Chapter 2: Costing Methodology for Model Facilities

INTRODUCTION

This chapter presents the methodology used by the Agency to develop cost estimates for model facilities. For the final rule, the Agency used the cost modules, presented in Chapter 1, to develop cost estimates for 543 model facilities. These model facility costs and other costs of complying with the various requirements of the final rule were then used in the economic analysis to develop unit costs. Unit costs were then assigned to the 554 in-scope facilities, based on the facilities' modeled compliance responses, and aggregated to the national level. See the Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule for additional information national costs.

The term model facility is used frequently throughout this chapter. The Agency notes that model facilities are not actual existing facilities. Model facilities are statistical representations of existing facilities (or fractions of existing facilities). Therefore, the cost estimates developed for the rule should not be considered to reflect those exactly of a particular existing facility. However, in the Agency's view, the national estimates of benefits, compliance costs, and economic impacts are representative of those expected from the industry as a whole.

1.0 TECHNOLOGY COST MODULES APPLIED TO MODEL FACILITIES

EPA developed the following costing modules for assessing model-facility compliance costs for today's final rule:

1. Fish handling and return system (impingement mortality controls only (I only))
2. Fine mesh traveling screens with fish handling and return (impingement mortality & entrainment controls (I&E))
3. New larger intake structure with fine mesh, handling and return (I&E)
4. Passive fine mesh screens with 1.75 mm mesh size at shoreline (I&E)
5. Fish barrier net (I only)
6. Gunderboom (I&E)
7. Relocate intake to submerged offshore with passive fine mesh screen with 1.75 mm mesh size (I&E)
8. Velocity cap at inlet of offshore submerged (I only)
9. Passive fine mesh screen with 1.75 mm mesh size at inlet of offshore submerged (I&E)
10. Add/modify shoreline tech for submerged offshore (I only or I&E)
11. Add double-entry, single-exit with fine mesh and fish handling and return (I&E)
12. Add passive fine mesh screens with 0.76 mm mesh size at shoreline (I&E)
13. Relocate intake to submerged offshore with passive fine mesh screen with 0.75 mm mesh size (I&E)
14. Passive fine mesh screen at inlet of offshore submerged with 0.75 mm mesh size (I&E)

The derivation and background for each of these technology cost modules is presented in Chapter 1 of this document.

For the final rule, each model facility had three potential compliance actions: (1) no controls for impingement mortality or entrainment, (2) impingement morality controls only, or (3) impingement mortality controls plus entrainment controls. A facility qualifies for compliance action (1) if it has recirculating cooling systems in place or meets the impingement and/or entrainment reduction requirements with controls in-place. Figures 1 and 2 at the end of this section provide a decision tree for assigning compliance actions (2) and (3) to the in-scope Phase II model facilities.

Of the modules listed above, numbers 1, 5, and 8 are dedicated to impingement mortality controls alone. The Agency generally applied the remainder of the technology modules for cases where the model facility received entrainment and impingement requirements.

In the cases that a facility had a functional impingement control system at baseline and was deemed to require upgrades to entrainment controls, the Agency generally assigned costs to the model facility to upgrade the existing impingement mortality controls in addition to the entrainment upgrade. The Agency learned through its research that in the majority of cases when upgrading a technology for entrainment controls, the effort and cost of replacing the attached impingement controls generally compared with the effort and cost to retain and reuse the existing impingement controls (for more details, see the traveling screen technology module documentation in Chapter 1). The Agency assigned entrainment only (with no additional impingement upgrade costs) requirements to a few unique situations for the main option in the final rule. This included the case of a low-velocity, double-entry, single-exit screening system operating in-place at baseline. The Agency assigned only the costs associated with adding fine-mesh overlays for this system because the model facility had additional, redundant impingement technologies in-place. In addition, those facilities with barrier net systems in-place that required entrainment upgrades received only the entrainment system costs, as the existing barrier net would be functional for impingement controls regardless of changes to an intake structure.

The Agency based its approach of assigning costing modules to model facilities on a combination of facility and intake-specific questionnaire data in addition to publicly available satellite photos and maps, where appropriate. Because not all facilities received the same questionnaire, the Agency attempted to utilize data responses to questions that were asked in both the short-technical and detailed questionnaires whenever possible. In the end, the primary difference in data analysis between short-technical (STQ) and detailed questionnaire (DQ) respondents was the level to which the Agency developed costs. The STQ respondents did not provide significant intake-level data, outside of intake identification information and velocity. For instance, for the STQ, the Agency did not obtain intake-specific information on the exact technology in-place for each intake. The Agency instead obtained technology in-place information at the facility-level for STQs. Necessarily, the Agency utilized this facility-level information for the STQ respondents and treated the facility as though it were a single intake with the characteristics reported for the facility. For the DQ respondents, the Agency obtained sufficient intake-level information to develop individual costing decisions for each intake.

The Agency utilized questionnaire data as the primary tool in the assessment of the types of intake technologies and upgrades applied at each model-facility. For those facilities utilizing recirculating cooling systems in-place, the Agency assigned no compliance actions as they meet the requirements at baseline. For those with once-through, combination, other, or unknown cooling system types, the Agency treated the facility as though all intakes were of once-through configuration. The Agency chose this method so as to best estimate the compliance costs, as the Agency's methodology utilizes flow as the independent variable. For example, one intake of three at a facility is recirculating and the others of once-through configuration, then the flow rate of the recirculating intake assigned costs would not be too great in comparison to the once-through flows. See DCN 6-3585 for a discussion of the small effect on costs from this assumption about combination cooling system types The Agency then determined those intakes (facilities) that met compliance requirements with technologies in-place. These facilities received no capital or annual operating and maintenance compliance upgrade costs (although they may receive administrative or monitoring costs). The Agency categorized facilities according to waterbody type from which they withdraw cooling water. The Agency then sorted the intakes (facilities) within each waterbody type based on their configuration as reported in the questionnaires. (Note, as discussed above, the Agency examined short-technical questionnaire facilities on the facility-level and detailed questionnaire respondents by the intake level.)

