UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

OSWER Directive 9360.1-02

**MEMORANDUM**

SUBJECT: Final Guidance on Numeric Removal Action Levels for Contaminated Drinking Water Sites

FROM: Deborah Y. Dietrich, Director
Emergency Response Division

TO: Removal Managers
Regions I - X

## Purpose

The purpose of this memorandum is to transmit the final OERR methodology and guidance on the calculation of numeric removal action levels (RALs), to assist Superfund personnel in deciding whether to provide alternate sources of drinking water to populations adversely affected by releases of hazardous substances into the environment.

## Introduction

RALs are drinking water concentrations of contaminants that are considered, along with other factors, in determining whether to provide alternate water supplies under Superfund removal authority. RALs were established in OSWER (Office of Solid Waste and Emergency Response) Directive 9360.1-01, Interim Final Guidance on Removal Action Levels at Contaminated Drinking Water Sites (October 1987). That directive defined two types of RALs: (1) numeric levels for individual substances, which apply generally across most sites, and (2) site-specific levels, which are based on a more detailed analysis of conditions at a particular site and are determined on a case-by-case basis. A methodology for calculating numeric RALs for drinking water was presented in the 1987 OSWER directive, and values for 34 substances were listed in Exhibit 2 of that directive. The Office of Emergency and Remedial Response (OERR)/Emergency Response Division (ERD) distributed an updated and significantly expanded table of numeric RALs in April 1991 that listed values - calculated using the same methodology described in the 1987 OSWER Directive - for 165 substances.

## Objective

ERD has adopted a new methodology for determining RALs for contaminated drinking water. This memorandum explains the new methodology and provides the rationale for adopting it. As discussed in the next section, the new methodology better matches the needs of the Superfund removal program and is more consistent with procedures used by the Office of Water (OW) than the previous guidance. The attached table lists updated numeric RALs for 204 substances developed using the new methodology. These updated RALs supersede the values given in the April 1991 table distributed by ERD. Regions should begin using the newly updated RALs immediately, in the same manner as previous values were used (i.e., as one factor in deciding whether to provide alternate water supplies under Superfund removal authority). Issuance of this update of numeric RALs does not in any way restrict the existing flexibility of a Regional office to develop and apply site-specific RALs. Note that the updated numeric RALs apply to new removal starts, and, in general, are not intended to affect ongoing or completed removal actions.

## Implementation

### New RAL Methodology: Background and Rationale

ERD has adopted the procedures recently developed by OW for determining short-term acceptable risk (STAR) levels as the new methodology for setting numeric RALs for drinking water. The STAR is one factor, along with cost and affordability considerations, used in making unreasonable risk to health (URTH) determinations under the Safe Drinking Water Act. Under the Act, EPA (or primacy states) may grant a public water system a variance or exemption from a Maximum Contaminant Level (MCL; for definition, see box on page 5) if it finds that the variance or exemption will not result in an URTH.

The STAR is defined as the upper-bound concentration of a contaminant in drinking water, generally above the MCL (and never lower than the MCL), that would not pose a health risk for exposures lasting up to seven years (approximately 10 percent of an individual's lifetime). As of the date of this memorandum, OW has released STAR values for 47 chemical substances, all of which are included in the attached table of updated RALs. In addition, OW has issued Guidance for Determining Unreasonable Risks to Health (EPA/OW/Office of Science and Technology, 1992), which describes in detail the procedures for determining STARs. The guidance also allows for development of site-specific URTHs, where appropriate, and lists factors to be considered in their development.

ERD adopted the STAR methodology to replace its previous approach to determining RALs for drinking water primarily for the following reasons:

- As risk-based levels developed specifically for relatively short-term exposures to individual contaminants in drinking water, STARs are the Agency numbers that most closely correspond to the needs of the Superfund removal program for action levels. Levels based on exposure periods of up to seven years are more relevant to removal program decision-making than levels based on lifetime exposures (as used in the previous approach). It is important to note, however, that while the STAR is a level for short-term exposure, it is derived from numbers (e.g., MCLs and drinking water equivalent levels (DWELs)) that are protective over a lifetime of exposure.

- STARs are developed using OW procedures and data, which are extensively reviewed both within the Agency and by independent scientific groups, including EPA's Science Advisory Board and the National Academy of Sciences. In addition, the STAR methodology was subject to public review and comment as part of its development process.

- Problems that potentially could arise from inconsistencies between RALs and STARs will be avoided, as EPA will be using the same approach to evaluating short-term exposures to drinking water contamination in the Superfund removal program as in the OW drinking water program.

Thus, the new methodology enhances both the scientific credibility of RALs and their consistency with OW procedures and data.

**Differences Between the Old and New Methodologies**

There are several differences between the newly adopted methodology and the previous approach to determining RALs, including: (1) primary reliance on OW data and procedures; (2) explicit consideration of short-term toxicity data; (3) elimination of the possibility of a numeric RAL being lower than the corresponding MCL; and (4) elimination of the two-fold reduction factor applied to volatile non-carcinogens. The previously used adjustment factor for volatiles was eliminated because the OW values and calculation procedures that are the basis of the new methodology are considered protective of exposures from inhalation of volatiles released from drinking water as well as from direct ingestion.

It is important to note that exposure to volatiles other than through ingestion is receiving much Agency attention. The

Office of Water is investigating methodologies for assessing inhalation risks from volatile contaminants (mainly trihalomethanes) and is scheduled to take action on this issue this year. What the Office of Water does with trihalomethanes will have important implications for other volatiles and may lead to some modifications of the assumptions and methodologies used to derive STAR levels and other drinking water standards. Currently, the Office of Water considers the RfD/DWEL, longer-term health advisory, and cancer risk level protective for volatile and non-volatile contaminants because exposure from sources other than drinking water are not factored out of the risk calculations as they are for the MCL/MCLG. This approach continues to have the approval of the NAS and SAB. Please keep in mind that regional personnel may always choose to factor in inhalation exposure as they would any other site-specific consideration when deciding to perform a removal action.

In addition, OW's 10-day Health Advisory values are no longer considered in the RAL process. Although never part of the actual calculation procedure for numeric RALs, 10-day Health Advisories were listed in the October 1987 and April 1991 tables of values, and the October 1987 directive instructed that they be considered in certain "special cases" (including the case referred to above, which no longer occurs, when a calculated numeric RAL was lower than the corresponding MCL). Because 10-day Health Advisories are developed for much shorter exposure periods (i.e., 10 days) than is appropriate for many removal site situations, where exposure to contaminated drinking water may have occurred over weeks, months, or even years, they are not considered adequately protective, in general, for application at removal sites. Moveover, at many sites there is substantial uncertainty over exactly how long exposures have been occurring. Therefore, the newly updated RALs, which are based on a more relevant exposure period, should be used rather than 10-day Health Advisories, except possibly in the (presumably rare) situation where it can be documented that exposure is extremely short-term and will not exceed approximately 10 days in duration.

**Overview of OW's STAR Methodology**

Several toxicity- or risk-based levels developed by OW are considered in developing STARs. These levels are defined in the box on the next page. The STAR methodology is described in detail in OW's referenced 1992 URTH guidance.

MCLG (maximum contaminant level goal): A non-regulatory health goal based solely on considerations of protecting the public from adverse health effects of drinking water contamination.

MCL (maximum contaminant level): A regulatory level that sets the maximum permissible concentration of a contaminant in water delivered to users of public water systems. The MCL is set as close to the MCLG as feasible, considering such factors as analytical capability, treatment availability, and treatment costs.

