinton Power Station, Unit 1 — Loss of Instrument Air (LIA) [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:**
High Pressure Core Spray (HPCS)	1/1 HPCS pump (1 train) with dedicated EDG
Reactor Core Isolation Cooling (RCIC)	1/1 RCIC pump (1 ASD train)
Early Inventory Control Rod Drive Pumps (CRD)	1/2 CRD pumps (1 multi-train system) [2]
Depressurization (DEP)	1/16 safety relief valves (SRVs) (auto ADS is inhibited) (operator action = 3)
Low Pressure Injection (LPI)	[1/3 RHR pumps in LPCI mode](1 multi-train system) or [1/1 LPCS pumps] (single train)
Residual Heat Removal Suppression Pool Cooling (RHRSPC)	{[1/2 RHR pumps in suppression pool cooling (SPC) mode for RCIC operation] (operator action = 3)
Late Inventory Makeup (LDEP)	Depressurization (3/16 SRVs) and1/3 firepumps (diesel driven) [3] (operator action = 2)

Circle Affected Functions	**Recovery of Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Sequence**	**Sequence Color**
1 LIA - HPCS - RHRSPC - CRD - LDEP (5)			
2 LIA - HPCS - RCIC - LPI (7)			
3 LIA - HPCS - RCIC - DEP (8)			

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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 causes loss of TD feedwater pumps and MSIV closure and, thus, a reactor trip on low feedwater flow, low vessel level and turbine trip. Thus, the condenser is not available as a heat sink.

   Initiating Event Frequency: 4.3-3/yr.

2. After a reactor scram at rated pressure, if the operators took no action to increase control rod drive (CRD) flow, CRD flow would increase automatically to 140 GPM. If the second CRD pump were to be used, it would have to be manually initiated and the total flow rate would be only 150 gpm. This is due to high pressure drop in the lines. The Clinton IPE PRA model assumed only the 140 gpm flow rate of one CRD pump after 1 hour. (See CLNT IPE pages 3-30, 3-32, and 3-80.) CRD is modeled as a recovery action in the IPE. Here it is assumed that CRD will be successful if RCIC is initially successful, and then the RCIC eventually fails due to lack of suppression pool cooling. This is assuming that in the first hour RCIC was running and the operator had to trip RCIC due to high suppression pool temperature.

3. Use of the fire protection system requires that a check valve between WS and FP systems would need to be disassembled. The fire pumps require several hours to align before injection into the reactor pressure vessel can begin. As an injection source, the fire pumps are not modeled as a frontline system but are used as a recovery upon delayed failure of other systems. (CLNT IPE pages 3-20, 3-32 and 3-89.) Only 2 out of 3 diesel fire pumps are credited in the IPE.

Table 3.12 SDP Worksheet for Clinton — Interfacing System LOCA (ISLOCA)[1,2]

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

Initiation Pathways:	**Mitigation Capability**: **Ensure Component Operability for Each Pathway**
LPCI Injection Lines	3 lines
LPCS Injection Line	1 line
RHR Shutdown Cooling Suction Line	1 line
HPCS Suction Line	1 line
RCIC Suction line	1 line
Feedwater Lines	2 feedwater pump suction lines

Circle Affected Component in Pathways	**Recovery of Failed Train**	**Remaining Mitigation Capability Rating for Each Affected Pathway**	**Sequence Color**

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 initiation pathways defined are primarily based on NUREG/CR-5928, ISLOCA Research Program, Final Report, July 1993. The licensee provided comments on the ISLOCA event trees but not on the details of the pathways to ISLOCA. Therefore, the SDP worksheet currently does not have information on the various isolation mechanisms and line sizes.

2. This worksheet is different from the other worksheets in that ISLOCA is typically an unmitigated initiating event in most PRAs. Therefore, the right side of the worksheet contains valves, whose failure may lead to an ISLOCA or LOC rather than mitigating systems to address an event in progress. As such, it is not intended to be referenced by the last column of Table 1.2, Initiators and System Dependency Table.

1.4 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) (TRANS)
2. Small LOCA (SLOCA)
3. Intermittent Opening of SRVs (IORV)
4. Medium LOCA (MLOCA)
5. Large LOCA (LLOCA)
6. Loss of Offsite Power (LOOP)
7. Anticipated Transients Without Scram (ATWS)
8. Loss of Non-Safety DC Power (LDC)
9. Loss of Non-Safety Service Water (LSW)
10. Loss of Instrument Air (LIA)

Clinton 1

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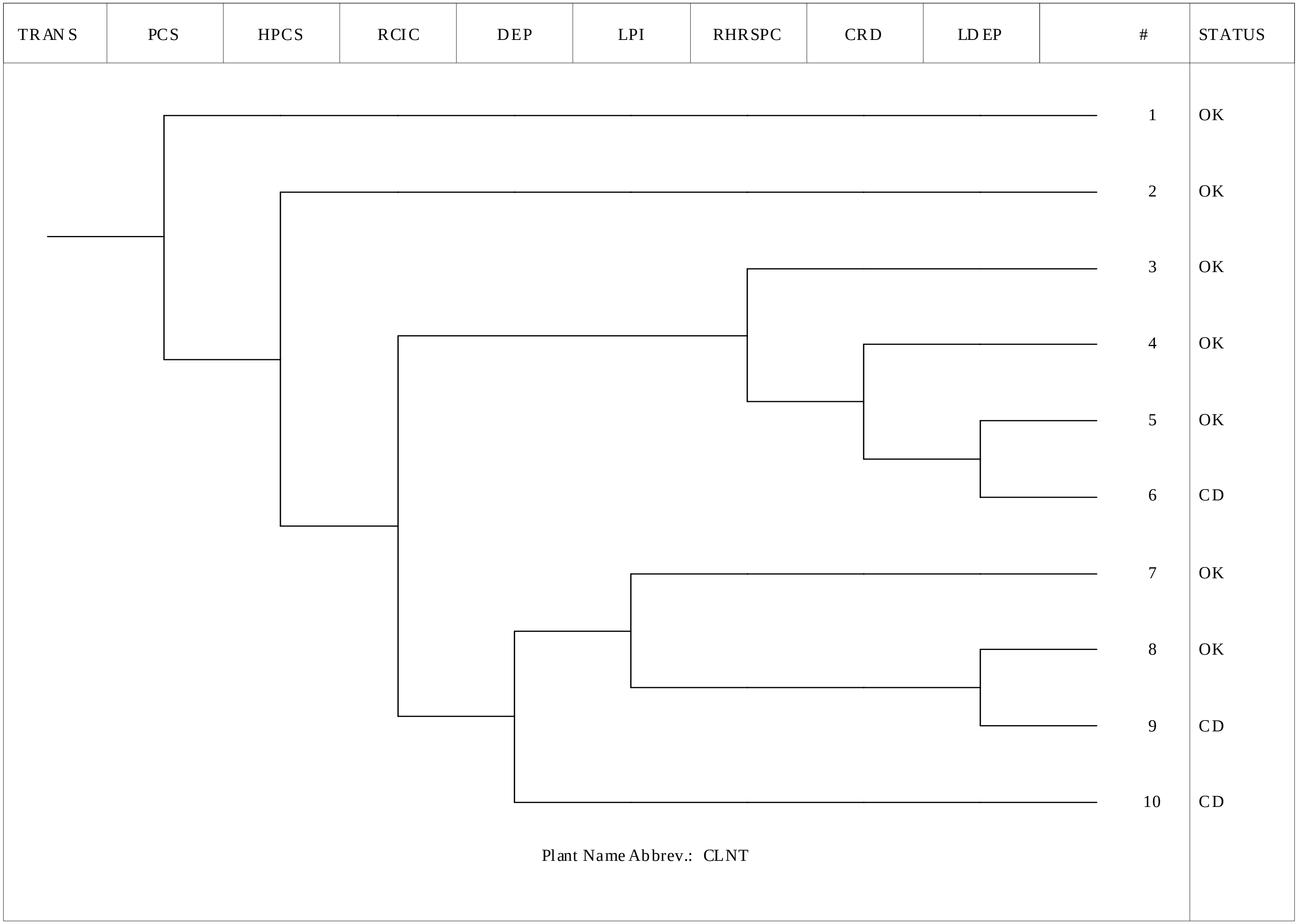

