ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 61

[AD-FRL 3409-9]

National Emission Standards for Hazardous Air Pollutants; Benzene Emissions From Maleic Anhydride Plants, Ethylbenzene/Styrene Plants, Benzene Storage Vessels, Benzene Equipment Leaks, and Coke By-Product Recovery Plants

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule and notice of public hearing.

SUMMARY: On December 8, 1987, the D.C. Circuit Court granted the EPA's motion for a voluntary remand of the benzene equipment leak standard and the withdrawal of proposed standards for ethylbenzene/styrene (EB/S) and maleic anhydride process vents, and benzene storage vessels in light of the same court's recent decision on the vinyl chloride standard [*Natural Resources Defense Council, Inc.* v. *EPA,* 824 F.2d 1146 (1987)] (hereafter referred to as *Vinyl Chloride*). The court ordered EPA to propose action on the above standards within 180 days and to promulgate them within 360 days. The order was subsequently modified to extend the time for proposal of actions by 45 days. This notice presents the Administrator's reexamination of the benzene withdrawals and the benzene equipment leak standard. The Agency's reassessment of the proposed coke by-product recovery plants standard is also presented. Also included is a response to public comments on the previously proposed coke by-product recovery plants standard.

This notice proposes four policy approaches that could be used in setting national emission standards for hazardous air pollutants (NESHAP) and would be consistent with the court's decision in *Vinyl Chloride.* The decisions that would result from application of each of the policy approaches to the five benzene source categories are described, and alternative standards are proposed.

A public hearing will be held to provide interested persons an opportunity for oral presentation of data, views, or arguments concerning these proposed actions.

DATES: *Comments.* Comments must be received on or before October 3, 1988.

Public Hearing. A public hearing will be held on September 1, 1988, and, if additional time is needed, will continue on September 2, 1988. The hearing will begin at 9:00 a.m. and is scheduled to conclude at 5:00 p.m. on both days.

Request to Speak at Hearing. Persons wishing to present oral testimony must notify EPA by August 25, 1988.

ADDRESSES: *Comments.* Comments should be submitted (in duplicate if possible) to: Central Docket Section (LE-131), Attention (to the appropriate docket numbers), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460. The applicable dockets are: Docket No. OAQPS 79-3, Part I for comments on benzene health effects; Docket No. OAQPS 79-3, Part II for comments addressing maleic anhydride process vents; Docket No. A-79-49 for comments addressing regulation of EB/S process vents; Docket No. A-80-14 for comments addressing the regulation of benzene storage vessels; Docket No. A-79-27 for comments addressing benzene equipment leaks; or Docket No. A-79-16 for comments addressing coke by-product recovery plants.

Public Hearing. The hearing will be held at the U.S. Department of Agriculture Auditorium, 14th Street and Independence Avenue, Washington, DC 20250. Persons wishing to present oral testimony should notify Ms. Ann Eleanor, Standards Development Branch (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5578.

Background Information Documents. A background document responding to comments on the coke by-product recovery plants standard originally proposed on June 6, 1984, may be obtained from the U.S. EPA Library (MD-35), Research Triangle Park, North Carolina 27711, telephone (919) 541-2777. Please refer to EPA-450/3-83-016b, "Benzene Emissions from Coke By-Product Recovery Plants—Background Information for Revised Proposed Standards."

Dockets. Docket No. OAQPS 79-3 (Part I) contains information considered in the health effects, listing, and regulation of benzene. Docket No. A-79-16 contains supporting information used in the development of the proposed standard for coke by-product recovery plants, Docket No. A-79-27 contains supporting information used in the development of the standard for benzene equipment leaks, and Docket Nos. OAQPS 79-3 (Part II), A-79-49, and A-80-14 contain supporting information on maleic anhydride process vents, EB/S process vents, and benzene storage vessels, respectively. These dockets are available for public inspection and copying between 8:00 a.m. and 3:30 p.m., Monday through Friday, at the EPA's Central Docket Section, South Conference Center, Room 4, Waterside Mall, 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: For information specific to coke by-product recovery plants or benzene storage vessels, contact Ms. Gail Lacy at (919) 541-5261, Standards Development Branch, Emission Standards Division (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. For information specific to benzene equipment leaks, EB/S process vents, or maleic anhydride process vents, contact Dr. Janet Meyer, at the above address, telephone number (919) 541-5254. For information concerning the health effects of benzene and the risk assessment, contact Dr. Ila Cote at (919) 541-5342, Pollutant Assessment Branch, Emission Standards Division (MD-13), at the above address.

SUPPLEMENTARY INFORMATION: The information presented in this preamble is organized as follows:

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I. Overview of Proposed Alternative Actions

Policy Approaches

Under section 112 of the Clean Air Act (CAA), EPA is required to establish emission standards for hazardous air pollutants at a level which provides an ample margin of safety to protect public health. In *Vinyl Chloride,* the court set out a two-step decision process for EPA to follow in setting NESHAP under section 112. The two steps set out in *Vinyl Chloride* are: (1) Determine a "safe" or "acceptable risk" level, and (2) set the standard at the level—which may be lower but not higher than the "safe"' or "acceptable" level—that protects public health with an ample margin of safety. The court emphasized that judgments by EPA concerning scientific uncertainty are an important part of the process for establishing NESHAP.

As discussed in detail in Section V of this notice, the Agency is proposing four alternative policy approaches for making these two decisions for NESHAP. Commenters should assume that the final decision on the NESHAP approach could be one of the four described specifically in this notice or a variation. The final policy approach and the relative weight it gives to the various risk measures and uncertainties will become the framework for decisions on future NESHAP. Consequently, the Agency is interested in comments on general implications of the alternative policy approaches as well as in comment on the specific applications to the four benzene source categories.

The framework adopted for NESHAP will not apply to other Agency programs. The Court's interpretation of the process required for establishing NESHAP did not extend to regulatory decisions under any other statute administered by EPA; therefore, the Agency does not envision applying the process described below to regulatory judgments under other Acts. Regulatory decisions under other Acts will continue to be made using individual deliberative processes pursuant to those distinct statutory mandates.

The alternative Policy approaches being proposed differ in how the question of acceptable risk is addressed and in how uncertainty in risk measures is considered. The agency is using both the four proposed approaches and the applications of the approaches to the benzene source categories as a means to frame the public debate on these questions. The Administrator believes that the broad ramifications of any particular approach for establishing acceptable risk levels for all NESHAP should be subject to public debate, in order to elicit the fullest range of information on these important decisions.

Each of the four approaches treats the acceptable risk decision differently. The major characteristics of the four proposed approaches to acceptable risk and ample margin of safety decisions are described below.

Approach A. Case-by-Case Approach

This is the only approach in which all the health information, risk measures, and potential biases, underlying assumptions, and quality (i.e., uncertainties) of the information are considered together in the acceptable risk decision. The preferred range for the maximum individual lifetime risk in this approach is 10^{-4} or less; however, different decisions on acceptable risk for various pollutants and source categories may be made based on consideration of all the health information.

Approach B. Incidence-Based Approach

This approach only considers total incidence in the acceptable risk decision. All of the health information, the uncertainties, and individual risk are not considered until the ample margin decision. The incidence level being proposed as acceptable is 1 case/yr per source category.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

The only parameter considered in determining acceptable risk is maximum individual lifetime risk. The other health information, the uncertainties, and incidence are not considered until the ample margin decision. In this approach, a maximum risk of 1×10^{-4} or lower is defined as acceptable.

Apporach D. 1×10^{-6} or Less Maximum Individual Risk Approach

This approach is similar to Approach C; however, acceptable risk is defined as a maximum individual lifetime risk of 1×10^{-6} or lower.

Ample Margin of Safety Decisions

This decision is made the same way under the four alternative approaches. In each, all the health risk measures as well as technical feasibility, cost, estimation uncertainties, and economic impacts are considered. A question of particular concern in these decisions is whether to require all technically feasible controls for which costs are reasonable no matter how small the risk reduction.

Application of Approaches to Benzene Source Categories

In reexamining the previous benzene decisions, the Administrator used data and analyses available as of the publications in June 1984 and August 1985. The reassessment for coke by-product recovery plants used the estimated impacts which were revised after the June 6, 1984, proposal. The risk estimates for the benzene source categories and the acceptable risk determinations under the alternative approaches are summarized in Table I-1. Maleic anhydride process vents are not included in this summary because benzene is no longer used to produce maleic anhydride. The ample margin of safety risk levels and associated control levels determined under the alternative approaches are summarized in Table I-2. The standards under the alternatives include no additional control, application of all known technology that is available at a reasonable cost, and plantwide benzene emission limits, which are not expected to be generally achievable in several source categories using known technology. The bases for these decisions are discussed in Sections VII through X of this notice.

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TABLE I-1. SUMMARY OF ACCEPTABLE DECISIONS UNDER THE ALTERNATIVE POLICY APPROACHES

	Baseline[a] Risk Estimates								Is Baseline Risk Acceptable?			
			Cumulative Population[d]			Noncumulative Incidence[e]			Approach			
Source Category	MIR[b]	Case/yr[c]	$\geq 10^{-4}$	$\geq 10^{-5}$	$\geq 10^{-6}$	10^{-4}	10^{-5}	10^{-6}	A	B	C	D
Ethylbenzene/Styrene Process Vents	2×10^{-5}	0.004	0	700	40,000	0	0.0002	0.001	Yes	Yes	Yes	No
Benzene Storage Vessels[f]	4×10^{-5} to 4×10^{-4}	0.05 to 0.1	10	20,000	900,000	0	0.004	0.02	Yes	Yes	No	No
Equipment Leaks NESHAP	6×10^{-4}	0.2	3,000	60,000	1,000,000	0.007	0.02	0.04	Yes	Yes	No	No
Coke By-Product Recovery Plants	6×10^{-3}	3	100,000	3,000,000	30,000,000	0.4	0.9	1	Yes	No	No	No

[a] The baseline level of control is described for each source category in Sections VII through X.

[b] Maximum individual lifetime risk (MIR) is the increased risk of cancer due to exposure for 70 years to the maximum modeled concentration.

[c] Case/yr is the annual incidence in the modeled population. This is a measure of population aggregate risk.

[d] The estimated number of people exposed to benzene concentrations resulting in predicted individual risk levels above the level shown. Population is cumulative.

[e] This is the estimated annual number of leukemia cases for the population exposed to each risk level. It is not cumulative.

[f] The range of risks associated with storage vessels represents the range of emission estimates.

TABLE I-2. SUMMARY OF AMPLE MARGIN OF SAFETY DECISIONS UNDER THE ALTERNATIVE POLICY APPROACHES

	Ethylbenzene/Styrene Process Vents	Benzene Storage Vessels	Equipment Leaks	Coke By-Product Plants
Approach A: Case-by-Case				
Level of Control	No additional control. Existing control provides ample margin.	Cost effective equipment.[a]	1984 NESHAP Provides ample margin.	Cost effective equipment and work practices.[b]
MIR[c]/ case/yr	2×10^{-5}/0.004	3×10^{-5}/0.04	6×10^{-4}/0.2	4×10^{-4}/0.2
Population at $>10^{-4}/10^{-6}$	0/40,000	0/80,000	3,000/1,000,000	2,000/2,000,000
Approach B: ≤ 1 case/yr				
Level of Control	Same as above.	Same as above.	Same as above.	Same as above.
MIR/ case/yr				
Population at $>10^{-4}/10^{-6}$				
Approach C: $\leq 1 \times 10^{-4}$				
Level of Control	Same as above.	Same as above.	14 kg/day[d] and 1984 NESHAP.	34 kg/day[d] and controls required in A.
MIR/ case/yr			1×10^{-4}/0.07	1×10^{-4}/0.07
Population at $>10^{-4}/10^{-6}$			0/unknown	0/unknown
Approach D: $\leq 1 \times 10^{-6}$				
Level of Control	5.5 kg/day[d]	0.47 kg/day[d]	0.14 kg/day[d]	0.34 kg/day[d]
MIR/ case/yr	1×10^{-6}/0.0007	1×10^{-6}/0.002	1×10^{-6}/0.0007	1×10^{-6}/0.0004
Population at $>10^{-4}/10^{-6}$	0/0	0/0	0/0	0/0

[a] Controls required are internal floating roofs on fixed roof vessels, effective primary seals and fittings on all vessels, and secondary seals on external floating roof vessels.

[b] Controls required are gas blanketing on all process vessels, tar-bottom final coolers at foundry plants, wash-oil final coolers at furnace plants, and leak detection and repair for equipment leaks.

[c] MIR = maximum individual lifetime risk.

[d] Limit on total benzene emissions from plant

Table I–3 summarizes estimates of major anticipated economic impacts of the ample margin decisions made under the approaches for the benzene source categories. The estimates of number of facilities shown under Approaches C and D to be permanently shut down (i.e., a closure) are based on limits of known control technologies. These particular estimates are rough estimates and are not based on economic analysis. The job loss estimates are also rough approximations which include only the regulated plants. Estimates of impacts on related industries and general communities are not included and cannot be quantified at this time.

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TABLE I-3. SUMMARY OF ESTIMATED ECONOMIC IMPACTS OF AMPLE MARGIN OF SAFETY DECISIONS UNDER THE ALTERNATIVE POLICY APPROACHES

	Ethylbenzene/Styrene Process Vents	Benzene Storage Vessels	Equipment Leaks	Coke By-Product Plants
Approach A: Case-by-Case				
Annual control cost, million $/yr	No additional cost.	0.1	No additional cost.	16
Closure/No. of facilities	0/13	0/126	0/131	0/44
Jobs lost	None	None	None	None
Approach B: <1 case/yr				
Annual control cost, million $/yr	Same as above.	Same as above.	Same as above.	Same as above.
Closure/No. of facilities				
Jobs lost				
Approach C: $\leq 1 \times 10^{-4}$				
Annual control cost, million $/yr	Same as above.	Same as above.	Unknown[a] but at least 52, if controls were applied.	Unknown[a] but at least 26.
Closure/No. of facilities			100/131	4 closures and 8 with reduced production/44 40% loss of coke production capacity
Jobs lost			~27,000[b]	~3,000[b]
Approach D: $\leq 1 \times 10^{-6}$				
Annual control cost, million $/yr	Unknown[a]	Unknown[a]	Unknown[a]	Unknown[a] but at least 29 if controls were applied
Closure/No. of facilities	6-8/13[c,d]	Unknown/126[d]	131/131	44/44
Jobs lost	Unknown[d]	Unknown[d]	~35,000[b]	~7,000[b]

[a]The cost of closure is not included and cannot be estimated at this time. Closure estimate is not based on economic feasibility
[b]Estimate represents only jobs that would be directly affected by closure of plants. No estimate can be made for job losses in associated industries This estimate is only a rough approximation of job losses
[c]Estimate derived from number of facilities with emissions exceeding 2 Mg/yr Range reflects variation in amount of additional reduction required
[d]These facilities are also affected by standard for equipment leaks. Thus, actual number of closures will be determined by the equipment leak standard

As shown in Table I-3, ample margin decisions under the alternative approaches are estimated to result in widely varying cost and economic impacts. These differences arise due to differences in technical feasibility of achieving the standards.

Although under the court's decision in *Vinyl Chloride*, EPA may not take cost or feasibility into account in setting an acceptable level of risk, those factors are relevant to the second, or ample margin of safety step. In any event, should widespread closure of facilities producing and using benzene result from any alternative standard, significant social as well as economic impacts would result. Benzene is a basic chemical used to manufacture a diverse number of chemicals and products; such as polystyrene, nylon, and synthetic rubber. These derivatives are used in consumer goods (toys, tires, packaging), household goods (refrigerators, carpeting), and transportation.

Request for Comment

Throughout this notice, comments and information are requested on specific areas. In addition, partly in response to the *Vinyl Chloride* decision, EPA is reexamining assumptions and decision methods it has relied upon in making section 112 hazardous air pollutant regulatory determinations. As part of that process, EPA is seeking to engage the public and all interested parties in discussion concerning both specific elements of alternative proposals for benzene standards and a broader reexamination of assumptions and decision methods.

In an effort to structure that discussion, EPA has formulated the four alternative approaches noted earlier for the control of hazardous air pollutant emissions under section 112 of the CAA. Today's **Federal Register** notice proposes these four approaches for the control of air emissions of benzene and thereby provides the opportunity for EPA to solicit comments from the public on a variety of issues associated with this reexamination of the Federal program for hazardous air pollutants. Determinations on many of these specific issues within the proposed benzene regulation are expected to set precedents for the approach to be used for the substantial number of forthcoming NESHAP decisions. Major areas on which the Administrator requests public comment include, among others:

(1) Should EPA consider all risk information in decisions on risk acceptability or rely on a single numerical risk criterion? If multiple risk measures are to be used as the basis for decisions on risk acceptability, how should EPA balance individual versus population risk reductions?

(2) What health risk is acceptable not considering cost and technical feasibility of achieving it? Moreover, what constitutes an ample margin of safety in cases where all exposures pose some risk?

(3) Should EPA require standards pursuant to the ample margin of safety decisions under section 112 that are "technology forcing"? What criteria should EPA use to define the "availability" and "feasibility" of technological controls?

(4) In the ample margin of safety determination, how should EPA balance the residual health risks versus the possibility of plant closures?

(5) How should uncertainty in risk estimates be considered in these decisions?

(6) How should EPA balance the various risk, technical, and economic considerations in ample margin of safety decisions? How should EPA consider the ramifications of potential errors and uncertainy of judgments on technology capability and costs?

(7) Should EPA allow site-by-site analyses by sources to comply with risk targets in lieu of reasonable worst-case emission limits?

II. Background Documents and Notices

Background Documents

The following is a listing of background documents pertaining to the health effects of benzene and previous regulatory development efforts for each source category. The complete title, EPA publication number, publication date, and National Technical Information Service (NTIS) and document numbers are included. Where appropriate, an abbreviated descriptive title used to refer to the document throughout this notice is also listed.

General Health and Policy Regarding Benzene (Docket No. OAQPS 79-3, Part I)

(1) "Assessment of Human Exposures to Atmospheric Benzene," EPA-450/3-78-031. May 1978. (NTIS Number PB-284203). (Docket Item II-A-28).

(2) "Assessment of Health Effects of Benzene Germane to Low Level Exposures," EPA-600/1-78-61. September 1978. (NTIS Number PB-289789). (Docket Item II-A-30).

(3) "Carcinogen Assessment Group's Final Report on Population Risk to Ambient Benzene Exposures," EPA-450/5-80-004. January 1979. (NTIS Number PB82-227372). (Docket Item II-A-31 and 31A).

(4) "Response to Public Comments on EPA's Listing and Regulation of Benzene Under Section 112: Comments of a General Policy Nature," EPA-450/5-84-001. May 1984. (Docket Item VII-B-2).

(5) "Response to Public Comments on EPA's Listing of Benzene Under Section 112," EPA-450/5-82-003. May 1984. (Docket Item VII-B-1).

(6) "Interim Quantitative Cancer Unit Risk Estimates Due to Inhalation of Benzene." Internal Draft. EPA-600/X-85-22. February 1985. (Docket Item VIII-A-4).

Maleic Anhydride Process Vents (Docket No. OAQPS 79-3, Part II)

(1) "Benzene Emissions from Maleic Anhydride Plants—Background Information for Proposal to Withdraw Proposed Standard," EPA-450/3-84-002. March 1984. (NTIS Number PB84-170174). (Docket Item V-B-1). Referred to in maleic anhydride sections of this preamble as: Withdraw Background Information Document (BID).

Ethylbenzene/Styrene Process Vents (Docket No. A-79-49)

(1) "Benzene Emissions from the Ethylbenzene/Styrene Industry—Background Information for Proposal to Withdraw Proposed Standards," EPA-450/3-84-003. March 1984. (NTIS Number PB84-176874). (Docket Item V-B-1). Referred to in EB/S sections of this preamble as: Withdrawal BID).

Benzene Storage Vessels (Docket No. A-80-14)

(1) "Benzene Emissions from Benzene Storage Tanks—Background Information for Proposal to Withdraw Proposed Standards," EPA-450/3-84-004. March 1984. (NTIS Number PB84-167683). (Docket Item V-B-1). Referred to in storage vessel sections of this preamble as: Withdrawal BID.

Benzene Equipment Leaks (Fugitive Emisions) (Docket No. A-79-27)

(1) "Benzene Fugitive Emissions—Background Information for Proposed Standards," EPA-450/3-80-032a. November 1980. (NTIS Number PB81-151664). (Docket Item III-B-1). Referred to in equipment leak sections of this preamble as: Proposal BID.

(2) "Fugitive Emission Sources of Organic Compounds—Additional Information for Emissions, Emission Reduction, Costs," EPA-450/3-82-010. April 1982. (NTIS Number PB82-217126). (Docket Item IV-A-24). Referred to in equipment leak sections of this preamble as: Additional Information Document (AID).

(3) "Benzene Fugitive Emissions—Background Information for Promulgated Standards," EPA-450/3-80-032b. June 1982. (NTIS Number PB84-210301). (Docket Item V-B-1). Referred to in equipment leak sections of this preamble as: Promulgation BID.

"Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft," EPA Contract Number 68-02-4338. December 1987. (Docket Item VII-A-1).

Coke By-Product Recovery Plants (Docket No. A-79-16)

(1) "Benzene Emissions from Coke By-Product Recovery Plants—Background Information Document for Proposed Standards," EPA-450/3-83-016a. May 1984. (NTIS Number PB84-209477). (Docket Item III-B-1). Referred to in coke by-product sections of this preamble as: Proposal BID.

(2) "Benzene Emissions from Coke By-Product Recovery Plants—Background Information for Revised Proposed Standards," EPA-450/3-83-016b. June 1988. Referred to in coke by-product sections of this preamble as: Revised Proposal BID.

The background documents listed above can be found in the dockets or purchased from NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161, telephone number (703) 487-4650. The Revised Proposal BID for Coke By-Product Recovery Plants can be obtained from the U.S. EPA Library.

Previous Federal Register Notices

Previous **Federal Register** notices pertaining to standards development for the five source categories emitting benzene are listed below in chronological order. Since the complete **Federal Register** citation and dates are listed here, they will not be repeated throughout this notice.

(1) "National Emission Standards for Hazardous Air Pollutants: Addition of Benzene to List of Hazardous Air Pollutants," 42 FR 29332, June 8, 1977.

(2) "National Emission Standards for Hazardous Air Pollutants: Benzene Emissions from Maleic Anhydride Plants; Proposed Rule and Notice of Public Hearing," 45 FR 26660, April 18, 1980.

(3) "National Emission Standards for Hazardous Air Pollutants; Benzene Emissions from Ethylbenzene/Styrene Plants; Proposed Rule and Notice of Public Hearing," 45 FR 83448, December 18, 1980.

(4) "Benzene Emissions from Benzene Storage Vessels; National Emission Standards for Hazardous Air Pollutants; Proposed Rule and Notice of Public Hearing," 45 FR 83952, December 19, 1980.

(5) "National Emission Standards for Hazardous Air Pollutants; Benzene Fugitive Emissions; Proposed Rule and Notice of Public Hearing," 46 FR 1165, January 5, 1981.

(6) "National Emission Standards for Hazardous Air Pollutants; Benzene Emissions from Maleic Anhydride Plants, Ethylbenzene/Styrene Plants, and Benzene Storage Vessels; Proposed Withdrawal of Proposed Standards," 49 FR 8386, March 6, 1984.

(7) "National Emission Standards for Hazardous Air Pollutants; Regulation of Benzene; Response to Public Comments," 49 FR 23478, June 6, 1984.

(8) "National Emission Standards for Hazardous Air Pollutants; Benzene Equipment Leaks (Fugitive Emission Sources); Final Rule," 49 FR 23498, June 6, 1984.

(9) "National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Benzene Emissions from Coke By-Product Recovery Plants; Proposed Rule and Notice of Public Hearing," 49 FR 23522, June 6, 1984.

(10) "National Emission Standards for Hazardous Air Pollutants; Benzene Emissions from Maleic Anhydride Plants, Ethylbenzene/Styrene Plants, and Benzene Storage Vessels; Withdrawal of Proposed Standards," 49 FR 23558, June 6, 1984.

(11) "National Emission Standards for Hazardous Air Pollutants; Benzene Emissions from Maleic Anhydride Plants, Ethylbenzene/Styrene Plants, Benzene Storage Vessels, and Benzene Equipment Leaks; Denial of Petition for Reconsideration," 50 FR 34144, August 23, 1985.

III. Background

Since the early 1900's, the scientific and medical communities have recognized benzene as a potentially toxic substance. Benzene was recognized as a potential human carcinogen (leukemia) in the mid-1970's based on occupational studies of synthetic rubber, chemical, and shoe workers. Other documented occupational effects include impairment of the blood-forming system, immunotoxicity, chromosome breakage, and neurotoxicity. Results of animal studies support the leukemogenic potential of benzene and show reproductive and developmental toxicity also.

Benzene is common in our indoor and outdoor air. Major sources of benzene include automobile exhaust, automobile refueling operations, consumer products, cigarette smoking, and industrial emissions.

In 1977, the Administrator announced his decision to list benzene as a hazardous air pollutant under section 112 of the CAA (42 FR 29332, June 8, 1977). Benzene was determined to be a hazardous air pollutant because of its carcinogenic properties. A hazardous air pollutant is defined as an

> * * * air pollutant to which no ambient air quality standard is applicable and which * * * may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness.

Section 112(b)(1)(B) of the CAA requires EPA to establish emission standards for a hazardous air pollutant "at the level which in [the Administrator's] judgment provides an ample margin of safety to protect the public health from such hazardous air pollutant."

The listing of benzene as a hazardous air pollutant led to the development of proposed standards for benzene emissions from maleic anhydride process vents, EB/S process vents, benzene storage vessels, and benzene equipment leaks. These proposed standards were published respectively by EPA in the **Federal Register** in 1980 and 1981 (45 FR 26660, April 18, 1980; 45 FR 83448, December 18, 1980; 45 FR 83952, December 19, 1980; 46 FR 1165, January 5, 1981).

After receipt of comments from industry and members of the public, EPA published a final rule setting an emission standard for benzene equipment leaks on June 6, 1984 (49 FR 23498). On that date, EPA also withdrew its proposed standards for maleic anhydride process vents, EB/S process vents, and benzene storage vessels (49 FR 23558). The withdrawal was based on the conclusion that both the benzene health risks to the public from these three source categories, and the potential reductions in health risks achievable with available control techniques were too small to warrant Federal regulatory action under section 112 of the CAA. Also on that date, EPA published a proposed standard for benzene emissions from coke by-product recovery plants (49 FR 23522).

On August 3, 1984, the Natural Resources Defense Council (NRDC) filed a petition in the United States Court of Appeals for the District of Columbia Circuit, seeking review of the EPA's three withdrawals of proposed benzene emission standards, and the EPA's final standard for benzene equipment leaks (*Natural Resources Defense Council, Inc.* v. *Thomas*, No. 84-1387 (hereafter referred to as "*Benzene*")). On October 17, 1984, NRDC petitioned EPA under section 307(d)(7)(B) of the CAA to reconsider its decisions to withdraw standards for maleic anhydride process vents, EB/S process vents, and benzene storage vessels, and to reconsider the promulgated standard for benzene equipment leaks. The EPA denied this petition on August 23, 1985 (50 FR 34144).

On July 28, 1987, the court handed down an *en banc* decision in *Natural Resources Defense Council, Inc.* v. *EPA*, 824 F.2d 1146 (D.C. Cir. 1987) (hereafter referred to as "*Vinyl Chloride*") (Docket No. OAQPS 79-3, Part I, Docket Item X-I-4). The case concerns the emission standard under section 112 for vinyl chloride. The court concluded in *Vinyl Chloride* that EPA had acted improperly in withdrawing a proposed revision to the standard for vinyl chloride by considering costs and technological feasibility without first determining a "safe" or "acceptable" emissions level. In light of the *Vinyl Chloride* opinion, EPA requested a voluntary remand in *Benzene* to reconsider its June 6, 1984, rulemakings. In an order dated December 8, 1987, the court approved the EPA's voluntary remand and established a schedule under which EPA must propose its action on reconsideration within 180 days of the order and take final action within 360 days of the order. This order was subsequently modified under a joint motion to extend the time for proposal of actions by 45 days. The EPA also decided to reconsider the proposed standard for benzene emissions from coke by-product recovery plants in light of the *Vinyl Chloride* decision and to publish a supplemental proposal.

In reconsidering the previous decisions, the Administrator has used data on emissions and plants, and analyses available as of the publications in June 1984, and the denial of the petition for reconsideration in August 1985. The health information considered consists of the information available at the time of the 1984 decisions as well as the recent assessment provided by the Agency for the Toxic Substances and Disease Registry (ATSDR) that was released for public comment in December 1987 (Docket No. OAQPS 79-3, Part I, Docket Item X-1-2). For coke by-product recovery plants, the estimated impacts were revised based on comments received after the June 6, 1984, proposal. These revised impacts were used in the Administrator's reconsideration.

The EPA received in April 1988 from the American Petroleum Institute (API) a report entitled "Quantitative Re-evaluation of the Human Leukemia Risk Associated with Inhalation Exposure to Benzene." This report is in Docket No. OAQPS 79-3, Part I (Docket Item X-D-2) and is available for public comment. Due to the limited time available between submittal of this report and the court deadline, this information could not be evaluated before the reconsideration.

IV. Characterization of Benzene Health Risks

The characterization of the potential adverse health effects of human exposure to benzene emitted from the subject source categories is presented in four parts: Hazard identification, dose/response assessment, exposure assessment, and risk characterization. Based upon the documented association between exposure to benzene and elevated leukemia incidence in occupational populations, the risk characterization section includes estimates of excess leukemia risk for the general population exposed to benzene emissions from the subject source categories. The attendant uncertainties in these estimates are also described.

Hazard Identification

As a widely used organic chemical, the potential toxicity of benzene has been recognized since the erly 1900's. Initially identified as a causative agent in cases of bone marrow poisoning and blood abnormalities, the understanding of benzene's toxic properties has gradually expanded to include associations with aplastic anemia and cancer.

Although a tentative association between exposure to benzene and leukemia was first documented in 1928, benzene was not broadly recognized as a potential human carcinogen until the early 1970's with the publication of several epidemiological studies of benzene-exposed workers reported by the Occupational Safety and Health Administration (OSHA) (Docket No. OAQPS 79-3, Part I, Docket Item X-J-2). Based on this evidence, the Administrator, on June 8, 1977, announced a decision to list benzene as a hazardous air pollutant under section 112 of the CAA. Supplementary information on the listing may be obtained from the EPA document "Response to Public Comments on EPA's Listing of Benzene under Section 112" (Docket No. OAQPS 79-3, Part I, Docket Item VII-B-1).

Although acute nonlymphocytic leukemia (leukemia) is not the only adverse health effect attributed to benzene, the serious nature of this disease and the uncertainties regarding the existence of any risk-free levels of exposure combined to make it of central importance in hazard assessment. The EPA's health basis for listing rested primarily on retrospective studies in occupationally exposed human populations. Of these, three reports documenting an association received the greatest emphasis: Infante el al., published in 1977, Aksoy et al., published in 1976, and Ott et al., published in 1977 (Docket No. OAQPS 79-3, Part I, Docket Items II-I-86, IV-J-16, and II-I-71). In the interval since the listing decision, additional human data and animal data have become available which further support a casual relationship. Notable in this regard are studies published in 1981 by Rinsky et al. of the National Institute for Occupational Safety and Health (NIOSH) (Docket No. OAQPS 79-3, Part I, Docket Item IV-J-9) providing improved follow-up of the Infante cohorts, and a study by the Chemical Manufacturers Association (CMA) published by Wong et al. in 1983, of mortality among chemical workers exposed to benzene (Docket No. OAQPS 79-3, Part I, Docket Item X-I-I). The results of these studies are summarized below.

Infante et al. reported on a cohort of 748 white males occupationally exposed to benzene at any time between 1940 and 1949 at two facilities manufacturing rubber hydrochloride (pliofilm). The cohort mortality study revealed a significant excess of leukemia deaths (7 observed versus 1.38 expected) associted with benzene exposure. Aksoy and co-workers reported the incidence of leukemia between 1967 and 1973 among 28,500 Turkish shoe, slipper and handbag workers exposed to airborne benzene. The shoe workers had more than twice the rate of leukemia when compared to the annual leukemia incidence in the general population of Turkey. Ott et al. reported the long-term mortality patterns of 794 workers in chemical manufacturing facilities. Three deaths from leukemia were observed at a chemical plant among benzene-exposed employees when only 0.8 deaths from leukemia were expected, a 3.75-fold excess risk. Rinsky et al. (1981, 1987) provided a follow-up retrospective mortality study of the benzene exposed workers in the pliofilm industry (Docket No. OAQPS 79-3, Part I, Docket Items IV-J-9 and X-I-3). In the 1981 analysis in which the workers were followed through June 30, 1975, 7 leukemia cases were observed as compared to 1.25 expected cases. Rinsky also provided further detail on atmospheric benzene concentrations to which the workers were exposed. Rinsky et al. (1987) extended the follow-up of the cohort members to 1982. At this time, 9 cases of leukemia were observed when 2.7 were expected.

Wong et al. examined the causes of death for 7,676 chemical workers employed for at least 6 months between 1946 and 1975 (Docket No. OAQPS 79-3, Part I, Docket Item X-I-1). Upon comparison of specific mortality rates between workers exposed and workers not exposed to benzene, the authors found significant increased risk for benzene exposed workers of over four-fold when compared to nonexposed workers. Seven leukemia deaths were observed in the exposed group, and none were observed in the nonexposed group.

The EPA reviewed the weight of evidence of carcinogenicity from the various occupational studies and concluded that there is sufficient evidence of a causal relationship between benzene exposure and leukemia. Based on this evaluation, the Agency has classified benzene as Group A, a known human carcinogen, following the procedures set forth in the EPA's Guidelines for Cancer Risk Assessment (51 FR 33992, September 24, 1986).

In addition to leukemia, several of the studies described above noted increases in other cancers, most notably lymphosarcoma and multiple myeloma, in benzene-exposed cohorts. In these cases, however, the data are currently considered insufficient to document an association.

Animal studies that have been extensively reviewed in the OSHA rulemaking, offer general confirmation of the carcinogenic potential of benzene. Maltoni and Scarnoto (1979) reported that benzene administered orally to rats was associated with increases in tumors of the Zymbal gland and mammary tumors, as well as leukemia. (Docket No. OAQPS 79-3, Part I, Docket Item IV-J-6). Maltoni et al. (1982) found subsequently that Zymbal gland tumors were induced in rats exposed by inhalation exposure to benzene. Snyder et al. (1978) published a preliminary finding of myelogenous leukemia in mice exposed by inhalation to benzene (Docket No. OAQPS 79-3, Part I, Docket Item II-I-92). Snyder et al. (1980) also reported increased leukemia and lymphomas in mice exposed by inhalation of 300 parts per million (ppm) benzene, 6 hours per day, 5 days per week over a lifetime (Docket No. OAQPS 79-3, Part I, Docket Item IV-J-7).

In 1983, the National Toxicology Program (NTP) completed a 2-year chronic study of mice and rats orally exposed to benzene (Docket No. OAQPS 79-3, Part I, Docket Item IV-H-5). The study found a significant incidence in cancers at multiple sites in both sexes and both species of rodent. In rats an increased incidence of Zymbal gland carcinomas, skin cancer, and cancer of the oral cavity was observed. Increases in six types of tumors including malignant lymphoma, preputial gland carcinoma, and lung cancer were observed in male mice, and seven tumor types including lymphoma, lung cancer, ovarian cancer, breast cancer, and liver cancer were found in female mice.

Toxic effects in humans, other than cancer, have been associated with benzene exposure in various epidemiologic studies of occupationally exposed populations. Effects on the human hematopoietic (blood-forming) system have been documented by OSHA (Docket No. OAQPS 79-3, Part I, Docket Item X-J-2). A common clinical finding in benzene hematotoxicity is a decrease in various cellular elements of the circulating blood, termed cytopenia. This decrease can proceed to aplastic anemia, which is a rare disorder characterized by a reduction in all cellular elements in the peripheral blood and bone marrow. The OSHA has observed a case fatality rate of 30 to 50 percent within the first year of diagnosis of aplastic anemia.

The OSHA also reviewed numerous occupational studies in a recent rulemaking associating chromosomal aberrations in bone marrow cells and peripheral lymphocytes in workers exposed to benzene. Generally the epidemiologic studies indicate that chromosomal breakage can occur at exposures at or below 10 ppm, 8 hours per day.

Through the ATSDR with the help of EPA, the U.S. Public Health Service has recently reviewed the scientific literature on noncancer effects observed in animal studies (Docket No. OAQPS 79-3, Part I, Docket Item X-I-2). This review found that animal inhalation studies are available showing adverse systemic effects such as bone marrow depression, injury to cells of the hematopoietic organs, and immunotoxicity. Numerous studies in whole animals have associated the induction of bone marrow depression with inhalation exposure to benzene (Toft et al., Snyder et al., 1984). This effect generally occurs during short-term exposure to about 10 ppm benzene or above. Cellular immune dysfunction in mice has been reported by Rosenthal and Snyder, and was associated with short-term inhalation exposures of about 30 ppm benzene.

A number of investigations cited in the ATSDR review have evaluated developmental and reproductive toxicity in animals following inhalation exposure to benzene. These studies have shown that benzene is toxic to the developing embryo and fetus. Ward et al. (1985) observed that mice exposed to benzene at 300 ppm for 13 weeks experienced changes in the ovaries and testes such as atrophy, degeneration, and decreased spermatozoa. Ungvary and Tatrai (1985) demonstrated dose-dependent fetotoxic effects in mice and rabbits exposed to benzene during gestation. Keller and Snyder (1985) demonstrated alterations in hematopoiesis in the fetuses and offspring of pregnant mice exposed by inhalation to 10 ppm benzene (Docket No. OAQPS 79-3, Part I, Docket Item X-J-2).

Dose/Response Assessment

The dose/response assessment addresses the relationship between the dose of benzene administered or received in the various human and animal studies, and the incidence of an adverse health effect in the exposed study population. Although human exposure to benzene in the workplace has been associated with leukemia, aplastic anemia, multiple myeloma, lymphomas, pancytopenia, chromosomal breakages, and depression of bone marrow, EPA believes that the leukemia incidence in epidemiologic studies provides the clearest association between human exposures and the induction of disease for dose/response estimation purposes. Toxicity of the hematopoietic system as well as cytogenetic effects in humans have been causally related to benzene exposure; however, the magnitude and duration of dose required to elicit these effects are not well known at this time. Thus, carcinogenicity, specifically leukemia, is currently the focus of greatest concern in estimating the potential risk to the general population exposed to benzene emitted from stationary industrial sources. The association between benzene exposure and human leukemia is strengthened by observations of increased leukemia mortality rates among independent cohorts in different occupational settings. In addition, individuals exposed to benzene were evaluated over a time period that spanned the latency of leukemia. Although a dose/response association between cancer and benzene exposure has been demonstrated in rodent bioassays, EPA believes that human data, when available, should be given greater weight in assessing the potential risk to the benzene-exposed human population.

Since a specific environmental carcinogen is likely to be responsible for, at most, a small fraction of a community's overall cancer incidence, and since the general population is exposed to a complex mixture of potential causative agents, attempts to directly link actual human cancers with ambient air exposure to chemicals such as benzene are easily confounded. Epidemiologic techniques are generally not sensitive enough to measure such an association directly. Therefore, EPA must rely upon mathematical modeling techniques to estimate human health risks. These techniques, collectively termed "quantitative risk assessment," provide a means of mathematically estimating the risk of adverse health effects from ambient exposure to benzene by extrapolating effects found at higher occupational exposure levels to lower concentrations characteristic of population exposure in the vicinity of industrial sources. A key element in this extrapolation is the unit risk estimate (URE). For benzene this estimate is derived from the dose/response relationship observed in the occupational studies and represents the estimated upperbound on the increased risk of contracting leukemia for an individual exposed for a lifetime (70 years) to a specific concentration of benzene (e.g., 1 ppm) in the air.

In deriving the URE for benzene, EPA has used the geometric mean of four URE (derived by maximum likelihood) based on two model types (additive risk and multiplicative risk) each with two measures of exposure (unweighted and weighted cumulative exposure). It is assumed that the leukemia response is linearly related to benzene dose, even at very low levels of exposure. The Office of Science and Technology Policy maintains that while there are biological data supporting this approach, and epidemiologists have frequently assumed a linear model for dose/response analysis of carcinogens, there are also data which suggest that, for some carcinogenic agents, the dose/response relationship is not linear, with the response decreasing faster than the dose at low levels of exposure (Docket No. OAQPS 79-3, Part I, Docket Item X-J-1). At such low levels the nonlinear model produces smaller risk factors than the linear model.

The possibility of a carcinogenic threshold for benzene, an exposure level below which there would be no risk of leukemia, has also been debated (Docket No. OAQPS 79-3, Part I, Docket Item VII-B-2). At present, the mechanisms involving the induction of leukemia following chronic benzene exposure remain largely unknown, and data are limited. In the absence of sound scientific evidence to the contrary, EPA has concluded that a nonthreshold presumption represents appropriate scientific policy.

The EPA has elected to use the linear nonthreshold assumption for the benzene dose/response assessment because it is generally considered to be conservative compared to the nonlinear alternatives, is consistent with some proposed mechanisms of carcinogenesis, and provides a good "fit" for the benzene data. This choice of models results in a plausible estimate of leukemia unit risk to the exposed population. If true linearity holds at low environmental exposures, then these numbers will overestimate risk 50 percent of the time and underestimate risk 50 percent of the time. If the true low-dose/response relationship is less than linear, then these estimates would err on the high end and in favor of the protection of the public health. The limited data from which the extrapolation is made are consistent with the linear model.

On October 17, 1984, NRDC petitioned the Administrator of EPA to, in part, evaluate the most current scientific literature on benzene carcinogenicity and revise the EPA's URE accordingly. This petition culminated in an update of the carcinogenic potency estimate for benzene summarized in a report entitled "Interim Quantitative Cancer Unit Risk Estimates Due to Inhalation of Benzene," (Docket No. OAQPS 79-3, Part I, Docket Item VIII-A-4). In response to the concerns of the petitioner, EPA evaluated the risk implications of the epidemiological findings of the 1981 Rinsky et al. study of rubber workers, the Wong et al. study of chemical workers, and the Ott et al. study of chemical workers, all of which were known to involve benzene exposure in the workplace (50 FR 34144, August 23, 1985) (Docket No. OAQPS 79-3, Part I, Docket Item IX-A-1). Although various animal bioassays were considered, EPA concluded that the URE for inhalation of benzene was appropriately based upon the epidemiologic studies since these studies were of recognized quality, and had the greatest relevance in the estimation of health risk to humans. In the reevaluation of the URE, EPA pooled the leukemia responses observed in the 1981 Rinsky et al. and Ott et al. cohorts, and computed a geometric mean of each maximum likelihood point risk estimate. The observations of Wong et al. were used as a comparison to the computed risk estimates of the pooled studies. The resulting ratio between these two sets of data was used to adjust the computed geometric mean estimate. Based on these calculations, the URE for benzene was revised in 1985 from an excess of 2.2 chances in 100 of contracting leukemia for a lifetime exposure to 1 ppm benzene in the air (0.022/ppm) to an excess of 2.6 chances in 100 (0.026/ppm) (50 FR 34146, August 23, 1985) (Docket No. OAQPS 79-3, Part I, Docket Item IX-A-1).

There are uncertainties inherent in the derivation of the URE for benzene that can only be addressed qualitatively at this time. These uncertainties may lead to either an overestimation or underestimation of the potential leukemia risk to the exposed population. The derivation of the URE considered only the incidence of myelogenous leukemia in epidemiological studies. The URE might be increased by considering other types of cancers manifested in the benzene exposed workers, e.g., multiple myeloma. In contrast, the assumption of low dose linearity in the risk modeling may tend to overestimate the dose/response function if the true shape of the relationship is curvilinear. A third major area of uncertainty is that EPA has extrapolated the leukemia risks identified for occupationally exposed populations (generally healthy white males) to the general population in which susceptibility to a carcinogenic effect could differ. Such susceptibility can differ with age, sex, genetic variability, and present state of health. The URE for benzene may underestimate the leukemia risk to more susceptible subgroups.

Exposure Assessment

Estimation of the potential leukemia risk associated with the emission of benzene from industrial sources requires estimation of the concentrations of benzene to which the population may be exposed, and determination of the magnitude of population exposure. In the absence of adequate monitored ambient air levels near the industrial sources, EPA used mathematical models to predict the dispersion of emissions and subsequent potential for human exposure.

Estimates of population exposure to benzene in the ambient air resulting from emissions from industrial sources were developed using the EPA's Human Exposure Model (HEM). The HEM accepts as inputs the locations and emission characteristics of the subject source categories of benzene. This information is combined with census and meteorological data contained in the model to estimate the magnitude and distribution of population exposure. Emission and plant parameters often must be estimated rather than measured, particularly in determining the magnitude of fugitive emissions, and where there are large numbers of sources that individually emit small amounts of benzene. As discussed in more detail later in this notice, this can lead to overestimates or underestimates of exposure. Similarly, meteorological data are not available at specific plant sites, but are available only from the closest recording weather stations that may or may not be representative of the meteorology of the plant vicinity. The dispersion modeling of the emissions usually assumes that the terrain in the vicinity of the sources is flat. For sources located in complex terrain where the surrounding topography is at higher elevation than the emission point, this assumption would tend to underestimate the maximum annual concentration of benzene, although estimates of aggregated population exposure would be less affected.

The exposure modeling also assumes that the population density in the vicinity of the source remains unchanged for 70 years and that the population is exposed for 24 hours per day for a 70-year lifetime. The exposure estimates do not consider the dynamics of population growth, decline, or mobility. This may lead to over- or underestimates of population exposure, depending on the nature of population flux. The benzene exposure assessment also assumes the industrial sources under analysis will operate for 70 years to account for potential lifetime exposures. This assumption overestimates maximum and aggregate exposure. The degree of overstatement varies, however, among industries.

The current exposure analysis does not include an analysis of indirect exposure pathways of benzene such as dermal absorption or ingestion. Furthermore, the analysis did not include concomitant exposure that may result from pollutants co-emitted from the sources. Exclusion of such factors may underestimate total potential exposure from these sources. A final uncertainty in the exposure analysis is that the current version of HEM does not account for potential increased maximum exposures that may result from the co-location of facilities, although EPA believes this effect would, in most cases, be very small.

The mathematical exposure models predict population exposure based on the estimated rate of release of benzene from the industrial source categories. While no reliable benzene monitoring data exist in the vicinity of the subject industrial source categories, EPA has reviewed a limited number of measurements taken of benzene concentrations in urban and rural areas of the United States. Table IV-1 summarizes the range of measured benzene concentrations in urban and rural air. It must be emphasized that these data are the result of 24-hour measurements, and may not reflect annual average benzene concentrations in the atmosphere at those locations. Nevertheless, the data suggest that the average background benzene concentration in urban areas ranges from about 1.5 to 6 parts per billion (ppb), and the average background concentration of benzene in rural areas seems to be less than 1 ppb.

