

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WSG 11

Date Signed: May 8, 1978

Revised: April 17, 1998

Revised by: Paul Berger

MEMORANDUM

SUBJECT: Emergency Disinfection of Drinking Water - Boiling

FROM: Victor J. Kimm, Deputy Assistant (signed by Victor J. Kimm) Administrator for
Drinking Water (WH-550)

TO: Water Supply Representatives, Regions I-X

This guidance clarifies how long to boil water during a boil water advisory or other drinking water emergency. This guidance was prompted by the fact that various agencies have issued inconsistent instructions on the duration of boiling.

The Office of Ground Water and Drinking Water and the Centers for Disease Control recently conducted a joint literature review on how long pathogens can survive boiling. On the basis of this review, OGWDW and CDC recommend that water be brought to a boil for one minute; this will inactivate all major waterborne bacterial and protozoan pathogens, including *Giardia* and *Cryptosporidium*. Although information about the waterborne viruses is incomplete, hepatitis A virus--considered one of the more heat-resistant waterborne viruses--is also inactivated by boiling for one minute. If viral pathogens are suspected in drinking water in communities at elevations above 6562 feet (2 km), the boiling time should be extended to three minutes. This is because water boils at lower temperatures with increasing altitude. This guidance was published in Morbidity and Mortality Weekly Report, vol 43(36): pp: 661-663, 669 (see p. 663); September 16, 1994.

The recommendation of a one minute boil, at or near 100° C, refers to the total time the water is held at the boiling point. A rolling boil should not be confused with the first sight of dissolved oxygen being released, which occurs at a temperature far below the boiling point. Some highly resistant organisms may survive boiling for one minute. However, the presence of a pathogen would be extremely rare and that level of risk is acceptable.

If the water contains a significant amount of sediment or floating matter, the water should be strained through a clean cloth into a container to remove the debris before boiling. This treatment, however, may not remove toxic chemicals or radioactive constituents that may be present in the water.

Some data on thermal inactivation is presented below:

Table 1

Microbial Quality of Potable Water in a "Boil Water Order"*

Water Temperature °C	Surviving Holding Time (Seconds)	Standard Plate Count** Per ml
25	0	8,900
30	0	8,700
40	0	7,600
50	0	760
60	0	< 1
70	0	< 1
80	0	< 1
90	0	< 1
100	0	< 1

* Unpublished data: Drs. Martin J. Allen and John Caruthers, EPA, Cincinnati, Ohio

** Municipal water passed through a carbon filter attachment.

Table 2

Effect of Boiling on Giardia Cyst Viability*

Additional boiling time (Minutes)	Initial Viable cyst count (Cysts per field)	Surviving cysts after addition to boiling water (Cysts per field)**
0	32	< 1
1	35	< 1
3	33	< 1
5	38	< 1
10	38	< 1
15	35	< 1
20	63	< 1
25	46	< 1
30	63	< 1

* Unpublished data: Dr. E. Meyer and A. Bingham.

** Immediately after adding 10 ml of cysts to 9 ml of boiling water, 1 ml of sample was removed, cooled to room temperature and examined microscopically.

SAFE

drinking

water

in emergencies

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Health departments and officials responsible for public water supplies use many safeguards to protect the sanitary quality of your drinking water. However, this protection may break down during emergencies caused by natural disasters, sabotage, or enemy attack. Then the water supplied to your home may be shut off or become dangerous to use. **YOU MUST THEN KNOW WHAT TO DO TO PROVIDE A SAFE AND ADEQUATE SUPPLY OF WATER FOR YOUR FAMILY.**

Private Water Supplies

If you have your own source of supply, such as a well, cistern, spring, or other private source, ask your health department to inspect it for sanitary quality and to show you how to keep it safe. Typhoid fever, dysentery, and infectious hepatitis are diseases often associated with unsafe water. They are unpleasant and sometimes fatal. Your health officials would rather help you keep well than to investigate why you got sick. If you follow their advice in the construction and operation of your private supply, you can have confidence that, under normal conditions, it is safe to drink. However, under emergency or disaster conditions, particularly during floods, these sources may also become dangerous to use; unless you are assured otherwise by competent advice, **NO WATER CAN BE PRESUMED SAFE AND ALL WATER SHOULD BE PURIFIED.**

Travelers, Campers, Sportsmen

When you are away from the protection of approved water supplies during periods of traveling, camping, hunting, or fishing, you must take precautions to make sure that available water is safe for consumption. Remember that no matter how clear and sparkling a brook or mountain stream may look, it is not always safe to drink. Whenever you must use drinking water from a source where the purity is doubtful, **ALWAYS PURIFY IT YOURSELF.**

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Emergency Sources--Out-of-Doors

If it is necessary to select an outdoor emergency water source, remember that water from underground, such as that obtained from wells or springs, is less likely to contain contamination harmful to health than water from surface sources.

However, if underground water is not available, look next for a creek, stream, lake, or pond--in that order, if a choice is possible. Avoid water having a dark color, an odor, or containing floating materials, as any one of these may indicate heavy pollution. If possible, surface water should be obtained upstream from an inhabited area, dipped from below the surface **AND PURIFIED.**

Emergency Sources--At Home

If your home supply is interrupted, limited amounts of water may be obtained by draining the hot water tank or by melting ice cubes. Also, water may be dipped from the toilet-flush tank, but this water should be purified.

When available, water from stock tanks, irrigation tanks, cisterns, and farm ponds may be used after proper purification.

after nuclear attack

EXPOSED TO R[ADIATION]
DETERMINED S[A__]
AVAILABLE B[___]

Purification

The following simple procedures, requiring the use of either *heat* or certain *chemicals*, and clean containers to the extent possible, will destroy the usual harmful germs that may be present in water obtained from emergency sources.

HEAT

1. Strain water through a clean cloth into a container to remove any sediment or floating matter.
2. Boil the water vigorously for at least one full minute.
3. After allowing the water to cool it is ready to use. If desired, a pinch of salt added to each quart of boiled water, or pouring it back and forth from one clean container to another several times, will improve the taste.

CHEMICALS

If boiling is not possible, strain the water as in Step 1 above and purify with any one of several chemicals as follows (choice of chemical to use is based on availability):

open water sources such as

streams

lakes

ponds

uncovered wells

and tanks

**RADIOACTIVE FALLOUT SHOULD NOT BE USED
UNLESS [SA]FE BY SPECIALLY TRAINED**

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MONITORING SERVICES AS [] THE AREA.