From: Christopher Ryder
Sent: Monday, April 30, 2007 11:46 AM
To: Albert Wong
Cc: Andy Campbell; Robert Johnson (NMSS); Sheena Whaley
Subject: Revised Descriptions of the HVAC and Electrical Systems
Attachments: Electrical System.wpd; HVAC system.wpd

Albert,

Per your request, I have revised the description of the HVAC and electrical systems to address comments from Region IV.

Currently, DOE has suggested that the transfer to the diesel generator will be automatic, but this view has changed several times in the past three years.

Comment: “I don't see anything in this operation that would require a quick restoration of power. I recommend manual diesel generator startup, warmup and loading. It is much easier on the engine and far less costly.”
Reply: I agree that the operation does not require an immediate restoration of power. I am merely stating what DOE has said. Also, auto start is not necessarily synonymous with "crash" start as is done at the power plants. At the plants, the start up of the diesel generators is based on a design basis LOCA. The diesel generators must start and come up to speed, and then have select loads sequences back onto line to meet the design basis. I have heard no information about the design basis of the GROA. I would expect the start up requirements to be must less stringent. Still, the diesel generators could b automatically started. I studied this in 1981 and gave a presentation to an ACRS subcommittee. Revision: Added some words to this effect.

Comment: Regarding the HVAC system, “I recommend a dual (parallel) filter system such that one filter at a time can be changed without shutting down the fans.”
Reply: I do not know enough about this to say how the remote filter will be configured. The preliminary design that I saw about three years ago in a public document did not have parallel trains on the remote filter. But there may not be a remote filter on the current design. The previous design was when fuel would be transferred in a dry environment. The current design, in the pool, is much cleaner. In a BWR, filter back consists of the following units:

> moisture separator
> roughing filter
> HEPA filter
> charcoal filter
> HEPA filter

The charcoal filter removes iodine, which at the plant is predominately iodine 131. This form of iodine has a high activity (half-life of 8 days). By the time the fuel reaches the GROA, it is at least five years old. Iodine 131 has decayed away; only iodine 129 remains. Iodine 129 is not a preclosure concern because of the low activity (half-life of 15.7 million years). This explains why there is no charcoal filter on the preliminary design that I saw years ago. There is also no need for the second HEPA filter that would be present to remove charcoal particles. But in the HVAC of the dry transfer facility, two HEPA filters in series were present.
Revision: From my perspective, there is no need for a remote filter, hence, I removed it from my description. The text states that there are two HEPA filters present. I did not distinguish between the HEPA filters and the prefilter.

Chris

Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 73

Mail Envelope Properties (Christopher.Ryder@nrc.gov20070430114541)

Subject: Revised Descriptions of the HVAC and Electrical Systems
Sent Date: 4/30/2007 11:45:41 AM
Received Date: 4/30/2007 11:45:41 AM
From: Christopher Ryder

Created By: Christopher.Ryder@nrc.gov

Recipients:
"Andy Campbell" <Andy.Campbell@nrc.gov>
Tracking Status: None
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Tracking Status: None
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Tracking Status: None

Post Office:

Files	**Size**	**Date & Time**
MESSAGE	2901	4/30/2007 11:45:41 AM
Electrical System.wpd	66232	
HVAC system.wpd	50994	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

System Description

From discussion with DOE during technical exchange meetings, the HVAC system will be a once through system that is operated continuously; it does not change state when radioactive material is detected. Determine what types of SSCs are typically used (automatic vs manual sequencing of loads onto a DG).

From discussions with DOE and the IEEE standard for designing such systems, a plausible electrical system can be postulated as illustrated in Figure 1. The system consists of the following components:

- offsite power lines
- diesel generator power system
- main electrical bus
- electrical loads
- battery charger
- inverter
- instrument and control (I&C) systems

Power is normally supplied from one of the offsite power lines, through the main electrical bus, to the electrical loads throughout the facility. I&C systems are powered through the battery charger that also keeps batteries charged.

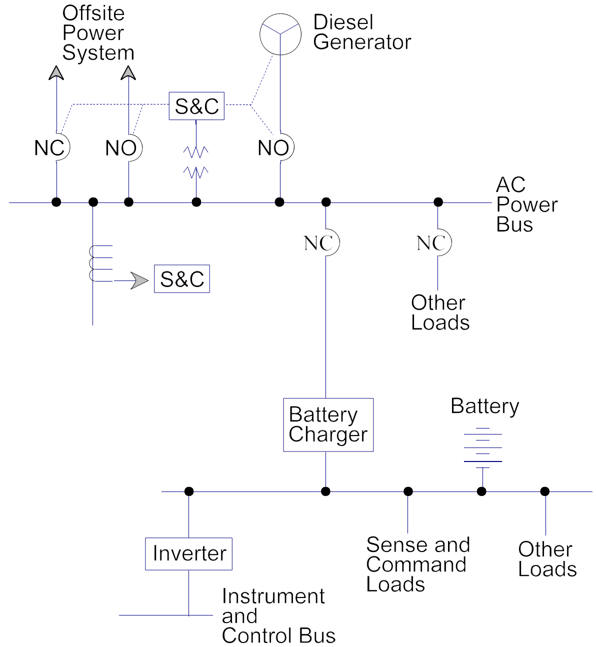

Figure 1. Simplified electrical diagram. LEGEND: NC: normally closed switch. NO: normally open switch. S&C: sense and commend.

If power is lost from one offsite line, a sense and control system closes a switch on the other offsite line. If there is still no power on the main bus, the loads are shed from the main bus. After the diesel generator is started and comes up to speed, a switch closes, connecting the diesel generator to the main electrical bus. The loads are then sequenced back on, either manually or automatically. If the diesel generator fails to supply the AC power bus, the battery remains to supply instruments and controls.

