DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Water Supply and Wastewater Management

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TITLE:	Health Effects and Risk Management Guidance
EFFECTIVE DATE:	October 4, 2003
AUTHORITY:	Pennsylvania's Safe Drinking Water Act (35 P.S. §721.1 *et seq.*) and regulations at 25 Pa. Code Chapter 109.
POLICY:	Department staff will follow the guidance presented in this document to respond to the occurrence of regulated and unregulated contaminants found in public drinking water systems.
PURPOSE:	The Health Effects and Risk Management Guidance was developed as part of the Department of Environmental Protection's (DEP) continuing effort to provide basic information and guidance to staff personnel on responding to contamination incidents.
APPLICABILITY:	This guidance will apply to all public water systems.
DISCLAIMER:	The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.
PAGE LENGTH:	36 pages
LOCATION:	Volume 18, Tab 1
DEFINITIONS:	See 25 Pa. Code Chapter 109

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RISK MANAGEMENT
OF CONTAMINANTS IN DRINKING WATER

INTRODUCTION

The Health Effects and Risk Management Guidance was developed as part of the Department of Environmental Protection's (DEP) continuing effort to provide basic information and guidance to staff personnel on regulated and unregulated contaminants, which have been identified in public or individual water systems. The guidance provides DEP's Unregulated Contaminants Guidance, Glossary of Terms, and a List of Acronyms and Abbreviations. The Health Effects and Risk Management Guidance also includes important sources of risk management information such as links to the U.S. Environmental Protection Agency (EPA) Drinking Water Standards and Health Advisories tables that summarize regulatory and guidance levels for contaminants in drinking water. Links are also provided to Contaminant Fact Sheets prepared by the EPA.

The Health Effects and Risk Management Guidance
may be found in the online document warehouse at http://www.dep.state.pa.us .

HEALTH ADVISORIES

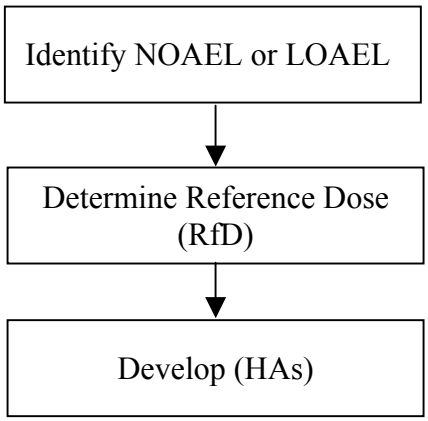
Health Advisories (HAs) provide information on contaminants that can cause adverse human health effects and are known or anticipated to occur in drinking water. HAs are guidance values prepared by the EPA based on non-cancer health effects for different durations of exposure (e.g., one-day, ten-day, and lifetime). HAs are not enforceable standards. Their purpose is to provide technical guidance to EPA regional offices, state governments, and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

EPA's Office of Water periodically publishes an updated summary table that compiles the current drinking water standards and health advisories. This compilation of Drinking Water Standards and Health Advisories is available on the Internet.

Find the Drinking Water Standards and Health Advisories links at
http://www.epa.gov/ost/drinking/standards and
http://www.epa.gov/ost/drinking/standards/dwstandards.pdf .

The following is a brief illustration intended to show key steps that EPA uses to develop their HAs.

Key Steps in the Development of Health Advisories (HAs)



The first step in developing a HA is to identify a no-observable-adverse-effect level (NOAEL) or lowest-observable-adverse-effect level (LOAEL). The NOAEL and LOAEL levels are derived from experimental, usually animal, studies of appropriate duration and are expressed as milligrams contaminant per kilograms body weight per day (mg/kg/day). In these studies, toxicologists evaluate potential risk for significant increases in frequency or severity of adverse effects in an exposed human or animal population compared to its appropriate control. Then the toxicologists weigh the merits of all the tests, include margins of safety, and choose, in their best professional judgment, the NOAEL, or if the NOAEL cannot be determined, the LOAEL.

A NOAEL is the highest experimental dose of a chemical at which there are *no* statistically or biologically significant increases in frequency or severity of adverse effects in the subject population. Effects may be evident at or below a NOAEL, but they are not considered to be adverse. A LOAEL is the *lowest* dose of a chemical in a study or group of studies that produces statistically or biologically significant increases in the frequency or severity of adverse effects in the subject population.

In the next step, a reference dose (RfD) is determined by dividing the NOAEL or LOAEL by an uncertainty factor. The uncertainty factor consists of multiples of ten that reflects the degree of uncertainty inherent in the available data. Uncertainty factors may range from 1 to 10,000 but typically seen values range from 100 to 1,000. Uncertainty factors take into account extrapolations from laboratory animals to humans (10), variations in subpopulation sensitivities (10), the extrapolation from short-term to chronic studies (10), and use of a LOAEL rather than a NOAEL (10). In addition, a modifying factor is sometimes used to account for deficiencies in the entire toxicological database of the chemical.

HAs for less-than-lifetime (e.g. 1-day and 10-day) exposure are calculated by multiplying an RfD of an appropriate duration by the assumed body weight of the protected individual and dividing by the assumed water consumption for the protected individual. For example, when calculating 1-day and 10-day HAs for a child, it is assumed that the protected individual is a 10 kg. child who consumes 1 liter of water per day.

Calculation of lifetime HAs assumes the protected individual is a 70 kg. adult who consumes 2 liters of water per day. Using the RfD derived from a chronic animal or human study, a drinking water equivalent level (DWEL) is developed. The DWEL is calculated by multiplying the RfD by 70 kg.

(weight of an adult) and dividing by 2 liters (consumption of water per day by an adult). The lifetime HA is determined by multiplying the DWEL by a relative source contribution (RSC). The RSC is an additional protective measure used in the calculation of lifetime HAs to take into consideration the exposure to the contaminant from other sources, such as food or air. In the absence of quantitative data, the RSC from drinking water is conservatively assumed to be 20 percent (80 percent allowed from non-water sources). When quantitative data is available -- more likely for inorganic contaminants than for organic compounds -- proportionate exposure from drinking water can be assessed to be greater than the default 20 percent, up to a maximum of 80 percent. For example, EPA selected 70 percent for the chromium RSC because available data indicated that drinking water provides about 70 percent of the total daily chromium intake when chromium concentrations in water are at the lifetime health advisory level of 0.1 mg/L.

One-day and ten-day HAs incorporate the assumption that 100 percent of an individual's exposure to a contaminant comes from drinking water.

One-day HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for up to one day of exposure.

Ten-day HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for up to ten days of exposure.

Lifetime HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for a lifetime of exposure.

CARCINOGENICITY RISK ASSESSMENT

In addition to the determination of noncarcinogenic endpoints of toxicity, contaminants are also evaluated for carcinogenic potential. Applying the criteria described in EPA's "Guidelines for Carcinogen Risk Assessment" (51 *Federal Register* 33992, 9/24/86), EPA places a contaminant into one of the following weight-of-evidence groups:

Group A: Human Carcinogen

Sufficient evidence in epidemiological studies to support causal association between exposure and cancer.

Group B: Probable Human Carcinogen

B1 - Almost sufficient to inadequate evidence in epidemiological studies.

B2 - Sufficient evidence from animal studies.

Group C: Possible Human Carcinogen

Absence of data in humans; limited evidence from animal studies.

Group D: Not Classified

Inadequate animal evidence.

Group E: No Evidence of Carcinogenicity for Humans

No evidence in multiple studies.

For chemicals classified as human or probable human carcinogens (group A or B), EPA evaluates available laboratory animal studies and human epidemiological studies. Through this evaluation EPA produces a quantitative estimate of the probability of an increased risk of cancer, given that an individual is exposed to the chemical by drinking 2 liters of drinking water for a lifetime of 70 years.

