Public Service™

Public Service
Company of Colorado
P.O. Box 840
Denver, CO 80201-0840

R. F. WALKER
PRESIDENT

May 12, 1986
Fort St. Vrain
Unit No. 1
P-86280

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Mr. H. N. Berkow, Director
Standardization and Special
Projects Directorate

Docket No. 50-267

SUBJECT: FSV Design Basis Accidents and Electric Equipment Qualification to 10 CFR 50.49

REFERENCE: 1) NRC letter, Berkow to Walker, dated 2/14/86 (G-86086)

Dear Mr. Berkow:

The purpose of this letter is to request the Nuclear Regulatory Commission's (NRC) written concurrence with the position of Public Service Company of Colorado (PSC) relative to including Fort St. Vrain (FSV) design basis accidents (DBA) in the FSV environmental qualification (EQ) program as requested in the Reference 1 letter.

In Reference 1, it is the NRC's position that Design Basis Accident No. 1 (DBA-1), Permanent Loss of Forced Circulation (LOFC), and Design Basis Accident No. 2 (DBA-2), Rapid Depressurization of the Reactor Vessel, must be reflected in Fort St. Vrain's (FSV) Environmental Qualification (EQ) program at least as follows:

1. Electric Equipment described in the FSV-FSAR under these DBA scenarios should be included in the FSV-EQ program.

A049
1/1

2. Harsh environments created by these DBAs as described in the FSV-FSAR should be evaluated in the basis for the FSV-EQ program. The program should also evaluate the spectrum of harsh environments that could be created by accidents less severe than the DBA itself.

DEVELOPMENT OF THE FSV-EQ PROGRAM

The FSV-EQ program has been developed in accordance with 10 CFR 50.49 which states that electric equipment important to safety that is relied upon to mitigate the consequences of design basis events (DBEs) shall be qualified for the postulated environmental conditions. DBAs are included (consistent with Reference 1) in the 10 CFR 50.49 definition of design basis events. The FSV DBAs are DBA-1 and DBA-2. Electric equipment that is relied upon to mitigate the consequences of these two FSV accidents have been considered for inclusion in the FSV-EQ program's master equipment list. However, it is PSC's position that the master list should not include the following categories of DBA electric equipment:

1. Electric equipment that is relied upon to mitigate the consequences of Design Basis Accident No. 1 (DBA-1), would not be exposed to a harsh environment during the course of DBA-1 and is not relied upon to mitigate the consequences of any accident in which it could be exposed to a harsh environment.

2. Electric equipment that is relied upon to mitigate the consequences of Design Basis Accident No. 2 (DBA-2), that would not be exposed to a harsh environment during the course of DBA-2 and is not relied upon to mitigate the consequences of any accidents in which it could be exposed to a harsh environment.

NOTES

1. In this letter, PSC intends that "relied upon to mitigate the consequences of" shall be interpreted per the requirements of 10 CFR 50.49(b)(1). That is, it ensures (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe condition, and (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR 100 guidelines.

2. PSC fully intends to qualify, to the requirements of 10 CFR 50.49, electric equipment which is relied upon to mitigate the consequences of design basis accidents, and would be exposed to a harsh environment during the course of those design basis accidents.

3. In accordance with 10 CFR 50.49(C)(iii), electric equipment that is located in a mild environment when it is relied upon to mitigate the consequences of an accident is not in the scope of 10 CFR 50.49.

PSC's position is also consistent with the discussion in Section B of Revision 1 of Regulatory Guide 1.89, which states that: "It is essential that safety-related electric equipment be qualified to demonstrate that it can perform its safety function under the environmental service conditions in which it will be required to function....The specific environment for which individual electric equipment must be qualified will depend on the installed location and the conditions under which it is required to perform its safety function."

ENVIRONMENTS CREATED BY DBAs FOR THE FSV-EQ PROGRAM

In order to establish the severity of the environment for the FSV-EQ program, PSC has evaluated each of the DBEs that could result in a harsh environment, including DBA-1 and DBA-2. FSV-FSAR Section 14.10, which describes DBA-1, does not identify any harsh environment resulting from DBA-1, whereas FSV-FSAR Section 14.11, which describes DBA-2, does identify a harsh environment in the reactor building that is created by DBA-2. FSV-FSAR Section 1.4.5.4 describes the original comparative analysis between the temperatures resulting from DBA-2 and a cold reheat steam pipe double ended rupture in the reactor building which is manually terminated at four minutes. The results shown in FSV-FSAR Figure 1.4-1 show that while the initial reactor building atmosphere temperature is considerably higher for DBA-2 than for the steam leak, the reverse is true for the surface temperatures of components. This occurs because the heat transfer coefficient for steam is much larger than for helium. Because the surface temperature and time-at-temperature of a component (and not the building atmosphere temperature) determines the temperature endurance limit of the component, the harsh environment in the reactor building created by a cold reheat steam pipe rupture terminated at four minutes was selected as the worst case harsh environment for the original FSV-EQ program.