Generally, the categories of intakes within one waterbody type are as follows: canal/channel, bay/embayment/cove, shoreline, and offshore. Once the intake (facility) is classified to this level the Agency examines the type of technology in-place and compares that against the compliance requirements of the particular intake (facility). For the case of entrainment requirements, the intake technologies (outside of recirculating cooling) that qualify to meet the requirements at baseline are fine mesh screen systems, and combinations of far-offshore inlets with passive intakes or fish handling/return systems. A small subset of intakes has entrainment qualifying technologies in-place at baseline (for the purposes of this costing effort). The Agency estimates that intakes at 24 facilities would pre-qualify for the entrainment requirements and avoid costs of such upgrades. Therefore, in the case of entrainment requirements, most facilities with the requirement would receive technology upgrades. The methodology for choosing these entrainment technology upgrades is explained further on in this discussion. For the case of impingement requirements, there are a variety of intake technologies that qualify (for the purposes of this costing effort) to meet the requirements at baseline. The intake types meeting impingement requirements at baseline include the following: barrier net, passive intakes (of a variety of types), and fish handling and return systems. A significant number of intakes (facilities) have impingement technology in-place that meets the qualifications for this costing effort. The Agency estimates that intakes at 87 facilities would pre-qualify for the impingement requirements and avoid costs of such upgrades. Therefore, some intakes (facilities) require no technology upgrades when only impingement requirements apply.

For facilities that do not pre-qualify for impingement and/or entrainment technology in-place (for the purposes of this costing effort), the Agency focuses next on questionnaire data relating to the intake type – canal/channel, bay/ embayment/cove, shoreline, and offshore. Within each intake type, the Agency further classifies according to certain specific characteristics. For the case of bays, embayments, and coves, the Agency determined if the intake is flush, protruding, or recessed from shoreline. For the case of canals and channels, the Agency similarly focuses on whether the intake is flush, protruding, or recessed from a shoreline. In addition, the Agency calculates an approximate approach velocity using reported information on the canal flow rate and cross-sectional area, where applicable (specific to detailed questionnaire respondents only). The approximated approach velocity aided the Agency in verifying the reported mean intake velocity. For the case of shoreline intakes, the Agency necessarily assessed whether the intake is flush, protruding, or recessed. For the case of offshore intakes, the Agency attempted to examine whether or not the intake has an onshore terminus (or well) and assesses the characteristics of the onshore system. The Agency found that very few facilities with offshore intakes reported consistent and clear information about onshore wells. Therefore, the Agency chose to develop costs for onshore intakes without using technology module 10.

The information the Agency gathers up to this point is sufficient to narrow down the likely technology applications for each intake (facility). However, in order to determine the best technology application, the Agency also utilizes publicly available satellite images and maps where appropriate. The use of the satellite images and maps aided the Agency in determining the potential for the construction of expanded intakes in-front of existing intakes, the possibility of installing a barrier net system, and the potential for an intake modification to protrude into the waterbody (such as a near-shore t-screen) due to the degree of navigational traffic in the near vicinity of the intake and whether a protrusion might be tolerated. The satellite images also helped identify obvious signs of strong currents, the relative distance of a potentially relocated intake inlet, the possibility for fish return installations of moderate length, etcetera. The Agency was able to collect satellite images for most intakes (facilities) for which it required the resource. However, in some cases (especially those in the rural, mid-western US), only maps were available. Hence, for the case of a significant number facilities located near small freshwater rivers/streams and lakes/reservoirs, the Agency utilized only the questionnaire data and the overhead maps available.

The Agency prepared the following crosswalk and breakdown of the application of the technology modules. The following sections provide the factors that the Agency used in determining the proper technology application and explain any exceptions to these cases.

Module 1 - Add Fish Handling and Return System: This technology applies for the case of impingement only upgrades. The Agency applied this technology generally to facilities that when requiring the impingement only upgrade had an existing traveling screen system. The Agency applied this technology generally when the intake velocity of the intake (facility) was roughly 1 ft/sec or below. The rationale behind applying this technology in this case is that because the intake velocity is relatively low and the existing traveling screen system is functional, the fish handling and return system could be added to the operating system and would perform under these conditions. Vendors noted that approximately 75% of the existing screen components would require replacement when adding fish handling and return. It would be more prudent to replace the entire screen unit. (See the traveling screen cost module in Chapter 1 of this document.)

Module 2 - Add Fine Mesh Travelling Screens with or without Fish Handling and Return: This technology generally applies for the case of impingement and entrainment upgrades. The Agency applied this technology to intakes (facilities) with an existing traveling screen system in-place. The Agency applied this technology when the intake velocity was roughly 1 ft/sec or below. The rationale behind the application is similar to that of Module 1, in that the low existing velocity allowed for replacement of the existing screen overlays without expanding the size of the intake appreciably to lower the velocity. As a general approach, the Agency applied this technology to a variety of waterbody types and intake locations (such as in canals, in coves, and along shorelines). In addition to adding fine-mesh screens that this technology also may replace the fish handling and return system of the intake. When the replacement of fish handling scenario is applied it requires replacement of all screen units with units that include fish handling and return features plus additional spray water pumps and a fish return flume. For those facilities with existing functional fish handling and return systems, the Agency may have applied fine mesh screen overlay panels only. See the documentation for this particular module in Chapter 1 of this document for more information.