REGULATORY LEVELS

The 1996 Amendments to the Safe Drinking Water Act (SDWA) require EPA to go through several steps to determine, first, whether setting a standard is appropriate for a particular contaminant, and if so, what the standard should be. Peer-reviewed science and data support an intensive technological evaluation that includes many factors, such as:

1. Occurrence in the environment.

2. Human exposure and risks of adverse health effects in the general population and sensitive subpopulations.

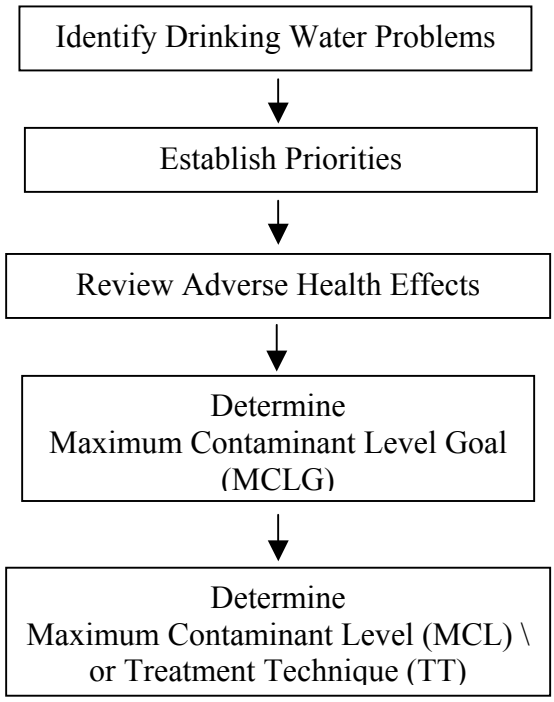
3. Analytical methods of detection.

4. Technical feasibility.

5. Impacts of regulation on water systems, the economy and public health.

The following is a brief illustration intended to show key steps that EPA uses to develop standards.

Key Steps to Establish Regulatory Level Standards
for Contaminants in Drinking Water



Identify Drinking Water Problems

EPA must first make determinations about which contaminants to regulate. These determinations are based on health risks and the likelihood that the contaminant occurs in public water systems at levels of concern.

Establish Priorities

The SDWA requires EPA to establish a list of contaminants to aid in priority setting for EPA's drinking water program. The Contaminant Candidate List (CCL) is a list of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulation (NPDWR), are known or anticipated to occur in public water systems, and may require regulations under SDWA. In establishing the list, EPA has divided the contaminants among those which are priorities for additional research, those which need additional occurrence data, and those which are priorities for consideration for rulemaking.

The CCL will be the primary source of priority contaminants for EPA's drinking water program. Contaminants for priority drinking water research, occurrence monitoring, and guidance development, including health advisories, will be drawn from the CCL. Certain contaminants on the CCL have also been designated as those from which EPA will determine whether to regulate specific contaminants. The CCL, developed with considerable input from the scientific community and other interested parties, may be found at http://www.epa.gov/safewater/ccl/cclfs.html#table2 .

Review Adverse Health Effects, and Determine Maximum Contaminant Level Goal (MCLG)

After it reviews the health effects studies, EPA establishes regulatory levels for contaminants in drinking water. The SDWA requires EPA to simultaneously promulgate (1) a maximum contaminant level goal (MCLG), and (2) either a maximum contaminant level (MCL) or treatment technique. Conceptually, the MCLG/MCL development process consists of two stages. First, EPA sets a MCLG based on health effects alone. Then, based on the health effects data, EPA determines what is a feasible, enforceable level.

The MCLG is based solely on toxicological data and is not an enforceable concentration level. By policy, the MCLGs of human and probable human carcinogens (groups A and B) are set at zero. For contaminants in which evidence of carcinogenicity is inadequate or lacking (groups D and E), the MCLGs are set at a number derived by the same process as the lifetime health advisory described earlier. When there is equivocal evidence of carcinogenicity (group C), the MCLG preferentially is set at a number equal to the lifetime health advisory level divided by an additional uncertainty factor ranging from one to ten, to account for possible carcinogenicity. In the absence of reliable non-carcinogenic data, EPA may set the MCLG for a group C chemical at the 10^{-5} or 10^{-6} excess cancer risk level. (56 Federal Register 3533, January 30, 1991).

Determine Maximum Contaminant Level (MCL) or Treatment Technique (TT)

Once the MCLG is determined, EPA develops an enforceable standard. In most cases, the standard is a **Maximum Contaminant Level (MCL)**, the maximum permissible level of a contaminant in water, which is delivered to any user of a public water system. The SDWA, as amended in 1996, requires EPA to set the MCL as close to the MCLG as feasible, which the SDWA defines as the level that may be achieved with the use of the best available technology. Factors considered while setting MCLs include analytical and treatment feasibility, costs to large metropolitan and regional water systems, and national economic impact. For noncarcinogens and equivocal-evidence carcinogens, the MCL is usually set at the MCLG. For group A and B carcinogens, the target range for setting the MCL is between the 10^{-4} and 10^{-6} excess cancer risk level. If it is economically or technically unfeasible to determine the concentration level of a contaminant in water, a treatment technique can be set for the contaminant in place of an MCL.

When there is no reliable method that is economically and technically feasible to measure a contaminant at particularly low concentrations, a **Treatment Technique (TT)** is set rather than an MCL. A TT is an enforceable procedure or level of technological performance, which public water systems must follow to ensure control of a contaminant. Examples of TT rules are the Surface Water Treatment Rule (disinfection and filtration) and the Lead and Copper Rule (optimized corrosion control).

More detailed information on EPA's standard-setting protocol may be found at
http://www.epa.gov/safewater/standard/setting.html

1996 SDWA Amendments

Future drinking water standard setting has new flexibility compared to the previous law. As a new requirement, EPA must publish a cost-benefit analysis along with MCL proposals. After first defining an MCL or TT standard based on affordable technology, as previously, EPA must determine whether the costs of that standard would be justified by the benefits. If not, then EPA may adjust an MCL to a level that "maximizes health risk reduction benefits at a cost that is justified by the benefits." Flexibility to

"minimize the overall risk of adverse health effects" is also authorized where certain means of controlling one contaminant may increase the risk from another contaminant.

The cost-benefit provision was included mainly to address the concern that the health protection benefits of certain future standards might not be "worth" their costs, even if large systems could afford to meet such standards through their economies of scale -- i.e. spreading the cost of water treatment over a large number of customers. The new standard setting retains the previous law's approach to defining an affordable technology standard, but subjects that standard to the "justified" test. EPA can proceed with a standard based on the affordable technology approach, or may adjust an affordable technology-based MCL to a level that is "justified." In the latter case, the new law's further requirement that the MCL must also maximize health benefits ensures that health protection remains the paramount consideration in standard setting.

While EPA will continue to use feasibility for large systems in setting drinking water regulations, the 1996 amendments to the SDWA specifically require EPA to make small system technology assessments for both existing and future regulations. The new requirements will provide small systems with options designed specifically for their use. This should aid in the implementation of the regulations because smaller systems may be able to successfully install and operate treatment technologies to achieve compliance.

UNREGULATED CONTAMINANTS GUIDANCE

BACKGROUND

The purpose of this guidance is to address contamination of drinking water sources by contaminants without enforceable regulatory levels (unregulated contaminants). The Bureau of Water Supply and Wastewater Management (BWSWM) developed a guidance which recommends a prioritization protocol for determining a guidance level in place of a federally promulgated MCL. This guidance level in place of an MCL is referred to as the **maximum unregulated contaminant concentration.** This guidance also recommends appropriate responses when the contaminant is detected in a public water system.

If an unregulated contaminant is detected by a water supply, the first guideline for the **maximum unregulated contaminant concentration** is to search for an MCL proposed by EPA. In the absence of a proposed MCL, the maximum unregulated contaminant concentration is set as close as feasible to an alternate health criterion. This maximum unregulated contaminant concentration takes into consideration analytical and treatment technologies. For chemicals in the A or B carcinogen groups, the criterion is the 10^{-6} excess lifetime cancer risk concentration. For noncarcinogens and equivocal-evidence contaminants (in carcinogen groups C, D, and E), the appropriate health criterion is the lifetime health advisory concentration.

