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March 6, 1992

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Document Control Desk

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Resolution of Single Failure Vulnerabilities
Associated with Combustible Gas Control (10 CFR 50.44)
NRC Docket Nos. 50-237/50-249 & 50-254/50-265

References:
(a) A.W. Dromerick Summary of December 6, 1991 Meeting between General Public Utilities Nuclear and NRR, dated December 11, 1991

(b) Conference Call between NRR (R. Barrett, et al) and Commonwealth Edison Company (J. Schrage, et al) on December 6, 1991

(c) R.J. Barrett to T.J. Kovach letter dated November 28, 1990

(d) B.L. Siegel Summary of May 20, 1991 Meeting between Commonwealth Edison Company and NRR, dated June 13, 1991

Dear Dr. Murley:

During the December 6, 1991 meeting between General Public Utilities Nuclear (GPUN) and NRR (Reference(a)), NRR provided guidance on verifying the ability of normal containment inerting systems to function under accident conditions in order to meet 10 CFR 50.44 requirements, including the associated General Design Criteria (GDC 41, 42 and 43). This guidance instructed GPUN to identify the single failure vulnerabilities of the normal containment inerting systems; discuss the actions necessary to correct and resolve these vulnerabilities through pre-planned repair procedures; and justify the acceptability of these procedures given the time frame necessary to implement the procedures.

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As a result of the meeting, which was attended by a Commonwealth Edison Company (CECo) representative, NRR and CECo conducted a teleconference (Reference (b)) to evaluate the guidance as it related to the current 10 CFR 50.44 compliance status at Dresden and Quad Cities Stations. At that time, CECo indicated that single failure vulnerabilities had been identified for the normal containment inerting system for both Dresden and Quad Cities Stations. This letter describes CECo's proposed method to correct and resolve these vulnerabilities through pre-planned repair procedures, and justification for these procedures, given the time frame necessary for implementation.

Attachment A describes the regulatory background of compliance with 10 CFR 50.44 for Dresden and Quad Cities Stations; the proposed system configuration; the single failure vulnerabilities of the system configuration; and the proposed method to resolve these vulnerabilities.

Based upon the information presented in Attachment A, CECo concludes that the use of the existing Primary Containment Inerting System with its two flow paths, coupled with potential compensatory measures, provides the redundant means to meet the intent of 10 CFR 50.44 and GDC 41, 42, and 43 for Dresden and Quad Cities Stations. CECo is prepared to implement revised procedures; generate new procedures; provide prestaged jumper kits; and conduct training to implement post-LOCA Primary Containment inerting if the existing systems are judged acceptable by the NRC.

Please direct any questions or comments to John L. Schrage at 708-515-7283.

Sincerely,

John L. Schrage
Nuclear Licensing Administrator

Attachment

cc: A. Bert Davis, Regional Administrator-RIII
R.J. Barrett, Director-NRR
B.L. Siegel, Project Manager-NRR
L.N. Olshan, Project Manager-NRR
T.E. Taylor, Senior Resident Inspector-Quad Cities
W.E. Rogers, Senior Resident Inspector-Dresden

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ATTACHMENT

PROPOSED METHOD TO MEET REQUIREMENTS OF 10 CFR 50.44 DRESDEN AND QUAD CITIES STATION

REGULATORY BACKGROUND OF 10 CFR 50.44 COMPLIANCE FOR DRESDEN AND QUAD CITIES STATION

Standards for the control of combustible gas mixtures following design basis accidents are described in 10 CFR 50.44. This regulation requires that Boiling Water Reactors (BWRs) with a Mark I containment maintain the primary containment inerted to mitigate the short term presence of combustible gas following a Loss of Coolant Accident (LOCA). The long term control of combustible gas is also required by 10 CFR 50.44. However the requirements for long term control are dependent upon the plant vintage and date of construction. In particular, 10 CFR 50.44 (g) details the requirements specific to Dresden and Quad Cities Stations based upon their construction permit hearing date. This section of 10 CFR 50.44 allows licensees to make use of purge and repressurization systems, provided that:

(a) The off-site dose is acceptable per 10 CFR 50.44, and

(b) the purge and repressurization systems comply with General Design Criteria 41, 42, and 43 of 10 CFR 50 Appendix A, and

(c) containment repressurization is limited to 50% of containment design pressure.