Module 3 - Add New Larger Intake Structure with Fine Mesh, Handling and Return: This technology generally applies for the case of impingement and entrainment upgrades. However, in a few select cases, the Agency applied it for the case of impingement only, more on that below. The Agency applied this technology to intakes with a variety of onshore configurations. The Agency applied this technology when the intake velocity was appreciably above 1 ft/sec. The rationale behind the application is that demonstrated cases of operable fine-mesh screening systems for large plants have used design velocities of approximately 1 ft/sec. Because of the velocity implications, the Agency necessarily required certain intakes (facilities) to enlarge their intakes. Therefore, these intakes would be constructed anew in front of an existing structure and tied in towards the end of the construction project. As a general approach, the Agency applied this technology to a variety of waterbody types and intake locations (such as in canals, in coves, and along shorelines). Note that the Agency verified (through observation of satellite images and overhead maps) that sufficient open water area existed in front of the existing intake, and that the new protruding intake would not hinder boat traffic. In a select few cases, the intake velocity of a facility complying with the impingement only requirements was extremely high (ie, above 3 ft/s). In these cases, the Agency may have applied this module to allow for proper operation of the impingement technologies.

Modules 4 and 12 - Add Passive Fine Mesh Screens at Shoreline: This technology applies mostly for the case of entrainment and impingement upgrades. Module 12 applied to ocean and estuarine environments and module 4/12 to all others. The Agency applied this technology generally in a very similar fashion to Module 3 above. The primary difference for their applications is that Module 4/12 is slightly more flexible in its location than Module 3 and that Module 4/12 has the ability to be retrofitted to unusual intake structures, such as protruding intakes, submerged shoreline intakes, etc. In addition, the passive wedgewire t-screen system is very well suited for application where currents are present, as the system is designed to utilize currents for controlling impingement. The Agency applied this technology generally when the intake velocity of the intake (facility) was above roughly 1 ft/sec. However, that is not exclusively the case, as there were exceptions where even for low velocity, unusual passive screen systems, the Agency upgraded these intakes with Module 4/12. This module, similarly to Module 3 above, would apply for a select few cases that had extremely high intake velocities, even though they were required to comply with impingement only.

Module 5 - Add Fish Barrier Net: The Agency applied the barrier net module to control impingement, both in the case of impingement only upgrades and in a few cases for the combined impingement/entrainment upgrades. As a general rule, the Agency applied the barrier net only to cases where it could acertain that a favorable geographical condition existed, such as the case of a wide mouth canal without boat traffic and low current potential, the similar conditions in a wide mouth cove/bay, and the similar conditions for a lake/reservoir shore. In a select number of situations, the Agency applied both the fish barrier net system and an entrainment controlling system. Generally, this was for the case that a fish handling and return system could not reasonably be configured to deliver impinged fish safely away from the intake. Therefore, the barrier net served the purpose of preventing the cyclical impingement/reimpingement condition in several cases. The Agency did not examine intake velocities when applying barrier nets. Instead, the Agency focused on the configuration of the intake and its adjoining shorelines and sized the net according to an empirical, through-net velocity.

Module 6 - Marine Life Exclusion System (gunderboom): The Agency applied the gunderboom system to several intakes for the final rule analysis. The Agency examined the set of intakes according to similar criteria as for barrier nets (module 5 above), with respect to entrainment and impingement upgrade requirements. If an intake had an extremely high intake velocity (above 3 ft/sec), an below average intake flow, a suitable environment for a gunderboom system, similar to that for the barrier net technology described above, and no other entrainment options appeared reasonable, the Agency considered applying the gunderboom. This was a very small set of intakes, several of which the Agency did not have sufficient information to determine the potential wave/current activity, nor navigation traffic. Hence, the Agency applied the gunderboom in only a small set of cases for entrainment and impingement upgrades. It is likely that the Agency has underestimated the degree to which the gunderboom system could be applied in the final analysis, due to data uncertainty and its concern for applying the best technology for known site conditions. This had the effect of potentially biasing costs upward for entrainment controls in select cases, as the gunderboom system is less expensive than some other entrainment control technologies.

Modules 7 and 13 - Relocate Intake to Submerged Offshore with Passive Screen: The Agency applied these costing modules to address impingement and entrainment requirements. The Agency applied these module, generally, to any waterbody for which there was a clear advantage to its implementation. The module 13 was used for estuarine and ocean waters, and module 7 for all others. What the Agency defined as an advantage for this module generally related to the fact that an onshore intake or short canal intake provided no clear avenue for applying one of the velocity reducing modules, such as numbers 3 and 4. As a rule the Agency applied the relocation of an intake to submerged offshore only for cases where the existing intake velocity was significantly above 1 ft/s. At the NODA, the Agency relied on this module to represent situations where there was not one module that stood out as the clear choice solution, but in response to comments did not use that approach for the final rule. Instead, the Agency applied the module in a portion of the cases where no clear entrainment module choice stood out, balancing the number and distribution of applications so as not to bias costs upward above the median cost for entrainment controls in the final analysis. Contrary to intuition, the Agency learned in its research of offshore submerged intakes that a good number are used in river environments. Hence, the Agency utilized this module in several cases for large rivers. The relocation distance utilized for each case was that derived from the median of those within the intake's waterbody class.

