State of California

AIR RESOURCES BOARD

STAFF REPORT

PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF BENZENE FROM RETAIL SERVICE STATIONS

Prepared by
Toxic Pollutants Branch
Stationary Source Division

With the participation of the Technical Review Group
and its Nonvehicular Benzene Control Subcommittee

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Date of Release: May 22, 1987
Date of Proposed Action: July 9, 1987

ACKNOWLEDGEMENTS

In appreciation for their participation in developing this report, the Air Resources Board staff would like to acknowledge the following members of the Nonvehicular Benzene Control Subcommittee:

Gale Karels, Bay Area Air Quality Management District

Gary Martin, Fresno County Air Pollution Control District

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* The Technical Support Document to this report is available upon request. The Benzene Control Plan Technical Support Document and relevant comments received during consultation with the districts, affected sources and the public are also available upon request.

EXECUTIVE SUMMARY

INTRODUCTION

In accordance with State law, the Air Resources Board identified benzene as a toxic air contaminant in January, 1985. In June and July 1986, the Board considered the Benzene Control Plan (Plan), which along with the Technical Support Document addresses the issues listed in Health and Safety Code Section 39665 and set forth the costs and effectiveness of potential vehicular and nonvehicular benzene airborne toxic control measures (ATCM). The Plan was found by the Board to be an appropriate overall course of action for staff to follow in developing specific benzene control measures. Presented here and being recommended for adoption by the Board is the first benzene control measure developed by staff in accordance with the Benzene Control Plan, a measure to control benzene emissions from retail service stations. The proposed service station measure would extend vapor recovery controls now used at retail service stations in most areas of the state to the rest of the state. Other control measures identified in the Plan will be developed and presented to the Board over the next two years.

This report was developed in consultation with the air pollution control districts, affected sources and the interested public. The Technical Review Group (TRG)* formed a Subcommittee to allow interested districts to participate in developing nonvehicular benzene control measures identified in the Plan. The Subcommittee met four times over the course of

* A longstanding committee of district, ARB, and EPA representatives established to provide a technical forum for discussion, coordination and development of emission control measures and strategies within California.

seven months to discuss various control alternatives for service stations. A public consultation meeting was held in December 1986 to obtain public comments on the proposed benzene control measure.

PROPOSED BENZENE CONTROL MEASURE

The staff proposes that the Board adopt a benzene airborne toxic control measure which would require use of ARB-certified vapor recovery control equipment at most retail service stations in attainment areas of California.

Vapor losses at retail service stations are controlled in two phases. Phase I vapor recovery controls vapors displaced from underground storage tanks when cargo tank trucks transfer gasoline into the storage tanks. These vapors are returned to the tank truck during the gasoline transfer. Phase II vapor recovery controls the breathing losses from underground storage tanks and the vehicle tank vapors which are displaced with gasoline during vehicle fueling. The vapors recovered from vehicle tanks are returned to the underground storage tank. Vapor recovery systems are complete systems and include all piping, nozzles, couplers, dispenser components, and any other equipment necessary for the control of gasoline vapors during fueling operations at service stations.

Adoption of this measure would result in an expeditious reduction in cancer risk from service station and community exposures to benzene. The proposed measure is patterned after existing vapor recovery control programs which are currently in effect in areas of the state which have not attained the federal ozone standard. These existing regulations control gasoline vapors from approximately 90 percent of the gasoline consumed in California;

the proposed measure would require controls on most of the remaining 10 percent of gasoline consumed. The staff is also proposing exemptions from the measure. The primary exemption from Phase I and II requirements is for existing service stations with annual sales (excluding sales from some exempt tanks) of less than 240,000 gallons. This exemption is based on the disproportionately high cost of installing and maintaining vapor recovery equipment on an existing station relative to the low gasoline throughput.

Under the proposed measure, existing stations would be required to install vapor recovery controls within two years of district adoption of the control measure. New service stations would have to comply no later than a year after the station commences gasoline sales. District boards must adopt the ATCM adopted by the state board or, alternatively, a district board may adopt one which is as or more effective than the state board's. District boards must adopt a measure within six months of the effective date of the state board's adoption of the ATCM.

LEGAL BASIS FOR PROPOSED AIRBORNE TOXIC CONTROL MEASURE

State law specifies that for identified toxic air contaminants for which the state board has not specified a threshold exposure level, such as benzene, the airborne toxic control measure must be designed, in consideration of the factors specified in the Health and Safety Code Section 39665, to reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method unless, based on an assessment of risk, it is determined that an alternative level of emission reduction is adequate or necessary to prevent an endangerment to public health. Vapor recovery at service stations is

considered best available control technology. The staff has considered but is not proposing any alternative level of control since the proposed vapor recovery requirement represents the greatest degree of control of service station benzene emissions currently available, and a lesser degree of control could result in cancers which would be avoided by adoption of the proposed control measure. The staff has considered alternative measures (banning self service stations or mandating hold open latches) which theoretically might accomplish the same reduction in cancer risk to individuals fueling their vehicles as the proposed measure. Staff is not recommending these alternative measures for state board adoption for the reasons discussed below. However, district boards may adopt an alternative retail service station benzene control measure if the alternative measure is as effective or more effective than the state board's measure at reducing benzene emissions and the risks resulting therefrom.

HEALTH BASIS FOR PROPOSED AIRBORNE TOXIC CONTROL MEASURE

Benzene emitted from service stations results in benzene exposure and cancer risks to the public in three ways. First, individuals who fuel their own vehicles at uncontrolled service stations experience highly concentrated short-term benzene exposures, a so-called "hot spot" exposure. Second, residents near uncontrolled service stations have an increased risk due to localized increases in ambient concentrations of benzene from emissions at nearby stations, again, a hot-spot exposure. Third, the general population is exposed to areawide ambient benzene levels resulting in part from service stations emissions. These three exposure routes from service station-

emitted benzene result in cancer risks, which, when multiplied by the number of persons at risk in each exposure environment, lead to the estimated incidence of cancer cases. The impact of the ATCM on cancer risk and cancer incidence is discussed below.

CANCER RISK

The staff evaluated the probability of people contracting cancer from uncontrolled service station benzene emissions in California for each of the three exposures described above. Risk factors developed by the Department of Health Services, and approved by the Scientific Review Panel*/, were used. The probability of contracting cancer is referred to as cancer risk in this report. The units of cancer risk are the number of predicted cancer cases occurring among one million persons exposed to a known benzene concentration for a lifetime (70 years). Table A shows the estimated incremental cancer risk for persons who fuel their own vehicles at uncontrolled service stations, the estimated incremental risk above the average to persons residing near a service station, and the estimated incremental risk to the general population in areas which do not currently require the use of vapor recovery equipment. The greatest risk from service station benzene emissions is due to direct exposure during vehicle fueling and is estimated to affect over one million persons. The lifetime cancer risk associated with this exposure is 7 to 51 cancer cases per million persons.

* The Scientific Review Panel was established by Health and Safety Code Section 39670 to advise the state board and the Department of Food and Agriculture in their evaluation of the health effects and toxicity of substances.

Table A

BENZENE CANCER RISKS FROM
SERVICE STATION BENZENE EMISSIONS (YEAR 2000)*

Exposure	Incremental Cancer Risk** Pre-control	Incremental Cancer Risk** w/Vapor Control	Risk Reduction (percent)	Population Exposed (millions)
1. Individual-vehicle fueling (hot spot)	7 to 51	1.1 to 7.7	85	1.1
2. Residing in Neighborhood near station (hot spot)	1.5 to 12	.15 to 1.2	90	0.14
3. General ambient air, areawide	1 to 5	.1 to 1	80	3.2

* In areas of California which currently do not require service station vapor recovery control equipment.
** Lifetime cancer cases per million persons.

As shown in Table A, implementation of the proposed ATCM would significantly reduce the cancer risks associated with each of these three service station related exposures to benzene. Lines one and two show the reductions in cancer risk for individuals fueling a vehicle at and residing near stations controlled by the measure. Line three shows the areawide reduction in cancer risk for the general population.

Approximately 4 percent of the 3.2 million residents who live in areas affected by the proposed measure live in neighborhoods near service stations. These 140,000 people are subject to an additional cancer risk from benzene of 1.5 to 12 cancer cases per million above the general ambient risk level. The general areawide population cancer risk in the year 2000 from uncontrolled service stations is estimated to be 1 to 5 cancer cases per million for a population of 3.2 million living in air basins with uncontrolled service stations.

INCIDENCE OF CANCER CASES

The incidence of cancer cases due to exposure to benzene emissions from uncontrolled service stations is shown in Table B, and is estimated to be 10 to 77 cancer cases among an exposed population of 3.2 million persons. The incidence of cancer cases as used in this report refers to the number of potential cancer cases occurring among a defined population over a lifetime (70 years) exposure via inhalation to benzene. Approximately 78 percent of these cancer cases are caused by vehicle fueling exposure; the remaining cases are due to ambient exposures of the general population to service station-emitted benzene (2 to 15 cases), and to incremental exposure of persons who reside near service stations (2 or fewer cases).

Table B

NUMBER OF CANCER CASES DUE TO
SERVICE STATION BENZENE EMISSIONS (YEAR 2000)*

Exposure	Pre-control	Percent of Total	w/Vapor Control
1. Individual-vehicle fueling (hot spot)	8 to 60	78%	1.9 to 14
2. Residing in neighborhood near station (hot spot)	0.2 to 2	3%	.04 to 0.3
3. General ambient air, areawide	2 to 15	19%	.44 to 3.4
Total	10 to 77	100%	2 to 18

* Lifetime cancer cases among 3.2 million population in areas of California which currently do not require service station vapor recovery control equipment.

BENEFITS AND COSTS OF PROPOSED AIRBORNE TOXIC CONTROL MEASURE

Implementation of the proposed benzene control measure would reduce the incidence of cancer cases due to exposure to service station benzene emissions by 8 to 59 cases, a reduction of 77% for the exposed population of 3.2 million. Adoption of the proposed control measure will reduce the statewide incidence of cancer due to exposure to benzene from all sources, including sources other than service stations, by 2 percent. This reflects the fact that the major source of benzene emissions is automobile exhaust.

The average cost of preventing one cancer case through the use of the proposed service station vapor recovery equipment ranges from 9.8 to 76 million dollars. This is within the range of costs projected for the vehicular and fuel-related benzene control measures identified in the Benzene Control Plan (2.2 to 110 million dollars per cancer case reduced). Service stations could recover the cost of installing and maintaining vapor recovery equipment by increasing the price of gasoline. The increase is estimated to be 0.8 cent per gallon on average, with a maximum increase of 1.2 cents per gallon for the smallest service station affected by the proposed measure.

In addition to reducing benzene emissions, implementation of the proposed service station vapor recovery control measure would also reduce total hydrocarbon emissions in the year 2000 by 8,100 tons in the affected areas, saving about 2 million gallons of gasoline annually which would otherwise be emitted to the atmosphere. The staff's estimate of cost takes into account credit for these fuel savings.

Although being considered by the Board as a toxic control measure, this measure will also aid in achieving and/or maintaining the State and Federal ambient oxidant and ozone standards in areas where the State standard is violated but the Federal standard is not. For example, the State oxidant standard was violated during 1983-85 in the North Central Coast, South Central Coast and Northern Sacramento Valley Air Basins. The reduction in hydrocarbon emissions obtained from the proposed control measure would also aid in visibility improvement and in reducing contributions to ambient levels of PM_{10}.

The proposed measure would also reduce exposure to total gasoline vapors. Although the Board has not identified total gasoline vapor as a toxic air contaminant, EPA's Carcinogen Assessment Group recently (April 1987) found "there is sufficient evidence to conclude that gasoline vapors are carcinogenic in animals..... Based on sufficient evidence in animal studies and inadequate evidence in epidemiologic studies, the overall weight of evidence for unleaded gasoline is EPA category B2, meaning that unleaded gasoline is a probable human carcinogen." EPA found gasoline vapor to be a less potent carcinogen than benzene. However, the gasoline vapor exposure level is significantly higher than the benzene exposure level during vehicle fueling. Therefore, the total gasoline vapor cancer risk may be significantly greater than the risk attributable to benzene vapors alone. Staff has not identified any negative environmental impacts associated with implementation of the proposed control measure.

OTHER CONSIDERATIONS

The staff analyzed the adverse impact of the measure on small businesses and, as a result, is proposing that existing retail service stations with annuual throughputs (excluding sales from some exempt tanks) of less than 240,000 gallons be exempt from the measure.

In developing the proposed service station control measure, staff considered alternative approaches of control, such as a ban on self-service vehicle fueling and the use of hold-open latches which would allow the person fueling the vehicle to step away from the nozzle, thereby reducing exposure to benzene emissions. However, staff is not recommending these alternatives because they do not represent best available control technology, and do not reduce the incremental exposure to residents living near service stations, nor do they reduce the areawide exposure experienced by the general population. In addition, a ban on self-service vehicle fueling would only transfer part of the cancer risk from the general public to service station employees fueling the vehicles, unless the station employees were required to wear air filtration equipment. The use of hold-open latches on the vehicle fueling nozzle could reduce the exposure to benzene experienced during vehicle fueling if self-serve customers stepped away from the nozzle during fueling. Stepping away from a nozzle 9 feet may reduce the direct exposure during fueling by about 75 percent. However, it would be difficult to enforce this requirement, and some local fire marshals prohibit the use of hold-open latches due to fire hazard concerns.

The staff also considered the impact which implementation by EPA of its proposed onboard refueling vapor control requirement would have on the

effectiveness of the proposed service station control measure. Current information is that EPA's proposal would affect new motor vehicles produced starting in the early to mid 1990's. Implementation of an onboard program would eventually reduce cancer risk to individuals who fuel vehicles by about the same degree as the proposed service station vapor recovery measure. However, it would take approximately 20 years for an onboard program to become 85 percent effective because of the turnover rate for controlled vehicles to replace older uncontrolled vehicles. The average cost of the proposed service station measure would increase from 0.8 to 1.1 cent per gallon if EPA adopts an onboard vapor control requirement for new vehicles because gasoline vapors would not be recovered at the station and because there would be a shortening in the effective lifetime of the service station control equipment from 15 to 10 years. The effectiveness of the proposed service station control measure in reducing cancer incidence between 1990 and 2000 would decrease approximately 32 percent.

The primary issues related to the implementation of the proposed control measure are related to district management of the measure and the impact upon district programs. If the proposed measure is adopted by the Board, staff is prepared to assist districts with guidance and training in order to implement an effective vapor recovery program. Smaller districts may choose to manage the program cooperatively by sharing enforcement resources. State law authorizes districts to assess fees to cover the costs of funding district activities related to nonvehicular airborne toxic control measures (Health and Safety Code Section 42311(h)).

RECOMMENDATION

The staff recommends that the Board adopt the proposed benzene airborne toxic control measure for retail service stations and forward the adopted measure to the air pollution control and air quality management districts.

State of California
Air Resources Board

Proposed Airborne Toxic Control Measure for Emissions of Benzene from Retail Service Stations

I. INTRODUCTION

Benzene was identified as a toxic air contaminant (TAC) by the Air Resources Board (ARB) in January 1985 in accordance with state law (Health and Safety Code Section 39650 et seq.). The Board identified benzene as a toxic air contaminant for which there is not sufficient available scientific evidence to support the identification of a threshold exposure level below which no significant adverse health effects are anticipated (Title 17, California Administrative Code, Section 93000). Once a compound is identified as a TAC, Health and Safety Code Section 39665 requires the ARB Executive Officer, with the participation of local air pollution control districts, to prepare a report on the need and appropriate degree of regulation for the TAC.

At the July 24, 1986 Board meeting, the Board found that the Benzene Control Plan (Plan) as supplemented by the Addendum to Benzene Control Plan presents an appropriate overall course of action for the staff to follow in developing specific benzene control measures. The reports and the accompanying Technical Support Document addressed the issues set forth in Health and Safety Code Section 39665. The Board directed the ARB staff to work closely with the districts through the Technical Review Group (TRG)* and with affected industry sources to further analyze and assess potential

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* A longstanding committee of district, ARB, and Environmental Protection Agency (EPA) representatives established to provide a technical forum for the discussion, coordination and development of control measures and strategies within California.

nonvehicular benzene control measures related to gasoline marketing sources, and to bring before the Board those measures which warrant further consideration. The service station measure was identified in the Plan as one of the first measures to be brought before the Board in 1987 for its consideration because the control technology is readily available. Other benzene control measures identified in the Plan will be developed and presented to the Board over the next two years.

At the August 5, 1986 TRG meeting, its members decided to establish a Nonvehicular Benzene Control Subcommittee to participate with ARB in the development of nonvehicular measures related to gasoline marketing. All districts were invited to participate on the Subcommittee. The Subcommittee includes district representatives from the Bay Area, South Coast, San Bernardino County, Monterey Bay, Tuolumne County and Fresno County. The Subcommittee and ARB staff evaluated the potential costs and benefits of implementing benzene control measures for retail service stations, bulk plants and bulk terminals. The control of service station benzene emissions addresses over 80 percent of the potential benzene reduction benefits from implementing control measures for the three gasoline marketing categories investigated by the Subcommittee. Therefore, highest priority was given to pursuing development of a benzene control measure for retail service stations.

The ATCM was developed by the ARB staff with the participation of the TRG Subcommittee. The Subcommittee met 4 times over the course of 7 months to discuss various control alternatives. A public consultation meeting was held in December 1986 to give the public, industry representatives, and local

districts an opportunity to comment on the ATCM. Written comments on the ATCM and staff responses are included in the Technical Support Document.

This staff report on the ATCM includes: (1) estimates of benzene emissions, exposure, cancer risk and cancer incidence from retail service stations; (2) a discussion of the availability, technological feasibility and costs of an airborne toxic control measure (ATCM) to reduce benzene emissions from retail service stations; (3) the proposed ATCM (Attachment A); (4) a discussion of the anticipated effect of the ATCM on benzene exposure and risk; (5) a discussion of the alternatives to the ATCM; and (6) identification of any potential adverse health, safety or environmental impacts of the ATCM.

This report in conjunction with the Benzene Control Plan and Addendum to Benzene Control Plan (attached) and the Technical Support Document for the Plan constitutes the report on the need and appropriate degree of regulation for benzene as required by Health and Safety Code Section 39665. A Technical Support Document to this staff report, which is available upon request, presents in further detail the costs and benefits of the proposed ATCM.

The proposed control measure requires ARB-certified Phase I and II vapor recovery systems at retail service stations. The measure contains exemptions from the controls based on station and storage tank deliveries, capacity and use. Existing retail stations would be required to install the controls within two years after district adoption of the measure, and new retail stations (those which are not yet under construction at the time of district adoption) would be required to install the controls within one year after gasoline sales commence at the station.

If the Board adopts the ATCM, local districts must, within 120 days of the effective date of the Board's adoption, propose regulations enacting the ACTM or an equally effective or more stringent control measure. Within six months after the effective date of the Board's adoption, the districts must adopt the regulations enacting the control measure. Existing service station vapor recovery control programs in nonattainment districts are as effective as the proposed ATCM and thus would not require revision as a result of adoption by the Board of the proposed ATCM. However, such districts may wish to formally designate their existing vapor recovery regulation as both an ozone and an airborne toxic control measure. If the proposed ATCM is adopted by the Board, existing district regulations may not be amended to provide a lesser level of benzene emission control than the proposed ATCM.

II. STAFF RECOMMENDATION

The staff recommends Board adoption of the service station benzene ATCM (Attachment A) reflecting use of best available control technology which requires installation of Phase I and II vapor recovery control equipment (95 percent control efficiency) at all new retail service stations (within one year after gasoline sales commence) and at existing retail service stations (within two years after district adoption). The measure contains exemptions based on station and storage tank deliveries, capacity and use. The primary exemption from Phase I and II is for existing retail service stations with annual gasoline throughputs (excluding sales from some exempt tanks) of less than 240,000 gallons.

The proposed measure would primarily affect rural areas of the state which do not currently require Phase I and II vapor recovery; these rural areas contain approximately 10 percent of the state's population. There are

several Phase I and II vapor recovery systems certified by ARB to meet a 95 percent control efficiency requirement. Thus, vapor recovery control technology is readily available and proven to be effective.

Staff proposes the ATCM for retail service stations because the control technology to reduce the risk from benzene exposure from these sources is readily available and would achieve the earliest practicable control of benzene from service stations. The proposed ATCM would control from 90 percent to 95 percent of gasoline throughput in attainment areas at a maximum cost of 1.2 cents per gallon, and is predicted to result in about an 80 percent reduction in benzene cancer incidence (cases).

III. BASIS FOR PROPOSING THE AIRBORNE TOXIC CONTROL MEASURE

A. LEGAL BASIS

Staff is proposing an ATCM for benzene emissions from retail service stations in response to the statutory requirements for controlling TACs, and direction received from the Board when it approved the Benzene Control Plan. Benzene was identified as a TAC in January 1985 in accordance with State law (Health and Safety Code Section 39650). The Board identified benzene as a TAC for which there is not sufficient available scientific evidence to support the identification of a threshold exposure level below which no significant adverse health effects are anticipated (Title 17, California Administrative Code, Section 93000).

After a compound is identified as a TAC, Health and Safety Code Section 39665 requires the ARB Executive Officer in cooperation with local air pollution control districts and affected industry sources to prepare a report on the need and appropriate degree of regulation for the TAC. The Benzene

Control Plan, Addendum to Benzene Control Plan and the Technical Support Document for the Plan and this Staff Report and Technical Support Document address the issues specified in Health and Safety Code Section 39665. The Plan presents the overall framework for review and evaluation of benzene control measures in general, and this Staff Report discusses in detail issues regarding this specific control measure, most particularly the magnitude of the risk posed by benzene emissions from service stations, the availability and technological feasibility of vapor recovery, the cost of the vapor recovery controls, the anticipated effect of the controls on levels of exposure and the potential adverse impacts that may occur as a result of implementation of the vapor recovery controls.

Health and Safety Code Section 39666 requires that control measures for TACs such as benzene for which the Board has not specified a threshold exposure level must be designed, in consideration of the factors addressed in the report, to reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method unless, based on an assessment of risk, an alternative level of emissions reduction is adequate or necessary to prevent an endangerment of public health. As discussed in other portions of the report, Phase I and II vapor recovery controls are the best available control technology for control of retail service station benzene emissions.

When an airborne toxic control measure for nonvehicular sources is adopted by the Board, Health and Safety Code Section 39666(d) requires all local districts to propose and adopt the measure, or at its option, an equally effective or more stringent control measure. The districts must propose measures within 120 days of the effective date of the Board's adoption and

adopt measures by regulation within six months of the effective date of the Board's adoption.

In discussions with the districts, the issue of whether the law permits the districts to adopt a control measure less stringent than that adopted by the Board has been raised. The Board staff believes that the districts are not authorized by the law to adopt a measure which is less strict than the one adopted by the Board and has so informed the districts. The resolution of the issue hinged on the interpretation of seemingly contradictory language of Sections 39666(c) and 39666(d) with regard to district responsibilities. Section 39666(c) addresses the design of airborne toxic control measures for TACs without an identified threshold for adverse effects. The measure must "reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method, unless the state board or a district board determines, based on an assessment of risk, that an alternative level of emission reduction is adequate or necessary to prevent an endangerment of public health". While this section appears to give districts the authority to design control measures less stringent than the Board's, Section 39666(d) limits the districts to adopting "equally effective or more stringent control measures" than those adopted by the Board. Section 39666(d) clearly does not confer upon the districts any authority to adopt less stringent measures, and in view of the section's very explicit language, that authority can not be implied.

The view that the Board's airborne toxic control measure establishes a statewide minimum level of TAC control is supported by other provisions of the law. In Health and Safety Code Section 39650(k), the Legislature finds and declares that "a statewide program to control TACs is necessary and desirable

in order to .... promote the development and use of advanced control technologies and alternative processes and materials ... and to minimize inconsistencies in protecting the public health in various areas of the state." The expressed legislative intent is only fulfilled if the Board's control measure establishes the statewide minimum level of control of the TAC.

B. BENZENE CONTROL PLAN

In response to Health and Safety Code requirements for compounds identified as TACs, staff presented an overall plan for controlling benzene emissions to the Board. At the July 24, 1986 Board meeting, the Board found that the Benzene Control Plan as supplemented by the Addendum to Benzene Control Plan presented an appropriate overall course of action for the staff to follow in developing specific benzene control measures.

The Plan predicted a 50 percent reduction in statewide benzene cancer incidence between 1984 and 2000 with implementation of measures in the Plan. The current and projected hydrocarbon controls for motor vehicles would account for 37 percent of the reduction. The remaining 13 percent reduction in benzene cancer incidence would result from benzene-specific control measures.

The Board in its resolution regarding the Plan directed the ARB staff to work closely with the districts through the Technical Review Group (TRG) and with affected industry sources to further analyze and assess potential nonvehicular measures related to gasoline marketing sources, and bring before the Board those measures which warrant further consideration. Because the gasoline marketing control measures identified in the Plan are based on the use of available and proven control technology, the Board directed staff to

bring these measures to the Board in 1987. The vehicular and fuel-related measures in the Plan require more time for development, as technology and or data are not presently available to fully evaluate and develop these measures.

The control technology identified in the Plan for gasoline marketing sources of benzene is Phase I and II vapor recovery. Phase I and II vapor recovery systems are presently required at gasoline marketing sources in nonattainment areas for the purpose of ozone precursor control. These systems presently control about 90 percent of California's gasoline which is dispensed at 14,000 service stations. Phase I vapor recovery systems also control bulk terminals and large bulk plants in nonattainment areas. Phase I and II vapor recovery systems are certified by ARB to have a 95 percent control efficiency.

At the August 5, 1986 TRG meeting, its members decided to establish a Nonvehicular Benzene Control Subcommittee to participate with ARB in the development of nonvehicular measures related to gasoline marketing. All districts were invited to participate on the Subcommittee. The Subcommittee and ARB staff evaluated the potential costs and benefits of implementing benzene control measures for retail service stations, bulk plants and bulk terminals. As a result of this evaluation, the Subcommittee gave the highest priority to pursuing development of a benzene control measure for retail service stations. The service station measure addresses approximately 84 percent of the potential reduction in benzene cancer incidence from implementing control measures for the three gasoline marketing categories investigated by the Subcommittee.

The TRG also decided at its August 5, 1986 meeting that the nonvehicular measures related to refinery sources would be developed by the ARB staff in

conjunction with the Bay Area and South Coast Districts since these districts would be directly affected by such measures. Table III-1 summarizes the overall Benzene Control Plan including the nonvehicular measures related to gasoline marketing and refinery sources. This table shows that since the Plan was developed, some of the refinery sources no longer exist or are controlled by other regulations. The table also shows the updated estimates of the potential costs and benefits of controlling gasoline marketing sources identified as part of Group C in the Plan. The table shows that vapor recovery at service stations would have the greatest benefit in reducing statewide cancer incidence from nonvehicular benzene sources and would account for two percent of the reduction in cancer incidence from implementation of the Plan.

IV. DISCUSSION OF THE PROPOSED AIRBORNE TOXIC CONTROL MEASURE

A. SUMMARY OF REQUIREMENTS

The proposed benzene ATCM is patterned after existing vapor recovery control programs which are currently in effect in areas of the state which are nonattainment for ozone. The measure would require the application of ARB-certified Phase I vapor recovery systems (which recover vapors during the transfer of gasoline from gasoline delivery vehicles into stationary storage tanks) and ARB-certified Phase II vapor recovery systems (which recover vapors during the fueling of motor vehicles from stationary storage tanks) on retail service stations. There are a number of exemptions to the proposed measure.

State law provides that a person who violates an airborne toxic control measure is liable for a civil penalty not to exceed ten thousand dollars ($10,000) for each day in which the violation occurs. There is no liability if the person can establish that the violation is caused by an act which was not

Table III-1

SUMMARY OF BENZENE CONTROL PLAN
(All entries apply statewide in 2000)

Source Category	Statewide Cancer Incidence	Priority Group	Control Measure	Reduction in Statewide Cancer Incidence	$ 10^6 per Cancer Reduced
Vehicular/ Vehicular Fuel	1,400 to 10,800	A	ARB Vehicle Program	110 to 900	4.1 to 31
		A	More stringent HC standards	70 to 600	8.9 to 69
		B	Gasoline spec. 1.0% benzene or	200 to 1,510	13 to 99
			1.4% benzene	90 to 700	14 to 110
			Exhaust benzene limit	70 to 550	2.2 to 17
Nonvehicular** Gasoline Marketing	40 to 310	C	Vapor recovery at service stations	8 to 59	9.8 to 76
			afterburners at bulk terminals*	.5 to 3	39 to 300
			vapor recovery at bulk plants	1 to 10	18 to 140
Refinery Sources	1.7 to 13	C	vapor recovery on benzene tanks	Source already controlled	
			Improve seals on benzene	Source eliminated	
			Replace riveted benzene tanks	Source eliminated	
			Improve seals on gasoline tanks	.02 to .2	59 to 450

* Assumes refrigeration processing units
** Updated information since Board approval of Plan in July 1986

the result of intentional or negligent conduct (Health and Safety Code Section 39674).

The discussion below is a summary of the specific provisions of the measure. Section 93100 provides that the nonvehicular airborne toxic control measures contained in subchapter 7.5 shall be implemented by adoption of regulations by the districts pursuant to Health and Safety Code Section 39666(d). This benzene control measure is the first airborne toxic control measure proposed by board staff for state board adoption under the provisions of Health and Safety Code Section 39650 et seq. Board staff believes that a section describing the applicability of the nonvehicular airborne toxic control measures is necessary to inform the readers of the regulation of the effect of state board adoption of the measure. Section 93100 makes it clear that after the state board adopts a nonvehicular toxic control measure it must be implemented by district adoption of regulations. Section 93101(a) sets forth the definitions for the terms used in the ATCM.

Section 93101(b) of the ATCM includes the Phase I requirements and exemptions. ARB-certified Phase I vapor recovery is required on stationary storage tanks to reduce benzene emissions to the ambient air which result from displacement when gasoline is loaded into the tanks. These emissions increase benzene exposure and cancer risk to nearby residents and to the general population. With Phase I vapor recovery, the gasoline vapors are recovered initially by the tank truck and are returned to stationary storage tanks at bulk loading facilities when the tank truck is reloaded with gasoline. Thus, Phase I vapor recovery is only fully effective when the service station, tank truck and bulk loading facility are all equipped with vapor controls.

The proposed Phase I requirement would not apply to a transfer to: (A) A stationary storage tank with a capacity of less than 1.0 cubic meter (260

gallons); (B) A stationary storage tank used primarily for the fueling of implements of husbandry; (C) A stationary storage tank used exclusively to fuel motor vehicles with a fuel capacity of five gallons or less; (D) An existing retail service station with an annual station gasoline throughput from tanks other than those described in (A), (B) and (C) of less than 240,000 gallons; (E) A stationary storage tank at an existing retail service station which receives gasoline exclusively from tank trucks that are not equipped with vapor recovery systems. All of the above exemptions are estimated to reduce the potential effectiveness of the proposed ATCM by no more than 10 percent.

Stationary storage tanks with a capacity of less than 260 gallons and those tanks used primarily for the fueling of implements of husbandry are exempt from the Phase I requirement because these tanks are mainly used for farming purposes in remote areas that do not impact the general public. It would be difficult and costly for local districts to enforce the vapor recovery requirement in remote locations. Also, these stationary storage tanks receive a large proportion of the gasoline deliveries from uncontrolled tank trucks that would not recover gasoline vapors even if the tanks were controlled. Stationary storage tanks used exclusively to fuel motor vehicles with a fuel capacity of five gallons or less (primarily motorcycles) are exempt from Phase I because they are exempt from Phase II and the cost of installing Phase I without Phase II is significantly increased relative to the minimal benefits realized.