DWEL (drinking water equivalent level): The concentration of a contaminant in drinking water that is not expected to cause any adverse non-cancer health effects in humans over a lifetime of continuous exposure. The DWEL, in mg/l, is calculated by multiplying the oral reference dose (RfD), in mg/kg-day, by 70 kg (standard adult body weight) and dividing it by 2 liters/day (standard adult water consumption rate).

Longer-term HA (health advisory) (child): The concentration of a contaminant in drinking water that is not expected to cause any adverse non-cancer health effects in children over a continuous exposure period of up to seven years. The Longer-term HA is calculated similarly to the DWEL, but instead of the RfD, a no- or lowest-observed-adverse-effect-level (NOAEL or LOAEL) from a study in which the exposure duration is comparable to seven years of human exposure is used. The NOAEL or LOAEL, in mg/kg-day, is divided by appropriate uncertainty factors, then multiplied by 10 kg (standard child body weight) and divided by 1 l/day (standard child water consumption rate).

$10^{-4}$ cancer risk level: The concentration of a contaminant in drinking water that would result in a $10^{-4}$ upper-bound lifetime excess cancer risk to an individual exposed continuously over a lifetime (other pre-specified risks, such as $10^{-5}$, also can be defined). The cancer risk level is calculated based on the pre-specified risk, the contaminant's cancer slope factor, the standard adult body weight of 70 kg, and the standard adult water consumption rate of 2 l/day.

The level that ultimately becomes the basis for a STAR depends in part on the type of effects caused by the substance. Of particular importance in the STAR methodology is a substance's potential for human carcinogenicity, as reflected in EPA's cancer weight-of-evidence classification. EPA's classification system

(described in detail in Guidelines for Carcinogen Risk Assessment, 51 Federal Register 33992, September 24, 1986) defines the following major categories:

| | |
|---|---|
| A | Human carcinogen |
| B | Probable human carcinogen |
| C | Possible human carcinogen |
| D | Not classifiable as to human carcinogenicity |
| E | Evidence of non-carcinogenicity |

For Group A or B carcinogens, the STAR is set at the MCL whenever the MCL is greater than or equal to the $10^{-4}$ cancer risk level. When the MCL is less than the $10^{-4}$ cancer risk level, the STAR is the lowest value among the $10^{-4}$ cancer risk level, the DWEL, or the Longer-term HA (child). As examples of these two cases, consider ethylene dibromide and benzene.

- The STAR for ethylene dibromide is set at the MCL, 0.05 µg/l, because the MCL is greater than the $10^{-4}$ cancer risk level, 0.04 µg/l.

- Conversely, the STAR for benzene is set at the $10^{-4}$ cancer risk level, 100 µg/l, because the MCL of 5 µg/l is less than the $10^{-4}$ cancer risk level (no DWEL or Longer-term HA (child) available).

For Group D, E, or unrated substances (i.e., substances considered to be non-carcinogens for purposes of this methodology), the STAR is set at the MCL whenever a contaminant's main health effects are very short-term and the MCL is based on effects of acute exposures. Otherwise, the STAR is the lower of the DWEL or Longer-term HA (child) values. For example, the DWEL for methoxychlor is 200 µg/l, the Longer-term HA (child) is 50 µg/l, and the MCL is not based on very short-term effects. Therefore, the STAR is set at 50 µg/l.

For Group C carcinogens, which have limited evidence for human carcinogenicity, the STAR is usually based on non-cancer effects and is the lowest value among the DWEL, the Longer-term HA (child), or the MCLG multiplied by 10.[1] The 10-fold adjustment of the MCLG removes the additional safety factor included in the MCLG for Group C carcinogens to protect against possible cancers resulting from lifetime exposure, a factor not considered necessary for developing a STAR. As an example, consider atrazine, which has a DWEL of 200 µg/l, a Longer-term HA (child) of 60 µg/l, and an "MCLG times 10" value of 30 µg/l (MCLG equals 3 µg/l). Therefore, the STAR is set at the lowest of these three values, or 30 µg/l.

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[1] If toxicity information is inadequate to develop a DWEL or Longer-term HA (child), the MCLG (and therefore the STAR) can be based on a cancer risk level.

**Development of Numeric RALs Using the STAR Methodology**

If a STAR value is available from OW, it is used without adjustment as the numeric RAL. If OW has evaluated a substance but has not developed a STAR, the numeric RAL is determined using the STAR methodology and input data from OW. When an OW evaluation is unavailable for a substance, a few modifications to the STAR methodology are necessary because some of the needed input values may not be available.

For substances lacking an OW evaluation, RALs are based on a subset of the STAR procedures. MCLs, MCLGs, and Longer-term HAs (child) are unavailable in these situations and are not considered; DWELs and cancer risk levels are calculated based on toxicity information (oral RfDs, oral cancer weight-of-evidence ratings, and oral cancer slope factors) from other Agency data sources and then used to determine the RAL. EPA's on-line Integrated Risk Information System (IRIS) should be the first source consulted for this toxicity information (assuming no information is available directly from OW), followed by EPA's Health Effects Assessment Summary Tables (HEAST) (Office of Research and Development, March 1992 or most recent update).

Exhibit 1 is a matrix summarizing the new numeric RAL methodology for both situations - when an OW evaluation is available for a substance and when an OW evaluation is unavailable. Exhibits 2A (OW evaluation available) and 2B (OW evaluation unavailable) are a parallel set of flowcharts depicting the RAL determination process.

**Site-specific RALs**

A significant health threat may exist at a site even if no substance is currently present in drinking water at a concentration exceeding its numeric RAL. A removal action may be initiated if the health risk at a site has been analyzed in detail and the analysis indicates that a serious risk is present due to site-specific factors. Examples of such factors include evidence that a ground-water plume with contamination exceeding a RAL is moving toward drinking water wells, current contaminant levels will likely increase (e.g., due to increased pumping from an aquifer anticipated during summer months), people have been drinking contaminated water for a long period of time already, multiple contaminants are likely to result in additive or synergistic effects, or sensitive populations are present and being exposed to the contamination. OW's URTH guidance, adopted as the new basis for numeric RALs, provides for similar site-specific flexibility to depart from recommended STAR levels based on considerations such as site-specific exposures, exposures from other sources, past exposure (if known), exposure to mixtures of drinking water contaminants, population sensitivity, chemical characteristics such as volatility, or other factors not directly related to the contaminant.

Decisions to undertake a removal action when a numeric RAL has not been exceeded should be made on a case-by-case basis. Because ERD wishes to know how guidance is used in the Regions, please notify your Regional Coordinator of any Action Memo approved for contaminated drinking water sites where the removal action decision is based solely on site-specific factors (i.e., no numeric RAL is exceeded).

**Information Sources**

The attached table of numeric RALs for drinking water, dated November 1992, lists values for many substances of concern at drinking water contamination sites. ERD plans to distribute updates to the table, as appropriate, such as when OW releases a significant number of new or revised STARs. In the meantime, Regional offices should use the most up-to-date STAR available for a substance as the numeric RAL. If OW has released a revised STAR that differs from the value given in the attached table, Regional offices should use that revised STAR as the numeric RAL. Information on STARs and other OW data used in the new RAL methodology is available through the Safe Drinking Water Hotline at 800-426-4791.

