MALCOLM PIRNIE WATER ALERT

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VOLATILE ORGANIC CHEMICALS (VOCs) - ADVANCE NOTICE OF PROPOSED RULEMAKING

For several years, the United States Environmental Protection Agency (USEPA) has been considering alternative regulatory approaches to controlling high levels of VOCs which have been detected in many groundwater supplies throughout the country. To initiate dialogue and obtain feedback on this matter, on March 4, 1982, USEPA issued an Advance Notice of Proposed Rulemaking (ANPRM) concerning VOCs in drinking water. The chemicals being considered in this ANPRM are:

Trichloroethylene*	Benzene
Tetrachloroethylene*	Chlorobenzene
Carbon tetrachloride*	Dichlorobenzene(s)
1,1,1-Trichloroethane*	Trichlorobenzene(s)
1,2-Dichloroethane*	1,1-dichloroethylene
Vinyl chloride*	cis-1,2-dichloroethylene
Methylene chloride	trans-1,2-dichloroethylene

The ANPRM includes available occurrence and health data on the first six VOCs (noted with an asterisk). However, any proposed regulations would consider at least the 14 VOCs listed above.

Objective of ANPRM

The primary objective of the ANPRM is to initiate discussions on the issue of VOCs in drinking water and on alternatives for dealing with this new drinking water problem. Through the ANPRM, USEPA is inviting public comment on the following broad issues:

- What is the significance of contamination of drinking water by VOCs?
- Should national standards be set for VOCs?
- If standards are appropriate, how should levels be established?

A public meeting (April 28, 1982) and several technical workshops (to be conducted by AWWA) are planned to provide an exchange of technical information and data.

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Another objective of the ANPRM is to obtain information for determining whether any regulations would be a "major rule." Necessary information to make this determination includes annual national costs, increased costs to consumers, effects in employment and investment areas.

Regulatory Options

USEPA is considering several regulatory options for dealing with the VOC problem. These options include:

- Nonfederal Regulatory Approach: Provision of Health and Treatment Guidance by USEPA
- National Monitoring Regulations with State Response Based Upon Guidance on Health Effects and Treatment
- National Standards: Monitoring and Maximum Contaminant Levels (MCLs)

The first option is essentially identical to USEPA'S current approach to the VOC situation, in which the Office of Drinking Water provides guidance to the states in the form of SNARLS - Suggested No Adverse Response Levels.

The second option is similar to the first option with the exception that public water systems would be required to monitor for VOCs. If VOCs are detected, the states would take appropriate action in a manner similar to that which currently is being done.

The third option involves promulgating Revised Primary Regulations for VOCs, including both monitoring requirements and MCLs. The range of potential MCLs being considered by USEPA is listed below:

	Potential MCLs (ug/l)
Trichloroethylene	5 to 500
Tetrachloroethylene	5 to 500
Carbon Tetrachloride	5 to 500
1,1,1-Trichloroethane	1000
1,2-Dichloroethane	1 to 100
Vinyl Chloride	1 to 100

These levels fall approximately within a lifetime exposure risk range of 1 in 10,000 (one excess cancer death per 10,000 population) to 1 in 1,000,000. The option of setting an MCL for total VOCs also is being considered.

Determining an appropriate MCL is based on consideration of several factors, including health risks and benefits, treatment costs, and national economic impacts. Malcolm Pirnie (Paramus, New Jersey Office) has been working with USEPA over the past two years in identifying and evaluating alternative treatment techniques for removing VOCs from groundwater supplies. This work has included developing preliminary designs and cost estimates for several VOC removal techniques (including aeration and carbon adsorption), and will provide the basis for determining national economic impacts of any proposed regulation. The ANPRM includes preliminary costs, prepared by Malcolm Pirnie, for controlling TCE in drinking water.

Request for Comments

USEPA is requesting public analyses, comments and information on this ANPRM. Comments on the regulatory approaches and the MCLs, health effects, treatment designs and costs, and monitoring requirements should be sent to USEPA by June 2, 1982. For more detailed information to provide a basis for responding, a complete copy of the ANPRM is attached to this Water Alert. Feel free to contact Malcolm Pirnie if you have any specific questions about the ANPRM.

