



## Project Summary

# Evaluation of Control Technologies for Hazardous Air Pollutants

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The purpose of this manual is to help EPA regional, state, and local air pollution control agency technical personnel to select, evaluate, and cost air pollution control techniques for reducing or eliminating the emission of potentially hazardous air pollutants (HAPs) from industrial/commercial sources. The information provided by this manual will be useful for reviewing permit applications or for informing interested parties as to the type, basic design, and cost of available HAP control systems.

Since the definition of a HAP is very broad and, thus, encompasses potentially thousands of specific compounds, it is not possible for this manual to develop an all-inclusive list of HAP compounds and compound-specific control techniques. However, the number of generic air pollution control techniques available is small, and the factors affecting the cost and performance of these controls as applied to many noncriteria pollutants have been identified and discussed in the literature. Therefore, the main focus of this manual is to provide sufficient guidance to select the appropriate air pollution control system(s) for an emission stream/source containing HAPs.

The manual will help the user perform three distinct functions: (1) to select the appropriate control technique(s) that can be applied to each HAP emission stream generated at a specific facility, (2) to determine the basic design parameters of the selected air pollution control device(s) and accompanying auxiliary equipment, and (3) to estimate order-of-magnitude control system capital and annualized costs.

*This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in two separate volumes of the same title (see Project Report ordering information at back).*

### Introduction

The objective of this manual is to present a methodology for determining the performance and cost of air pollution control techniques for reducing or eliminating the emission of potentially hazardous air pollutants (HAPs) from industrial/commercial sources. [Note: The term "hazardous" in this manual is very broad. It does not reflect the specific compounds listed under current regulations (i.e., the Clean Air Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act).] This manual is to be used by EPA regional, state, and local air pollution control agency technical personnel for two basic purposes: (1) to respond to inquiries from interested parties (e.g., prospective permit applicants) regarding the HAP control requirements that would be needed at a specified process or facility, and (2) to evaluate/review permit applications for sources with the potential to emit HAPs. Note that this manual provides general technical guidance on controls; it does not provide guidance for compliance with specific regulatory requirements for HAPs. Specifically, the manual does not specify design requirements necessary to achieve compliance with standards established under specific programs; e.g., Section 112 of the Clean Air Act or

standards established under the Resource Conservation and Recovery Act. Such requirements vary with the HAP emitted and with the emission source; thus, regulatory-specific detailed specifications are beyond the scope of this manual.

## Contents of the Manual

Chapter 1 discusses the use of the manual.

Chapter 2 assists the user in identifying HAPs and their respective emission sources. Information on potential HAP emissions is provided for the following source categories: solvent usage operations, metallurgical industries, the Synthetic Organic Chemical Manufacturing Industry (SOCMI), the inorganic chemical manufacturing industry, the chemical products industry, the mineral products industry, the wood products industry, petroleum related industries, and combustion sources. Potential HAPs are identified as organic vapors, inorganic vapors, or particulates. Both point source and fugitive emissions are covered. Chapter 2 also identifies the key emission stream characteristics necessary to select appropriate control techniques.

Chapter 3 provides additional information to assist the user in the control technique selection process for each HAP emission source/stream. Control techniques applicable to the following types of sources are discussed: organic vapor emissions from point sources, inorganic vapor emissions from point sources, organic/inorganic vapor emissions from process fugitive sources, organic/inorganic vapor emissions from area fugitive sources, particulate emissions from point sources, and particulate emissions from fugitive sources.

Chapter 4 presents simple step-by-step procedures to determine basic design parameters of the specific control devices and auxiliary equipment. The following control technologies are covered: thermal incinerators, catalytic incinerators, flares, carbon adsorbers, absorbers/scrubbers, condensers, fabric filters, electrostatic precipitators, and venturi scrubbers.

Chapter 5 provides the necessary data and procedures to determine order-of-magnitude estimates (-60 to +30 percent) for the capital and annualized costs of each control system.

Several appendices provide pertinent information not found in the main text. The appendices are divided into three

groups. Appendices in Group A present supplementary data that clarify/expand the information discussed. (For example, Appendix A.1 contains the "New York State Air Guide - 1," which illustrates some of the methods that might be used when developing a HAP program.) Group B appendices contain derivations of equations, calculation procedures, and unit conversion techniques for emission stream physical characteristics. Blank worksheets to be used for performing the functions of this manual are in the Group C appendices.

## How to Use the Manual

Figure 1 is a flowchart of the steps performed when responding to inquiries; Figure 2 presents the same type of flowchart for use when reviewing permits. These figures show that these two functions are basically the same; the only substantive difference is that the review process also compares the determined/calculated parameters with the corresponding parameters stated in the permit application to ensure that the control system(s) proposed by the applicant will provide the required reduction of HAP emissions.