Module 8 - Add Velocity Cap at Offshore Inlet: The Agency applied a velocity cap at the inlet of a submerged offshore pipe in several cases to address impingement only requirements. The prerequisite for this module was that the intake/facility had to have a submerged offshore intake with no reported impingement controls. This combination was not too common, as a significant portion of submerged offshore intakes had either passive offshore intake inlets or fish handling systems onshore. However, for the small number of cases where facilities did not have impingement controls (or at least did not report them in the questionnaire), the Agency applied this module to meet the impingement only requirements. As a general rule, the Agency has reservations about the ability of a velocity cap system to meet the numerical requirements of the impingement standards. However, it should be noted that in the case of offshore intakes that the "location" of an intake can be considered for the compliance action. Therefore, an offshore intake with a velocity cap is a combination that the Agency feels reasonably represents the costs of complying with the impingement requirements.

Modules 9 and 14 - Add Passive Fine Mesh Screen at Inlet of Offshore Submerged: The Agency applied a passive, fine-mesh, wedgewire, t-screen system at the inlet of a submerged offshore pipe to address impingement and entrainment requirements. Module 14 applied to ocean and estuarine environments and module 9 to all others. The prerequisite for this module was that the intake/facility had to have a submerged offshore intake with no reported entrainment controls. In some cases, the intake (facility) may have reported impingement controls, but the Agency generally ignored these controls and presumed that the installation of the passive fine mesh at the offshore inlet would suffice to control both entrainment and impingement effectively. This module obviously is one of the simplest in application, as it is clear for all intakes (facilities) through the questionnaire whether or not their intake is submerged offshore. The primary nuance for this situation exists where the intake (facility) may have reported both offshore inlet controls and onshore screening controls. See module 10 for more discussion of onshore screening technologies for submerged offshore intakes. For the purposes of the discussion of this module, it should be noted that the Agency treated the existence of an offshore inlet as the primary location for the application of a compliance technology over an onshore modification where both pre-existed.

Module 10 - Add/Modify Shoreline Tech for Submerged Offshore: The Agency did not apply this module for any of the intakes/facilities for the final rule. Even though this technology would be a reasonable method for an intake (facility) to comply with the rule, the Agency chose not to use it. The basic reason that the Agency did not use the technology was due to an incomplete and unclear data set on the existence and type of onshore wells for offshore intakes. In addition, in most cases where entrainment controls would be required this method did not allow the reconfigured intake to be enlarged in order to lower the intake velocity. In addition, the passive screen intake at the inlet of the offshore pipe was slightly more expensive. From the perspective of a range of facilities, the passive screen is likely more applicable for a wider range of applications.

Module 11 - Add Double-Entry, Single-Exit with Fine Mesh, Handling and Return: This would be a useful application for facilities attempting to comply with the impingement and entrainment requirements in the narrow terminus of a canal or cove. Additionally, in cases where the intake is recessed from shore, this technology can be applied to shoreline applications. The Agency generally applied this technology to canal facilities and when the intake velocity was roughly 1 ft/sec. The Agency mistakenly assumed for the NODA analysis that this module would lower the through-screen velocity for an intake without enlarging the intake structure. This is not the case, the Agency learned upon further research. However, the Agency did confirm that this module will offer considerable advantage in some high debris situations over a conventional flat-panel traveling screen, as the configuration allows for reduced debris carry through. Hence, the Agency chose to apply this type of technology as the standard for the screening portion of module 3, new expanded intake. This module may require clear space in front of the structure, which the Agency considered in its application.

2.0 EXAMPLES OF THE APPLICATION OF TECHNOLOGY COST MODULES TO MODEL FACILITIES

Because the determination of the best technology application depends on a variety of factors and there is a large population of intakes to which these multiple factors apply, the Agency views a series of examples as the best means for demonstrating the logical progression that it applied to the decisions. Based on the classification system described above, the Agency presents examples of each major intake type – canal/channel, bay/ embayment/cove, shoreline, and offshore– to aid the understanding of the Agency's costing assignment process.

Example 1: Canal or Channel Intake

In this example, an intake withdraws cooling water through a canal branching off a tidal river. The intake is a shoreline intake, flush with the shore and built at the terminus of the canal. Based on its characteristics, the facility is subject to impingement and entrainment requirements. The detailed questionnaire reports that the existing intake is a coarse-mesh traveling screen with a fish diversion system in-place. The Agency determined that the reported fish diversion technology in-place was a fish-bypass technology. The reported mean intake velocity is 1.0 ft/s, and the Agency calculated the approximate canal approach velocity as 1.1 ft/s based on the canal cross-sectional area and canal flow rate reported in the questionnaire. Therefore, the Agency concludes that the reported intake velocity is accurate. The canal length is reported at 100 ft. Both the overhead map and satellite photo demonstrate that the intake is close to this estimated length. In addition, the Agency observes that the intake location at the terminus of the canal is less than 100 feet from the bank of the tidal river. The Agency determines that the mouth of the canal is not significantly wider than the canal itself and that the apparent route of boat navigation is to utilize a portion of the canal for barge docking and traffic.

Based on the above factors, the Agency determines that the best technology for this model intake application is to add fine mesh traveling screen with fish handling and return system. The Agency studied existing cases of retrofit fine-mesh screen applications and found the 1 ft/s threshold a reliable design criterion for large intake systems where surface area can be constricted. Therefore, in this case, the existing screen system is sufficiently large to accommodate fine-mesh. The fish handling and return system in this case addresses the impingement control requirements. Because the canal is not long and the return branch would be of reasonable length, the Agency considered the fish handling and return system to be appropriate. The existing fish by-pass system is not considered to be adequate (in and of itself) for meeting the impingement requirements of the national rule. In addition, the navigational use of the canal and the canal's limited throat width necessarily prevents the use of a barrier net system.