Calculations of maximum unregulated contaminant concentrations are recommended to be consistent with the EPA drinking water standards and health advisory data. The values developed by EPA for HAs, MCLGs, and MCLs are usually rounded to one significant figure. This rounding procedure is appropriate because using two or more significant figures implies a degree of precision that is unwarranted. As described above, the large uncertainty factors (up to 1,000), included as margins of safety by toxicologists, would affect the degree of precision. To maintain consistency, when comparing laboratory results to a maximum unregulated contaminant concentration, the laboratory result should be rounded to the same number of significant figures as that of the maximum unregulated contaminant concentration. This is the same process used to determine compliance with existing MCLs. For

example, if comparing a contaminant's laboratory result of 0.0447 mg/L to its maximum unregulated contaminant concentration of 0.04 mg/L, the laboratory result would be rounded to 0.04 mg/L. The rounded laboratory result does not exceed the maximum unregulated contaminant concentration and thus does not justify action associated with exceeding the maximum unregulated contaminant concentration.

Appropriate determinations may be made about the length of time a consumer should drink water containing a contaminant exceeding the maximum unregulated contaminant concentration. The following factors need to be considered about consumption of water containing these contaminants:

1. Concentration of the contaminant and how close that concentration is to exceeding its HA.

2. Additional sources of consumer exposure to the same contaminant (occupational, environmental, etc.).

3. Severity of anticipated adverse health effect.

4. Uncertainty factor(s) used to develop the HA (10, 100, 1000, etc.).

5. Other contaminants (i.e. chemical mixtures) contained in the water which may affect the same body organ or body function.

6. All possible routes of entry to the body (ingestion, inhalation, dermal) which may compound exposure.

In addition, tap water is most often used for activities other than drinking (ingestion through the digestive tract). A large share of the total volume of water used by residential customers may involve agitation or heating, such as bathing, showering, laundering, cleaning, dish washing, or toilet flushing. It is generally agreed that for **most** chemicals in drinking water, the risk from non-ingestion pathways is less than the risk from direct ingestion. However, volatile organic compounds may escape from the water in large enough concentrations during these activities to present an additional risk to the inhabitants. The activity of most concern is showering or bathing which may potentially expose an individual to the contaminant by inhalation or by absorption through the skin.

EPA recognizes that dermal absorption and inhalation of chemicals in the home are factors in the overall exposure from certain chemicals. However, due to its concern about the limited amount of data available and the uncertainty of proposed calculation methodologies, EPA decided in 1985 not to include exposure from showering, bathing, or swimming as part of its quantitative standard-setting protocol (50 *Federal Register* 46895, 11/13/85).

Chemicals that may penetrate the skin (skin penetrants) of most concern during showering, bathing, or swimming activities are ones that are low molecular weight, non-ionized, and soluble in both lipids (fat) and water. Permeability coefficients and pathway exposure factors are useful tools in evaluating the contribution of inhalation and dermal exposure to the total body burden. Unfortunately, these permeability coefficients and pathway exposure factors have been determined for only a few environmental contaminants. Based on their permeability coefficients, three chemicals have been experimentally identified as potential water supply contaminants. Ethylbenzene, styrene, and toluene, which are normally of concern via ingestion, may also pose a significant dermal absorption hazard at low concentrations.

Measurements of physical-chemical parameters such as vapor pressure, solubility and molecular weight may be used to evaluate a contaminant's tendency to volatilize. These parameters relating to the behavior of gases are included in Henry's Law, which was first proposed by J. W. Henry in 1800. Henry's Law Constants have been measured and are available in table form. A Henry's Law Constant for a contaminant above 0.001 atm m^3/mole suggests volatilization and subsequent inhalation as a potentially significant route of exposure.

DEP recommends that an alternate source of water be used for bathing and showering activities when the concentration of a chemical is high enough to potentially pose a significant risk from ingestion. In these situations, simply providing bottled water for drinking may not adequately protect consumers from contamination of their water supply.

The Unregulated Contaminants Guidance

The "Unregulated Contaminants Guidance" pertains to all unregulated chemical contaminants **except radon and the four unregulated contaminants which comprise the total trihalomethane MCL (bromoform, bromodichloromethane, chloroform, and chlorodibromomethane**). This guidance replaces all previous guidance for the unregulated contaminants.

This guidance is divided into three parts. Part I defines the terminology used in the guidance. Part II describes the procedure used to determine the maximum unregulated contaminant concentrations. Part III recommends actions to follow when an unregulated contaminant is detected in a public water system.

PART I - DEFINITIONS

1. Carcinogenic contaminant – a cancer-producing contaminant which has been classified by EPA as a known (Group A) or probable (Group B) human carcinogen.

2. DEP – the Department of Environmental Protection.

3. Health Advisories – guidance values prepared by the EPA based on non-cancer health effects for different durations of exposure (e.g., 1-day, 10-day, and lifetime).

4. Lifetime exposure – the total amount of exposure to a substance that a human would receive in a lifetime (usually assumed to be 70 years). The true risk is not likely to be higher and may be lower. For example, a lifetime cancer risk of 10^{-4} indicates an increased probability of contracting cancer for 1 person out of 10,000 people exposed to the carcinogen at a specified concentration during their entire lifetime of 70 years.

5. Maximum unregulated contaminant concentration – The maximum allowable concentration of an unregulated contaminant in finished water, as determined from health risk data by DEP.

6. Method detection limit (MDL) – The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the true value is greater than zero, as determined by EPA.

7. Practical quantitation level (PQL) – The lowest level of a substance in water that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions, as determined by EPA (or available as needed on a case by case basis through EPA).

8. Unregulated contaminant – A contaminant for which no maximum contaminant level or treatment technique has been established under **§109.202** of the Pennsylvania Safe Drinking Water Regulations (relating to state maximum contaminant levels and treatment technique requirements).

PART II - MAXIMUM UNREGULATED CONTAMINANT CONCENTRATIONS

The following protocol should be used to establish a maximum unregulated contaminant concentration:

1. If available, the maximum unregulated contaminant concentration should be set equal to the concentration that EPA has proposed or is considering to propose as a primary maximum contaminant level for the contaminant.

2. If EPA has not proposed or is not considering to propose a primary maximum contaminant level as noted in paragraph 1, the maximum unregulated contaminant concentration should be set equal to:

   - the concentration associated with a lifetime cancer risk of 10^{-6} for carcinogenic contaminants.

   - the concentration equal to the lifetime health advisory for noncarcinogenic contaminants.

3. If the concentration specified in paragraph 2 is not equal to or greater than the practical quantitation level or is not achievable through the use of available treatment technology, the maximum unregulated contaminant concentration should be set at the lowest concentration these limiting factors will allow.

PART III - RECOMMENDED ACTION

Public water systems should supply finished water that fulfills the maximum unregulated contaminant concentrations determined according to Part II above. Compliance with the maximum unregulated contaminant concentration should be based on the running annual average concentration of quarterly results when monitoring is conducted quarterly or more frequently. If monitoring frequency is annual or less frequent, compliance should be based on the average of the initial sample and a check sample.

When a single monitoring sample demonstrates that an unregulated contaminant is present in a concentration equal to or greater than the EPA method detection limit, the water supplier should take a check sample from the same sampling point within 24 hours of receipt of the sample results indicating detection of the unregulated contaminant. (This recommendation does not apply to new source sampling conducted under **§109.503(a)(1)(iii)(B)** of the Safe Drinking Water Regulations.) If detection of an unregulated contaminant is verified as described above, the water supplier should do the following:

1. Where the average concentration of the original and a check sample is equal to or greater than the method detection limit (MDL) but less than or equal to the maximum unregulated contaminant concentration, the water supplier (community and noncommunity) should monitor

at least quarterly at the entry point(s) for the detected contaminants. After the analyses of four consecutive quarterly samples demonstrates that the concentration of the contaminant in each quarterly sample does not exceed the maximum unregulated contaminant concentration, DEP may reduce the recommended monitoring to one sample per entry point per year, or less frequently, as appropriate, to protect public health.

DEP may recommend more appropriate sampling points if the source of contamination is within the distribution system.

2. Where the average concentration of the original and a check sample is determined to exceed the maximum unregulated contaminant concentration, but is less than a concentration which poses an imminent hazard to public health, the following should be provided:

   a. Public notification:

      (1) The water supplier, except a bottled water or retail water supplier**,** shall provide Tier 2 public notification as follows:

         (a) Report the circumstances to DEP within 1 hour of discovery of the situation.