If a substance of concern is not listed in the attached table, Regional offices may determine the appropriate numeric RAL by applying the methodology summarized in this memorandum (refer to the OW URTH guidance for a more detailed description of the STAR procedures). Alternatively, a Regional office may request ERD's assistance in determining the appropriate numeric RAL. If a Region decides to develop a numeric RAL itself, it must first check with OW to determine if a STAR is available and, if not, whether OW has developed any of the other risk-based levels needed as inputs (e.g., MCL/MCLG, DWEL, Longer-term HA (child), $10^{-4}$ cancer risk level). If there is no information available from OW, the Regional office may calculate and use DWELs and cancer risk levels to develop numeric RALs, based on toxicity information in IRIS or HEAST. For additional information on IRIS, contact user support in the Office of Research and Development, Cincinnati, OH, at 513-569-7254. For additional information on HEAST, contact the Superfund Health Risk Technical Support Center in the Office of Research and Development, Cincinnati, OH, at 513-569-7300.

**Substances With Significant Changes in Numeric RALs**

Exhibit 3 lists those substances for which the RAL has changed significantly (defined as more than a factor of two) from the value in the table distributed by ERD in April 1991.

Please distribute this update to all removal program staff in your Regional office. If you have any questions on this document, contact Lisa Boynton (OERR/ERD), at 703-603-9052.

**EXHIBIT 1**
**SUMMARY OF NEW METHODOLOGY FOR NUMERIC RALs**

| Cancer Weight-of-evidence Class | OW Evaluation of Substance Available[1] | OW Evaluation of Substance Unavailable[2] |
|---|---|---|
| A or B | •If MCL $\geq 10^{-4}$ cancer risk level:<br>RAL = MCL<br>•If MCL $< 10^{-4}$ cancer risk level:<br>RAL = lowest of:<br>$10^{-4}$ cancer risk level, or<br>DWEL, or<br>Longer-term HA (child) | •RAL = lower of:<br>$10^{-4}$ cancer risk level, or<br>DWEL |
| C | •RAL = lowest of:<br>MCLG x 10, or<br>DWEL, or<br>Longer-term HA (child) | •If DWEL can be calculated:<br>RAL = DWEL x 0.2<br>(20% relative source contribution assumed)<br>•If DWEL cannot be calculated:<br>RAL = $10^{-4}$ cancer risk level |
| D, E, or unrated | •If MCL based on acute toxicity:<br>RAL = MCL<br>•If MCL not based on acute toxicity:<br>RAL = lower of:<br>DWEL, or<br>Longer-term HA (child) | •RAL = DWEL |

[1] Use OW values for MCL, MCLG, DWEL, Longer-term HA (child), and $10^{-4}$ cancer risk level.

[2] Obtain oral RfD, oral cancer weight-of-evidence rating, and oral cancer slope factor from IRIS (or HEAST if unavailable in IRIS), then calculate DWEL and $10^{-4}$ cancer risk level.

