Public Comments on the Proposed Revisions to Section 3.1 Chapter 1 (Refrigerated Condensers) of the Control Cost Manual

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Chapter 1: Refrigerated Condensers

Comments were received from 2 sources that include industry trade associations and consultants. Table 1 lists the individuals that submitted comments on the proposed updates to Chapter 1, Refrigerated Condensers. All of the comments submitted by the commenters and EPA's responses to the comments are summarized in this document.

Table 1. List of Commenters for Refrigerated Condensers.

Document Control Number	Commenter Name	Commenter Affiliation
EPA-HQ-OAR-2015-0341-0040	Ted Steichen, Senior Policy Advisor, American Petroleum Institute	American Petroleum Institute (API)
EPA-HQ-OAR-2015-0341-0042	Paul Noe, Vice President for Public Policy, American Forest & Paper Association	Coalition of: American Coke and Coal Chemicals Institute (ACCCI), American Forest & Paper Association (AF&PA), American Fuel & Petrochemical Manufacturers (AFPM), American Wood Council (AWC), Brick Industry Association (BIA), Council of Industrial Boiler Owners (CIBO), and Rubber Manufacturers Association (RMA)

1.1 Applicability

Commenter: American Petroleum Institute (API)
DCN: EPA-HQ-OAR-2015-0341-0040
Comment: The draft refrigerated condenser chapter should be retitled to clarify its applicability. While this chapter includes useful general information in refrigerated surface condensers, it only provides cost information for packaged and nonpackaged solvent vapor recovery systems and packaged gasoline vapor recovery systems (see page 2-15 of Section 2.4). This is a limited subset of refrigerated condenser applications and to avoid confusion and misuse, API recommends the title of this Cost Estimating Manual chapter be revised to reflect its limited applicability. We suggest the title be changed to "Refrigerated Surface Condensers for Solvent and Gasoline Vapor Recovery".

Response: We disagree with the commenter's suggestion that the Refrigerated Condensers chapter should be renamed. The Condenser chapter includes general information regarding design and operation that is generally applicable to Refrigerated Condensers applied to other types of condensables. While the available data in the chapter do primarily reflect solvent and gasoline vapor recovery systems, the chapter also provides useful general information and some useful cost information for all refrigerated condensers. The chapter should retain its current name.

1.2 Control Device Description

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association
DCN: EPA-HQ-OAR-2015-0341-0042
Comment: The second question EPA posed for this chapter was "Is the description of refrigerated condensers complete, up-to-date, and accurate, particularly with regard to control of VOC?"

The process description of refrigeration condenser systems presented in subsection 2.2 of this Chapter is essentially unchanged from the description presented in the Sixth Edition of the Manual, with the exception of additional information presented about different refrigerants available presented in subsection 2.2.2. The descriptions presented are generally complete and accurate.

Response: The EPA appreciates the commenter's input.

1.3 Design Parameters

1.3.1 Condenser Fouling

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association
DCN: EPA-HQ-OAR-2015-0341-0042
Comment: The fifth question EPA posed for this chapter was "Is the discussion on the effect of fouling on refrigerated condensers accurate?"

The fouling discussion that is presented in subsection 2.3.3 is essentially accurate. However, insufficient technical information on condenser fouling is provided for this discussion to add any benefit to the equipment design procedure or the equipment cost estimates presented. No data have been provided to quantify the influence of fouling on the energy or VOC removal efficiency of a refrigerated condenser system, or the resulting effect on cost.

Response: A short discussion was included in the draft chapter to introduce the basic concept of surface condenser fouling. This short discussion was intended to introduce a factor that the user/reader could consider if applicable to their condenser unit. Based on the suggestions of the commenter, we conducted an additional review of condenser fouling and included additional discussion in the revised chapter. As noted previously in the revised draft chapter, a fouling factor is applied to the overall heat transfer coefficient, *U*. As already noted in the draft chapter, the fouling factor is a site-specific factor and depends on the materials of construction, VOC condensed and other pollutants present, and the coolant type.