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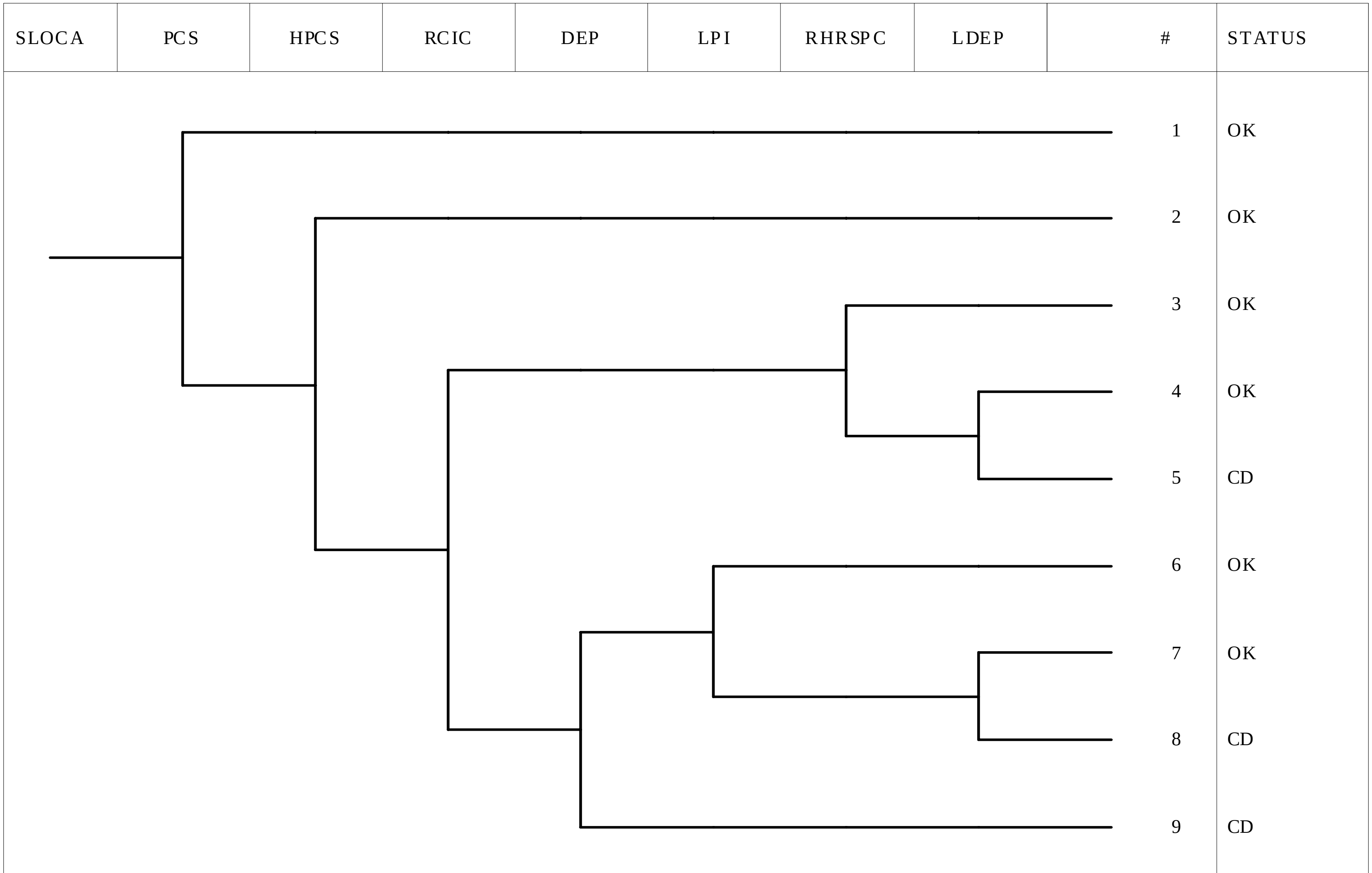
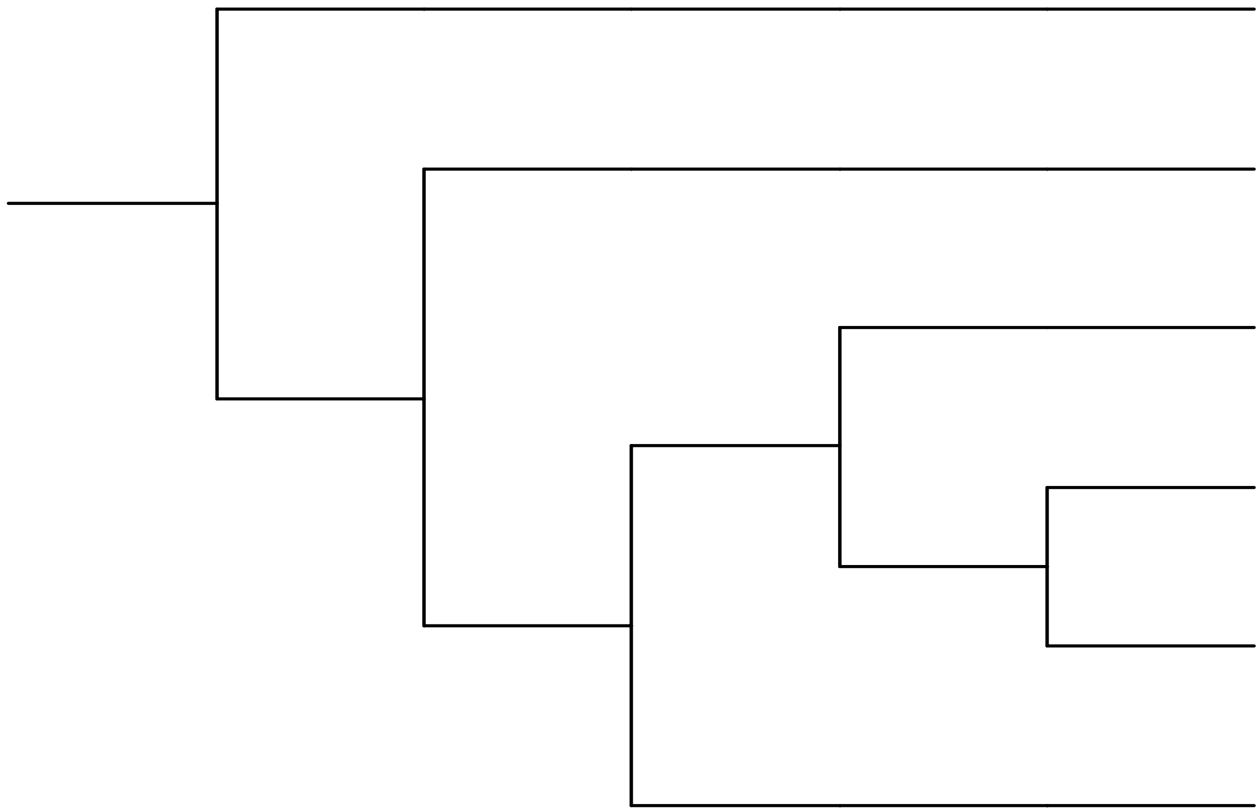