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TABLE IV-1. 24-HOUR MEASUREMENTS IN URBAN AND RURAL AREAS IN THE UNITED STATES

Study	Benzene Concentration (ppb)		
	Minimum	Average	Maximum
TEAM (1986)[1]			
Elizabeth-Bayonne	0.4	3.0	28.25
Los Angeles	0.6	N/A	6.2
HUNT (EPA 1985)[1*]	2.0	3.0	5.0
EPA (1986)[1**]	1.5	3.26	5.0
SINGH (1982)[2,3]			
Houston	0.84	5.78	37.7
St. Louis	0.11	1.41	5.82
Denver	0.11	4.39	23.91
Staten Island	0.082	4.20	19.03
Chicago	0.588	2.56	8.77
ROBERTS (1985)[2,3]			
73 kilometers (km) from Denver rural area	0.02	N/A	0.85
HOLZER (1977)[2,3]			
Rural area - Talladega National Forest	0.2	0.4	1.3

*Minimum = Philadelphia; Average = Baltimore, Los Angeles, N. New Jersey, Houston, Philadelphia; Maximum = Houston.

**Urban measurements in California.

[1]Docket No. OAQPS 79-3, Part I, Docket Items X-A-1, X-A-2, X-A-3.

[2]Quality assurance/quality control not available.

[3]Sources cited in Toxicological Profile for Benzene (1987), Draft Report, ATSDR, U. S. Public Health Service (Docket No. OAQPS 79-3, Part I, Docket Item X-I-2).

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The principal sources of the ambient background levels of benzene are not well understood. Benzene is both naturally occurring and has a fairly long atmospheric half-life. There is speculation that anthropogenic sources, especially tail-pipe emissions from mobile sources, may be largely responsible for these general background levels in the U.S.; however, EPA recognizes the possible influence on benzene levels in urban areas from petrochemical facilities, chemical manufacturing facilities, and other industrial sources of benzene located in these cities.

Risk Characterization

The exposure estimates obtained from the HEM are combined with the estimate of carcinogenic potency for benzene ("unit risk") to calculate the probability of the increased risk of cancer in the exposed population. In combining the estimates of population exposure with the URE for benzene, two measures of excess leukemia risks are calculated: the aggregate population risk, and the maximum individual lifetime cancer risk. Individual lifetime risks can also be expressed in terms of population risk distribution. The aggregate population risk, expressed as annual cancer incidence, is defined as the average number of excess cancer cases expected annually in the exposed population residing in the vicinity of the industrial sources of benzene. This measure is obtained by dividing the expected excess lifetime incidence by 70.

The maximum individual lifetime cancer risk is defined as the probability of contracting cancer following a lifetime exposure to benzene at the maximum modeled long-term ambient benzene concentration. Estimates of maximum individual lifetime cancer risk are usually expressed as a probability represented in scientific notation as a negative exponent of 10. A risk of contracting cancer of 1 chance in 10,000 is written as 1×10^{-4}, 1 chance in 1,000,000 as 1×10^{-6}, etc. These risks, because of the uncertainties and assumptions inherent in the dose/response assessment and exposure assessment, cannot be construed as absolute measures of the true risk burden to the benzene exposed population. The quantitative risk assessment is best viewed as a relative estimate of the likelihood of cancer associated with benzene emissions from the industrial source category, for comparision with estimates from alternative emission scenarios or other benzene source categories.

The estimated maximum individual lifetime cancer risk and annual cancer incidence resulting from inhalation exposure to predicted ambient concentrations of benzene emitted from the industrial source categories are summarized in Table IV-2.

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TABLE IV-2. SUMMARY OF THE MAXIMUM INDIVIDUAL CANCER RISK[a] AND ANNUAL CANCER INCIDENCE[b] ASSOCIATED WITH BASELINE BENZENE EMISSIONS FROM INDUSTRIAL SOURCES

Industrial Source Category	Maximum Individual Lifetime Risk (MIR)[a,e]	Estimated Excess Annual Leukemia Incidence[b,e]
Maleic Anhydride	0	0
Ethylbenzene/Styrene	2×10^{-5}	0.004
Benzene Storage[c]	4×10^{-5} to 4×10^{-4}	0.05 to 0.1
Equipment Leaks[d]	6×10^{-4}	0.2
Coke By-Product Recovery Plants	6×10^{-3}	3

[a]Maximum individual lifetime risk is defined as the upperbound of the probability of contracting cancer following a lifetime exposure at the maximum modeled average annual ambient benzene concentration.

[b]Annual cancer incidence is defined as the average number of excess leukemia cases expected annually in the exposed population.

[c]Range of risks associated with benzene storage reflects the range for emission estimates.

[d]Risk estimates based on emissions remaining after application of 40 CFR Part 61, Subpart J.

[e]Based on the weight of evidence from epidemiological studies, EPA classifies benzene as Group A, a known human carcinogen.

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As was noted in the dose/response subsection, the estimated excess cancer risk estimates calculated from the URE are based on leukemia mortality in rubber and chemical workers exposed to benzene. One uncertainty in the quantative risk assessment involves the linear extrapolation from relatively high occupational benzene exposures to much lower predicted ambient exposures in the vicinity of the industrial source categories. The study by Ott eta al. demonstrates a four-fold increase in leukemia for workers who had been exposed to average benzene concentrations of about 5 ppm for an average of about 9 years. Furthermore, two out of the four individuals in the study who died from leukemia were characterized as having been exposed to average benzene levels below 2 ppm. Case 2, for example, had 1.5 ppm-years cumulative benzene exposure over 18 months. Daily exposures in the NIOSH cohort were more typically in the range of 20 to 40 ppm over an 8-hour shift (Docket No. OAQPS 79-3, Part I, Docket Item II-J-9).

By comparison, EPA has estimated maximum modeled annual ambient benzene concentrations near the industrial source categories of benzene emissions to range from 0.8 ppb (near an EB/S facility) up to 230 ppb (near a coke by-product recovery plant). Thus, the highest predicted ambient air exposures to benzene are at least roughly one order of magnitude lower than those associated with increased leukemia risk in the epidemiological studies. In addition, an elevated leukemia risk has not been detected in the vicinity of stationary sources emitting benzene; however, it is very unlikely that such an association could be detected, given the limited power of epidemiological studies.

The subsequent sections of this notice provide tables of the distribution of lifetime cancer risk and an estimate of the number of people that may fall within a particular risk interval. These risk distributions are specific to benzene emissions from the industrial sources identified in Table IV-2. Sources that are located within the HEM exposure modeling radius (e.g., 20 to 50 km) of each other would result in an overestimation of the number of people exposed to the long-term predicted benzene concentration. However, the estimates of aggregate population risk are not affected by this particular modeling approach. That is because with a linear dose/response model, two individuals exposed to a concentration of 1 ppm benzene represent the same population risk as one individual exposed to a concentration of 2 ppm benzene.

The maximum individual lifetime risk will almost never be significantly affected by proximity of sources unless the industrial sources are located very close together. This is because the predicted benzene concentrations within the modeling radius decline quickly with distance from the emission point. In the rare cases where sources are very close in proximity (within 200 to 300 meters), the maximum individual lifetime risk may be underestimated.

The estimated distribution of individual cancer risks, however, is affected by the proximity of sources. Correction for double counting of exposed individuals would somewhat increase the individual risk for the population who are exposed to more than one source. Elimination of double counting may shift some of the population at the lower risk levels (i.e., 10^{-6}) to the next higher risk level. However, the principal effect of eliminating double counting would be a reduction in the number of people in the middle to lower risk categories.

Other factors of the quantitative risk assessment may tend to overestimate or underestimate the computed benzene risks. The relative uncertainty associated with the derivation of the cancer risk estimates can only be qualitatively discussed. The EPA currently cannot statistically describe the error range associated with each of the assumptions comprising the quantitative risk assessment. For example, the fact that the risk assessment focused only on leukemia and not other forms of cancer that have been causally linked with benzene exposure in epidemiological studies may lead to an underestimation of the overall potential cancer risk. In addition, the risk analysis excludes consideration of serious, noncancer effects associated with occupational exposure to benzene. Though it is not known whether such effects could occur at much lower ambient benzene exposures, there remains a possibility that the current analysis may underestimate the total potential population health risk.

Although benzene exposure has been associated with other cancer and noncancer effects (multiple myeloma, lymphomas, aplastic anemia, pancytopenia, depression of blood cells, and chromosomal aberrations), EPA has determined that leukemia incidence in workers provides the strongest basis for quantitative risk assessment. Departure from the assumption of nonthreshold, low dose linearity inherent in the derivation of the URE for benzene might result in lower estimates of benzene's carcinogenic potency. The Agency does not find, however, that there is sufficient scientific evidence given the current knowledge of the mechanisms of carcinogenesis, to warrant departure from the nonthreshold and low dose linearity assumptions.

The assumptions involving the exposure assessment may tend to overestimate or underestimate risk. The dispersion modeling normally assumes flat terrain in the vicinity of the source. For sources located in rolling or complex terrain, this assumption would tend to under-predict maximum benzene exposure and maximum individual lifetime risk. Other assumptions are likely to overestimate the exposure to the most exposed subset of the population. Maximum individual lifetime risk estimates are based on the assumption that the individual is exposed for 70 years to the estimated maximum annual average concentration and that the source continues to operate for 70 years. The degree of overestimation will vary among industries and as a function of individuals' movements.

A final factor of uncertainty in the risk assessment is the fact that the analysis did not account for individuals within the exposed population who may be uniquely susceptible to benzene carcinogenesis because of incompetent immunity, or chronic infirmity. For this subgroup within the exposed population the risks may be underestimated.

V. Policy

Legal Framework Under Vinyl Chloride

The EPA considers the *Vinyl Chloride* decision to further define the legal framework for setting NESHAP under section 112 of the CAA. The court set out a two-step process for EPA to follow in making these judgments: (1) Determine a "safe" or "acceptable" risk level, and (2) set the standard at the level—which may be lower but not higher than the "safe"' or "acceptable" level—that protects public health with an ample margin of safety.

In this case, the court emphasized that judgments by EPA concerning scientific uncertainty are an important part of the process for establishing NESHAP. As the court noted, Congress, in directing EPA to set NESHAP, recognized that uncertainties over the health effects of the pollutants greatly complicate the task. *Vinyl Chloride,* 824 F.2d at 1152. These same uncertainties, according to the court, mean that the Administrator's "decision in this area 'will depend to a greater extent upon policy judgments' to which we must accord considerable deference." *Id.*, 824 F.2d at 1163 (citations omitted).

"Safe" or "Acceptable" Level

The first step is for the Administrator to determine what level of risk to health caused by emissions of a hazardous air pollutant is "safe" or "acceptable." (The court used these terms interchangeably). The court in *Vinyl Chloride* explicitly declined to determine what risk level is "acceptable" or to set out the method for determining the "acceptable risk" level. Instead, the court stated that these determinations are within the Administrator's discretion.

The court did, however, provide some guidance on the "safe" or "acceptable risk" determination. The court stated that the Administrator must base the "safe" decision on "an expert judgment" concerning "the level of emissions that will result in an 'acceptable' risk to health (*Vinyl Chloride*, 824 F.2d at 1164–65)." To exercise this judgment, "the Administrator must determine what inferences should be drawn from available scientific data and decide what risks are acceptable in the world in which we live." *Id.* at 1165. However, the court emphasized that "safe" does not require elimination of all risk. To support these propositions, the court cited *Industrial Union Dep't, AFL–CIO* v. *American Petroleum Inst.*, 448 U.S. 607, 642 (1980) (hereafter referred to as *OSHA Benzene Case*) and its statement that "There are many activities that we engage in every day—such as driving a car or even breathing city air—that entail some risk of accident or material health impairment; nevertheless, few people would consider those activities 'unsafe.' " *Vinyl Chloride*, 824 F.2d at 1165. As a final matter, the court said the Administrator cannot consider costs or technological feasibility in this step.

Ample Margin of Safety

Once an "acceptable risk" level is determined, the second step under *Vinyl Chloride* is to determine whether the emission levels accompanying that determination should be reduced further in setting an "ample margin of safety." Noting that the purpose of the ample margin of safety requirement is to protect against incompletely understood dangers, the court stated that EPA "may * * * decide to set the level below that previously determined to be safe." The court reiterated that because the assessment of risk is uncertain, "the Administrator must use his discretion to meet the statutory mandate." The court added that it is at this stage of the standard-setting process that EPA may consider costs and technological feasibility and other relevant factors: "Because consideration of these factors at this stage is clearly intended 'to protect the public health', it is fully consistent with the Administrator's mandate under Section 112." *Vinyl Chloride*, 824 F.2d at 1165.

Uniqueness of Decision

The effect of the *Vinyl Chloride* decision is to require a unique decisionmaking process for public health protection decisions, unlike any other regulatory decision faced by the Agency. This is the result of the court's prescription of two separate steps for decisionmaking, the first in which only health factors can be considered in setting an acceptable risk level, and the second in which additional factors including cost, technological feasibility, and other relevant factors may be considered in providing an ample margin of safety. This scheme is unlike any other under the CAA itself, or any of the other statutes administered by EPA because the acceptable risk that EPA adopts in the first step cannot be exceeded by the standard EPA adopts in the second step.

In contrast, other EPA statutes have very different structures and legal requirements for decisionmaking on public health standards. For example, while the Safe Drinking Water Act provides for two separate decisions, the first is a purely health-based goal toward which to work, but not necessarily meet; the second is an enforceable standard that is based on cost and feasibility considerations. Under both the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the balancing of health concerns and benefits of continued chemical use, and control costs are explicitly provided for in decisionmaking. The Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act both require statutory decisionmaking very different from the bifurcated process mandated by the court for section 112.

Although not reflected in the *Vinyl Chloride* decision reviewed by the D.C. Circuit, the EPA's recent judgments under section 112 were made in integrated approaches that considered a range of health and risk factors, as well as cost and feasibility in certain cases. These approaches were followed in NESHAP for the source categories of radionuclides, arsenic, and the prior decisions on benzene source categories (49 FR 23498, 49 FR 23522, 49 FR 23558, 50 FR 5190, 50 FR 7280, 51 FR 27958, 51 35056). However, the *Vinyl Chloride* decision eliminates those approaches to section 112, since the integrated approaches did not partition consideration of health factors into a first step separate from consideration of the other relevant factors.

Thus, the *Vinyl Chloride* decision forces EPA to consider whether a risk is acceptable *without* at the same time considering benefits of the activity causing risk, feasibility of control, or other factors that EPA (or anyone) would normally consider in deciding whether a risk was "acceptable." This problem is particularly acute in the case of many carcinogens, for which the Agency has stated that it is unable to identify a threshold no-effect level.

The very examples cited by the court bring home the unusual nature of the court's "acceptable risk" decision step. The court (quoting the Supreme Court's decision in the *OSHA Benzene Case*) cited "driving a car or even breathing city air" as activities that "few people would consider * * * 'unsafe.' " But driving a car entails risks that most people would consider high; the annual incidence approximates 50,000 fatal accidents, and the average individual risk (not the maximum, but the actuarial average risk) approximates a 1 in 100 chance of automobile-related death over a 70-year lifetime. Yet the court was correct to say that our society accepts (or tolerates) risk from driving cars. As a society we continue to try to reduce the level of risk, but we value the benefits in increased mobility that the automobile affords. The same is true of "breathing city air"—leaving aside the circularity (city air may contain some of the contaminants that EPA is considering regulating), individuals live in cities to be close to the workplace, for the recreational and cultural advantages associated with cities, and for a variety of reasons extrinsic to the risk itself.

If decisions on the acceptability of risks are inherently balancing judgments, how is EPA to make those judgments on acceptability? Later in this section, EPA sets forth four approaches that deal with this issue in differing ways.

The approaches cover a range of possible risk levels and they give prominence to different measures of risk, e.g., individual versus population risk. The purpose is to elicit comment that will contribute to the EPA's resolution of the decisionmaking problems presented by *Vinyl Chloride*.

Survey of Societal Risk

After assessing the health risks for emissions of a specific hazardous air pollutant, the Administrator, in following the *Vinyl Chloride* decision, is next faced with the question of how to determine an acceptable risk for a particular source category emitting that pollutant. This question cannot be answered in a vacuum, but requires him to determine "what risks are acceptable *in the world in which we live.*" 824 F.2d at 1165 [Emphasis added]. Such a determination requires some context within which to evaluate and compare risks and other health factors bearing on that question.

In approaching the question of what level of risk is "acceptable or "safe," EPA surveyed a range of health risks that our society faces. The objective of this survey was to develop information to place the benzene risk estimates in perspective. Thus, the survey included risks encountered in everyday life, such as driving a car and breathing city air, which were cited in the *Vinyl Chloride* decision, as well as a range of regulatory judgments or risks. The EPA surveyed both the individual risk and the incidence in the population exposed to risk associated with the activities. Considering incidence comports with the purpose of section 112 to protect "public health" when incidence is viewed as a measure of health of the population as a whole.

The risks surveyed ranged from individual risks of 1 in 10 (10^{-1}) to less than 1 in 10,000,000 (10^{-7}). Everyday risks include risks from natural background radiation as well as risks from home accidents. Natural background radiation at sea level creates individual lifetime cancer risks in the range of 3 in 1,000 (10^{-3}) and an estimated 10,000 cancer cases per year. Naturally occurring radon in homes poses an additional source of radiation risk, and these risks can be as high as 1 in 100 to 1 in 10 (10^{-2} to 10^{-1}) and cause an estimated 5,000 to 20,000 cancer cases/yr. In the U.S., accidents, natural disasters, and rare diseases pose individual risks of death from 1 in 10,000 (10^{-4}) (e.g., tripping and falling which cause approximately 470 deaths per year) to 1 in 10,000,000 (10^{-7}) (e.g., rabies which causes an average of 1.5 deaths per year).

Judgments on risks have also spanned a broad range of risk levels. The National Council on Radiation Protection and Measurement (NCRP), following recommendations of the International Commission on Radiological Protection, has recommended that maximum individual exposures be limited to an amount corresponding to risks of 3 in 1,000 (3×10^{-3}).

The Food and Drug Administration (FDA) establishes tolerances for poisonous or deleterious substances, such as polychlorinated biphenyls (PCB's), at a level found necessary to protect the public health, taking into account the extent to which the substance is required or unavoidable in the food supply and the other ways the consumer may be affected by the same substance. For example, FDA has established a tolerance level for PCB's in fish at an individual risk of 7×10^{-5}, which would result in 34 cancer cases each year among heavy fish consumers alone (44 FR 38333, June 29, 1979).

The EPA regulates pesticide uses under the FIFRA based on whether the pesticide creates unreasonable adverse effects, a statutory term defined as requiring balancing risks and benefits. The EPA has authorized some uses of the pesticide chlorobenzilate that would create individual risk of 1×10^{-6} to 7×10^{-6}, and would result in 2 to 9 additional cancer cases per year (EPA banned other uses of this pesticide).

Regulatory judgments have also been made to require lower risks. For example, under the provisions of the Food, Drug, and Cosmetic Act (FDCA), which provides that "no residue" from carcinogenic additives to animal feed may remain in any edible portion of the animal, FDA has established a policy of not allowing the use of additives that create a risk to the animal higher than 1 in 1,000,000 (1×10^{-6}). A more complete description of the risks EPA considered is presented in a document in the docket entitled, "Survey of Risks" (Docket No. OAQPS 79-3, Part I, Docket Item X-B-1).

No fixed risk level could be identified as acceptable in all cases and under all regulatory programs for two main reasons. First, as discussed above, in most cases the calculation of risks depends on different data, assumptions, and uncertainties. For example, the risk associated with motor vehicle and other common accidents can be calculated directly from accident records and therefore reflect actual risk; whereas environmental risks are based on estimating procedures and assumptions and therefore are more uncertain. Thus, actuarial and environmental risk estimates cannot be directly compared so as to draw precise judgments as to whether one risk is larger, or less acceptable, than another. Second, acceptability of risk is a relative concept and involves consideration of different factors. Considerations in these judgments may include: The certainty and severity of the risk; the reversibility of the health effect; the knowledge or familiarity of the risk; whether the risk is voluntarily accepted or involuntarily imposed; whether individuals are compensated for their exposure to the risk; the advantages of the activity; and the risks and advantages for any alternatives. Thus, different judgments on acceptability can be made for similar numerical risks. In addition, the uses of individual risk and incidence as comparative factors face limitations since the relative size of the risks associated with an activity are sensitive to how the activity is defined. For example, the individual risk and incidence associated with a single leaking pipe at a plant within a particular industry could be quite small, but the cumulative risks associated with all plants within the industry could be significant. This limitation can be ameliorated by careful selection of the appropriate category of sources.

In summary, EPA surveyed and considered this risk information to provide perspective on society's consideration and acceptance of risks. In its consideration, EPA is not judging whether each of the risks presented here is acceptable or unacceptable. They are presented, instead, to provide a context for evaluating the relative public health implications of a range of activities and the risks presented in activities being considered for regulation under section 112.

General NESHAP Policy Considerations

The purpose of this section is to discuss and solicit comments on the appropriate criteria for the two decisions the *Vinyl Chloride* opinion requires. In the two decisions EPA will both consider the information available to it relating to measures of health risk, and take into account the limitations and uncertainties of the risk estimation methods and basic data. In the discussion which follows, the risk estimates, methods, and their limitations and uncertainties will be discussed, and four approaches to making the two "acceptable risk" and "ample margin of safety" decisions will be proposed. Comments are solicited on all aspects of the discussion and the four approaches and potential combinations of approaches. Commenters should assume that the final decision on the approach to be used and the policies adopted about relative weight to be given to various parameters and related factors will apply not only to the decisions before the Agency in this proceeding, but also may become the policies for decisions on future NESHAP. The framework adopted will not, however apply to other Agency programs or other sections of the CAA.

The main purpose of the discussion presented here is to provide a basis for comment on the major policy issues raised by the court's opinion, in particular, on the requirement that in regulating under CAA section 112 the Agency must decide what risk is acceptable in "the world in which we live." In the months since the court's decision, issues about acceptability of risk from air toxics have been the subject of discussion both within the Agency and in public debate. The four alternative policy approaches outlined address the acceptable risk decision in different ways. Each approach would answer the following questions in a different way. The basis questions are: What measure or measures of risk should be given weight in the acceptable risk decision? Are there specific levels of individual or population risk that are acceptable? How should EPA balance individual versus population risk reductions? Should the same levels be set and the same measures applied for all NESHAP? How should uncertainty in risk estimation be considered?

The approaches described include one in which all risk information and measures available as well as estimation limitations and uncertainties are considered in determining acceptable risk on a case-by-case basis. Other approaches simply apply one quantitative risk parameter, either risk to the maximally exposed individual or aggregate risk of increased cancer incidence in the population (population risk). The approaches also vary in the level of risk that would be acceptable. The details of the results of applying each of the approaches to benzene source categories are described in Sections VII through X of this preamble. A later part of this section describes the effects of single-criterion approaches on source categories for pollutants other than benzene.

Three of the approaches use either maximum individual risk or population risk as the criterion for acceptable risk. Some take the view that added cancer risk to the individual is the most, or only, important measure. Two of the approaches use this as the only criterion for acceptable risk. Others would consider the number of people at risk and the estimated added cancer incidence in the population to be most important. One of the approaches uses incidence as the only criterion for acceptable risk. Arguments in favor of the individual risk measure are that no individual should be at high risk, that considering the number of people at risk leads to acceptance of higher individual risk when few people are exposed, and that it is inequitable for acceptable risk to an individual to depend upon the number of people similarly exposed. Arguments favoring use of added incidence are that it is an appropriate measure of total public health impact and this total risk to the population is a good indicator of acceptable risk. On the other hand, incidence is only one of a number of possible health effects and thus may not accurately measure the total health impact nor total population risk. Comments on these issues and on using these parameters singly or in combination are requested.

Uncertainty of risk estimates is also dealt with differently by the alternative approaches. Under Approach A, the case-by-case approach, all risk factors including estimation uncertainties would be considered in the acceptable risk determination. Approaches B, C, and D use a single risk measure as the criterion for the acceptable risk decision and thus would leave consideration of other risk measures and specific judgments concerning much of the overall uncertainty until the second step, the ample margin of safety decision. How to weigh these uncertainties is a problem under any approach because while the Agency often has quantitative estimates of uncertainty to use on specific elements of the risk assessment, it can often only make a qualitative judgment about whether the overall uncertainty in the methods and assumptions has resulted in an over- or underestimated risk. Comment is solicited on the consideration of uncertainty in acceptable risk decisions.

Each alternative deals similarly with the ample margin of safety decison. In each, all the health information as well as cost, technical feasibility, estimation uncertainties, and other relevant factors would be considered. Comment is requested on five issues in particular. First, is the margin of safety step more suitable than the acceptable risk step to take into account (usually qualitatively) the direction and extent of estimation uncertainties? Second, should all technically feasible and affordable controls be required without regard to whether any significant risk reduction is associated with the control? Third, should the Agency adopt a policy of using the ample margin step to force technology to reduce risk? Fourth, how should EPA balance the various risk, technical, and economic considerations in ample margin of safety decisions? Fifth, what criteria should EPA use to define the "availability" and "feasibility" of technological controls?

The remainder of this section covers various risk measures, how they are derived, general questions regarding control technology and plant closure considerations, and the four alternative regulatory approaches. The approaches are considered from the perspective of application to the benzene source categories covered in today's notice and to the NESHAP program.

Risk Measures Considered in NESHAP Policy Approaches

In decisions on cancer risks from stationary sources of hazardous air pollutants, the Agency has estimated three measures of health risk. These are termed "maximum individual risk," "risk distribution," and "incidence". Each of these combines an estimate of the dose/response for a pollutant with estimates of exposure to the pollutant. The response estimated is the pollutant-related increase in the probability that an individual will develop cancer in his or her lifetime. The exposure estimated is the average daily exposure assuming continuous exposure for 70 years.

Maximum Individual Risk

Individual risk is expressed as an estimated probability, e.g., 1 in 100 (10^{-2}), 1 in 1,000 (10^{-3}), 1 in 10,000 (10^{-4}). Thus, a 1×10^{-3} individual risk is an *added* "chance" of 1 in 1,000 of developing cancer sometime in the individual's lifetime.

In this discussion, the maximum individual lifetime risk is the addition to cancer risk of a person due to continuous exposure for 70-year lifetime at a point of maximum concentration of a pollutant emission. (The maximum individual risk is sometimes called the maximum exposed individual risk). This estimate is based on the fact that the concentration of an emission, and the consequent risk, diminishes with distance from its source. For NESHAP decisions, the practice has been to estimate this figure for the largest annual average pollutant concentration to which any member of the public may be subject according to census data on residence locations. It has also been estimated in other Agency decisions as the maximum at the source perimeter.

The maximum individual lifetime risk is different from average individual risk which is sometimes estimated for sources like public drinking water systems or food in which the concentration of a pollutant and other factors are assumed to be equal at all distribution locations. This distinction is particularly relevant when considering the maximum risk one might find acceptable from different sources.

In using the maximum individual risk in acceptable risk decisions for hazardous air pollutants, its limitations should be considered. Used alone, the measure does not tell how many people may be so affected; it relates only to the risk to the most exposed individual(s).

Risk Distribution

A risk distribution estimates how many persons within a certain distance (e.g., 20 to 80 km) of a source of pollutant emissions are at what level of individual risk (see, e.g., Table V-1A shown in the discussion of Approach A later in this section). Typically, the distribution is given for 10-fold increments of individual risk. Such a distribution provides the decisionmaker with information on both the individual risk level for those exposed and the number of persons exposed at each level. For NESHAP and other decisions, the Agency has examined risk distributions both as measures of risk and to compare the effects of various strategies for risk reductions across a source category.

In making an acceptable risk decision, one relevant consideration could be how many people are exposed at each risk level, e.g., a 10^{-2} risk might be acceptable if only one person were at that level, but not if 1,000 people were subject to it. Similarly, the numbers of persons exposed at various individual risk levels could be an important element in deciding on acceptable risk. The risk distribution could be used in a similar way to consider whether an ample margin of safety exists.

Incidence

Incidence is an estimate of population, rather than individual, risk. Incidence estimates the addition to population cancer incidence in the specified population. It is derived by multiplying individual risk by the estimate of the number of persons at that level of risk. This number which provides a lifetime population risk figure is then divided by 70 (years) to give an annual cancer incidence estimate. The incidence parameter can be used as an estimate of impact on the entire exposed population within a given area by totalling the incidences associated with each increment of individual risk. Incidence can also be portrayed along with individual risk and population numbers in a risk distribution (e.g., see Table V-1A shown in the discussion of Approach A later in this section). Typically, the Agency weighs incidence estimates in conjunction with maximum individual risk or average individual risk estimates. Estimated incidence generally is a particularly informative parameter when looking at aggregate risk from a category of like sources. One feature to take into account whenever it is used is its dependence on the size of the source category.

Uncertainties in Risk Measures

Each of the three risk parameters defined above has three elements. These are the estimated response per unit of pollutant concentration (e.g., ppm in air), the estimated exposure concentration, and the estimation of the population residing in the area of the sources (usually taken from census data).

Uncertainties exist in estimating each of these elements for a variety of reasons including the fact that the relevant data and our understanding of the biological events involved are not complete. Where data gaps exist, qualitative and quantitative assumptions are made and science policies are invoked which are based on our present understanding of biological mechanisms of cancer causation, estimates of air dispersion, engineering estimates, and other factors. Alternative plausible assumptions are often availabale for interpreting given data. Selection of certain assumptions to be used is a science policy choice. The Agency has published guidelines covering many of these for both cancer risk assessment and exposure assessment. They are "Final Guidelines for Carcinogen Risk Assessment," 51 FR 33992 (September 24, 1986) and "Final Guidelines for Estimating Exposures," 51 FR 34042 (September 24, 1986).

The following is a general outline of methods used to calculate these parameters, together with a few examples of some of the uncertainties.

Risk assessment under EPA guidelines takes into account the nature and amount of evidence that the agent will cause the effect of concern in humans as well as the uncertainties of interpretation of data and its quantification. When the toxicity data are from human studies, as they are for benzene which is a known human carcinogen, there are fewer uncertainties about the hazard of dose/response considerations than when they are solely from animal studies. Nevertheless, there are important uncertainties in using human data; these are explored in Sections IV and VII through X of this notice with regard to benzene. Examples include the fact that human epidemiological studies are often retrospective and measure effects of exposure that occurred many years in the past. The level of exposure to the agent at that time usually must be estimated and cannot be verified. Also, the human studies are often of workers exposed to the pollutant. Workers populations are not representative of the general population with respect to age, and usually not with respect to sex. Workers are also generally the healthier segment of the population. These factors of exposure and representation of human sensitivity to the agent can lead to over- or underestimation of risk. These are two of the important uncertainties; others exists.

When data from tests of a pollutant's carcinogenic activity in animals are used, uncertainties about exposure are experimentally controlled, but other uncertainties arise. Many of these concern the use of data from animal tests to estimate effects on humans. Many relationships have to be accounted for in doing this, for example, the equivalent dose for humans and laboratory animals given the size differential, and potential differences in metabolism and excretion of a chemical pollutant.

It is uncommon for there to be enough data to address all of the uncertainties. In addition to qualitative uncertainties of drawing conclusions about risk to the general populations from either human epidemiologic data or animal data, uncertainties arise in extrapolating the observed dose/response relationship from either workplace or animal test exposures to the usually lower dose levels of the general population.

In estimating exposure, the dispersion of a pollutant from a source is usually quantified by a predictive mathematical model using a known or model source emission rate, temperature, and velocity characteristics, and weather patterns at nearby stability array (STAR) stations; these are typically the nearest recording weather station. The model predicts the concentration of the dispersed pollutant at various distances from the source. Standard assumptions are that the population around the source resides there for a 70-year lifetime and is continuously exposed to the modeled concentrations for 24 hours a day. The amount of emissions can be derived from sampling and analysis of emissions at the source or from engineering estimates, with more or less uncertainty associated with each method according to the type of emission. There are varying degrees of accuracy and precision in sampling, analysis, estimates of emissions, or assumptions about the half-life of the pollutant in the air. Uncertainties in the method of estimating individual exposure and the number of individuals exposed are numerous. The method of estimating the resident population and its location according to the census does not account for the fact that residents may be outnumbered by the workers or students who reside elsewhere, but come into the area during the day for months or years. Future increases in population in the area are not considered. Thus the method may underestimate the population exposed for some part of a lifetime. On the other hand, the method overestimates exposure for those who reside in the area fewer than 70 years or who leave the area for substantial parts of the day.

By these few examples, it can be seen that one can generally discuss and judge over- or underestimation in particular estimates, but not usually collect enough data to quantify uncertainty. Questions relevant to two-step decisionmaking under the *Vinyl Chloride* opinion are: At which step or steps should uncertainty be accounted for? How should uncertainty be considered if it cannot be quantified?

Graphical Method of Combining Maximum Individual Risk and Incidence

There are graphical ways to show individual risk and incidence concepts together, and one of these is explained here. Comment is requested on the use of such a method of considering these risk measures. Although specific maximum individual lifetime risks and incidences are shown on the figures, these are illustrative examples only.

Figure V–1 is a simple plot of individual risk on the y axis and the population size on the x axis. The plotted lines are 1×10^{-4} and 1×10^{-6} maximum individual lifetime risk. Figure V–2 shows the plot of the combinations of maximum individual lifetime risk and population size that correspond to an incidence of 1 cancer case per year. Figure V–3 shows the maximum individual lifetime risk and incidence lines together, and Figure V–4 adds shading in the area of the graph that contains all points meeting a hypothetical requirement that no person be at greater than 1×10^{-4} maximum individual lifetime risk and that the entire population risk be at less than 1 added cancer case per year.

The graphical approach can be used to plot the data from a risk distribution (such as that in Table V–1A shown in the discussion of Approach A). On Figure V–5, distributions are plotted for risk from four hypothetical sources. By examining where parts of a line fall with respect to selected maximum individual lifetime risk and incidence parameters, one can see how many people are at risks lower than any maximum individual lifetime risk or interest or whether a particular incidence is exceeded. It is also possible to see whether a risk distribution is skirting the edge of being above any acceptable risk line or is well under it. This allows consideration of whether to try to narrow uncertainties in the risk assessment.

Graphs such as these could be used to make regulatory decisions and communicate about them. Comment is requested.

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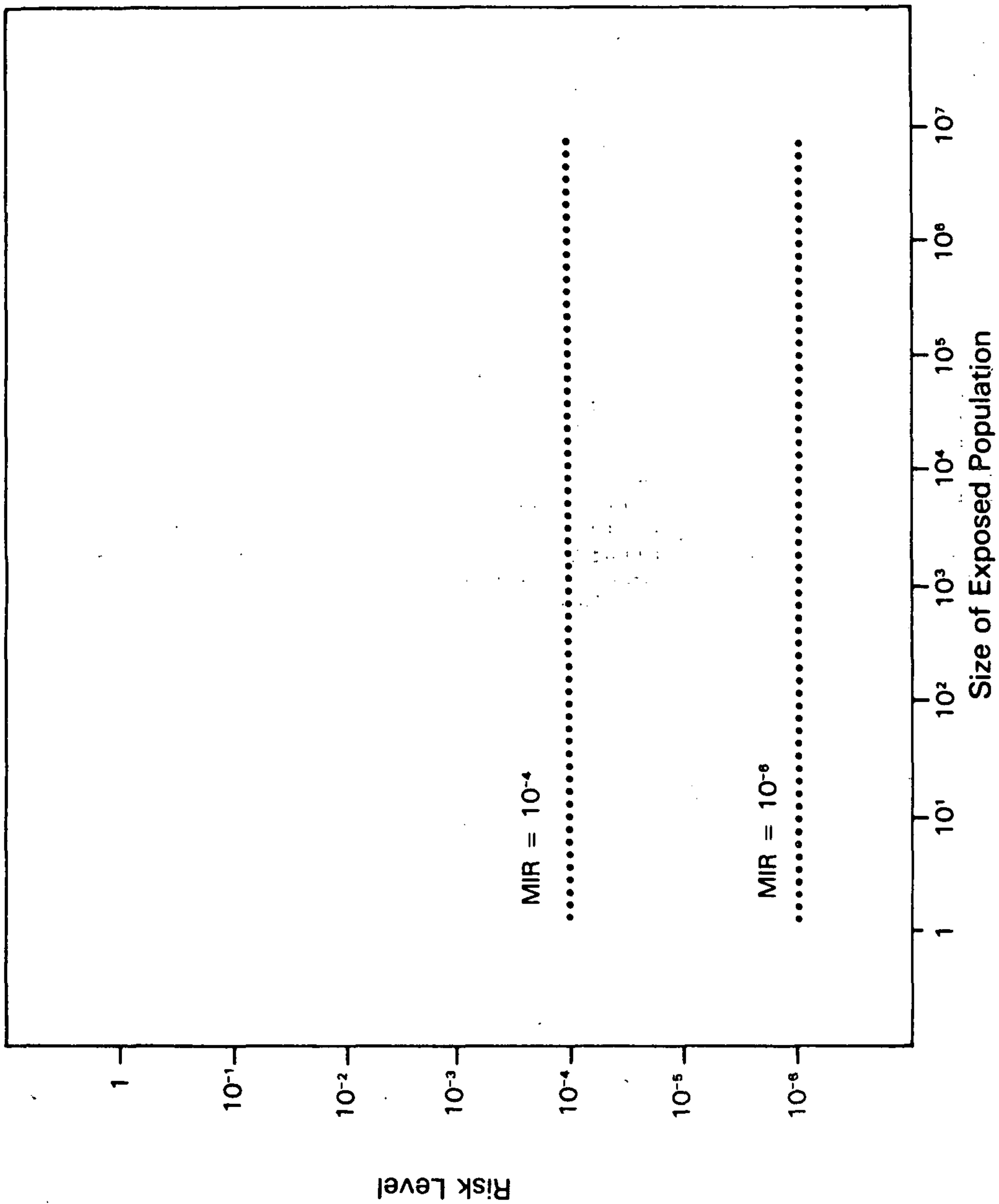

Figure V-1. Maximum Individual Lifetime Risk (MIR) Line for Acceptable Risk

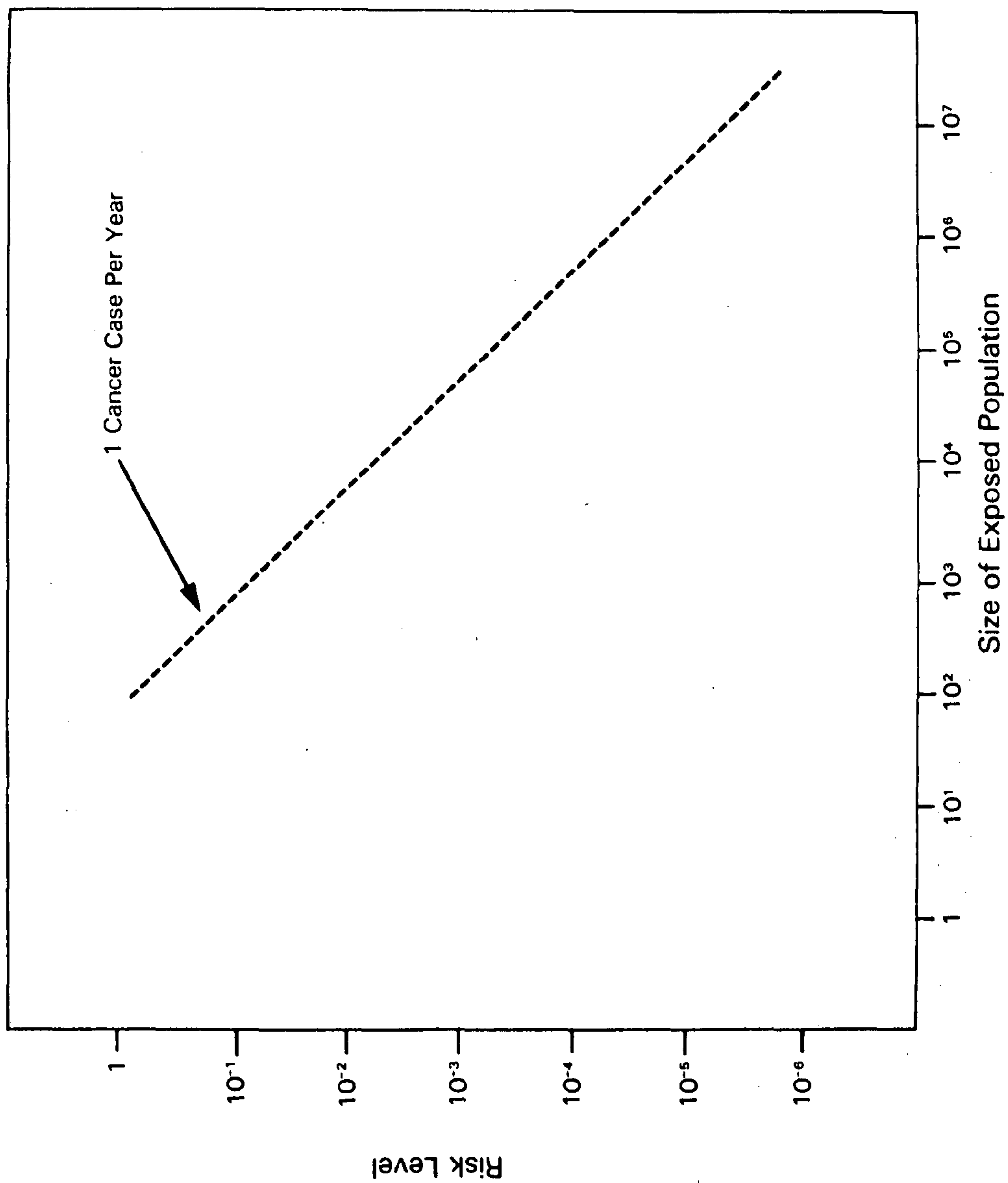

Figure V-2. Incidence, or Aggregate Population Risk, Line for Acceptable Risk

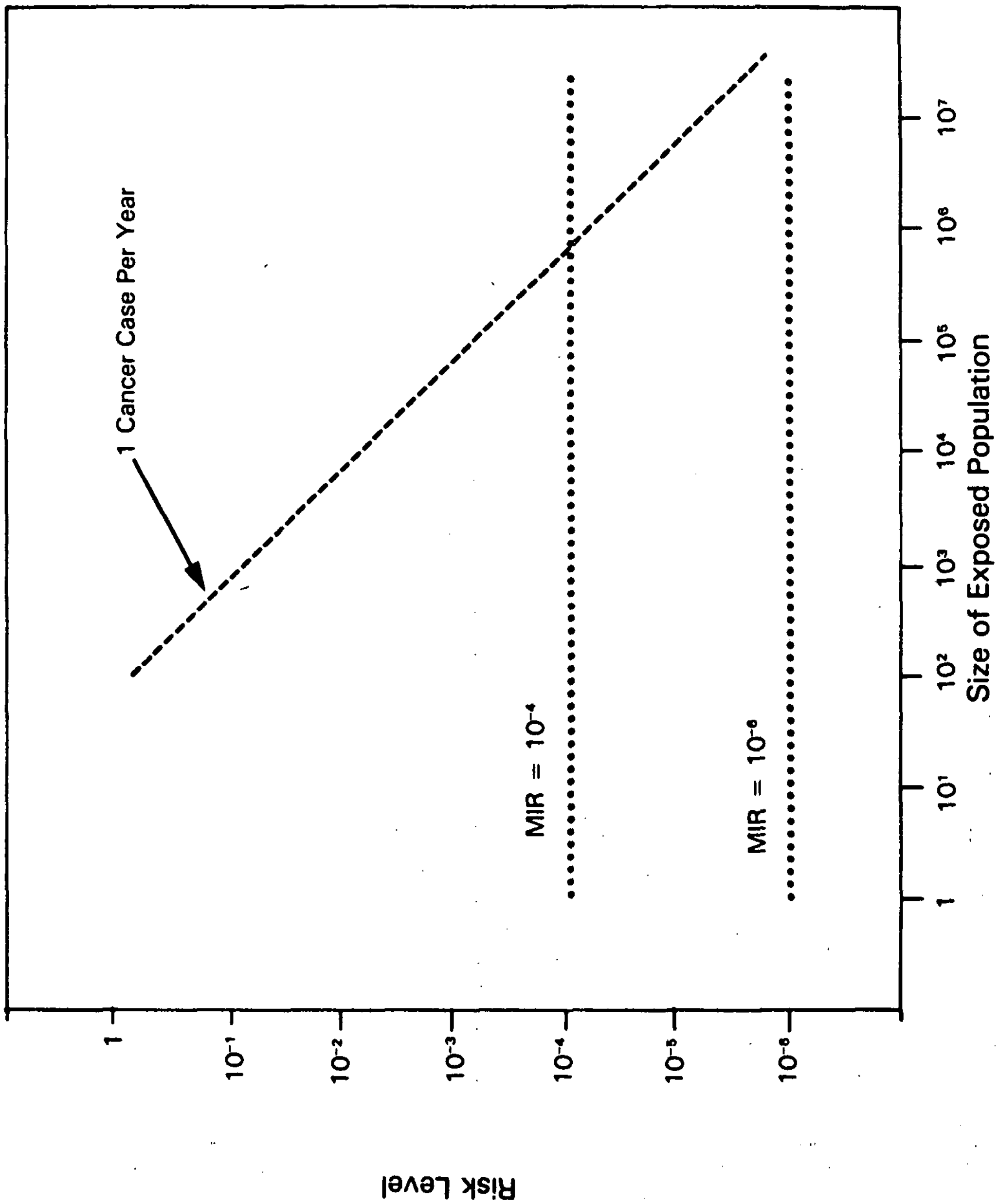

Figure V-3. Maximum Individual Lifetime Risk (MIR) and Incidence Line for Acceptable Risk