1.3.2 VOC Removal Efficiency

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association
DCN: EPA-HQ-OAR-2015-0341-0042
Comment:. The fourth question EPA posed for this chapter was "Are the estimates of VOC destruction efficiency for refrigerated condensers accurate?"

Refrigerated condensers reduce atmospheric VOC emissions by reducing the temperature of the vapor stream and, thereby, condensing the VOC constituents from the vapor phase to the liquid phase. This process allows the condensed VOC constituents to be separated from the vapor stream and subsequently collected for reuse or disposal. As such, it is not accurate to characterize a refrigerated condenser as a VOC destruction system. subsection 2.1.1 of Chapter 2 refers to the "removal efficiency" of a refrigerated condenser system, not "destruction efficiency."

The VOC removal efficiency of a refrigerated condenser system depends on many factors; including the concentration of VOC in the uncontrolled process exhaust stream, the operating temperature of condenser, the type of refrigerant used, and the vapor pressure of the individual VOC constituents at the condenser operating temperature. As cited in "EPA Technical Bulletin – Refrigerated Condensers for Control of Organic Air Emissions,"[1] reductions in VOC emissions associated with the use of refrigerated condensers can range from 50% to 99%.

According to this Bulletin, a condenser system operating with chilled brine as the coolant can only expect to achieve 50% to 90% reduction. Condenser systems can achieve 90% reduction or greater when operated with chlorofluorocarbon or hydrofluorocarbon refrigerants as the coolant. A reverse Brayton Cycle system can meet 98% reduction efficiency, and cryogenic refrigeration systems can remove as much as 99% of the VOC in exhaust streams for which these systems are technically feasible.

In subsection 2.1.1, EPA states that "removal efficiencies above 90 percent can be achieved with coolants such as chilled water, brine solutions, ammonia, liquid nitrogen, chlorofluorocarbons, hydrochlorofluorocarbons or hydrofluorocarbons, depending on the VOC composition and concentration level of the emission stream." Although 90% reduction is achievable under certain circumstances, this is a broad statement that overstates removal efficiency and does not account for all of the many factors and variables involved which can affect efficiency.

Response: The EPA agrees with the commenter that VOC "removal efficiency" is the appropriate term to characterize the control technique achieved by condensers, rather than use of the term "destruction efficiency". The revised draft chapter for review did consistently use the removal term, however use of the term destruction efficiency in the preamble was an error. The EPA agrees that typical numerical values for removal efficiency should be more clearly stated in the chapter and has clarified the ranges in the final chapter as suggested by the commenter (see section 2.1.1).

1.4 Total Capital Investment

1.4.1 Out-of-date Equipment Cost Data

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association
DCN: EPA-HQ-OAR-2015-0341-0042
<u>Comment:</u> The third question EPA posed for this chapter was "Are the cost correlations, factors, and equations for refrigerated condensers accurate? If not, how should they be revised?"

[1] U.S. EPA. *Technical Bulletin - Refrigerated Condensers for Control of Organic Air Emissions*. Office of Air Quality Planning and Standards, Clean Air Technology Center. EPA Document No. 456/R-01-004. December 2001.

EPA presents estimated costs for refrigerated condenser systems in Subsections 2.4.1 to 2.4.3. These estimates appear to use base costs that were obtained in about 1990, escalated to 2014 dollars using the ratio of the Chemical Engineering Plant Cost Index (CEPCI) for those years.

In this regard, EPA is presenting equipment costs that escalate base costs that are over 24 years old, which again directly violates the Agency's own recommendation presented in Subsection 2.4.4 of Section 1, Chapter 2 to limit escalation of costs to five years or less. As a consequence, the cost data presented in these Subsections are very inaccurate.

For example, we found that a recent cost quote obtained for a single stage refrigerated condenser system with a chiller load of 2.5 tons was 4.5 times higher than the cost estimate for this system that was obtained using equation 2.26 in Subsection 2.4.1.

Additionally, the 1990 cost estimate data were obtained from only two vendors, with one vendor providing cost information for a single stage system and a second vendor providing cost information for a multi-stage system. This is in contrast with Section 1 Chapter 2, where EPA states that large groups of vendors were surveyed to develop the average cost for each equipment alternative. One cost quote per system type does not and should not determine an industry average. More data points are needed to determine more accurate equipment cost estimates for refrigerated condenser systems.

