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Larry Sorrels
Health and Environmental Impacts Division
Environmental Protection Agency
C439-02, 109 T.W. Alexander Drive
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Attention: Docket ID Number EPA-HQ-OAR-2015-0341
Submitted to the Federal eRulemaking Portal (www.regulations.gov)

Re: Notice of Availability of Two Updated Chapters in the Environmental Protection Agency's Air Pollution Control Cost Manual, 82 Fed. Reg. 33903 (July 21, 2017) EPA-HQ-OAR-2015-0341

Dear Mr. Larry Sorrels:

The American Fuel & Petrochemical Manufacturers (AFPM) hereby submits comments on the proposed updates to Section 3.1, Chapter 1 ("Carbon Adsorbers") and Section 3.2, Chapter 1 ("Flares") in EPA's Air Pollution Control Cost Manual (82 Fed. Reg. 33903 (July 21, 2017)).

AFPM is a national trade association representing nearly 400 companies that encompass virtually all U.S. refining and petrochemical manufacturing capacity. Millions of Americans use products produced by AFPM members every day.

Our member companies own and operate air pollution control systems of various types that may be evaluated for application of controls using EPA's Air Pollution Control Cost Manual. As this manual is used by both regulators and industry to inform pollution control strategies and cost analyses, it is imperative that the updates to these chapters include the most recent, best available information on equipment cost estimating methodologies, as well as the applicability, performance, and cost of air pollution control systems. Therefore, we respectfully request that EPA address our comments regarding the draft chapters prior to releasing them in final form.

Thank you for your consideration of these comments. Please feel free to contact me at (202) 602-6604 if you have questions or need more information.

Sincerely,

David Friedman
Vice President, Regulatory Affairs

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I. **Summary**

EPA has issued draft revisions for two chapters of the Air Pollution Control Cost Manual (Manual) for comment. The chapters are Section 3.1, Chapter 1 (Carbon Adsorbers), and Section 3.2, Chapter 1 (Flares).

The purpose of EPA's Manual is to provide methodologies to estimate the costs of air pollution control systems that can be applied consistently to a wide array of industries and source types. The Manual is an important resource for both regulators and the regulated community. It is used by EPA for estimating the cost impacts of prospective rulemakings, and it serves as a basis for industry to estimate costs of air pollution controls that may be considered as Best Available Control Technology (BACT) under the New Source Review (NSR) program, Best Available Retrofit Technology (BART) under the Regional Haze Program, and for other programs (*e.g.*, Reasonably Available Control Technology (RACT)).

EPA, states, and industry need reliable access to the most up-to-date technical and economic information on air pollution control systems as they evaluate alternatives to reduce emissions and to assess the feasibility and cost effectiveness of strategies to comply with the frequently-changing National Ambient Air Quality Standards (NAAQS), pollutant transport rules, New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAP). Our members rely on the Manual, along with site-specific data, as they prepare BACT analyses for permit applications and evaluate feasibility of installing controls under programs such as BART and RACT.

The Manual heavily influences air pollution control and regulatory decisions made by EPA, permitting authorities, and industry. It is therefore critical that the air pollution control system performance data and cost information contained in the Manual be of the highest quality possible so that decisions will be technically sound, and applied control strategies will be effective and economically feasible. As EPA is conducting rulemaking activities and developing impacts estimates as part of its periodic technology reviews, that information should be incorporated into the cost manual, as appropriate.

Accordingly, we take issue with the equipment and total installed cost data presented in Section 3.1, Chapter 1, and Section 3.2, Chapter 1. Specifically, these sections rely on outdated equipment cost data; in many cases, the cost data that form the basis of the cost estimates provided were gathered and compiled more than 25 years ago. EPA also recommends the use of a methodology to escalate equipment cost data to current dollars that is technically unsupportable and results in cost estimates that are very inaccurate.

Due to the importance of this resource to both regulators and the regulated community, it is imperative that the equipment and total installed cost data on air pollution control systems contained in the Manual be accurate. In particular, the use of inaccurate data for regulatory development misrepresents the costs to industry of prospective regulatory actions.

Many advances in air pollution control technologies have occurred in the 30 or more years since the first published edition of the Manual. However, for the Seventh Edition of these chapters of the Manual, EPA appears to have simply recycled old equipment cost data and made no effort to gather new data that reflect equipment advances and other developments that have occurred.

