

Annex F. Candidate vesicants and irritant compounds tested during World War II.

F.1. Introduction

During World War II many miscellaneous compounds were tested to see if they offered alternatives to established agents. Candidate vesicant compounds were assessed by the "vesicant power test" (see Chapter 17) in which a small drop of the compound was placed on the arm of a volunteer and the skin reaction noted. Many hundreds of volunteers took part in these tests. Vesicant power tests of variants and mixtures of established vesicants are described in Chapter 17. Section F.2 of this annex lists the miscellaneous compounds which were tested. The names used are those shown in the experimental records. Sometimes the compounds are grouped together in the list at Section F.2, which reflects the groupings in the experimental logs. Miscellaneous compounds which were tested as vesicants but induced no skin reaction at all do not appear on the list.

Various alternatives to established harassing agents were tested as well. The nature of the test was to put up low concentrations of a compound in the chamber and the effects induced in volunteers would be noted. Mixtures and chemical analogues of established harassing agents were tested in this way and those tested with Service volunteers are covered in Chapter 17. Section F.3 of this annex deals with harassing compounds which were tested with volunteers from the Porton staff. It is split into three sections:

- tests of established harassing agents, and mixtures/chemical analogues of them;
- tests of miscellaneous compounds as candidate harassing agents;
- tests at low concentrations of established vesicants to explore their harassing effects.

The final list, in Section F.4., covers the miscellaneous compounds tested as potential irritants in chamber tests with Service volunteers.

F.2. Miscellaneous compounds tested with Service volunteers as candidate vesicants.

Methyl mercuric nitrate 50/50 in water	
bis (β - chlor-ethyl) arsenious chloride	α chloromethyl-n- β dichloroethyl piperidine hydrochloride
2 chloropropyl 2 chloroacetyl sulphide	di β chloroethyl phenyl dithioarsenite
Tri(dimethylaminophenyl) arsine, Di-(p-methoxyphenyl)-chlorarsine	$\alpha\alpha$ dichloro dimethyl sulphide
Methyl β -chloracrolate	Chloracetal
Pure sulphuric acid	chloroethyl 2 chloro n propyl sulphide, di β chloro-n-propylthio-ethane
β diethylaminoethyl chloride, dichlor-dimethyl ether	sap of wild parsnip
cacodyl selenide	dichloro formaldoxime
$\beta\beta$ -dibromo-di-allyl-sulphide	chlorobenzyl thiocyanate, chlorophenyl thiocyanate
$\beta\beta$ -dichloro dipropyl sulphide	β chloroethyl sulphides
β -dibromodivinyll sulphide	Bromo acetyl bromide
diphenyl chlorostibine	bis 2 3 epoxy-propyl sulphide
phenyl stibine dichlorides	bis-(β chloroethylthio)-phosphine

trichloro acetaldoxime, trichlorotrimethyl phosphine, trichlorotriethylamine metho chloride, N chloroacetyl dichlorodiethylamine tribromo triethylamine hydrobromide, tri-β-chloroethyl-thio-ethylamine hydrochloride, tribromotriethylamine

thienylarsine dichloride, di-thienyl arsine chloride, tri-thienyl arsine

ethyl dichloro stibine, methyl dichloro stibine, diethyl chloro stibine.

selenium monochloride, selenium monobromide, n-selenovaleraldehyde, diselenoacetone, seleno-mono-acetophenone, benzyl selenocyanate.

chloromethyl β chlorovinyl ketone, bromomethyl β chlorovinyl ketone, chloromethyl β bromovinyl ketone, dichloromethyl β chloroethyl ketone, dichloromethyl vinyl ketone.

ethyl difluoroarsine, methyl difluoroarsine, ethyl dichloroarsine [ED].

furyl-chloro-arsine, difuryl-chloro-arsine, trifuryl-chloro-arsine.

p-phenylene arsine stibine tetrachloride, lewisite-dioxan, arsenic chloride-dioxan, arsenic chloride-thioxan.