In summary, EPA must research and obtain multiple-source cost information in order to present accurate equipment costs in this Chapter. Additionally, the cost data presented in Subsections 2.4.1 to 2.4.3 are only for new installations. These subsections should also address the cost of equipment for retrofit installations.

Response: The data presented in the chapter provides the data we obtained from searches of publicly available information. The Agency attempted to collect more current data on both costs and technology advances through extensive searches of various information sources, including databases (e.g., the EPA's BACT/RACT/LAER Clearinghouse), construction permits, journal articles, vendor information, EPA documents, and conference presentations. However, the cost data we collected was not sufficient to allow us to develop new cost correlations. For this reason, we specifically solicited comment and data on cost correlations, factors, and equations and asked for input on how the capital and operating costs should be updated (see 81 FR 65353, September 22, 2016).

Although we agree with the commenter's remarks regarding the age of the data and the problems associated with scaling the data to current costs, the cost correlations included in the Control Cost Manual nevertheless represent the best data currently available to us.

Although the data used to develop the cost correlations is dated, we concluded that these data were still useful for developing the study-level capital and operating cost estimates for which the Control Cost Manual is designed. Consequently, we have retained these data in the final chapter. However, we also agree with the commenter that these study-level estimates should not be the sole information used to select the most cost effective control device. Selection of the most cost-effective option for a control device should be based on a detailed engineering study and cost quotations from system suppliers, which help provide data to support a more accurate analysis (that is, better than ±30% accuracy), rather than on the study-level estimate accuracy provided by the Control Cost Manual.

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association

DCN: EPA-HQ-OAR-2015-0341-0042
Comment: The methodologies for estimating capital and operating costs of air pollution control equipment described in Section 1, Chapter 2 are considered by our members to be generally acceptable, but the specific cost data presented in Section 3.1, Chapter 1 [Refrigerated Condensers] are not accurate. The data presented in these sections were gathered over 25 years ago, and the method EPA has used to escalate these costs to current dollars is not supportable. Accordingly, we urge EPA to gather current equipment cost data from vendors of refrigerated condenser systems (or other reliable sources of cost data) and discontinue relying outdated equipment cost information.

Response: For the response to this comment, please see the response to the previous comment.

1.4.2 Cost Analysis

Commenter: American Petroleum Institute (API)
DCN: EPA-HQ-OAR-2015-0341-0040
Comment: The detailed cost discussions in this chapter only reflect the costs for the simplest refrigerated condensers and that should be clarified and the included information adjusted. Section 2.4.1 provides cost equations for the equipment costs for packaged solvent vapor recovery systems. Section 2.4.2 provides cost equations for equipment costs for nonpackaged (custom) solvent vapor recovery systems. Section 2.4.3 provides cost equations for equipment costs for packaged gasoline vapor recovery systems. In all three cases, the cost for the major system components or packaged refrigeration units is estimated and factors used to escalate that cost to the entire project and then to a total purchased equipment cost (PEC). While there is some discussion of the items that have not been included, we believe that discussion is much too limited and suggest it be expanded to include the following.

- An allowance of 2% of the major equipment cost is allowed for piping. Even for a dedicated system serving only on[e] gasoline loading operation this is an unreasonably low allowance. Piping and valves will be needed to collect the vapors and route them to the surface condenser and then to route the recovered material to storage. Additional piping will be needed to allow for the refrigerant to be charged to the unit and to be removed. In the Example provided (Example 2.6), the PEC is calculated to be $76,040. Two percent of that is $1,540. That would likely not be enough to buy the two valves needed to isolate the vapor line to the condenser, much less the pipe and pipe supports and the piping and valves needed for the vapor line and to connect the refrigeration system to the condenser, or where applicable to connect multiple vents to a single condenser. At least twice this estimate likely would prove conservative.

