



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

April 12, 1994

Docket file

Docket No. 52-002

APPLICANT: ABB-Combustion Engineering, Inc. (ABB-CE)  
PROJECT: CE System 80+  
SUBJECT: PUBLIC MEETING OF JANUARY 26, 1994, REGARDING IN-CONTAINMENT  
REFUELING WATER STORAGE TANK (IRWST) PH CONTROL AND THE USE OF THE  
NEW SOURCE TERM FOR THE ABB-CE SYSTEM 80+ STANDARD PLANT DESIGN

On January 26, 1994, a public meeting was held at the U.S. Nuclear Regulatory Commission (NRC) headquarters offices in Rockville, Maryland, between representatives of the NRC, ABB-CE, and ABB-CE's contractors Duke Engineering and Services (DE&S), and Stone and Webster Engineering Corporation (SWEC). Enclosure 1 provides a list of attendees.

The purpose of the meeting was to discuss the mechanisms for post-accident control of pH in the IRWST and ABB-CE's use of the new source term in the System 80+ design. Presentations were made by ABB-CE, DE&S, and SWEC. Enclosure 2 provides a copy of the material presented at the meeting.

Regarding the IRWST pH control issue, ABB-CE indicated that acid generation from post-accident radiolysis of cable insulation was considered in the context of the System 80 design. The materials of construction for the System 80+ insulation have not been specified, however, the quantity of chloride-producing insulation material used in the System 80 design was agreed by all to bound the System 80+ design. ABB-CE committed to add the amount of chloride-producing cable insulation used in the System 80 design to the list of organic material in Table 6.1-4 of CESSAR-DC. They also committed to add a COL action item that would require the COL applicant to verify that the amount of chloride-producing cable insulation used is less than the limiting amount.

ABB-CE and their contractors stated, in their presentations, that a pH of 7.0 is reached in the IRWST within two and a half hours after an accident. The staff raised questions about the completeness of the analysis performed. After some discussion, it was agreed that ABB-CE should increase the amount of trisodium phosphate dodecahydrate stored inside containment to an amount sufficient to maintain a concentration of 2,000 ppm. ABB-CE committed to revise CESSAR-DC to reflect this. The staff committed to discuss this issue with experts at Oak Ridge National Laboratory and to provide feedback to ABB-CE as soon as possible.

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April 12, 1994

Aerosol deposition in containment and containment spray removal were also discussed during the meeting. The staff had previously raised concerns about the appropriateness of the aerosol deposition values and the containment spray removal lambda values used by ABB-CE. In their presentations, ABB-CE and SWEC provided additional justification for the use of these values. The staff committed to reviewing the values with experts at Sandia National Laboratory and to provide feedback to ABB-CE as soon as possible.

**Original Signed By:**

Stewart L. Magruder, Project Manager  
Standardization Project Directorate  
Associate Directorate for Advanced Reactors  
and License Renewal  
Office of Nuclear Reactor Regulation

Enclosures:  
As stated

cc w/enclosures:  
See next page

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OFC: LA:PDST:ADAR	PM:PDST:ADAR	SC:PDST:ADAR
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DATE: 04/11/94	04/11/94	04/12/94

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Docket No. 52-002

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ABB-CE SYSTEM 80+  
IRWST pH CONTROL/SOURCE TERM MEETING ATTENDEES  
January 26, 1994

<u>Name</u>	<u>Organization</u>
H. Walker	NRC
M. Jacob	ABB-CE
F. Carpentino	ABB-CE
T. Wambach	NRC
A. Drozd	NRC
J. Kudrick	NRC
L. Soffer	NRC
T. Essig	NRC
T. Rudek	ABB-CE
C. Brinkman	ABB-CE
K. Eccleston	NRC
J. Schaperow	NRC
J. Mazetis	NRC
J. Hayes	NRC
T. Crom	DE&S
S. Ritterbusch	ABB-CE
J. Metcalf	SWEC
S. Ferguson	SWEC
W. Peng	SWEC
R. Architzel	NRC
S. Magruder	NRC
K. Parczewski	NRC

Enclosure 1

LONG TERM POST ACCIDENT pH CONTROL

LONG TERM pH MAINTAINED AT A MINIMUM OF 7.0 AND LESS THAN 8.5 BASED ON A REFERENCE TEMPERATURE OF 25 °C.

MAXIMUM BORIC ACID CONCENTRATION OF IRWST 4400 PPM

THE FOLLOWING WATER SOURCES ARE CONSIDERED (TOTAL = 708316 GALLONS)

IRWST (NORMAL OPERATING VOLUME)  
REACTOR COOLANT SYSTEM, INCLUDING  
PRESSURIZER  
SAFETY INJECTION TANKS  
SAFETY INJECTION SYSTEM PIPING  
CONTAINMENT SPRAY SYSTEM PIPING

pH CONTROL ACCOMPLISHED WITH 796 CUBIC FEET (45,372 POUNDS) OF TRISODIUM PHOSPHATE DODECAHYDRATE STORED IN BASKETS LOCATED IN THE HOLDUP VOLUME

THIS PROVIDES A PHOSPHATE CONCENTRATION EQUAL TO 1719 PPM AS  $PO_4$

## LONG TERM POST ACCIDENT pH CONTROL

pH CONTROL OF IRWST IS INITIATED WHEN WATER SPILLS BACK TO THE IRWST FROM THE HOLDUP VOLUME

59,100 GALLONS IN HOLDUP VOLUME BEFORE SPILL OVER

SPILL OVER OCCURS AT 11.8 MINUTES BASED ON 5000 GPM FROM A SINGLE CONTAINMENT SPRAY PUMP

pH WILL BE AT A MINIMUM OF 7.0 AFTER ALL OF THE ABOVE WATER VOLUME IS RECIRCULATED THROUGH THE HOLDUP VOLUME

2.5 HOURS CONSIDERING FLOW FROM A SINGLE CONTAINMENT SPRAY PUMP OF 5000 GPM

LONG TERM POST ACCIDENT pH CONTROL

**TYPICAL**  
COMPARISON 

LONGTERM pH CONTROL ACCOMPLISHED WITH TRISODIUM PHOSPHATE DODECAHYDRATE STORED IN BASKETS LOCATED IN THE CONTAINMENT SUMP