Existing retail service stations with annual gasoline throughputs (from tanks other than those described in exemptions A, B and C above) of less than 240,000 gallons are also exempt from the proposed Phase I requirement. Staff

is recommending this exemption because the cost of installing and maintaining the vapor recovery equipment at small existing facilities is disproportionate to the benefits realized from controlling these sources. Also, these small existing stations account for no more than 10 percent of retail gasoline sales in areas affected by the measure and thus represent a small fraction of benzene emissions and risk from retail service stations. The costs and benefits of the measure in relationship to station size are described elsewhere in the report.

Stationary storage tanks at existing retail service stations which receive gasoline exclusively from uncontrolled tank trucks are exempt from the Phase I requirement because Phase I controls on stationary storage tanks are less effective if the tank trucks delivering gasoline are not equipped with or required to be equipped with a vapor recovery system. Staff has not proposed a vapor recovery requirement for tank trucks because this requirement would not reduce benzene emissions unless the bulk plants supplying the tank trucks are also equipped with vapor recovery. The majority of bulk plants and tank trucks in California are already equipped with vapor recovery systems as a result of district regulations. Staff has not fully analyzed the costs and benefits of an ATCM to control benzene emissions from tank trucks and bulk plants.

Section 93101(c) of the proposed ATCM includes the Phase II requirements and exemptions. ARB-certified Phase II vapor recovery is required to reduce benzene emissions to the ambient air from vehicle fueling operations. Benzene emissions from vehicle fueling are the greatest source of benzene exposure from retail service stations accounting for most of the cancer incidence

from these sources. More than three-fourths of the total cancer incidence from vehicle fueling emissions, is from direct exposure during fueling. The proposed ATCM would exempt from the Phase II requirement all sources which are exempt from the Phase I requirement except for existing retail service stations which receive gasoline exclusively from uncontrolled tank trucks.

As discussed under the exemptions to the Phase I requirement, sources with stationary storage tanks having capacities less than 260 gallons or tanks used primarily for fueling of implements of husbandry are exempt from the Phase II requirement because they are mainly used for farming purposes in remote areas and thus do not significantly impact the general public. Stationary storage tanks used exclusively to fuel motor vehicles with a fuel capacity of five gallons or less (primarily motorcycles), are exempt from Phase II because their fill pipes are often not compatible with the Phase II nozzle. Existing retail service stations with annual gasoline throughputs (excluding the throughput from exempt stationary storage tanks described in A, B and C above) of less than 240,000 gallons are exempt from the Phase II requirement for the same reasons they are exempt from the Phase I requirement. The costs of controlling the relatively low benzene emissions from small existing retail service stations are relatively high in consideration of the minimal potential benefits. Additionally, it might be dificult for an owner of an existing station with a low sales volume to recover the cost of installing the equipment.

Existing retail service stations that are exempt from Phase I because they receive gasoline exclusively from uncontrolled tank trucks are required to install Phase II vapor recovery because the majority of cancer risk results

from vehicle fueling and these sources impact individuals fueling vehicles as well as the general public.

All gasoline vapor recovery systems installed in California, including those which would be installed as a result of this measure if adopted, must comply with the applicable provisions of Health and Safety Code Sections 41954-41961 and the ARB regulations implementing those statutes (Title 17, California Administrative Code, Section 94000 et seq.). The statutes require the Board to adopt performance standards related to air quality for vapor recovery systems and to certify any system, which on the basis of established test procedures meets the standards. The Technical Support Document contains the most recent Executive Orders showing the ARB-certified Phase I (G-70-97-A) and Phase II (G-70-52-AI) vapor recovery systems used in California.

Health and Safety Code Section 41960.2 requires the Board to specify equipment defects in Phase II systems which substantially impair their effectiveness in reducing air contaminants. The board has listed defects in Title 17, California Administrative Code, Section 94006. When district personnel determine that a system component has a defect which has been listed, district personnel are required to mark the component "Out of Order", and use of the component is prohibited until appropriate remedial action is taken. Section 93101(d) of the proposed ACTM provides that no owner or operator shall use or permit the use of a Phase II system or any component thereof which has a listed defect. Under the ATCM, in circumstances where the owner/operator rather than district personnel has tagged the system as "Out of Order", the owner/operator may repair and use the system without inspection by district personnel. If district personnel have tagged the system, Health and Safety Code Section 41960.2 provides that reinspection or authorization is required by the district before the repaired system may be used. The last

sentence in 93101(d) makes it clear that the provisions of this subsection do not excuse compliance with the requirement that a Phase II vapor recovery system is to be installed and used during all non-exempt transfers from a stationary storage tank at a retail service station into a motor vehicle fuel tank.

Section 93101(e) of the proposed ATCM contains the compliance schedule. Existing retail service stations affected by the measure would be required to install vapor recovery controls within two years of district board adoption. An owner or operator of an existing retail service station or stationary storage tank which is initially exempt but later becomes subject to the measure based on a change in operations or throughput, would be required to install vapor recovery controls within two years after the change in operations or throughput. All new stations constructed after district board adoption of the measure would be required to utilize vapor recovery controls within a year after gasoline sales at the station are commenced. These compliance schedules will enable the local districts to train personnel and develop a control program. It will also give retail service station owners sufficient time to acquire funds for the required capital expenditures.

Any ARB-certified system including balance systems, vacuum assist systems, and aspirator assist systems which meets the current requirements for new installations would meet the requirements of the proposed ATCM. The durability and ease of use of Phase II vapor recovery systems has increased dramatically since the first systems were installed in the early 1970's. The latest balance systems are user-friendly because both the nozzle and the vapor hose (single coaxial hose) weigh about the same as those for the older uncontrolled conventional systems. The number of customer complaints regarding the use of vapor recovery systems has decreased significantly with

the improvements made in the control equipment. All ARB-certified vapor recovery systems comply with requirements of the State Fire Marshal and the Division of Industrial Safety for protection against fire and safety hazards.

B. EFFECTS OF THE PROPOSED CONTROL MEASURE

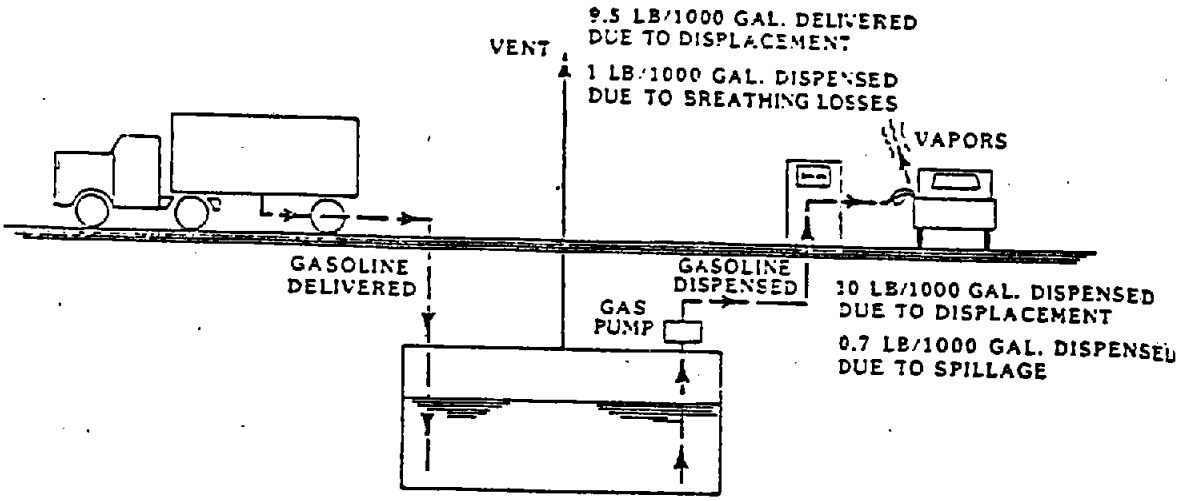
The proposed ATCM would reduce by 95 percent benzene and total hydrocarbon emissions (excluding spillage and breathing losses) from uncontrolled stations affected by the measure. Figure IV-1 shows how Phase I and II vapor recovery systems (also called Stage I & II vapor recovery) control gasoline vapor losses at retail service stations.

This figure shows that Stage I vapor recovery reduces by 95 percent the vapor losses from underground storage tanks which result from displacement when gasoline is delivered. These vapors are returned to the tank truck delivering the gasoline. Stage II vapor recovery reduces by 90 percent the breathing losses from underground storage tanks, and reduces by 95 percent the vapor losses due to displacement during vehicle fueling. The vapors recovered from vehicle fueling are returned to the underground storage tank.

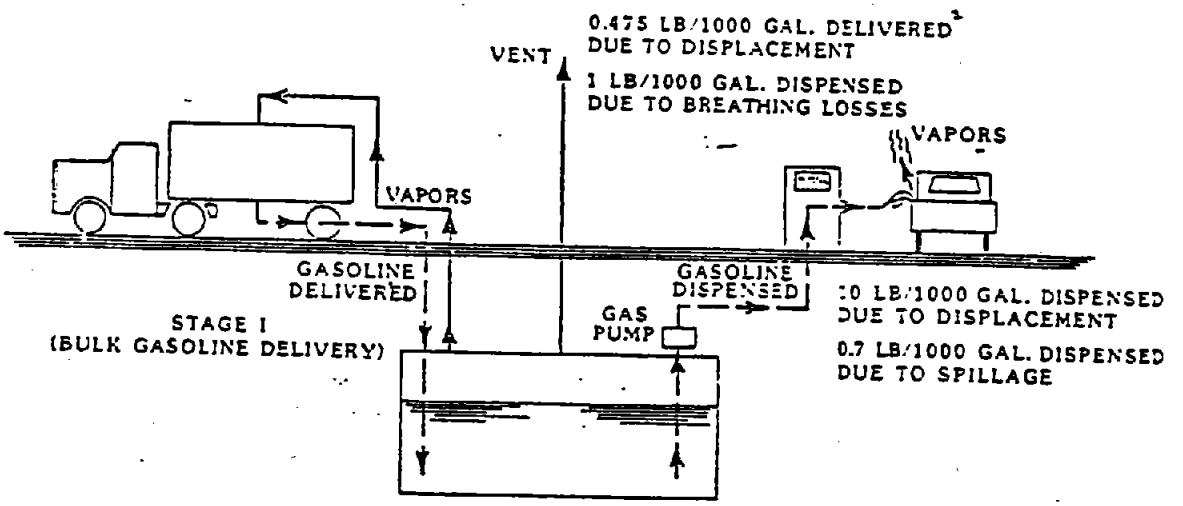
Risk factors developed by the Department of Health Services, and approved by the Scientific Review Panel were used to estimate cancer risk and cancer incidence from benzene sources. The primary benzene cancer risk from uncontrolled service stations in attainment areas is to individuals who fill their own tanks at self-service stations or live near service stations. Individuals who fill their own tanks are exposed to a short-term elevated benzene concentration of about 1.5 parts per million (ppm) for two minutes a week. This short-term elevated exposure equates to a 0.3 parts per billion (ppb) annual exposure which results in an individual lifetime cancer risk of 7

Figure IV-1

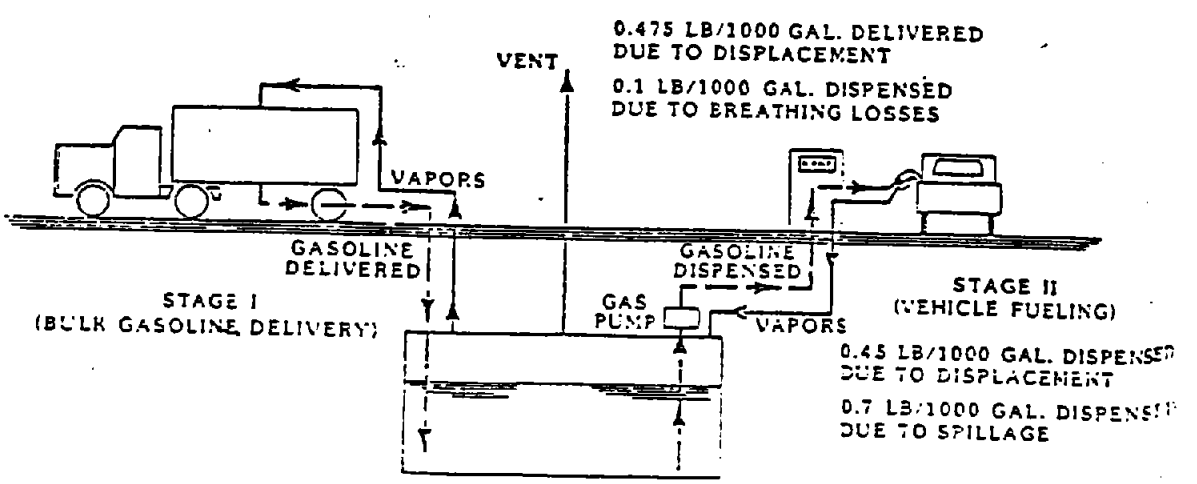
HYDROCARBON EMISSIONS WITH NO VAPOR RECOVERY



WITH STAGE I VAPOR RECOVERY ONLY



WITH STAGE I AND II VAPOR RECOVERY



to 51 cancers per million. Staff estimates that over one million persons will experience this risk, if the ATCM is not implemented.

Individuals living in a neighborhood near an uncontrolled service station are exposed to an incremental elevated benzene concentration of .07 ppb which results in an additional cancer risk from benzene of 1.5 to 12 cancers per million above the general ambient risk level. Approximately 4 percent of the 3.2 million residents who live in areas affected by the proposed measure (140,000 persons in year 2000) live in neighborhoods near service stations. When a service station is controlled with Phase I and II vapor recovery, the average benzene concentration at distances greater than 100 meters from the station results in an additional cancer risk of less than 1 cancer per million (the average cancer risk is .13 to 1 case per million at 100 meters from a 960,000 gallons per year station). As stated above, not every person in an affected area is assumed to be exposed to these risk levels. When the fueling cancer risk levels are prorated over the entire population in attainment areas, the 7 to 51 individual cancer risk decreases to an equivalent 2 to 16 cancers per million for the areawide population. Summing the prorated individual fueling risk and the risk due to ambient air concentrations attributable to service station benzene emissions yields an overall individual risk of 3 to 24 potential cancers per million. This risk from service station benzene emissions results in a potential lifetime cancer incidence of 10 to 77 predicted cancer cases in attainment areas. Seventy-eight percent of these cancer cases are caused by vehicle fueling exposure. The remaining cases are due to ambient exposures of the general population to service station-emitted benzene (2 to 15 cases), and to incremental exposure of persons who reside

near service stations (2 or fewer cases). The statewide average cancer risk from all benzene sources is estimated to be 52 to 400 excess lifetime cancers per million without implementation of benzene-specific control measures.

Table IV-1 shows that the proposed ATCM would significantly reduce the cancer risks associated with vehicle fueling, neighborhood benzene exposures, and general ambient exposures from uncontrolled service station benzene emissions.

Table IV-2 summarizes the estimated cancer incidence attributable to uncontrolled versus controlled service station benzene emissions. The values presented are based on all areas of California which do not require service station vapor recovery control equipment; some basins will have slightly different exposures and risks due to differences in size, population densities and meteorology. This table indicates that the largest incidence is attributable to individual fueling exposure as mentioned earlier. ARB staff estimates that implementation of the ATCM would reduce the number of cancer incidences due to exposure to service station benzene emissions by 8 to 59 cases, a reduction of 80 percent for the exposed population of 3.2 million. The annual statewide cost of the proposed ATCM would be 8.2 million dollars which equates to an increase in cost of .8 cent per gallon on average and a maximum of 1.2 cents per gallon to recover the cost of installing and maintaining vapor recovery equipment. Of the total cost per gallon, .1 cent per gallon is attributable to installation of Phase I vapor recovery and the remaining 0.7 cent per gallon is due to Phase II vapor recovery. These costs would be significantly reduced if the underground plumbing for vapor recovery is already in place.

Table IV-1

CANCER RISKS FROM SERVICE STATIONS
BENZENE EMISSIONS (YEAR 2000)*

Exposure	Incremental Cancer Risk** Pre-control	Incremental Cancer Risk** w/Vapor Control	Risk Reduction (percent)	Population Exposed (millions)
1. Individual-vehicle fueling (Hot Spot)	7 to 51	1.1 to 7.7	85%	1.1
2. Residing in neighborhood near station (Hot Spot)	1.5 to 12	.15 to 1.2	90%	0.14
3. General ambient air, areawide	1 to 5	.1 to 1	80%	3.2

* In areas of California which currently do not require service station vapor recovery control equipment.
** Lifetime cancer cases per million persons.

Table IV-2

NUMBER OF CANCER CASES DUE TO
SERVICE STATION BENZENE EMISSIONS (YEAR 2000)*

Exposure	Pre-control	Pre-control Percent of Total	w/Vapor Control
1. Individual-vehicle fueling (hot-spot)	8 to 60	78%	1.9 to 14
2. Residing in neighborhood-near station (hot-spot)	0.2 to 2	3%	.04 to .3
3. General ambient air, areawide	2 to 15	19%	.44 to 3.4
Total	10 to 77	100%	2 to 18

* Lifetime cancer cases among 3.2 million population in areas of California which currently do not require service station vapor recovery control equipment.

Table IV-3 summarizes the cancer risk and cancer incidence from retail service stations and the potential costs and benefits of implementing the recommended ATCM in each air basin and statewide. This table shows that statewide implementation of the ATCM would result in a reduction in cancer incidence of 8 to 59 excess lifetime cancer cases and the average cost of preventing one cancer case is 9.8 to 76 million dollars. The statewide weighted average cost per pound benzene reduced would be 64 dollars. The areawide weighted average cost per pound benzene reduced ranges from 53 dollars to 83 dollars. The cost of preventing one cancer case through the use of the proposed service station vapor recovery equipment in million dollars ranges from a low range of 7.6 to 59 to a high range of 12 to 96.

The cost of preventing one cancer case for the other nonvehicular benzene control measures identified in the Benzene Control Plan are projected to range from 18 to 450 million dollars. The cost of preventing one cancer case for the vehicular and fuel-related benzene control measures identified in the Plan are projected to range in cost from 2.2 to 110 million dollars. The methods of calculating emission and risk reductions and cost impacts of the proposed ATCM are included in Appendix A of the Technical Support Document.

In an attempt to put these costs and benefits in some perspective, the staff offers the following discussion of EPA's risk management policy and what role cost-effectiveness plays in EPA's policy. EPA's Air and Policy Offices have attempted to set cost-effectiveness levels to be used in setting New Source Performance Standards for criteria pollutants, but consider cost-effectiveness on a case-by-case basis for hazardous air

TABLE IV-3

POTENTIAL COSTS AND BENEFITS FROM THE SERVICE STATION BENZENE CONTROL MEASURE[1/]

Basin	Baseline Service Station Health Impacts: Cancer Incidence[2/]	Cancer Risk[3/]	Reduction in Cancer Incidence	Cost/lb. Reduced	10^6/Cancer Case Reduced[4/]
GBV	.3-2.3	8.5-66	.23-1.8	$53	$12-$96
Lake County	.16-1.2	2.7-21	.12-.94	$53	$9.2-$71
Lake Tahoe	.22-1.7	3.4-26	.16-1.3	$83	$10-$81
Mountain Counties	1.6-12	3.5-27	1.2-9.3	$66	$10-$81
No. Central Coast	2.0-15	2.8-22	1.6-12	$67	$8.5-$66
North Coast	1.3-9.7	4.0-3	1.0-7.4	$53	$11-$83
Northeast Plateau	.39-3.0	3.8-29	.30-2.3	$53	$11-$81
Sacramento Valley	5.0-39	2.6-20	1.6-13	$69	$11-$82
San Diego	1.5-12	.59-4.6	Not affected by measure		
S.F. Bay Area	4.7-36	.70-5.4	Not affected by measure		
San Joaquin Valley	3.5-27	1.3-9.7	Not affected by measure		
Southeast Desert	1.0-7.7	1.2-9.0	.63-4.9	$61	$7.6-$59
South Coast	11-84	.77-6.0	Not affected by measure		
So. Central Coast	1.6-12	1.2-9.0	.8-6.2	$72	$9.4-$73
Attainment Areas Only	9.9-77	3.1-24	7.6-59		
Weighted Average				$64	$9.8-$76
Total	34-260	1-8			

1/ Applies to retail service stations in year 2000

2/ Potential excess lifetime cancer cases

3/ Potential excess lifetime cancer cases per million persons

4/ 10^6/Cancer Case Reduced = $\frac{\text{Annual Cost}}{\text{Cancers reduced per year}}$

pollutants. For example, EPA has proposed hazardous air pollutant standards for coke oven emissions that would require controls on all sources and cost up to $41 million per cancer avoided (52 Fed. Reg. 13586 (Apr. 23, 1987)).

In evaluating the impacts of the proposed ATCM, we considered the impacts of other potential benzene-specific control measures on the effectiveness of the proposed ATCM. The only other potential benzene control measure that would impact the effectiveness of this ATCM would be a limit on the benzene content of gasoline. The Benzene Control Plan includes potential benzene in gasoline limits of 1.4 volume percent and 1.0 volume percent. The estimated effectiveness of the retail service station ATCM is based on a 1.8 volume percent benzene content of gasoline. Thus, if a 1.4 volume percent benzene limit in gasoline is required concurrently with the proposed ATCM the effectiveness of the ATCM would be reduced by 22 percent. If a 1.0 volume percent benzene limit in gasoline is required concurrently with the proposed ATCM, the effectiveness of the proposed ATCM would be reduced by 44 percent. Table IV-4 summarizes the impact of a benzene limit in gasoline on the costs and benefits of the proposed ATCM.

The staff analyzed and considered alternatives to the provisions of the proposed ATCM in an effort to lessen the adverse impact of the measure on small businesses. The cost impacts for small independently-owned retail service stations was a major consideration in the staff's decision to recommend an ATCM with an annual throughput cutoff of 240,000 gallons. Further discussion of the cost impacts for small businesses and local air pollution control districts is included at the end of this section. Prior to selecting the 240,000 gallon per year throughput cutoff, staff evaluated the costs and benefits for the following options:

1. control only new stations;

2. control new stations plus existing stations with annual throughput cutoffs of at least 480,000 gallons;
3. control new stations plus existing stations with annual throughput cutoffs of at least 240,000 gallons;
4. control new stations plus existing stations with annual throughput cutoffs of at least 120,000 gallons;
5. control new stations plus existing stations with annual throughput cutoffs of at least 60,000 gallons; and
6. control new stations plus existing stations with annual throughput cutoffs of at least 24,000 gallons.

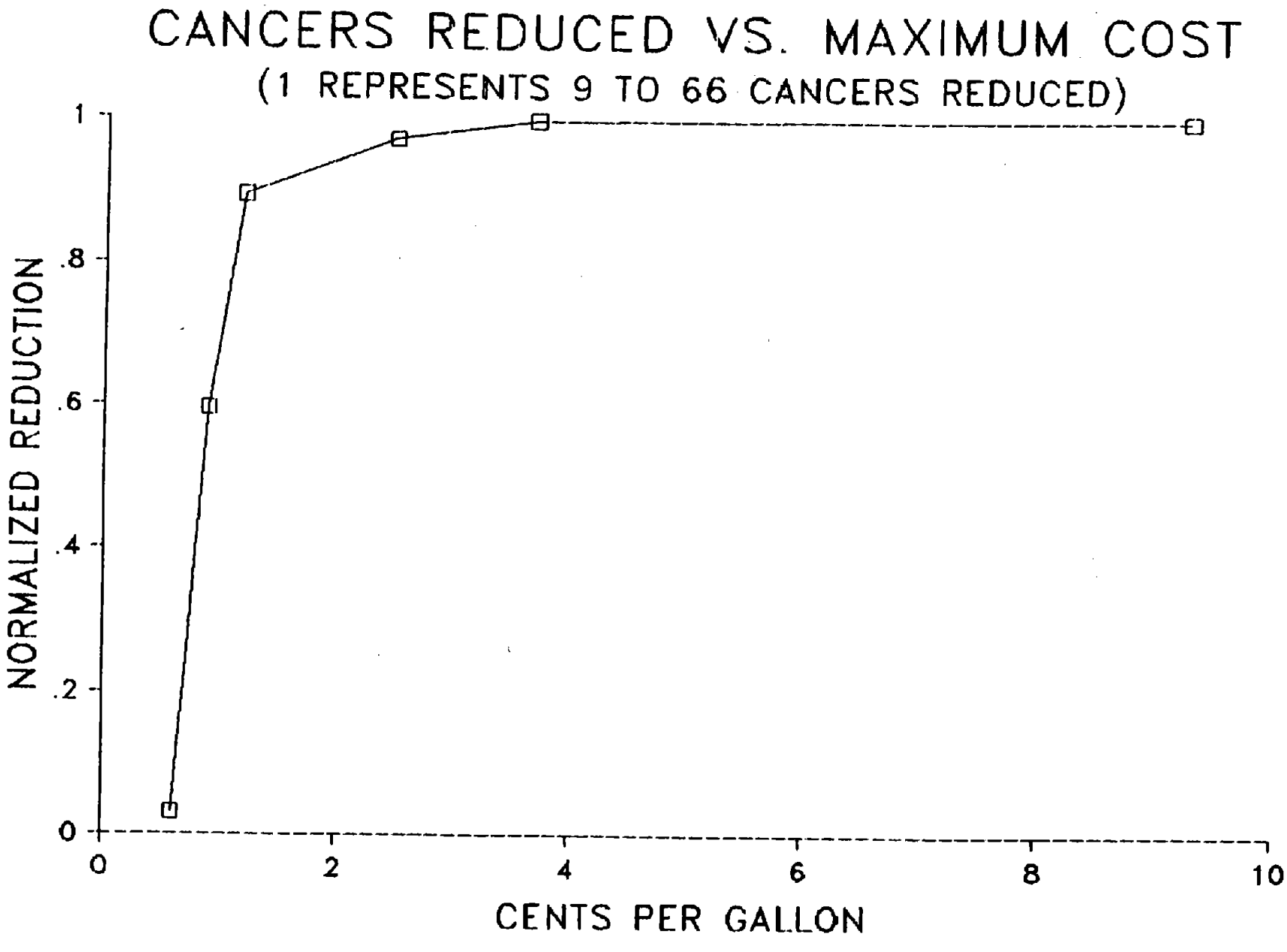
Table IV-4

IMPACT OF BENZENE LIMIT
IN GASOLINE ON EFFECTIVENESS OF SERVICE STATION MEASURE
(Year 2000)

Benzene Limit	Reduction in Cancer Cases	Average Cost per Gallon	10^6/Cancer Case Reduced
No limit	8 to 59	.8 cent	9.8 to 76
1.4 volume percent	6 to 46	.8 cent	13 to 97
1.0 volume percent	4 to 33	.8 cent	18 to 135

Figure IV-2 shows the relative reduction in cancer cases vs. maximum cost per gallon for each of these six options. Data are not available to estimate the reduction in cancer cases with a throughput cutoff between 240,000 and 480,000 gallons per year. For comparative purposes, the reduction in cancer cases is normalized to one which represents the potential reduction in cancer cases estimated for option 6 (9 to 66 excess lifetime cancers reduced statewide). This figure shows that controlling new stations only would result in three percent of the potential reduction in

FIGURE IV-2


CANCERS REDUCED VS. MAXIMUM COST
(1 REPRESENTS 9 TO 66 CANCERS REDUCED)
NORMALIZED REDUCTION
1
.8
.6
.4
.2
0
0
2
4
6
8
10
CENTS PER GALLON

cancer cases at a maximum cost of .6 cent per gallon. Controlling new stations and existing stations with at least 480,000 gallons per year throughput would result in about 60 percent of the potential reduction in cancer cases at a maximum cost of .9 cent per gallon. Controlling new stations and existing stations with at least 240,000 gallons per year throughput, which is proposed by staff, would control 88 to 95 percent of gasoline throughput and would result in about 90 percent of the potential reduction in cancer cases at a maximum cost of 1.2 cents per gallon. Controlling new stations and existing stations with at least 120,000 gallons per year throughput would result in about 97 percent of the potential reduction in cancer cases at a maximum cost of 2.5 cents per gallon. Controlling new stations and existing stations with at least 60,000 gallons per year throughput would result in about 99.7 percent of the potential reduction in cancer cases at a maximum cost of 3.7 cents per gallon. Controlling new stations and existing stations with at least 24,000 gallons per year throughput would result in an additional 0.3 percent reduction in cancer cases at a maximum cost of 9.3 cents per gallon for a station at the throughput cutoff. This figure shows the 240,000 gallon per year throughput cutoff for existing stations, which is proposed by staff, would achieve a significant reduction in cancer cases while maintaining a reasonable cost for the small service station owner. Existing stations pumping less than 240,000 gallons per year have been exempted from the regulation due to their minimal impact and the disproportionate cost of installing and maintaining vapor recovery equipment at the small existing stations.

Alternatives

Staff considered and evaluated a number of alternative ways to control benzene emissions from retail service stations. Staff also considered the option of not proposing a control measure for benzene emissions from retail service stations. Staff is not recommending a "no control" alternative for benzene emissions from retail service stations because of the magnitude of the cancer risk from the benzene emissions which can be substantially reduced through the use of proven control technology. Staff also considered a number of alternative gasoline throughput cutoffs for the small existing station exemption in the proposed measure. The staff's discussion of this issue is set forth above.

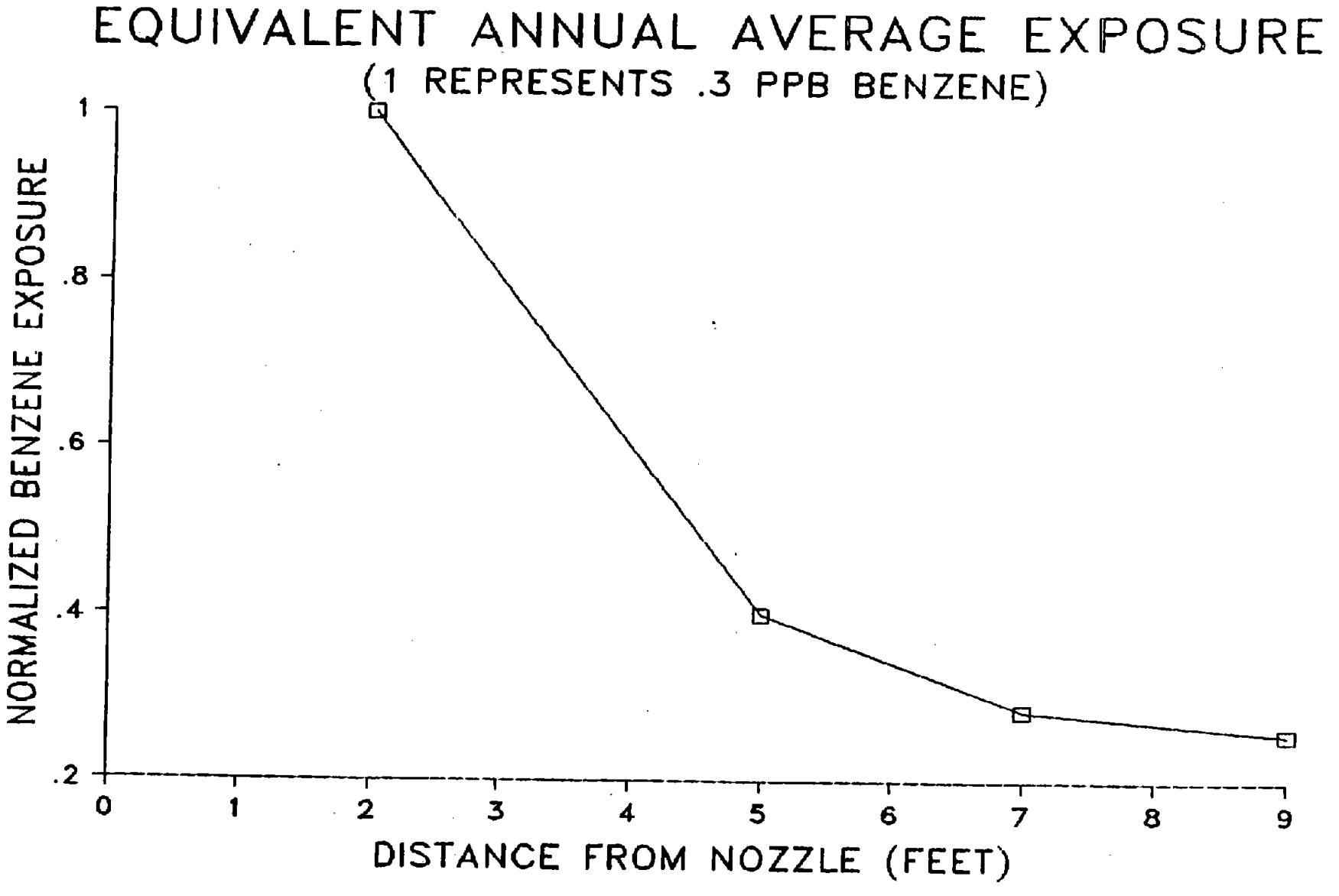
Staff did not identify any control alternatives to the Phase I vapor recovery requirement. Staff is not aware of any alternative to Phase I control equipment which would result in any reduction in benzene emissions during the transfer of gasoline from the delivery vehicle to the stationary storage tank.