When an inquiry or permit application is received, determine the HAPs applicable to the source category in question (Section 2.1). The HAPs are in four categories: organic vapor, organic particulate, inorganic vapor, and inorganic particulate. [Note: For each HAP group, a list of potentially or suspected hazardous compounds that may be emitted as a HAP from the source category is provided. This list is neither all-inclusive nor a declaration that the compounds presented are hazardous.] Next, identify the potential emission sources for each HAP group (Section 2.1). The HAP emission sources are listed under one of the three classifications: process point sources, process fugitive sources, and area fugitive sources. After determining each emission source, identify the key HAP emission stream characteristics (e.g., HAP concentration, temperature, flow rate, heat content, particle size) needed to select the appropriate control technique(s) (Section 2.2). Obtain the actual values for these characteristics from the owner/operator or from available literature. If two or more emission streams are combined prior to entry into an air pollution control system, determine the characteristics of the combined emission stream (Appendix B.2).

Depending on the specific regulation and the type/characteristics of the HAP emission source/stream, the remaining steps in the methodology will differ. There are four basic formats for a regulation: (1) a particular control device may be required, (2) a numerical limit may be specified, (3) a technology forcing requirement may be imposed, and (4) a specific work practice or other related practice may be required. The regulation format will define the steps that lead to the selection of the appropriate control technique(s). The control device and other formats specify the appropriate control technique(s). A numerical limit format requires the determination of the HAP removal efficiency before the appropriate control technique(s) can be identified. Lastly, the technology forcing format has two paths: one where the cost of the control system is a factor in the decision, and one where cost is not a factor. If control system cost is a factor, the agency must determine the cost constraints that will be imposed on the control technique selection process. The steps that occur in defining the HAP control requirements will depend on each agency's regulatory policies.

The HAP emission stream characteristics, in conjunction with the limitations imposed by the applicable regulations, are used to select the appropriate control techniques (Chapter 3) for each HAP emission source/stream. General guidelines are provided that match specific control devices with specified emission stream properties (e.g., HAP content, temperature, moisture, heat content, particle size, flow rate). Basic design parameters are then determined to provide general design conditions that should be met or exceeded for each selected control technique to achieve the specified HAP removal efficiency (Chapter 4). This exercise also identifies which of the selected control techniques will not achieve the desired HAP control requirements. The basic design parameters also can be used to obtain an order-of-magnitude cost estimate for each control device (Chapter 5). As noted above, this cost information can be an integral part of the HAP control system selection process. After completing the above process, a HAP control program can be recommended and evaluated.