NINE BASKETS 2 FT X 2 FT X 2 FT

EIGHT BASKET 4 FT X 4 FT X 4 FT

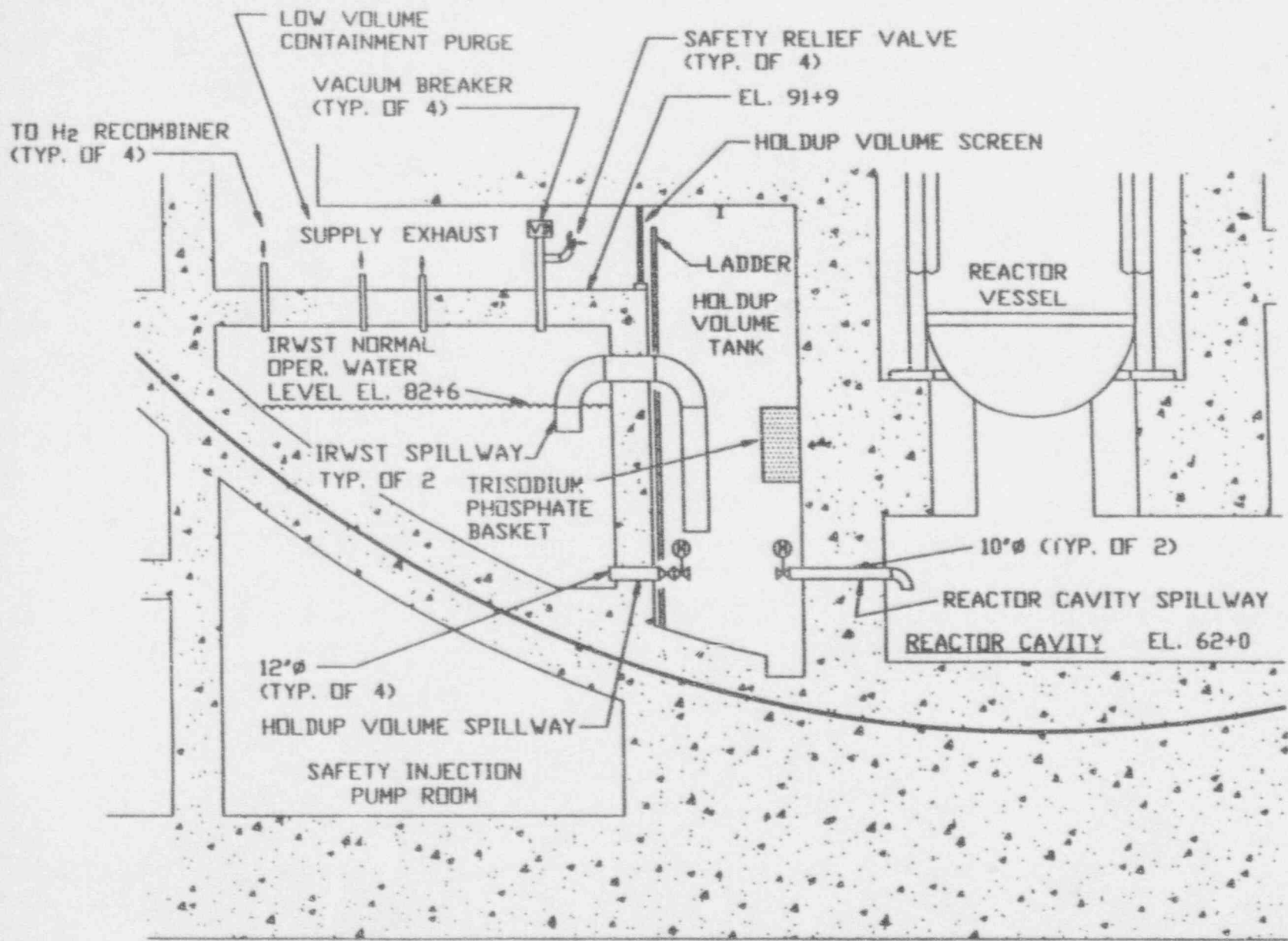
pH MAINTAINED BETWEEN 7.0 AND 8.5

464 CUBIC FEET OF TRISODIUM PHOSPHATE DODECAHYDRATE (26,000 POUNDS)

MAXIMUM BORON CONCENTRATION OF EXTERNAL REFUELING WATER STORAGE TANK - 4400 PPM

PHOSPHATE CONCENTRATION EQUAL TO 2000 PPM THIS ACHIEVES A pH OF 7.7 AT A REFERENCE TEMPERATURE OF 25 °C

A MINIMUM pH OF 7.0 IS ASSUMED WITHIN 4 HOURS THROUGH DISSOLUTION WITHIN THE CONTAINMENT SUMP BEFORE RECIRCULATION IS INITIATED



LOW VOLUME  
CONTAINMENT PURGE

VACUUM BREAKER  
(TYP. OF 4)

SAFETY RELIEF VALVE  
(TYP. OF 4)

EL. 91+9

TO H<sub>2</sub> RECOMBINER  
(TYP. OF 4)

HOLDUP VOLUME SCREEN

SUPPLY EXHAUST

LADDER

REACTOR  
VESSEL

IRWST NORMAL  
OPER. WATER  
LEVEL EL. 82+6

HOLDUP  
VOLUME  
TANK

IRWST SPILLWAY  
TYP. OF 2

TRISODIUM  
PHOSPHATE  
BASKET

10"Ø (TYP. OF 2)

REACTOR CAVITY SPILLWAY

REACTOR CAVITY EL. 62+0

12"Ø  
(TYP. OF 4)

HOLDUP VOLUME SPILLWAY

SAFETY INJECTION  
PUMP ROOM



LADDER TO GRATING  
FOR SERVICING CHEMICAL BASKETS

FL. EL. 91'+9"

LADDER TO HOLDUP  
VOLUME TANK AREA

CHEMICAL  
BASKET

24" SPILLWAY PIPE  
TYP. 2 PLACES

TOP OF CHEMICAL  
BASKETS EL. 82'+0"

CHEMICAL  
BASKET

BOT. OF CHEMICAL  
BASKETS EL. 75'+6"

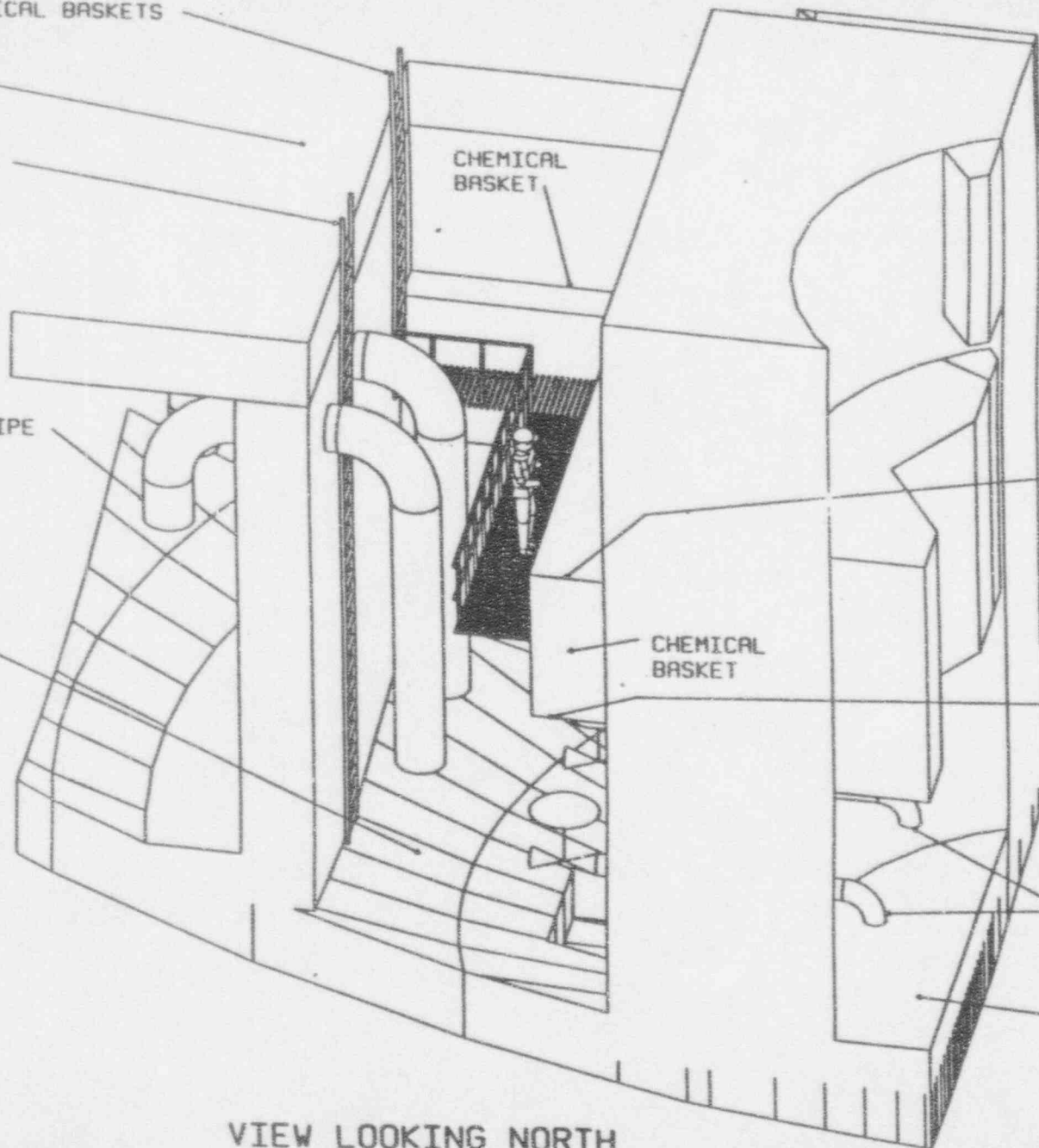
FLOOR EL. BELOW  
CENTER OF SPILLWAY  
PIPES = EL. 63'+10.1/4"

