

## INDIVIDUAL TREATMENT OF DRINKING WATER IN THE CZECH ARMY

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The problem of drinking water treatment in case of emergencies has still been topical. It is demonstrated by problems with drinking water supply during the floods in East-Bohemia in 1999 and in Moravia in 1998.

Therefore, let me to inform you about the Czech Republic Army possibilities as for drinking water treatment.

Supply of a first-quality drinking water is of a great importance considering possibilities of a biological threat in endemic regions, risk of biological, chemical attack, not only during a war conflict but also during terrorist activities, environmental disasters, etc.

Another reason for importance of water supply is army participation in humanitarian action and an effort to quench thirst may result in drinking of undrinkable water and thus to endanger seriously the health status of the population and soldiers. An essential daily standard of the Czech Republic Army

is 8 litres of drinking water per person per day. The daily drinking water standard depends on climatic conditions and character of the work pursued.

Drinking water safety proves indirectly by microbiologic determination of the fecal contamination indicators. In justified cases we can supplement the investigation with a direct determination of pathogenic microorganisms. Indicators of the drinking water quality are microbiologic and biologic, physical and chemical, radiologic indicators.

Biological indices belong among the general indicators of the drinking water quality. From the microbiologic indicators we are mostly interested in the presence of fecal coliform bacteria, coliform bacteria and enterococci a positive finding indicates a fresh fecal contamination. Presence of mesophilic and psychrophilic bacteria indicates organic contamination and presence of vital and dead organisms indicates a fault in the water treatment technology function.

Drinking of undrinkable water is connected with risk to get sick by some waterborne diseases, for example, typhoid fever, shigellosis, poliomyelitis, viral hepatitis A, anthrax, tularemia or nonspecific conjunctivitis.

Compliance with standards of drinking water quantity and quality is provided in the peace-time by water supply units from the civil sector and army wells. Under emergencies (disasters, war conflict), when it is impossible to provide the supply due to destruction or an acute contamination of the water source, the Czech Republic Army is equipped with individual means (a part of the medical equipment of the individual), mobile water treatment units or supply of bottled drinking water. It was used during floods in 1998 and 1999.

It is possible to divide the present possibilities of drinking water treatment into chemical and physical methods. The water treatment using chemical means is most frequently carried out by means of halogens - chlorine, bromine and iodine, exceptionally by ozone or using oligodynamic action of metals, e.g. silver. UV radiation, 30 - minute boiling can be used from physical methods.

In case unknown or contamination water we prefer the chemical methods within the framework of an emergency, targeted disinfection of water. From chlorine disinfectants are most often used in the civilian sector Chloramin B, Sodium hypochlorite, Sagen, Savo.

Especially sodium dichlorisocyanurate, an active substance with a prompt action, has a dominant position among the chlorine preparations. This disinfectant is more stable and well soluble in water and suitable for travellers, army units. Effervescent forms are the developmental trend. This year PRESEPT was approved by the State Institute of Health for disinfection of drinking water. It is used with dosage 3-9 mg of  $\text{Cl}_2/\text{l}$  (1 tablet a 0.5 g per 83 and 28 l of water resp.) It is possible to use the water treated in this way after 48 hours.

Nowadays DIKACID in the form of small white tablets is used for individual drinking water treatment in the Czech Republic Army. DIKACID is based on sodium dichlorisocyanurate. Every tablet contains 14 mg of active chlorine. DIKACID is a part of the medical protection of the individual. But the manufacturer has not been producing that preparation any longer. A gradual decrease of the active substance content occurs due to long-term storage and impossibility of alteration. Therefore, 1.5 tablet per 750 ml of water (formerly 1 tablet per 750 ml) has been administered at present with exposure of 30 minutes.