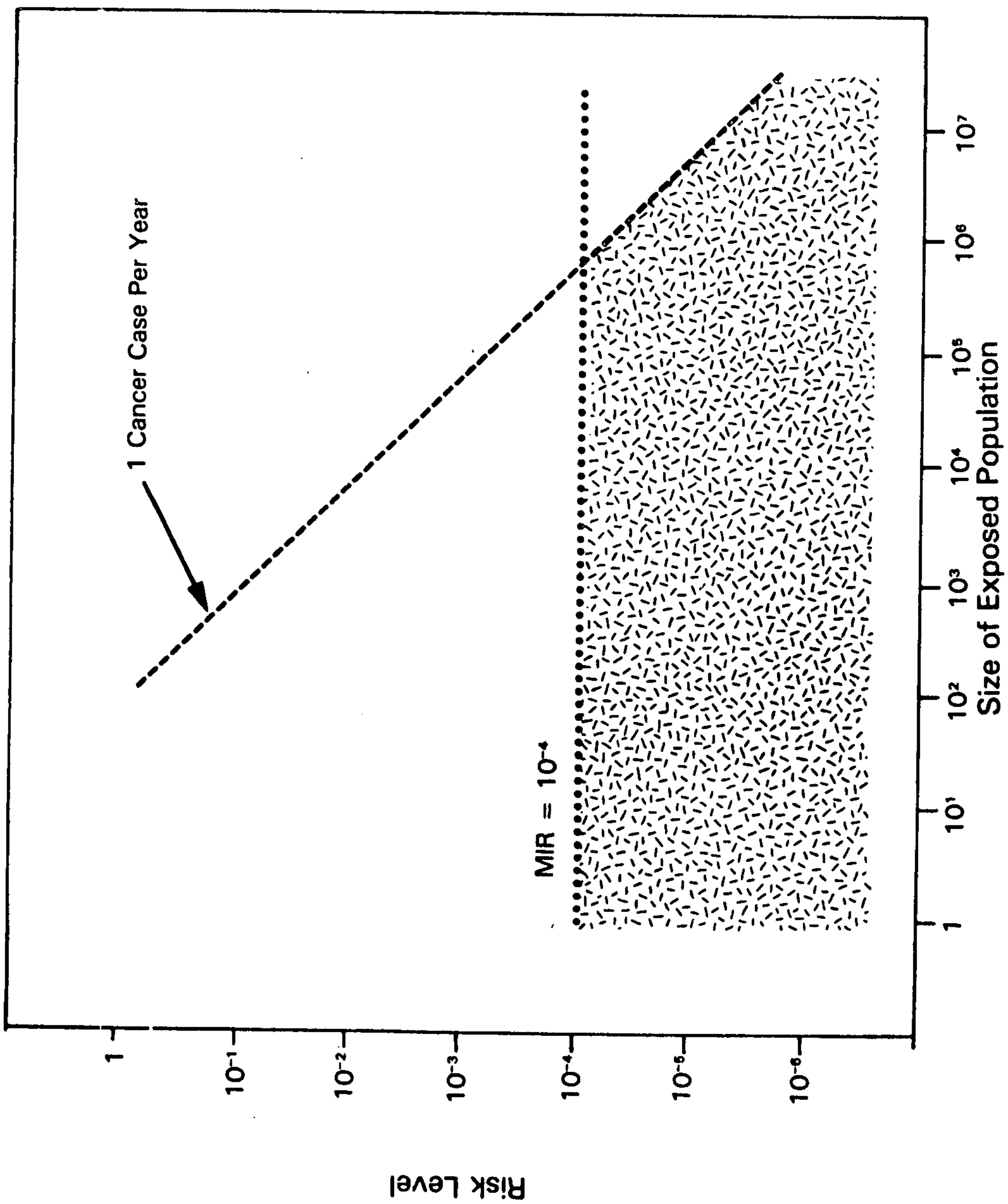

Figure V-4. Area of Acceptable Risk Under 1 × 10^{-4} Maximum Individual Lifetime Risk (MIR) and 1 case/yr Criteria

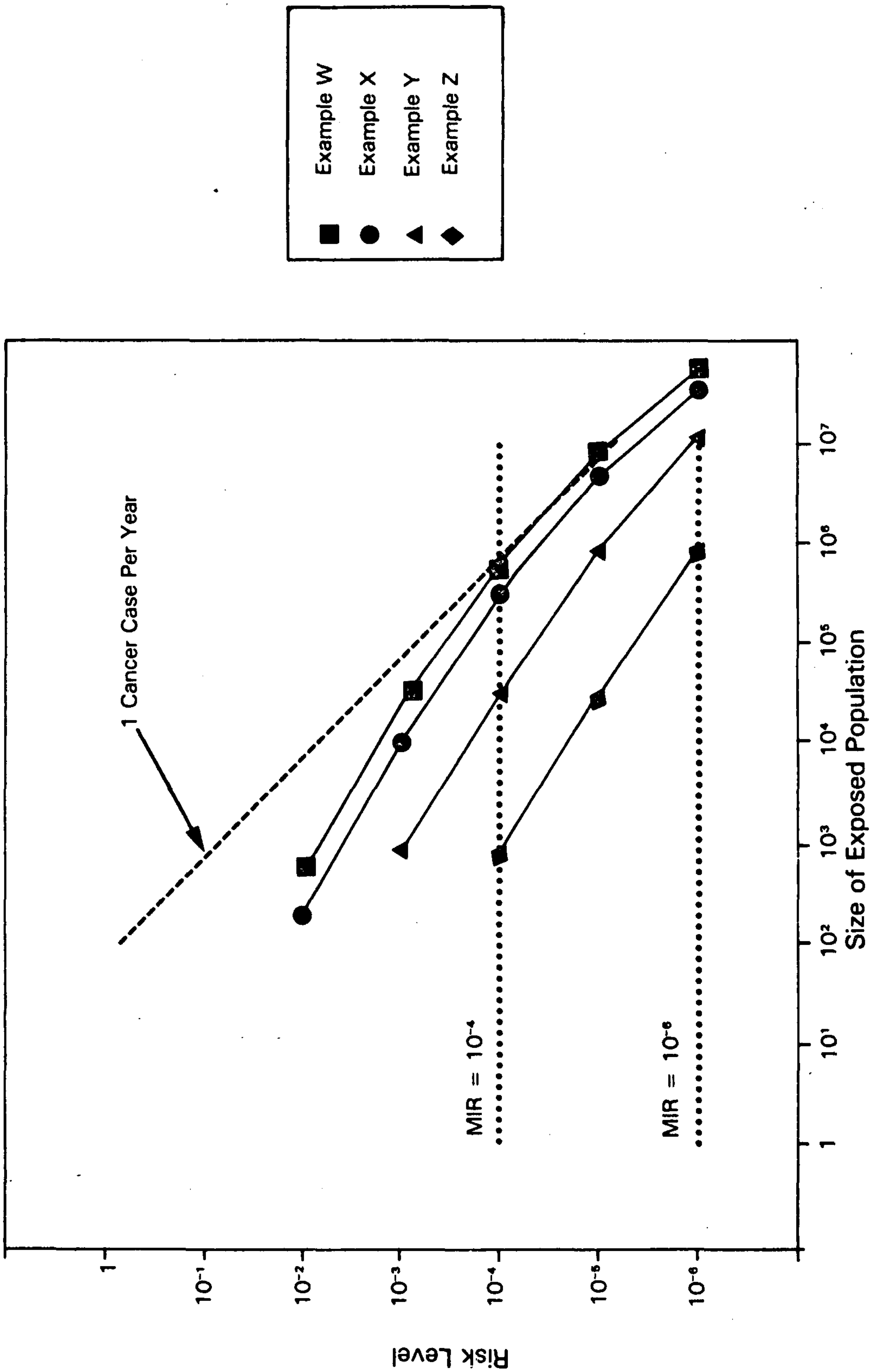

Figure V-5. Comparison of Several Hypothetical Risk Distributions with the Maximum Individual Lifetime Risk (MIR) and Incidence Lines for Acceptable Risk

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Technology Availability and Plant Closure Considerations

In previous NESHAP decisions, EPA has given primary consideration to the objective of reducing risks to public health. However, in evaluating alternative regulatory options, EPA has also considered the extent to which plants would be forced to: (a) Install control technologies which are not cost effective or fully demonstrated and/or (b) curtail or stop production. These considerations are reflected in today's proposal to the extent that they apply to affected benzene sources. However, these sources do not represent the full range of circumstances that exist among other source categories which will be affected by NESHAP decisions. For example, in other source categories control technology may be less effective, or costs may be greater; the financial strength of the industries may be greater or less; the ability to pass through control costs may be greater; and/or the ability to use nonhazardous materials to produce the same products may exist. The EPA is today soliciting public comment on several specific issues relating to technology availability and plant closure issues both in the context of today's proposal and in the broader context of future NESHAP decisions.

With regard to the availability of technology to control air pollutants, EPA has typically considered a technology available if it has been installed on a commercial scale in the U.S. and adequate data have been collected on plant and control equipment characteristics and performance. However, at various times in the past, and in the present proposal, EPA has considered emission standards which force plants to install technologies which do not meet these current "availability" criteria or curtail production or shutdown. For example, EPA has in the past considered a technology "available" if it has been commercially demonstrated in other countries, even if no units have been installed in the U.S. Also, EPA has considered bench- or pilot-scale demonstrations in order to judge reasonableness of expenditures for commercial demonstration of a given technology. Some have argued that potentially superior, costlier, but commercially undemonstrated technologies will not be installed in the absence of regulatory requirements to do so. Others have argued that EPA should not be concerned about the extent to which technologies are "available" since the standards should be solely based on public health considerations. Proponents of this latter view argue that the health-based standards will themselves provide adequate incentive for currently high risk industries to develop new control technologies. Still others argue that the compliance schedules in section 112 will cause sources to close rather than undertake the risk of installing costly technology that is uproven.

The EPA solicits public comment on the relative merits of alternative criteria for determining the availability of technology, and on the question of appropriate alternative methods for encouraging development of alternative technologies, processes, product substitutes, and/or lifestyle changes.

In regard to plant closure issues, EPA today solicits public comment on several specific issues relating to the procedures used to estimate plant closures:

1. *Compliance cost estimation.* It is reasonable to assume that plants would engage in cost mitigation strategies, such as production factor substitution, common ducting of emission streams, or exploitation of available control equipment capacity. In contrast, conditions such as age or type of equipment at other individual plants may result in above average control costs. How should EPA incorporate such plant-specific considerations in estimations of the cost of complying with new regulatory requirements?

2. *Price effect estimation.* In assessing economic impacts, EPA uses available data to assess the extent to which compliance costs may be passed through to consumers. Do the EPA's current approaches adequately consider the extent to which the use of substitute products, production inputs, or price effect mitigation strategies modifies the economic impact of new regulatory requirements? How should EPA consider uncertainties in these and other market factors which affect the impact of new regulations?

3. *Projection of demand effects and plant closures.* The EPA typically projects the proportion of existing domestic production plants which would close by examining the availability of technology the meet the standard. Where technology is available, EPA examines and projects changes in total demand for products or production inputs by considering supply cost functions of existing domestic plants, new domestic plants, and foreign sources. Are the EPA's current procedures for estimating plant closures resulting from predicted price and quantity effects reasonable?

4. *Employment effect estimation.* The Agency has presented information previously that predicts the direct employment effects of closures in the benzene source categories considered in this rule. Generally, these results have been derived from studies that assess the technological feasibility of control and, for Approach A, economic factors that may force closures. Further, the Agency has not calculated the secondary employment impacts from shutdowns (so called "multiplier effects") for any of the approaches and the employment effects of closures of plants using or producing benzene products.

In light of the above, the Agency is interested in whether there are methodologies that are available to calculate these secondary employment effects. In addition, what are the likely consequences of closures of plants using or producing benzene products?

5. *Balancing of costs and risk reduction benefits.* Generally, as air pollution control equipment becomes more efficient the cost of each additional increment of control becomes increasingly great. Thus, the incremental health benefits associated with each additional increment of control often become smaller while costs become greater. In determining an ample margin of safety, how should EPA determine at what point the cost of further control outweighs the additional health benefit?.

The EPA also solicits public comment on the appropriate treatment of plant closure risk in the post-*Vinyl Chloride* regulatory framework. For example, is it reasonable, as a general principle, to establish regulatory requirements which compel individual high-risk sources to either install less-than-fully demonstrated control technologies or curtail operations? For the particular benzene standards proposed in today's **Federal Register** notice, is it likely that plant closures or production cutbacks would be required to meet the standards? What are the potential consequences of domestic plant closures? Would foregone production from existing U.S. plants be made up through increased production from new U.S. plants which comply with the new regulatory requirements as opposed to increased imports?

Description of Alternative Policy Approaches

Each of the four approaches described here for comment approaches the "acceptable risk" decision differently. The first approach considers all risk factors in the acceptable decision and all risk factors plus cost and feasibility of emission controls in the ample margin of safety decision. The other three approaches differ from the first in that they use a single parameter, maximum individual lifetime risk or incidence, as the sole deciding factor for acceptable risk, while considering other factors in the "ample margin" step.

The case-by-case and single parameter approaches differ in the degree to which they possess each of two desirable features. One feature is the ability of the Agency to consider the weight of evidence, or confidence, in the hazard data from which risk numbers are derived, and the confidence in the emission and exposure estimates. The second feature is the degree to which decisions are clear and understandable, and thus can be perceived by the public as consistent.

The case-by-case approach is designed to bring all of the evidence to bear in association with risk numbers at both decision steps. The Agency has adopted the policy of risk assessment contained in the 1983 study by the National Academy of Sciences entitled "Risk Assessment in the Federal Government: Managing the Process," National Academy Press. This study covers the various elements of cancer risk assessment and the assumptions and uncertainties it involves. One of the policies emphasized in the report and adopted by EPA is to give the risk manager a risk characterization which contains the information needed for a decision on how much confidence to place on numbers. For example, numbers for risk estimates for two different pollutants might look the same, but be based on data sets of quite different quality. A very large set of data from human and animal studies could be the foundation for a high degree of confidence in deriving a quantitative dose/response relationship. On the other hand, a quantitative dose/response estimate based on less evidence could be more uncertain. Moreover, emission estimates and exposure modeling may be based on site-specific information, assumptions, or combinations of the two. Depending on the data and assumptions, there can be large differences in the confidence of the exposure estimates. A risk manager would be justified in using the two kinds of estimates differently in decisionmaking, in spite of the fact that the numbers might be very similar. An advantage of the case-by-case approach is that it is designed to use the full range of evidence behind the risk numbers in determining acceptable risk and in deciding on an ample margin of safety. A disadvantage of this approach is that it is reliant on case-by-case interpretation and judgment of data, which makes the basis for decision difficult for the public to understand, and decisions may appear inconsistent when different numerical risks are judged to be acceptable in different cases.

The single measure approaches tend to take risk numbers at face value for the acceptable risk decision, with a fuller consideration of the weight of all evidence at the margin of safety step. The advantages of these approaches are their clarity and ease of administration, which are good bases for adoption of such an approach. Their disadvantage is that they do not consider all of the risk factors, risk characterization, and uncertainties in the initial step. The Agency would weigh all of the evidence in final decisions under any of the approaches.

Approach A. Case-by-Case Approach

In this approach individual risk, risk distribution, and incidence and their estimation limitations and uncertainties are all considered in determining what is an acceptable risk. The acceptability of an individual risk level is judged as a function of the number of persons at that level and the associated incidence for the exposed population. Judgment on an acceptable total incidence includes consideration of how much of the incidence is associated with higher or lower individual risk.

In applying Approach A, the approach is to examine the risk distribution and to consider maximum individual risks around 10^{-4} or less to be the preferred range. The 10^{-4} level was selected for reasons analogous to its use in Approach C (see discussion of Approach C for further explanation). Under all Approach A decisions, however, the Agency will closely examine the aggravating and mitigating factors associated with the risk estimates. Included in this examination is recognition that there are considerable uncertainties in the risk characterization, emission estimates, and exposure assumptions; these uncertainties may vary widely among assessment. Acceptability of higher risks includes consideration of the number of people at that risk and the total incidence. Greater weight is given to the incidence associated with individual risks greater than 10^{-6}; this is because risks lower than this are generally considered small. In addition, both the dose/response and exposure estimates increase in uncertainty at these lower levels, which generally represent large extrapolations from high to low doses and dispersion of the pollutant at greater distance from the source, respectively. Risks greater than the 10^{-4} or less preferred range may be judged acceptable in this approach when all factors are considered. Examples of circumstances that EPA believes appropriate to consider include: (1) the uncertainties of the analysis; (2) the degree of over or underestimation in the risk characterization; (3) the weight of evidence of the health effects and non-quantified health effects; (4) modeled versus measured exposures; and (5) the estimated population predicted at lifetime risk of around 1 in 10,000 or greater.

Table V-1A shows the risks proposed as acceptable under Approach A for two benzene source categories: Equipment leaks and coke by-product recovery plants. The findings are more completely discussed in later sections of this notice. In considering the risk parameters for the acceptable risk decision the fact that most of the incidence was associated with lower range individual risks was balanced against the fact that the maximum individual lifetime risks were higher than the preferred range of around 10^{-4} or less. The overall risk distributions shown in Table V-1A were considered acceptable when all factors and their estimation uncertainties were weighed.

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TABLE V-1A. ACCEPTABLE RISK LEVELS FOR TWO SOURCE CATEGORIES (APPROACH A)[a]

Risk Distribution	Equipment Leaks		Coke By-Product Recovery	
	Cumulative Population at Indicated Risk Level	Non-cumulative Incidence (case/yr)	Cumulative Population at Indicated Risk Level	Non-cumulative Incidence (case/yr)
$\geq 1 \times 10^{-2}$	0	0	0	0
$\geq 1 \times 10^{-3}$	0	0	4,000	0.1
$\geq 1 \times 10^{-4}$	3,000	0.007	100,000	0.4
$\geq 1 \times 10^{-5}$	60,000	0.02	3,000,000	0.9
$\geq 1 \times 10^{-6}$	1,000,000	0.04	30,000,000	1
$< 1 \times 10^{-6}$	-	0.2	-	0.3
	200,000,000	0.2	90,000,000	3
MAXIMUM INDIVIDUAL LIFETIME RISK:	6×10^{-4}		6×10^{-3}	

[a]All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

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The uncertainty of the risk estimation is considered at both the acceptable risk and ample margin of safety steps. For both source categories the uncertainty of the dose/response estimate for benzene was considered. In general, the data set on benzene is one of the better ones available on any chemical carcinogen. Benzene is classified as a human carcinogen and judgment that the quantitative dose/response estimate, derived from studies on humans, for leukemia might be on the high side, but still plausible, was balanced by consideration of the fact that other types of malignancy have been observed in human studies. Because these effects were not quantifiable from the available data, uncertainty existed about whether all of the cancer risk had been accounted for. On the exposure from both source categories, for several reasons described in later sections, the existing emission estimates were considered to be upperbound estimates.

For the proposed ample margin of safety decision the risk parameters were again considered along with the cost and feasibility of risk reduction. The costs and technical factors differ greatly among the categories and are discussed in detail in later sections. As shown in Table V–1B, these decisions result in similar after-regulation risk distributions for the two categories, equipment leaks and coke by-product recovery plants, with very low incidence associated with individual risks above 10^{-4} or 10^{-5}. At both steps, uncertainty is given weight and the risk parameters are considered together.

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TABLE V-1B. AMPLE MARGIN OF SAFETY FOR TWO SOURCE CATEGORIES (APPROACH A)[a]

Risk Distribution	Equipment Leaks: Cumulative Population at Indicated Risk Level	Equipment Leaks: Non-cumulative Incidence (case/yr)	Coke By-Product Recovery: Cumulative Population at Indicated Risk Level	Coke By-Product Recovery: Non-cumulative Incidence (case/yr)
$\geq 1 \times 10^{-2}$	0	0	0	0
$\geq 1 \times 10^{-3}$	0	0	0	0
$\geq 1 \times 10^{-4}$	3,000	0.007	2,000	0.005
$\geq 1 \times 10^{-5}$	60,000	0.02	70,000	0.03
$\geq 1 \times 10^{-6}$	1,000,000	0.04	2,000,000	0.05
$< 1 \times 10^{-6}$	-	0.2	-	0.07
	200,000,000	0.2	90,000,000	0.2
MAXIMUM INDIVIDUAL LIFETIME RISK:	6×10^{-4}		4×10^{-4}	

[a] All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

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Approach B. Incidence-Based Approach

In this approach, incidence is proposed to be the only parameter used to decide acceptability of risk. At the ample margin of safety step, all of the risk parameters as well as estimation uncertainties, cost, and feasibility would be considered. The annual incidence proposed as acceptable would be 1 case/yr. Thus, under Approach B all NESHAP would be set to result in no greater than 1 case/yr for a source category, as a whole. The EPA is proposing an incidence number of 1 because it is small in relation to the millions of persons exposed to benzene, and in relation to the incidence associated with risks from numerous everyday activities. Comment is requested on the appropriateness of this criterion or another number.

Approach B would rely upon incidence for several reasons. First, incidence reflects the overall "public health" concerns toward which section 112 is directed. As noted above, most of the members of the public who are exposed to emissions, and therefore most of the incidence associated with those emissions, is associated with individuals exposed to levels lower than the individuals who receive the maximum exposure. Moreover, although both incidence and maximum individual lifetime risk are highly uncertain figures, in general incidence figures are more likely to be accurate than maximum individual lifetime risk figures. A maximum individual life time risk estimate is much more sensitive to errors in modeling assumptions in the exposure estimate. When those uncertainties are spread throughout the exposed population in an incidence estimate, they tend to average out, and thus to yield results closer to "true" risk. For example, the incidence would be the same as long as the residence is occupied during the 70-year period, regardless by which persons. That is, the incidence would be the same if the same person lived at the residence for 70 years as it would be if 10 different persons lived at the residence during this time.

Figure V–6 is a graph with the log of individual risk on the y axis and log of annual incidence on the x axis. The lines entered on the graph correspond to the 1 case per year incidence of Approach B and the 1×10^{-4} and 1×10^{-6} maximum individual risks of Approaches C and D. The points entered on the graph are the intersection points of maximum individual risk and incidence numbers estimated for risks from the source categories listed in the key. (*Note:* Numbers given in this discussion for radiation risk are for fatal tumors). The figure indicates that, of the baseline risks shown there for benzene source categories, those for benzene from coke by-product recovery plants would be at greater than 1 case/yr. The associated maximum individual risk would be 10^{-3}. The acceptable risk decisions for coke by-product recovery plants differ significantly under policy Approaches A and B since the baseline risk would be acceptable under A, but not B. The ample margin of safety decision under Approach B would parallel that under Approach A in method. The annual incidence of less than 1 case/yr is, of course, the starting point for ample margin decisions in Approach B. The analysis would focus on additional reductions in incidence as well as for the other risk parameters, considering cost, feasibility, and other relevant factors. For the benzene source categories, the regulatory outcome would be the same under both approaches. These results are discussed in Sections VII through X.

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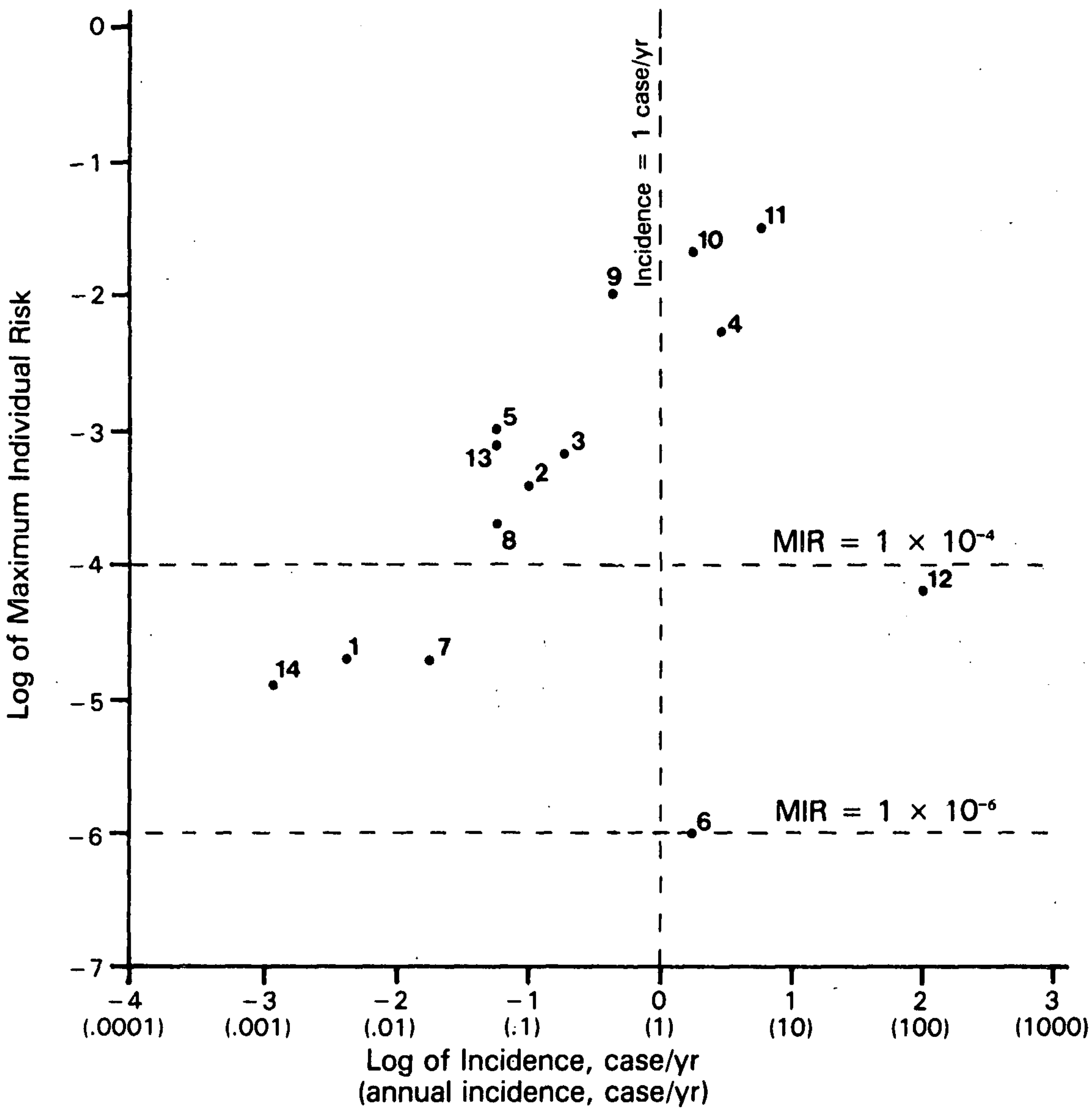

KEY

1 Ethylbenzene/Styrene (benzene)
2 Benzene storage vessels
3 Equipment leaks (benzene)
4 Coke by-product recovery plants (benzene)
5 Elemental phosphorus plants (radionuclides)
6 Coal-fired boilers (radionuclides)
7 NRC licensees (radionuclides)
8 DOE facilities (radionuclides)
9 Underground uranium mine (radon)
10 Active uranium mill tailings
11 Coke oven emissions
12 Chromium from comfort cooling towers
13 Vinylidene chloride
14 Hexachlorobenzene

Figure V-6. Maximum Individual Lifetime Risk (MIR) and Incidence for Selected NESHAP Categories

Features to note about Approach B include the fact that since maximum individual risks plays no role in the acceptable risk decision, high maximum individual risk levels would be acceptable so long as the exposed population is sufficiently small that the incidence level is met (see Figure V-6). Another point to note is that the size of the incidence number may be due largely to exposure of a very large population to a small individual risk. For example, see Table V-1A. This makes the acceptable risk decision dependent to a great degree on estimates of exposure to the least exposed individual furthest from the source. As previously mentioned, the dose/response and exposure estimates increase in uncertainty at these low levels which generally represent large extrapolations from high to low dose and dispersion of the pollutant at greater distance from the source, respectively. Deficiencies of using only one risk measure in the first decision could be addressed in the "ample margin" decision. For example, when using only incidence gives slight attention to circumstances in which a small population may be at high individual risk, EPA could consider action to impart a margin of safety for the small population.

Approach C. 1×10^{-4} or less Maximum Individual Risk Approach

This approach would use maximum individual risk as the sole parameter for deciding acceptable risk. At the ample margin of safety step the risk distribution and incidence would be added to the factors considered as well as uncertainty, cost and feasibility.

The acceptable risk level for maximum individual risk under this approach is 1×10^{-4} or less. This level is analogous to the top of the target individual risk range used in some other EPA programs. This target range has evolved through a history of decisionmaking under the structure of other statutes. However, the decisionmaking structures under the statutes governing those programs are quite different, so comparison is imperfect. And, typically the target range there is for post-control risks, while here it would be the first step of the decisionmaking process. Additionally, the 10^{-4} risk level falls roughly into the middle of the risk range developed in the survey of risks, discussed earlier in this section.

For benzene, the regulatory outcome for the coke by-product and equipment leak source categories would be greater control than under either Approach A or B. Neither of the two categories would be at an acceptable risk level prior to regulation, and each would require control beyond the NESHAP proposed under previous approaches in order to be at 1×10^{-4} maximum individual risk or less. The result for benzene storage vessels and EB/S process vents would be the same under all three approaches.

This approach and Approach D would put great weight on the estimation of the maximum concentration to which anyone could be exposed, which is the exposure element of the maximum individual risk. Without the additional perspective of the risk distribution and incidence estimates and all other risk information, many decisions would ride exclusively on the highly uncertain prediction of the concentration and location of the area of maximum exposure. The accuracy of emission factors, meteorological data, and census data for specific source locations are among the more uncertain estimates, but would be the most critical elements under this decision.

However, at the ample margin of safety step, the other risk measures could be examined to bring the needed perspective to the overall decision.

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

This approach is identical to Approach C except that it uses a more stringent criterion for individual risk. The acceptable risk is defined as 1×10^{-6} maximum individual risk. One reason why this level might be selected is that the risk below this level have been generally regarded as negligible additions to an individual lifetime risk of cancer. Additionally, the 10^{-6} level falls at the lower end of the risk range in the survey of risks, discussed earlier in this section.

Each of the benzene source categories would require additional control to reduce risks to an acceptable level meeting the acceptable risks which is also an ample margin of safety level for these categories. Requirements would entail maximum control and cessation of operation for some or all facilities in each category as later described.

Comparison of Effects of Policy Approaches on Pending NESHAP

Costs and feasibility cannot be considered at the acceptable risk stage, under *Vinyl Chloride*. However, as in other programs, such as setting National Ambient Air Quality Standards under CAA section 109, EPA will provide information to the public about broader implications of Approaches B, C, and D. The EPA views such information to be similar to that provided in an analysis under Executive Order 12291, or an environmental impact statement, but which is not considered as part of the statutory basis for decisionmaking. This section outlines questions about the feasibility of meeting such requirements in future NESHAP. It is apparent from analyzing the impact of various measures of acceptability on benzene source categories that such questions arise.

Because Approach A uses balancing of the three risk parameters and all other relevent risk information, as well as risk estimation limitations and uncertainties, it requires a separate judgment in each case. As a result, it is not susceptible of simple comparisons of effects on source categories of various pollutants. In contrast, Approaches B, C, and D use a single risk parameter as the criterion for acceptable risk, and their effects can be more easily compared among the baseline risk for other pollutants.

For Approach B, Figure V-6 indicates that, of the baseline risks shown there for other than benzene categories, those for coke oven emissions, radionuclides from coal-fired boilers, chromium from comfort cooling towers, and active uranium mill tailings would be at greater than 1 case/yr. The associated maximum individual risks range from 10^{-6} to over 10^{-2}. The highest individual risks that would be left (because associated incidence is less than 1 case/yr) would be between 10^{-3} and 10^{-2} for four source categories.

For the coke oven emissions category, current estimates indicate that in order to reduce annual incidence to less than 1 case/yr, all sources would have to meet the most stringent level of emission control being achieved by any currently operating coke oven, or otherwise comply with a maximum emissions cap. Some source closures and/or shutdowns of large proportions of some existing batteries would be likely. Overall, even applying present technology at all sources might not achieve the emission levels needed to meet the incidence criterion within the 2-year NESHAP compliance period. New technology for control of existing coke ovens, or alternative technologies for producing coke would likely be necessary, or, alternatively, imported coke would be used.

The incidence associated with emissions of radionuclides from coal-fired boilers comes from about 200,000,000 people being within 50 km of the 50,000 sources while exposed at individual risk below 1×10^{-6}. Whether it is feasible, considering costs, to achieve less than 1 annual incidence for this source category is presently unknown. Currently existing requirements for disposal of uranium tailings will achieve an acceptable incidence level for emissions of radionuclides. With few exceptions, active mill tailings facilities could only achieve an annual incidence less than 1 by closing, and by going to disposal.

Chromium from comfort cooling towers is proposed to be regulated under the TSCA.

For Approach C, Figure V-6 shows that five of the source categories are within the acceptable range. The incidence associated with the categories above the line ranges from roughly 1 per 1,000 years to about 100 per year. Any category above the line would have to be controlled to achieve a level below the acceptable risk criterion.

Table V-2 shows the likelihood of several important source categories being able to meet this acceptable risk requirement. Table V-2 include rough estimates of the number of plants that would permanently shut down, and coke production cutbacks for coke by-product recovery plants. Although the underlying assumptions vary somewhat for the different categories, all of the estimates shown under Approaches C and D are based on the technological limits of the controls known to EPA. These estimates are not derived from economic analyses. More detail on the benzene source categories can be found in Sections VII through X.

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TABLE V-2. TECHNOLOGICAL FEASIBILITY OF COMPLIANCE WITH ACCEPTABLE RISK CRITERIA

Category	Approach B 1 case/yr		Approach C 1×10^{-4}		Approach D 1×10^{-6}	
	Feasible Control[a]	Shutdown/ Total Sources[a]	Feasible Control[a]	Shutdown/ Total Sources[a]	Feasible Control[a]	Shutdown/ Total Sources[a]
Chemicals						
Ethylbenzene/styrene	+		+	-	+Some	Some
Benzene storage	+	-	+	-	Unknown	Unknown
Equipment leaks	+	-	+(30/131)	100/131	-	All
Coke by-product plants	+	-	+(40/44)[b]	4/44	-	All
Coke ovens	±[c]	c	+(1-4/40)	36 to 39/40	-	All
Radionuclides/Radon						
Active uranium mill tailings	+	NA[d]	+	NA	-	NA
Underground uranium mines	+	NA	-	NA	-	NA
Elemental phosphorus plants	+	NA	+	NA	±	NA
DOE facilities	+	NA	+	NA	±	NA
NRC licensees	+	NA	+	NA	±	NA
Coal-fired boilers	+	NA	+	NA	+	NA

[a] Achievability of control level is estimated using available analyses of risks and technical feasibility, not costs. Qualitative assessments represent: "+" = technology is available and should achieve risk target in all cases; "±" = available technology will not reduce risks to target at all sites; and "-" = available technology cannot achieve target.

[b] Of the 40, 8 are not expected to meet the 1×10^{-4} risk with technologically feasible controls alone: production cutbacks would be necessary It is estimated that there would be a loss of 40 percent of the total coke production at 1×10^{-4}

[c] Theoretically, controls could achieve < 1 case/yr. However, it is not likely all sources can achieve this level of control

[d] NA = not assessed

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Additional perspective on the question of what proportion of source categories would or would not be at or below 1×10^{-4} maximum individual risk prior to regulation is gained from EPA preliminary risk assessment results on 1,878 sources of 19 carcinogens. About two-thirds of the sources were estimated to present risk at or below 1×10^{-4}, and would therefore meet this acceptable risk requirement. A 90 percent reduction in emissions is taken to correspond to a 10-fold reduction in maximum individual risk. Thus, a reduction from 1×10^{-2} to 1×10^{-4} would require a 99 percent reduction in emissions. If it is assumed that the greatest impact of this 10^{-4} acceptable risk level is on sources that would have to reduce emissions by 99 percent or more, then about 10 percent of the 1,878 sources would be in the group of greater impact.

Approach D would operate much like Approach C. However, the effect of having a 1×10^{-6} maximum individual risk "ceiling" on all toxic risk would be to impose significant additional requirements beyond those of any previous approach. First, many decisions not to regulate, or not to enter source categories into the Agency's ongoing risk assessment program would have to be reexamined. The surveyed assessment results discussed above indicate that approximately 85 percent of the 1,878 sources covered would be above 1×10^{-6} prior to regulation. About 40 percent would have to reduce emissions by 99 percent or more. Virtually every source of radionuclides or radon would require action. The specific impacts and costs cannot be projected accurately at this time, but would likely be measured in billions of dollars. A comparison with natural background radiation levels will give an idea of the extent of control that would be needed. A 1×10^{-6} lifetime risk would compare with:

1. For radionuclides other than radon—0.03 percent of annual natural background does.
2. For radon—0.01 percent of annual natural background dose from outdoor air.

To achieve this level of control, underground uranium mines would likely have to be closed and sealed. Uranium tailings piles would have to be covered; however, the practice of using soil and rock as cover would not be sufficient for some of the largest piles since average soil contains enough radium so that the amount needed to keep radon from escaping the tailings would itself generate enough radon to exceed the 1×10^{-6} maximum individual risk ceiling. Many processors and users of radioactive materials would have to control to virtually no emissions. The cost and feasibility of meeting the requirements can only be roughly estimated at this time, but may be assumed to impose significant burdens.

Table V-2 shows the effects of Approach D on the source categories on which effects were shown for other approaches. Because Approach D would require the most significant emission reductions, it would have the greatest impact. However, under each of the approaches there would be a potential of production curtailment or closure of some or many sources.

As noted earlier, the criteria and method of decisionmaking for the ample margin of safety step would be the same for all approaches. Because the decision involves a judgment based on concurrent consideration of numerous factors, the potential outcomes cannot be discussed simply here. The Agency requests comments on how the various risk, technical, cost, economic, and uncertainty considerations should be balanced in the decision process for the ample margin of safety.

General Discussion on Format of Standards Which Have No Technology Basis

For some source categories, the acceptable risk and/or ample margin of safety decisions can result in the necessity of risk and emission reductions beyond what is achievable with any known technology. This situation occurs under Approach C for equipment leaks and coke by-product plants and Approach D for all benzene source categories. Examples of potential formats for expressing such standards are emission limits that would apply to whole facilities, emission limits with risk-based waivers, or actual risk formats. The various formats are discussed under Approach D in Section VII of this notice. Selection of one of these formats requires the Agency to consider whether to allow sources to comply with risk targets using site-by-site analyses or whether to require compliance with a national emission limit standard. For today's benzene proposals the emission limit format was used. Comment is requested on this format as well as any alternative formats.

VI Maleic Anhydride Process Vents

Since proposal of the standard for maleic anhydride plants in 1980, the industry has consistently and voluntarily switched to the more economical n-butane feed process. Since the publication of the denial of petition for reconsideration, the one facility using benzene feed in the production of maleic anhydride has ceased to produce maleic anhydride (Docket No. OAQPS 79-3, Part II, Docket Item VIII-A-9). All benzene exposure due to this industry, and therefore, all risk from benzene, has been eliminated. Thus, the questions of acceptable risk and ample margin of safety are moot, and no Federal action is warranted.

VII. Ethylbenzene/Styrene Process Vents

Source Category Overview

In 1985, there were 13 plants manufacturing ethylbenzene, styrene, or both. These facilities emitted benzene from process vents, including emergency release vents. Benzene emissions from equipment leaks at these plants were regulated under the benzene equipment leak standard (40 CFR Part 61, Subpart J).

Estimation Methods and Uncertainties

In analysis of the EB/S source category, as with the other sources of benzene emissions, emission estimates were used in calculating leukemia risk. This section discusses how benzene emissions and the associated health risks were calculated for EB/S process vents and the uncertainties associated with these estimates.

Benzene emission estimates from EB/S process vents considered in today's notice were based on emissions from the 13 EB/S plants operating in 1985. Benzene emissions from the process vents at these facilities totaled an estimated 155 Mg/yr.

The EPA developed plant-specific estimates of emissions from EB/S process vents using data on emissions and control practices requested by the Agency under the authority of section 114 of the CAA and provided by the sources. These emission estimates were calculated using detailed vent-by-vent information that was based on measurements and site-specific engineering calculations (Docket No. A-79-49, Docket Items IV-D-13, IV-D-34, IV-D-35, and IV-D-36). At plants where control was already in place, the estimate relfects at least 98-percent control efficiency from boilers, flares and incinerators, and facility-specific efficiencies for product recovery. Using this methodology, EPA estimated total emissions to be 208Mg/yr. This estimate was used in calculating the risk estimates previously presented in the **Federal Register** notice on denial of the petition for reconsideration. However, the Agency also presented a revised benzene emission estimate of 155 Mg/yr in the same notice. The revision was based on data supplied by CMA and reflected changes in emissions at 3 of the 13 plants (Docket No. A–79–49, Docket Item IV–F–2, VI–D–2). These changes included the addition of controls and process modifications. The fact that this total of 155 Mg/yr is based on site-specific measurements or engineering calculations at the 13 individual plants gives the Agency a high degree of confidence in this estimate of emissions from EB/S process vents in 1985.

To estimate leukemia risks attributable to benzene emissions from EB/S process vents nationwide, the EPA's Industrial Source Complex (ISC) dispersion model was used to predict ambient benzene concentrations, and the HEM was used to estimate population exposure to the concentrations and predict leukemia risk. Population exposure was modeled out to 20 km from each of the 13 sources. The ISC dispersion model was run using plant-specific data from the 13 plants for the case where total emissions were 208 Mg/yr. The risk estimates presented in today's notice were calculated by proportional adjustment of the risk estimates generated using ISC and HEM to account for changes in emissions at the three plants mentioned above.

The uncertainties associated with the ambient concentration estimates from the ISC and the exposure estimates from the HEM are typical of the general uncertainties associated with exposure modeling discussed in Section VI.

Risk Characterization

As discussed in Section V, the first step in making NESHAP decisions is determination of an acceptable risk level. In deciding what level of risk is acceptable for EB/S process vents under the four approaches, the Administrator considered the range of levels shown on Table VII–1. The levels represent example scenarios to show how different emission levels would result in different health risk profiles. Implicit in the range considered is the emission level of zero, not only for this source category, but also for the subsequent source categories discussed in this notice. The table presents the risk estimates at baseline in terms of estimated annual leukemia incidence, maximum individual lifetime risk, total population exposed at or above particular risk levels (i.e., risk distribution), and annual incidence attributable to the population exposed at each risk level. All risk estimates for this and the subsequent source categories discussed in this notice have been presented to one significant figure. The baseline level represents the emissions as of 1985 with no Federal standard (i.e., the emission level of 155 Mg/yr). The table also presents available estimates of annual incidence and maximum individual lifetime risk for a lower emission level identified as Emission Level A.

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TABLE VII-1. RISKS[a] FOR ETHYLBENZENE/STYRENE PROCESS VENTS AT DIFFERENT EMISSION LEVELS

		Emission Levels: Baseline	Emission Levels: A
Incidence (case/yr)		0.004	0.001
Maximum Individual Lifetime Risk (MIR)		2×10^{-5}	1×10^{-5}
Risk Distribution, cumulative (persons)[b,c] (modeled to 20 km)	$\geq 1 \times 10^{-2}$	0	Not available
	$\geq 1 \times 10^{-3}$	0	
	$\geq 1 \times 10^{-4}$	0	
	$\geq 1 \times 10^{-5}$	700	
	$\geq 1 \times 10^{-6}$	40,000	
	Total Modeled	400,000	
Incidence for Each Risk Group, non-cumulative (case/yr)[d]	$\geq 1 \times 10^{-2}$	0	Not available
	$\geq 1 \times 10^{-3}$	0	
	$\geq 1 \times 10^{-4}$	0	
	$\geq 1 \times 10^{-5}$	0.0002	
	$\geq 1 \times 10^{-6}$	0.001	
	$< 1 \times 10^{-6}$	0.003	

[a]All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

[b]The estimated number of people exposed to ambient concentrations resulting in predicted individual risk levels above the level shown. Population is cumulative (e.g., at baseline 40,000 people are exposed to risks greater than or equal to 1 in 1,000,000).

[c]Risks were calculated on a plant-by-plant basis and summed. Persons exposed to emissions from more than one plant were counted for each plant's impact. The effects of double counting on individual and other risk estimates are discussed in Section IV of this notice.

[d]This is the estimated annual number of cases of leukemia for the population exposed to each risk level. It is not cumulative (e.g., at baseline there would be 0.001 case/yr in the population exposed to risk levels greater than or equal to 1 in 1,000,000 but less than 1 in 100,000).

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Application of Alternative Policy Approaches

The decisions that would result from application on each of the four policy approaches, described in Section V, to the EB/S process vents source category are presented below.

Approach A. Case-by-Case Approach

Decision on Acceptable Risk. The estimated maximum individual lifetime risk of EB/S process vents is 2×10^{-5} at baseline. (This is the increased risk of contracting cancer if an individual were exposed continuously to the maximum modeled annual average concentration of 0.8 ppb for 70 years). This estimate is within the range generally considered to be preferred under the case-by-case approach. The annual incidence at the baseline is estimated to be 0.004 leukemia case/yr, which is considered to be small. In addition, as the table shows, only 0.0002 case/yr is associated with lifetime risk levels of 1×10^{-5} or higher. Most of the incidence is associated with the large population exposed to predicted lifetime risks in the 10^{-6} range or lower. As noted in Section V, incidence estimates at the 10^{-6} and lower risk levels are given less weight under this approach because they are generally considered to be small and the uncertainty in the risk estimates increases at these lower levels. The modeled maximum benzene concentration from EB/S emissions in 0.8 ppb, which is close to the estimated average rural background exposure, but most of the population is exposed to lower concentrations from EB/S emissions.

Based on consideration of the preceding factors, the health impacts at the baseline benzene emission level from EB/S process vents are considered acceptable under the case-by-case approach.

Decision on Ample Margin of Safety. In determining an ample margin of safety under all four policy approaches, and for any source category, factors such as model uncertainties, available controls and the risk reductions they would achieve, the cost effectiveness of emission and risk reductions, and other relevant factors are considered.

For EB/S process vents, the estimates of annual incidence and maximum individual lifetime risk at the baseline emission level are quite low. Moreover, the majority (75 percent) of the incidence is associated with lifetime risk levels of less than 1×10^{-6}. A very small additional reduction in risk achievable by control of the few remaining uncontrolled intermittent emission sources using 98-percent efficient combustion devices (e.g., boilers and flares). Control of these sources would further reduce benzene emissions by approximately 100 Mg/yr. Such additional control measures could reduce the estimated maximum individual lifetime risk from 2×10^{-5} to 1×10^{-5} and could reduce the annual incidence by 0.003 case/yr. The estimated cost of this additional control is relatively low, about $200,000/yr (1982$).

The baseline risks are considered under this approach to provide an ample margin of safety given that the majority of the low baseline risk is associated with exposure at lifetime risks of less than 1×10^{-6}. Additional control is not warranted because the costs are disproportionately high when compared to the small reductions in risk which would be achieved. Present controls in the EB/S industry are in the form of product recovery devices or by routing emissions to the process unit's boilers to conserve energy (less fuel would be required due to the energy content of the waste stream). Thus, there is no incentive for removal of existing controls. Additionally, there is no incentive for new sources to waste product or energy and major new sources would be subject to other EPA requirements (e.g., new source review, prevention of significant deterioration). Thus, less effective controls are not expected in the future. For these reasons, no standard mandating the present control level is proposed under Approach A.

Approach B. Incidence-Based Approach

Decision on Acceptable Risk. Total annual incidence from benzene emissions from EB/S process vents is estimated to be 0.004 case/yr, or 1 case every 250 years. Under the criteria of the incidence-based approach, the baseline level of risk for EB/S process vents would clearly be acceptable.