Plant Name Abbrev.: CLNT

Clinton 1

IORV	PCS	HPCS	DEP	LPI	LDEP	#	STATUS



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

Plant Name Abbrev.: CLNT

0 00 0

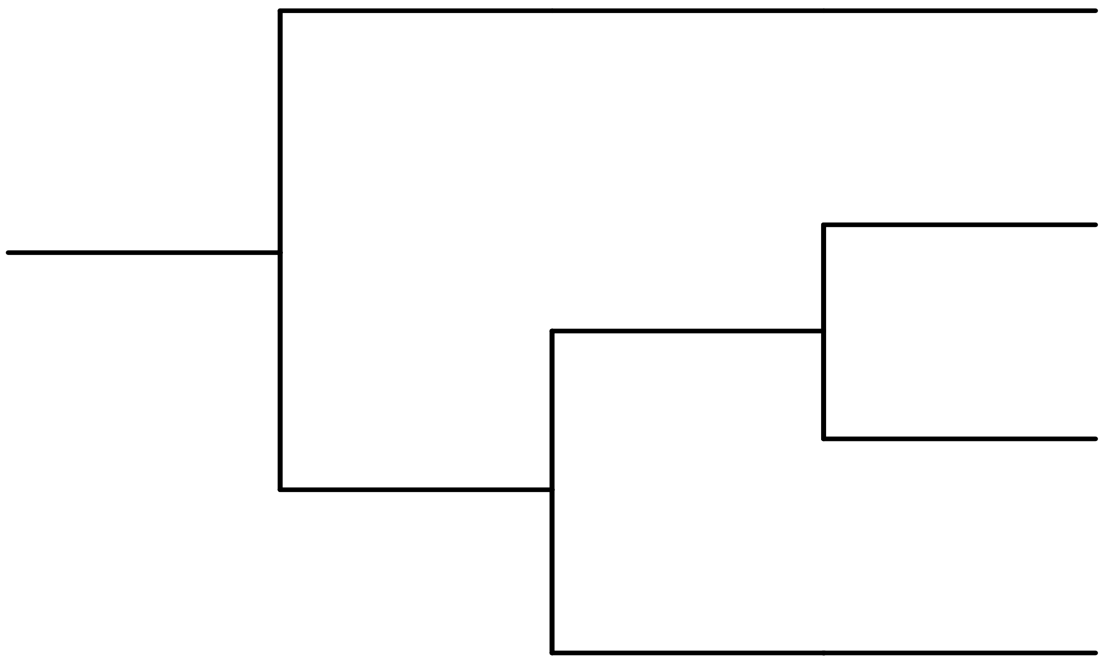
0000 00 00n0 000 0001

Clinton 1

0 00 0

0000 00 00n0 000 0001

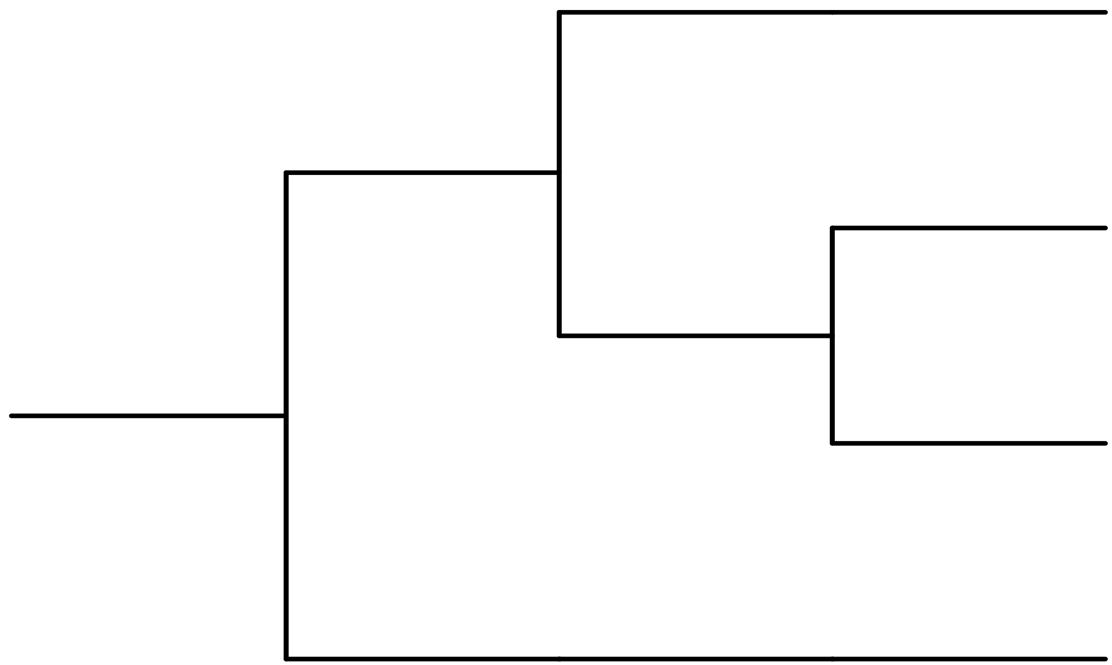
MLOCA	HPCS	DEP	LPI	#	STATUS
				1	OK
				2	OK
				3	CD
				4	CD