Editor of this issue of WATER ALERT: John E. Dyksen

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Thursday
March 4, 1982

Federal Register

Part IV

Environmental Protection Agency

National Revised Primary Drinking Water Regulations, Volatile Synthetic Organic Chemicals in Drinking Water; Advanced Notice of Proposed Rulemaking

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Executive Order 12291

Following Executive Order 12291 (46 FR 13193, Feb. 19, 1981), EPA will prepare a regulatory impact analysis prior to proposal of any regulations if it is determined that the regulations are considered to be "major rules". A "major rule" is defined as any regulation that is likely to result in:

(1) An annual effect on the economy of $100 million or more;

(2) A major increase in costs or prices for consumers, individual industries, federal, State, or local government agencies, or geographic regions; or

(3) Significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets.

EPA has not yet determined whether any regulations that would follow this ANPRM would be "major rules;" information upon which to make this determination is not yet available and is one of the objectives of this ANPRM.

The regulatory impact analysis would contain a description of the potential net benefits and costs and a determination of the potential net benefits of any rule. Further, a description would be included of alternative approaches.

Regulatory Flexibility Analysis

Following the requirements of 5 U.S.C. 603, known as the Regulatory Flexibility Act, an analysis of the impacts on small entities of any regulations must be carried out if there is likely to be a significant economic impact on a substantial number of small entities. Therefore, whether or not the possible regulation for volatile organic contaminants is found to be a "major" regulation, it would have an accompanying analysis of possible economic impacts upon small entities, either to assess the effects of any significant impacts, or to document that no such impacts exist.

Other Pertinent Agency Actions

Several other actions by EPA are pertinent to incidences of contamination by VOCs. There are three new federal programs with state participants designed to protect ground water from contamination resulting from waste disposal on or into the ground. These programs include: Regulation of hazardous waste transporters and hazardous waste treatment, storage and disposal sites under the Resource, Conservation and Recovery Act (40 CFR Parts 122–124, 260–266); regulations for control of underground injection of wastes (40 CFR Part 146, June 20, 1980, August 27, 1981, October 1, 1981) under the Safe Drinking Water Act, section 1421; and the "Superfund" Program under the Comprehensive Environmental Response, Compensation, and Liability Act which provides for remedial measures to clean-up incidences of contamination. In addition, other pertinent programs include: Under the Clean Water Act, section 304, water quality criteria (45 FR 79318, November 28, 1980) for 64 toxic pollutants or pollutant categories which provide guidance for ambient water quality; the EPA Office of Drinking Water program under the SDWA, section 1442, which provides advice on the potential health effects of exposure to non-regulated contaminants; and the efforts under the Agency's Toxic Substances Priority Committee to integrate and coordinate Agency efforts on regulating toxic compounds.

II. Background on VOCs in Drinking Water

Occurrence of Volatile Organic Chemicals in Drinking Water

The application of sophisticated analytical measurement techniques has detected the presence of a broad range of synthetic organic chemicals in many drinking water supplies. Because of their frequency of occurrence, occasional presence in high concentrations, and potential health risks, the class of compounds termed volatile synthetic organic chemicals are of particular concern. Available data show that these compounds occur in both surface waters and ground waters; this finding contradicts previous perceptions of ground water quality.

Historically, ground water has been viewed as a relatively pristine resource, and it is generally used as a drinking water source without major treatment other than disinfection. However, recent data from EPA and State monitoring surveys, as shown in Table 1, indicate that a significant number of drinking water supplies derived from ground waters, as well as surface waters, contain some volatile organic chemicals. While surface waters subject to industrial contamination can contain a broad spectrum of synthetic organic chemicals, typically their concentrations would be in the low microgram per liter levels (e.g., less than 5 μg/l). Although only a small percentage of ground water supplies have been found to be contaminated by one, two or several discrete compounds, their concentrations can be much higher (e..g., 100 to 1000 μg/l). While Table 1 shows a level as high as 35,000 μg/l of trichloroethylene, this is not to imply that most contamination incidents reflect concentrations of that magnitude. More commonly, contamination is found at less than 10 μg/l with smaller percentages in the 10–100 μg/l and in the 100–1000 μg/l range, respectively. The State data in particular reflect noticeably higher levels of contamination than the EPA surveys. This would be expected since State sampling is generally in response to a specific problem such as a spill, or investigations around hazardous waste sites, or citizen complaints of taste and odor problems.

