Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

September 26, 2006

Mr. James McIndoe, Chief
Water Division
Alabama Department of Environmental
Management
1400 Coliseum Boulevard
Montgomery, Alabama 36130-2059

Dear Mr. McIndoe:

TENNESSEE VALLEY AUTHORITY (TVA) - BROWNS FERRY NUCLEAR PLANT (BFN) - NPDES PERMIT NO. AL0022080 - PHASE II 316(b) RULE FOR EXISTING FACILITIES - PROPOSAL FOR INFORMATION COLLECTION - REVISION TO REFLECT REVISED MONITORING SCHEDULE AND ADDITIONAL MEASURES TO BE EVALUATED IN THE COMPREHENSIVE DEMONSTRATION STUDY (CDS)

Pursuant to 40 CFR § 125.95(b)(1) of the Phase II rule for Cooling Water Intake Structures (CWIS) at Existing Facilities, TVA is submitting for your review this Proposal for Information Collection (PIC) for BFN. The rule, published in the Federal Register on July 9, 2004, requires the PIC to be submitted prior to start of information collection activities, but allows facilities to initiate such activities prior to receiving comment from the permitting agency. *See* 69 Fed. Reg. 41575, p. 41687, (July 9, 2004).

BFN is a three unit nuclear plant, but only Units 2 and 3 are currently in service. TVA is undergoing efforts to return Unit 1 to service by spring of 2007. Part of this effort includes the return to service of the three condenser cooling water (CCW) pumps associated with Unit 1. As part of NEPA commitments associated with the return to service of Unit 1, impingement data associated with the operation of Units 2 & 3 have been collected as recently as 2002 and 2004. Therefore, in order to assess the normal and routine operations of the BFN CWIS for three unit operations, further impingement data collection has been deferred until all CCW pumps are in service. The current project schedule anticipates that these pumps will begin operation in early 2007, several months in advance of the full unit operation.

The preamble to the rule encourages the Director of the permitting agency to provide comments expeditiously (i.e., within 60 days) so that the permit applicant can make responsive modifications to its information gathering activities. *See* 69 Fed. Reg. 41575, p. 41635, (July 9, 2004). Your expeditious review of the PIC is appreciated so that we are poised to initiate data collection as soon as the Unit 1 CCW pumps are returned to service. We respectfully request ADEM to promptly provide its comments on this PIC and suggest that your review first focus on that portion of the PIC that addresses impingement sampling (located under **§125.95(b)(1)(iv)** below).

TVA plans to collect weekly impingement mortality samples for a minimum period of one year. However, because the Unit 1 intake system will be integral to the near future and continued operation of BFN, a meaningful impingement mortality assessment cannot be performed until after these pumps are put into service. As noted above, the expected date for return to service for these pumps is less than a year from the January 7, 2008, deadline for submittal of the CDS.

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As such, the BFN CDS submittal will have less than a year's worth of impingement data for three unit operations. However, to ensure an adequate assessment, TVA will include a schedule for additional monitoring and updates based on these data as part of the CDS. The schedule will provide for at least one full year of monitoring after the unit 1 intake pumps are returned to service. A longer monitoring period may be proposed after evaluating the costs of collecting additional data versus the greater uncertainties introduced by the absence of such data.

The following sections address the requirements for the PIC as spelled out in the Phase II rule. Several of the items below refer to components of the CDS that are due at a future date.

The preamble to the Phase II rule recognizes that collection and analysis of information is an iterative process and plans for information gathering may change as information is gathered and evaluated and new data needs are identified. Accordingly, TVA will periodically review the PIC in light of new information as it becomes available and provide updates as necessary.

**§125.95(b)(1)(i): A description of the proposed and/or implemented technologies, operational measures, and/or restoration measures to be evaluated in the [Comprehensive Demonstration] Study [to be provided later]:**

TVA will assess the current impingement mortality levels at BFN and determine the appropriate baseline in order to evaluate the status of compliance with EPA's national performance standards. The performance standards for impingement mortality (IM) require a reduction of 80-95 percent from the calculation baseline. Comparison of the current impingement mortality to the worst case baseline will provide an indication of the effectiveness of the following technologies, operational measures, and intake features already in use at BFN:

