92

EP-AA-110-301 TMI INSTRUCTION MEMO

Date 12-5-03 Verif: DKB Box No. 20030349 T1 ✓ T2 ____

		C 3H
Control Rm Control Room Master Book, OOB	M. Mixon	1
Control Rm Shift Emergency Director, OOB	M. Mixon	
Control Rm Shift Communicator, OOB	M. Mixon	
Control Rm Damage Control Communicator, OOB	M. Mixon	
Control Rm Operations Communicator, OOB	M. Mixon	
Central File, SOB	D. Marshbank	PLAIN
Document Control Desk, Label	NRC	1
EP Department, NOB-2	R. Brady	1
Field Monitoring Team 1, Rad Field Ops Svc Bldg	T. Berstler	
Field Monitoring Team 2, Rad Field Ops Svc Bldg	T. Berstler	
TSC Master Book, OSF-1	IKON	1
TSC Station Emergency Director, OSF-1	IKON	
TSC Director, OSF-1	IKON	
TSC Logistics Coordinator, OSF-1	IKON	
TSC Security Coordinator, OSF-1	IKON	
TSC State/Local Communicator, OSF-1	IKON	
TSC Operations Manager, OSF-1	IKON	
TSC ENS Communicator, OSF-1	IKON	
TSC Operations Communicator, OSF-1	IKON	
TSC Technical Manager, OSF-1	IKON	
TSC Technical Communicator, OSF-1	IKON	
TSC Tech Support Area, OSF-1	IKON	
TSC Maintenance Manager, OSF-1	IKON	
TSC Damage Control Communicator, OSF-1	IKON	
TSC Radiation Protection Manager, OSF-1	IKON	
TSC Radiation Controls Coordinator, OSF-1	IKON	
TSC Radiation Controls Engineer, OSF-1	IKON	
TSC HPN Communicator OSF-1	IKON	
JPIC Master Book, JPIC	IKON	1

		C 3H
JPIC Corporate Spokesperson, JPIC	IKON	
JPIC Director, JPIC	IKON	
JPIC Technical Spokesperson, JPIC	IKON	
JPIC Radiation Protection Spokesperson, JPIC	IKON	
JPIC Administrative Coordinator, JPIC	IKON	
JPIC Coordinator, JPIC	IKON	
JPIC Access Controller, JPIC	IKON	
OSC Master Book, Rad Field Ops. Svc Bldg	T. Berstler	1
OSC Director, Rad Field Ops. Svc Bldg	T. Berstler	
OSC Assistant OSC Director, Rad Field Ops. Svc Bldg	T. Berstler	
OSC Damage Control Communicator, Rad Field Ops. Svc Bldg	T. Berstler	
OSC Operations Group Lead, Rad Field Ops. Svc Bldg	T. Berstler	
OSC Radiation Protection Group Lead, Rad Field Ops Svc Bldg	T. Berstler	
OSC Chemistry Group Lead, Rad Field Ops Svc Bldg.	T. Berstler	
OSC Mech Maint Group Lead, Rad Field Ops. Svc Bldg	T. Berstler	
OSC I&C/Elect Maint Group Lead, Rad Field Ops. Svc Bldg	T. Berstler	
OSC Spare Group Leader Binder, Rad Field Ops Svc. Bldg	T. Berstler	
OSC Shift Dose Assessor, Rad Field Ops Svc Bldg	T. Berstler	
RP Shift Dose Assessor, Rad Field Ops Svc Bldg	T. Berstler	
Training Department, Trng Bldg	C. Flory	
NRC Region 1, Label	N.McNammara	1
NRC Onsite, Svc. Bldg	P. Sauder	1
Simulator Rm Simulator Master Book, Sim Bldg	IKON	1
Simulator Rm Shift Emergency Director, Sim Bldg	IKON	
Simulator Rm Shift Communicator, Sim Bldg	IKON	
Simulator Rm Damage Control Communicator, Sim Bldg	IKON	
Simulator Rm Operations Communicator, Sim Bldg.	IKON	
Record Box, SOB + History Pkg.	S. Zimmerman	PLAIN

Please update your file with the attached listed below, destroy the superseded/cancelled document(s). Also, please sign the acknowledgment at the bottom of this memo and return to Debbie Marshbank, Configuration Cntrl., Rm. 135 SOB, TMI.

Procedure Number	Rev	TC Number	TC/PROC CLD	Page Change	Entire	Level
EP-AA-110-301	2				✓	2

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2 Plain Copies, Staple, 3 Hole Punch
____ Plain Copies, Staple, 3 Hole Punch (TC Dist)

I hereby acknowledge receipt of this memo and have complied with the instructions

Signature ______________________ Date ____________

A045

CORE DAMAGE ASSESSMENT (BWR)

1. PURPOSE

1.1. This procedure provides emergency response personnel with the methodology to estimate the degree of possible core damage at Exelon Nuclear's Boiling Water Reactor (BWR) stations, with the exception of Oyster Creek Generating Station (OCGS). Refer to EP-AA-110-302 for methodology to estimate potential core damage for a Pressurized Water Reactor (PWR).

1.2. This Core Damage Assessment process is designed to assist in estimating core damage after an accident with potential clad or core damage conditions, and is intended to provide an acceptable alternative to existing station core damage assessment models and methods utilized by Reactor Engineering to assist in the following:

- Determining if the fuel barriers are breached to evaluate the appropriate Emergency Action Level (EAL) classification.
- Providing input on core configuration (coolable or uncoolable) for prioritization of mitigating activities.
- Determining the potential quantity and isotopic mix of a radiological release to project offsite doses.
- Predicting the radiation protection actions that should be considered for long term recovery activities.
- Satisfying inquiries from local and federal government agencies and provide evidence that the utility knows the plant conditions.

1.3. Core damage may be assessed by:

- Evaluating the drywell radiation levels (and confirmed by evaluating the extent of time the core was uncovered),
- Concentration of certain isotopes in a reactor coolant analysis, or
- Concentration of hydrogen in the primary containment.
- History of Core Cooling

2. TERMS AND DEFINITIONS

2.1. **BWR** – Boiling Water Reactor

2.2. **Cladding** – The outer coating (usually zirconium alloy), which covers the nuclear fuel elements to prevent corrosion of the fuel and the release of fission products into the coolant.

2.3. **Containment Type** –

- Clinton (Mark III)
- Dresden (Mark I)
- LaSalle (Mark II)
- Limerick (Mark II): 764 assemblies
  Cont. Volume (384,570 ft^3) = Suppression Pool (149,380 ft^3) + Drywell (235, 190 ft^3)
- Peach Bottom (Mark I): 764 assemblies
  Cont. Volume (303,600 ft^3) = Suppression Pool (127,800 ft^3) + Drywell (175, 800 ft^3)
- Quad Cities (Mark I)

2.4. **Core Release Fraction** – The fraction of each isotope in the core inventory that is assumed to be released from the core under given core conditions.

2.5. **Core Uncovery Time** – For BWRs this is the period of time when reactor water level is less than that required for minimum steam cooling, or about ≥ 20% of the core active fuel is uncovered.

2.6. **Cladding Failure**

1. Also referred to as “Cladding Oxidation”, “Gap Release” or “Clad Rupture” in other documents.

2. 100% clad failure refers to the rupture of 100% of the fuel rods in the core. This would result in all fission products contained in the gap space being released to the reactor coolant system.

2.7. **Equilibrium** – Conditions associated with evaluation of different volumes of liquid or gas that contain concentrations of radioactive materials or hydrogen, when these concentrations are approximately the same. This is normally an extended period of time following accident initiation.

2.8. **Fission Products** – The nuclei (fission fragments) formed by the fission of heavy elements or by subsequent radioactive decay of the fission fragments.

2.9. **Fuel Melt**

1. Referred to as “Core Melt,” “In-Vessel Melt” or “Over-temperature” damage in reference documents.

2. 100% fuel melt refers to high temperatures in the fuel pellets in 100% of the fuel rods in the core. This would result in all the fission products contained in the fuel pellet matrix being released to the reactor coolant system.

2.10. **Gap** – The space inside a reactor fuel rod that exists between the fuel pellet and the fuel rod cladding.

2.11. **Gap Release** – The release into containment of fission products in the fuel pin gap.

2.12. **In-Vessel Core Melt** – A condition during a reactor accident in which some of the cladding or reactor fuel melts as a result of overheating the fuel and remains inside the reactor vessel.

2.13. **In-Vessel Core Melt Release** – A release into containment from the reactor vessel, which assumes the entire core has melted, releasing a representative mixture of radioisotopes.