In this case, the Agency determines that the debris loading potential near the intake is high. This is due to the clear evidence of boat/barge traffic and the known nature of the particular tidal river from which this facility withdraws water.

Example 2: Bay/Embayment/Cove

In this example, an intake withdraws cooling water from a Great Lake. The intake is a shoreline intake, flush with shore and built at the terminus of the cove. Based on its characteristics, the facility is subject to impingement and entrainment requirements. The detailed questionnaire reports that the existing intake is a coarse-mesh traveling screen with no impingement reducing technologies in-place. The reported mean intake velocity is 2.0 ft/s. Both the overhead map and satellite photo demonstrate that the cove recedes approximately 500 ft from the main water body. The Agency determines that the mouth of the cove is approximately 250 feet in width. Based on the overhead map and satellite image, there is no evidence of boat traffic in the cove. The onshore access routes of the plant apparently meet the fuel delivery needs of the plant.

Based on the above factors, the Agency determined that the best technology for this model intake application is construction of a new, larger intake directly in front of the existing structure. The reason that the Agency utilized a new, larger intake system in this case is that the velocity of the intake is significantly above 1 ft/s and the there is ample room directly in front of the existing intake to allow for the larger intake. The larger intake system provides increased surface area (compared to the existing single-entry, single-exit system), thereby reducing the intake velocity to a level that would facilitate use of the fine-mesh system. Alternatively, the Agency could have applied the gunderboom technology, but the flow of the intakes implied that the size of the system would be far larger than other planned and demonstrated cases of the technology.

A fish handling and return system in this case would be difficult to implement due to the orientation of the deep cove. Therefore, the Agency determined that a barrier net system would address the impingement requirements imposed on the intake. The Agency would be concerned about the creation of a cyclical impingement condition, which would exacerbate the strain on the organisms. A 500-foot return system could be built, but the alternative system of a barrier net is favorable for this particular situation, in the Agency's view. The lack of navigational use of the cove and the cove's wide throat provides a good environment for barrier net deployment.

In this case, the Agency determines that the debris loading potential near the intake is low. This is due to the lack of boat/barge traffic evidence and the known nature of the particular Great Lake from which this facility withdraws water.

Example 3: Shoreline

In this example, an intake withdraws cooling water from a freshwater river. The facility withdraws more than 5 percent of the mean annual flow of this river, even though this is a large river. Hence, it is subject to impingement and entrainment requirements. The intake is a shoreline intake, protruding from shore. The Agency determined that the intake extends 10 feet into the waterbody by examining the satellite imagery and overhead maps, using the reported latitude and longitude of the intake. The Agency also observes that the apparent river width at the intake location is well over 200 feet. The intake is located on a straight section of river, and an approximately 25 foot protruding diversion wall protects the intake from river debris and traffic. The detailed questionnaire reports that the existing intake is a coarse-mesh traveling screen with a fish handling and return system. The reported mean intake velocity is 3.0 ft/s. Based on the satellite images, there is evidence of coal barge traffic near the intake, but significantly far away to allow for the protruding intake.

Based on the above factors, the Agency determines that the best technology for this model intake application is construction of a fine-mesh, cylindrical, wedge wire t-screen system. This passive intake would be constructed to branch from the original protruding intake. In the Agency's view, the wedge wire t-screen system will address the impingement and entrainment requirements imposed on the intake. The reason that the Agency utilized a new intake system in this case is that the velocity of the intake is significantly above 1 ft/s and there is already precedence to allow for a protruding intake. With the construction of a properly sized replacement intake, the velocity can be lowered for entrainment and impingement controls, and the current of the river can be utilized to aid the operation of the intake. Another alternative would be to use a new, larger intake protruding into the waterbody as in the cove example above. Both of the larger intake system provides increased surface area (compared to the existing single-entry, single-exit system), thereby reducing the intake velocity to a level that would facilitate use of the fine-mesh system. However, the wedgewire screen system would provide additional advantages in the form of inherent impingement controls. A fish handling and return system with a traditional traveling system could be an option. Alternatively, the Agency could have applied a relocated intake to the center of the river and applied fine-mesh passive screens. For other cases where the Agency encountered similar conditions, the Agency did vary the application of modules so as to achieve a set of costs about the median cost technology.

In this case, the Agency determines that the debris loading potential near the intake is high. This is due to the clear evidence of boat/barge traffic and the known nature of the particular river from which this facility withdraws water.

Example 4: Offshore

In this example, an intake withdraws cooling water from a submerged offshore intake in an Ocean. At the offshore inlet of the intake is a passive intake built approximately 500 feet from shore. The facility is a short-technical questionnaire facility, and the Agency has no information as to whether or not the intake delivers water to an onshore well. Based on observations of the satellite imagery, the Agency was also unable to identify an onshore well. Based on its characteristics, the facility requires neither an entrainment nor impingement technology upgrade. The existing intake – a passive screen system – is insufficient to meet the entrainment requirements in and of itself. However, in combination with the offshore intake location, the intake meets both requirements.

3.0 REGIONAL COST FACTORS

As described in the sections above, the Agency developed technology-specific cost estimates for model facilities using the cost modules presented in Chapter 1. However, capital construction costs can vary significantly for different locations within the United States. Therefore, to account for these regional variations, EPA adjusted the capital cost estimates for the existing model plants using zip-code based cost factors. The applicable cost factors were multiplied by the facility model cost estimates to obtain the facility location-specific capital costs used in the impact analysis. The Agency derived the site-specific capital cost factors from the "location cost factor database" in RS Means Cost Works 2001. The Agency used the weighted-average factor category for total costs (including material and installation). The RS Means database provides cost factors (by 3-digit Zip code) for numerous locations.