- In colder climes, an allowance for insulation and heat tracing of the waste gas transfer pipe will also be needed.
- The cost for a flare header or combustion device, a knockout pot and connections to the hydrocarbon side of the condenser, the vapor line and to any other equipment where hydrocarbon can be present should be included if the equipment is to be located at a site with a flare or combustion device that is used for purging hydrocarbon. The cost for safety valves for the equipment and associated piping to connect each valve to the flare or combustion device should also be included. If the refrigerant can auto refrigerate, cold safety also becomes a concern and the need for upgraded materials and possible vaporization facilities for the safety relief systems must be considered.
- If a chlorofluorinated refrigerant is used, the refrigerant system pricing should specify that the estimate include all the equipment and upgrades required for compliance with the chlorofluorocarbon (CFC) rules and refrigerant pricing should be based on the newest generation of refrigerants. A brief discussion of the CFC rules would be a useful addition to the chapter.
- An allowance for sewers, firewater systems, safety showers and bringing utilities to the location including steam, nitrogen and utility water, as appropriate to the location, is needed and, if ammonia is the refrigerant, an allowance for an area ammonia alarm system should be included.
- An allowance for compliance demonstration facilities, including platforms and instrumentation for continuous monitoring of the condenser outlet temperature, connection of that temperature monitor to the centralized data system and platforms for stack testing may also be needed, depending on whether the location is a major or area source and the specific regulations that apply.

Response: The EPA agrees that several of the items suggested by the commenter could and should be revised or added to the discussion in the chapter as additional costs to consider. In general, the Control Cost Manual is meant to provide example costs for typical cases, and the Cost Manual also includes general discussion on other items that could be considered for site-specific applications. We agree that additional costs will be needed for some applications depending on the facility and note that these site-specific issues could be considered in the costing. For example, as the commenter notes, colder climates would require insulation and heat tracing, however warmer climates may not need.

The piping cost factor is considered to be a direct cost and is consistently 2 percent of PEC across most chapters in the Control Cost Manual, with a few exceptions. The exceptions are for the Wet Scrubber for Acid Gas chapter, where piping is 30 percent of PEC, for the Fabric Filter chapter where piping is 1 percent of PEC, for the Wet Scrubber for Particulate Matter chapter where piping is 5 percent of PEC, and the ESP chapter where piping is 1 percent of PEC.

If fluorinated refrigerants and alternative refrigerants are used as primary refrigerants (i.e., with phase change), it is possible that certain regulatory requirements for fluorinated refrigerants must be followed for this type of unit. For refrigerated condensers that use secondary refrigerants (i.e., no phase change) that are not fluorinated, such as ethylene glycol or brine, these additional requirements would not be necessary. No additional discussion of CFC, HCFC, or newer generation refrigerant requirements were added to the chapter.

With respect to the suggestion that sewers, firewater systems, safety showers, and utilities must all be costed as part of the TCI, we note that these are anticipated to be outside the battery limits. As stated in the original section 2.4, the TCI does not include "utilities, services, or roads to the site; the backup facilities; the land; the working capital; the research and development required; or the process piping and instrumentation interconnections." It is anticipated that many facilities will already have plant systems in place to support condenser units, and the costs would be related to tie-in of the condenser unit into existing plant support systems. In general, these plant support systems would still be in place even if the condenser unit was removed. (See additional discussion in section 2.3.1, Elements of Total Capital Investment, section 1, chapter 2, Cost Estimation: Concepts and Methodology.) Where more accurate cost estimates are needed beyond the study-level range of accuracy of cost estimates in the Control Cost Manual, we recommend capital and operating costs be determined based on detailed design specifications and extensive quotes from suppliers.

For instrumentation and monitoring equipment, it is anticipated that these would be costed following the methodologies provided in the Monitoring chapter. (See additional discussion in sections 4.2 Continuous Emissions Monitoring Systems and 4.3 Parametric Monitoring, section 2, chapter 4, Monitors.) The methodology for monitoring includes costs for installing and checking a DAS (see section 4.2.3, Data Acquisition System).

With respect to the addition of a flare or combustion device, it is anticipated that the costs of these devices will be estimated using the methodologies provided in the Flare or Incinerator/Oxidizer chapters (see section 3.2).

