

New York State Department of Environmental Conservation

Division of Fish and Wildlife

Technical Guidance 1

Issuing Authority:

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 Director, Division of Fish and Wildlife

Signature: _____

Title: Procedures for Determining
 Entrainment Survival of Fish at Industrial
 Facilities Operating Cooling Water Intake
 Structures

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I. Summary: This document describes the procedures for allowing entrainment survival estimates to be included as a component of Best Technology Available ("BTA") for the purposes of meeting the requirements of 6 NYCRR Part 704.5. This guidance was developed by the Bureau of Ecosystem Health in the Division of Fish and Wildlife.

Commissioner Policy CP- #52 (2011) allows for entrainment survival to be considered as part of a BTA decision under 6 NYCRR Part 704.5 *only* if a site-specific biological study is conducted which clearly demonstrates survival of the species and lifestages of fish which are entrained¹ by the facility's cooling water system. For the purposes of this guidance, the non-contact cooling water system includes the entire path through which the cooling water flows from the intake up to and including the thermal discharge

¹ Entrainment is the incorporation of all life stages of fish and aquatic organisms with intake water flow entering and passing through a cooling water intake structure and into a cooling water system. Entrained aquatic organisms are generally those that are small enough to pass through a conventional traveling screen with an effective mesh opening of 3/8 inch.

location. For facilities where site-specific entrainment survival studies are completed consistent with this guidance, Department staff may include entrainment survival as a portion of the required reductions in entrainment mortality contained in a facility's State Pollutant Discharge Elimination System ("SPDES") permit.

II. Policy: It is the policy of the Department that, where applicable and as described in this guidance, SPDES permits issued for cooling water intake structures in New York State may include a site-specific estimate for the survival of fish entrained through a non-contact cooling water system as long as Department approved, site-specific entrainment survival studies are conducted consistent with the procedures outlined in this guidance. The final inclusion of site-specific entrainment survival of fish as part of a BTA decision for a facility is at the discretion of the Department when making a BTA determination following procedures set forth in Department Policy CP-52 (July 10, 2011).

III. Background: Industrial facilities operating a cooling water intake structure in connection with a point source thermal discharge must minimize the adverse environmental impact caused by the cooling water intake structure (6 NYCRR Part 704.5). DEC Policy CP-52, which implements 6 NYCRR Part 704.5, defines adverse environmental impact as the number of fish and shellfish killed or injured through entrainment and impingement mortality by the operation of cooling water intake structures. Impingement mortality is the death of all life stages of fish and shellfish as a result of being entrapped on the outer part of a cooling water intake structure or against a screening device during periods of water withdrawal. Entrainment is the incorporation of all life stages of fish and shellfish with intake water flow entering and passing through a cooling water intake structure and into a cooling water system. The Department assumes that entrainment results in 100 percent mortality of the entrained organisms unless a lesser mortality is demonstrated to Department staff based on the results obtained from Department approved site-specific studies (see, Commissioner Policy CP-#52). In the 2014 Section 316(b) Phase II Rule for existing facilities operating a CWIS, the U.S. EPA allows for entrainment survival to be considered if a permittee demonstrates an entrainment mortality less than 100 percent based on site specific biological monitoring studies (see, 40 CFR § 125.96(d)(3)).

Entrainment survival studies have been conducted at New York steam electric generating facilities since the 1970s (Young *et al.* 2009, EPRI 2005, EPRI 2000, Muessig *et al.* 1988, Jinks *et al.* 1981). Most of these early studies (conducted prior to 1990) were conducted at facilities withdrawing cooling water from the Hudson River estuary (e.g., Indian Point, Roseton, and Danskammer) where the larval stages of fish were typically entrained. Results of these early studies were mixed, primarily because the larvae suffered injury and death when sampled, and this high level of sampling mortality made it difficult to determine the ability of the organisms to survive entrainment. Improvements in sampling gear and holding methods greatly reduced this experimental mortality (EPRI 2005, Muessig *et al.* 1988, Christensen and DeAngelis 1982, Jinks *et al.* 1981). Once sampling mortality was minimized and entrainment

survival estimates were able to be made, it was evident that ichthyoplankton² were able to survive entrainment. It was also evident that the ability of ichthyoplankton to survive entrainment was very dependent on species and lifestage (EPRI 2009). Of all the stresses faced by entrained organisms (e.g., mechanical forces, exposure duration, temperature, and biocides), the factor that had the greatest influence on entrainment survival was the absolute temperature of the cooling water upon discharge (EPRI 2009, Jinks *et al.* 1982).