Decision on Ample Margin of Safety. For EB/S process vents, the estimates of annual incidence and maximum individual risk are low. The maximum modeled annual average benzene concentration is 0.8 ppb, which is comparable to rural background levels. Most of the population is exposed to much lower concentrations from EB/S process vents.

The baseline level of emissions reflects the fact that most EB/S process vents already have emission control equipment. Control of the remaining uncontrolled intermittent emission sources would further reduce benzene emissions by approximately 100 Mg/yr. Estimated annual incidence would be reduced by 0.003 case/yr, leaving a residual incidence of 0.001 case/yr. The majority of the baseline incidence is associated with the population at lifetime risk levels below 1×10^{-6}, and most of the incidence reduction is associated with the population exposed to these low risk levels. The estimated cost of this additional control is estimated to be about $200,000/yr (1982$).

Under the incidence-based approach, the baseline incidence is considered to provide an ample margin of safety. Factors considered in this determination include the fact that the population is exposed to very low risk levels at baseline and the disproportionate cost of control relative to the small risk reduction which could be achieved. Furthermore, for reasons stated in the discussion of Approach A, EPA would not propose a standard to mandate the present level of control under this approach.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. As shown in Table VII–1, the maximum individual lifetime risk at baseline is estimated to be 2×10^{-5}. As previously discussed, this risk level is associated with exposures to an annual average concentration of 0.8 ppb continuously for a period of 70 years.

Under the criterion of this approach, which requires target maximum individuals risks in the range of 1×10^{-4} or less, the baseline risks would be judged acceptable.

Decision of Ample Margin of Safety. For EB/S process vents, the estimates of annual incidence and maximum individual risks are low. The predicted baseline maximum individual risk of 2×10^{-5} is within the target range for Approach C, and is well below the 1×10^{-4} level. As described in the discussions of Approaches A and B, the majority of the population exposed to emissions from EB/S process vents are exposed to risk levels below 1×10^{-6}. Only a small reduction in risks would be achievable using known control techniques. Maximum individual risks would be reduced from a baseline level of 2×10^{-5} to a level of 1×10^{-5} by applying these controls, and incidence would be reduced by 0.003 case/yr.

Considering the above factors, the baseline emission level would be judged to provide an ample margin of safety under policy Approach C. Furthermore, for reasons discussed in the section on Approach A, EPA would not propose a standard to mandate the present level of control.

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. At baseline, the estimated maximum individual lifetime risk is 2×10^{-5}, and maximum risks for 6 of the 13 facilities exceed the Approach D target maximum risk level of 1×10^{-6}. Therefore, under Approach D, the baseline risks would be judged unacceptable, and EPA would propose standards to reduce maximum individual risks to at or below 1×10^{-6}.

Decision on Ample Margin of Safety. For the facilities with baseline maximum individual risks above 1×10^{-6}, EPA cannot identify control technologies that would achieve risk levels of 1×10^{-6} or lower. As previously noted, application of the additional feasible control to uncontrolled intermittent emission sources would result in an estimated maximum risk of 1×10^{-5}, which exceeds the target level of Approach D of 1×10^{-6}. Thus, the only types of standards that could be proposed to reduce maximum individual risk to below 1×10^{-6} for all facilities would be emission limits, emission limits with risk-based waiver provisions, or risk-based limits. These limits would apply to the total combined benzene emissions from all process vents at an EB/S facility.

Under an emission limit format, total emissions from all facilities would be required to be below a given level. The level would be computed to ensure that no facility would cause maximum risks above 1×10^{-6}. However, since risk estimates will vary even for facilities with the same emission rate depending on dispersion characteristics (e.g., stack height, exit velocity, and flue gas temperature), meteorology, and population patterns, some facilities complying with the emission limit could have maximum individual risks well below 1×10^{-6}.

Under an emission limit with a risk-based waiver, a facility would be permitted a waiver from the emission limit if it could demonstrate that because of emission source dispersion characteristics, meteorology, or population patterns (in the case in which maximum risk were determined with reference to actual residences), the generally applicable emission limits resulted in maximum individual risks lower than 1×10^{-6}.

If a risk-based limit were chosen, each facility would have to reduce emissions to achieve estimated maximum individual risks of 1×10^{-6} or lower. Under this format, as well as the emission limit with risk-based waiver format, emission rates would be allowed to vary among facilities. The emission reduction required for each facility could be determined by facility-specific dispersion and exposure modeling. This alternative format could allow for land use planning in addition to emission reductions as means of achieving the target risk level.

To implement either a standard or a waiver to an emission limit that is risk-based, EPA would have to develop guidance on acceptable methodology for conducting the risk modeling. This would include guidance on acceptable (1) dispersion modeling assumptions such as, meteorology and atmospheric stability; (2) characterization of the emission rate, gas exit velocity and temperature, and release height of the emission sources; (3) estimation of the population and their location in the modeled area; and (4) the radial distances from the source for which concentrations are estimated. In addition, the Agency would have to decide whether maximum individual lifetime risk is to be determined at actual or potential sites of exposure. Even with the models used by EPA in risk assessments, many different assumptions can be used and these can significantly affect the estimates. Without such guidance it would be difficult for enforcement personnel to determine if the modeling analysis is appropriate for demonstrating compliance or to demonstrate that a modeling analysis is unacceptable. Although guidance can be developed from the existing models, it would require more time than is available under the court order to define precisely the range of acceptable assumptions for site-specific analyses.

For benzene, an ambient monitoring alternative to site-specific risk analysis also cannot be used for either 1×10^{-6} or 1×10^{-4} standards. A 1×10^{-6}, or lower, standard would require the benzene concentration from the source to be 0.04 ppb or lower; for a 1×10^{-4} risk standard, the concentration would be 4 ppb, or lower. Since background concentrations of benzene are typically 1 to 6 ppb, it would not be feasible to differentiate between a source's contribution to ambient concentrations and variations in natural background levels or in analytical measurements. Thus, compliance with or violation of the standards could not be demonstrated by monitoring.

As with a risk-based standard or waiver, it will take considerable time both to develop procedures, and to review and approve demonstrations of compliance with an emission limit standard. Compliance with an emission limit is expected to require extension of available procedures to low concentrations or development of new test methods and acceptable engineering analyses. In addition, many facilities may elect, subject to EPA approval, to conduct site-specific analyses including testing. In such cases it would be resource intensive to industry and EPA to implement the standard. However, of the alternatives, the risk-based limit is considered to present somewhat greater difficulties because of the additional considerations involved.

Therefore, in today's notice, to illustrate the effects of applying policy Approach D (1×10^{-6} risk target), EPA has selected an emission limit alternative. It is anticipated that all the alternatives would be difficult and costly to implement. However, the Agency requests comments on all alternatives.

The emission limit that would ensure that no EB/S plant produces maximum individual risks exceeding 1×10^{-6} is a total emission limit of 5.5 kg benzene/day (or 2 Mg/yr) from all process vents at any EB/S facility. This emission limit was calculated by determining the emission/risk ratios for EB/S facilities that control all process vent streams by combustion as seen in the risk modeling results and calculating the emission level that would correlate to a maximum risk of 1×10^{-6} for facilities with the highest risk per unit of emissions. This calculation assumes that risk will be reduced in proportion to emissions.

With an emission limit of 5.5 kg benzene/day, annual emissions from the 13 facilities would be reduced to no more than 26 Mg/yr if all 13 facilities continued to operate. Annual incidence for EB/S process vents would be reduced to about 0.0007 case/yr. No individual would be exposed to a lifetime risk level above 1×10^{-6}, and the majority of the population would be exposed to much lower levels. Therefore, under Approach D, this emission limit would also be considered to provide an ample margin of safety.

Since EPA has not identified control techniques that would reduce benzene emissions to 5.5 kg/day, the owners or operators would have to determine appropriate means of demonstrating compliance with the standard. Furthermore, the benzene concentrations in the exhaust gas that would be required to meet this emission limit at some facilities are below detectable concentrations using the available EPA-approved test methods. Therefore, EPA requests comments on how compliance would be demonstrated under this approach. It is also unknown if plantwide emissions can be reduced to 5.5 kg/day at all facilities. Controlled process vents emissions at 8 of 13 facilities operating in 1985 exceeded this limit. Because EPA does not know how the standard might be achieved at those facilities, EPA cannot at present estimate the costs or economic impacts of achieving this emission limit. However, it is thought that some closures might result due to technical difficulties of achieving the emission limit. The potential economic impacts of any closures could include increased unemployment and the associated community impacts, loss of tax revenues, and price increases. The EPA also invites comment on the economic impacts of closure.

VIII. Benzene Storage Vessels

Source Category Overview

As of the June 6, 1984, withdrawal of the proposed standard for benzene storage vessels, 126 facilities with benzene storage vessels were identified. These facilities generally have multiple vessels. Benzene storage vessels are located in petroleum refineries, chemical plants, and bulk storage terminals.

Estimation Methods and Uncertainties

In analysis of the benzene storage vessel source category, as with other sources of benzene emissions, emission estimates were used in calculating leukemia risk. This section discusses how benzene emissions and the associated health risks were calculated for benzene storage vessels and the uncertainties associated with these estimates.

Benzene emission estimates presented in this notice are based on vessels at 126 plants, using model vessels as a basis for the estimates. The emission estimates have not been revised or updated since the analysis for the withdrawal of the proposed standard in 1984. When developing benzene emission estimates for storage vessels, EPA carefully considered data from four different testing programs conducted by Chicago Bridge and Iron for a storage vessel vendor, EPA, and API (two test programs). These tests spanned the range of equipment configurations typically used on benzene storage vessels such as various roof and seal types.

The emission estimates derived from the testing programs were applied to model units for large and small benzene producers, benzene consumers, and bulk storage terminals. The model units were assigned to each of 126 plants with benzene storage vessels in one or more of the above uses. Total emissions are estimated to be between 620 and 1,290 Mg benzene per year. The lower end of this range, 620 Mg/yr, reflects the assumption that all storage vessels have continuous seals. The upper end of the range, 1,290 Mg/yr, was based on the assumption that some vessels are equipped with shingled seals, which emit more benzene than continuous seals. The number of vessels estimated to have shingled seals is based on a 1978 survey of benzene storage vessels.

The Agency believes that the emission factor used to estimate emissions from vessels with shingled seals is likely higher than the true value. The emission tests on shingled seals involved some test procedure irregularities which EPA strongly believed caused emissions to be overestimated, although the Agency could not quantify this overestimation. More details on the development of emission estimates from test data can be found in the Withdrawal BID.

The risk of leukemia attributable to benzene emissions from benzene storage vessels was calculated based on the range of emission estimates that reflect the assumptions about the use of continuous seals and shingled seals. In developing the risk estimates, EPA ran the HEM based on the assumption that all model vessels had continuous seals. From these results, the estimates were proportioned to reflect the use of shingled seals. The HEM was run for 126 plants with exposure modeling to a 20-km radius around each plant.

Industry practice is to equip new benzene storage vessels with continuous seals rather than shingled seals. Thus, over the 70-year risk estimating period as existing shingled seal vessels are replaced with new continuous seal vessels, the estimated emissions and risks from storage vessels will likely lessen.

For a general discussion of risk assessment and modeling uncertainties, the reader is referred to Section IV of this preamble.

Risk Characterization

In deciding what level of risk is acceptable under the four approaches, the Administrator considered the range of levels presented in Table VIII-1, including, as noted previously, a zero emissions level.

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TABLE VIII-1. RISKS[a] FROM BENZENE STORAGE VESSELS AT DIFFERENT EMISSION LEVELS

		Emission Levels	
		Baseline	A
Incidence (case/yr)		0.05 - 0.1	0.03
Maximum Individual Lifetime Risk (MIR)		4×10^{-5} to 4×10^{-4}	3×10^{-5}
Risk Distribution cumulative (persons)[b,c] (modeled to 20 km)	$\geq 1 \times 10^{-2}$	0	0
	$\geq 1 \times 10^{-3}$	0	0
	$\geq 1 \times 10^{-4}$	10	0
	$\geq 1 \times 10^{-5}$	20,000	700
	$\geq 1 \times 10^{-6}$	900,000	80,000
	Total Modeled	70,000,000	70,000,000
Incidence for Each Risk Group, non-cumulative (case/yr)[d]	$\geq 1 \times 10^{-2}$	0	0
	$\geq 1 \times 10^{-3}$	0	0
	$\geq 1 \times 10^{-4}$	0	0
	$\geq 1 \times 10^{-5}$	0.004	0.0002
	$\geq 1 \times 10^{-6}$	0.02	0.02
	$< 1 \times 10^{-6}$	0.08	0.01

[a] All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

[b] The estimated number of people exposed to ambient concentrations resulting in predicted individual risk levels above the level shown. Population is cumulative (e.g., at baseline 900,000 people are exposed to risks greater than or equal to 1 in 1,000,000).

[c] Risks were calculated on a plant-by-plant basis and summed. Persons exposed to emissions from more than one plant were counted for each plant's impact. The effects of double counting on individual and other risk estimates are discussed in Section IV of this notice.

[d] This is the estimated annual number of cases of leukemia for the population exposed to each risk level. It is not cumulative (e.g., at baseline there would be 0.02 case/yr in the population exposed to risk levels greater than or equal to 1 in 1,000,000 but less than 1 in 100,000).

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The levels represent example scenarios to show how different emission levels would result in different health risk profiles. The table summarizes the risks (i.e., annual incidence, maximum individual lifetime risk, risk distribution, and incidence by risk group) that were estimated for the baseline emission level and a lower level shown as Emission Level A. The baseline represents the emissions as of 1984 with no Federal standard (i.e., the emission level ranging from 620 Mg/yr to 1,290 Mg/yr).

Application of Alternative Policy Approaches

The decisions that would result from application of each of the four policy approaches, described in Section V, to the benzene storage vessel source category are presented below.

Approach A. Case-by-Case Approach

Decision on Acceptable Risk. As shown in Table VIII–1, the estimated maximum individual lifetime risk at baseline ranges from 4×10^{-5} to 4×10^{-4}. (This is the increased risk of contracting cancer if an individual were exposed continuously to the maximum extrapolated concentration of 1 to 15 ppb for 70 years). These estimates are within the range generally considered to be preferred under the case-by-case approach. The lower end of this range reflects the assumption that all storage vessels have continuous seals, while the upper end of the range is based on the assumption that all vessels at the maximum risk plant have shingled seals. The upper end of the range 4×10^{-4}) is a particularly conservative estimate for three reasons. First, the emission estimate for shingled seals is believed to be an overestimate. Second, the assumption that all storage vessels at the maximum risk plant have shingled seals is a worst-case assumption and probably overestimates the risk. Third, over the assumed 70-year exposure period, many of the existing vessels will be replaced and the new vessels will likely have continuous seals and, therefore, lower emissions.

The estimated annual incidence ranges from 0.05 to 0.1 case/yr. The range reflects the range of emission estimates discussed above (620 to 1,290 Mg/yr). These incidence levels are considered to be relatively small. Furthermore, 0.004 case/yr is associated with a lifetime risk level of 1×10^{-5} or higher. Therefore, almost all of the incidence (0.1 case/yr) is associated with the large population exposed to lifetime risks in the 10^{-6} range or less. As previously noted, incidence estimates at the 10^{-6} risk level and lower are given less weight because they are generally considered to be small and the uncertainty in the risk estimates increases at these lower risk levels.

The annual average concentrations due to emissions from benzene storage vessels that result in the maximum risk range of 4×10^{-5} to 4×10^{-4} are around 1 to 15 ppb. Additionally, as mentioned above, essentially all of the incidence is associated with risks in the 10^{-5} range or less; these risks are from exposure to concentrations of less than 4 ppb. Average urban ambient (background) concentrations are around 3 to 6 ppb (see Section IV).

After consideration of the above factors, the baseline level of risk for benzene storage vessels is determined to be acceptable under the case-by-case approach.

Decision on Ample Margin of Safety. For further analysis, the Agency examined two control options that would require all vessels to have emission reduction equipment that many vessels already have. Option 2 would require the use of internal floating roofs on fixed roof tanks, more effective primary seals, improvements to fittings (e.g., gaskets), and secondary seals on external floating roof tanks. These are the same controls that are required for volatile organic liquid storage vessels (including benzene vessels) in 40 CFR Part 60, Subpart Kb, which affects vessels constructed or rebuilt after July 23, 1984. Option 1 would require the controls under Option 2 and additionally require secondary seals for internal floating roof tanks. The estimated impacts of the options are shown in Table VIII–2. These include the emission reduction, annual control cost, cost per Mg of emission reductions, the residual incidence, and the maximum individual lifetime risk.

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TABLE VIII-2. IMPACTS OF OPTIONS FOR BENZENE STORAGE VESSELS

Option	Annual Cost ($MM/yr) 1982[a]	Emission Reduction (Mg/yr)[b]	Average[c] $/Mg	Incremental[c] $/Mg	Population Left at Risk $>1 \times 10^{-4}$	Residual Incidence[d]	Maximum Individual Lifetime Risk[d]
1	1.3	900	1,400	9,900	0	0.03	3×10^{-5}
2	0.1	780	140	140	0	0.04	3×10^{-5}
Baseline	0	0[e]	0	0	0 to 10	0.05 to 0.1	4×10^{-5} to 4×10^{-4}

[a] $MM is millions of dollars. The dollar year is 1982.

[b] Bz = benzene, VOC = volatile organic compounds.

[c] "Average" means compared to baseline. "Incremental" numbers compare each option with next less stringent option. They are not the same as the highest incremental value per source type.

[d] Risk estimates are rounded to one significant figure. Note that essentially all of the baseline incidence occurs in the large population with risk levels of 10^{-5} or less. These risks are associated with exposure to concentrations of less than 4 ppb. Average urban ambient (background) concentrations are around 3 ppb.

[e] Baseline emissions are between 620 and 1,290. The reductions are calculated from 1,290 Mg/yr, which is the more likely value of the two ends of the emissions range.

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Option 2 would reduce the estimated maximum individual lifetime risk to 3×10^{-5} from the baseline range of 4×10^{-5} to 4×10^{-4}. (Under the control options, the risks are not expressed as ranges because all vessels would be required to have continuous seals. Thus, no facility could have vessels with shingled seals, which represent the upper end of the baseline range). The estimated annual incidence would be reduced by 0.01 to 0.06 case/yr. This option would also substantially reduce the population exposed to risk levels of greater than 1×10^{-5} and 1×10^{-6}. The nationwide annual costs associated with Option 2 are $0.1 million/yr, which are considered to be relatively low.

The Agency also considered Option 1. However, it would result in no additional reduction in maximum individual lifetime risk beyond that achieved by Option 2. Furthermore, annual incidence would be reduced by only an additional 0.01 case/yr, at a cost of $1.3 million/yr. The additional incidence reduction is associated mainly with the population exposed to lifetime risk levels of below 1×10^{-6}.

Under Approach A, EPA would consider Option 2 to provide an ample margin of safety. Although the baseline risks are relatively low (considering the conservatism in the upper end of the range), they can be reduced further at a reasonable cost using available control technology. Additional controls beyond Option 2 are not warranted. The costs of additional controls are disproportionately high considering that no additional reduction in maximum individual lifetime risk and only a small reduction in annual incidence would be achieved.

The regulation proposed under this approach would consist of the equipment specifications and operating practices described in Section XII.

A question in all of the approaches for the ample margin of safety decisions is whether to require all technically feasible controls for which costs are in some sense reasonable no matter how small the health risk or whether there is some risk reduction which is too small to warrant the public cost of rulemaking. Public comment is requested on this area.

Approach B. Incidence-Based Approach

Decision on Acceptable Risk. Total annual incidence resulting from benzene emissions from storage vessels is estimated to range from 0.05 to 0.1 case/yr. As previously described, the range reflects the range in emission estimates. The lower end of the range is based on the assumption that all plants have continuous seals while the upper end is based on the assumption that some vessels are equipped with shingled seals, which emit more benzene than continuous seals. Under the criteria of the incidence-based approach, the baseline level of risk for benzene storage vessels would clearly be acceptable.

Decision on Ample Margin of Safety. For benzene storage vessels, the estimates of annual incidence and maximum individual risk at the baseline emission level are relatively low and the upper end of the estimated ranges are conservative. Essentially all of the annual incidence is associated with lifetime risks below 1×10^{-5}, and the great majority of incidence (about 80 percent, or 0.08 out of 0.1 case/yr) is associated with lifetime risk levels of below 1×10^{-6}. Risk levels of 1×10^{-5} and below are associated with ambient concentrations of 0.4 ppb and lower, which is close to the average rural background exposure.

The baseline estimates reflect the assumption that most storage vessels are already fitted with equipment that reduces emissions. However, additional reduction in risk would occur by requiring that all vessels have emission reduction equipment. Table VIII–2 shows the impacts of two control options which are described under the discussion for Approach A. Option 2 would reduce the estimated maximum individual lifetime risk to 3×10^{-5} and incidence by 0.01 to 0.06 case/yr (from baseline) at a reasonable cost. Option 1 would further reduce residual incidence by 0.01 case/yr and would not change the maximum individual lifetime risk compared to Option 2. This would cost $1.3 million/yr. For these reasons (which are described more fully under Approach A), Option 2 would be considered to provide an ample margin of safety under Approach B. Additional control beyond Option 2 would not be warranted. The details of the equipment specifications and operating practices that are proposed under this approach are described in Section XII.

As with Approach A, a question was whether to require in the ample margin of safety step all technically feasible controls for which costs are in some sense reasonable no matter how small the health risk or whether there is some risk reduction which is too small to warrant the public cost of rulemaking.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. As shown in Table VIII–1, the estimated maximum individual lifetime risk at baseline ranges form 4×10^{-5} to 4×10^{-4}. The upper end of the range, which exceeds the target risk, reflects the assumption that all storage vessels at the maximum risk plant have shingled seals. Under the criteria of the approach requiring target maximum risks in the range of 1×10^{-4} or less, the baseline risks would not be considered acceptable. Additional control would be necessary to reduce risks to an acceptable level at or below the 1×10^{-4} target.

Decision on Ample Margin of Safety. Reduction in maximum individual lifetime risks to below the 1×10^{-4} level can be achieved through application of available emission control equipment. Two options considered are shown in Table VIII–2. As previously noted, many benzene storage vessels are already fitted with emission reduction equipment at baseline. As noted in Approach A, Option 2 would require that all vessels have emission reduction equipment including the use of internal floating roofs on fixed roof tanks, more effective primary seals, improvements to fittings (e.g., gaskets) and secondary seals on external floating roofs. This option would reduce the estimated maximum individual lifetime risk to 3×10^{-5}, which is within the target range. Estimated annual incidence would be reduced by 0.01 to 0.06 case/yr. This would substantially reduce the population exposed to risk levels of greater than 1×10^{-5}. Control of the maximum individual risk to this level also reduces the population exposed to lifetime risks levels between 1×10^{-6} and 1×10^{-5}. The costs associated with this option are about $0.1 million/yr, which are considered to be low.

Option 1 would result in no additional reduction in maximum individual risk beyond that achieved by Option 2 (i.e., maximum risk would remain at the 3×10^{-5} level). Furthermore, annual incidence would be reduced by only an additional 0.01 case/yr, at a cost of $1.3 million/yr. The additional incidence reduction is associated mainly with the population exposed to lifetime risk levels of below 1×10^{-6}.

Under Approach C, EPA would consider Option 2 to provide an ample margin of safety. This option would reduce the maximum individual risk to within the target range and well below the 1×10^{-4} level. As described above, the population exposed to lifetime risks in the 10^{-5} and 10^{-6} ranges would be significantly reduced. Additional controls beyond Option 2 are not warranted. The costs of additional controls are disproportionately high considering that no additional reduction in maximum individual risk and only a very small reduction in annual incidence would be achieved.

The regulation proposed under this approach would consist of the equipment specifications and operating practices described in the summary of standards in Section XII of this preamble.

Approach D. 1×10^{-6} or Less Maximum Individual Approach

Decision on Acceptable Risk. At baseline, the estimated maximum indi vidual lifetime risk ranges from 4×10^{-5} to 4×10^{-4}, as described in previous sections. Since this is clearly above the 1×10^{-6} target risk level of Approach D, baseline risks would be judged unacceptable under this approach. Under this approach, EPA would propose standards to reduce the maximum individual risk to 1×10^{-6} or less.

Decision on Ample Margin of Safety. The EPA cannot explicitly state at this time what control technologies would be capable of achieving maximum individual lifetime risk levels of 1×10^{-6} or lower for all facilities with benzene storage vessels. As shown in Table VIII-2, application of the identified control techniques (Options 1 and 2), would result in an estimated maximum individual risk of 3×10^{-5}, which is still significantly above the target level of Approach D of 1×10^{-6}. Therefore, a facility emission limit (or risk limit) is currently the only means of reducing maximum individual risks to below 1×10^{-6} at all sites. As previously discussed in the EB/S section (Section VII) under Approach D, an emission limit format has been selected for illustrative purposes, however comments on both formats are requested.

The emission limit that would ensure that no facility produces maximum individual risks exceeding 1×10^{-6} is 0.47 kg/day (170 kg/yr). This emission limit would apply to the combined emissions from all benzene storage vessels located at a facility. The emission limit was calculated by proportional reduction of emissions from the storage facility with the highest maximum individual risk per unit of emissions.

With an emission level of 0.47 kg/day, annual emissions for the estimated 126 plants would be reduced to below 22 Mg/yr if all plants continued to store benzene. Annual incidence from benzene storage vessels would be reduced to about 0.002 case/yr, and no individual would be exposed to a lifetime risk level greater than 1×10^{-6}. Moreover, the majority of the population would be exposed to lifetime risk levels much lower than 1×10^{-6}. Therefore, under Approach D, this emission limit would be judged to provide an ample margin of safety.

Since EPA has not identified control techniques that would reduce emissions to 0.47 kg/day at all facilities, the owners or operators would have to determine the appropriate means of demonstrating compliance with the standard. One possibility that a plant may consider for complying with the emission limit is the venting of emissions from all storage vessels to a combustion device, such as a flare. However, EPA does not presently know if the emission limit could be achieved at all plants if this technique were applied to fixed roof vessels with no control equipment such as internal floating roofs. Moreover, EPA is not able to determine at this time whether the combination of emission reduction equipment (i.e., Options 1 and 2 in Table VIII-2) with a flare could achieve the emission limit at all plants. This is because EPA does not presently know if the emission reduction equipment specified in Options 1 and 2 will achieve as much control when used in combination with a flare as when used alone.

Because EPA does not know how the standard might be achieved, EPA cannot at present estimate the costs or economic impacts (including the potential for closures) of achieving this emission limit. However, it is expected that, at a mininum, the costs would be greater than those shown for the most stringent identified control technology (Option 1) in Table VIII-2. For example, the cost of retrofitting existing storage vessels with add-on control devices, such as flares, would vary with vessel design and the control device added. If a flare were used, an existing vessel may have to be replaced if it were unable to handle an inert gas blanket (which may be needed to avoid venting oxygen-containing streams to the flare). Also, the cost would vary depending on whether a flare were available onsite, and on the amount of supplemental fuel that was necessary for the flare.

IX. Equipment Leaks

Source Category Overview

Typical stationary sources which handle benzene and, therefore, are likely to have fugitive benzene emissions from equipment leaks are petroleum refineries, chemical plants, and bulk storage terminals. As of publication of the final rules for benzene equipment leaks in 1984, there were 131 such facilities in the United States. These facilities are now required to be in compliance with the standard specified in 40 CFR Part 61, Subpart J, that was promulgated in 1984.

In these facilities, the fugitive emission sources of benzene are pieces of equipment handling process streams that contain benzene. These sources include pumps, pipeline valves, open-ended valves, flanges, compressors, safety/relief valves, sampling connections, process drains, and product accumulator vessels. The standard affects equipment that contacts process streams with at least 10 percent benzene (by weight).

Estimation Methods and Uncertainties

The evaluation of human health effects of benzene emissions from equipment leaks involved estimating emissions from the equipment sources described above and then using the HEM to predict concentrations, exposures, and leukemia risks from the estimated exposures. In addition to the uncertainties inherent in estimating risk described in Section IV of this preamble, considerable uncertainty is involved in estimating emissions from equipment leaks of benzene. This section describes the methods EPA used and highlights areas of uncertainty, so that the basis and limitations of the EPA's estimates can be better understood.

When Subpart J was promulgated in 1984, EPA estimated the NESHAP would reduce benzene emissions from equipment leaks by about 69 percent from the existing baseline. The standard was estimated to reduce benzene emissions from about 7,900 Mg/yr to 2,500 Mg/yr. The estimate of 2,500 Mg/yr is based on all 131 facilities existing in 1984 implementing the requirements of Subpart J. The Agency's current estimate of benzene emissions from equipment leaks remains as 2,500 Mg/yr. This estimate has not been revised to reflect changes in the number of facilities or changes in typical industry practices which might have occurred after promulgation of the standard and which might have affected the quantity of benzene emitted from equipment leaks. To be meaningful, such adjustments must be based on additional information and actual analysis of current industry practices. However, such analysis and revisions to the emission estimate based on a new analysis were not feasible in the time available for reconsideration of the standard.

A model unit methodology based on estimated average numbers of various equipment components was used to estimate benzene equipment leak emissions. Emissions for each model unit were estimated using petroleum refinery VOC emission factors for each equipment component as explained in a memorandum to the docket (Docket No. A-79-27, Docket Item IV-B-22) and in the Promulgation BID. Average weight percentages of benzene assumed for each model unit's process stream were used to adjust the VOC emissions to total benzene emissions as described in the Proposal BID, pp. 7-6 to 7-7. The petroleum refinery VOC emission factors were developed statistically from field measurements. An explanation and analysis of emission factor development may be found in the AID. Emission estimates made using the emission factors and model units were aggregated on a process unit basis to develop nationwide estimates and on a facility basis to estimate population exposures and risks (Docket No. A-79-27, Docket Item IV-B-11).

As stated previously, the 2,500 Mg/yr was based on compliance by all facilities with the NESHAP. Control efficiencies reflected in this estimate were based on estimates of efficiencies of NESHAP controls as shown in Table IX-1 for each equipment type. Finally, the entire emission estimation procedure is described more completely in the Promulgation BID and the AID.

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TABLE IX-1. EFFICIENCIES OF CONTROLS FOR EQUIPMENT LEAKS

Equipment Component	Control Technique	Percent Reduction in Benzene Emissions[a]
Pumps	Monthly leak detection and repair	61
Compressors	Degassing reservoir vents	100
Valves:		
Gas	Monthly leak detection and repair	73
Liquid	Monthly leak detection and repair	59
Pressure relief devices	Control equipment (no detectable emissions)	100
Sampling connections	Closed-purge sampling	100
Open-ended lines	Caps on open ends	100

[a]Percent reductions in benzene emissions based on data from the AID, Docket No. A-79-27, Docket Item IV-A-24. Benzene emissions were assumed to be reduced by the same percentage as VOC emissions.

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In evaluating uncertainties in the emission estimates, two issues should be mentioned. One involves the representativeness of petroleum refinery average emission factors used for estimating emissions of benzene. The benzene sources overall may have lower percentages of leaking equipment than were observed in the petroleum industry before implementation of leak controls. Recent studies indicate that the percentage of leaking components is probably lower than previously estimated due to changes over time and use of better controls for chemicals such as benzene with known human health risks. Specifically, limited surveys of sources subject to Subpart J show that the leak frequencies for valves are 2 percent or less (Docket No. A-79-27, Docket Items VII-I-2, VII-E-4, VII-D-2, VII-B-2). Evidence shows that improved maintenance does result in fewer leaking components and lower emission rates (Docket No. A-79-27, Docket Item VII-B-2). This lower percentage of leaking sources indicates that emission estimates may be overstated. The equipment leak estimates were calculated using factors estimating emissions for leaking and for nonleaking equipment, and these factors reflect average emission rates from facilities with higher percentages of leaking sources. For facilities with lower percentages of leaking sources, these factors will overestimate emissions for two reasons. First, the percentage of leaking sources, and hence the overall factor is overstated. Second, the average emission rates for leaking and nonleaking sources will not be characteristic of the distribution of sources at the facility. Therefore, the 2,500 Mg/yr estimate for equipment leak benzene emissions is likely to be overstated. However, the EPA believes that this level of control would not necessarily be found in the absence of a regulation.

The second uncertainty involved in the emission estimates concerns the assumed use of ordinary pumps and values in the model units. In actual practice, many facilities may use equipment with a lower potential to leak. Information has been submitted to the Agency showing that primary pumps in benzene service have been equipped with dual mechanical or packless seals in some facilities (Docket No. A-79-49, Docket Item II-D-13; Docket No. OAQPS 79-3, Part II, Docket Item II-D-008; Docket No. A-79-27, Docket Items II-D-65, II-D-70, II-D-77). The use of equipment with lower leak rates is not reflected in the emission estimates. Moreover, as mentioned previously, within the time allowed for reconsideration of the standard, it was impossible to revise the analysis of industry practice. Consequently, the emission estimates for the 131 facilities were viewed as upperbound estimates, and it is recognized that actual emissions today may be substantially lower.

The benzene equipment leak emission estimates for the 131 plants were input to the HEM and used to estimate population exposure and leukemia risks. Modeling revisions since 1984 included an extension of the modeling radius around each source from 20 to 50 km, and incorporation of the revised URE. For a general discussion of risk assessment and modeling uncertainties, the reader is referred to Section IV of this preamble.

In addition to the general modeling uncertainties discussed in Section IV, dispersion modeling of equipment leaks contains more uncertainty than modeling of emissions from stacks because equipment leaks are area sources. Only extremely limited verifications of area source modeling methodologies have been done to date. It is not possible to estimate the uncertainty because the uncertainty varies with the specific plant location and the meteorology used.

Risk Characterization

In deciding what level of risk is acceptable for equipment leaks under the four approaches, EPA considered the range of levels shown in Table IX-2. The levels represent example scenarios to show how different emission levels would result in different health risk profiles. Table IX-2 summarizes the risks (i.e., annual incidence, maximum individual lifetime risk, risk distribution, and incidence by risk group) that were estimated for the baseline emission level and two lower emission levels, shown as Emission Levels A and B. The baseline represents the emissions remaining after application of the NESHAP promulgated in 1984 (i.e., 2,500 Mg/yr).

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TABLE IX-2. RISKS[a] FROM EQUIPMENT LEAKS AT DIFFERENT EMISSION LEVELS

		Emission Levels		
		NESHAP (Current Baseline)	A	B
Incidence (case/yr)		0.2	0.1	0.04
Maximum Individual Lifetime Risk		6×10^{-4}	2×10^{-4}	4×10^{-5}
Risk Distribution, cumulative,[b,c] (persons) (modeled to 50 km)	$\geq 1 \times 10^{-2}$	0	0	0
	$\geq 1 \times 10^{-3}$	0	0	0
	$\geq 1 \times 10^{-4}$	3,000	600	0
	$\geq 1 \times 10^{-5}$	60,000	20,000	5,000
	$\geq 1 \times 10^{-6}$	1,000,000	300,000	200,000
	Total Modeled	200,000,000	200,000,000	200,000,000
Incidence for Each Risk Group, non-cumulative (case/yr)[d]	$\geq 1 \times 10^{-2}$	0	0	0
	$\geq 1 \times 10^{-3}$	0	0	0
	$\geq 1 \times 10^{-4}$	0.007	0.001	0
	$\geq 1 \times 10^{-5}$	0.02	0.006	0.001
	$\geq 1 \times 10^{-6}$	0.04	0.01	0.005
	$< 1 \times 10^{-6}$	0.2	0.08	0.03

[a]All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

[b]The estimated number of people exposed to ambient concentrations resulting in predicted individual risk levels above the level shown. Population is cumulative (e.g., at baseline 1,000,000 people are exposed to risks greater than or equal to 1 in 1,000,000).

[c]Risks were calculated on a plant-by-plant basis and summed. Persons exposed to emissions from more than one plant were counted for each plant's impact. The effects of double counting on individual and other risk estimates are discussed in Section IV of the notice.

[d]This is the estimated annual number of cases of leukemia for the population exposed to each risk level. It is not cumulative (e.g., at baseline there would be 0.04 case/yr in the population exposed to risk levels greater than or equal to 1 in 1,000,000 but less than 1 in 100,000).

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Application of Alternative Policy Approaches

The decisions that would result from application of each of the four policy approaches, described in Section V, to the benzene equipment leaks category are presented below.

Approach A. Case-by-Case Approach

Decision on Acceptable Risk. As shown on Table IX-2, the estimated maximum individual lifetime risk of 6×10^{-4} at the NESHAP emission level would fall within the range generally considered to be preferred under the case-by-case approach. (This is the increased risk of contracting cancer if an individual were exposed continuously to the maximum modeled annual average concentration of 35 ppb for 70 years). The estimated annual incidence at baseline is 0.2 case/yr, and nearly all of these cases occur in the large population exposed to predicted lifetime risks in the 10^{-6} range and lower. As noted in Section V, incidence estimates at the 10^{-6} and lower risk levels are given less weight under this approach because they are generally considered to be small and the uncertainty in the risk estimates increases at these lower risk levels.

In deciding an acceptable risk level under the case-by-case approach, EPA particularly examined the uncertainties discussed in Section IV and described earlier in this section. The assessment of these factors is summarized below. The overall weight of evidence for benzene carcinogenicity is strong (the URE is based on data from occupational exposure studies). Although the use of alternative dose/response models could produce different URE's for benzene (Docket Number OAQPS 79-3, Part I, Docket Item VIII-A-4), the linear non-threshold model used by EPA represents the best fit for the available data. The model is judged, however, to be conservative and therefore, the URE, as a measure of leukemogenic potency, could be considered to err in favor of the protection of public health. This URE, however, does not include nonleukemia cancer risks because statistical associations with other cancers have been found to date only in animal bioassays.

As previously noted, exposure modeling contains uncertainties and is based on emission estimates and other assumptions that, in this case, tend to overstate exposures. Specifically, the assumption that individuals are exposed continuously to the maximum modeled annual average concentration for 70 years may overestimate maximum individual lifetime risk. The assumption that the facilities will continue to operate at the same emission rate for 70 years particularly tends to overstate exposures because it ignores changes in design and operation of chemical plants and petroleum refineries. Furthermore, as discussed in the previous section, the annual emission estimates used in the analysis are considered to represent an upperbound estimate. If actual emissions and the expected decline in emissions over time could be considered in the exposure analysis, the risk estimates would be proportionally lower.

Even under these conservative emission assumptions, the estimated annual leukemia incidence is relatively low, 0.2 case/yr. Of this incidence, the majority is associated with lifetime risks of 10^{-6} and lower. Only 0.02 case/yr is associated with 10^{-5} risks and 0.007 caes/yr is associated with risks of 1×10^{-4} and greater. It is estimated that no one would be exposed to lifetime risks of 1×10^{-3} or higher, and the population at risk in the 10^{-4} range is estimated to be 3,000.

More than 90 percent of the predicted annual incidence is associated with the population exposed to benzene concentrations of less than 4 ppb, concentrations which are comparable with risks of less than 10^{-4}. These concentrations are similar to average urban ambient (background) concentrations described in section IV.

Thus, after consideration of all of the above factors concerning the estimated maximum individual lifetime risk and annual incidence, the large proportion of the incidence associated with lifetime risks of less than 1×10^{-6}, and the likely overstatement of emissions, the Agency would propose that estimated baseline risks due to emissions of benzene from equipment leaks are acceptable under Approach A.

Decision on Ample Margin of Safety. As discussed above, the baseline risks would be acceptable under Approach A. Further analysis of equipment leaks was based on a review of the leak controls identified during the development of the NESHAP for this source category. For these sources, the estimated impacts of application of additional controls (Option 1) are shown in Table IX-3. The emission reduction, anticipated cocontrol of VOC, annual control costs, cost per Mg of emission reduction, residual incidence, and maximum individual lifetime risk were estimated. Table IX-3 shows the emission, risk, and cost impacts of the identified additional control techniques. The additional control of Option 1 reflects use of dual mechanical seals for pumps and sealed bellows valves. For the purposes of this analysis, this equipment is considered to be leakless (i.e., 100-percent control). It is not known if leakless valves/sealed bellows valves are available for all sizes and types of equipment in benzene service. Equipment or maintenance practices that would provide emission and risk reductions beyond Option 1 have not been explicitly identified by EPA.

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TABLE IX-3. IMPACTS OF OPTIONS FOR BENZENE EQUIPMENT LEAKS

Option	Additional Annual Cost ($MM/yr) 1979[a]	Emission Reduction (Mg/yr) Bz/VOC[b]	$/Mg Bz/VOC	Population Left at Risk, $>1 \times 10^{-4}$	Residual Incidence[c]	Maximum Individual Lifetime Risk (MIR)[c]
Option 1	52.4	1,300/2,300	40,000/23,000	900	0.1	6×10^{-4}
Baseline = Current NESHAP	0	0/0[d]	0	3,000	0.3	1×10^{-3}

[a] $MM is million of dollars. The dollar year is 1979.

[b] Bz = benzene; VOC = volatile organic compounds.

[c] Risk estimates are rounded to one significant figure. Note that essentially all of the incidence occurs in the population at the 1 in 100,000 risk level or less. These risks are associated with exposure to concentrations of less than 4 ppb. Average urban ambient (background) concentrations are around 3 ppb.

[d] Baseline emissions are 2,500 Mg/yr of benzene and 3,900 Mg/yr of VOC (including benzene). Emissions before implementation of the standard were 7,900 Mg/yr of benzene and 12,300 Mg/yr of VOC.

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Under Option 1, the estimated maximum lifetime risk would be reduced from 6×10^{-4} to 2×10^{-4}, and the annual incidence would be reduced from 0.2 case/yr under the current NESHAP baseline to 0.1 case/yr. The majority of this incidence reduction occurs among the population exposed to lifetime risks less than 10^{-4} (i.e., exposed to concentrations of less than 4 ppb). As previously noted, these estimates are based on upperbound emission estimates. The actual emission reduction is expected to be less than indicated and the risk reduction would be proportionally lower. The additional annual cost to achieve Option 1 is estimated to be $52.4 million (Docket No. A-79-27, Docket Item V-A-1). The costs were computed using the annual cost per control component and the number of components used nationwide in existing units (Docket No. A-79-27, Docket Item IV-B-14). The majority of the estimated cost is from the cost of sealed bellows valves and would be incurred regardless of the magnitude of the actual emissions.

Although Option 1 shows some additional emission and risk reduction to be achievable, the control cost is disproportionately great when compared to the small reductions in risk which would be achieved. If the actual emission reduction were known and used, the option would likely be even less cost effective. Recognizing the conservatism in the emission estimates, the large proportion of the incidence associated with lifetime risks less than 1×10^{-6}, the questions regarding technical feasibility, and the costs of additional controls, under Approach A the Administrator would consider the emission levels associated with the existing NESHAP to protect public health with an ample margin of safety. Therefore, additional control beyond the existing NESHAP would not be warranted and thus would not be required under Approach A.

Approach B. Incidence-Based Approach

Decision on Acceptable Risk. Under the criterion of this approach, the incidence of 0.2 case/yr associated with the existing benzene equipment leaks standard would be acceptable.

Decision on Ample Margin of Safety. Since the predicted risk and incidence resulting from the current standard would be found acceptable under Approach B, the Agency would then consider other factors in determining an ample margin of safety. First uncertainties associated with the dose/response model were examined. As shown in Table IX-2, about 90 percent of the leukemia incidence is associated with risk levels less than 1×10^{-5}, which corresponds to exposure to benzene concentrations of less than 0.4 ppb. As noted in Section V, risk estimates in the 10^{-6} range and lower are given less weight because they are generally considered to be small and uncertainty in the risk estimates increases at these lower levels. Additionally, actual risks may be substantially lower due to actual leak frequencies in equipment subject to the NESHAP being lower than was assumed in the analysis. Other sources of uncertainty are discussed in Section IV and under Approach A in this section.

Next, EPA reviewed emission controls which were identified during development of the NESHAP for this source category. Table IX-3 shows the effects of an additional control level, Option 1, which reflects the use of dual mechanical seals for pumps and sealed bellows valves. For the purposes of this analysis, this equipment is considered to be leakless (i.e., 100 percent control). It is not known if leakless valves/sealed bellows valves are available for all sizes and types of equipment in benzene service. Equipment or maintenance practices that would provide emission and risk reductions beyond Option 1 have not been explicitly identified by EPA.

Risk reduction, cost, and cost effectiveness of controls were also examined in the evaluation of ample margin of safety. Under Option 1, the estimated maximum lifetime risk would be reduced from 6×10^{-4} to 2×10^{-4}, and the annual incidence would be reduced from 0.2 case/yr under the current NESHAP baseline to 0.1 case/yr. The majority of this incidence reduction occurs among the population exposed to lifetime risks less than 10^{-4} (i.e., exposed to concentrations of less than 4 ppb). As previously noted, these estimates are based on upperbound emission estimates and the actual emission reduction is expected to be less than indicated. As discussed under Approach A for equipment leaks, the additional annual cost to achieve Option 1 is estimated to be $52.4 million. The majority of the estimated cost is from the cost of sealed bellows valves and would be incurred regardless of the magnitude of the actual emissions.

Although Option 1 shows some additional emission and risk reduction to be achievable, the control cost is disproportionately high when compared to the small reductions in risk which could be achieved. If the actual emissions, and thus emission reduction, could be quantified, the option would likely be even less cost effective.

Under the criteria of this approach, the existing NESHAP would be judged to protect public health with an ample margin of safety. Additional control would not be judged warranted considering the small emission and risk reduction that would be achieved, the questions regarding technical feasibility, and the large cost.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. Under the assumptions used in the analysis, the maximum lifetime risks under the existing benzene equipment leaks NESHAP is 6×10^{-4}. Under the criterion of the approach requiring target maximum risks of 1×10^{-4} or less, the baseline risks would not be considered acceptable. Additional control would be necessary to reduce maximum lifetime risks to 1×10^{-4} or below.

Decision on Ample Margin of Safety. To ensure that no facility has risks exceeding 1×10^{-4}, emission reductions beyond Option 1 would be required. Therefore, the only method of specifying the level of control necessary to achieve a maximum lifetime risk of 1×10^{-4} or less at all facilities would be through either a standard limiting facility emissions or a risk level standard. As previously discussed in Section VII, Approach D, a facility emission limit format has been selected to illustrate this. Comments are requested on both formats, however.

The emission limit for benzene equipment leaks which ensures that no facility engenders risk exceeding 1×10^{-4} would be 14 kg/day (5 Mg/yr). Thus, emissions from all 131 plant sites would, at the minimum, be reduced to less than 700 Mg/yr total. This 14 kg/day limit would apply to benzene emissions from all equipment contacting benzene at each and any plant site which contains equipment subject to the existing NESHAP. As discussed in Section VII, this limit was derived by proportional calculations of maximum risks and corresponding emissions.