Plant Name Abbrev.: CLNT

Clinton 1

LLOCA	EC	HPCS	LPI	#	STATUS



#	STATUS
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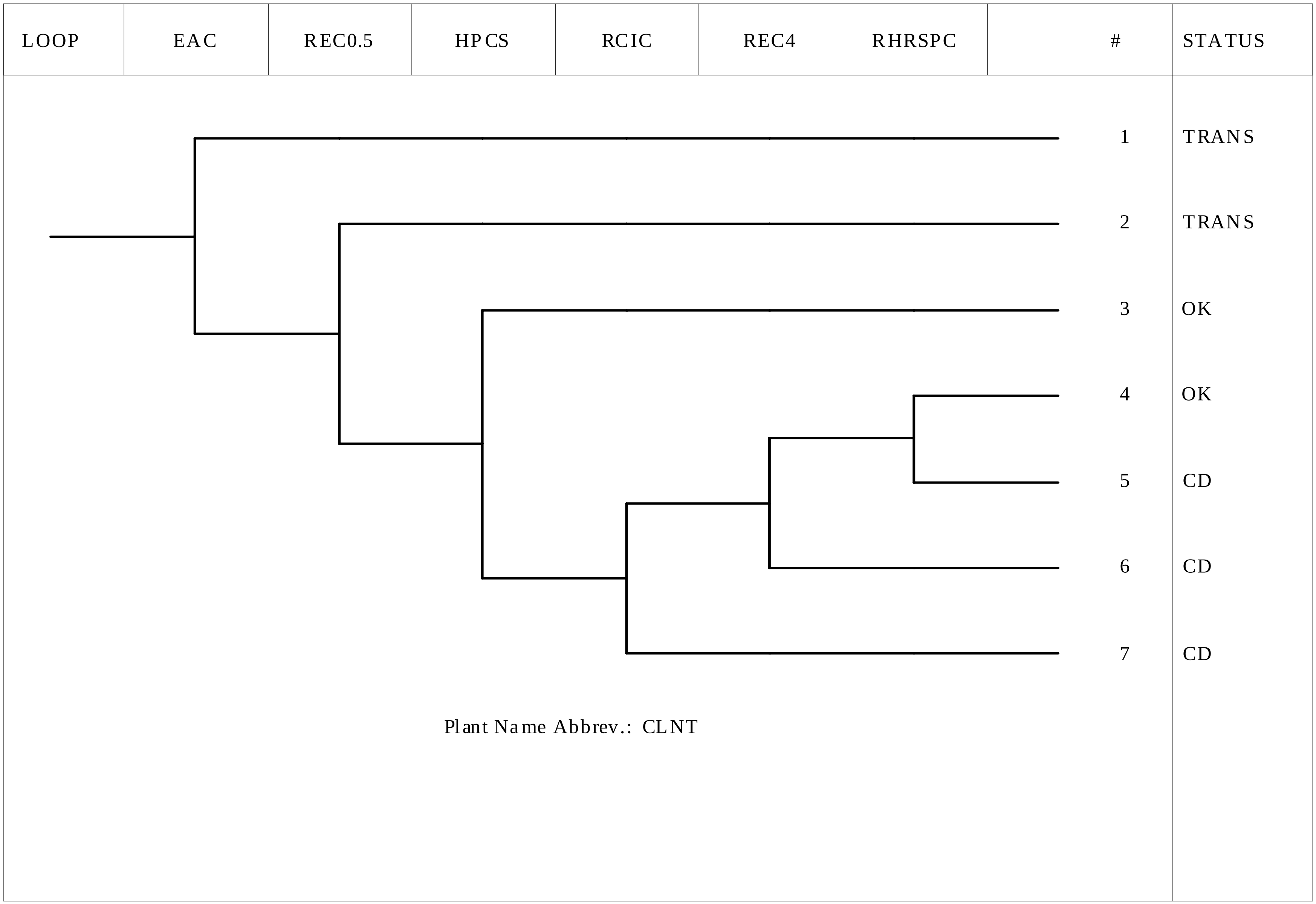
2	OK
3	CD
4	CD

Plant Name Abbrev.: CLNT

0 00 0

0000 00 00n0 000 0001

Clinton 1



Plant Name Abbrev.: CLNT

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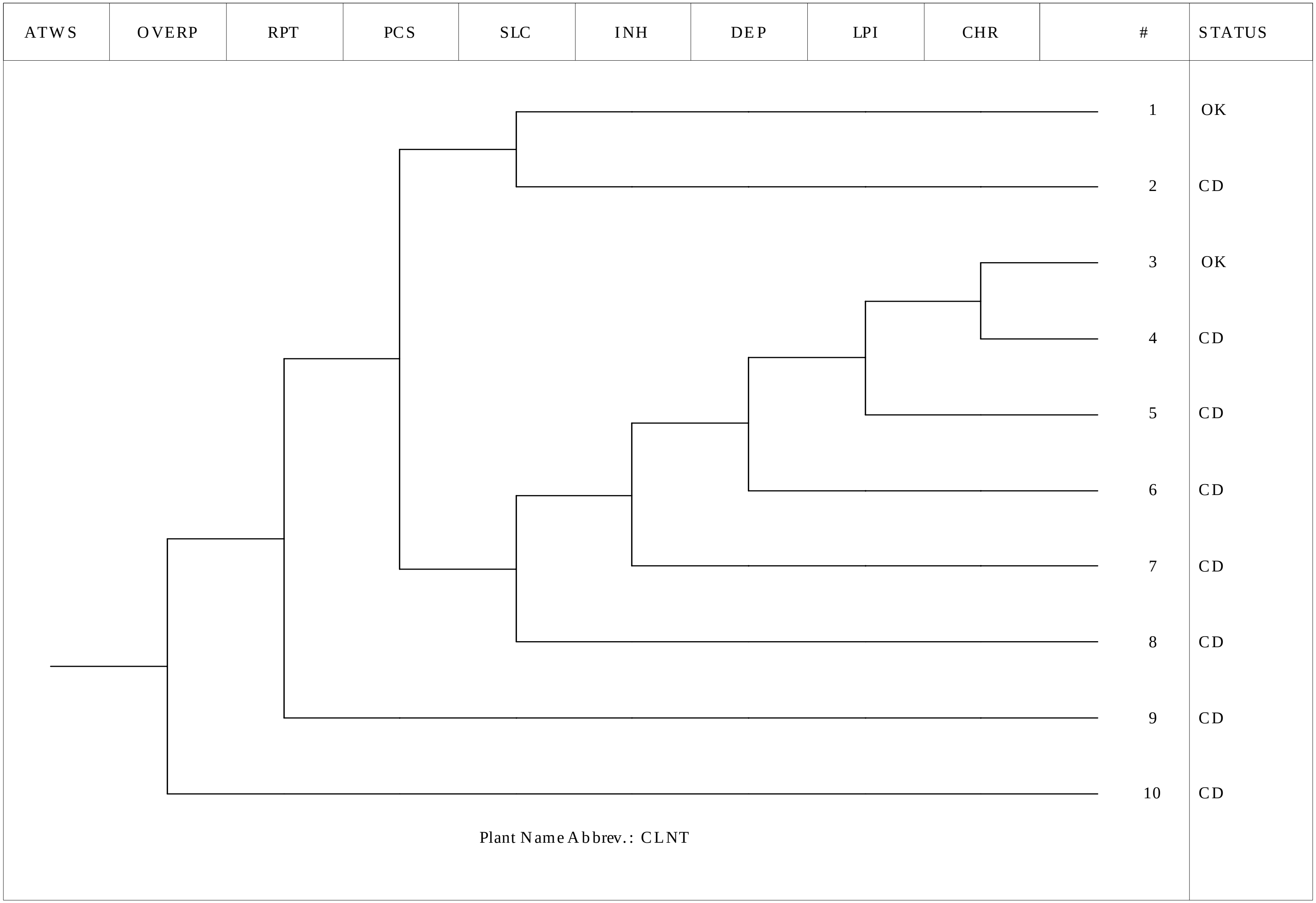
Clinton 1