- Submerged plant intake and traveling screens (see drawings numbered 0-31E201 and 0-H58239-1 that were attached with original PIC submitted February 24, 2006.)
- Concrete skimmer wall at inlet to CCW intake channel (see drawing number 0-31N410-2 that was attached with original PIC submitted February 24, 2006)
- The current traveling screen and fish return system - assess to determine reduce net liability and possible existing compliance with the performance standard
- Other site-specific characteristics that may reduce IM impacts

TVA will be investigating the calculation shoreline IM baseline in addition to the "as built" IM calculation baseline in order to determine appropriate credits (if any). The relationship of the current IM to the national performance standard (and if appropriate an analysis of the monetary benefits to be derived from further mitigation relative to the standard) will impact the measures to be evaluated. TVA is also conducting and following research regarding the application of additional existing, new and emerging technologies, and will conduct preliminary evaluations of the following technologies or operations for BFN as appropriate for compliance with the rule.

Impingement Standard Measures

Replacement or modification of existing traveling screens with fish handling and return systems - This option entails replacing or retrofitting existing traveling water screens with "fish-friendly" designs which incorporate features that allow fish to be continuously removed from the screens and returned to the environment. One common type is the Geiger Screen which utilizes water-

filled buckets incorporated into the traveling screens which collect impinged organisms and lift them to a return system that is designed to transfer them back to the source waterbody. The Geiger screens/systems are being closely evaluated for both for debris management and 316(b) compliance for BFN. Published and ongoing studies have shown these systems/screens to meet the national performance standard for impingement. As such, should BFN formally decide to install Geiger screens (or those with equivalent performance), baseline studies would be halted and the CDS with an appropriate Technology Installation and Operation Plan (TIOP) would be provided instead.

- Fish avoidance technologies - These incorporate various behavioral deterrent features such as strobe lights, sound, or air bubbles. These systems have been researched for years but to date has very limited "in-service" applications. Currently available systems typically target specific species, and ages of fish so that their implementation has been limited as a result. TVA is involved in further research and testing of these types of systems under the sponsorship of the Electric Power Research Institute (EPRI).

- Barrier Nets – These are woven nets which could be placed in front of the Cooling Water Intake System (CWIS) to prevent entrance into the immediate area of the CWIS. These are an option where debris loading is relatively light since they are subject to damage and/or ineffectiveness by floating debris or heavy current. The size of the mesh is based upon the species present in the source water body and must be small enough to prevent fish from passing through the net or becoming gill-netted. Effectiveness evaluations are underway in areas of the country and this technology is being monitored further by TVA and the electric power industry. Note that there is ongoing research regarding rigid 3/8 inch mesh "nets" (screen panels) which may resist some debris loadings and perhaps reduce calculated thru-screen velocity to 0.5 fps or less.

- Operational modifications - this option involves implementing operational changes which might include changes to the current mode of rotation and/or timing of screen travel, utilizing planned plant outages or providing for intake flow reductions. Intake flow reductions would likely be used as a last resort where all other options are not effective or economically feasible.

- Restoration projects - restoration could include fish stocking as a means of replacing impinged fish (either with in-kind or out-of-kind species), or habitat improvement or water quality improvements which result in increased production of fish or shellfish.

**§125.95(b)(1)(ii): A list and description of any historical studies characterizing impingement mortality and entrainment and/or the physical and biological conditions in the vicinity of the cooling water intake structures and their relevance to this [Comprehensive Demonstration] Study...:**

TVA has conducted numerous studies both characterizing impingement mortality and the physical and biological conditions in the vicinity of the CWIS. More recently, in advance of the Unit 1 restart, impingement data were collected between 2002 and 2004 for comparison to historical data and determined that no significant impacts have resulted from the CWIS operation. However, TVA believes it prudent to collect at least one additional year of impingement and IM data after the Unit 1 CCW pumps become operational in order to reconfirm and verify the three unit operation impingement rates for BFN.

At the conclusion of this data gathering effort, TVA will evaluate this latest year's data in conjunction with historical data to determine whether the current "as-built" impingement mortality, as well as calculation shoreline impingement mortality, can be sufficiently characterized. This evaluation will be presented and/or discussed with ADEM at that point.

The following reports characterize the impingement and entrainment as well as the physical/biological conditions in the vicinity of the CWIS that historically occurred at BFN:

Baxter, D. S. and D. R. Lowery. 2005. Biological Monitoring of the Tennessee River near Browns Ferry Nuclear Plant Discharge 2004. Aquatic Monitoring and Management, Knoxville, TN. 27pp.

