FPL

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L-2000-198
10CFR 50.12
10 CFR 50.90

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, D.C. 20555

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Request for Exemption to 10 CFR 50.44 and 10 CFR 50, Appendix E, Section VI and Proposed License Amendments for Relaxation of Post-Accident Hydrogen Monitoring and Control Requirements

In accordance with the provisions of 10 CFR 50.12, "Specific Exemptions," Florida Power and Light Company (FPL) requests an exemption from the requirements of 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Power Reactors," and 10 CFR Part 50, Appendix E Section VI, "Emergency Response Data System." The purpose of the exemption is to remove the requirements for hydrogen control systems from the Turkey Point Units 3 and 4 design basis. Attachment 1 provides the justification for the exemption request. Accordingly, FPL requests a change to the Confirmatory Order dated March 14, 1983, and revised by NRC letter dated October 5, 2000, confirming Turkey Point Units 3 and 4 commitments related to NUREG-0737, post-TMI requirements. Specifically, FPL requests deletion of the commitment to NUREG-0737, Item II.F.1, Item 6, Containment Hydrogen Monitor requirements.

In addition, in accordance with 10 CFR 50.90, FPL requests that Appendix A of Facility Operating Licenses DPR-31 and DPR-41 for Turkey Point Units 3 and 4 be amended to remove the Post-Accident Hydrogen Monitoring and Control Requirements from the technical specifications.

The proposed amendments revise Table 3.3-5, Accident Monitoring Instrumentation, and Table 4.3-4, Accident Monitoring Instrumentation Surveillance Requirements. The revision deletes reference to the containment hydrogen monitors from the Accident Monitoring Instrumentation. Additionally, the proposed amendments will delete Technical Specification 3/4.6.5, Combustible Gas Control - Hydrogen Monitors, and Technical Specification 3/4.6.6, Post Accident Containment Vent System. Attachment 2 provides the proposed license amendments application.

A description and justification of the amendments request is provided in Enclosure 1 of Attachment 2. The no significant hazards determination in support of the proposed technical specifications changes is provided in Enclosure 2 of Attachment 2. The environmental impact analysis is provided in Enclosure 3 of Attachment 2. Enclosure 4 of Attachment 2 provides the proposed revised technical specifications pages. FPL has determined that the proposed license amendments do not involve a significant hazards consideration pursuant to 10 CFR 50.92.

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Approval of the requested exemption and license amendments will allow Turkey Point to accomplish the following: 1) eliminate the need for a leased hydrogen recombiner following design basis or severe accidents, 2) modify or downgrade the existing post-accident hydrogen monitors without further approval, and 3) abandon or remove the existing post-accident containment vent system. FPL plans to maintain the hydrogen monitors as non-safety grade devices.

As documented in Attachment 1, the requested exemption will improve the safety focus at Turkey Point Units 3 and 4 and represent a more effective and efficient method for maintaining adequate protection of public health and safety. As documented in Attachment 2, the requested license amendments will have a positive impact on Turkey Point Units 3 and 4 Probabilistic Risk Assessment due to a reduction in operator errors by permitting simplification of the Emergency Operating Instructions, thereby enabling operators to give priority to important safety functions immediately following postulated plant accidents.

The proposed license amendments are similar in nature to other NRC approved industry license amendments related to elimination of hydrogen control systems, such as for Southern California Edison's San Onofre Nuclear Generating Station, Units 2 and 3, where requests for exemptions from 10 CFR 50.44, 10 CFR 50, Appendix A and 10 CFR 50, Appendix E were also submitted along with license amendment requests.

The license amendments proposed by FPL have been reviewed by the Turkey Point Plant Nuclear Safety Committee and the FPL Company Nuclear Review Board. In accordance with 10 CFR 50.91(b)(1), a copy of these proposed license amendments is being forwarded to the State Designee for the State of Florida.

FPL requests that the exemption request and the proposed license amendments be approved by March 31, 2001, with a 90 day implementation period to allow for the necessary documentation changes.

Should there be any questions on this request, please contact us.

Very truly yours,

R. J. Hovey
Vice President
Turkey Point Plant

OIH

Attachments

Enclosures

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant
Florida Department of Health

L-2000-198

Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Request for Exemption to 10 CFR 50.44 and 10 CFR 50, Appendix E, Section VI
And Proposed License Amendments for Relaxation of Post-Accident
Hydrogen Monitoring and Control Requirements

STATE OF FLORIDA)
)ss.
COUNTY OF MIAMI-DADE)

R. J. Hovey being first duly sworn, deposes and says:

That he is Vice President, Turkey Point Plant, of Florida Power and Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

R. J. Hovey

Subscribed and sworn to before me this
23 day of October, 2000.

Cheryl A. Stevenson
Name of Notary Public (Type or Print)

CHERYL A. STEVENSON
NOTARY PUBLIC - STATE OF FLORIDA
COMMISSION # CC929876
EXPIRES 6/19/2004
BONDED THRU ASA 1-888-NOTARY1

R. J. Hovey is personally known to me.

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ATTACHMENT 1 to L-2000-198

JUSTIFICATION FOR EXEMPTION REQUEST

1.0 INTRODUCTION

1.1 Purpose

This enclosure provides information in support of a request for exemption pursuant to Title 10 of the Code of Federal Regulations Part 50.12, Specific Exemptions, from requirements contained in 10CFR50.44 and 10CFR50, Appendix E.

The purpose of this exemption is to remove the requirements for hydrogen control systems from the Turkey Point Units 3 and 4 design basis. If approved, it would allow Florida Power and Light Company (FPL) to eliminate the need for a leased hydrogen recombiner at the Turkey Point site during design basis or severe accidents.

FPL currently leases an external hydrogen recombiner for the Turkey Point site from another utility. The current lease agreement expires at the end of the year 2000, and the lessor had informed FPL that the lease agreement would not be renewed for another term. At FPL's request, the lessor has agreed to extend the current lease for an additional year. Therefore, FPL requests that the NRC approve this exemption by March 31, 2001.

The proposed license amendments provided in Attachment 2 to this submittal requests the removal of the applicable hydrogen control system components from the Turkey Point Technical Specifications (TS). The proposed TS changes include deletion of the limiting conditions for operation and surveillance requirements associated with the hydrogen monitors and Post-Accident Containment Vent Systems.

1.2 Regulatory Requirements

1.2.1 Requirements of 10CFR50.44 and 10CFR50, Appendix E

10CFR50.44, Standards for Combustible Gas Control System in Light-water-cooled Power Reactors, establishes requirements for controlling the amount of hydrogen inside the reactor containment following a postulated LOCA. These requirements provide specific assumptions and methods to define the amount of hydrogen generated, the rate at which the hydrogen is generated, and the requirements of a combustible gas control system to control the concentration of hydrogen in the containment following a design basis LOCA to below flammability limits. 10CFR50, Appendix E, Emergency Response Data System, contains requirements to provide information on the concentration of hydrogen inside the containment following accidents as part of the Emergency Response Data System.

As applied to Turkey Point Units 3 and 4, the regulations require the following:

A means for control of hydrogen gas that may be generated following a postulated LOCA by:

a) metal-water reaction involving the fuel cladding and the reactor coolant;

b) radiolytic decomposition of the reactor coolant; and,

c) corrosion of metals.

The hydrogen control measures must be capable of:

a) measuring the hydrogen concentration in the containment;

b) ensuring a mixed atmosphere in the containment; and,

c) controlling combustible gas concentrations in the containment following a LOCA.

It must be shown that following a LOCA, but prior to effective operation of the combustible gas control system, either:

a) an uncontrolled hydrogen-oxygen recombination would not take place in the containment; or,

b) the plant could withstand the consequences of uncontrolled hydrogen-oxygen recombination without loss of safety function.

A combustible gas control system to maintain the concentrations of combustible gases within containment following a LOCA below flammability limits is required. Such systems may be of two types:

1) those allowing controlled release from containment such as a purge system;

2) those that do not result in a significant release from containment such as recombiners.

Such a system must control hydrogen as necessary following a LOCA to assure that containment integrity is maintained.

1.2.2 Existing Precedence

On September 10, 1998, Southern California Edison submitted a "Request for Exemption to 10CFR50, Appendix A, General Design Criteria 41, and 10CFR50, Appendix E, Section VI for the San Onofre Nuclear Generating Station, Units 2 and 3." A letter from Southern California Edison to the Nuclear Regulatory Commission, dated July 19, 1999, supplemented this exemption request. The Nuclear Regulatory Commission issued an "Exemption from certain requirements of 10CFR50.44 - San Onofre Nuclear Generating Station, Units 2 and 3," on September 3, 1999, in a letter to Mr. Harold B. Ray from Mr. L. Raghavan.

This exemption request for Turkey Point Units 3 and 4 uses parts of the material contained in the San Onofre exemption request and the Nuclear Regulatory Commission approval of the exemptions.

1.2.3 Criteria for Exemptions - 10CFR50.12 Requirements

The Nuclear Regulatory Commission has established certain criteria that permit any interested person to request specific exemptions to its rules and regulations provided special circumstances exist. These criteria are promulgated in 10CFR50.12, Specific Exemptions:

a) The Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of this part which are:

(1) Authorized by the law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security.