ATWS
OVERP
RPT
PCS
SLC
INH
DEP
LPI
CHR
#
STATUS
1 OK
2 CD
3 OK
4 CD
5 CD
6 CD
7 CD
8 CD
9 CD
10 CD
Plant Name Abbrev.: CLNT

Clinton 1

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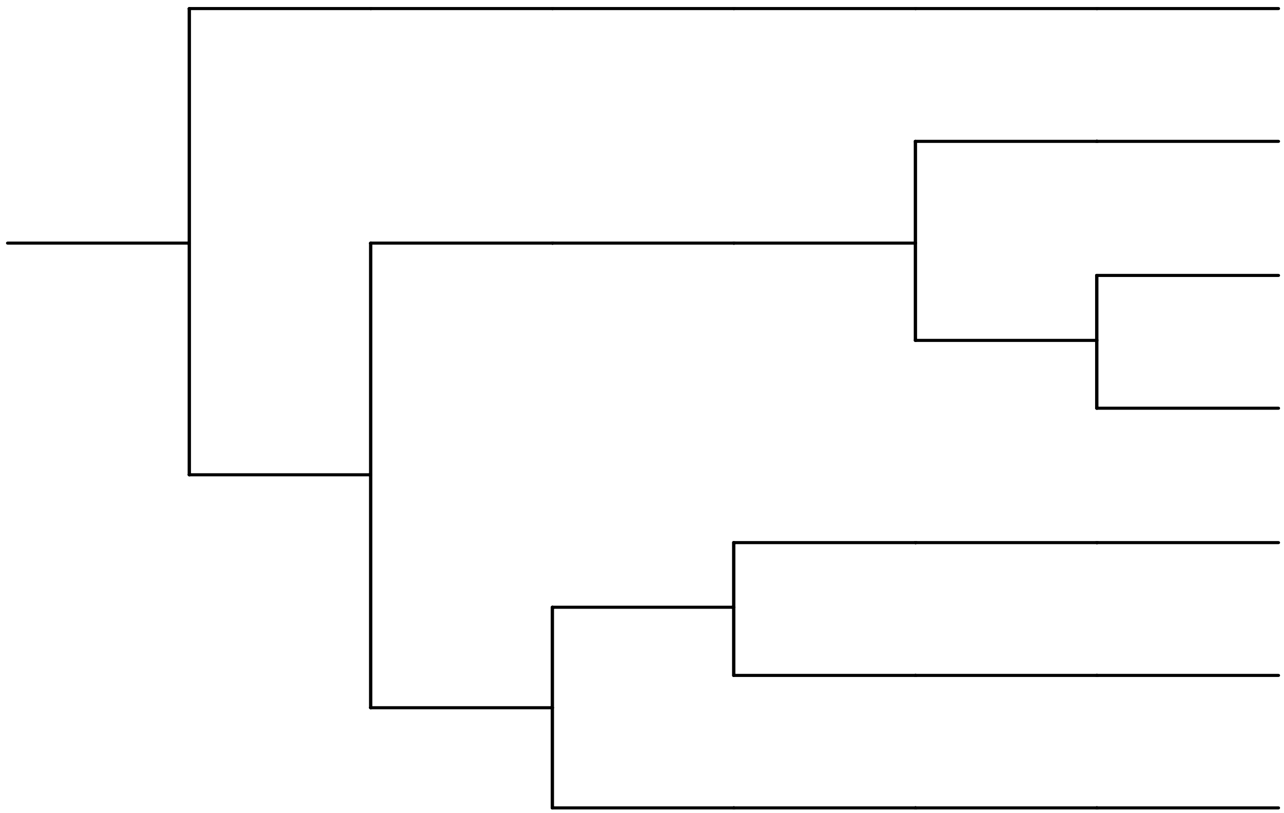
LDC	HPCS	RCIC	DEP	LPI	RHRSPC	LDEP	#	STATUS