Staff identified and considered three alternatives to requiring Phase II vapor recovery systems. The three alternatives are: (1) a ban on self-service vehicle fueling; (2) the use of hold-open latches; and (3) onboard controls. If self-service vehicle fueling was banned, the total cancer incidence from vehicle fueling would remain the same but would be transferred to service station employees fueling the vehicles; the individual risk of the employees would increase proportionately to the number of vehicles fueled unless the station employees were required to wear air filtration equipment. A study on service station attendants' exposure

to benzene at uncontrolled stations shows the mean eight-hour time weighted average benzene exposure level is 100 ppb. Assuming the attendant works 250 days per year, the eight-hour exposure level equates to an annual average benzene exposure level of about 23 ppb. The individual risk resulting from exposure to 23 ppb benzene is 500 to 3,900 cancer cases per million. Staff is not recommending this alternative to the proposed measure because it would not reduce ambient benzene levels and it is not best available control technology. Furthermore, unless attendants wore air filtration equipment, a ban on self-service stations would serve only to transfer the risk from the customers to the station attendants. Also, service station owners would be required to incur additional costs to hire additional staff to dispense gasoline.

Requiring service station customers to use hold-open latches is another alternative to Phase II vapor recovery. Staff is aware that a recent EPA study shows the direct benzene exposures during fueling may be reduced by 60 to 75 percent when individuals use the hold-open latch and move five to nine feet away from the nozzle. Figure IV-3 shows the reduction in equivalent annual average benzene exposure from vehicle fueling when the individual dispensing the gasoline uses the hold-open latch and moves away from the nozzle. Conventional gasoline dispensing nozzles are currently approved for use in California with or without a hold-open latch. However, local fire marshalls in some areas do not allow hold-open latches at self-service stations because of the potential fire hazard. Hold-open latches are designed to shut off the nozzle automatically when the fuel tank is full or the prepaid amount is dispensed. If the amount dispensed does not fill the

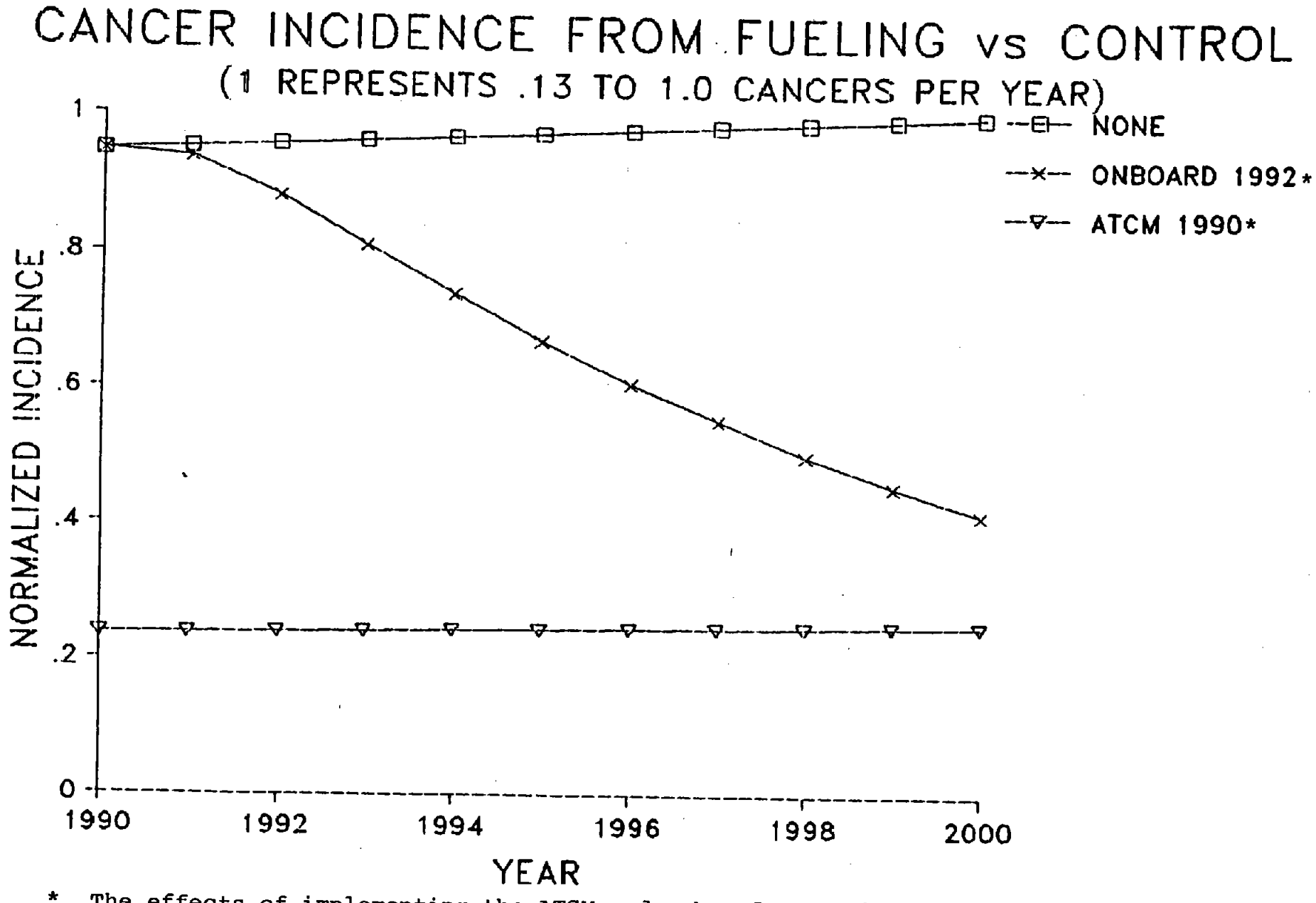
FIGURE IV-3


EQUIVALENT ANNUAL AVERAGE EXPOSURE
(1 REPRESENTS .3 PPB BENZENE)
NORMALIZED BENZENE EXPOSURE
1
.8
.6
.4
.2
0
1
2
3
4
5
6
7
8
9
DISTANCE FROM NOZZLE (FEET)

tank and is not prepaid, the self-serve customer must manually disconnect the hold-open latch to prevent spillage resulting from premature delivery of fuel the next time a purchase is made at that pump. Although a hold-open latch if properly used would significantly reduce benzene exposure from vehicle fueling and is cost-effective, it does not represent best available control technology because it would not reduce benzene emissions or ambient exposures. District enforcement of a hold-open latch control requirement would be difficult. Districts could inspect stations to ensure that the hold-open latches are in place, but they would not be able to verify that the public properly uses these devices and moves away from the vehicle. For these reasons, staff is not recommending this alternative to the proposed measure.

Another control alternative identified is onboard controls for motor vehicles. The EPA is considering a regulation requiring model year 1992 and later vehicles to have onboard controls which would collect gasoline vapors during vehicle fueling. This control alternative would not reduce benzene exposure to individuals fueling pre-1992 model year vehicles. If this proposal becomes a regulation, it would reduce the cancer incidence from vehicle fueling by 55 percent between 1990 and 2000 and would be fully implemented after the year 2010 when the pre-1992 vehicles are fully replaced with newer vehicles. Figure IV-4 compares the reduction in cancer incidence from vehicle fueling with implementation of the proposed ATCM and with implementation of onboard controls on all 1992 and later model year vehicles.

FIGURE IV-4



* The effects of implementing the ATCM and onboard control are shown independently.

This figure shows that the cancer incidence from vehicle fueling would be reduced by about 80 percent in 1990 with the proposed ATCM. The earliest possible implementation of onboard controls would achieve the same reduction in risk in year 2010. Assuming implementation of onboard controls will occur on 1992 and later model year vehicles is realistic since EPA is expected to allow 24 months lead time before implementing a phase-in control program. Other states, such as New Jersey, New York, and Massachusetts are continuing to pursue Phase II vapor recovery programs even with EPA's impending proposal for an onboard control program. Implementation of onboard controls for motor vehicles would increase the average cost per gallon for the proposed ATCM by .3 cent (38 percent) due to the absence of product recovery and a shortening in the effective lifetime of the service station control equipment. The overall reduction in cancer incidence due to the ATCM would decrease by 32 percent between 1990 and 2000 if onboard controls are implemented in model year 1992.

In accordance with Government Code Section 11346.14(a), Board staff specifically considered whether there is any alternative to the ATCM's mandate that specific technologies or equipment, that is, ARB-certified vapor recovery systems be installed. There is no alternative to a requirement of ARB certification because Health and Safety Code Section 41954 et seq. requires that all systems used in California for the control of gasoline vapor emissions during gasoline marketing operations comply with performance standards and certification requirements established by the state board.

After consideration of the alternatives described above, the Board staff has determined that no alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective and less burdensome to affected private persons than the proposed regulation. However, while the Board staff is not recommending any specific alternatives to the proposed ATCM, pursuant to Health and Safety Code Section 39666(d) a district may, at its option, design and adopt an alternative control measure which the district demonstrates to be as effective or more stringent at controlling benzene emissions from retail service stations.

Cost to Small Businesses

Staff estimated the cost to small businesses of the proposed ATCM by using 1986 cost data developed from survey results by the American Petroleum Institute, and equipment costs data from the OPW Fueling Components Group. Data from Bay Area Air quality Management District (BAAQMD) and a report written by Sierra Research for Ford Motor Company were used to estimate the number of service station islands and nozzles requiring controls at stations with varying annual throughputs.

Using these data, the maximum cost for the smallest size station affected by the measure (240,000 gallons per year, 1 island, 4 nozzles) is estimated to be about $14,000 for the capital investment and about $1,000 per year for maintaining the vapor recovery system. The annual maintenance costs include replacement of equipment, permit fees imposed by local districts, and property taxes. Amortizing the capital investment over the useful life of the equipment (15 years for underground plumbing and first

year nozzle and hose costs; 3 years for remaining equipment), and including the annual maintenance costs, the annualized cost for a 240,000 gallons per year station is about $2,600 or 1.2 cents per gallon. Of the 1.2 cents per gallon for installing and maintaining Phase I and II vapor controls at an existing station with a 240,000 gallon per year throughput, 0.1 cent per gallon is attributable to Phase I vapor controls. The Phase I costs are a small fraction of total costs because minimal equipment and maintenance are required. The average annualized cost for a 480,000 gallon per year station is about $3,800 or .8 cent per gallon.

In developing the cost estimates, staff assumed the highest range of installation and maintenance costs, and therefore staff's estimates are expected to exceed those actually incurred by station owners. Staff's estimates exceed those developed by EPA for its recent onboard controls proposal and by the BAAQMD for its recent service station vapor recovery rule revision which made the existing rule more stringent.

Cost to Local Agencies

Staff conducted a phone survey of nine districts with vapor recovery programs in place to estimate the costs for local agencies to initiate and enforce a vapor recovery program for retail service stations. Since many districts charge permit fees on a cost per nozzle basis, the survey results may be expressed as the cost per nozzle to determine the permit fees necessary for districts to recover enforcement costs. The costs incurred initially are greater than in later years because initial permits and authorities to construct must be reviewed and processed. After the first year, costs are related to annual inspections and reinspections resulting

from equipment defects or customer complaints.

The first year cost estimates for initiating the vapor recovery program and conducting inspections are based on the following assumptions: (1) about one billion gallons of gasoline throughput would require controls in 1990; (2) a 960,000 gallons per year station typically has 12 nozzles; (3) about 13,000 nozzles would require controls if the ATCM is adopted; and (4) the first year costs include processing of permits and authorities to construct ($244 + $44/nozzle/station) and inspection costs ($22.50/nozzle). Based on these assumptions, the first year costs for reviewing and processing permits would be about $830,000. The costs for inspections and reinspections would be about $290,000. The total start-up costs incurred by all 30 districts which would be affected by the regulation would be $1.1 million. In subsequent years the enforcement costs would be about $22.50 per nozzle times the number of nozzles with vapor recovery controls.

C. IMPLEMENTATION ISSUES

Issues related to the proposed control measure were thoroughly discussed by the TRG Subcommittee, the TRG and the ARB staff during the course of four meetings. All of the air pollution control districts were invited to participate in the discussions. A public consultation meeting was held in December 1986 to give industry representatives and the public an opportunity to comment on the draft ATCM. Staff also met individually with

representatives from the Western Oil and Gas Association to discuss technical issues related to the measure. Written comments on the ATCM and staff responses are included in Appendix B of the Technical Support Document.

A number of issues related to implementation of the proposed ATCM have been raised by local districts. The primary issues raised are: 1) district enforcement personnel requirements; 2) training of district staff to process permits and enforce the measure; 3) the enforceability of an exemption based on throughput and an acceptable alternative to a throughput cutoff; and 4) the effect upon risk of not requiring Phase I controls on tank trucks concurrently.

In order to estimate enforcement requirements for rural districts, staff conducted a survey of nine districts with Phase II vapor recovery in place. We asked these districts the costs of initial permits and control equipment certifications and resource requirements for annual inspections and reinspections in response to customer complaints. The district survey data on permit fees required to cover enforcement costs were used in the cost-benefit analysis.

Table IV-5 summarizes the staff resources required for enforcing Phase II vapor recovery based on the district survey. This table shows that .3 to .4 person-days/station/year are required for enforcement of the ATCM's requirement of one inspection per year. This estimate includes annual inspections, reinspections following customer complaints, travel time and paperwork. The estimate of .3 to .4 person-days/station/year does not include clerical support. To ensure that we did not underestimate district

Table IV-5

DISTRICT PERSONNEL REQUIREMENTS FOR ENFORCING PHASE II VAPOR RECOVERY

DISTRICT	APPROXIMATE NUMBER OF STATIONS	ANNUAL PERSON-DAYS PER STATION
BAY AREA	2,360	.9 (2 inspections/year)
KINGS CO.	100	.4
MERCED CO.	190	.7 (2-4 inspections/year)
PLACER CO.	86	2.7 (2 inspections/year)
SACRAMENTO CO.	550	.3
SAN DIEGO	1,250	1.8 (3 inspections/year)
SOUTH COAST	8,000	.6 (2 inspections/year)
STANISLAUS CO.	400	.3
YOLO-SOLANO	225	.3

ASSUMPTIONS:
1) 250 working days per year.
2) 1 inspection per year except where noted.
3) Includes travel time and paperwork.
4) Does not include clerical support.

personnel requirements for enforcing the ATCM in rural areas, we used 1 person-day/station/year for district enforcement. Health and Safety Code Section 42311(h) gives district boards the authority to adopt a schedule of annual fees to cover the costs of enforcing airborne toxic control measures developed pursuant to Health and Safety Code Section 39666. Local districts may share resources, contract out for inspection services, or adopt such strategies as they deem necessary to carry out the program.

Another issue related to implementation is the need for training district staff to perform inspections and process permit applications. If this ATCM is adopted by the Board, ARB staff would provide the necessary training for district staff to implement the program.

Some districts have expressed concern about the enforceability of a 240,000 gallon per year throughput cutoff. The concern is that stations which are initially exempt based on the throughput cutoff may exceed the cutoff at a later date and not be controlled due to failure to submit a permit application. Data received from Shasta and Tuolumne County Air Pollution Control Districts show that relatively few stations in those districts have annual throughputs below the cutoff level. Almost every district which has a small station exemption bases the exemption on throughput. An acceptable control alternative to a throughput cutoff would be a cutoff based on the number of nozzles if the district demonstrates that this alternative is equally effective as the throughput cutoff.

Another implementation issue is the effect upon risk of not requiring Phase I controls on tank trucks concurrently. Staff is aware that in a few small districts in the Sacramento Valley, Mountain Counties and Northeast

Plateau Air Basins, the Phase I requirement would not reduce benzene emissions from stations receiving gasoline solely from uncontrolled tank trucks. The proposed control measure includes a provision that stations receiving gasoline solely from uncontrolled tank trucks would be exempt from the Phase I requirement. This provision is included in some existing regulations for nonattainment areas. Although data are not available to estimate the gasoline throughput remaining uncontrolled with this exemption, the impact on the reduction in cancer incidence is expected to be minimal (not more than 10 percent if no Phase I controls are implemented in Sacramento Valley, Mountain Counties and Northeast Plateau Air Basins). These stations would still be required to install Phase II vapor recovery systems.

V. ENVIRONMENTAL IMPACTS

In addition to reducing benzene emissions, implementation of the proposed service station vapor recovery measure would reduce total hydrocarbon emissions in the year 2000 by 8,100 tons in the affected areas, saving about 2 million gallons of gasoline annually which would otherwise be emitted to the atmosphere. Although being considered by the Board as a toxic control measure, this measure will also aid in achieving and/or maintaining the State and Federal ambient oxidant and ozone standards in areas where the State standard is violated but the Federal standard is not. For example, the State oxidant standard was violated during 1983-1985 in the North Central Coast, South Central Coast and Northern Sacramento Valley Air

Basins. The reduction in hydrocarbon emissions obtained from the proposed control measure would also improve visibility and reduce contributions to ambient levels of PM_{10}.

The proposed measure would also reduce exposure to total gasoline vapors. Although the Board has not identified total gasoline vapor as a toxic air contaminant, EPA's Carcinogen Assessment Group recently (April 1987) found "there is sufficient evidence to conclude that gasoline vapors are carcinogenic in animals. . . Based on sufficient evidence in animal studies and inadequate evidence in epidemiologic studies, the overall weight of evidence for unleaded gasoline is EPA category B2, meaning that unleaded gasoline is a probable human carcinogen." EPA found gasoline vapor to be a less potent carcinogen than benzene, however, the gasoline vapor exposure level is significantly higher than the benzene exposure level during vehicle fueling. Therefore, the total gasoline vapor cancer risk may be significantly greater than the risk attributable to benzene vapors alone. Excerpts from the EPA report "Evaluation of the Carcinogenicity of Unleaded Gasoline," April 1987, are included in Appendix E of the Technical Support Document. Staff has not identified any negative environmental, health or safety impacts associated with implementation of the proposed airborne toxic control measure.

ATTACHMENT A

PROPOSED AIRBORNE TOXIC CONTROL MEASURE TO REDUCE BENZENE EMISSIONS FROM RETAIL SERVICE STATIONS

Adopt Subchapter 7.5., Sections 93100 and 93101, Chapter 1, Part III, Titles 17 and 26, California Administrative Code, to read as follows:

Subchapter 7.5. AIRBORNE TOXIC CONTROL MEASURES

93100. Nonvehicular Airborne Toxic Control Measures.

The nonvehicular airborne toxic control measures contained in this subchapter have been adopted by the state board and shall be implemented by adoption of regulations by local air pollution control and air quality management districts pursuant to Health and Safety Code Section 39666.

NOTE: Authority cited: Sections 39600, 39601, 39650 and 39666, Health and Safety Code. Reference: Sections 39650 and 39666, Health and Safety Code.

93101. Benzene Airborne Toxic Control Measure - Retail Service Stations.

(a) Definitions: For the purposes of this section, the following definitions shall apply:

(1) "ARB-certified vapor recovery system" means a vapor recovery system which has been certified by the state board pursuant to Section 41954 of the Health and Safety Code.

(2) "Gasoline" means any petroleum distillate having a Reid vapor pressure of four pounds or greater or any fuel which is commonly or commercially known or sold as gasoline, or any fuel sold to power a vehicle certified by the state board as a gasoline-powered vehicle without modifying the vehicle.

(3) "Motor vehicle" has the same meaning as defined in Section 415 of the Vehicle Code.

(4) "Owner or operator" means an owner or operator of a retail service station.

(5) "Phase I vapor recovery system" means a gasoline vapor recovery system which recovers vapors during the transfer of gasoline from delivery vehicles into stationary storage tanks.

(6) "Phase II vapor recovery system" means a gasoline vapor recovery system which recovers vapors during the fueling of motor vehicles from stationary storage tanks.

(7) "Retail service station" means any new or existing motor vehicle fueling service station subject to payment of California sales tax on gasoline sales.

(8) "Existing retail service station" means any retail service station operating or under construction as of the date of district adoption of this control measure.

(9) "New retail service station" means any retail service station which is not constructed or under construction as of the date of district adoption of this control measure.

(10) "Throughput" means the volume of gasoline dispensed at a retail service station.

(b) Phase I Vapor Recovery System Requirements

(1) No owner or operator shall transfer, or permit the transfer, or provide equipment for the transfer of gasoline, and no other person shall transfer gasoline from a gasoline delivery vehicle into a stationary storage tank at a retail service station unless an ARB-certified Phase I vapor recovery system is installed on the stationary storage tank and used during the transfer.

(2) The provisions of subdivision (b)(1) shall not apply to a transfer to:

(A) A stationary storage tank with a capacity of less than 1.0 cubic meter (260 gallons).

(B) A stationary storage tank used primarily for the fueling of implements of husbandry as defined in Division 16, Chapter 1, of the Vehicle Code.

(C) A stationary storage tank used exclusively to fuel motor vehicles with a fuel capacity of five gallons or less.

(D) An existing retail service station with an annual station gasoline throughput from tanks other than those described in subdivisions (b)(2)(A), (b)(2)(B) and (b)(2)(C) of less than 240,000 gallons during the calendar year prior to district adoption of the measure. If during any calendar year thereafter the gasoline throughput at the station exceeds 240,000 gallons, this exemption shall cease to apply commencing with the first day of the following calendar year.

(E) A stationary storage tank at an existing retail service station which receives gasoline exclusively from delivery vehicles that are not equipped with and are not required to be equipped with vapor recovery systems.

(c) Phase II Vapor Recovery System Requirements

(1) No owner or operator shall transfer, permit the transfer or provide equipment for the transfer of gasoline from a stationary storage tank at a retail service station into a motor vehicle fuel tank unless an ARB-certified Phase II vapor recovery system is installed and used during the transfer.

(2) The provisions of subdivision (c)(1) shall not apply to:

(A) A transfer of gasoline from a stationary storage tank which is exempt from Phase I under subdivision (b)(2)(A), (b)(2)(B), or (b)(2)(C).

(B) A retail service station which is exempt from Phase I requirements under subdivision (b)(2)(D).

(d) Correction of Defects No owner or operator shall use or permit the use of any Phase II system or any component thereof containing a defect identified in Title 17, California Administrative Code, Section 94006 until it has been repaired, replaced, or adjusted, as necessary to remove the defect, and, if required under Health and Safety Code Section 41960.2, district personnel have reinspected the system or have authorized its use pending reinspection. Nothing in this subdivision shall excuse compliance with subdivision (c)(1).

(e) Compliance Schedule For purposes of this section, the following compliance schedule shall apply:

(1) The owner or operator of any new retail service station subject to this section shall comply with the provisions of this section no later than 12 months after gasoline is first sold from the station.

(2) The owner or operator of an existing retail service station subject to this section shall within 15 months after district adoption of the measure secure all permits and other approvals necessary for installation of the equipment required by this section. The owner or operator shall comply with the provisions of this section within 24 months after district adoption of the measure.

(3) The owner or operator of a previously exempt stationary storage tank or retail service station where the operation or throughput has changed

such that the exemption from either the Phase I or II requirements or both is no longer applicable, shall comply with the section's provisions in accordance with (e)(2) above, provided that the first day the retail station or stationary storage tank is no longer exempt shall be considered as the date of "district adoption" of the measure.

NOTE: Authority cited: Sections 39600, 39601, 39650 and 39666, Health and Safety Code. Reference: Sections 39650 and 39666, Health and Safety Code.

State of California
AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER THE ADOPTION OF AN AIRBORNE TOXIC CONTROL MEASURE FOR BENZENE EMISSIONS FROM RETAIL GASOLINE SERVICE STATIONS

The Air Resources Board (the "Board" or "ARB") will conduct a public hearing at the time and place noted below to consider adoption of an airborne toxic control measure for benzene emissions from retail gasoline service stations.

DATE: July 9, 1987

TIME: 10:00 a.m.

PLACE: Lincoln Plaza Auditorium, First Floor
400 P Street
Sacramento, CA

This item will be considered at a two-day meeting of the Board which will commence 10:00 a.m., July 9, 1987, and will continue 8:30 a.m., July 10, 1987. This item may not be considered until July 10, 1987. Please consult the agenda for the meeting which will be available at least 10 days before July 9, 1987, to determine the day on which this item will be considered.

Informative Digest of Proposed Action

Sections Affected: Proposal of a new Subchapter 7.5, Airborne Toxic Control Measures, Sections 93100 and 93101, Title 17, California Administrative Code.

State law directs the ARB to identify and adopt control measures for toxic air contaminants in their non-pesticidal uses (Health and Safety Code §§ 39650 et seq.). Board staff is recommending that the Board adopt an airborne toxic control measure for benzene emissions from retail gasoline service stations. Benzene is present in gasoline.

The Board has listed benzene by regulation as a toxic air contaminant (§ 93000, Title 17, California Administrative Code) in accordance with the procedures set forth in Health and Safety Code §§ 39661 and 39662 and the Administrative Procedure Act (Government Code §§ 11340 et seq.). As part of the benzene identification regulation, the Board has determined that benzene is a toxic air contaminant for which there is not sufficient available scientific evidence to identify a threshold exposure level below which no significant adverse health effects are anticipated.

After identification of benzene as a toxic air contaminant, the Board staff, with the participation of local air pollution control districts, and in consultation with affected sources and the interested public, prepared a report on the need and appropriate degree of regulation of benzene. In public meetings in June and July 1986, the Board considered the plan and an addendum,

which together set forth an overall course of action for controlling benzene. The Benzene Control Plan (the Plan and the July addendum), the Staff Report for the benzene control measure proposed here, and their associated Technical Support Documents comprise the report required by Health and Safety Code § 39665.

In approving the Benzene Control Plan, the Board concurred with the staff's proposed schedules and priorities for benzene control measure development. The retail service station measure which the staff is now proposing for Board adoption was identified in the Plan as among the first of the benzene control measures that the Board would consider because the control technology is proven and readily available.

State law specifies the reductions in emissions of toxic air contaminants which must be achieved by the control measures designed and adopted by the Board (Health and Safety Code § 39666). For toxic air contaminants such as benzene for which the Board has not specified a threshold exposure level, the control measure must be designed, in consideration of the factors addressed in the report required by Health and Safety Code § 39665, to reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method, unless, based on an assessment of risk, an alternative level of emission reduction is determined to be adequate or necessary to prevent an endangerment to public health.

Board staff has determined that the proposed measure is the best available control technology for control of retail service station benzene emissions and recommends its adoption by the Board. If the Board adopts the proposed airborne toxic control measure, Health and Safety Code § 39666(d) requires local districts to adopt the measure or one equally effective or more stringent. The districts must adopt a measure within six months of the effective date of the Board's adoption.

If adopted by the Board and the affected districts, the proposed airborne toxic control measure would reduce benzene emissions from retail service stations by requiring statewide application of ARB-certified vapor recovery controls at existing retail service stations within two years after district adoption of the measure and at new retail service stations within one year after district adoption. The proposed vapor recovery controls are the same as those currently required in the areas of California which do not meet the federal ambient air quality standard for ozone. Thus, the vapor recovery control systems being proposed by staff for Board adoption are currently installed on service stations selling approximately 90 percent of the retail gasoline sales in California. The proposed measure would require application of the controls for purposes of benzene control on almost all of the retail service stations selling the remaining 10 percent of the gasoline sold in California.

The proposed vapor recovery control would reduce benzene emissions by approximately 65 tons per year by the year 2000. This reduction in emissions would reduce cancer incidence by approximately 8 to 59 cancer cases by the year 2000.

The proposed measure would require the application of Phase I vapor recovery systems (which recover vapors during the transfer of gasoline from gasoline delivery vehicles into stationary storage tanks) and Phase II vapor recovery systems (which recover vapors during the fueling of motor vehicles from stationary storage tanks) at most retail gasoline service stations. The measure contains exemptions based on retail service station capacity and use. The proposed regulation also provides that the owner or operator of a retail station shall not permit the use of any Phase II system or any component thereof containing a defect until it has been repaired, replaced, or adjusted, as necessary, and, if required under Health and Safety Code Section 41960.2, the Air Pollution Control Officer has reinspected the system or has authorized its use pending reinspection.

All gasoline vapor recovery systems installed in California, including those which would be installed as a result of this measure if adopted, must comply with the applicable provisions of Health and Safety Code §§ 41954-41961 and the ARB regulations implementing those statutes (Title 17, California Administrative Code, §§ 94000 et seq.).

Availability of Documents and Contact Person

The Board staff has prepared an initial statement of the reasons for the proposed action, which includes a Staff Report and a Technical Support Document, and a summary of the environmental impacts. The Staff Report, the full text of the proposed regulation, and any other information on which the proposal is based, including the Benzene Control Plan and its Technical Support Document, will be available for inspection at the Board's Public Information Office, 1102 Q Street, Sacramento, CA 95814, (916) 322-2990, at least 45 days prior to the scheduled hearing. Copies of the documents may be obtained at the above Public Information Office.

Further inquiries regarding this matter should be directed to Mr. Don Ames, Manager, Technology Assessment Section of the Toxic Pollutants Branch, at (916) 322-8285, P. O. Box 2815, Sacramento, CA 95812.

Costs to Public Agencies and to Businesses and Persons Affected

The Board's Executive Officer has determined that the regulation will not create costs or savings, as defined in Government Code § 11346.5(a)(6), to any state agency or in federal funding to the state, nor nondiscretionary savings imposed on local agencies. The Board's Executive Officer has also determined that adoption of the regulation would impose costs on those air pollution control districts affected, i.e., those districts which do not currently have retail service station vapor recovery regulations. However, the costs are not mandated by the state, as defined in Government Code §§ 17514 and 17556(d) and thus are not reimbursable by the state because Health and Safety Code § 42311(h) authorizes district boards to adopt a schedule of annual fees to cover the costs of enforcing airborne toxic control measures developed pursuant to Health and Safety Code § 39656. The Board staff has estimated, in accordance with instructions adopted by the Department of Finance, the total

nondiscretionary cost imposed on the affected local agencies should not exceed $1.1 million per year. The cost of the district activities needed to begin implementation of the vapor recovery regulation, including inspections and granting initial permits and authorities to construct, is not expected to exceed $800 for each retail service station. This cost is expected to decline significantly in later years of the program when the district enforcement should consist primarily of annual inspections of the stations.

