

EPA'S DISINFECTION POLICY

While protecting public health is of primary concern, the need to protect aquatic ecology must be considered along with the need for disease-free water. To achieve this goal, discharges of chlorination residuals and by-products should be reduced where possible, as long as public health is not compromised. The preamble to EPA's 1976 Secondary Treatment Regulation and EPA's disinfection policy (41 Federal Register, pp. 30786-89 July 26, 1976), summarized below, reinforce this view.

The U.S. Environmental Protection Agency (EPA) believes that although the protection of public health from disease will remain a major criterion in making decisions about disinfection requirements, protection of public health can be maintained without continuous disinfection of all municipal wastewater discharges. Regulations which require disinfection where it is not needed unnecessarily increase toxicity to human and aquatic environments. Due to potential problems associated with the unnecessary use of disinfectants and the variable need for disinfection, the EPA's policy is that disinfection requirements be set on a case-by-case basis, consistent with applicable state water quality standards for bacterial indicator organisms and for chlorine. In addition, serious consideration should be given to the use of dechlorination or alternate disinfection processes in those areas where organic compounds which can react with chlorine to form potentially toxic compounds are known to exist in the wastewater.

EPA ACTIVITIES

EPA is developing additional guidance on ways to reduce chlorine impacts on aquatic life. This will include documents which address topics such as:

- Improving chlorination efficiency
- Seasonal disinfection
- Alternate disinfection technologies and dechlorination
- Procedures for evaluating the impacts of modifying disinfection requirements on public health and aquatic life

ADDITIONAL INFORMATION

For more general information, contact:

Office of Municipal Pollution Control
Performance Assurance Branch (WH-595)
U.S. Environmental Protection Agency
Washington, D.C. 20460
202-382-7356

For technical information, contact:

Dr. Albert D. Venosa
Risk Reduction Engineering Laboratory
U.S. Environmental Protection Agency
Cincinnati, OH 45268
513-569-7668

The following publications are available through the National Technical Information Service (703-487-4650) and the Instruction Resource Center (614-292-6717):

Municipal Wastewater Disinfection State-of-the-Art Document. (EPA/430/09-91-02) U.S. Environmental Protection Agency, Office of Municipal Pollution Control, Washington, D.C.

Municipal Wastewater Disinfection: Protecting Aquatic Life and Human Health. (EPA/430/09-91-01) U.S. Environmental Protection Agency, Office of Municipal Pollution Control, Washington, D.C.

Proceedings of the Municipal Wastewater Disinfection Policy Review Task Force. (EPA/430/09-91-03) U.S. Environmental Protection Agency, Office of Municipal Pollution Control, Washington, D.C.

Other References:

EPA Design Manual - Municipal Wastewater Disinfection. (EPA/625/1-86-021) U.S. Environmental Protection Agency, Office of Research and Development, Water Engineering Research Laboratory, Cincinnati, Ohio.



Municipal Wastewater Disinfection

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Protecting Aquatic Life and Human Health from the Impacts of Chlorination

THE CHLORINATION CHALLENGE: PROTECTING PUBLIC HEALTH AND AQUATIC LIFE

Chlorination has long been the primary method of disinfection for municipal wastewater. Its use provides substantial public health benefits by reducing discharges of many waterborne disease-causing organisms (especially bacteria) to water supplies, recreational waters, shellfish waters, and other waters that can potentially transmit disease to humans.

Despite its tremendous benefits, chlorination has a negative side. A variety of substances have been found in wastewater effluents as a result of chlorination. Some are known to be (and others are suspected of being) harmful to humans and aquatic life when discharged to the environment.

CHLORINATION RESIDUALS AND BY-PRODUCTS

The substances produced during wastewater chlorination can generally be categorized as chlorination residuals and chlorination by-products.

Chlorination residuals include free chlorine (hypochlorous acid and hypochlorite ion) and various forms of combined chlorine, which result from reactions with ammonia in wastewater. Free chlorine is a highly effective disinfectant. Combined chlorine is less effective but its action persists for a longer time. Free chlorine and combined chlorine together are often referred to as total residual chlorine (TRC).

Chlorination by-products are the result of chlorine reacting with organic compounds in wastewater. The most widely recognized group of these compounds is the trihalomethanes (THMs). Some THMs (e.g., chloroform) are possible carcinogens.

IMPACT OF CHLORINE ON AQUATIC LIFE

The harmful effects of chlorination residuals on aquatic life have been recognized for many years. Even at the low concentrations produced at wastewater treatment plants, fish and invertebrate species can suffer short- and long-term effects, such as:

- Death
- Changes in population diversity and density
- Inhibited growth
- Changes in reproduction and migration
- Avoidance of chlorine plumes by mobile organisms, which can mean loss of habitat, increased environmental stress, and depressed activity

Aquatic plants are less susceptible, but are not immune to the toxic effects of chlorination residuals.

Chlorination by-products may be toxic to aquatic life, although little information is available about specific effects.

HOW WIDESPREAD IS THE PROBLEM OF CHLORINE TOXICITY?

Chlorination is widely practiced because of its low cost, availability, and bactericidal effectiveness. Because wastewater chlorination is so prevalent, there is widespread potential for adverse effects on aquatic life from discharges of chlorination residuals and by-products.

In 1986, EPA studied 6300 municipal wastewater treatment plants that chlorinate and discharge to freshwater streams. This analysis showed that up to two-thirds of the plants were likely to discharge wastewater that exceeded EPA's acute freshwater chlorine criteria. As a result, some 3500 different water bodies may be at risk.