         (b) Provide the public notice as soon as possible, but no later than 30 days after the system learns of the situation.

         (c) Repeat the notice every 3 months as long as the situation persists.

      (2) The water supplier shall provide the initial public notice and any repeat notices in a form and manner that is reasonably designed to reach all persons served in the required time period. The form and manner of the public notice may vary based on the specific situation and type of water system, but the public water supplier shall at a minimum meet the following requirements:

         (a) Community water systems shall provide notice using the following forms of delivery:

            (i) Mail or other direct delivery to each customer receiving a bill and to other service connections to which water is delivered.

            (ii) Any other method reasonably designed to reach other persons regularly served by the system, if they would not normally be reached by the notice required above.

         (b) Noncommunity water systems shall provide notice using the following forms of delivery:

            (i) Posting the notice in conspicuous locations throughout the distribution system frequented by persons served by the system, or by mail or direct delivery to each customer and service connection, when known.

(ii) Any other method reasonably designed to reach other persons served by the system if they would not normally be reached by the notice required above.

b. Monitoring: The water supplier (community and noncommunity) should be required to monitor at least quarterly at the entry point(s) for the detected contaminants. After the analyses of four consecutive quarterly samples demonstrates that the concentration of the contaminant in each quarterly sample does not exceed the maximum unregulated contaminant concentration, DEP may reduce the recommended monitoring to one sample per entry point per year.

DEP may recommend more appropriate sampling points if the source of contamination is within the distribution system.

c. For all bottled water and retail water for which the average of the original and a check sample exceeds the maximum unregulated contaminant concentration, the water supplier should recall the contaminated water and cease distribution until the contaminant concentration is equal to or less than the maximum unregulated contaminant concentration.

3. Where the average concentration of the original and a check sample is determined by DEP to pose an imminent hazard to public health, the public water supplier should provide the following:

a. Public Notification:

(1) The public water supplier, except a bottled water or retail water supplier, shall provide Tier 1 public notification as follows:

(a) Provide a public notice as soon as possible, but no later than 24 hours after the water supplier learns of the situation.

(b) Report the circumstances to DEP within 1 hour of discovery of the situation.

(c) Initiate consultation with DEP as soon as possible, but no later than 24 hours after the water supplier learns of the situation, to determine initial and any additional public notice requirements.

(d) Comply with initial and any additional public notification requirements that are established as a result of the consultation with DEP. The repeat notice frequency, if applicable, for a Tier 1 public notice shall be established as a result of the consultation, but may be no less often than once every 30 days as long as the situation persists.

(2) The form and manner used by a public water supplier shall fit the specific situation and shall be reasonably designed to reach residential, transient and

nontransient users of the water system. To reach all persons served, a water supplier shall use, at a minimum, one or more of the following forms of delivery:

(a) Appropriate broadcast media, such as radio or television.

(b) Posting of the notice in conspicuous locations throughout the area served by the water system.

(c) Hand delivery of the notice to persons served by the water system.

(d) Another method approved in writing by DEP.

b. Monitoring - The water supplier should be required to monitor at least daily at the entry point(s) for the detected contaminant until the weekly average concentration of the daily samples indicates the contaminant no longer poses an imminent threat. Monitoring should then continue as in Part III-2 above.

c. For all bottled water and retail water for which the average of the original and a check sample exceeds the maximum unregulated contaminant concentration, the water supplier should recall the contaminated water and cease distribution until the contaminant concentration is equal to or less than the maximum unregulated contaminant concentration.

4. For systems, which have installed treatment to remove an unregulated contaminant, monitoring for the unregulated contaminant for which treatment has been installed should be conducted at least quarterly.

5. Every effort will be made to keep the Contaminant Summary information on the intranet current with revised information from EPA, but verification from BWSWM may be necessary before actions are taken.

Should the health risk be determined to be a serious one and the water supplier is unable to issue a notice to its water customers, DEP will issue a notice on behalf of the water supplier.

Find Public Notification requirements in
25 Pa. Code Chapter 109
Subchapter D. PUBLIC NOTIFICATION

In addition, community water systems are required to prepare and provide to their customers annual Consumer Confidence Reports (CCRs) on the quality of water delivered by the systems. CCRs summarize information that a community water system collects, such as the source(s) of water provided, levels of detected contaminants, violations of any state regulations, health information concerning drinking water violations and the potential risks from detected contaminants. If a system has performed voluntary monitoring that indicates the presence of non-regulated contaminants in the finished water, DEP encourages the system to report any results that may indicate a health concern. DEP considers any detection above a proposed MCL or health advisory level to indicate concern. For these contaminants, DEP recommends that the report contain: (1) the results of monitoring, and (2) an explanation of the significance of the results, noting the existence of the health advisory or proposed MCL.

DRINKING WATER STANDARDS AND HEALTH ADVISORIES TABLE

As an overview, Pennsylvania Drinking Water Standards, adopted from standards developed by EPA, are currently in effect in Pennsylvania. Generally, the Pennsylvania MCLs include both federal EPA primary MCLs as State MCLs and the current EPA secondary maximum contaminant levels (SMCLs) as State MCLs. Exceptions to the federal standards include, but are not necessarily limited to, the State primary MCL for fluoride of 2 mg/L and the secondary MCL for aluminum of 0.2 mg/L. Specific details of Pennsylvania standards and treatment techniques are provided in 25 Pa. Code Chapter 109, available on the Internet at http://www.pacode.com/secure/data/025/chapter109/s109.202.html . §109.202. State MCLs, MRDLs and treatment technique requirements.

Pennsylvania Drinking Water Standards: applicable to public drinking water systems Maximum Contaminant Levels: (22KB PDF file) listed by contaminant at http://www.dep.state.pa.us/dep/deputate/watermgt/wsm/WSM_DWM/PA-MCLs.pdf and Treatment Technique Requirements: (15KB PDF file) in lieu of an MCL at http://www.dep.state.pa.us/dep/deputate/watermgt/wsm/WSM_DWM/PA-TrtTech.pdf .

The risk management source for HAs is the federal EPA publication, *Drinking Water Standards and Health Advisories* that is a compendium of regulatory standards and guidance levels for contaminants in drinking water. It is comprised of:

1. Acute, subchronic, and lifetime health advisories developed by EPA's Office of Water, and

2. Qualitative and quantitative carcinogenic potential assessments developed by EPA.

The *Drinking Water Standards and Health Advisories* publication is accessible on the Internet at http://www.epa.gov/waterscience/drinking/standards/ . Its HAs provide additional information on certain contaminants and are guidance values based on health effects other than cancer. In its *Drinking Water Standards and Health Advisories* table, EPA publishes the cancer risk at 10^{-4} or one in 10,000 risk level. DEP, for the calculation of its maximum unregulated contaminant concentration, uses a cancer risk at 10^{-6} or one in one million.

The cancer risk and associated contaminant concentration are assumed to be a linear (straight-line) relationship. To convert a cancer risk with its associated contaminant concentration from 10^{-4} to 10^{-6} risk level, move the decimal point of the contaminant concentration two places to the left. For example, if 0.5 milligrams per liter of contaminant would pose a lifetime risk of 10^{-4}, then 0.005 milligrams per liter would pose a risk of 10^{-6}. As a service, we are providing the associated Chemical Abstract Service registry numbers (CASN) for two contaminants listed in the **Drinking Water Advisory Table** of EPA's *Drinking Water Standards and Health Advisories*.

CHEMICAL	**(CAS Number)**
Methyl tertiary-butyl ether (MtBE)	1634-04-4
Sodium	7440-23-5

While the health advisory information is meant primarily to be a technical resource for staff in the drinking water program responding to contamination incidents involving *public* water supplies (water provided by municipal authorities, investor-owned utilities, schools, factories, mobile home parks, etc.), this information may also be useful to technical staff in other program areas of DEP who need to deal with contamination incidents involving drinking water supplies owned by *private* home-owners. As a follow-up to reviewing the health advisory data, users from field operations of other programs should also utilize the knowledge and expertise of the drinking water staff in their respective locations for additional advice.