(2) The Commission will not consider granting an exemption unless special circumstances are present.

Special circumstances are identified in 10CFR50.12(a)(2). The special circumstance most relevant to Turkey Point Units 3 and 4 is:

(ii) Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.

Special circumstances may also be present with respect to:

(iv) The exemption would result in benefit to the public health and safety that compensates for any decrease in safety that may result from the grant of the exemption.

(vi) There is present any other material circumstance not considered when the regulation was adopted for which it would be in the public interest to grant an exemption.

This enclosure provides documentation in support of an exemption request for Turkey Point Units 3 and 4.

2.0 TECHNICAL DISCUSSION

2.1 Overview

The containment Combustible Gas Control System installed at Turkey Point Units 3 and 4 is in accordance with the requirements of 10CFR50.44, and sized to control the hydrogen concentration inside the Reactor Containment below the hydrogen flammability limit of 4.1 volume percent (4.1%) following design basis LOCA conditions. The containment Combustible Gas Control System design basis is provided in Sections 9.12 and 14.3.6 of the Turkey Point Units 3 and 4 Final Safety Analysis Report (FSAR). Measurement and reporting of the hydrogen volume percentage is required by 10CFR50, Appendix E, Emergency Response Data System.

2.2 Design Considerations

2.2.1 System Description

The containment Combustible Gas Control System consists of the Post-Accident Hydrogen Monitoring System (two hydrogen monitors per unit), the Post-Accident Containment Vent System (repressurization and purge), and a backup external Hydrogen Recombination System (hydrogen recombiner located off site). These are briefly described below.

2.2.1.1 Post-Accident Hydrogen Monitoring System

The Post-Accident Hydrogen Monitoring System is designed to measure the hydrogen concentration inside containment and to alert the operators in the control room of the need to activate the Post-Accident Containment Vent System and/or the backup external hydrogen recombiner. The hydrogen

monitors consist of a primary monitor and a backup monitor for each unit. The primary monitor cabinets are located in the Post-Accident Sample System (PASS) room of the auxiliary building. The backup monitor cabinets are located on the 4' elevation of the auxiliary building, under the hot chemistry lab.

Each hydrogen monitor has a range of 0-10% hydrogen in the narrow band and a range of 0-20% in the wide band. Remote indication and controls are provided on a panel installed in the Main Control Room. A hydrogen concentration of 4% is alarmed in the Main Control Room. The hydrogen monitors are not required to operate in a continuous mode and are normally isolated from containment by locked closed manual valves. Startup of the hydrogen monitors is required following an accident[1].

2.2.1.2 Post-Accident Containment Vent System

The Post-Accident Containment Vent System is provided to facilitate controlled venting of Reactor Containment through High Efficiency Particulate Air (HEPA) filters and charcoal filters either to waste gas tanks or the atmosphere (via the Plant Vent) following a hypothetical accident. The system is designed to add air (Service Air backed up by Instrument Air) to the Reactor Containment and vent air from the Reactor Containment to effectively maintain hydrogen concentration below 4.0%.

If the hydrogen level in the Reactor Containment following an accident reaches the hydrogen control limit of 3.0%, operation of the Post-Accident Containment Vent System may be initiated under direction of the Technical Support Center (TSC) staff. The air supply, Service Air or Instrument Air, would pressurize the Reactor Containment to over 1.5 psig but less than 10 psig at which time venting of the Reactor Containment would commence. The venting process would be shut down when the hydrogen concentration is reduced to 2.7%.

Under design basis LOCA conditions, operation of either the Post-Accident Containment Vent System or the backup hydrogen recombiner within 12 days will prevent hydrogen concentrations from exceeding 4.0%.

The Post-Accident Vent System is normally isolated by locked closed manual valves during plant operation. It is only operated under normal conditions for valve operability verification tests.

2.2.1.3 Hydrogen Recombination System

Provisions have been made at the site to connect a hydrogen recombiner to the containment atmosphere as a backup to the Post-Accident Containment Vent System. Turkey Point Units 3 and 4 have access to a recombiner that is maintained off site (at Duke Power Oconee Nuclear Plant). This recombiner is shared by a number of nuclear units (H. B. Robinson, Oconee - Units 1, 2, 3, and Turkey Point - Units 3 and 4) in the case of an accident at any one of the nuclear units.

If the Post-Accident Containment Vent System cannot control hydrogen concentrations in the Reactor Containment following an accident, the FSAR requires a hydrogen recombiner be operational within 12 days of a

[1] FPL commitment to NUREG-0737, Item II.F.1, Item 6, Containment Hydrogen Monitor, specified in NRC Confirmatory Order dated March 14, 1983, and revised by NRC letter dated October 5, 2000.

design basis LOCA event. The external recombiner comes on a mechanical skid which contains hydrogen processing equipment and a power/control cabinet. The location for the recombiner skid is identified on the Auxiliary Building roof and the location is accessible by the Spent Fuel Cask Crane.

Mechanical connections on the Auxiliary Building roof are available to draw Reactor Containment air to the hydrogen recombiner and return it back to the containment following recombination. The air is heated electrically within the recombiner until recombination occurs between the hydrogen and oxygen to form water vapor. Appropriate electrical hookups are also provided on the Auxiliary Building roof for the specific unit that would be brought on site.

Plant personnel may receive radiation doses in excess of 2 Rem/hr during installation of the backup hydrogen recombiner skid.

2.2.2 Supporting Systems

2.2.2.1 Containment Air Mixing

Hydrogen mixing within the containment is accomplished by the Emergency Containment Cooling System fans and the Containment Spray System. These systems and the internal structures of the containment are designed to maintain a well-mixed containment atmosphere, and to prevent hydrogen pocketing.

The safety equipment for containment air mixing (Emergency Containment Cooling and Containment Spray) start on automatic signals following a LOCA to remove heat from the containment atmosphere, as well as to minimize localized hydrogen buildup inside containment. This exemption request proposes no changes to the containment air mixing equipment.

2.2.3 Impact of Hydrogen Control Changes on Defense-in-Depth Design

As explained below, the requested changes in post-accident hydrogen control will not significantly impact the defense-in-depth protection provided against the release of radioactive material to the environment due to (1) the existing margin in the containment design, (2) the minimal impact of the hydrogen control system on the ability of the containment to withstand challenges due to hydrogen production following a design basis LOCA, and (3) the limited capacity of the hydrogen control system in defense against containment failure resulting from hydrogen buildup inside the containment following severe accidents.

2.2.3.1 Impact of Hydrogen Control on Containment Safety Margin

Turkey Point Units 3 and 4 employ large, dry containment designs with a design pressure of 55 psig and an estimated limiting pressure for failure of 145 psig. This type of PWR containment is believed to be the least susceptible to damage from a hydrogen burn. The following factors ensure that sufficient safety margin will exist following a hydrogen burn during design basis and severe accidents to preclude loss of the containment function.

- The containment pressure will be reduced to approximately 3 psig due to operation of the containment heat removal systems when the hydrogen concentration is predicted to reach the flammability limit.

Thus, significant pressure margin will exist inside containment to accommodate hydrogen burns.

- Deflagration is the most likely mode of hydrogen combustion in PWRs with a dry containment. This combustion mechanism is the least damaging and does not produce any dynamic or impulsive loads on the containment structure.

- Hydrogen concentrations above the flammability limit will not last very long without being ignited due to the large number of random ignition sources inside containment. Common sources of random ignition inside containment include sparks from electrical equipment and small static electric discharges.

Following a design basis LOCA without operation of the hydrogen control system, hydrogen could accumulate inside the containment and could exceed the flammability limit. However, in light of the above factors, containment failure due to hydrogen combustion is not credible.

The hydrogen burn that occurred during the 1979 event at Three Mile Island 2 (TMI-2) confirms that hydrogen concentration inside a PWR containment will not remain very long above the flammability limit without being ignited. The hydrogen concentration at TMI-2 peaked at about 8.1% and resulted in a containment pressure of about 28 psig, well below the containment design pressure of 60 psig (NSAC-22, 1981). The Turkey Point containment with a similar design is expected to provide an equivalent safety margin against hydrogen burn following design basis and severe accidents, such that the hydrogen control system is not needed.

The Turkey Point Individual Plant Examination (IPE) indicates that none of the accident sequences addressed in the Turkey Point IPE could realistically threaten containment due to hydrogen combustion. The IPE also concluded that the containment would remain intact for severe accidents. The IPE did not take credit for the hydrogen control system. As long as the containment heat removal systems (Containment Emergency Cooling and Containment Spray) work as modeled in the analyses, the containment remained intact. This exemption request makes no changes to the containment heat removal systems or air mixing systems.

Both the nuclear industry and the NRC conducted numerous analyses and tests following the event at TMI-2 in 1979 to determine the containment capability of pressurized water reactor plants with a large, dry containment. For example, NUREG/CR-5662 (1991) reports the computed containment peak pressure due to global hydrogen burn based on a 75% fuel cladding metal-water reaction (MWR) (which can be expected to occur during severe accidents) for a group of pressurized water reactor plants with large, dry, containments similar to those at Turkey Point. The reported containment peak pressure values are all within the plants' estimated containment capacities. Therefore, the NRC-sponsored study concludes that it seems unlikely that containment integrity would be threatened by a hydrogen burn from a 75% MWR in the containments examined. The 75% MWR estimate was intended to be representative of a range of core melt accidents. It should be noted that the TMI-2 accident involved about 45% MWR which resulted in a hydrogen concentration of about 8.1% (NUREG/CR-4330, Volume 3, 1987). The NRC concluded that the large, dry, containments could withstand the containment pressure following severe accidents and there was no need to

backfit these containments with glow plug igniters, or to inert the containment atmospheres.