EXHIBIT 2A
DECISION FLOW DIAGRAM FOR RAL METHODOLOGY:
OFFICE OF WATER EVALUATION AVAILABLE

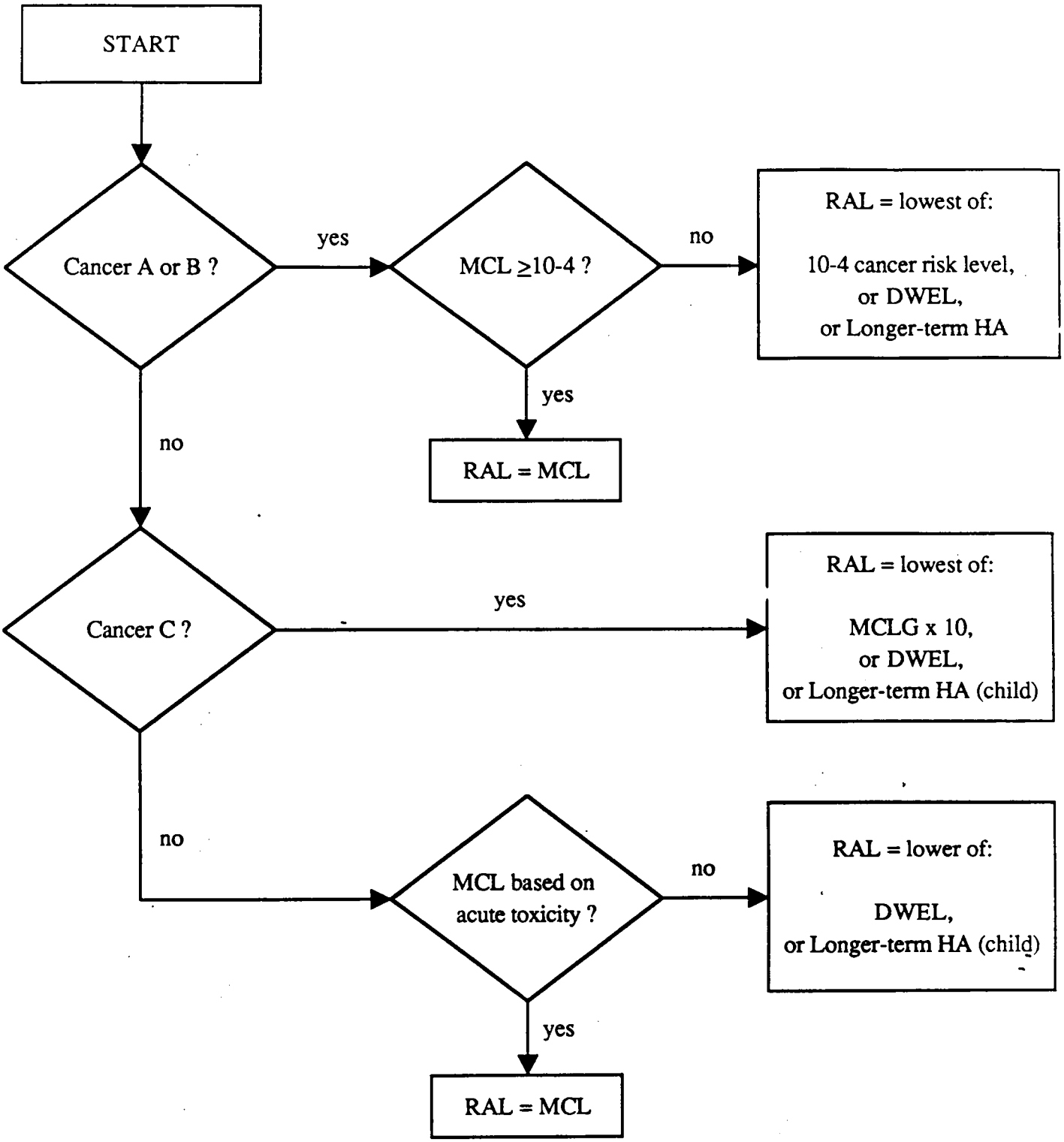

EXHIBIT 2B
DECISION FLOW DIAGRAM FOR RAL METHODOLOGY:
OFFICE OF WATER EVALUATION NOT AVAILABLE

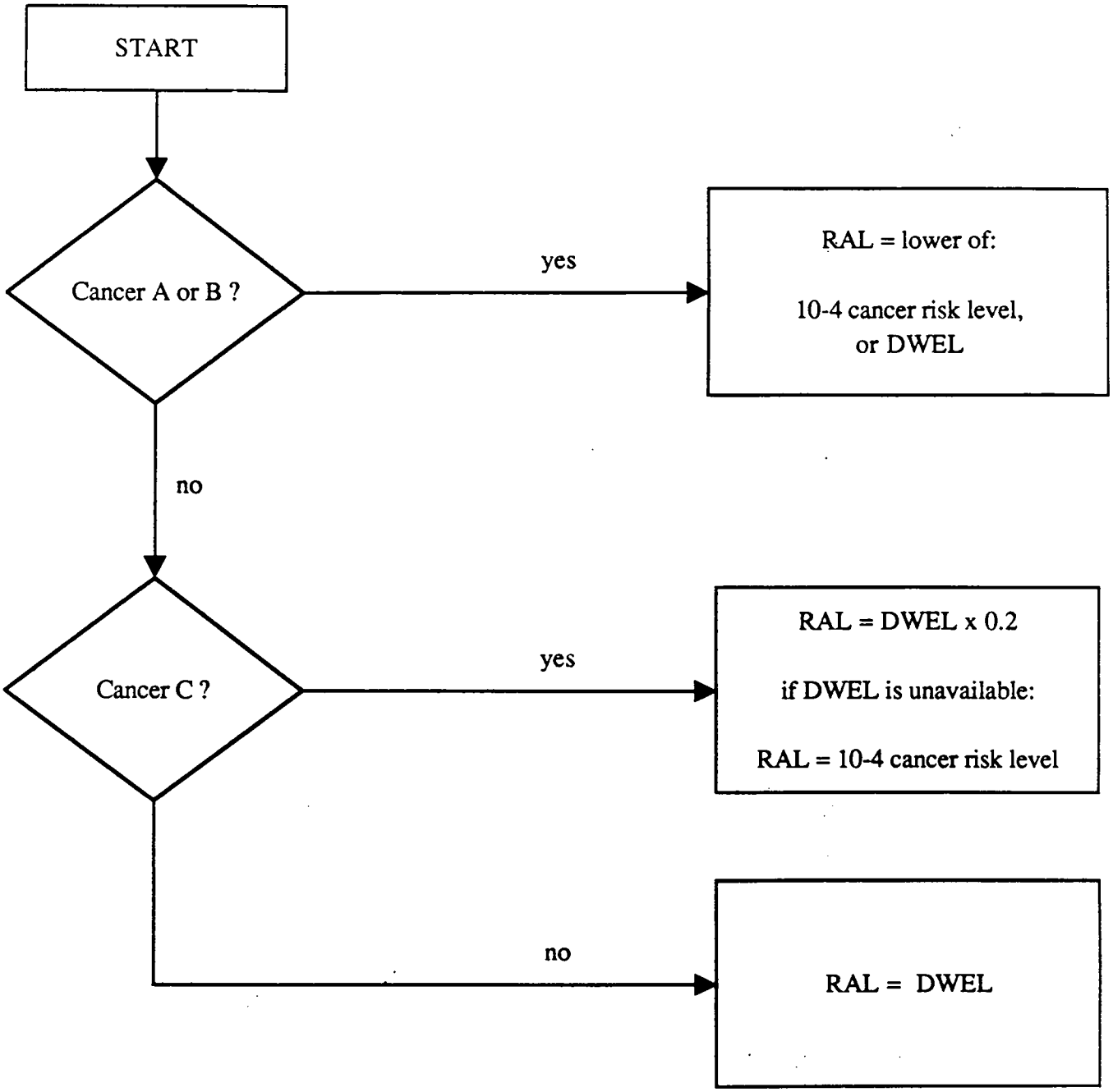

**EXHIBIT 3**
**SUBSTANCES FOR WHICH NUMERIC RALs HAVE CHANGED SIGNIFICANTLY**

| Substance | 1991 (Old) RAL (µg/l) | New RAL (µg/l) | Factor Increase/ Decrease |
|---|---|---|---|
| ORGANICS | | | |
| Acifluorfen (Tackle) | 460 | 100 | -4.6 |
| Acrylonitrile | 6.5 | 1 | -6.5 |
| Aldicarb (Temik) | 2.5 | 7 | +2.8 |
| Atrazine | 180 | 30 | -6.0 |
| Baygon | 140 | 40 | -3.5 |
| Bromodichloromethane | 27 | 60 | +2.2 |
| Bromomethane | 25 | 50 | +2.0 |
| Carbaryl | 3,500 | 1,000 | -3.5 |
| Carbofuran | 180 | 50 | -3.6 |
| Carbon tetrachloride | 12 | 30 | +2.5 |
| Carboxin | 3,500 | 1,000 | -3.5 |
| Chloramben | 530 | 200 | -2.7 |
| Chlorodibromomethane | 42 | 700 | +17 |
| Chloromethane | 270 | 100 | -2.7 |
| Chlorophenol (2-) | 180 | 50 | -3.6 |
| Chlorothalonil | 530 | 150 | -3.5 |
| Chlorotoluene (o-) | 350 | 700 | +2.0 |
| Chlorpyrifos | 110 | 30 | -3.7 |
| Cyanazine | 70 | 20 | -3.5 |
| 2,4-D (2,4-Dichloro-phenoxyacetic acid) | 350 | 100 | -3.5 |
| Dacthal (DCPA) | 18,000 | 5,000 | -3.6 |
| Dalapon | 1,100 | 300 | -3.6 |
| Diazinon | 32 | 3 | -11 |
| Dicamba | 46 | 300 | +6.5 |
| Dichlorobenzene (1,4-) | 150 | 750 | +5.0 |
| Dichloroethylene (1,1-) | 5.8 | 70 | +12 |
| Dichlorophenol (2,4-) | 110 | 30 | -3.7 |
| Dimethyl phthalate | 35,000 | 350,000 | +10 |
| Dinoseb | 35 | 10 | -3.5 |

EXHIBIT 3 (continued)
SUBSTANCES FOR WHICH NUMERIC RALs HAVE CHANGED SIGNIFICANTLY

| Substance | 1991 (Old) RAL (µg/l) | New RAL (µg/l) | Factor Increase/ Decrease[1] |
|---|---|---|---|
| Dioxane (1,4-) | 320 | 700 | +2.2 |
| Diphenamid | 1,100 | 300 | -3.7 |
| Endothall | 700 | 200 | -3.5 |
| Endrin | 11 | 3 | -3.7 |
| Ethylene glycol | 70,000 | 6,000 | -12 |
| Fonofos | 70 | 20 | -3.5 |
| Glyphosate | 3,500 | 1,000 | -3.5 |
| Hexane (n-) | 21,000 | 4,000 | -5.3 |
| Isophorone | 850 | 7,000 | +8.3 |
| Isopropylbenzene (Cumene) | 1,400 | 14,000 | +10 |
| Malathion | 700 | 200 | -3.5 |
| Maleic hydrazide | 18,000 | 5,000 | -3.6 |
| MCPA ((4-Chloro-2-methylphenoxy)-acetic acid) | 18 | 50 | +2.8 |
| Methomyl | 880 | 300 | -2.9 |
| Methoxychlor | 180 | 50 | -3.6 |
| Metolachlor | 5,300 | 2,000 | -2.7 |
| Metribuzin | 880 | 300 | -2.9 |
| Oxamyl (Vydate) | 880 | 200 | -4.4 |
| Paraquat | 160 | 50 | -3.2 |
| Pentachloronitrobenzene | 14 | 100 | +7.2 |
| Phenol | 21,000 | 6,000 | -3.5 |
| Picloram | 2,500 | 700 | -3.6 |
| Prometon | 530 | 200 | -2.7 |
| Pronamide (Kerb) | 2,600 | 800 | -3.3 |
| Propachlor | 460 | 100 | -4.6 |
| RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | 32 | 100 | +3.2 |
| Styrene | 3,500 | 1,000 | -3.5 |
| TCDD (2,3,7,8-) (Dioxin) | 22 pcg/l | 50 pcg/l | +2.3 |
| Tebuthiuron | 2,500 | 700 | -3.6 |
| Terbufos | 3.5 | 1 | -3.5 |

