# Clean Water Act Section §316(b)

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- Please check to ensure your volume is turned up
- Please submit questions via the chat window, participant phones are muted to avoid noise disturbances
- Today's presentation will be available for download on S&L's website www.sargentlundy.com
- Sargent & Lundy's detailed summary of the Phase II §316(b) Rule is also available for download on our website

# Clean Water Act Section §316(b)

## Cooling Water Intake Structures

## Phase II

## Implementation & Timing

## Presenters

Ken Snell – Manager - Environmental Regulations & Permitting Group

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## Panelists

Andy Carstens – Director - Environmental Services

Mehrdad Salehi – Water Resources Specialist

# Agenda

Today's presentation will focus on the following:

## 316(b) Rule Requirements and Timeline

- Brief Overview of the Phase II §316(b) Rule
- Impingement Mortality Compliance Technologies
- Entrainment Compliance Technologies

## Implementation & Compliance Planning

- Permit Application Requirements
- BTA Studies & Timing
- Technical Feasibility & Cost Evaluation Study
- Implementing a Compliance Plan

# BRIEF OVERVIEW OF PHASE II §316(b) RULE

## Clean Water Act Section §316(b)

*Any standard established pursuant to section 1311 (Effluent Limitations) or section 1316 (National Standards of Performance) and applicable to a point source shall require that the "location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."*

Adverse environmental impacts = Impingement Mortality & Entrainment

Statutory requirement = Best Technology Available for minimizing adverse environmental impact ("BTA")

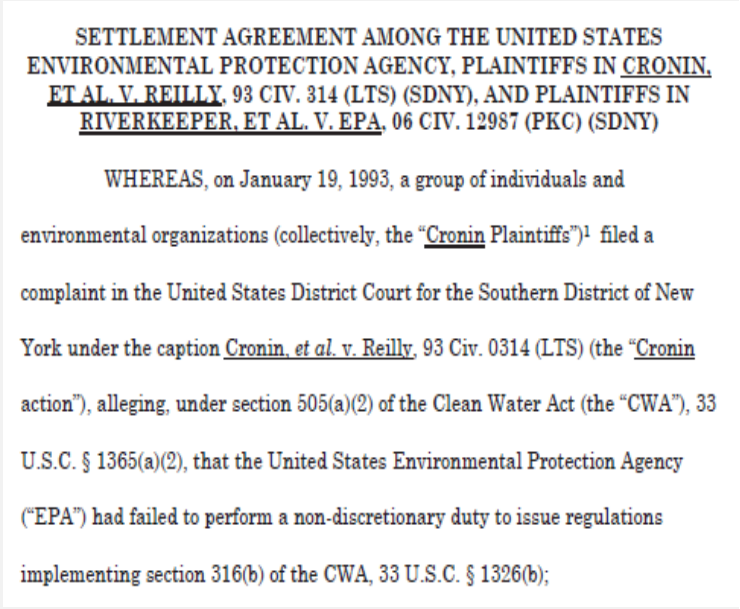
# Overview of Phase II §316(b) Rule

- EPA published draft guidance addressing §316(b) implementation in 1977:

  *"[t]he environmental-intake interactions in question are highly site-specific and the decision as to best technology available for intake design, location, construction, and capacity must be made on a case-by-case basis."*

- January 1993: Complaint filed alleging that EPA failed to perform a nondiscretionary duty to issue regulations implementing §316(b). *Cronin, et. al. v. Reilly*

- 1995: Consent Decree providing for the implementation of §316(b) in three separate rulemakings:
  - Phase I: CWIS at new facilities;
  - Phase II: CWIS at large-flow existing power plants;
  - Phase III: CWIS at existing smaller-flow facilities

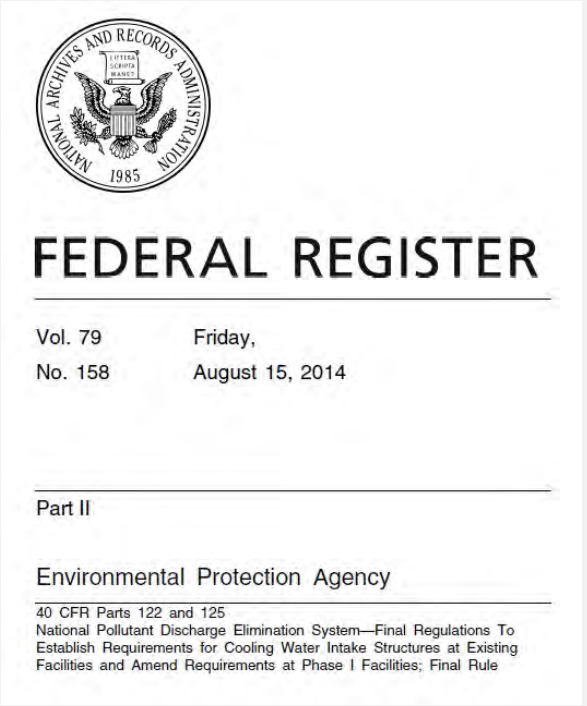


SETTLEMENT AGREEMENT AMONG THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, PLAINTIFFS IN CRONIN, ET AL. V. REILLY, 93 CIV. 314 (LTS) (SDNY), AND PLAINTIFFS IN RIVERKEEPER, ET AL. V. EPA, 06 CIV. 12987 (PKC) (SDNY)

WHEREAS, on January 19, 1993, a group of individuals and environmental organizations (collectively, the "Cronin Plaintiffs")[1] filed a complaint in the United States District Court for the Southern District of New York under the caption Cronin, *et al.* v. Reilly, 93 Civ. 0314 (LTS) (the "Cronin action"), alleging, under section 505(a)(2) of the Clean Water Act (the "CWA"), 33 U.S.C. § 1365(a)(2), that the United States Environmental Protection Agency ("EPA") had failed to perform a non-discretionary duty to issue regulations implementing section 316(b) of the CWA, 33 U.S.C. § 1326(b);