The Executive Officer has determined that adoption of this regulation may have a significant economic impact on small businesses. The small businesses affected would be retail service stations in those districts which would be required to adopt the measure that the Board adopted or one equally effective or more stringent to control benzene emissions from retail service stations. The regulation if adopted would require the non-exempt retail service stations to install vapor recovery controls. The initial installation of these controls at an average size service station is $18,000, with annual maintenance costs of $2,000. Amortizing the cost over the lifetime of the equipment and assuming average station gasoline sales of 480,000 gallons per year, the station owner could recover his/her costs by increasing the price of gasoline by 0.8 to 1.2 cents per gallon. The measure does not impose any recordkeeping or reporting requirements although as a result of the measure districts may require stations within their jurisdiction to submit statements of annual gasoline sales.

In view of the Executive Officer's determination that the regulation might have a significant economic impact on small businesses and in accordance with Government Code § 11346.53, staff makes the following statement:

> The Executive Officer finds that the adoption of this regulation may have a significant adverse impact on small businesses. The Board staff has considered proposed alternatives that would lessen any adverse economic impact on small business and invites you to submit such proposals. Submissions may include the following considerations:
>
> A. The establishment of differing compliance or reporting requirements or timetables which take into account the resources available to small businesses.
>
> B. Consolidation or simplification of compliance and reporting requirements for small businesses.
>
> C. The use of performance standards rather than design standards.
>
> D. Exemption or partial exemption from the regulatory requirements for small businesses.

The Executive Officer has determined that there will be no, or an insignificant, potential cost impact on private persons or businesses directly affected other than the retail service stations discussed above as small businesses.

Submittal of Comments

The public may present comments relating to this matter orally or in writing. To be considered by the Board, written submissions must be addressed to and received by the Board Secretary, Air Resources Board, P.O. Box 2815, Sacramento, CA 95812, no later than 12:00 noon, July 8, 1987, or received by the Board Secretary at the hearing.

The Board requests but does not require that 20 copies of any written statement be submitted and that all written statements be filed at least 10 days prior to the hearing. The Board encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulation.

Statutory Authority and Hearing Procedures

This regulation is proposed under the authority granted in §§ 39600, 39601, 39650, and 39666 of the Health and Safety Code. The regulation is proposed to implement, interpret and make specific §§ 39650 and 39666 of the Health and Safety Code.

The public hearing will be conducted in accordance with the California Administrative Procedure Act, Title 2, Division 3, Part 1, Chapter 3.5 of the Government Code.

Following the public hearing, the Board may adopt the proposed regulation as proposed or with nonsubstantial or grammatical modifications. The Board may also adopt the proposed regulation with other modifications if the regulation as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice that the regulation as modified could result from the proposed regulatory action; in such event the full text of the amendments with the modifications clearly indicated will be made available to the public, for written comment, at least 15 days before they are adopted. The public may request the text of the modified regulation from the Board's Public Information Office, 1102 Q Street, Sacramento, CA 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

James D. Boyd
Executive Officer

May 12, 1987

ATTACHMENT C

LIST OF DISTRICTS AFFECTED BY THE PROPOSED

BENZENE AIRBORNE TOXIC CONTROL MEASURE

ATTACHMENT C

LIST OF DISTRICTS AFFECTED BY THE PROPOSED
BENZENE AIRBORNE TOXIC CONTROL MEASURE

1. Amador County APCD
2. Butte County APCD
3. Calaveras County APCD
4. Colusa County APCD
5. El Dorado County APCD
6. Glenn County APCD
7. Great Basin Unified APCD
8. Imperial County APCD
9. Kern County APCD (Southeast Desert Air Basin only)
10. Lake County APCD
11. Lassen County APCD
12. Mariposa County APCD
13. Mendocino County APCD
14. Modoc County APCD
15. Monterey Bay Unified APCD
16. Nevada County APCD
17. North Coast Unified APCD
18. Northern Sonoma County APCD
19. Placer County APCD (Lake Tahoe Air Basin only)
20. Plumas County APCD
21. San Bernardino County APCD
22. San Luis Obispo County APCD

23. Santa Barbara County APCD (Northern attainment portion only)
24. Shasta County APCD
25. Sierra County APCD
26. Siskiyou County APCD
27. Sutter County APCD
28. Tehama County APCD
29. Tuolumne County APCD
30. Yuba County APCD

ATTACHMENT D

PROPOSED BENZENE CONTROL PLAN AND

ADDENDUM TO PROPOSED BENZENE CONTROL PLAN

State of California
AIR RESOURCES BOARD

STAFF REPORT

PROPOSED BENZENE CONTROL PLAN

May 1986

Prepared by the Toxic Pollutants Branch
Stationary Source Division
With the Participation of the
Bay Area Air Quality Management District,
San Diego County Air Pollution Control District,
and the South Coast Air Quality Management District

Principal Investigators:

Donald J. Ames, Manager - Technology Assessment Section
Barbara Fry
Richard Vincent

Contributing Divisions:
Mobile Source Division
Technical Support Division

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PROPOSED BENZENE CONTROL PLAN

INTRODUCTION

Benzene was identified in January, 1985 by the Air Resources Board (ARB) as a toxic air contaminant (TAC). State law defines a TAC as an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health. Benzene meets these criteria since it was found to be a human carcinogen by the Department of Health Services and the Scientific Review Panel. State law requires (H&SC Section 39665) that once a substance is identified as a TAC, the ARB Executive Officer, with the participation of air pollution control districts, prepare a report on the need for and appropriate degree of control for the substance. The statute requires that the report address the following issues to the extent data are available:

1) present and future benzene emissions and levels of human exposure;

2) benzene's persistence and dispersion potential in the ambient air;

3) the categories and relative contribution of present or future mobile, industrial, agricultural and natural sources of benzene;

4) the availability and technical feasibility of measures to reduce benzene emissions, and the anticipated effect of those measures on levels of human exposure;

5) the approximate cost of each toxic control measure, and the magnitude of risk posed by benzene emissions from the identified sources;

6) the availability of substitute compounds that are less hazardous; and,

7) the potential adverse health, safety or environmental impacts resulting from implementation of each toxic control measure. These issues are

addressed in the proposed Benzene Control Plan. They will also be presented when specific control measures are considered by the Board for adoption at public hearing, as required by H & SC Section 39665 and 39666.

This proposed Benzene Control Plan is divided into three parts. Part I - Basis for Benzene Control - addresses the first three items listed above and includes comparisons of benzene exposures in environmental settings other than ambient air. Part II - Staff Recommendations - contains a discussion of the staff's recommendations for controlling benzene. Part III - Benzene Control Measures - addresses items 4 through 7 listed above and includes discussions of costs, benefits, technical feasibility, priority and a time table for development of specific benzene control measures. Accompanying this report is a Technical Support Document which provides more detail and discussion on the technical material presented in this report.

In developing this plan the staff worked with the districts through the Technical Review Group (TRG)* on potential non-vehicular benzene control measures. The districts contributing to this effort are: South Coast Air Quality Management District (SCAQMD), the Bay Area Air Quality Management District (BAAQMD), and the San Diego County Air Pollution Control District (SDAPCD).

The responsibilities for investigating potential benzene control measures were divided as follows:

Source Category	Responsible Agency
Petroleum Refineries, Marine Terminals, Manufacturing Plants	SCAQMD and BAAQMD
Gasoline Marketing	SDAPCD and ARB

* A longstanding committee of district, ARB, and EPA representatives, established to provide technical coordination among its members in the development of control measures.

Motor Vehicles	ARB
Fuel Specifications and Combustion Operations	ARB

Four public consultation meetings, three industry surveys, and numerous meetings with industry representatives were conducted during the development of this report. An introductory consultation meeting was held in March 1985. The SCAQMD held a consultation meeting in July 1985 to solicit industry input on the refinery emissions estimates. The districts and the ARB staff participated in another consultation meeting in March 1986 to obtain public comments on a draft report. The written comments prior to finalizing this report and ARB staff's responses to those comments are included in Appendix K of the Technical Support Document. The TRG met after the March 1986 public consultation meeting and formulated recommendations for prioritizing development of non-vehicular benzene control measures. The TRG's recommendations are incorporated in this report. The fourth public consultation meeting to obtain comments on the revised draft report was held in May 1986.

The industry surveys that were conducted during the development of this report included a December 1984 request to the automobile industry to provide input on potential motor vehicle control measures. In April 1985 with the assistance of the Western Oil and Gas Association (WOGA), California's oil refiners were asked for data on current and projected benzene and aromatic contents of gasoline. Oil refiners were surveyed again in May 1985 to obtain data on the costs of limiting the benzene content of gasoline. Several meetings with oil industry representatives were held to obtain their input while developing the oil refiners surveys.

PART I - BASIS FOR BENZENE CONTROL

The purpose of this part of the Benzene Control Plan is to present information related to benzene uses, emissions, ambient air exposures and atmospheric persistence. Also presented is a discussion of other environmental exposures to benzene.

A. BENZENE USES, EMISSIONS AND ATMOSPHERIC PERSISTENCE

Benzene is a natural component of crude oil. It is also formed during gasoline production and burning of gasoline in motor vehicle engines. Benzene constituted about 1.4 volume percent of gasoline in 1984 and it's content in gasoline is projected to increase 31 percent to 1.8 volume percent by 1990 as lead is phased out of gasoline.

The major sources of benzene emissions in California are: 1) vehicular exhaust and fuel systems (93 percent)*; 2) gasoline marketing chain (1.4 percent); 3) petroleum refineries, marine terminals, and detergent alkylate plants (0.4 percent); 4) oil and gas extraction (1.3 percent); 5) non-vehicular fuel combustion (1.2 percent); and 6) waste burning (3.2 percent). Current and projected benzene emissions are summarized in Table I-1. The emission estimates presented in Table I-1 for on-road vehicles should be considered preliminary at this time. Recent revisions in ARB's EMFAC model (viz., changes in registration fractions) cause an increase in the

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*For purposes of this report, this category includes on-road vehicles, off-road vehicles, trains, ships, aircraft, mobile equipment and utility equipment. However, trains, ships, aircraft and utility equipment are considered in the H&SC to be "non-vehicular" sources, and are directly regulated by the APCDs and not the ARB. ARB directly regulates vehicular emissions and fuels insofar as they affect tail-pipe emissions from motor vehicles.

Table I-1

Benzene Emissions in California (Statewide)

(tons/year)

Year	1984	2000
Emission Source		
Non-vehicular Sources		
Refineries, marine terminals and detergent alkylate plants	93	110
Oil and gas extraction	280	310
Gasoline marketing	300	420
Fuel combustion	250	410
Waste burning	690	820
Other	3	3
Non-vehicular Total	1,600	2,100
Vehicular (on-road & off-road)	19,800	15,900
Total	21,400	18,000

1984 baseline exhaust benzene emissions for light-duty vehicles, thereby resulting in an emission reduction (over the period 1984 to year 2000) which is larger than previous estimates. In addition to this change, HC emission factors for all on-road motor vehicles are being updated. This change may further reduce estimated on-road motor vehicle benzene emissions by as much as one third over the period 1984 to year 2000. Consequently, the overall emission reduction due to fleet turnover will be substantially greater than the estimates shown here.

To evaluate the progress already made in reducing benzene emissions, we estimated statewide benzene emissions in the year 1964. These historical

emissions estimates show benzene emissions today would be much higher in the absence of the emission control efforts made to date to meet ozone standards. Figure I-1 depicts statewide benzene emission estimates in the years 1964, 1984 and 2000. As indicated in the figure, the 1984 emission level represents about a 50 percent reduction of the 1964 levels. These benzene reductions have occurred as a result of the state vehicular and non-vehicular control program aimed at reducing ambient ozone levels.

Benzene is persistent in the atmosphere, having an atmospheric half-life of 12 days. Over this time, benzene will become widely dispersed from its emission source. It is thus apt to be present throughout an urban air shed.

B. BENZENE EXPOSURE AND RISK ASSESSMENT

1. Ambient Air

"Exposure" to an air pollutant normally refers to the concentration of the pollutant in the air multiplied by the number of people breathing that air multiplied again by the amount of time the pollutant is breathed (concentration x population x duration). However, as estimated in this report, exposure to benzene is calculated as the annual average ambient benzene concentration (parts per billion or ppb) times the number of persons (millions). Thus, the units for expressing exposure are millions of ppb-persons. The use of an annual average concentration implies that the duration is one year. This is convenient because when multiplied by the commonly used units for a compound's risk factor (expressed as excess cancers per ppb among a million people exposed for 70 years), each unit of exposure (10^6 ppb-persons) corresponds to a number of "theoretical cancers" occurring prematurely during 70-year lifetimes.

The population exposure to benzene in California for 1984 and 2000 were estimated from modeling results using benzene emissions data and monitoring data.

Figure I-1

Statewide Benzene Emissions Trends
Under Current Control Programs

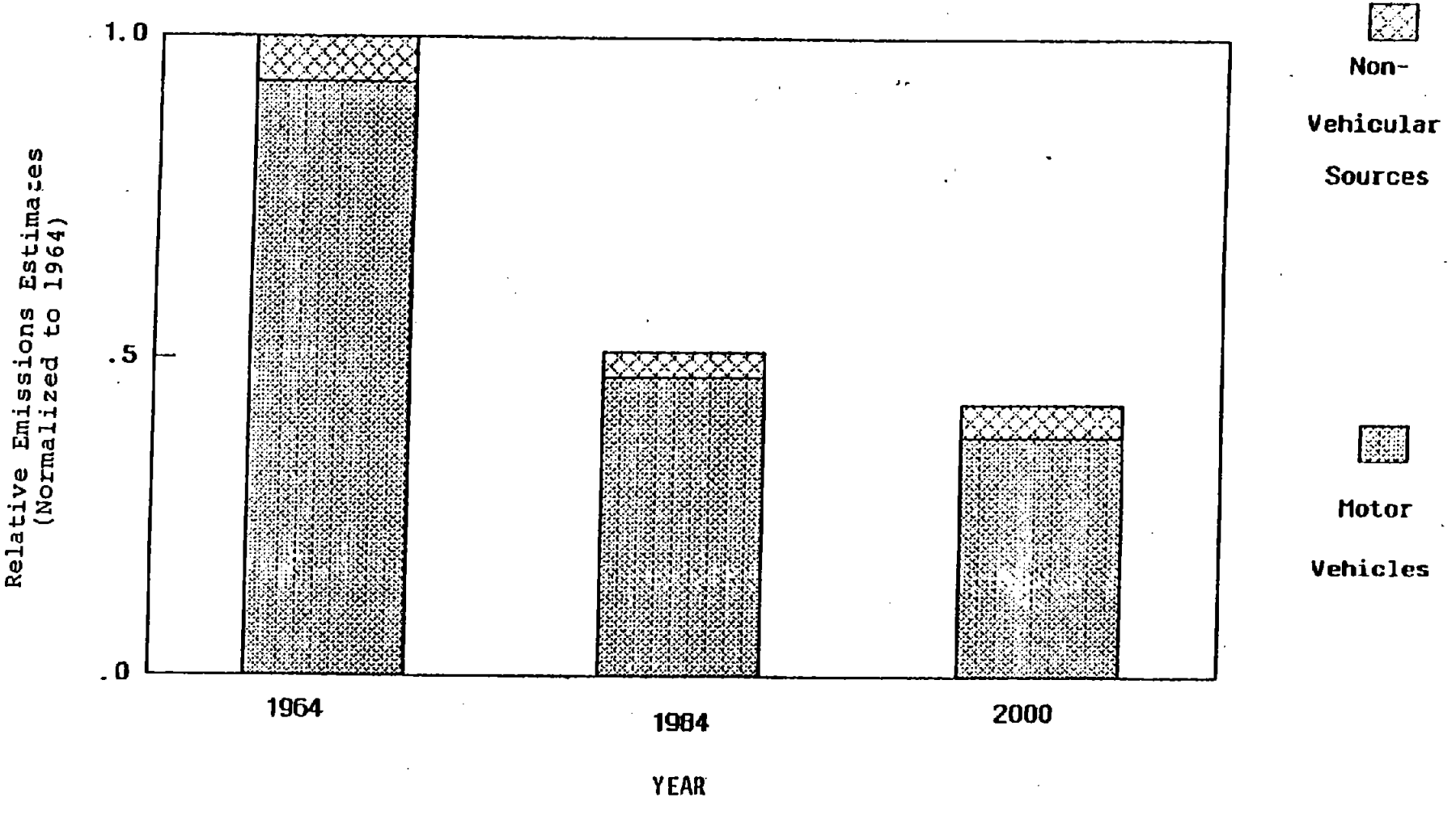


Table I-2 summarizes by air basin the population exposure to benzene in 1984, and the resulting range of excess risk. As shown in Table I-2, the estimated 1984 annual average benzene concentrations ranged from .81 parts per billion (ppb) in rural areas to 4.2 ppb in the SCAQMD, with a population weighted average of 3.3 ppb. The estimated statewide annual average exposure to benzene in 1984, 84 x 10^6 ppb-persons, is equal to 25.8 million, the number of people exposed to benzene, times 3.3 ppb, the annual average benzene concentration.

In addition to annual average exposure, estimates were made for local exposure to benzene from refineries, marine terminals, detergent alkylate producers, and vehicle refueling at service stations. These local exposures are included in the total exposure column in Table I-2. Near source or local exposure accounts for about one percent of the total ambient exposure to benzene in California.

In the Report to the Scientific Review Panel on Benzene that was the basis for the Board's decision to identify benzene as a TAC, the Department of Health Services (DHS) estimated the added lifetime cancer risk (risk factor) from ambient benzene exposure to be 22-170 excess cancers per million people continuously exposed per ppb benzene. Multiplying the 1984 California total population exposure to benzene (85 x 10^6 ppb-persons) by the risk factor results in a 70-year estimated cancer risk ranging from about 1,900 to 14,500 excess cancers for California. This range is believed to be a conservative risk estimate, that is, there is a high degree of confidence (95%) that the actual risk is not greater than identified.

Table I-3 summarizes by source category the current and projected population exposure and range of risk while Figures I-2 and I-3 graphically depict present and projected cumulative risk and risk per million population.

Table I-2

1984 EXPOSURE AND RISK TO BENZENE BY AIR BASIN

Air Basin	Annual Avg. Conc. Benzene (ppb)[a]	Annual Average Exposure[b] (10^6 ppb-persons)	Total Exposure[c] (10^6 ppb-persons)	Estimated Range of Risk[d,e]
Great Basin	1.0	.03	.04	1-7
Lake County	2.3	.09	.1	2-17
Lake Tahoe	3.5	.15	.2	4-34
Mountain Counties	2.2	1.0	1.0	22-170
No. Central Coast	2.2	1.1	1.2	26-200
North Coast	.8	.2	.3	7-50
Northeast Plateau	.8	.05	.1	2-17
Sacramento Valley	2.0	3.0	3.1	68-530
San Diego	2.7	5.4	5.4	120-920
S. F. Bay Area	3.0	16.9	17.5	390-3,000
San Joaq. Valley	2.1	4.4	4.4	100-750
So. Central Coast	1.8	2.0	2.0	44-340
South Coast	4.2	48.9	49.2	1,100-8,400
Southeast Desert	1.3	.9	.9	20-150
State	3.3	84	85	1,900-14,500

a Population-weighted mean of annual average

b Exposure expressed as 10^6 ppb-persons; excludes localized elevated individual exposures.

c Exposure expressed as 10^6 ppb-persons; includes localized elevated individual exposures.

d The reasonable conservative range of risk recommended by the California Department of Health Services is 22-170 excess cancers per million people exposed per ppb. The actual risk may be at or below those indicated.

e Range of risk expressed as statewide excess cancers per 70 years.

Table I-3

CURRENT AND PROJECTED BENZENE EXPOSURE AND RISK

(STATEWIDE)

Source Category	Exposure (10^6 ppb-persons) 1984	2000[2/]	Estimated Range of Risk[1/] 1984	2000[2/]
Refineries, Marine Terminals, Detergent Alkylate Producers				
SCAB*	.07	.08	2-12	2-14
SFAB*	.01	.03	.2-2	.7-5
SJV*	.001	.001	.02-.2	.02-.2
Oil & Gas Extraction	1.0	1.3	22-170	29-220
Gasoline Marketing	1.8	2.9	40-310	64-490
Fuel Combustion	.8	1.6	18-140	35-270
Waste Burning	1.5	2.3	33-260	51-390
Other	.01	.01	.2-2	.2-2
Vehicular	79.8	78.4	1,800-13,600	1,700-13,300
Total	85	87	1,900-14,500	1,900-14,800

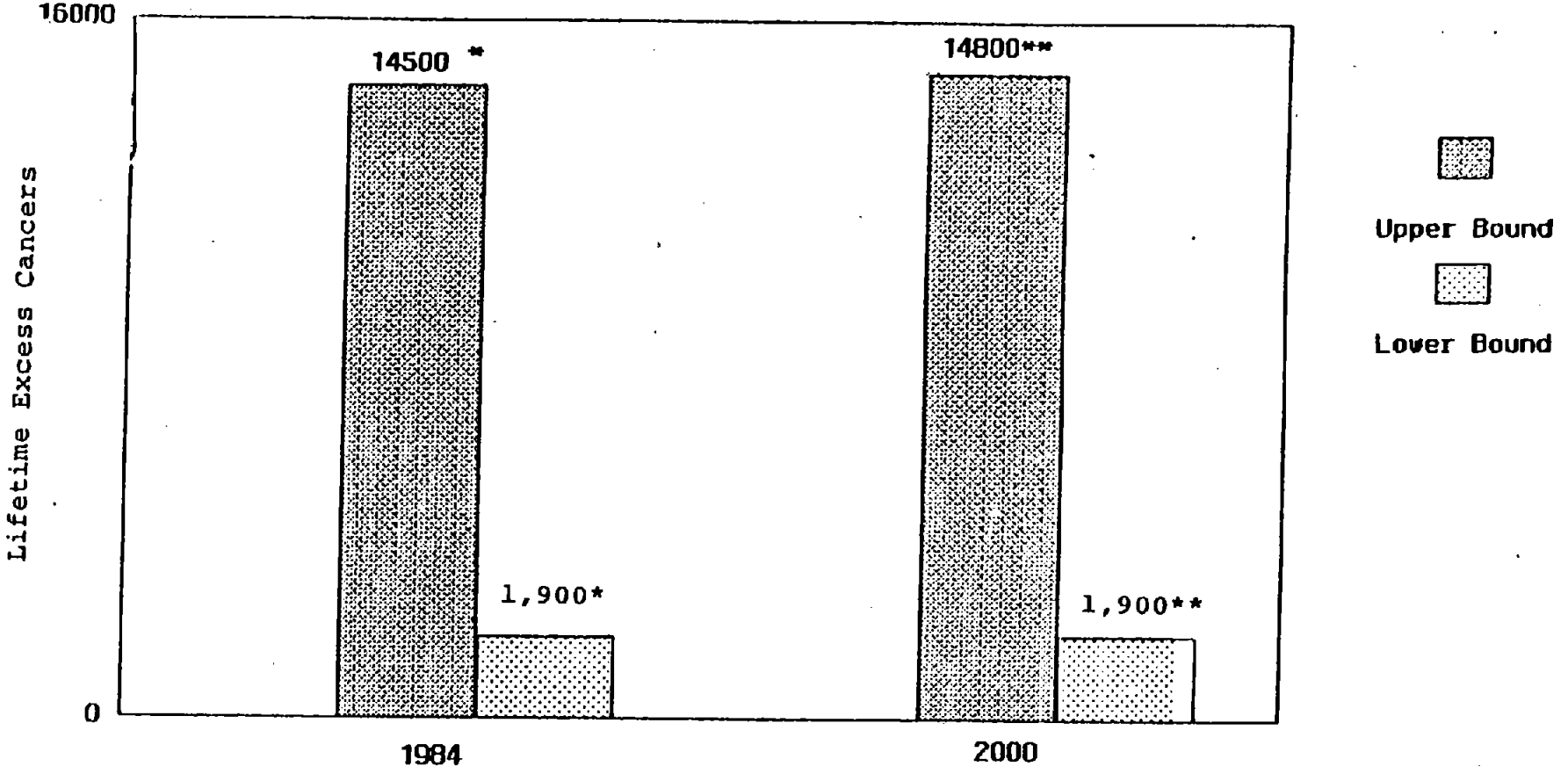
1/ The Department of Health Services estimates that continuous exposure to 1 ppb benzene will result in a reasonable, conservative range of risk of 22 to 170 cancer cases per million people exposed in 70 years. The actual risk may be at or below those indicated. Range of risk expressed as excess cancer cases per 70 years.

2/ Projected exposure and risk without implementation of benzene specific control measures.

* SCAB = South Coast Air Basin
SFAB = San Francisco Bay Area Air Basin
SJV = San Joaquin Valley Air Basin

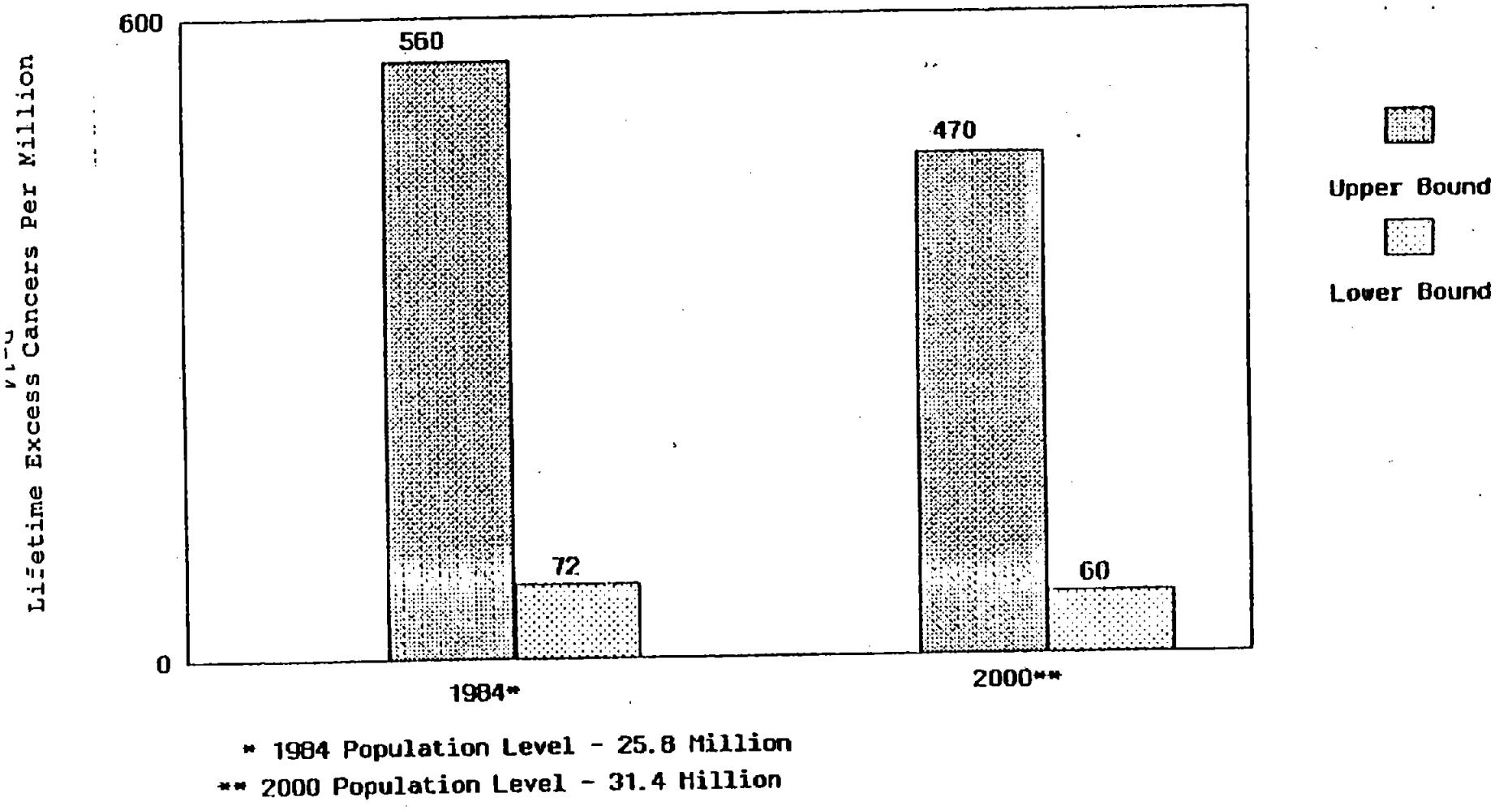
Figure I-2

Statewide Benzene Risk Estimates
Without Further Emission Controls



* Excess Cancers Per Million is 72-560 at 1984 Population Level (25.8 Million)
**Excess Cancers Per Million is 60-470 at 2000 Population Level (31.4 Million)

Figure I-3
Benzene Risk
Per Million Population Without
Further Emission Controls



* 1984 Population Level - 25.8 Million
** 2000 Population Level - 31.4 Million

Table I-3 and Figure I-2 show that without the implementation of benzene specific control measures, the estimated cumulative range of risk from ambient exposure to benzene in California will increase approximately two percent by the year 2000 as a result of population increases. Figure I-3 shows that the risk per million population will decrease sixteen percent by the year 2000 as a result of emission decreases.

2. Other Environmental Exposures

The following discussion summarizes available data for California on other environmental exposures to benzene and compares those exposures with benzene ambient air exposures.

Population exposure data for workplace or indoor air environments is sparse. Data regarding indoor exposures may be significant because it is generally agreed that most people spend 75 to 90 percent of their time indoors. The limited indoor benzene data available for California show that indoor benzene concentrations average 0.8 to 1.5 ppb above outdoor levels. This represents a 24 to 45 percent increase in exposure above statewide average outdoor concentrations. These estimates are based on EPA monitoring data for the cities of Carson, Torrance (South Coast Air Basin), Antioch and Pittsburg (Bay Area Air Basin). The EPA study was designed to provide monitoring data on personal exposure and outdoor concentrations of a number of volatile organic compounds including benzene. The night time personal exposure measurements provide an indication of residential indoor concentrations. The EPA study was not designed to identify indoor benzene sources nor was it designed to develop correlations between outdoor and indoor benzene levels.

