

CHAPTER 12

DISPOSITION OF CONTAMINATED FOOD AND WATER

SECTION I - GENERAL

1201. Introduction.

- a. Although it is expected that chemical agents will be used mainly against personnel, food and water supplies may easily become contaminated and may be contaminated deliberately. This may occur from contact with chemical agents in the form of vapour, aerosol, drops or splashes of liquid or particulate smokes. This may render food both unpalatable and toxic, but on the other hand, dangerously contaminated food may appear normal.
- b. Decontamination of food is difficult and often impossible, so that all food not packed in agent proof containers must be stored under protection. When decontamination of food is possible, the decision to undertake decontamination must depend on local factors, for example, the availability of new food.
- c. Food supplies in storage are not likely to be seriously contaminated if precautions are taken to protect them against chemical attack. For this reason, large supplies of food should not be condemned as a whole, simply because they have been exposed to possible chemical contamination. A prompt and careful survey of the supplies may reveal only a few items have been so contaminated and require special treatment. Prompt segregation of the heavily contaminated portions will prevent or minimise contamination of the remainder. Generally, foods not packed in protective packages constitute the major difficulty. The type and extent of contamination, the availability of replacement supplies, and the available means of decontamination will dictate whether or not reclamation of contaminated items is worthwhile.
- d. Water is liable to contamination and may be contaminated deliberately. There are several methods of decontamination. Water is likely to be in short supply, and is more immediately important to the body than food, so that methods of protection, control and decontamination of water must be considered.

SECTION II - EFFECTS OF CHEMICAL AGENTS ON FOOD AND WATER FOOD

1202. General.

The effects of chemical agents on food depend on the properties of both the agent and the food. Contamination of water may lead to a toxic hazard when it is used for food preparation.

1203. Penetration.

Nerve and mustard agents readily penetrate fatty foods and will also penetrate granular foods (e.g., grain and sugar). Arsenical penetrate proteins less readily owing to their coagulating

action. Fruit may be penetrated by nerve agents. Three groups of foods may be considered on the basis of their composition.

- a. Foods with high water content, but low fat and a crystalline structure (e.g., fresh vegetables, fruit, sugar and salt). These absorb mustard and nerve agents in vapour and in liquid form.
- b. Foods with low fat content and amorphous structure (flour, bread, grain, rice cereals, dried fruit and vegetables, tea, coffee, peas and beans). These absorb liquid nerve and mustard agents; some absorption of vapour may occur.
- c. Foods with high fat and low water content (butter, fat, oil, ham, fat meat, cheese, milk, eggs and fish). These absorb nerve agents and mustard so readily that decontamination is impossible.

1204. Effect on Food.

- a. Food may become highly toxic without any change in its appearance.
- b. The expected effect of some chemical agents on the appearance of food are summarised in Table 12-I. The absence of these signs must *not* be relied upon in deciding that exposed food is fit for consumption. (See Table 12-II.)

Table 12-I. Effect Of Certain Agents On The Appearance of Food

Agent	Taste	Smell	Colour	Residual toxicity
Mustard	Affected	Garlic	Meat discoloured	+
N-Mustards	Affected	Fishy	No discolouration	+
Arsenicals	Acid	Unpleasant	Meat & vegetables discoloured	+
Nerve agents	None	None	No effect	+
White phosphorus	Acid	Garlic	Glow in dark	+

1205. Effect on Crops.

Heavy contamination of plants with mustard or arsenical will destroy crops. Lighter contamination may cause partial defoliation. Arsenical agents will leave sufficient arsenic to render the plant toxic, and nerve agents may penetrate plants so as to make them toxic.

1206. Effect on Livestock.

The effects of chemical agents on livestock will be the same as those upon human casualties apart from species specific variations. Mustard does not cause blistering in animals. The presence of large numbers of dead animals may indicate contamination in the area and these animals should not be eaten.

