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Subcommittee Report "V"

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF, CHEMICAL CORPS
Chemical Corps Technical Committee
Army Chemical Center, Maryland

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17 February 1948
Revised 16 Apr 48
& 18 May 48

CMLWH

SUBJECT: Classification of Quick-Acting, Nonpersistent Agent, GB, as a Substitute Standard Type

TO: The Chairman, Chemical Corps Technical Committee

1. References:

- a. Intelligence Div Report No. 3709, Hq, ETO, CWS, CLOS, 28 Apr 1945.
- b. British Intelligence Objectives Subcommittee Final Report No. 138, Item 8, "Interrogation of German Medical Personnel", aug-Sep 1945.
- c. Monthly and Quarterly Progress Reports 1946, Medical Div, Cml C.
- d. Safety Memo on G Series Compounds from C, Med Div, Cml C, to all Branch and Section Chiefs, dated 13 Aug 47.
- e. TDMR 1292, Memo Report, "Physical Constants of the G-Series Compounds", EA1210, EA1211, EA1213, EA1214.
- f. Monthly and Quarterly Progress Reports, 1946, Tech Cmd, Cml C.
- g. TDMR 1346, A Memo Report, "Storage Stability in Steel at 65°C. of Pure GD Corrosion Rates of Steel at 65°C."
- h. MDR No. 127, "Toxicity, Stability and Protective Studies of GA."
- i. TDMR 1316, "Protection Afforded by Gas Mask Canisters, Agent GB".
- j. Report, "A New Reaction For the Detection of Metalloid (Non-metal) Labile Halogen Linkage", Dr. Schoenemann, Spandau, Germany, 29 July 1944.
- k. TDMR 1307, A Memo Report, "analysis of GA by the Metalloid Halogen Reaction".
- l. TDMR 1335, A Memo Report, "Development of Test Methods for the Determination of Penetration of G Agents Through Impermeable Clothing."
- m. Technical Command Chemical Corps, "Safety Memo on G Series Compounds", ACC, Md.
- n. TCIR No. 393, "The Hydrolysis Rate of G Agents".
- o. Porton Technical Paper No. 25, "German KC III Gr Bomb Charged GA. Programme 42/46 Dropping Trial With Impact Fuzing."
- p. Porton Technical Paper No. 35, "Tests of GA Filled German KC 250 III Gr Bomb, Second Static Trial."

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1. References continued:

- q. TCIR 382, "Observations on GA Field Trials, 1 Through 6, Inclusive, Single Munition Static Tests of Bomb, Chemical, 115-lb., E46, Charged GA."
- r. TDMR 1138, "The Synthesis of Cyanodimethylaminoethoxyphosphine oxide."
- s. TDMR 1176, "MCE Process Development."
- t. TDMR 1354, "Development of a Manufacturing Process for GB, A Status Report."
- u. Note, CCS 883/10, Combined Chiefs of Staff, 21 Aug 1946, Subject: "Policy on Security Classification and Dissemination of Information Concerning German War Gases."
- v. CWTC Item 1573, 16 Jan 1946
- w. British Military Intelligence Division WDGG Report No. R370-46, dated 30 Jan 46, "Translation of a Top Secret German Document Dealing with Sequence of Development of the German Agent Trilon 83 (Tabun)."

2. Discussion:

a. Reference a. and b. report in great detail on information first obtained near the end of World War II that the Germans had developed a new group of quick-acting, chemical warfare agents classified as organo-phosphorous compounds. Of these, GA is identified as cyanodimethylaminoethoxyphosphine oxide, German code name, Tabun, which had been produced in large quantity and used for filling 250 kg. bombs, 10.5 cm and 15 cm shells. Only 1000 lbs. of GB, which is identified as fluoroisopropoxymethylphosphine oxide, German code name, Sarin, had been produced in a pilot plant although it was recognized that this agent is superior to GA from the standpoint of volatility, stability, and toxicity. Reference w. contains the following significant statements on GA: "From many observations made during the development work it is concluded that man reacts to GA in a manner very similar to that of animals.....it is the first gas introduced which damages the central nervous system and produces effects which, when seen, might well produce panic among the unaffected soldiers. This war gas has, therefore, an added morale effect". The Germans also had determined that the closely related compounds, GD, fluoromethylpinacolyloxyphosphine oxide; GE, ethylfluoroisopropoxyphosphine oxide; and GF, cyclohexoxyfluoromethylphosphine oxide, are of the same order of toxicity and effectiveness. Reference v. identifies the Technical Committee action whereby the symbols for these G-series agents were formally approved.