A detailed comparative analysis of containment integrity for the Turkey Point Units 3 and 4 IPE indicates that the limiting pressure for containment failure is approximately 145 psig (Turkey Point Units 3 and 4 IPE, Section 4.4). Hence, a safety margin exists for containment integrity at higher hydrogen concentration levels following a design basis LOCA, without the use of a hydrogen control system.

With respect to equipment survivability, NUREG/CR-5662 states:

> "Equipment survivability depends on the specific plant design and on the containment environment during a specific accident. The large-scale Nevada test site experiments demonstrated that various types of plant equipment are capable of operating successfully when subjected to the severe thermal environments associated with large-volume hydrogen burns.
>
> The recent analytical and experimental study performed at Sandia National Laboratories showed that the simulated equipment can withstand a LOCA and single burn resulting from a 75% Metal Water Reaction in a large, dry containment. However, the multiple burn due to the operation of ignition systems could pose a serious threat to safety-related equipment located in the source compartment."

It should be noted that the Turkey Point Units 3 and 4 containments do not have igniters. This reduces the potential for multiple burns. During the TMI-2 accident, containment was not breached and damage inside containment was essentially limited to plastics and other low melting point materials such as telephone cases and the crane operator's seat (NUREG/CR-4330, Volume 3, 1987).

In summary, pressurized water reactor plants with large, dry, containments possess sufficient safety margin against containment rupture from hydrogen burn at higher hydrogen concentration levels during severe accidents or following a design basis LOCA, without using any hydrogen control system. Additionally, the NRC has determined that pressurized water reactor plants with large, dry, containments can withstand the containment pressure following severe accidents and there was no need to backfit these containments with igniters or to inert the containment atmospheres.

2.2.3.2 Impact of Hydrogen Control on Design Basis Accidents

The existing Turkey Point Units 3 and 4 Containment Combustible Gas Control System meets the requirements of 10CFR50.44 and 10CFR50, Appendix E to control the concentration of hydrogen which may be released into the reactor containment following postulated design basis accidents. The existing containment hydrogen control system is designed to ensure that the hydrogen concentration is maintained below 4.0% following a design basis LOCA. The Emergency Containment Cooling System, the Containment Spray System, and the internal containment structural design provide excellent hydrogen mixing capability inside the containment that would prevent hydrogen pocketing following a postulated design basis LOCA. These hydrogen mixing systems are not impacted by this exemption request.

The post-LOCA hydrogen generation model for Turkey Point Units 3 and 4 is described in Section 14.3.6 of the FSAR. Figure 14.3.6-1 shows the predicted accumulation of hydrogen gas inside containment as a function of time (days) after the occurrence of a design basis LOCA. The figure shows the contribution from each source of hydrogen, as well as the total accumulation rate. Figure 14.3.6-2 shows the predicted rate of hydrogen removal by a portable hydrogen recombiner when manually initiated by the control room operators. The figure shows the hydrogen concentration reaching approximately 3.5% at about 12 days when the hydrogen recombiner is started. The hydrogen recombiner is stopped at about 35 days when the hydrogen concentration decreases to 2.7%.

Without the activation of the hydrogen recombiner, the hydrogen concentration would continue to rise following a design basis accident and eventually reach the 4 volume percent limit. In severe accidents, hydrogen concentration would probably exceed 4.0% before the hydrogen recombiner and Post-Accident Containment Vent System could be safely placed in service. For accidents in which the reactor core is not damaged, it is likely that hydrogen concentration would remain below the 4 volume percent limit. In addition, containment failure due to hydrogen combustion is not credible, based on the results of the Turkey Point IPE study. The Turkey Point Units 3 and 4 IPE study concluded that the containment would remain intact for severe accidents, which included hydrogen burns for which no credit was taken for the hydrogen control system, as long as the containment heat removal systems (Containment Emergency Cooling and Containment Spray) remained operable. The IPE indicates that none of the accident sequences addressed for Turkey Point could realistically threaten containment due to hydrogen combustion.

There is also no potential for containment integrity to be challenged due to hydrogen pocketing based on the Turkey Point Units 3 and 4 containment internal structural design (generous vent paths), and availability of the safety-related Containment Air Mixing Systems. The results of a study for several PWR plants with large dry, containments indicated that, depending on the containment volume and fan capacity, a mixing of the total containment air volume by fans alone would take only 10 to 30 minutes for the PWRs examined (NUREG-CR-5662, Section 2.3). The time required to process one containment volume for Turkey Point Units 3 and 4 is approximately 30 minutes with two fan coolers operating.

Eliminating the requirement to install a hydrogen recombiner will reduce personnel exposure to high radiation following a design basis LOCA. Radiation doses in the hydrogen recombiner staging area could exceed 2 Rem/hr. Eliminating the requirement to activate the Post-Accident Containment Vent System will reduce radiological releases to the public.

In summary, the Containment Combustible Gas Control System is designed to maintain the hydrogen concentration level below the flammability limit during design basis accidents. Without operation of the hydrogen control system, the hydrogen concentration inside containment could be expected to rise above 4.0% following a design basis LOCA and the assumptions presently used for accident analysis. However, containment failure due to hydrogen combustion is not credible based on the results of the Turkey Point IPE. Eliminating the hydrogen control requirements for Turkey Point Units 3 and 4 will have a positive impact on the health and safety of public and plant personnel.

2.2.3.3 Impact of Hydrogen Control on Severe Accidents

For severe accidents, i.e., those beyond the design basis in which the reactor core is significantly damaged, containment hydrogen concentrations in the range of 10% over short periods of time are possible. This was demonstrated by the TMI-2 accident in 1979. The Containment Combustible Gas Control System is designed to maintain the hydrogen concentration level below 4.0% during design basis accidents that result in small amounts of hydrogen produced slowly over long periods of time, i.e., many days. For severe accidents during which containment hydrogen concentration will rapidly rise to above the 4.0% level, the present Containment Combustible Gas Control System is ineffective and potentially detrimental, and hence would provide no benefit to hydrogen concentration control and containment performance. An NRC-sponsored study (NUREG/CR-5567, 1990) corroborates this point by stating that the hydrogen control systems are designed to accommodate hydrogen accumulation for design basis events (oxidation of 5% Zircalloy surrounding the active fuel). These systems are not designed for the hydrogen generation that might accompany a severe core damage event. Consequently, the Containment Combustible Gas Control System was not included in the Turkey Point Units 3 and 4 IPE. Subsequent to the TMI-2 accident, improvements in equipment, operator training, and procedures make it extremely unlikely that a severe core damaging event comparable to TMI-2 would occur at Turkey Point.

Worker actions to activate the portable hydrogen recombiner occur just outside the Reactor Containment Building boundary. To be used, the recombiner must be shipped from its storage location at the Oconee Nuclear Power Plant in South Carolina and placed on the Turkey Point Reactor Auxiliary Building roof in a designated area adjacent to the Reactor Containment Building. The recombiner must then be electrically and mechanically connected to the existing Containment Combustible Gas Control System, leak tested, and then placed in service. This involves many procedural steps and requires coordination between control room operators and other work groups, such as Electrical Maintenance, Mechanical Maintenance, Instrumentation and Control, and Health Physics. Such actions would also be detrimental to worker health and safety due to the high radiation fields that would be present outside the Reactor Containment Building during a severe accident.

Additionally, placing the recombiner in service would extend the containment boundary (with the use of the associated piping and associated mechanical connections) increasing the risk of uncontrolled/unfiltered leakage of the containment atmosphere.

As discussed previously, the usefulness of the hydrogen monitors is very limited during severe accidents. The only safety-related use of the hydrogen monitors is to alert the operators to turn on the hydrogen recombiner.

In summary, the usefulness of the existing Containment Combustible Gas Control System is limited to design basis accidents. Studies resulting from the TMI-2 accident have demonstrated that the system is ineffective during severe accidents and hence provides no benefit for these events. During severe accidents, the activation of the Post-Accident Containment Vent System could be detrimental to public health and safety due to the radiological releases involved. The activation of the backup recombiner would be detrimental to worker health and safety due to the high doses

expected during equipment installation, and the potential for unfiltered leakage during system operation.

The proposed exemption does not affect the consequences of potential accidents at Turkey Point since (1) there is adequate margin in the containment design, and (2) the existing Containment Combustible Gas Control System is undersized for severe accidents, and hence provides no benefit for these events.