Licensees may demonstrate compliance with the requirements of 10 CFR 50.44 through the application of Regulatory Guide (RG) 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss of Coolant Accident". RG 1.7 provides the basis for calculating the amount of combustible gas that must be controlled, and thus the time frame in which mitigation measures must be implemented. With respect to Dresden and Quad Cities Stations, calculations indicate that 5% Oxygen concentration will be reached 15 hours into a LOCA. As required by RG 1.7, measures to control the combustible gas mixture in primary containment would be required at that time.

In a letter dated November 28, 1990 (Reference (c)), the NRC requested a meeting with CECo to discuss resolution of issues pertaining to compliance with 10 CFR 50.44 at Dresden and Quad Cities Stations. This meeting was held in May, 1991 (Reference (d)). At that meeting, CECo described the capabilities of the normal Nitrogen Inerting and Makeup system to provide active combustible gas control. However, since this system did not meet the redundancy requirement of GDC 41, CECo described plans to upgrade the Atmosphere Containment Air Dilution (ACAD) system to a Nitrogen Containment Air Dilution (NCAD) system. This upgrade was designed to ensure full compliance to GDC 41, 42 and 43. At that time, installation was delayed pending resolution with the NRC of a BWR Owners Group Emergency Procedure Guideline (BWROG EPGs) concern with repressurization.

Revision 4 of the BWROG EPGs describe the current BWR industry guidance with respect to the use of a purge and repressurization system for combustible gas control. The BWROG EPGs, which have been approved by the NRC in a Safety Evaluation Report (SER), specifically direct operators not to repressurize the primary containment with systems such as Nitrogen Containment Atmosphere Dilution (NCAD). Rather, the BWROG EPGs direct operators to vent and purge the primary containment when the combustible gas concentrations reach a combination of 6% Hydrogen and 5% Oxygen. Successful completion of these actions would then be followed by a return to primary containment isolation and potential repressurization until either the BWROG EPG pressure limit is reached or the combustible gas concentrations are reached.

In December, 1991, the NRC conducted a meeting with General Public Utilities Nuclear (GPUN) to discuss compliance with 10 CFR 50.44 at the Oyster Creek Nuclear Generating Station (Reference (a)). A CECo representative attended that meeting. At the meeting, GPUN described the design features of the normal Nitrogen inerting system, including a discussion pertaining to single failure components of the system. The NRC staff advised GPUN to provide justification that the system could function under accident conditions. This justification should include a discussion of single failure vulnerabilities, and the actions necessary to correct and/or resolve the vulnerabilities. If a single failure vulnerability is resolved through pre-planned repair procedures, the NRC instructed GPUN to discuss the time frame for the repairs and the basis for acceptability.

Subsequent to the December 6, 1991 meeting, a teleconference between NRR (R. Barrett, et al) and CECo (J. Schrage, et al) was conducted to discuss the applicability of the NRC guidance to the current situation at Dresden and Quad Cities Stations. During the teleconference, CECo committed to provide similar information for the normal Nitrogen Inerting and Makeup system at Dresden and Quad Cities Stations. This information is provided in the subsequent sections of this attachment.

PROPOSED SYSTEM CONFIGURATION

The primary containments for Dresden Station Units 2 and 3 and Quad Cities Station Units 1 and 2 are maintained inerted with Nitrogen per the applicable Technical Specifications during operation. Initial inerting and subsequent makeup gas for each station is provided by a shared on-site storage system and Unit specific Nitrogen Inerting and Makeup system. The Nitrogen Inerting and Makeup system for both Dresden and Quad Cities Stations are configured as shown in Figure 1. The common source of Nitrogen for inerting and containment makeup is a liquid Nitrogen tank. Note that Dresden has two tanks versus a single tank at Quad Cities Station. The Nitrogen inerting system consists of two flowpaths.

