UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C 20460

Dear Concerned Citizen:

In response to your request, please find enclosed a SNARL package. The Health Effects Branch of the Office of Drinking Water continuously develops SNARLS to the extent feasible. Our suggested action guidance, however, is completed on a case-by-case basis and should be established and used accordingly.

Sincerely,

William L. Lappenbusch, Ph.D.
Chief, Health Effects Branch
Criteria and Standards Division
Office of Drinking Water (WH-550)

Enclosure

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ENCLOSURE (5)

March 19, 1980

SNARL for Fuel Oil #2 or Kerosene

Health Effects Branch
Criteria and Standards Division
Office of Drinking Water
Environmental Protection Agency
Washington, D.C. 20460

THE OFFICE OF DRINKING WATER "SNARLS" PROGRAM

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In the absence of a formal drinking water standard for fuel oil #2 or kerosene, the Office of Drinking Water has estimated a suggested no adverse response level (SNARL) following the state-of-the-art concepts in toxicology for non-carcinogenic risk for short-term exposures. For carcinogenic risk, where appropriate, a range of risk estimates is provided for life-time exposures using a model and computations from the NAS Report (1979) entitled "Toxicity of Selected Drinking Water Contaminants." However, SNARLs are given on a case-by-case basis in emergency situations such as spills and accidents. The SNARL calculations for short-term exposures ignore the possible carcinogenic risk that may result from those exposures. In addition, SNARLs usually do not consider the health risk resulting from possible synergistic effect of other chemicals in drinking water, food and air.

SNARLs are not legally enforceable standards; they are not issued as an official regulation, and they may or may not lead ultimately to the issuance of a national standard or Maximum Contaminant Level (MCL). The latter must take into account occurrence, relative source contribution factors, treatment technology, monitoring capability, and costs, in addition to health effects. It is quite conceivable that the concentration set for SNARL purposes might differ from an eventual MCL. The SNARLs [illegible] change as additional information becomes available. [illegible] SNARLs are offered as advice to assist those that are dealing with specific contamination situations to protect public health.

Fuel oil #2, also called diesel oil, is a brown, slightly viscous liquid, with a flash point of 100° F (Sax, N. Irving, "Dangerous Properties of Industrial Materials," 1975, p. 639, Van Nostrand Reinhold Company, New York). It is prepared by fractional distillation of crude petroleum. It is a mixture of hydrocarbons, belonging to both aliphatic and aromatic series; in addition, it may contain sulfur and mercaptans. Its composition varies depending upon the source of origin such as the United States, Middle East, South America, etc. In general, it is expected to contain low molecular weight volatile aliphatic hydrocarbons, 10-16 carbon-containing aliphatic hydrocarbons, low molecular weight aromatic hydrocarbons of the benzene series and a mixture of polynuclear aromatic hydrocarbons (PAH).

The volatile aliphatic hydrocarbons in the range of C_7-C_8 should not be a problem in drinking water, and they are relatively non-toxic. The hydrocarbons having 10-16 carbon atoms in fuel oil #2 are probably the same as those present in kerosene. These hydrocarbons are very insoluble in water and one would expect low concentrations of these hydrocarbons in drinking water at saturation. One would not expect significant adverse health risks for a short-term exposure. Similar compounds, but not in identical formulation, are present in liquid paraffin which has been used as a laxative in the past, and in medicinal mineral oil.

From among the low molecular weight aromatic hydrocarbons, the chemical of concern from the health point of view is benzene. The National Academy of Sciences, in their recent report, "Toxicity of Selected Drinking Water Contaminants," 1979, has provided guidance on the health effects of benzene. Their conclusion and recommendations are:

> The acute effects of benzene cover a wide range of signs and symptoms. The effects are transitory but may lead to more lasting chronic effects such as anemia. If exposure is continuous and great enough, leukemia is a strong possibility for susceptible members of the population. There are no dose-response data on animals, and the data on humans are inadequate to calculate a risk estimate for benzene with mathematical models.

The EPA's Carcinogen Assessment Group, using epidemiological data, has attempted to calculate the excess cancer risks associated with the intake of benzene via inhalation. Using their guidance, it would indicate that an oral consumption of 1.5 or 15 ug benzene/liter of water, two liters per day over a lifetime, would result in an excess cancer risk of 1 in a million or 1 in a hundred thousand. It should be kept

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in mind that these estimates and associated concentrations, however, are rough estimates and are limited by the lack of the use of animal toxicological data where exposure levels were vague and where benzene exposures were complicated with other possible chemicals. Furthermore, the concentrations specified for 10^{-6} and 10^{-5} risks are for life-time exposures and not directly applicable to short-term or transient exposures associated with spills.