Dycus, D.L., Dennis Meinert and Tyler Baker. 1999. Aquatic ecological health determinations for TVA reservoirs, 1998, an informal summary of 1998 vital signs monitoring results and ecological health determination methods. Tennessee Valley Authority; Water Management, Chattanooga, Tennessee.

Dycus, D.L. 1995. Aquatic ecological health determinations for TVA reservoirs, 1994, an informal summary of 1994 vital signs monitoring results and ecological health determination methods. Tennessee Valley Authority; Water Management, Chattanooga, Tennessee.

Dycus, D.L. and Dennis Meinert. 1995. Aquatic ecological health determinations for TVA reservoirs, 1994, an informal summary of 1994 vital signs monitoring results and ecological health determination methods. Tennessee Valley Authority; Water Management, Chattanooga, Tennessee.

Biological Effects of Intake Browns Ferry Nuclear Plant Volume 1: Summary of the Evaluation of the Browns Ferry Nuclear Plant Intake Structure. 1978. TVA Volume 1:

Biological Effects of Intake Browns Ferry Nuclear Plant: Volume 3: Evaluation of Plankton Entrainment by the Intake of Browns Ferry Nuclear Plant. 1978. Division of Environmental Planning; Water Quality & Ecology Volume 3:

Biological Effects of Intake Browns Ferry Nuclear Plant Volume 4: Effects of the Browns Ferry Nuclear Plant Cooling Water Intake on the Fish Populations of Wheeler Reservoir. 1978. FFWD, Fisheries and Waterfowl Resources Branch Volume 4:

Fish Entrainment at Browns Ferry Nuclear Plant, Wheeler Reservoir, Alabama, for the Year 1978. Buchanan, JP Schneider, RW & Scott, EM. 1979. TVA; Fisheries and Aquatic Ecology Branch

Fish Entrainment and Impingement at Browns Ferry Nuclear Plant, Wheeler Reservoir, Alabama, for the Years 1978 and 1979. Buchanan, JP & Barr, WC. 1980. TVA; Fisheries and Aquatic Ecology Branch March: (Supplement to: Effects of the Browns Ferry Nuclear Plant Cooling Water Intake on the Fish Populations of Wheeler Reservoir, Vol. 4, of Biological Effects of Intake BFNP, Jan. 1978

Assessment of Fish Standing Stocks in Wheeler Reservoir from Cove Rotenone Samples in 1981 and 1982 with Historical Data Comparison. Buchanan, JP. 1984. TVA; Office of Natural Resources and Economic Development TVA/ONR/WRF-84/2:

Assessment of Fish Standing Stocks in Wheeler Reservoir from Cove Rotenone Samples in 1983 and 1984 with Historical Data Comparison. Buchanan, JP. 1985. TVA; Office of Natural Resources and Economic Development TVA/ONRED/WRF-85/2:37.Thermal Variance Monitoring for Browns Ferry Nuclear Plant, Wheeler Reservoir, 1987-1989. Buchanan, JP. 1990. TVA; Aquatic Biology Department July:

Thermal Variance Monitoring for Browns Ferry Nuclear Plant, Wheeler Reservoir, 1990-1991. Lowery, DR & Poppe, WL. 1992. TVA; Aquatic Biology Department August:

Browns Ferry Nuclear Plant Thermal Variance Monitoring Program Assessment of Fish Standing Stock in Wheeler Reservoir from 1993 and 1994 Cove Rotenone Data. Kay, LK. 1995. TVA; Water Resources; Environmental Compliance

Browns Ferry Nuclear Plant Fish Pump Study. Ray, SS & Tomljanovich, DA. 1979. TVA; Office of Power PRS 45:

Water Quality and Biological Conditions in Wheeler Reservoir before Operation of Browns Ferry Nuclear Plant - 1968-1973. TVA. 1974. TVA; Division of Environmental Planning M-WQ-74-1-BF1:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant (Unit 1) August 17, 1973 - February 17, 1974. TVA. 1974. TVA; Division of Environmental Engineering M-WQ-74-2-BF2:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant (Unit 1) February 18, 1974 - June 30, 1974. TVA. 1974. TVA; Water Quality and Ecology Branch M-WQ-74-3-BF-3:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant (Units 1 and 2) July 1, 1974 - December 31, 1974. TVA. 1975. TVA; Water Quality and Ecology Branch M-WQ-75-1-BF4:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant (Units 1 and 2) January 1, 1975 - June 30, 1975. TVA. 1975. TVA; Water Quality and Ecology Branch WQ-75-2-BF-5:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant (Units 1 and 2) July 1, 1975 - December 31, 1975. TVA. 1976. TVA; Water Quality and Ecology Branch M-WQ-76-1-BF-6:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant January 1, 1976 - December 31, 1976. TVA. 1977. TVA; Water Quality and Ecology Branch M-EAC-77-01:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant January 1, 1977 - December 31, 1977. TVA. 1978. TVA; Division of Environmental Planning M-EACS-78-02:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant January 1, 1978 - December 31, 1978. Taylor, MP Mullins, JR Me inert, DL Schneider, RW & Ferguson, B. 1979. TVA; Water Quality and Ecology Branch March:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant January 1, 1979 - December 31, 1979. Taylor, MP Mullins, JR Schneider, RW & Taylor, F. 1980. TVA; Division of Water Resources April:

Water Quality and Biological Conditions in Wheeler Reservoir during Operation of Browns Ferry Nuclear Plant January 1, 1980-December 31, 1980. Taylor, MP Graham, RL Lowery, RL & Taylor, FH. 1980. TVA; Division of Water Resources

A Supplemental 316(a) Demonstration for Alternative Thermal Discharge Limits for Browns Ferry Nuclear Plant, Wheeler Reservoir, Alabama. TVA. 1983. TVA February:

Summary of the Impact of Browns Ferry Nuclear Plant upon the Aquatic Ecosystem of Wheeler Reservoir. TVA. 1975. TVA; Division of Environmental Planning

**§125.95(b)(1)(ii): ... If you propose to use existing data, you must demonstrate the extent to which the data are representative of current conditions and that the data were collected using appropriate quality assurance/quality control procedures.**

TVA will be evaluating data collected in accordance with this PIC and comparing the results with previously collected data to ascertain if historic data are still representative of current levels of impingement. TVA is assessing historic data and records to verify that data were collected in accordance with a valid Quality Assurance Procedure for IM; it is believed that is the case. Additional information may be provided later, as appropriate, in support of using historic data.

**§125.95(b)(1)(iii): A summary of any past or ongoing consultations with appropriate Federal, State, and Tribal fish and wildlife agencies that are relevant to this [Comprehensive Demonstration] Study and a copy of written comments received as a result of such consultations:**

There are ongoing oral and written consultations with state and federal wildlife agencies in the past year associated with the *Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama.* A comprehensive, written response to questions posed by the U.S. Fish and Wildlife Service is forthcoming and will be forwarded to ADEM upon final submittal.

As previously stated, TVA has a good understanding of the aquatic community "in the vicinity of the CWIS and susceptible to impingement", and that the combination of historical and current 316(b) impingement studies will provide a scientifically sound determination of impingement and impingement mortality. If TVA demonstrates that it meets the national performance standard (through a combination of existing operational, technological, and restoration measures and dead- or moribund-upon-arrival fish), ADEM may not find it necessary to consult with other agencies. Otherwise, if TVA determines that the national performance standard for IM is not met, then ADEM may well decide to consult with fishery management agencies in order to assess the IM fishery value to be derived from further mitigation of impingement mortality relative to the national performance standard and/or to evaluate potential restoration options which may be proposed by TVA.

**§125.95(b)(1)(iv): A sampling plan for any new field studies you propose to conduct in order to ensure that you have sufficient data to develop a scientifically valid estimate of impingement mortality and entrainment at your site. The sampling plan must document all methods and quality assurance/quality control procedures for sampling and data analysis. Proposed methods must be appropriate for a quantitative survey including consideration of methods used in other studies performed in the source water body. The sampling plan must include a description of the study area including the area of influence of the cooling water intake structure(s), and provide a taxonomic identification of the sampled biological assemblages (including all life stages of fish and shellfish).**

Plant Description

BFN is located on the north shore of Wheeler Reservoir at Tennessee River Mile (TRM) 294.5 (Figure 1). The three units (boiling water reactors) each have a nameplate rating of 1100 megawatts (MW) (licensed thermal power of 3293 MW thermal on Unit 1 and 3458 MW thermal on Units 2 & 3 each). Each Unit has the potential to increase to 1,280 MW (3952 MW thermal) upon approval by the NRC. However, the proposed future uprates to current generating capacity will be accomplished without additional increases in CCW flows. Five mechanical draft cooling towers enable BFN to operate in either open or helper mode.