Consequently, the equipment and total installed cost estimates that are presented are inaccurate and unreliable, particularly for regulatory development efforts. Current equipment cost estimates should be gathered and included in this update of the Manual in order to provide its users with the most current and accurate information possible.

II. Comments on the Draft Carbon Adsorbers Chapter (Section 3.1, Chapter 1)

2.1 Equipment Life

In the *Federal Register* Notice of Availability for these two chapters of the Manual (82 FR 33903), EPA presented a list of questions that it characterized as being particularly interested in addressing. 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?"

The only information provided in this Chapter on equipment life is presented in Section 1.6 ("Estimating Total Annual Cost"). EPA states in Section 1.6.2 that adsorber system lifetime is typically 10 years except for the carbon, which has an operational life of five years.

Establishing a "reasonable" estimate of equipment life is difficult for the hardware associated with carbon adsorption systems because equipment life varies depending on system operating conditions. Systems that handle waste gases containing chlorinated hydrocarbons have relatively shorter operational lives than other systems. The five-year operational life estimate for carbon is reasonable; however, the 10-year life for the adsorber hardware (vessels, pumps, etc.) appears to be low. Adsorption systems typically have operational lifetimes of 15 to 25 years.

We encourage EPA to conduct research among adsorption system equipment vendors to obtain the most technically supportable information about the range of expected equipment life and the factors that influence it.

2.2 Accuracy of Equipment/Process Description

The second question EPA posed for this Chapter was, "Is the description of carbon adsorbers complete, up-to-date, and accurate, particularly with regard to control of VOC?"

Technical descriptions of both fixed bed and canister carbon adsorption units are presented in Subsection 1.2 of the Seventh Edition of this Chapter. The subsection has been expanded slightly from the Sixth Edition to provide additional clarifying details about certain aspects of these systems. Little new technical information is provided in this edition that was not provided in previous editions. As with the Sixth Edition of this Chapter, EPA notes that there are other types of carbon adsorption systems (traveling bed adsorbers, fluid bed adsorbers, and chromatographic baghouses) beyond the fixed bed and canister systems that are described in detail. No technical information is provided about these other types of systems and the current state of their commercial applicability or the reasons for their potential suitability in lieu of fixed bed or canister systems.

Moreover, apart from a brief mention in Subsection 1.1, this Chapter fails to address that there are currently other types of adsorbent media in widespread use in the air pollution control industry. Other media types include synthetic and naturally-occurring zeolites, silica gel, activated alumina, and fuller's earth. EPA justifies not including further description of these alternative media options by stating, without attribution, that activated carbon is the most commonly used adsorbent for volatile organic compounds (VOC). This same statement is included in the Sixth Edition of this Chapter, and a similar statement was included in the Fourth Edition of this Chapter that was issued in 1989. In fact, there have been numerous technical advances in the use of other adsorbent materials besides carbon since 1989, and we encourage EPA to research and include up-to-date information about other media and the emission control situations in which other media would be superior to carbon.

For example, multiple manufacturers offer rotary adsorbers (often referred to as concentrators) that utilize zeolite, for use either alone (for solvent recovery) or in front of an oxidizer (to concentrate the air stream that goes to the oxidizer upon regeneration of the adsorbent in the wheel). These units are commonly included in certain VOC BACT analyses; EPA should review recent BACT analyses to expand the scope of the types of adsorbers included in this Chapter.

With respect to the process descriptions for carbon-based fixed bed and canister adsorber systems that are presented in Subsection 1.2 of this Chapter, generally the process descriptions and other information that are presented appear to be reasonably complete and accurate.

2.3 Accuracy of Cost Information Presented

The third question EPA posed for this Chapter was, "Are the cost correlations, factors, and equations for carbon adsorbers accurate? If not, how should they be revised?" EPA presents estimated costs for fixed bed and canister carbon adsorption systems in Subsection 1.5.1 and 1.5.2, respectively.

As with previous versions of this Chapter, the total capital cost of carbon adsorber systems are described as consisting of three elements: the cost of the adsorber vessels; the cost of the carbon; and the cost of ancillary equipment. In the example cost estimate provided, the cost elements break down approximately as follows: 40 percent for the vessels; 20 percent for the carbon; and 40 percent for auxiliaries.