# Overview of Phase II §316(b) Rule

- Phase I Rule: Final Rule (66 FR 65255, December 26, 2001)
  - New facilities with design intake flow of 2 MGD or more
  - Two-Track Approach (40 CFR 125 Subpart I)
- Phase II Rule: Final Rule (69 FR 41576, July 9, 2004)
  - Existing large-flow power plants
  - July 2007: EPA suspended the rule pending further rulemaking (*Riverkeeper, Inc. v. U.S.EPA)*
- Phase III Rule: (71 FR 35006, June 16, 2006)
  - New offshore oil & gas extraction facilities
- Phase II Rule (79 FR 48300, August 15, 2014)
  - Replaced withdrawn 2004 Rule


FEDERAL REGISTER

Vol. 79 Friday,
No. 158 August 15, 2014

Part II

Environmental Protection Agency

40 CFR Parts 122 and 125
National Pollutant Discharge Elimination System—Final Regulations To Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities; Final Rule

# Overview of Phase II §316(b) Rule

## Phase II §316(b) Rule

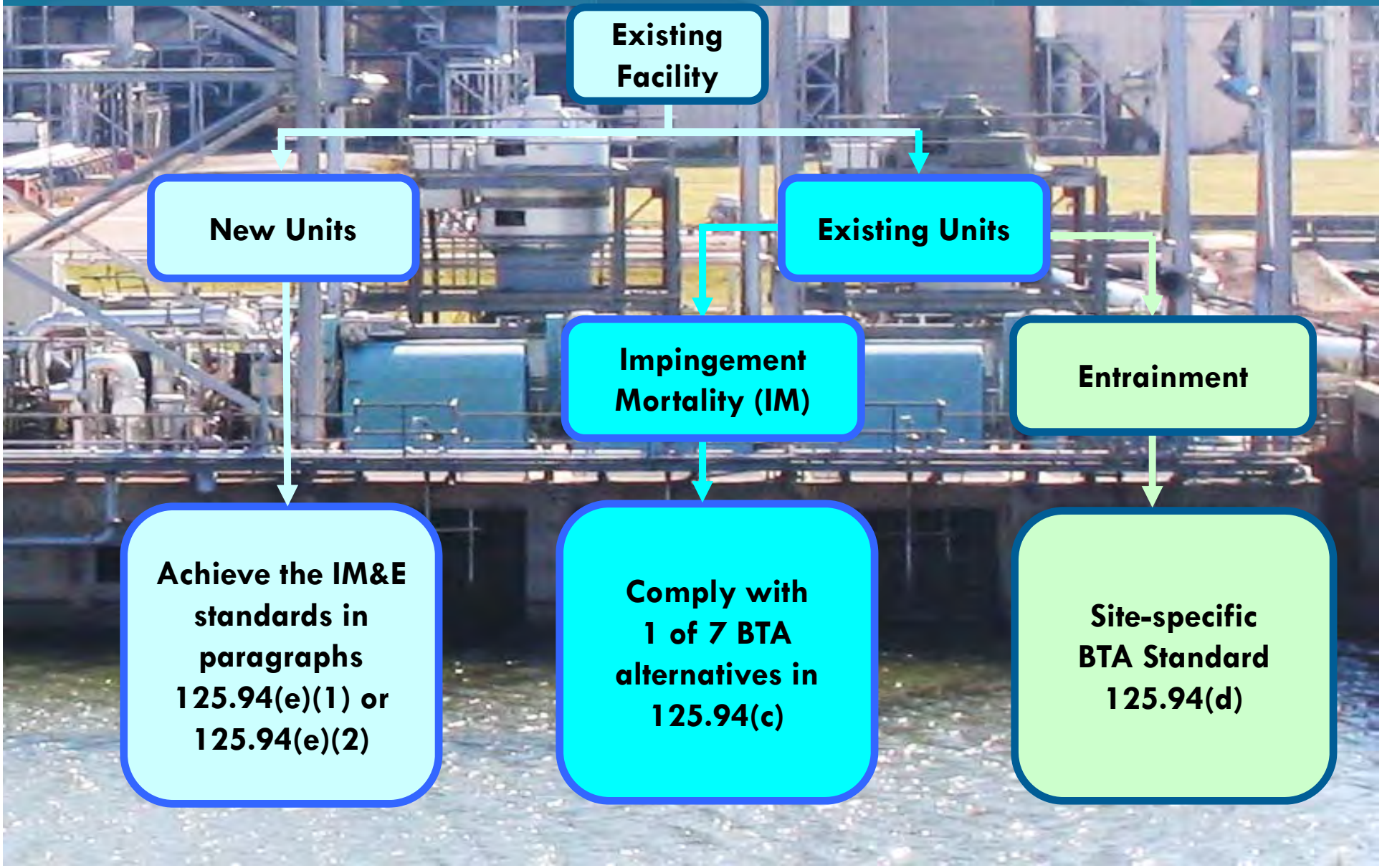
The Phase II Rule applies to existing facilities if:

a) the facility is a point source;