Table 12-II. Effect of Chemical Agents on Food

Type of agent	High fat content (butter, fats, cheese, meat, bacon and shell eggs, etc.)	Low fat, high moisture content (fruit, vegetables, sugar, salt, etc.)	Low fat, low moisture content (cereal, tea, coffee, flour, bread, rice, etc.)
Nerve agents (liquid)	Condemn.	Condemn.	Condemn.
Nerve agents (vapour)	Condemn.	Expose dry food to the air for 48 hours. Wash other foods with 2% sodium bicarbonate solution, peel where applicable, and cook by boiling.	Expose dry food to the air for 48 hours. Wash other foods with 2% sodium bicarbonate solution, peel where applicable, and cook by boiling.
Blister agents (liquid)	Condemn.	Condemn.	Condemn.
Blister agents (vapour)	Condemn.	Expose dry food to the air for 48 hours. Wash other foods with 2% sodium bicarbonate solution, peel where applicable, and cook by boiling.	Expose dry food to the air for 48 hours. Wash other foods with 2% sodium bicarbonate solution, peel where applicable, and cook by boiling.
Choking agents*	Wash food with water where possible and expose to the air for 24 hours. Food may be unpalatable due to the acid product of hydrolysis.	Wash food with water where possible and expose to the air for 24 hours. Food may be unpalatable due to the acid product of hydrolysis.	Wash food with water where possible and expose to the air for 24 hours. Food may be unpalatable due to the acid product of hydrolysis.
Cyanide type agents	Unlikely to produce dangerous contamination of foodstuffs.	Unlikely to produce dangerous contamination of foodstuffs.	Unlikely to produce dangerous contamination of foodstuffs.
Riot control agents	Food may be unpalatable to the extent of being inedible.	Food may be unpalatable to the extent of being inedible.	Food may be unpalatable to the extent of being inedible.

*Agents decompose rapidly on contact with water.

SECTION III - PROTECTION OF FOOD AND WATER AGAINST CONTAMINATION WITH CHEMICAL AGENTS

1207. Packaging Materials.

Decontamination of food is difficult and not likely to be satisfactory, so that the protection of food and drink is of the first importance. Food supplies should therefore always be covered when transported or stored. Even the thinnest covering is better than no covering at all, but good protection can be given by suitable methods of packing and storing.

1208. Disposition of Packaged and Stored Supplies.

In determining the disposition of packaged and stored supplies which have been contaminated, consideration must be given to the nature of the contaminant, as well as to the type of foodstuffs and the security afforded by the packaging material. Some of these factors are outlined below:

- a. Airtight glass bottles, sealed aluminium laminated packages, and sealed metal cans give complete protection against vapour and liquid.
- b. Wooden boxes not sealed for the exclusion of air give almost no protection against vapour and liquid.
- c. Waxed paper boxes sealed for the exclusion of air give good protection against vapour and fair protection against liquid.
- d. Untreated wrapping papers give poor protection against vapour and very little against liquid.
- e. Ordinary textiles in a single layer packaging give almost no protection against vapour and liquid.
- f. Coverings of sod and earth give good protection against vapour and liquid.
- g. Overhead shelters give protection against liquid sprays and splashes. Closed buildings give protection against liquids but often not against vapours, unless overpressured with filtered air.
- h. Generally, double layers greatly increase the protective efficiency of packaging materials.
- i. Field rations are packaged to protect the enclosed foods for hours even when the outside of the package is heavily contaminated with a liquid agent.

SECTION IV - MONITORING FOR CONTAMINATION**1209. Monitoring Food.**

- a. *All food exposed to chemical attack which has not been protected by agent-proof containers or in fully protected stores must be considered contaminated.*
- b. Monitoring for *volatile agents* only may be undertaken by putting the food into a clean plastic bag and sampling the air in the bag with suitable detection equipment.
- c. Where arsenical contamination is suspected, the food may be suspended in water and the water tested with a water testing kit. Liquid contamination on the surface of containers may be tested for using detector papers, but this method will only be reliable whilst liquid agent remains.
- d. *Mental incapacitants, biological agents and nuclear fallout will not be detected by these means.*

SECTION V - DECONTAMINATION OF FOOD AND WATER**1210. Classification of Supplies.**

Before any decontamination is done, a careful survey should be made to determine the extent of the contamination. From information gained in this survey, the exposed items should be divided into three groups for separate treatment as described below.