> Pathway one provides the Nitrogen makeup for maintaining an inert containment during reactor operations. Liquid Nitrogen passes from the bulk storage tank through a heat exchanger to vaporize the liquid Nitrogen. The heat exchanger at Dresden Station utilizes ambient heat to vaporize the Nitrogen. The Quad Cities heat exchanger utilizes electrical resistance for vaporization. The Nitrogen gas is directed into the containment through

Primary Containment isolation valves. This pathway relies upon an automatic pressure control valve linked to a containment pressure sensor. Typical makeup flow is less than one SCFM, however flowrates in excess of those required for post-LOCA inerting can be achieved.

Pathway two provides the Nitrogen used for initial inerting of the Primary Containment during reactor startup. Large quantities of liquid Nitrogen are vaporized with steam provided by the Station Heating Boiler. The Nitrogen gas is then directed into the containment through Primary Containment isolation valves. This pathway also relies upon an automatic pressure control valve linked to a containment pressure sensor. Typical flow rates for containment inerting are far in excess of the post-LOCA inerting requirements.

Use of both pathways over the number of years since Mark I containments have been required to be inerted has shown both pathways to be reliable. Both systems are simple and have a minimum of active components. The reliability of the makeup inerting line (Pathway one) has been demonstrated to be exceptional, as this pathway is always in operation to support reactor operations. Pathway one would be the expected configuration in the event of a design basis LOCA and thus no manual actions outside of the Control Room would be required to utilize this pathway under accident circumstances.

Commonwealth Edison proposes that the existing Nitrogen Inerting and Makeup system described above meets the intent of 50.44.

SINGLE FAILURE VULNERABILITIES OF THE PROPOSED SYSTEM CONFIGURATION

This section describes the generic redundancy issues that have been identified by Commonwealth Edison for the use of the normal Nitrogen Inerting and Makeup System as the primary combustible gas control system.

Electrical

120VAC power for the containment isolation pilot solenoid valves is shared between flow paths 1 and 2. All inboard valves are powered from the same 120VAC isolation valve bus as are all outboard isolation valves. This is a normal consequence of the original design intent for these types of containment isolation valves to either close upon a LOCA or to fail closed upon loss of either electrical control power or valve motive power. In order to re-inert the Primary Containment following a LOCA, at least two normally closed containment isolation valves must to be opened, i.e. one inboard and one outboard valve.

Valve Operator Pneumatic Supply

The valve motive power for the Primary Containment isolation valves that need to be repositioned to conduct re-inerting is supplied by the Instrument Air System. All but one of the valves are fed from this system (one valve is operated with a motor), and all valves are located outside of Primary Containment. Again, the original design intent for these types of containment isolation valves is either to close upon a LOCA or to fail closed upon loss of either electrical control power or valve motive power.

Each flow path is also reliant upon a pressure control valve (PCV) which is operated with Instrument Air and controlled by an instrument loop as described below. The Instrument Air System is non-safety related and the air compressors that supply this system are powered from non-safety related busses. The Service Air System provides a backup to the Instrument Air System; however, this system's compressors share the same non-safety related power supplies as the Instrument Air System. The availability of instrument Air is contingent upon having non-essential power restored in at least one of the two units.

Nitrogen Supply

There is a single source of liquid Nitrogen at each Station which is shared between the units. Since this system is non-safety related and has not experienced a history of failures, a single Nitrogen source has proven effective over a number of years of operation. Thus a single failure such as loss of the Nitrogen supply would preclude post-LOCA re-inerting.

Instrumentation

Flow paths 1 and 2 share a common instrument loop for pressure control. This is again a normal consequence of the original design. In the design, a control signal is sent concurrently to both pressure control valves whether that flow path is in use or not. The flow path is established by alignment of other valves in the system.