4.0 REPOWERING FACILITIES AND MODEL FACILITY COSTS

Under this final rule certain forms of repowering could be undertaken by an existing power generating facility that uses a cooling water intake structure and it would remain subject to regulation as a Phase II existing facility. For example, the following scenarios would be existing facilities under the rule:

- An existing power generating facility undergoes a modification of its process short of total replacement of the process and concurrently increases the design capacity of its existing cooling water intake structures;

- An existing power generating facility builds a new process for purposes of the same industrial operation and concurrently increases the design capacity of its existing cooling water intake structures;

- An existing power generating facility completely rebuilds its process but uses the existing cooling water intake structure with no increase in design capacity.

Thus, in most situations, repowering an existing power generating facility would be addressed under this final rule.

As discussed in the preamble, the section 316(b) Survey acquired technological and economic information from facilities for the years 1998 and 1999. With this information, the Agency established a subset of facilities potentially subject to this rule. Since 1999, some existing facilities have proposed and/or enacted changes to their facilities in the form of repowering that could potentially affect the applicability of the final rule or a facility's compliance costs. The Agency therefore conducted research into repowering facilities for the section 316(b) existing facility rule and any information available on proposed changes to their cooling water intake structures. The Agency used two separate databases to assemble available information for the repowering facilities: RDI's NEWGen Database, November 2001 version and the Section 316(b) Survey.

In January 2000, EPA conducted a survey of the technological and economic characteristics of 961 steam-electric generating plants. Only the detailed questionnaire, filled out by 283 utility plants and 50 nonutility plants, contains information on planned changes to the facilities' cooling systems (Part 2, Section E). Of the respondents to the detailed questionnaire, only six facilities (three utility plants and three nonutility plants) indicated that their future plans would lead to changes in the operation of their cooling water intake structures.

The NEWGen database is a compilation of detailed information on new electric generating capacity proposed over the next several years. The database differentiates between proposed capacity at new (greenfield) facilities and additions/modifications to existing facilities. To identify repowering facilities of interest, the Agency screened the 1,530 facilities in the NEWGen database with respect to the following criteria: facility status, country, and steam electric additions. The Agency then identified 124 NEWGen facilities as potential repowering facilities.

Because the NEWGen database provides more information on repowering than the section 316(b) survey, the Agency used it as the starting point for the analysis of repowering facilities. Of the 124 NEWGen facilities identified as repowering facilities, 85 responded to the section 316(b) survey. Of these 85 facilities, 65 are in-scope and 20 are out of scope of this rule. For each of the 65 in scope facilities, the NEWGen database provided an estimation of the type and extent of the capacity additions or changes planned for the facility. The Agency found that 36 of the 65 facilities would be combined-cycle facilities after the repowering changes. Of these, 34 facilities are projected to decrease their cooling water intake after repowering (through the conversion from a simple steam cycle to a combined-cycle plant). The other 31 facilities within the scope of the rule would increase their cooling water intake. The Agency examined the characteristics of these facilities projected to undergo repowering and determined the waterbody type from which they withdraw cooling water. The results of this analysis are presented in Table 2-2.

Of the 65 in scope facilities identified as repowering facilities in the NEWGen database, 24 received the detailed questionnaire, which requested information about planned cooling water intake structures and changes to capacity. Nineteen of these 24 facilities are utilities and the remaining five are nonutilities. The Agency analyzed the section 316(b) detailed questionnaire data for these 24 facilities to identify facilities that indicated planned modifications to their cooling systems (in the NEWGen database) which will change the capacity of intake water collected for the plant and the estimated cost to comply with today's rule. Four such facilities were identified, two utilities and two nonutilities. Both utilities responded that the planned modifications will decrease their cooling water intake capacity and that they do not have any planned cooling water intake structures that will directly withdraw cooling water from surface water. The two nonutilities, on the other hand, indicated that the planned modifications will increase their cooling water intake capacity and that they do have planned cooling water intake structures that will directly withdraw cooling water from surface water.

Table 2-2: In-Scope Existing Facilities Projected to Enact Repowering Changes

Waterbody Type	Repowering Facilities Projected to Increase Cooling Water Withdrawals	Repowering Facilities Projected to Decrease or Maintain Cooling Water Withdrawals
Ocean	N/A	N/A
Estuary/Tidal River	3	17
Freshwater River/Stream	14	10
Freshwater Lake/Reservoir	10	1
Great Lakes	0	1

Using the NEWGen and section 316(b) detailed questionnaire information on repowering facilities, the Agency examined the extent to which planned and/or enacted repowering changes would effect cooling water withdrawals and, therefore, the potential costs of compliance with this final rule. Because the Agency developed a cost estimating methodology that primarily utilizes design intake flow as the independent variable, the Agency examined the extent to which compliance costs would change if the repowering data summarized above were incorporated into the cost analysis of this rule. The Agency determined that projected compliance costs for facilities withdrawing from estuaries could be lower after incorporating the repowering changes. The primary reason for this is the fact that the majority of estuary repowering facilities would change from a steam cycle to a combined-cycle, thereby maintaining or decreasing their cooling water withdrawals (note that a combined-cycle facility generally will withdraw one-third of the cooling water of a comparably sized full-steam facility). Therefore, the portion of compliance costs for regulatory options that included flow reduction requirements or technologies could significantly decrease if the Agency incorporated repowering changes into the analysis. As shown in Table 2-2 the majority of facilities projected to increase cooling water withdrawals due to the repowering changes use freshwater sources. In turn, the compliance costs for these facilities would increase if the Agency incorporated repowering for this final rule.