2.14. **Minimum Steam Cooling RPV Water Level (MSCRWL)** – The lowest RP water level at which the covered portion of the reactor core will generate sufficient steam to maintain the hottest clad temperature below 1500oF.

2.15. **Minimum Zero-Injection RPV Water Level (MZIRWL)** – The lowest RPV water level at which the covered portion of the reactor core will generate sufficient steam to maintain the hottest clad temperature below 1800oF, assuming no injection into the RPV.

2.16. **Shutdown** – As defined by station emergency operating procedures.

2.17. **Slump** – Relocation of molten reactor core during an accident.

2.18. **Source Term** – The amount and isotopic composition of material released or the release rate, used in modeling releases of material to the environment.

2.19. **Spiked Coolant** – Reactor coolant containing increased concentrations of non-noble isotopes, sometimes seen with rapid shutdown or depressurization of primary system.

2.20. **Spiked Coolant Release** – The release into containment of 100 times the non-noble gas fission products found in the coolant.

2.21. **Subcritical** – The reactor condition when the number of neutrons released by the fission is not sufficient to achieve a self-sustaining nuclear chain reaction. Defined under station emergency operating procedures.

2.22. **Suppression Chamber** – May also be referred to as Wetwell or Torus. The Large steel pressure vessel containing a large volume of water that acts as a heat sink for the Drywell.

2.23. **TID** – Total Isotopic Distribution

2.24. Vessel Melt-Through

1. Referred to as "Ex-Vessel Melt" or "Melt Release" in reference documents.

2. Core debris is relocated to the primary containment building after the reactor pressure vessel has failed.

3. RESPONSIBILITIES

3.1. The TSC Core/Thermal Hydraulic Engineer shall serve as the Core Damage Assessment Methodology (CDAM) Evaluator.

3.2. The TSC Radiation Controls Engineer shall coordinate radiological and chemistry information with the Core/Thermal Hydraulic Engineer in support of core damage assessment.

3.3. The TSC Technical Manager shall coordinate core damage assessment activities.

4. MAIN BODY

4.1. **REFER** to Attachment 1, BWR CDAM User Guide for instructions on use of the Core Damage Assessment Methodology (CDAM) Software Program.

5. DOCUMENTATION

5.1. A Summary Form and method specific reports are generated by the BWR CDAM Software for use in documenting the results of the assessment.

6. REFERENCES

6.1. NEDO-22214, Procedures for the Determination of the Extent of Core Damage Under Accident Conditions

6.2. NEDC-33045P, Rev 0 (July 2001), Methods of Estimating Core Damage in BWRs

6.3. WCAP-14696 (July 1996) Westinghouse Owners Group Core Damage Assessment Guidance.

6.4. WCAP-14696-A (November 1999), Westinghouse Owners Group Core Damage Assessment Guidance.

6.5. NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Accidents"

6.6. <u>Station Commitments</u>

6.6.1. Peach Bottom

CM-1 T04511 (Attachment 1, 5.6)

6.6.2. Limerick Bottom

CM-2 T04512 (Attachment 1, 5.6)

7. ATTACHMENTS

7.1. Attachment 1, BWR CDAM User Guide

Attachment 1
BWR CDAM User Guide

1. **OVERVIEW**

1.1. As a windows based application designed in Microsoft Access, BWR CDAM, uses many standard user interfaces. Instructions are not provided in basic computer operations in the windows® environment. The user must be familiar with these to efficiently operate the program.

1.2. It is also assumed user is familiar with basic reactor physics and core damage fundamentals. Emergency Response Organization training will provide an overview of core damage assessment methodologies.

1.3. The program should be used by qualified personnel as a tool to estimate the type and amount of core damage.

2. **DETERMINE APPROPRIATE AND AVAILABLE ASSESSMENT METHODS**

Mid-West Region Stations

REFER to EP-MW-110-1001 for a listing of appropriate plant parameter points to be used following a LOCA.

2.1. The magnitude and type of event, transport mechanism and time after shutdown will be influencing factors on the method(s) utilized to determine the extent of core damage. Damage estimates can be developed using one or more methods as they become available or applicable.

2.1.1. Indications Of Core Damage

1. The primary indicators of core damage that are available during the early phases of an event:
   - Drywell/Containment Radiation Monitor Readings
   - Drywell/Containment Hydrogen Readings

2. Auxiliary indicators that are used to confirm and better define the possible type of damage are:
   - Reactor Pressure Vessel Level Indication System readings
   - Estimation of maximum temperature reached within the core
   - Estimated core uncovery time
   - Abnormal Source Range Monitor readings

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3. Long Term Indicators (once liquid or gaseous samples can be safely obtained) are:
   - Isotopic Ratios
   - Presence of high levels of rare isotopes
   - Quantity of isotopes present in samples

2.1.2. **SELECT** the assessment method(s) most appropriate for the existing conditions. Methods available for assisting in the determination of the extent of core damage include the following:

Method	Use	Comment
Containment Radiation Monitor	Early Indication of Core Damage	Uncertainties due to variables in release of fission products from RCS and effects of containment sprays.
Core Conditions	Indication of onset of Core Damage	May not be reliable during later phases of core overheating due to changes in core geometry.
RPV Level	Indication of Core Uncovery	Indicates possible damage not useful in estimating the quantity of damage.
Source Range Monitor	Indication of Core Uncovery	Loss of water level leads to increase in gamma detection.
Containment Hydrogen Monitor	Early Indication of Core Damage	Significant uncertainties due to variable Hydrogen generation in core and in release of Hydrogen from RCS and effects of containment sprays.
RCS Samples and Containment Sump and Atmosphere Samples	Late Indication of Core Damage —Suppression Pool Samples provide indication of Rx Vessel Failure	Very large uncertainties until all systems have reached equilibrium. Useful in planning long term recovery.

3. <u>START UP THE CDAM PROGRAM</u>

3.1. **ACCESS** the application by one of the following:

3.1.1. **OPEN** the BWR CDAM desktop icon on applicable computers.

1. **START** the BWR CDAM program for the plant that has declared an emergency. Programs are labeled BWR CDAM.

2. **SELECT** the appropriate icon or run from the 'start bar' and type in the file path and name as follows <u>**C:\CDAM\BWR CDAM.MDB**</u>

3.1.2. **If** the assigned Core Damage Assessment Computer cannot access the application or the CDAM program will not run, **then** install BWR CDAM on any computer from CDs or Disks located in the TSC or the EOF Library.

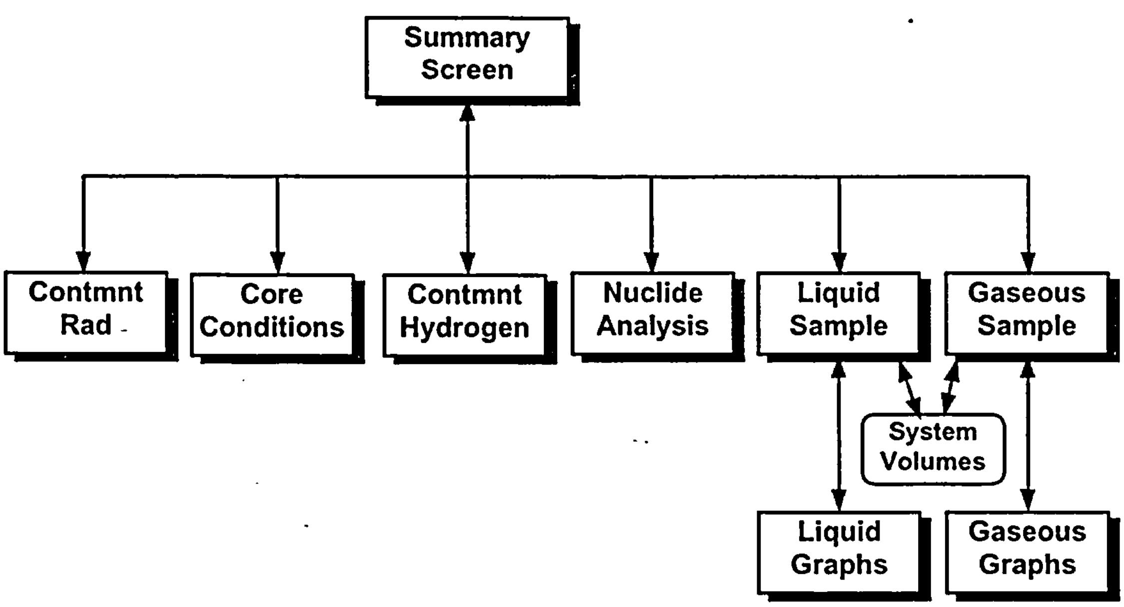
1. **INSTALL** CDAM by copying appropriate file to computer's hard drive.
2. **UPDATE** the "properties" of the file by deselecting write protection.