b. Reference c. contains the results of continuous research on the medical aspects of these compounds. As will be noted from some of the data summarized in paragraph 2.d., the G-series agents are all much more toxic than other standard chemical warfare gases either by

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2.b. Discussion continued:

inhalation of the vapor or application of the liquid to the skin or eyes. Another very important property of these compounds is the relatively short time required to produce serious physiological effects and death which are results almost directly proportional to the effective concentration. However, for purposes of generalization it may be said that all of these agents in lethal concentrations will cause death within an hour from the time of exposure. In the body these agents deplete the protein enzyme cholinesterase. Complete recovery from a non-fatal exposure may require from 3 to 14 days although during this time exposure to normally sublethal concentrations may prove fatal.

c. Exposure to G-series agents results in the following symptoms which may or may not develop in the following order:

- (1) Constriction of the pupils of the eyes
- (2) Headache
- (3) Sensation of tightness of the chest
- (4) Asthmatic breathing
- (5) Abdominal cramps
- (6) Vomiting
- (7) Diarrhea
- (8) Skeletal muscular twitchings
- (9) Weakness
- (10) Hallucinations and depression
- (11) General nervous hyperexcitability progressing to convulsions

Death may be due to central and peripheral respiratory and possible vasomotor failure. Whether the hallucinations and other mental effects are of direct toxic or indirect psychological origin remains to be determined. In any case there is strong support for the German conclusion that the psychological effects for GA will be great and even greater for GB. Reference d. indicates details concerning the treatment of personnel exposed to the compounds of the G-series. In contrast to treatment for casualties from exposure to most other agents, treatment for exposure to the G agents must be initiated within a few minutes in order to be effective. The most effective therapeutic agent is atropine administered intramuscularly. This may protect against lethal doses if used within five minutes of exposure and will return many incapacitated casualties to the ambulatory stage. On the battlefield, atropine should be in the soldiers' hands if prompt treatment is to be given. Atropine is a powerful drug which makes its use hazardous since improper usage may result in further casualties.

d. The following data for three members of the G-series and the standard agents, distilled mustard, HD; phosgene, CG; and cyan-

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2.d. Discussion continued:

genchloride, CK, are taken from references c., e., and f. and show comparative physical toxicological characteristics?

Agents	GA	GB	GE	HD	CG	CK
Formula weight	162.3	140.1	154.1	159.0	98.9	61.5
Freezing point °C.	-50	-58	<-50	14.45	-104	-6.7
Boiling point °C.	246	147	162	228	8.3	12-15
Volatility mg/l at 30°C.	0.86	23	17.8	1.38	8640	4646
Hydrolysis rate: Half life, hours	6	36	64	8 min.	very rapid	hydrolyzed slowly
Toxicity L Ct 50 total exposure for 10 minutes mg min/m ³ of:						
Pigeon ---	300	61	99	1660		
Mouse ---	535±5	379	553	1200	3650	14000-20000
Rabbit ---	960±290	115	308	1025		
Rat ---	450	295	340	850	2000	13500
Toxicity LD50 mg/Kg body weight						
ocular (conjunctival) Rabbits ---	0.17	0.03	0.1	Blinding but not lethal		
Percutaneous for						
Pigeons ---	19.7					
Rabbits ---	3.3	4.7	3.0	10-15		
Odor	faintly fruity	scarcely detectable	faintly fruity	garlic	new mown hay	burning sensation
Median Detectable conc. mg/m ³	2.2	high		0.6 H 1.6 H purified	4.4	12
Man, Inhalation Toxicity, L Ct 50 mg/min/m ³ (Estimated: low reliability)	(b)(2) HIGH					

b(2) high

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2.k. Discussion continued:

of GB which warrants its classification at this time as a Substitute Standard type in anticipation of the solution of production and dispersion problems for other members of the series which are also under development and for which eventual standardization is anticipated. In this connection it should be stated that the first four steps in GB production may be utilized for GD and GF and that three steps may also be used for GE manufacture so that a solution of the plant production difficulties encountered with GB will facilitate a solution of the problems connected with other members of the series. In order that the complete development of these candidate agents be expedited, the proposed action is recommended at this time in order to provide the necessary intermediate compounds for study and at the same time make available for continued testing, and combat use if this should ever be deemed necessary, the most effective agent of the series that is now available. A production directive for GB is in process of preparation and it is considered that this agent is fully ready for classification on the basis proposed above.