The cost equation for adsorber vessels (equation 1.25) is described by EPA as being a correlation of vendor data received and having a cost basis of fall 1999 dollars. Reference 10 is cited as the source of these data. However, the reference section for this Chapter describes Reference 10 as correspondence between M&W Industries and EPA taking place in September 1989. Moreover, apart from the fabricated material factor (F_m) that EPA has now included in this equation, this cost equation is exactly the same as equation 4.20 presented in the Fourth Edition of this Chapter. Therefore, it is apparent that equation 1.25 actually presents vessel cost information on the basis of 1989 dollars, not 1999 dollars as stated. Consequently, the carbon vessel cost information presented in this Chapter is nearly 30 years old.

Similarly, the unit cost information for replacement carbon presented in Section 1.5.1.2 is exactly the same unit cost presented in Section 1.3.1.1 of the Sixth Edition of this Chapter. These costs are described as having a 1999 cost basis, which means that these cost data are 18 years old.

The cost estimating methodology presented has no accommodation for the impact that a facility's elevation with respect to sea level has on the design and equipment cost for fixed bed adsorption systems. The methodology presented in Section 2.4.1 of the Manual chapter on selective catalytic reduction for nitrogen oxide (NOx) control, in which base equipment and balance of plant costs are proportional to the ratio of the atmospheric pressure between sea level and the location of the system, is an appropriate way to account for the cost increase associated with systems at higher elevations.

EPA describes cost information for canister carbon adsorption systems in Section 1.5.2. This section cites equipment cost information from a single vendor (Calgon) and the costs are described as having a mid-1999 basis (*i.e*., eighteen-year-old data).

Thus, the cost information presented in this Chapter is inaccurate and EPA must obtain updated cost information for the two principal elements of this emission control system.

EPA has previously stated that the Chemical Engineering Plant Cost Index (CEPCI) can be used to adjust nominal equipment costs from a base year to real equipment costs for the current year. Thus, in concept, current costs for carbon adsorption equipment could be estimated from the 1989 or 1999 base year costs that are presented in this Chapter. However, in the draft Seventh Edition of Section 1, Chapter 2 of this Manual ("Cost Estimation: Concepts and Methodology"), EPA appropriately states that the accuracy associated with escalation of equipment costs in this fashion declines the longer the time period over which escalation is done. EPA further states that escalation of equipment costs that are more than five years old is not considered to be appropriate because it "…does not yield a reasonable accurate estimate." Accordingly, the cost information presented in this Chapter is inaccurate both because it is not current and because it is too old to be used in conjunction with the escalation procedure that EPA advocates.

Moreover, EPA's strict reliance on outdated cost data, rather than obtaining current cost data from equipment vendors, has essentially eliminated from consideration the impact that external influences have had on equipment and operating costs. The increased focus on energy efficiency, changes in the carbon regeneration and disposal industry, and regulatory changes (*e.g.*, the Resources Conservation and Recovery Act, Benzene Waste Operations NESHAP) that have occurred all have had a direct impact on the capital and operating costs associated with carbon adsorption systems. Thus, the cost estimates included in this Chapter are inaccurate because these impacts are not addressed.

We recognize that gathering, compiling, and maintaining current and accurate cost information on air pollution control systems is a time-consuming and resource-intensive endeavor. In the past, this effort has been the responsibility of EPA's Office of Air Quality Planning and Standards (OAQPS). We recognize that current Agency budget and resource constraints may necessitate a different course of action going forward, and so encourage the Agency to consider other alternatives.

One alternative for EPA to achieve the goal of having accurate and current equipment cost information is to hire an engineering firm to assemble cost information, as an actual equipment buyer would do. This alternative is practiced by other branches of the Federal government that have similar needs for accurate and current cost information. For example, the National Energy Technology Laboratory (NETL) of the Department of Energy recently published a series of studies on the costs and performance of fossil fuel-fired electric generating plants. NETL hired the engineering firm Worley Parsons to gather equipment quotes from vendors for major equipment items and to use Worley Parsons' equipment cost database to calculate current costs of new power plants of several alternative configurations. Hiring an engineering firm to generate current cost data for air pollution control systems would be a faster and more accurate way to update the Manual equipment cost data.