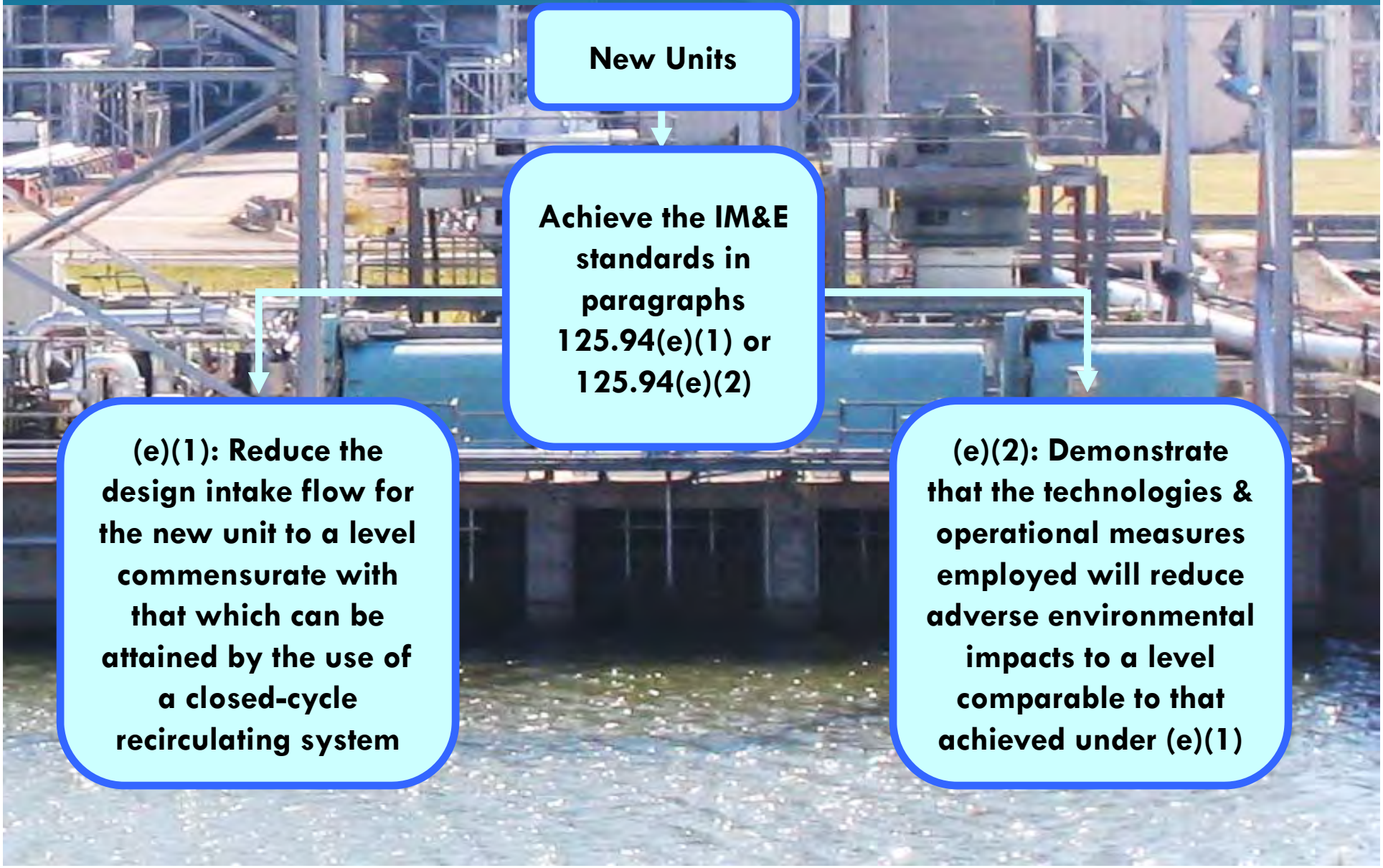
b) the facility uses one or more CWIS with a cumulative design intake flow (DIF) of >2 MGD to withdraw water from waters of the U.S.; and

c) 25% or more of the water the facility withdraws on an actual intake flow (AIF) basis is used exclusively for cooling purposes.

# Overview of Phase II §316(b) Rule



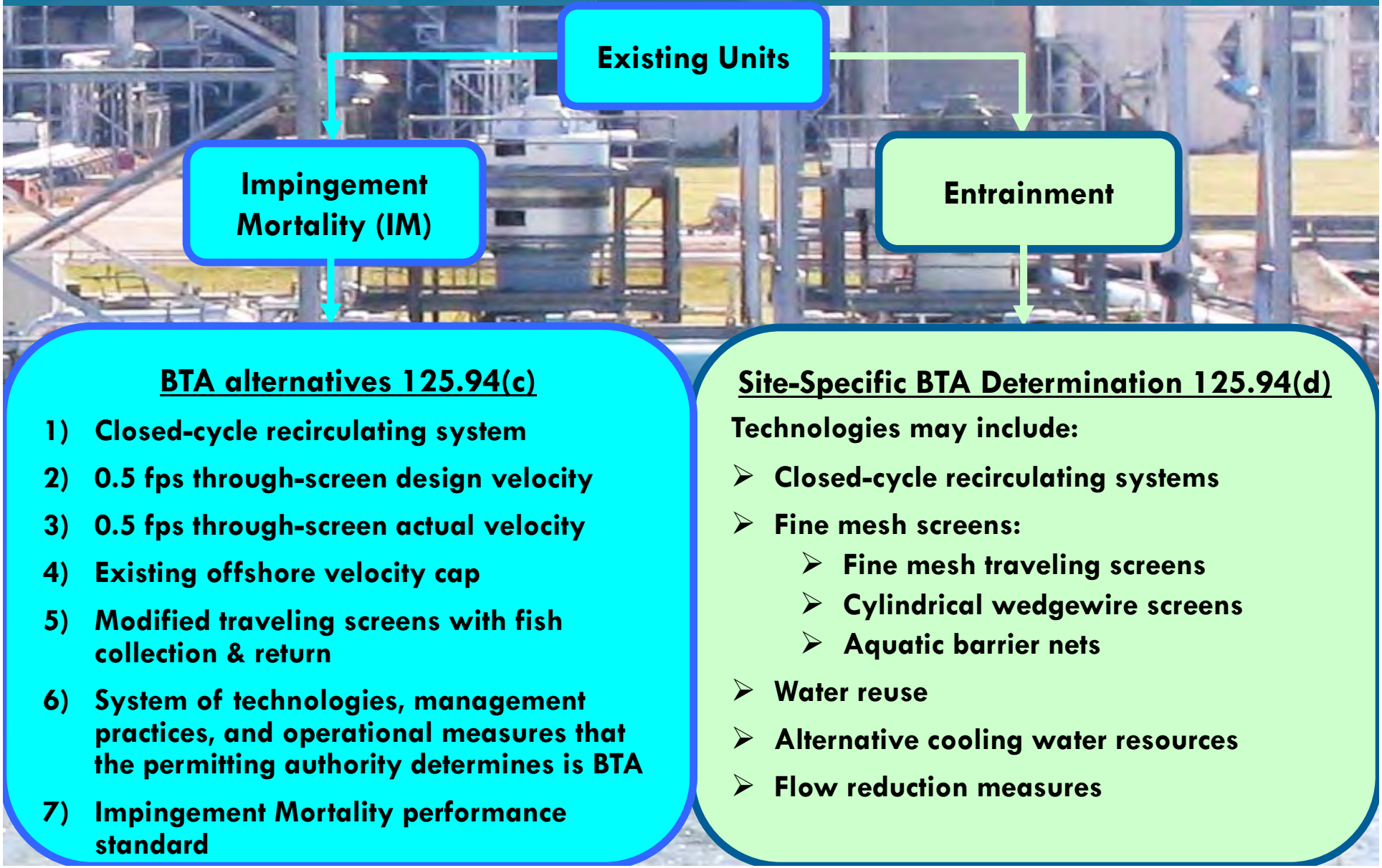
# Overview of Phase II §316(b) Rule



# Overview of Phase II §316(b) Rule

- **New units at existing facilities**
  - A new "standalone" unit at an existing facility where construction of the new unit begins after October 14, 2014 and that does not otherwise meet the definition of a "new facility" at §125.83.
  - Note: The term "new facility" does not include new units that are added to a facility for purposes of the same general industrial operation (for example, a new peaking unit at an electrical generating station).

