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CHARACTERISTICS OF RIOT CONTROL AGENT CS

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FOREWORD

This report was prepared for release to non - DOD requesters, including local and state law enforcement agencies and medical and safety personnel, in response to requests for information on the characteristics and effects of riot control agent CS.

The human subjects in the tests conducted by this installation are enlisted US Army volunteers. There is no coercion or enticement to volunteer. The most stringent medical safeguards surround every human test.

In conducting the research described in this report, the investigators adhered to the "Guide for Laboratory Animal Facilities and Care," as promulgated by the Committee on the Guide for Laboratory Animal Resources, National Academy of Sciences - National Research Council.

CHARACTERISTICS OF RIOT CONTROL AGENT CS

CS is the symbol identifying a riot control agent which has come into prominence in the last few years and is increasingly finding favor over the more familiar "tear gas" of the past. CS has sometimes been referred to as super-tear gas because of its more potent action. It is, however, an extremely safe material to use in spite of its potency. The Army made CS its standard riot control agent in 1959 and has practically replaced the previous CN tear gas in stockpiles. CS has been widely disseminated to Army and National Guard units and its ready availability through several commercial sources has placed it in the hands of many law enforcement agencies.

CS takes its name from the two scientists, B. B. Corson and R. W. Stoughton, who first prepared it in 1928. Its descriptive name in the language of the chemist is ortho-chlorobenzalmalononitrile which favors the use of the symbol. Contrary to its common name, it is not a gas but is a white, crystalline powder, similar in appearance to talcum powder. To get it to its intended target rapidly, it is dispersed as an aerosol cloud of finely divided particles. This dispersal is accomplished by blowers or bursting grenades or by burning a mixture of the powder and a fuel. Riot control hardware is designed to avoid mechanical or physical injury on the target, grenade and other dispersal devices being small and light (in one case made of rubber).

The effects of CS are impressive. CS produces immediate effects even in low concentrations. The irritating effects of the compound are felt immediately and the duration of effects is 5 to 10 minutes after the affected individual is removed to fresh air. During this time, affected persons are incapable of effective concerted action. The agent cloud causes severe burning sensation in the eyes with copious tears, coughing and difficulty in breathing with tightness of chest. The eyes close involuntarily, the nose runs, and moist skin stings.

Area decontamination is not required as CS has a short duration of effectiveness in the concentrations used in riot control operations. Personnel exposed to CS may shower as necessary. When individuals are affected by CS, they should move to fresh air, face the wind and should <u>not</u> rub their eyes. If, in handling CS dissemination devices, a person receives accidental gross contamination, he should remove clothing and flush his body with large amounts of water to remove most of the agent. If available, a 5% sodium bisulfite solution is helpful in removing the remainder of the agent.

To understand the small amount of agent required for effects, this can be related to quantities we are more familiar with. The effective concentration for the average person is 10 to 20 milligrams per cubic meter. Twenty milligrams is a quantity about one sixth the amount in an ordinary saccharin tablet. A cubic meter is about 35 cubic feet and it takes a man about 66 minutes to need that much air. This means that a man remaining in an effective cloud for 1 minute will breathe only one sixty-sixth of that one sixth of a saccharin tablet, or about one four-hundredth of the tablet.

Munitions when utilized efficiently produce concentrations which generally do not greatly exceed the effective dose. However, since unforeseen circumstances may occur in which higher concentrations are entered by individuals, it is necessary to know what the effect would be; i. e., what is the safety factor? First, it can be stated that CS has never been implicated in any death in man despite repeated use. Second, it was certified for use only after elaborate safety tests had been performed.

The physicians and toxicologists who were charged with this safety testing approached their tasks in a manner analagous to the testing of a new experimental drug. First resort was to extensive use of small rodents in carefully designed and humane experiments. Here the toxicologist determined the effect on the animal and, by gradually increasing dosages, determined the safety ratio. The investigation then extended to a number of other larger animal species to give insight into the reaction of diverse types. Lastly, the higher animals, the primates, were tested to make closer analogy to man. In these experiments, animals of different sexes, ages, and weights were used to determine the effects of these differences. Animals were given brief exposures or repeated exposures to determine this effect. In addition to observing the apparent response of the animal, clinical and pathological measurements were made to determine if unseen changes were occurring. Lastly, after combining and reviewing all these results from lower animals experiments, since there were no contrary indications of toxic effects, volunteer men were tested to determine their response to the experimental chemical. It is obvious that volunteers were not given a dose much higher than an effective dose. The toxic dose level for the experimental animals can be used to estimate the safety factor for men.

The results of this extensive testing attest to the safety of CS. The combined data for mice, rats, guinea pigs, rabbits, dogs, and monkeys were used as the lethal estimate for men, despite the fact that this value ignores the more resistant swine, goats, sheep and burros. On this basis, a 2600 safety factor is provided. This means at least 2600 times as much as is required to affect man would be required to be fatal. If the swine, goat, sheep, and burro data were included, the safety factor estimate would rise to 15,000. This indicates that it is extremely unlikely that in field use lethal concentrations could ever be present.

Even more confidence in safety of CS has been developed from further toxicological studies. For example, monkeys and goats, ill with pneumonia, were not adversely affected by high concentrations of CS. Also, rats and dogs exposed for 5 weeks to repeated doses of CS showed no significant effects as shown by gross pathological examinations. Repeated exposures did not seem to make the animals more sensitive. To evaluate effects on the eye, CS was dropped in rabbits eyes. Only a temporary conjunctivitis resulted with no corneal damage. Finally, the response of men over 50 years of age or having medical histories of allergies, hypertension, jaundice, or hepatitis did not differ from that of young, healthy volunteers.

In summary, CS has been subjected to testing of a type typical for a new drug or medicine. These results, coupled with extensive field use, show CS to be a highly effective riot control agent, fast acting, psychologically feared, but with a safety factor that makes the probability extremely low that lasting effects or death will come from its use in riot situations.