Commenter: American Petroleum Institute (API)
DCN: EPA-HQ-OAR-2015-0341-0040
Comment: Section 2.4.4 of this chapter deals with converting the PEC to a total capital Investment (TCI), by adding installation and other project costs. The factors used to convert PEC to TCI are the same as those used in the oxidizer examples in the Incinerators/Oxidizers Chapter and we comment on those factors in Section IV below and in Section II.2 above.

Citation from Section II.2 of API's comment letter that provided comments on OAQPS Control Cost Manual, Section 1, Chapter 2, Concepts and Methodology Chapter:

The last paragraph in Section 2.5.4.1, deals with construction and installation costs and suggests that cost estimates developed for the power industry should be used as guidance. While those estimates might be of some value for estimating costs for SOx, NOx and PM controls for power generation facilities at petroleum and petrochemical operations, they are of little value for the bulk of cost estimates for our industries. We recommend that the draft paragraph be deleted and a more specific discussion of construction and installation costs as a percentage of total material cost (including piping) be included. Such a discussion should include factors for estimating the significant design and detailed engineering costs associated with these projects and owner's costs, including permitting and initial compliance demonstration costs, in addition to factors for estimating the actual field erection costs.

While this chapter hardly deals with indirect construction cost, this is a major cost area that must be addressed for a study level estimate. In the Incinerator/Oxidizer chapter, indirect project costs are identified as: engineering (10% of purchased equipment cost); construction and field expenses (5% of purchased equipment cost); contractor fees (10% of purchased equipment cost); startup (2% of purchased equipment cost) and performance test (1% of purchased equipment cost). While these are, in fact, indirect cost categories, the indicated factors are woefully inadequate, because the purchased equipment cost is not the correct basis, because some of the factors are totally inaccurate and because equipment cost is the wrong basis for some of the items.

The estimate for engineering and contractor fees low, but not unreasonably so at 10%. However, the bulk of the cost for these items is associated with the facilities that are not purchased equipment (e.g., piping, pumps and compressors, instrumentation, structure, electrical). Thus, the 10% factor should be applied to a realistic estimate, albeit at the study level, of the total project materials cost and then adjusted for the retrofit factor. Even then, we would still expect the estimate for these categories to be low for projects with significant piping, instrumentation and electrical, since those construction categories have a much higher indirect cost to materials ratio. Further, as discussed below, engineering costs should be adjusted to account for the use of overtime, due to the constrained project schedule.

The 5% of purchased equipment cost factor for construction and field costs is completely unrealistic. Industry experience would indicate this factor should be closer to 50% of total purchased equipment cost, before adjustment by the retrofit factor.

While performance test costs are a lesser factor, this should not be included as a function of materials cost. Performance test costs are primarily associated with setup of the test, determining stack information, running the test, and writing the report and handling the required electronic submission. A typical cost for a simple test, where sampling ports and access platforms already exist, has historically been in the range of $20,000 and we would suggest including this as a fixed quantity for this level of estimate. More complex tests, involving multiple pollutants and/or operating conditions has historically involved costs in the $50,000 range.

Owner's project costs are typically included in estimates and should be added to the Control Cost Manual procedure. These include the costs for the owner's project personnel. In addition to project management, technical specialist and general oversite and obtaining the required permits, there are significant owner's field costs including field permits, gas testing, equipment preparation, inspection, operator training and startup.

Finally, it is important that the impacts of compliance schedules on project costs be reflected in the estimate. Generally, control projects are only allowed two to three years after finalization of the requirement for installation. Typically, project activities cannot begin until finalization of a requirement, since proposals can change significantly and project designers must know all the detailed requirements prior to beginning design. Furthermore, permitting cannot begin until a requirement is finalized and activities often cannot begin until permits are received and any additional permit requirements are known.