Currently, DOE has suggested that the transfer to the diesel generator will be automatically, but this view has changed several times in the past three years.

The automatic transfer does not necessarily mean that the diesel generators are started and loaded rapidly as in power plants. In the plants, the required startup and loading to reestablish cooling is established by a design basis accident analysis. In the preclosure facility, while a design basis may be necessary, specific requirements would be expected to be much less critical because the fuel is spent and at least five years old, not at full power.

General Discussion

An HVAC system can be designed in many different ways to accomplish a particular purpose. There is no standard design. Codes specify certain general configurations, but a designer has latitude when configuring ducts, fans, and dampers. One design may operate continuously regardless of the conditions in the work area. Another design may change when radioactive material become airborne in the work area. Here, the exhaust side may consists of two trains, a normal train and a standby train. The normal train functioned during normal operations. When radioactive material is detected, the normal train isolates and the supply side both. The standby train starts, maintaining the negative pressure in the primary confinement zone.

The exhaust side draws more air than the supply side delivers to maintain a slightly negative pressure in the work area, the difference in the flow being made up by leakage into the work area. The design the system so as to maintain a negative pressure when a fan trips can vary. When a fan on the exhaust side trips, either the standby fan on the exhaust may start or the supply side will trip when the exhaust side trips to maintain the negative pressure. But if the supply side trips, the exhaust side may be made to continue operating.

The motors of the fan are of two types, fixed speed and variable speed. A single speed motor is either on or off. Its speed would decrease as the load on the fans increases. Variable-speed motors are also used in HVAC systems. These motors adjust to varying loads on the fans to maintain a constant speed.

A bank of fans, instead of a single fan, may move air through either side of the HVAC system For example, a bank may consists of three fans, two of which are operating an one is in a standby mode. Each of the operating fans moves 50% of the air that is needed. If one fan trips, the standby fan come on line to maintain the necessary flow. The change-over to a standby fan may be manual or automatic.

Preclosure Facility

From previous discussions with DOE and knowledge about HVAC systems, the facility is divided into three zones. The primary confinement zone (PCZ) is the work area that can become contaminated. The secondary confinement zone includes the areas that could potentially become contaminated. The tertiary zone is the uncontaminated area. Each zone has its own HVAC system. Along the three zones is a pressure gradient, from the tertiary zone, where the pressure is highest, to the primary zone, where the pressure is lowest.

The HVAC system for the primary confinement zone will be continuously operated, regardless of whether airborne radioactive material is present or not. Figure 1 illustrates a plausible configuration of the HVAC system for the preclosure facility. The system consists of a supply side and an exhaust side. Each side consists of three fans, two that are operating and one that is a standby. Each fan has an inlet and outlet damper. Presumably, if a damper on a given fan closes while a fan is operating, the fan will trip because of low flow and high temperature.

The HEPA filters remove particulates from the airstream. In a previous design, where fuel was handled in air, a remote filter was immediately on the exhaust side of the PCZ to reduce contamination long the ducts leading to the filter bank on the exhaust side. Now fuel will be transferred in a pool, as is done is power plants. The wet transfer facility will be much inherently much cleaner. Therefore, for the conceptual design, there is no remote filter. The train it the filter bank of the exhaust side had two HEPA filters in series. From public discussions with

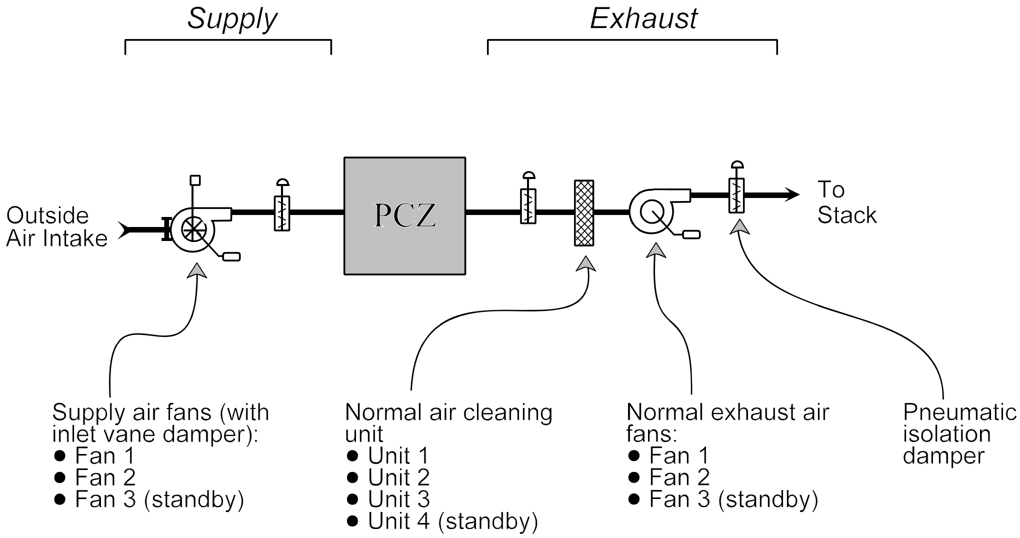

Figure 1. HVAC System

DOE, two HEPA filters are in series. The number of trains is unknown at this time.

Suppositions

- The system operates continuously.
- If one fan in a fan bank trips, its dampers isolate, and the standby fan automatically comes on line.
- Two exhaust fans must be operating for the supply side to operate.