β chloroethyl di 3 chloro N propylamine, di β chloroethyl β chloro N propylamine

chloroacetaldehyde cyanohydrin, 3-bromo-crotonitrile, tetra bromo diethyl sulphone, di bromo vinyl sulphone, 2 chloro di bromo diethyl sulphone, 2 bromo vinyl sulphone, 1 4 dithian-1-hydroxy etho chloride

3 3 dichloropropyl sulphone, T4, T5, di-(β chloroethyl-thio) methane, 1 3 di (β-chloroethyl-thio) propane, 1 4 di (β-chloroethyl thio) butane, tri-(2 chloroethyl thio) arsine, di-(2 chloroethyl thio)-2 chlorovinyl arsine, tetrachloro diethyl sulphide.

2-chloroethylthiobromoacetate, 2-chloroethylthiochloroacetate

laccol, 1 8 di (β chloro ethylthio) octane 1%, 1 9 di (β chloro ethyl thio) nonane, 1 10 di(β chloroethylthio) decane.

N-nitroso N-carbomethoxy β chloro β amino diethyl sulphide, N N di β chloroethyl piperazine.

F.3. Chamber tests with volunteers from the Porton staff.

F.3.1. Established harassing agents and mixtures/chemical analogues of them

BBC

KSK

DA, o-chloro DA, DA oxide

DM, DM and CN

DC, DC and deccane, 2:4 dimethyl DC, DC and benzocaine, 2-chloro-4-methyl DC, DC and di(phenoxy β hydroxypropyl) piperazine, DC and diethylamino β hydroxypropoxy-3-butoxybenzene, 3:3 di amino DC,

CN, p-amino-w CN, m-amino CN, o-acetamino CN, m-chloroacetylamino-w-CN, o-nitro CN, m-formylamino CN, 3:5-di amino-w-CN, p-propionamino-w-CN, n-valerylamido-w-CN, p-laurylamido-w-CN, p-undecenoyl-w-CN, p-myristlamido-w-CN, p-stearyl amino-w-CN, p-β-chloropropionamido CN, 2-chloro CN

F.3.2. Miscellaneous compounds tested for irritancy

α α furane dimercuric chloride

ammonia

β bromo ethyl diethylarsine

α-chloro-crotonaldehyde

arsanthrene cyanide

β chlorovinyl dichloro stibine

α difuryl dichloroarsine

arsenic chloride-dioxan compound

β chlorovinyl dithio phenyl arsine

α furyl mercuric chloride

arsenic trifluoride

β chlorovinyl diethylarsine

β chlorovinyl furyl chloroarsine	diphenyl stibinous oxide	m-cyano phenyl stibinous chloride
β chlorovinyl furyl cyano arsine	diselenoacetone	m-phenylene diarsine tetrachloride
β naphthyl stibine dichloride	dithienyl-arsine-chloride	m-tolyl selenocyanate
benzaldehyde-m-stibinous chloride	di-m-amino diphenyl stibine oxide	nitro isobutane
benzoyl fluoride	di-m-amino phenyl stibine hydroxide	n β -hydroxy ethyl thiazan dioxide hydrochloride
benzyl selenocyanate	di (p methoxyphenyl) chlorarsine	n bromoacetyl-carbazole
bromine trifluoride	di-p-nitro phenyl stibinous chloride	n bromomethyl phthalimid
bromoacetone	dithienyl arsine acetate	n-butyl dibromo lead
bromomethyl ethyl ketone	dithienyl chloroarsine	n iodoacetyl-carbazole
bromomethyl naphthalene	dithienyl cyanoarsine	n iodomethyl phthalimid
bromoethyl vinyl ketone	ethyl bromoacetate	1-bromo methyl naphthalene
carbon diselenide	ethyl chloroformate	1-nitropropene
chlorine trifluoride	ethyl difluoroarsine	osmic acid
chloroacetyl carbazole	ethyl difluoroarsine	osmium tetroxide
chloro-iso-nitroso-acetone	5-chlorostibacarbazole	o-chlorophenyl selenocyanate
chloromethyl vinyl ketone	formaldehyde	o-chlorophenyl thiocyanate
chloromethyl sulphonyl chloride	iodine	o-nitrobenzyl selenocyanate
cyano formyl chloride	menthol	o-phenyl selenocyanate
cyanogen diselenide	methyl- α -bromo ethyl ketone	o-phenyl α thienyl chloroarsine
cyanogen fluoride	methyl arsine disulphide	o-phenylene diarsinoxychloride
di α furylchlorarsine	methyl bromoacetate	phenoxarsine chloride
dibenzarsenole chloride	methyl-di (β chloromethyl) amine hydrochloride	phenoxarsine oxide
di (β dichloroethyl) ethyl arsine	methyl-di (β chloroethyl) amine	phenyl- α -naphthal cyanarsine
di- β -naphthyl chlorostibine	methyl difluoroarsine	phenyl β naphthyl cyanoarsine
dibutyl lead dichloride	methyl dimethoxy arsine	phenyl-p-tolyl cyanoarsine
dichlorodimethyl ether	methyl-di-(chloromethyl) arsine	p-anisyl selenocyanate
diethyl amino ethyl chloride	methyl difuryl arsine	p-benzyloxyphenyl selenocyanate
diethyl lead chloride	methyl dithiomethoxyarsine	p-carbethoxyphenyl stibinous chloride
diethyl tin dichloride	methyl dithiophenyl arsine	p-chlorophenyl stibinous chloride
diethyl tin chloro cyanate	methyl fluoroacetate	p-cyano phenyl stibinous chloride
difuryl cyano-arsine	monochloromethyl ether	p-nitrobenzyloxy phenyl selenocyanate
diphenyl- α furyl stibine	m-acetyl phenyl stibinous chloride	p-phenethyl selenocyanate
diphenyl- α thienyl stibine	m carbethoxy phenyl stibine dichloride	p-phenoxyphenyl stibinous chloride
di phenyl chloroethyl thio arsine	m-chloro phenyl thiocyanate	
diphenyl methoxyarsine		
diphenyl stibinous acetate		
diphenyl stibinous formate		