In addition to ensuring that no one is exposed to lifetime risks greater than 1×10^{-4}, the 14 kg/day emission limit would also reduce risks to the total exposed population. Incidence would be reduced to roughly 0.07 case/yr total (if all 131 facilities continued to operate), and of this about 0.007 case/yr (or 7 cases in 1,000 years) would occur in the population exposed to lifetime risks greater than 1×10^{-5}. Many facilities would have maximum risks below 1×10^{-6}, and the additional emission reduction will primarily reduce the exposure levels of the populations which are currently in the less than 10^{-6} lifetime risk category.

Based on available information, it is believed that the 14 kg/day emission limit will require control beyond Option 1 at all but the very smallest facilities. However, to ensure that no facility achieving less than 14 kg/day through a leak detection and repair program allows emissions to increase, the current NESHAP (40 CFR Part 61, Subpart J) would still be required. The majority of facilities would have to achieve an additional 50 percent emission reduction to comply with the 5 Mg/yr emission limit. Based on available information, it is unlikely that this can be easily done.

As previously noted, the Agency has not explicitly identified controls beyond Option 1. Thus, if the emission limit required by this approach were adopted, the plant owners or operators would have to determine the appropriate means of achieving essentially leakless operation throughout the plant. Consequently, EPA cannot at present quantify the costs and economic impacts of achieving this emission limit. However, it is suspected that the costs will exceed the control costs estimated for Option 1 in Table IX–3. Based on emission rates and technical feasibility for further emission reduction, the Agency expects that a substantial number of facilities (about 100 out of 131 plants) would permanently shut down under this approach. This estimate of permanent closures is not based on cost impacts or an economic analysis.

Of the approximately 150,000 people employed in the synthetic organic chemical industry, roughly 30,000 to 40,000 are estimated to be employed by facilities producing benzene and benzene derivatives. (To derive this estimate the ratio of benzene production and consumption capacity to total organic chemical production was applied to the total industry employment). If roughly 100 facilities were to close, roughly 27,000 jobs would be lost in the chemical and petroleum refining industries. In addition to these job losses, jobs would be lost in the affected communities and in related industries, such as manufacturers of rubber tires, lubricants, nylon fibers, and other plastics for consumer and military uses. The health risks associated with increased unemployment are an additional impact that has not been quantified. Indirect impacts of a substantial number of closures such as price increases and increased imports have not been quantified but are expected to be significant. Higher prices would be charged for imported goods made from benzene or for more expensive substitutes; thus, there would be a general inflationary impact. The balance of payments would be affected by an increase in imports of benzene-derived goods.

In summary, under the 1×10^{-4} risk target approach for NESHAP, the proposed standard would: (1) Limit benzene emissions from equipment leaks to no more than 14 kg/day at all facilities with equipment contacting benzene; and (2) require compliance with the existing NESHAP (40 CFR Part 61, Subpart J), so as to ensure that no facility currently achieving less than 14 kg/day through a leak detection and repair program could allow its emissions to increase. These two requirements together would be judged to provide an ample margin of safety under Approach C. Further description of the provisions of these alternative standards are contained in Section XII.

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. Under the assumptions used in this analysis, maximum lifetime risk under the existing NESHAP exceed the 1×10^{-4} target risk and would not be considered acceptable. Additional control would be necessary to reduce the maximum individual risk to 1×10^{-6} or less.

Decision on Ample Margin of Safety. As discussed under Approach C, the only method of specifying the level of control necessary to achieve a maximum lifetime risk of 1×10^{-6} or less would be through either a risk limit standard or a standard limiting facility emissions. A facility emission limit standard has been selected to illustrate this approach, but comments are requested on both types of standards.

The emission limit for benzene equipment leaks which ensures that no facility causes risks exceeding 1×10^{-6} would be 0.14 kg/day (50 kg/yr). Emissions from all 131 facilities would then be reduced to below 6.6 Mg/yr. The 0.14 kg/day limit would apply to all equipment contacting benzene, at any plant site that contains equipment subject to the existing NESHAP; even those facilities now exempted because they use or produce less than 1,000 Mg benzene/yr would be required to comply with the emission limit. As discussed previously, this limit was derived by proportional calculations of maximum risks and corresponding emissions.

In addition to ensuring that no one is exposed to lifetime risks greater than 1×10^{-6}, the 0.14 kg/day limit would also reduce the total leukemia incidence to 0.0007 case/yr in the modeled population of 200,000,000. Thus, under this approach, public health would be protected by an ample margin of safety with this emission limit.

However, the EPA has no knowledge of technology-based control measures that would acheive the 0.14 kg/day benzene emission rate. If this limit were adopted as the standard, the plant owners or operators themselves would have to determine how to achieve compliance with the standard. Consequently, the Agency cannot at present estimate the costs or economic impacts of such a standard. Qualitatively, based on known control measures, emission rates, and technical feasibility of further emission reduction, this emission limit would be expected to result in closures of essentially all operations producing or using benzene including chemical plants, petroleum refineries, and other facilities. If all 131 facilities were to close, roughly 30,000 to 40,000 jobs would be directly affected. As discussed under Approach C, other job losses in associated industries could also be expected. The health risks associated with inceased unemployment also have not been quantified. Indirect impacts associated with shutdown of the industry have not been quantified but are expected to be severe.

In summary, the proposed standard would: (1) Limit benzene emissions from equipment leaks to no more than 0.14 kg/day at all facilities with equipment in benzene service; and (2) eliminate the exemption existing in the current NESHAP for facilities producing or using less than 1,000 Mg/yr of benzene. These requirements would be judged to provide an ample margin of safety under Approach D.

X. Coke By-Product Recovery Plants

Source Category Overview

In the Coke by-product recovery process, various components of the gases emitted from coke oven batteries are separated and recovered to obtain products such as crude tar, naphthalene, light oils, benzene mixtures, and refined benzene. Benzene emissions from 44 existing plants are largely uncontrolled and are released from a variety of sources such as process vessels, sumps, storage vessels, the cooling tower associated with the final cooler, and leaking equipment (e.g., pumps and valves).

Estimation Methods and Uncertainties

In the analysis of the coke by-product recovery plant source category, as with other benzene source categories, emission estimates were used in estimating leukemia risk. This section discusses how benzene emissions and the associated health risks were calculated for coke by-product recovery plants and the uncertainties associated with these estimates.

The emission estimates presented in this notice were developed based on emission factors derived from source sampling surveys and emission tests, engineering judgment, and site-specific production rates and process information provided by the plants. Differences in methods of operation, operating parameters, and design factors were taken into account to the extent possible by averaging applicable measurements to obtain an emission factor representative of a typical source. The nationwide emission estimates were based on application of the emission factors (which were in terms of benzene emissions per Mg of coke production) to site-specific information on which processes exist in each plant and each plant's coke production capacity, rather than by extrapolation from model plants.

Since the 1984 proposal, revisions to the emission factors and the data base have been made based on public comments. As discussed further below in the "Response to Comments" section of this preamble, separate emission factors have been developed to distinguish furnace from foundry plants because foundry plants use less volatile coal and longer coking cycles. The data base also has been updated using information provided by the industry and major trade associations at the close of the comment period for the proposal. As of November 1984, a total of 44 furnace and foundry plants with a combined operating capacity of 50.9 million Mg/yr were identified that are either in active operation or on cold-idle status (i.e., temporarily closed but able to restart on demand). Plants on cold-idle are included in the data base because information is insufficient to determine whether these sites will be closed permanently. Nationwide baseline benzene emissions from the 44 plants assuming all operate at full capacity are estimated at 26,000 Mg/yr. More detail on the estimation of emissions can be found in the Proposal and Revised Proposal BID's.

At proposal, the health risks attributable to benzene emissions from coke by-product recovery plants were calculated using the HEM dispersion model to estimate the benzene concentrations to which people living within 20 km of the plants were exposed. After the 1984 proposals, the HEM was again employed for the health risk analysis using the revised benzene URE, updated data base and revised emission factors, and with exposure modeling carried out to 50 rather than 20 km. In the risk analyses, EPA assumed that all plants were operating at full capacity.

The Agency acknowledges that many uncertainties are present in the emissions and risk estimates. Uncertainties in the emission estimates include the emission factors and the application of the emission factors to various plants that employ different methods of operation, designs, and operating parameters; these may tend to over- or under-estimate emissions. In addition, the 44 existing plants are not all operating at full capacity and, in fact, some are on cold-idle. Thus, nationwide emissions are overestimated. Further, the declining domestic coke market makes it particularly likely that EPA has overestimated emissions for the 70-year lifetime assumed in the exposure analysis. Additional uncertainty also is present for the dispersion modeling of area sources, such as are found in coke by-product plants, than for modeling of stack point sources. Only extremely limited verifications of area source modeling procedures have been done to date. Further information on general uncertainties in the exposure and risk analysis for benzene are described in Section IV of this preamble.

Risk Characterization

As discussed in Section V, the first step in making NESHAP decisions is determination of an acceptable risk level. In deciding what level of risk is acceptable for coke by-product recovery plants under each of the four approaches, the Administrator considered the range of levels shown in Table X–1, as well as a zero emission level. The levels represent example scenarios to show how different emission levels would result in different health risk profiles. Table X–1 presents the risk estimates, calculated as described above, in terms of annual incidence, maximum individual lifetime risk, risk distribution, and incidence by risk group.

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TABLE X-1. RISKS[a] FROM COKE BY-PRODUCT RECOVERY PLANTS AT DIFFERENT EMISSION LEVELS

		Emission Levels				
		Baseline	A	B	C	D
Incidence (case/yr)		3	0.5	0.2	0.05	0.004
Maximum Individual Lifetime Risk (MIR)		6×10^{-3}	1×10^{-3}	4×10^{-4}	2×10^{-4}	1×10^{-5}
Risk Distribution, cumulative, (persons)[b,c] (modeled to 50 km)	$\geq 1 \times 10^{-2}$	0	0	0	0	0
	$\geq 1 \times 10^{-3}$	4,000	400	0	0	0
	$\geq 1 \times 10^{-4}$	100,000	10,000	2,000	200	0
	$\geq 1 \times 10^{-5}$	3,000,000	300,000	70,000	20,000	1,000
	$\geq 1 \times 10^{-6}$	30,000,000	6,000,000	2,000,000	400,000	30,000
	Total Modeled	90,000,000	90,000,000	90,000,000	90,000,000	90,000,000
Incidence for Each Risk Group, non-cumulative (case/yr)[d]	$\geq 1 \times 10^{-2}$	0	0	0	0	0
	$\geq 1 \times 10^{-3}$	0.1	0.01	0	0	0
	$\geq 1 \times 10^{-4}$	0.4	0.02	0.005	0	0
	$\geq 1 \times 10^{-5}$	0.9	0.09	0.03	0.006	0.0004
	$\geq 1 \times 10^{-6}$	1	0.2	0.05	0.01	0.001
	$< 1 \times 10^{-6}$	0.3	0.2	0.07	0.03	0.002

[a] All risk estimates are rounded to one significant figure. Due to independent rounding, figures given in the table for risk group incidence may not sum to the value given for total incidence.

[b] The estimated number of people exposed to ambient concentrations resulting in predicted individual risk levels above the level shown. Population is cumulative (e.g., at baseline 30,000,000 people are exposed to risks greater than or equal to 1 in 1,000,000).

[c] Risks were calculated on a plant-by-plant basis and summed. Persons exposed to emissions from more than one plant were counted for each plant's impact. The effects of double counting on individual and other risk estimates are discussed in Section V of this notice.

[d] This is the estimated annual number of cases of leukemia for the population exposed to each risk level. It is not cumulative (e.g., at baseline there would be 1 case/yr in the population exposed to risk levels greater than or equal to 1 in 1,000,000 but less than 1 in 100,000)

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Application of Alternative Policy Approaches

The consideration of each of the alternative approaches to decisions on the coke by-product plant source category are summarized in this section. A summary of alternative proposed standards under each approach is included in Section XII.

Approach A. Case-by-Case Approach

Decision on Acceptable Risks. As shown on Table X-1, the estimated risk to an individual exposed to the maximum modeled annual average concentration of about 200 ppb for 70 years is 6 x 10^{-3} at baseline. This risk is above the range generally considered under this approach to be preferred. The estimated annual incidence at baseline is 3 cases/yr; however, about one half of these cases occurs in the large population exposed to predicted lifetime risks in the 10^{-6} range or lower. As noted in Section V, under this approach, incidence estimates at the 10^{-6} and lower risk levels are given less weight because they are generally considered to be small and to have increased uncertainty. In addition, the majority of the estimated incidence (2 out of 3 cases/yr) occurs in the population exposed to risks in the 10^{-5} range and below. This group represents persons who would be exposed to concentrations of less than 4 ppb, which is comparable to average urban background concentrations of about 3 to 6 ppb (see Section IV).

In deciding an acceptable level for coke by-product plants under this approach, the Administrator particularly examined the uncertainties described in Section IV and earlier in this section. The assessment of these factors is summarized here. The overall weight of evidence for benzene carcinogenicity is strong (the URE being based on data from occupational exposure studies). Although the use of alternate dose/response models could produce different URE's for benzene (Docket No. OAQPS 79-3, Part I, Docket Item VIII-A-4), the linear nonthreshold model used by EPA represents the best fit for the available data. The model is judged, however, to be conservative, and, therefore, the URE, as a measure of leukemogenic potency, could be considered to err in favor of the protection of public health. This URE, however, does not include nonleukemia cancer risk because statistical associations with other cancers have been found to date only in animal bioassays.

The dispersion modeling of area sources, such as are found in coke by-product plants, is more uncertain than modeling of stack emission sources. The assumption in the exposure assessment that individuals are exposed continuously to the maximum modeled annual average concentration for 70 years will overestimate the maximum individual lifetime risk for those individuals exposed for significantly less than 70 years. As previously stated, the risk analysis assumes that all existing coke by-product plants operate at full capacity over the modeled 70-year exposure period. It is reasonable to include the cold-idle plants and to assume full capacity when estimating the emissions because they are presently potential sources of emissions; however, this assumption overestimates the actual current emissions. In addition, the decline in the domestic coke market makes it likely that the emission estimate overstates the long-term emissions.

Based on consideration of all the factors concerning exposure, the estimated maximum lifetime risk, and incidence, the Administrator decided under this approach that the estimated baseline benzene emission level from coke by-product recovery plants is acceptable.

Decision on Ample Margin of Safety. For further analysis, the Administrator considered several technical regulatory options. The controls analyzed to determine an ample margin of safety under this approach for each of the many emission points were the same as those analyzed for the June 1984 proposal. For each of these emission sources and controls, the emission reduction, estimated benefits of cocontrol of VOC's, control costs, and the risk reduction were estimated. The controls for individual emission points then were grouped into four regulatory options of varying stringencies for the Administrator's consideration. These options are shown on Table X-2.

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TABLE X-2. CONTROLS INCLUDED IN EACH OPTION

Emission source	Control option/ efficiency (%)		Option 1 furnace	Option 1 foundry	Option 2 furnace	Option 2 foundry	Option 3 furnace	Option 3 foundry	Option 4 furnace	Option 4 foundry
Final cooler, cooling tower; naphthalene processing/handling	Tar-bottom final cooler	(81)						X	X	X
	Wash-oil final cooler	(100)	X	X	X	X	X			
Tar decanter, tar inter-cepting sump, and flushing-liquor circulation tank	Gas blanketing	(98[a])	X	X	X	X	X	X	X	X
Tar storage and tar-dewatering tanks	Gas blanketing	(98)	X	X	X	X	X	X		
Light-oil condenser, light-oil decanter, wash-oil decanter, and wash-oil circulation tanks	Wash-oil scrubber	(90)								
	Gas blanketing	(98)	X	X	X	X	X	X	X	
Excess ammonia-liquor storage tank	Wash-oil scrubber	(90)								
	Gas blanketing	(98)	X	X	X					
Light-oil and BTX storage tanks	Wash-oil scrubber	(90)								
	Gas blanketing	(98)	X	X	X					
Benzene storage tanks	Wash-oil scrubber	(90)								
	N_2 gas blanketing	(98)	X	X	X					
Light-oil sump	Cover	(98)	X	X	X	X	X	X	X	
Pumps	Quarterly inspections	(71)								
	Monthly inspections	(83)			X	X	X	X	X	X
	Dual mechanical seals	(100)	X	X						
Valves	Quarterly inspections	(63)								
	Monthly inspections	(73)			X	X	X	X	X	X
	Sealed-bellows valves	(100)	X	X						
Exhausters	Quarterly inspections	(55)			X	X	X	X	X	X
	Monthly inspections	(64)								
	Degassing reservoir vents	(100)	X	X						
Pressure-relief devices	Quarterly inspections	(44)								
	Monthly inspections	(52)								
	Rupture disc system	(100)	X	X	X	X	X	X	X	X
Sampling connection systems	Closed-purge sampling	(100)	X	X	X	X	X	X	X	X
Open-ended lines	Cap or plug	(100)	X	X	X	X	X	X	X	X
Napthalene processing/ handling[b]	Mixer-settler	(100)	X	X	X	X	X	X	X	X

a 95-percent efficiency for tar decanter.

b The mixer-settler control option for naphthalene processing and handling is shown separately to address a comment on new indirect cooling technology that would not necessarily control naphthalene processing emissions.

Option 1 would require the most stringent controls available on all emission points that were analyzed at furnace and foundry plants. To achieve greater public health risk reduction than estimated for Option 1 may cause the closure of many plants. Options 2, 3, and 4 would require decreasingly stringent controls and would control fewer emission points than Option 1. Many factors were considered in grouping the controls into options. They included benzene emission and leukemia incidence reductions, costs, and, to a lesser extent, the emission reduction of total VOC. In general, the least cost-effective controls were deleted first when departing from Option 1 to develop Options 2 through 4. Also, in constructing Options 2 through 4, the Agency was consistent with the promulgated rules for equipment leaks of benzene and volatile hazardous air pollutants (40 CFR Part 61, Subparts J and V) in cases where the sources in coke by-product plants were similar and could be controlled for similar costs.

The estimated impacts of each of the four options are shown in Table X-3 below. These include the emission reduction, anticipated cocontrol of VOC, annual control cost, cost per Mg of emission reduction, the residual incidence, the population at individual risk of 1×10^{-4} and greater, and the maximum individual lifetime risk. The EPA also anticipates that there may be unquantified reductions in coemitted pollutants with potentially adverse health effects.

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TABLE X-3. IMPACTS OF OPTIONS FOR COKE BY-PRODUCT RECOVERY PLANTS

Option[a]	Annual Cost ($MM/yr) 1984[b]	Emission Reduction (10^3 Mg/yr) Bz/VOC[c]	Average[d] $/Mg Bz/VOC	Incremental[d] $/Mg Bz/VOC	Population Left at Risk $>1 \times 10^{-4}$	Residual[e] Incidence (Percent Reduction)	Maximum Individual Lifetime Risk (MIR)[e]
Option 1 (30)	29	25/169	1,100/200	36,000/25,000	200	0.05 (98)	2×10^{-4}
Option 2 (27,6LS)	21	25/169	800/100	5,100/ 1,300	300	0 08 (97)	2×10^{-4}
Option 3 (24,7LS)	16	24/165	700/100	4,300/ 200	2,000	0 2 (93)	4×10^{-4}
Option 4 (20,8LS)	1	21/101	50/ 10	50/ 10	11,000	0 5 (81)	1×10^{-3}
Baseline	0	0/0[f]	0/ 0	0/ 0	141,000	3(0)	6×10^{-3}

[a] The () shows (number of sources controlled, number of sources with less stringent control than Option 1).

[b] $MM is millions of dollars. The dollar year is 1984.

[c] Bz = benzene, VOC = volatile organic compounds.

[d] "Average" means compared to baseline. "Incremental" numbers compare each option with next less stringent option. They are not the same as the highest incremental value per source type.

[e] Risk estimates are rounded to one significant figure. Note that the total incidence is primarily affected by the large population that is at low risk. For example, at baseline, 2 out of 3 cases/yr occur among the population in the risk level of 1 in 100,000 or less. These risks are associated with exposure to concentrations of less than 4 ppb Average urban ambient (background) concentrations are around 3 ppb.

[f] Baseline emissions are 26,000 Mg/yr of benzene and 171,000 Mg/yr of VOC (including benzene)

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After consideration of the risk characterization, the factors noted above, and the economic impacts, the Administrator decided that under Approach A, Option 3 provides an ample margin of safety. The Administrator's reasons are described below.

Option 3 controls 24 of the 30 emission points; 17 of the 24 emission points are controlled to the maximum feasible control level. It differs from the proposed rule (49 FR 23522, June 6, 1984) for only a few types of emission points. More stringent control would be required for final cooler emissions at furnace plants than proposed originally. The 1984 proposal would have required zero emissions from naphthalene processing for both furnace and foundry plants, based on the use of a tar-bottom final cooler. Under Option 3, a tar-bottom cooler is still the basis for naphthalene processing for foundry plants. For furnace plants, Option 3 would require zero emissions from the final cooler and cooling tower, as well as from naphthalene processing, based on the use of a wash-oil final cooler. No controls would be required for storage tanks for excess ammonia-liquor, benzene, light oil, or BTX mixtures at either furnace or foundry plants. These tanks represent only 3 percent of the baseline benzene emissions from coke by-product plants, and the health risks are comparably small. The originally proposed standard would have required 90-percent control of these storage tanks. With the revised cost estimates, the 90-percent control level generally was more costly for these storage tanks than the gas blanketing control level rejected at proposal. For all other sources, Option 3 is the same as the 1984 proposed standard.

Many factors were considered in selecting Option 3 as the ample margin of safety under this approach. With these controls, the estimated maximum individual lifetime risk is reduced to 4×10^{-4} from the baseline level of 6×10^{-3} (a 93 percent reduction). The population estimated to be exposed to risk in the 10^{-4} range is reduced from about 100,000 to about 2,000 after implementation of Option 3. This option also reduces the estimated incidence from about 3 cases/yr at baseline to about 0.2 case/yr, a reduction of 93 percent. Of the remaining 0.2 case/yr, only 0.03 case/yr is associated with the population exposed to risks of 10^{-5} and higher.

Under Option 3, estimated nationwide benzene emissions would be reduced to approximately 2,000 Mg/yr from the baseline level of 26,000 Mg/yr. Also, estimated VOC emissions from coke by-product plants would be reduced to about 6,000 Mg/yr—a substantial reduction from the baseline level of about 171,000 Mg/yr. Because 80 percent of the plants are in ozone nonattainment areas, this reduction is expected to have a favorable impact in helping affected States meet ozone standards in State implementation plans.

The nationwide annual costs of Option 3 (estimated at $16 million/yr in 1984 dollars) are considered reasonable, particularly when compared to both public health risk reductions and VOC emission reduction benefits. As discussed in Chapter 8 of the Revised Proposal BID, the increase incurred in the price of furnace and foundry coke as a result of this option is estimated to be small, less than 1 percent. The EPA's economic analysis indicates that at baseline, several plants may have marginal costs of operation greater than the price of coke. The analysis predicts that implementation of this option may add one more plant to this group. However, a company decision to actually close a plant would be based on a number of factors that the economic model does not consider, including: The premium a plant is willing to pay for a secure, captive coke supply; requirements for a particular coke quality; age of the batteries, foundry, or steel mill; continued access to profits from steel production; and management's perception regarding their future costs and revenues. The Agency recognizes that implementation of this option could be the factor that would trigger closure decisions at plants that are presently marginal or operating at a loss. The EPA's economic analysis also examined the revised capital costs of control, as discussed in Appendix C of the Revised Proposal BID. The Agency judges that the estimated capital costs are not unduly burdensome when compared with normal annual investment expenditures or cash flow for companies for which data are available.

The Administrator also considered a more stringent option for the ample margin of safety under Approach A. This option would have required both furnace and foundry coke plants to meet a zero emission limit for the final cooler, cooling tower, and naphthalene processing, based on the use of a wash-oil final cooler. Also, this option would have established a standard for storage tanks containing excess ammonia-liquor, light oil, BTX, or benzene at furnace plants, based on the 98-percent control afforded by gas-blanketing systems. This more stringent level of control would decrease emissions by only about 1,000 Mg/yr of benzene and 4,000 Mg/yr of VOC more than Option 3. The estimated maximum individual lifetime risk would be reduced from about 4×10^{-4} to about 2×10^{-4}, and about 300 persons would be exposed to a risk of greater than 1×10^{-4}. The nationwide annual incidence would be reduced by an estimated 0.1 case/yr. However, most (about 80 percent) of this estimated reduction occurs in the population exposed to risks in the 10^{-6} range or lower. Annual costs would be increased by about $5 million/yr. The Administrator decided under this approach that this more restrictive option is not warranted considering the small risk reductions achieved, the small additional VOC reductions, and the greater control costs compared to Option 3.

A less stringent level of control also was considered. Under this option, both furnace and foundry producers would be required to meet a zero emission limit for naphthalene processing, but not for final coolers and final-cooler cooling towers; this would be based on the use of tar-bottom final coolers. No standard for storage of excess ammonia-liquor, light oil, BTX, or benzene would be included for furnace or foundry plants. Also, there would be no required control of tar storage (including dewatering) tanks at furnace or foundry plants. For foundry plants, there would be no standard for control of light-oil condensers, light-oil decanters, wash-oil decanters, wash-oil circulation tanks and light-oil sumps. Selection of this option would have reduced benzene emissions by about 80 percent from the baseline level (a reduction of about 3,000 Mg/yr less than the selected control level), and VOC emissions would have been reduced only by about 60 percent. This VOC emission reduction would be about 64,000 Mg/yr less than would be achieved by the higher level of control. This is particularly significant because 80 percent of the plants are in nonattainment areas where further reductions are needed.

As a result of these greater emissions, the estimated annual incidence within the exposed population would have been about 0.3 case/year more than under the more stringent level of control. These emissions also would result in a shift in the distribution of the population towards more people at higher risks. For example, approximately 11,000 persons would have been exposed to a risk level in the 10^{-4} range or higher. This reflects an increase of about 9,000 more persons in the 10^{-4} range than under Option 3.

The estimated maximum individual lifetime risk remaining after implementation of a standard based on this less stringent option would have been 1×10^{-3}. The nationwide annual costs would be reasonable (about $1 million/yr). Considering the residual benzene and VOC emissions and risk associated with this option and the availability of more stringent controls at reasonable costs, the Agency decided under this approach that this option would not provide an ample margin of safety for the public health.

Approach B. Incidence-Based Approach

Decision on Acceptable Risk. As shown in Table X-1, the total leukemia incidence at baseline for the modeled population of 90,000,000 persons exposed to benzene emissions from coke by-product plants is about 3 cases/yr. Under the criterion of this approach (i.e., 1 case/yr), the Agency would decide that the baseline emission level is not acceptable, and EPA would propose standards to reduce the estimated incidence to 1 case/yr or less.

Decision on Ample Margin of Safety. The Administrator considered the technical regulatory options shown in Table X-2 for supplemental control to ensure protection of the public health with an ample margin of safety. As shown in Table X-3, the residual incidence under each of the options considered would be less than 1 case/yr. Therefore, all of the technical regulatory options would be considered acceptable. After consideration of the risk characterization, the information shown in Tables X-1 and X-3, and the economic impacts, the Administrator decided that under this approach, Option 3 would best protect the public health with an ample margin of safety. The basis for this conclusion is summarized below, and described more fully under Approach A.

As previously discussed, Option 3 differs from the 1984 proposal for only a few emission points (e.g., more stringent control for final cooler emissions at furnace plants and no control of benzene, excess amonia-liquor, BTX mixtures, or light-oil storage tanks). Option 3 would reduce the estimated maximum individual lifetime risk from 6×10^{-3} at baseline to 4×10^{-4}, and the estimated incidence from about 3 cases/yr at baseline to about 0.2 case/yr. These represent 93-percent reductions from both risk measures. Of the remaining 0.2 case/yr, only 0.03 case/yr is associated with the population exposed to risks of 1×10^{-5} and higher. As discussed earlier, these estimates of risk are based on emission estimates that are likely to be overestimated. Therefore, Option 3 would meet the criterion for acceptable risk of this approach (no more than 1 case/yr) and also would provide an ample margin of safety. Other emission, risk, cost, and economic considerations are discussed above under Approach A.

The Administrator considered a more stringent level of control which would reduce annual incidence by an additional 0.1 case/yr. However, as previously discussed, about 80 percent of this estimated reduction would occur in the population exposed to risks in the 10^{-6} range or lower. For the same reasons as discussed under Approach A, the Administrator concluded that controls more restrictive than Option 3 are not warranted considering the small risk reduction achieved, the small additional VOC reduction, and the greater control costs. The Administrator also considered a less restrictive control level which would allow about 0.3 case/yr more than Option 3. However, about 11,000 persons would have been exposed to a risk level in the 10^{-4} range or higher—an increase of about 9,000 more persons than under Option 3. The maximum individual lifetime risk after control would be reduced from 6×10^{-3} to about 1×10^{-3}. Considering the residual incidence and risk associated with this option and the availability of controls at reasonable costs, the Administrator decided that under this approach, this option would not provide an ample margin of safety to protect the public health.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. As shown on Table X-1, the maximum individual lifetime risk at baseline is 6×10^{-3}, which clearly exceeds 1×10^{-4}, and hence would not be considered acceptable under Approach C. Therefore, under this approach, EPA would propose standards to reduce the maximum individual lifetime risk to no more than 1×10^{-4}.

Decision on Ample Margin of Safety. To ensure that no facility has risks exceeding 1×10^{-4}, emission reductions beyond Option 1 would be required (see Table X-3). As previously discussed in Section VII under Approach D, an emission limit approach has been selected to specify this necessary control. Comments are requested on the emission limit approach to achieving the risk target as well as on the risk target approach itself.

Based on EPA's risk analysis, a plantwide benzene emission limit of 34 kg/day (or 12.5 Mg/yr) applicable to the total of all emission points identified in Table X-2 would ensure than no facility has risks exceeding 1×10^{-4}. This limit was derived by identifying the plant with the highest risk per unit of benzene emissions and then applying that ratio to determine the emissions that correspond to a risk of 10^{-4}.

Different facilities would have to do different things to meet the emission limit of 34 kg/day. Some facilities would have to reduce emissions further than the most stringent technology option, but others would apply substantially less control, and in a few cases, no control. To ensure protection of the public health with an ample margin of safety, EPA also considered additional control requirements for plants able to comply with the emission limit with little or no control. The controls considered were those presented previously in Table X-2. For the same reasons discussed under Approach A, EPA selected Option 3 as the minimum control requirement for all facilities.

Implementation of this plantwide emission limit combined with the minimum control level of Option 3 would reduce nationwide benzene emissions from coke by-product plants from 26,000 Mg/yr at baseline to about 840 Mg/yr; nationwide VOC emissions would be reduced from about 171,000 Mg/yr to about 1,900 Mg/yr. Estimated annual incidence would be reduced from about 3 cases/yr to about 0.07 case/yr. The estimated maximum individual lifetime risk would not exceed 1×10^{-4}, and most of the exposed population would have much lower risk. Therefore, under the criterion of Approach C, the Administrator would consider that these combined requirements provide an ample margin of safety.

Based on the 1984 data and on the assumptions in the analyses, EPA estimates that 9 of the 44 plants would achieve the emission limit by applying Option 3, 5 plants could achieve it by applying Option 2, and 18 plants could achieve it by applying the maximum feasible controls in Option 1. In addition, the Agency estimates that 12 plants would not be able to meet the emission limit even with the most stringent technology option. Of these 12 plants, the Agency estimates that 8 plants may be able to comply by permanently reducing production by an amount that may not be large enough to trigger closure decisions (e.g., by roughly 40 percent or less). This is based on EPA's emission estimates, which are generally proportional to coke production. The cost of applying the technology to these 40 plants is estimated to be $26 million/yr. The cost of lost production could not be estimated at this time. The EPA estimates that the remaining 4 plants would need to permanently reduce production by roughly 60 percent or more in order to comply. Although EPA has not conducted an economic analysis of this particular approach, the Agency believes that it is likely that this reduction would trigger closure decisions. These 4 plants account for 30 percent of the domestic cokemaking capacity. Including the 8 plants that may be able to comply by reducing production, the total cokemaking production loss under Approach C could be about 40 percent.

The potential economic impacts of closures could include increased unemployment in the affected geographic areas and the health risk associated with long-term unemployment. Based on information on the by-product cokemaking industry prepared after the 1984 proposal, about 7,000 people were employed. Of these 7,000 jobs, roughly 3,000 could be lost with a 40 percent production reduction (assuming employment is reduced in the same proportion as production capacity). In addition to these job losses, other job losses in industries supplying the cokemaking industry could be expected, such as in coal mining, transportation, and with equipment suppliers. The impacts could also include loss of tax revenue from the closed facilities, coke price increases, and substantially greater dependence on imported coke to replace the lost production.

There are two processes that may offer some long-term prospect of replacing conventional by-product cokemaking and, in doing so, eliminate the need for by-product recovery plants. These processes are the manufacture of formcoke (coke briquettes) and direct reduced ironmaking (DRI), which is an ironmaking process requiring no coke. Neither of these processes could be feasible alternatives in the maximum period of 2 years that a source has to comply with a NESHAP; they only may be potential alternatives over the long term.

Formcoking is the general name applied to a number of processes that convert coal into shaped coke pieces in closed process vessels. Formcoking is expected to create less air pollution than conventional by-product cokemaking; wastewater impacts are unknown. However, a complete assessment of any of the processes to confirm the anticipated environmental and health benefits has not been made.

The use of formcoke in a blast furnace as a complete replacement for furnace coke has never been demonstrated and the steel industry is concerned that the mechanical strength of the formcoke may not be adequate for this use. Yet, in order to generate enough fuel to conduct a valid blast-furnace trial, a large formcoke plant would have to be built and formcoke produced for an extensive period of time. Due to these uncertainties, steel firms are reluctant to invest in such a plant without financial assistance. Two steel industry proposals in the early 1980's requested the federal government to invest several hundred million dollars to assist in the design and construction (and assume some risk) of a large formcoke facility that would allow an adequate demonstration of the product coke suitability, and potential environmental and energy-saving benefits. This funding was not provided. Also, successful completion of full-scale blast furnace trials would not necessarily mean formcoke could replace all conventionally made coke. A similar experimental program might be necessary to confirm that foundry coke could likewise be replaced.

The direct reduction of iron ore is an alternative to the production of iron for steelmaking by blast furnaces that use coke for fuel. Since the product of direct reduction is solid iron, it is most suitable for use in combination with electric arc furnace steelmaking by replacing a portion of the scrap charge. None of the reductant processes involve the generation and recovery of benzene or benzene-containing by-products. The different types of reductant processes vary in whether or not polynuclear aromatic hydrocarbons (other potential air pollutants) are formed; afterburners and control devices could potentially limit their emissions. No complete environmental assessment of any reductant processes has been made, however, and it is unknown whether the risks of nonbenzene pollutants would be able to achieve the acceptable criterion of this approach.

There are many more full-scale DRI plants in operation worldwide than formcoke facilities. However, the extensive use of DRI in the U.S. would mean almost complete restructuring of the iron and steel industry away from basic oxygen furnaces to electric arc furnaces. This would necessitate the write-off of existing capital equipment (including blast furnaces and basic oxygen furnaces) and investment in new capital equipment. Substantial cost and economic impacts would result from this.

Approach D. 1 x 10^{-6} or Less Maximum Individual Risk Approach

Decision on Acceptable Risk. As shown on Table X–1, the maximum individual lifetime risk at baseline is 6 x 10^{-3}, which clearly exceeds 1 x 10^{-6}, and would not be considered acceptable under this Approach D. Therefore, under this approach, EPA would propose standards to reduce the maximum individual lifetime risk to no more than 1 x 10^{-6}.

Decision on Ample Margin of Safety. To ensure that no facility has risks exceeding 1 x 10^{-6}, emission reductions beyond Option 1 would be required (see Table X–3). An emission limit was developed to specify the 1 x 10^{-6} control level for the same reasons the emission limit format was selected under Approach C. At the 1 x 10^{-6} level, the plantwide emission limit would be 0.34 kg/day (125 kg/yr) for the facility, including all the emission points identified in Table X–2. This limit was derived the same way as the limit was derived under Option C. Assuming that facilities might be able to achieve compliance without closing, this emission limit would reduce benzene and VOC emissions to approximately 5.5 Mg/yr and 12.7 Mg/yr, total leukemia incidence to 0.004 cases/yr, and maximum individual lifetime risk to 1 x 10^{-6}. Most of the exposed population would be at a much lower risk.

As discussed under Approach C, the potential for development of new technology within the next 2 years is doubtful. Achievement of the emission limit without substantial production reductions is unlikely. The EPA estimates that most plants would have to reduce production permanently by 95 percent or more (and all plants by 75 percent or more) as well as applying the controls of Options 1 in order to achieve the emission limit. As discussed in Approach C, these estimates were derived using EPA's emission estimates, which are generally proportional to coke production. The magnitude of these cutbacks would likely cause closure of all plants, thus reducing the emissions and risks from coke by-product recovery plants to zero. The EPA judges that this emission limit would protect the public health with an ample margin of safety.

The EPA can not at present estimate the cost or economic impacts associated with the 0.34 kg/day limit. However, the economic impacts would be severe. Adverse impacts could include increased unemployment in the affected geographical areas and the health risk impacts associated with long-term unemployment in a community, loss of tax revenue, price increases, total dependence on imported coke or a total change in the steelmaking process, and potential trade deficits. Based on employment information discussed under Approach C, closure of all facilities will result in about 7,000 job losses. In addition to these job losses, other job losses in industries supplying the cokemaking industry could be expected, such as in coal mining, transportation, and with equipment suppliers.

XI. Summary of Major Comments and Responses on 1984 Proposed Standard for Coke By-Product Recovery Plants

The EPA received 20 comment letters on the national emission standards for coke by-product recovery plants originally proposed on June 6, 1984. These comments are available for review in Docket A-79-16. The comments are grouped by topics that include: (1) Safety, operation, and demonstration of emission control technology; (2) impact analyses; and (3) general comments. The following is a summary of EPA's responses to these comments; detailed responses are included in the Revised Proposal BID (EPA-450/3-83-016b).

Safety, Operation, and Demonstration of Emission Control Technology

Comment: Six commenters recommended that gas-blanketing systems, although appropriate and cost effective for some plants, should not be required at all sites because of safety, design, and operational concerns. Some commenters stated that, without redesign of process operations and installation of new equipment, the safety of gas-blanketing systems is in question because leaks from older pieces of equipment present a potential fire or explosive hazard. One of these commenters submitted a qualitative comparative study of the safety of gas blanketing for one of their plants. The report concluded that gas blanketing would involve a significant increase in risk to operating personnel and the surrounding community. Other commenters argued that the presence of electrical equipment and vehicular traffic may present a hazard. Naphthalene clogging in cold climates if power for heated lines were lost also was cited. Four commenters claimed that gas-blanketing controls have not been well-demonstrated. In support, two of these commenters cited closure of one plant that had gas blanketing.

Response: The EPA disagrees with these commenters. Gas-blanketing systems have been demonstrated as safe and effective at a total of five plant sites over a combined operating period of more than 24 years. The closure of one plant has no effect on the successful use of gas blanketing at this site for the 4-year period prior to closure. As discussed in the Proposal BID and in the Revised Proposal BID, gas-blanketing systems currently are in use at four other plant sites.

The safety of recommended control systems should always be considered, and a system considered inherently unsafe would not be selected by EPA as the potential basis of a standard. In direct contradiction to the commenters' statements, EPA considers that well-designed, well-operated, and well-maintained gas-blanketing systems will improve the safety level now found in uncontrolled by-product plants. A detailed response to these concerns is provided in Chapter 5 of the Revised Proposal BID. The Agency's reasons for concluding that gas blanketing will actually improve current safety conditions are summarized below.

One commenter contends that "the low positive pressure of the proposed system is insufficient to alleviate explosive conditions if leaks occur." The standard that would be proposed under Approaches A, B, and C do not dictate an overall pressure level for system operation. The system installed may be positive or negative pressure or a combination of the two. The pressure maintained will vary by necessity according to the type of source and location of the connections to the system (i.e., at the main or the gas holder) and overall process design.

If leaks in the system occur or the positive pressure blanket fails, the possibility of an explosive atmosphere forming is no greater than the possibility under current plant conditions. At most uncontrolled plant sites, explosive conditions are present. Liquid organics float on the surface of open sumps and trenches, and they leak from equipment components and piping systems throughout the plant. Organic vapors also are released from "breathing" tanks as air enters venting systems or holes in the covers. In EPA's judgment, enclosing these sources and ducting the emissions back to the process via a closed positive pressure gas-blanketing system will reduce substantially the explosive hazard that now exists. The Agency does recognize that some sources at existing plants may be in poor condition and require upgrading to accept gas blanketing. The necessary modifications for typical plants, however, have been reflected in the cost estimates.

The EPA reviewed a commenter's submittal of a qualitative assessment of his plant to support the contention that gas blanketing would involve a significant increase in risk to operating personnel and the surrounding community. However, EPA does not believe that such a conclusion can be drawn from the assessment for several reasons. First, the assessment is qualitative; it does not draw quantitative conclusions as to the frequency of a major failure. In the hazard assessment, probability ratings were assigned to various hazards within the plant for present uncontrolled conditions and gas blanketing with various blanketing gases. For example, for explosion potential under current plant conditions, they assigned a probability rating of "D" which means "likely to occur 1 time every 10 years." With coke gas blanketing, the explosion potential was reduced to "C" which means "likely to occur every 100 years." However, with gas blanketing, higher ratings were assigned to the potential for explosion propagation, on-site safety, and financial loss. These types of ratings were assigned to various plant operations and to various control scenarios. The results were weighted and combined to provide a relative qualitative rating that may be used by the firm in evaluating options in terms of economic and safety. However, EPA does not believe the commenter's contention based on the report is warranted for the following reasons: (1) The report did not utilize a gas-blanketing design for the plant on which to base a quantitative comparison; without a specific design, it is not possible to evaluate safety features that could be engineered into the system, (2) the assessment was based on a review of the existing conditions in the plant, without consideration of the substantial upgrading of the process vessels that would be necessary to accommodate installation of a gas-blanketing system, and (3) the report did not provide any basis or criteria for assigning the probability ratings or consequence categories that are reported. After reviewing the assessment, EPA remains convinced that the upgrading of equipment needed to accommodate gas blanketing, together with the installation of the well-designed control system, will improve existing safety conditions at the sites.

The Agency's review of the safety aspects of gas blanketing does not support the contention of some commenters that the presence of electrical equipment and vehicular traffic in gas-blanketed areas aggravates the potential explosive danger. Hydrogen and methane are the major components of coke oven gas, accounting for 69 to 97 percent of the emission stream. According to National Fire Code (NFC) guidelines, these lighter-than-air gases seldom produce hazardous mixtures (i.e., presenting a fire or explosive danger) in the zones where most electrical connections are made. If special equipment is required, it should already be in place at plants where the NFC or plant safety codes have required its installation. In addition, the NFC guidelines state that, in the experience of the code's authors, it generally has not been necessary to classify as hazardous "locations that are adequately ventilated where flammable substances are contained in suitable, well-maintained, closed piping systems which include only the pipes, valves, fittings, flanges, and meters."

Prior to proposal of the standard in 1984, EPA thoroughly evaluated the safety aspects of gas-blanketing systems. This review included visits to five plant sites where safety and operational problems were discussed with plant personnel. No safety or operational concerns were reported that routine minimal maintenance would not resolve. Since the 1984 proposal additional safety features such as water drains and overflow connections for tar tanks and liquid level sampling/gauging instrumentation with vapor-tight seals also have been added to the cost. Assuming each system is properly operated and maintained after installation, EPA considers that the positive pressure system is a safe and effective control technique and that leaks (if repaired as required) do not present the fire or explosive danger described by the commenters.

The EPA agrees that loss of power for heated lines could cause naphthalene clogging in cold climates. Unless a backup power supply is available for the entire plant, EPA assumes that such a power loss would affect most plant operations and probably would result in a shutdown until power was restored. The EPA is aware if no other reasonable approach for overcoming the effects of cold climates.

Comment: Five commenters believe that negative pressure gas-blanketing systems present a fire or explosive danger because of air infiltration from ineffective sealing of older vessels, operator error, or equipment failure. One commenter also stated that additional monitoring controls are necessary to monitor the explosive hazard, in addition to measures such as automatic nitrogen dilution or enrichment with natural gas to keep the coke oven gas mixture below the lower explosive limit or above the upper explosive limit.

Response: The standard that would be proposed under Approaches A, B, and C (and associated cost) is based on the use of a positive pressure system because comments made by the industry before the 1984 proposal questioned the safety of the negative pressure system recommended initially. Although the use of a negative pressure system is not precluded, EPA encourages companies to install safety and monitoring equipment as necessary in accordance with their historical safety policies and the system's characteristics. The EPA does recommend, however, that firms install the equipment included in the costs for the positive pressure system intended to alleviate many of the operating concerns cited by the commenters. Recommendations for specific equipment and their application are discussed further in the Revised Proposal BID. Regarding the potential danger from equipment failure, EPA considers that a failure of a negative pressure system under the scenario suggested by the commenters presents no more danger than similar situations encountered in the current uncontrolled plant environment.

Comment: Two commenters are concerned that overpressurization of a positive pressure system poses an explosive and occupational hazard because of the carbon monoxide (CO) released. One commenter stated that the presence of CO increases costs for additional monitoring and employee training because CO hazards do not exist currently. Similarly, another commenter believes that additional employees would be necessary for monitoring for explosive conditions or that hydrocarbon detection monitoring should be required on each piece of gas-blanketed equipment.

Response: Coke plant operators have stated that pressure control in the collecting main and gas holder is inherently reliable because large pressure fluctuations can cause serious operating and safety difficulties in battery and plant operation. Collecting-main pressure is controlled by an Askania valve at a few millimeters of water pressure, and the pressure is often watched and adjusted manually if necessary. Similarly, the pressure in the gas holder also is carefully controlled. Overpressurization is prevented by bleeder or pressure relief valves and water seals.

A CO hazard from coke oven gas would not be unique to blanketed vessels. The coke oven gas in handled is many parts of the coke and steel plants. If all of these locations are subject to the stated monitoring by the company, then consistent application of the policy would dictate monitoring of CO and explosive conditions for gas-blanketed vessels. Although the regulation includes costs for semiannual inspections for leaks, no costs are included for monitoring CO or explosive conditions because the existing systems did not have such provisions. Therefore, the monitoring questions on CO and explosive conditions appear to be those of company policy and site-specific conditions.

Comment: Two commenters believe that covering and sealing sumps create a fire or explosive hazard from concentrated fumes because no gas or steam can be used for purging.

Response: Steam purging strips organic compounds from the sump and can be especially efficient at removing volatile compounds such as benzene. Most sumps are installed below grade; consequently, workers and others in the plant can be exposed to high concentrations of these organic compounds at ground level, especially with a purge gas. The current practice of discharging tramp steam to an open sump already poses a hazard if concentrations are high enough to be explosive. Also, the steam purging may create the movement of explosive vapor from the sump to ground level if a surge or slug of organic material enters the sump during purging. An air-tight seal and a vent to the atmosphere are included in the sump cover costs for safety considerations. The operator also may choose other measures to increase safety, such as including a flame arrestor on the vent, installing explosive condition detectors, or replacing the sump with an above-grade closed tank. The solution to the commenters' question will depend on the site's specific conditions and the company's policy.