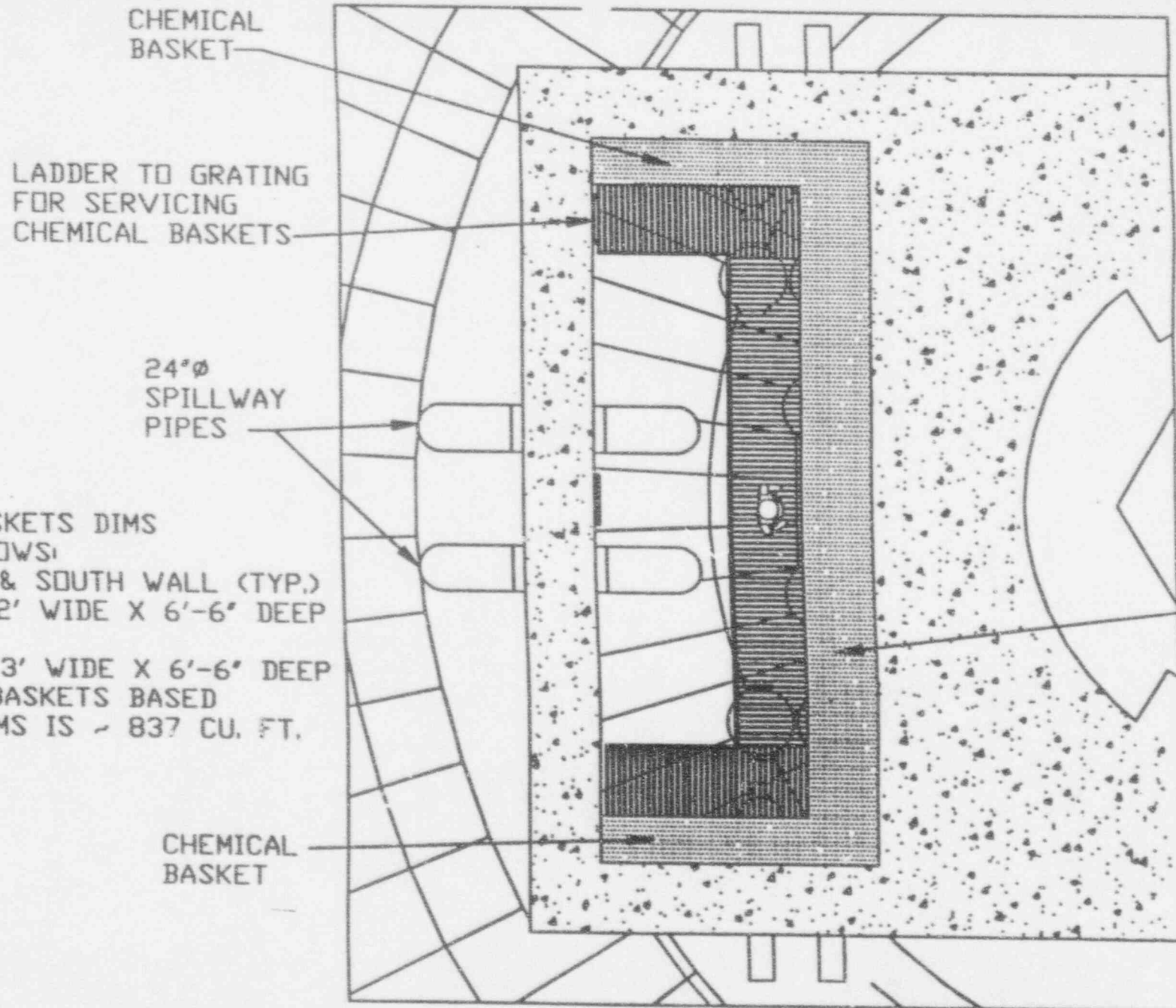
REACTOR CAVITY  
FLOODING PIPING

FL. EL. 62'+0"

VIEW LOOKING NORTH  
THRU HOLDUP VOLUME TANK AREA

FILENAME:CHEMBASK.HIT





NOTE:

CHEMICAL BASKETS DIMS  
ARE AS FOLLOWS:  
NORTH WALL & SOUTH WALL (TYP.)  
8'-10" LG. X 2' WIDE X 6'-6" DEEP  
EAST WALL -  
31'-2" LG. X 3' WIDE X 6'-6" DEEP  
VOLUME OF BASKETS BASED  
ON THESE DIMS IS ~ 837 CU. FT.

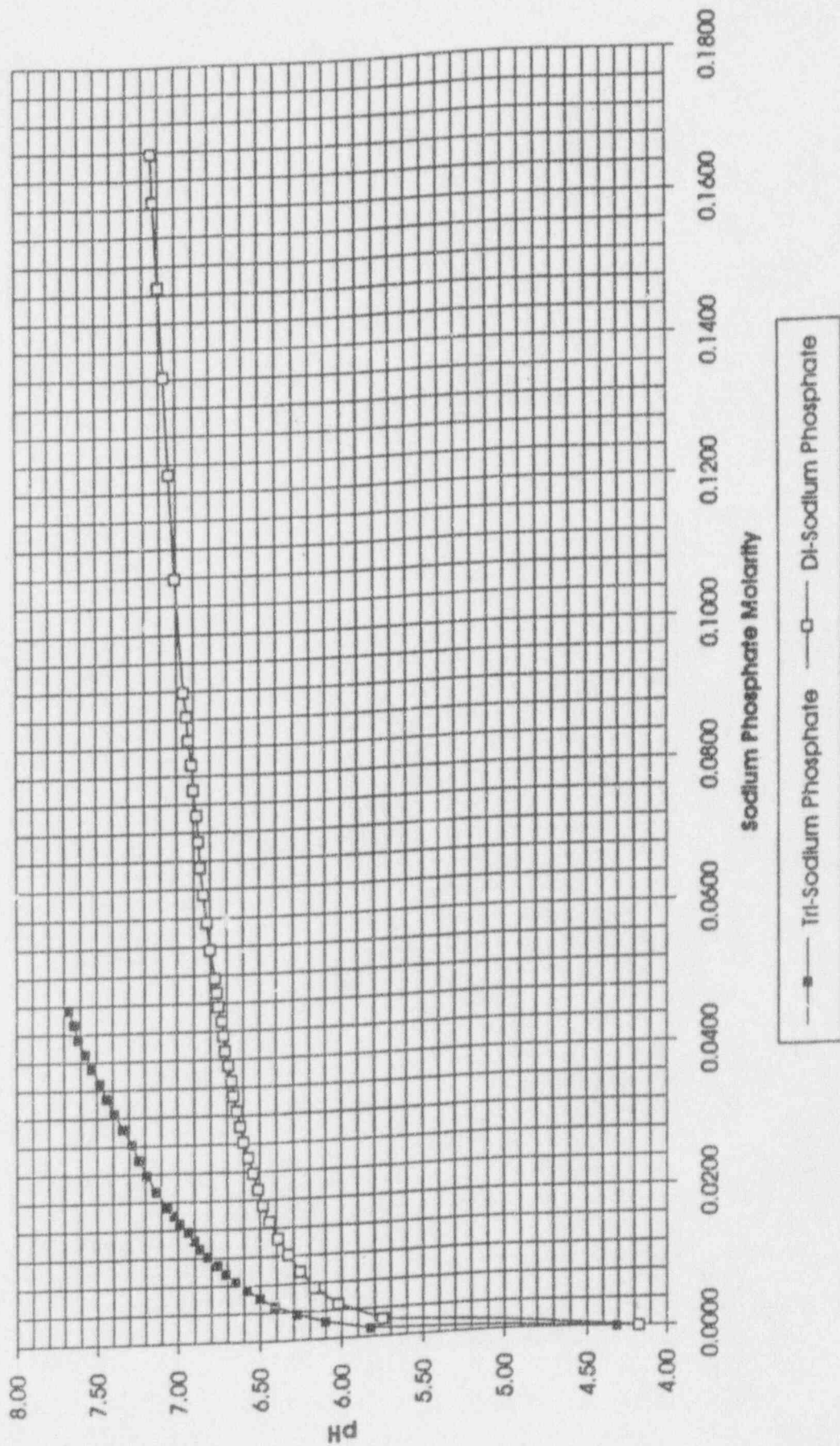
CHEMICAL  
BASKET

CHEMICAL  
BASKET

FILENAME | PLANHVT.DWG

PARTIAL PLAN OF HOLDUP VOLUME TANK AREA

pH of 4400 ppm B Boric Acid with Sodium Phosphate Added



PARTICLE SIZE DEFINITION  
INPUT TO SWNAUA

DISTRIBUTION USED FOR EPRI REPORT:

