

Tennessee Valley Authority

SECONDARY WATER CHEMISTRY PROGRAM

SEQUOYAH AND WATTS BAR NUCLEAR PLANTS

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Scope

The Secondary Water Chemistry Program for the Sequoyah and Watts Bar Nuclear Plants consists of the following.

1. System metal corrosion will be controlled by feeding all volatile chemicals to the secondary systems for minimizing dissolved oxygen and maintaining an alkaline pH in the feedwater to each steam generator. All volatile treatment will also be used as required for wet layup of secondary systems during periods of unit shutdown.
2. Impurity ingress into the secondary systems will be controlled by the use of condensate polishing and steam generator blowdown systems.
3. A sampling and analyses program will be established and maintained for monitoring the blowdown from each steam generator. Several concentration levels for each parameter have been established with specific unit operational action required in the event a concentration level is exceeded.

All Volatile Treatment (AVT)

1. A chemical feed system has been provided to feed both a pH control chemical and dissolved oxygen control chemical. Feed points are provided at the inlet to the condensate booster pumps and at the inlet to each steam generator. The latter feed points are provided to feed chemicals to each steam generator for wet layup chemistry control but may be used as required to maintain chemistry during power operations.
2. Laboratory analyses and continuous inline monitors located at various points in the secondary systems will be used to monitor the AVT program. While no control parameters have been established, the following analyses of unit feedwater will be performed in order to maintain the listed specifications as close to the indicated limits as possible during power operation.

<u>Parameter</u>	<u>Specification</u>	<u>Minimum Manual Sampling Frequency</u>
Dissolved oxygen	5 ppb	1/72 hrs*
N ₂ H ₄ residual	15 ppb	1/72 hrs*
pH	8.8 to 9.2	1/72 hrs*
Copper	2.0 ppb	1/week

*These parameters are also capable of being monitored by inline instrumentation.

Control of Impurity Ingress into Secondary Systems

1. The two principle modes of impurity removal from secondary systems (the condensate polishing system and the steam generator blowdown system) are capable of variable operation. The condensate polishing system may be operated at full flow from the unit hotwells, be completely bypassed, or be partially bypassed. Steam generator blowdown flow is variable. Operating conditions for each will be established as necessary to maintain steam generator blowdown chemistry during power operation and to bring the blowdown chemistry within power operation limits during startup.
2. When in service, the effluent from the condensate polishing system will also be monitored to ensure that steam generator blowdown chemistry is maintained. The primary parameters monitored are cation conductivity and differential pressure. Each parameter has the capability of being monitored by inline instrumentation.

Steam Generator Blowdown Chemistry Control

1. The steam generator blowdown chemistry should be brought within normal limits during unit startup and prior to reaching power operation, i.e., MW₁.
2. The following table specifies the steam generator blowdown chemistry parameters to be monitored, the normal operating limits, recommended action to be taken when limits are exceeded, and the frequency for laboratory analyses of each parameter.

Steam Generator Blowdown Chemistry

Parameter ⁽¹⁾	Specification Limits				Manual Sampling Frequency ⁽⁴⁾
	Normal Operating Limit	Action Level 1	Action Level 2	Action Level 3	
Cation conductivity, umhos/cm	≤ 2.0	> 2.0 ≤ 4.0	> 4.0 ≤ 7.0	≥ 7.0	1/72 hrs ⁽³⁾
Sodium, ppb	≤ 50	-	> 50 ≤ 200	≥ 200	1/72 hrs ⁽²⁾
Chloride, ppb	≤ 75	-	> 75 ≤ 300	≥ 300	1/72 hrs
pH ⁽²⁾	8.5-9.2	-	-	-	1/72 hrs ⁽³⁾

Action Level 1. Recommended action is to identify and eliminate the problem source, set steam generator blowdown to maximum flow until specification is within limits, and to reduce power to 30 percent if out-of-limit condition is not corrected within 8 hours from detection of the out-of-limit condition. Full power should not be restored until the parameter is returned to within normal limits.

Action Level 2. Recommended action is immediate power reduction to 30 percent and steam generator blowdown set to maximum flow until specification is within normal limits. Unit brought to at least standby if out-of-limit condition is not corrected within 24 hours from detection of out-of-limit condition.

Action Level 3. Recommended action is immediate reduction in power started with the unit placed in hot standby until the out-of-limit condition is reduced to normal limits.

- (1) Parameters do not include radioactivity analyses. These requirements are incorporated in each plant's technical specifications.
- (2) pH is not a control parameter but is used as an indicator of potential out-of-limit condition.
- (3) Cation conductivity, sodium, and pH are capable of being monitored by inline instrumentation.
- (4) Laboratory analyses should be performed using procedures specified in ASTM or Standard Methods for Analysis of Water and Wastewater or by methods demonstrated to be equivalent to those listed in the above reference.

Feedwater Chemistry Control

1. The following table specifies the feedwater chemistry parameters to be monitored, the normal operating limits, recommended action to be taken when limits are exceeded, and the frequency for laboratory analyses of each parameter.

Feedwater Chemistry

<u>Parameter</u> ⁽¹⁾	<u>Specification Limits</u>			<u>Manual Sampling Frequency</u> ⁽³⁾
	<u>Normal Operating Limit</u>	<u>Action Level 1</u>	<u>Action Level 2</u>	
Cation conductivity, ⁽²⁾ umhos/cm	≤ 2.0	>2.0 ≤ 7.0	> 7	Daily
pH ⁽²⁾	8.6-9.2	8.5-8.6 9.2-9.4	≤ 8.5 > 9.4	Daily

Action Level 1. Recommended action is to identify and eliminate the problem source and to reduce power to 30 percent if out-of-limit condition is not corrected within two weeks from detection of out-of-limit condition. Full power should not be restored until the parameter is returned to within normal limits.

Action Level 2. Recommended action is immediate power reduction started within two hours with the unit placed in hot standby until the out-of-limit condition is reduced to normal limits.

- (1) Parameters do not include radioactivity analyses. These requirements are incorporated in each plant's technical specifications.
- (2) Cation conductivity and pH are capable of being monitored by inline instrumentation.
- (3) Laboratory analyses should be performed using procedures specified in ASTM or Standard Methods for Analysis of Water and Wastewater or by methods