2.2.4 Additional Considerations

In a postulated LOCA, the Turkey Point Units 3 and 4 Emergency Operating Procedures direct the control room operators to monitor and control the hydrogen concentration inside the containment after they have carried out the steps to maintain and control the highest priority critical safety functions such as reactivity, RCS inventory, RCS pressure, and core heat removal. The key operator actions in controlling the hydrogen concentration are to place the hydrogen monitors, Post-Accident Containment Vent System, and/or the backup recombiner in operation. Placement of the Post-Accident Containment Vent System, and/or the backup recombiner in operation involves many procedural steps and requires coordination between the control room operators and other work groups, such as plant Maintenance, Chemistry, and Health Physics. In design basis accidents, these procedural steps would take place days after the accident and are therefore not burdensome to the plant operators. During severe accidents, however, any actuation of the Post-Accident Containment Vent System and/or backup recombiner would have to take place within hours of the initiating event.

An exemption from the requirements for a hydrogen control system will eliminate the need for Emergency Operating Procedure steps for hydrogen control and hence simplify the post-accident recovery strategy. While this elimination of steps will have only a small impact on public health risk, the impact on public health risk will be positive by reducing the probability of operator error during potential accidents and hence reduce the core damage frequency. Also, it will be less likely that the operators would activate either the Post-Accident Containment Vent System or the backup hydrogen recombiner during severe accidents.

In summary, the changes described in this exemption request result in a risk positive change (that is, a positive impact on the health and safety of plant workers and the general public if the exemption is granted). Exemption from the requirements for a Containment Combustible Gas Control System and, as such, the consideration of hydrogen generation within the Turkey Point Units 3 and 4 design basis, will eliminate the need for Emergency Operating Procedure steps for hydrogen control and hence simplify the EOPs, resulting in lower operator error probabilities. It will also reduce the probability of actuation of the Post-Accident Containment Vent System and/or the backup hydrogen recombiner during severe accidents.

2.3 INDUSTRY EXPERIENCE

The regulatory requirements for containment hydrogen control systems were based on knowledge that existed before the TMI-2 event in March 1979. Following TMI-2, the nuclear industry and the NRC initiated extensive analysis and testing to increase the scope of knowledge concerning hydrogen generation and hydrogen control following severe accidents. This new knowledge invalidated many of the assumptions and

methods in the regulations. Based on the new knowledge, it became clear that hydrogen control systems designed for design basis LOCA conditions were not adequate in severe accidents to maintain the hydrogen concentration below the postulated flammability limit of 4.1%. Following TMI-2, the nuclear industry performed extensive analysis and testing which indicated that for large, dry, containments, the containment would withstand the burn of large amounts of hydrogen generated in severe accidents. Therefore, the required hydrogen control systems were determined to be unnecessary for design basis LOCA conditions, and ineffective for severe accidents.

In addition, the Nuclear Regulatory Commission conducted analyses with respect to backfitting the installation of igniters to replace the hydrogen recombiners in nuclear units with large, dry, containments. The NRC determined that the requirement for igniters could not be justified for nuclear units with large, dry, containments according to the provision of 10 CFR 50.109. This was because large, dry, containments have a greater ability to accommodate the large quantity of hydrogen associated with a degraded core accident than the smaller containments. In general, the nuclear units with large, dry, containments rely exclusively on the containment structure to withstand any postulated uncontrolled burn of hydrogen gas generated in severe accidents.

2.4 CONCLUSION

The existing Containment Combustible Gas Control System is of no benefit in design basis and severe accidents. Elimination of the present requirements for the initiation of the hydrogen monitors, the Post-Accident Containment Vent System, and the backup hydrogen recombiner will result in a risk positive change. In addition, elimination of the present requirements will have a positive impact on worker health risk.

3.0 EXEMPTION CRITERIA OF 10CFR50.12

3.1 Overview

The present compliance with 10CFR50.44 and 10CFR50, Appendix E (the rule) at Turkey Point Units 3 and 4 does not serve the underlying purpose of the rule and is not useful in achieving the underlying purpose of the rule. The underlying purpose of the rule was to provide assurance that the containment would not fail due to combustible gas accumulation and ignition in accident situations where fission products were present in the containment. The reliance on the design basis LOCA conditions as described in the rule was ineffective in achieving this result.

The TMI-2 accident produced hydrogen in quantities far exceeding the assumptions in 10CFR50.44, and, even though an uncontrolled hydrogen burn did occur, the containment did not fail.

Probabilistic Risk Assessments (PRAs) quantify the probabilities and consequences of similar accidents. In the PRAs performed for the Turkey Point IPE, the existing Containment Combustible Gas Control System was not credited in addressing hydrogen concentrations during severe accidents. Using the Containment Combustible Gas Control System diverts operator attention from more important actions.

As described below, the requested exemption to the requirements of

10CFR50.44 satisfies the requirements of 10CFR50.12. The purpose of this exemption is to remove the requirements for hydrogen monitors, the Post-Accident Containment Vent System, and the backup, off-site hydrogen recombiner from the Turkey Point design basis. As such, the consideration of hydrogen generation will no longer be included in the design basis of Turkey Point Units 3 and 4.

3.2 No Undue Risk

Section (a) (1) [There is no undue risk to the public health and safety]

As stated earlier, eliminating the existing hydrogen control requirements does not affect the Turkey Point Units 3 and 4 containment safety margin due to the fact that containment failure due to hydrogen combustion is not credible based on the results of the Turkey Point Units 3 and 4 Individual Plant Examination. Furthermore, the usefulness of the existing Containment Combustible Gas Control System is limited to design basis accidents that result in small amounts of hydrogen produced slowly over long periods of time (many days). The system has no benefit for severe accidents and under certain circumstances may represent a potential hazard.

A detailed comparative analysis of containment integrity for Turkey Point Units 3 and 4 indicates that the limiting pressure for containment failure is approximately 145 psig (Turkey Point Units 3 and 4 IPE, Section 4.4).

Eliminating the hydrogen control requirements for the Turkey Point Units 3 and 4 large, dry, containments has a positive impact on the risk to the public by reducing the potential operator error probabilities due to simplifying the Emergency Operating Procedures (eliminating their hydrogen control steps). Elimination of existing requirements also minimizes the possibility of activation of the containment Post-Accident Containment Vent System and/or the backup hydrogen recombiner during severe accidents.

3.3 Underlying Purpose of the Rule Not Served

Section (a)(2) (ii) [Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule and is not necessary to achieve the underlying purpose of the rule]

The underlying purpose of the rule was to reduce the probability of failure of the containment building during accidents and thus prevent fission products from the reactor core from being released through the containment boundary to the outside environment during accidents. Application of the rule at Turkey Point has resulted in equipment and procedures that have no impact on the probability of failure of the containment building under conditions where fission products from the reactor core exist in the containment. In the Turkey Point Units 3 and 4 IPE, the hydrogen monitors, Post-Accident Containment Vent System, and the backup, off-site hydrogen recombiner were not credited for controlling hydrogen concentrations during severe accidents. The existing hydrogen control system may divert operator attention from more important actions. Activation of the existing hydrogen control system during severe accidents could be detrimental to public health and safety. Activation of the Post-Accident Vent System results in intentional releases of radioactivity to the public. Activation of the hydrogen recombiner results in increased worker dose rates, and the

potential for unfiltered releases during system operation.

3.4 Benefit To Public Health and Safety

Section (a)(2) (iv) [There is a benefit to the public health and safety]

Implementation of the exemption from the hydrogen control requirements would achieve a benefit to the public health and safety. In addition to the direct positive impact on the public health and safety by reducing the public risk (see Section 2.2.4), there is also an indirect safety benefit to the public. The indirect benefit comes from eliminating unnecessary requirements from the Turkey Point Units 3 and 4 Technical Specifications and Emergency Operating Procedures. The recent NRC statement on compliance versus safety: Requirements that are duplicative, unnecessary, or unnecessarily burdensome can actually have a negative safety impact, is a recognition of the indirect safety benefit of the proposed exemption.

3.5 Material Circumstances Not Considered

Section (a)(2)(vi) [There are present material circumstances not considered when the regulation (i.e., 10CFR50.44) was adopted]

Experience and information obtained over time provide a better perspective about hydrogen generation and the impact of hydrogen burning on containment integrity and safety equipment during accidents. Two important material circumstances are (a) the effects and (b) the risks of hydrogen generation.

a. *Effects of hydrogen generation*

Traditionally, technical and regulatory evaluation perspectives have held that a hydrogen burn is to be avoided due to the uncertainties of containment failure. The TMI-2 accident in March 1979 provided an important benchmark for the effects of a hydrogen burn on safety equipment and containment integrity. The TMI-2 accident, which involved about a 45% core cladding-water reaction, resulting in about 8.1% hydrogen concentration, produced no containment breach and minimal damage to equipment (NUREG/CR-4330, Vol. 3, 1987). The containment peak pressure was about 28 psig, well below the containment design pressure of 60 psig. Containment damage was essentially limited to plastics and other low melting point materials such as telephone cases and the crane operator's seat. The TMI-2 hydrogen burn thus provides actual experience which establishes a significantly higher threshold for containment damage than was thought to be available when the regulations were promulgated.

b. *Risks of hydrogen generation*

Many PRA evaluations (e.g., plant-specific IPEs) and tools (e.g., MAAP code) have been developed which provide a better insight about the risks of hydrogen generation and burning during severe accidents than were available when the regulations were promulgated. The Turkey Point Units 3 and 4 IPE concluded that containment failure due to hydrogen combustion during severe accidents is not credible.