$r_g = 0.21 \mu\text{m}$ ,  $\sigma = 1.7$  (USED BY SWEC FOR ANS LARGE BREAK LOCA  
STUDIES - 1983)

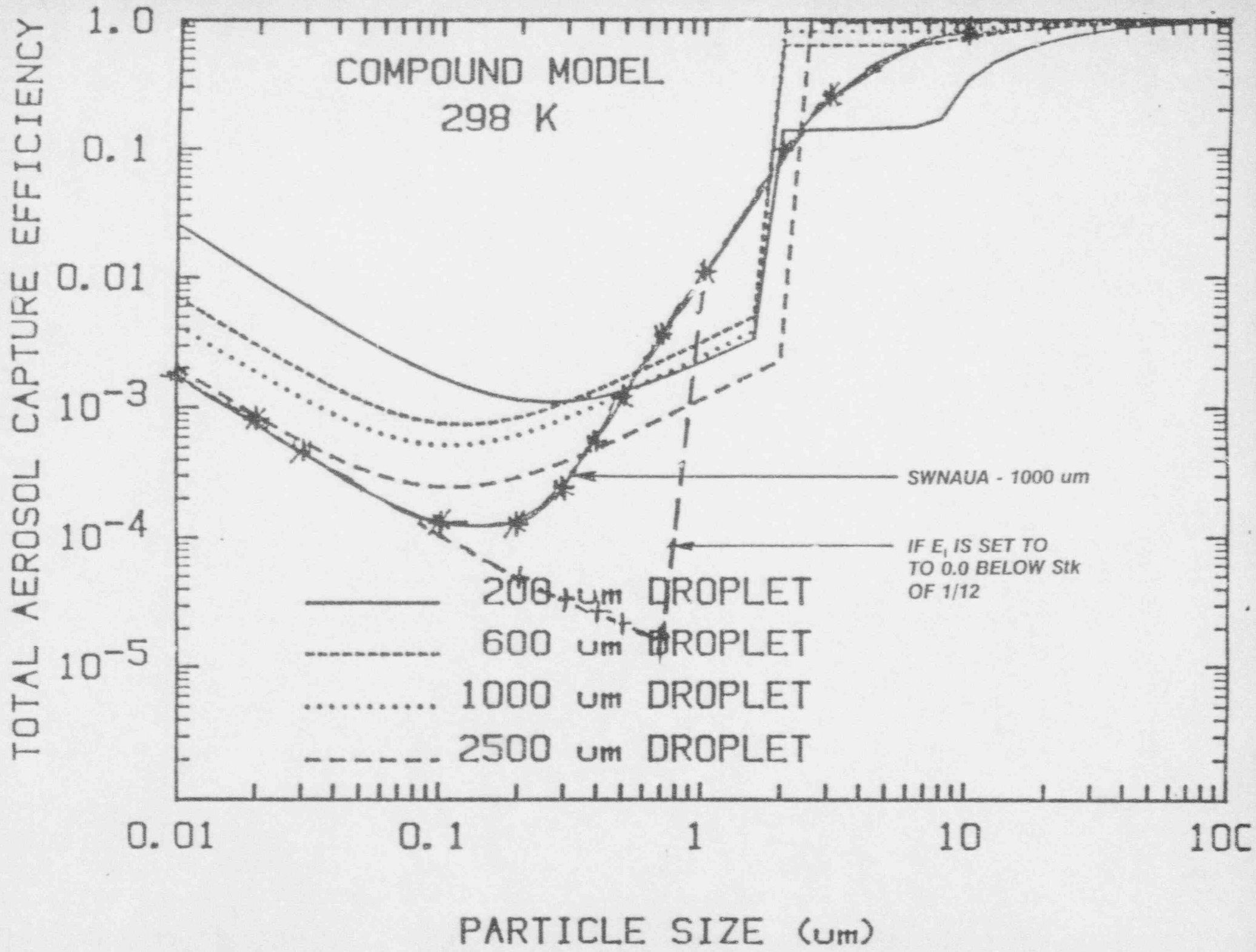
PERCENT LEAKED @ ~ 100 MIN AFTER START OF FUEL RELEASE  
(NO HYGRO) = 0.00065%

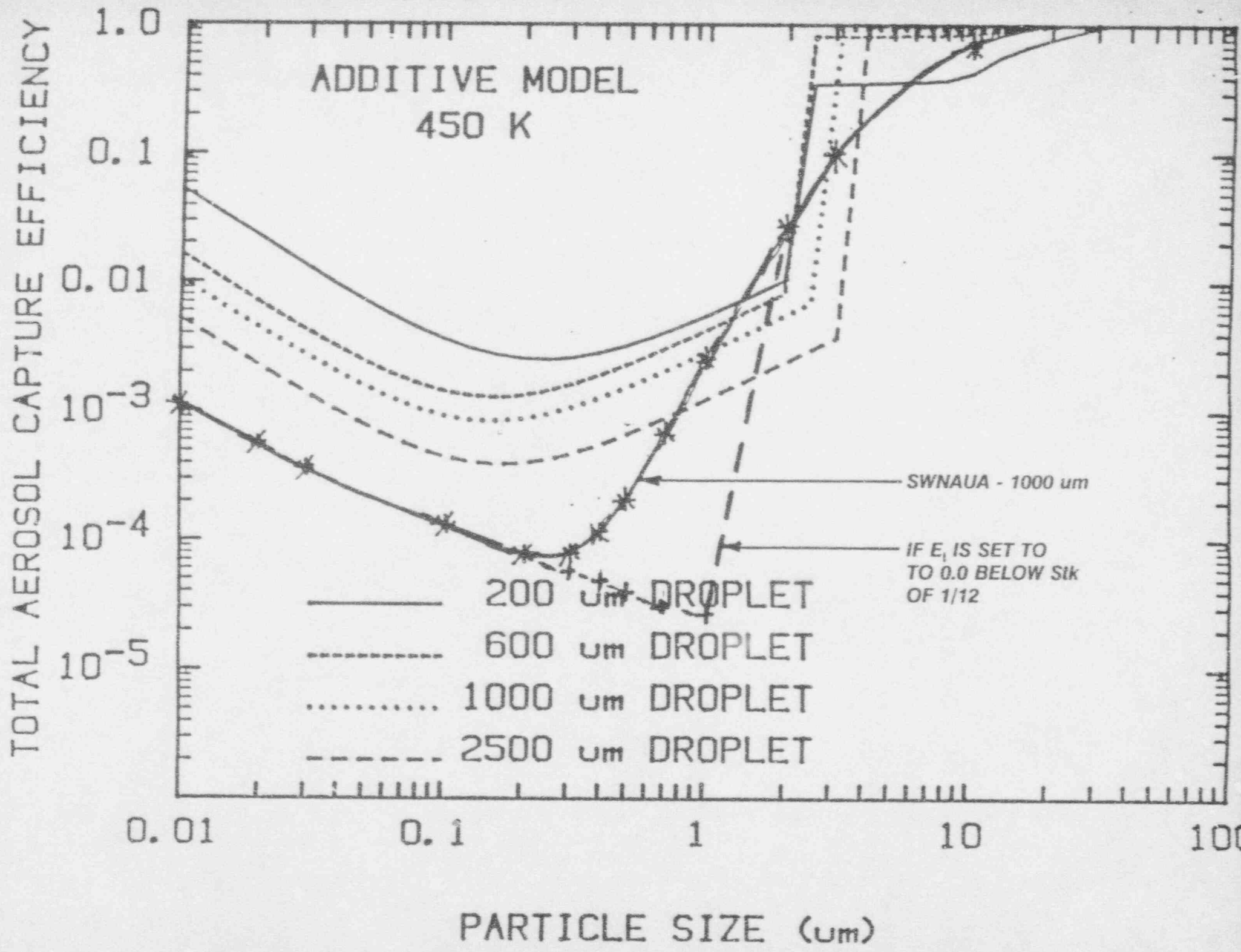
DISTRIBUTION(S) USED FOR SYSTEM 80+ DBA LOCA CALC (BASED ON  
RAFT ANALYSIS OF STEP-1 EXPERIMENT)