4. SELECTION AND PERFORMANCE OF ASSESSMENT

4.1. **SELECT** the assessment method(s) most appropriate for the existing conditions. Methods available for assisting in the determination of the extent of core damage include the following:

- Containment Radiation Analysis - (Section 5.2)
- Core Conditions Analysis (Cooling History) - (Section 5.3)
- Containment Hydrogen Analysis - (Section 5.4)
- Nuclide Analyses (Ratios and Abnormal Isotopes) - (Section 5.5)
- Liquid Samples Analysis - (Section 5.6)
- Gaseous Samples Analysis - (Section 5.7)

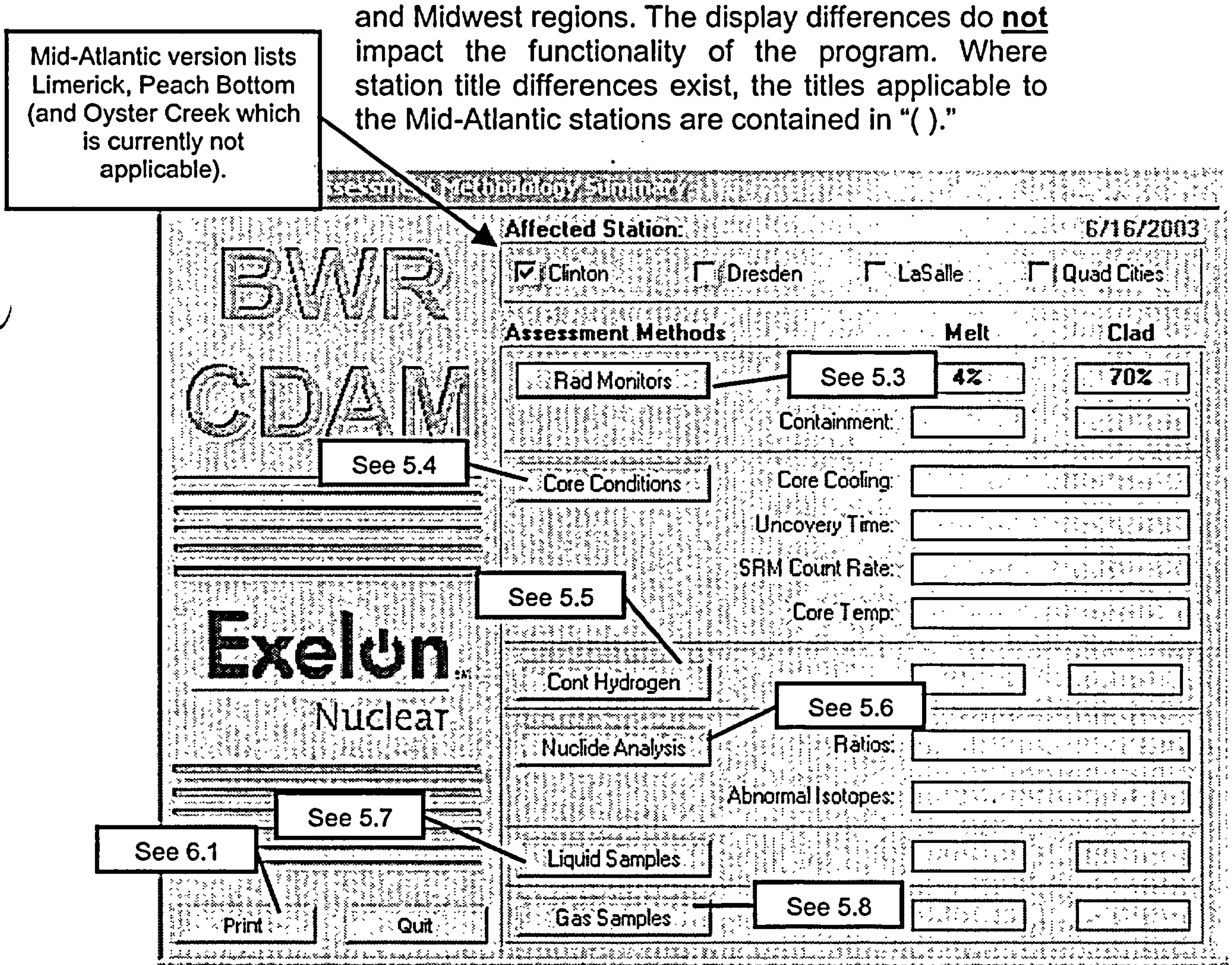
Basic Program Flow Diagram



5. PROGRAM SCREENS AND INPUTS

5.1. When the program is started the following screen appears:

NOTE: The value boxes are empty when the program is originally launched. The examples below may deviate from the CDAM displays during use due to different software versions in use in the Mid-Atlantic and Midwest regions. The display differences do **not** impact the functionality of the program. Where station title differences exist, the titles applicable to the Mid-Atlantic stations are contained in "( )."



CAUTION

Selecting an "Affected Station" resets all inputs to default values.

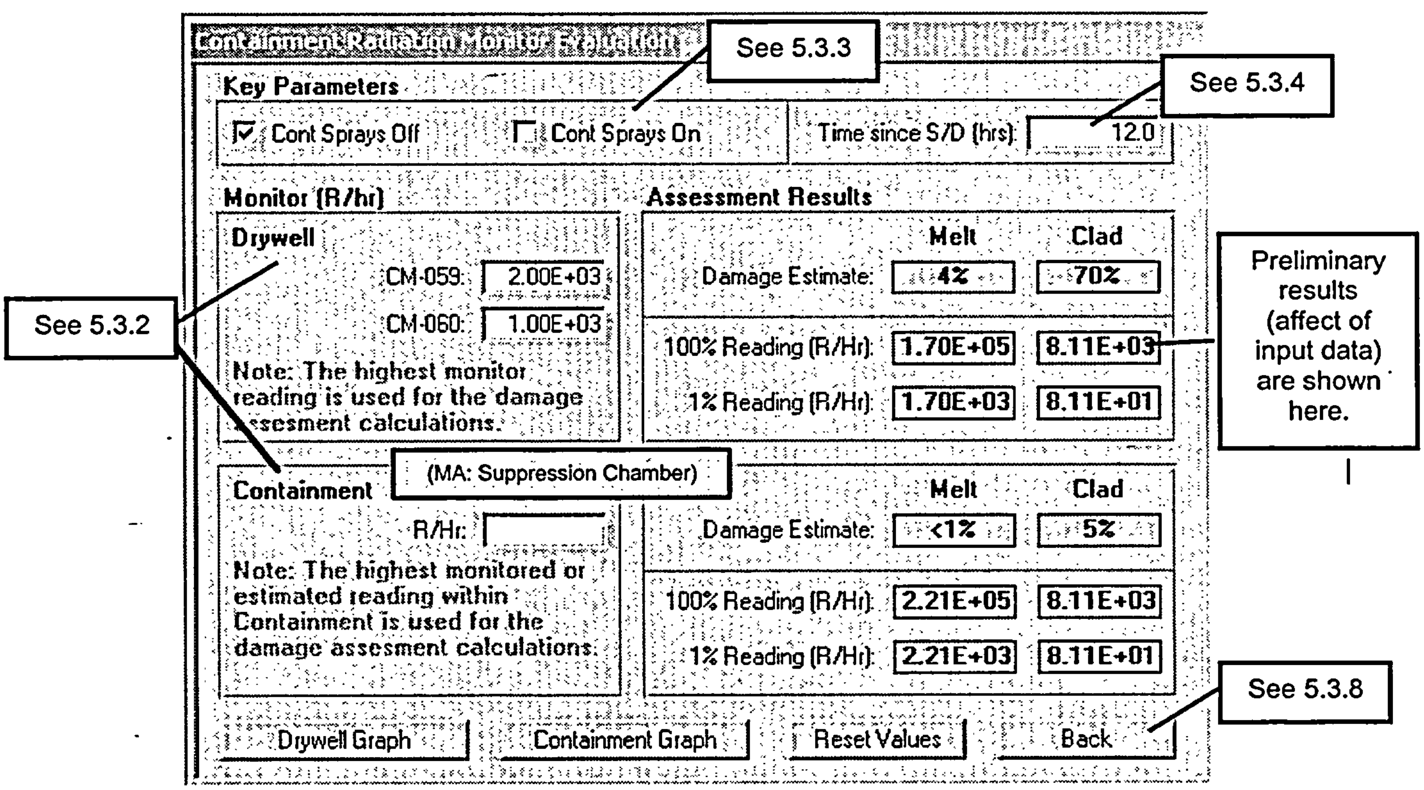
5.2. **SELECT** the Affected Station before other "Assessment Methods."