Considering the available benzene data and other studies correlating non-reactive air pollutant indoor and outdoor data, it appears that outdoor

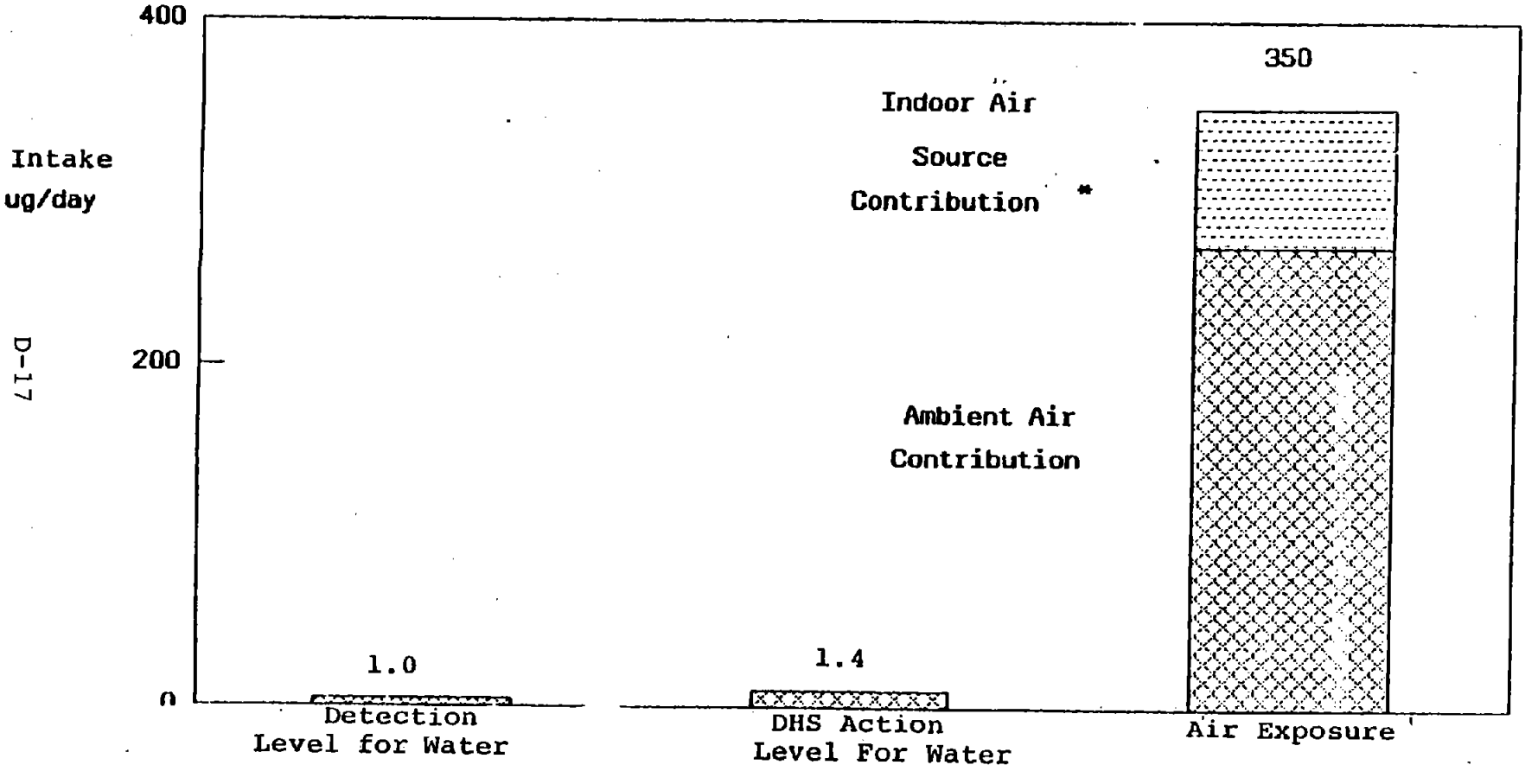
benzene concentrations may account for baseline indoor concentrations for the following reasons: 1) benzene has an atmospheric half-life of 12 days; 2) the air infiltration rate in U.S. homes ranges from 0.25 to 2.5 air changes per hour with doors and windows closed; 3) indoor benzene concentrations vary seasonally with outdoor concentrations; and 4) there is no identified or suspected mechanism that would reduce levels of benzene in indoor air below those outside the home. If outdoor levels do establish a baseline indoor level, as seems the case, then ambient benzene concentration reductions should result in equivalent, or nearly equivalent, indoor benzene concentration reductions. Therefore, risk calculations based on 24 hour averaged ambient benzene exposures need not be discounted for time spent indoors.

As shown earlier in Table I-2, the annual average benzene concentrations in the South Coast and Bay Area Air Basins are 4.2 and 3.0 ppb, respectively. Assuming the indoor benzene concentrations exceed outdoor concentrations by 0.8 to 1.5 ppb, the average increase in indoor versus outdoor concentrations is 19 to 36 percent in the South Coast Air Basin (SCAB) and 27 to 50 percent in the Bay Area Air Basin. Further discussion of indoor benzene levels is included in Appendix C of the Technical Support Document and the methods for estimating population exposure to benzene are included in Appendix B of the Technical Support Document.

The staff compared the intake of benzene the public receives from breathing the air in the SCAB to intake received from drinking water in the SCAB and to state action levels for contaminated drinking water. Figure I-4 depicts a comparison of estimated total air benzene daily intake in the SCAB to intake levels equivalent to the benzene water contamination detection level and the Department of Health Services water clean-up action level.

FIGURE I-4

Average Daily Benzene Intake
in the SCAB



* Assumptions: a) 80% of time is spent indoors; b) ambient air contribution of 4.2 ppb results in the baseline for indoor concentrations; and c) indoor concentration is 1.5 ppb greater than ambient concentration.

The water clean-up action level is the one in a million risk level and is not legally enforceable by DHS. When this action level is met or exceeded, the DHS recommends one of the following actions: 1) blend the contaminated water with clean water to decrease the benzene concentration; 2) shut down the contaminated well; or 3) notify the public about the contaminated water. Application of the DHS action level to ambient air exposures would require more than 99 percent control of benzene emissions. Also, as the figure shows, the public breathes in 350 times more benzene than they would drink from water contaminated at the detection level, and the clean-up action level for water is 250 times lower than the presently experienced average daily air intake in the SCAB.

PART II - STAFF RECOMMENDATIONS

The staff is required by State law to address the appropriate degree of benzene regulation. However, neither State law nor general State policy suggest a specific level of acceptable risk for exposure to toxic air contaminants. To date, districts have made risk management decisions regarding permits for new sources emitting toxic or potentially toxic air pollutants on a case-by-case basis (most districts have used a one in a million risk level as an action level for either further emission control or analysis). The development of a risk reduction strategy for benzene is the first attempt in California to deal specifically with questions relating to acceptable risks for existing TAC pollution sources.

The lifetime risk estimates in this report are based on the Department of Health Services (DHS) risk assessment which identified a range of risk of 22-170 excess cancers per million people continuously exposed to 1 ppb benzene. The Scientific Review Panel approved the DHS risk assessment for benzene and stated in its findings,

> "Although other less conservative estimates of risk can be derived from different data sets or from the same data set using different extrapolation models or scaling factors, it is agreed by the Scientific Review Panel that the estimates presented by the DHS are reasonable, appropriately conservative, and are based on valid scientific judgment."

The Scientific Review Panel's findings and the executive summary of the DHS risk assessment for benzene are included in Appendix L of the Technical Support Document.

Total population lifetime risk levels for present and future ambient levels of benzene discussed earlier, 1,900 to 14,500 excess lifetime cancers

in 1984 and 1,900 to 14,800 excess lifetime cancers in the year 2000, correspond to relative population risks of 72 to 560 in 1984 and 60 to 470 excess lifetime cancers per million people in 2000. This means that although the relative or individual risk levels are decreasing, the total California population risk is not expected to change significantly between 1984 and 2000 unless specific benzene emission controls are implemented.

The staff believes that the residual risk in 2000 in California from exposure to ambient benzene is significant based on the total and relative risks in the future as discussed above. Therefore, in order to be consistent with State law, the staff believes additional control of benzene emissions is necessary. Section 39650 of the Health and Safety Code states:

(1) "That it is the public policy of the state that emissions of toxic air contaminants should be controlled to levels which prevent harm to the public health" (H&SC Section 39650(c)), and

(2) "That a statewide program to control toxic air contaminants is necessary and desirable in order to provide technical and scientific assistance to the districts, to achieve the earliest practicable control of toxic air contaminants, to promote the development and use of advanced control technologies...and to minimize inconsistencies in protecting the public health in various areas of the state" (H&SC Section 39650 (k)).

Also, in order to be consistent with State law (H&SC Section 39666), for substances identified as a TAC without an identifiable threshold exposure level, the ARB must follow one of three courses for controlling non-vehicular benzene emission sources:

1) adopt control measures to reduce emissions to the lowest level achievable through application of best available control technology; or

2) adopt an alternative level of emission reduction which is more effective than best available control technology, which is deemed necessary to prevent an endangerment of public health; or

3) adopt an alternative level of emission reduction which is less effective than best available control technology, which is deemed adequate to prevent an endangerment of public health.

For vehicular sources of benzene, the Board must determine whether revisions are needed in vehicle emission standards to prevent harm to the public health from vehicular benzene emissions.

In other words, State law requires the Board to adopt non-vehicular, vehicular, and fuel related control measures which are designed to reduce benzene emissions to a level which does not endanger public health. Local air districts must adopt regulations implementing non-vehicular measures within six months following the adoption of such measures by the ARB.

Guided by these requirements of State law, staff has developed an overall plan for controlling benzene emissions. The plan consists of:

(1) existing hydrocarbon ccntrol measures;

(2) other hydrocarbon control measures from the Board's motor vehicle Reasonable Extra Efforts Program;

(3) additional motor vehicle control measures;

(4) control measures specifying fuel content; and,

(5) control measures for gasoline marketing and refinery sources.

Specific portions of the plan are presented in Part III of this report. The staff recommends the approval of the action plan identified for controlling benzene emissions. If the plan is approved, the staff will develop the benzene specific control measures and present them to the Board for its

consideration on a case by case basis. Full implementation of the plan will result in a reduction of benzene emissions by approximately 50 percent in the year 2000 and will reduce the risk per million population due to ambient benzene exposure by 50 percent. The statewide risk from ambient benzene exposure will be reduced approximately 39 percent between 1984 and 2000 with full implementation of the plan.

PART III - BENZENE CONTROL MEASURES

This part of the proposed Benzene Control Plan addresses measures which, if implemented, would reduce benzene emissions approximately 50 percent by the year 2000. Included in this part is a discussion of the availability and technical feasibility of benzene control measures, the estimated costs, the estimated reduction in risk, and potential environmental impacts if the measures are implemented.

The measures identified reflect best available control technology or more stringent control for non-vehicular sources. The staff interprets the best available control technology requirement of State law to mean the most effective emission control method technologically feasible. The motor vehicle measures also reflect technologically feasible emission controls to protect public health . In the identification of these measures, staff has attempted to identify all potential benzene control measures which either reflect best available control technology or which presently are further advanced than best available control technology but need further development before consideration as regulation.

Before identifying potential control measures for benzene, we assessed the impact on California of the Environmental Protection Agency (EPA) actions to control benzene emissions since its identification as a hazardous air pollutant in June 1977. Since that time, EPA has proposed national emission standards for benzene emissions from maleic anhydride plants, ethylbenzene/ styrene plants, benzene storage vessels and benzene equipment leaks. After proposing the emission standards, EPA updated its nationwide risk estimates for these sources and decided to withdraw the proposed standards for maleic

anhydride plants, ethylbenzene/styrene plants, and benzene storage vessels and promulgate only the proposed standard for benzene equipment leaks in June 1984.

The Bay Area Air Quality Management District adopted a similar benzene equipment leak rule which applied to one facility in that district in 1985. This facility has not exceeded the emission standard, and recently notified the district that it will cease operations in 1986. Thus, the EPA has promulgated only one national emission standard for benzene since 1977, and that standard does not affect any of the benzene sources in California.

A. SUMMARY OF MEASURES

The measures are separated into vehicular and non-vehicular measures. The non-vehicular benzene control measures were identified with the participation of the Technical Review Group (TRG). The ARB staff identified the vehicular measures. The potential benzene control measures are identified in Table III-1 along with each measures' estimated emission reductions, reductions in risks, cost/pound of benzene reduced, cost/risk reduced and technical feasibility. Table III-1 also includes the recommendations of the TRG and ARB staff for prioritizing development of the potential measures.

The motor vehicle measures shown in Table III-1 include various total hydrocarbon (THC) measures planned for development by staff and one benzene-specific control strategy. All of the motor vehicle measures listed, except the benzene-specific measure (Measure A-6 in Table III-1), are being evaluated within the scope of existing ARB programs. These include THC control measures which are aimed at the elimination of excess motor vehicle emissions (190 tons hydrocarbon per day reduction statewide in 2000), the implementation of more stringent standards, and the facilitation of alternative energy technologies.

TABLE xxI-1

SUMMARY OF BENZENE CONTROL MEASURES

	Technical Feasibility[1]	Statewide Emission Reduction,[2] 2000 (tons/yr)	Statewide Reduction in Risk[3]	Cost[2] ($/lb. Benzene Reduced)	10^6/Risk Reduced[3]	Priority for Measure Development
A. Motor Vehicles						
1. Oxygen Sensor Durability/On-Board Diagnostics	A	290	31-240	NA*		Adopted 4/85
2. Modifier-Certified New Vehicle Regulations	A	180	20-150	NA*		Adopted 12/85
3. More Stringent Exhaust HC Standard	B	1,900	210-1,600	NA*		High
4. More Stringent Evaporative HC Standard	B	37	4-31	NA*		High
5. Other HC Measures	B	2,400	260-2,000	NA*		High
6. Exhaust Emission Benzene Limit	C	1,500	160-1,260	$5 - $25	$.8 - $31	High
7. Alternative Fuels	B	700	73-560	NA*		High
B. Non-vehicular						
1. Gasoline Marketing**						
a. Vapor Recovery at Service Stations	A	130	20-150	$19	$2 - $18	High
b. Vapor Recovery at Bulk Plants	A	36	2-17	$28	$8 - $66	High
c. Afterburners at Bulk Terminals	A	40	4-34	$23	$4 - $31	High
2. Gasoline Specifications						
a. 1.4 vol.% benzene limit	B	1,400	160-1,240	$33	$8 - $66	High
b. 1.0 vol.% benzene limit	B	2,800	320-2,500	$49	$8 - $60	High
3. Refinery Sources***						
a. Vapor Recovery on Benzene Tanks	A	11	.7-5	$ 1 - $2	$.4 - $4	High
b. Improve Seals on Benzene Tanks[4]	A	7	.02-.2	$ 1	$3.5 - $27	High
c. Vapor Recovery on Marine Loading	B	23	.2-2	$75 - $520	$130-$14x10^3	Low
d. Improve Seals on Gasoline Tanks	A	2.3	.02-.2	$22 - $33	$23 - $950	High
e. Replace Riveted Benzene Tank[4]	A	7.4	.07-.5	$11	$23 - $190	High
f. Replace Gasoline Tanks	A	.3	.002-.02	$700-$2,800	$2.5x10^3-73x10^3	Low
4. Diesel Specifications[5]	C	Unknown	Unknown	NA*		High

[1] Technical Feasibility: A) presently available control technology; available and proven control method. B) Technically feasible but not available commercially at present; more development time is needed. C) Advanced control method which requires additional research and/or time to develop technology prior to commercial applications.

[2] Neither the emission reductions nor the reductions in risk are additive since implementation of some measures will affect other measures' costs and emission reductions.

[3] Reduction in risk is the estimate of cancer cases avoided per 70 years. 10^6/risk reduced is the annual cost divided by the estimate of cancer cases avoided per year. Department of Health Services estimates the reasonable, conservative lifetime cancer risk from ambient benzene exposure ranges from 22-170 excess cancers per million people exposed to 1 ppb benzene.

[4] The Bay Area Air Quality Management District was notified on 3-17-86 that the facility affected by these measures will cease operations in 1986.

[5] This potential control measure was identified at the 3-4-86 public consultation meeting.

* Not Applicable, potential vehicular control measures planned for criteria pollutant control. No cost is attributed to benzene control.

** Gasoline marketing measures identified by San Diego County Air Pollution Control District and Air Resources Board.

***Refinery measures identified by South Coast Air Quality Management District and Bay Area Air Quality Management District.

Implementation of these measures is expected to result in significant benzene emission reductions as well as THC emission reductions. The benzene-specific vehicular measure would likely require that vehicles meet a specific benzene emission limit in the exhaust.

The potential non-vehicular benzene control measures include gasoline and diesel specifications and control of gasoline and benzene vapors. Reducing the benzene content of gasoline would reduce the evaporation of benzene from the marketing and storage of gasoline as well as reduce benzene in the exhausts of gasoline-powered vehicles. This reduction in exhaust benzene would not be proportional to the change in the benzene content of gasoline because part of the exhaust benzene is formed by the combustion of other aromatic compounds in the fuel. The quantitative relationship between other aromatic compounds in gasoline and exhaust benzene emissions is not known; research sponsored by the ARB is expected to provide this information by June 1987.

Benzene is not present in diesel fuel but may be formed from the combustion of another aromatic compound(s) in diesel fuel. The staff is investigating a reduction in the aromatics content of diesel fuel. Such a reduction in aromatics may reduce benzene emissions from diesel vehicles.

The other non-vehicular measures are aimed at reducing evaporative benzene emissions from gasoline and benzene storage facilities. The gasoline storage facilities include service stations, bulk plants, bulk terminals, and refinery gasoline storage tanks. The benzene storage tanks for which potential measures have been identified are located at refineries and chemical manufacturing plants.

The technical feasibility of both the vehicular and non-vehicular measures varies greatly; thus much development work is required on some of the measures before a regulation can be presented to the Board for consideration for adoption. Table III-2 summarizes the staff's proposed schedule for benzene control measure development for public hearing. As seen in the Table, all measures reflecting the use of presently available control technology (Group I) are proposed for immediate development into regulation for the Board's consideration within the next six months. The Group II measures are technically feasible but more development time is needed for staff to obtain information necessary to develop specific regulatory language. The Group III measures are not being recommended for further development at this time. The following section of this report contains one page summaries of the various benzene control strategies and the Technical Support Document contains a detailed description and discussion of each potential benzene control measure.

B. BENZENE STRATEGY SUMMARIES

This section contains one page summaries of the potential benzene control measures previously shown in Table III-1. Included in the summaries are brief descriptions of the measure, it's technical feasibility, potential emission and risk reductions, costs and schedule for development. The motor vehicle measures are summarized within one of the following general vehicular strategy approaches: (1) THC measures which are aimed at the elimination of excess motor vehicle emissions; (2) the implementation of more stringent criteria pollutant emission standards for new vehicles, and the facilitation of alternative energy technologies; and (3) the benzene-specific vehicular measure.

TABLE III-2

PROPOSED BENZENE CONTROL PLAN

Benzene Control Measure	Date Measure to Board	Comments
GROUP I - Presently available control technology		
1. Oxygen sensor durability/on-board diagnostics	Adopted 4/85	
2. Modifier-certified new vehicle regulations	Adopted 12/85	
3. Vapor recovery at service stations	11/86	
4. Vapor recovery at bulk plants	11/86	
5. Afterburners at bulk terminals	11/86	
6. Vapor recovery on benzene tanks	11/86	
7. Improve seals on benzene tanks	11/86	Facility scheduled to cease operation by 1/8
8. Improve seals on gasoline storage tanks	11/86	
9. Replace riveted benzene tank	11/86	Facility scheduled to cease operation by 1/8
GROUP II - Technologically feasible but development time needed		
1. Gasoline specifications	11/87	Includes investigation of multiple levels of benzene and substitute fuels.
2. More stringent exhaust HC standard	11/88	
3. More stringent evaporative HC standard	11/88	
4. Exhaust emission benzene limit	6/89	Requires development of benzene specific control technology.
5. Diesel fuel specification	To be determined	
6. Other vehicle HC measures	11/89	
7. Alternative fuels	--	Not regulatory
GROUP III-Potential measures not recommended		
1. Vapor recovery on marine loading	NA*	Although technically feasible, measures in Group III are relatively costly and would result in a small risk reduction.
2. Replace gasoline tanks	NA*	

*Not applicable

A one page summary is provided for each of the non-vehicular control measures. A detailed description of each measure is contained in the Technical Support Document.

A. 1., 2., 5. Motor Vehicles - Reasonable Extra Efforts Program Measures: O_2 Sensor/On-Board Diagnostics, Modifier-Certified Regulations, Other HC Measures

Summary:

These measures are components of the staff's "Reasonable Extra Efforts Program" plan to reduce "excess" hydrocarbon emissions by 190 tons per day in 2000. The O_2 Sensor Durability/On-Board Diagnostics measure has been adopted by the Board to take effect in 1988. The Modifier-Certified New Vehicle Regulations were adopted by the Board in December 1985. The other measures have not been developed.

Technical Description:

The O_2 Sensor measure will require a minimum maintenance interval of 50,000 miles for the oxygen sensor and a system to inform the driver of a failure in emission control equipment. The Modifier-Certified Regulations would legalize new foreign vehicles modified to meet California's emission standards, and they would impose test requirements relating to the deterioration of emission controls during use. The other measures are described in Appendix G of the Technical Support Document.

Technical Feasibility:

The O_2 Sensor and Modifier-Certified Regulations are Level A (proven and available). The other measures are Level B (feasible but not commercially available at this time).

Emission Reductions:

O_2 Sensor - 290 tons/year in 2000
Modifier-Cert - 180 tons/year in 2000
Others - 2,400 tons/year in 2000

Risk Reduction:

O_2 Sensor - 31 to 240 lifetime cases avoided
Modifier-Cert - 20 to 150 lifetime cases avoided
Others - 260 to 2,000 lifetime cases avoided

Cost:

None attributable to benzene control; these measures are being developed by staff for control of total HC emissions.

Development Schedule:

Other HC control measures to meet existing emission standards are being developed on a continuous basis. Not all measures will require Board consideration (e.g. improvements to the I/M program).

Priority:

High

A. 3., 4., 7. Motor Vehicles - Exhaust and Evaporative HC Standards, Alternative Fuels

Summary:

The first of these (combined) measures would set limits of .25 gram/mile and 1.0 gram/test, respectively for exhaust and evaporative hydrocarbon emissions from new cars. Under the alternative fuels measure, the Board would encourage methanol and electricity to power fleet vehicles.

Technical Description:

Improved emission control hardware will be required to meet the more stringent HC standards for new vehicles. No regulatory means to encourage alternative fuels have been proposed.

Technical Feasibility:

HC standards - Level B (feasible but not commercially available)
Alternative fuels - Level B (feasible but not commercially available)

Emission Reduction:

HC standards - 1,900 tons/year in 2000
Alternative fuels - 700 tons/year in 2000

Risk Reduction:

HC standards - 210 to 1,600 lifetime cases avoided
Alternative fuels - 73 to 560 lifetime cases avoided

Cost:

None attributable to benzene control; these measures are planned for development for purposes of total HC control.

Development Schedule:

New vehicle standards to Board November 1988

Priority:

High

A. 6. Motor Vehicles - Exhaust Benzene Limit

Summary:
This measure would reduce benzene emissions from the exhaust of gasoline-powered vehicles by 50% (as a target).

Technical Description:
A limit would be placed on the mass of benzene emitted per mile.

Technical Feasibility:
Level C (advanced control method). A vehicular catalyst may be developed which more effectively reduces benzene and other aromatic compounds.

Emission Reductions:
1,500 tons/year in 2000 if a vehicular exhaust standard of 0.25 gm HC/mile is already in place.

Risk Reduction:
160 to 1,260 lifetime cases avoided

Cost:
$5 to $25/pound of benzene reduced
$.8 to $31 million/lifetime case avoided

Development Schedule:
Control measure to Board June 1989

Priority:
High

Comments
Requires development of benzene specific control technology. A contract to investigate the feasibility of more effective benzene control requirements will be awarded in mid 1986, with results available in early 1988.

B. 1. a. - Vapor Recovery at Service Stations

Summary:
Control of gasoline vapors is presently required at service stations in non-attainment areas. This control measure would extend the present requirements to attainment areas; primary focus to be urbanized areas.

Technical Description:
95% control applicable to service stations pumping 2000 gallons or more per month.

Technical Feasibility:
Level A, presently implemented in non-attainment areas; best available control technology.

Emission Reductions:
130 tons/year in 2000 in attainment areas.

Risk Reduction:
20 - 150 lifetime cases avoided

Costs:
$19/pound of benzene reduced
$2-18 million/lifetime case avoided

Development Schedule:
Control measure to Board, 11/86. Implementation - dependent on phase-in schedule; as early as 5/87.

Priority:
High

Comments:
Best available control technology for this source; implementation to be coordinated with districts.

B. 1. b. - Vapor Recovery at Bulk Plants

Summary:
Control of gasoline vapors is presently required at most bulk plants in non-attainment areas. This control measure would extend the present requirements to attainment areas and exempt facilities in non-attainment areas.

Technical Description:
95% control applicable to bulk plants with gasoline throughputs less than 5 million gallons per year.

Technical Feasibility:
Level A, presently implemented in non-attainment areas; best available control technology.

Emission Reductions:
36 tons/year in 2000, mainly in attainment areas

Risk Reduction:
2-17 lifetime cases avoided

Costs:
$28/pound of benzene reduced
$8-66 million/lifetime case avoided

Development Schedule:
Control measure to Board, 11/86.

Priority:
High

Comments:
Best available control technology for this source; implementation to be coordinated with districts.

B. 1. c. - Afterburners at Bulk Terminals

Summary:
Control of gasoline vapor emissions to .55 - .65 lbs. total hydrocarbon (THC)/1,000 gallons throughput is presently required at bulk terminals and large bulk plants in non-attainment areas. This control measure would decrease the THC emission limit to .08 lbs. THC/1,000 gallons throughput.

Technical Description:
Requires retrofitting an afterburner to existing vapor recovery systems at bulk terminals and plants with gasoline throughputs greater than 5 million gallons per year.

Technical Feasibility:
Level A, presently achievable; best available control technology.

Emission Reductions:
40 tons/year in 2000 in non-attainment areas

Risk Reduction:
4-34 lifetime cases avoided

Costs:
$23/pound of benzene reduced
$4-31 million/lifetime case avoided

Development Schedule:
Control measure to Board, 11/86.

Priority:
High

Comments:
Best available control technology for this source; implementation to be coordinated with districts.

B. 2. a. Gasoline Specification, 1.4% benzene

Summary:
The control would limit the benzene content of gasoline sold in California to approximately its 1984 level which was 1.4 volume percent, annual average. Benzene is present in gasoline as a component of crude oil and is formed in the refining process. Due to the phase-out of lead in gasoline, the average benzene content of gasoline is projected to increase by 31% between 1984 and 1990. This will increase benzene emissions from evaporation and combustion of gasoline by 10% in 2000.

Technical Description:
The structure of a regulation has not been developed. The limit would be set so that most refineries could comply by extracting benzene from reformate or naphtha.

Technical Feasibility:
Level B. Annual average benzene contents as low as 1.0 volume percent can be achieved when processing facilities are constructed without affecting product quantity or quality. (The projected benzene level for 1990 is 1.8% without a benzene regulation.) More information is needed to identify other aromatic compounds which contribute to exhaust benzene in order to develop the most cost effective and practical regulation.

Emission Reductions:
1400 tons/year in 2000, statewide

Risk Reduction:
160 to 1,240 lifetime cases avoided

Cost:
$53/pound of benzene reduced
$8 million to $66 million/lifetime case avoided

Priority:
High

B. 2. b. Gasoline Specification, 1.0% benzene

Summary:

The control measure would reduce the benzene content of gasoline sold in California to 1.0 volume percent, annual average. (Benzene is present in gasoline as a component of crude oil and as a product of octane-enhancing processes. Due to the severely reduced lead content of gasoline pool, the average benzene content of gasoline will increase by 31% between 1984 and 1990. This will increase benzene emissions from evaporation and combustion of gasoline by 10% in 2000.)

Technical Description:

The structure of a regulation has not been developed. The limit would be set so that most refineries could comply by extracting benzene from reformate or naphtha.

Technical Feasibility:

Level B. Annual average benzene contents as low as 1.0 volume percent can be achieved when processing facilities are constructed without affecting product quantity or quality. (The projected value for 1990 is 1.8%.) The nature of the limit to impose and any attendant difficulties in compliance have not been determined.

Emission Reductions:

2,800 tons/year in 2000, statewide

Risk Reduction:

320 to 2,500 lifetime cases avoided

Cost:

$49/pound of benzene reduced
$8 million to $60 million/lifetime case avoided.

Priority:

High

B. 3. a. - Vapor Control on Benzene Storage Tanks

Summary:
This control measure would require vapor recovery or best available seal systems on fixed roof benzene storage tanks.

Technical Description:
Requires: 1) installation of vapor recovery systems on fixed roof benzene tanks with standard relief valves; and 2) replacement of internal pontoon floating roofs with bolted aluminum internal floating roofs with primary and secondary seals.

Technical Feasibility:
Level A; best available control technology.

Emission Reductions:
11 tons/year in 2000 in South Coast Air Quality Management District

Risk Reduction:
.7-5 lifetime cases avoided in South Coast Air Quality Management District

Costs:
$1-2/pound of benzene reduced
$0.4-$4 million/lifetime case avoided

Development Schedule:
Control measure to Board, 11/86.

Priority:
High

Comments:
Best available control technology for this source; implementation to be coordinated with South Coast Air Quality Management District.

B. 3. b. - Improve Seals on Benzene Storage Tanks

Summary:
This control measure requires best available seal systems on benzene storage tanks with floating roofs.

Technical Description:
Requires a primary liquid mounted seal and a secondary rim mounted seal on benzene storage tanks with floating roofs.

Technical Feasibility:
Level A; best available control technology.

Emission Reductions:
7 tons/year in 2000 in Bay Area Air Quality Management District

Risk Reduction:
.02-.2 lifetime case avoided in Bay Area Air Quality Management District

Costs:
$1/pound of benzene reduced
$3.5-$27 million/lifetime case avoided

Development Schedule:
Control measure to Board 11/86.

Priority:
High

Comments:
Best available control technology for this source; facility notified Bay Area Air Quality Management District that it will cease operations in 1986.

B. 3.c. - Vapor Recovery on Marine Loading

Summary:
This control measure would require vapor recovery on ships and barges loading gasoline.

Technical Description:
Requires installation of vapor recovery systems for ships loading gasoline at marine terminals. Current requirement is submerged fill pipes.

Technical Feasibility:
Level B; technically feasible but not commercially available.

Emission Reductions:
23 tons/year in 2000 in Bay Area Air Quality Management District.

Risk Reductions:
.2-2 lifetime cases avoided in Bay Area Air Quality Management District.

Costs:
$75-$520/pound of benzene reduced
$130 million to $14 billion/lifetime case avoided

Development Schedule:
Not planned

Priority:
Low

B. 3. d. - Improve Seals on Gasoline Storage Tanks

Summary:
This control measure would require best available seal systems on gasoline storage tanks.

Technical Description:
Requires primary liquid mounted seals and secondary rim mounted seals on gasoline tanks with floating roofs.

Technical Feasibility:
Level A; best available control technology.

Emission Reductions:
2.3 tons/year in 2000 in Bay Area Air Quality Management District

Risk Reductions:
.02-.2 lifetime cases avoided in Bay Area Air Quality Management District.

Costs:
$22-$33/pound of benzene reduced
$23-$950 million/lifetime case avoided

Development Schedule:
Control measure to Board 11/86

Priority:
High

B. 3. e. - Replace Riveted Benzene Storage Tank

Summary:
This control measure would require replacement of a riveted benzene storage tank with a welded tank having the best available seal system.

Technical Description:
Requires benzene storage tanks to have welded shell construction with floating roofs using double seals. The primary seal would be liquid mounted.

Technical Feasibility:
Level A; best available control technology.

Emission Reductions:
7.4 tons/year in 2000 in Bay Area Air Quality Management District

Risk Reduction:
.07-.5 lifetime cases avoided in Bay Area Air Quality Management District

Costs:
$11/pound of benzene reduced
$23-$190 million/lifetime case avoided

Development Schedule:
Control measure to Board 11/86

Priority:
High

Comments:
The Bay Area Air Quality Management District was notified that the facility affected by this measure will cease operations in 1986.

B. 3. f. - Replace Gasoline Storage Tanks

Summary:

This control measure would require replacement of riveted gasoline tanks with welded tanks having the best available seal system.

Technical Description:

Requires gasoline storage tanks to have welded shell construction with floating roofs using double seals. The primary seal would be liquid mounted.

Technical Feasibility:

Level A; best available control technology.

Emission Reductions:

.3 ton/year in 2000 in Bay Area Air Quality Management District.

Risk Reductions:

.002-.02 lifetime cases avoided in Bay Area Air Quality Management District.

Costs:

$700-$2,800/pound of benzene reduced
$2.5-$73 billion/lifetime case avoided

Development Schedule:

Not planned

Priority:

Low

B. 4. - Diesel Specification

Summary:
The staff is investigating a reduction in the aromatics content of diesel fuel. Such a reduction in aromatics may reduce benzene emissions from diesel vehicles.