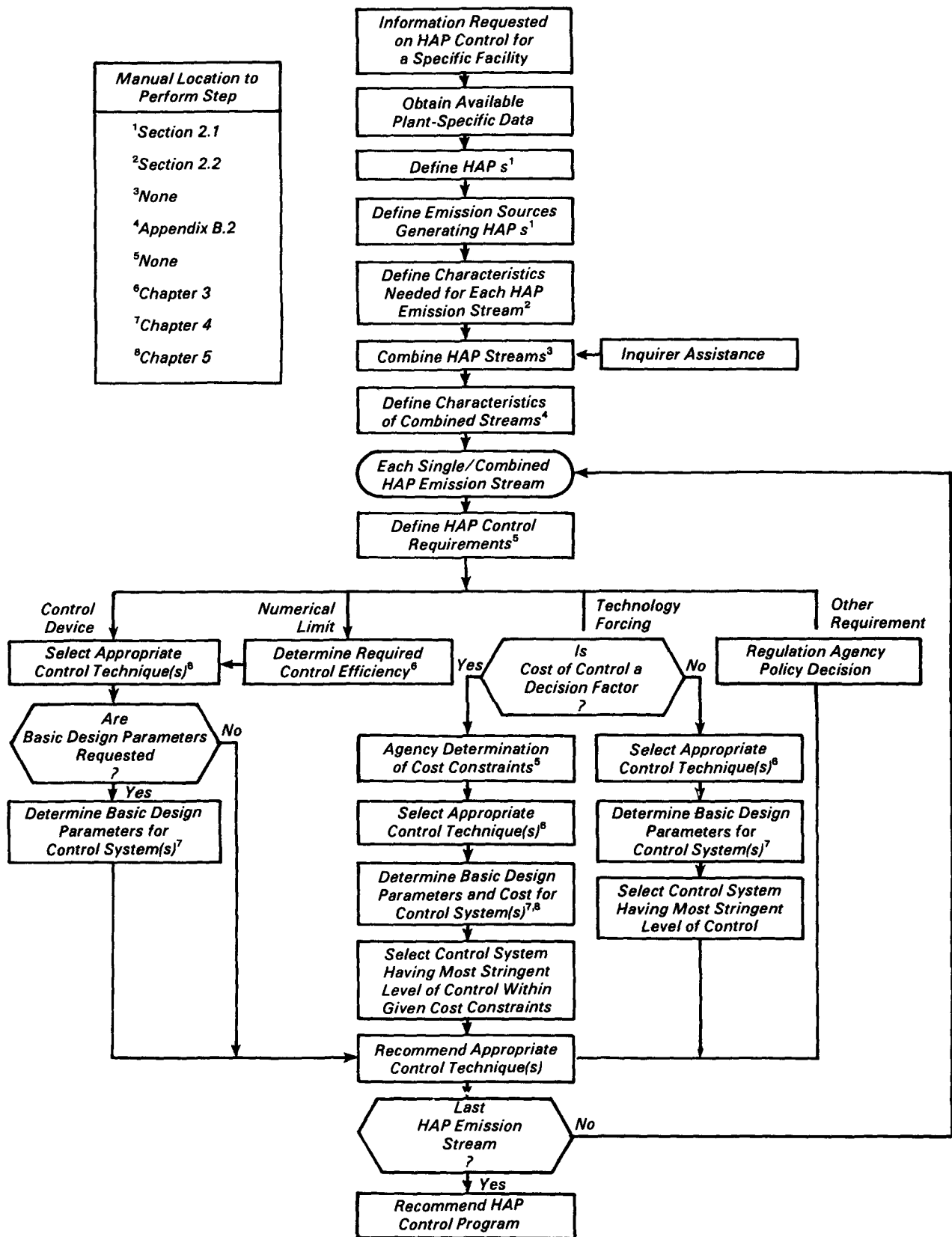


Figure 1. Steps used when responding to inquiries.

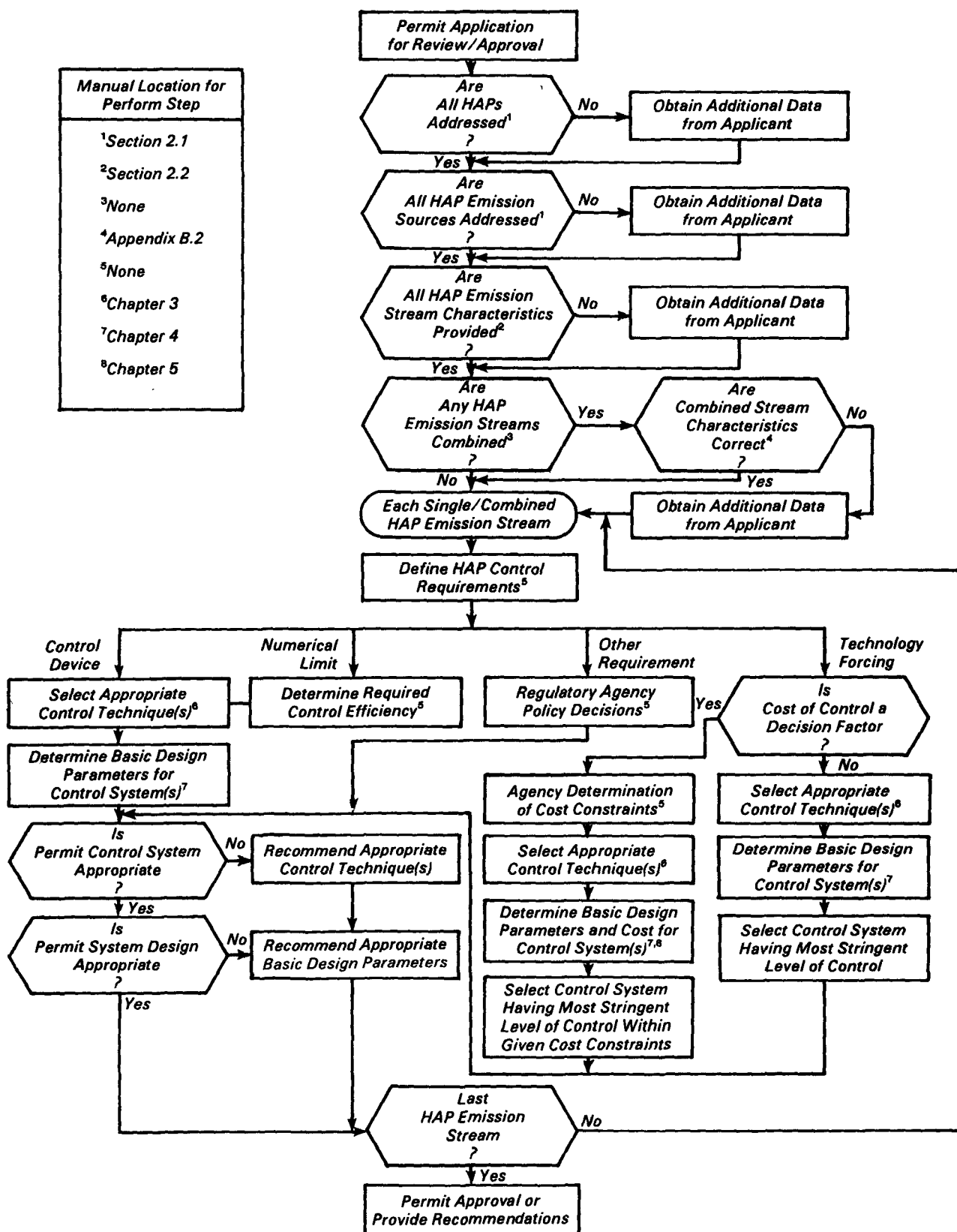


Figure 2. Steps used when reviewing permits.

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*The complete report consists of two volumes, entitled "Evaluation of Control Technologies for Hazardous Air Pollutants:—"*

*"Volume 1. Technical Report," (Order No. PB 86-167 020/AS; Cost: \$28.95)*

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