# Overview of Phase II §316(b) Rule



**Existing Units**

**Impingement Mortality (IM)**

**Entrainment**

**BTA alternatives 125.94(c)**

1) Closed-cycle recirculating system
2) 0.5 fps through-screen design velocity
3) 0.5 fps through-screen actual velocity
4) Existing offshore velocity cap
5) Modified traveling screens with fish collection & return
6) System of technologies, management practices, and operational measures that the permitting authority determines is BTA
7) Impingement Mortality performance standard

**Site-Specific BTA Determination 125.94(d)**

Technologies may include:

- Closed-cycle recirculating systems
- Fine mesh screens:
  - Fine mesh traveling screens
  - Cylindrical wedgewire screens
  - Aquatic barrier nets
- Water reuse
- Alternative cooling water resources
- Flow reduction measures

# §316(b) Compliance Technologies (Impingement Mortality)

# IM Compliance Technologies
# Option 1

## Closed-Cycle Recirculating Systems

- Withdraw make-up water only to replenish losses that have occurred due to blowdown, drift, and evaporation
- Includes  wet, dry, or hybrid cooling towers
- Also includes a system with impoundments of waters of the U.S. where the impoundment was constructed prior to October 14, 2014 and created for the purpose of serving as part of the cooling system

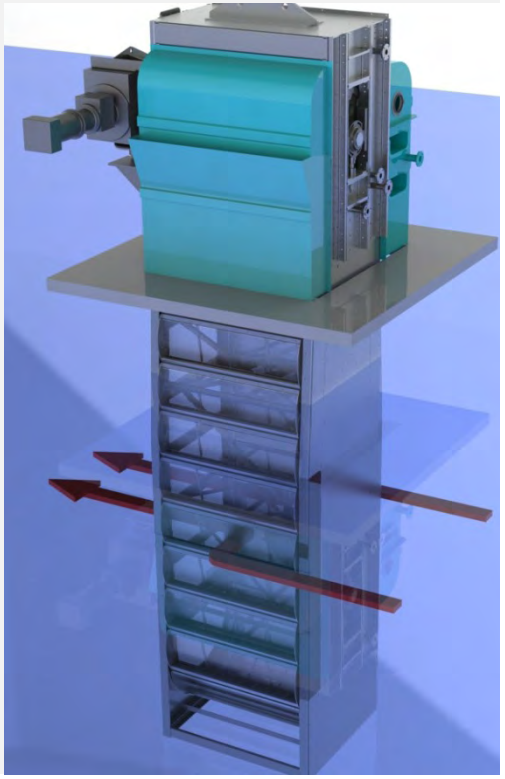
# IM Compliance Technologies
# Options 2 & 3

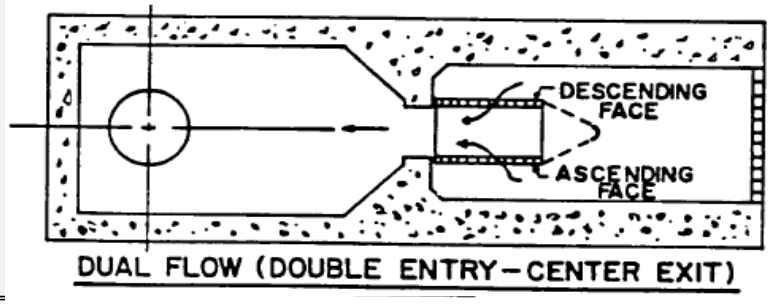
## Reduced Intake Velocity

- Maximum through-screen design velocity of 0.5 fps
- Operate with maximum actual through-screen velocity of 0.5 fps

**Options to reduce through-screen velocity:**

- Expand intake structure
- Retire existing generating unit(s)
- Retrofit with Dual Flow Screens
- Cylindrical Wedgewire Screens
- Aquatic Barriers






*Source: ASCE*

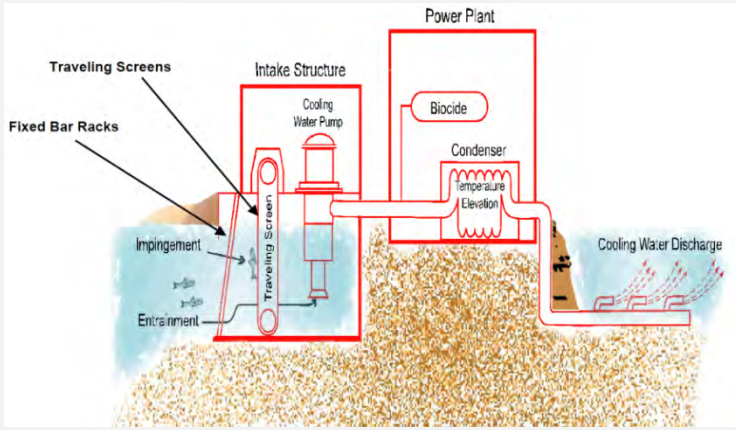
# IM Compliance Technologies
# Options 5 & 6

## Modified Traveling Screens

- Modify existing traveling screen with fish collection buckets and fish return system

## System of Technologies, Management Practices, and Operational Measures

- Any combination of technologies, management practices, and operational measures that the permitting authority determines is BTA for reducing impingement mortality.



