ATTACHMENT 1
Additional Information Supporting the Request for License Amendment Regarding Shutdown Cooling System Isolation Instrumentation

The NRC provided Exelon Generation Company, LLC (EGC) with the following draft Request for Additional Information (RAI) associated with the Dresden Nuclear Power Station (DNPS) Units 2 and 3 amendment request for revision of Technical Specifications (TS) 3.3.6.1, "Primary Containment Isolation Instrumentation," Table 3.3.6.1-1, "Primary Containment Isolation Instrumentation," Function 6.a, "Shutdown Cooling System Isolation, Recirculation Line Water Temperature – High," to enable implementation of a modification that replaces the temperature-based isolation instrumentation with reactor pressure-based isolation instrumentation. Based on a telephone conference call between the NRC and EGC personnel, it was agreed that EGC would provide the requested information in the draft RAI. The draft RAI and the requested information are provided below.

NRC Requested Information:

1. *In a letter dated October 6, 2010, Clarification 4 indicates that during a total loss of shutdown cooling (SDC), various alternate core cooling (ACC) methods are available for decay heat removal (DHR) and reactor coolant system (RCS) inventory control. The methods indicated included the condensate/feed and main steam (MS) system, the reactor water cleanup (RWCU) system, control rod drive (CRD) system and the emergency core cooling systems (ECCS) [including the isolation condenser, high pressure coolant injection (HPCI), MS relief valves with the suppression pool cooling mode of the low pressure coolant injection system (LPCI)].*

   Discuss use of the above ACC methods for DHR and RCS inventory control during a total loss of SDC under the following plant conditions:

   (1) The reactor pressure vessel (RPV) head is tensioned;
   (2) The RPV is detensioned; and
   (3) The RV head is removed and the MS line plugs are put in place.

   The discussion should address the availability and adequacy of operating procedures to provide clear guidance to the operator for applying the methods.

2. *Provide a discussion of plant administration controls, programs or procedures which ensure that the equipment (pumps, valves, and instrumentation) needed for the ACC methods is operable.*

EGC Response:

NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States," contains the results of the NRC Staff's evaluation of shutdown and low-power operations at commercial nuclear power plants in the United States. The report describes studies conducted by the NRC as well as evaluations of a number of technical issues associated with shutdown and low-power operations. One area addressed is the issue of loss of Residual Heat Removal (RHR) capability (see Section 6.6 of Reference 1). This section states that if RHR is lost in a BWR, "operators can usually significantly extend the time available for recovery of the system by adding water to the core from several sources, including condensate system, low-pressure coolant injection (LPCI) system, core spray (CS) system, and control rod drive (CRD) system." This section of Reference 1 goes on to state that "[i]n the event that RHR cannot be recovered in the short term, alternate RHR methods covered by procedures

are normally available. The particular method selected will depend on the plant configuration and the decay heat load." The three plant configurations evaluated in NUREG-1449 include when the reactor vessel head is tensioned, the reactor vessel head is detensioned, and the reactor vessel head is removed and the main steamline plugs are in place.

EGC utilizes several procedures to support the decay heat removal function at DNPS Units 2 and 3. DNPS procedure OU-DR-104, "Shutdown Safety Management Program," (Reference 2) defines the key safety functions for DNPS and applies to the planning, scheduling, and execution of work on a unit already in or expected to be in a shutdown mode of operation. This is the site specific procedure that implements the corporate shutdown safety management program.

DNPS procedure DOA 1000-01, "Residual Heat Removal Alternatives," (Reference 3) provides the alternatives available to shutdown a DNPS unit and maintain the reactor in cold or hot shutdown condition based on the availability of specific systems and reactor temperature and pressure. In addition, DNPS procedure DOP 1000-07, "Alternate Shutdown Cooling," (Reference 4) provides an alternate means to remove decay heat from the Reactor when the SDC or support systems are unavailable and other means of maintaining reactor coolant temperature below 212°F are inadequate.