CAUTION

Pressing the **"Quit"** button exits the program. When the program is closed all data is reset. Program saves no information to disk; printed reports serve as record of core damage assessments.

5.3. Drywell/Containment Radiation Monitor Method

5.3.1. **PRESS** the "Cont Rad Monitors" button on the Summary Screen to open the following form:



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NOTE: Program allows entry from 2 high range monitors for Drywell location and 1 for Torus or Containment / Suppression Chamber, however a reading may be entered from any monitor or measurement taken external to suppression chamber, which accurately indicated containment radiation levels. If two entries are made only the highest is used.

5.3.2. **ENTER** the highest Drywell radiation monitor reading that occurred in these boxes

1. **If** Drywell radiation monitor readings are not available, **then** enter the containment / Suppression Chamber radiation monitor reading.

5.3.3. **SELECT** Drywell/Containment Spray status:

1. **If** the Drywell/Containment Spray system was operated for the majority of the time since the estimated time of the onset of core damage **then** choose "Drywell Spray On."

2. **If** the Drywell/Containment Spray system was <u>not</u> operated or only operated briefly (e.g., <10% of time since the estimated time of the onset of core damage) **then** choose "Drywell Spray Off."

5.3.4. **ENTER** the time after reactor shutdown, which corresponds the time the containment radiation reading was taken. Value must be between 1 hour and 24 hours after shutdown, which corresponds to the time period in which this method is considered effective.

NOTE: Pressing "Reset" button resets values on this form only.

5.3.5. **PRESS** "Containment Graph" or "Supp Chamber Graph" button to display a screen similar to the following:

(See example display on next page.)

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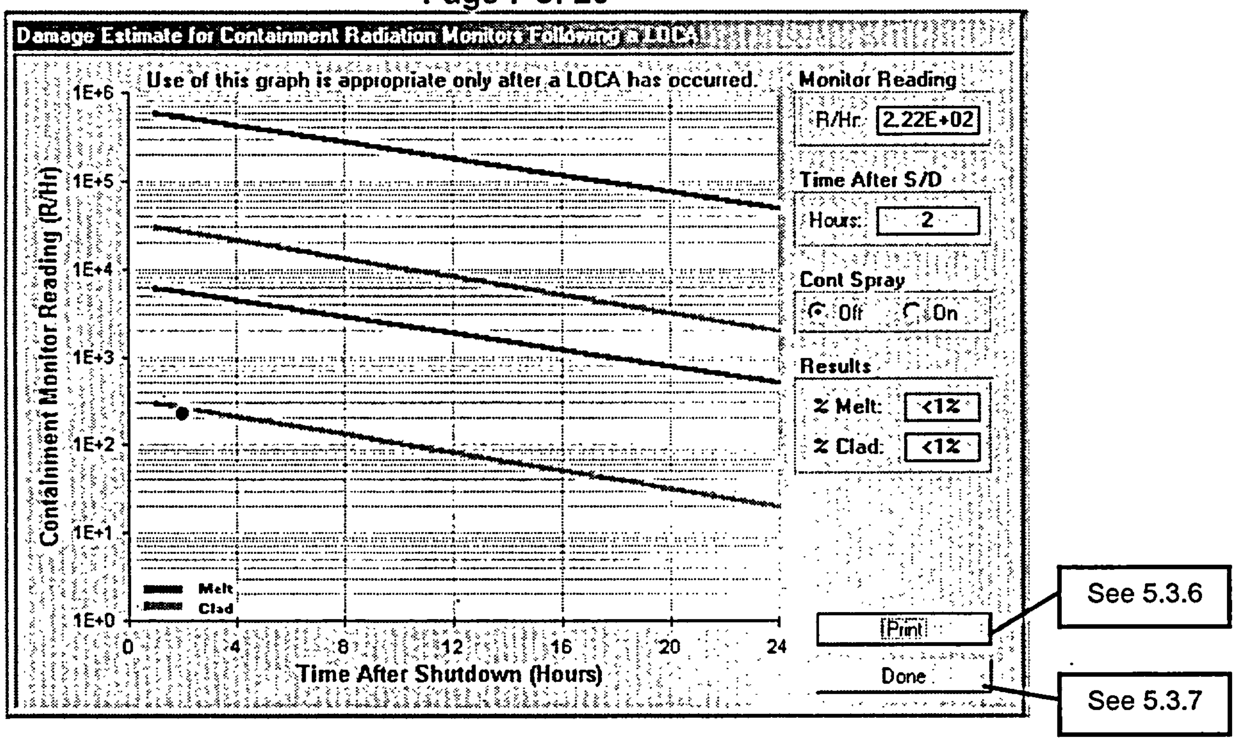


NOTE: Graph shows high and low containment radiation levels which correspond to 100% Melt or Clad or 1% Melt or Clad damage. A dot shows the last containment radiation level entered into the program for assessment.

5.3.6. **PRESS** the "Print" button to print a report of containment radiation method inputs and best estimate of damage.

5.3.7. **PRESS** the "Done" button to return to the Containment Radiation Monitor Evaluation Screen.

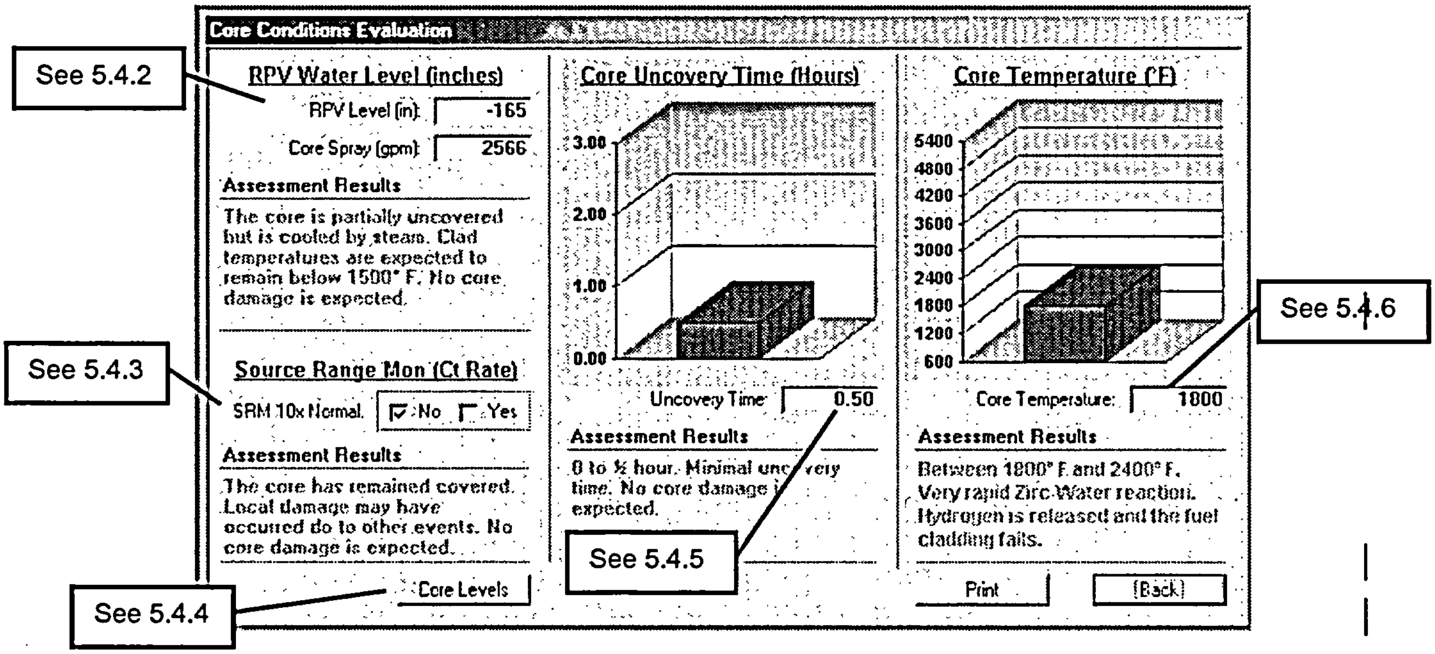
5.3.8. **PRESS** the "BACK" button to return to the Summary Screen.

5.4. Core Conditions Methods

NOTE: Each of these four methods is an independent assessment method.

5.4.1. **PRESS** the "Core Conditions" button on the Summary Screen to open the following form:

(See example form on next page.)