Recent studies conducted at facilities located on Long Island (*i.e.*, Port Jefferson, E.F. Barrett, and Northport) using improved sampling methods have significantly minimized the mortality associated with sampling, resulting in more accurate estimates in survival.³ These improved sampling methods have resulted in a greater consistency with species and lifestage specific entrainment results at each of these three facilities.

IV. Responsibility: The Department's Division of Fish and Wildlife ("DFW") has the primary responsibility to ensure that the methods contained in this guidance are adhered to by a SPDES permittee requesting the Department to consider entrainment survival at a permitted industrial facility.

V. Procedure

A. General: Definitions, Applicability, and Limitations

1. Definitions

Consistent with Department Policy CP-52 and existing regulations (*i.e.*, 6 NYCRR §§ 700 and 704 and 40 CFR §§122 and 125), the following definitions will be used for this guidance:

- *Adverse environmental impact:* the fish and shellfish killed or injured through entrainment and impingement by the operation of cooling water intake structures. The "adverse environmental impact" that must be minimized by the BTA standard of 6 NYCRR §704.5 relates only to aquatic resources (Commissioner Policy CP-#52).
- *Best Technology Available ("BTA"):* technology based standard established under CWA Section 316(b), 40 C.F.R. Part 125, subpart I; 40 C.F.R. Part 125.90(b); and 40 C.F.R. Part 125, subpart N and 6 NYCRR Part 704.5 as the most effective technology, process, or operational method for minimizing adverse environmental impact from a CWIS (Commissioner Policy CP-#52).

² Ichthyoplankton are the collective term for the eggs and larvae of fish.

³Fish eggs were the dominant life stage entrained at these Long Island facilities and were much better at surviving sampling than the larvae of sensitive species such as bay anchovy. Even with improvements in sampling gear, bay anchovy larvae still exhibited a high sampling and handling mortality at Long Island facilities.

- *Calculation baseline*: an estimate of impingement mortality and entrainment that would occur at a cooling water intake structure assuming that: the cooling water system has been designed as a once-through system; the opening of the cooling water intake structure is located at, and the face of the standard 3/8-inch mesh conventional traveling screen is oriented parallel to, the shoreline near the surface of the source waterbody and is operated at the full rated capacity 24 hours a day, 365 days a year (Commissioner Policy CP-#52).
- *Cooling water*: the water used for contact or non-contact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The intended use of the cooling water is to absorb waste heat rejected from the process or processes used, or from auxiliary operations on the facility's premises [6 NYCRR § 700.1(a)(11)].
- *Cooling water intake structure (CWIS)*: the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of New York State. The cooling water intake structure extends from the point at which water is withdrawn from the waters of the State up to, and including the intake pumps [6 NYCRR § 700.1(a)(12)].
- *Entrainment*: the incorporation of all life stages of fish with intake water flow entering and passing through a cooling water intake structure and into a cooling water system. The Department assumes that entrainment results in 100 percent mortality of the entrained organisms unless a lesser mortality is demonstrated to Department staff based on the results of Department approved, site-specific entrainment survival studies (Commissioner Policy CP-#52).
- *Ichthyoplankton*: refers to the early life stages of fish including eggs, yolk-sac larvae, and post yolk-sac larvae.
- *Impingement mortality*: the death of all life stages of fish as a result of being entrapped on the outer part of a cooling water intake structure or against a screening device during periods of water withdrawal (Commissioner Policy CP-#52).
- *Once-through, non-contact cooling water system*: a system designed to withdraw water from a natural or other water source, use it at the facility to support contact and/or noncontact cooling uses, and then discharge it to a waterbody without recirculation (Commissioner Policy CP-#52).