Technical Description:
The structure of a regulation has not been developed.

Technical Feasibility:
Level B (feasible but not commercially available). Additional research and time is needed to identify the fuel compounds which contribute to exhaust benzene and to determine the feasibility of reducing the use of these compounds in diesel fuel.

Emission Reductions:
Unknown

Risk Reduction:
Unknown

Cost:
Unknown

Development Schedule:
To be determined

Priority:
High

C. POTENTIAL REDUCTION IN RISK

The potential reduction in risk from implementation of the control measures identified for benzene is estimated as the statewide reduction in excess lifetime cancers between 1984 and 2000. Since data from the Department of Finance Demographic Research Unit show California's population is projected to increase 22 percent between 1984 and 2000, the reduction in statewide excess lifetime cancer risk is less than the reduction per million population.

The estimated reductions in risk are based on the following sequence for implementing control measures:

1) all of the control measures reflecting the use of presently available control technology (Group I);

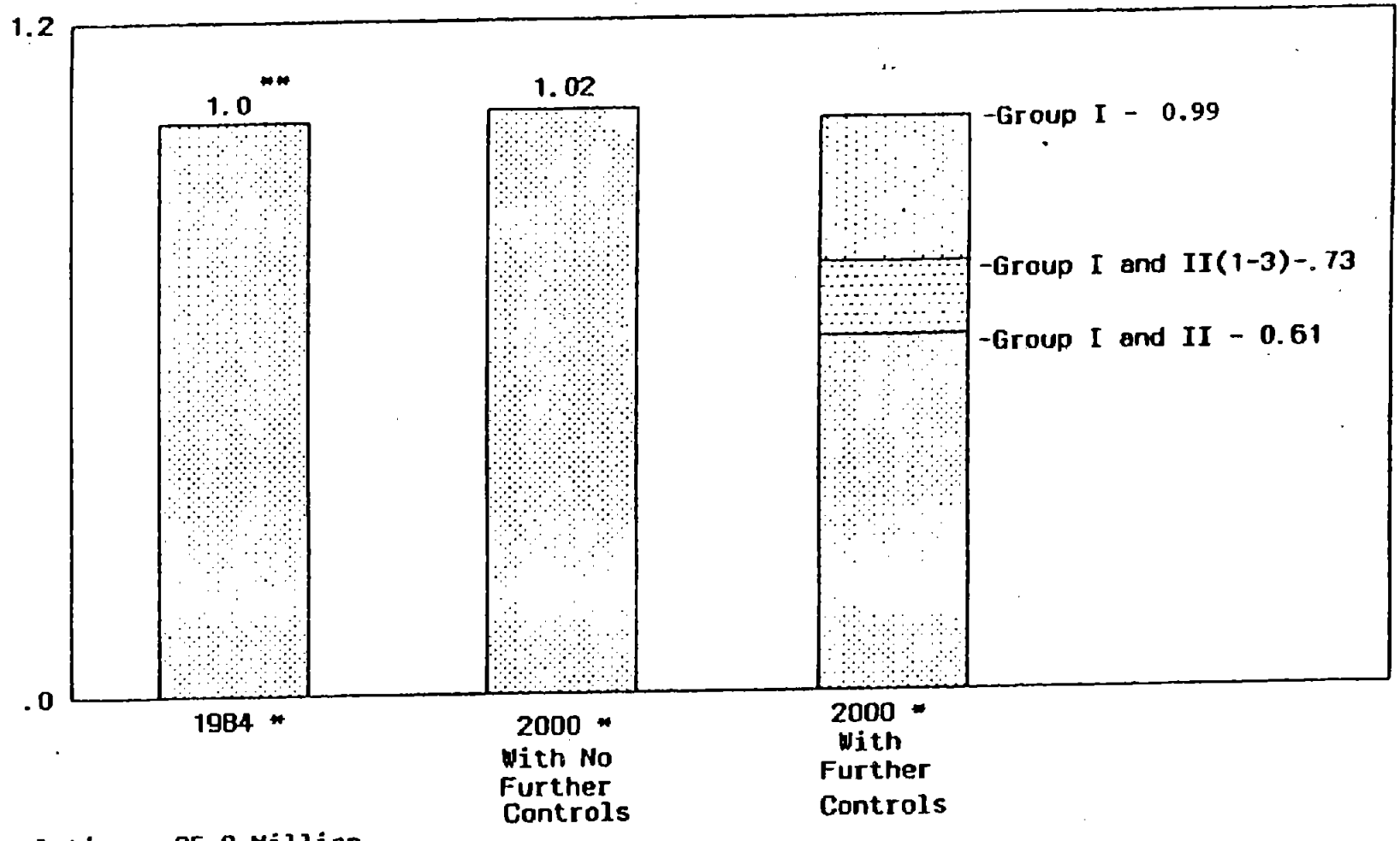
2) the fuel specifications and all of the motor vehicle measures except exhaust emission benzene limit and other HC measures (Group II; 1-3); and

3) exhaust emission benzene limit and other HC measures (Group II; 4 and 6). The sequence of implementation is based on the technical feasibility of the measures and the development schedule outlined in Table III-2.

The potential reduction in statewide cancer risk between 1984 and 2000 is shown in Figure III-1. This figure shows the statewide cancer risk will increase about 2 percent between 1984 and 2000 if no further controls are implemented. Figure III-1 shows implementation of all of the control measures reflecting the use of presently available control technology (Group I) would reduce the statewide cancer risk by 1 percent. Subsequent implementation of the fuel specifications and all of the motor vehicle

FIGURE III-1

Comparative Statewide Cancer Risks
From Ambient Benzene Exposure
(1984 as 1)



1984 Population = 25.8 Million
2000 Population = 31.4 Million

** Range of Excess Cancers is 1,900 - 14,500

measures except for the exhaust emission benzene limit and the other HC measures, will reduce the statewide cancer risk from benzene exposure 27 percent between 1984 and 2000. Figure III-1 shows that implementation of all of the recommended control measures (Groups I and II) would reduce the statewide cancer risk from exposure to benzene 39 percent between 1984 and 2000.

The potential reduction in cancer risk per million population between 1984 and 2000 is shown in Figure III-2. This figure shows the cancer risk per million population will decrease 16 percent between 1984 and 2000 if no further controls are implemented. Figure III-2 shows implementation of all of the control measures reflecting presently available control technologies (Group I) would reduce the risk per million population by an additional 3 percent between 1984 and 2000. Subsequent implementation of the fuel specifications and all of the motor vehicle measures except for the exhaust emission benzene limit and the other HC measures, would reduce the risk per million population 40 percent between 1984 and 2000. Figure III-2 shows that implementation of all of the recommended control measures (Groups I and II) would reduce the risk per million population 50 percent between 1984 and 2000.

D. ENVIRONMENTAL IMPACTS

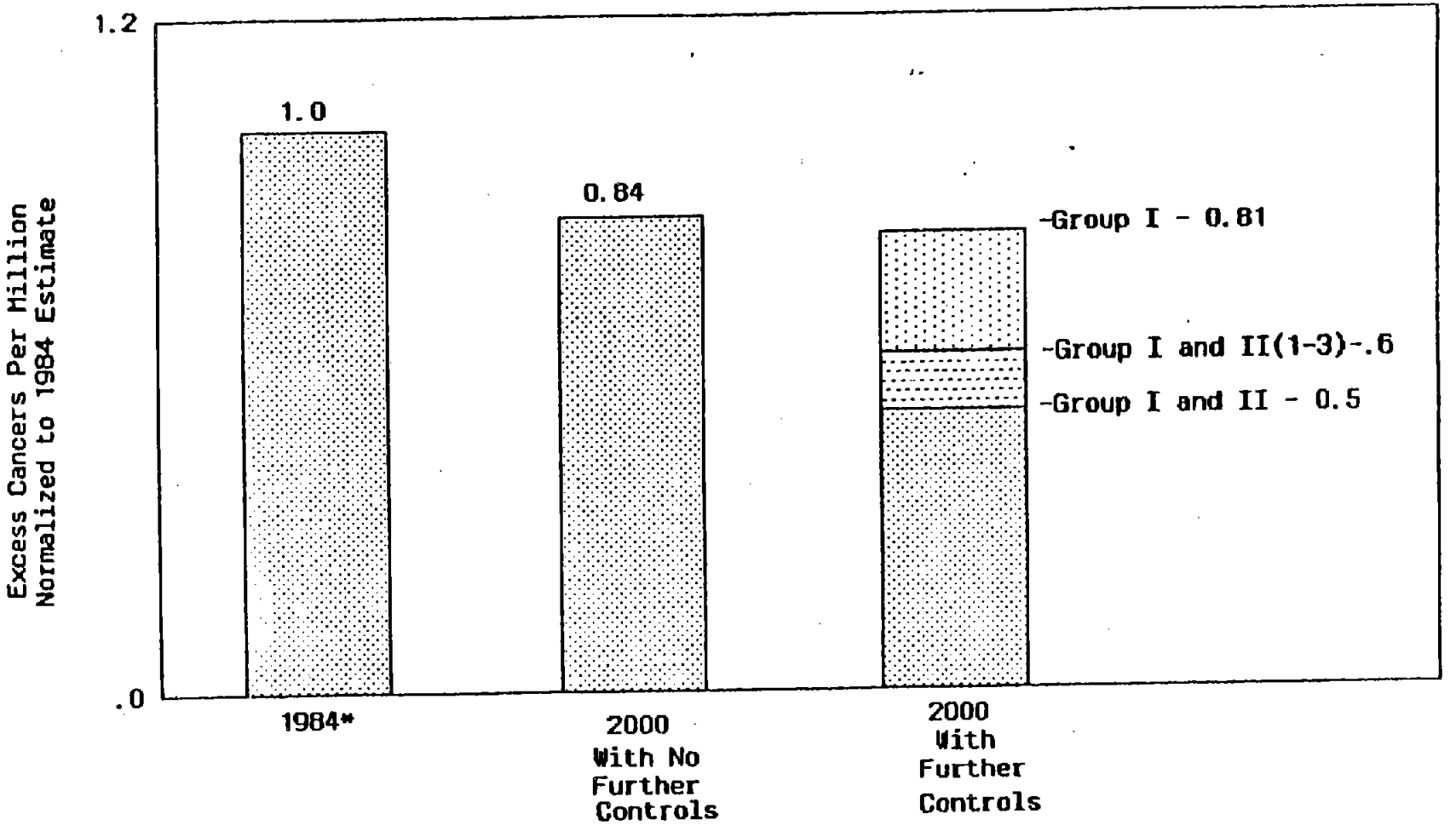
Because benzene is a known human carcinogen without any known benefits to any organism, regulations to control its emissions would provide environmental benefits. In addition, several contemplated benzene controls would also reduce emissions of organic gases.

Staff has identified three potential negative environmental effects of the contemplated regulations. One would be a slight increase in emissions of NO_x from incinerating emissions from vapor recovery units at gasoline transfer facilities. This increase would be small as a fraction of the total NOx burden in any air basin.

FIGURE III-2

Lifetime Cancer Risk From

Ambient Benzene Exposure



* Range of Excess Cancers per Million is 72 - 560

The second would be a slight change in the chemistries of exhaust effluent and evaporated gasoline if the benzene in gasoline were limited. These changes are not predictable with data on hand. However, since the changes in the composition of gasoline would be modest, any increase in the emissions of other substances should be slight. The third potential negative environmental effect would be additional sources of benzene emissions (e.g. storage tanks and fugitive emissions) from refineries if it is extracted from reformate to meet a limit on the benzene content of gasoline.

Staff will address the environmental impacts associated with implementation of the benzene control plan in greater detail if the Board approves the plan and during the development of specific benzene control measures.

ATTACHMENTS

A. Assembly Bill 1807

B. Notice of March 12, 1985 Public Consultation Meeting

C. Notice of July 10, 1985 Public Consultation Meeting

D. Notice of March 4, 1986 Public Consultation Meeting

E. Notice of May 13, 1986 Public Consultation Meeting

ATTACHMENT A

ASSEMBLY BILL 1807

ATTACHMENT A

Assembly Bill No. 1807

CHAPTER 1047

An act to add Article 1.5 (commencing with Section 14021) to Chapter 3 of Division 7 of the Food and Agricultural Code, and to add Chapter 3.5 (commencing with Section 39650) to Part 2 of Division 26 of the Health and Safety Code, relating to air pollution.

[Approved by Governor September 23, 1983. Filed with Secretary of State September 23, 1983.]

LEGISLATIVE COUNSEL'S DIGEST

AB 1807, Tanner. Air pollution: toxic air contaminants.

(1) Under existing law, the State Air Resources Board is required to adopt ambient air quality standards for each air basin in the state. Standards relating to health effects are required to be based upon the recommendations of the State Department of Health Services. Air pollution control districts and air quality management districts are required to adopt and enforce rules and regulations which assure that reasonable provision is made to achieve and maintain ambient air quality standards. The Department of Food and Agriculture has general authority to regulate pesticides.

This bill would require, upon request of the state board, the State Department of Health Services, in consultation with and with the participation of the state board, to evaluate and prepare recommendations on the health effects of substances, other than pesticides in their pesticidal use, emitted into the ambient air which may be determined to be toxic air contaminants, and would require the state board, in consultation with and with the participation of, the State Department of Health Services, to prepare a report which would serve as the basis for regulatory action and to determine, by regulation, whether a substance is a toxic air contaminant. The Director of Food and Agriculture, in consultation with the State Department of Health Services and the state board, would be required to evaluate health effects of pesticides which may be or are emitted into the ambient air and may be hazardous to human health. It would define the terms "toxic air contaminant," "airborne toxic control measure," and "pesticide." The state board would be required to adopt airborne toxic control measures to reduce emissions of toxic air contaminants from nonvehicular sources below the threshold exposure level, if any, at which no significant adverse health effects are anticipated.

The Director of Food and Agriculture would be required to determine which pesticides are toxic air contaminants and to determine, in consultation with the State Department of Health Services, the state board, and districts, the appropriate degree of control measures needed for pesticides identified as toxic air

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contaminants. The director, in consultation with county agricultural commissioners and districts in the affected counties, would be required to develop and adopt control measures designed to reduce emissions from those pesticide sources.

The bill would require the state board, based on its determination of toxic air contaminants, to determine whether revisions are needed in vehicular emission standards and motor vehicle fuel additives standards to prevent harm to the public health from vehicular emissions.

The bill would impose a state-mandated local program by requiring districts to propose regulations enacting airborne toxic control measures on nonvehicular sources not later than 120 days after their adoption by the state board, except that districts would be authorized to adopt and enforce equally effective or more stringent control measures. A district would be required to adopt regulations implementing airborne toxic control measures on nonvehicular sources within 6 months after adoption by the state board. District new source review rules and regulations would be required to control emissions of toxic air contaminants, except that processors of food and fiber operating 6 months or less in any calendar year would be exempt until January 1, 1987.

The bill would require the appointment of a 9-member Scientific Review Panel on Toxic Air Contaminants to advise the state board in its evaluation of the health effects toxicity of substances.

The bill would make any person who violates any rule or regulation, emission limitation, or permit condition adopted to control a toxic air contaminant liable for a civil penalty not exceeding $10,000 per day.

(2) The bill would declare legislative intent that the state board, the State Department of Health Services, and the Department of Food and Agriculture perform functions required by the bill in the 1983–84 fiscal year within their existing resources and budgetary authorizations.

(3) Article XIII B of the California Constitution and Sections 2231 and 2234 of the Revenue and Taxation Code require the state to reimburse local agencies and school districts for certain costs mandated by the state. Other provisions require the Department of Finance to review statutes disclaiming these costs and provide, in certain cases, for making claims to the State Board of Control for reimbursement.

However, this bill would provide that no appropriation is made and no reimbursement is required by this act for a specified reason.

The people of the State of California do enact as follows:

SECTION 1. Chapter 3.5 (commencing with Section 39650) is added to Part 2 of Division 26 of the Health and Safety Code, to read:

CHAPTER 3.5. TOXIC AIR CONTAMINANTS

Article 1. Findings, Declarations and Intent

39650. The Legislature finds and declares the following:

(a) That public health, safety, and welfare may be endangered by the emission into the ambient air of substances which are determined to be carcinogenic, teratogenic, mutagenic, or otherwise toxic or injurious to humans.

(b) That persons residing in California may be exposed to a multiplicity of toxic air contaminants from numerous sources which may act cumulatively to produce adverse effects, and that this phenomenon should be taken into account when evaluating the health effects of individual compounds.

(c) That it is the public policy of the state that emissions of toxic air contaminants should be controlled to levels which prevent harm to the public health.

(d) That the identification and regulation of toxic air contaminants should utilize the best available scientific evidence gathered from the public, private industry, the scientific community, and federal, state, and local agencies, and that the scientific research on which decisions related to health effects are based should be reviewed by a scientific review panel and members of the public.

(e) That, while absolute and undisputed scientific evidence may not be available to determine the exact nature and extent of risk from toxic air contaminants, it is necessary to take action to protect public health.

(f) That the state board has adopted regulations regarding the identification and control of toxic air contaminants, but that the statutory authority of the state board, the relationship of its proposed program to the activities of other agencies, and the role of scientific and public review of the regulations should be clarified by the Legislature.

(g) That the Department of Food and Agriculture has jurisdiction over pesticides to protect the public from environmentally harmful pesticides by regulating the registration and uses of pesticides.

(h) That while there is a statewide program to control levels of air contaminants subject to state and national ambient air quality standards, there is no specific statutory framework in this division for the evaluation and control of substances which may be toxic air contaminants.

(i) That the purpose of this chapter is to create a program which specifically addresses the evaluation and control of substances which may be toxic air contaminants and which complements existing authority to establish, achieve, and maintain ambient air quality standards.

(j) That this chapter is limited to toxic air contaminants and nothing in the chapter is to be construed as expanding or limiting the

authority of any agency or district concerning pesticides which are not identified as toxic air contaminants.

(k) That a statewide program to control toxic air contaminants is necessary and desirable in order to provide technical and scientific assistance to the districts, to achieve the earliest practicable control of toxic air contaminants, to promote the development and use of advanced control technologies and alternative processes and materials, to identify the toxic air contaminants of concern and determine the priorities of their control, and to minimize inconsistencies in protecting the public health in various areas of the state.

Article 2. Definitions

39655. For purposes of this chapter, "toxic air contaminant" means an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health. Substances which have been identified as hazardous air pollutants pursuant to Section 7412 of Title 42 of the United States Code shall be identified by the state board as toxic air contaminants. Toxic air contaminants which are pesticides shall be regulated in their pesticidal use by the Department of Food and Agriculture pursuant to Article 1.5 (commencing with Section 14021) of Chapter 3 of Division 7 of the Food and Agricultural Code.

39656. For purposes of this chapter, "airborne toxic control measure" means recommended methods, and where appropriate a range of methods, of reducing the emissions of a toxic air contaminant, including, but not limited to, emission limitations, control technologies, the use of operational and maintenance conditions and closed system engineering.

39657. For purposes of this chapter, "pesticide" means any economic poison as defined by Section 12753 of the Food and Agricultural Code.

Article 3. Identification of Toxic Air Contaminants

39660. (a) Upon the request of the state board, the State Department of Health Services, in consultation with and with the participation of the state board, shall evaluate the health effects of and prepare recommendations regarding substances, other than pesticides in their pesticidal use, which may be or are emitted into the ambient air of California which may be determined to be toxic air contaminants.

(b) In conducting this evaluation, the State Department of Health Services shall consider all available scientific data, including, but not limited to, relevant data provided by the state board, the Occupational Safety and Health Division of the Department of

Industrial Relations, international and federal health agencies, private industry, academic researchers, and public health and environmental organizations.

(c) The evaluation shall assess the availability and quality of data on health effects, including potency, mode of action, and other relevant biological factors, of the substance.

The evaluation shall also contain an estimate of the levels of exposure which may cause or contribute to adverse health effects and, in the case where there is no threshold of significant adverse health effects, the range of risk to humans resulting from current or anticipated exposure.

(d) The State Department of Health Services shall submit its written evaluation and recommendations to the state board within 90 days after receiving the request of the state board pursuant to subdivision (a). The State Department of Health Services may, however, petition the state board for an extension of the deadline, not to exceed 30 days, setting forth its statement of the reasons which prevent the department from completing its evaluation and recommendations within 90 days. Upon receipt of a request for extension of, or noncompliance with, the deadline contained in this section, the state board shall immediately transmit to the Assembly Committee on Rules and the Senate Committee on Rules, for transmittal to the appropriate standing, select, or joint committee of the Legislature, a statement of reasons for extension of the deadline, along with copies of the department's statement of reasons which prevent it from completing its evaluation and recommendations in a timely manner.

(e) The state board or a district may request, and any person shall provide, information on any substance which is or may be under evaluation and which is manufactured, distributed, emitted, or used by the person of whom the request is made, in order to carry out its responsibilities pursuant to this chapter. To the extent practical, the state board or a district may collect the information in aggregate form or in any other manner designed to protect trade secrets.

Any person providing information pursuant to this subdivision may, at the time of submission, identify a portion of the information submitted to the state board or a district as a trade secret and shall support the claim of a trade secret, upon the written request of the state board or district board. Information supplied which is a trade secret, as specified in Section 6254.7 of the Government Code, and which is so marked at the time of submission, shall not be released to any member of the public. This section shall not be construed to prohibit the exchange of properly designated trade secrets between public agencies when those trade secrets are relevant and necessary to the exercise of their jurisdiction provided that the public agencies exchanging those trade secrets shall preserve the protections afforded that information by this paragraph.

Any information not identified as a trade secret shall be available

to the public unless exempted from disclosure by other provisions of law. The fact that information is claimed to be a trade secret is public information. Upon receipt of a request for the release of information which has been claimed to be a trade secret, the state board or district shall immediately notify the person who submitted the information, and shall determine whether or not the information claimed to be a trade secret is to be released to the public. The state board or district board, as the case may be, shall make its determination within 60 days after receiving the request for disclosure, but not before 30 days following the notification of the person who submitted the information. If the state board or district decides to make the information public, it shall provide the person who submitted the information 10 days' notice prior to public disclosure of the information.

(f) The State Department of Health Services and the state board shall give priority to the evaluation and regulation of substances based on factors related to the risk of harm to public health, amount or potential amount of emissions, manner of usage of the substance in California, persistence in the atmosphere, and ambient concentrations in the community.

39661. (a) Upon receipt of the evaluation and recommendations prepared pursuant to Section 39660, the state board, in consultation with and with the participation of the State Department of Health Services, shall prepare a report in a form which may serve as the basis for regulatory action regarding a particular substance pursuant to subdivisions (b) and (c) of Section 39662.

The report shall include and be developed in consideration of the evaluation and recommendations of the State Department of Health Services.

(b) The report, together with the scientific data on which the report is based, shall, with the exception of trade secrets, be made available to the public and shall be formally reviewed by the scientific review panel established pursuant to Section 39670. The panel shall review the scientific procedures and methods used to support the data, the data itself, and the conclusions and assessments on which the report is based. Any person may submit any information for consideration by the panel which may, at its discretion, receive oral testimony. The panel shall submit its written findings to the state board within 45 days after receiving the report. The panel may, however, petition the state board for an extension of the deadline, which may not exceed 15 working days.

(c) If the scientific review panel determines that the health effects report is seriously deficient, the report shall be returned to the state board, and the state board, in consultation with and with the participation of the State Department of Health Services, shall prepare revisions to the report which shall be resubmitted, within 30 days following receipt of the panel's determination, to the scientific review panel which shall review the report in conformance with

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subdivision (b) prior to a formal proposal by the state board pursuant to Section 39662.

39662. (a) Within 10 working days following receipt of the findings of the scientific review panel pursuant to subdivision (c) of Section 39661, the state board shall prepare a hearing notice and a proposed regulation which shall include the proposed determination as to whether a substance is a toxic air contaminant.

(b) After conducting a public hearing pursuant to Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, the state board shall list, by regulation, substances determined to be toxic air contaminants.

(c) If a substance is determined to be a toxic air contaminant, the regulation shall specify a threshold exposure level, if any, below which no significant adverse health effects are anticipated.

(d) In evaluating the nature of the adverse health effect and the range of risk to humans from exposure to a substance, the state board shall utilize scientific criteria which are protective of public health, consistent with current scientific data.

(e) Any person may petition the state board to review a determination made pursuant to this section. The petition shall specify the additional scientific evidence regarding the health effects of a substance which was not available at the time the original determination was made and any other evidence which would justify a revised determination.

Article 4. Control of Toxic Air Contaminants

39665. (a) Following adoption of the determinations pursuant to Section 39662, the executive officer of the state board shall, with the participation of the districts, and in consultation with affected sources and the interested public, prepare a report on the need and appropriate degree of regulation for each substance which the state board has determined to be a toxic air contaminant.

(b) The report shall address all of the following issues, to the extent data can reasonably be made available:

(1) The rate and extent of present and anticipated future emissions and estimated levels of human exposure.

(2) The stability, persistence, transformation products, dispersion potential, and other physical and chemical characteristics of the substance when present in the ambient air.

(3) The categories, numbers, and relative contribution of present or anticipated sources of the substance, including mobile, industrial, agricultural, and natural sources.

(4) The availability and technological feasibility of airborne toxic control measures to reduce or eliminate emissions, and the anticipated effect of airborne toxic control measures on levels of exposure.

(5) The approximate cost of each airborne toxic control measure

and the magnitude of risks posed by the substances as reflected by the amount of emissions from the source or category of sources.

(6) The availability, suitability, and relative efficacy of substitute compounds of a less hazardous nature.

(7) The potential adverse health, safety, or environmental impacts that may occur as a result of implementation of an airborne toxic control measure.

(c) The staff report, and relevant comments received during consultation with the districts, affected sources, and the public, shall be made available for public review and comment at least 45 days prior to the public hearing required by Section 39666.

39666. (a) Following a noticed public hearing, the state board shall adopt airborne toxic control measures to reduce emissions of toxic air contaminants from nonvehicular sources.

(b) For toxic air contaminants for which the state board has determined, pursuant to Section 39662, that there is a threshold exposure level below which no significant adverse health effects are anticipated, the airborne toxic control measure shall be designed, in consideration of the factors specified in subdivision (b) of Section 39665, to reduce emissions sufficiently so that the source will not result or contribute to ambient levels at or in excess of the threshold exposure.

(c) For toxic air contaminants for which the state board has not specified a threshold exposure level pursuant to Section 39662, the airborne toxic control measure shall be designed, in consideration of the factors specified in subdivision (b) of Section 39665, to reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method, unless the state board or a district board determines, based on an assessment of risk, that an alternative level of emission reduction is adequate or necessary to prevent an endangerment of public health.

(d) Not later than 120 days after the adoption by the state board of an airborne toxic control measure pursuant to this section, the districts shall propose regulations enacting control measures on nonvehicular sources within their jurisdiction which meet the requirements of subdivisions (b), (c), and (e), except that a district may, at its option, adopt and enforce equally effective or more stringent control measures than the airborne toxic control measures adopted by the state board. A district shall adopt rules and regulations implementing airborne toxic control measures on nonvehicular sources within its jurisdiction in conformance with the requirements of subdivisions (b), (c), and (e), not later than six months following the adoption of airborne toxic control measures by the state board.

(e) District new source review rules and regulations shall require new or modified sources to control emissions of toxic air contaminants consistent with subdivisions (b), (c), and (d), except for processors of food and fiber that operate for six months or less in

any calendar year. The exception for processors of food and fiber shall become inoperative on January 1, 1987. On or before January 1, 1986, the state board, in consultation and with the participation of the Department of Food and Agriculture, shall report to the Legislature on the feasibility of implementation and the economic impact of this section on processors of food and fiber.

39667. Based on its determinations pursuant to Section 39662, the state board shall determine if revisions are needed in the emission standards for vehicular sources, or in the standards for motor vehicle fuel additives, adopted pursuant to Part 5 (commencing with Section 43000), in order to prevent harm to the public health from vehicular emissions.

Article 5. Scientific Review Panel

39670. (a) A nine-member Scientific Review Panel on Toxic Air Contaminants shall be appointed to advise the state board and the Department of Food and Agriculture in their evaluation of the health effects toxicity of substances pursuant to Article 3 (commencing with Section 39660) of this chapter and Article 1.5 (commencing with Section 14021) of Chapter 3 of Division 7 of the Food and Agricultural Code.

(b) The members of the panel shall be highly qualified and professionally active or engaged in the conduct of scientific research, and shall be appointed as follows for a term of three years:

(1) Five members shall be appointed by the Secretary of the Environmental Affairs Agency, one of whom shall be qualified as a pathologist, one of whom shall be qualified as an oncologist, one of whom shall be qualified as an epidemiologist, one of whom shall be qualified as an atmospheric scientist, and one who shall have relevant scientific experience and shall be experienced in the operation of scientific review or advisory bodies.

(2) Two members shall be appointed by the Senate Committee on Rules, one of whom shall be qualified as a biostatistician and one of whom shall be a physician or scientist specializing in occupational medicine.

(3) Two members shall be appointed by the Speaker of the Assembly, one of whom shall be qualified as a toxicologist and one of whom shall be qualified as a biochemist.

(4) Members of the panel shall be appointed from a pool of nominees submitted to each appointing body by the President of the University of California. The pool shall include, at a minimum, three nominees for each discipline represented on the panel, and shall include only individuals who hold, or have held, academic or equivalent appointments at universities and their affiliates in California.

(c) The panel may establish ad hoc committees, which may include other scientists, to assist it in performing its functions.

(d) Members of the panel, and any ad hoc committee established by the panel, shall submit annually a financial disclosure statement that includes a listing of income received within the preceding three years, including investments, grants, and consulting fees derived from individuals or businesses which might be affected by regulatory actions undertaken by the state board or districts pursuant to this chapter. The financial disclosure statements submitted pursuant to this subdivision are public information. Members of the panel shall be subject to the disqualification requirements of Section 87100 of the Government Code.

(e) Members of the panel shall receive one hundred dollars ($100) per day for attending panel meetings, and shall be reimbursed for reasonable and necessary travel and other expenses incurred in the performance of their duties.

(f) The state board and the State Department of Health Services, and, in the case of pesticides, the Department of Food and Agriculture shall provide technical and clerical staff support to the panel.

Article 6. Penalties

39674. (a) Any person who violates any rule or regulation, emission limitation, or permit condition adopted pursuant to Article 4 (commencing with Section 39665) is liable for a civil penalty not to exceed ten thousand dollars ($10,000) for each day in which the violation occurs.

(b) There is no liability under subdivision (a) if the person accused of the violation alleges by affirmative defense and establishes that the violation is caused by an act which was not the result of intentional or negligent conduct.

SEC. 2. Article 1.5 (commencing with Section 14021) is added to Chapter 3 of Division 7 of the Food and Agricultural Code, to read:

Article 1.5. Pesticides

14021. (a) As used in this article, "pesticide" means any economic poison as defined in Section 12753.

(b) For purposes of this article, "toxic air contaminant" means an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health. Pesticides which have been identified as hazardous air pollutants pursuant to Section 7412 of Title 42 of the United States Code shall be identified by the director as toxic air contaminants.

14022. (a) In consultation with the State Department of Health Services and the State Air Resources Board, the director shall evaluate the health effects of pesticides which may be or are emitted into the ambient air of California and which may be determined to

be a toxic air contaminant which poses a present or potential hazard to human health. Upon request of the State Air Resources Board, the director shall include a pesticide for evaluation.

(b) In conducting this evaluation, the director shall consider all available scientific data, including, but not limited to, relevant data provided by the State Department of Health Services, the Occupational Safety and Health Division of the Department of Industrial Relations, international and federal health agencies, private industry, academic researchers, and public health and environmental organizations. At the request of the director, the State Air Resources Board shall document the level of airborne emissions and the State Department of Health Services shall provide an assessment of related health effects of pesticides which may be determined to pose a present or potential hazard and each agency shall provide technical assistance to the department as it conducts its evaluation.