$r_g = 0.08 \mu\text{m}$ ,  $\sigma = 1.6$  (GAP RELEASE)

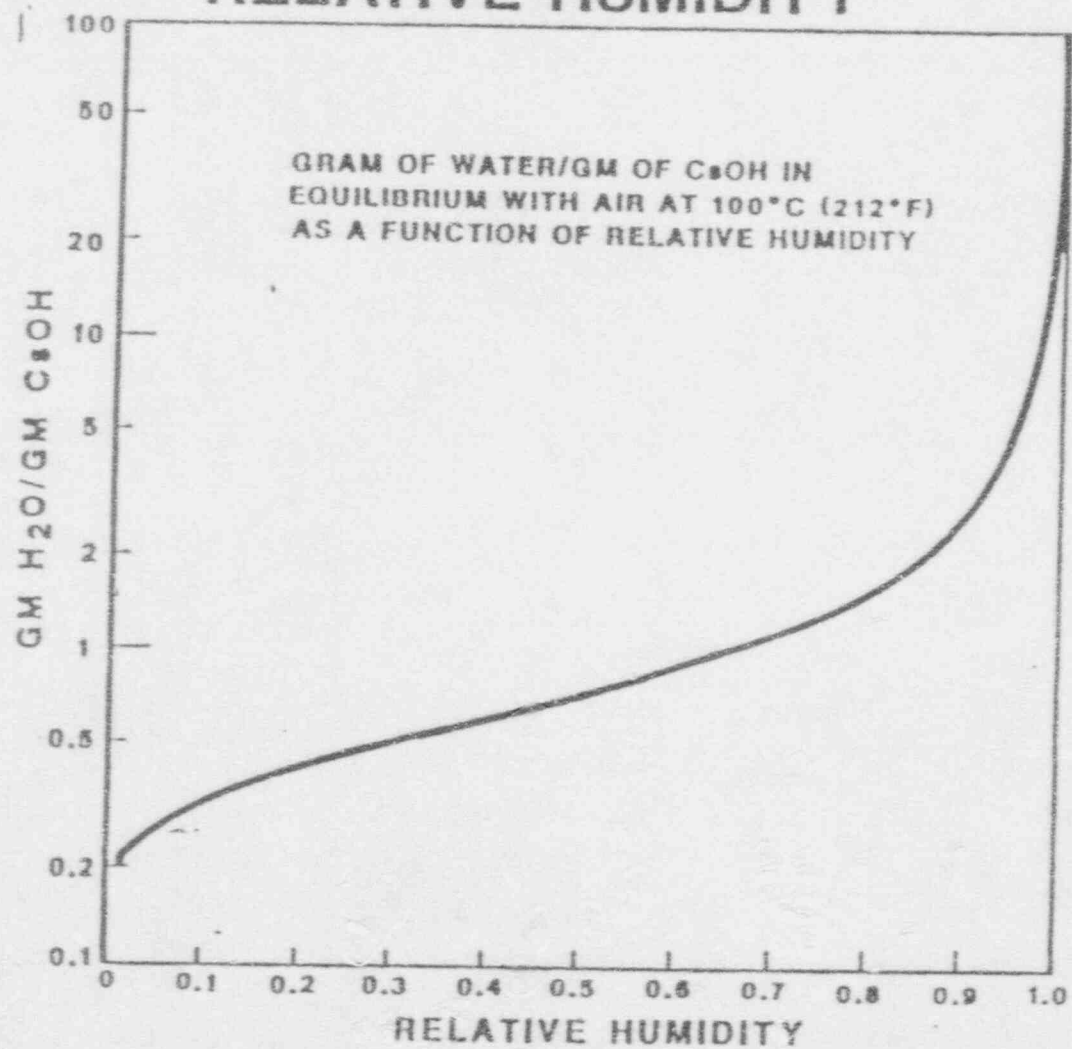
$r_g = 0.40 \mu\text{m}$ ,  $\sigma = 1.46$  (FUEL RELEASE)