Significant projects can only be completed on a three-year schedule if detailed design and construction is performed on an accelerated schedule. This will result in purchased equipment cost increases due to the need for expedited fabrication and delivery and extra costs for design and construction labor and those additional costs must be included in the estimate. Thus, the Control Cost Manual, should specify that any major equipment costs requested from vendors, be based on a short delivery time basis (as appropriate for the particular project). Furthermore, process outages are often needed to connect the vent(s) to the new control device and to connect electrical and other utilities. Since typical planned downtimes in refinery and petrochemical operations are on the order of every 5 years, some projects will require either an out-of-sequence outage or extraordinary and expensive actions (e.g., hot taps) to meet a 2 to 3-year schedule. Some projects will require planned outages to be extended. Thus, the costs for premium time, unscheduled process outages and/or extraordinary tie-in measures must be considered in developing a cost estimate. Premium time and extraordinary measure costs may be reflected in the estimate by increasing installation and retrofit factors, but the value of lost production and the environmental impacts of unscheduled outages need to be included on a project-by-project basis.

Citation from Section IV of API's comment letter that provided comments on OAQPS Control Cost Manual, Section 3.2, Chapter 2, Incinerators and Oxidizers Chapter:

Section 2.5.1.2 and Tables 2.9 and 2.10 deal with installation costs. Except for the comments below and in Section II.2, we have no data on which to question the indicated factors for simple package systems, but believe it should be made clear in each Table, that these estimates are for package installations on open sites only. Our experience is that these factors would be unacceptably low controls of any complexity in our types of operations.

- The instrumentation factor may be appropriate for equipment operated with local digital controllers, but is unrealistic for most facilities in our industry, where operations are monitored and controlled centrally.
- Historically engineering costs for simple projects can typically range from 10-40%, and can be higher for systems with complex auxiliaries. For project management costs, historically the range has been 20-40+%. Thus, the minimum engineering and project management cost could more appropriately be estimated at 30%, rather than 10%. The 10% EPA allows for contractor profit appears to be reasonable, based on limited historical information. Thus, API believes the factor used to reflect these categories of costs should be set at a minimum of 40% (10% for engineering, 20% for project management, and 10% for contractor profit and other installation related costs).

Several of the factors provided in the tables should either be fixed quantities or have a minimum cost, because they are not primarily a function of TO throughput.

- Onsite instrumentation is mostly a fixed cost for each TO design. The number of control loops is not a function of throughput for each design. Only the size of control values would be expected to change as a function of TO throughput. The instrumentation variable cost is the distance the instrument cabling must traverse to connect to the general plant systems. This can be a significant distance and cost, since the TO must have a safe zone around it. Thus, it would be best if a minimum instrumentation cost is established.
- The costs of performance tests are not significantly different as a function of TO throughput and the indicated cost of $3000-5000 is totally unrealistic, even for only a stack Total Organic Carbon determination. A more realistic estimate would be $20,000, regardless of TO throughput.
- Permitting is not indicated as an installation cost. At least $10,000 should be assigned. Even for a small TO, New Source Review and Operating permit activities involve significant engineering effort and time.

Many of the comments we discuss above and in our comments on the Methodology Chapter were also discussed in the context of specific thermal oxidizer/scrubber cost estimates in comments on the Polymer and Resins 1 Risk and Technology proposal.[2] API recommends those comments be reviewed and considered in updating this chapter of the Cost Control Manual and, particularly this chapter [Incinerators and Oxidizers], as those comments were based on thermal oxidizer cost estimates developed using the current Cost Control Manual. Overall, it was determined in a side-by-side comparison of several specific thermal oxidizer projects that the estimated capital and annual costs would be multiples of the cost estimated by EPA using the Control Cost Manual methodology.

Response: The verbatim comments above were made on the proposed section 1 chapter 2 *Cost Estimation: Concepts and Methodology*, and the commenter made reference to these same comment statements for the Refrigerated Condenser chapter. For EPA's response to this comment, see the Response to Comment document for *Public Comments on the Proposed Revisions to Section 1, Chapter 2 (Cost Estimation: Concepts and Methodology) of the Control Cost Manual*.