(c) The director may request, and any person shall provide, information on any substance which is or may be under evaluation and which is manufactured, distributed, or used by the person to whom the request is made, in order to carry out his or her responsibilities pursuant to this chapter. Any person providing information pursuant to this subdivision shall, at the request of the director, identify that portion of the information submitted to the department which is a trade secret and, upon the request of the director, shall provide documentation to support the claim of the trade secret. Information supplied which is trade secret, as specified in Section 6254.7 of the Government Code, and which is so marked at the time of submission shall not be released to the public by the director, except in accordance with Section 1060 of the Evidence Code and Section 21160 of the Public Resources Code.

(d) The director shall give priority to the evaluation and regulation of substances based on factors related to the risk of harm to public health, amount or potential amount of emissions, manner of usage of the pesticide in California, persistence in the atmosphere, and ambient concentrations in the community.

14023. (a) Upon completion of the evaluation conducted pursuant to Section 14022, the director shall, in consultation and with the participation of the State Department of Health Services, prepare a report on the health effects of the pesticide which may be determined to be a toxic air contaminant which poses a present or potential hazard to human health due to airborne emission from its use. The report shall assess the availability and quality of data on health effects, including potency, mode of action, and other relevant biological factors, of the substance. The report shall also contain an estimate of the levels of exposure which may cause or contribute to adverse health effects and, in the case where there is no threshold of significant adverse health effects, the range of risk to humans, resulting from current or anticipated exposure. The report shall

include the findings of the State Department of Health Services. The report shall be made available to the public, subject to subdivision (c) of Section 14022.

(b) The report prepared pursuant to subdivision (a) shall be formally reviewed by the scientific review panel established according to Section 39670 of the Health and Safety Code. The director shall also make available the data deemed necessary to the scientific review panel, according to departmental procedures established to ensure confidentiality of proprietary information. The panel shall review, as appropriate, the scientific data on which the report is based, the scientific procedures and methods used to support the data, and the conclusions and assessments on which the report is based.

(c) If the scientific review panel determines that the health effects report is seriously deficient, the report shall be returned to the director who shall revise and resubmit the report to the panel prior to development of emission control measures.

(d) The director shall determine which pesticides are toxic air contaminants.

(e) The director shall determine, in consultation with the State Department of Health Services, the State Air Resources Board, and the air pollution control districts or air quality management districts in the affected counties, the need for and appropriate degree of control measures for each pesticide identified as a toxic air contaminant in subdivision (d). Any person may submit written information for consideration by the director in making his determinations pursuant to subdivisions (d) and (e).

14024. (a) For those pesticides for which a need for control measures has been determined pursuant to subdivision (e) of Section 14023 and pursuant to provisions of this code, the director, in consultation with the agricultural commissioners and air pollution control districts and air quality management districts in the affected counties, shall develop and adopt control measures designed to reduce emissions sufficiently so that the source will not expose the public to the levels of exposure which may cause or contribute to significant adverse health effects. Where no demonstrable safe level or threshold of significant adverse health effects has been established by the director, the control measures shall be designed to adequately prevent an endangerment of public health through the application of best practicable control techniques.

(b) Best practicable control techniques may include, but are not limited to, the following:

(1) Label amendments.
(2) Applicator training.
(3) Restrictions on use patterns or locations.
(4) Changes in application procedures.
(5) Reclassification as a restricted material.
(6) Cancellation.

96 330

14025. Any person may petition the department to review a determination made pursuant to this article. The petition shall specify the additional scientific evidence regarding the health effects of a pesticide which was not available at the time the original determination was made and any other evidence which would justify a revised determination.

14026. Nothing in this article shall be construed to limit or expand the department's authority regarding pesticides which are not determined to be toxic air contaminants.

SEC. 3. It is the intention of the Legislature, in the enactment of this act, that the State Air Resources Board, the State Department of Health Services, and the Department of Food and Agriculture shall perform the functions required by this act within their respective existing resources and budgetary authorizations during the 1983–84 fiscal year, by appropriating sufficient funds in Items 3400-001-001, 3400-001-044, 4260-001-001, 4260-001-044, 4260-001-455, 8570-001-001, 8570-001-111, 8570-001-890, 8570-101-001 and 8570-101-111 of the Budget Act of 1983 (Ch. 324, Stats. 1983).

SEC. 4. No appropriation is made and no reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution or Section 2231 or 2234 of the Revenue and Taxation Code because the local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act.

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ATTACHMENT B

Notice of March 12, 1985 Public Consultation Meeting

STATE OF CALIFORNIA
AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

ATTACHMENT B

GEORGE DEUKMEJIAN, Governor

February 25, 1985

Dear Sir or Madam:

Subject: Introductory Meeting on Stationary Source Benzene Control Measures

This is to invite you to a get acquainted meeting with ARB and district staff members who will be working on the evaluation and development of stationary source benzene control measures. Subsequent to the ARB adoption of a regulation identifying benzene as a toxic air contaminant, we are required to prepare a "needs report" on the need and appropriate degree of regulation for benzene. We will be developing stationary source control measures with the participation of the Bay Area Air Quality Management District, the San Diego County Air Pollution Control District, and the South Coast Air Quality Management District. The Mobile Source Division of ARB is evaluating motor vehicle related benzene control measures.

As an initial step in developing the needs report, we are scheduling a consultation meeting on March 12, 1985, at 1 p.m., at the South Coast Air Quality Management District auditorium, 9150 Flair Drive, El Monte. The primary objectives of the meeting are: 1) introduce the staff members assigned to the development of stationary source benzene control measures; 2) establish open communication with the public and affected industries; 3) identify the areas we plan to focus on in developing benzene control measures; and 4) gather information on benzene uses, sources, emissions and ambient concentrations in California.

This letter is being sent to all persons on our master mailing list for matters concerning toxic air contaminants. Our subsequent mailings regarding benzene will be only to persons who complete and return the attached form.

February 25, 1985

I hope that you can attend the March 12 meeting and will bring your questions and suggestions on benzene control measure development. Please contact me at (916) 445-0650 if you have any questions.

Sincerely,

Peter D. Venturini, Chief
Stationary Source Division

cc: Peter Hess, BAAQMD
Dick Smith, SDCAPCD
Larry Bowen, SCAMQD

ATTACHMENT C

Notice of July 10, 1985 Public Consultation Meeting

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (213) 572-6200

ATTACHMENT C

June 28, 1985

TO INTERESTED PARTIES:

BENZENE CONTROL MEASURES

This is to invite you to a technical meeting with the District staff members who are working on preparing a "needs report" on the need for regulation on benzene.

As a preliminary step in developing the "needs report", we will identify the stationary benzene sources, estimate emissions, proposed emission controls and develop population exposure model.

We would like to establish open communication with the affected industries by discussing the above items.

I hope that you can attend a meeting on July 10, 1985 at 10:00 a.m. in the Rules Division Conference Room at District Headquarters, 9150 Flair Drive, El Monte.

Should you have any questions, please contact Moustafa Elsherif at (818) 572-6227.

Very truly yours,

Larry M. Bowen
Director of Rule Development

LMB:ri

ATTACHMENT D

Notice of March 4, 1986 Public Consultation Meeting

ATTACHMENT D

STATE OF CALIFORNIA
AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

GEORGE DEUKMEJIAN, Governor

February 4, 1986

Dear Sir or Madam:

Subject: Consultation Meeting to Discuss Draft Benzene Regulatory Needs Report

This is to notify you of a consultation meeting we will hold to discuss the draft report titled "Benzene Regulatory Needs Report". The draft report was prepared in response to Health and Safety Code Section 39665 which requires us, with the participation of the districts, to prepare a report on the need and appropriate degree of regulation for toxic air contaminants. As required by H&SC Section 39665, this report addresses present and future benzene emissions and exposure. It also identifies potential benzene control measures, along with their respective costs and reduction in emissions, exposure and health risks. The purpose of the consultation meeting is to obtain your comments on the draft report. The meeting will be held at the time and place shown below:

Date: March 4, 1986
Time: 10:00 a.m.
Place: Library and Courts Building
914 Capitol Mall, Room, 540
Sacramento, CA

Since benzene was identified as a toxic air contaminant in January 1985, we and the districts via the Technical Review Group have been investigating the feasibility of various benzene control measures. The draft regulatory needs report discusses our findings to date. The report does not contain regulatory language.

We anticipate that the draft report will be available in our Public Information Office approximately three (3) weeks prior to the consultation meeting (February 11, 1986) or you may request the draft report by returning the attached response form to us. The draft report will have two parts. One part will contain a summary and an overview. The second part will be a technical support document.

If you have any questions regarding the meeting, please contact Don Ames at (916) 322-8285.

Sincerely,

Peter D. Venturini, Chief
Stationary Source Division

Attachment

cc: Larry Bowen, SCAQMD
Peter Hess, BAAQMD
Dick Smith, SDAPCD

Attachment

Request for Benzene Reports

Please send me the indicated number of reports regarding Benzene:

	Preliminary Draft*	Final Report (to Board)**
Summary and Overview (only)	_____	_____
Technical Support Document (only)	_____	_____
Both parts	_____	_____

I understand that I may be billed $15.00 for each set of reports in excess of 2 sets.

_____
(Signature)

Agency or Company:

Address:

City, State, Zip:

Attention:

Title:

Mail this request to:

Toxic Pollutants Branch
Air Resources Board
Attn: Benzene Requests
P.O. Box 2815
Sacramento, CA 95812

* Anticipated release date: February 11, 1986.
** Anticipated release date: March 26, 1986.

ATTACHMENT E

Notice of May 13, 1986 Public Consultation Meeting

STATE OF CALIFORNIA
AIR RESOURCES BOARD
1102 Q STREET
P. O. BOX 2815
SACRAMENTO, CA 95812
GEORGE DEUKMEJIAN, Governor

ATTACHMENT E

May 5, 1986

Dear Sir or Madam:

Subject: Consultation Meeting to Discuss Revised Draft Benzene Regulatory Needs Report

This is to notify you of a consultation meeting we will hold to discuss the revised draft report titled "Proposed Benzene Control Plan" which previously was titled "Benzene Regulatory Needs Report". This is a follow-up meeting to the March 4 meeting at which we discussed the first draft report. The report was prepared in response to Health and Safety Code Section 39665 which requires us, with the participation of the districts, to prepare a report on the need and appropriate degree of regulation for toxic air contaminants. As required by H&SC Section 39665, this report contains the staff's recommendations regarding the need and appropriate degree of regulation for benzene. This is the most significant difference between the two draft reports. This report also addresses present and future benzene emissions and exposure, and identifies potential benzene control measures, along with their respective costs and reduction in emissions, exposure and health risks.

The purpose of the consultation meeting is to obtain your comments on the revised report. We anticipate revising the report within one week of the meeting in order to release it 30 days in advance of a June 19, 1986 Board meeting. Therefore, we would appreciate receiving your comments (written or oral) by May 15, 1986. The meeting will be held at the time and place shown below:

Date: May 13, 1986
Time: 10:00 a.m.
Place: State Office Building
107 So. Broadway
Room 1122
Los Angeles, CA

The report will have two parts. One part will contain a staff report. The second part will be a technical support document similar in content to the previous version, but reformatted into appendices to the staff report. If you previously requested this report, we anticipate mailing the staff report to you on May 6, 1986. If you wish to receive the staff report and did not previously request it, please contact Barbara Fry at (916) 322-8276. The technical support document will be available at the consultation meeting.

If you have any questions regarding the meeting or revised report, please contact Don Ames at (916) 322-8285.

Sincerely,

for Peter D. Venturini, Chief
Stationary Source Division

cc: Larry Bowen, SCAQMD
Peter Hess, BAAQMD
Dick Smith, SDAPCD

State of California
AIR RESOURCES BOARD

STAFF REPORT

ADDENDUM TO
PROPOSED BENZENE CONTROL PLAN

July 1986

Prepared by the Toxic Pollutants Branch
Stationary Source Division

Contributing Divisions:

Mobile Source Division
Technical Support Division

TABLE OF CONTENTS

INTRODUCTION

This document supplements the Proposed Benzene Control Plan (May 1986) that was considered by the Air Resources Board at its June 19, 1986 meeting. The Board continued its consideration of the plan and instructed the staff to re-format certain information included in the original report. The Board requested more detailed and updated information on factors that the Board may use in evaluating and selecting benzene control measures for further development.

In response to the Board's direction, staff has prepared the following information:

1. Revised benzene emission estimates to reflect motor vehicle emission factor changes;
2. Revised benzene emission trends from 1964 to 2000 and expanded the trends to include 1955 and 2020; and
3. Ranked potential benzene control measures according to:
   a) cost per pound;
   b) cost per risk reduced;
   c) reduction in emissions and risk; and
   d) time required for measure development.

In addition, the staff has included information on cancer risks of the total population from all causes and all environmental sources.

In the emission inventories for benzene, we have incorporated new estimates of past and future benzene emissions from on-road vehicles. As a result of changing the mobile source emission estimate, the total baseline (no new controls) inventory for benzene, and the effects of some proposed control measures have both changed from those presented in the May 1986 report.

I. REVISED ESTIMATES OF BENZENE EMISSIONS

As directed by the Board, the staff has revised the estimates of benzene emissions using the latest motor vehicle emission data available. The revised estimates, shown in Table I-1, indicate the total benzene emissions for the year 2000 will be 13,000 tons, 29% less than the emissions estimated for year 1984. The decrease from 1984 to 2000 is primarily due to an expected decrease in on-road gasoline vehicle emissions attributable to: (1) replacement of older vehicles which are not as effectively controlled as newer vehicles, (2) an increasing trend of fuel-injection application, and (3) revised estimates of vehicle-miles traveled.

Figure I-1 is a plot of the statewide benzene inventory from 1955 to 2020 reflecting the current control program. For reference, the figure also shows the old emission inventory as presented in the original (May 1986) report. The original estimates projected a 16% decrease in benzene emissions in the year 2000 from a 1984 baseline without further controls; the revised estimates project a 29% decrease. The figure shows benzene emissions increased about 64% between 1955 and 1964, reaching an estimated maximum annual emission rate of 40,000 tons/year in 1964 and decreased about 54% between 1964 and 1984. The emissions increase between 1955 and 1964 was primarily due to an increased use of pre-controlled motor vehicles and the emissions decrease between 1964 and 1984 resulted primarily from control of vehicular hydrocarbon emissions. As Figure I-1 also shows, benzene emissions beyond 2000 are expected to increase with vehicular activity growth.

Figure I-2 is a bar chart of the vehicular and total benzene inventory from 1984 to 2000 without new controls. The figure shows that vehicular sources account for 91% of total benzene emissions in 1984 and 84% of total benzene emissions in 2000.

Table I-1

STATEWIDE EMISSIONS OF BENZENE BY SOURCE CATEGORY
(TONS/YEAR)

Category	1984		2000	
	New	Old*	New	Old*
Refineries, marine terminals and detergent alkylate plants	93	93	110	110
Oil & gas extraction	280	280	310	310
Gasoline marketing	300	300	420	420
Fuel combustion	250	250	410	410
Waste burning	690	690	820	820
Other	3	3	3	3
Total Non-Vehicular	1,600	1,600	2,100	2,100
Vehicular**	16,800	19,800	10,900	15,900
TOTAL	18,400	21,400	13,000	18,000
Percent Reduction from 1984 Baseline			29%	16%

* "Old" refers to emissions estimates contained in ARB staff report Proposed Benzene Control Plan, May 1986.

**For purposes of this report, this category includes on-road vehicles, off-road vehicles, trains, ships, aircraft, mobile equipment and utility equipment.

FIGURE I–1

Statewide Benzene Emission Trends

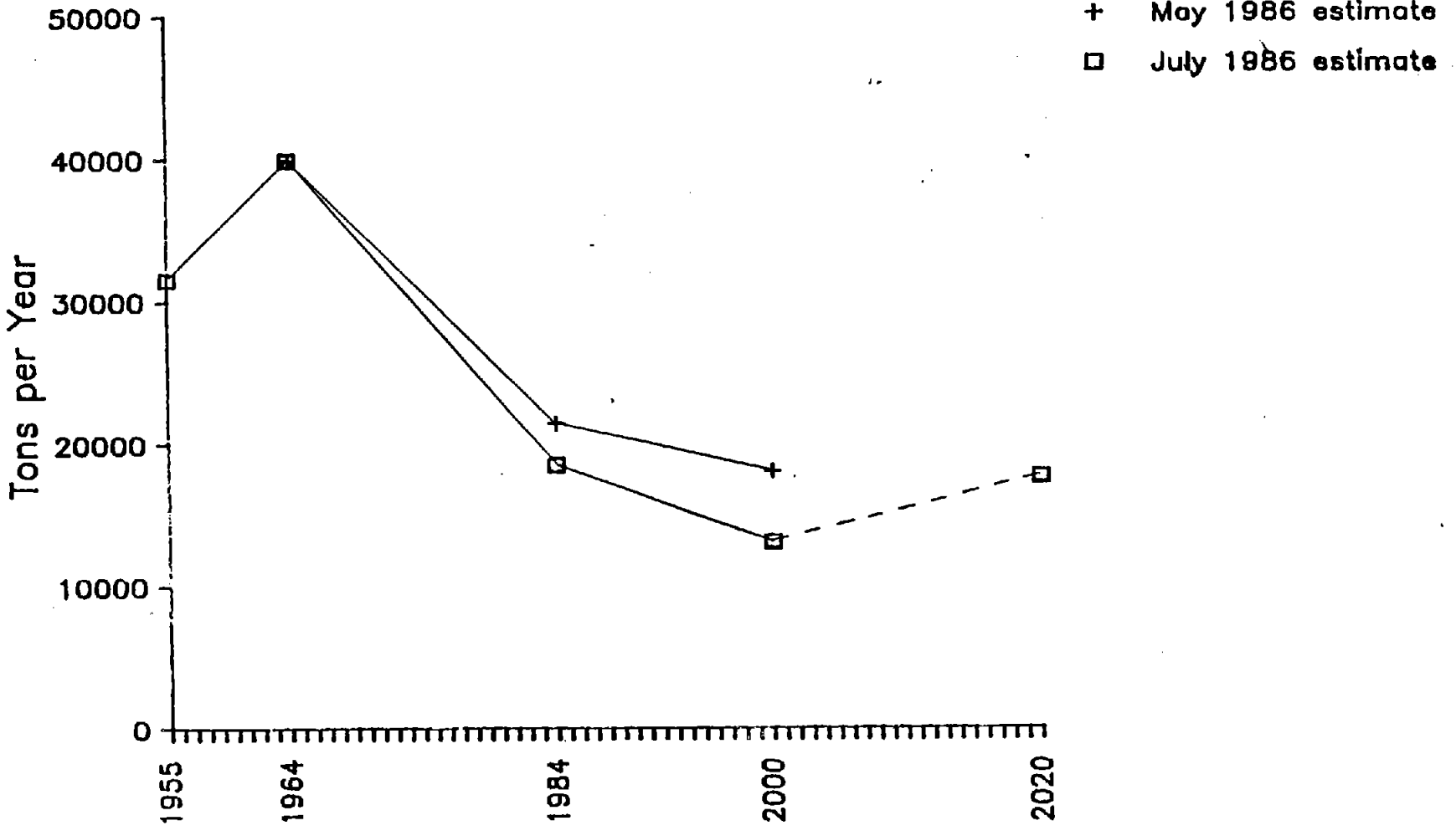
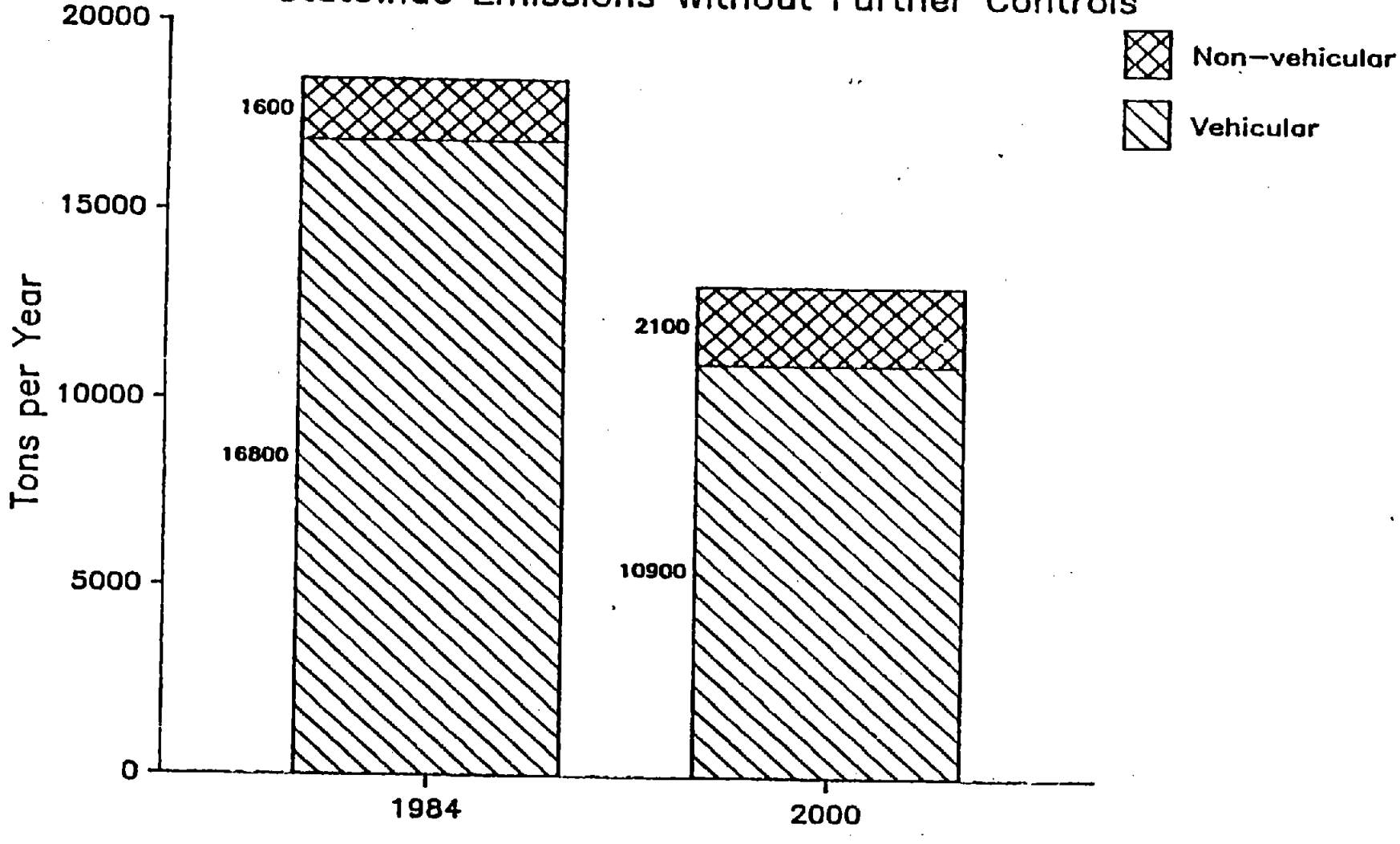


FIGURE 1-2

Statewide Emissions Without Further Controls



II. REVISED ESTIMATES OF RISK

This chapter describes the staff's revised estimates of risk due to changes in the emission inventory and includes some new information comparing risk from ambient benzene exposure to other cancer risks. The basis of the health effects estimates is the range of risk prepared by the Department of Health Services (DHS) of 22-170 excess cancers per million people exposed for 70 years to a benzene concentration of one ppb. The estimate of risk for 1984 is unchanged from the May report because it is based on applying the DHS risk factors to the 1984 ambient air monitoring data (3.3 ppb statewide average). The calculated risks for future years change in proportion to the revised emission estimates for those years. Table II-1 shows the estimated individual and statewide risk in year 2000 from various categories of emission sources. Vehicular sources are expected to cause approximately 86 percent of the ambient benzene risk in the year 2000.

When multiplied by the state's population in 1984 or 2000, the individual's risks are converted to numbers labelled "statewide risk." These numbers combine the effects of the changing emissions (thus, the changing ambient concentrations) and the changing size of population to provide an estimate of the carcinogenic potential from exposure to ambient benzene concentrations in the specified year. The statewide risk is estimated to decrease by 14% between 1984 and 2000. Figures II-1 and II-2 graphically depict the estimated statewide cumulative risk and the risk per million population between 1984 and 2000. Like the emission inventory, the average individual's risk of cancer is projected to decrease about 30% between 1984 and 2000.

Table II-1

BASELINE RISK IN 2000[a]

Source Category	Individual Risk[b]	Statewide Risk[c]
Refineries, marine terminals, detergent alkylate plants	.08 - .61	2.5 - 19
Gasoline marketing	2.3 - 18	72 - 550
Other non-vehicular*	5.0 - 39	160 - 1220
Total, Non-Vehicular	7.4 - 57	230 - 1800
Vehicular	45 - 340	1400 - 10800
TOTAL	52 - 400	1630 - 12600

[a] based on 22 to 170 cases/70 years-million people-ppb benzene

[b] theoretical lifetime cases per million people

[c] theoretical lifetime cases among 31.4 million people (2000 projected population)

* includes waste burning, oil & gas extraction, fuel combustion and "other" categories

FIGURE II-1

Statewide Benzene Risk Without Further Controls

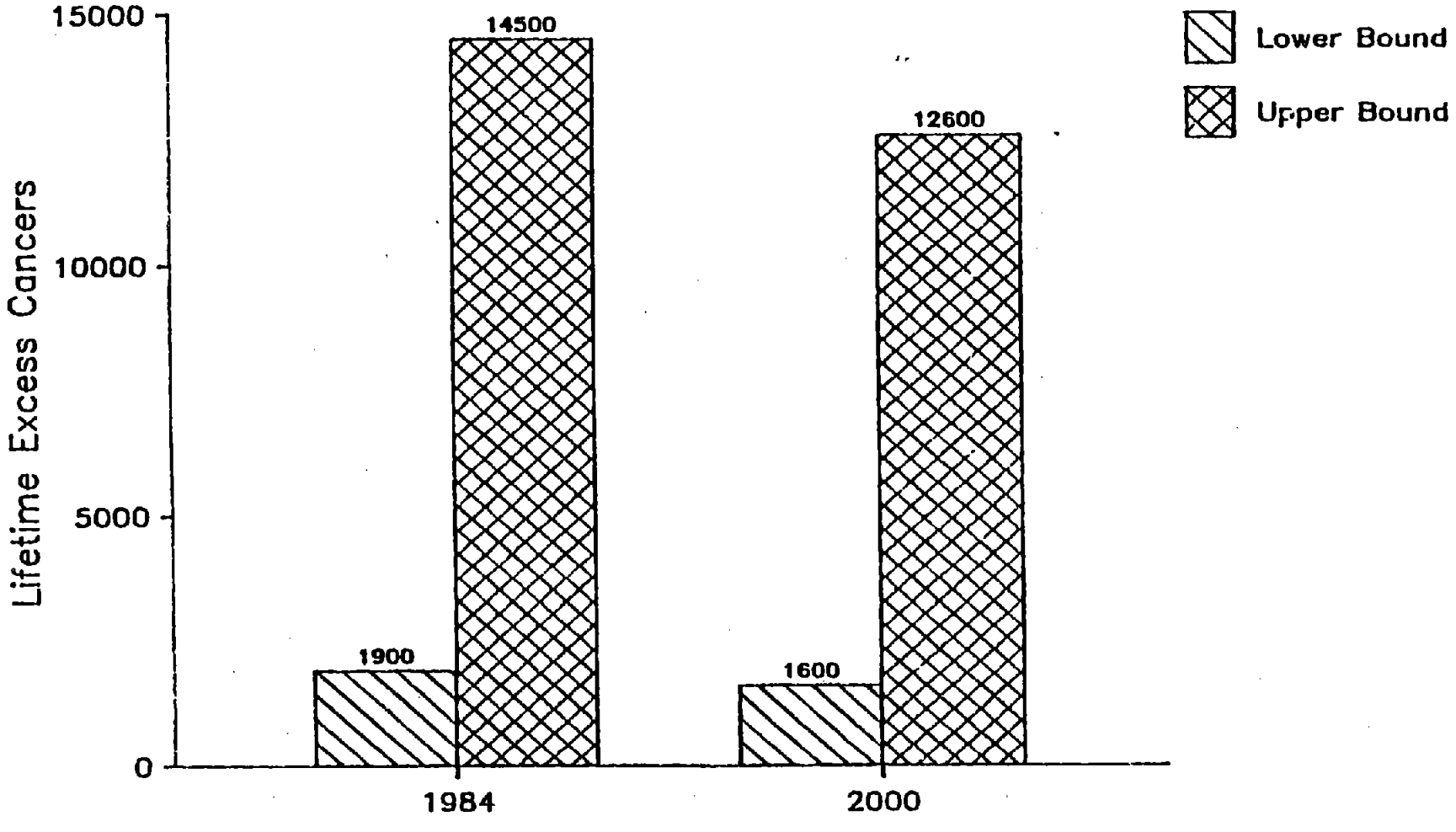
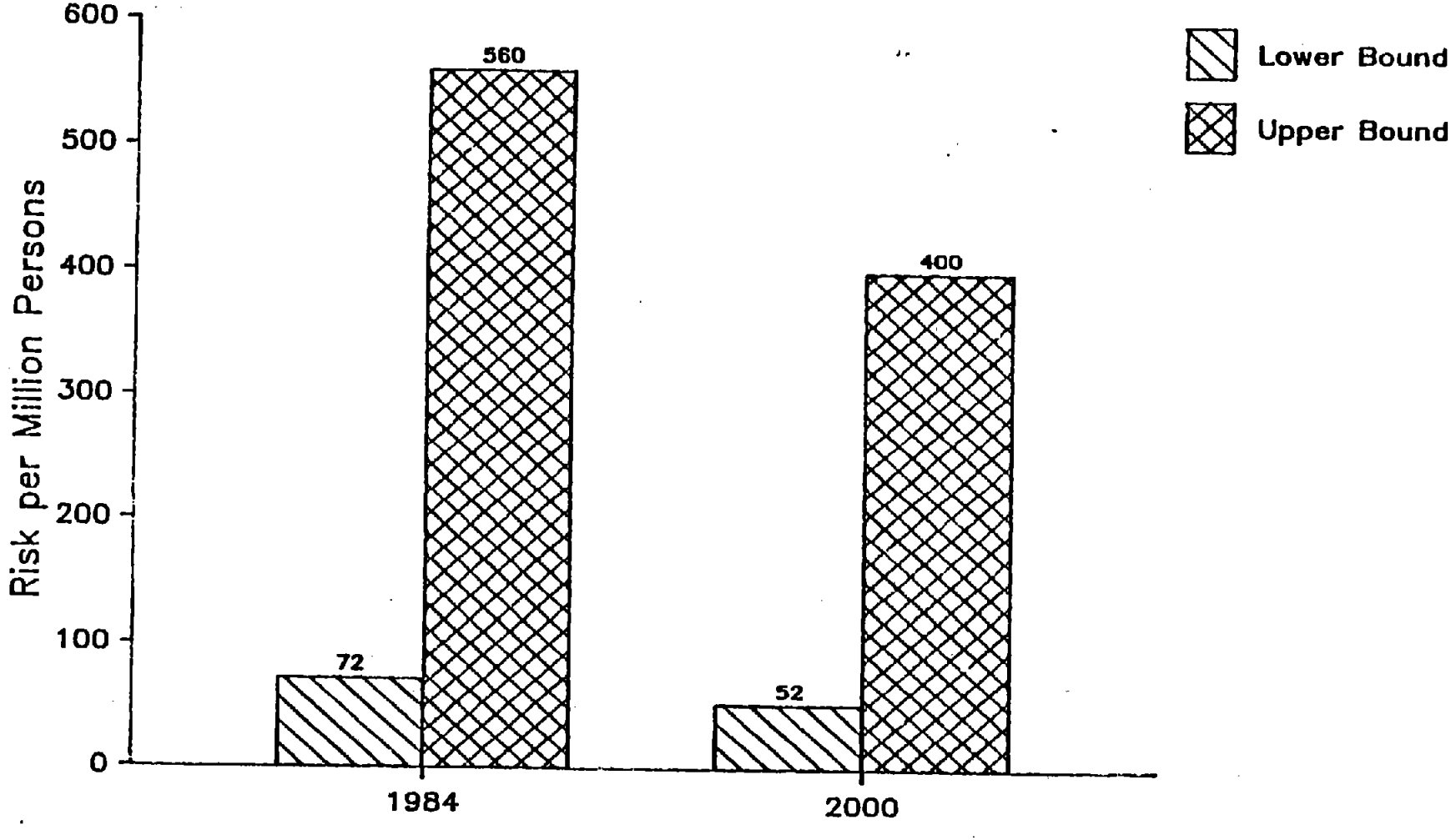


FIGURE II-2

Individual Benzene Risk Without Further Controls



In response to Board discussion at its June 1986 meeting regarding the significance of ambient benzene risks, the staff has included Table II-2 which compares the current (1984) ambient benzene risk with other cancer risks and the DHS' action level for benzene in water. The increased risk of cancer from exposure to benzene in the ambient air is a relatively small fraction of the "average" individual's total lifetime risk of cancer. However, exposure to benzene in the air is strictly involuntary unlike the dominant factors for carcinogenesis (smoking, diet), each of which involve a substantial amount of personal choice. The risk from all exposures to environmental contaminants (generally involuntary), is reported to be between one and five percent of all cancers. For benzene contamination of drinking water as a specific source of environmental risk, the Department of Health Services (DHS) requires remedial action when the estimated individual risk exceeds one in a million. The estimated risk from benzene in the ambient air is presently about 100 times higher than the DHS action level.