PROPOSED METHOD TO RESOLVE SINGLE FAILURE VULNERABILITIES

The single failure vulnerabilities described above require a compensatory strategy. The information presented below and in Figures 2 and 3 details the strategy for each of the single failure vulnerabilities. Figure 2 illustrates the time line of actions necessary to prepare for Nitrogen injection in a post-LOCA environment. Figure 3 illustrates the approximate post-LOCA Nitrogen flow rates versus time after the accident that are required to maintain an inert atmosphere. Calculations were performed assuming the Regulatory Guide 1.7 assumptions. The flow rates calculated with the Regulatory Guide assumptions can be achieved by either of the two potential inerting pathways. Since these actions can be successfully concluded within the time line, Commonwealth Edison is confident that the intent of 10 CFR 50.44 has been met.

Electrical Jumpers and Lifted Leads

The Primary Containment Isolation System (PCIS) design for both Dresden and Quad Cities Stations utilizes a 120VAC distribution bus for all inboard isolation valve pilot solenoids and a separate 120VAC bus for all outboard isolation valve pilot solenoids. The PCIS design also groups valves by system/function and provides an isolation fuse for each group. Failure of either distribution bus would inhibit the ability to provide Nitrogen since at least one inboard and one outboard valve is required for either flow path. If a failure occurred in either 120VAC bus, power can be restored to the required valves by lifting two wires (hot and neutral) that connect the valve group to the failed supply and then connecting a separate 120VAC source from the other unit. These actions would be performed at the main control panels (901-3, 902-3, or 903-3).

In addition to providing power to the 120VAC bus, the containment isolation signal must also be overriden to open the required valves. This signal isolates power from the pilot solenoids causing the containment isolation valves to close.

To override the signal, two jumpers, one for each inboard and outboard valve, must be placed in the same panels as discussed above. These jumpers will provide the operator with normal control at the control switches.

The placement of the isolation override jumpers and connection of an alternate 120VAC power supply can be performed within a single shift (8 hours).

Cross Connection To Other Unit for Instrument/Service Air

Since the design basis for both Dresden and Quad Cities Stations is a LOCA concurrent with a Loss of Offsite Power (LOOP) for the affected unit and a LOOP in the other unit, Instrument Air or its backup, the Service Air System, for both units would be expected to be depressurized. Power to the unaffected unit's Instrument Air compressors can be obtained through back-feed procedures from an operating diesel generator in the event of a sustained LOOP. Additionally, research performed for resolution of the Station Blackout Issue identified the very high probabilities associated with restoring offsite power sources within the time line required for containment re-inerting. Cross connections exist for both the Instrument Air and Service Air Systems to be pressurized from the compressors of the unaffected unit. Thus air power can be supplied with minimal manual action to align the system. These actions can also be accomplished within the time line described in Figure 2.