2. Applicability and Limitations

a. General Application of Entrainment Survival

The entrainment survival procedures outlined in this guidance only need to be followed if a SPDES permittee requests the Department to consider an entrainment mortality less than 100 percent at an industrial facility. If the permittee does not want to demonstrate

an entrainment mortality less than 100 percent, an entrainment survival study as outlined in this guidance does not need to be undertaken at that facility. Entrainment survival only applies to the lifestages of fish that would pass through a standard 3/8 inch conventional traveling screen. These generally include all fish eggs and larvae (yolk-sac and post yolk-sac) and small juvenile fish. Entrainment survival cannot be applied to lifestages of fish that would be impinged on a standard 3/8 inch conventional traveling screen. These lifestages generally include larger juveniles, young of the year, and adult fish.

If a permittee completes an entrainment survival study following the procedures outlined in this guidance document, it is still at the discretion of the Department whether the results of the approved study are robust enough to demonstrate a reliable estimate of entrainment survival for compliance purposes. Factors that can lead to the Department's rejection of the site-specific survival results include (but are not limited to): inadequate number of organisms and lifestages being collected during the study; too great a variability in the measured survival for the species and lifestages entrained at the facility; an unacceptably large (>20%) handling mortality; a large percentage of unidentified ichthyoplankton (particularly dead eggs); or lack of exposure of the entrained organisms to waste heat during the study (e.g., the facility did not generate electricity during the study).

b. The Application of Surrogate Taxa Survival is Not Allowed

The ability of ichthyoplankton to survive entrainment is highly dependent on species and lifestage. Since entrainment survival data for many species is sparse or absent, the practice of applying a survival estimate to such species based on the measured survival of surrogate taxa⁴ has been attempted as a means to fill this data gap. By adopting a surrogate taxa survival estimate to a species in which entrainment survival is unknown, it is assumed that it is reasonable to believe the entrainment survival would be similar among the species. However, the ability of one or more taxa to represent the entrainment survival of another species is simply unknown. Since past entrainment survival studies have consistently demonstrated that entrainment survival is species and lifestage dependent and do not support this concept, the Department does not allow for the application of surrogate taxa survival when estimating site-specific entrainment survival.

c. Estimating Site-specific Entrainment Survival Prior to Determining BTA

Species-specific entrainment survival results from studies conducted at other facilities can provide useful information when determining *if* entrainment survival could be a viable part of a BTA selection at a facility. This practice is allowed in the *absence* of site-specific entrainment survival data or if reliable species-specific survival data are available from another facility where a similar application of BTA technologies and operational measures is in operation. The resulting *species-specific* survival estimates

⁴ A surrogate taxa is one that is assumed to have a similar response to that of another species based on either taxonomic relatedness, body form, or some other physical or behavioral trait.

are to be used *only* to make the BTA determination and may not include surrogate taxa. Final entrainment survival must be demonstrated at the facility during the Verification Monitoring Program after all BTA technologies are installed and are operational.

d. Entrainment Survival Estimates must be based on Site-specific Studies after BTA is Installed and Becomes Operational

The Department will only consider entrainment survival of fish species and lifestages for compliance purposes that are sampled and included in a site-specific entrainment survival study when the verification monitoring study is being conducted at a facility. Most BTA determinations require the installation of new equipment for the purposes of reducing impingement mortality and entrainment. Since these changes can influence the survival of entrained ichthyoplankton, an entrainment survival study cannot be initiated until these construction projects are completed. The results from any entrainment survival studies conducted at the facility before these changes were made would need to be verified since the changes to the cooling water intake structure may alter a species ability to survive entrainment. For example, variable speed drive pumps or other operational reductions in cooling water withdrawal may expose the entrained organisms to higher water temperatures. Since entrainment survival is mostly effected by exposure temperatures, this rise in temperature may result in a lower survival of the entrained ichthyoplankton than that which was previously demonstrated.