CONTAMINANT FACT SHEET RESOURCES

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk.

More detailed information on specific contaminants is available at http://www.epa.gov/safewater/hfacts.html . Consumer and technical fact sheet links are provided at http://www.epa.gov/safewater/Pubs/standards.html#chem1 .

GLOSSARY OF TERMS

Absorbed dose. The amount of a chemical that enters the body of an exposed organism.

Absorption. The uptake of water or dissolved chemicals by a cell or an organism.

Absorption factor. The fraction of a chemical making contact with an organism that is absorbed by the organism.

Acceptable daily intake (ADI). Estimate of the largest amount of chemical to which a person can be exposed on a daily basis that is not anticipated to result in adverse effects (usually expressed in mg/kg/day). (Synonymous with RfD.)

Activated Carbon. A highly adsorbent form of carbon used to remove odors and toxic substances from water.

Active transport. An energy-expending mechanism by which a cell moves a chemical across the cell membrane from a point of lower concentration to a point of higher concentration, against the diffusion gradient.

Acute. Occurring over a short period of time; used to describe brief exposures and effects which appear promptly after exposure.

Additive Effect. Combined effect of two or more chemicals equal to the sum of their individual effects.

Administrative Order on Consent. A legal agreement signed by EPA and an individual, business, or other entity through which the violator agrees to pay for correction of violations, take the required corrective or clean-up actions, or refrain from the activity. The agreement describes actions to be taken at a site and may be subject to a public comment period.

Adsorption. The process by which chemicals are held on the surface of a mineral or soil particle. Compare with absorption.

Advisory. A non-regulatory document that communicates risk information to persons who may have to make risk management decisions.

Aerobic. Life or processes that require, or are not destroyed by, the presence of oxygen.

Ambient. Environmental or surrounding conditions.

Anaerobic. A life or process that occurs in, or is not destroyed by, the absence of oxygen.

Animal studies. Investigations using animals as surrogates for humans, on the expectation that results in animals are pertinent to humans.

Antagonism. Interference or inhibition of the effect of one chemical by the action of another chemical.

Aquifer. An underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs.

Assay. A test for a particular chemical or effect.

Background level. In toxic chemical monitoring, the average presence in the environment, originally referring to naturally occurring phenomena.

Beta Particle. An elementary particle emitted by radioactive decay; may cause skin burns; is stopped by a thin sheet of paper.

Bias. An inadequacy in experimental design that leads to results or conclusions not representative of the population under study.

Bioaccumulation. Accumulation of substance in a plant or animal as a result of repeated exposure to a substance not easily expelled from the body.

Bioassay. Test which determines the effect of a chemical on a living organism.

Bioconcentration. The accumulation of a chemical in tissues of an organism (such as fish) to levels that are greater than the level in the medium (such as water) in which the organism resides. (See bioaccumulation.)

Biodegradation. Decomposition of a substance into more elementary compounds by the action of microorganisms such as bacteria.

Biotransformation. Conversion of a substance into other compounds by organisms; includes biodegradation.

BW. Body weight.

CAG. Carcinogen Assessment Group of the federal EPA.

Cancer. A disease characterized by the rapid and uncontrolled growth of aberrant cells into malignant tumors.

Carcinogen. A chemical which causes or induces cancer.

CAS registration number. A number assigned by the Chemical Abstracts Service to identify a chemical.

Central nervous system. Portion of the nervous system which consists of the brain and spinal cord; CNS.

Characteristic (Solid Waste). Any one of the four categories used in defining hazardous waste: ignitability, corrosivity, reactivity, and toxicity.

Chronic. Occurring over a long period of time, either continuously or intermittently; used to describe ongoing exposures and effects that develop only after a long exposure.

Chronic exposure. Long-term, low level exposure to a toxic chemical.

Cleanup. Actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and/or the environment.

Clinical studies. Studies of humans suffering from symptoms induced by chemical exposure.

Comment period. Time given the public to review and comment on a proposed EPA action or rulemaking after it is published in the Federal Register.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Commonly known as Superfund; federal law authorizing investigation and remediation of abandoned or uncontrolled hazardous waste sites. Funded by a special tax that goes into a Trust Fund; EPA can either pay for site cleanup when responsible parties are unavailable, unwilling or unable to perform the work or take legal action to force the responsible parties to clean up the site or pay back the government for the cost of cleanup.

Confounding factors. Variables other than chemical exposure level which can affect the incidence or degree of a parameter being measured.

Consent Decree (CD). A legal document, approved and issued by a judge, that formalizes an agreement reached between EPA and potentially responsible parties (PRPs) where PRPs will perform all or part of a Superfund site cleanup.

Corrosion. The dissolving and wearing away of metal caused by a chemical reaction such as between acid water and water pipes.

Cost/benefit analysis. A quantitative evaluation of the costs which would be incurred versus the overall benefits to society of a proposed action such as the establishment of an acceptable dose of a toxic chemical.

Cost-effective alternative. The cleanup alternative selected for a site on the National Priorities List based on technical feasibility, permanence, reliability, and cost.

Cumulative exposure. The summation of exposures of an organism to a chemical over a period of time.

Curie. A quantitative measure of radioactivity equal to 3.7×10^{10} disintegrations per second.

Degradation. Chemical or biological breakdown of a complex compound into simpler compounds.

Dermal exposure. Contact between a chemical and the skin.

Diffusion. The movement of suspended or dissolved particles from a more concentrated to a less concentrated region as a result of the random movement of individual particles; the process tends to distribute them uniformly throughout the available volume.

DNA. Deoxyribonucleic acid; the molecule in which the genetic information for most living cells is encoded.

Dosage. The quantity of a chemical administered to an organism.

Dose. The actual quantity of a chemical to which an organism is exposed. (See absorbed dose.)

Dose-response. A quantitative relationship between the dose of a chemical and an effect caused by the chemical.

Dose-response evaluation. A component of risk assessment that describes the quantitative relationship between the amount of exposure to a substance and the extent of toxic injury or disease.

Dose-response relationship. The quantitative relationship between the amount of exposure to a substance and the extent of toxic injury produced.

Drinking Water Advisory. A nonregulatory concentration of a contaminant in water that is likely to be without adverse effects on both health and aesthetics.

DWEL. Drinking Water Equivalent Level - estimated exposure (in mg/L) which is interpreted to be protective for noncarcinogenic endpoints of toxicity over a lifetime of exposure, assuming that this exposure would be limited exclusively to drinking water that contained the contaminant.

Endangerment assessment. A site-specific risk assessment of the actual or potential danger to human health or welfare and the environment from the release of hazardous substances or waste. The endangerment assessment document is prepared in support of enforcement actions under CERCLA or RCRA.

Endpoint. A biological effect used as an index of the effect of a chemical on an organism.

Environmental Response Team. EPA experts in Edison, New Jersey, and Cincinnati, Ohio, who can provide around-the-clock technical assistance to EPA regional offices and states during all types of emergencies involving hazardous waste sites and spills of hazardous substances.

Epidemiologic study. Study of human populations to identify causes of disease. Such studies often compare the health status of a group of persons who have been exposed to a suspect agent with that of a comparable non-exposed group.

Estimated Exposure Dose (EED). The measured or calculated dose to which humans are likely to be exposed considering exposure by all sources and routes.

Exposure. Contact with a chemical or physical agent which represents a potential health threat to the living organisms in that environment.

Exposure assessment. The determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, route, and extent (number of people) of exposure to a chemical.

Exposure coefficient. Term which combines information on the frequency, mode, and magnitude of contact with contaminated medium to yield a quantitative value of the amount of contaminated medium contacted per day.

Exposure level, chemical. The amount (concentration) of a chemical at the absorptive surfaces of an organism.

Exposure scenario. A set of conditions or assumptions about sources, exposure pathways, concentrations of toxic chemicals and populations (numbers, characteristics and habits) which aid the investigator in evaluating and quantifying exposure in a given situation.

Extrapolation. Estimation of unknown values by extending or projecting from known values.