p-phenylene arsine stibine tetrachloride	triethyl lead acetate
p-phenylene diselenocyanate	triethyl lead bromide
p-tolyl stibine dichloride	triethyl-lead-chloride
succinic anhydride	triethyl lead chloroacetate
10 chloro-9:10-dihydro-arsacridine	triethyl lead crotonate
10-chloro-2 methyl-phenoxstibine	triethyl lead cyanide
10-cyano-5-10-di hydrophenarsazine	triethyl lead monobromoacetate
tetraphenyl tin	triethyl lead p-toluene sulphate
thienyl α α dimercuric chloride	triethyl tin chloride
thienyl phenyl chloroarsine	trithienyl-arsine
thienyl phenyl cyano arsine	tri-m-amino phenyl stibine
3-bromo-crotonitrile	tri-m-propyl lead benzene sulphonamide
tri α furylarsine	2-chloroethyl thiobromo-acetate
triethyl-arsine-dichloride	2.2.4 trimethyl cyanoarsine
	zinc chloride

F.3.4. Established vesicants tested for irritancy

Methyl dichloroarsine (ED), Lewisite, Lewisite and dioxan, phenyl dichloroarsine (PD)

F.4. Miscellaneous compounds tests with Service volunteers as candidate irritants.

diphenyl chlor bismuthine	2:w-dichloro-4-methyl acetophenone
triphenyl bismuthine	2:w-dichloro-5-methyl acetophenone
Uranium hexafluoride	4:w-dichloro-3-methyl acetophenone
10-chloro-9:10-dihydro stibacridine	bromophenyl acetone
diphenyl methane-o-stibinous chloride	o-chloro benzyl thiocyanate
2-chloroacetyl p-cresol	m chloro benzyl thiocyanate
phenyl difluoroarsine	chloroacetyl urea
Nitroso methyl urethane	2:6 dichlorobenzyl chloride
p-thiocyano phenyl stibinous chloride	2-methyl-5-cyano-5:10-dihydroarsacridine
5 cyano-5:10-dihydroarsacridine	ammonium vanadate
tetrachloride dinitroethane	nonoyl vanillylamide
tetrachloride dinitroethane	undecenoylvanillylamide
dichloroformaldoxime	1:1-dibromo-1-nitropropane
diphenyl fluorarsine	1-bromo-1-nitropropane
dimethyl fluorarsine	1:1:1-trichloro-3-nitro-2-17-butene
phenyl azide	

1-nitro-propylene-1

chloracetyl cresol

methane sulphochloride

1-nitropropene

ethyl chloroformate

α bromo acrylic nitrile

Iodo acetonitrile

chloromethyl 1 2 2 trichloroethyl ketone

Bromoxylcyanide

chloro-iso-nitrosoacetone