e. Potential Biases to Site-specific Estimates of Entrainment Survival

There are several potential biases inherent in conducting an entrainment survival study. These biases can either lead to an overestimate or underestimate of entrainment survival and need to be carefully considered prior to undertaking or approving an entrainment survival study. These potential biases include (but may not be limited to):⁵

1. Sampling gear avoidance and selectivity;
2. Sampling and handling induced mortality;
3. Sampling gear extrusion of organisms;
4. Collection of dead organisms which died prior to being sampled;
5. Independent natural mortality occurring after collection;
6. Complete destruction of organisms entrained by the cooling system;
7. Unequal probability of being sampled at intake and discharge (for both dead and live organisms);
8. High percentages of unidentified organisms;
9. Synergistic stress effects of entrainment and sampling; and
10. The inability to identify dead organisms (particularly eggs).

The influence biases numbered 1-5 above have on the final estimated entrainment survival for a species and lifestage can be minimized by concurrently collecting samples at the intake and discharges using identical sampling gear (EPRI 2009, EPRI 2005). Biases numbered 6-9 above are not readily avoidable simply by the design of the study

⁵ EPRI 2009, EPRI 2005, Christensen and DeAngelis 1982, Boreman and Goodyear 1981

or the methodology employed. For example, the numbers of organisms susceptible to collection tend to differ between the intake and discharge for most entrainment survival studies. Fewer fish eggs and a greater number of fish larvae tend to be collected at the discharge. This artifact of conducting an entrainment survival study may not influence the final results unless this effect is not equally applicable to both live and dead organisms. If, for example, dead larvae are equally likely to be collected at the intake and discharge yet live larvae are more likely to be collected at the discharge, the resulting entrainment survival may be overestimated (Boreman and Goodyear 1981). Similarly, if the reason that fewer eggs are collected at the discharge is due in part to the complete destruction of eggs as they pass through the cooling system, this too can lead to an over estimation of survival. Careful review of the final data should help determine if issues 6 and 7 likely bias the final estimates for survival.

The inability to identify dead fish eggs and larvae (potential bias #10) is of particular concern. If an entrainment survival study results in large numbers of unidentified dead organisms, the survival results of the study may be biased high. Since they are unidentified, this mortality will be treated independently from the identified species. This can result in an overestimation of the survival of one or more of the identified species. This is more likely to affect estimations of species specific egg survival since dead eggs are much more difficult to identify than dead larvae. A high percentage of unidentified organisms can be justification to reject the inclusion of entrainment survival in the entrainment reduction requirements of a permittee's SPDES permit.

3. Projects for Which Permits Have Already Been Issued

For industrial facilities required to meet the BTA requirements of 6 NYCRR Part 704.5 which already have been issued a permit inclusive of BTA, the permittee can request approval to conduct an entrainment survival study. If at the end of the study, the Department accepts a percent reduction in entrainment due to a demonstration of site-specific entrainment survival, the permittee may request a permit modification to incorporate the additional reduction in entrainment mortality as part of the previously determined BTA for that facility. The modified permit would be subject to the permit requirements of 6 NYCRR Part 621 Uniform Procedures.

B. Procedures and Methods for Conducting Site-Specific Entrainment Survival Studies

1. Required Study Plans, Reports, and Submittals

- *Proposed Study Plan:* The permittee must provide a study plan for the Department's review and approval that is consistent with the study methods described in this guidance. The proposed study plan must include all field and lab methods, the proposed sampling schedule, all quality assurance and quality control procedures, all calculations and statistical analyses to be used, all data management procedures, and a proposed schedule for reporting. A discussion of

past entrainment survival studies conducted at the facility should also be included.