Physical Data

1. Intake Channel:
   The intake channel extends approximately 500 feet from the CWIS to the skimmer wall, which is a 218 foot long concrete and steel structure positioned across the entrance of the intake channel. The skimmer wall is situated near the river channel and extends below the river bottom to bedrock. Water is drawn into the intake channel through the lower portion of the wall through three 40 foot wide sections, enabling BFN to withdraw cooler water from the lower stratum. The three open sections have movable gates with bottom elevations that can vary between 527.0 feet msl and 547.0 feet msl. The river bottom elevation along the wall varies between approximately 519 feet msl and 526 feet msl. Actual water depth in the channel varies based on reservoir elevations: the normal minimum pool elevation is 550 feet msl and normal maximum pool elevation is 556.0 feet msl. See drawing 0-31N410-2 that was attached with original PIC submitted February 26, 2006 for additional details.

2. CCW Pumping Station:
   The concrete pumping structure is 232 feet long by 117 feet wide and 47 feet high. The bottom elevation of the pumping station is 517 feet msl. Each unit has three CCW pumps. Each pump has a design flow rate of 220,000 gpm, giving a design intake flow of 660,000 gpm per unit. The pumps are installed in separate pump bays that are each covered by two trash racks and two traveling screens. The screens are each 7.5 feet wide with mesh openings of 3/8 inch. The design through screen velocity is 2.0 feet per second at normal minimum pool and 1.64 feet per second at normal high pool. See drawings 0-31E201 and 0-H58239-1 that were attached with original PIC submitted February 26, 2006 for additional details.

   The CCW pumps can operate in parallel for each unit. However, if one pump is out of service, the two remaining pumps will deliver sufficient flow for full-load operation but with a higher turbine backpressure.

The traveling screens and screen wash system can be operated automatically or manually. Differential pressure across each pair of traveling screens for a given CCW pump is monitored. When operating the system in the automatic mode, the screen wash pump is started when a preset differential pressure of water is reached across any of the three pairs of screens. When a preset pressure is established at the screen wash nozzles, the screen motors are automatically started and the screens are washed. In either manual or automatic mode the pump and screens run until manually stopped.

3. *Area of Influence:*
TVA notes that the terms used in the rule with regards to a zone of influence are the "area" of influence and "in the vicinity of", and that the terms zone of influence or hydraulic zone of influence are more appropriate for assessing entrainment rather than impingement. Fish that become impinged are those in the area of the CWIS which for behavioral or other reasons end up in the small area directly in front of the screens where the ambient flow velocity exceeds their individual capability to escape or avoid impingement if they attempt to do so. As such, the "area" of influence associated with impingement at the CWIS would not extend beyond a few feet. Further review of published procedures, such as the EPRI documents describing the hydraulic zones of influence which occur around these structures in various source water settings (*Ref - Using Computational Fluid Dynamics to Define the Hydraulic Zone of Influence (HZI) of Cooling Water Intake Structures - EPRI Report No. 105528, August 2004*), will be considered in development of the CDS.

Impingement Sampling Methods

Samples will be collected according to TVA's Quality Assurance Procedure (NR OPS-FO-0BR-23.11) for Impingement Counts (TVA 1983a or later). A copy of this procedure was attached with the original PIC submitted February 26, 2006. This procedure is being revised to accommodate electronic data storage methodologies and to include updated chain-of-custody forms that are already in use. Otherwise, the sampling and data-gathering methodologies as described below will remain the same. The revised procedure will be provided to ADEM once finalized.

Weekly counts of fish impinged during a 24-hour period on the intake traveling screens at BFN will be collected beginning in late 2006 (contingent upon return to service of the Unit 1 CCW pumps) and continuing for at least one year. Prior to conducting the sampling, Operations personnel will be notified in time to ensure that all available traveling screens for units in operation are washed 24-hours prior to the scheduled sampling event. These washings, occurring 24-hours in advance of the sampling, will be conducted concurrently if possible. At the time of the scheduled sample collection, available screens will be rotated and back-washed individually or in groups. During periods of heavy debris load, it may become necessary for Operations personnel to wash more frequently than once per 24-hours. If this proves to be true, daily counts of fish impinged will be adjusted to account for the actual time between screen backwash operations or a continuous sample will be collected during the entire 24-hour wash cycle, if necessary, to properly quantify the impingement counts.