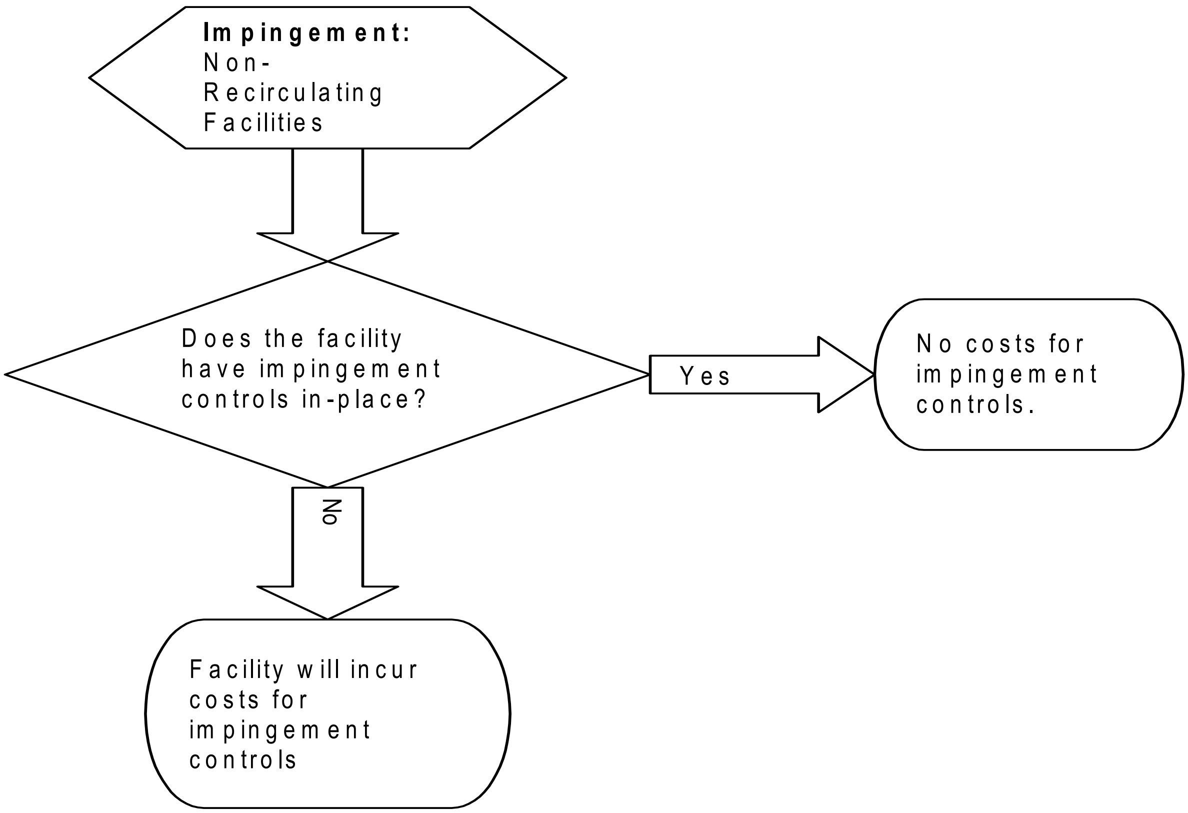

Figure 1. Impingement Controls Flowchart for Model Facility Compliance Costs

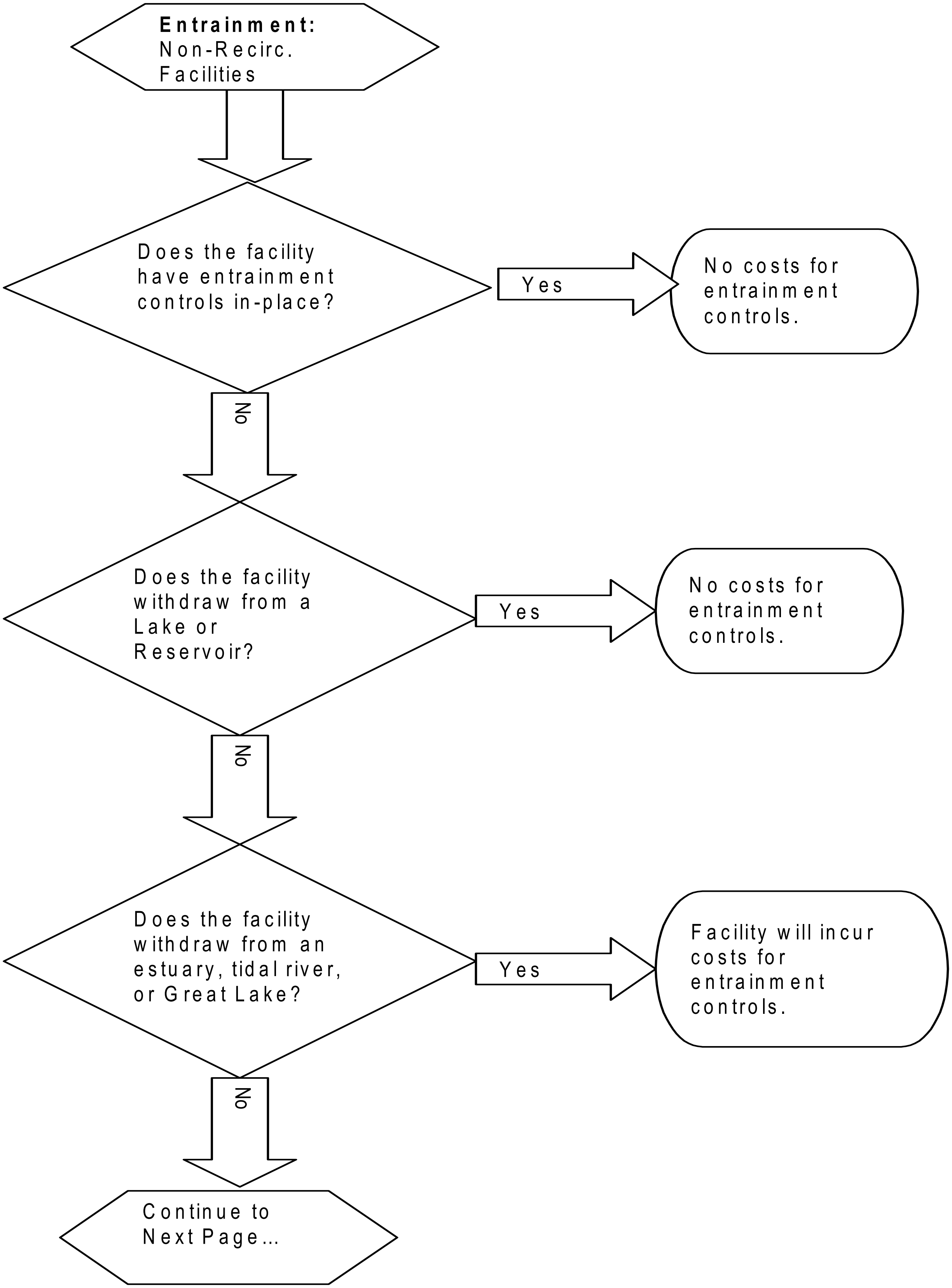