5.4.2. Under Reactor Pressure Vessel (RPV) Water Level **ENTER** the lowest recorded (or estimated) RPV level (range 0 to –350 inches) and core spray flow at time of lowest reading

NOTE: Steps 5.4.3 through 5.4.6 are based on inputs from Reactor Operators, TSC Staff and other engineering personnel (including outside sources such as General Electric personnel).

5.4.3. Under Source Range Monitor **REVIEW** plant parameter history and if the SRM (Wide Range Monitor at Peach Bottom) had indications of a reading 10 times those expected check "Yes."

5.4.4. **PRESS** the "Core Levels" button to view information regarding water levels associated with the Station reactor and vessel level indications.

(See example form on next page.)

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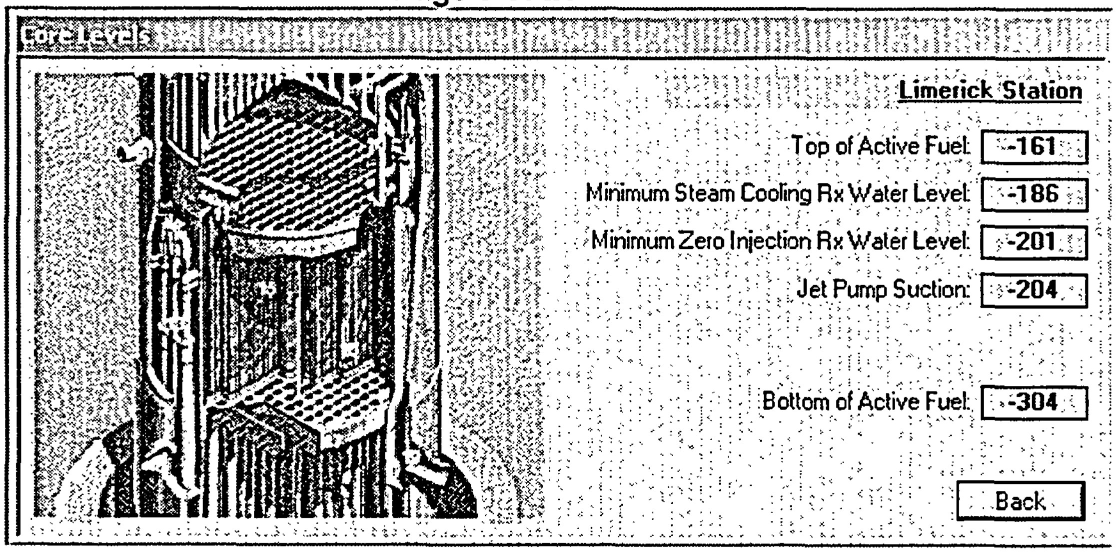

5.4.5. **ENTER** the estimated time the reactor core (20% of top of active core) was uncovered without steam (level below the Minimum Steam Cooling Rx Water Level) or spray cooling reactor core.

5.4.6. **ENTER** the estimated highest temperature reached in the reactor core.

5.4.7. **PRESS** the "Print" button to print a report of inputs and results of core temperature methods of core damage assessment.

5.4.8. **PRESS** the "Back" button to return to the Summary Screen.

5.5. Containment Hydrogen Evaluations

CAUTION

This CDAM assumes no ignitor operation. Ignitor use limits containment hydrogen concentration affecting the reliability of this method.

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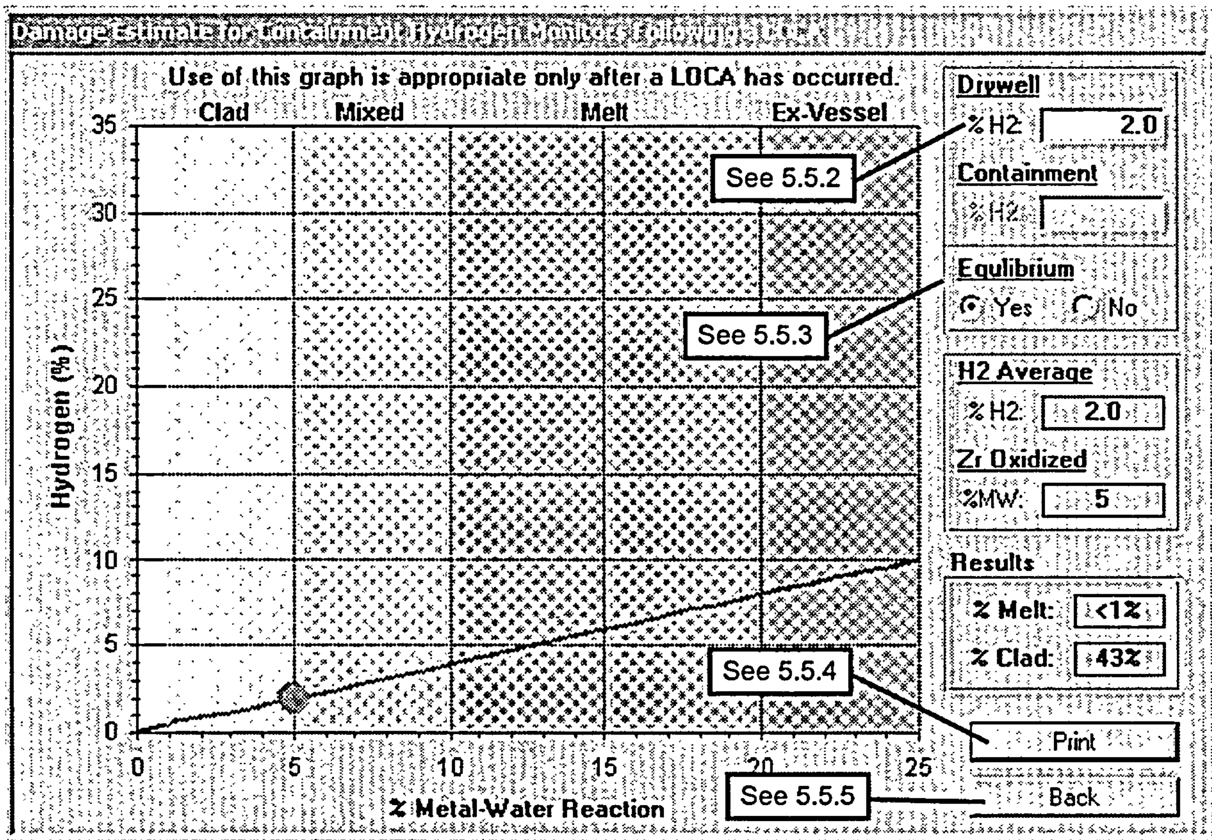
5.5.1. **PRESS** the "Cont Hydrogen" button on the Summary Screen to open the following form:



5.5.2. **ENTER** highest Drywell and/or Suppression Chamber hydrogen level measured.

NOTE: Suppression Chamber reading can only be entered if user selects "no" under Equilibrium in step 5.5.3 below.

5.5.3. **SELECT** the applicable System Equilibrium status based on the following:

1. **If** Containment and Suppression Chamber monitors read the same or only atmospheres are assumed equalized, **then SELECT** "Yes" for equilibrium.

2. **If** containment and suppression chamber atmospheres are not in equilibrium or only containment H2 reading is available, **then SELECT** "No" for equilibrium.

5.5.4. **PRESS** the "Print" button to print a report of inputs and results of core level methods of core damage assessment.