Extremely hazardous substances. Any of 406 chemicals identified by EPA on the basis of toxicity; listed under SARA Title III.

Fecal coliform bacteria. A group of bacteria which are commonly found in the intestinal tracts of mammals. Their presence in water is an indication of pollution and possible contamination by pathogens.

First Draw. The water that immediately comes out when a tap is first opened. This water is likely to have the highest level of lead contamination from plumbing materials.

Fluorosis. An abnormal condition caused by excessive intake of fluorine, characterized chiefly by mottling of the teeth.

Formulation. The substance or mixture of substances which is comprised of all active and inert ingredients in a pesticide.

Fresh water. Water that generally contains less than 1,000 milligrams per liter of dissolved solids.

Gamma radiation. Gamma rays are true rays of energy in contrast to alpha and beta radiation. The properties are similar to x-rays and other electromagnetic waves. They are the most penetrating waves of radiant nuclear energy but can be blocked by dense materials such as lead.

Gavage. Type of exposure in which a substance is administered to an animal through a stomach tube.

Gene. A length of DNA that directs the synthesis of a protein.

Generator. A facility or mobile source that emits pollutants into the air or releases hazardous wastes into water or soil.

Gram. 1/454 of a pound.

Gross alpha particle activity. Total activity due to emission of alpha particles. Used as the screening measurement for radioactivity generally due to naturally occurring radionuclides. Activity is commonly measured in picocuries (pCi).

Gross beta particle activity. Total activity due to emission of beta particles. Since the decay products of fission are beta particles and gamma ray emitters, used as the screening measurement for radioactivity from man-made radionuclides. Activity is commonly measured in picocuries (pCi).

Half-life. The length of time required for the mass, concentration, or activity of a chemical or physical agent to be reduced by one-half.

Halogen. Any of a group of five chemically-related non-metallic elements (bromine, fluorine, chlorine, iodine, astatine) that form Group VIIA of the periodic table.

Hazard evaluation. A component of risk assessment that involves gathering and evaluating data on the types of health injury or disease (e.g., cancer) that may be produced by a chemical and on the conditions of exposure under which injury or disease is produced.

Hazardous Ranking System (HRS). The principle screening tool used by EPA to evaluate risks to public health and the environment associated with abandoned or uncontrolled hazardous waste sites. The HRS calculates a score based on the potential of hazardous substances spreading from the site through the air, surface water, or groundwater and on other factors such as nearby population. This score, from 0 to 100, is the primary factor in deciding if the site should be placed on the National Priorities List, and, if so, what ranking it should have compared to other sites on the list.

Hazardous substance. (1) Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. (2) Any substance named by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or if otherwise emitted into the environment.

Heavy Metals. Metallic elements with high atomic weights which characteristically can damage living things at low concentrations and tend to accumulate in the food chain. They include mercury, chromium, cadmium, arsenic, and lead.

Hematopoiesis. The production of blood and blood cells.

Hepatic. Pertaining to the liver.

Hepatoma. A malignant tumor occurring in the liver.

Heterotrophic bacteria. Bacteria which are dependent on organic matter for food, absolutely requiring at least one organic compound for its source of carbon.

High-to-low dose extrapolation. The process of prediction of low exposure risks to rodents from the measured high exposure-high risk data.

Histology. The study of the structure of cells and tissues; usually involves microscopic examination of tissue slices.

Human equivalent dose. A dose which, when administered to humans, produces an effect equal to that produced by a dose in animals.

Human exposure evaluation. A component of risk assessment that involves describing the nature and size of the population exposed to a substance and the magnitude and duration of their exposure. The evaluation could concern past exposures, current exposures, or anticipated exposures.

Human health risk. The likelihood (or probability) that a given exposure or series of exposures may have or will damage the health of individuals experiencing the exposures.

Hydrocarbons. Organic compounds containing only carbon and hydrogen; petroleum is a complex mixture of hydrocarbons with a small amount of other substances.

Hydrogeology. The geology of groundwater, with particular emphasis on the chemistry and movement of water.

Hydrology. The science dealing with the properties, distribution, and circulation of water.

Incidence of tumors. Percentage of animals with tumors.

Incineration. (1) Burning of certain types of solid, liquid or gaseous materials. (2) A treatment technology involving destruction of waste by controlled burning at high temperatures.

Indicator organisms. Organisms whose survival and presence in an environment indicate that environment's physical conditions.

Information file (Superfund). A file that contains accurate up-to-date documents on a Superfund site. The file is usually located in a public building (repository) such as a school, library, or city hall that is convenient for local residents.

Ingestion. Type of exposure through the mouth.

Inhalation. Type of exposure through the lungs.

Injection well. A well into which fluids are injected for purposes such as waste disposal, improving the recovery of crude oil, or solution mining.

Inorganic chemicals. Chemicals not basically of carbon structure.

Integrated exposure assessment. A summation over time, in all media, of the magnitude of exposure to a toxic chemical.

Interspecies extrapolation model. Model used to extrapolate from results observed in laboratory animals to humans.

In vitro studies. Studies of chemical effects conducted in tissues, cells or subcellular extracts from an organism (i.e., not in the living organism).

In vivo studies. Studies of chemical effects conducted in intact living organisms; in vivo tests are those laboratory experiments carried out on whole animals or human volunteers.

Irreversible effect. Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

Latency. Time from the first exposure to a chemical until the appearance of a toxic effect.

Leachate. A liquid that results from water collecting contaminants as it percolates through wastes, agricultural pesticides, or fertilizers. The leaching process may result in hazardous substances entering surface water, groundwater, or soil.

Lesion. A pathological or traumatic discontinuity of tissue or loss of function of a part.

Lethal. Deadly; fatal.

Lethal Concentration 50 (LC50). The concentration of a chemical in air or water which is expected to cause death in 50 percent of test animals living in that air or water.

Lethal Dose 50 (LD50). The dose of a chemical taken by mouth or absorbed by the skin which is expected to cause death in 50 percent of the test animals so treated.

Lifetime exposure. Total amount of exposure to a substance that a human would receive in a lifetime (usually assumed to be 70 years).

Linearized multistage model. Derivation of the multistage model, where the data are assumed to be linear at low doses.

LOAEL. Lowest-Observed-Adverse-Effect Level; the lowest dose in an experiment which produced an observable adverse effect.

Malignant. Very dangerous or virulent, causing or likely to cause death.

Margin of Exposure (MOE). The ratio of the no-observed-adverse-effect-level (NOAEL) to the estimated exposure dose (EED).

Margin of Safety (MOS). The older term used to describe the margin of exposure (MOE).

Mathematical Model. Model used during risk assessment to perform extrapolations.

Metabolism. The sum of the chemical reactions occurring within a cell or a whole organism; includes the energy-releasing breakdown of molecules (catabolism) and the synthesis of new molecules (anabolism).

Metabolite. Any product of metabolism, especially a transformed chemical.

Metastatic. Pertaining to the transfer of disease from one organ or part to another not directly connected with it.

Microgram (ug). One-millionth of a gram (3.5×10^{-8} oz. = 0.000000035 oz.).

Milligram (mg). One-thousandth of a gram (3.5×10^{-5} oz. = 0.000035 oz.).

Mitigation. Measures taken to reduce adverse impacts on the environment.

Modeling. Use of mathematical equations to simulate and predict real events and processes.

Modifying Factor. Uncertainty factor that is greater than zero and less than or equal to 10; the magnitude of the modifying factor depends upon the professional assessment of scientific uncertainties of the study and database not explicitly treated with the standard uncertainty factors (e.g., the

completeness of the overall database and the number of species tested); the default value for the modifying factor is 1.

Monitoring. Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals, and other living things.

Monitoring Wells. Wells drilled at a hazardous waste management facility or Superfund site to collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine such things as the direction in which groundwater flows and the types and amounts of contaminants present.

Mortality. The number of deaths in a given time or place.

MTD. Maximum tolerated dose, the dose that an animal species can tolerate for a major portion of its lifetime without significant impairment or toxic effect other than carcinogenicity.

Multistage model. Mathematical model based on the multistage theory of the carcinogenic process, which yields risk estimates either equal to or less than the one-hit model.