The recent re-analysis of worst case HELBs for the current FSV-EQ program developed a composite atmosphere temperature profile that envelopes both large and small HELBs in the reactor building and turbine building. This also resulted in re-analysis of DBA-2. Utilizing the same basic model and CONTEMPT-G computer code which was used to analyze HELBs, the reactor building atmosphere temperatures created by DBA-2 were determined. Based upon these conservative reactor building atmosphere temperatures, equipment surface temperatures were computed for both HELBs and for DBA-2. The equipment surface temperature profile for a HELB shown in Attachment 1 envelopes the equipment surface temperature profile for a DBA-2. Therefore, it is concluded that the worst case HELB composite

atmosphere temperature profile and the associated HELB composite surface temperature profile for a HELB can be used for the qualification of electric equipment in the FSV-EQ program. Electric equipment qualified for the worst case HELB composite temperature profile in the reactor building will satisfy environmental qualification requirements for the DBA-2 accident.

It is noted that the harsh environment created by a primary coolant leak less severe than DBA-2, namely the Maximum Credible Accident (MCA) described in FSV-FSAR Section 14.8, was evaluated for inclusion into the FSV-EQ program. The MCA consists of a rupture of a 2 inch I.D. helium purification regeneration line outside of the Prestressed Concrete Reactor Vessel (PCRV) with failure of a stop valve and failure of operators to close upstream valves. The result of a recent analysis for this event, using the CONTEMPT-G code, is shown in Attachment 2. This figure shows that the reactor building atmosphere temperature does not exceed 104 degrees Fahrenheit, obviating inclusion of the MCA in the FSV-EQ program, since this constitutes a mild environment.

FSV-FSAR SCENARIOS FOR DBAs

Equipment that is relied upon to mitigate the consequences of the DBA-1 and DBA-2 accidents are described in FSV-FSAR Sections 14.10 and 14.11, respectively.

SCENARIO FOR DBA-1

DBA-1 is the hypothetical permanent Loss of Forced Circulation (LOFC). When DBA-1 occurs, the reactor is scrammed and within two hours following the LOFC from full power the plant operator would begin depressurization of the reactor coolant system via the operating train of the helium purification system and the reactor building vent stack filters to the outside atmosphere. About 5 hours following the LOFC, when resumption of forced circulation may cause steam generator damage, the reserve shutdown system would be operated to assure an adequate negative reactivity margin for shutdown. The PCRV liner cooling water system continues in operation and would be closely monitored as it is vital to the integrity of the PCRV during this accident. The plant operators would redistribute PCRV liner cooling water flows to assure adequate cooling of the PCRV top head. The reactor plant ventilation system would continue to operate normally during the accident in order to provide filtration and elevated release of any fission product activity escaping from the PCRV during the course of this accident.

FSV-FSAR Section 14.10 does not identify any harsh environment in the reactor or turbine buildings resulting from DBA-1. That is, there is no release of hot helium or hot steam into the environment of these buildings that would create a harsh environment. The radiation

environment in the reactor building would be below the 1,000 Rads integrated dose level that could result in radiation damage to electric equipment per IE Bulletin 79-01B, Appendix C, Table C-1.

During the ongoing discussions with the NRC staff, PSC was informally asked the following question:

> "If a harsh environment is created by a steam line break, and the response is an interruption of forced circulation cooling, what is the probability of a permanent loss of forced circulation cooling requiring DBA-1 equipment to be environmentally qualified? Also, is there some reason to think that PSC is not going to be able to restore forced circulation cooling?"

The Steam Line Rupture Detection/Isolation System (SLRDIS) will, following a steam line break with the reactor above 2% rated thermal power, temporarily interrupt the forced circulation cooling systems. However, prior to 100% power operation, PSC will have completed environmental qualification of the redundant, safety related forced circulation safe shutdown trains. Either of these trains are adequate to drive a circulator and to supply cooling water to a steam generator. Following a steam line break, and assuming a single failure renders one of these trains inoperable, the other train will ensure that forced circulation cooling can be restarted and the plant can be maintained in a safe condition.