Figure 2. Entrainment Controls Flowchart for Model Facility Compliance Costs

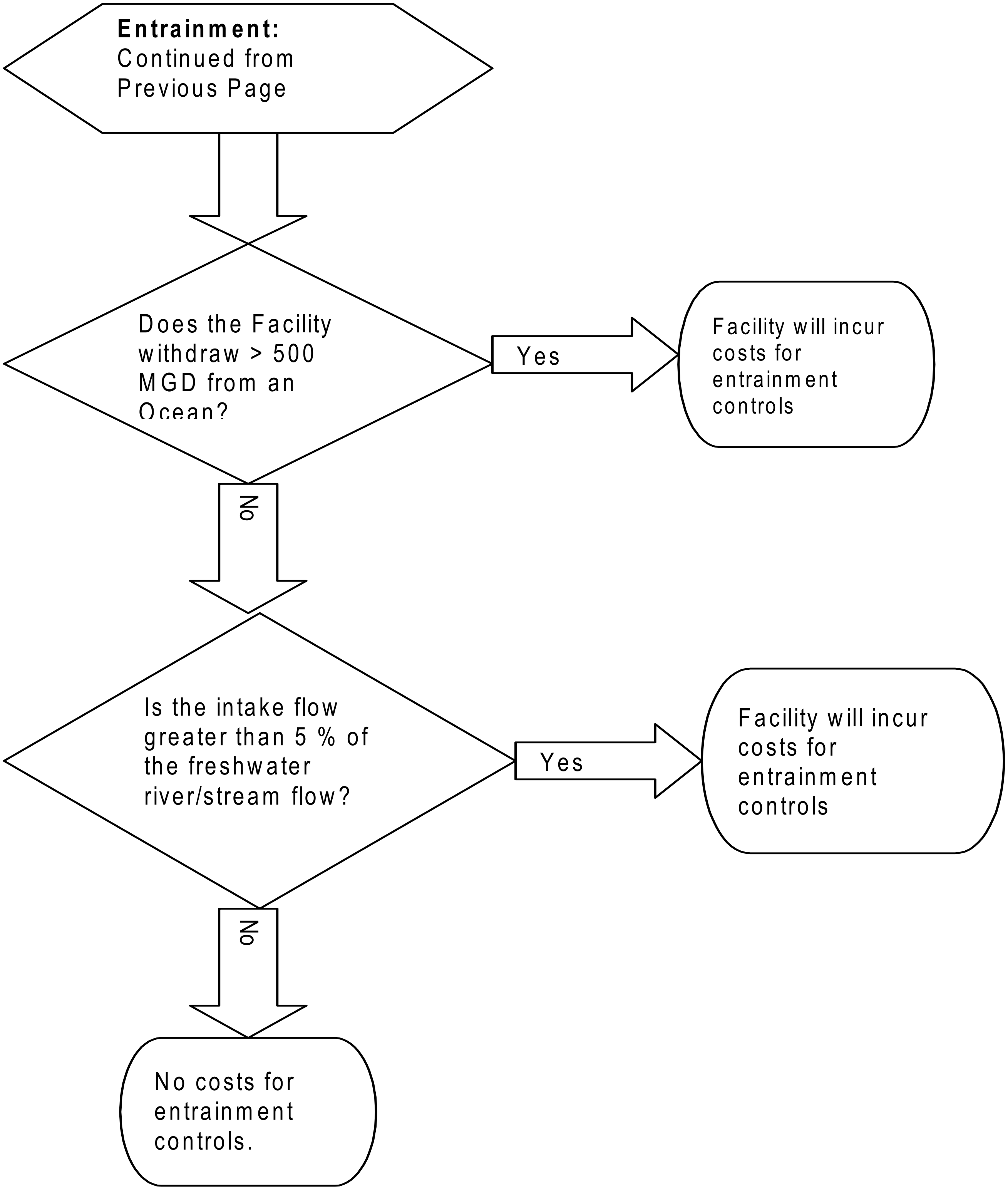

Figure 2 (cont.). Entrainment Controls Flowchart for Model Facility Compliance Costs