1. In accordance with WD Memo 850-25-10, dated 30 Sep 47, the following pertinent information is listed with reference to the proposed classification action:

- (1) GB is an expendable item to be used for filling munitions. For planning and classification purposes GB is considered a substitute standard agent for CK.
- (2) GB is not a commercial item.
- (3) Estimated unit cost with present facilities is \$8.00 per lb. An estimated cost of \$1.00 to \$2.00 per lb. is eventually anticipated.
- (4) This agent meets the military characteristics such an item should possess with the exceptions so noted.
- (5) No special "battlefield" requirements are involved.
- (6) Procurement status:
 - (a) Procured - 300 lbs.
 - (b) On hand - 250 lbs.
 - (c) On contract - 0 lbs.
- (7) This agent is intended for procurement when funds and facilities are available.
- (8) No funds are presently available for procurement; however, \$96,000 are available for Phase I production planning studies pending classification action.

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2.1. Discussion continued:

- (9) Sufficient facilities for peacetime and wartime production do not exist at the present time. The studies of par. (8) are the initial steps to provide such facilities.

(b)(2) HIGH

b(2) high

- (11) No special steps are needed for the training of specialists except that extra care and precaution must be taken when handling this agent. Manufacturing problems will require that extreme care and precaution must be exercised.

- (12) Training literature is available as noted in Dept of the Army Circular 74, "Chemical Agents of the G-Series", dated 19 March 1948.

- (13) Security classification: See paragraph 3.e. below.

3. Recommendations:

It is recommended that:

- a. Quick-Acting, Nonpersistent Agent, GB, be classified as a Substitute Standard type.
- b. GB be further classified as a Class V, authorized, essential item of current supply.
- c. The Chemical Corps be charged with the preparation of the specification, determination of requirements, provision of funds, purchase, storage, issue, and maintenance of the subject agent, GB.
- d. The use of GB as a munition filling be authorized by subsequent action based on more detailed studies.
- e. GB itself be classified as a Restricted item; that the symbol, GB, when used alone be Unclassified; that the symbol, GB, when used in conjunction with the chemical name or formula of this item be classified Secret; and that all other security classification pertaining to this agent be in accord with the provisions of the OCS directive identified as reference u.

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Concurrence Signature Record

/s/ J. F. Babcock, Lt Col, USAF Deputy Air Cml Officer	/s/ C. F. Filter, OQMG
/s/ R. E. Sims, Lt Col, USAF for Brig Gen Coupland, Air Ord	/s/ L. A. Nickerson, Signal Corps
/s/ D. J. Munson, Lt Col, R&D Div, USAF	/s/ J. W. Koletty, Lt Col, TC
/s/ R. E. Johnson, Col, Cml C Field Chemical Officer	/s/ W. O. Krause, Maj, MSC (SGO)
/s/ W. Fultz, Lt Col, OCAFF for Col Klepinger, GSC, AFF	/s/ L. M. Swanson, Bu Aero, USN
/s/ D. R. King, Col, Cml C, Mgmt O.	/s/ W. J. Barry, Cmdr, Bu Ord, USN
/s/ T. H. James, Lt Col, Cml C, Insp Div	/s/ P. M. Curran, Capt, Bu Ships, USN
/s/ W. A. Guild, Col, Cml C, PT&I Div	/s/ J. J. Cassidy, Cmdr, USN Bu Yds & Docks
/s/ L. F. Walsh, S&P Div, OC-Cml C	/s/ E. A. Ramskill, Naval Research Lab
/s/ R. A. Bergseth, S&P Div, OC-Cml C	/s/ E. L. Claussen, C of E
/s/ J. A. MacLaughlin, Col, Cml C Cml C Technical Command	/s/ J. M. Gray, PMGO-CMP
/s/ O. Woolpert, Biol Div, Cml C	/s/ J. T. Willis, Lt Col, Inf National Guard Bureau
/s/ J. H. Defendorf, Col, Cml C Medical Div, Cml C	/s/ C.H.M. Roberts, Col, Ord
/s/ I. B. Morgan, R&E Div, OC-Cml C	/s/ E. H. Lewis, Major, Cml C R&E Div, OC-Cml C
/s/ R. L. Fox, Cml Research Br R&E Div, OC-Cml C	/s/ A. H. Williams, Major, Cml C S&P Div, OC-Cml C

ACCEPTED BY THE CHEMICAL CORPS
TECHNICAL COMMITTEE, 3 May 1948:

/s/ T. S. Eckert
Secy, CCTC

APPROVED FOR THE CHIEF,
CHEMICAL CORPS, 24 April 1948:

/s/ Charles E. Loucks
Colonel, Cml C
Chairman, CCTC

APPROVAL BY GSUSA REPRESENTATIVES IS RE-
QUIRED IN ORDER TO COMPLETE THIS ACTION.

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