Mutagen. An agent that causes a permanent genetic change in a cell other than that which occurs during normal genetic recombination.

National Oil and Hazardous Substances Contingency Plan (NOHSCP/NCP). The federal regulation that guides the determination of the sites to be corrected under the Superfund program and the program to prevent or control spills into surface waters or other portions of the environment.

National Priorities List (NPL). EPA's list of the serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based on the Hazard Ranking System (HRS). EPA is required to update the NPL at least once a year.

National Response Center (NRC). The federal center operated by the U.S. Coast Guard that receives and evaluates reports of oil and hazardous substance releases into the environment and notifies the appropriate agency; open 24 hours a day.

National Response Team (NRT). Representative of 13 federal agencies that, as a team, coordinate federal responses to nationally significant incidents of pollution and provide advice and technical assistance to the responding agency(ies) before and during a response action.

Necrosis. Death of cells or tissue.

Neoplasm. An abnormal growth or tissue, as a tumor.

Neurotoxicity. Exerting a destructive or poisonous effect on nerve tissue.

NOAEL. No-Observed-Adverse-Effect Level; the highest dose in an experiment which did not produce an observable adverse effect.

NOEL. No-Observed-Effect Level; dose level at which no effects are noted.

Non-point source. Pollution sources which are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet.

NTP. National Toxicology Program.

Oncogenic. A substance that causes tumors, whether benign or malignant.

Oncology. Study of tumors.

One-hit model. Mathematical model based on the biological theory that a single "hit" of some minimum critical amount of a carcinogen at a cellular target -- namely DNA -- can initiate an irreversible series of events, eventually leading to a tumor.

On-Scene Coordinator (OSC). The predesignated EPA, Coast Guard, or Department of Defense official who coordinates and directs Superfund removal actions or Clean Water Act oil- or hazardous-spill corrective actions.

Operable Unit. Term for each of a number of separate activities undertaken as part of a Superfund site cleanup.

Operation and Maintenance, O & M, (Superfund). Activities conducted at a site after a Superfund site action is completed to ensure that the action is effective and operating properly.

Oral. Of the mouth; through or by the mouth.

Organic chemicals. Naturally occurring (animal- or plant-produced) or synthetic substances containing mainly carbon, hydrogen, nitrogen and oxygen. Other atoms found in organic chemicals may include chlorine, bromine, iodine, sulfur, phosphorus, and many others.

Pathogen. Any disease-causing agent, usually applied to living agents.

Pathology. The study of disease.

Pathway exposure. The route by which a contaminant travels from the source area to reach a receptor (humans, birds, etc.).

Permeability coefficient. The rate(s) that chemicals cross through the layers of dermal or respiratory cells. Constant for a given substance (moving through a given membrane).

Permissible dose. The dose of a chemical that may be received by an individual without the expectation of a significantly harmful result.

Pharmacokinetics. The dynamic behavior of chemicals inside biological systems; it includes the processes of uptake, distribution, metabolism, and excretion.

Point source. A stationary location or fixed facility from which pollutants are discharged or emitted.

Population at risk. A population subgroup that is more likely to be exposed to a chemical, or is more sensitive to a chemical, than is the general population.

Potency. Amount of material necessary to produce a given level of a deleterious effect.

Potentially Responsible Party (PRP). An individual or company (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites PRP's have contaminated.

Potentiation. The effect of one chemical to increase the effect of another chemical.

ppb. Parts per billion.

ppm. Parts per million.

Preliminary Assessment. The process of collecting and reviewing available information about a known or suspected waste site or release.

Prevalence study. An epidemiological study which examines the relationships between diseases and exposures as they exist in a defined population at a particular point in time.

Prospective study. An epidemiological study which examines the development of disease in a group of persons determined to be presently free of the disease.

Qualitative. Descriptive of kind, type or direction, as opposed to size, magnitude, or degree.

Quality Assurance/Quality Control (QA/QC). A system of procedures, checks, audits, and corrective actions used to ensure that field sampling and laboratory analysis are of the highest achievable quality.

Quantitative. Descriptive of size, magnitude, or degree.

Receptor. (1) In biochemistry, a specialized molecule in a cell that binds a specific chemical with high specificity and high affinity. (2) In exposure assessment, an organism that receives, may receive, or has received environmental exposure to a chemical.

Record of Decision (ROD). A public document that explains which cleanup alternative(s) will be used at National Priorities List sites where, under Superfund, Trust Funds pay for the cleanup.

Red Border. An EPA document that is undergoing final review before being submitted for final management decision.

Regional Response Team (RRT). Representatives of federal, local, and state agencies who may assist in coordination before and during a Superfund response action.

Remedial Action (RA). The actual construction or implementation phase of a Superfund site cleanup that follows remedial design.

Remedial design (RD). An engineering phase that follows the Record of Decision where technical drawings and specifications are developed for the subsequent remedial action at a site on the National Priorities List.

Remedial Investigation/Feasibility Study (RI/FS). An EPA investigation at a Superfund site to gather the data necessary to determine the type and extent of contamination, and to identify and analyze cleanup alternatives. These two distinct but related studies are usually performed at the same time.

Remedial Project Manager (RPM). The EPA official responsible for overseeing remedial action at a site.

Remedial response. A long-term action that stops or substantially reduces a release or threat of a release of hazardous substances that is serious but not an immediate threat to public health.

Removal action. Short-term immediate actions taken to address release of hazardous substances that require expedited response.

Renal. Pertaining to the kidney.

Reservoir. A tissue in an organism or a place in the environment where a chemical accumulates, from which it may be released at a later time.

Resource Conservation and Recovery Act (RCRA). Federal law that regulates management and disposal of hazardous substances currently being generated, treated, transported, stored, and disposed.

Response Action. A Superfund authorized action involving either a short-term removal action or a long-term removal response that may include, but is not limited to: treatment, containment, or destruction of hazardous waste on-site or off-site; or identification and halting further movement of the contaminants.

Responsiveness Summary. A summary of oral and/or written public comments received by EPA during a comment period on key EPA documents, and EPA's responses to those comments.

Retrospective study. An epidemiological study which compares diseased persons with non-diseased persons and works back in time to determine exposures.

Reversible effect. An effect which is not permanent, especially adverse effects which diminish when exposure to a toxic chemical is ceased.

RfD. Reference dose; the daily exposure level which, during an entire lifetime of a human, appears to be without appreciable risk on the basis of all facts known at the time. (Synonymous with ADI.)

Risk. The potential for realization of unwanted adverse consequences or events.

Risk assessment. A qualitative or quantitative evaluation of the environmental and/or health risk resulting from exposure to a chemical or physical agent (pollutant); combines exposure assessment results with toxicity assessment results to estimate risk.

Risk characterization. Final component of risk assessment that involves integration of the data and analysis involved in hazard evaluation, dose-response evaluation, and human exposure evaluation to determine the likelihood that humans will experience any of the various forms of toxicity associated with a substance.

Risk estimate. A description of the probability that organisms exposed to a specified dose of chemical will develop an adverse response (e.g., cancer).

Risk factor. Characteristic (e.g., race, sex, age, obesity) or variable (e.g., smoking, occupational exposure level) associated with increased probability of a toxic effect.

Risk management. Decisions about whether an assessed risk is sufficiently high to present a public health concern and about the appropriate means for control of a risk judged to be significant.

Risk specific dose. The dose associated with a specified risk level.

Route of exposure. The avenue by which a chemical comes into contact with an organism (e.g., inhalation, ingestion, dermal contact, injection).

Safe. Condition of exposure under which there is a "practical certainty" that no harm will result in exposed individuals.

Sink. A place in the environment where a compound or material collects. (See reservoir.)

Site Inspection. The collection of information from a Superfund site necessary to score the site, using the Hazard Ranking System, and to determine if the site presents an immediate threat that requires prompt removal action.

Solder. A metallic compound used to seal the joints between pipes. Until recently, most solder contained 50 percent lead.

Sorption. A surface phenomenon which may be either absorption or adsorption, or a combination of the two; often used when the specific mechanism is not known.

Stochastic. Based on the assumption that the actions of a chemical substance result from probabilistic events.