- *Standard Operating Procedures:* The permittee must develop standard operating procedures (“SOP”) for all field and lab procedures required to be followed by study personnel. These must include a list of all equipment required and all data sheets that will be used to record data and track samples. These must be attached to the Proposed Study Plan when the plan is provided to the Department for review.
- *Interim Progress Reports:* Interim progress reports shall be provided to the Department on a monthly basis. These interim reports will report on the number of sampling dates completed, the number of samples collected, and whether any unforeseen issues resulted in a reduction in the number of samples collected or if a change in the approved field methodology is required.
- *Interim-Annual and Final Entrainment Survival Reports:* These reports will include interim and final results of the entrainment survival study. The following sections must be included: Introduction and Background; Methods, Results, and Conclusion. Results will be presented as follows: entrainment survival for each species (or least practicable taxon) and lifestage sampled; and entrainment survival for each lifestage (*i.e.*, eggs, yolk-sac larvae, post yolk sac larvae, and juveniles), for all species combined. Tables and figures will be included as appendices.
- *Entrainment Reduction Compliance Report:* This report will incorporate findings from the *Final Entrainment Survival Report* with all other entrainment reduction technologies and operational measures (*e.g.*, wedgewire screens, fine mesh screens, variable speed drive pumps, reduced flow, and unit outages). For facilities where final BTA determinations included an *estimated* entrainment survival, the reductions presented in this report will be used to determine if the facility has met the entrainment reduction compliance requirements contained in the SPDES permit. For permittees desiring to incorporate entrainment survival into a previously finalized BTA determination, the report will provide the supporting documentation for a permittee initiated SPDES permit modification. The final metric to be used to determine the overall reduction in entrainment, including entrainment survival, is the total number of organisms that either survive entrainment or are not entrained as a result of implementing BTA at the facility. The Department does not accept age equivalents in the estimation of the overall efficacy of BTA.
- *Final Data:* All final data must be provided to the Department in an agreed upon format and be inclusive of the following fields: Date, time, the initial number of organisms by species and lifestage collected at the intake, the initial number of organisms by species and lifestage collected at the discharge, the number alive (by species and lifestage) at time of collection and at the following holding time

intervals: 6, 12, 24, 48 (end time for larvae), and up to 72 hours (end time for eggs), intake temperature and discharge temperature at time of sample collection, and other water quality parameters measured (e.g., salinity or conductivity, dissolved oxygen). See, EPRI 2005 for more information on data types and collection methods.

2. Field Methods and Sampling Equipment

Entrainment survival studies involve the collection of ichthyoplankton at both the intake and thermal discharge point of a cooling water intake system. The organisms are collected at each location using the same sampling equipment and then are transferred to a field laboratory. In the lab, all organisms are counted and the dead are separated from the live and stunned organisms. Fish eggs that are not evidently dead are considered to be alive at this time and are transferred with live larvae to a flow through water table. Larvae are observed for 24 to 48 hours. All larvae still surviving after this time are considered to have survived sampling at the intake or sampling and entrainment at the discharge. Eggs are held until hatching or up to 72 hours. Holding time for eggs may be reduced to 24 hours if survival can be determined and species can be identified. All eggs that hatch are considered to have survived either sampling at the intake or sampling and entrainment at the discharge. There have been some advances in determining the viability of a fish egg before it hatches. Therefore, it may be possible for properly trained field personnel to determine whether a fish egg is alive sooner than 72 hours. *For more information see, EPRI 2011a, EPRI 2009, EPRI 2005, EPRI 2000.*

Ichthyoplankton are generally a very fragile lifestage of fish and entrainment survival studies conducted in the 1970s and 1980s resulted in a high sampling and handling mortality. This made it difficult to distinguish the percentage of mortality associated with sampling from that caused by entrainment (EPRI 2005). Though the intensive effort to determine entrainment survival at Hudson River facilities ended in the late 1980s, several sampling tools were developed that showed promise to be effective in significantly reducing sampling mortality (EPRI 2005, Muessig *et al.* 1988, ESEERCO 1982). These include the barrel sampler and the larval table (see, Figures 1&2 for examples).