REMEDIES TO HARMFUL IMPACTS OF CHLORINATION

Despite their potential severity and extent, the ecologically harmful impacts of wastewater chlorination are easy to reduce compared to other forms of toxicity because the sources are known and readily controlled. Three strategies can be used to reduce the impacts of chlorination residuals and by-products on aquatic life:

1) *Eliminate or Reduce Some Disinfection Requirements.*

One way to reduce discharges of chlorination residuals and by-products is to eliminate unnecessary or excessive disinfection practices. It is likely that some disinfection requirements can be eliminated or reduced without exceeding acceptable levels of risk to public health. For example, seasonal disinfection may be adequate where recreation is unlikely to occur year-round.

2) *Make Operational Improvements.*

Improvements in chlorination efficiency can effectively reduce discharges of chlorination residuals and by-products at many treatment plants. Chlorination efficiency can be improved by upgrading treatment systems to allow for rapid mixing, plug flow contacting, and automatic residual control.

Changes in the treatment process prior to disinfection to reduce pathogens and organics can also reduce the need for chlorination and maximize efficiency. However, these changes may affect other aspects of plant operation, such as sludge processing.

3) *Change the Disinfection Technology.*

A number of alternative disinfection technologies, such as ultraviolet (UV) radiation and ozonation, can be used in place of chlorination. These technologies are often less hazardous to aquatic life than chlorination, and are becoming more functionally and economically viable.

Dechlorination, the process of removing chlorine residuals after chlorination, can also be used to reduce discharges of chlorine residuals, but not by-products. This technology is economically feasible and can be added to most wastewater chlorination facilities.

Several natural treatment technologies, such as lagoons, constructed wetlands, and other land treatment systems, enhance natural die-off of pathogens. These technologies have the potential to reduce the need for chlorination.

EPA CHLORINE CRITERIA

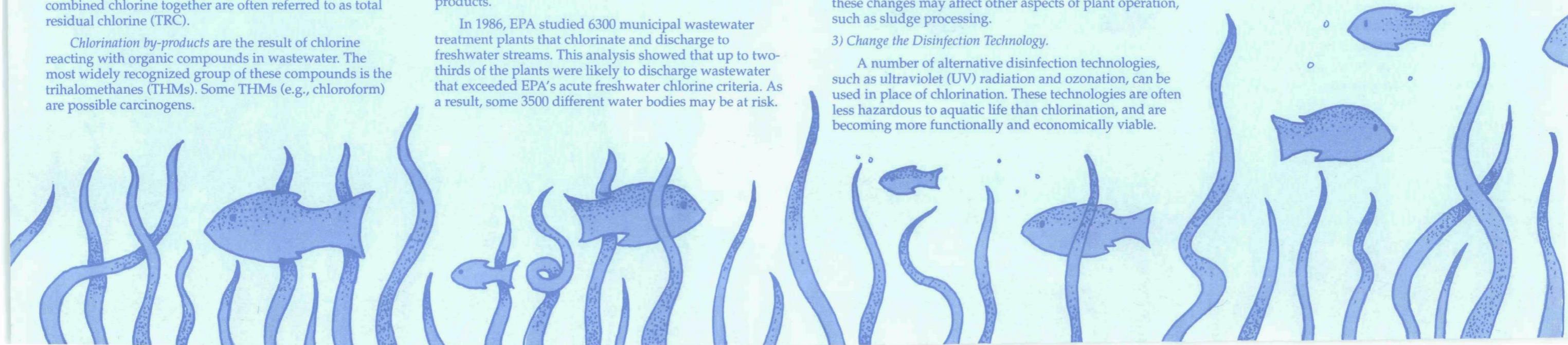
In 1985, the U.S. Environmental Protection Agency (EPA) published criteria to provide guidance on maximum levels of TRC that are believed to protect aquatic life. States can use these criteria when establishing water quality standards to protect the aquatic environment. Close to half of the States have adopted chlorine water quality standards that are based on these criteria. The recommended criteria are:

Freshwater:

- acute criterion (1-hour average): 19 µg/l (ppb)
- chronic criterion (4-day average): 11 µg/l (ppb)

Saltwater:

- acute criterion (1-hour average): 13 µg/l (ppb)
- chronic criterion (4-day average): 7.5 µg/l (ppb)



Attachment for flyer entitled "Municipal Wastewater Disinfection - Protecting Aquatic Life and Human Health from the Impacts of Chlorination" (February 1991) (assigned EPA # 832-F-91-001 after the initial printing)

Thank you for ordering the flyer indicated above. We regret the information indicated on the back of this flyer is incomplete. The explanation indicated below has been prepared in a chronological order as appears on the back of the document.

- (1) "Municipal Wastewater Disinfection State-of-the-Art Document (EPA 430/09-91-002)"
NEVER FINALIZED
- (2) "Municipal Wastewater Disinfection: Protecting Aquatic Life and Human Health" (EPA 430/09-91-01) is an incomplete title. The title of this material is as follows: "Municipal Wastewater Disinfection - Protecting Aquatic Life and Human Health from the Impacts of Chlorination" (see above) (430/09-91-001) **THE # OF THIS MATERIAL WAS CHANGED TO THE 832# INDICATED ABOVE.** (Item in-hand)
- (3) "Proceedings of the Municipal Wastewater Disinfection Policy Review Task Force" (EPA 430/09-91-003) **NEVER FINALIZED**
- (4) "EPA Design Manual - Municipal Wastewater Disinfection" (EPA 625/1-86-021) (1986) is available from the following address:

ERIC/CSMEE
1929 Kenny Road
Columbus, Ohio 43210-1015

Telephone: 1-800-276-0462

We regret any inconvenience the above-mentioned corrections may have caused but encourage you to check our website for more information on disinfection. The website is as follows: www.epa.gov/owm (click on Municipal Technologies and then to Innovative and Alternative)

Again, thank you for your interest in the environment.