3.6 Conclusion

As discussed above, this exemption request is in compliance with 10CFR50.12, specifically, with applicable Sections (a)(1) and (a)(2)(ii). The discussion has demonstrated (1) that granting the exemption will not present an undue risk to public health and safety, and (2) that application of the rule in the particular circumstance would not serve the underlying purpose of the rule and is not necessary to achieve the underlying purpose of the rule. Additionally, special circumstances may also exist with respect to Section (a)(2)(iv) and Section (a)(2)(vi).

ATTACHMENT 2

PROPOSED LICENSE AMENDMENTS APPLICATION

ENCLOSURE 1

1.0 DESCRIPTION AND TECHNICAL JUSTIFICATION OF PROPOSED CHANGES

Florida Power and Light Company (FPL) requests that Appendix A of Facility Operating Licenses DPR-31 and DPR-41 for Turkey Point Units 3 and 4 be amended to remove the requirements for post-accident hydrogen monitoring and control from the plant technical specifications.

1.1 DESCRIPTION OF CHANGES

The proposed amendments revise Technical Specification 3/4.6.5, "Combustible Gas Control - Hydrogen Monitors," Technical Specification 3/4.6.6, "Post Accident Containment Vent System," Technical Specification Table 3.3-5, "Accident Monitoring Instrumentation," and Technical Specification Table 4.3-4, "Accident Monitoring Instrumentation Surveillance Requirements."

The proposed changes involve deleting Technical Specifications 3/4.6.5 and 3/4.6.6 in their entirety, and deleting reference to the containment hydrogen monitors in Tables 3.3-5 and 4.3-4. A markup of the affected technical specification (TS) pages is provided in Attachment 4 to this enclosure.

An exemption pursuant to Title 10 of the Code of Federal Regulations Part 50.12, Specific Exemptions, from requirements contained in 10CFR50.44 and 10CFR50, Appendix E is submitted in concert with the amendment requests.

On approval of the exemption request and this license amendments application, FPL will revise the applicable Technical Specification Bases pages. The affected sections of the Turkey Point Units 3 and 4 Final Safety analysis Report (FSAR) will also be revised. The affected sections include:

- Section 9.12, Post Accident Hydrogen Control
- Section 9.14, Post Accident Hydrogen Monitoring System
- Section 14.3.6, Hydrogen Concentration Control

Furthermore, after NRC approval of the requested TS changes, FPL will be authorized to:

a) refrain from obtaining and installing a portable hydrogen recombiner following design basis or severe accidents;

b) abandon, or remove the existing Post-Accident Containment Vent System; and

c) modify or downgrade the existing hydrogen monitors without further approval.

FPL will also be released from commitments regarding a Combustible Gas Control System for Turkey Point Units 3 and 4. As such the consideration of post-accident hydrogen generation will no longer be included in the Turkey Point design basis.

1.2 BACKGROUND

The hydrogen control system at Turkey Point Units 3 and 4 was installed in accordance with the requirements of 10 CFR 50.44 and 10 CFR 50, Appendix E to control the hydrogen postulated to be released into the reactor containment following a design basis loss of coolant accident (LOCA). As prescribed by 10 CFR 50.44, hydrogen gas was postulated to be generated as a result of the following:

- metal-water reaction involving the fuel cladding and the reactor coolant;
- radiolytic decomposition of the reactor coolant; and,
- corrosion of metals.

The hydrogen control system is designed to ensure that any hydrogen generated from these sources is maintained below its flammability limit of 4.1 volume percent (4.1%). Maintaining the hydrogen concentration below this value provides assurance that containment integrity will be maintained under design basis accident conditions.

2.0 TECHNICAL DISCUSSION

2.1 OVERVIEW

The containment Combustible Gas Control System installed at Turkey Point Units 3 and 4 is in accordance with the requirements of 10CFR50.44, and sized to control the hydrogen concentration inside the Reactor Containment below the hydrogen flammability limit of 4.1% following design basis LOCA conditions. The containment Combustible Gas Control System design basis is provided in Sections 9.12 and 14.3.6 of the Turkey Point Units 3 & 4 Final Safety Analysis Report (FSAR). Measurement and reporting of the hydrogen volume percentage is required by 10CFR50, Appendix E, Emergency Response Data System.

2.2 DESIGN CONSIDERATIONS

2.2.1 System Description

The containment Combustible Gas Control System consists of the Post-Accident Hydrogen Monitoring System (two hydrogen monitors per unit), the Post-Accident Containment Vent System (repressurization and purge), and a backup external Hydrogen Recombination System (hydrogen recombiner located off site). These are briefly described below.

2.2.1.1 Post-Accident Hydrogen Monitoring System

The Post-Accident Hydrogen Monitoring System is designed to measure the hydrogen concentration inside containment and to alert the operators in the control room of the need to activate the Post-Accident Containment Vent System and/or the backup external hydrogen recombiner. The hydrogen monitors consist of a primary monitor and a backup monitor for each unit. The primary monitor cabinets are located in the Post-Accident Sample System (PASS) room of the auxiliary building. The backup monitor cabinets are located on the 4′ elevation of the auxiliary building, under the hot chemistry lab.

Each hydrogen monitor has a range of 0-10% hydrogen in the narrow band and a range of 0-20% in the wide band. Remote indication and controls are provided on a panel installed in the Main Control Room. A hydrogen concentration of 4% is alarmed in the Main Control Room. The hydrogen monitors are not required to operate in a continuous mode and are normally isolated from containment by locked closed manual valves. Startup of the hydrogen monitors is required following an accident LOCA[1].

2.2.1.2 Post-Accident Containment Vent System

The Post-Accident Containment Vent System is provided to facilitate controlled venting of Reactor Containment through High Efficiency Particulate Air (HEPA) filters and charcoal filters either to waste gas tanks or the atmosphere (via the Plant Vent) following a hypothetical accident. The system is designed to add air (Service Air backed up by Instrument Air) to the Reactor Containment and vent air from the Reactor Containment to effectively maintain hydrogen concentration below 4.0%.

If the hydrogen level in the Reactor Containment following an accident reaches the hydrogen control limit of 3.0%, operation of the Post-Accident Containment Vent System may be initiated under direction of the Technical Support Center (TSC) staff. The air supply, Service Air or Instrument Air, would pressurize the Reactor Containment to over 1.5 psig but less than 10 psig at which time venting of the Reactor Containment would commence. The venting process would be shut down when the hydrogen concentration is reduced to 2.7%.

Under design basis LOCA conditions, operation of either the Post-Accident Containment Vent System or the backup hydrogen recombiner within 12 days will prevent hydrogen concentrations from exceeding 4.0%.

The Post-Accident Vent System is normally isolated by locked closed manual valves during plant operation. It is only operated under normal conditions for valve operability verification tests.

2.2.1.3 Hydrogen Recombination System

Provisions have been made at the site to connect a hydrogen recombiner to the containment atmosphere as a backup to the Post-Accident Containment Vent System. Turkey Point Units 3 and 4 have access to a recombiner that is maintained off site (at Duke Power Oconee Nuclear Plant). This recombiner is shared by a number of nuclear units (H. B. Robinson, Oconee - Units 1, 2, 3, and Turkey Point - Units 3 and 4) in the case of an accident at any one of the nuclear units.

If the Post-Accident Containment Vent System cannot control hydrogen concentrations in the Reactor Containment following an accident, the FSAR requires a hydrogen recombiner be operational within 12 days of a design basis LOCA event. The external recombiner comes on a mechanical skid which contains hydrogen processing equipment and a power/control cabinet. The location for the recombiner skid is identified on the Auxiliary Building roof and the location is accessible by the Spent Fuel Cask Crane.

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[1]FPL commitment to NUREG-0737, Item II.F.1, Item 6, Containment Hydrogen Monitor, specified in NRC Confirmatory Order dated March 14, 1983, and revised by NRC letter dated October 5, 2000.

Mechanical connections on the Auxiliary Building roof are available to draw Reactor Containment air to the hydrogen recombiner and return it back to the containment following recombination. The air is heated electrically within the recombiner until recombination occurs between the hydrogen and oxygen to form water vapor. Appropriate electrical hookups are also provided on the Auxiliary Building roof for the specific unit that would be brought on site.

Plant personnel may receive radiation doses in excess of 2 Rem/hr during installation of the backup hydrogen recombiner skid.

2.2.2 Supporting Systems

2.2.2.1 Containment Air Mixing

Hydrogen mixing within the containment is accomplished by the Emergency Containment Cooling System fans and the Containment Spray System. These systems and the internal structures of the containment are designed to maintain a well-mixed containment atmosphere, and to prevent hydrogen pocketing.

The safety equipment for containment air mixing (Emergency Containment Cooling and Containment Spray) start on automatic signals following a LOCA to remove heat from the containment atmosphere, as well as to minimize localized hydrogen buildup inside containment. This proposed license amendments request proposes no changes to the containment air mixing equipment.

2.2.3 Impact of Hydrogen Control Changes on Defense-in-Depth Design

As explained below, the requested changes in post-accident hydrogen control will not significantly impact the defense-in-depth protection provided against the release of radioactive material to the environment due to (1) the existing margin in the containment design, (2) the minimal impact of the hydrogen control system on the ability of the containment to withstand challenges due to hydrogen production following a design basis LOCA, and (3) the limited capacity of the hydrogen control system in defense against containment failure resulting from hydrogen buildup inside the containment following severe accidents.