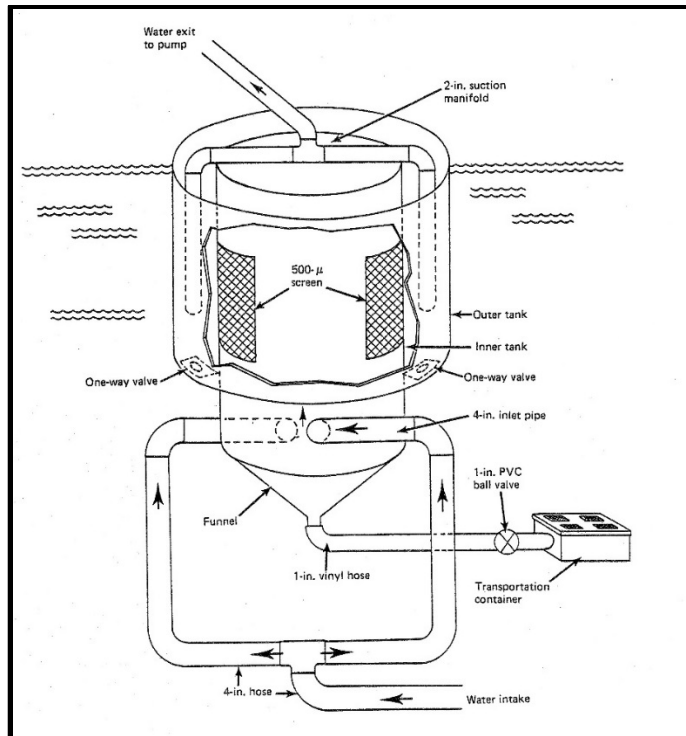


Figure 1: Example of a barrel sampler used for entrainment survival studies (from ESEERCO 1982, Figure 3-2).

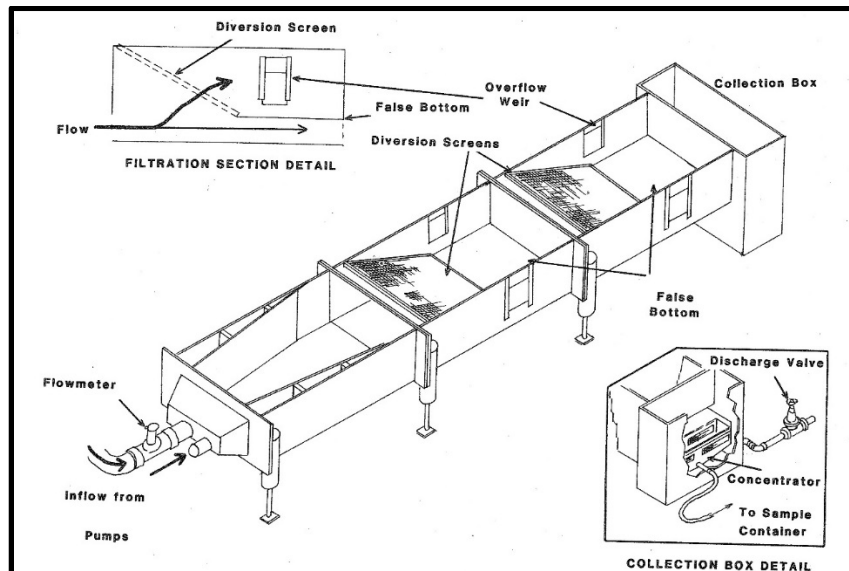


Figure 2: Example of an entrainment survival flume table collector (from Muessig *et al.* 1988; Figure 46). Note that this schematic represents a table where the organisms pass through the pump before being collected in the table. It was determined that this resulted in substantial sampling mortality so the pump was repositioned at the back of the sampler (rear drawn sampling table) whereby the organisms were collected before the water passed through the pump.