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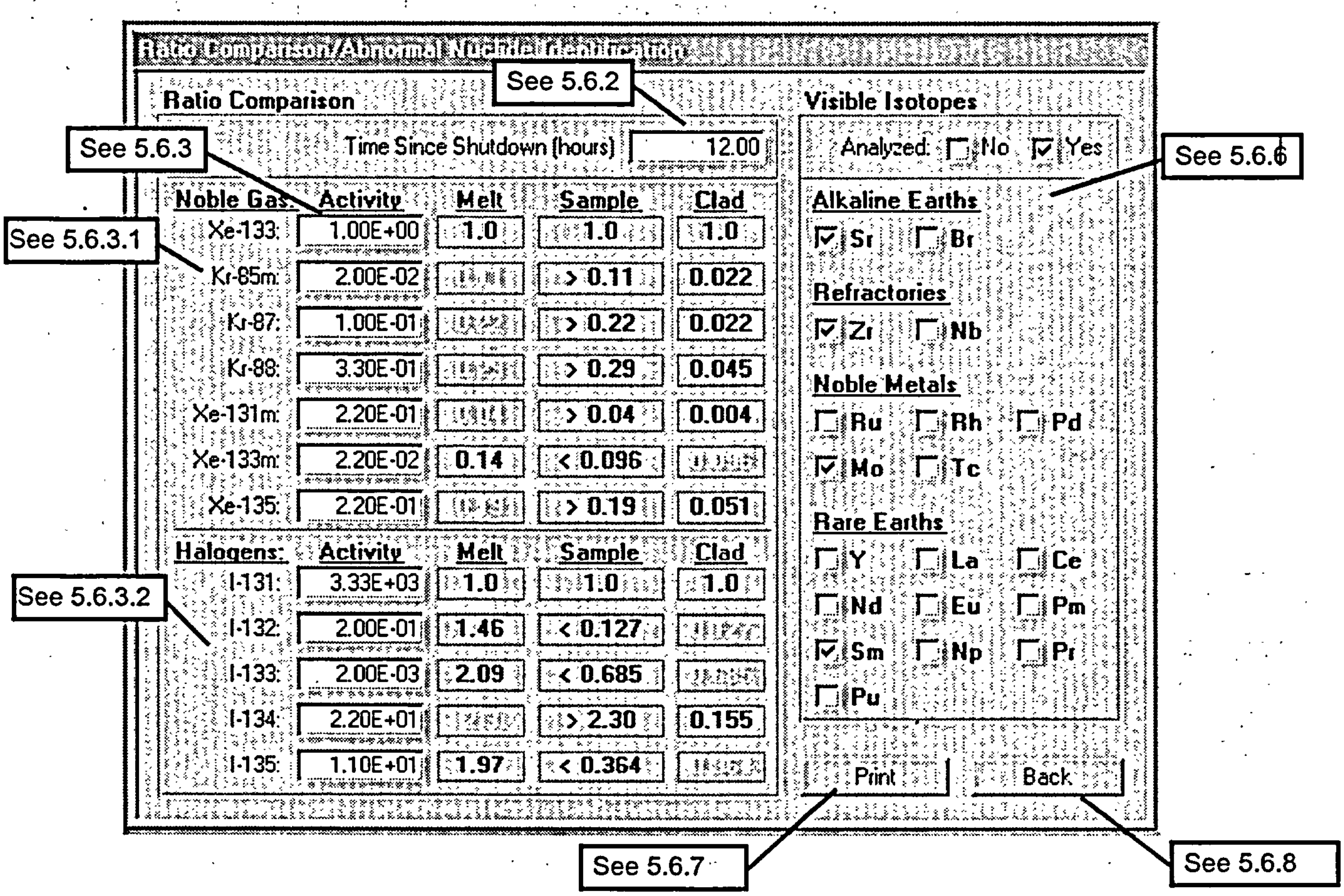
5.5.5. **PRESS** the "Back" button to return to the Summary Screen.

5.6. Nuclide Analysis **(CM-1, CM-2)**

5.6.1. **PRESS** the "Nuclide Analysis" button on the Summary Screen to open the following form:



5.6.2. **ENTER** the time since reactor shutdown (time between shutdown and sample being drawn).

5.6.3. **ENTER** isotopic sample results in uCi/cc. Sample results are to be decay corrected back to time after shutdown that the sample was drawn.

1. Noble Gases are ratioed to Xe-133

2. Halogens are ratioed to I-131

5.6.4. **If** the ratios evaluated above are greater than predicted melt ratio, **then** melt damage is predicted

5.6.5. **If** the ratios evaluated above are less than clad ratio, **then** clad damage is predicted.

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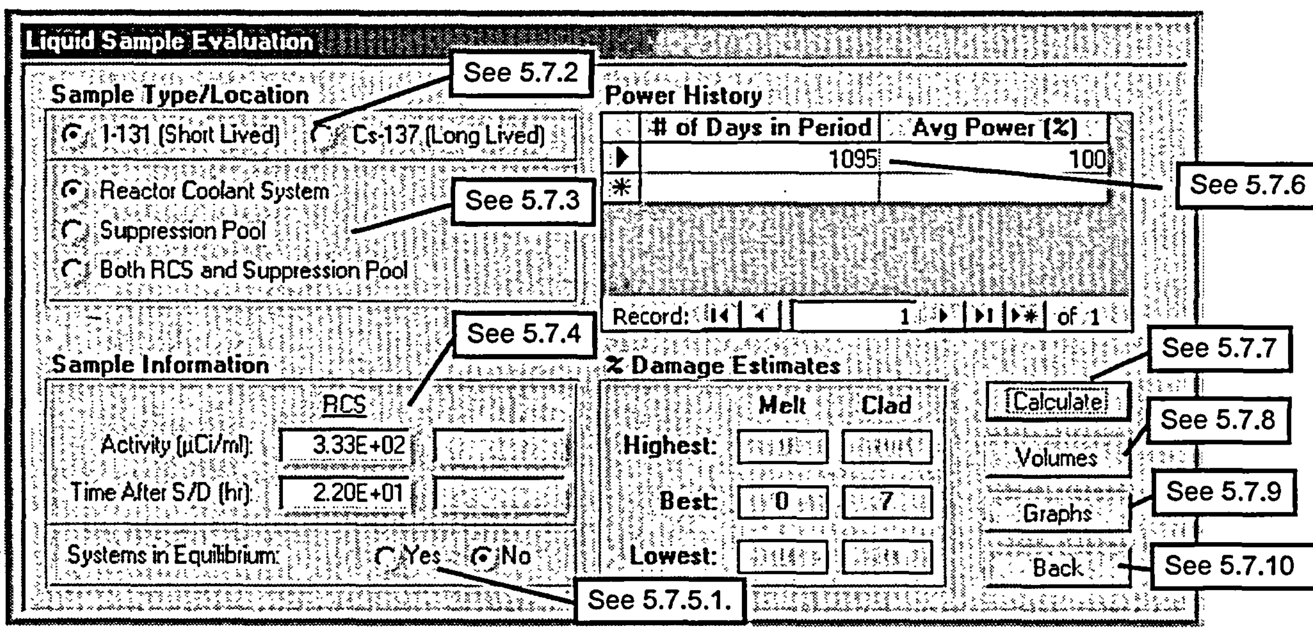
5.6.6. **If** abnormal levels of rare isotopes are present **then** check "Yes" **and** check which isotopes are present.

5.6.7. **PRESS** the "Print" button to print a report of inputs and results of core level methods of core damage assessment.

5.6.8. **PRESS** the "Back" button to return to the Summary Screen.

5.7. Liquid Samples

5.7.1. **PRESS** the "Liquid Samples" button on the Summary Screen to open the following form:



5.7.2. **SELECT** appropriate isotope.

5.7.3. **SELECT** sample location.

1. **If** samples are available from both locations, **then** select both.

5.7.4. **ENTER** Sample Information:

1. Activity is isotopic sample results in uCi/cc (uCi/ml). Sample results are to be decay corrected back to time after shutdown that the sample was drawn

2. Time After S/D (reactor shutdown) is the time between shutdown and sample being drawn.

5.7.5. **SELECT** the appropriate System Equilibrium status:

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1. **If** sample was taken from only one location and systems are in equilibrium, **then** check "yes" for "Systems in Equilibrium," **otherwise** check "no."

5.7.6. **ENTER** power history (past to present, i.e. oldest steady state history as record number) of core since last refueling. Shutdown times are entered as the number of days with Ave Power (%) set at 0.

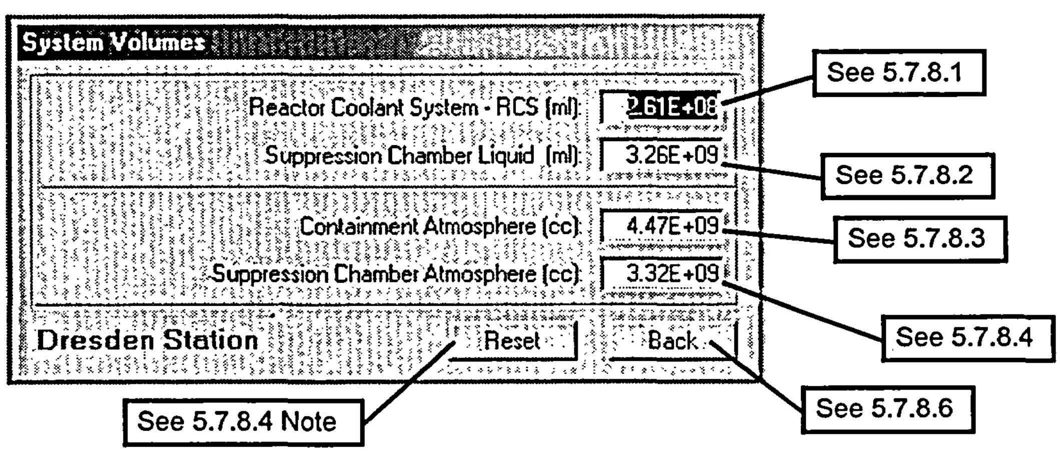
1. For short-lived isotopes, **EXTEND** Power History at least 30 days.