# §316(b) Compliance Technologies (Entrainment Controls)

# Entrainment Control Options

## Entrainment Controls:

- Flow Reduction Technologies & Operational Measures

  *For purposes of this rulemaking, EPA assumes that entrainment and entrainment mortality at a site are proportional to source water intake volume. Thus, if a facility reduces its intake flow, it similarly reduces the amount of organisms subject to entrainment.*

- Exclusion Technologies

# Entrainment Control Options

## Flow Reduction Technologies & Operational Measures

**Cooling Towers:**

- Reduce water intake by 95 to 98%
- Commensurate reduction in entrainment
- Satisfies impingement mortality BTA Option 1

**Other Flow Reduction Technologies & Operational Measures:**

- Variable Speed Pumps
- Seasonal Operation or Seasonal Flow Reductions
- Unit Retirements
- Water Reuse & Alternative Sources of Cooling Water

# Entrainment Control Options

## Exclusion Technologies

- Designed to exclude entrainable organisms from the cooling water intake
- Generally requires fine mesh screen with openings of 2 mm or less
- May be designed to take advantage of existing onshore intake structure, pumps, screen house, etc.
- Requires site-specific evaluation
- IM BTA Option 2 (0.5 fps DIF)

**Examples include:**

- Fine fine mesh traveling screens
- Cylindrical wedgewire screens
- Aquatic filter barriers

# §316(b) IMPLEMENTATION

# §316(b) Implementation

## Implementation:

The §316(b) IM&E requirements will be applied to facilities through their NPDES Permit.

- Current permit expires *after* July 14, 2018
  - submit all the information required in the applicable provisions of 40 CFR 122.21(r)
- Current permit expires *prior to or on* July 14, 2018
  - May request alternate schedule for submission of the information required when applying for permit
  - If the facility can demonstrate that it could not develop the required information by the applicable date, the permitting agency must establish an alternate schedule

# §316(b) Implementation

| Permit Application Materials | Existing facilities that withdraw ≤125 MGD | Existing facilities that withdraw >125 MGD |
|---|---|---|
| 122.21(r)(2) Source water physical data | X | X |
| 122.21(r)(3) Cooling water intake structure data | X | X |
| 122.21(r)(4) Source water baseline biological characterization | X | X |
| 122.21(r)(5) Cooling water system data | X | X |
| 122.21(r)(6) Chosen method(s) of compliance with IM standard and Impingement Technology Optimization Study | X | X |
| 122.21(r)(7) Existing Entrainment Performance studies | X | X |
| 122.21(r)(8) Operational status | X | X |
| 122.21(r)(9) Entrainment characterization study | | X |
| 122.21(r)(10) Comprehensive Technical Feasibility and Cost Evaluation | | X |
| 122.21(r)(11) Benefits valuation study | | X |
| 122.21(r)(12) Non-water quality environmental and other impacts | | X |

# §316(b) Implementation

## Impingement Optimization Study [(§122.21(r)(6)]

- Facilities that choose IM BTA Options 5 or 6 must conduct an Impingement Technology Optimization Study
- Demonstrate that the technology is optimized to minimize impingement mortality of all non-fragile species.

## Entrainment Performance Studies [(§122.21(r)(7)]

- Facilities must submit any previously conducted studies (or studies obtained from other facilities) addressing through-facility entrainment survival, technology efficacy, etc.