This guidance does not identify or endorse a single design for the ichthyoplankton sampler. However, whichever sampling design is selected the following criteria are critical to ensure a representative sample is collected and sampling mortality is minimized: (1) A high survival of collected ichthyoplankton has been demonstrated for the selected sampling equipment ($\geq 80\%$ survival); (2) A 335- μ mesh is used to ensure all ichthyoplankton are collected (this size mesh will also reduce the likelihood of abrasion and extrusion of organisms); (3) A design whereby the sampled ichthyoplankton will not likely become impinged on the net surface or extruded through the net; and (4) A collection box or tray to ensure nearly 100% of the sampled ichthyoplankton are collected.

3. Sample Collection and Handling

Entrainment at cooling water intakes is very seasonal since it occurs during the time of year when the fish spawn (EPRI 2011b, EPRI 2005). Therefore, sampling only needs to be scheduled during the time of year when entrainment is known to occur at the facility. This study period may be extended beyond the time when the majority of the entrainment occurs to ensure all species of concern are included in the study⁶. In addition, entrainment can vary based on diel and tidal cycles (EPRI 2005). Entrainment sampling should occur one to three times weekly with each sampling event spanning 12-24 hours unless a strong diel effect is known to occur at the facility. If a strong diel effect is observed, sampling could be reduced to a period less than 24 hours. However, given the variability in entrainment survival and the fragility of the organisms, it is important to not overly restrict the sampling period to ensure adequate numbers of species and lifestage combinations are collected. Typically, six (6) samples at the intake and discharge should be collected during a sampling event. Sampling duration is dependent on the density of organisms occurring in the water which will likely vary throughout the season.

Collected samples must be transported quickly to an on-site field laboratory for sorting, identification, and be transferred to flow-through holding benches for survival observance. Careful attention is required to assure that laboratory conditions are not excessively stressful on the study organisms for the duration of time the samples are being processed and monitored. Larvae should be held for at least 24 hours and may be held up to 48 hours. Fish eggs should be held until hatching or 72 hours (whichever occurs first) provided that the consultant is capable of determining the vitality of the eggs prior to their hatching.⁷ If not, the eggs will be held until they hatch or are

⁶ For example, most of the species of fish entrained at Hudson River electric generating facilities spawn from mid-Spring through mid-Summer with the exception of Atlantic tomcod. Atlantic tomcod spawn in December and January with the entrainment of larvae beginning in February and continuing through April. Therefore, though an entrainment survival study covering the period from May through August would account for the majority of the entrainment, this sampling period would provide for no assessment of the ability of Atlantic tomcod to survive entrainment. Additional sampling outside of the May to August window would be required to determine the entrainment survival of Atlantic tomcod.

⁷ EPRI is sponsoring research to improve the ability to determine if and when a viable egg dies. For example, characteristics that can be used to distinguish dead and life eggs include transparency, turgidity, and buoyancy (EPRI 2011a).

definitively dead; potentially up to 172 hours (see, EPRI 2011a). It should be noted that the longer the organisms are held for observation, the greater the influence the study procedures will have on the final mortality results. Young (2009) investigated the potential to apply a failure time analysis model to help in determining holding times for entrainment study organisms. It is possible that some form of this model could be applied to assist in determining appropriate holding times for a site-specific entrainment survival study.

4. Field Identification of the Organisms Studied

All ichthyoplankton collected must be identified to the lowest practicable taxon. It is critical to identify the organisms to species whenever possible since entrainment survival is highly dependent on the species being entrained. However, it is not always possible to determine the species of an early lifestage fish and it may only be possible to identify the organisms to genus or in some cases only to the family level. Some recent work being supported by the Electric Power Research Institute has demonstrated promising results for applying DNA sequencing techniques for identifying unknown organisms, especially fish eggs (unpublished).

