NEI 99-02 FAQ 14-03
ANO Scram March 31, 2013

Plant:	Arkansas Nuclear One Unit 2 (ANO-2)	
Date of Event:	March 31, 2013	
Submittal Date:	March 20, 2014	
Licensee Contact:	Stephenie Pyle	Tel/email: 479-858-4704 / spyle@entergy.com
NRC Contact:	Matt Young	Tel/email: 479-858-3113 / matt.young@nrc.gov

Performance Indicator:

IE04 - Unplanned Scrams with Complications (USwC)

Site-Specific FAQ (see Appendix D)? Yes

FAQ to become effective: October 30, 2014

Question Section

NEI 99-02 Guidance needing interpretation (include page and line citation):

Pg H-4 Lines 27, 28, 29

> Since all PWR designs have an emergency feedwater system that operates if necessary, the availability of the normal or main feedwater system as a backup in emergency situations can be important for managing risk following a reactor scram.

Pg H-5 Lines 3, 4, 5

> Condenser vacuum, cooling water, and steam pressure values should be evaluated based on the requirements to operate the pumps and may be lower than normal if procedures allow pump operation at that lower value.

Event or circumstances requiring guidance interpretation:

ANO-2 Loss of a Condenser Vacuum due to Transfer to Startup Transformer #2 (SU2)

In determining if a scram is complicated/uncomplicated, the guidance asks "Was **main** feedwater unavailable or not recoverable using approved plant procedures during the scram?" *(emphasis added)* The question fails to include the phrase “normal or” as stated in H-4 above. The intent is to determine if a backup feedwater source is available should Emergency Feedwater (EFW) fail.

The NEI 99-02 guidance uses the term Auxiliary Feedwater (AFW) interchangeably with EFW. ANO-2 has two EFW pumps and has installed a low power feedwater system referred to as AFW. The ANO AFW pump (2P-75) and its connections to the EFW and the main feedwater (MFW) headers has called into question whether it is a "normal or main Feedwater system as a backup in emergency situations" and an “electric-driven main feedwater pump”.

NEI 99-02 FAQ 14-03
ANO Scram March 31, 2013

Beginning March 31, 2013, ANO-2 has experienced the loss of condenser vacuum due to the transfer of the offsite power sources to Startup Transformer #2 (SU2) on two separate occasions. Since SU2 is shared between the two units at ANO, SU2 power feed to 4160V switchgear 2A-2 breaker and SU2 power feed to both 6900V switchgear 2H-1 and 2H-2 are maintained in pull-to-lock per procedure OP-2107.001, Electrical System Operation (normal configuration). This avoids a challenge to the millstone relay setpoints should both ANO units transfer to SU2 simultaneously. In both events SU2 automatically powered 4160 V switchgear 2A-1 successfully, which in turn provided offsite power to safety bus 2A-3. Switchgear 2A-1 remained energized throughout the events.

ANO-2 has two offsite power sources: SU2 and Startup Transformer #3 (SU3). When available (i.e., not removed from service for maintenance, testing, or grid conditions), SU3 is the preferred source of offsite power following a reactor trip. This is because SU3 is not shared between the two ANO units and, therefore, no load shedding is required for transfer to SU3. A reactor trip with SU3 available will automatically result in MFW being reduced to a single MFW pump (both MFW pumps are high capacity steam-driven pumps), which is driven to minimum speed and respective valves driven to minimum positions (referred to a reactor trip override or RTO). The MFW system is subsequently manually secured and the electric-driven AFW pump placed in service to maintain hot standby conditions or to support plant cooldown. When AFW is available, all plant startups and shutdowns are performed with AFW as the preferred source. The AFW pump is capable of supplying sufficient feedwater flow to remove decay heat up through ~4% reactor power. The AFW pump is tested quarterly in accordance with Supplement 8 of procedure OP-2106.006, Emergency Feedwater System Operations.

When SU3 is unavailable, switchgear 2A-1 loads are transferred to SU2 as described above. However, the two circulating water pumps necessary to maintain condenser vacuum are powered from 2H-1 and 2H-2, which are not automatically transferred to SU2. SU2 continues to supply power to vital buses and some non-vital equipment, although the AFW pump is also initially load-shed if in operation.