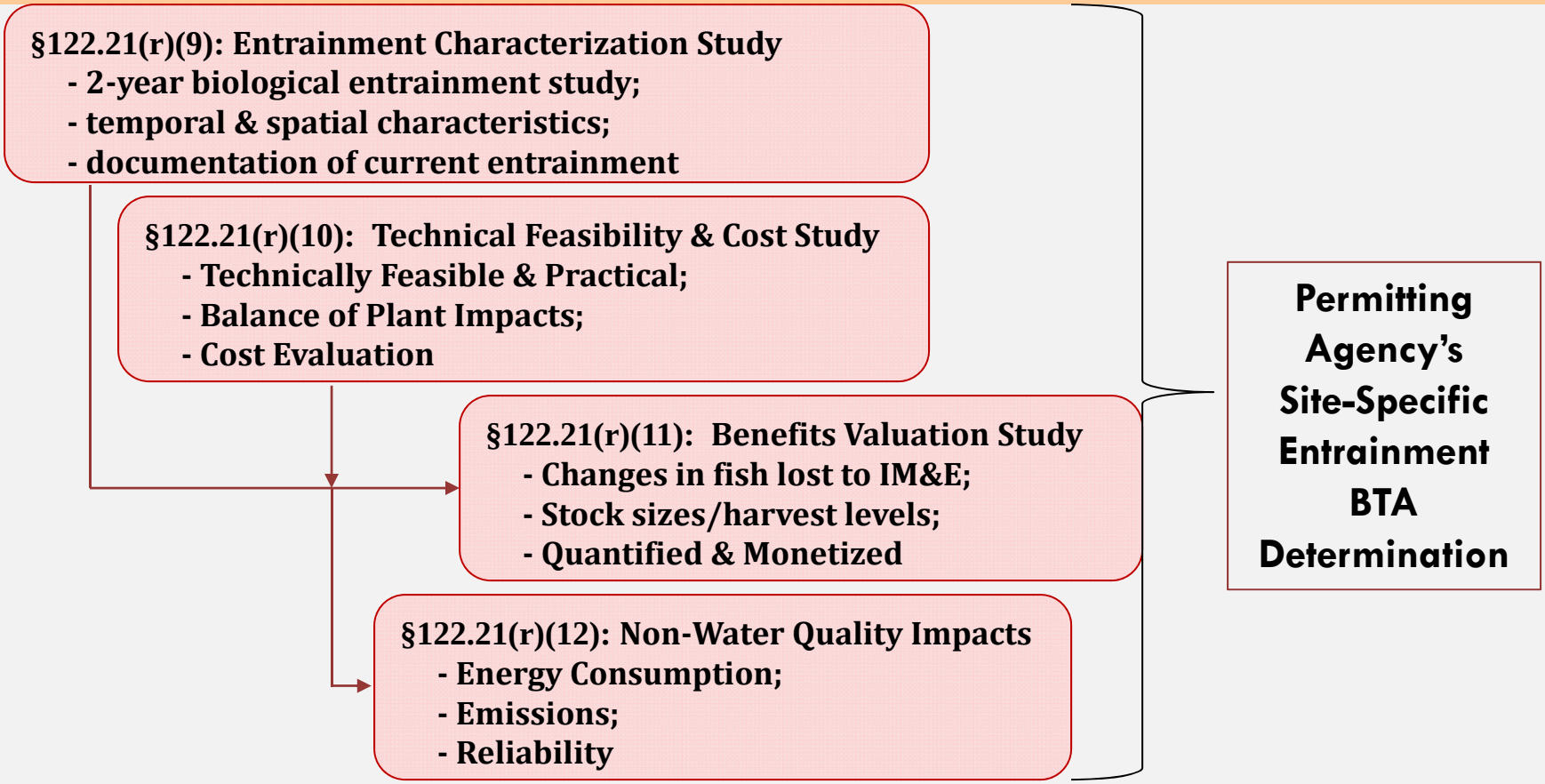
# §316(b) Implementation

## Impingement Optimization Study

- Includes 2-years of biological data collection measuring the reduction in IM:
- Design study to determine optimal configuration and operating conditions of the system:
  - adjust the spray wash pressure;
  - adjust speed of rotation;
  - re-angle the fish sluicing sprays;
  - ensure adequate water in the return flume;
  - modify the fish return to avoid avian and animal predation on the aquatic organism;
  - locate the fish return in such a way to avoid predation

# §316(b) Implementation

## >125 MGD



# §316(b) Implementation

## Site-Specific Entrainment BTA Determinations

Factors relevant to determining BTA:

- Numbers and types of organisms entrained;
- Federally listed T&ES and critical habitat;
- Impact of changes in PM emissions or other pollutants;
- Land availability;
- Remaining useful life of plant; and
- Quantified and qualitative social costs and benefits of available entrainment technologies.

# §316(b) Implementation

Aligning compliance deadlines for impingement mortality and entrainment requirements [§125.94(b)]:

- After issuance of a final permit that establishes the entrainment BTA requirements, the facility would finalize its chosen method for compliance with IM BTA.
- The facility must comply with the IM and entrainment standards as soon as practicable.
- The permitting agency will develop a schedule whereby the facility would proceed to design, construct, and implement its technologies for IM, entrainment, or both.

# §316(b) Implementation

**>125 MGD**

**Submit Permit Application**

**Permit**

- **Entrainment Characterization Study**
  - **Technical Feasibility & Cost**
    - **Benefits Valuation Study**
    - **Non-Water Quality Impacts**

**Agency Review**

**Permit**

- **BTA determination for entrainment**
- **Select IM BTA compliance alternative**
- **Establish schedule to proceed IM&E controls "as soon as practicable"**
- **Conduct IM Optimization Study, if required, after installation of IM controls**

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

Study must include an evaluation of the technical feasibility of:

- Closed-cycle recirculating systems as defined at §125.92(c); may include:
  - natural draft cooling towers,
  - mechanical draft cooling towers,
  - hybrid designs, and
  - compact or multi-cell arrangements
- Fine mesh screens with a mesh size of 2 mm or smaller
- Water reuse and alternate sources of cooling water
- Other technologies as requested by permitting authority

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

The technical feasibility evaluation must include:

- Description of all technologies and operational measures considered;
- Discussion of land availability, as applicable;
- Discussion of available sources of process water, grey water, wastewater, or other waters for use as some or all of the cooling water needs;
- Documentation of factors other than cost that may make a candidate technology impractical or infeasible for further evaluation.

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Technical Feasibility Evaluation Example:

## Fine Mesh Screens

- Input to the design basis for Fine Mesh Screens:
  - Location of facility
  - Water source (e.g. River, Lake, etc.)
  - Source water characteristics (e.g., bathymetry, flow, etc.)
  - Types and size of entrainable organisms in the source water
  - Drawings of existing screens and intake structure
  - Existing intake velocities, spray wash capacity, circulating water pump information

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Fine Mesh Screens - Factors to consider:

- If coupled with fish collection/return:
  - Water requirements to support fish spray and fish return
  - Impact on intake velocity with smaller screen openings
  - Effect on circulating water intake pumps
  - Potential for increased CWIS and intake pump maintenance

Source: Evoqua Water Technologies

- If designed with cylindrical wedgewire screen:
  - Screen plugging & debris build-up
  - Biofouling
  - Frazil ice and zebra mussel colonization
  - Design with hydroburst system for automatic cleaning
  - Space availability and impacts to navigation
  - Source water bathymetry & currents

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Technical Feasibility Evaluation Example:

## Closed-Cycle Cooling

- Input to design basis for New Cooling Towers
  - Condenser design information
  - Circulating water flow and temperature
  - Wet bulb temperatures
  - Approach temperature
  - Plant thermal kits/heat balances
  - Cycles of concentration

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Closed-Cycle Cooling – Factors to Consider:

- Land Availability;
- Location and Space Restriction (approx. 160 acres per GW)
- Wind Rose for Plume
- Increased Air Emissions
  - Total Dissolved Solids emitted → $PM_{10}$ emissions
- Icing and Fogging
- Balance of Plant Impacts
- Impact on electric generation and unit efficiency
- Remaining Useful Life of the Facility
- Cooling tower blowdown characteristics and discharge
- Consumptive use impacts

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Technical Feasibility Evaluation Example:

## Water Reuse and Alternate Sources of Cooling Water

- Examine available opportunities to reuse of water and wastewater generated at the facility;
- Identify wastewater dischargers in the vicinity of the facility;
- Evaluate discharge volumes, characteristics, and water treatment requirements;
- Note: the volume of available water need not be for the full intake flow;
- This analysis should include an estimate of the cost to build any new infrastructure (e.g., piping, pump houses) and the ongoing operational costs (e.g., pump costs)

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

Sargent & Lundy LLC

## Control Technology Cost Evaluation

- Cost estimates for the technologies will be used in the cost/benefit evaluation
- Currently no EPA guidelines on development of equipment cost estimates
- Well-defined design basis for cost estimate in order to determine site-specific entrainment BTA

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

- Example of Cooling Tower Capital Cost Estimate (Multiple Gas Units) – Facility Compliance Cost

| Description | $ |
|---|---|
| Direct & Construction Indirect Cost (includes cooling tower, circulating water pipe, pump basin, etc.) | $44,000,000 |
| Indirect Costs: consumables, freight, sales tax, contractor's general admin., etc. | $8,000,000 |
| Engineering, Procurement & Project Services | $5,000,000 |
| Construction Management/Field Engineer | $2,400,000 |
| Startup & Commissioning | $1,100,000 |
| Contingency | $11,000,000 |
| Total Project Cost | $71,500,000 |

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

Control Technology Cost Evaluation:

§122.21(r)(10)(iii): The cost evaluation must:

- Include engineering cost estimates of all technologies considered;
- Include costs of any facility modifications necessary to support construction and operation of a technology;
- All costs must be presented as the net present value (NPV) and corresponding annual cost;
- Facility compliance costs must be adjusted to estimate *social costs*.

