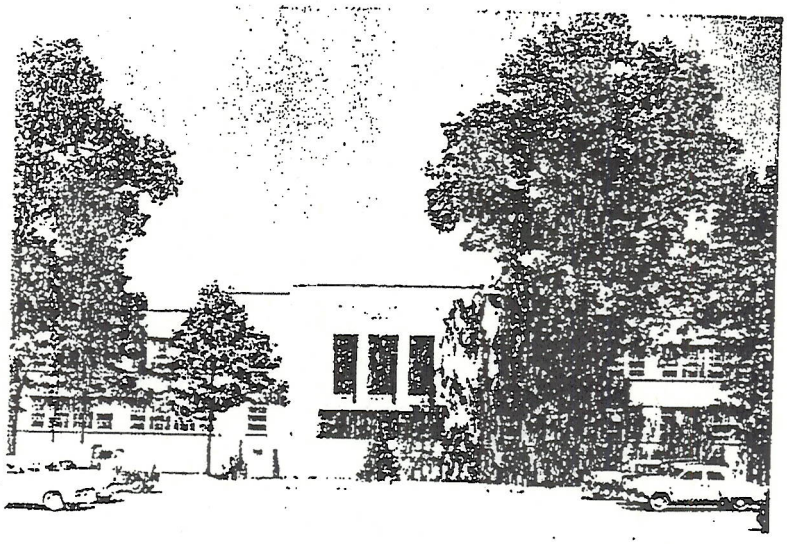
~~SECRET~~
UNCLASSIFIED

CRLR 419

SIGNIFICANT ACCOMPLISHMENTS F.Y. 54



CML C CHEMICAL AND RADIOLOGICAL LABORATORIES

ARMY CHEMICAL CENTER, MARYLAND

28 October 1954

RESTRICTED DATA
ATOMIC ENERGY ACT - 1954

UNCLASSIFIED

~~SECRET~~

SECRET

II. TOXIC CHEMICAL WARFARE.

A. Agents.

1. Agent GB.

As in fiscal year 1953, the most urgent problems facing the Chemical Corps were again those associated with the production facilities for agent GB. C&RL research and development activities related to these problems were therefore continued under highest priority. In carrying out C&RL responsibilities in this area, the following work was accomplished.

a. DMHP Process.

A continuous process for production of DMHP (dimethyl hydrogen phosphite) without internal coolant was successfully piloted under contract. Process laboratory studies on variations of methods for degassing DMHP were undertaken. Although this investigation could not be completed because of the pressure of higher-priority work, it did point out that continuous degassing at normal pressure is feasible. The results will be of value to Site A (Muscle Shoals, Ala.) production facility if the problem of stripping under vacuum cannot be solved.

C&RL Plants Division personnel were transferred to Site A on temporary duty and assisted in getting this facility in operating condition.

b. Alternative Processes.

Other processes for the manufacture of GB which are under study are the salt and the HTM (high-temperature methane) processes. Certain unavoidable delays have postponed completion of salt-process piloting. The HTM process is proceeding normally. The present status of these alternative processes is as follows:

(1) Salt Process.

According to original plans, steps I through IV of the salt process for GB production were to be piloted under contract. Steps I, II, and III were successfully piloted during this fiscal year. The contractor also accomplished some work on step IV piloting, but could not finish the job because of lack of funds. This work was therefore taken over by C&RL. Sufficient pilot-plant data have been assembled to demonstrate the practicality of both steps IV and V. However, this change in responsibility, together with

the transfer of personnel for temporary duty at Site A, has resulted in postponement of completion of salt-process piloting at least until late in 1954 or early 1955. About 10 tons of GB was produced at C&RL in the study of salt process step V.

(b)(3):10 USC 130

b(3) 10 USC 130

(2) HTM Process.

(b)(3):10 USC 130

c. Chemistry of GB.

In continuation of a comprehensive study of the chemistry of GB, a highly significant development during fiscal year 1954 was the discovery of a new detection reagent, diisonitrosoacetone (DIA). The chemistry of this substance and in particular its reaction with GB are being studied intensively. DIA shows promise of application to various types of detector items such as crayons and detector papers. Applications of this new reagent are discussed in greater detail in Section C, 1, e, New Approaches in G-Agent Detection.

Two further developments in the chemistry of GB which are of interest to the field of detection are (1) a study of the reduction of G agents to phosphine and identification of this substance, and (2) investigation of the application of the Schoeneman reaction to a potentiometric detection of GB. The first of these investigations showed promise in the laboratory, but has not yet proved practical for adaptation to field use. The second has given good preliminary results and may develop into a practical system for an automatic field analysis device.