After each available screen (or groups of available screens) is washed, all fish (and debris) will be removed from the collection baskets. The baskets installed to collect the fish and debris may be pressure washed with relatively small amounts of potable water or raw water (approximately 50 gallons). The wash water from the baskets will drain to the CCW trash sluice and is expected to have no discernable impact.

The EPA 316(b) rule for existing facilities requires impingement mortality estimates for fish and shellfish. Shellfish such as fresh water mussels are noted on the impingement data sheets, photographed and, if alive, returned to the source water body. Fish will be sorted by species in 25-mm total length (TL) groups, then counted, weighed and recorded. The standard procedures for Impingement Counts states in section 6.5.1 Quality Control - "All fish of questionable identity shall be preserved and taken or sent to the Aquatic Biology Lab in Norris, Chattanooga or Muscle Shoals for identification or verification". Any fish that cannot be positively field-identified will be preserved in 10 percent formalin and taken to the designated lab for that geographical region. TVA has an extensive fish reference collection at the Aquatic Biology Laboratory in Norris, Tennessee, and at the University of Tennessee, Knoxville, for quality control. Specimens are added to the collections on an as-needed basis.

At times when it is determined that a complete count of all fish impinged during the sample cannot be made during the working day with the available field personnel, the crew leader may elect to subsample as described below:

- All fish of a species over 300-mm TL will be sorted into size classes, weighed and recorded.
- Only size classes containing large numbers of individuals will be sub sampled by mixing them and scooping approximately 2.5 kg as a subsample from the pile.
- Fish from the subsample will then be separated into length classes and the number and weight for each size class recorded.
- All remaining fish from which the subsample was taken are then weighed and that total weight recorded.

Moribund/Dead Fish

Fish collected from a 24-hour screen wash will usually all be dead when processed. Incidental numbers of fish which appear to have been dead for more than 24-hours will not be included in the sample. Determinations of previously dead fish will be made using Best Professional Judgment based on observations of condition of fish. Also, during winter, species of fish such as shad occasionally suffer die-offs and could be impinged after death or in a moribund state. In that case, field personnel would document that due to ambient temperatures, either all, or a portion of impinged species of fish were due to cold-shock and would not have been impinged otherwise. Additionally, if species of fish were observed dying in the reservoir from cold-shock, this would be documented and presented in the records and report to indicate cold-shock as the primary cause of unusually high impingement of this species.

TVA determines "previously dead fish" based on best professional judgment by observing the state of decay or postmortem decomposition of the fish. The fish would exhibit a severe state of decay with muscle tissue deterioration and would be referred to as "rotten". This is a very conservative method for determining previously dead fish and has been approved for use by many states. Fish that are previously dead prior to impingement are excluded from the impingement mortality count, but are noted on field data forms and, if numbers are significant, could be included in the total impingement counts for establishing credit against a calculation shoreline baseline.

There are two situations when TVA field personnel will determine previously dead fish or fish being left in a moribund state resulting from a fish kill or stress in the source water body. The first is defined above, and the second is an obvious fish kill occurring in the source water body. Fish kills will be investigated and documented by TVA Resource Stewardship Standard Operating Procedure RS-SOF-3.9 Rev. 0000. In this procedure the American Fishery Society special publication 24 procedure-*Investigating and Valuation of Fish Kills* is followed. TVA is also surveying the literature and sponsoring research with regard to previously dead and moribund fish.

Records and Recordkeeping
Data collection forms will be completed with the counts and weights of species. These forms will include the date, time, facility name and location of the sample (i.e., at intake screen backwash), and the person collecting data.

The audit procedure will include site visits to ensure proper QA/QC procedures are followed by a TVA Fisheries Biologist or Aquatic Zoologist. Duplicate counts and weights of fish collected will be verified, field data sheets will be proofed by a TVA Fisheries Biologist or Aquatic Zoologist and signed. Completed data forms will be submitted to the project leader for technical review and signoff. For quality control and assurance, voucher specimens will be sent to the TVA Aquatic Biology Laboratory for verification. Once the data have been verified and the project leader has signed the forms, copies of all forms will be provided to Site Environmental. Site Environmental may replace the draft form with the signed official record. Records will be maintained on site per requirements of TVA's Environmental Records Management Process (currently 10 years). Data will then be entered by a TVA Resource Stewardship employee into the TVA Dazzler database (or equivalent) for subsequent analysis and reporting. In addition, during the sample year, a minimum of two sampling audits will be conducted to ensure proper standard procedures are followed.