Stratification. (1) The division of a population into subpopulations for sampling purposes. (2) The separation of environmental media into layers, as in lakes.

Subchronic. Of intermediate duration, usually used to describe studies or levels of exposure between 5 and 90 days.

Superfund. The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act.

Superfund Amendments and Reauthorization Act (SARA). Modifications to CERCLA enacted on October 17, 1986.

Synergism. An interaction of two or more chemicals that result in an effect that is greater than the sum of their effects taken independently.

Systemic. Relating to the whole body, rather than its individual parts.

Systemic effects. Effects observed at sites distant from the entry point of a chemical due to its absorption and distribution into the body.

Teratogen. Substance that causes malformation or serious deviation from normal development of embryos and fetuses.

Teratogenesis. The induction of structural or functional development abnormalities by external factors acting during gestation; interference with normal embryonic development.

Therapeutic Index. The ratio of the dose required to produce toxic or lethal effects to the dose required to produce non-adverse or therapeutic response.

Threshold. The lowest dose of a chemical at which a specified measurable effect is observed and below which it is not observed.

Time-Weighted Average. The average value of a parameter (e.g., concentration of a chemical in air) that varies over time.

Tissue. A group of similar cells.

Toxicant. A harmful substance or agent that may injure an exposed organism.

Toxicity. The quality or degree of being poisonous or harmful to plant, animal or human life.

Toxicity assessment. Characterization of the toxicological properties and effects of a chemical, including all aspects of its absorption, metabolism, excretion and mechanism of action, with special emphasis on establishment of dose-response characteristics.

Transformation. Acquisition by a cell of the property of uncontrolled growth.

Treatment, storage, and disposal facility (TSD). Site where a hazardous substance is treated, stored, or disposed. TSD facilities are regulated by EPA and states under RCRA.

Trust Fund (CERCLA). A fund set up under CERCLA to help pay for cleanup of hazardous waste sites and for legal action to force those responsible for sites to clean them up.

Tumor incidence. Fraction of animals having a tumor of a certain type.

Uncertainty factor. A number (equal to or greater than one) used to divide NOAEL or LOAEL values derived from measurements in animals or small groups of humans, in order to estimate a NOAEL value for the whole human population.

Unit cancer risk. Estimate of the lifetime risk caused by each unit of exposure in the low exposure region.

Upper bound estimate. Estimate not likely to be lower than the true risk.

Volatile. Readily vaporizable at a relatively low temperature.

Working Level (WL). A unit of measure for documenting exposure to radon decay products. One working level is equal to approximately 200 picocuries per liter (pCi/L).

ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
AWWA	American Water Works Association
BAT	best available technology
BEIR	National Academy of Sciences Advisory Committee on the Biological Effects of Ionizing Radiation
BTEX	benzene, toluene, ethylbenzene, and xylene(s)
BW	body weight
CAA	Clean Air Act
CAG	Carcinogen Assessment Group, U.S. EPA
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Responsibility, Compensation and Liability Act (1976); Superfund
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CFU	colony-forming units (bacteriological analysis)
CHD	county health department
CNS	central nervous system
CRAVE	Carcinogen Risk Assessment Verification Endeavor
CRL	cancer risk level
CWA	Clean Water Act
DBCP	1,2 dibromo-3-chloropropane
D/DBP	disinfectants and disinfection by-products
DNA	deoxyribonucleic acid
DW	drinking water
DWEL	Drinking Water Equivalent Level
E	exponent (e.g. 1.0 E-6 = 1.0 x 10 to the power of -6)
EDB	ethylene dibromide; 1,2-dibromoethane
EP	extraction procedure (solid waste)
EPA	U.S. Environmental Protection Agency
EQB	Environmental Quality Board, Pennsylvania
FFDCA	Federal Food, Drug, and Cosmetics Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FOIA	Freedom of Information Act
FR	Federal Register
FRDS	Federal Reporting Data System
GAC	granular activated carbon
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
GI	gastrointestinal
GIS	geographic information system

GRAS	generally recognized as safe
HA	health advisory
HAA	haloacetic acid
HAN	haloacetonitrile
HPLC	high-performance liquid chromatograph
HRS	hazard ranking system
HSCA	Hazard Sites Cleanup Act, Pennsylvania
HSWA	Hazardous and Solid Waste Amendments (1984)
IARC	International Agency for Research on Cancer
ICP-MS	inductively coupled plasma - mass spectrometry
insol.	insoluble
IOC	inorganic chemical
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram
Koc	organic carbon partition coefficient
Kow	n-octanol/water partition coefficient
L	liter
LC_{LO}	lethal concentration low (inhalation)
LC_{50}	lethal concentration 50 percent (inhalation)
LD_{LO}	lethal dose low
LD_{50}	lethal dose 50 percent
LOAEL	lowest-observed-adverse-effect level
LUST	leaking underground storage tank
m	meter
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDL	method detection limit
MED	minimum effective dose
MEK	methyl ethyl ketone
MF	modifying factor
mg/kg/dy	milligrams per kilograms of body weight per day
mg/L	milligram per liter
MOE	margin of exposure
MOS	margin of safety
MOU	memorandum of understanding
mrem	millirem
MtBE	methyl tertiary butyl ether (MTBE)
MTD	maximum tolerated dose
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
ng	nanogram
NIH	National Institutes of Health
NIOSH	National Institute of Occupational Safety and Health

NLM	National Library of Medicine
NOAEL	no-observed-adverse-effect level
NORM	naturally occurring radioactive materials
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulations
NPL	National Priorities List (Superfund)
NRC	National Research Council
NRC	National Response Center
NTIS	National Technical Information Service
NTP	National Toxicology Program
OGWDW	Office of Ground Water and Drinking Water, U.S. EPA
ORD	Office of Research and Development, U.S. EPA
ORP	oxidation-reduction potential
ORSANCO	Ohio River Valley Water Sanitation Commission
OSC	on-scene coordinator
OSHA	U.S. Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response, U.S. EPA
PAC	powdered activated carbon
PADWIS	Pennsylvania Drinking Water Information System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi	picocurie
PEL	permissible exposure level
PENNVEST	Pennsylvania Infrastructure Investment Authority Act
POTW	publicly owned (sewage) treatment works
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
PQL	practical quantitation level
PRP	potentially responsible party
PTA	packed tower aeration
QA/QC	quality assurance/quality control
RAD	radiation absorbed dose
RBC	red blood cells
RCRA	Resource Conservation and Recovery Act, U.S. EPA
REM	roentgen equivalent man
RfD	reference dose
RfDi	inhalation reference dose
RfDo	oral reference dose
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision (Superfund)
RP	responsible party
RQ	reportable quantity
RRT	regional response team
RSC	relative source contribution

RTECS	registry of toxic effects of chemical substances
SARA	Superfund Amendments and Reauthorization Act of 1986
s.c.	subcutaneous
SDWA	Safe Drinking Water Act
SI	site investigation (Superfund)
SI	International System of Units
SMCL	secondary maximum contaminant level
SOC	synthetic organic chemicals
sol.	soluble
SPC	standard plate count (bacteriological analysis)
STEL	short-term exposure limit
STORET	Storage and Retrieval of Water-Related Data
TAD	total absorbed dose
TBC	to be considered (Superfund)
TCDD	dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin)
TCDF	tetrachlorodibenzofurans
TCE	trichloroethylene
TD	toxic dose
TDS	total dissolved solids
THM	trihalomethane
TIC	tentatively identified compounds
TLV	threshold limit value
TOC	total organic carbon
TOX	total organic halide
TPH	total petroleum hydrocarbon
TRI	Toxic Release Inventory, U.S. EPA
TSCA	Toxic Substances Control Act, U.S. EPA
TT	treatment technique
TTHM	total trihalomethanes
TWA	time-weighed average
UF	uncertainty factor
USGS	United States Geological Survey
UST	underground storage tank
ug/L	microgram per liter
VOA	volatile organic analysis
VOC	volatile organic chemical
v/v	volume per volume
WBC	white blood cells
WHO	World Health Organization
WL	working level
WQC	water quality criteria
ZRL	zero risk level