EXHIBIT 3 (continued)
SUBSTANCES FOR WHICH NUMERIC RALs HAVE CHANGED SIGNIFICANTLY

| Substance | 1991 (Old) RAL (µg/l) | New RAL (µg/l) | Factor Increase/ Decrease[1] |
|---|---|---|---|
| Tetrachloroethane (1,1,1,2-) | 130 | 900 | +6.9 |
| Tetrachloroethane (1,1,2,2-) | 18 | 2 | -9.0 |
| 2,4,5-TP (2(2,4,5-Trichlorophenoxy)propionic acid) | 280 | 70 | -4.0 |
| Trichlorobenzene (1,2,4-) | 46 | 100 | +2.2 |
| Trichloroethane (1,1,2-) | 61 | 30 | -2.1 |
| Trifluralin | 260 | 80 | -3.3 |
| **INORGANICS** | | | |
| Arsenic | 2 | 50 | +25 |
| Barium | 1,800 | 5,000 | +2.8 |
| Boron | 3,200 | 900 | -3.6 |
| Cadmium | 18 | 5 | -3.6 |
| Cyanide | 700 | 200 | -3.5 |
| Fluoride | 2,100 | 5,000 | +2.4 |
| Maganese | 3,500 | 200 | -17 |
| Molybdenum | 140 | 10 | -14 |
| Nitrite | 3,500 | 1,000 | -3.5 |
| Vanadium | 250 | 30 | -8.3 |
| Zinc | 7,000 | 3,000 | -2.3 |

[1] The ratio between the new RAL and the old RAL. A "+" indicates that the RAL has increased, while a "-" indicates that the RAL has decreased.

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES

## Tables

Emergency Response Division
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
Washington, DC 20460