Study of reactions whereby hydrolysis of GB is hastened has revealed several α-keto-oximes and aldoximes which are quite reactive. Further, it has been found that GB hydrolysis is markedly catalyzed by certain metal ions, e.g., cupric and uranyl, and some chelates containing them. Under some conditions the chelated ion was found to be more active than the nonchelated. It is believed that chelation achieves this effect by furnishing a more soluble active metal complex. Materials of this type have interest as possible decontaminants for agent GB.

In addition to routine analytical work, research on new and improved methods applicable to GB production and to the newer experimental agents was carried out. Of particular interest are conductivity methods for monitoring step III, DMHP process, and step IV, salt process.

Study of the thermochemistry of intermediates and reagents related to the preparation of GB was continued. This work is required for more complete understanding of the reactions of these substances.

2. Persistent Agents.

The Advisory Committee on New CW Agents made the following recommendations on persistent agents early in the fiscal year:

a. On persistent agents which may present a hazard by inhalation.

(b)(2) HIGH

b(2) hig

b. On persistent agents of such low volatility that they present no vapor hazard.

(b)(2) HIGH

(2) hig

b(2) high

(b)(2) HIGH

3. Agent Mixtures.

The study of mixtures for possible use under cold weather conditions was continued. Pertinent physical data were reported for the following mixtures:

37% HD	63% L
30% HT	70% methyl mustard
20% HD	80% GB
35% HD	65% GB
50% GB	50% CX (phosgene oxime)
38% AC	62% CK

Several mixtures of GB and L

(b)(2) HIGH

In cooperation with Medical Laboratories, work is in progress on study of GB additives which will change the physical or toxicological properties in some desired way, e.g., reduce the vapor pressure, enhance percutaneous toxicity, enhance penetration of clothing. Medical Laboratories have noted an enhancement of GB percutaneous toxicity in mixture with xylene and with kerosene and other petroleum fractions. The physical chemistry of these mixtures is under study in these Laboratories.

Studies on GB thickened with 1% of high-molecular-weight methyl methacrylate polymer showed this mixture to be stable for at least a year at ordinary temperatures. Although the agent itself was not affected, the viscosity of the mixture was destroyed on storage at 71°C. Mixing time for this thickener is excessive, and studies on possible means of decreasing this time are now under way. Preliminary experiments using cellulose nitrate as thickener have given promising results. Although 4% to 8% of this reagent is re-

quired to thicken GB to the same extent as 1% of methyl methacrylate polymer, mixing time is reduced 10 to 20 fold. The GB-cellulose nitrate mixture appears to be stable at ordinary temperatures for at least 2 wk.

4. New Agents Search.

The Advisory Committee on New Agents continued its work of correllating the activities of Research and Engineering Command, Medical Laboratories, and Chemical and Radiological Laboratories in the field of new candidate chemical warfare agents. Since questions of dissemination of agents frequently arise during the discussions of this committee, membership representation was extended during fiscal year 1954 by inclusion of a representative from this field. Aside from its usual work on toxicity, chemical structure, and mechanism of toxic action, the committee spent considerable time on the study of candidate persistent agents related to GB (see Section A 2, Persistent Agents, p. 4).

C&RL and its contractors submitted about 117 compounds to the Medical Laboratories for toxicity screening. Of these, 90 were synthesized by C&RL or under contract, and other outside sources submitted the remaining 27 compounds. Results of screening tests were returned to these Laboratories on 88 experimental compounds. The screening tests indicated that 24 of the tested substances, most of which were prepared by these Laboratories and associated contractors, were sufficiently toxic to merit further study.

In devising the synthetic program which resulted in the preparation and testing of the above-mentioned compounds, increased emphasis is now being placed on the study of naturally occurring toxics and synthetics suggested by the structure of these substances. Further, the newer concepts of the actions of hormones, vitamins, enzymes, and other metabolites are being applied to this study to the extent possible. Medical Laboratories associate closely with C&RL in this work by furnishing the toxicity screening program and biochemical studies on the mechanism of toxic action. These projects are essential to the successful prosecution of the new agents program.

b(2) high

During the current fiscal year, the following specific subjects were under investigation in the search for new agents: fluorine compounds, boron compounds, metal chelates, indolethylamine derivatives and other lysergic acid diethylamide (LSD) fragments, homologs and analogs of tetrahydrocannabinol, homologs and analogs of mescaline, Amanita muscaria, carbamates, bis-quaternary compounds, and fish poisons.

Progress during the year on these topics was briefly as follows: The synthesis of new fluorine compounds is being carried out; the field is believed to offer promise, but as yet has yielded no substance of definite interest. The work is continuing. Sufficient work has been done here and in England on esters of boron-containing acids somewhat analogous to G agents to