PERCENT LEAKED @ ~ 100 MIN AFTER START OF FUEL RELEASE =  
0.0018%

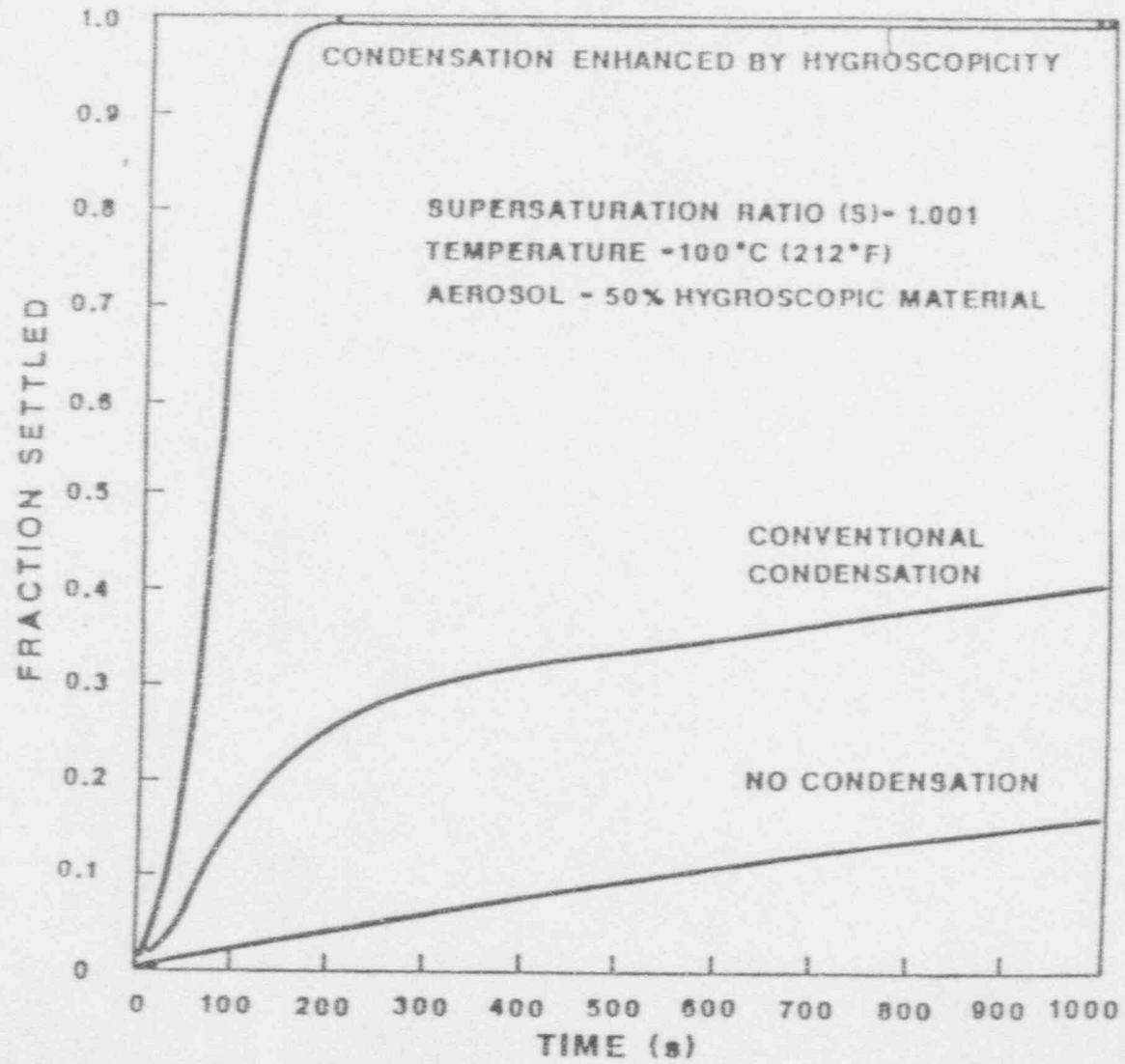




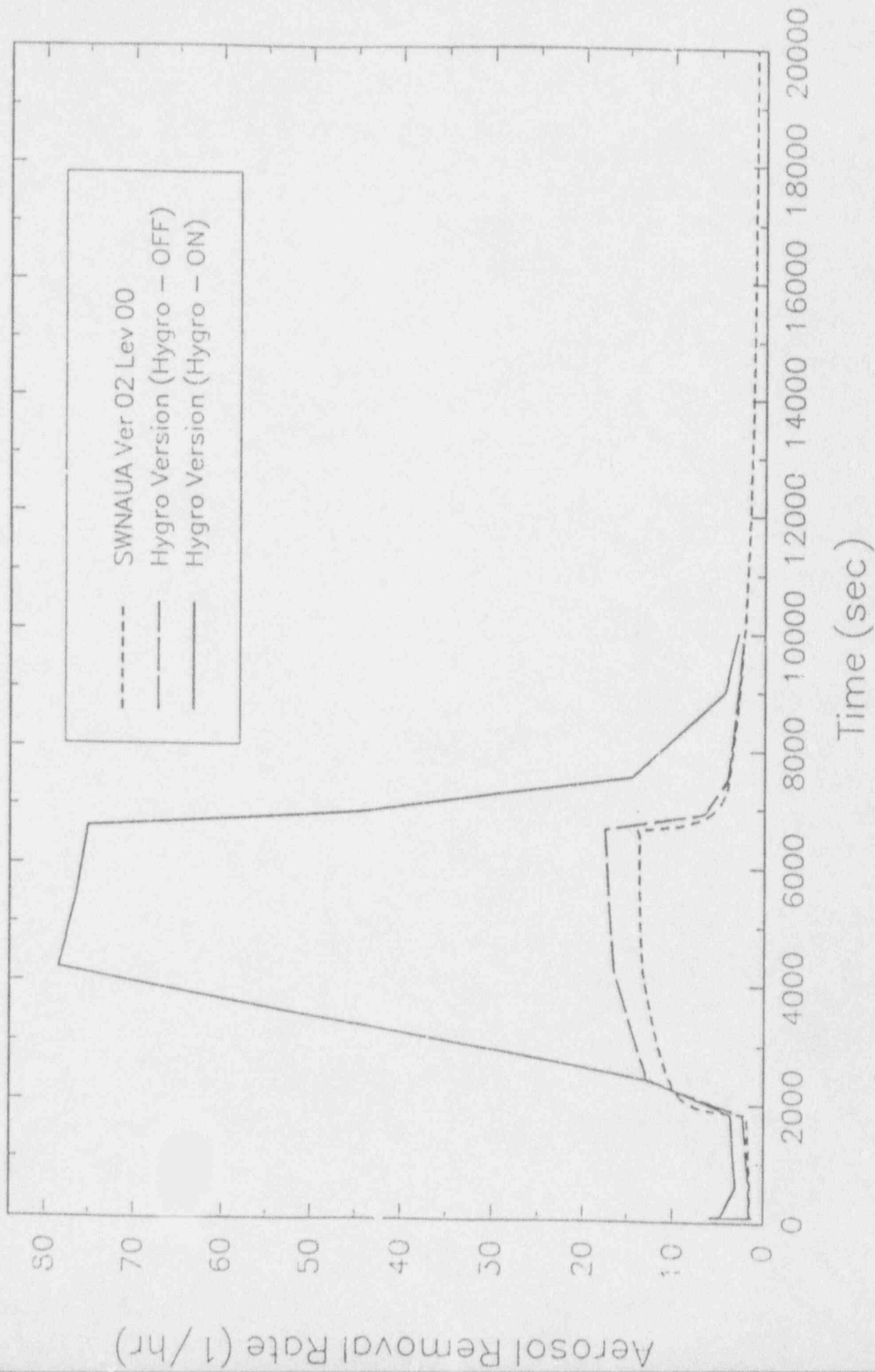
# GRAM OF H<sub>2</sub>O/GRAM OF C<sub>5</sub>OH VS RELATIVE HUMIDITY



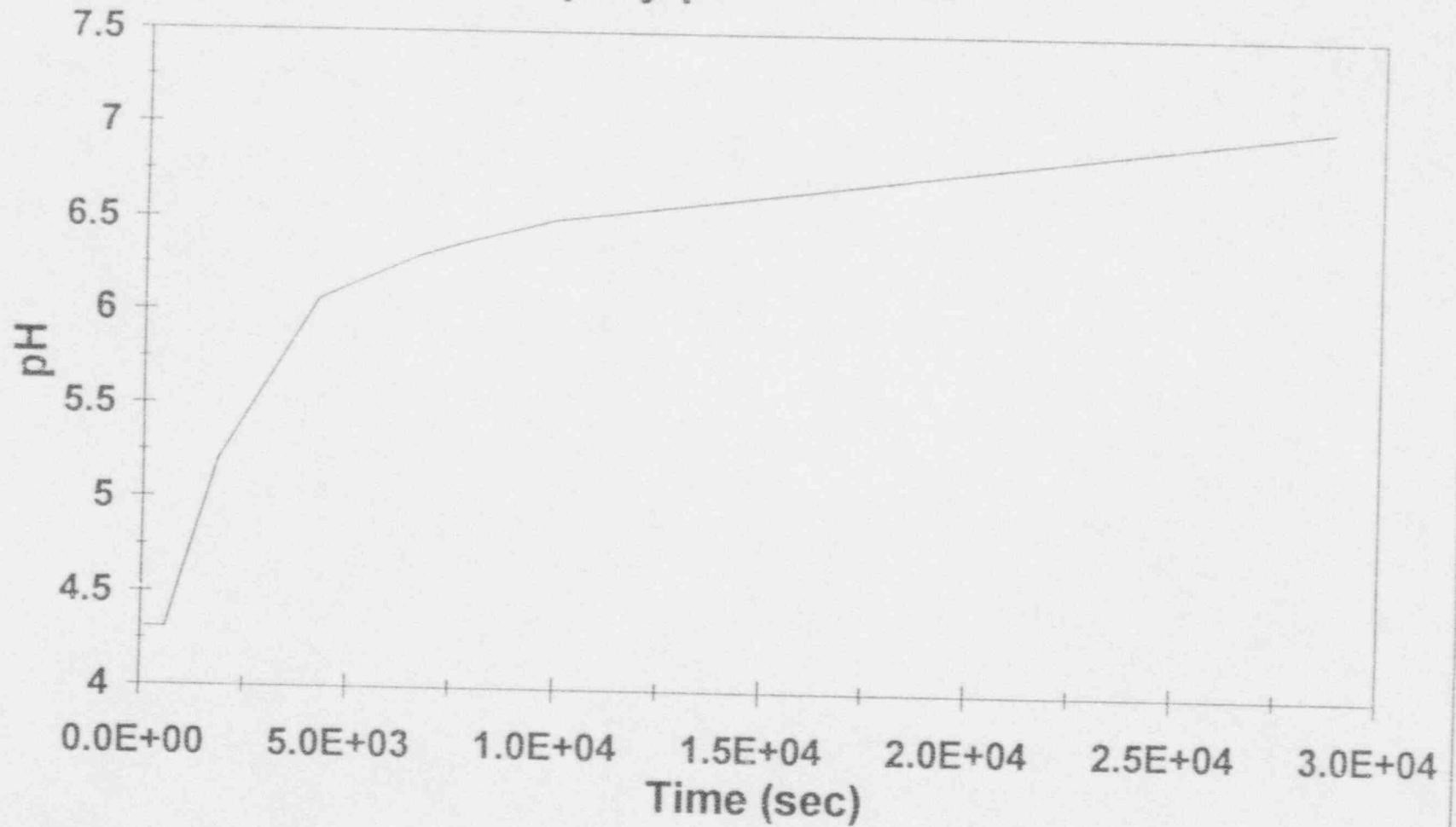
# FRACTION SETTLED VS TIME







### Spray pH vs. Time



## Basis of Analysis

- TSP added at a constant rate over 7.5 hours
- pH vs. TSP data based on Duke Engineering experiments
- Partitions Coefficients Calculated using NUREG/CR-5950
  - Section 3.2 (Appendix C)
  - Section 3.3.1
- Instantaneous Equilibrium w. radiolysis
- No credit for iodate reaction