2.2.3.1 Impact of Hydrogen Control on Containment Safety Margin

Turkey Point Units 3 and 4 employ large, dry containment designs with a design pressure of 55 psig and an estimated limiting pressure for failure of 145 psig. This type of PWR containment is believed to be the least susceptible to damage from a hydrogen burn. The following factors ensure that sufficient safety margin will exist following a hydrogen burn during design basis and severe accidents to preclude loss of the containment function.

- The containment pressure will be reduced to approximately 3 psig due to operation of the containment heat removal systems when the hydrogen concentration is predicted to reach the flammability limit. Thus, significant pressure margin will exist inside containment to accommodate hydrogen burns.

- Deflagration is the most likely mode of hydrogen combustion in PWRs

with a dry containment. This combustion mechanism is the least damaging and does not produce any dynamic or impulsive loads on the containment structure.

- Hydrogen concentrations above the flammability limit will not last very long without being ignited due to the large number of random ignition sources inside containment. Common sources of random ignition inside containment include sparks from electrical equipment and small static electric discharges.

Following a design basis LOCA without operation of the hydrogen control system, hydrogen could accumulate inside the containment and could exceed the flammability limit. However, in light of the above factors, containment failure due to hydrogen combustion is not credible.

The hydrogen burn that occurred during the 1979 event at Three Mile Island 2 (TMI-2) confirms that hydrogen concentration inside a PWR containment will not remain very long above the flammability limit without being ignited. The hydrogen concentration at TMI-2 peaked at about 8.1% and resulted in a containment pressure of about 28 psig, well below the containment design pressure of 60 psig (NSAC-22, 1981). The Turkey Point containment with a similar design is expected to provide an equivalent safety margin against hydrogen burn following design basis and severe accidents, such that the hydrogen control system is not needed.

The Turkey Point Individual Plant Examination (IPE) indicates that none of the accident sequences addressed in the Turkey Point IPE could realistically threaten containment due to hydrogen combustion. The IPE also concluded that the containment would remain intact for severe accidents. The IPE did not take credit for the hydrogen control system. As long as the containment heat removal systems (Containment Emergency Cooling and Containment Spray) work as modeled in the analyses, the containment remained intact. The proposed license amendments make no changes to the containment heat removal systems or air mixing systems.

Both the nuclear industry and the NRC conducted numerous analyses and tests following the event at TMI-2 in 1979 to determine the containment capability of pressurized water reactor plants with a large, dry containment. For example, NUREG/CR-5662 (1991) reports the computed containment peak pressure due to global hydrogen burn based on a 75% fuel cladding metal-water reaction (MWR) (which can be expected to occur during severe accidents) for a group of pressurized water reactor plants with large, dry, containments similar to those at Turkey Point. The reported containment peak pressure values are all within the plants' estimated containment capacities. Therefore, the NRC-sponsored study concludes that it seems unlikely that containment integrity would be threatened by a hydrogen burn from a 75% MWR in the containments examined. The 75% MWR estimate was intended to be representative of a range of core melt accidents. It should be noted that the TMI-2 accident involved about 45% MWR which resulted in a hydrogen concentration of about 8.1% (NUREG/CR-4330, Volume 3, 1987). The NRC concluded that the large, dry, containments could withstand the containment pressure following severe accidents and there was no need to backfit these containments with glow plug igniters, or to inert the containment atmospheres.

A detailed comparative analysis of containment integrity for the Turkey Point Units 3 and 4 IPE indicates that the limiting pressure for containment failure is approximately 145 psig (Turkey Point Units 3 and 4 IPE, Section 4.4). Hence, a safety margin exists for containment integrity at higher hydrogen concentration levels following a design basis LOCA, without the use of a hydrogen control system.

With respect to equipment survivability, NUREG/CR-5662 states:

> "Equipment survivability depends on the specific plant design and on the containment environment during a specific accident. The large-scale Nevada test site experiments demonstrated that various types of plant equipment are capable of operating successfully when subjected to the severe thermal environments associated with large-volume hydrogen burns.
>
> The recent analytical and experimental study performed at Sandia National Laboratories showed that the simulated equipment can withstand a LOCA and single burn resulting from a 75% Metal Water Reaction in a large, dry containment. However, the multiple burn due to the operation of ignition systems could pose a serious threat to safety-related equipment located in the source compartment."

It should be noted that the Turkey Point Units 3 and 4 containments do not have igniters. This reduces the potential for multiple burns. During the TMI-2 accident, containment was not breached and damage inside containment was essentially limited to plastics and other low melting point materials such as telephone cases and the crane operator's seat (NUREG/CR-4330, Volume 3, 1987).

In summary, pressurized water reactor plants with large, dry, containments possess sufficient safety margin against containment rupture from hydrogen burn at higher hydrogen concentration levels during severe accidents or following a design basis LOCA, without using any hydrogen control system. Additionally, the NRC has determined that pressurized water reactor plants with large, dry, containments can withstand the containment pressure following severe accidents and there was no need to backfit these containments with igniters or to inert the containment atmospheres.

2.2.3.2 Impact of Hydrogen Control on Design Basis Accidents

The existing Turkey Point Units 3 and 4 Containment Combustible Gas Control System meets the requirements of 10CFR50.44 and 10CFR50, Appendix E to control the concentration of hydrogen which may be released into the reactor containment following postulated design basis accidents. The existing containment hydrogen control system is designed to ensure that the hydrogen concentration is maintained below 4.0% following a design basis LOCA. The Emergency Containment Cooling System, the Containment Spray System, and the internal containment structural design provide excellent hydrogen mixing capability inside the containment that would prevent hydrogen pocketing following a postulated design basis LOCA. These hydrogen mixing systems are not impacted by this exemption request.

The post-LOCA hydrogen generation model for Turkey Point Units 3 and 4 is described in Section 14.3.6 of the FSAR. Figure 14.3.6-1 shows the

predicted accumulation of hydrogen gas inside containment as a function of time (days) after the occurrence of a design basis LOCA. The figure shows the contribution from each source of hydrogen, as well as the total accumulation rate. Figure 14.3.6-2 shows the predicted rate of hydrogen removal by a portable hydrogen recombiner when manually initiated by the control room operators. The figure shows the hydrogen concentration reaching approximately 3.5% at about 12 days when the hydrogen recombiner is started. The hydrogen recombiner is stopped at about 35 days when the hydrogen concentration decreases to 2.7%.

Without the activation of the hydrogen recombiner, the hydrogen concentration would continue to rise following a design basis accident and eventually reach the 4%. In severe accidents, hydrogen concentration would probably exceed 4% before the hydrogen recombiner and Post-Accident Containment Vent System could be safely placed in service. For accidents in which the reactor core is not damaged, it is likely that hydrogen concentration would remain below 4%. In addition, containment failure due to hydrogen combustion is not credible, based on the results of the Turkey Point IPE study. The Turkey Point Units 3 and 4 IPE study concluded that the containment would remain intact for severe accidents, which included hydrogen burns for which no credit was taken for the hydrogen control system, as long as the containment heat removal systems (Emergency Containment Cooling and Containment Spray) remained operable. The IPE indicates that none of the accident sequences addressed for Turkey Point could realistically threaten containment due to hydrogen combustion.

There is also no potential for containment integrity to be challenged due to hydrogen pocketing based on the Turkey Point Units 3 and 4 containment internal structural design (generous vent paths), and availability of the safety-related Containment Air Mixing Systems. The results of a study for several PWR plants with large dry, containments indicated that, depending on the containment volume and fan capacity, a mixing of the total containment air volume by fans alone would take only 10 to 30 minutes for the PWRs examined (NUREG-CR-5662, Section 2.3). The time required to process one containment volume for Turkey Point Units 3 and 4 is approximately 30 minutes with two fan coolers operating.

Eliminating the requirement to install a hydrogen recombiner will reduce personnel exposure to high radiation following a design basis LOCA. Radiation doses in the hydrogen recombiner staging area could exceed 2 Rem/hr. Eliminating the requirement to activate the Post-Accident Containment Vent System will reduce radiological releases to the public.

In summary, the Containment Combustible Gas Control System is designed to maintain the hydrogen concentration level below the flammability limit during design basis accidents. Without operation of the hydrogen control system, the hydrogen concentration inside containment could be expected to rise above 4.0% following a design basis LOCA and the assumptions presently used for accident analysis. However, containment failure due to hydrogen combustion is not credible based on the results of the Turkey Point IPE. Eliminating the hydrogen control requirements for Turkey Point Units 3 and 4 will have a positive impact on the health and safety of public and plant personnel.