May 1993

## Table Acronyms

| | |
|---|---|
| CAS # | Chemical Abstract Number |
| DWEL | Drinking Water Equivalent Level (calculated by multiplying the oral RfD by 70 kilograms (adult body weight) and dividing by the average volume of water (2 liters) consumed per day) |
| Longer-term HA (Child) | Drinking Water Health Advisory for 10 kg child consuming 1 liter water per day for up to 7 years |
| MCL | Maximum Contaminant Level (National Primary Drinking Water Standard) |
| MCLG | Maximum Contaminant Level Goal |
| MFL | Million Fibers per Liter |
| Treat. Tech. | MCL is based on the capability of the treatment technology |
| URTH-STAR | Draft Short-term Risk Level (STAR) recommended for an Unreasonable Risk to Health (URTH) under Safe Drinking Water Act |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical ORGANICS | CAS # | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| | | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Acenaphthene | 83329 | — | — | 2,100 | — | — | — | 2,100 |
| Acetone | 67641 | D | — | 3,500[a] | — | — | — | 3,500 |
| Acifluorfen (Tackle) | 62476599 | B2 | 100 | 400 | 100 | — / 0 | — | 100 |
| Acrylamide (2-Propenamide) | 79061 | B2 | 1 | 7 | 20 | Treat. Tech. / 0 | 1 | 1 |
| Acrylonitrile | 107131 | B1 | 6 | — | — | — / 0 | — | 6 |
| Adipates (Diethylhexyl) | 103231 | C | — | 20,000 | — | 500 / 500 | — | 5,000 |
| Alachlor | 15972608 | B2 | 40 | 400 | — | 2 / 0 | 40 | 40 |
| Aldicarb (Temik) | 116063 | D | — | 35 | — | 3 / 1 | — | 35 |
| Aldicarb sulfone | 1646884 | D | — | 35 | — | 2 / 1 | — | 35 |
| Aldicarb sulfoxide | — | D | — | 35 | — | 4 / 1 | — | 35 |
| Aldrin | 309002 | B2 | 0.2 | 1 | 0.3 | — | — | 0.2 |
| Ametyrn | 834128 | D | — | 300 | 900 | — | — | 300 |
| Ammonium sulfamate | 7773060 | D | — | 8,000 | 20,000 | — | — | 8,000 |
| Anthracene | 120127 | D | — | 11,000 | — | — | — | 11,000 |
| Atrazine | 1912249 | C | — | 200 | 60 | 3 / 3 | 30 | 30 |
| Baygon | 114261 | C | — | 100 | 40 | — | — | 40 |
| Bentazon | 25057890 | D | — | 90 | 300 | — / 20 | — | 90 |
| Benz(a)anthracene | 56553 | B2 | — | — | — | 0.1 / 0 | — | 0.1 |
| Benzene | 71432 | A | 100 | — | — | 5 / 0 | 100 | 100 |
| Benzo(a)pyrene | 50328 | B2 | — | — | — | 0.2 / 0 | — | 0.2 |
| Benzo(b)fluoranthene | 205992 | B2 | — | — | — | 0.2 / 0 | — | 0.2 |
| Benzo(k)fluoranthene | 207089 | B2 | — | — | — | 0.2 / 0 | — | 0.2 |
| bis-2-Chloroisopropyl ether | 108601 | D | — | 1,000 | 4,000 | — | — | 1,000 |
| Bromacil | 314409 | C | — | 5,000 | 3,000 | — | — | 3,000 |
| Bromochloromethane | 74975 | D[a] | — | 500 | 1,000 | — | — | 500 |
| Bromodichloromethane | 75274 | B2 | 60 | 700 | 4,000 | 100 / 0 | — | 60 |
| Bromoform | 75252 | B2 | 400 | 700 | 2,000 | 100 / 0 | — | 400 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical ORGANICS | CAS # | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| | | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Bromomethane (Methyl bromide) | 74839 | D | — | 40 | 100 | — | — | 40 |
| Butanone (2-) (see Methyl ethyl ketone) | | | | | | | | |
| Butyl benzyl phthalate | 85687 | C | — | 6,000 | — | 100 / 0 | — | 6,000 |
| Butylate | 2008415 | D | — | 2,000 | 1,000 | — | — | 1,000 |
| Carbaryl | 63252 | D | — | 4,000 | 1,000 | — | — | 1,000 |
| Carbofuran | 1563662 | E | — | 200 | 50 | 40 / 40 | 50 | 50 |
| Carbon tetrachloride | 56235 | B2 | 30 | 30 | 70 | 5 / 0 | 30 | 30 |
| Carboxin | 5234684 | D | — | 4,000 | 1,000 | — | — | 1,000 |
| Chloral hydrate (Trichloroacetaldehyde monohydrate) | 302170 | C | — | 70 | 200 | — / 60 | — | 70 |
| Chloramben | 133904 | D | — | 500 | 200 | — | — | 200 |
| Chlordane | 57749 | B2 | 3 | 2 | — | 2 / 0 | 2 | 2 |
| Chlorobenzene (see Monochlorobenzene) | | | | | | | | |
| Chlorodibromomethane (Dibromochloro-methane) | 124481 | C | — | 700 | 2,000 | 100 / 0 | — | 700 |
| Chloroform (Trichloromethane) | 67663 | B2 | 600 | 400 | 100 | 100 / 0 | — | 100 |
| Chloromethane (Methyl chloride) | 74873 | C | — | 100 | 400 | — | — | 100 |
| Chlorophenol (2-) | 95578 | D | — | 200 | 50 | — | — | 50 |
| Chlorothalonil | 1897456 | B2 | 150 | 500 | 200 | — | — | 150 |
| Chlorotoluene, o- | 95498 | D | — | 700 | 2,000 | — | — | 700 |
| Chlorotoluene, p- | 106434 | D | — | 700 | 2,000 | — | — | 700 |
| Chlorpyrifos | 2921882 | D | — | 100 | 30 | — | — | 30 |
| Chrysene | 218019 | B2 | — | — | — | 0.2 / 0 | — | 0.2 |
| Cumene (see Isopropylbenzene) | | | | | | | | |
| Cyanazine | 21725462 | C | — | 70 | 20 | — / 1 | — | 20 |
| 2,4-D (2,4-Dichlorophenoxyacetic acid) | 94757 | D | — | 400 | 100 | 70 / 70 | 100 | 100 |
| Dacthal (DCPA) | 1861321 | D | | 20,000 | 5,000 | — | — | 5,000 |
| Dalapon | 75990 | D | — | 900 | 300 | 200 / 200 | — | 300 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| ORGANICS | CAS # | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Di[2-ethylhexyl]adipate | 103231 | C | 3,000 | 20,000 | 20,000 | 400 / 400 | — | 4,000 |
| Diazinon | 333415 | E | — | 3 | 5 | — | — | 3 |
| Dibenzo[a,h]anthracene | 53703 | B2 | — | — | — | 0.3 / 0 | — | 0.3 |
| Dibromoacetonitrile | 3252435 | C | — | 800 | 2,000 | — | — | 800 |
| Dibromochloromethane (see Chlorodibromomethane) | | | | | | | | |
| Dibromochloropropane (DBCP) | 96128 | B2 | 3 | — | — | 0.2 / 0 | 3 | 3 |
| Dibromomethane (Methylene Bromide) | 74953 | D | — | — | — | — | — | — |
| Dibutyl phthalate (Di-n-butyl phthalate) | 84742 | D | — | 4,000 | — | — | — | 4,000 |
| Dicamba | 1918009 | D | — | 1,000 | 300 | — | — | 300 |
| Dichloroacetic acid | 79436 | B2 | — | 300 | 5,000 | — / 0 | — | 300 |
| Dichloroacetonitrile | 3018120 | C | — | 300 | 800 | — | — | 300 |
| Dichlorobenzene -o (1,2-) | 95501 | D | — | 3,000 | 9,000 | 600 / 600 | 3,000 | 3,000 |
| Dichlorobenzene -m (1,3-) | 541731 | D | — | 3,000 | 9,000 | 600 / 600 | — | 3,000 |
| Dichlorobenzene -p (1,4-) | 106467 | C | — | 4,000 | 10,000 | 75 / 75 | 750 | 750 |
| Dichlorodifluoromethane (Freon-12) | 75718 | D | — | 5,000 | 9,000 | — | — | 5,000 |
| Dichloroethane (1,1-) | 75343 | C[a] | — | 3,500[a] | — | — | — | 3,500 |
| Dichloroethane (1,2-) (Ethylene dichloride) | 107062 | B2 | 40 | — | 700 | 5 / 0 | 40 | 40 |
| Dichloroethylene (1,1-) | 75354 | C | — | 400 | 1,000 | 7 / 7 | 70 | 70 |
| Dichloroethylene (cis- 1,2-) | 156592 | D | — | 400 | 3,000 | 70 / 70 | 400 | 400 |
| Dichloroethylene (trans- 1,2-) | 156605 | D | — | 600 | 2,000 | 100 / 100 | 600 | 600 |
| Dichloromethane (Methylene chloride) | 75092 | B2 | 500 | 2,000 | — | 5 / 0 | — | 500 |
| Dichlorophenol (2,4-) | 120832 | D | — | 100 | 30 | — | — | 30 |
| Dichloropropane (1,2-) | 78875 | B2 | — | — | — | 5 / 0 | — | 5 |
| Dichloropropene (1,3-) (cis and trans) | 542756 | B2 | 20 | 10 | 30 | — / 0 | — | 10 |
| Dieldrin | 60571 | B2 | 0.2 | 2 | 0.5 | — | — | 0.2 |
| Diethyl phthalate | 84662 | D | — | 30,000 | — | — | — | 30,000 |
| Diethylhexyl (see Adipates) | | | | | | | | |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| ORGANICS | CAS # | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Dicthylhexyl phthalate | 117817 | B2 | 300 | 700 | — | 6 / 0 | — | 300 |
| Dimethrin | 70382 | D | — | 10,000 | 10,000 | — | — | 10,000 |
| Dimethyl methylphosphonate | 756796 | C | 700 | 7,000 | 2,000 | — | — | 2,000 |
| Dimethyl phthalate | 131113 | D | — | 350,000[a] | — | — | — | 350,000 |
| DIMP (Diisopropylmethylphosphonate) | 1445756 | D | — | 3,000 | 8,000 | — | — | 3,000 |
| Dinitrobenzene (1,3-) | 99650 | D | — | 5 | 40 | — | — | 5 |
| Dinitrotoluene (2,4-) | 121142 | — | — | 100 | 300 | — | — | — |
| Dinitrotoluene (2,6-) | 25321146 | — | — | 40 | 400 | — | — | — |
| Dinitrotoluene, tg[b] (2,6- & 2,4-) | — | B2 | 5 | — | — | — | — | 5 |
| Dinoseb | 88857 | D | — | 40 | 10 | 7 / 7 | — | 10 |
| Dioxane p- (1,4-) | 123911 | B2 | 700 | — | — | — | — | 700 |
| Dioxin (see 2,3,7,8-TCDD) | | | | | | | | |
| Diphenamid | 957517 | D | — | 1,000 | 300 | — | — | 300 |
| Diphenylamine | 122394 | D | — | 1,000 | 300 | — | — | 300 |
| Diquat | 85007 | D | — | 80 | — | 20 / 20 | — | 80 |