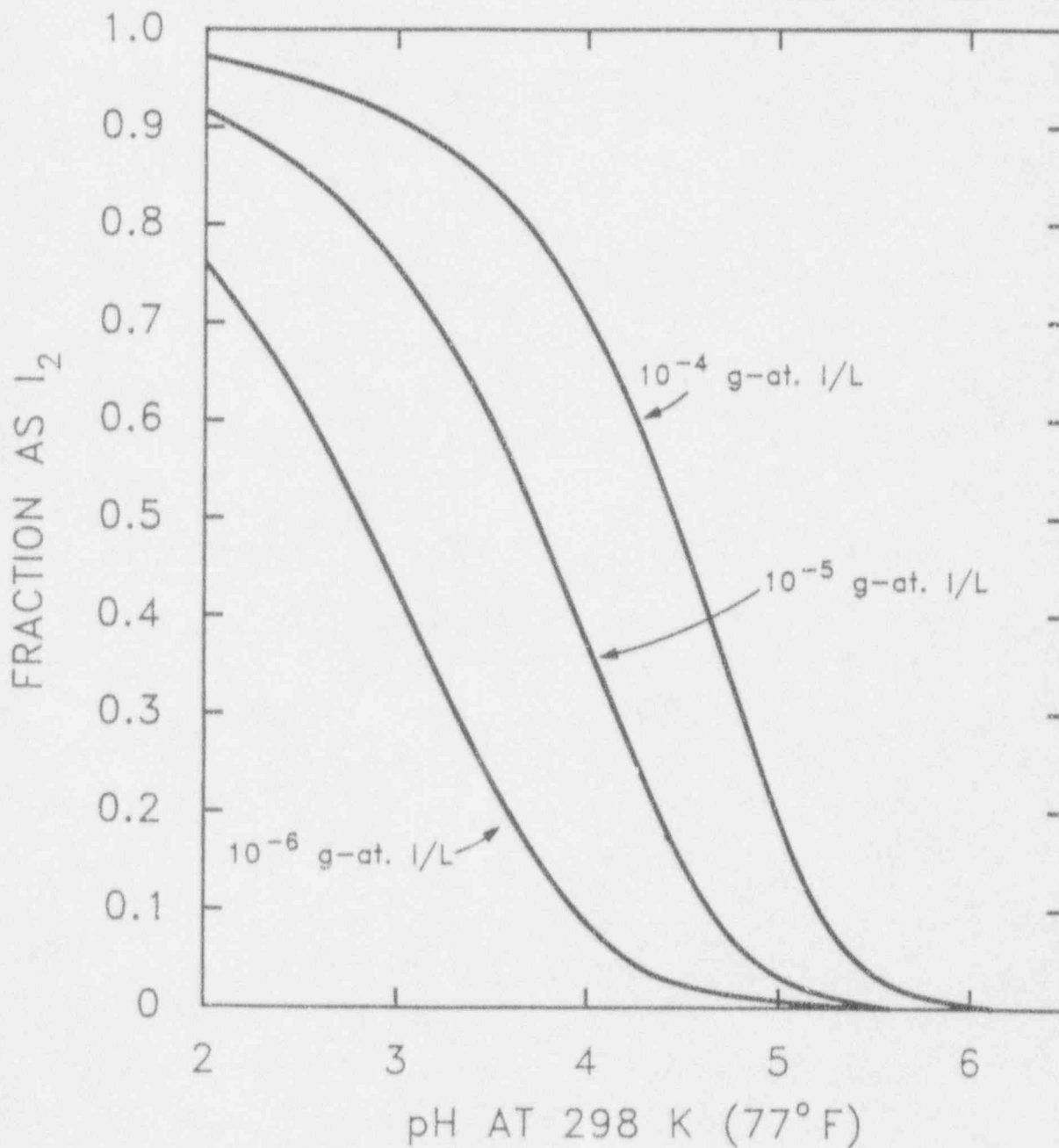
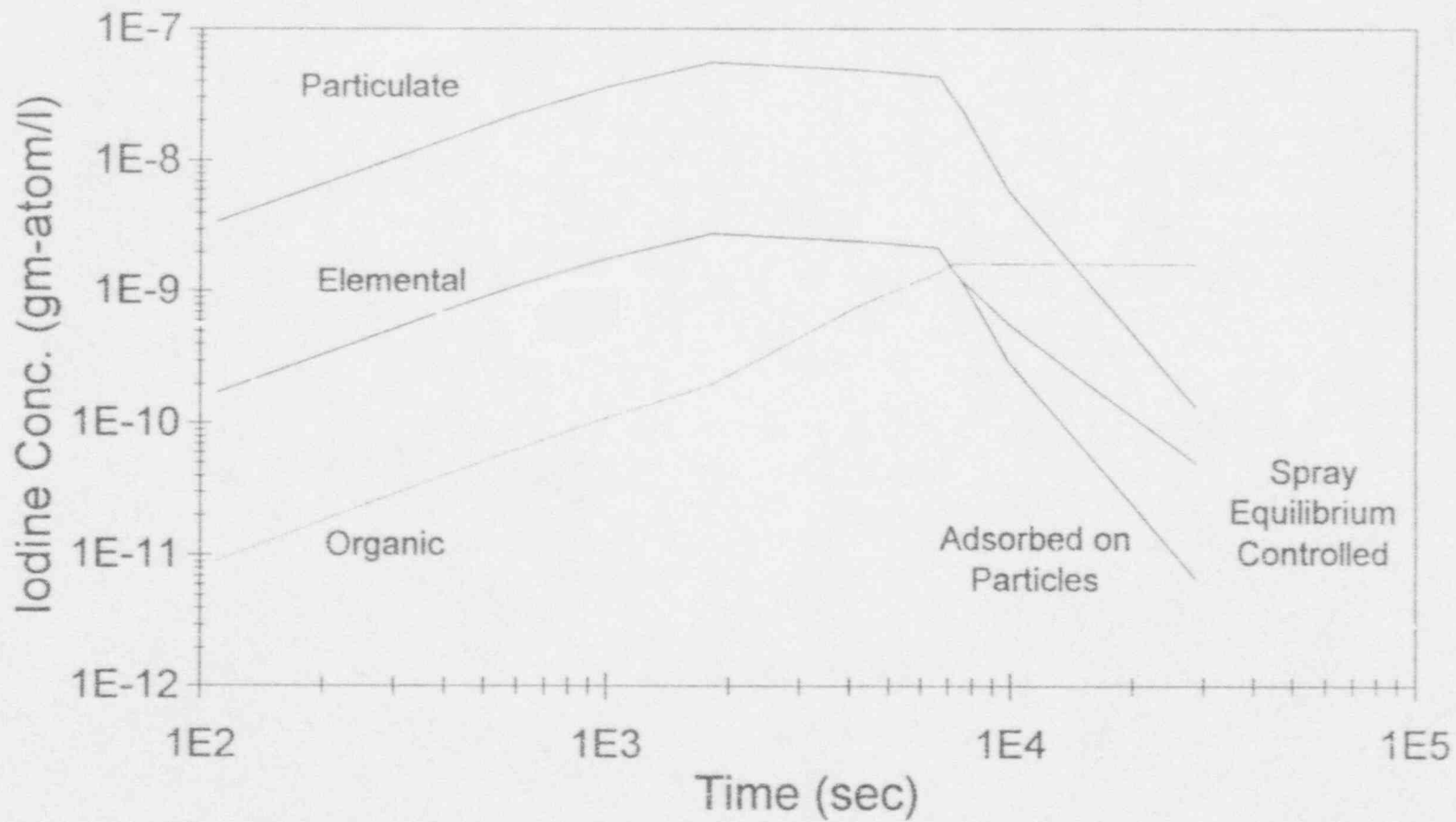
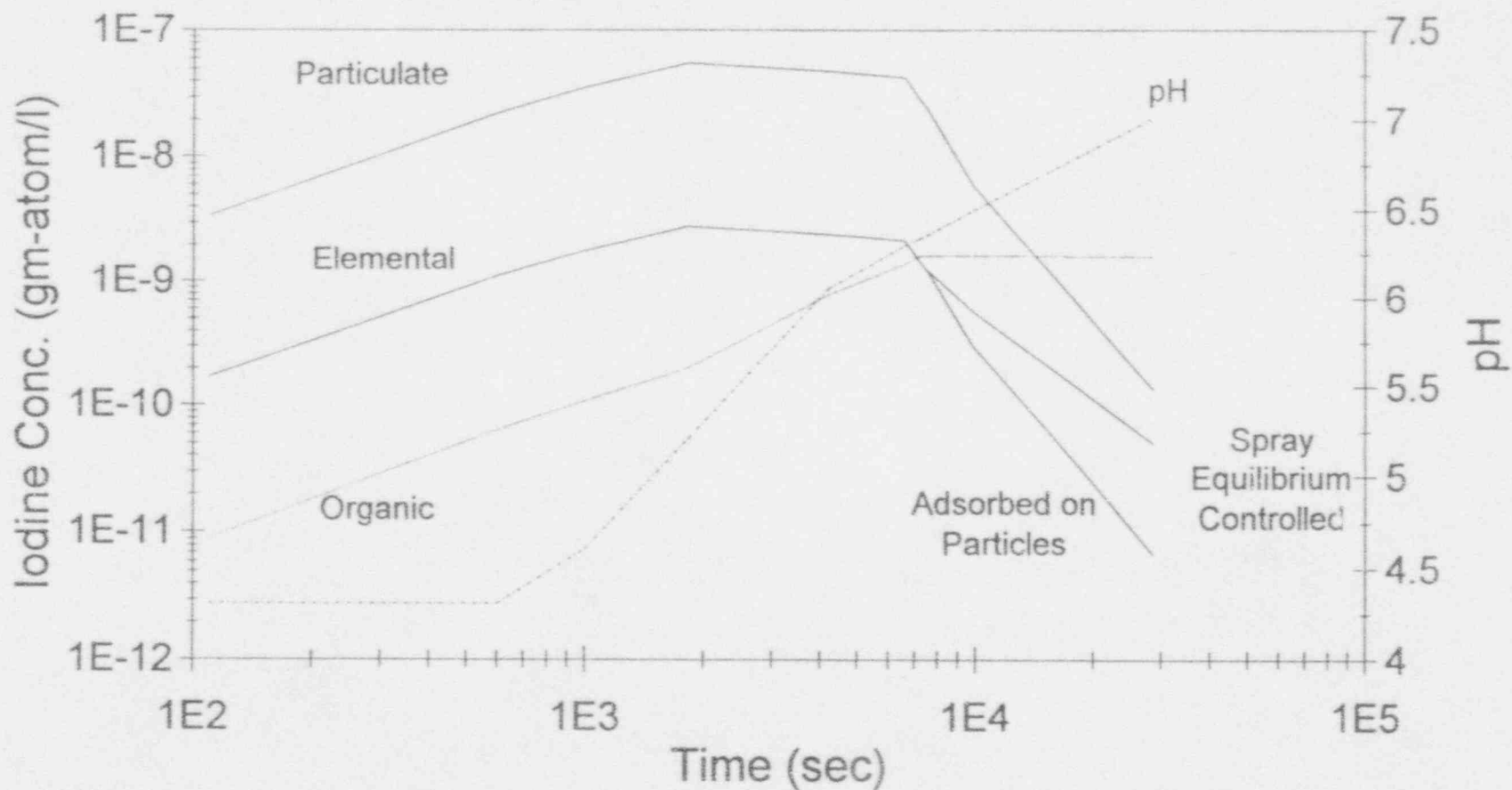