The Academy has provided guidance for the short-term exposure levels for benzene in drinking water. They recommend a level of 12.6 mg/l benzene for a seven-day exposure level. This recommendation ignored the leukemogenic effect of benzene and does not consider the organoleptic threshold of benzene in drinking water. Furthermore, the NAS' seven-day SNARL addresses the 70 kg adult and not the 10 kg child. Also, the NAS used a safety factor of 100 rather than 1000. The Office of Drinking Water would assume an uncertainty factor of 1000 since the no-observed-adverse health effect number was not established for this animal study. Consequently, using the study specified by the NAS, a seven-day SNARL of 12.6 mg/l should be reduced to 0.35 milligrams per liter.

$$\frac{(50 \text{ mg/kg})\ (5)\ 10 \text{ kg}}{(1 \text{ l/day})\ (7)\ (1000)} = 0.357 \text{ mg/l}$$

where: 50 mg/kg = bioeffects observed at level administered

5/7 = fraction converting from 5 to 7-day exposure

10 kg = average weight of a child

1 l/day = child's daily consumption of drinking water

1000 = uncertainty factor due to animal study where health effect was observed

It should be recognized that human exposure to benzene also results from breathing contaminated air and eating food in addition to drinking contaminated water. Normally, air contributes the majority of an urban dweller's intake. Benzene has also been detected in fruits, nuts, vegetables, dairy products, meat, poultry, egg, fish and several beverages, etc. According to the NAS, the average urban dweller's intake of [illegible] sources other than drinking water is normally 85 ug per day.

Among the polyaromatic hydrocarbons that might be expected to be present in drinking water following a spill, the greatest concern from the health effects point-of-view would include, among others, benzo(a)pyrene and 7,12-dimethylbenz[a]anthracene which are carcinogenic. These compounds are not very toxic for short-term exposure at the low concentrations expected to be present in drinking water as a result of fuel oil spill. In regard to the carcinogenicity of benzo(a)pyrene, the National Academy of Sciences (1977) stated:

> There is no firm evidence that benzo(a)pyrene alone produces toxicity, including teratogenicity, mutagenicity or carcinogenicity in humans. On the other hand, a mixture of compounds which contain benzo(a)pyrene as a constituent have been associated with cancer in man. In such cases, the exact role of benzo(a)pyrene is difficult to assess.

For long-term exposure the international standards for drinking water on polynuclear aromatic hydrocarbons is not in excess of 0.2 ug/l. This is an aggregate of six representative polynuclear aromatic hydrocarbons--fluoranthene, 3,4-benzofluoranthene, 11,12-benzfluoranthene, 3,4-benzopyrene, 1,12-a-benzoperylene and indeno (1,2,3-cd)pyrene. Acceptable levels for a transient situation or short-term exposure undoubtedly would be higher.

Without the existence of sufficient oral ingestion data for benzo(a)pyrene via drinking water and if no better quality water were available, it would be appropriate to suggest that drinking water contaminated with benzo(a)pyrene would be acceptable to drink for a short period under a spill situation if its concentration is such that it is approximately equivalent to that normally consumed in food. In other words, a transient exposure from water at equivalent levels to that from food and other sources would not significantly increase normal background related risks. Using EPA's draft, "Water Quality Criterion Document for Polynuclear Aromatic Hydrocarbons," prepared by Santodonato, Basu and Howard of January 1979, it can be calculated that man probably eats food containing at least 48 ug benzo(a)pyrene each day. As a result, an additional total consumption of 50 ug of benzo(a)pyrene from contaminated drinking water for a short period would seem acceptable. Should an adult drink two liters of water during the emergency situation, then in that case, only 25 ug/l would be acceptable.

To conclude: the recommended seven-day SNARL, based upon acute and subacute toxicity considerations for fuel oil #2 or kerosene, is 0.35 mg/l for benzene and 25 ug/l (50 ug total from drinking water per day) of benzo(a)pyrene. These concentrations should only be tolerated, however, in emergency situations where no other higher quality sources of water are available. In other words, finished drinking water containing such substances should be considered adulterated and would not be considered acceptable for human consumption. The PAH's are readily reduced to very low levels by conventional sedimentation and adsorption processes and they are also oxidized and chlorinated during chlorination. Benzene is readily reduced by treatment with activated carbon. All of these treatments should be applied where necessary to obtain finished water at the lowest feasible concentrations.

From a practical point of view, the Office of Drinking Water recommends that the taste and odor threshold level for kerosene or fuel oil of approximately 0.1 mg/l (Stofen, 1973. Toxicology 1: 187-195) should be used for the action level for transient exposures. Transient exposure below the taste and odor detection limit would be acceptable in the event of emergency and should be considered the action level. In addition, 0.35 mg/l for benzene and 25 ug/l for total PAH would also be controlling.