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Social Costs

*"The costs estimated from the viewpoint of society…*

*…represents the total burden imposed on the economy*

*…adjustments to facility compliance costs to produce social costs cause [social costs] to be higher than compliance costs, while other [adjustments] cause social costs to be lower."*

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Compliance Cost vs. Social Cost

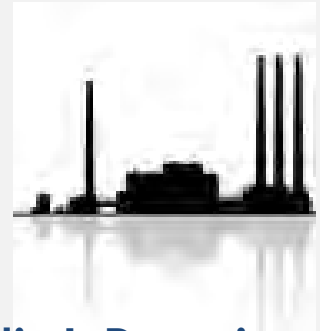
| | |
|---|---|
| Compliance costs: | Calculated as after-tax costs |
| Social costs: | Calculated as pre-tax |
| Compliance costs: | Include the facility's administrative costs to comply with the rule(e.g., permit application costs) |
| Social costs: | Include the permitting agency's administrative costs |
| Compliance costs: | Include outages, downtime, and other impacts to facility net revenue |
| Social costs: | Include only that portion of lost net revenue that does not accrue to other producers |

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

| Total Social Costs |
| --- |
| **Facility Compliance Costs** |
| Technology Capital Cost |
| Annual O&M Costs |
| Installation Downtime |
| Energy Penalty |
| Start-Up and Permitting Activities |
| Annual Administrative Monitoring Activities |
| Permit-Related Non-Annually Recurring |
| **State and Federal Government Costs** |

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Example of Installation Downtime Cost



**Facility's Downtime Cost**

4 Week Outage for Installation → Planned 2 Week Outage

2 weeks of Electric Generating Capacity — less — 2 weeks of cost savings for not operating

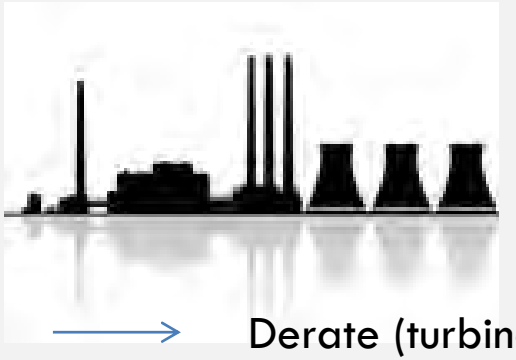
**Society's Downtime Cost**

4 Week Outage for Installation → Planned 2 Week Outage

2 weeks of Replacement Megawatts — less — 2 weeks of facility's typical operating expenses

# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Example of Energy Penalty Cost



Cooling Tower → Derate (turbine backpressure)

### Facility's Energy Penalty Cost

Increase Input → Decrease MW Output

### Society's Energy Penalty Cost

Different Facility → Replacement MW Cost

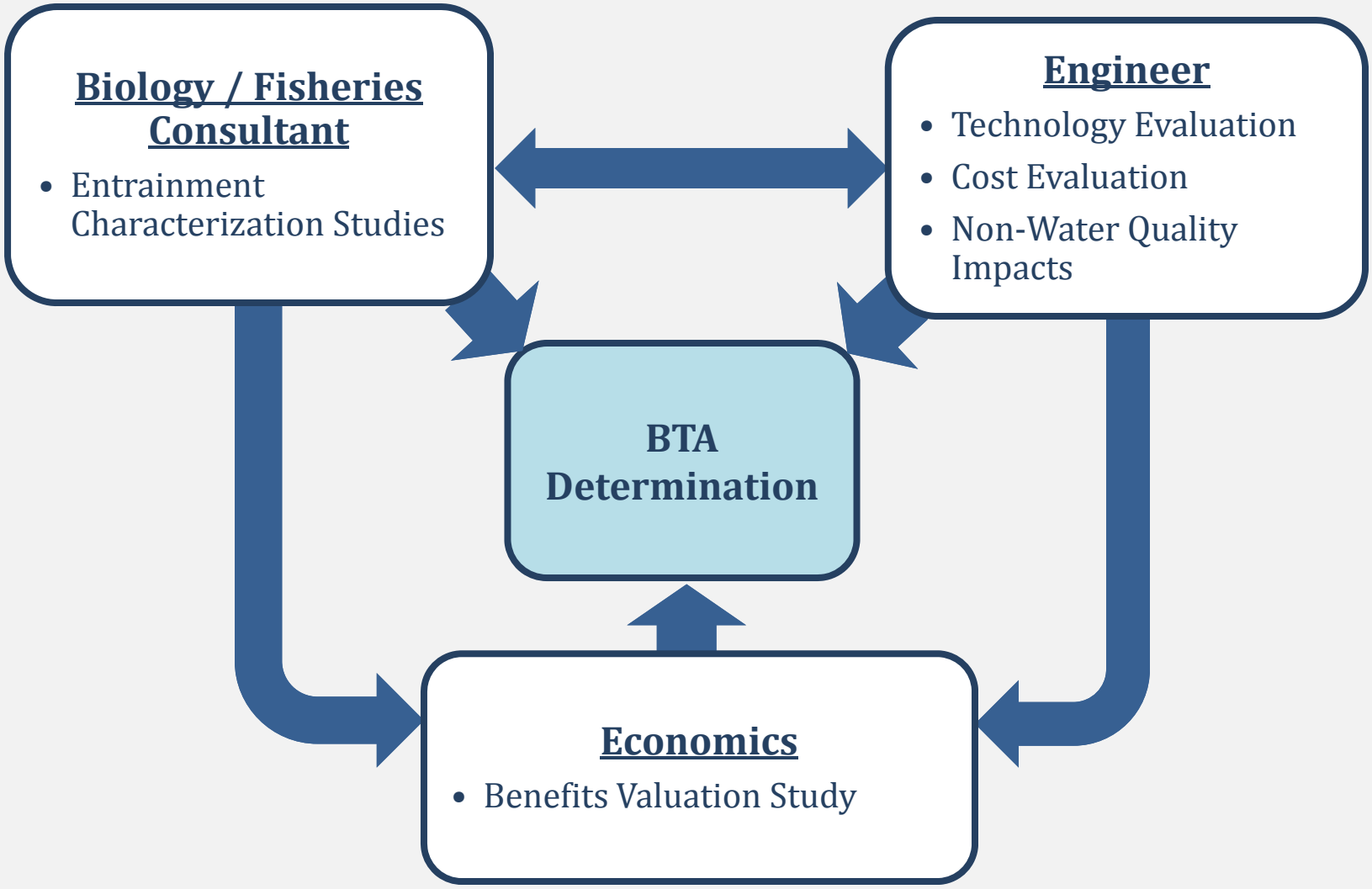
# §316(b) Comprehensive Technical Feasibility and Cost Evaluation Study