TABLE 1.—OCCURRENCE OF VOLATILE ORGANIC CHEMICALS IN DRINKING WATER

Survey	No. sampled	No. positive	Range of positives
Trichloroethylene:			
State data [1]	2,894	810	Tr–35,000 μg/1
NOMS [2]	113	28	0.2–49.0 μg/1.
NSP [2*]	142	36	Tr–53 μg/1.
CWSS [2]	452	15	0.5–210 μg/1.
Tetrachloroethylene:			
State data [1]	1,652	201	Tr–3,000 μg/1.
NOMS [2]	113	48	0.2–3.1 μg/1.
NSP [2*]	142	24	Tr–3.2 μg/1.
CWSS [2]	452	22	0.5–30 μg/1.
Carbon Tetrachloride:			
State data [1]	1,659	166	Tr–170 μg/1.
NOMS [2]	113	14	0.2–29 μg/1.
NSP [2*]	142	37	Tr–30 μg/1.
CWSS [2]	452	9	0.5–2.8 μg/1.
1,1,1-Trichloroethane:			
State data [1]	1,611	370	Tr–401,300 μg/1.
NOMS [2]	113	19	0.2–1.3 μg/1.
NSP [2*]	142	32	Tr–21 μg/1.
CWSS [2]	452	19	0.5–650 μg/1.
1,2-Dichloroethane:			
State data [1]	1,212	85	Tr–400 μg/1.
NOMS [2]	113	2	0.1–1.8 μg/1.
NSP [2*]	142	2	Tr–4.8 μg/1.
CWSS [2]	451	4	0.5–1.8 μg/1.
Vinyl Chloride:			
State data [1]	1,033	73	Tr–380 μg/1.
NOMS [2]	113	2	0.1–0.18 μg/1.
NSP [2*]	142	7	Tr–78 μg/1.
CWSS	Did not look for this compound		

*Analysis based on GC single column tentative identification.

Tr = Trace.

[1] All ground water sources—aggregated from various state reports on local contamination problems. Includes drinking water and other wells. As noted in text, the State data is normally in response to contamination incidents and is not considered to be statistically representative of national occurrence.

[2] Surface and ground water sources. NOMS = National Organics Monitoring Survey. NSP = National Screening Program. CWSS = Community Water Supply Supply Survey.

Currently over 100 million people are served drinking water from 45,000 public water systems and over 11 million private wells draw upon ground water resources. Results of EPA's Community Water Supply Survey showed that volatile organic chemicals were detected in approximately 45 percent of public water systems using ground water serving over 10,000 people and in approximately 12 percent serving less

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• Material should be assessed in terms of human risk, rather than as "safe" or "unsafe".

Cancer risk models specified by the NAS and the EPA's Cancer Assessment Group (CAG) were used to calculate concentrations which, if consumed over a lifetime at two liters per day, might result in excess lifetime cancer risks of 10^{-4} (1:10,000), 10^{-5} (1:100,000) and 10^{-6} (1:1,000,000) (Table 3). The range of projected upper limit risks for cancer can be used as a guide to understanding the potential for excess cancer risks that will result from consumption of drinking water that contains VOCs at various concentrations. Care should be taken not to overemphasize their accuracy or precision, however, and in some cases non-carcinogenic health risks may be equally significant. Potential additive or synergistic effects resulting from simultaneous exposures to more than one chemical are not addressed but it would be prudent to assume that these may exist since often the same organ systems are involved when some of these chemicals are metabolized.

TABLE 3.—PROJECTED UPPER LIMIT LIFETIME CANCER RISKS FOR INDICATED DRINKING WATER CONCENTRATIONS BY TWO CONCENTRATIONS BY TWO CANCER RISK CALCULATIONS

Compound	Projected upper limit excess lifetime cancer risk	Concentrations in drinking water (μg/1)	
		CAG	NAS
Trichloroethylene	10^{-4}	280	450
	10^{-5}	28	45
	10^{-6}	2.8	4.5
Tetrachloroethylene	10^{-4}	90	350
	10^{-5}	9	35
	10^{-6}	0.9	3.5
Carbon Tetrachloride	10^{-4}	40	450
	10^{-5}	4	45
	10^{-6}	0.4	4.5
1,2-Dichloroethane	10^{-4}	95	70
	10^{-5}	9.5	7.0
	10^{-6}	0.95	0.7
Vinyl Chloride	10^{-4}	200	100
	10^{-5}	20	10
	10^{-6}	2	1

Assumes: Lifetime exposure (70 years) by 70 kg adult. Consumption of 2 liters of water per day. Non-threshold toxicity mechanism is operative at low doses in humans. Assimilation in humans at low doses is the same as animals at experimental doses. Inter-species (animal/human) dose scaling is proportional to body surface area.