- a. Group I will consist of canned and unopened packaged items which have been exposed only to the vapours of a chemical agent. Generally, the items in this group will be safe to issue to personnel after a brief period of outdoor airing to remove clinging vapours.
- b. Group II will consist of canned and unopened packaged items, the outsides of which have been contaminated with a liquid chemical agent. The best procedure is to allow self decontamination of the packaging material by ageing and airing. If a shortage of food does not permit the necessary time for self decontamination, then a decontamination procedure is to strip off the outer contaminated coverings and examine the inner layer to see if agent penetration has occurred. If it has, continue stripping off layers until an uncontaminated layer is reached.
- c. Group III will consist of unpackaged or poorly packaged items which have been exposed to an agent in either vapour or liquid form. Decontamination of food itself will be attempted only in emergency situations when there is no alternative supply of food. The general decontamination procedure to be followed in sequence is:
 - (1) Trimming of surface fat and /or grossly contaminated areas.
 - (2) Washing with water of 2% sodium bicarbonate solution or 1% chlorine solution.
 - (3) Boiling in water. Frying, roasting or boiling will not remove traces of nerve or blister agents from meats. In general, salvage of foods contaminated with droplets of the blister agents, especially the arsenical blister agents, is not practical.

1211. Water.

- a. Contamination of water may lead to a toxic hazard when it is used for drinking, washing, and food preparation.
- b. Although many agents hydrolyse in water, this is not satisfactory as a method of decontamination. Arsenical agents leave degradation products which are toxic even when hydrolysis is complete. The appearance of water does not indicate contamination, and any water exposed to high concentrations of vapour, or any liquid contamination must be regarded as toxic until tests have been made.
- c. Open water sources subjected to chemical attack should be considered contaminated until tested. Water from deep wells will be safe provided that the well mouth is covered. Water in closed metal tanks will be safe provided that the tap and air inlet are decontaminated. Table 12-III gives the maximum allowable concentrations for certain agents in accordance with Stanag 2136.

Table 12-III. Maximum Allowable Concentrations of Agents in Drinking Water

Agent	Maximum Allowable Concentration (mg.l ⁻¹) consumed at 5 litres per day for not more than 7 days
Mustard	0.2
Nerve agents	0.02*
Arsenic	0.3
Cyanogens	6.0
* Many water testing kits are not sufficiently sensitive to detect nerve agent at this concentration.	

1212. Monitoring Water.

- a. Water testing kits will detect the following agents: mustard, nerve agents (0.05 ppm only), arsenic, antimony, cyanogen agents, other heavy metals (lead, copper, mercury). Water with a pH less than 3 is condemned since this high acidity may be due to contamination with mustard, but if free chlorine is present throughout 30 minutes mustard will be destroyed. Chlorine in excess of 5 ppm will, however, interfere with the testing and should be reduced (e.g., with thiosulphate).
- b. The water testing kits will not detect mental incapacitants, biological agents or nuclear fallout.

1213. Decontamination of Water.

Simple boiling is not a reliable method of decontamination. The following methods are available for decontaminating water and may be used in combination:

- a. *Filtration.*
 - (1) In a small scale emergency, water may be decontaminated by running it through a spare unused respirator canister, provided that the flow rate is such that the water emerges drop by drop; any water coming through at first faster than this should be discarded. No more than 5 litres should be filtered with one canister. *The canister cannot be used on a respirator after being used for this purpose.*
 - (2) On a larger scale, a modified water purification unit in which the kieselguhr filter is supplemented by a bed of activated charcoal is under development.
- b. *Superchlorination.* Small amounts of water, in units of one litre, may be superchlorinated. Simple chlorination, as is used to disinfect water from naturally occurring bacterial contaminants, is not sufficient to decontaminate water suspected of being contaminated with chemical agents.

- c. *Flocculation*. Larger quantities of water may be treated by flocculation with metal salts, after which the water is treated with chlorine.
- d. *Reverse Osmosis*. Reverse osmosis is an effective method of removing contamination, including heavy metals.