The cost estimates for the various elements of carbon adsorption systems all appear to be presented on the basis of 1999 dollars. To improve their accuracy, all of the cost estimates should be presented on the basis of the year in which the Chapter revision will be finalized (*e.g.*, 2017 or 2018).

Finally, we note that the cost information that is presented in this Chapter is only for new installations; no cost data for retrofit carbon adsorption systems is included. This is a very important topic for the regulated community because there are many instances where the possible cost impact of the addition of emission control systems on existing sources must be considered (*e.g.*, prospective MACT standards for existing sources or other BACT or RACT control cost analyses for modifications to existing sources). EPA has previously stated that no definitive retrofit factors or rules can be developed because each existing source is unique. Nonetheless, retrofits are significantly more expensive than new installations and having more definitive guidance or a range of expected retrofit ratios for the various elements of a carbon adsorption system would be a helpful addition to this Chapter.

2.4 Accuracy of the VOC Removal Efficiency Estimates Presented

The fourth question EPA posed for this Chapter was, "Are the estimates of VOC removal or control efficiency for carbon adsorbers accurate? If not, what are more accurate estimates?"

There does not appear to be any definitive information or estimates provided in this Chapter on the VOC removal efficiency of carbon adsorption systems. As with the previous revision of this Chapter, the information presented about VOC removal efficiency of these systems is somewhat general. This is appropriate because, as described on page 1-25 of Subsection 1.6.3, VOC removal efficiency with carbon adsorption systems is a function of time. Moreover, the removal efficiency that can be achieved depends on a number of factors, including the specific VOC constituents to be adsorbed, the type of carbon used, the physical characteristics (temperature, humidity, etc.) of the adsorber feed stream, and other factors. The revision of this Chapter appears to contain essentially the same discussion about VOC removal efficiency and the factors that influence it that was included in the previous revision.

Section 1.7 of this Chapter, which consists of an example problem that appears to be intended to illustrate the procedures for designing and developing a cost estimate for a carbon adsorption system, references a VOC removal efficiency of 98 percent. However, this appears to be a required level of emissions control for this particular example, not a definitive level of emission control that can be expected for systems controlling different VOC species or at different conditions.

Accordingly, no definitive data on the removal efficiency of carbon adsorption systems are presented in this Chapter.

III. <u>Comments on the Draft Flares Chapter (Section 3.2, Chapter 1)</u>

3.1 Equipment Life

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?"

EPA has not presented any definitive information in this Chapter on equipment life of flare systems. The discussion in Section 1.5.2 that addresses procedures to estimate indirect annual costs uses an estimated equipment life of 15 years. Section 1.5.3 refers to a study by the Colorado Department of Public Health and Environment that also uses an assumed equipment life of 15 years.

It is important to draw a distinction between the equipment life of flare tips and the equipment life of other system components. Depending on the application, flare tips and their associated components (pilots, thermocouples, etc.) can have a lower life span than the rest of the flare system because they are subject to flame impingement. This distinction is not addressed in either this edition or in previous editions of this Chapter. In section 1.5.2 of this Chapter, the flare system capital recovery cost is estimated based on an estimated 15-year equipment life for all flare system components.

Based on industry experience, the equipment life of flare system components other than flare tips is substantially longer than 15 years. It is not uncommon for elevated flare systems in petroleum refineries to have service lives exceeding 30 years. We encourage EPA to survey flare system equipment vendors and obtain the most technically supportable information about the system equipment life and the factors that influence it.

3.2 Accuracy of Equipment/Process Description

The second question EPA posed for this Chapter was, "Is the description of flares technology complete, up-to-date, and accurate?"

The process description of flare systems presented in the draft Seventh Edition of this Chapter is essentially the same description that was provided in the Sixth Edition of this Chapter, which itself consisted principally of information presented in earlier editions. The discussion in Section 1.1.1 on flare types is quite general in nature, covers only single-point and enclosed flares, and addresses the different categories of flares in very broad terms. The process description presented in Section 1.2 focuses exclusively on one flare type (elevated steam-assisted flares). Many of the components of this type of flare system are common to other flare types, but the lack of substantive process discussion about other flare types limits the usefulness of this section.