NUREG-1449 states in Section 6.6 that "[i]f the RV head is tensioned, the reactor pressure vessel (RPV) is first allowed to pressurize and then steam is dumped to the suppression pool via a safety-relief valve (SRV), and makeup water is provided by one of the water sources listed above." Reference 3 provides actions to be taken in the event that SDC is isolated. Step D.5.b addresses the use of the Main Steam Turbine Bypass valves to remove heat by releasing steam to the condenser and maintaining reactor water level using Feedwater and Condensate Systems. This procedure also provides guidance (i.e., steps D.5 and D.6 of Reference 3) on the use of Reactor Water Cleanup (RWCU) System, CRD System, Main Steamline Drain Valves, and use of Unit House Loads in addition to use of other systems such as the Isolation Condenser System, High Pressure Coolant Injection (HPCI) System and the Electromagnetic Relief Valves (ERVs). The ERVs at DNPS serve the same function as the SRVs when it comes to RPV depressurization (i.e., they dump steam from the RPV to the torus). If these methods do not maintain coolant temperature below 212°F then the operator is directed to perform procedure DOP 1000-07 (Reference 4).

As described in Reference 1, when the reactor "vessel head is detensioned, decay heat must be removed without the RPV pressurized." DNPS procedure DOA 1000-01 again provides the operator with alternatives available to shutdown the unit based on the availability of specific systems and the reactor pressure and temperature. As stated in Section F.2 of Reference 3, these include Main Turbine Bypass Valves, raising unit house load demands, RWCU system for feed and bleed, raising CRD system cooling water flow rate, isolation condenser system, HPCI system, and opening ERVs.

Reference 1 also describes the alternate RHR methods available for the condition where "the RPV head is removed and main steamline plugs are put in place." Reference 3, Section D.7 states that "in Mode 5 with the Reactor Cavity flooded, then use one or more of the following Decay Heat removal alternatives as directed by the Unit Supervisor to control reactor water temperature." These alternatives include the RWCU system, cross

cooling from the Fuel Pool Cooling or SDC in the Fuel Pool Cooling Mode, and realign SDC in Fuel Pool Cooling Mode back to the Reactor Cavity.

As stated above, Reference 2 defines the key safety functions at DNPS. One of these functions is Decay Heat Removal. Section 4.5.1 provides guidelines for maintaining the reactor decay heat removal key safety function. This section goes on to state that "[c]ontingency plans should be in place if activities that potentially impact decay heat removal systems must be scheduled during periods of Short Time to boil or reduced inventory." This procedure identifies the primary and alternate sources of shutdown cooling for DNPS. These sources are consistent with the guidance provided in References 3 and 4. Reference 2 drives the station to ensure that if the primary source of SDC is not available for a given plant condition, then an alternate source is maintained available to ensure shutdown safety. Finally, Section 4.5.1.6 of Reference 2 requires that at the beginning of each shift, when applicable, operators are designated and briefed to restore decay heat removal equipment. The briefing includes the procedures and recovery actions, current conditions (i.e., time to boil, core uncovery time, and available equipment), prioritizing the available alternate cooling methods to be employed for the current conditions, and actions needed to restore secondary containment if breached.

The above guidance is currently provided in plant procedures and the operators are trained in the use of these procedures. These procedures have been in place for an extended period of time and they have been used as necessary during shutdown of DNPS Units 2 and 3.

In summary, DNPS maintains procedural controls during outages to maintain a minimum set of decay heat removal components with alternate methods covered by procedures and the operators are trained to use those alternate sources to cool the core including condensate system, LPCI system, CS system, and CRD system.

References:

1. NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States," dated September 1993

2. Procedure OU-DR-104, "Shutdown Safety Management Program," Revision 11

3. Procedure DOA 1000-01, "Residual Heat removal Alternatives," Revision 28

4. Procedure DOP 1000-07, "Alternative Shutdown Cooling," Revision 01