By design and as discussed previously, unavailability or a lockout of SU3 results in the loss of non-vital circulating water pumps and the subsequent loss of condenser vacuum. In relation to the aforementioned ANO events, the loss of condenser vacuum initially results in the loss of MFW pump (high exhaust pressure). Procedures provide the necessary instructions to defeat the load shed relay for the AFW pump if EFW is lost or to support plant cooldown as needed. In addition, procedures provide the necessary instructions to restart the MFW pump without vacuum if both EFW and AFW become unavailable. Either of these backup options to EFW can be accomplished within approximately 30 minutes and prior to Steam Generator dry-out (reference NEI 99-02, H1.5). During the subject ANO events, no equipment malfunctions occurred that would have prevented at least one of the backup options from being utilized if needed. The AFW pump can be supplied directly from the Condensate Storage Tanks, does not rely on condenser vacuum or portions of the MFW system, and is the normal and preferred feedwater source to support plant cooldown, heatup, hot standby conditions, and startup (Emergency Operating Procedure (EOP) OP-2202.002, Reactor Trip Recovery, Step 12, among all the relevant EOPs, Abnormal Operating Procedures (AOPs), and Normal Operating procedures, place 2P-75 pump in service as the preferred source). All necessary features which support operation of 2P-75 remained available.

> Applicable procedure steps from reactor trip through completion of restarting a MFW pump without condenser vacuum were reviewed and qualitatively timed. The timing was reviewed by Operations personnel including SRO's responsible for simulator training. GE input was obtained which qualitatively confirmed MFW pump capability to operate with no condenser vacuum for several hours. ANO-2 Reactor Coolant System parameters were stabilized in the subject scram event in less than 30 minutes, upon the establishment of natural circulation cooling. Plant stabilization via natural circulation cooling would not be delayed if MFW pump restart had been required.

If licensee and NRC resident/region do not agree on the facts and circumstances, explain:

> With respect to feedwater sources, Entergy has determined the scram to be uncomplicated because at least one or more "normal or main" feedwater sources remained available as backup to the EFW system, as designed. The aforementioned timing and flow path through relevant procedures was provided to the ANO NRC Resident inspector. In addition, GE provided information, based on engineering judgment, regarding the operation of the MFW pump under a loss of vacuum condition. Based on the information provided, the ANO NRC Resident Inspectors and associated NRC Regional personnel have verbally concurred that a MFW pump could likely have been recovered within 30 minutes and, therefore, the subject scrams should be considered uncomplicated.

Potentially relevant FAQs:

FAQ 481 (10-02) significantly revised Section 2.1 of NEI 99-02 Rev 7 on August 31, 2013.

FAQ 467 response: "availability of feedwater beyond 30 minutes and whether consideration of the scram response time window remains an appropriate marker for judging a complication to recovery from an unplanned scram"

5
Response Section

Proposed Resolution of FAQ:

Due to the plant design of ANO-2, the response to the guidance question:

> "Was main feedwater unavailable or not recoverable using approved plant procedures during the scram?"

Should be "NO" provided that the MFW and/or AFW pump was available for use within an estimated 30 minutes in both events.

If appropriate, provide proposed rewording of guidance for inclusion in next revision:

Because this FAQ is site-specific, no wording changes are proposed with regard to NEI 99-02. This FAQ concludes that the ANO-2 Auxiliary Feedwater pump provides an appropriate electric-driven backup feedwater capability to the ANO-2 safety-related Emergency Feedwater system.

PRA update required to implement this FAQ? No

MSPI Basis Document update required to implement this FAQ? No

NRC Response

The NRC staff used the following reference from NEI 99-02 during the review of this FAQ:

Pg H-4 Lines 27, 28, 29

"Since all PWR designs have an emergency feedwater system that operates if necessary, the availability of the normal or main feedwater system as a backup in emergency situations can be important for managing risk following a reactor scram."

For this event, ANO proposes that backup to EFW could have been provided in two ways: (1) using AFW, or (2) restarting MFW without condenser vacuum. The staff's review was focused on the licensee's ability to recover MFW, since NEI 99-02 highlights the importance of having normal or main feedwater available as a backup to EFW in emergency situations. NEI 99-02 does not discuss the applicability of AFW as a backup to EFW under the Unplanned Scrams with Complications PI.

The staff reviewed the licensee's procedures for restarting MFW without condenser vacuum and agrees that MFW could likely have been recovered within 30 minutes. The staff also recognizes that the Reactor Coolant System parameters were stabilized in less than 30 minutes, and that the MFW pump could operate without condenser vacuum for several hours, according to the information provided in this FAQ. The staff concludes that this event does not count in the Unplanned Scram with Complications PI.