The Chapter contains no information about multipoint or portable flares. Multipoint flares are used to improve combustion of hydrocarbon vapors by routing the gas stream to multiple burning points, which may be divided into stages or arranged in arrays. Multipoint flares can be located at or near grade for ease of maintenance or on elevated booms as is typical for flares located on offshore oil and gas production platforms. Portable flare systems are designed to be transportable and are thus typically trailer- or skid-mounted. Both of these flare types are commonly employed in industry and some discussion of these designs should be included in this Chapter.

This Chapter contains no information about flare gas recovery systems, which are used to recover waste and reuse gases that would normally be flared. Such systems, which reduce emissions and save costs, are now in use at many domestic petroleum refineries and are encouraged by the revised Refinery NSPS.

The process descriptions that are provided about flare systems are also incomplete because very little information is provided about the rationale for selecting one flare type over another. The Chapter contains very little discussion about differences between the processes or facilities that utilize flare systems and the impact of these differences on flare selection and design. EPA notes in Section 1.1.2 that chemical plants and refineries utilize flare systems to manage safe disposal of flammable vapors discharged during emergencies. Flares are certainly used extensively in the hydrocarbon and petrochemical industries for safe disposal of vapor releases, but have other applications as well, including odor control and continuous VOC destruction. The section on flare types (Section 1.1.1) contains a limited discussion about certain types of flares, and specifically mentions some of the selection criteria used for enclosed flares. The Chapter contains very little information about flares used for landfill gas disposal or odor control beyond briefly mentioning in Section 1.1.1 that enclosed flares are commonly found at landfills. Consequently, this edition of the Chapter fails to address the specific equipment selection and design issues that are required for these applications.

3.3 Cost Information

The third question EPA posed for this Chapter was, "Are the cost correlations, factors, and equations for flares accurate? If not, how should they be revised?" EPA presents estimated costs for elevated, steam-assisted flare systems in Sections 1.4 and 1.5 of this Chapter. The Chapter contains no cost information for the many other types of flare systems.

Section 1.4 states that the elevated flare equipment costs are presented in 2014 dollars, and also states that the capital costs are based on information received from vendor contacts in the summer of 2000. However, as explained below, this statement appears to be inaccurate.

Section 1.4.1 states that the basis of the costs presented in Tables 1.6, 1.7, and 1.8 are quotes received from commercial flare vendors. The references presented for these quotes are personal communications between flare vendors and the original authors of this Chapter (William Vatavuk and Diana Stone) that occurred in the 1990 timeframe. For the Sixth Edition of this Chapter, these 1990 cost estimates appear to have been escalated to 2000 dollars using the CEPCI for those years. These same cost quotes appear to have been escalated again using the CEPCI to 2014 dollars for this edition of this Chapter. In this regard, EPA appears to be presenting equipment costs for flares that escalate base costs that are 27 years old. As was noted above for the Carbon Adsorber cost estimates, this procedure 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 flare cost data that are presented in this Chapter are not considered to be accurate.

Section 1.4 describes the flare cost estimates as being presented in 2014 dollars. The selection of 2014 as the base year means that the estimated costs presented in the Seventh Edition of this Chapter will already be at least three years old by the time the Chapter is published. To improve their accuracy, the cost estimates should be presented with a basis of the year in which the Chapter revision will be finalized (*e.g.*, 2017 or 2018).

Section 1.4.1 includes cost information about auxiliary systems needed to support flare operation. There are three issues with the cost information presented in this section. The first issue is that a different cost basis is used for each of these auxiliary systems, which reduces the accuracy of the overall flare system cost estimates. Piping costs are based on 1990 data, and knockout drum costs are based on 1981 and 1988 data. Additionally, this section includes several new paragraphs discussing the costs associated with waste gas flow and heat content monitoring. Monitoring costs are based on cost quotes received in 2010. Although all of these auxiliary cost data are escalated to a common basis (*i.e*., 2014 dollars), the fact that inconsistent base year costs are used adversely impacts the overall accuracy of the system cost estimate.

The second issue is that the list of flare auxiliary systems is incomplete, and thus the total system costs estimates that are presented are inaccurate. In particular, estimated costs associated with flare gas recovery systems are not addressed.