TVA employees involved in impingement counts in the past and present are responsible for performing work in accordance with the impingement count NR FO-BR 23.11 procedure and all other applicable procedures, keeping proper records, and reporting problems to the crew leader. The quality control procedures listed in the Reservoir Cove Rotenone Sampling S&F OPS-BR 23.7 states in section 6.7.2 that sampling personnel will periodically (minimum of once each day of use) calibrate the platform and hanging scales using standard weights.

A list of species identified from historical impingement monitoring at BFN is presented in Table 1 on the following page.

Extrapolation of Impingement Losses to Equivalent Adult (EA) and Production Foregone (PF).
TVA Power Plants in Alabama are only required to comply with the EPA's Section 316(b) Impingement Mortality standard. The Entrainment Standard is not applicable. Therefore, quantifying egg and larval fish does not apply. Impingement losses of early life stages of fish will be evaluated by extrapolating the losses to equivalent reductions of adult fish, or of biomass production available to predators. EPRI has identified two models for extrapolating losses of fish eggs, larvae, and juveniles at intake structures to numbers or production of older fish. Equivalent Adult (EA) models quantify entrainment and impingement losses in terms of the number of fish that would have survived to a given future age. Production Foregone (PF) models are applied to forage fish species and quantify the loss from entrainment and impingement in terms of potential available forage for consumption by predators. Requirements of the models are site-specific data on the distribution and abundance of fish populations vulnerable to impingement. The methods developed by EPRI report number 1008471, 'Extrapolating Impingement and Entrainment Losses in Equivalent Adult and Production Foregone 2004' will be used to determine the "biological liability" of the intake structure. Detailed methods will be included in the final report submitted in each facility Comprehensive Demonstration Study.

General Water Quality Parameters
TVA collects water quality information for all TVA reservoirs as part of the Vital Signs Program. Water quality trends are tracked with biological information to determine the health of the reservoir. This information will be included in the Comprehensive Demonstration Study.

**TABLE 1** - List of Fish Impinged on the Intake Screen at Browns Ferry Nuclear Plant in Ten Samples Collected Between 2002 and 2004

| Family | Common Name | Scientific Name |
|---|---|---|
| **Fish** | | |
| Clupeidae | | |
| | Alewife | *Alosa pseudoharengus* |
| | Gizzard shad | *Dorosoma cepedianum* |
| | Threadfin shad | *Dorosoma petenense* |
| Cyprinidae | | |
| | Bluntnose minnow | *Pimephales notatus* |
| Ictaluridae | | |
| | Channel catfish | *Ictalurus punctatus* |
| | Flathead catfish | *Pylodictis olivaris* |
| Poeciliidae | | |
| | Mosquitofish | *Gambusia affinis* |
| Percichthyidae | | |
| | Striped bass | *Morone saxatilis* |
| Centrarchidae | | |
| | Redbreast sunfish | *Lepomis auritus* |
| | Bluegill | *Lepomis macrochirus* |
| | Redear sunfish | *Lepomis microlophus* |
| | Largemouth bass | *Micropterus salmoides* |
| | White crappie | *Pomoxis annularis* |
| Percidae | | |
| | Logperch | *Percina caprodes* |
| Sciaenidae | | |
| | Freshwater drum | *Aplodinotus grunniens* |
| **Mussels** | | |
| | Zebra mussels | *Dreissena polymorpha* |

To help meet the proposed winter 2007 commencement of impingement sampling mentioned above, TVA suggests that your review of this PIC first focus on the impingement sampling section since that is the first component of the PIC to be implemented. TVA sincerely appreciates your expeditious review of this PIC so that your comments may be appropriately incorporated into the impingement sampling methods.

*If you need additional information, or would like to schedule a meeting to discuss this document please* contact Rusty Cooper at (256) 729-2681, or by email at crcooper@tva.gov.

Conrad K. Otthenfeld
Chemistry/ Environmental Manager
Browns Ferry Nuclear Plant

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