Comment: Several comments were received that related to the selection of controls for naphthalene processing and final coolers. Environmental groups and State agencies pointed to the significant emissions and risk reduction achievable with more stringent control of the final cooler. Comments from foundry coke producers on emission estimates and from the industry on costs, which are discussed in more detail in other sections of the preamble, influenced the analysis of the impacts of the controls for naphthalene processing and final coolers. Also, the industry commenters submitted plans for final coolers using indirect cooling technology that they believed to be more effective than tar-bottom final coolers and less expensive.

Response: In response to comments received on the 1984 proposal, EPA analyzed the impacts of control alternatives separately for furnace and foundry plants. Also, the costs for both tar-bottom and wash-oil final coolers were revised based on industry's comments. The revised costs for tar-bottom final coolers were higher than proposed; those for wash-oil final coolers were lower. The revised cost analysis is discussed in Appendix B of the Revised Proposal BID responding to comments on the 1984 proposal.

One of the major reasons that wash-oil final coolers were not selected as the basis of the original proposed standard is that an analysis of the capital costs for a wash-oil final cooler compared to annual net income and investment indicated a potential for an unreasonably adverse economic impact on some firms. The EPA reanalyzed the economic impact of a regulatory option that is slightly more stringent than the revised standard proposed under Approaches A and B and that included wash-oil final coolers. The Agency concluded from the new analysis (Appendix C of the Revised Proposal BID) that the capital costs were not unreasonable when compared with normal annual investment expenditures or cash flow.

The Agency used the revised impacts of both wash-oil final coolers and tar-bottom final coolers when grouping the controls into the regulatory options considered by the Administrator. The selection of the regulatory option under Approaches A, B, and C that includes wash-oil final coolers at furnace plants is explained in Section X of this preamble.

Two industry commenters submitted plans for final coolers using indirect cooling technology that they believed to be more effective than tar-bottom final coolers and less expensive. In addition, an engineering firm that designs emission control systems for by-product plants provided information about certain alternative indirect cooling schemes. As discussed in Chapter 5 of the Revised Proposal BID, EPA based its reconsideration on evaluations of the tar-bottom and wash-oil final coolers because they are installed at several plants and EPA had more reliable design and cost information on them. However, the commenters' technologies could be used if they would achieve the zero emission limit included in the revised proposed standard for naphthalene processing, the final cooler, and associated final-cooler cooling tower at furnace plants or the zero emission limit for naphthalene processing at foundry plants.

One of the commenter's designs eliminated emissions from the final-cooler cooling tower, but provided only partial control of the naphthalene processing operations. Based on EPA's analysis of wash-oil final coolers at furnace plants, EPA concluded that complete control of both the final cooler and naphthalene processing is reasonable. In addition, EPA concluded that control of naphthalene processing alone, based on the use of a tar mixer-settler, is reasonable for foundry plants. Therefore, the design for indirect final cooling could be used to achieve the standard proposed for furnace or foundry plants under Approaches A, B, and C only if it included complete control of naphthalene processing emissions.

Implementation of a wash-oil final cooler, in which the naphthalene is absorbed in wash oil, eliminates the emissions that result from the practice of separating naphthalene from the hot well of a direct-water final cooler. Therefore, the zero emission limit for naphthalene processing that was proposed in 1984 still is appropriate for the revised standard proposed under Approaches A, B, and C for naphthalene processing at furnace and foundry plants. The wash-oil final cooler (or a similar indirect cooling scheme) also would eliminate emissions from the final cooler and associated cooling tower. Consequently, a zero emission limit for the final cooler and final-cooler cooling tower at furnace plants (as well as for naphthalene processing) was selected for the revised standard that would be proposed under Approaches A, B, and C. Wash-oil decanters and wash-oil circulation tanks are associated with wash-oil final-cooler designs. As described in the 1984 proposed standard and in today's proposal, these would be subject to the same gas-blanketing requirements as wash-oil decanters and wash-oil circulation tanks occurring in the light-oil recovery operation.

Under Approaches A, B, and C, if an owner or operator chose to meet the zero emission limit with an indirect cooling scheme in which the naphthalene is absorbed in tar or another medium (such as flushing liquor), then the vessel in which absorption takes place (e.g., the tar mixer-settler) must be gas blanketed. This is consistent with the standard proposed in 1984.

The use of wash-oil final coolers (or other indirect cooling systems) would reduce emissions of hydrogen cyanide (HCN) to the air, but could increase its concentration in the wastewater. The Agency estimates that about 200 grams (g) of HCN/Mg of coke produced could be added to the wastewaters of a medium-sized plant producing 4,000 Mg of coke/day. This increase is not anticipated to cause problems for compliance with effluent regulations.

No testing or monitoring provisions applicable to wash-oil final coolers are included in the revised proposed standard under Approaches A, B, and C because compliance would be achieved with installation of the appropriate equipment. However, any associated gas-blanketed vessels (e.g., wash-oil decanter and circulation tanks or tar mixer-settlers) would be subject to semiannual inspections for leaks using Method 21 in 40 CFR Part 60. These requirements for gas-blanketed vessels are described in this preamble in Section XII for coke by-product plants.

Compliance with the zero emission limit would be assessed through recordkeeping and reporting requirements. The owner or operator must record and keep in a readily available location a description of the control system used to achieve compliance (e.g., schematics), the installation date, and a description of any changes made after installation. In the initial compliance report required by 40 CFR 61.10, the owner or operator would be required to submit a statement notifying EPA that the provisions of the standard are being implemented. For gas-blanketed vessels associated with the final cooling system, the recordkeeping and reporting requirements for gas-blanketed vessels described in the 1984 proposed standard and in today's revised proposed standard under Approaches A, B, and C would be applied.

Impact Analysis

Comment: Two commenters noted the effect of plant closures and reduced battery capacities.

Response: The interim status of the estimated environmental impacts was acknowledged in the preamble to the proposed standard (49 FR 23524). As stated, the impacts were calculated initially from a data base of 55 plants. Data from the U.S. Department of Energy (DOE) received just before proposal indicated that 13 of the 55 plants had been closed. Information was not available, however, to determine whether all reported closures were permanent. Consequently, the preamble presented impacts based on 42 plants and stated that they would be revised after proposal.

After the June 6, 1984, proposal, the information regarding closures, changes in battery capacities, and changes or corrections in site-specific operating processes was updated to November 1984. These data were supplied by individual companies and by two major industry trade associations—the American Iron and Steel Institute (AISI) and the American Coke and Coal Chemicals Institute (ACCCI). As shown in Appendix A of the Revised Proposal

BID, 44 furnace and foundry plants with a combined operating capacity of 50.9 million Mg/yr of coke are included in the data base for the revised proposed standard. Plants on cold-idle in November 1984 are included in the data base because information is insufficient to determine whether these sites will be closed permanently. If these cold-idle plants were deleted from the data base, the operating capacity would be reduced by about 7 million Mg/yr of coke.

Comment: Five commenters stated that fewer emissions are generated from foundry plants compared to furnace plants because of the use of less volatile coal and longer coking cycles.

Response: In response to public comments received on the emission factors for foundry plants, EPA reviewed available information and data to determine whether separate factors were warranted for furnace and foundry plants. In general, EPA agrees with the commenters' assertions that benzene emissions from a foundry coke plant would be expected to be less than the emissions from a furnace coke plant of similar capacity. Foundry coke is produced from a coal mixture that contains less volatile matter than the mixtures used to produce furnace coke. Data supplied by DOE on light-oil yields show that, over a 4-year period, the light-oil yields at merchant plants (mainly foundry coke producers) averaged about 66 percent of those at furnace plants on a per-ton-of-coal-charged basis. These yields, displayed in Table A-11 of the Revised Proposed BID, represent the principal basis for the techniques used to adjust the emission factors for foundry coke plants.

The EPA also agrees with commenters who suggested that the lower coking temperatures associated with foundry coke production compared to furnace coke production (for the same coal) would lead to production of less by-product benzene. Although one merchant plant commenter indicated that the light-oil from coking contains 55 to 60 percent benzene (compared to the 70 percent assumed in the Proposal BID for furnace and foundry plants), the ACCCI provided an average estimate of 63.5 percent for foundry plants based on an informal poll of member companies. For furnace coke production, however, a light-oil content of 70 percent still is considered appropriate.

Separate emission factors for foundry plant sources were developed by applying correction factors to the emission rates initially proposed for furnace and foundry plants; computations of correction factors and the final emission factors are shown in Appendix A of the Revised Proposal BID.

Comment: The Agency received four comments that the risks were overestimated because of: (1) Inclusion of the epidemiologic study by Ott et al. in developing the URE, (2) use of a conservative, linear nonthreshold model for dose/response, and (3) application of conservative assumptions in the HEM, such as assuming exposure for 24 hours/day for 365 days/year over a 70-year lifetime. One commenter felt that the risks were underestimated because the analyses did not reflect updated epidemiological studies that would increase the URE. Also, if EPA had used the ISC model rather than the HEM, the estimated maximum individual lifetime risk would have been higher.

Response: The EPA has responded to comments on the benzene URE on several occasions (see "Response to Public Comments on EPA's Listing of Benzene under Section 112" (EPA-450/5-82-003) and EPA's response to an NRDC petition for reconsideration of the benzene URE based on the review of new scientific reports on benzene carcinogenicity (50 FR 34144, August 23, 1985)). In response to the NRDC petition, EPA reevaluated the benzene URE in light of current scientific literature. The URE was revised from 0.022 to 0.026/ppm, a 17-percent increase in the URE that was reflected in the estimates of risk that accompanied the 1984 proposal. Also since the time of proposal, EPA has revised the modeling radius from 20 km to 50 km around each plant. This reflects the Agency's judgment that the dispersion model yields reasonable estimates of concentrations out to 50 km. When advocating the ISC over the HEM, the commenter cites in support the estimated uncertainty factor of 2 or 3 discussed for the benzene fugitive emissions rulemaking. Comparisons of ISC and HEM do not always result in the ISC yielding higher concentrations. After comparing the two models for the 1984 benzene fugitive emissions rule, EPA concluded that the use of the ISC results would not change the Agency's decision on the standard. Because of this, the Agency decided this additional analysis for coke by-product plants was not warranted.

The EPA recognizes that the assumption of continuous exposure over a 70-year lifetime likely overestimates the cancer risk for individuals exposed for significantly less than 70 years. The uncertainties in the risk estimates are discussed further in Sections IV and X of this preamble.

Comment: Several commenters argue that the capital costs of the standard are significantly higher than estimated at proposal. Other commenters believe that the value for potential product recovery credits was overstated or that the cost for their particular plant would be higher than the model unit costs at proposal.

Response: The cost impact analysis has been revised since proposal to respond to many of the concerns cited by the commenters. The revised analysis, details of which are included in Chapter 7 and Appendix B of the Revised Proposal BID, indicates nationwide capital costs for Option 3 under Approaches A and B of about $84 million (1984 dollars) compared to $24 million (1982 dollars) estimated at proposal. This revised estimate under Approaches A and B includes the use of wash-oil final coolers at furnace coke plants, which were not included in the original proposal. Of the $84 million, approximately $48.5 million (or 58 percent) is for wash-oil final coolers at furnace plants.

In revising the analysis, EPA conducted a detailed review of the estimates and data supplied by commenters. The EPA also secured the assistance of a design and engineering firm/equipment vendor to assist in the development of revised unit costs. Included in the review was a site visit to a plant to resolve questions regarding equipment locations and source applicability, and to obtain examples of site-specific conditions pertinent to the development of the revised unit cost factors. Included in the revised analysis are higher unit costs for most materials based on data received from commenters in addition to the data developed by the design and engineering firm. Costs also have been added for sealing all sources, installing roofs on certain storage tanks, adding more pipe support, installing pressure/vacuum relief values for sealed sources, and making adjustment for work in hazardous areas requiring special safety precautions.

As stated above, costs for wash-oil final coolers also have been revised since proposal. Based on information supplied by industry, the annualized cost of a wash-oil final cooler is estimated at $872,400/yr for a medium-sized furnace plant producing 4,000 Mg of coke/day. The estimated capital cost for this size plant is $2.7 million. Further information on wash-oil final cooler costs appear in Appendix B of the Revised Proposal BID.

The Agency essentially agrees with the two commenters that the value of potential product recovery credits was overestimated at proposal. The difference in production quantity (reflected in new emission factors for foundry plants) was taken into account in the computation of revised fuel value and light oil recovery credits. Also, the credit for light oil has been decreased from $0.33/kilogram (kg) to $0.27/kg based on DOE information (see Table A-11 of the Revised Proposal BID). The fuel value recovery credit for coke oven gas also was revised from $0.14/kg coke oven gas compared to $0.15/kg estimated at proposal. Credits for recovery of benzene and/or light oil were applied to all plants except those few specifically identified as not being able to benefit from recovery.

The EPA acknowledges that costs for particular plants may be higher or lower than EPA estimates, depending on the site-specific conditions. However, the revised cost analysis addresses the concerns cited by the commenters and the costs are reasonable estimates of the industry-wide cost of controls.

Comment: Commenters from both the furnace and foundry coke segments of the industry state that the economic analysis fails to consider the true condition of the industry at baseline and that the standard will have an adverse effect.

Response: At the time the original analysis for the proposed standard was conducted, the information from published and unpublished sources was current. A reanalysis has been performed since proposal (see Chapter 8 and Appendix C of the Revised Proposal BID) that utilizes data on plants and capacity in existence in November 1984. Financial data and production data used in baseline estimates are from the available published and unpublished sources as of 1984.

The reanalysis also examines the economic impacts of control options in terms of the effects on coke price and production, imports, and employment. These impacts have been examined separately for furnace and foundry producers. Two scenarios were used for foundry producers. Scenario A reflects a constant price in imported coke; Scenario B assumes the maximum effect of import substitution. In all cases, impacts appear to be small. For the standard for foundry plants, under Approach A or B, Scenario A would yield an increase of less than 0.6 percent over baseline for coke prices and production. Under Scenario B, no price impact is estimated; coke production could decrease by about 2 percent from 1984 levels. About a 0.6- and 2-percent decline in employment levels could occur at foundry plants under the Scenario A or B, respectively. For the revised proposed standard for furnace plants proposed under Approach A and B, coke prices could increase by about 0.33 percent from baseline levels, and coke production could decrease by less that 0.5 percent. The level of imported coke could increase by 0.64 percent. Employment levels at furnace coke plants could decrease by less than 0.5 percent as a result of Approach A or B.

The economic analysis also compared the capital costs of compliance to average annual net investment and to the annual cash flow for individual companies. As shown in Appendix C, the capital costs of compliance for the revised regulation proposed under Approaches A and B are up to 5 and 8 percent of the average annual net investments and annual cash flow, respectively, for companies for which data are available.

The revised economic analysis did not include an examination of the emission limits that would be required under Approaches C and D.

General Comments

Comment: One commenter requests that EPA reconsider lowering the definition of an equipment "leak" from 10,000 parts per million volume (ppmv) to 1,000 ppmv or to the highest level at which the EPA can demonstrate, with data, that directed maintenance does not result in net emission reductions.

Response: The Agency's rationale for selecting the 10,000-ppmv leak definition was discussed in the preamble for the original proposal of this rule, and in the rulemakings for equipment leaks of benzene and VOC in synthetic organic chemicals manufacturing plants and petroleum refineries. The issue also is discussed in EPA's response to NRDC's petition for reconsideration of the benzene rulemakings (50 FR 34144, August 23, 1985).

As discussed in Chapter 10 of the Revised Proposal BID, the key criterion for selecting a leak definition is the mass emission reduction demonstrated to be achievable. The EPA has not concluded that a lower leak definition is achievable. A net increase in mass emissions might result if higher concentration levels result from attempts to repair a source with a screening value between 1,000 and 10,000 ppmv. Although many leaks can be repaired successfully at concentrations less than 1,000 ppmv, even one repair failure would offset many successful repairs. Most data on leak repair effectiveness have applied 10,000 ppmv as the leak definition and, therefore, do not indicate the effectiveness of repair for leak definitions between 1,000 and 10,000 ppmv. Although data between these values are available, they are not sufficient to support a leak definition below 10,000 ppmv. Moreover, even though there is some evidence that directed maintenance is more effective, available data are insufficient to serve as a basis for requiring directed maintenance for all sources. In summary, EPA does not disagree with the commenter in that additional emission reductions potentially could be achieved by reducing the leak definition from 10,000 to 1,000 ppmv. However, although EPA has concluded that the 10,000-ppmv level is a demonstrated and effective leak definition (i.e., there are enough emissions that repair can be accomplished with reasonable costs), EPA has not concluded that 1,000 ppmv is a demonstrated definition. Until EPA has adequate data to support a lower level, EPA is selecting the clearly demonstrated leak definition of 10,000 ppmv as the basis of the equipment leak requirements.

Comment: One commenter recommends that the standard permits the use of a 90-percent efficient control device (e.g., a wash-oil scrubber) in lieu of gas blanketing on process vessels, tar storage tanks, and tar-intercepting sumps. The commenter suggests that the control efficiency of blanketing at an older plant may be lower than 98 percent because of leakage and downtime, and a wash-oil scrubber may achieve higher than 90-percent control.

Response: The control efficiency of gas blanketing theoretically is 100 percent. For conservative comparisons with other controls, this efficiency has been reduced to 98 percent to account for leakage. The 98-percent level or higher should be maintained continuously through proper leak detection and repair. Although a wash-oil scrubber may achieve an efficiency higher than 90 percent, the parameters were developed to ensure that all plants using this technique could achieve a 90-percent control continuously. Based on a 90-percent control efficiency, wash-oil scrubbers are less effective than gas blanketing and may be more costly from a nationwide perspective.

XII. Summary of Alternative Proposed Standards

This section summarizes the format and provisions of the standards that are proposed under the four policy approaches described in Section V. The alternative policy approaches result in alternative standards. The rationales for selection of the standards for each source category under each policy approach are contained in Section VII through X of this preamble. In this section, general provisions applicable to all standards are listed first, followed by a summary of the alternative proposed standards organized by source category.

General Compliance Provisions

Provisions Applicable to all Standards

All of the proposed regulations would require compliance within 90 days of promulgation for existing sources, and at startup for new sources. Methods for determination of compliance are described in each subpart. A waiver of compliance for an existing source could be approved by the Administrator for no more than 2 years from the date of promulgation, as provided in 40 CFR 61.11. The following reports are required by the General Provisions of Part 61:

1. An initial source, report;
2. Notification 30 days prior to any emission test to permit the Administrator to have an observer present; and
3. A written report regarding any emission test within 30 days following the test.

The following records would need to be maintained on site for at least 2 years, and be available for inspection by the Administrator:

1. Any emission test data and calculations used to demonstrate compliance;
2. Monitoring records;
3. A log of startups, shutdowns, and malfunctions; and
4. A log of maintenance and repair of control devices.

Records on control system design and specifications would be maintained as long as a piece of control equipment was in use.

Compliance Procedures for Emission Limit Standards

The following procedures apply to the alternative standards proposed under Approaches C and D for equipment leaks and coke by-product recovery plants, and the standards proposed under Approach D for benzene storage vessels and EB/S process vents.

Compliance with the emission limit would be determined by an emission test, calculation procedures that are described in the applicable subpart, or by an alternative method approved by the Administrator. A report of the results of the emission test shall be submitted within 30 days of the test. If a calculation procedure or alternative method is used to determine compliance, a compliance report shall be submitted with the source report required in § 61.10 or the notification of startup required in § 61.09 of 40 CFR Part 61, whichever is applicable.

An operating and maintenance plan would be required within 90 days of promulgation for existing sources, and within 90 days of startup for new sources. The plan would have to describe any control techniques used to achieve compliance, identify the parameter(s) to be monitored, explain the criteria used in deciding on the parameters, and establish the types and frequency of maintenance necessary. It would also include a schedule for reporting of excess emissions or reporting of other information demonstrating continued compliance with the emission limit. Excess emissions would be indicated by exceedences of the monitored parameter(s) specified in the operating plan. The reporting schedule should be consistent with the compliance, monitoring, and maintenance methods, and would be no more frequent than quarterly. The operating and maintenance plan would be subject to the Administrator's approval.

Standards for EB/S Process Vents

Approach A. Case-by-Case Approach

No standard is proposed for EB/S process vents.

Approach B. Incidence-Based Approach

No standard is proposed for EB/S process vents.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

No standard is proposed for EB/S process vents.

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

The proposed standard would limit total benzene emissions from all process vents at any EB/S plant to 5.5 kg/day.

Standards for Benzene Storage Vessels

Approach A. Case-by-Case Approach

The proposed standard would require control of all new and existing storage vessels greater than 38 m^3 (10,000 gallons) used to store benzene with a specific gravity within the range of specific gravities specified for industrial grade benzene in ASTM-D-836-80. It would not apply to storage vessels used for storing benzene at coke by-product recovery facilities because they are considered under the coke by-product plant NESHAP. The proposed standard would require use of certain kinds of equipment on each type of benzene storage vessel. Table XII-1 lists the requirements.

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TABLE XII-1. EQUIPMENT TO BE REQUIRED ON BENZENE STORAGE VESSELS IN STANDARD PROPOSED UNDER APPROACHES A, B, AND C

Tank size and time of construction	Requirements
1. Fixed roof internal floating roof tank	
a. ≥ 38 m^3, commenced construction prior to date of proposal, and had no internal floating roof as of proposal	Internal floating roof with liquid-mounted primary seal and gasketed roof fittings or internal floating roof with liquid-mounted primary seal and a continuous secondary seal.
b ≥ 38 m^3, commenced construction prior to date of proposal, and had an internal floating roof as of proposal.	Internal floating roof with any type of seal and gasketed roof fittings[1] or internal floating roof with liquid-mounted primary seal and a continuous secondary seal.
c. ≥ 38 m^3, commenced construction after date of proposal.	Internal floating roof with liquid-mounted primary seal and gasketed roof fittings and pipe column with flexible frabic sleeve. or internal floating roof with liquid-mounted primary seal and a continuous secondary seal.
2 External floating roof tank	
a ≥ 38 m^3, commenced construction prior to date of proposal.	Liquid-mounted primary seal and a continuous secondary seal.[2,3]
b ≥ 38 m^3, commenced construction on or after date of proposal	Liquid-mounted primary seal and a continuous secondary seal[3]

[1]Gasketing of roof fittings is required the first time tank is degassed

[2]If external floating roof is already equipped with liquid-mounted primary seal, the secondary seal is required to be added the first time the tank is degassed

[3]Mechanical-shoe primary seal is also allowed, provided that the tank is also equipped with a continuous secondary seal

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The proposed benzene storage vessel standard would require that fixed roof tanks include an internal floating roof. The proposed standard would also require that, when an internal floating roof is added to an existing fixed roof tank after the effective date of the standard, a liquid-mounted rather than a vapor-mounted seal be used with the roof and that fittings on the roof be gasketed. (A mechanical-shoe seal may also be used.) Existing fixed roof tanks that already have internal floating roofs on the effective date would not be required to have their vapor-mounted seals replaced with liquid-mounted seals, although they would be required to have their roof fittings gasketed when the tank is emptied and degassed for other purposes. New fixed roof storage tanks would be required to be constructed with the same controls as are required for existing tanks with no internal roof (i.e., with an internal floating roof, a liquid-mounted primary seal, and controlled roof fittings) and they would also be required to have pipe columns equipped with a flexible fabric sleeve seal. Note that if tanks were equipped with a secondary seal in accordance with the proposed standard, gasketed fittings would not be required; the two control techniques achieve the same emission reduction.

Owners of existing and new external floating roof tanks would have to install liquid-mounted primary seals (or mechanical-shoe seals) and continuous secondary seals meeting certain gap requirements. Existing external floating roof tanks already equipped with a liquid-mounted primary seal, however, would not be required to add the secondary seal until the first degassing of the tank.

The standard would require that each internal floating roof vessel be inspected from inside prior to the filling of the vessel (if it is emptied to install control equipment) and at least once every 10 years. An internal floating roof having defects or a seal having holes or tears would have to be repaired before filling the storage vessel with benzene. The proposed standard would also require that the internal floating roof and its seal be inspected through roof hatches on the fixed roof at least once annually. However, if an internal floating roof were equipped with a primary and secondary seal, the owner or operator could conduct an internal inspection every 5 years rather than perform the annual inspections. Any major defects such as roof sinking or primary seal detachment as viewed through the roof hatches would be required to be repaired within 30 days or the storage vessel would have to be emptied. If repair or emptying within 30 days is not possible, the owner or operator could request an extension of up to 30 additional days.

The proposed standard would also require that, for external floating roof tanks, the primary seal and secondary seal gaps be measured initially and at least once every 5 years for the primary seal and at least once annually for the secondary seal.

Approach B. Incidence-Based Approach

The proposed standard would be the same as that described under the preceding discussion of Approach A.

Approach C. 1 × 10^{-4} or Less Maximum Individual Risk Approach

The proposed standard would be the same as that described under the preceding discussion of Approach A.

Approach D. 1 × 10^{-6} or Less Maximum Individual Risk Approach

The proposed standard would limit total combined emissions from all benzene storage vessels at a plant to 0.47 kg/day. To determine compliance, the owner or operator would calculate emissions from each vessel and add these to estimate total facility emissions. One calculation method EPA would approve is use of the equations and procedures in the EPA document "Compilation of Air Pollutant Emission Factors", Volume I, September 1985, EPA Publication No. AP-42. Other methods of demonstrating compliance could also be used after approval by EPA.

Standards for Equipment Leaks

Approach A. Case-by-Case Approach

No new standard is proposed for control of benzene equipment leaks. The standard in 40 CFR Part 61, Subpart J, which was promulgated on June 6, 1984, would remain in effect without revision. The standard applies to equipment components such as valves, pumps, compressors, pressure relief devices, open-ended valves or lines, sample connection systems, and product accumulator vessels. Equipment that contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene is required to follow specific control procedures. Generally, for each type of equipment, Subpart J includes equipment specifications and/or schedules and procedures for monitoring and repair of leaks.

Approach B. Incidence-Based Approach

No new standard is proposed for benzene equipment leaks. The current standard in 40 CFR Part 61, Subpart J, which is summarized in the discussion of Approach A, would remain in effect without revision.

Approach C. 1 × 10^{-4} or Less Maximum Individual Risk Approach

The proposed standard would require that each facility with equipment subject to Subpart J meet a total facility emission limit of 14 kg/day for the combined emissions from all equipment components located at the facility. In addition, the proposed standard would include the current requirements in Subpart J (i.e., those promulgated on June 6, 1984). Compliance with the emission limit could be determined through the procedures established in the "Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft" or through design specifications (i.e., leakless equipment).

Approach D. 1 × 10^{-6} or Less Maximum Individual Risk Approach

The proposed standard would limit emissions from all equipment components at any facility with equipment in benzene service to 0.14 kg/day. The proposed standard does not retain the exemption for facilities producing or using less than 1,000 Mg/yr that is currently in Subpart J (as promulgated on June 6, 1984). The exemption is not appropriate under this approach because uncontrolled emissions from many facilities using less than 1,000 Mg/yr would exceed the 0.14 kg/day emission limit. The current Subpart J provisions would not be required, because this would be unnecessary since plants would have to use even more stringent controls to comply with the emission limit.

Standards for Coke By-Product Recovery Plants

Approach A. Case-by-Case Approach

There are two major differences between the standard proposed under Approach A and the 1984 proposal. A design standard requiring a 90-percent emission reduction was proposed in 1984 for storage tanks containing light oil, benzene, excess ammonia-liquor, or BTX mixtures. The Approach A proposal would not require that these sources be controlled. Also, the standard proposed for naphthalene processing under this approach would differ from the 1984 proposal by requiring zero emissions from the final cooler and associated cooling tower at furnace plants, as well as from naphthalene processing. The proposed standard for naphthalene processing at foundry plants is not different from the 1984 proposal.

Under Approach A, an equipment standard would be established for the control of emissions from each tar decanter, tar-intercepting sump, tar dewatering tank, light-oil condenser, light-oil decanter, wash-oil decanter, and wash-oil circulation tank. The rule that would be proposed under Approach A would be identical to that proposed for these sources in 1984. Each of these sources would be required to be totally enclosed with emissions ducted to the gas collection system, gas distribution system, or other enclosed point in the by-product recovery process. Unless otherwise specified, pressure relief devices, vacuum relief devices, access hatches, and sampling ports would be the only openings allowed on each source. Access hatches and sampling ports would have to be equipped with a gasketed cover.

The standard under Approach A could be achieved with a gas-blanketing system. A gas-blanketing system is a closed system operated at positive pressure and is generally composed of piping, connections, and flow-inducing devices (if necessary) that transport emissions from the enclosed source back to the coke-oven battery gas holder, the collecting main, or another point in the by-product recovery process. Dirty or clean coke oven gas, nitrogen, or natural gas are examples of gases that may be used as the gas blanket.

To ensure proper operation and maintenance of the control equipment, the proposed standard would require a semiannual inspection of the connections and seals on each gas-blanketing system for leaks, using EPA method 21 test for no detectable emissions (40 CFR Part 60, Appendix A). Monitoring also would be required at any other time after the control system is repressurized following removal of the cover or opening of the access hatch. An organic chemical concentration would indicate the presence of a leak. The standard also would require a semiannual visual inspection of each source and the piping of the control system for visible defects such as gaps or tears. A first attempt at repair of each leak or visible defect would be required within 5 days of detection, with repair within 15 days. The owner or operator would be required to record the results of the inspections for each source and to include the results in a semiannual report. The revised proposed regulation under Approach A also would require an annual maintenance inspection for abnormalities such as pluggages, sticking valves, and clogged or improperly operating condensate traps. A first attempt at repair would be required within 5 days, with any necessary repairs made within 15 days of the inspection.

An equipment standard would be proposed to require that the surface area of each light-oil sump be completely enclosed. This proposed standard would be based on the use of a tightly fitting permanent or removable cover, with a gasket on the rim of the cover. The standard would allow the use of an access hatch and a vent in the sump cover. However, any access hatch would need to be equipped with a gasket and with a cover or lid, and any vent would need to be equipped with a water leg seal, pressure relief device, or vacuum relief device. Semiannual inspections of the gaskets and seals for detectable emissions would be required; monitoring also would be required at any other time the seal system is disturbed by removal of the cover. The inspection and monitoring requirements would be the same as previously described for gas-blanketed sources. This revised proposed standard would not allow venting of steam or gases from other points in the coke by-product process to the light-oil sump.

The revised proposed standard also would apply to leaks (i.e., fugitive emissions) from new and existing pieces of equipment in benzene service, including pumps, valves, exhausters, pressure relief devices, sampling connections, and open-ended lines, all of which except exhausters comprise those components that contact or contain materials having a benzene concentration of at least 10 percent by weight. Exhausters that contact or contain materials having a benzene concentration of at least 1 percent benzene by weight also are in benzene service. The standard for equipment leaks would be identical to the 1984 proposed standard. Because this standard is the same as requirements in 40 CFR Part 61, Subpart V, for equipment except exhausters, the coke by-product rule would reference Subpart V where appropriate rather than repeating the provisions. Subpart V also would be amended where necessary for clarification of the cross referencing. The specific requirements for exhausters are summarized in detail below, because they are not in Subpart V.

The revised proposed standard would require that all exhausters in benzene service be monitored quarterly for the detection of leaks. If an organic chemical concentration at or above 10,000 ppm were detected, as measured by Method 21, the revised proposed standard would require a first attempt at repair within 5 days, with repair of the leak within 15 days from the date the leak was detected, except when repair would require a process unit shutdown. "Repair" means that the measured concentration is below 10,000 ppm. The standard proposed under Approach A provides three types of alternatives to the leak detection and repair requirements for exhausters. An owner or operator could (1) use "leakless" equipment to achieve a "no detectable emission" limit (i.e., 500 ppm above a background concentration, as measured by Method 21), (2) equip the exhauster with enclosed seal areas vented to a control device designed and operated to achieve a 95-percent benzene control efficiency, or (3) equip the exhausters with seals having a barrier fluid system. The proposed regulation includes specific requirements for each of these three alternatives to the leak detection and repair requirements.

For foundry coke by-product plants, the revised proposed standard under Approach A would allow no emissions from the processing of naphthalene separated from the final cooler water. A foundry coke by-product plant would be defined as a coke by-product recovery plant connected to the coke batteries whose annual coke production is at least 75 percent foundry coke. "Foundry coke" means coke that is produced from raw materials with less than 26 percent volatile material by weight and that is subject to a coking period of 24 hours or more. This emission limit could be achieved by a process modification involving the absorption of naphthalene in tar, wash oil, or an alternative medium (other than water). For example, a mixer-settler could be added to the final cooler, or a direct-water final cooler could be replaced by a tar-bottom or wash-oil final cooler system or another design that allows no emissions from naphthalene processing. If a mixer-settler were used to remove naphthalene from the final cooler water, the mixer-settler must be gas blanketed and would be subject to the same provisions as other gas-blanketed sources.

For furnace coke by-product plants, the revised proposed standard under Approach A for naphthalene-processing operations, final coolers, and the associated cooling towers would require zero emissions from the final cooler and cooling tower, as well as from naphthalene processing. It would be based on the use of a wash-oil final cooler; however, other final cooler designs that achieve zero emission limits could be used.

Compliance with the revised proposed standard under Approach A would be assessed through plant inspections and the review of records and reports that document implementation of the requirements. On a semiannual basis, the owner or operator would be required to report the number of leaks detected and the number of leaks not repaired during the 6-month period. The owner or operator also would be required to submit a signed statement in each semiannual report, indicating whether provisions of the standard have been met for the 6-month period.

Approach B. Incidence-Based Approach

The proposed standard would be the same as that described under the preceding discussion of Approach A.

Approach C. 1×10^{-4} or Less Maximum Individual Risk Approach

The proposed standard would require that total benzene emissions from all emission points listed in Table X-2 not exceed 34 kg/day. In addition, the owner or operator would be required to meet the standards discussed above for Approach A. To determine compliance with the emission limit, the plant owner or operator may calculate emissions from all affected sources based on the emission factors for each unit and submit these calculations with the initial source report. The benzene emission factors for furnace and foundry plants, as revised based on public comments from the 1984 proposal, are included in the regulation for this approach and in the Revised Proposal BID. Alternatively, the owner or operator could choose to perform emission tests to estimate emissions using methods and procedures subject to approval by the Administrator. However, because EPA has not developed and promulgated a test method for determining benzene emissions from process vessels and area sources, the owner or operator would need to provide an appropriate method for review and approval by EPA. For equipment leaks, established procedures can be found in "Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft".

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

The proposed standard would require that total benzene emissions from all emission points listed in Table X-2 not exceed 0.34 kg/day. To demonstrate compliance with the emission limit, the plant owner or operator would use the methods described above for Approach C.

XIII. Format of Alternative Standards

Section 112 of the CAA requires an emission standard whenever it is feasible. Section 112(e)(1) states that "if in the judgment of the Administrator, it is not feasible to prescribe or enforce an emission standard for control of a hazardous air pollutant or pollutants, he may instead promulgate a design, equipment, work practice, or operational standard, or combination thereof * * *". The term "not feasible" is applicable if the emissions cannot be captured and vented through a vent or stack designed for that purpose, or if the application of a measurement methodology is not practicable because of technological or economic limitations. This section presents the rationale for the selected formats for the standards being proposed under the four alternative policy approaches.

Ethylbenzene/Styrene Process Vents

Approach D. 1×10^{-6} or Less Maximum Individual Risk Approach

The proposed standard is expressed as a limit on the mass of benzene emitted per day to ensure that no faclity has risks exceeding 1×10^{-6}. Because EB/S process vents vary widely in concentration and flowrates, it is not possible to ensure that any specific concentration or emission reduction would achieve the target risk. Therefore, a limit was placed on the total mass emitted on a daily basis.

Benzene Storage Vessels

Approach A. Case-by-Case Approach

The standard being proposed under Approach A is based on design, equipment and operational requirements due to the infeasibility of measuring emissions in this case. Internal and external floating roof storage vessels, both before and after the identified controls are installed, do not typically have a conveyance system designed to capture the emissions or a stack or vent through which the emissions pass to the atmosphere.

Equipping each storage vessel with a capture and stack system would require that the vessel vents be sealed and that the emissions be transported to a measurement system. In most cases, the closure of the vessel vents would require the vessel to be blanketed with inert gas to prevent the creation of explosive or flammable mixtures in the vessel or measurement system. This would certainly be economically impracticable, especially considering that the sole purpose of the system would be for emission testing. For this reason the Administrator concluded that requiring emission testing to measure emissions and demonstrate compliance with an emission standard is not feasible for internal floating-roof storage vessels.

External floating-roof storage vessels are open to the atmosphere in that they have no fixed roof. Because of this, it is technologically impossible to equip these vessels with a closed vent system. It is possible to equip these vessels with fixed roofs, in which case they become internal floating-roof vessels. The argument against an emission standard for internal floating-roof vessels presented in the previous paragraph would then hold for them. Therefore, the Administrator has concluded that requiring emission testing to measure emissions and demonstrate compliance with an emission standard for external floating-roof vessels is infeasible.

The possibility of establishing a "design, equipment, work practice, or operational standard, or combination thereof" was then examined. Types of equipment available to limit emissions from fixed roof benzene storage vessels are an internal floating-roof with a liquid-mounted primary seal, or a secondary seal and controlled fittings. Equipment available for external floating roof tanks include continuous secondary seals. Equipment standards can be specified to require installation of these types of controls. Operational and work practice requirements, which consist of inspection and repair requirements, are necessary to ensure the continued integrity of the control equipment. Therefore, the Administrator concluded that the format of the standard for benzene storage vessels should include a combination of design, equipment, work practice, and operational standards.

Another control option allowed under the standards is a vapor control system consisting of two distinct parts: (1) A closed vent system and (2) a control device. The closed vent system collects benzene vapors that have been vented from the storage vessel and transfers them to a control device that then processes the benzene vapors by either recovering them as product, or disposing of them. After reviewing analyses of vapor control systems performed during the development of the previous NSPS for VOL storage vessels and the NESHAP for equipment leaks (40 CFR Part 61, Subpart V) which have provisions for closed vent systems and control devices, the Administrator concluded that the format of the standard for storage vessels equipped with closed vent systems and control devices should also include a combination of design, equipment, work practice and operational standards.

Approach B. Incidence-Based Approach

The same standard is being proposed under Approach B as under Approach A. Therefore, the same format was selected for the reasons described under Approach A.

Approach C. 1 × 10^{-4} or Less Maximum Individual Risk Approach

The same standard is being proposed under Approach C as under Approach A. Therefore, the format was selected for the same reasons.

Approach D. 1 × 10^{-6} or Less Maximum Individual Risk Approach

For the development of this standard, EPA considered establishing additional equipment and design requirements. Because the identified controls (in Option 1 of Table VIII–2) would not achieve 1 × 10^{-6} at all facilities, it is not possible at this time to use this format to specify the required control level. Therefore, a limit was placed on the total benzene emissions from all storage vessels at a facility.

Equipment Leaks

Approach C. 1 × 10^{-4} or Less Maximum Individual Risk Approach

For the development of this alternative standard, EPA considered establishing additional equipment and design requirements. (In selecting the format for the current Subpart J, EPA had previously determined that mass, concentration, or percent reduction formats were not feasible or practicable.) Because the additional controls available would not achieve 1 × 10^{-4} at all facilities, it was not possible to use an equipment and design format to specify the required control. Therefore, the format selected was a daily mass emission limit that would not exceed 1 × 10^{-4} risk. This emission limit may be achieved through design of the facility to minimize the number of components as well as through use of leakless equipment. Additionally, the standards retain requirements of Subpart J (as promulgated on June 6, 1984), which are expressed as equipment, design, and work practice standards because some small facilities may be able to reduce emissions to below the 14 kg/day emission limit by compliance with these provisions.

Approach D. 1 × 10^{-6} or Less Maximum Individual Risk Approach

A limit on the mass of emissions per day was chosen for this standard for the same reasons described under Approach C.

Coke By-Product Recovery Plants

Approach A. Case-by-Case Approach

As described in detail for each emission source in the June 6, 1984, proposal, pollutants are not emitted through a conveyance or are not practicable to measure for many of the sources in coke by-product plants. Therefore, the proposed standard under Approach A is a combination of emission limits, equipment, work practice, and operational requirements, depending on the source to be controlled.

Approach B. Incidence-Based Approach

The same standard is being proposed under Approaches A and B. Therefore, the format was selected for the same reasons.

Approach C. 1 × 10^{-4} or Less Maximum Individual Risk Approach

The emission rate corresponding to the 1 × 10^{-4} target is 34 kg/day from all emission points listed in Table X–2. Since EPA has not identified any control equipment or procedures that would achieve this emission level at all facilities, it was not possible to specify the standard solely in terms of emission standards for particular equipment, work practice, and operational requirements depending on the source to be controlled. Therefore, a limit was placed on total daily benzene emissions from all affected sources in coke by-product recovery plants. In addition, since some facilities could comply with the 34 kg/day standard using less than the provisions of the proposed standard under Approach A, the standard also specifies minimum control requirements (i.e., the requirement of Approach A) in terms of equipment, design, work practices, and emission limits on particular sources.

Approach D. 1 × 10^{-6} or Less Maximum Individual Risk Approach

A limit on the mass of emissions released per day from the total of all emission points listed in Table X–2 was chosen for this standard for the same reasons described under Approach C.

XIV. Paperwork Reduction Act

The information collection provisions associated with the proposed rules have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act (PRA) of 1980, 44 U.S.C. 3501 *et seq.* Comments on these requirements should be submitted to the Office of Information and Regulatory Affairs, OMB, 726 Jackson Place, NW., Washington, DC, 20503, marked "Attention: Desk Officer for EPA", as well as to EPA. Please note on the comments that they apply to ICR Number 1080. The final rules will respond to any OMB or public comments on the information collection requirements.

During the first 3 years that the proposed standards would be in effect, the public reporting burden for collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information is estimated to be:

(1) 4,184 averaged annual hours with an average of 322 hours/yr per respondent for EB/S plants' process vents under Approach D;

(2) 2,134 averaged annual hours with an average of 17 hours/yr per respondent for plants with benzene storage vessels under Approaches A, B, and C;

(3) 126 averaged annual hours with an average of 1 hour/yr per respondent for plants with benzene storage vessels under Approach D;

(4) 1,383 averaged annual hours with an average of 11 hours/yr per respondent for plants with equipment in benzene service (equipment leaks) under Approach C;

(5) 129 averaged annual hours with an average of 1 hour/yr per respondent for plants with equipment in benzene service (equipment leaks) under Approach D;

(6) 7,112 averaged annual hours with an average of 161 hours/yr per respondent for coke by-product recovery plants under Approaches A, B, and C each; and

(7) 44 averaged annual hours with an average of 1 hour/yr per respondent for coke by-product recovery plants under Approach D. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM–223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

There are no recordkeeping and reporting requirements for EB/S process vents under Approaches A, B, and C. Also, for equipment leaks under Approaches A and B, the Agency proposes no change in the regulation, therefore, there would be no additional recordkeeping and reporting burden.

XV. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 *et seq.*) requires EPA to consider potential impacts of proposed regulations on small "entities." If a preliminary analysis indicates that a proposed regulation would have a significant economic impact on 20 percent or more of small entities, then a regulatory flexibility analysis must be prepared.

Present RFA guidelines indicate that an economic impact should be considered significant if it meets one of the following criteria:

(1) Compliance increases annual production costs by more than 5 percent;

(2) Compliance costs as a percentage of sales for small entities are at least 10 percent more than compliance costs as a percentage of sales for large entities;

(3) Capital costs of compliance represent a "significant" portion of capital available to small entities, considering internal cash flow plus external financial capabilities; and

(4) Regulatory requirements are likely to result in closures of small entities.

For EB/S process vents, no small business would be subject to any proposed EB/S standard. For benzene storage vessels and equipment leaks, very few businesses would be considered small businesses. According to Small Business Administration guidelines, a small business that manufacturers cyclic crudes and cyclic intermediates, pharmaceuticals, and many other chemicals is one that has 750 employees or fewer. Very few of the businesses in the existing industry employ fewer than 750 people. Even if benzene storage facilities owned by small businesses do become subject to a standard under Approaches A, B, or C, none will be adversely affected. In the economic analysis for this standard, the price increase and profitability impacts were estimated for small as well as for larger facilities. The impacts for the small benzene storage facilities were very small (about $800/year). For benzene storage vessels under Approach D and for benzene equipment leaks under Approaches C and D, small businesses will not be more adversely affected than larger businesses.

For coke by-product recovery plants, the EPA has determined under the Small Business Administration guidelines that any coke firm that employs fewer than 1,000 workers is a small business. Six foundry coke firms were identified as being small. For the standard proposed under Approaches A, B, and C, the economic analysis estimates that one plant may exceed criterion (2) above. However, these standards are not subject to the RFA because there is not a substantial number (i.e., 20 percent of the small businesses) that would be adversely affected. For standards proposed under Approach D, the impacts are not expected to be more adverse for small businesses than for large businesses.

XVI. Public Hearing

A public hearing will be held to discuss the proposed actions, in accordance with sections 112(b)(1)(B) and 307(d)(5) of the CAA. Persons wishing to make oral presentations should contact EPA at the address given in the **ADDRESSES** section of this preamble. Oral presentations will be limited to 10 minutes each. Any member of the public may file a written statement before, during, or within 30 days of the hearing. Written statements should be addressed to the Central Docket Section address given in the **ADDRESSES** section of this preamble and should refer to Docket No. A-79-16 for coke by-product recovery plants, Docket No. A-79-27 for benzene equipment leaks, Docket No. OAQPS 79-3 (Part II) for maleic anhydride process vents, Docket No. A-79-49 for EB/S process vents, and Docket No. A-80-14 for benzene storage vessels.

A verbatim transcript of the hearing and written statements will be available for public inspection and copying during normal working hours at the EPA's Central Docket Section in Washington, DC (see **ADDRESSES** section of this preamble).

XVII. Docket

The docket is an organized and complete file of all the information submitted to or otherwise considered by EPA in the development of this proposed rulemaking. The principal purposes of the docket are: (1) To allow interested parties to identify and locate documents so that they can participate effectively in the rulemaking process and (2) to serve as the record in case of judicial review (except for interagency review materials (section 307(d)(7)(A))).

XVIII. Miscellaneous

As prescribed by section 112 of the CAA, as amended, establishment of today's proposed national emissions standards was preceded by the Administrator's listing of benzene as a hazardous air pollutant on June 8, 1977 (42 FR 29332).

The final regulations will be reviewed 5 years from the dates of their promulgation. This review will include an assessment of such factors as the need for integration with other programs, the existence of alternative methods, enforceability, improvements in emission control technology and health data, and reporting requirements.