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SNARL for 1,1,1-Trichloroethane
Office of Drinking Water
U.S. Environmental Protection Agency
Washington, D.C. 20460

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In the absence of a formal drinking water standard for 1,1,1-trichloroethane the Office of Drinking Water has estimated a suggested no adverse response level (SNARL) following the state-of-the-art concepts in toxicology for non-carcinogenic risk for short and long term exposures. For carcinogenic risk, a range of risk estimates is provided for life-time exposures using a model and computations from the NAS Report (1979) entitled "Toxicity of selected drinking water contaminants." However, SNARLS are given on a case-by-case basis in emergency situations such as spills and accidents. The SNARL calculations for short-term and chronic exposures ignore the possible carcinogenic risk that may result from those exposures. In addition, SNARLS usually do not consider the health risk resulting from possible synergistic effect of other chemicals in drinking water, food and air.

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ENCLOSURE 5

General Information and Health Effects

The organic chemical 1,1,1-trichloroethane (methyl chloroform) is used as a cleaner and degreaser of metals and is considered a solvent of lipophilic substances. This substance is found in drinking water supplies in the United States of America.

According to the National Academy of Sciences, 1,1,1-trichloroethane is probably readily absorbed from the gastro-intestinal tract, however, there is insufficient data on the uptake, distribution, metabolic and excretion patterns of this compound or its metabolites. Fortunately, some toxicological data does exist following ingestion and/or inhalation of animals and/or man. Compared to other alkyl halocarbons, 1,1,1-trichloroethane is considered less toxic perhaps due to its relative metabolism and excretion.

The health effects from 1,1,1-trichloroethane exposure at high doses include:

1. depression of the central nervous system and psychophysiological changes as demonstrated by the loss of manual dexterity, coordination and perception;
2. some fatty vacuolation and weight gain of the liver;
3. transient eye irritation and dizziness especially following an inhalation exposure;
4. some cardiovascular changes including diminished systolic pressure and premature ventricular contractions; and
5. weakly mutagenic activity.

1,1,1-Trichloroethane SNARL

Since 1,1,1-trichloroethane is not considered to be a carcinogen, is relatively low in toxicity compared to some of the other alkyl halocarbons and has a taste and odor threshold range of 300-500 ug/l, it would appear reasonable to establish a chronic SNARL.

In the absence of definitive information on the chronic toxicity of ingested 1,1,1-trichloroethane, the NAS chose to identify a dose of 750 mg/kg given to mice and rats in a NCI study as the observed adverse effect level. At this dose a depression in body weight gain was observed in males while diminished survival times were noted for both male and female rats. Consequently, the NAS calculated the chronic SNARL value to be 3.8 mg/l as follows:

$$\frac{(750\ mg/kg)(5\ days)(20\%\ D.W.)(70\ kg\ man)}{(7\ days)(2\ l/day)(1{,}000)} = 3.8\ mg/l$$

where:

750 mg/kg = observed adverse effect dose
5/7 = fraction converting from 5 to 7-day exposure
20% D.W. = relative source contribution from drinking w
70 kg = average weight of an adult
1000 = uncertainty factor via 100 factor for an animal study and 10 factor because data did not specify the no observed adverse effect level
2 l/day = adult consumption per day

Extrapolation of an inhalation threshold limit value (TLV) of the National Institute of Occupational Safety and Health to an equivalent chronic ingestion limit for drinking water for the general population could be made which supports the NAS lifetime SNARL for the adult. This can be obtained by assuming a TLV of 200 ppm or 1092 mg/m^3 where 10 m^3 are inhaled/day, a 30% absorption factor and 20% contribution from drinking water, 2 l/day consumption by adults, and a 100 safety factor for extrapolating an adult occupational exposure to the general population. Numerically a supporting lifetime SNARL for the adult could be determined to be 3.3 mg/l:

$$\frac{(1092\ mg/m^3)(10\ m^3/day)(0.30)(0.20)}{(2\ l/day)(100\ safety\ factor)} = 3.27\ mg/l$$

In order to protect the child and most sensitive members of the population, the Health Effects Branch feels that the 10 kg child should be considered with the assumption that a child drinks water 1 liter/day. Applying this concept to the NAS data, the chronic SNARL value becomes approximately 1 mg/l. This value is obtained as follows:

$$\frac{(750\ mg/kg)\ (5)(.20)(10\ kg)}{(7)(1\ l/day)(1000)} = 1.07\ mg/l$$

where:

750 mg/kg = observed adverse effect dose
5/7 = fraction converting from 5 to 7-day exposure
.20 = relative source contribution (20%) via drinking water
10 kg = average weight of a child
1000 = uncertainty factor via 100 factor for an animal study and 10 factor because data did not specify the no observed adverse effect level
1 l/day = child consumption of drinking water each day

It should be concluded that based on health a 1 mg/l chronic SNARL should protect the public especially since 1,1,1-trichloroethane was negative in the NCI cancer bioassay. It should also be remembered that the taste and odor concentration for 1,1,1-trichloroethane ranges from 300-500 ug/l. Consequently, the limiting concentration to protect the aesthetic value of drinking water should also protect public health.

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