Table II-2

RISK FROM AMBIENT BENZENE IN PERSPECTIVE

Source of Risk	Individual's Risk (per 10^6)	Comments
Benzene in urban ambient air (1984)	72 to 560	Corresponds to population-weighted mean concentration of 3.3 ppb.
Benzene in remote area ambient air	2 to 17	Implies a background concentration of .1 ppb[a].
Benzene in drinking water at DHS's "action level"	1	DHS undertakes water clean-up if benzene greater than .7 ppb (the one in a million risk concentration).
All environmental contamination	4,800	2% of all cancers as estimated by EPA[b]; the total effect of environmental carcinogens is uncertain.
All causes of cancer	237,000[c]	National statistic; smoking, diet, and lifestyle dominate.

a Based on data from several monitoring studies which yielded a range of 0.017 to 1.4 ppb as probable background benzene concentrations. ARB memo J. Pederson to B. Loscutoff, dated July 3, 1986, Subject: Background Benzene Concentrations (memo contained in Attachment A).

b "The Air Toxics Problem in the United States: An Analysis of Cancer Risks for Selected Pollutants." U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation, May 1985.

c SEER program, 1981, Surveillance Epidemiology and End Results Incidence and Mortality Levels, 1973-77, NCI Monograph #57.

III. RANKING POTENTIAL CONTROL MEASURES

There are many ways in which the control measures listed in the May report could be ranked and evaluated. In response to the Board's request, staff prepared Tables III-1, III-2, III-3 and III-4 that rank measures by cost effectiveness ($/lb), reduction in emissions and risk, time required for full measure development, and cost per risk reduced, respectively. Each method of ranking provides additional perspective on how the Board might proceed to develop control measures for benzene. All costs are the sum of amortized capital costs (generally 15 years) and annual operating costs in 1985 dollars. The costs, reduction in emissions and reduction in risks are estimated for each measure as if it were implemented independently of other measures. Implementation of some measures will affect other measures' costs and emission reductions, thus the values in Tables III-1, III-2, and III-4 are not additive.

Table III-1 shows that benzene control costs are estimated to vary from $1 to $2,800 per pound. The more cost effective non-vehicular measures include $1.90/lb. for benzene tank controls, $19-28/lb. for gasoline marketing and $80-90/lb. for gasoline fuel specifications. The average cost for limiting benzene in vehicular exhaust is estimated to be $15/lb. For comparison of relative costs, staff included the costs for the vehicular portion of the Reasonable Extra Efforts Program (REEP) and other more stringent vehicular HC standards as if these costs were solely for the purpose of benzene control; these costs range from $17 to $50/lb.; as footnoted, benzene control costs would be zero if these measures are implemented for hydrocarbon control.

TABLE III-1

POTENTIAL BENZENE CONTROL MEASURES RANKED BY COST-EFFECTIVENESS

Measure	Cost-Effectiveness ($/lb. reduced)	Annual Cost[a] ($10^6)
Improve seals on benzene tanks	1	.04
Vapor recovery on benzene tanks	1.90	.04
Replace riveted benzene tank	11	.16
Exhaust emission benzene limit	15	17
Motor vehicle REEP[b]	17[c]	53[c]
Gasoline Marketing		
Vapor recovery at service stations	19	4.9
Afterburners at bulk terminals	23	1.8
Vapor recovery at bulk plants	28	2.0
Improve seals on gasoline tanks	30	.13
More stringent exhaust and evaporative HC standards	50[c]	72[c]
1.0 vol. % benzene in gasoline	80	276
1.4 vol. % benzene in gasoline	90	144
Vapor recovery on marine loading	75 - 520 mean 160	7.3
Replace riveted gasoline storage tanks at refineries	700 - 2800 mean 1600	.87
Alternative fuels, diesel specifications	*	*

[a] millions of 1985 dollars in 2000

[b] includes oxygen sensor durability/on-board diagnostics, modifier-certified new vehicle regs., and other HC measures

[c] assumes $0.75/lb. HC reduced; benzene cost is zero if all cost assigned to HC control

* not available

TABLE III-2

POTENTIAL BENZENE CONTROL MEASURES RANKED BY REDUCTION IN STATEWIDE EMISSIONS AND RISK

Measure	Reduction in 2000[a]	
	tons benzene statewide	statewide risk[b] lifetime
Current control program	5,400[c]	680 - 5,100
1.0 vol. % benzene in gasoline	1,700	220 - 1,700
Motor vehicle REEP[d]	950	120 - 910
1.4 vol. % benzene in gasoline	800	100 - 770
More stringent exhaust and evaporative HC standards	710	90 - 690
Exhaust emission benzene limit	570	70 - 550
Gasoline marketing		
Vapor recovery at service stations	130	30 - 220
Afterburners at bulk terminals	40	5 - 40
Vapor recovery at bulk plants	36	2 - 20
Vapor recovery on marine loading	24	.2 - 2
Vapor recovery on benzene tanks	11	.7 - 5
Replace riveted benzene tank	7.4	.07 - .5
Improve seals on benzene tanks	7	.02 - .2
Improve seals on gasoline tanks	2.3	.02 - .2
Replace riveted gasoline storage tanks at refineries	.27	.002 - .02
Diesel specifications, alternative fuels	*	*

[a] Neither the emission reductions nor the reductions in risk are additive since implementation of some measures will affect other measures' potential emissions and risk reductions.

[b] the 1984 statewide risk was 1,900 to 14,500; a 22% increase in risk due to population growth between 1984 and 2000 is projected if emissions remain constant.

[c] results of on-road vehicle fleet turn-over

[d] includes oxygen sensor durability/on-board diagnostics, modifier-certified new vehicle regs., and er HC measures.* data not available

TABLE III-3

CONTROL MEASURES RANKED BY TIME REQUIRED FOR DEVELOPMENT

Measure	Completion Date
Gasoline marketing*	1/87
Vapor recovery on benzene tanks	1/87
Improve seals on benzene tanks	1/87
Improve seals on gasoline tanks	1/87
Replace riveted benzene tank	1/87
Limit benzene in gasoline (1.0 vol. % or 1.4 vol. %)	11/87
More stringent exhaust and evaporative HC standards	11/88
Exhaust emission benzene limit	6/89
Motor vehicle REEP	11/89
Diesel specifications	not determined
Alternative fuels	not determined
Replace riveted gasoline storage tanks at refineries	low priority, no date recommended
Vapor recovery on marine loading	low priority, no date recommended

*includes vapor recovery at service stations, vapor recovery at bulk plants, and afterburners at bulk terminals.

TABLE III-4

CONTROL MEASURES RANKED BY COST[a] PER RISK REDUCED

Measure	10^6 per Reduced Statewide Risk
Vapor recovery on benzene tanks	.4 - 4
Vapor recovery at service stations	1.6 - 12.3
Exhaust emission benzene limit	2.2 - 17
Afterburners at bulk terminals	3.2 - 25.2
Motor vehicle REEP[b]	4.1 - 31.4
More stringent exhaust and evaporative HC standards	7.3 - 56.6
Vapor recovery at bulk plants	9.3 - 70
1.0 vol. % benzene in gasoline	11.6 - 89.9
1.4 vol. % benzene in gasoline	13.0 - 101
Improve seals on benzene tanks	18 - 140
Replace riveted benzene tank	22.4 - 160
Improve seals on gasoline tanks	58.9 - 450
Vapor recovery on marine loading	331 - 2,560
Replace riveted gasoline storage tanks at refineries	3,950 - 30,500
Diesel specifications, alternative fuels	*

a costs are expressed in annualized 1985 dollars
b includes oxygen sensor/onboard diagnostics, modifier-certified new vehicle regulations, other HC measures
* data not available

Table III-2 shows that implementation of individual measures will reduce the statewide lifetime risk from a high of 220-1,700 cases for gasoline fuel specifications to a level of less than one lifetime case for some measures.

Table III-3 shows that gasoline marketing measures and vapor recovery controls on benzene and gasoline tanks are the only measures that could be considered for adoption within the next year. Other measures will take 18 months to 3 years to develop.

Table III-4 shows that benzene costs per risk reduced range from .4 million to 30.5 billion dollars.

In reviewing the various ranking schemes presented in Tables III-1 through III-4, no single measure or group of measures consistently ranked high. For example, the fuel specifications measure is relatively low in cost effectiveness ($/lb.), but medium in implementation timeframe and highest in potential emission and risk reduction.

IV. DISCUSSION

The previous chapter ranked potential benzene control measures in several ways, any combination of which may be the basis for the Board to decide which and what sequence control measures should be developed by the staff for future consideration. If the Board were to select a single criterion for deciding on which measures to develop, the rankings provided in Chapter III could be used to decide where to draw the "cutoff". For example, if the Board decided the criterion to be used in identifying measures for development was only cost per risk reduced, the priority would start with the first measure listed in Table III-4 and would continue in descending order until a measure was not considered cost-effective by the Board.

However, the staff believes that the intent of State law is that some combination of the various factors discussed in Chapter III be considered by the Board in deciding which benzene measures are needed to protect public health. Section 39666(c) states that the control measures shall be designed in consideration of the factors specified in subdivision (b) of Section 39665. These factors include present and future emissions and human exposure, the availability and feasibility of control measures and the anticipated effect of measures upon exposure, and the cost of each measure and magnitude of risks posed by the toxic air contaminant.

Furthermore, as stated in the May report, for substances identified as a toxic air contaminant without an identifiable threshold exposure level, the law requires the Board to follow one of three courses for controlling nonvehicular emission sources:

1) adopt control measures to reduce emissons to the lowest level achievable through application of best available control technology; or

2) adopt an alternative level of emission reduction which is more effective than best available control technology, which is deemed necessary to prevent an endangerment of public health; or

3) adopt an alternative level of emission reduction which is less effective than best available control technology, which is deemed adequate to prevent an endangerment of public health.

For vehicular sources of benzene the Board must determine whether revisions are needed in vehicle emission standards to prevent harm to the public health from vehicular benzene emissions.

Based on the information available on the total and relative risks associated with exposure to ambient benzene, the staff believes that the residual risk estimated for year 2000 should be reduced, and that additional control of benzene emissions should be considered.

After consideration of the factors identified in State law for the control of toxic air contaminants and the rankings of the control measures shown in Chapter III, the staff has prepared Table IV-1 in which the staff has prioritized measures for development. The primary consideration used in developing the priority was potential reduction in risk since this would be most protective of public health. However, the staff also considered (qualitatively) emission reductions, costs, cost effectiveness, technical feasibility and control measure development time. Table IV-1 presents costs of implementing the measures in two ways: cumulative annual costs and costs per risk reduced for each measure if these measures were adopted in the sequence shown in the table.

Table IV-1 stratifies the overall control plan into five separate groups:

Group A - Includes all vehicular measures which are being developed for hydrocarbon control purposes;

Group B - Benzene specific vehicular or vehicular fuel content related measures for which the ARB has direct authority to implement. These items are estimated to have the largest benefit from among all the benzene specific control measures;

Group C - Nonvehicular control measures that reflect existing, available technology at a reasonable cost effectiveness ratio. These measures would ultimately be implemented and enforced by the districts;

Group D - Highly speculative control measures which may require research prior to deciding on viability; and,

Group E - Low priority control measures.

The percent reduction from a 1984 baseline in the year 2000 of individual risk according to what group of measures are implemented is displayed in Figure IV-1. As shown, individual risk will be decreased 29 percent by the current control program. An additional 8 percent decrease can be expected from measures being developed to control hydrocarbon emissions (Group A). The Group B benzene specific control measures would decrease individual risk another 12 percent and Group C measures one percent. If the Group B and Group C benzene measures are combined with the current control program and Group A measures an overall reduction in individual risk of 50 percent is estimated from a 1984 baseline.

TABLE IV-1

RECOMMENDED PRIORITY FOR DEVELOPMENT OF BENZENE CONTROL MEASURES
(All entries apply statewide in 2000)

	Priority Group	Control Measure	Incremental Decrease in Statewide Risk[a]	Residual Statewide Risk in 2000	Cumulative Annual Cost (10^6)	$10^6 per Risk Reduced[b]
hydrocarbon measures		Current Control Program	680 to 5,100	1,633 to 12,600	0	0
	A	Vehicular under development				
		*REEP,	110 to 900	1,520 to 11,700	53	4.1 to 31
		*More string. HC stds.	70 to 600	1,450 to 11,100	125	8.9 to 69
benzene specific measures	B	Gasoline spec.				
		*1.0% benzene or	200 to 1,510	1,250 to 9,590	401[c]	13 to 99
		*1.4% benzene	90 to 700			14 to 110
		Exhaust benzene limit	70 to 550	1,180 to 9,040	418	2.2 to 17
	C	Gasoline Marketing				
		*vap. rec. @ svc. sta.	20 to 120	1,160 to 8,920	423	2.9 to 21
		*vap. rec. @ bulk plt.	1 to 10	1,160 to 8,910	425	14 to 110
		*aftrbrnr., bulk term	3 to 20	1,157 to 8,890	427	6.0 to 45
		Refinery Sources				
		*vap. rec. on benzene tanks, gas. tank seals	1 to 10	1,156 to 8,880	427	4.3 to 32
	D	Diesel specs, alternative fuels	unknown		unknown	
	E	Vap. rec. in marine term	0.1 to 0.77	1,150 to 8,880	434	660 to 5,100
		Replace gasoline tanks	0.001 to 0.008	1,150 to 8,880	435	7,600 to 61,000

Increasing priority ↑

[a] lifetime cases among 31.4 million people (2000 population); a 22% increase in risk due to population growth between 1984 and 2000 is projected if emissions remain constant.

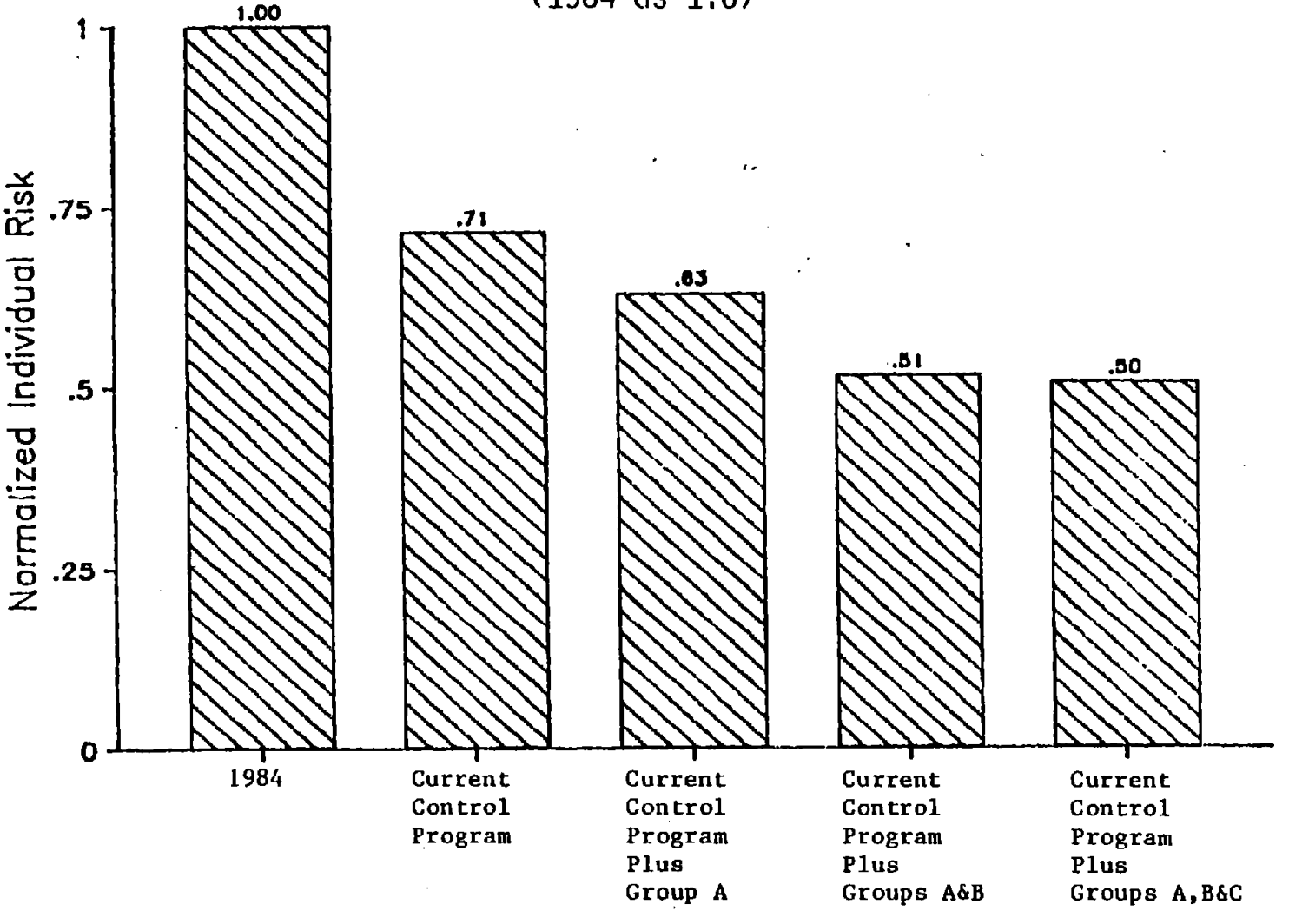
[b] by measure; calculated as if preceding measures in effect

[c] used for subsequent cumulative annual cost estimates

FIGURE IV–1

Comparative Individual Cancer Risks in Year 2000

(1984 as 1.0)



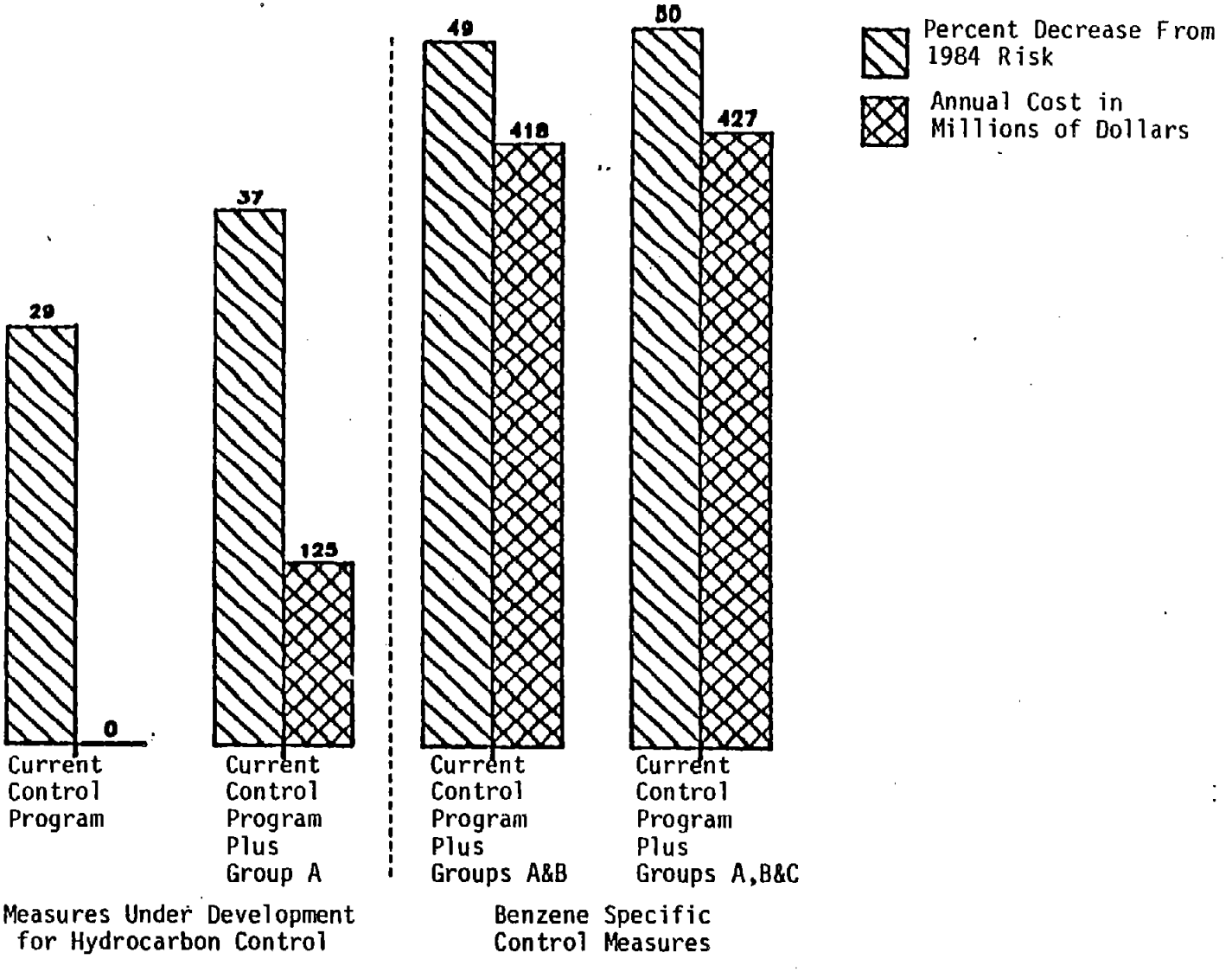
The percent of individual risk reduction and annualized costs associated with implementation of each of these groups of measures are shown in Figure IV-2. The risk reduction and costs are cumulative with each successive set of bar graphs. That is, the first set of bar graphs in Figure IV-2 (current control program) represents the baseline statewide risk reduction of 29 percent. The next set of bars includes the current control program and all Group A measures, and indicates an additional 8 percent or 37 percent total reduction at a cost of 125 million dollars annually. Group A measures are presently being developed for purposes of controlling hydrocarbons; Group B and Group C measures would only be developed for purposes of controlling benzene.

If all measures identified in Groups A, B and C and the current control program were fully implemented in year 2000, staff estimates that the statewide reduction in lifetime risk compared to 1984 would be between 750 and 5,620 cases (50 percent reduction) at an annual cost of 427 million dollars. For the purposes of consistency, the total statewide potential lifetime risk reduction should be divided by 70 (estimated lifetime) to estimate annual risk reduction. Annual statewide risk reduction when estimated in this way ranges from 11 to 80 excess cancers to yield a cost per cancer reduced ratio of 5.3 to 40 million dollars per cancer reduced.

In an attempt to put these costs and benefits in some perspective, the staff offers the following discussion of EPA risk management policy and what role cost-effectiveness plays in EPA's policy. While EPA does consider cost-effectiveness of regulatory options, the agency emphasizes that cost-effectiveness estimates do not account for the benefits of regulations.

FIGURE IV–2

Reduction in Individual Risk in Year 2000 and Associated Costs



EPA's Air and Policy Offices have attempted to set cost-effectiveness levels to be used in setting New Source Performance Standards for criteria pollutants, but consider cost-effectiveness on a case-by-case basis for hazardous air pollutants. For example, EPA is considering proposing hazardous air pollutant standards for coke oven emissions that would require BACT on all sources and cost up to $40 million per cancer avoided. If formally proposed, EPA will have determined an incremental cost-effectiveness of $40 million to be acceptable in this case.

The risk management policy emerging under the present EPA Administrator's direction, emphasizes that cost/benefit analysis is not a rigid formula for making regulatory choices. In a September 1985 memo, EPA staff were directed not to use calculations of cost-per-life-saved as the sole basis for ruling out regulatory options when estimates exceed the $7.5 million level suggested in EPA's regulatory impact analysis guidelines.

Although staff agrees cost-per-life-saved should not be the sole basis for ruling out regulatory options, as a whole, and individually, the costs of Group B and C measures approximate the $7.5 to $40 million levels per cancer reduced that EPA has considered for decision making purposes.

Another factor to be considered is since the Board has direct authority for vehicular and fuel related emission sources, and because the specific vehicular and fuel content control measures to reduce benzene emissions (Group B) appear to have the greatest emissions and risk reduction benefit of all benzene specific control measures identified, the Board may decide to give highest priority to the development of Group B measures by ARB staff. The nonvehicular benzene control measures (Group C), which generally have lower potential for risk reduction, may be most effectively considered on a district-by-district basis. This could be accomplished by the staff working

closely with the Technical Review Group to identify appropriate nonvehicular benzene control measures for specific areas. The nonvehicular control measures for benzene could in this way be considered with the perspective of considering local hot spots of benzene. It should be noted that the specific Group C control measures for benzene are amenable to this approach because of their relatively low statewide risk reduction but their potential for reducing high personal exposure.

Based on the analysis included in this addendum to the Proposed Benzene Control Plan, the staff has expanded its original recommendation. Specificially, the staff recommends that priority be given to the continued development of the vehicular REEP and more stringent hydrocarbon emission standards being developed for hydrocarbon control purposes (Group A) and the development of vehicular and vehicle fuel related benzene specific control measures (Group B) for which the Board has direct authority to implement and enforce. For the nonvehicular benzene control measures (Group C), staff would work closely with the districts to refine further these measures and assess which of these should be brought back to the Board for consideration of adoption. Speculative measures which may have significant benefits (Group D) should be investigated further and only developed as benzene control measures if warranted by such study. The Group E measures would not be developed at this time.

ATTACHMENT A

ARB MEMO ON BACKGROUND
BENZENE CONCENTRATIONS

State of California

ATTACHMENT A

Memorandum

To : Bill Loscutoff, Chief
Toxic Pollutants Branch

Date : July 3, 1986

Subject : Background Benzene Concentrations

From : Jim Pederson JP
Technology Assessment Section
Air Resources Board

Reported background benzene concentrations range from 0.017 to 1.4 ppb. A reasonable estimate of background benzene concentration appears to be 0.1 ppb.

A rural background of 0.017 ppb is reported by D. Wagoner in the draft EPA report Compilation of Ambient Trace Substances, 1976. This draft has been superceeded by Volatile Organic Chemicals in the Atmosphere: An Assessment of Available Data, EPA-600/3-83-027(A).

In the later report SRI International has summarized available US ambient data for the Environmental Science Research Laboratory, RTI. For 100 rural/remote measurements, the first quartile, median, and third quartile concentrations are 0.89, 1.4, and 2.5 ppb respectively. Lowest reported non-zero concentrations were for Magna Utah with a mean .071 ppb and standard deviation of .036 ppb. An attached table from this report, details benzene measurements by location and by categories of rural/remote, urban/suburban, and source areas.

Concentrations of 0.1 to 0.2 ppb for a park in Stinson Beach with onshore winds are reported by Wester et. al. Their article Benzene Levels in Ambient Air and Breath of Smokers and Nonsmokers in Urban and Pristine Environments, has been accepted for publication in Journal of Toxicology and Environmental Health. Table attached.

Attachments

cc: Lynn Terry

State of California
AIR RESOURCES BOARD

Resolution 86-69

July 24, 1986

Agenda Item No.: 86-8-2

WHEREAS, on January 25, 1985, pursuant to Section 39662 of the Health and Safety Code, the Board identified benzene as a toxic air contaminant for which there is not sufficient available scientific evidence to support the identification of a threshold exposure level below which no significant adverse health effects are anticipated (see Title 17, California Administrative Code, Section 93000);

WHEREAS, following identification of benzene as a toxic air contaminant, the Board is required to consider the need for and appropriate degree of control of benzene;

WHEREAS, the staff prepared for the Board's review the "Proposed Benzene Control Plan" (the "Plan") which describes an overall course of action for control but does not propose for adoption any specific benzene control measures;

WHEREAS, the Plan contains potential nonvehicular benzene control measures identified by the staff and the districts working through the Technical Review Group and potential vehicular and fuel related benzene control measures identified by the staff;

WHEREAS, the Plan identifies potential benzene control measures that reflect the use of either presently available control technology or technology which is expected to be feasible in the near future;

WHEREAS, the Plan was made available to the public for review and comment;

WHEREAS, at a public meeting held June 19, 1986 the Board reviewed the Plan and considered the written comments and public testimony it received and directed the staff to provide more detailed and updated information which the Board may use in evaluating and selecting benzene control measures for further development;

WHEREAS, at the Board's direction, the staff prepared an "Addendum to Proposed Benzene Control Plan" which includes: revised motor vehicle emissions estimates; revised estimates of benzene emission trends; and rankings of potential benzene control measures by cost effectiveness, reduction in emissions and risk, time required for measure development, and a qualitative ranking;

WHEREAS, the Addendum to the Plan has been made available to the public for review and comment;

WHEREAS, at a public meeting held July 24, 1986, the Board reviewed the Addendum to the Plan and considered the written comments and public testimony it received;

WHEREAS, the Board finds that the Plan as supplemented by the Addendum to the Plan presents an appropriate overall course of action for the staff to follow in developing specific benzene control measures for the Board's consideration in order to reasonably reduce the public health risk from ambient benzene exposure.

NOW, THEREFORE, BE IT RESOLVED, the Board hereby directs the staff as follows:

1. To continue development as expeditiously as practicable of the motor vehicle hydrocarbon control measures identified as Group A in the Addendum;

2. To develop and bring before the Board as expeditiously as practicable the vehicular and motor vehicle fuel-related benzene-specific control measures set forth in Group B in the Addendum;

3. To work closely with the air pollution control districts through the Technical Review Group and with affected industry sources to further analyze and assess the nonvehicular control measures identified in Group C in the Addendum and bring before the Board those measures which warrant further consideration;

4. To study further the speculative measures set forth in Group D and develop and bring before the Board those which warrant further consideration; and

5. To provide progress reports to the Board no less frequently than on an annual basis.

I hereby certify that the above is a true and correct copy of Resolution 86-69, as adopted by the Air Resources Board.

Harold Holmes, Board Secretary