5. Data Analysis

There are two acceptable methods for estimating entrainment survival using the data collected during an entrainment survival study. These include a modified application of the Abbott's method for assessing the effectiveness of pesticides (Abbott 1925) and the application of a Maximum Likelihood Analysis ("MLA") model to the data (Young *et al.* 2009). There are several limitations to applying the Abbott's method to estimate entrainment survival that are eliminated by the use of MLA. However, results should be presented comparing the results of the two methods. Though the two results may not match exactly, they should provide some agreement which will help determine the level of confidence with the results of the study. If both methods demonstrate similar results, the MLA model should be used to determine final compliance levels. If the results are in substantial disagreement, it is important that one or more plausible reasons be identified as the root cause of the disagreement. Reasons for disagreement can include, but may not be limited to: (1) small sample sizes, (2) high sampling mortality, (3) higher mortality measured at the intake, and (3) extremely sensitive species (e.g., bay anchovy larvae). Disagreements between the results obtained by applying these two analytical methods must be resolved prior to the Department's acceptance of the measured entrainment survival.

It is likely that for many species and lifestage combinations, it will not be possible to make an entrainment survival estimate at a facility. This may be due to one or more of the following reasons: (1) a high sampling mortality; (2) no individuals were sampled during the study; and (3) not enough individuals were sampled to confidently estimate entrainment survival. Issues numbers 2 and 3 will generally not be an issue when

estimating compliance since these tend to be a very small percentage of the total entrainment occurring at the facility being studied.

6. Data Management, Quality Assurance and Quality Control (“QAQC”)

Entrainment survival studies are extremely intensive and generate a large volume of data. Special attention must be placed on reviewing and approving the section of the Entrainment Survival Study Plan that discusses how these issues will be implemented and the methods to be used to assure quality is maintained during all phases of the study. Critical areas for the application of detailed QAQC procedures include (but are not limited to): (1) assurance of accurate taxonomic identification; (2) assurance of accurate counts of live and dead organisms; (3) transcription of data and data entry; (4) chain of custody of samples; (5) calibration of water quality equipment; (6) assurance of capturing the entire sample in the collection box; and (7) proper archiving of samples and data files.

C. Permit Conditions

It is not a requirement that a SPDES permit include conditions requiring an entrainment survival study to be conducted unless the final BTA selected for the facility incorporates an estimated survival of entrained organisms in the final suite of technologies and operational measures. If an entrainment survival study is required to verify that the required reductions in entrainment mortality are met, the requirement to conduct the entrainment survival study shall be included as part of the Verification Monitoring Plan contained in the Biological Monitoring Requirements section of the facility’s SPDES permit. The following requirements shall be contained in the Biological Monitoring Requirements section of the facility’s SPDES permit:

“Verification Monitoring Plan

Within 6 months of Department approval of the Technology Installation and Operation Plan, the permittee must submit an approvable Verification Monitoring Plan. This plan must include details of procedures to confirm that the necessary reductions in impingement and entrainment required by this permit are being achieved, and must include the following:

- a. Use of the five-year averaging period to verify full-scale performance of all BTA measures. The average estimated reductions in impingement mortality by at least **XX**⁸ percent and entrainment by at least **XX** percent (including through-plant survival) shall be based on a minimum of two years of in-plant impingement and entrainment monitoring.

⁸ A facility specific percent reduction in impingement mortality and entrainment from the calculation baseline will be incorporated into a SPDES permit containing BTA requirements. These required reductions will meet the requirements of 6 NYCRR Part 704.5 and be consistent with the performance goals contained in Commissioner Policy CP-#52 and the Clean Water Act 316(b) Phase II Rule (40 CFR Subpart J Section 125).

- b. Verification monitoring must include at least two years of site-specific through-plant entrainment survival data following procedures consistent with Division of Fish and Wildlife Technical Guidance Document DWF TG-01.
- c. A description of the frequency and duration of monitoring, the parameters to be monitored, and the basis for determining the parameters and the frequency and duration for monitoring.
- d. A schedule of implementation.
- e. A draft proposed Standard Operation Procedure (SOP) that describes the sampling protocols for these monitoring studies.

Upon receipt of Department approval the permittee must complete the Verification Monitoring Plan in accordance with the approved schedule. The Verification Monitoring Plan and approved schedule will become an enforceable condition of this SPDES permit.”

VI. References:

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