2.2.3.3 Impact of Hydrogen Control on Severe Accidents

For severe accidents, i.e., those beyond the design basis in which the reactor core is significantly damaged, containment hydrogen concentrations in the range of 10% over short periods of time are possible. This was demonstrated by the TMI-2 accident in 1979. The Containment Combustible Gas Control System is designed to maintain the hydrogen concentration level below 4.0% during design basis accidents that result in small amounts of hydrogen produced slowly over long periods of time, i.e., many days. For severe accidents during which containment hydrogen concentration will rapidly rise to above the 4.0% level, the present Containment Combustible Gas Control System is ineffective and potentially detrimental, and hence would provide no benefit to hydrogen concentration control and containment performance. An NRC-sponsored study (NUREG/CR-5567, 1990) corroborates this point by stating that the hydrogen control systems are designed to accommodate hydrogen accumulation for design basis events (oxidation of 5% Zircalloy surrounding the active fuel). These systems are not designed for the hydrogen generation that might accompany a severe core damage event. Consequently, the Containment Combustible Gas Control System was not credited in mitigating hydrogen in the Turkey Point Units 3 and 4 IPE. Subsequent to the TMI-2 accident, improvements in equipment, operator training, and procedures make it extremely unlikely that a severe core damaging event comparable to TMI-2 would occur at Turkey Point.

Worker actions to activate the portable hydrogen recombiner occur just outside the Reactor Containment Building boundary. To be used, the recombiner must be shipped from its storage location at the Oconee Nuclear Power Plant in South Carolina and placed on the Turkey Point Reactor Auxiliary Building roof in a designated area adjacent to the Reactor Containment Building. The recombiner must then be electrically and mechanically connected to the existing Containment Combustible Gas Control System, leak tested, and then placed in service. This involves many procedural steps and requires coordination between control room operators and other work groups, such as Electrical Maintenance, Mechanical Maintenance, Instrumentation and Control, and Health Physics. Such actions would also be detrimental to worker health and safety due to the high radiation fields that would be present outside the Reactor Containment Building during a severe accident.

Additionally, placing the recombiner in service would extend the containment boundary (with the use of the associated piping and associated mechanical connections) increasing the risk of uncontrolled/unfiltered leakage of the containment atmosphere.

As discussed previously, the usefulness of the hydrogen monitors is very limited during severe accidents. The only safety-related use of the hydrogen monitors is to alert the operators to turn on the hydrogen recombiner.

In summary, the usefulness of the existing Containment Combustible Gas Control System is limited to design basis accidents. Studies resulting from the TMI-2 accident have demonstrated that the system is ineffective during severe accidents and hence provides no benefit for these events. During severe accidents, the activation of the Post-Accident Containment Vent System could be detrimental to public health and safety due to the radiological releases involved. The activation of the backup recombiner would be detrimental to worker health and safety due to the high doses

expected during equipment installation, and the potential for unfiltered leakage during system operation.

The proposed technical specification changes do not affect the consequences of potential accidents at Turkey Point since (1) there is adequate margin in the containment design, and (2) the existing Containment Combustible Gas Control System is undersized for severe accidents, and hence provides no benefit for these events.

2.2.4 Additional Considerations

In a postulated LOCA, the Turkey Point Units 3 and 4 Emergency Operating Procedures direct the control room operators to monitor and control the hydrogen concentration inside the containment after they have carried out the steps to maintain and control the highest priority critical safety functions such as reactivity, RCS inventory, RCS pressure, and core heat removal. The key operator actions in controlling the hydrogen concentration are to place the hydrogen monitors, Post-Accident Containment Vent System, and/or the backup recombiner in operation. Placement of the Post-Accident Containment Vent System, and/or the backup recombiner in operation involve many procedural steps and require coordination between the control room operators and other work groups, such as plant Maintenance, Chemistry, and Health Physics. In design basis accidents, these procedural steps would take place days after the accident and are therefore not burdensome to the plant operators. During severe accidents, however, any actuation of the Post-Accident Containment Vent System and/or backup recombiner would have to take place within hours of the initiating event.

Removal of the existing requirements for a hydrogen control system will eliminate the need for Emergency Operating Procedure steps for hydrogen control and hence simplify the post-accident recovery strategy. While this elimination of steps will have only a small impact on public health risk, the impact on public health risk will be positive by reducing the probability of operator error during potential accidents and hence reduce the core damage frequency. Also, it will be less likely that the operators would activate either the Post-Accident Containment Vent System or the backup hydrogen recombiner during severe accidents.

In summary, the changes described in this proposed license amendments request result in a risk positive change (that is, a positive impact on the health and safety of plant workers and the general public if the exemption is granted). Elimination of the requirements for a Containment Combustible Gas Control System and, as such, the consideration of hydrogen generation within the Turkey Point Units 3 and 4 design basis, will eliminate the need for Emergency Operating Procedure steps for hydrogen control and hence simplify the EOPs, resulting in lower operator error probabilities. It will also reduce the probability of actuation of the Post-Accident Containment Vent System and/or the backup hydrogen recombiner during severe accidents.

2.3 INDUSTRY EXPERIENCE

The regulatory requirements for containment hydrogen control systems were based on knowledge that existed before the TMI-2 event in March 1979. Following TMI-2, the nuclear industry and the NRC initiated extensive analysis and testing to increase the scope of knowledge concerning hydrogen generation and hydrogen control following severe accidents. This new knowledge invalidated many of the assumptions and

methods in the regulations. Based on the new knowledge, it became clear that hydrogen control systems designed for design basis LOCA conditions were not adequate in severe accidents to maintain the hydrogen concentration below the postulated flammability limit of 4.1%. Following TMI-2, the nuclear industry performed extensive analysis and testing which indicated that for large, dry, containments, the containment would withstand the burn of large amounts of hydrogen generated in severe accidents. Therefore, the required hydrogen control systems were determined to be unnecessary for design basis LOCA conditions, and ineffective for severe accidents.

In addition, the Nuclear Regulatory Commission conducted analyses with respect to backfitting the installation of igniters to replace the hydrogen recombiners in nuclear units with large, dry, containments. The NRC determined that the requirement for igniters could not be justified for nuclear units with large, dry, containments according to the provision of 10 CFR 50.109. This was because large, dry, containments have a greater ability to accommodate the large quantity of hydrogen associated with a degraded core accident than the smaller containments. In general, the nuclear units with large, dry, containments rely exclusively on the containment structure to withstand any postulated uncontrolled burn of hydrogen gas generated in severe accidents.

2.4 CONCLUSION

The existing Containment Combustible Gas Control System is of no benefit in design basis or severe accidents. Elimination of the present requirements for the initiation of the hydrogen monitors, the Post-Accident Containment Vent System, and the backup hydrogen recombiner will result in a risk positive change. In addition, elimination of the present requirements will have a positive impact on worker health risk.

ENCLOSURE 2

NO SIGNIFICANT HAZARDS CONSIDERATIONS

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10CFR50.92. A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. A discussion of these standards as they relate to this change request follows.

1. Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   No. The Containment Combustible Gas Control System is composed of two hydrogen monitors, the Post-Accident Containment Vent System, and a leased hydrogen recombiner. Hydrogen control components are not considered to be accident initiators. Therefore, this change does not increase the probability of an accident previously evaluated.

   The Containment Combustible Gas Control System is provided to ensure that the hydrogen concentration is maintained below 4.0% so that containment integrity is not challenged following a design basis Loss Of Coolant Accident (LOCA). Existing analysis show that the hydrogen concentration will not reach 4.0% for at least 12 days after a design basis LOCA. Containment failure due to hydrogen combustion without the Post-Accident Containment Vent System and backup hydrogen recombiner is not credible based on the results of the Turkey Point Units 3 and 4 Individual Plant Examination study. Therefore, this change does not increase the consequences of accidents previously evaluated.

   Removal of the existing requirements for hydrogen control will reduce the consequences of postulated accidents by eliminating Post-Accident Containment Vent System releases, and by eliminating potential unfiltered release paths during operation of the hydrogen recombiner.

   Removal of the existing requirements for hydrogen control will also allow elimination of the Emergency Operating Procedure (EOP) steps for hydrogen control and hence simplify migration through the EOPs. This would have a positive impact on public health risk by reducing the probability of operator error during potential accidents and hence reduce the core damage frequency. In addition, approval of these amendment requests will minimize the potential for actuation of the Post-Accident Containment Vent System and/or the backup hydrogen recombiner during severe accidents. The changes described in this request result in an overall decrease in risk.

   Therefore, this change does not involve a significant increase in the probability or consequences of any accident previously evaluated.

2. Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   No. This proposed change does not change the design or configuration of the plant beyond the containment Combustible Gas Control System. Hydrogen generation following a design basis LOCA has been evaluated in accordance with regulatory requirements. Deletion of the containment Combustible Gas Control System from the technical specifications does not alter the hydrogen generation processes post-LOCA. The consideration of hydrogen generation will no longer be included in the design basis of Turkey Point Units 3 and 4. Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?

   No. The Containment Combustible Gas Control System is provided to ensure that the hydrogen concentration is maintained below 4.0% so that containment integrity is not challenged following a design basis Loss Of Coolant Accident (LOCA). Existing analysis show that the hydrogen concentration will not reach 4.0% for at least 12 days after a design basis LOCA. Containment failure due to hydrogen combustion without the Post-Accident Containment Vent System and backup hydrogen recombiner is not credible based on the results of the Turkey Point Units 3 and 4 Individual Plant Examination study. Therefore, this change does not result in a reduction in a margin of safety.

   The changes proposed in these amendment requests result in a reduction in risk. Removal of the existing requirement for a containment Combustible Gas Control System will, by eliminating the EOP steps for hydrogen control, result in lower operator error probabilities. In addition, approval of these amendment requests will minimize the potential for actuation of the Post-Accident Containment Vent System and/or the backup hydrogen recombiner during severe accidents. Therefore, this change involves an increase in safety, not a reduction in a margin of safety.