In accordance with section 117 of the Act, publication of these actions on benzene was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies to the maximum extent practical.

Under Executive Order 12291, EPA is required to judge whether this regulation is a "major rule" and therefore subject to certain requirements of the Order. The EPA has determined that the regulations proposed for benzene storage vessels under Approaches A, B, and C and for coke by-product recovery plants under Approaches A and B will result in none of the adverse economic effects set forth in section 1 of the Order as grounds for finding a regulation to be a "major rule." These regulations are not major because: (1) Nationwide annual compliance costs are not as great as the threshold of $100 million; (2) the regulations do not significantly increase prices or production costs; and (3) the regulations do not cause significant, adverse effects on domestic competition, employment, investment, productivity, innovation, or competition in foreign markets.

The regulations proposed under Approach C for benzene equipment leaks and coke by-product recovery plants and under Approach D for EB/S process vents, benzene storage vessels, equipment leaks and coke by-product plants may be determined to be a "major rule" under Executive Order 12291. The regulations could cause significant adverse effects on domestic competition, employment, investment, productivity, innovation, or competition in foreign markets. As provided by section 8 of the Order, the Agency has not conducted a regulatory impact analysis (RIA) of these proposed regulations because of the time constraint of the judicially-ordered schedule.

All of the proposed regulations presented in this notice were submitted to OMB for review as required by Executive Order 12291. Any written comments from OMB to EPA and any written EPA response to those comments will be included in the dockets listed at the beginning of today's notice under "Dockets". These dockets are available for public inspection at the EPA's Central Docket Section, which is listed in the **ADDRESSES** section of this preamble.

Pursuant to the provisions of 5 U.S.C. 605(b), I hereby certify that all the rules proposed under Approaches A and B, the rules for benzene storage vessels and coke by-product recovery plants proposed under Approach C, and the rules for EB/S process vents proposed under Approach D, if promulgated, will not have a significant economic impact on a substantial number of small entities. I also hereby certify that the rules proposed under Approach C for benzene equipment leaks and under Approach D for benzene storage vessels, equipment leaks, and coke by-product recovery plants will not have a more adverse economic impact on small entities than on large entities.

List of Subjects in 40 CFR Part 61

Asbestos, Benzene, Beryllium, Coke oven emissions, Hazardous substances, Incorporation by reference, Inorganic arsenic, Inter-governmental relations, Mercury, Radionuclides, Reporting and recordkeeping requirements, Vinyl chloride, Volatile hazardous air pollutants.

Date: July 20, 1988.

Lee M. Thomas,

Administrator.

It is proposed to amend Title 40, Chapter I, Part 61 of the Code of Federal Regulations as follows:

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

1. The authority for 40 CFR Part 61 continues to read as follows:

Authority: Sections 112, 114, 301(a) of the Clean Air Act (CAA), as amended (40 U.S.C. 7412, 7414, 7601(a)).

2. Under *Approach C* as described in the preamble, Subpart J would be revised to read as follows:

Subpart J—National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene

Sec.

61.110 Applicability and designation of sources.
61.111 Definitions.
61.112 Standards.
61.113 Monitoring and compliance.
61.114 Recordkeeping requirements.
61.115 Reporting requirements.
61.116 Delegation of authority.

Subpart J—National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene

§ 61.110 Applicability and designation of sources.

(a) The provisions of this subpart apply to each of the following sources that are intended to operate in benzene service: Pumps, compressors, pressure relief devices, sampling connections, systems, open-ended valves or lines, valves, flanges and other connectors, product accumulator vessels, and control devices or systems required by this subpart.

(b) The provisions of this subpart do not apply to sources located in coke by-product plants.

(c)(1) If an owner or operator applies for one of the exemptions in this paragraph, then the owner or operator shall maintain records as required in § 61.114.

(2) Any equipment in benzene service that is located at a plant site designed to produce or use less than 1,000 megagrams of benzene per year is exempt from the requirements of § 61.112.

(3) Any process unit (defined in § 61.241) that has no equipment in benzene service is exempt from the requirements of § 61.112.

(d) While the provisions of this subpart are effective, a source to which this subpart applies that is also subject to the provisions of 40 CFR Part 60 only will be required to comply with the provisions of this subpart.

§ 61.111 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, in Subpart A of Part 61, or in Subpart V of Part 61, and the following terms shall have the specific meanings given them:

"In benzene service" means that a piece of equipment either contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene by weight as determined according to the provisions of § 61.245(d). The provisions of § 61.245(d) also specify how to determine that a piece of equipment is not in benzene service.

"Plant" means any combination of process units and equipment used at one site in the production of benzene as an intermediate or final product or in the use of benzene.

"Semiannual" means a 6-month period: The first semiannual period concludes on the last day of the last month during the 180 days following initial startup of new sources; and the first semiannual period concludes on the last day of the last full month during the 180 days after June 6, 1984, for existing sources.

§ 61.112 Standards.

(a) Each owner or operator subject to the provisions of this subpart shall comply with the requirements of Subpart V of this part.

(b) An owner or operator may elect to comply with the requirements of § 61.243-1 and § 61.243-2.

(c) An owner or operator may apply to the Administrator for a determination of an alternative means of emission limitation that achieves a reduction in emissions of benzene at least equivalent to the reduction in emissions of benzene achieved by the controls required in paragraph (a) of this section. In doing so, the owner or operator shall comply with requirements of § 61.244.

(d) In addition to complying with paragraph (a) of this section, no owner or operator of a plant subject to the provisions of this subpart shall cause to be discharged to the atmosphere total benzene emissions from all leaking equipment in the plant exceeding 14 kg/day (5 Mg/yr). Leaking equipment shall include all equipment in benzene service.

§ 61.113 Monitoring and compliance.

(a) Each owner or operator of a source subject to the provisions of § 61.242 shall comply with the test methods and procedures of § 61.245.

(b) Each owner or operator seeking to demonstrate compliance with the annual limit in § 61.112(d) shall measure or calculate emissions according to one of the procedures given in the document "Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft;" December 1987; EPA Contract No. 68-02-4338, and apply the emission reduction efficiency of the control program on a component basis.

(c) In lieu of using the procedures referred to in paragraph (b) of this section, an owner or operator may apply to the Administrator for approval of an equivalent method of measuring or calculating emissions.

(d) Each owner or operator subject to the provisions of § 61.112(d) shall submit an operating and maintenance plan to the Administrator for approval within 90 days of the effective date for existing sources, or within 90 days of startup for new sources. The plan shall include the following:

(1) A description of the control techniques by which the owner or operator will comply with the emission limit.

(2) Identification of the parameter(s) to be monitored to ensure that each control device is operated in conformance with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary

(5) A schedule for reporting excess emissions or reporting of other information demonstrating continued compliance with § 61.112(d). The

reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(e) Each owner or operator shall conduct operations, monitor the parameters, and maintain equipment in accordance with the approved operating plan.

§ 61.114 Recordkeeping requirements.

(a) Each owner or operator of a source subject to the provisions of § 61.242 shall comply with the recordkeeping requirements of § 61.246.

(b) Each owner or operator subject to the provisions of § 61.112(d) shall maintain at the plant for a period of at least 2 years, and shall make available to the Administrator upon request, the following:

(1) Records of all data and calculations used to demonstrate compliance with § 61.112(d).

(2) Records of all leaks and repairs to equipment in benzene service.

(3) Records of all malfuctions of each air pollution control device used in controlling benzene emissions.

(4) Records of all maintenance and repairs to each air pollution control device used in controlling benzene emissions.

(5) For each air pollution control device used in the control of benzene emissions, detailed schematics and records of design specifications and instrumentation.

(6) Records of all relevant data and information for any additional methods used to achieve compliance with § 61.112(d) other than the use of air pollution control devices, or leak detection and repair.

(c) A list of identification numbers of all equipment in benzene service at the plant site shall be recorded in a log that is kept in a readily accessible location.

(d) The following information shall be recorded in a log that is kept in a readily accessible location for use in determining exemptions as provided in § 61.110(c)(2) of this subpart:

(1) An analysis demonstrating that the plant site is designed to produce or use less than 1,000 Mg of benzene per year.

(2) Any information and data used in the analysis described in paragraph (1) above.

(e) The following information for use in determining exemptions as provided in § 61.110(c)(3) of this subpart shall be recorded in a log that is kept in a readily accessible location:

(1) An analysis demonstrating that a piece of equipment is not in benzene service.

(2) Any information and data used in the analysis described in paragraph (e)(1).

§ 61.115 Reporting requirements.

(a) Each owner or operator subject to the provisions of § 61.112(d) shall:

(1) Comply with the reporting requirements of § 61.247.

(2) Provide the Administrator 30 days prior notice of any emission test required in § 61.13 to afford the Administrator the opportunity to have an observer present.

(3) Submit to the Administrator a written report of the results of the emission test and associated calculations, as applicable, within 30 days of conducting the test.

(4) Submit to the Administrator a written report of excess emissions at the frequency established in the approved operating and maintenance plan. For the purposes of this paragraph, excess emissions shall be considered to be any exceedence of the monitoring parameters specified in the approved operating and maintenance plan required by § 61.113.

(5) If a calculational procedure is used to demonstrate compliance, a report including the calculations shall be submitted with either the source report required in § 61.10 for existing sources, or the notification of startup required in § 61.09 for new sources.

(b) A report shall be submitted to the Administrator semiannully, starting 6 months after submittal of the intitial operating and maintenance plan required in § 61.113(d). All semiannual reports shall be postmarked by the 30th day following the end of the 6-month report period. This report includes the following information:

(1) Plant identification.

(2) For each month during the period, the number of equipment leaks which occurred, the number of equipment leaks for which repair was attempted, and the number of equipment leaks for which repair was completed.

§ 61.116 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States: None.

3. Under *Approach D* as described in the preamble, Subpart J would be revised to read as follows:

Subpart J—National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene

Sec.
61.110 Applicability and designation of sources.
61.111 Definitions.
61.112 Standards.
61.113 Monitoring and compliance.
61.114 Recordkeeping requirements.
61.115 Reporting requirements.
61.116 Delegation of authority.

Subpart J—National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene

§ 61.110 Applicability and designation of sources.

(a) The provisions of this subpart apply to each of the following sources that are intended to operate in benzene service: Pumps, compressors, pressure relief devices, sampling connections, systems, open-ended values or lines, valves, flanges and other connectors, product accumulator vessels, and control devices or systems required by this subpart.

(b) The provisions of this subpart do not apply to sources located in coke by-product plants.

(c)(1) If an owner or operator applies for one of the exemptions in this paragraph, then the owner or operator shall maintain records as required in § 61.114.

(2) Any process unit (defined in § 61.241) that has no equipment in benzene service is exempt from the requirements of § 61.112.

(d) While the provisions of this subpart are effective, a source to which this subpart applies that is also subject to the provisions of 40 CFR Part 60 only will be required to comply with the provisions of this subpart.

§ 61.111 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, in Subpart A of Part 61, or in Subpart V of Part 61, and the following terms shall have the specific meanings given them:

"In benzene service" means that a piece of equipment either contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene by weight as determined according to the provisions of § 61.245(d). The provisions of § 61.245(d) also specify how to determine that a piece of equipment is not in benzene service.

"Plant" means any combination of process units and equipment used at one site in the production of benzene as an intermediate or final product or in the use of benzene.

"Semiannual" means a 6-month period: The first semiannual period concludes on the last day of the last month during the 180 days following initial startup of new sources; and the first semiannual period concludes on the last day of the last full month during the 180 days after June 6, 1984, for exisitng sources.

§ 61.112 Standards.

(a) No owner or operator of a plant subject to this subpart shall cause to be discharged to the atmosphere total benzene emissions from all leaking equipment in the plant exceeding 0.14 kg/day (50 kg/yr). Leaking equipment shall include all equipment in benzene service.

§ 61.113 Monitoring and compliance.

(a) Each owner or operator seeking to demonstrate compliance with the annual emission limit in § 61.112(a) shall measure or calculate emissions according to one of the producers given in the document "Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP-Draft;" December 1987; EPA Contract No. 68-02-4338, and apply the emission reduction efficiency of the control program on a component basis.

(b) In lieu of using the procedures referred to in paragraph (a) of this section, an owner or operator may apply to the Administrator for approval of an equivalent method of measuring or calculating emissions.

(c) Each owner or operator subject to the provisions of § 61.112(a) shall submit an operating and maintenance plan to the Administrator for approval within 90 days of the effective date for existing sources, or within 90 days of startup for new sources. The plan shall include the following:

(1) A description of the control techniques by which the owner or operator will comply with the emission limit.

(2) Identification of the parameter(s) to be monitored to ensure that each control device is operated in conformance with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary.

(5) A schedule for reporting excess emissions or reporting of other information demonstrating continued compliance with § 61.112(d). The reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(d) Each owner or operator shall conduct operations, monitor the parameters, and maintain equipment in accordance with the approved operating plan.

§ 61.114 Recordkeeping requirements.

(a) Each owner or operator subject to the provisions of § 61.112(a) shall maintain at the plant for a period of at least 2 years, and shall make available to the Administrator upon request, the following:

(1) Records of all data and calculations used to demonstrate compliance with § 61.112(a).

(2) Records of all leaks and repairs to equipment in benzene service.

(3) Records of all malfunctions of each air pollution control device used in controlling benzene emissions.

(4) Records of all maintenance and repairs to each air pollution control device used in controlling benzene emissions.

(5) For each air pollution control device used in the control of benzene emissions, detailed schematics and records of design specifications and instrumentation.

(6) Records of all relevant data and information for any additional methods used to achieve compliance with § 61.112(a) other than the use of air pollution control devices, or leak detection and repair.

(b) A list of identification numbers of all equipment in benzene service at the plant site shall be recorded in a log that is kept in a readily accessible location.

§ 61.115 Reporting requirements.

(a) Each owner or operator subject to the provisions of § 61.112(a) shall:

(1) Provide the Administrator 30 days prior notice of any emission test required in § 61.113 to afford the Administrator the opportunity to have an observer present; and

(2) Submit to the Administrator a written report of the results of the emission test and associated calculations, as applicable, within 30 days after conducting the test.

(3) Submit to the Administrator a written report of excess emissions at the frequency established in the approved operating and maintenance plan. For the purposes of this paragraph, excess emissions shall be considered to be any exceedence of the monitoring parameters specified in the approved operating and maintenance plan required by § 61.113.

(4) If a calculational procedure is used to demonstrate compliance, a compliance report including the calculations shall be submitted with either the source report required in § 61.10 for existing sources, or the notification of startup required in § 61.09 for new sources.

(b) A report shall be submitted to the Administrator semiannually starting 6 months after submittal of the initial operating and maintenance plan required in § 61.113(c), that includes the following information:

(1) Plant identification.

(2) For each month during the period, the number of equipment leaks which occurred, the number of equipment leaks for which repair was attempted, and the number of equipment leaks for which repair was completed.

(c) All semiannual reports shall be postmarked by the 30th day following the end of the 6-month report period.

§ 61.116 Delegating of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States: None.

4. Under *Approaches A and B,* as described in the preamble, Subpart L would be added to Part 61 of Title 40 as follows:

Subpart L—National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants

Sec.
61.130 Applicability and designation of sources.
61.131 Definitions.
61.132 Standard: Process vessels, tar storage tanks, and tar-intercepting sumps.
61.133 Standard: Light-oil sumps.
61.134 Standard: Naphthalene processing, final coolers, and final-cooler cooling towers.
61.135 Standard: Equipment leaks.
61.136 Compliance provisions and alternative means of emission limitation.
61.137 Test methods and procedures.
61.138 Recordkeeping and reporting amendments.
61.139 Delegation of authority.

Subpart L—National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants

§ 61.130 Applicability and designation of sources.

(a) The provisions of this subpart apply to each of the following sources at furnace and foundry coke by-product recovery plants: Tar decanters, tar storage tanks, tar-intercepting sumps, flushing-liquor circulation tanks, light-oil sumps, light-oil condensers, light-oil decanters, wash-oil decanters, wash-oil circulation tanks, and the following equipment that are intended to operate in benzene service: Pumps, valves, exhausters, pressure relief devices, sampling connection systems, open-ended valves or lines, flanges or other connectors, and control devices or systems required by § 61.135.

(b) The provisions of this subpart also apply to naphthalene processing at foundry coke by-product recovery plants and to naphthalene processing, final coolers, and final-cooler cooling towers at furnace coke by-product recovery plants.

§ 61.131 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, in Subpart A of Part 61, in Subpart V of Part 61, and the following terms shall have the specific meanings given them:

"Annual coke production" means the coke produced in the batteries connected to the coke by-product recovery plant over a 12-month period. The first 12-month period concludes on the first December 31 that comes at least 12 months after the effective date or after the date of initial startup if initial startup is after the effective date.

"In benzene service" means a piece of equipment, other than an exhauster, that either contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene by weight or any exhauster that either contains or contacts a fluid (liquid or gas) at least 1 percent benzene by weight as determined by the provisions of § 61.137(b). The provisions of § 61.137(b) also specify how to determine that a piece of equipment is not in benzene service.

"Coke by-product recovery plant" means any plant designed and operated for the separation and recovery of coal tar derivatives (by-products) evolved from coal during the coking process of a coke oven battery.

"Equipment" means each pump, valve, exhauster, pressure relief device, sampling connection system, open-ended valve or line, and flange or other connector in benzene service.

"Exhauster" means a fan located between the inlet gas flange and outlet gas flange of the coke oven gas line that provides motive power for coke oven gases.

"Foundary coke" means coke that is produced from raw materials with less than 26 percent volatile material by weight and that is subject to a coking period of 24 hours or more. Percent volatile material of the raw materials (by weight) is the weighted average percent volatile material of all raw materials (by weight) charged to the coke oven per coking cycle.

"Foundry coke by-product recovery plant" means a coke by-product recovery plant connected to coke batteries whose annual coke production is at least 75 percent foundry coke.

"Flushing-liquor circulation tank" means any vessel that functions to store or contain flushing liquor that is separated from the tar in the tar decanter and is recirculated as the cooled liquor to the gas collection system.

"Furnace coke" means coke produced in by-product ovens that is not foundry coke.

"Furnace coke by-product recovery plant" means a coke by-product recovery plant that is not a foundry coke by-product recovery plant.

"Light-oil condenser" means any unit in the light-oil recovery operation that functions to condense benzene-containing vapors.

"Light-oil decanter" means any vessel, tank, or other type of device in the light-oil recovery operation that functions to separate light oil from water downstream of the light-oil condenser. A light-oil decanter also may be known as a light-oil separator.

"Light-oil sump" means any tank, pit, enclosure, or slop tank in light-oil recovery operations that functions as a wastewater separation device for hydrocarbon liquids on the surface of the water.

"Mixer-settler" means a tank that is inserted into the final cooling process that serves to remove naphthalene from final cooler water by means of absorption into tar or another organic liquid.

"Naphthalene processing" means any operations required to recover naphthalene, including the separation, refining, and drying of crude or refined naphthalene.

"Process vessel" means each tar decanter, flushing-liquor circulation tank, light-oil condenser, light-oil decanter, wash-oil decanter, or wash-oil circulation tank.

"Semiannual" means a 6-month period; the first semiannual period concludes on the last day of the last full month during the 180 days following initial startup for new sources; the first semiannual period concludes on the last day of the last full month during the 180 days after the effective date of the regulation for existing sources.

"Tar decanter" means any vessel, tank, or other type of container that functions to separate heavy tar and sludge from flushing liquor by means of gravity, heat, or chemical emulsion breakers. A tar decanter also may be known as a flushing-liquor decanter.

"Tar storage tank" means any vessel, tank, reservoir, or other type of container used to collect or store crude tar or tar-entrained naphthalene, except for tar products obtained by distillation, such as coal tar pitch, creosotes, or carbolic oil. This definition also includes any vessel, tank, reservoir, or other type of container used to reduce the water content of the tar by means of heat, residence time, chemical emulsion breakers, or centrifugal separation. A tar storage tank also may be known as a tar-dewatering tank.

"Tar-intercepting sump" means any tank, pit, or enclosure that serves to separate light tars and aqueous condensate received from the primary cooler. A tar-intercepting sump also may be known as a primary-cooler decanter.

"Wash-oil circulation tank" means any vessel that functions to hold the wash oil used in light-oil recovery operations or the wash oil used in the wash-oil final cooler.

"Wash-oil decanter" means any vessel that functions to separate, by gravity, the condensed water from the wash oil received from a wash-oil final cooler or from a light-oil scrubber.

§ 61.132 Standard: Process vessels, tar storage tanks, and tar-intercepting sumps.

(a)(1) Each owner or operator shall enclose and seal all openings on each process vessel, tar storage tank, and tar-intercepting sump.

(2) The owner or operator shall duct gases from each process vessel, tar storage tank, and tar-intercepting sump to the gas collection system, gas distribution system, or other enclosed point in the by-product recovery process where the benzene in the gas will be recovered or destroyed. This control system shall be designed and operated for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background and visual inspections, as determined by the methods specified in § 61.245(c). This system can be designed as a closed, positive pressure, gas-blanketing system.

(i) Except, the owner or operator may elect to install, operate, and maintain a pressure relief device, vacuum relief device, an access hatch, and a sampling port on each process vessel, tar storage tank, and tar-intercepting sump. Each access hatch and sampling port must be equipped with a gasket and a cover, seal, or lid that must be kept in a closed position at all times, unless in actual use.

(ii) The owner or operator may elect to leave open to the atmosphere the portion of the liquid surface in each tar decanter necessary to permit operation of a sludge conveyor. If the owner or operator elects to maintain an opening on part of the liquid surface of the tar decanter, the owner or operator shall install, operate, and maintain a water leg seal on the tar decanter roof near the sludge discharge chute to ensure enclosure of the major portion of liquid surface not necessary for the operation of the sludge conveyor.

(b) Following the installation of any control equipment used to meet the requirements of paragraph (a) of this section, the owner or operator shall monitor the connections and seals on each control system to determine if it is operating with no detectable emissions, using Reference Method 21 (40 CFR Part 60 Appendix A) and procedures specified in § 61.245(c), and shall visually inspect each source (including sealing materials) and the ductwork of the control system for evidence of visible defects such as gaps or tears. This monitoring and inspection shall be conducted on a semi-annual basis and at any other time after the control system is repressurized with blanketing gas following removal of the cover or opening of the access hatch.

(1) If an instrument reading indicates an organic chemical concentration more than 500 ppm above a background concentration, as measured by Reference Method 21, a leak is detected.

(2) If visible defects such as gaps in sealing materials are observed during a visual inspection, a leak is detected.

(3) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected.

(4) A first attempt at repair of any leak or visible defect shall be made no later than 5 calendar days after each leak is detected.

(c) Following the installation of any control system used to meet the requirements of paragraph (a) of this section, the owner or operator shall conduct a maintenance inspection of the control system on an annual basis for evidence of system abnormalities, such as blocked or plugged lines, sticking valves, plugged condensate traps, and other maintenance defects that could result in abnormal system operation. The owner or operator shall make a first attempt at repair within 5 days, with repair within 15 days of detection.

§ 61.133 Standard: Light-oil sumps.

(a) Each owner or operator of a light-oil sump shall enclose and seal the liquid surface in the sump to form a closed system to contain the emissions.

(1) Except, the owner or operator may elect to install, operate, and maintain a vent on the light-oil sump cover. Each vent pipe must be equipped with a water leg seal, a pressure relief device, or vacuum relief device.

(2) Except, the owner or operator may elect to install, operate, and maintain a vent on the light-oil sump cover. Each access hatch must be equipped with a gasket and cover, seal, or lid that must be kept in a closed position at all times, unless in actual use.

(3) The light-oil sump cover may be removed for periodic maintenance but must be replaced (with seal) at completion of the maintenance operation.

(b) The venting of steam or other gases from the by-product process to the light-oil sump is not permitted.

(c) Following the installation of any control equipment used to meet the requirements of paragraph (a) of this section, the owner or operator shall monitor the connections and seals on each control system to determine if it is operating with no detectable emissions, using Reference Method 21 (40 CFR Part 60, Appendix A) and the procedures specified in § 61.245(c), and shall visually inspect each source (including sealing materials) for evidence of visible defects such as gaps or tears. This monitoring and inspection shall be conducted semiannually and at any other time the cover is removed.

(1) If an instrument reading indicates an organic chemical concentration more than 500 ppm above a background concentration, as measured by Reference Method 21, a leak is detected.

(2) If visible defects such as gaps in sealing materials are observed during a visual inspection, a leak is detected.

(3) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected.

(4) A first attempt at repair of any leak or visible defect shall be made no later than 5 calendar days after each leak is detected.

§ 61.134 Standard: Naphthalene processing, final coolers, and final-cooler cooling towers.

(a) No ("zero") emissions are allowed from naphthalene processing at furnace and foundry coke by-product recovery plants.

(b) The emission limit specified in paragraph (a) of this section is not applicable if a mixer-organic liquid.

(c) If a mixer-settler is used to separate naphthalene, the mixer-settler is subject to all requirements specified in § 61.132 for process vessels, including lead detection and repair provisions.

(d) No ("zero") emissions are allowed from final coolers and final-cooler cooling towers at furnace coke by-product recovery plants.

§ 61.135 Standard: Equipment leaks.

(a) Each owner or operator of equipment in benzene service shall comply with the requirements of 40 CFR Part 61, Subpart V, except as provided in this section.

(b) The provisions of §§ 61.242-3 and 61.242-9 of Subpart V do not apply to this subpart.

(c) Each piece of equipment in benzene service to which this subpart applies shall be marked in such a manner that it can be distinguished readily from other pieces of equipment in benzene service.

(d) Each exhauster shall be monitored quarterly to detect leaks by the methods specified in § 61.245(b) except as provided in § 61.136(d) and paragraphs (e) through (g) of this section.

(1) If an instrument reading of 10,000 ppm or greater is measured, a leak is detected.

(2) When a leak is detected, it shall be repaired as soon as practicable, but no later than 15 calendar days after it is detected, except as provided in § 61.242-10 (a) and (b). A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.

(e) Each exhauster equipped with a seal system that includes a barrier fluid system and that prevents leakage of process fluids to the atmosphere is exempt from the requirements of paragraph (d) of this section provided the following requirements are met:

(1) Each exhauster seal system is:

(i) Operated with the barrier fluid at a pressure that is greater than the exhauster stuffing box pressure; or

(ii) Equipped with a barrier fluid system that is connected by a closed vent system to a control device that complies with the requirements of § 61.242-11; or

(iii) Equipped with a system that purges the barrier fluid into a process stream with zero benzene emissions to the atmosphere.

(2) The barrier fluid is not in benzene service.

(3) Each barrier fluid system shall be equipped with a sensor that will detect failure of the seal system, barrier fluid system, or both.

(4)(i) Each sensor as described in paragraph (e)(3) of this section shall be checked daily or shall be equipped with an audible alarm.

(ii) The owner or operator shall determine, based on design considerations and operating experience, a criterion that indicates failure of the seal system, the barrier fluid system, or both.

(5) If the sensor indicates failure of the seal system, the barrier system, or both (based on the criterion determined under paragraph (e)(r)(ii) of this section), a leak is detected.

(6)(i) When a leak is detected, it shall be repaired as soon as practicable, but not later than 15 calendar days after it is detected, except as provided in § 61.242-10.

(ii) A first attempt at repair shall be made no later than 5 calendar days after each leak is detected.

(f) An exhauster is exempt from the requirements of paragraph (d) of this section if it is equipped with a closed vent system capable of capturing and transporting any leakage from the seal or seals to a control device that complies with the requirements of § 61.242-11 except as provided in paragraph (g) of this section.

(g) Any exhauster that is designated, as described in § 61.246(3) for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, is exempt from the requirements of paragraph (d) of this section if the exhauster:

(1) Is demonstrated to be operating with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background, as measured by the methods specified in § 61.245(c); and

(2) Is tested for compliance with paragraph (g)(1) of this section initially upon designation, annually, and at other times requested by the Administrator.

(h) Any exhauster that is in vacuum service is excluded from the requirements of this subpart if it is identified as required in § 61.246(e)(5).

§ 61.136 Compliance provisions and alternative means of emission limitation.

(a) Each owner or operator subject to the provisions of this subpart shall demonstrate compliance with the requirements of §§ 61.132 through 61.135 for each new and existing source, except as provided under §§ 61.243-1 and 61.243.2.

(b) Compliance with this subpart shall be determined by a review of records, review of performance test results, inspections, or any combination thereof, using the methods and procedures specified in § 61.137.

(c) On the first January 1 after the first year that a plant's annual coke production is less than 75 percent foundry coke, the coke by-product recovery plant becomes a furnace coke by-product recovery plant and shall comply with § 61.134(d). Once a plant becomes a furnace coke by-product recovery plant, it will continue to be considered a furnace coke by-product recovery plant, regardless of the coke production in subsequent years.

(d)(1) An owner or operator may request permission to use an alternative means of emission limitation to meet the requirements in §§ 61.132, 61.133, and 61.135 of this subpart and §§ 61.242-2, -5, -6, -7, -8, and -11 of Subpart V. Permission to use an alternative means of emission limitation shall be requested as specified in § 61.12(d).

(2) When the Administrator evaluates requests for permission to use alternative means of emission limitation for sources subject to §§ 61.132, 61.133, (except tar decanters), the Administrator shall compare test data for the means of emission limitation to a benzene control efficiency of 98 percent. For tar decanters, the Administrator shall compare test data for the means of emission limitation to a benzene control efficiency of 95 percent.

(3) For any requests for permission to use an alternative to the work practices required under § 61.135, the provisions of § 61.244(c) shall apply.

§ 61.137 Test methods and procedures.

(a) Each owner or operator subject to the provisions of this subpart shall comply with the requirements in § 61.245 of 40 CFR Part 61, Subpart V.

(b) To determine whether or not a piece of equipment is in benzene service, the methods in § 61.245(d) shall be used, except that, for exhausters, the percent benzene shall be 1 percent by weight (rather than the 10 percent by weight described in § 61.245(d)).

§ 61.138 Recordkeeping and reporting requirements.

(a) The following information pertaining to the design of control equipment installed to comply with §§ 61.132 through 61.134 shall be recorded and kept in a readily accessible location:

(1) Detailed schematics, design specifications, and piping and instrumentation diagrams.

(2) The dates and descriptions of any changes in the design specifications.

(b) The following information pertaining to sources subject to § 61.132, sources subject to § 61.133, and mixer-settlers used to comply with § 61.134(b) shall be recorded and maintained for 2 years following each semiannual (and other) inspection and each annual maintenance inspection:

(1) The date of the inspection and the name of the inspector.

(2) A brief description of each visible defect in the source or control equipment and the method and date of repair of the defect.

(3) The presence of a leak, as measured using the method described in § 61.245(c). The record shall include the date of attempted and actual repair and method of repair of the leak.

(4) A brief description of any system abnormalities found during the annual maintenance inspection, the repairs made, the date of attempted repair, and the date of actual repair.

(c) Each owner or operator of a source subject to § 61.135 shall comply with § 61.246.

(d) For foundry coke by-product recovery plants, the annual coke production of both furnace and foundry coke shall be recorded and maintained for 2 years following each determination.

(e)(1) An owner or operator of any source to which this subpart applies shall submit a statement in writing notifying the Administrator that the requirements of this subpart and 40 CFR Part 61, Subpart V, have been implemented.

(2) In the case of an existing source or a new source that has an initial startup date preceding the effective date, the statement is to be submitted within 90 days of the effective date, unless a waiver of compliance is granted under § 61.11, along with the information required under § 61.10. If a waiver of compliance is granted, the statement is to be submitted on a date scheduled by the Administrator.

(3) In the case of a new source that did not have an initial startup date preceding the effective date, the statement shall be submitted with the application for approval of construction, as described under § 61.07.

(4) The statement is to contain the following information for each source:

(i) Type of source (e.g., a light-oil sump or pump).

(ii) For equipment in benzene service, equipment identification number and process unit identification; percent by weight benzene in the fluid at the equipment; and process fluid state in the equipment (gas/vapor or liquid).

(iii) Method of compliance with the standard (e.g., "gas blanketing," "use of a tar-bottom final cooler," "monthly leak detection and repair," or "equipped with dual mechanical seals"). This includes whether the plant plans to be a furnace or foundry coke by-product recovery plant for the purposes of § 61.134.

(f) A report shall be submitted to the Administrator semiannually starting 6 months after the initial reports required in §§ 61.138(e) and 61.10, which includes the following information:

(1) For sources subject to § 61.132, sources subject to § 61.133, and mixer-settlers used to comply with § 61.134(c),

(i) A brief description of any visible defect in the source or ductwork,

(ii) The number of leaks detected and repaired, and

(iii) A brief description of any system abnormalities found during each annual maintenance inspection that occurred in the reporting period and the repairs made.

(2) For equipment in benzene service subject to § 61.135(a), information required by § 61.247(b).

(3) For each exhauster subject to § 61.135 for each quarter during the semiannual reporting period,

(i) The number of exhausters for which leaks were detected as described in § 61.135(d) and (e)(5),

(ii) The number of exhausters for which leaks were detected as repaired as required in § 61.135(d) and (e)(6),

(iii) The results of performance tests to determine compliance with § 61.135(g) conducted within the semiannual reporting period.

(4) A statement signed by the owner or operator stating whether all provisions of 40 CFR Part 61, Subpart L, have been fulfilled during the semiannual reporting period.

(5) For foundry coke by-product recovery plants, the annual coke production of both furnace and foundry coke, if determined during the reporting period.

(6) Revisions to items reported according to paragraph (e) of this section if changes have occurred since the initial report or subsequent revisions to the initial report.

Note: Compliance with the requirements of § 61.10(c) is not required for revisions documented under this paragraph.

(g) In the first report submitted as required in § 61.138(e), the report shall include a reporting schedule stating the months that semiannual reports shall be submitted. Subsequent reports shall be submitted according to that schedule unless a revised schedule has been submitted in a previous semiannual report.

(h) An owner or operator electing to comply with the provisions of §§ 61.243-1 and 61.243-2 shall notify the Administrator of the alternative standard selected 90 days before implementing either of the provisions.

(i) An application for approval of construction or modification, as required under §§ 61.05(a) and 61.07, will not be required for sources subject to § 61.135 if—

(1) The new source complies with § 61.135.

(2) In the next semiannual report required by § 61.138(f), the information described in § 61.138(e)(4) is reported.

(Approved by OMB under control number ———.)

§ 61.139 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States:

(1) Section 61.136(d).

5. Under *Approach C*, as described in the preamble, Subpart L would be added to Part 61 of Title 40 as follows:

Subpart L—National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants

Sec.
61.130 Applicability and designation of sources.
61.131 Definitions.
61.132 Emission limit.
61.133 Standard: Process vessels, tar storage tanks, and tar-intercepting sumps.
61.134 Standard: Light-oil sumps.
61.135 Standard: Naphthalene processing, final coolers, and final-cooler cooling towers.
61.136 Standard: Equipment leaks.
61.137 Compliance provisions and alternative means of emission limitation.
61.138 Test methods and procedures.
61.139 Recordkeeping and reporting requirements.
61.140 Delegation of authority.

Subpart L—National Emission Standard for Benzene Emission From Coke By-Product Recovery Plants

§ 61.130 Applicability and designation of sources.

(a) The provisions of this subpart apply to each of the following sources at coke by-product recovery plants: Tar decanters, tar-intercepting sumps, flushing-liquor circulation tanks, light-oil sumps, light-oil condensers, light-oil decanters, wash-oil decanters, wash-oil circulation tanks, naphthalene processing at foundry coke by-product plants, naphthalene processing, final coolers, and final cooler cooling towers at furnace coke by-product plants, tar storage tanks, benzene-toluene-xylene (BTX) storage tanks, light-oil storage tanks, excess ammonia-liquor storage tanks, and the following equipment that are intended to operate in benzene service: Pumps, valves, exhausters, pressure relief devices, sampling connection systems, open-ended valves or lines, flanges or other connectors, and control devices or systems required by § 61.136.

§ 61.131 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, in Subpart A of Part 61, in Subpart V of Part 61, and the following terms shall have the specific meanings given them:

"Benzene storage tank" means any tank, reservoir, or other type container used to collect or store refined benzene.

"BTX storage tank" means any vessel, reservoir, or container used for the storage of benzene-toluene-xylene or other light-oil fractions.

"Excess ammonia-liquor storage tank" means tank, reservoir, or other type container used to collect or store a flushing liquor solution prior to ammonia or phenol recovery.

"Light-oil storage tank" means any vessel, tank, reservoir, or other type container used to collect or store crude or refined light-oil, used for the storage of crude or refined light-oil.

(Remaining definitions identical to § 61.131 of Approach A. Full text would be printed in final rule.)

§ 61.132 Emission limit.

(a) No owner or operator of a plant subject to this subpart shall cause to be discharged to the atmosphere total benzene emissions from all sources listed in § 61.130(a) exceeding 34 kg/day, and

(b) Each owner or operator of a plant subject to this subpart also shall comply with the standards specified in §§ 61.133–61.136.

§ 61.133 Standard: Process vessels, tar storage tanks, and tar-intercepting sumps.

(Identical to § 61.132 of Approach A. Full text would be printed in final rule.)

§ 61.134 Standard: Light-oil sumps.

(Identical to § 61.133 of Approach A. Full text would be printed in final rule.)

§ 61.135 Standard: Naphthalene processing, final coolers, and final-cooler cooling towers.

(Identical to § 61.134 of Approach A. Full text would be printed in final rule.)

§ 61.136 Standard: Equipment leaks.

(Identical to § 61.135 of Approach A. Full text would be printed in final rule.)

§ 61.137 Compliance provisions and alternative means of emission limitation.

(a) Each owner or operator subject to the provisions of this subpart shall demonstrate compliance with the requirements of § 61.132 and §§ 61.133–61.136 for each new and existing source, except as provided under §§ 61.243–1 and 61.243–2.

(b) Compliance with § 61.132(a) of this subpart shall be determined by the procedures specified in § 61.138; compliance with §§ 61.133–61.136 of this subpart shall be determined by a review of records, review of performance test results, inspections, or any combination thereof, using the methods and procedures specified in § 61.138.

(c)–(d) (Identical to § 61.136(c)–(d) of Approach A. Full text would be printed in final rule.)

(e) If the owner or operator of a plant subject to this subpart complies with § 61.132(a) with methods different than those required in § 61.132(b), the owner or operator shall submit an operating and maintenance plan to the Administrator in addition to the semiannual reports required by § 61.139. Each owner or operator shall conduct operations, monitor the parameters, and maintain equipment in accordance with the approved operating plan.

§ 61.138 Test methods and procedures.

(a) Each owner or operator seeking to demonstrate compliance for sources with the emission limit in § 61.132(a) shall calculate total benzene emissions per year from all sources shown on Table 1 by multiplying, for each source, the plant annual production rate by the uncontrolled benzene emission factors from Table 1 and then applying the efficiency of the control system to obtain controlled emissions for each source. For equipment in benzene service, the owner or operator shall calculate emissions using one of the procedures given in the documents, *Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft,* November 1987; EPA Contract No. 68–02–4338, and apply the emission reduction efficiency for the control program. If the sum of total emissions from all affected sources divided by 365 is 34 kg/day or less, the plant is in compliance with § 61.132(a).

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Table 1. Uncontrolled Benzene Emission Factors (g benzene/Mg of coke/day)

Source	Furnace Plants	Foundry Plants
Cooling tower		
Direct-water	270	197
Tar-bottom	70	51
Naphthalene separation and processing	107	79
Light-oil condenser vent	89	48
Tar intercepting sump	90	45
Tar dewatering	21	9.9
Tar decanter	77	36
Light-oil sump	15	8.1
Light-oil storage	5.8	3.1
BTX storage	5.8	3.1
Benzene storage	5.8	3.1
Flushing-liquor circulation tank	6.6	9
Excess ammonia-liquor storage	9	6.6
Wash-oil decanter	3.8	6.6

BILLING CODE 6560-50-C

(b) Subject to approval by the Administrator, the owner or operator may determine compliance based on emission testing as described in § 61.13. To demonstrate compliance, the owner or operator shall submit supporting documentation as described in § 61.139.

(c)-(d) (Identical to § 61.137 (a)-(b)] of Approach A. Full text would be printed in final rule.)

§ 61.139 Recordkeeping and reporting requirements.

(a) The following information pertaining to compliance with the emission limit specified in § 61.132(a) shall be recorded and kept in a readily available location:

(1) If compliance is determined by § 61.138(a), all calculations based on annual production rate and benzene emission factors, including documentation of the basis of the efficiency of the control systems applied.

(2) If compliance is determined by § 61.138(b), results of emission tests used to demonstrate compliance and all supporting calculations, including documentation of the basis of the efficiency of the control systems applied.

(b)-(f) (iii) (Identical to §§ 61.138(a)–61.138(e) (iii) of Approach A. Full text would be printed in final rule.)

(g) If an owner or operator is required to submit an operating and maintenance plan as required in § 61.137(e), the plan shall be submitted to the Administrator for approval within 90 days of the effective date, along with the information required by § 61.10. For new sources, the owner or operator shall submit the plan within 90 days after initial startup. The plan shall include the following:

(1) A description of the control techniques by which the owner or operator will comply with the emission limit in § 61.132(a) and the general standards in §§ 61.133–61.136.

(2) Identification of the parameter(s) to be monitored to ensure that each control device is operated in conformance with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria to be used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary.

(5) A schedule reporting of other information demonstrating continued compliance with § 61.132(a). The reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(h) Each owner or operator subject to this subpart shall submit to the Administrator a written report of excess emissions established in the approved operating and maintenance plan. For the purposes of this paragraph, excess emissions shall be considered any exceedence of the monitoring parameters specified in the approved operating and maintenance plan.

(i) Each owner or operator subject to § 61.132(a) that demonstrates compliance using the procedures in § 61.138(b) shall:

(1) Provide the Administrator 30 days notice of any emission test required in § 61.13 to afford the Administrator the opportunity to have an observer present; and

(2) Submit to the Administrator a written report of the results of the emission test and associated calculations, as applicable, within 30 days of conducting the test.

(j) Each owner or operator subject to § 61.132(a) that demonstrates compliance using the procedures in § 61.138(a) shall provide the Administrator a report demonstrating compliance and containing all supporting calculations, including documentation of the basis of the efficiency of the control systems applied. For existing sources, the report shall be submitted to the Administrator within 90 days of the effective date, along with the information required by § 651.10. For new sources, the report shall be submitted to the Administrator along with the notification of startup required by § 61.09.

(k)-(l) (Identical to §§ 61.138 (f)-(i) of Approach A. Full text would be printed in final rule.)

§61.140 Delegation of authority.

(Identical to §61.139 of Approach A. Full text would be printed in final rule.)

6. Under *Approach D*, as described in the preamble, Subpart L would be added to Part 61 of Title 40 as follows:

Subpart L—National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants

Sec.
61.130 Applicability and designation of sources.
61.131 Definitions.
61.132 Emission limit.
61.133 Compliance provisions.
61.134 Recordkeeping and reporting requirements.
61.135 Delegation of authority.

Subpart L—National Emission Standard for Benzene Emission from Coke By-Product Recovery Plants.

§ 61.130 Applicability and designation of sources.

(a) The provisions of this subpart apply to each of the following sources at coke by-product recovery plants: Tar decanters, tar-intercepting sumps, flushing-liquor circulation tanks, light-oil sumps, light-oil condensers, light-oil decanters, wash-oil decanters, wash-oil circulation tanks, naphthalene processing at foundry coke by-product plants, naphthalene processing, final coolers, and final cooler cooling towers at furnace coke by-product plants, tar storage tanks, benzene-toluene-xylene (BTX) storage tanks, light-oil storage tanks, excess ammonia-liquor storage tanks, and the following equipment that are intended to operate in benzene service: Pumps, valves, exhausters, pressure relief devices, sampling connection systems, open-ended valves or lines, flanges or other connectors, and control devices or systems for these equipment.

§ 61.131 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, in Subpart A of Part 61, in Subpart V of Part 61, and the following terms shall have the specific meanings given them:

"Benzene storage tank" means any tank, reservoir, or other type container used to collect or store refined benzene.

"BTX storage tank" means any vessel, reservoir, or container used for the storage of benzene-toluene-xylene or other light-oil fractions.

"Excess ammonia-liquor storage tank" means tank, reservoir, or other type container used to collect or store a flushing liquor solution prior to ammonia or phenol recovery.

"Light-oil storage tank" means any vessel, tank, reservoir, or other type container used to collect or store crude or refined light-oil, used for the storage of crude or refined light-oil.

(Remaining definitions identical to § 61.131 of Approach A. Full text would be printed in final rule.)

§ 61.132 Emission limit.

(a) No owner or operator of a plant subject to this subpart shall cause to be discharged to the atmosphere total benzene emissions from all sources listed in § 61.130(a) exceeding 0.34 kg/day.

§ 61.133 Compliance provisions.

(a) Each owner or operator subject to the provisions of this subpart shall demonstrate compliance with the requirements of § 61.132 for each new and existing source.

(b) Each owner or operator seeking to demonstrate compliance for sources with the emission limit in § 61.132 shall calculate total benzene emissions per year from all sources shown in Table 1 by multiplying, for each source, the plant annual production rate by the uncontrolled benzene emission factors from Table 1 and then applying the efficiency of the control system to obtain controlled emissions for each source. For equipment in benzene service, the owner or operator shall calculate emissions using one of the procedures given in the document, "Protocols for Generating Unit-Specific Estimates for Equipment Leaks of VOC and VHAP—Draft," December 1987; EPA Contract No. 68–02–4338, and apply the emission reduction efficiency for the control program. If the sum of total emissions from all affected sources divided by 365 is 0.34 kg/day or less, the plant is in compliance with § 61.132.

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Table 1. Uncontrolled Benzene Emission Factors
(g benzene/Mg of coke/day)

Source	Furnace Plants	Foundry Plants
Cooling tower		
Direct-water	270	197
Tar-bottom	70	51
Naphthalene separation and processing	107	79
Light-oil condenser vent	89	48
Tar intercepting sump	90	45
Tar dewatering	21	9.9
Tar decanter	77	36
Light-oil sump	15	8.1
Light-oil storage	5.8	3.1
BTX storage	5.8	3.1
Benzene storage	5.8	3.1
Flushing-liquor circulation tank	6.6	9
Excess ammonia-liquor storage	9	6.6
Wash-oil decanter	3.8	6.6

BILLING CODE 6560-50-C

(c) Subject to approval by the Administrator, the owner or operator may determine compliance based on emission testing as described in § 61.13. To demonstrate compliance, the owner or operator shall submit supporting documentation as described in § 61.134.

§ 61.134 Recordkeeping and reporting requirements.

(a) The following information pertaining to compliance with the emission limit specified in § 61.132 shall be recorded and kept in a readily available location:

(1) If compliance is determined by § 61.133(b), all calculations based on annual production rate and benzene emission factors, including documentation of the basis of the efficiency of the control systems applied.