2. For long-lived isotopes, **EXTEND** power history at least 100 days, <u>however the power history for the extent of the cycle is preferred.</u>

3. **LIMIT** variations in steady state power to ± 20% within each operational period entered.

5.7.7. Once all data has been entered, **PRESS** the "Calculate" button to display the % Damage Estimates.

5.7.8. **PRESS** the "Volumes" button to display the follow screen:



1. Program enters default RCS volume, which the user may change based on RPV Level Readings at time of sample.

2. Program enters default Suppression Chamber volume, which the user may change based on readings at time of sample.

3. Program enters default Containment free air volume which user may change based on conditions at time of sample. Unless there has been significant flooding of drywell this value will not change.

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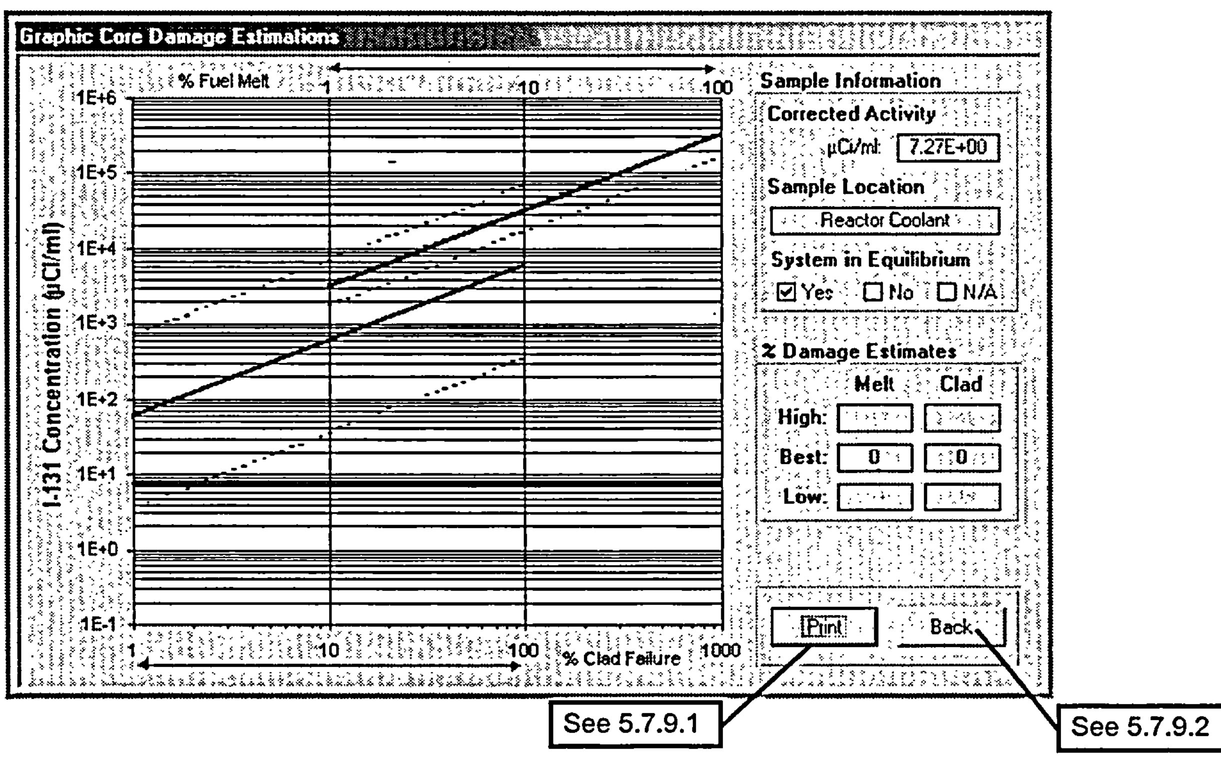
4. Program enters default Suppression Chamber free air volume which user may change based on conditions at time of sample. If there has been a significant increase or decrease in the water level in the Suppression Pool or Torus then the free air volume will change.

NOTE: Pressing the "Reset" button will reset all volumes to default values.

5. **PRESS** the "Back" button to return to the Liquid or Gaseous screen, which user used to call volume form.

5.7.9. **PRESS** the "Graph" button to display the following screen:



(See Note on next page.)

NOTE: Graph on previous page shows High, Low, and Best melt curves; High, Low, and Best clad damage curves, and a red line across graph indicating entered corrected sample activity.

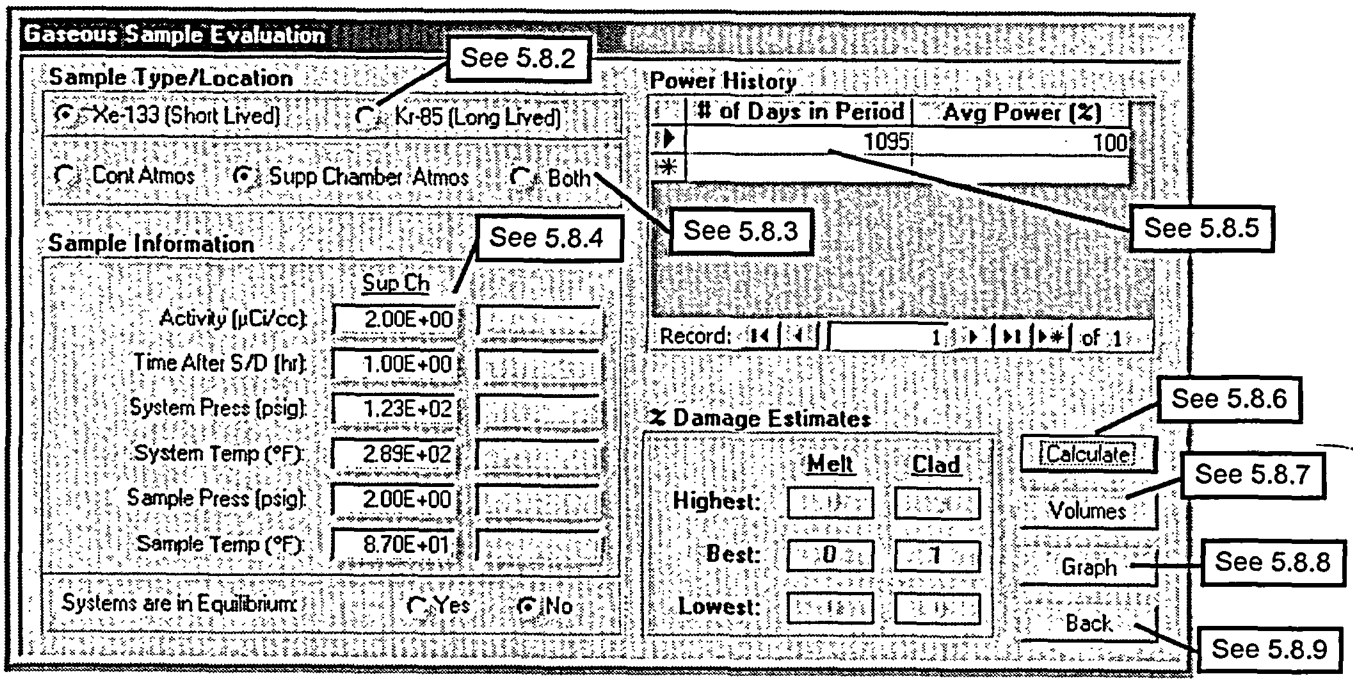
1. **PRESS** the "Print" button to print a graph and summary of inputs.

2. **PRESS** the "Back" button to go back to liquid or gaseous form which called this form.

5.7.10. **PRESS** the "Back" button to return to the Summary Screen.

5.8. Gaseous Samples

5.8.1. **PRESS** the "Gas Samples" button on the Summary Screen to open the following form:



5.8.2. **SELECT** appropriate isotope.

5.8.3. **SELECT** and sample location.

1. **If** samples are available form both locations, **then SELECT** "Both" option.

5.8.4. **ENTER** Sample Information:

1. **ENTER** sample activity for selected isotope in uCi/cc (uCi/ml). Sample results are to be decay corrected back to time after shutdown that the sample was drawn

2. **ENTER** Time After S/D that sample was taken.

3. **ENTER** the pressure and temperature of the system sampled

4. **ENTER** the end pressure and temperature of sample.