Based on the reasoning presented above, FPL has determined that the requested changes involve no significant hazards consideration.

ENCLOSURE 3

ENVIRONMENTAL CONSIDERATION

Turkey Point Units 3 and 4 has determined that the proposed technical specification (TS) changes do not result in any increase in the amount or type of effluent that may be released off site, and result in no increase in individual or cumulative occupational radiation exposure. As described above, the proposed TS amendments involve no significant hazards consideration and, as such, meets the eligibility criteria for categorical exclusion set forth in 10CFR51.22(c)(9).

ATTACHMENT 2, ENCLOSURE 4

to L-2000-198

PROPOSED MARKUP OF AFFECTED TECHNICAL SPECIFICATION PAGES

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TABLE 3.3-5 (Continued)

ACCIDENT MONITORING INSTRUMENTATION

INSTRUMENT	TOTAL NO. OF CHANNELS	MINIMUM CHANNELS OPERABLE	APPLI-CABLE MODES	ACTIONS
14. In Core Thermocouples (Core Exit Thermo-couples	4/core quadrant	2/core quadrant	1, 2, 3	31, 32
15. Containment High Range Area Radiation	2	1	1, 2, 3	34
16. Reactor Vessel Level Monitoring System	2(1)	1(1)	1, 2, 3	37, 38
17. Neutron Flux, Backup NIS (Wide Range)	2	1	1, 2, 3	31, 32
18. ~~Containment Hydrogen Monitors~~ **DELETED**	~~2~~	~~1~~	~~1, 2~~	~~35~~
19. High Range-Noble Gas Effluent Monitors				
a. Plant Vent Exhaust	1	1	ALL	34
b. Unit 3-Spent Fuel Pit Exhaust	1	1	ALL	34
c. Condenser Air Ejectors	1	1	1, 2, 3	34
d. Main Steam Lines	1	1	1, 2, 3	34
20. RWST Water Level	2	1	1, 2, 3	31, 32
21. Steam Generator Water Level (Narrow Range)	2/stm. Gen.	1/stm. Gen.	1, 2, 3	31, 32
22. Containment Isolation Valve Position Indication*	1\valve	1/valve	1, 2, 3	39

TABLE NOTATIONS

1. A channel is eight sensors in a probe. A channel is OPERABLE if a minimum of four sensors are OPERABLE.
2. Inputs to this instrument are from instrument items 3, 4, 5, and 14 of this Table.

*Applicable for containment isolation valve position indication designated as post-accident monitoring instrumentation (containment isolation valves which receive containment isolation Phase A, Phase B, or containment ventilation isolation signals).

ACTION 31 With the number of OPERABLE accident monitoring instrumentation channel(s) less than the Total Number of Channels either restore the inoperable channel(s) to OPERABLE status within 7 days, or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 32 With the number of OPERABLE accident monitoring instrumentation channels less than the Minimum Channels OPERABLE, either restore the inoperable channel(s) to OPERABLE status within 48 hours, or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 33 Close the associated block valve and open its circuit breaker.

ACTION 34 With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirements, initiate the preplanned alternate method of monitoring the appropriate parameter(s) within 72 hours, and:

1) Either restore the inoperable channel(s) to OPERABLE status within 7 days of the event, or

2) Prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within 14 days following the event outlining the action taken, the cause of the inoperability, and the plans and schedule for restoring the system to OPERABLE status

ACTION 35 ~~With one or both hydrogen monitor(s) inoperable, comply with Action Requirements of Specification 3.6.5.~~ **DELETED**

ACTION 36 With the number of OPERABLE accident monitoring instrumentation channels less than the Minimum Channels OPERABLE, either restore the inoperable channel(s) to OPERABLE status within 30 days, or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 37 With the number of OPERABLE channels one less than the Total Number of Channels, restore the system to OPERABLE status within 7 days. If repairs are not feasible without shutting down, prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within 30 days following the event outlining the action taken, the cause of the inoperability and the plans and schedule for restoring the system to OPERABLE status.

TABLE 4.3-4

ACCIDENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Containment Pressure (Wide Range)	M	R
2. Containment Pressure (Narrow Range)	M	R
3. Reactor Coolant Outlet Temperature - T_{HOT} (Wide Range)	M	R
4. Reactor Coolant Inlet Temperature - T_{COLD} (Wide Range)	M	R
5. Reactor Coolant Pressure - Wide Range	M	R
6. Pressurizer Water Level	M	R
7. Auxiliary Feedwater Flow Rate	M	R
8. Reactor Coolant System Subcooling Margin Monitor	M	R
9. PORV Position Indicator (Primary Detector)	M	R
10. PORV Block Valve Position Indicator	M	R
11. Safety Valve Position Indicator (Primary Detector)	M	R
12. Containment Water Level (Narrow Range)	M	R
13. Containment Water Level (Wide Range)	M	R
14. In Core Thermocouples (Core Exit Thermocouples)	M	R
15. Containment - High Range Area Radiation Monitor	M	R*
16. Reactor Vessel Level Monitoring System	M	R
17. Neutron Flux, Backup NIS (Wide Range)	M	R
18. ~~Containment Hydrogen Monitor~~ **DELETED**	~~M~~	~~R*~~
19. High Range - Noble gas Effluent Monitors		
a. Plant Vent Exhaust	M	R
b. Unit 3 - Spent Fuel Pit Exhaust	M	R
c. Condenser Air Ejectors	M	R
d. Main Steam Lines	M	R
20. RWST Water Level	M	R
21. Steam Generator Water Level (Narrow Range)	M	R
22. Containment Isolation Valve Position Indication	M	R

*Acceptable criteria for calibration are provided in Table II.F.1-3 of NUREG-0737.

~~CONTAINMENT SYSTEMS~~

~~3/4.6.5 COMBUSTIBLE GAS CONTROL~~

~~HYDROGEN MONITORS~~

~~LIMITING CONDITION FOR OPERATION~~

~~3.6.5 Two independent containment hydrogen monitors shall be OPERABLE.~~

~~APPLICABILITY: MODES 1 AND 2.~~

~~ACTION:~~

~~a. With one hydrogen monitor inoperable, restore the inoperable monitor to OPERABLE status within 30 days or be in at least HOT STANDBY within the next 6 hours.~~

~~b. With both hydrogen monitors inoperable, restore at least one monitor to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours.~~

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~~SURVEILLANCE REQUIREMENTS~~

~~4.6.5.1 Each hydrogen monitor shall be demonstrated OPERABLE by the performance of a CHANNEL CHECK at least once per 12 hours, an ANALOG CHANNEL OPERATIONAL TEST at least once per 92 days, and at least once each refueling interval by performing a CHANNEL CALIBRATION using sample gas containing:~~

~~a. One volume percent hydrogen, balance nitrogen, and~~

~~b. Four volume percent hydrogen, balance nitrogen.~~

~~4.6.5.2 The flow path to each hydrogen monitor shall be demonstrated OPERABLE at least once per 31 days by a system walkdown to verify that each accessible manual, power operated, or automatic valve is in its correct position and that power is available to those components related to the operability of the flowpath.~~

~~3/4.6.6 POST ACCIDENT CONTAINMENT VENT SYSTEM~~

~~LIMITING CONDITION FOR OPERATION~~

~~3.6.6 A Post Accident Containment Vent System shall be OPERABLE.~~

~~APPLICABILITY: MODES 1 and 2.~~

~~ACTION:~~

~~With the Post Accident Containment Vent System inoperable, restore the Post Accident Containment Vent System to OPERABLE status within 7 days or be in at least HOT STANDBY within 6 hours.~~

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~~SURVEILLANCE REQUIREMENTS~~

~~4.6.6 The Post Accident Containment Vent System shall be demonstrated OPERABLE:~~

~~a. At least once per 31 days by demonstrating system flow path operability via a system walkdown to verify that each accessible manual valve is in its correct position.~~

~~b. At least once per 18 months or (1) after any structural maintenance of the HEPA filter or charcoal adsorber housings, or (2) following operational exposure of filters to effluents from painting, fire, or chemical release in any ventilation zone communicating with the system, or (3) after 720 hours of system operation or (4) after replacement of a filter by:~~

~~1) A visual inspection of the system for foreign materials and gasket deterioration and verifying that the filter system satisfies the penetration and bypass leakage testing acceptance criteria of less than 1% for DOP and halogenated hydrocarbon tests conducted at a design flow rate of 55 cfm ± 10%;~~

~~2) Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample performed in accordance with ASTM D3803 – 1989 at 30 °C and 95% relative humidity, meets the methyl iodide penetration criteria of less than 10% and that any charcoal failing to meet the criteria be replaced with charcoal that meets or exceeds the stated performance requirement.~~

~~SURVEILLANCE REQUIREMENTS~~

~~c. At least once per 18 months by:~~

~~1) Verifying that the pressure drop across the combined HEPA filter and charcoal adsorber is less than 6 inches Water Gauge at a flow rate of 55 cfm ± 10%l,~~

~~2) Visual inspection of the system and operation of all valve~~

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