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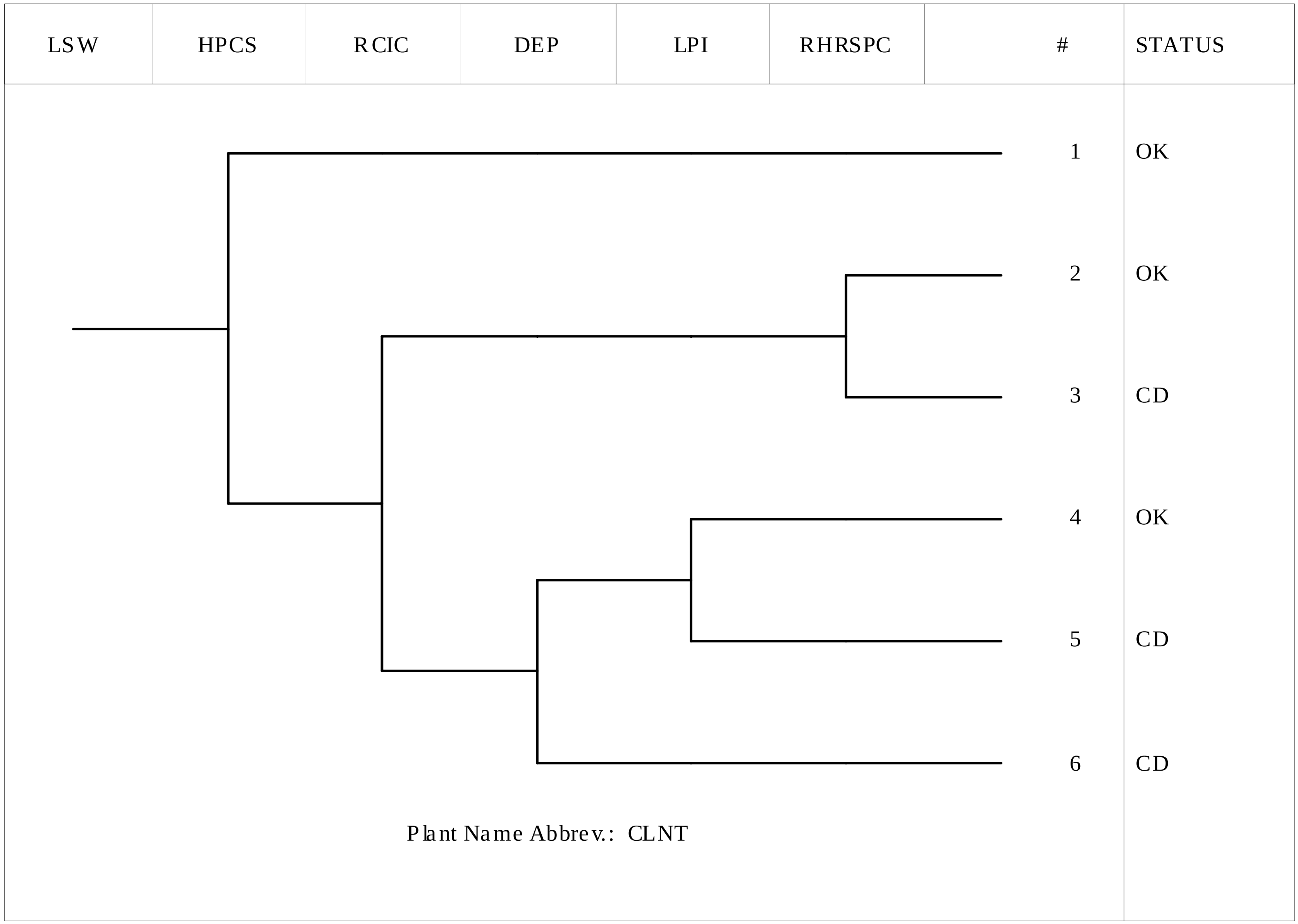
2	OK
3	OK
4	CD
5	OK
6	CD
7	CD

Plant Name Abbrev.: CLNT

Clinton 1



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Clinton 1

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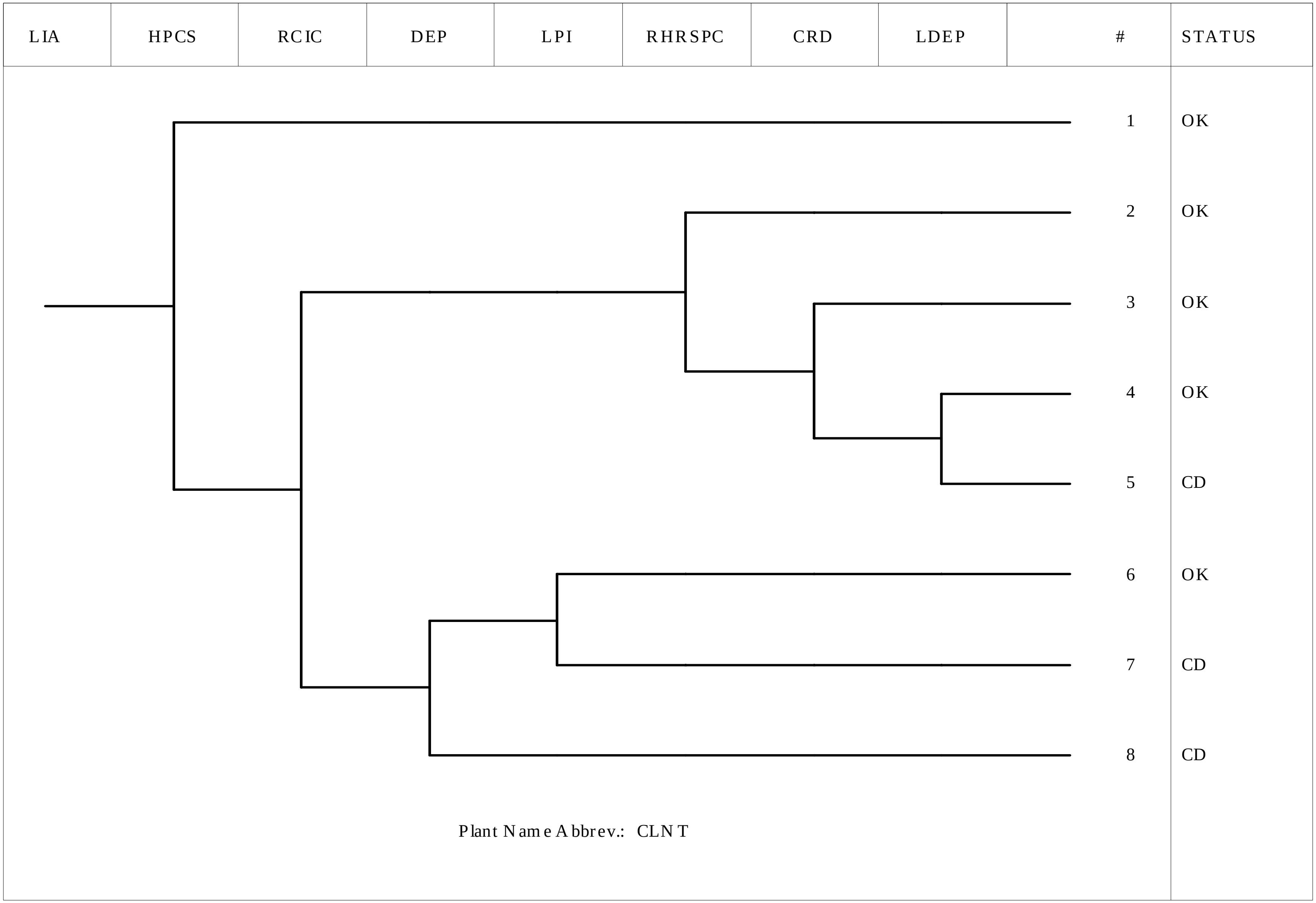

2. RESOLUTION AND DISPOSITION OF COMMENTS

This section is composed of two subsections. Subsection 2.1 summarizes the generic assumptions that were used for developing the SDP worksheets for the BWR plants. These guidelines were based on the plant-specific comments provided by the licensee on the draft SDP worksheets and further examination of the applicability of those comments to similar plants. These assumptions which are used as guidelines for developing the SDP worksheets help the reader better understand the worksheets' scope and limitations. The generic guidelines and assumptions for BWRs are given here. Subsection 2.2 documents the plant-specific comments received on the draft version of the material included in this notebook and their resolution.