| Disulfoton | 298044 | E | — | 1 | 3 | — | — | 1 |
| Dithiane (1,4-) | 505293 | D | — | 400 | 400 | — | — | 400 |
| Diuron | 330541 | D | — | 70 | 300 | — | — | 70 |
| Endothall | 145733 | D | — | 700 | 200 | 100 / 100 | — | 200 |
| Endrin | 72208 | D | — | 10 | 3 | 2 / 2 | — | 3 |
| Epichlorohydrin | 106898 | B2 | 400 | 70 | 70 | Treat. Tech. / 0 | 70 | 70 |
| Ethylbenzene | 100414 | D | — | 3,000 | 1,000 | 700 / 700 | 1,000 | 1,000 |
| Ethylene dibromide (1,2-) (EDB) | 106934 | B2 | 0.04 | — | — | 0.05 / 0 | 0.05 | 0.05 |
| Ethylene dichloride (see 1,2-Dichloroethane) | | | | | | | | |
| Ethylene glycol | 107211 | D | — | 40,000 | 6,000 | — | — | 6,000 |
| Ethyl ether | 60297 | — | — | 7,000[a] | — | — | — | 7,000 |
| Ethylene thiourea (ETU) | 96457 | B2 | 30 | 3 | 100 | — | — | 3 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| ORGANICS | CAS # | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Fenamiphos | 22224926 | D | — | 9 | 5 | — | — | 5 |
| Fluometuron | 2164172 | D | — | 400 | 2,000 | — | — | 400 |
| Fluorene | 86737 | D | — | 1,400 | — | — | — | 1,400 |
| Fluorotrichloromethane (Freon-11) | 75694 | D | — | 10,000 | 3,000 | — | — | 3,000 |
| Fonofos | 944229 | D | — | 70 | 20 | — | — | 20 |
| Formaldehyde | 50000 | B1 | — | 5,000 | 5,000 | — | — | 5,000 |
| Freon-11 (see Fluorotrichloromethane) | | | | | | | | |
| Freon-12 (see Dichlorodifluoromethane) | | | | | | | | |
| Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane) | 76131 | — | — | 1,100,000[a] | — | — | — | 1,100,000 |
| Glyphosate | 1071836 | D | — | 4,000 | 1,000 | 700 / 700 | — | 1,000 |
| Heptachlor | 76448 | B2 | 0.8 | 20 | 5 | 0.4 / 0 | 0.8 | 0.8 |
| Heptachlor epoxide | 1024573 | B2 | 0.4 | 0.4 | 0.1 | 0.2 / 0 | 0.4[c] | 0.4 |
| Hexachlorobenzene | 118741 | B2 | 2 | 30 | 50 | 1 / 0 | — | 2 |
| Hexachlorobutadiene | 87683 | C | — | 70 | 100 | — / 1 | — | 70 |
| Hexachlorocyclohexane, gamma (see Lindane) | | | | | | | | |
| Hexachlorocyclopentadiene | 77474 | D | — | 200 | — | 50 / 50 | — | 200 |
| Hexachloroethane | 67721 | C | — | 40 | 100 | — | — | 40 |
| Hexane (n-) | 110543 | D | — | — | 4,000 | — | — | 4,000 |
| Hexazinone | 51235042 | D | — | 1,000 | 3,000 | — | — | 1,000 |
| HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) | 2691410 | D | — | 2,000 | 5,000 | — | — | 2,000 |
| Indeno[1,2,3-c,d]pyrene | 193395 | B2 | — | — | — | 0.4 / 0 | — | 0.4 |
| Isophorone | 78591 | C | 4,000 | 7,000 | 15,000 | — | — | 7,000 |
| Isopropyl methylphosphonate | 6838933 | D | — | 4,000 | 30,000 | — | — | 4,000 |
| Isopropylbenzene (Cumene) | 88828 | — | — | 1,400[a] | — | — | — | 1,400 |
| Kerb (see Pronamide) | | | | | | | | |
| Lindane (Hexachlorocyclohexane, gamma) | 58899 | C | — | 10 | 30 | 0.2 / 0.2 | 2 | 2 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical ORGANICS | CAS # | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| | | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Malathion | 121755 | D | — | 800 | 200 | — | — | 200 |
| Maleic hydrazide | 123331 | D | — | 20,000 | 5,000 | — | — | 5,000 |
| MCPA (4-Chloro-2-methylphenoxy)-acetic acid) | 94746 | E | — | 50 | 100 | — | — | 50 |
| Methomyl | 16752775 | D | — | 900 | 300 | — | — | 300 |
| Methoxychlor | 72435 | D | — | 200 | 50 | 40 / 40 | 50 | 50 |
| Methyl bromide (see Bromomethane) | | | | | | | | |
| Methyl chloride (see Chloromethane) | | | | | | | | |
| Methyl ethyl ketone (2-Butanone) | 78933 | D[a] | — | 21,000[a] | — | — | — | 21,000 |
| Methyl parathion | 298000 | D | — | 9 | 30 | — | — | 9 |
| Methyl tert butyl ether | 1634044 | D | — | 200 | 500 | — | — | 200 |
| Methylene bromide (see Dibromomethane) | | | | | | | | |
| Methylene chloride (see Dichloromethane) | | | | | | | | |
| Metolachlor | 51218452 | C | — | 5,000 | 2,000 | — | — | 2,000 |
| Metribuzin | 21087649 | D | — | 900 | 300 | — | — | 300 |
| Monochloroacetic acid (Chloroacetic acid) | 79118 | — | — | 70[a] | — | — | — | 70 |
| Monochlorobenzene (Chlorobenzene) | 108907 | D | — | 700 | 2,000 | 100 / 100 | 700 | 700 |
| Naphthalene | 91203 | D | — | 100 | 400 | — | — | 100 |
| Nitroguanidine | 556887 | D | — | 4,000 | 10,000 | — | — | 4,000 |
| Nitrophenols p- | 25154556 | D | — | 300 | 800 | — | — | 300 |
| Octachlorocamphene (see Toxaphene) | | | | | | | | |
| Oxamyl | 23135220 | E | — | 900 | 200 | 200 / 200 | — | 200 |
| Paraquat | 1910425 | E | — | 200 | 50 | — | — | 50 |
| Pentachloronitrobenzene (PCNB) | 82688 | C[a] | — | 100[a] | — | — | — | 100 |
| Pentachlorophenol | 87865 | B2 | 30 | 1,000 | 300 | 1 / 0 | 30 | 30 |
| Perchloroethylene (see Tetrachloroethylene) | | | | | | | | |
| Phenol | 108952 | D | — | 20,000 | 6,000 | — | — | 6,000 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical ORGANICS | CAS # | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| | | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Picloram | 1918021 | D | — | 2,000 | 700 | 500 / 500 | — | 700 |
| Polychlorinated biphenyls (PCBs) | 1336363 | B2 | 0.5 | — | 1 | 0.5 / 0 | 0.5 | 0.5 |
| Prometon | 1610180 | D | — | 500 | 200 | — | — | 200 |
| Pronamide (Kerb) | 23950585 | C | — | 3,000 | 800 | — | — | 800 |
| Propachlor | 1918167 | D | — | 500 | 100 | — | — | 100 |
| Propazine | 139402 | C | — | 700 | 500 | — | — | 500 |
| Propham | 122429 | D | — | 600 | 5,000 | — | — | 600 |
| Pyrene | 129000 | D | — | 1,100 | — | — | — | 1,100 |
| RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | 121824 | C | 30 | 100 | 100 | — | — | 100 |
| Simazine | 122349 | C | — | 200 | 70 | 4 / 4 | — | 40 |
| Styrene | 100425 | C | — | 7,000 | 2,000 | 100 / 100 | 1,000 | 1,000 |
| T (2,4,5-) | 93765 | D | — | 350 | 800 | — | — | 350 |
| Tackle (see Acifluorfen) | | | | | | | | |
| TCDD (2,3,7,8-) (v) (Dioxin) | 1746016 | B2 | 0.00002 | 0.00004 | 0.00001 | 0.00003 / 0 | — | 0.00003 |
| Tebuthiuron | 34014181 | D | — | 2,000 | 700 | — | — | 700 |
| Temik (see Aldicarb) | | | | | | | | |
| Terbacil | 5902512 | E | — | 400 | 300 | — | — | 300 |
| Terbufos | 13071799 | D | — | 5 | 1 | — | — | 1 |
| Tetrachloroethane (1,1,1,2-) | 630206 | C | 100 | 1,000 | 900 | — | — | 900 |
| Tetrachloroethane (1,1,2,2-) | 79345 | C[a] | 20[a] | — | — | — | — | 2 |
| Tetrachloroethylene (Perchloroethylene) | 127184 | B2[a] | 70 | 500 | 1,000 | 5 / 0 | 70 | 70 |
| Toluene | 108883 | D | — | 7,000 | 2,000 | 1,000 / 1,000 | — | 2,000 |
| Toxaphene (Octachlorocamphene) | 8001352 | B2 | 3 | 3 | — | 3 / 0 | 3 | 3 |
| TP (2,4,5-) (2(2,4,5-Trichlorophenoxy-propionic acid) | 93721 | D | — | 300 | 70 | 50 / 50 | 70 | 70 |
| Trichloroacetaldehyde (Chloral) see Chloral hydrate (hydrated form of trichloroacetaldehyde) | | | | | | | | |
| Trichloroacetic acid | 76039 | C | — | 1,300 | 4,000 | — / 100 | — | 1,000 |
| Trichlorobenzene (1,2,4-) | 120821 | D | — | 400 | 100 | 70 / 70 | — | 100 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| ORGANICS | CAS # | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Trichlorobenzene (1,3,5-) | 108703 | D | — | 200 | 600 | — | — | 200 |
| Trichloroethane (1,1,1-) | 71556 | D | — | 1,000 | 40,000 | 200 / 200 | 1,000 | 1,000 |
| Trichloroethane (1,1,2-) | 79005 | C | — | 100 | 400 | 5 / 3 | — | 30 |
| Trichloroethylene (Trichloroethene) | 79016 | B2 | 300 | 300 | — | 5 / 0 | 300 | 300 |
| Trichloromethane (see Chloroform) | | | | | | | | |
| Trichlorophenol (2,4,6-) | 88062 | B2 | 300 | — | — | — | — | 300 |
| Trichlorophenoxypropionic acid (2(2,4,5-)) (see 2,4,5-TP) | | | | | | | | |
| Trichloropropane (1,2,3-) | 96184 | B2 | — | 200 | 600 | — | — | 200 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (see Freon 113) | | | | | | | | |
| Trifluralin | 1582098 | C | — | 300 | 80 | — | — | 80 |
| Trinitroglycerol | 55630 | — | — | — | 5 | — | — | 5 |
| Trinitrotoluene (2,4,6-) | 118967 | C | 100 | 20 | 20 | — | — | 20 |
| Vinyl chloride | 75014 | A | 1.5 | — | 10 | 2 / 0 | 2 | 2 |
| Vydate (see Oxamyl) | | | | | | | | |
| Xylenes (mixed) | 1330207 | D | — | 60,000 | 40,000 | 10,000 / 10,000 | 40,000 | 40,000 |