1.4.3 Refrigerant Costs

Commenter: American Petroleum Institute (API)
DCN: EPA-HQ-OAR-2015-0341-0040
Comment: Specific to the refrigerated condenser chapter, we noted that there does not seem to be any cost associated with refrigerant. While the example uses ethylene glycol solution as the heat transfer medium and its cost is likely nominal, refrigerant, depending on the specific one

[2] See Docket Document EPA-HQ-OAR- 2010-0600-0265, Comments on EPA's Proposed Rule: NESHAP for Group I Polymers and Resins; Residual Risk and Technology Reviews. 75 Fed. Reg. 65068 (October 21, 2010), December 6, 2010, pages 28-38.

chosen, can be very costly. A section should be added to the cost discussion on refrigerants and the examples and table should show an initial charge of refrigerant as a project cost and annual make-up of refrigerant with full replacement every several years. If fluorocarbons are used, additional ongoing cost for complying with the applicable Federal regulations must be included.

Response: EPA agrees that use of refrigerant should be included in the costs where needed, for both capital cost and annual cost. We have included example refrigerant costs for a few HFC and other refrigerants in the final Condenser chapter within the direct annual costs section (section 2.5.1). Costs for ethylene glycol and brine refrigerants are expected to be nominal, as the commenter notes.

1.4.5 Contingency

Commenter: American Petroleum Institute (API)
DCN: EPA-HQ-OAR-2015-0341-0040
Comment: An undefined allowance of at least 30% should be included in all total capital investment (TCI) estimates. Contingency factors are required for all project cost estimates, since direct estimates, particularly those based on only rough screening quality information, cannot anticipate every project need or impact. For instance, every potential siting and installation issue, every required upgrade to electrical, instrument or other utility services, every labor cost variation, every weather effect, etc. cannot be predicted in a screening quality estimate. Typically, project contingency factors use by the petroleum industry start quite high (e.g., 30-50%) and are reduced as project detail improves. However, even for projects with detailed process designs, project contingencies of at least 10-20% are still required (depending on company practice and experience). History indicates that 30–50% is the amount of contingency typically required for screening estimates, such as those developed through the Control Cost Manual. Thus, API recommends a project contingency of at least 30% to improve the probability that the cost estimate reflects the cost (±30%) of the control. Without inclusion of this allowance, even after addressing the other issues we have identified, the estimate would not meet the desired ±30% intent, but rather would, at best, be 0-30% low.

Response: The contingency was increased from 3% of PEC (purchased equipment cost) to 5-15% of total capital investment (TCI) in response to public comments on the magnitude of the contingency and also a review of the available literature of the subject. After this review and consideration of public comments, the Agency concluded that this increase in contingency yields an estimate that is consistent with guidance from the American Association of Cost Engineering International (AACE) and well-recognized references on process engineering such as Peters, Timmerhaus and West's Plant Design and Economics for Chemical Engineering (5th edition, 2002). This revised contingency estimate is appropriate for mature technologies such as carbon adsorbers.

1.5 Total Annual Costs

1.5.1 Equipment Life

Commenter: Coalition of American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Wood Council, Brick Industry Association, Council of Industrial Boiler Owners, and Rubber Manufacturers Association
DCN: EPA-HQ-OAR-2015-0341-0042
Comment: The first question EPA posed for this Chapter was "What is a reasonable estimate of equipment life (defined as design or operational life) for this control measure?"

We note that EPA has not presented any definitive information in this Chapter on equipment life. The cost estimate example presented in Subsection 2.6 uses an estimated equipment life of 15 years.

As with oxidizer systems, the equipment life of refrigerated condenser systems is difficult to establish definitively, because it varies depending on the condenser service conditions. We therefore encourage EPA to gather data on installed refrigerated condenser systems to obtain the most technically supportable information about the system equipment life and the factors that influence it.

Response: The data presented in the chapter provides the data we obtained from searches of publicly available information. In the Notice of Data Availability, we specifically solicited comment on the equipment life of refrigerated condensers (see 81 FR 65353, September 22, 2016), but we received only very limited data from industry or vendors in response to our request. As we noted in section 2.5, we believe that the 15-year equipment life for the refrigerated condenser used in the example is reasonable for most refrigerated condensers based on information available to us.