2.1 GENERIC GUIDELINES AND ASSUMPTIONS (BWRs)

Initiating Event Likelihood Rating Table

1. Assignment of plant-specific IEs into frequency rows:

Transient (Reactor trip) (TRANS), transients without PCS (TPCS), small, medium, and large LOCA (SLOCA, MLOCA, LLOCA), inadvertent or stuck-open SRVs (IORV), anticipated transients without scram (ATWS), interfacing system LOCA (ISLOCA), and LOCA outside containment (LOC) are assigned into rows based on consideration of industry-average frequency. Plant-specific frequencies can be different, but are not considered. Plant-specific frequencies for LOOP and special initiators are used to assign these initiating events.

2. Inclusion of special initiators:

The special initiators included in the worksheets are those applicable for the plant. A separate worksheet is included for each of the applicable special initiators. The applicable special initiators are primarily based on the plant-specific IPEs. In other words, the special initiator included are those modeled in the IPEs unless it is shown to be a negligible contributor. In some cases, in considering plants of similar design, a particular special initiator may be added for a plant even if it is not included in the IPE if such an initiator is included in other plants of similar design and is considered applicable for the plant. Except for the interfacing system LOCA (ISLOCA) and LOCA outside containment (LOC), if the occurrence of the special initiator results in a core damage, i.e., no mitigation capability exists for the initiating event, then a separate worksheet is not developed. For such cases, the inspection focus is on the initiating event and the risk implication of the inspection finding can be directly assessed. For ISLOCA and LOC, a separate worksheet is included noting the pathways that can lead to these events.

3. Inadvertent or stuck open relief valve as an IE in BWRs:

Many IPEs/PRAs model this event as a separate initiating event. Also, the failure of the SRVs to re-close after opening can be modeled within the transient tree. In the SDP worksheet, these events are modeled in a separate worksheet (and, are not included in the transient worksheets) considering both inadvertent opening and failure to re-close. We typically consider a single valve is stuck or inadvertently open. The frequency of this initiator is generically estimated for all BWR plants. This IE may behave similar to a small or medium LOCA depending on the valve size, and the mitigation capability is addressed accordingly.

4. LOCA outside containment (LOC):

A LOCA outside of containment (LOC) can be caused by a break in a few types of lines such as Main Steam or Feedwater. LOC is treated differently among the IPEs. Separate ETs are usually not developed in the IPEs for LOCs. Thus, credit is usually not taken for mitigating actions. LOC

sequences typically have a core damage frequency in the E-8 range. As such, LOCs are included together with ISLOCAs in a separate summary type SDP worksheet. Plant specific notes are included to explain how the particular IPE has addressed LOCs.

Initiating Event and System Dependency Table

1. Inclusion of systems under the support system column:

This table shows the support systems for the support and frontline systems. Partial dependency, which usually is a backup system, is not expected to be included. If included, they should be so noted. The intent is to include only the support system and not the systems supporting the support system, i.e., those systems whose failure will result in failure of the system being supported. Sometimes, some subsystems on which inspection findings may be noted have been included as a support system, e.g., EDG fuel oil transfer pump as a support system for EDGs.

2. Coverage of system/components and functions included in the SDP worksheets:

The Initiators and System Dependency Table includes systems and components which are included in the SDP worksheets and those which can affect the performance of these systems and components. One to one matching of the ET headings/functions to that included in the Table was not considered necessary.

SDP Worksheets and Event Trees

1. Crediting of non-safety related equipment:

SDP worksheets credit or include safety-related equipment and also, non-safety related equipment as used in defining the accident sequences leading to core damage. In defining the success criteria for the functions needed, the components included are typically those covered under the Technical Specifications (TS) and the Maintenance Rule (MR). No evaluation was performed to assure that the components included in the worksheets are covered under TS or MR. However, if a component was included in the worksheet, and the licensee requested its removal, it may not have been removed if it is considered that the components is included in either TS or MR.

2. No credit for certain plant-specific mitigation capability:

The significance determination process (SDP) screens inspection findings for Phase 3 evaluations. Some conservative assumptions are made which result in not crediting some plant-specific features. Such assumptions are usually based on comparisons with plants of similar design and to maintain consistency across the SDP worksheets of similar plant designs.

3. Crediting system trains with high unavailability

Some system component/trains may have unavailability higher than 1E-2, but they are treated in a

manner similar to other trains with lower unavailability in the range of 1E-2. In this screening approach, this is considered adequate to keep the process simple. An exception is made for steam-driven components which are designated as automatic steam driven (ASD) train with a credit of 1, i.e., an unavailability in the range of !E-1.

4. Treating passive components (of high reliability) same as active components:

Passive components, namely isolation condensers in some BWRs, are credited similar to active components. The reliability of these components are not expected to differ (from that of active components) by more than an order of magnitude. Pipe failures have been excluded in this process except as part of initiating events where appropriate frequency is used. Accordingly, a separate designation for passive components was not considered necessary.

5. Defining credits for operator actions:

The operator's actions modeled in the worksheets are categorized as follows: operator action=1 representing an error probability of 5E-2 to 0.5; operator action=2 representing an error probability of 5E-3 to 5E-2; operator action=3 representing an error probability of 5E-4 to 5E-3; and operator action=4 representing an error probability of 5E-5 to 5E-4. Actions with error probability > 0.5 are not credited. Thus, operator actions are associated with credits of 1, 2, 3, or 4. Since there is large variability in similar actions among different plants, a survey of the error probability across plants of similar design was used to categorize different operator actions. From this survey, similar actions across plants of similar design are assigned the same credit. If a plant uses a lower credit or recommends a lower credit for a particular action compared to our assessment of similar action based on plant survey, then the lower credit is assigned. An operator's action with a credit of 4, i.e., operator action=4, is noted at the bottom of the worksheet; the corresponding hardware failure, e.g., 1 multi-train system, is defined in the mitigating function.

6. Difference between plant-specific values and SDP designated credits for operator actions:

As noted, operator actions are assigned to a particular category based on review of similar actions for similar design plants. This results in some differences between plant-specific HEP values and credit for the action in the worksheet. The plant-specific values are usually noted at the bottom of the worksheet, when available.

