Technical Data Bulletin

#152 (Revised, March 2002)

Test Criteria for the 3M™ Canister FR-C2A1 Against Various Military and Industrial Chemical Agents

3M's FR-C2A1 canister has been tested against military and NIOSH protocol and found to be effective against a number of different chemical warfare agents and industrial chemicals (see testing footnotes below).

The FR-C2A1 canister contains a P100 filter to remove solid and liquid aerosols. It also contains activated and impregnated carbon to absorb or react with gases and liquid vapors. Air purifying respirators (APR) can only be used when sufficient oxygen is present and when the contaminant and concentration are known and below Immediately Dangerous to Life or Health (IDLH) limits. The maximum use concentration (MUC) in which an APR can be utilized is the product of the assigned protection factor (APF = 50 for a quantitatively fit tested full facepiece respirator) multiplied by the airborne exposure limit (such as TLV®). This number must be lower than the IDLH, otherwise the IDLH becomes the MUC (see columns 6 and 7).

Challenge Agent	**Challenge Concentration (mg/m^3)**	**Testing Relative Humidity (%)**	**Maximum Allowed Breakthrough (mg/m^3)**	**Meets Minimum Service Time of: (min)**	**TLV®[1] / IDLH[2] (mg/m^3)**	**Allowable Maximum Use Concentration (mg/m^3)[3]**
Sarin (GB)[4,5]	4,000	Dry	0.04	83	0.0001[6] / >0.2[6]	0.005
DMMP[4,5,7]	3,000	Dry	0.04	59	NA	NA
Cyanogen Chloride (CK)[4,5]	4,000	80	8.0	30	0.75C[8] / ND(118)[9]	37.7
Hydrogen Cyanide (AC)[4,10]	4,000	80	5.0[11]	28	5.2C[8] / 55.3	55.3
Phosgene (CG)[4,10]	20,000	50	8.0	25	0.40 / 8.1	8.1
Chloropicrin (PS)[4,12]	5,000	80	5.0	27	0.67 / 26.9	26.9
α-Chloroacetophenone (CN)[13,14]	101	50	0.32	480	0.32 / 101	15.8
o-Chlorobenzylidene-malononitrile (CS)[13,14]	23.1	50	0.39	480	0.39C[8] / 1.9	1.9
Chlorine (Cl_2)[13]	1450	50	14.5	17.5	1.5 / 87.0	72.5
Sulfur Dioxide (SO_2)[13]	1310	50	13.1	15	5.2 / 262	262
Hydrogen Chloride (HCl)[13]	746	50	7.5	25	7.5C[8] / 149	149
Particulates (P100)[13,14]	200 mg total loading w/ 0.3µm MMAD DOP particles	NA	<0.03%	2400[15]	10 I[16] / ND 3 R[17] / ND	500 150

NA = Not applicable ND = Not Determined ppm = parts per million mg/m^3 = milligrams per cubic meter of air

1. TLV = Threshold Limit Value from the American Conference of Governmental Industrial Hygienists. ACGIH Threshold Limit Values and Biological Exposure Indices, 2001.
2. IDLH = Immediately Dangerous to Life or Health limit. NIOSH Pocket Guide to Chemical Hazards, DHHS (NIOSH) Publication No. 90-177, 1990. Although newer IDLH values have been published, OSHA stated in a May 21, 1996 Memorandum that OSHA will use the older IDLH valves while NIOSH conducts further study.
3. Assuming a tight fitting full facepiece respirator that has been quantitatively fit tested and has an assigned protection factor of 50. These values are 50 times the TLV or the IDLH limit, whichever is lower.
4. 3M respirators are not NIOSH approved for these agents. There are no NIOSH approval schedules for GB, DMMP, CK, AC, CG or PS.
5. Performance Specification, Canisters Chemical-Biological Mask: C2A1 MIL-PRF-51560A(EA)
6. TLV and IDLH limit values have not been established for GB. The values listed for GB are the airborne exposure limit and the limit for which an SCBA is the only acceptable respiratory protection. The Office of the US Army Surgeon General (OASG) established these values.
7. DMMP is a common surrogate or simulant test agent for the nerve agent sarin (GB). TLV and IDLH limit values have not been established for DMMP.
8. C = Ceiling Limit refers to the concentration that should not be exceeded during any part of the working exposure without respiratory protection.
9. There is no actual IDLH value for CK. The NIOSH Pocket Guide to Chemical Hazards lists the value for "Cyanides as (CN)" as 50 mg/m^3, so multiply 50 by the MW of CK (61.47) and divide by the MW of CN (26.02).
10. Carbon, Activated, Impregnated, Copper-Silver-Zinc-Molybdenum-Triethylenediamine (ASZM-TEDA); EA-DTL-1704 applied to full canister.
11. Calculated as $(CN)_2$.
12. American British Canadian Australian Armies Standardization Program Standards for General Service Respirators/Masks for the Timeframe 1985-2005 – Second Draft QSTAG 695.
13. Testing criteria from NIOSH testing methods tables, 42 Code of Federal Regulations, Part 84.
14. These approvals are available for tight fitting, air-purifying respirators only.
15. If used in oil aerosol environment, dispose of respirator after 40 hours (2400 minutes) or 30 days, whichever is first.
16. I = Inhalable, Particles (Insoluble) Not Otherwise Specified (PNOS)
17. R = Respirable, Particles (Insoluble) Not Otherwise Specified (PNOS)

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