(2) If compliance is determined by § 61.133(c), results of emission tests used to demonstrate compliance and all supporting calculations, including documentation of the basis of the efficiency of the control systems applied.

(b) Each owner or operator subject to § 61.132 that demonstrates compliance using the procedures in § 61.133(b) shall provide the Administrator a report demonstrating compliance and containing all supporting calculations, including documentation of the basis of the efficiency of the control systems applied. For existing sources, the report shall be submitted to the Administrator within 90 days of the effective date, along with the information required by § 61.10. For new sources, the report shall be submitted to the Administrator along with the notification of startup required by § 61.09.

(c) Each owner or operator subject to § 61.132 that demonstrates compliance using the procedures in § 61.133(c) shall:

(1) Provide the Administrator 30 days notice of any emission test required in § 61.13 to afford the Administrator the opportunity to have an observer present; and

(2) Submit to the Administrator a written report of the results of the emission test and associated calculations, as applicable, within 30 days of conducting the test.

(d) Each owner or operator subject to this subpart shall submit an operating and maintenance plan to the Administrator for approval within 90 days of the effective date, along with the information required by § 61.10. For new sources, the owner or operator shall submit the plan within 90 days after initial startup. Each owner or operator shall conduct operations, monitor the parameters, and maintain equipment in accordance with the approved operating plan. The plan shall contain the following:

(1) A description of the control techniques by which the owner or operator will comply with the emission limit in § 61.132.

(2) Identification of the parameter(s) to be monitored to ensure that each control device is operated in conformance with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria to be used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary.

(5) A schedule for reporting of other information demonstrating continued compliance with § 61.132(a). The reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(e) Each owner or operator subject to this subpart shall submit to the Administrator a written report of excess emissions established in the approved operating and maintenance plan. For the purposes of this paragraph, excess emissions shall be considered any exceedence of the monitoring parameters specified in the approved operating and maintenance plan.

§ 61.135 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States: None.

7. Under *Approaches A, B, and C,* as described in the preamble for Coke By-Product Recovery Plants, § 61.241 of 40 CFR Part 61, Subpart V, would be amended by revising the definition of "repaired" and by adding a definition of "stuffing box pressure" as follows:

§ 61.241 Definitions.

* * * * *

"Repaired" means that equipment is adjusted, or otherwise altered, to eliminate a leak as indicated by one of the following: An instrument reading of 10,000 ppm or greater, detectable emissions as indicated by an instrument reading of 500 ppm or greater above a background concentration, indication of liquids dripping, or indication by a sensor that a seal system or barrier fluid system has failed.

"Stuffing box pressure" means the fluid (liquid or gas) pressure inside the casing or housing of a piece of equipment, on the process side of the inboard seal.

* * * * *

8. Under *Approaches A, B, and C,* as described in the preamble for Coke By-Product Recovery Plants, § 61.245 of 40 CFR Part 61, Subpart V, would be amended by revising introductory paragraph (b), introductory paragraph (c), and paragraph (d)(3) as follows:

§ 61.245 Test methods and procedures.

* * * * *

(b) Monitoring, as required in §§ 61.242, 61.243, 61.244, and 61.135, shall comply with the following requirements:

* * * * *

(c) When equipment is tested for compliance with no detectable emissions, the test shall comply with the following requirements:

* * * * *

(d) * * *

(3) Samples used in determining the percent VHAP content shall be representative, as determined by the Administrator, of the process fluid that is contained in or contacts the equipment or the gas being combusted in the flare.

9. Under *Approaches A, B, and C,* as described in the preamble for Coke By-Product Recovery Plants, § 61.246 of 40 CFR Part 61, Subpart V, would be amended by revising the introductions to paragraphs (b), (c), and (e) and by revising paragraphs (e)(2)(i), (e)(2)(ii), (e)(4)(i), and (h)(1) to read as follows:

§ 61.246 Recordkeeping requirements.

* * * * *

(b) When each leak is detected as specified in §§ 61.242-2, 61.242-3, 61.242-7, 61.242-8, and 61.135, the following requirements apply:

* * * * *

(c) When each leak is detected as specified in §§ 61.242-2, 61.242-3, 61.242-7, 61.242-8, and 61.135, the following information shall be recorded in a log and shall be kept for 2 years in a readily accessible location:

* * * * *

(e) The following information pertaining to all equipment to which a standard applies shall be recorded in a log that is kept in a readily accessible location:

(1) * * *

(2)(i) A list of identification numbers for equipment that the owner or operator elects to designate for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background.

(ii) The designation of this equipment for no detectable emissions shall be signed by the owner or operator.

(3) * * *

(4)(i) The dates of each compliance test required in §§ 61.242-2(e), 61.242-3(i), 61.242-4, 61.242-7(f), and 61.135(g).

* * * * *

(h) * * *

(1) Design criterion required in §§ 61.242-2(d)(5), 61.242-3(e)(2), and 61.135(e)(4) and an explanation of the design criterion; and

* * * * *

10. *Under Approaches A, B, and C,* as described in the preamble for Coke By-Product Recovery Plants, § 61.247 of 40 CFR Part 61, Subpart V, would be amended by revising paragraph (b)(5) to read as follows:

§ 61.247 Reporting requirements.

* * * * *

(b) * * *

(5) The results of all performance tests to determine compliance with no detectable emissions and with §§ 61.243-1 and 61.243-2 conducted within the semiannual reporting period.

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11. Under *Approaches A, B, and C* as described in the preamble, Subpart Y would be added to Part 61 of Title 40 as follows:

Subpart Y—National Emission Standard for Benzene Emissions From Benzene Storage Vessels

Sec.
61.270 Applicability and designation of sources.
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Subpart Y—National Emission Standard for Benzene Emissions From Benzene Storage Vessels

§ 61.270 Applicability and designation of sources.

(a) The source to which this subpart applies is each storage vessel that is storing benzene having a specific gravity within the range of specific gravities specified for Industrial Grade Benzene in ASTM-D-836-80 (incorporated by reference as specified in § 61.18). This specification includes Industrial Grade Benzene, Nitration Grade Benzene, and Refined Benzene-535.

(b) Except for paragraph (b) in § 61.276, storage vessels with a design storage capacity less than 38 cubic meters (10,000 gallons) are exempt from the provisions of this subpart.

(c) This subpart does not apply to storage vessels used for storing benzene at coke by-product facilities.

(d) This subpart does not apply to vessels permanently attached to motor vehicles such as trucks, rail cars, barges, or ships.

(e) This subpart does not apply to pressure vessels designed to operate in excess of 204.9 kPa and without emissions to the atmosphere.

(f) A designated source subject to the provisions of this subpart that is also subject to applicable provisions of 40 CFR Part 60, Subparts K, K(a), and K(b) shall be required to comply only with the provisions of this subpart.

§ 61.271 Emission standard.

The owner or operator of a storage vessel with a design storage capacity greater than 38 cubic meters (10,000 gallons) to which this subpart applies shall reduce emissions to the atmosphere by meeting the equipment and procedural requirements in paragraphs (a), (b), or (c) of this section, or equivalent as provided in § 61.273, and paragraph (d) of this section.

(a) Requirements for a permanently affixed roof and internal floating roof.

(1) Each storage vessel shall be equipped with an internal floating roof. An internal floating roof means a cover that rests on the liquid surface (but not necessarily in complete contact with it) inside a storage vessel that has a permanently affixed roof. The internal floating roof shall be floating on the liquid surface at all times, except during initial fill and during those intervals when the storage vessel is completely emptied or subsequently emptied and refilled. When the roof is resting on the leg supports, the process of filling, emptying, or refilling shall be continuous and shall be accomplished as rapidly as possible.

(2) Each internal floating roof shall be equipped with one of the closure devices listed in paragraphs (a)(2), (i), (ii), or (iii) of this section between the wall of the storage vessel and the edge of the internal floating roof. This requirement does not apply to each existing storage vessel for which construction of an internal floating roof commenced on or before July 28, 1988.

(i) A foam- or liquid-filled seal mounted in contact with the liquid (liquid-mounted seal). A liquid-mounted seal means a foam- or liquid-filled seal mounted in contact with the liquid between the wall of the storage vessel and the floating roof continuously around the circumference of the tank.

(ii) Two seals mounted one above the other so that each forms a continuous closure that completely covers the space between the wall of the storage vessel and the edge of the internal floating roof. The lower seal may be vapor-mounted, but both must be continuous

(iii) A metallic shoe seal. A metallic shoe seal (also referred to as a mechanical shoe seal) is, but is not limited to, a metal sheet held vertically against the wall of the storage vessel by springs or weighted levers and is connected by braces to the floating roof. A flexible coated fabric (envelope) spans the annular space between the metal sheet and the floating roof

(3) Each opening in the internal floating roof, except for automatic bleeder vents, leg sleeves, ladder wells, sampled wells, rim space vents, and stub drains, shall be equipped with a cover which is in a closed position at all times (i.e., no visible gap), except when the device is in actual use. If an existing storage vessel had an internal floating roof as of July 28, 1988, this requirement does not have to be met until the first time after the date of promulgation when the vessel is emptied and degassed or 10 years from the date of promulgation, whichever occurs first.

(4) Automatic bleeder vents are to be closed at all times when the roof is floating, except when the roof is being floated off or is being landed on the roof leg supports.

(5) Each internal floating roof shall meet the specifications listed below. If an existing storage vessel had an internal floating roof as of July 28, 1988, the requirements listed below do not have to be met until the first time after the date of promulgation when the vessel is emptied and degassed or 10 years from the date of promulgation, whichever comes first,

(i) Each cover on an opening of an internal floating roof shall be gasketed.

(ii) Covers on each access hatch and each automatic gauge float well shall be bolted when they are not in use.

(iii) Each penetration of the internal floating roof for the purposes of sampling shall be a sample well. Each sample well shall have a slit fabric cover that covers at least 90 percent of the opening.

(iv) Each automatic bleeder vent shall be gasketed.

(v) Rim space vents shall be equipped with a gasket and are to be set to open only when the internal floating roof is not floating or at the manufacturer's recommended setting.

(vi) Each penetration of the internal floating roof that allows for passage of a ladder shall have a gasketed sliding cover.

(6) A storage vessel with a continuous secondary seal does not have to meet the specifications for internal floating roofs included in paragraph (a)(5) of this section. A continuous secondary seal means the upper of two seals forming a continuous closure except as provided in § 61.272(b)(4) between the wall of the storage vessel and the internal floating roof.

(7) For a storage vessel for which construction commenced after July 28, 1988, each penetration of the internal floating roof that allows for passage of a column supporting the fixed roof shall have a flexible fabric sleeve seal or a gasketed sliding cover.

(8) Each opening in a noncontact internal floating roof except for automatic bleeder vents (vacuum breaker vents) and the rim space vents is to provide a projection below the liquid surface.

(b) Requirements for external floating roof tanks.

(1) Each storage vessel shall have an external floating roof. An external floating roof means a pontoon-type or double-deck-type cover that rests on the liquid surface in a vessel with no fixed roof.

(2) Each external floating roof shall be equipped with a closure device between the wall of the storage vessel and the roof edge. Except as provided in paragraph (b)(5) of this section, the closure device is to consist of two seals, one above the other. The lower seal is referred to as the primary seal and the upper seal is referred to as the secondary seal.

(i) The primary seal shall be either a metallic shoe seal or a liquid-mounted seal. A liquid-mounted seal means a foam- or liquid-filled seal mounted in contact except as provided in § 61.272(b)(4) with the liquid between the wall of the storage vessel and the floating roof continuously around the circumference of the tank. A metallic shoe seal (which can also be referred to as a mechanical shoe seal) is, but is not limited to, a metal sheet held vertically against the wall of the storage vessel except as provided in § 61.272(b)(4) by springs or weighted levels and is connected by braces to the floating roof. A flexible coated fabric (envelope) spans the annular space between the metal sheet and the floating roof. Except as provided in § 61.272(b)(4) the primary seal shall completely cover the annular space between the edge of the floating roof and the tank wall.

(ii) The secondary seal shall completely cover the annular space between the external floating roof and the wall of the storage vessel in a continuous fashion except as allowed in § 61.272(b)(4)(ii).

(3) Except for automatic bleeder vents and rim space vents, each opening in the noncontact external floating roof shall provide a projection below the liquid surface. Except for automatic bleeder vents, rim space vents, roof drains, and leg sleeves, each opening in the roof is to be equipped with a gasketed cover, seal or lid which is to be maintained in a closed position at all times (i.e., no visible gap) except when the device is in actual use. Automatic bleeder vents are to be closed at all times when the roof is floating, except when the roof is being floated off or is being landed on the roof leg supports. Rim vents are to be set to open when the roof is being floated off the roof leg supports or at the manufacturer's recommended setting. Automatic bleeder vents and rim space vents are to be gasketed. Each emergency roof drain is to be provided with a slotted membrane fabric cover that covers at least 90 percent of the area of the opening.

(4) The roof shall be floating on the liquid at all times (i.e., off the roof leg supports) except during initial fill until the roof is lifted off leg supports and when the tank is completely emptied and subsequently refilled. The process of emptying and refilling when the roof is resting on the leg supports shall be continuous and shall be accomplished as rapidly as possible.

(5) The requirement for a secondary seal does not apply to each existing storage vessel that was equipped with a liquid-mounted primary seal as of July 28, 1988, until after the first time after the date of promulgation when the vessel is emptied and degassed or 10 years from the date of promulgation, whichever occurs first.

(c) Requirements for closed vent system/control device.

(1) The closed vent system shall be designed to collect all benzene vapors and gases discharged from the storage vessel and operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background and visual inspections, as determined in Part 61, Subpart V, § 61.242–11.

(2) The control device shall be designed and operated to reduce inlet benzene emissions by 95 percent or greater. If a flare is used as the control device, it shall meet the specifications described in the general control device requirements of 40 CFR 60.18.

(3) The specifications and requirements listed in paragraphs (c)(1) and (c)(2) of this section for closed vent systems/control devices do not apply during periods of routine maintenance. During periods of routine maintenance, the benzene level in the storage vessel(s) serviced by the control device subject to the provisions of § 61.271(c) may be lowered but not raised. Periods of routine maintenance shall not exceed 72 hours as outlined in the maintenance plan required by § 61.272(c)(1)(iii) when approved by the Administrator.

(4) The specifications and requirements listed in paragraphs (c)(1) and (c)(2) of this section for closed vent/control devices do not apply during a control system malfunction. A control system malfunction means any sudden and unavoidable failure of air pollution control equipment. A failure caused entirely or in part by design deficiencies, poor maintenance, careless operation, or other preventable upset condition or equipment breakdown is not considered a malfunction.

(d) The owner or operator of each affected storage vessel shall meet the requirements of paragraph (a), (b), or (c) of this section, as follows:

(1) The owner or operator of each existing benzene storage vessel shall meet the requirements of paragraph (a), (b), or (c) of this section no later than 90 days after the effective date of this regulation with the exceptions noted in paragraphs (a)(3), (a)(5), and (b)(5) unless a waiver of compliance has been approved by the Administrator in accordance with § 61.11.

(2) The owner or operator of each benzene storage vessel upon which construction commenced after the date of promulgation shall meet the requirements of paragraph (a), (b), or (c) of this section prior to filling (i.e., roof is lifted off leg supports) the storage vessel with benzene.

(3) The owner or operator of each benzene storage vessel upon which construction commenced on or after July 28, 1988, and before the date of promulgation shall meet the requirements of paragraph (a), (b), or (c) of this section on the effective date of this regulation.

§ 61.272 Compliance provisions.

The owner or operator of each storage vessel to which this subpart applies shall meet the requirements of paragraphs (a), (b), (c), or (d) of this section for each storage vessel with a design capacity greater than 38 cubic meters (10,000 gallons). The applicable paragraph for a particular storage vessel depends on the control equipment installed to meet the requirements of § 61.271.

(a) After installing the control equipment required to comply with

§ 61.271(a) (permanently affixed roof and internal floating roof) each owner or operator shall:

(1) Visually inspect the internal floating roof, the primary seal, and the secondary seal (if one is in service), prior to filling the storage vessels with benzene. If there are holes, tears or other openings in the primary seal, the secondary seal, or the seal fabric, or defects in the internal floating roof, the owner or operator shall repair the items before filling the storage vessel.

(2) Visually inspect the internal floating roof and the primary seal or the secondary seal (if one is in service) through manholes and roof hatches on the fixed roof at least once every 12 months after initial fill, except as provided in paragraph (a)(4) of this section.

(i) If the internal floating roof is not resting on the surface of the benzene liquid inside the storage vessel, or there is liquid on the roof, or the seal is detached, or there are holes or tears in the seal fabric, the owner or operator shall repair the items or empty and remove the storage vessel from service within 30 days. If a failure that is detected during inspections required in this paragraph cannot be repaired within 30 days and if the vessel cannot be emptied within 30 days, an extension of up to 30 additional days may be requested from the Administrator in the inspection report required in § 61.275(a). Such a request for an extension must document that alternate storage capacity is unavailable and specify a schedule of actions the company will take that will ensure that the control equipment will be repaired or the vessel will be emptied as soon as possible.

(ii) If there are holes, tears, or other openings in the primary or secondary seal or seal fabric, the owner or operator shall repair the items the first time the vessel is emptied and degassed.

(3) Visually inspect the internal floating roof, the primary seal, and the secondary seal (if one is in service) each time the storage vessel is emptied and degassed. In no event shall inspections conducted in accordance with this provision occur at intervals greater than 10 years in the case of vessels conducting the annual visual inspections as specified in paragraph (a)(2) of this section and at intervals greater than 5 years in the case of vessels specified in paragraph (a)(4) of this section.

(i) For all the inspections required by paragraphs (a)(1) and (a)(3) of this section, the owner or operator shall notify the Administrator in writing at least 30 days prior to the refilling of each storage vessel to afford the Administrator the opportunity to have an observer present. If the inspection required by paragraph (a)(3) of this section is not planned and the owner or operator could not have known about the inspection 30 days in advance of refilling the tank, the owner or operator shall notify the Administrator at least 7 days prior to the refilling of the storage vessel. Notification shall be made by telephone immediately followed by written documentation demonstrating why the inspection was unplanned. Alternatively, the notification including the written documentation may be made in writing and sent by express mail so that it is received by the Administrator at least 7 days prior to refilling.

(ii) If the internal floating roof has defects, the primary seal has holes, tears, or other openings in the seal or the seal fabric, or the secondary seal has holes, tears, or other openings in the seal or the seal fabric, or the gaskets no longer close off the liquid surfaces from the atmosphere, or the slotted membrane has more than 10 percent open area, the owner or operator shall repair the items as necessary so that none of the conditions specified in this paragraph exist before refilling the storage vessel with benzene.

(4) For vessels equipped with a double-seal system as specified in § 61.271(a)(2)(ii):

(i) Visually inspect the vessel as specified in paragraph (a)(3) of this section at least every 5 years; or

(ii) Visually inspect the vessel annually as specified in paragraph (a)(2) of this section.

(b) After installing the control equipment required to comply with § 61.271(b) (external floating roof) the owner or operator shall:

(1) Determine the gap areas and maximum gap widths between the primary seal and the wall of the storage vessel, and the secondary seal and the wall of the storage vessel according to the following frequency.

(i) For an external floating roof tank equipped with primary and secondary seals, measurements of gaps between the tank wall and the primary seal (seal gaps) shall be performed during the hydrostatic testing of the vessel or within 90 days of the initial fill with benzene or within 90 days of the date of promulgation whichever occurs last, and at least once every 5 years thereafter except as provided in paragraph (b)(1)(ii) of this section.

(ii) For an external floating roof tank equipped with only a liquid-mounted primary seal as provided for in § 61.271(b)(5), measurements of gaps between the tank wall and the primary seal (primary seal gaps) shall be performed within 90 days of initial fill with benzene or within 90 days of the date of promulgation whichever occurs last, and at least once per year thereafter. In the event a secondary seal is installed over the primary seal, measurement of primary seal gaps shall be performed within 90 days of installation and at least once every 5 years thereafter.

(iii) For an external floating roof tank equipped with primary and secondary seals, measurements of gaps between the tank wall and the secondary seal shall be performed within 90 days of the initial fill with benzene, within 90 days of installation of the secondary seal, or 90 days of the date of promulgation, whichever occurs last, and at least once per year thereafter.

(iv) If any source ceases to store benzene for a period of 1 year or more, subsequent introduction of benzene into the vessel shall be considered an initial fill for the purposes of paragraphs (b)(1)(ii) and (b)(1)(iii) of this section.

(2) Determine gap widths and areas in the primary and secondary seals individually by the following procedures:

(i) Measure seal gaps, if any, at one or more floating roof levels when the roof is floating off the roof leg supports.

(ii) Measure seal gaps around the entire circumference of the tank in each place where a 0.32 cm (⅛ in.) diameter uniform probe passes freely (without forcing or binding against seal) between the seal and the wall of the storage vessel and measure the circumferential distance of each such location.

(iii) The total surface area of each gap described in paragraph (b)(2)(ii) of this section shall be determined by using probes of various widths to measure accurately the actual distance from the tank wall to the seal and multiplying each such width by its respective circumferential distance.

(3) Add the gap surface area of each gap location for the primary seal and the secondary seal individually. Divide the sum for each seal by the nominal distance of the tank and compare each ratio to the respective standards in § 61.272(b)(4) and § 61.272(b)(5).

(4) Repair conditions not meeting requirements listed in paragraphs (b)(2) (i) and (ii) of this section within 30 days of identification in any inspection or empty and remove the storage vessel from service within 30 days:

(i) The accumulated area of gaps between the tank wall and the metallic shoe seal or the liquid-mounted primary seal shall not exceed 212 cm^2 per meter of tank diameter (10.0 $in.^2$ per foot of tank diameter) and the width of any portion of any gap shall not exceed 3.81 cm (1½ in.).

(A) One end of the metallic shoe is to extend into the stored liquid and the other end is to extend a minimum vertical distance of 61 cm (24 in.) above the stored liquid surface.

(B) There are no holes, tears, or other openings in the shoe, seal fabric, or seal envelope.

(ii) The secondary seal is to meet the following requirements:

(A) The secondary seal is to be installed above the primary seal so that it completely covers the space between the roof edge and the tank wall except as provided in the following paragraphs of this section.

(B) The accumulated area of gaps between the tank wall and the secondary seal shall not exceed 21.2 cm^2 per meter of tank diameter (1.0 $in.^2$ per foot of tank diameter) or the width of any portion of any gap shall exceed 1.27 cm (½ in.). These seal gap requirements may be exceeded during the measurement of primary seal gaps as required by paragraph (b)(1)(i) of this section.

(C) There are to be no holes, tears, or other openings in the seal or seal fabric.

(iii) If a failure that is detected during inspections required in this paragraph cannot be repaired within 30 days and if the vessel cannot be emptied within 30 days, an extension of up to 30 additional days may be requested from the Administrator in the inspection report required in § 61.275(d). Such extension request must include a demonstration of unavailibility of alternate storage capacity and a specification of a schedule that will ensure that the control equipment will be repaired or the vessel will be emptied as soon as possible.

(5) The owner or operator shall notify the Administrator 30 days in advance of any gap measurement required by paragraph (b)(1) of this section to afford the Administrator the opportunity to have an observer present.

(6) Visually inspect the external floating roof, the primary seal, secondary seal, and fittings each time the vessel is emptied and degassed.

(i) If the external floating roof has defects, the primary seal has holes, tears, or other openings in the seal or the seal fabric, or the secondary seal has holes, tears, or other openings in the seal or the seal fabric, the owner or operator shall repair the items as necessary so that none of the conditions specified in this paragraph exist before filling or refilling the storage vessel with benzene.

(ii) For all the inspections required by paragraph (b)(6) of this section, the owner or operator shall notify the Administrator in writing at least 30 days prior to filling or refilling of each storage vessel to afford the Administrator the opportunity to inspect the storage vessel prior to refilling. If the inspection required by paragraph (b)(6) of this section is not planned and the owner or operator could not have known about the inspection 30 days in advance of refilling the tank, the owner or operator shall notify the Administrator at least 7 days prior to refilling of the storage vessel. Notification shall be made by telephone immediately followed by written documentation demonstrating why the inspection was unplanned. Alternatively, this notification including the written documentation may be made in writing and sent by express mail so that it is received by the Administrator at least 7 days prior to refilling.

(c) The owner or operator of each source that is equipped with a closed vent system and control device as required in § 60.271(c) (other than a flare) shall meet the following requirements.

(1) Within 90 days of initial fill or the date of promulgation, whichever comes last, submit for approval by the Administrator, an operating plan containing the information listed below.

(i) Documentation demonstrating that the control device being used achieves the required control efficiency during reasonably expected maximum loading conditions. This documentation is to include a description of the gas stream which enters the control device, including flow and benzene content under varying liquid level conditions (dynamic and static) and manufacturer's design specifications for the control device. If the control device or the closed vent capture system receives vapors, gases or liquids, other than fuels, from sources that are not designated sources under this subpart, the efficiency demonstration is to include consideration of all vapors, gases and liquids received by the closed vent capture system and control device. If an enclosed combustion device with a minimum residence time of 0.75 seconds and a minimum temperature of 816 °C is used to meet the 95 percent requirement, documentation that those conditions exist is sufficient to meet the requirements of this paragraph.

(ii) A description of the parameter or parameters to be monitored to ensure that the control device is operated and maintained in conformance with its design and an explanation of the criteria used for selection of that parameter (or parameters).

(iii) A maintenance plan for the system including the type of maintenance necessary, planned frequency of maintenance, and lengths of maintenance periods for those operations that would require the closed vent system or the control device to be out of compliance with § 61.271(c). The maintenance plan shall require that the system be out of compliance with § 61.271(c) for no more than 72 hours per year.

(2) Operate, monitor the parameters, and maintain the closed vent system and control device in accordance with the operating plan submitted to the Administrator in accordance with paragraph (c)(1) of this section, unless the plan was modified by the Administrator during the approval process. In this case, the modified plan applies.

(d) The owner or operator of each source that is equipped with a closed vent system and a flare to meet the requirements in § 61.271(c) shall meet the requirements as specified in the general control device requirements in § 60.18 (e) and (f).

§ 61.273 Alternative means of emission limitation.

(a) Upon written application from any person, the Administrator may approve the use of alternative means of emission limitation which have been demonstrated to his satisfaction to achieve a reduction in benzene emissions at least equivalent to the reduction in emissions achieved by any requirement in § 61.271 (a), (b), or (c) of this subpart.

(b) Determination of equivalence to the reduction in emissions achieved by the requirements of § 61.271 (a), (b) or (c) will be evaluated using the following information to be included in the written application to the Administrator.

(1) Actual emissions tests that use full-size or scale-model storage vessels that accurately collect and measure all benzene emissions from a given control device, and which accurately simulate wind and account for other emission variables such as temperature and barometric pressure.

(2) An engineering evaluation that the Administrator determines is an accurate method of determining equivalence.

(c) The Administrator may condition approval of equivalency on requirements that may be necessary to ensure operation and maintenance to achieve the same emission reduction as the requirements of § 61.271 (a), (b), or (c).

(d) If, in the Administrator's judgment, an application for equivalence may be approvable, the Administrator will publish a notice of preliminary determination in the **Federal Register** and provide the opportunity for public hearing. After notice and opportunity for public hearing, the Administrator will determine the equivalence of the alternative means of emission limitation and will publish the final determination in the **Federal Register.**

§ 61.274 Initial report.

(a) The owner or operator of each storage vessel to which this subpart applies and which has a design capacity greater than 38 cubic meters (10,000 gallons) shall submit an initial report describing the controls which will be applied to meet the equipment requirements in § 61.271. For an existing storage vessel or a new storage vessel for which construction and operation commenced prior to the promulgation date of this regulation, this report shall be submitted within 90 days of the effective date of this regulation, and can be combined with the report required by § 61.10. For a new storage vessel for which construction or operation commenced on or after the promulgation date, the report shall be combined with the report required by § 61.07. In the case where the owner or operator seeks to comply with § 61.271(c) with a control device other than a flare, this information may consist of the information required by § 61.272(c)(1).

(b) The owner or operator of each storage vessel seeking to comply with § 61.271 with a flare, shall submit a report containing the measurements required by § 60.18(f) (1), (2), (3), (4), (5), and (6). For the owner or operator of an existing storage vessel not seeking to obtain a waiver or a new storage vessel for which construction and operation commenced prior to the promulgation date, this report shall be combined with the report required by paragraph (a) of this section. For the owner or operator of an existing storage vessel seeking to obtain a waiver, the reporting date will be established in the response to the waiver request. For the owner or operator of a new storage vessel for which construction or operation commenced after the promulgation date, the report shall be submitted within 90 days of the date the vessel is initially filled (or partially filled) with benzene.

§ 61.275 Periodic report.

(a) The owner or operator of each storage vessel to which this subpart applies after installing control equipment in accordance with § 61.271(a) (fixed roof and internal floating roof) shall submit a report describing the results of each inspection conducted in accordance with § 61.272(a). For vessels for which annual inspections are required under § 61.272(a)(2), the first report is to be submitted no more than 12 months after the initial report submitted in accordance with § 61.274.

(1) Each report shall include the date of the inspection of each storage vessel and identify each storage vessel in which:

(i) The internal floating roof is not resting on the surface of the benzene liquid inside the storage vessel, or there is liquid on the roof, or the seal is detached from the internal floating roof, or there are holes or tears in the seal fabric;

(ii) There are visible gaps between the seal and the wall of the storage vessel; or

(iii) There are holes, tears, or other openings in the seal or the seal fabric.

(2) Where an annual report identifies any condition in paragraph (a)(1)(i) of this section the subsequent annual report shall describe the measures used to correct the condition, the date the storage vessel was emptied, and the date the condition was repaired.

(b) The owner or operator of each storage vessel to which this subpart applies after installing control equipment in accordance with § 61.271(a) (fixed roof and internal floating roof) shall submit a report describing the results of each inspection conducted in accordance with § 61.272(a) (3) or (4).

(1) The report is to be submitted within 60 days of conducting each inspection required by § 61.272(a) (3) or (4).

(2) Each report shall identify each storage vessel in which the owner or operator finds that the internal floating roof has defects, the primary seal has holes, tears, or other openings in the seal or the seal fabric, or the secondary seal (if one has been installed) has holes, tears, or other openings in the seal or the seal fabric, or the gaskets no longer close off the liquid surfaces from the atmosphere, or the slotted membrane has more than 10 percent open area. The report shall also provide a description of the repairs made to these items.

(c) Any owner or operator of an existing storage vessel which had an internal floating roof as of July 28, 1988, and which seeks to comply with the requirements of §§ 61.271(a)(3) and 61.271(a)(5) during the first time after the date of promulgation when the vessel is emptied and degassed or 10 years from the date of promulgation, shall notify the Administrator 30 days prior to the completion of the installation of such controls, and of the date of refilling of the vessel so the Administrator has an opportunity to have an observer present to inspect the storage vessel before it is refilled. This report can be combined with the one required by § 61.275(b).

(d) The owner or operator of each storage vessel to which this subpart applies after installing control equipment in accordance with § 61.271(b) (external floating roof) shall submit a report describing the results of each seal gap measurement made in accordance with § 61.272(b). The first report is to be submitted no more than 12 months after the initial report submitted in accordance with § 61.274(b). Each report shall include the date of the measurement, the raw data obtained in the measurement, and the calculations described in § 61.272(b) (2) and (3), and shall identify each storage vessel which does not meet the gap specification of § 61.271(b)(4). Where an annual report identifies any vessel not meeting the seal gap specifications of § 61.271(b) the report shall describe the measures used to correct the condition and the date the storage vessel was brought into compliance or the date the storage vessel was emptied.

(e) Excess emission report. (1) The owner or operator of each source seeking to comply with § 61.271(c) (vessels equipped with closed vent systems with control devices) shall submit a quarterly report informing the Administrator of each occurrence that results in excess emissions. Excess emissions are emissions that occur at any time when compliance with the specifications and requirements of § 61.271(c) are not achieved, as evidenced by the parameters being measured in accordance with § 61.272(c)(1)(ii) if a control device other than a flare is used, or by the measurements required in § 61.272(d) and the general control device requirements in § 60.18(f) (1) and (2) if a flare is used.

(2) The owner or operator shall submit the following information as a minimum in the report required by paragraph (e)(1) of this section:

(i) Identify the stack and other emission points where the excess emissions occurred;

(ii) A statement of whether or not the owner or operator believes a control system malfunction has occurred.

(3) If the owner or operator states that a control system malfunction has occurred, the following information as a minimum is also to be included in the report required under paragraph (e)(1) of this section:

(i) Time and duration of the control system malfunction as determined by continuous monitoring data (if any), or the inspections or monitoring done in accordance with the operating plan required by § 61.272(c).

(ii) Cause of excess emissions.

§ 61.276 Recordkeeping.

(a) Each owner or operator with a storage vessel subject to this subpart shall keep copies of all reports and records required by this subpart for at least 2 years, except as specified in paragraphs (b) and (c)(1) of this section.

(b) Each owner or operator with a storage vessel, including any vessel which has a design storage capacity less than 38 cubic meters (10,000 gallons), shall keep readily accessible records showing the dimensions of the storage vessel and an analysis showing the capacity of the storage vessel. This record shall be kept as long as the source is in operation. Each storage vessel with a design capacity of less than 39 cubic meters (10,000 gallons) is subject to no provisions of this subpart other than those required by this paragraph.

(c) The following information pertaining to closed vent system and control devices shall be kept in a readily accessible location.

(1) A copy of the operating plan. This record shall be kept as long as the closed vent system and control device is in use.

(2) A record of the measured values of the parameters monitored in accordance with §§ 61.272(c)(1)(ii) and 61.272(c)(2).

(3) A record of the maintenance performed in accordance with § 61.272(c)(1)(iii) of the operating plan, including the following:

(i) The duration of each time the closed vent system and capture device does not meet the specification of § 61.271(c) due to maintenance, including the following:

(A) The first time of day and date the requirements of § 61.271(c) were not met at the beginning of maintenance.

(B) The first time of day and date the requirements of § 61.271(c) were met at the conclusion of maintenance.

(C) A continuous record of the liquid level in each tank that the closed vent system and control device receive vapors from during the interval between the times specified by paragraphs (c)(3)(i)(A) and (c)(3)(i)(B) of this section. Pumping records (simultaneous input and output) may be substituted for records of the liquid level.

§ 61.277 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities which will not be delegated to States: § 61.273.

12. Under *Approach D* as described in the preamble, Subpart Y would be added to Part 61 of Title 40 as follows:

Subpart Y—National Emission Standard for Benzene Emissions From Benzene Storage Vessels

Sec.
61.270 Applicability and designation of sources.
61.271 Definitions.
61.272 Emission standard.
61.273 Demonstration of compliance.
61.274 Emission monitoring.
61.275 Recordkeeping.
61.276 Reporting requirements.
61.277 Delegation of authority.

Subpart Y—National Emission Standard for Benzene Emissions From Benzene Storage Vessels

§ 61.270 Applicability and designation of sources.

(a) The source to which this subpart applies is each storage vessel that is storing benzene having a specific gravity within the range of specific gravities specified for Industrial Grade Benzene in ASTM-D-836-80 (incorporated by reference as specified in § 61.18). This specification includes Industrial Grade Benzene, Nitration Grade Benzene, and Refined Benzene-535.

§ 61.271 Definitions.

"Plants" means any combination of process units, storage vessels and equipment used at one site in the production of benzene as an intermediate for final product or in the use of benzene.

§ 61.272 Emission standard.

(a) No owner or operator shall cause to be emitted to the atmosphere from all storage vessels subject to this subpart that are located at a plant total benzene emissions exceeding 0.47 kg/day.

§ 61.273 Demonstration of compliance.

(a) To demonstrate compliance with § 61.272, benzene emissions shall be determined using the following procedures:

(1) Calculate benzene emissions from each tank located at a plant using the equations and procedures given in Section 4.3 in the EPA document "Compilation of Air Pollutant Emission Factors"; Volume 1; September 1985; EPA Publication Number AP-42 (incorporated by reference as specified in § 61.18).

(2) Sum benzene emissions for all storage tanks subject to this subpart that are loacted at the plant.

(b) In lieu of using the procedures specified in paragraph (a) of this section, an owner or operator may apply to the Administrator for approval of an equivalent method of measuring or calculating emissions.

§ 61.274 Emission monitoring.

(a) Each owner or operator subject to the provisions of § 61.272(a) shall submit an operating and maintenance plan to the Administrator for approval within 90 days of the effective date for existing sources, or within 90 days of startup for new sources. The plan shall include the following:

(1) A description of each emission source and the control techniques by which the owner or operator will comply with the emission limit in § 61.272(a).

(2) Identification of the parameter or parameters to be monitored to ensure that each control device is operated in conformance with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary.

(5) A schedule for reporting excess emissions or reporting of other information demonstrating continued compliance with § 61.272(a). The reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(b) If control equipment that is the same as equipment specified in 40 CFR Part 60, Subpart Kb is used to comply with the provisions of § 61.272(a), the operating plan shall include the inspection, monitoring, operating and maintenance procedures specified in § 60.113b (a), (b) and (c).

(c) Each owner or operator shall conduct operations, monitor the parameters, and maintain equipment in accordance with the approved operating plan.

§ 61.275 Recordkeeping.

(a) Each owner or operator subject to the provisions of § 61.272(a) shall maintain at the plant for a period of at least 2 years, and make available to the Administrator upon request, the following:

(1) Records of any emission test data and all calculations used to demonstrate compliance with § 61.272(a).

(2) Records of all inspections and monitoring of parameters specified in the approved operating plan required under § 61.274.

(3) Records of all periods where there were excess emissions as indicated by the parameters monitored under § 61.274.

(4) Records of all malfunctions of all air pollution control equipment used to comply with § 61.272(a).

(5) Records of all maintenance and repairs of each storage vessel subject to this subpart and associated air pollution control equipment.

§ 61.276 Reporting requirements.

Each owner or operator of a storage vessel to which this subpart applies shall:

(a) If a calculational procedure is used to demonstrate compliance, a compliance report including the calculations shall be submitted with either the source report required in § 61.10 for existing sources, or the notification of startup required in § 61.09 for new sources.

(b) Submit the operating plan required in § 61.274 within 90 days of the effective date of the regulation for an existing source, or within 90 days of startup for a new source.

(c) Submit to the Administrator a written report of excess emissions at the frequency established in the operating and maintenance plant. For the purposes of this paragraph, excess emissions shall be considered to be any exceedence of monitored parameter(s) established under § 61.274. The report shall include:

(1) Time and duration of excess emissions,

(2) Identification of the emission point where the excess emission occurred,

(3) Description of any malfunction that is believed to have caused the excess emission,

(4) Descriptions of any repairs or actions taken to correct the cause of the excess emissions.

§ 61.277 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States: none.

13. Under *Approach D* as described in the preamble, Subpart Z would be added to Part 61 of Title 40 as follows:

Subpart Z—National Emission Standard for Benzene Emission from Ethylbenzene/ Styrene Plants

Sec.
61.280 Applicability and designation of sources.
61.281 Definitions.
61.282 Emission standard.
61.283 Compliance provision.
61.284 Emission monitoring.
61.285 Reporting.
61.296 Reporting requirements.
61.297 Delegation of authority.

Subpart Z—National Emission Standard for Benzene Emissions from Ethylbenzene/ Styrene plants.

§ 61.280 Applicability and designation of sources.

(a) The source to which this subpart applies is each integrated chemical process producing either ethylbenzene from benzene, or styrene from ethylbenzene, and containing any of the following equipment:

(1) Alkylation reactor section;

(2) Ethylbenzene hydroperoxidation reactor; or

(3) Hydrogen separation system.

§ 61.281 Definitions.

The terms used in this subpart are defined in the CAA, in § 61.102, or in this section as follows:

"Alkylation reactor section" means any equipment or combination of equipment in which benzene is reacted with ethylene to produce ethylbenzene, in which the reactor catalyst is neutralized or separated from reaction product or impurities, or in which diethylbenzene and polyethylbenzene are catalytically transformed to ethylbenzene and by-products.

"Atmospheric column" means each distillation unit that operates at atmospheric pressure.

"Boiler" means any enclosed combustion device that extracts useful energy in the form of steam or hot process fluids, including a boiler, process heater, superheater, or reboiler.

"Corrosive vent stream" means any vent stream determined to have a total concentration (by volume) of compounds containing chlorine or other halogens of 20 ppmv (by compound) or greater.

"Dehydrogenation reactor" means a reactor in which ethylbenzene is catalytically dehydrogenated in the presence of steam to produce styrene and by-products.

"Distillation operation" means a continuous or batch operation separating one or more feed stream(s) into two or more product streams, each product stream having component concentrations different from those in the feed stream(s). The separation is achieved by the redistrubution of the components between the liquid and vapor phase as they approach equilibrium within the distillation unit.

"Distillation unit" means a device or vessel (e.g., a column) in which distillation operations occur, including all associated internals (e.g., trays or packing) and accessories (e.g., reboiler, condenser), plus any associated recovery system.

"Ethylbenzene hyperoxidation reactor" means any equipment or combination of equipment in which ethylbenzene is oxidized with air or oxygen to produce ethylbenzene hydroperoxide.

"Hydrogen separation system" means the combination of equipment in which the crude styrene, unreacted ethylbenzene, and condensed steam are separated from the hydrogen-rich gas stream exiting the ethylbenzene dehydrogenation reactor.

"Incinerator" means an enclosed combustion device other than a boiler.

"Malfunction" means any sudden and unavoidable failure of process or air pollution control equipment. A failure of process or air pollution control equipment caused entirely or in part by design deficiencies, poor maintenance, careless operation, or other preventable equipment breakdown is not considered to be a malfunction.

"Plant" means any combination of process units and equipment used at one site in the production of ethylbenzene from benzene or stryrene from ethylbenzene.

"Pressure column" means each distillation unit that operates at greater than atmospheric pressure.

"Process vent stream" means each benzene-containing gas stream being released or having the potential of being released to the atmosphere from each of the following equipment:

(1) Alkylation reactor section;

(2) Atmospheric or pressure column;

(3) Hydrogen separation system; or

(4) Vacuum-producing device.

"Shutdown" means the cessation of operation and cooling to ambient temperature of the following:

(1) Entire sources as designated in § 61.280;

(2) Alkylation reactor section; or

(3) Dehydrogenation reactor.

"Startup" means the commencing of operation from ambient temperature of the following:

(1) Entire source as designated in § 61.280;

(2) Alkylation reactor section; or

(3) Dehydrogenation reactor.

"Vacuum-producing device" means each device that produces an absolute pressure less than atmospheric on any distillation unit.

§ 61.282 Emission standard.

No owner or operator of a source to which this subpart applies shall cause to be emitted to the atomosphere from all process vents at the plant total benzene emissions exceeding 5.5 kg/day.

§ 61.283 Compliance provisions.

The owner or operator of each source to which this subpart applies shall meet the requirement of paragraphs (a) and (b) of this section for each source.

(a) To demonstrate compliance with § 61.282, benzene emissions shall be determined and the data reduced using EPA-approved sampling and analysis procedures or using other procedures that EPA has determined to be acceptable.

(b) Unless a waiver of emission testing is obtained under § 61.13, the owner or operator shall demonstrate compliance with § 61.282:

(1) No later than 90 days after the effective date of this subpart for a source that has an initial startup date preceding the effective date; or

(2) No later than 90 days after startup for a source that has an initial startup date after the effective date.

(3) At such other times as may be required by the Administrator under section 114 of the Act.

(4) While the source is operating under such conditions as the Administrator may specify, based on representative performance of the source.

§ 61.284 Emission monitoring.

(a) Each owner or operator subject to the provisions of § 61.282 shall submit an operating and maintenance plan to the Administrator for approval:

(1) No later than 90 days after the effective date of this subpart for a source that has an initial startup date preceding the effective date; or

(2) No later than 90 days after startup for a source that has an initial startup date after the effective date.

(b) The operating and maintenance plan shall include the following:

(1) A description of each emission source and the control devices and techniques by which the owner or operator will comply with the emission limit in § 61.283. The description of any control system shall include its design specifications, performance certification, and maintenance procedures.

(2) Identification of the parameter or parameters to be monitored to ensure that each control device is operated in conformity with its design, and that the emission limit is not exceeded.

(3) An explanation of the criteria used in selecting the monitoring parameter(s).

(4) A description of the types and frequencies of maintenance necessary.

(5) A schedule for reporting excess emissions or reporting of other information demonstrating continued compliance with § 61.282(a). The reporting schedule shall be consistent with the compliance, monitoring, and maintenance methods, and shall be no more frequent than quarterly.

(c) Each owner or operator shall conduct operations, monitor the parameter(s), and maintain equipment in conformance with the approved operating and maintenance plan.

§ 61.285 Recordkeeping.

(a) Each owner or operator subject to the provisions of § 61.282 shall maintain at the plant for a period of at least 2 years, and shall make available to the Administrator upon request, the following:

(1) Records of all data and calculations used to demonstrate compliance with § 61.282.

(2) Records of all repairs to equipment subject to § 61.282.

(3) Records of all monitoring of parameter(s) specified in the approved operating plan required under § 61.284.

(4) Records of all malfunctions of any air pollution control device described in the operating and maintenance plan described in § 61.284.

(5) Records of all maintenance and repair to any air pollution control device described in the operating and maintenance plan described in § 61.284.

(6) Records of all relevant data and information for any additional methods used to achieve compliance with § 61.282.

(b) Detailed schematics and records of design specifications and instrumentation for any air pollution control device described in the operating and maintenance plan described in § 61.284 shall be kept for the life of the control device.

§ 61.286 Reporting requirements.

Each owner or operator of each source to which § 61.282 applies shall:

(a) Submit an initial report describing the control equipment which will be operated, monitored, and maintained in accordance with § 61.284. This report may be combined with the operating and maintenance plan required in § 61.284. This report shall be submitted either:

(1) No later than 90 days after the effective date of this subpart for a source that has an initial startup date preceding the effective date; or

(2) No later than 90 days after startup for a source that has an initial startup date after the effective date.

(b) Provide the Administrator 30 days prior notice of any emission test required in the operating and maintenance plan required in § 61.284, to afford the Administrator the opportunity to have an observer present;

(c) Submit a written report to the Administrator detailing the results of the emission test, and the associated calculations within 30 days after conducting the test.

(d) Submit a written report to the Administrator of any excess emissions at the frequency established in the approved operating and maintenance plan. For the purposes of this paragraph, excess emissions shall be considered to be any exceedences of the monitored parameter(s) established in the operating and maintenance plan required in § 61.284. The report shall include the following:

(1) The magnitude of each excess emission.

(2) Identification of each occurrence of excess emission that results from startups, shutdowns or malfunctions.

(e) If a calculational procedure is used to demonstrate compliance, a compliance report including the calculations shall be submitted with either the source report required in § 61.10 for existing sources, or with the notification of startup required in § 61.09 for new sources.

§ 61.287 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States: None.

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