The third issue is that recent rule changes for flare systems, particularly for flares at petroleum refineries subject to the 40 CFR 63, Subpart CC and UUU Maximum Achievable Control Technology (MACT) standards, require more comprehensive monitoring than was required when the previous edition of this Chapter was issued. These new requirements include flare vent gas flow rate monitoring, assist gas (steam or air) flow rate monitoring, and vent gas composition monitoring. These rule changes require that more comprehensive and costly monitoring systems be utilized on flares than are contemplated in section 1.4.1 of this Chapter. EPA has added a new Section 1.4.3 that presents an example cost for an enclosed flare system from a recent (2014) study. However, this information has limited applicability because no information is provided about the size, heat release rate, or other design parameters of the system that would enable this cost estimate to be used as the basis for estimating the cost of a different enclosed flare. Moreover, because the only other cost information provided in this Chapter is for elevated flares, the example cost provided in this section cannot even be used as an independent check on the validity of other cost information presented.

In summary, more current, consistent cost information from multiple vendors and a variety of flare types should be gathered in order that accurate equipment costs for a range of flare types can be presented in this Chapter. In addition, the impact that recent regulatory changes in the petroleum refining industry will have on flare system monitoring and control requirements should be carefully addressed when presenting updated equipment and operating costs in this revision of this Chapter. As part of recent regulatory efforts, EPA gathered and summarized cost data for flare systems and associated monitoring devices. [1] That information should be reviewed and incorporated into the cost manual.

3.4 Accuracy of VOC Removal Efficiency Information Presented

The fourth question EPA posed for this Chapter was, "Are the estimates of flares VOC destruction efficiency accurate? If not, what are more accurate estimates?"

Section 1.1 of this Chapter describes the VOC destruction efficiency of flares in somewhat general terms, and states that "…nearly compete (e.g., >98%) destruction…" of VOC constituents in waste gases being flared can be achieved. Section 1.1.3.1 discusses the factors that affect flare system

[1] *See* https://www.regulations.gov/document?D=EPA-HQ-OAR-2010-0682-0209.

VOC destruction efficiency. Except for the addition of some clarifying information, this section is essentially identical to Section 1.1.3.1 of the Sixth Edition of this Chapter. No quantitative information is presented anywhere in the Chapter which can be used to establish what level of VOC destruction can be achieved in a given situation. Consequently, the Chapter fails to present definitive information about VOC destruction efficiency.

There is only limited information available in the open literature that addresses flare destruction efficiency. One reason for this may be that it is difficult to measure destruction efficiency on flare systems, particularly elevated open flares, using conventional emissions testing methods. One study[2] found that destruction efficiencies exceeding 98 percent can be achieved when the gas being flared has a heating value of at least 300 Btu/ft^3. This study also concluded that:

- Varying the heating content of the waste gases above 300 Btu/ft^3 has no effect on destruction efficiency;
- A decrease in destruction efficiency was observed with waste gases with a heating content below 300 Btu/ft^3: and
- Destruction efficiencies greater than 98 percent were observed when flares are operated under conditions which are representative of industrial flare operating practices.

A separate study[3] reviewed the available flare test data and summarized the factors that should be considered to ensure a flare system can achieve good destruction efficiency. This study concluded that flares that operate outside of their "stable flame envelope" had reduced destruction efficiencies. Over steaming, excess aeration, high winds, and flame lift off were identified in this study as factors that all reduced flare performance.

3.5 Other General Comments

We appreciate that EPA has improved the functionality and clarity of the flare system design costing sections by defining and providing the units used for each of the equations in Sections 1.3 and 1.4.

IV. <u>Conclusion</u>

We appreciate the opportunity to submit these comments on the proposed updates to the Manual. While the technical descriptions of the pollution control systems described in each chapter are generally accurate, the specific cost data presented in Section 3.1, Chapter 1, and Section 3.2, Chapter 1, are not accurate. The cost data presented in these sections are based on equipment cost estimates that 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 carbon adsorber and flare systems (or other reliable sources of cost data) and discontinue its reliance on outdated equipment cost information.

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[2] Flare Efficiency Study, EPA-600/2-83-052, US EPA, July 1983.

[3] Parameters for Properly Designed and Operated Flares, EPA Office of Air Quality Planning and Standards, April 2012.