NOTE.—CAG—EPA Carcinogen Assessment Group, NAS—National Academy of Sciences Safe Drinking Water Committee

There are differences between the risk estimates derived by NAS and CAG for the five volatile organic chemicals suspected of being carcinogenic. Two factors contribute to these differences. The first factor is that somewhat different assumptions are made for use of experimental data in the mathematical models. Also the toxicological data selected for the derivation was different. For example, the differences in the NAS and CAG estimate for carbon tetrachloride are because of the following: The NAS chose to use the NCI gavage data in male rats even though the tumor response was less than statistically significant, because of the perceived mathematical difficulty in using the NCI male mice study, which showed 100 percent incidence of liver tumors. The CAG decided to base the risk estimate on the positive response in mice and made a mathematical approximation to 100 percent incidence in order to estimate the risk. Differences in the risk estimates for the other chemicals are a result of similar interpretations by NAS and CAG and use of the available data.

The actual risks for exposure to a fixed concentration are probably somewhere between zero (if indeed the nonthreshold model is not valid) up to the computed value since a linear, no threshold model was used in the estimates. This model is generally regarded as giving an upper bound of risk.

As noted above, quantitative risk extrapolation procedures can provide only a rough estimate of carcinogenic hazard because of the many unknown factors which enter into these estimates. Models using different assumptions may produce estimates ranging over several orders of magnitude. Since there is presently no way to demonstrate the accuracy of any model at low doses, this process is a subject of debate in the scientific community. However, in spite of these difficulties, quantitative risk estimation does provide the decisionmaker one means of setting priorities among pollutants and some gauge of the potential seriousness of environmental hazards.

An assessment of the risk of a suspected carcinogen consists of two parts: A judgment of the weight of evidence that the compound is a carcinogen, and, if it is concluded to be carcinogenic, an estimate of the size of the risk considering exposure to the population. The types of evidence of carcinogenicity might include human epidemiological studies, tests in laboratory animals, and short-term tests in bacteria or cell cultures which are thought to be suggestive of carcinogenicity. There may be evidence on the mechanisms involved which suggests the degree of confidence with which the data can be extrapolated from animals to humans and from high to low doses. Any of these studies may, of course, have individual strengths and weaknesses which increase or decrease confidence in relying on it for decisionmaking. These strengths and weaknesses can only be evaluated by scientists who are expert in the disciplines involved.

Risk extrapolation is generally recognized as the only tool available at this time for estimating the magnitude of potential health risks associated with non-threshold toxicants and has been endorsed by numerous federal agencies and scientific organizations, including EPA's Carcinogen Assessment Group, and the National Academy of Sciences Safe Drinking Water Committee.

The observed toxicological effects of these VOCs, in virtually all cases, occurred in tests at exposure levels 100 to 1,000 or more times higher than would be expected in drinking water, except in the very worst contamination cases. Risks in human populations at usual environmental exposure levels are generally unmeasurable by epidemiology studies. Animal testing with high dosages is considered to be a valid means of projecting potential health risks. Since, at environmental concentrations, the projected cancer risks are relatively small (e.g., less than one in 10,000) compared to the spontaneous rate of occurrence of tumors in experimental animals (on the order of several percentage points), a very large sample size (i.e., on the order of millions of animals) would be needed to reliably distinguish between treated and control groups if environmental levels were tested. Of course, it is not practical to actually carry out such an experiment. Therefore, in order to produce quantitative estimates, the assumption is made that health effects at low dose levels can be extrapolated from results observed in animals at high dose levels.