PSC considers this to be in compliance with the NRC regulations and to provide assurance that a DBA-1 will not occur. The question of the probability of <u>two</u> arbitrary single failures is beyond the licensing basis requirements of FSV and the requirements of 10 CFR 50.49. It is PSC's understanding that the NRC has not asked the LWR industry the equivalent question of what would be the probability of a failure of both environmentally qualified Emergency Core Cooling System (ECCS) trains in the event of a Loss of Coolant Accident (LOCA).

DBA-1 ELECTRIC EQUIPMENT EXCLUDED FROM THE FSV-EQ PROGRAM

PSC considers that environmental qualification of electric equipment in the PCRV liner cooling water system, helium purification system, liquid nitrogen system, and reactor building ventilation exhaust system which are relied upon to mitigate the consequences of DBA-1 as described in the FSV-FSAR is unnecessary for the following reasons:

1. This accident does not create a harsh environment in either the reactor or turbine buildings.

2. This equipment is not relied upon to function during either steam line break accidents or DBA-2, both of which do create harsh environments.

3. The consequences of DBA-1 and its effect on the public health and safety remain as described in the FSV-FSAR.

4. Compounding the DBA-1 accident with a HELB is beyond the scope of the FSV-FSAR and the practice applied to the LWR industry.

SCENARIO FOR DBA-2

DBA-2, as described in FSV-FSAR Section 14.11, is a Maximum Hypothetical Accident originally presented in the PSAR to illustrate that the essentially instantaneous release of the reactor circulating fission product inventory from the PCRV does not result in off-site doses in excess of 10 CFR 100 guidelines. While DBA-2 creates a harsh environment in the reactor building, the turbine building environment is unchanged by DBA-2. The radiation environment created by DBA-2 in the reactor building will be below the 1,000 Rads integrated dose level that could result in radiation damage to electric equipment. The instantaneous release of reactor coolant was assumed to result from a complete failure of both independent closures in the PCRV's bottom head access penetration, a depressurization flow area of 87 square inches. After a temporary interruption of forced circulation, the helium circulators are restarted on their water turbine drives, cooling down the core and removing heat from the reactor coolant via the steam generators. Two circulators (powered by feedwater and operating at 8000 rpm) are required to adequately remove core decay heat in this depressurized condition. The steam generators are supplied with feedwater from the electric motor driven feedwater pump located in the turbine building. The FSV-FSAR accident analysis assumed that the entire primary coolant inventory was dispersed into the outside atmosphere at ground level without any credit for hold up of fission products in the reactor building, pressure relief by the reactor building's louvers or filtration by the reactor building's ventilation system. While the reactor operators can manually actuate the core reserve shutdown systems at any time to introduce further negative reactivity into the core, the control rods alone provide adequate shutdown margin. In summary, the only electric equipment located in the harsh environment of the reactor building that is relied upon to mitigate the consequences of the DBA-2 accident is associated with the helium circulator auxiliary systems and the remote operated valves in the feedwater flowpath to the helium circulators and the steam generators.

DBA-2 ELECTRIC EQUIPMENT EXCLUDED FROM THE FSV-EQ PROGRAM

PSC considers that environmental qualification of electric equipment in the feedwater, condensate and steam systems that is located in the turbine building, and is relied upon to mitigate the consequences of DBA-2 as described in the FSV-FSAR, is unnecessary for the following

reasons:

1. A harsh environment in the turbine building is not created by this accident.

2. Any of this equipment that is relied upon to function during and following a steam line break accident in the turbine building will be environmentally qualified for the harsh environment created by that accident in the turbine building.

3. The consequences of DBA-2 and its effect on the public health and safety remain as described in the FSAR.

It is noted that electric equipment installed in the PCRV liner cooling system which is located in the harsh environment of the reactor building is not relied upon to function during or after either the DBA-2 accident or a HELB accident. This is because the PCRV can withstand a complete and permanent loss of liner cooling without producing a hazard to the public, provided forced circulation cooling is established.

SUMMARY

PSC requests NRC's written concurrence with PSC's position that environmental qualification of electric equipment located in a mild environment during either DBA-1 or DBA-2 and relied upon to mitigate the consequences of DBA-1 and DBA-2 is unnecessary to achieve the underlying purpose of 10 CFR 50.49 and is consistent with the provisions of 10 CFR 50.49 (c)(iii). NRC's concurrence is vital to the timely completion of the FSV-EQ master list and the FSV-EQ program. In summary, PSC's intentions may be summarized as follows:

1. PSC will not environmentally qualify electric equipment relied upon to mitigate the consequences of DBA-1 since none of this equipment is exposed to a harsh environment during the course of DBA-1, nor is it relied upon to mitigate the consequences of a steam line break accident or DBA-2 in which it could be exposed to a harsh environment.