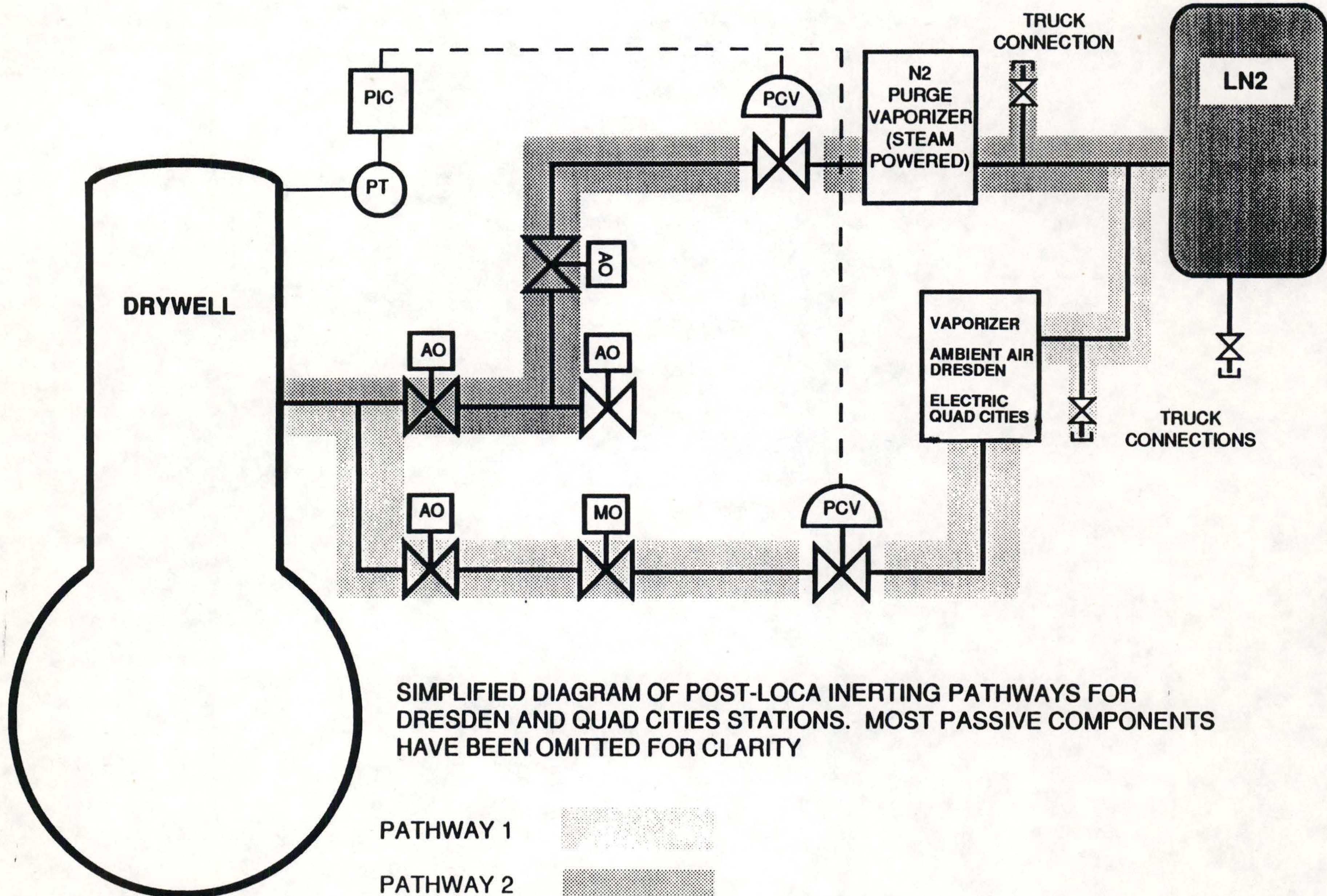
Delivery of Nitrogen Gas From Offsite

Commonwealth Edison has documented that sufficient gaseous Nitrogen can be provided from offsite sources within eight hours of a request. The Nitrogen truck connections currently exist at both Dresden and Quad Cities Stations and as illustrated by the time line, sufficient margin exists between the earliest possible demand and the potential delivery time to permit hook-up of the Nitrogen, and other manual actions necessary for inerting operations.

Instrumentation Substitution

The system design at both Dresden and Quad Cities Stations utilizes a common pressure transmitter and pressure controller for both the purge and inerting flow paths. In the event of a failure of either component, the pressure control valves can be remotely manually operated from the control room by lifting two wires from the pressure controller output and substituting a signal simulation. The pressure control valves can then be regulated by adjusting the simulated signal. This alteration would be made at the main control panel (901-3, 902-3, or 903-3), and could be accomplished within the time line described in Figure 2.