## Social Cost vs Benefit Analysis

The permitting agency will compare total social costs [§122.21(r)(10)] to total social benefits [§122.21(r)(11)] to develop its site-specific BTA determination

# §316(b) COMPLIANCE PLAN DEVELOPMENT

# Compliance Plan Development



# Compliance Plan Development

## Facility's Compliance Plan Approach:

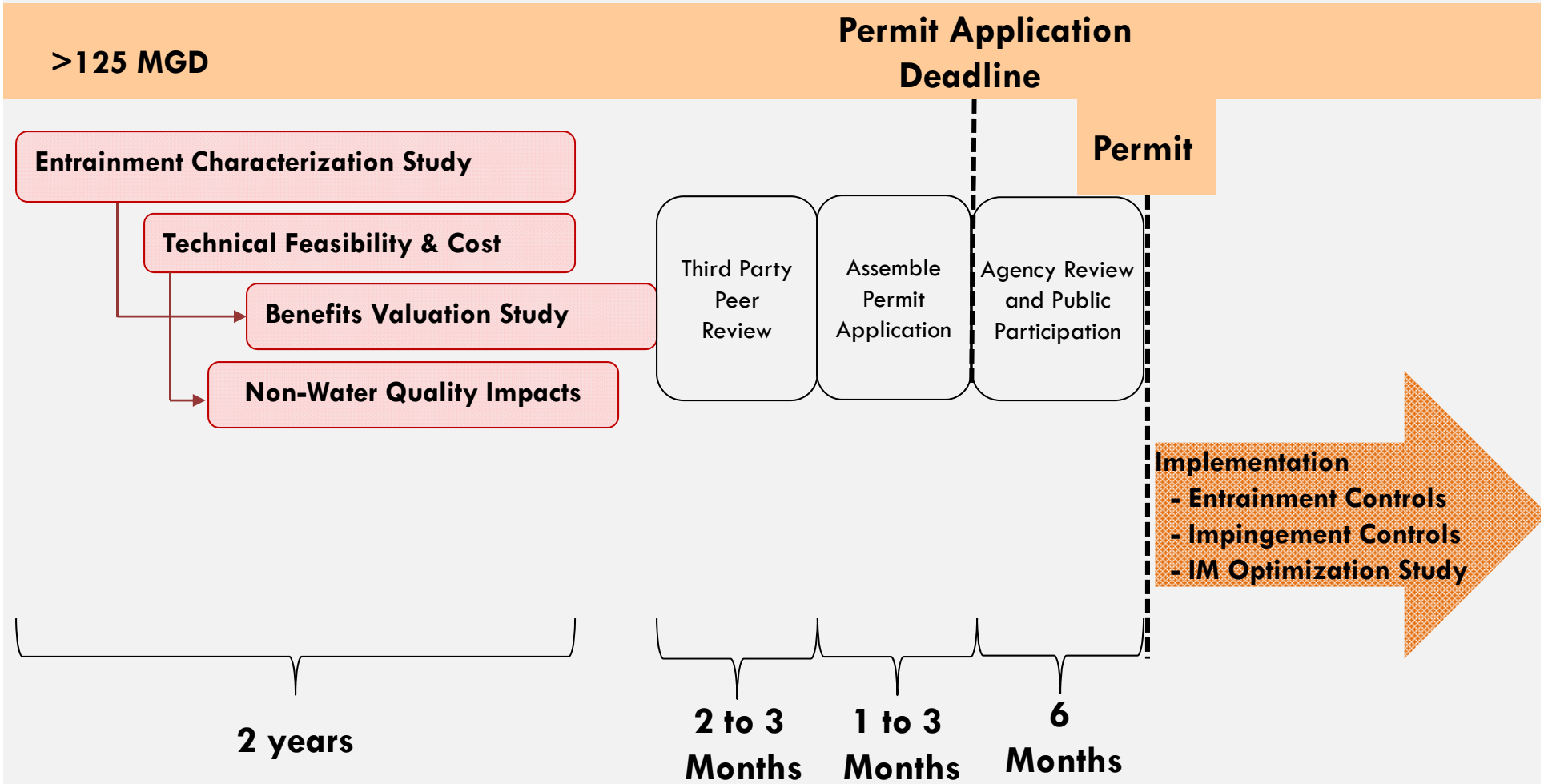
- Define baseline CWIS description & operation
- Identify existing IM&E controls and effectiveness
- Identify §122.21(r) requirements and NPDES renewal schedule
- Review existing IM&E studies for representativeness
- Develop plan to complete all required studies:
  - Entrainment Characterization Study
  - *Technical Feasibility and Cost Evaluation*
  - *Benefits Valuation*
  - *Non-Water Quality Impacts*

# Compliance Plan Development

## Facility's Compliance Plan Approach:

- Develop schedule to perform all required studies (start date/ end date)
- Identify support team with appropriate expertise:
  - Biological / Fisheries Consultant
  - Engineering / Cost Estimating / Non-Water Quality Impacts
  - Economic Impact Analysis
- Identify potential Peer Reviewers
- Recommend open line of communication with Agency to minimize potential issues and schedule conflicts

# Compliance Plan Development



# §316(b)

# Thanks for Attending

If you have any further questions about this topic or other environmental support, please contact: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