2. PSC will not environmentally qualify that electric equipment relied upon to mitigate the consequences of DBA-2 which would not be exposed to a harsh environment during the course of DBA-2 and which is not relied upon to mitigate the consequences of a steam line break accident in which it could be exposed to a harsh environment.

NOTE

Electric equipment which is relied upon to mitigate the consequences of DBA-2 and would be exposed to a harsh environment during the course of DBA-2 will be environmentally qualified to the requirements of 10 CFR 50.49.

If you have any questions concerning PSC's position on this request for NRC concurrence, please contact Mr. M. H. Holmes at (303) 480-6960.

Very truly yours,

R. F. Walker

R. F. Walker
President

RFW/AHW:kb

Attachments

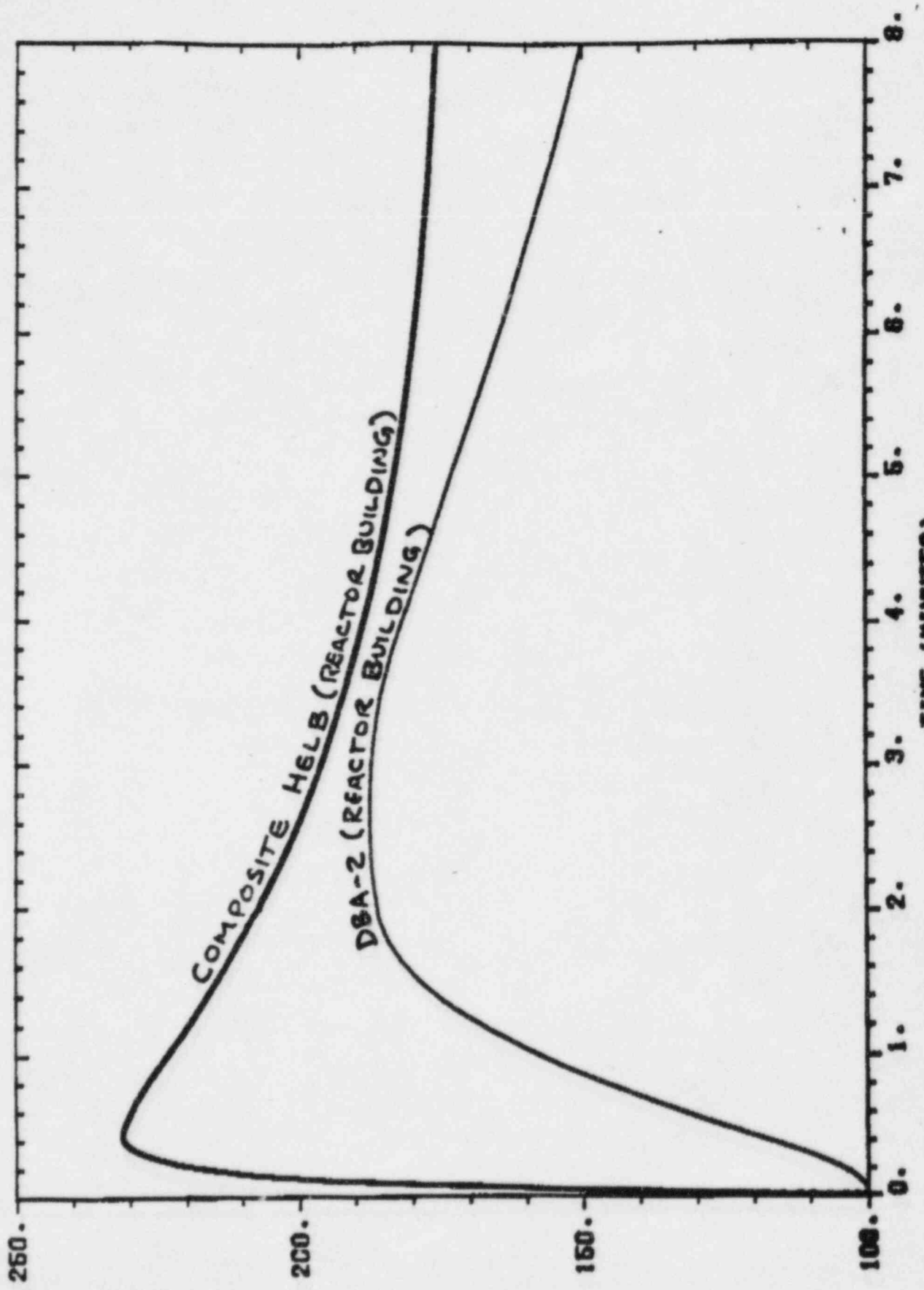

FIGURE 3: COMPONENT SURFACE TEMPERATURE

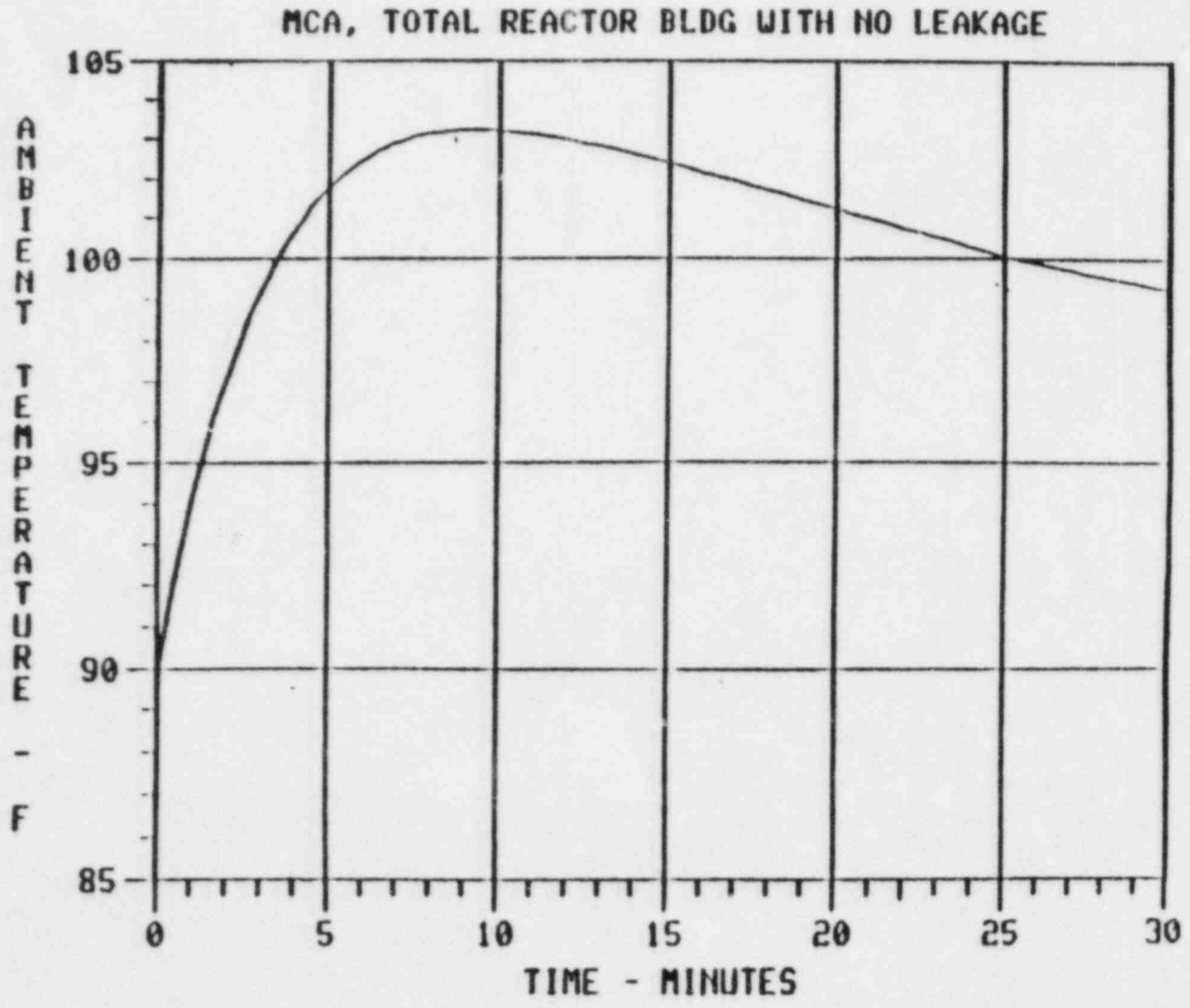

FIG 6 AMBIENT REACTOR BUILDING TEMPERATURES DURING MCA