5.8.5. **ENTER** power history (past to present, i.e. oldest steady state history as record number 1) of core since last refueling. Shutdown times are entered as the number of days with Avg Power (%) set at 0.

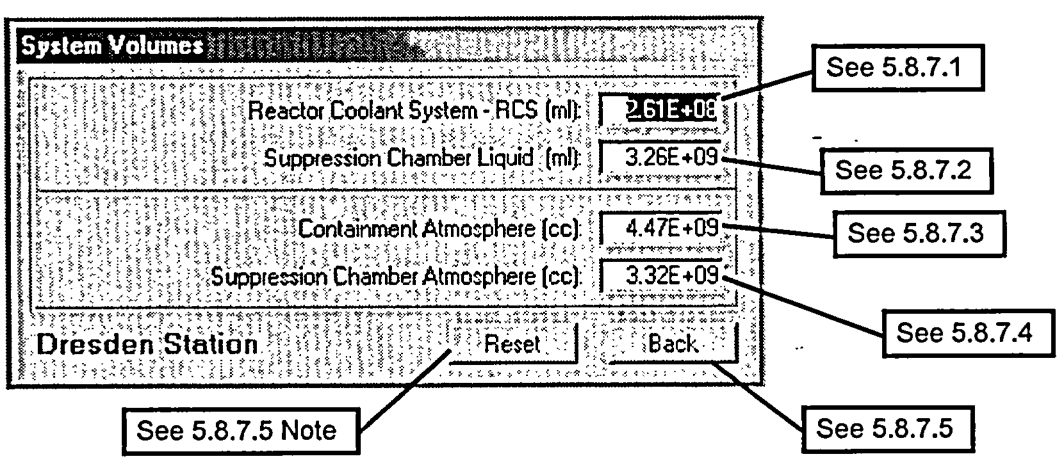
1. For short-lived isotopes, **EXTEND** Power History at least 30 days.

2. For long-lived isotopes, **EXTEND** power history at least 100 days, <u>however the power history for the extent of the cycle is preferred.</u>

3. **LIMIT** variations in steady state power to ± 20% within each operational period entered.

5.8.6. Once all data has been entered **PRESS** the "Calculate" button to display the % Damage Estimates.

5.8.7. **PRESS** the "Volumes" button to display the following screen (same as 5.7.8):



1. Program enters default RCS volume, which the user may change based on RPV Level Readings at time of sample.

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2. Program enters default Suppression Chamber volume, which the user may change based on readings at time of sample.

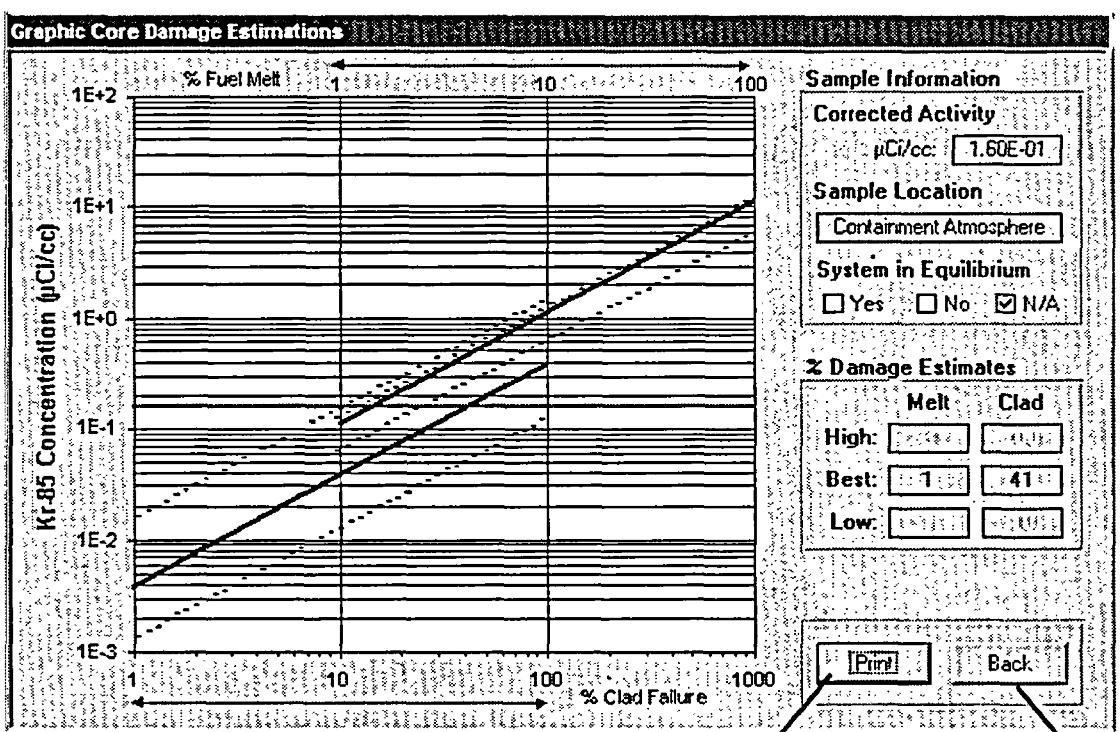
3. Program enters default Containment free air volume which user may change based on conditions at time of sample. Unless there has been significant flooding of drywell this value will not change.

4. Program enters default Suppression Chamber free air volume which user may change based on conditions at time of sample. If there has been a significant increase or decrease in the water level in the Suppression Pool or Torus then the free air volume will change.

NOTE: Pressing the "Reset" button will reset all volumes to default values.

5. **PRESS** the "Back" button to return to the Liquid or Gaseous screen, which user used to call volume form.

5.8.8. **PRESS** the "Graph" button to display the following screen:



See 5.8.8.1

See 5.8.8.2

NOTE: Graph shows High, Low, and Best melt curves; High, Low, and Best clad damage curves, and a red line across graph indicating entered.

1. **PRESS** the "Print" button to print a graph and summary of inputs.

2. **PRESS** the "Back" button to go back to liquid or gaseous form which called this form.

5.8.9. **PRESS** the "Back" button to return to the Summary Screen.

6. CORE DAMAGE SUMMARY REPORT

6.1. Once the program user enters data for all available assessment methods and the program calculates damage based on inputs, **SELECT** the "Print" button to print a summary of all methods used.

6.2. The values presented in the Assessment Methods section of the summary report show that they are in percent (%). Containment Hydrogen values are also in percent (but do not show the % symbol)..

(Sample report on next page.)

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CDAM Method: **Core Damage Summary**

Station: ☐ Clinton ☐ Dresden ☐ LaSalle ☒ Quad Cities

Assessment Methods:

		Melt	Clad
Containment Radiation Monitors*	Containment:	29%	79%
	Supperssion Chamber:	<1%	23%
Core Conditions	Core Cooling:	Clad Damage	
	Core Uncovery Time:	No Core Damage	
	SRM Count Rate:	No Core Damage	
	Core Temp:	Clad Failure	
Containment Hydrogen*		<1	20.8
Sample Analysis	Ratios:	Fuel Melt	
	Abnormal Isotopes:	6 of 19 Present	
	RCS: Liquid Samples:	0%	0%
	Chamber: Gas Samples:	23%	100%

* *These methods should NOT be used for qualitative or quantitative assessment except in the case of a LOCA.*

Analyst's Estimate:

☐ No Core Damage ☐ Cladding Failure ☐ Fuel Melt Amount:

NRC Core Condition Category:

Degree of Degradation	Minor (<10%)	Intermediate (10%-50%)	Major (>50%)
No Core Damage	1	1	1
Cladding Failure	2	3	4
Fuel Overheat	5	6	7
Fuel Melt	8	9	10

Generated By:

Name: ______________________ Date: 12/05/02 Time: 8:29 AM

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6.3. The Individual tasked with assessing core damage shall then **ANALYZE** the report to determine best estimate of type and amount of damage.

NOTE: The CDAM program does not use the Fuel Overheat Condition Category

6.4. Based on estimated type and amount of damage and following table (table also printed on summary report) **ASSIGN** NRC Core Condition Category (1-4 or 8 -10).

NRC Core Condition Categories

Degree of Degradation	Minor (<10%)	Intermediate (10% to 50%)	Major (>50)
No Core Damage	1	1	1
Cladding Failure	2	3	4
Fuel Overheat	5	6	7
Fuel Melt	8	9	10

7. <u>QUITING, OR EXITING, THE PROGRAM</u>

NOTE: When the program is closed all data is reset.

CAUTION

Program saves no information to disk; printed reports serve as record of core damage assessments.

7.1. **PRESS** the "Quit" button on the Summary Screen exits the program.