Another disinfectant which would be use for individual treatment of drinking water in the Czech Army is SANOSIL DDW (Sanosil LTD, Switzerland). SANOSIL is the liquid in a handy dispensing flask with active compounds 1.75 % hydrogen per-

oxide and 35 mg/l of silver maximum. SANOSIL is manufactured in several sizes, 5 ml, 50 ml, 80 ml, 125 ml, 250 ml, 500 ml, 1000 ml. Dosage is 10 drops per 1 litre of water (1 drop per 0.1 litre).

The filtration methods have been successful in the last few years. It is related to development of new membranes which are able to catch of organic compound, to catch even some dissolved salts by ultrafiltration, reverse osmosis. This particular method in combination with chlorination has often been used abroad in individual water treatment. The membranes suffer from preservation, extreme temperatures and operation stops, and from fragility. Those disadvantages limit the storage and utilization in the army.

Particular principles apply for water treatment in case of emergencies. They are primary elimination of a biological risk, protection of the treated water before recontamination during transport and storage, material resistance adopted to water transport and handling. It must be apply even under extreme temperature conditions (from -20 °C to +50 °C).

Besides the possibility of individual preparation in the army is also in possession of mobile water treatment units.

1<sup>st</sup> one is mobile unit UV - 20. It is 1<sup>st</sup> class water-treatment unit with capacity of 0.02-0.05 m<sup>3</sup>/h. We have this unit in the army since 1984. The unit has capacity of 20l/h. It is a small unit with dimension 430x295x190 mm (LxWxH), with stock of the service materials for 300 l of the treated water with 1 operator and deployment 25 minutes. The chemical treatment consists in decontamination of radioactive, toxic, and bacteriological agents when using ion exchangers, adsorption on active carbon and disinfection. 100% applicability but laborious operation, incongenital sporicidal efficacy and insufficient decontamination efficacy especially toxic agents.

Another type is the water treatment unit TUF 200/TF. It is 2<sup>nd</sup> class water - treatment unit with capacity of 0.3-0.5 m<sup>3</sup>/h. It was reconstructed in 1970-76, a planned service life was till 1985. This unit has capacity of 200 l/h and deployment time 40-60 minutes. The dimensions are 760x560x800 mm (LxWxH). It has service materials for 20 hours. This unit requires 2 operators for service. During the chemical treatment there occurs disinfection, water softening and clarification, then follows filtration and finishing with calcium hypochlorite.

Mobile unit TUF is physically out - of - date, 45% applicability.

In the 3<sup>rd</sup> class a water treatment unit UV-2000 was introduced into the Czech Republic Army equipment in 1970. It is water-treatment unit with capacity of 2-4 m<sup>3</sup>/h. This unit was started in 1970 and the production shut down in 1978. Unit has capacity of 2000 l/h, deployment time 30 min and service materials for 60 hours. Unit requires 2 operators for service and has dimensions 5.54x2.0x2.45 m (LxWxH). Disinfection consists only in mechanical separation of

bacteria, therefore, chlorination with calcium hypochlorite is conducted as far as in the tank for the water transport and the control of the residual chlorine after 20 min (0.3-0.5 mg of chlorine in 1 litre of water designated for the transport).

The Czech Army has not been equipped with the water treatment units of the 4<sup>th</sup> class. Their production was closed down due to economic reasons in 1988. There is no water treatment unit for treatment of water contaminated with crude oil substances.

How are development trends for water-treatment units? Reverse osmosis technology, superchlorination in disinfection (prechlorination and dechlorination) often in combination with oligodynamic methods. Active carbon still preferred from the sorption materials. Another developmental trend is automation of operation of middle and higher capacity classes of the water-treatment units.

In the Czech Army it is essential to update water treatment units either through its own design or purchase from abroad. The Czech Army should to have at disposal a suitable water-treatment unit for utilization in humanitarian actions, emergency situations and to resolve water-treatment for the individual.

The Czech Army should continue in solving problems of the new disinfectants, devices and technologies for drinking water treatment. Simultaneously It must deal with problems of a prompt and a first-quality detection of a contaminated drinking water.

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