Summaries of the toxicology of each of the six volatile organic contaminants are given below. These are discussed in detail in the draft criteria documents that are available from EPA on request. These documents will be updated and their conclusions reexamined as additional studies are reported on the toxicology of these substances.

Trichloroethylene (TCE) is readily absorbed into the blood stream when ingested. Its metabolites appear to have some moderate bioaccumulative properties. An epoxide intermediate, 2,2,3-trichlorooxirane, is thought to be responsible for its mutagenic and carcinogenic potential. Acute and chronic exposure at very high doses has resulted in liver toxicity and possible kidney damage. The National Cancer Institute (NCI) concluded that TCE is a liver carcinogen in mice but not in rats.

Tetrachloroethylene (PCE) metabolites also bioaccumulate to some degree during continued exposure. High

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TABLE 4.—SUMMARY OF PRELIMINARY COSTS FOR CONTROLLING TCE IN DRINKING WATER

[1981 dollars]

90% Removal: Before Treatment 500 µg/l; After Treatment 50 µg/l

	Population served		
	100–499	1,000–2,499	10,000–24,999
Aeration—Packed Tower:			
Capital expenditures [1 2]	27–40.5	103.5–134	367.5–524
Revenue requirements/year [1 2]	5–7	17–21.5	75.5–98
Cost per 1,000 gallons [2]	0.53–0.74	0.21–0.27	0.08–0.10
Increase in monthly residential costs [3]	4.65–6.49	2.04–2.58	0.72–0.92
Aeration—Diffused Air:			
Capital expenditures [1]	55.0	197.5	962.0
Revenue requirements/year [1]	10.5	42.0	252.0
Cost per 1,000 gallons [2]	1.11	0.53	0.26
Increase in monthly residential costs [3]	9.78	5.04	2.41
Adsorption—GAC:			
Capital expenditures [1]	82.0	344.0	741.0
Revenue requirements/year [1]	14.5	63.5	212.5
Cost per 1,000 gallons	1.53	0.79	0.22
Increase in monthly residential costs [3]	13.48	7.62	2.03

NOTES:
[1] Costs are presented in thousands of dollars.
[2] The low end of the range represents costs for fiberglass reinforced plastic towers with plastic media, and no housing requirements, while the high end of the range represents costs for carbon steel towers with ceramic media, with housing of the towers included.
Residential costs for average family of three were projected by Temple, Barker, and Sloane, Inc. These calculations assume that costs are directed among residents, commerical and industrial users based on a survey of historically billing allocations.

TABLE 5.—SUMMARY OF PRELIMINARY COSTS FOR CONTROLLING TCE IN DRINKING WATER

[1981 dollars]

99% Removal: Before Treatment 500 µg/1; After Treatment 5 µg/1

	Population served		
	100–499	1,000–2,499	10,000–24,999
Aeration-Packed Tower:			
Capital expenditures [1 2]	28.0–42.5	155–153	416–649
Revenue requirements/year [1 2]	5.5–8	19.5–28	88.5–117.5
Cost per 1,000 gallons [2]	0.58–0.84	0.25–0.33	0.09–0.12
Increase in monthly residential costs [3]	5.11–7.43	2.34–12	0.85–1.10
Aeration-Diffused Air:			
Capital expenditures [1]	67	276.5	1,362
Revenue requirements/year [1]	14.5	68.5	399
Cost per 1,000 gallons	1.53	0.86	0.41
Increase in monthly residental cost [3]	13.48	8.23	3.81

TABLE 5.—SUMMARY OF PRELIMINARY COSTS FOR CONTROLLING TCE IN DRINKING WATER—Continued

[1981 dollars]

99% Removal: Before Treatment 500 µg/1; After Treatment 5 µg/1

	Population served		
	100–499	1,000–2,499	10,000–24,999
Adsorption-GAC:			
Capital expenditures [1]	82	344	741
Revenue requirements/year	15	65.5	242.5
Cost per 1,000 gallons	1.58	0.82	0.25
Increase in monthly residential cost [3]	13.95	7.87	2.32

NOTES:
[1] Cost are presented in thousands of dollars.
[2] The low end of the range represents costs for fiberglass reinforced plastic towers with plastic media, and no housing requirements, while the high end of the range represents costs for carbon steel towers with ceramic media, with housing of the towers included.
[3] Residential costs for an average family of three were projected by Temple, Barker, and Sloane, Inc. These calculations assume that costs are divided among residents, commercial and industrial users based on a survey of historical billing allocations.