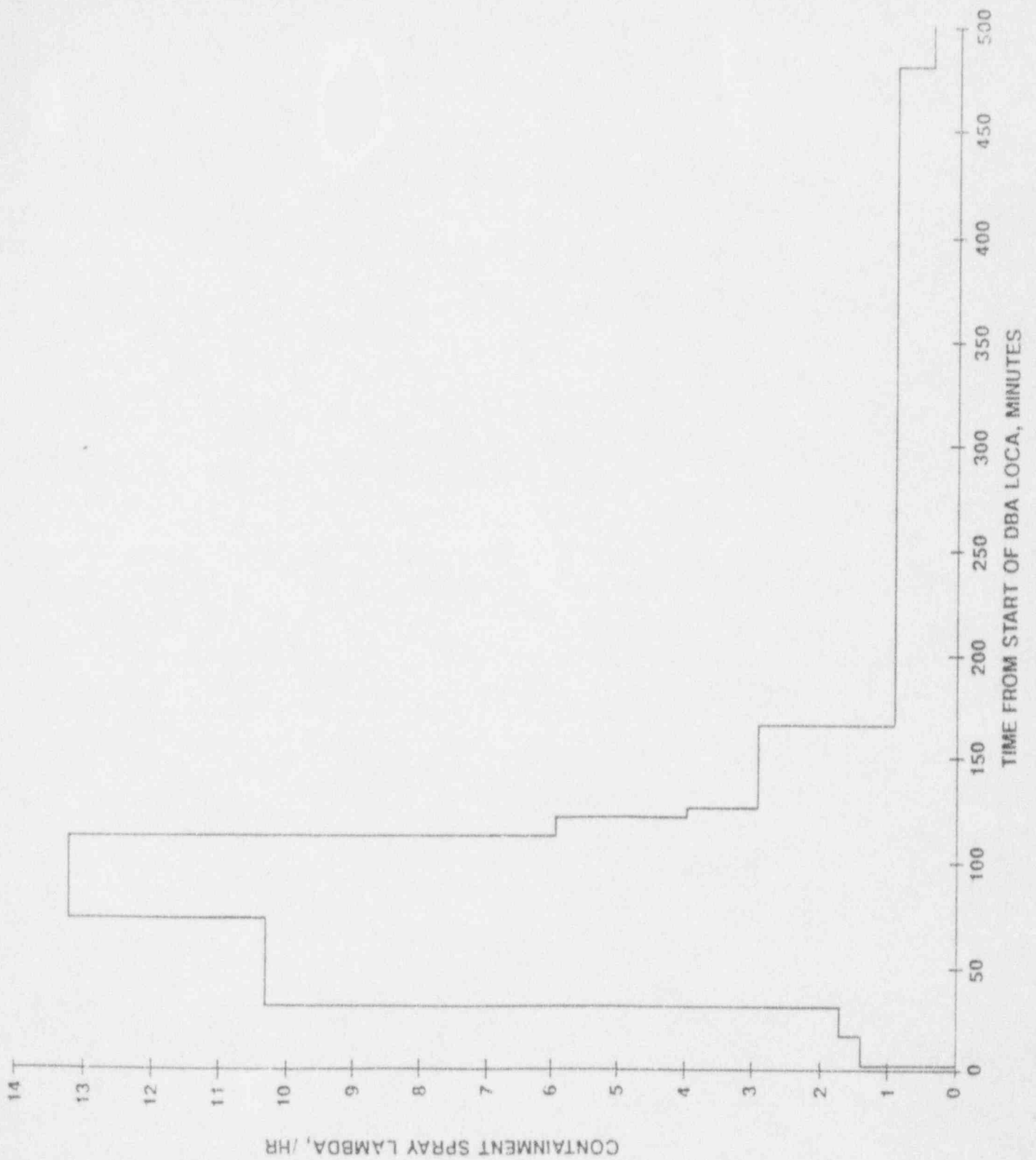
Figure 3.1. Model calculations of fraction as I<sub>2</sub> vs pH

# Airborne Iodine Concentrations



# Airborne Iodine Concentrations





Amendment R  
July 30, 1993

**SYSTEM 80+™**

DBA LOCA SPRAY LAMBDA

Figure  
6.5-5