FIGURE 1
FLOW PATHS FOR CONTAINMENT RE-INERTING



SIMPLIFIED DIAGRAM OF POST-LOCA INERTING PATHWAYS FOR DRESDEN AND QUAD CITIES STATIONS. MOST PASSIVE COMPONENTS HAVE BEEN OMITTED FOR CLARITY

PATHWAY 1

PATHWAY 2

FIGURE 2
TIME LINE FOR CONTAINMENT RE-INERTING

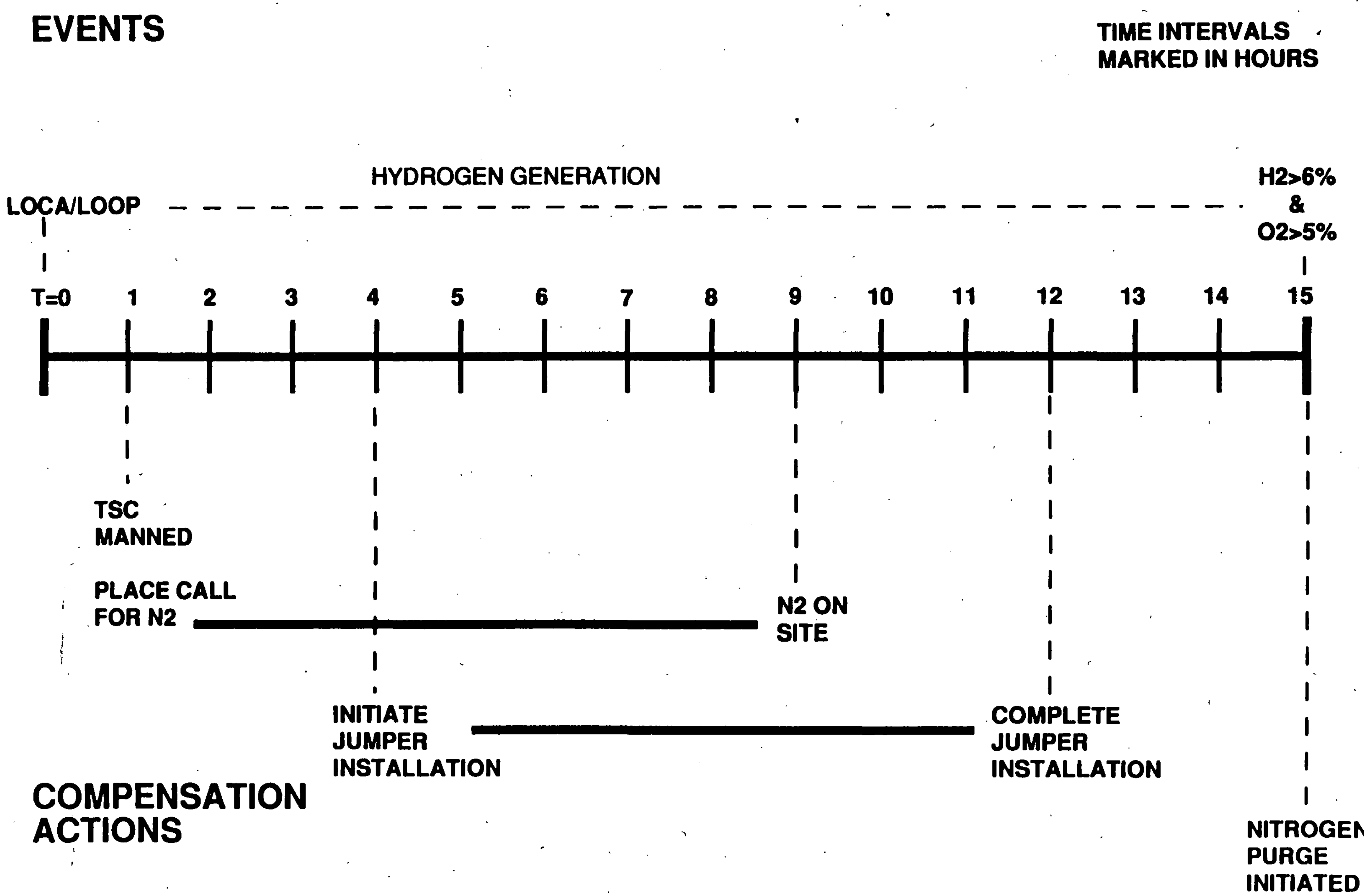


FIGURE 3

REG GUIDE 1.7 NITROGEN FLOWS