Increases in monthly residential costs are estimated using an economic model which takes into account system size, ownership and mix of customers. The model is based on a 1978 survey of operating and financial characteristics, and results in estimates only. The actual increase in monthly water bills will vary from the estimate depending on local conditions.

As was true concerning the cost estimates for use of aeration, the cost estimates for GAC must be cautiously applied. The designs in question obviously are heavily dependent upon the design assumptions used. Varying one or more of the design parameters would be expected to change the aplicable cost estimate. For example, these designs were based upon empty bed contact time (EBCT) of 10 minutes; researchers have reported typical EBCTs of between 5 and 30 minutes. As previously discussed, operating data that were available to EPA are not extensive, particularly in the area of carbon life. For example, EPA data from New England suggest that the capacity of GAC for both cis-1,2-dichloroethylene and 1,1,1-trichloroethane is relatively low.

On the other hand, in the past few years, several communities have responded to discovery of contaminated wells by installing GAC units to treat their drinking water. Design, operating and cost information concerning these facilities would be a major aid to EPA in its computation of potential economic impacts due to installation of GAC treatment. EPA encourages those communities to include such information in their official comments on this ANPRM.

Finally, macroreticular resins have potential for use as a treatment method for VOCs; however, questions still exist concerning their use; data describing actual exhaustive capacity of the resins are not available. Neither are data available to define the regeneration frequencies to be expected with the resins. Thus, costs have not yet been estimated for application of resin technology.

It appears that the most cost-efficient method of treating a VOC-contaminated water may often be achieved through some combination of aeration and GAC. Data to support this contention are limited but encouraging.

One consideration in application of these technologies is generation of any secondary impacts, such as air pollution caused by application of aeration technologies. Limited available data do not seem to indicate that a significant air pollution problem would be generated. For example, a one million gallons per day facility treating raw water with a concentration of 125 µg/1 of TCE by packed column aeration with an air to water ratio of 10:1 at 90 percent removal efficiency would yield an air effluent concentration in the stack of 11.25 µg/1 of 11.25 mg/m^3 or approximately one pound per day (the NIOSH recommended standard for work place exposure in 100 ppm of TCE). Additional information and data are being collected to further assess the potential secondary impacts.

In summary, aeration and GAC appear to be effective methods of removing VOCs from water—especially ground water. On-going and future EPA studies will attempt to provide more definitive information on the actual performance and costs of these processes for various contaminants. Additional information on costs of aeration and GAC can be found in "Preliminary Designs and Costs for Control of Volatile Organic Chemicals," Malcolm Pirnie, Inc. April 10, 1981.

Comments and additional data are requested on available treatment technologies and specific responses to the following would be helpful:

- What are the most cost-effective treatment alternatives (or combination of treatment alternatives) for removing these chemicals from drinking water to appropriate levels? GAC? Aeration? Resins? Others? are the design parameters used as the basis of the cost estimates reasonable? What other factors should be considered or how might the designs be improved? What are the capital and operating costs of such systems?
- Will small systems be able to install and effectively operate the available treatment

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approximate levels fall roughly within an upper limit lifetime exposure risk range of 1 in 10,000 (i.e., one excess cancer death per 10,000 population) to 1 in 1,000,000 as estimated by conservative relative risk computation models using data from animal tests. They also fall in the area of probable technical and economic feasibility for removal of these chemicals from water. However, these questions are receiving further evaluation.

Table 7.—Potential Recommended MCLs (RMCLs)

- RMCLs are health goals and not enforceable standards.
- RMCLs would be set at levels sufficient to prevent the occurrence of any known or anticipated adverse health effects with an adequate margin of safety. (Section 1412(b)(1)(B))
- Alternatives under consideration:

—Set the RMCLs for carcinogens at zero.

—Set the RMCLs for carcinogens at some low finite nominal upper limit risk level. The selected level would represent a virtually non-existent risk.

—For non-carcinogens, base the RMCLs upon chronic toxicity data with safety factors.