7. Dependency among multiple operator actions:

IPEs or PRAs, in general, account for dependencies among multiple operator actions that may be applicable. In this SDP screening approach, if multiple actions are involved in one function, then the credit for the function is designated as one operator action considering the dependency involved.

8. Crediting late injection (LI) following failure of containment heat removal (CHR), i.e., suppression pool cooling:

Following successful high or low pressure injection, suppression pool cooling is modeled. Upon failure of suppression pool cooling, containment venting (CV) is considered followed by late injection. Late injection is credited if containment venting is successful. Further, LI is required following CV success. The suction sources for the LI systems credited are different from the suppression pool. HPCI, LPCI, and CS are not credited in late injection. No credit is given for LI following failure of CV. The survival probability is low and such details are not considered in the screening approach here.

9. Combining late injection (LI) with low pressure injection (LPI) or containment venting (CV):

In some modeling approaches, LI is combined with LPI or CV. In the SDP worksheet approach here, these functions are separate. As discussed above, LPI and LI use different suction sources, and CV and LI may be two different categories of operator actions. In these respects, for some plants, SDP event trees may be different than the plant-specific trees.

10. Crediting condensate trains as part of multiple functions: power conversion system (PCS), low pressure injection (LPI), and late injection (LI):

Typically, condensate trains can be used as an LPI and LI source in addition to its use as part of the power conversion system. However, crediting the same train in multiple functions can result in underestimation of the risk impact of an inspection finding in the SDP screening approach since it does not account for these types of dependencies in defining the accident sequences. To simplify the process and to avoid underestimation, condensate train is not credited in LPI, but may be credited in LI.

11. Modeling vapor suppression success in different LOCA worksheets:

Vacuum breakers typically must remain closed following a LOCA to avoid containment failure and core damage. Some plants justify that vapor suppression is not needed for SLOCA. These sequences typically have low frequency and are not among the important contributors. However, an inspection finding on these vacuum breakers may make these sequences a dominant contributor. Accordingly, success of vapor suppression is included in the SDP worksheets. It is included for all three LOCA worksheets (LLOCA, MLOCA, and SLOCA); for plants presenting justification that they are not needed in a SLOCA appropriate modifications are made.

12. ATWS with successful PCS as a stable plant state:

Some plants model a stable plant state when PCS is successful following an ATWS. Following our comparison of similarly designed plants, such credits are not given.

13. Modeling different EDG configurations, SBO diesel, and cross-ties:

Different capabilities for on-site emergency AC power exist at different plant sites. To treat them consistently across plants, they are typically combined into a single emergency AC (EAC) function. The dedicated EDGs are credited following the standard convention used in the worksheets for equipment (1 dedicated EDG is 1 train; 2 or more dedicated EDGs is 1 multi-train system). The use

of the swing EDG or the SBO EDG requires operator action. The full mitigating capability for emergency AC could include dedicated Emergency Diesel Generators (EDG), Swing EDG, SBO EDG, and finally, nearby fossil-power plants. The following guidelines are used in the SDP modeling of the Emergency AC power capability:

1. Describe the success criteria and the mitigation capability of dedicated EDGs.

2. Assign a mitigating capability of “operator action=1" for a swing EDG. The SDP worksheet assumes that the swing EDG is aligned to the other unit at the time of the LOOP (in a sense a dual unit LOOP is assumed). The operator, therefore, should trip, transfer, re-start, and load the swing EDG.

3. Assign a mitigating capability of “operator action=1" for an SBO EDG similar to the swing EDG. Note, some of the plants do not take credit for an SBO EDG for non-fire initiators. In these cases, credit is not given.

4. Do not credit the nearby power station as a backup to EDGs. The offsite power source from such a station could also be affected by the underlying cause for the LOOP. As an example, overhead cables connecting the station to the nuclear power plant also could have been damaged due to the bad weather which caused the LOOP. This level of detail should be left for a Phase 3 analysis.

14. Recovery of losses of offsite power:

Recovery of losses of offsite power is assigned an operator-action category even though it is usually dominated by a recovery of offsite AC, independent of plant activities. Furthermore, the probability of recovery of offsite power in “X” hours (for example 4 hours) given it is not recovered earlier (for example, in the 1st hour) would be different from recovery in 4 hours with no condition. The SDP worksheet uses a simplified approach for treating recovery of AC by denoting it as an operator action=1 or 2 depending upon the HEP used in the IPE/PRA. A footnote highlighting the actual value used in the IPE/PRA is provided, when available.

15. Mitigation capability for containment heat removal:

The mitigation capability for containment heat removal (CHR) function is considered dominated by the hardware failure of the RHR pumps. The applicable operator action is categorized as an operator action with a credit 4, i.e., operator action=4. For this situation, the function is defined as 1 multi-train system since the operator action involved is considered routine and reliable, and is assigned a credit of 4. No other operator action in the worksheets is generically assigned this high credit.

16. Crediting CRD pumps as an alternate high pressure injection source:

In many plants, CRD pumps can be used as a high pressure injection source following successful operation of HPCI or RCIC for a period of time, approximately 1 to 2 hours. In some plants, CRD system is enhanced where it can be directly used and does not need the successful operation of other

HPI sources. In the worksheets, if the CRD pumps require prior successful operation of HPCI or RCIC as a success criteria, then CRD is not credited as a separate high pressure injection source. If the CRD can be used and does not require successful operation of HPCI or RCIC, then it is credited as a separate success path within the HPI function.

2.2 RESOLUTION OF PLANT-SPECIFIC COMMENTS

NRC staff met with the Licensee's personnel who provided useful comments on the updated worksheets. The updated information was documented in a letter from Mike Parker (SRA Region III) to Jose Ibarra (NRC/RES) dated April 12, 2000. The special initiators, plant response, and the initiator impacts were discussed. Other items included as a part of NRC review process were also discussed. The licensee comments were reviewed and incorporated into the SDP worksheet to the extent possible within the framework, scope, and limitations of the SDP worksheets. The licensee's comment and feedback have significantly contributed to the improvement of this document.

1. Licensee's comments on the Initiator and System Dependency Tables reflecting the up-to-date plant-specific system interactions, clarification notes, and plant specific acronyms were all incorporated.

2. Licensee's comments reflecting the current understanding of success criteria were all incorporated in the SDP worksheets.

3. The information provided by the licensee on the impacts of special initiators on the plants systems and components were all incorporated in developing the SDP worksheets for the special initiators and the associated Event Trees. It should be noted that the licensee provided information on flooding scenarios such as " MS tunnel FW line break". These flooding initiators are not currently incorporated in the SDP sheet. Footnotes are added under the worksheet for each special initiator to reflect the discussion provided by the licensee.

4. Licensee performed a series of importance and sensitivity calculations for the purpose of bench marking of the SDP worksheets. The outputs from these runs were also documented. These information are not currently used as a means of validation of the SDP sheets.

REFERENCES

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

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