[a] Based on data from IRIS or HEAST in the absence of a published U.S. EPA, Office of Water value

[b] Technical Grade (tg); 2,4- and 2,6-Dinitrotoluene are unlikely to occur alone

[c] Based on special considerations

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| INORGANICS | CAS # | Cancer Group | $10^{-4}$ Cancer Risk (µg/L) | DWEL (µg/L) | Longer-term HA (Child) (µg/L) | MCL / MCLG (µg/L) | URTH -STAR- Level (µg/L) | Removal Action Level (µg/L) |
| Ammonia | 7664417 | D | — | — | — | — | — | 34,000[a] (taste) |
| Antimony | 7440360 | D | — | 15 | 15 | 6 / 6 | — | 15 |
| Arsenic | 7440382 | A | 2 | — | — | 50 / — | — | 50 |
| Asbestos >10 µm | 1332214 | A | 700 MFL | — | — | 7 MFL / 7 MFL | 70 MFL | 70 MFL[b] |
| Barium | 7440393 | D | — | 2,000 | — | 2,000 / 2,000 | — | 2,000 |
| Beryllium | 7440417 | B2 | 0.8 | 200 | 4,000 | 4 / 4 | — | 1 |
| Boron | 7440428 | D | — | 3,000 | 900 | — | — | 900 |
| Cadmium | 7440439 | D | — | 20 | 5 | 5 / 5 | 5 | 5 |
| Chloramines | 10599903 | D[a] | — | 3,300 | 1,000 | — / 4,000 | — | 1,000 |
| Chlorine | 7782505 | D | — | — | — | — / 4,000 | — | — |
| Chlorine dioxide | 10049044 | D | — | 100 | — | — / 80 | — | 100 |
| Chromium III (see Chromium total) | 16065831 | | | | | | | |
| Chromium VI (see Chromium total) | 18540299 | | | | | | | |
| Chromium (total) | — | D | — | 200 | 200 | 100 / 100 | 200 | 200 |
| Copper | 7440508 | D | — | — | — | Treat. T. / 1,300 | 1,300 | 1,300 |
| Cyanide | 57125 | D | — | 800 | 200 | 200 / 200 | — | 200 |
| Fluoride | 16984488 | — | — | — | — | 4,000 / 4,000 | 5,000[c] | 5,000 |
| Hypochlorite | 7681529 | — | — | — | — | — / 4,000 | — | — |
| Hypochlorous acid | 7790923 | — | — | — | — | — / 4,000 | — | — |
| Lead at tap | 7439921 | B2 | — | — | — | Treat. Tech. / 0 | 30[c] | 30 |
| Manganese | 7439965 | D[a] | — | 200 | — | — / 200 | — | 200 |
| Mercury | 7439976 | D | — | 10 | — | 2 / 2 | 10 | 10 |
| Molybdenum | 7439987 | D | — | 200 | 10 | — | — | 10 |
| Nickel | 7440020 | D | — | 600 | 500 | 100 / 100 | — | 500 |
| Nitrate | 14797558 | D | — | 56,000 | — | 10,000 / 10,000 | 10,000 | 10,000 |
| Nitrite | 14797650 | — | — | — | — | 1,000 / 1,000 | 1,000 | 1,000 |
| Nitrate+Nitrite | — | — | — | — | — | 10,000 / 10,000 | 10,000 | 10,000 |

# NUMERIC REMOVAL ACTION LEVELS FOR CONTAMINATED DRINKING WATER SITES
## PRIMARY DRINKING WATER STANDARDS AND HEALTH ADVISORIES
May 1993

| Chemical | | Cancer Risk | | Standards and Health Advisories | | | | Superfund |
|---|---|---|---|---|---|---|---|---|
| **INORGANICS** | **CAS #** | **Cancer Group** | **$10^{-4}$ Cancer Risk (µg/L)** | **DWEL (µg/L)** | **Longer-term HA (Child) (µg/L)** | **MCL / MCLG (µg/L)** | **URTH -STAR- Level (µg/L)** | **Removal Action Level (µg/L)** |
| Selenium | 7782492 | — | — | 200 | — | 50 / 50 | 200 | 200 |
| Silver | 7440224 | D | — | 200 | 200 | — | — | 100[d] |
| Strontium | 7440246 | D | — | 90,000 | 25,000 | — | — | 25,000 |
| Sulfate | 7757826 | — | — | — | — | — | — | 250,000 (aesthetics) |
| Thallium | 7440280 | — | — | 2 | 7 | 2 / 0.5 | — | 2 |
| Vanadium | 7440622 | D | — | 250[a] | — | — | — | 250 |
| White phosphorus | 772314 | D | — | 0.5 | — | — | — | 0.5 |
| Zinc | 7440666 | D | — | 11,000 | 3,000 | — | — | 3,000 |
| Zinc chloride (measured as zinc) | — | D | — | 11,000 | 3,000 | — | — | 3,000 |

[a] Based on data from IRIS or HEAST in the absence of a published U.S. EPA, Office of Water value

[b] MFL = million fibers per liter

[c] Based on special considerations

[d] Secondary Maximum Contaminant Level intended to protect general public from argyuria (a cosmetic effect) over a lifetime