• • • The Administrator must consider the possible impact of synergistic effects, long-term and multimedia exposures, and the existence of more susceptible groups in the population. Finally, the recommended maximum level must be set to prevent the occurrence of any known or anticipated adverse effects. It must include an adequate margin of safety, unless there is no safe threshold for a contaminant. In such a case, the recommended maximum contaminant level should be set at the zero level. (House Report No. 93-1185 at 20.)

TABLE 8.—Potential MCLs* (μg/l)

Trichloroethylene	5 to 500.
Tetrachoroethylene	5 to 500.
Carbon tetrachloride	5 to 500.
1,1,1-Trichloroethane	1,000.
1,2-Dichloroethane	1 to 100.
Vinyl chloride	1 to 100.

*NOTE:

In addition, the feasibility of establishing an MCL for total volatile organic chemicals (TVOC) is being examined to address the concern over the potential risks from multiple contaminants. This would include those VOCs for which MCLs had been set (not including the MCL for total trihalomethanes in the National Interim Primary Drinking Water Regulations) but excluding 1,1,1-trichloroethane.

Another approach would be to set an MCL for total volatile halogenated chemicals (TOX) which would reflect the halogenated VOCs as measured by a single analytical test. While TOX is specific only for halogenated compounds as a group, the above six and seven of the additional eight in Table 2 as well as other organohalogen compounds would be included in the TOX test.

Potential MCLs also include those compounds listed in Table 2; data were not yet available to include in this table.

Determining an appropriate MCL for each chemical involves consideration of complex and competing factors. One aspect of the Agency's decisionmaking process in accordance with Executive Order 12291 is to analyze the benefits to be gained from the reduction of risk accompanying removal of contaminants from drinking water. These benefits are to be balanced against the feasibility and/or cost of removing such chemicals to the levels necessary to meet the standard.

A brief description of the methodology for comparing costs and benefits may be helpful. It should be kept in mind that all of these calculations are estimates subject to many uncertainties.

The analysis begins with estimates of national exposure to a given contaminant, both before regulation and after the imposition of a number of alternative levels. Since some compliance methods may lead to levels below the standard, estimates are developed of the number of systems, by size category, that would be likely to choose various treatment or non-treatment methods of compliance. These form the basis of both the total cost estimates and the total reduction in exposure, as a function of the level of the standard and other relevant variables.

Estimates of the benefits resulting from such a reduction in exposure are even less precise. For carcinogens, the reduction in aggregate exposure can be converted to projected numbers of cancer cases avoided, using the risk extrapolation models discussed earlier in this notice, with all their limitations. For non-carcinogens, estimates of benefits are much harder to develop: traditionally, standards for such chemicals are derived by applying a safety factor to a "no observed effect level," and no basis is available for quantifying the impact of a different safety factor.

Nevertheless, despite their uncertainties, these types of analyses are useful in explicitly displaying the impact of alternative regulatory and non-regulatory schemes.

Comments on this approach are requested and specific questions for which responses would be helpful are listed below.

- How should risk computations be used in establishing acceptable exposure levels in drinking water?
- Should relative source contribution, (i.e., from air, water, food) be a major factor in determination of the acceptable risk from water or should the incremental risk from water and/or quality demands stand alone?
- Should risk models be used to define a target or range of risks with the actual MCL determined by economic and feasibility factors? How should the factors of human exposure, potential human health risk, treatment technology feasibility/performance and costs of treatment be balanced in determining the level of MCL?
- Is setting an MCL for total VOCs or TOX an appropriate method for reducing risks from exposure to multiple carcinogens? If not, what better approach should be taken and on what basis? How should the MCL for total VOCs or TOX be determined: on a weight basis or a milliequivalent basis?
- Is the proposed methodology for looking at cost and risk reduction in arriving at a proposed standard level appropriate? Should other approaches be considered?

IV. References

The following supporting documentation for this ANPRM is available on request from the address listed at the beginning of this notice:

Bellar, T. A., Lichtenberg, J. J. "The Determination of Halogenated Chemical Indicators of Industrial Contamination in Water by the Purge and Trap Method: Method 502.1," U.S. EPA, EMSL, EPA #600/4-81-059

Bellar, T. A., Lichtenberg, J. J. "The Analysis of Aromatic Chemicals in Water by the Purge and Trap Method: Method 503.1," U.S. EPA, EMSL, EPA 600/4-81-057

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