

*** MATERIAL SAFETY DATA SHEET ***

MSS SOLUTIONS (U006-009)

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DATE OF PREP: 03/01/90

Each MSS-Solution is factory preformulated and certified for purity and titre.

This document covers MSS-RED, MSS-BLUE, and MSS-YELLOW.

SUMMARY STATEMENT

This document describes the health hazards of the MSS-Solutions and their components; all must individually and collectively be considered health hazards although, as is seen in the survey below, the exposure levels even under extremely adverse circumstances are extremely low. This survey shows the actual exposure limits encountered in normal use during CON-TROL-CURE® INK CURE ANALYZER™ operations as well as those associated with accidental breakage of ten ampules at one particular instant within the laboratory environment. Specifically the document includes pertinent data on tetrabromo-ethane-C14 and trifluorotrichloroethane in MSS-RED and the minor additional amounts (5% and 10%, respectively) of chloroform which are present in MSS-BLUE and MSS-YELLOW. Less than 1% of cyclo-pentane is included within each formulation.

RADIOCHEMICAL:

Tetrabromoethane-1,2-C14 (aka Acetylene tetrabromide)

SOLVENTS:

Trifluorotrichloroethane (aka Freon 113, Fluorocarbon 113)
Chloroform (aka Trichloroethane, Methyl trichloride)
Cyclopentane (aka Pentamethylene)

MSS-SOLUTION FORMULATIONS:

MSS-Solutions are factory preformulated as follows:

Each sealed-in-glass ampule contains a liquid volume of 0.2 millileters (ml) (200 microliters - ul) of low boiling solvent (MSS-RED: trifluorotrichloroethane; MSS-BLUE: trifluorotri-chloroethane/chloroform of 19/1 ratio by volume; MSS-YELLOW: as in MSS-BLUE but of 9/1 ratio) and also tetrabromoethane-C14 at a volume concentration of ca. 100,000/1. Each ampule also contains not more than 1% of cyclopentane.

Prior to use each ampule should be upended a number of times (the contents should be permitted to flow to the other end thus preventing layering of components, shaking if necessary).

Rules for User Combining of NSS-Solutions:

Aliquot portions of these MSS-Solutions may be combined (with extreme care for cleanliness and quantity conditions) to form an intermediate level for screening purposes. Thus 100 ul aliquots MSS-RED and MSS-BLUE, when mixed thoroughly, form 200 ul of trifluorotrichloroethane/chloroform of 39/1 ratio.

NOTE: Prior to combining, the individual MSS-Solutions must be thoroughly mixed by upending and shaking to prevent layering effects due to the high density of tetrabromoethane.

It is not recommended that total ampule contents be combined with the contents of a second ampule since the nominal 200 ul quantity in each case is production packaged to be 200 +20 or -20 ul and therefore less reliable volumetrically than pipetted aliquots.

NOTE: WHEN OPERATING UNDER THE 'LICENSE EXEMPT' RULES, UNDER NO CONDITIONS MAY THE TOTAL AMOUNT OF RADIOCHEMICAL IN ANY SINGLE QUANTITY OF ANY MIXTURE EXCEED THE MAXIMAL ALLOWABLE USNRC AND/OR 'AGREEMENT STATE' LIMIT OF 100 MICROCURIES OF CARBON-14.

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SURVEY OF USE

DESCRIPTION

The amounts of C-14 labeled material (1 microCurie C14 per ampule) are classified under the EXEMPT status in Nuclear Regulatory Commission and/or 'Agreement State' rules and regulations: in general, up to 100 microCuries of C-14 within a single ampule may be possessed and used without a specific license and multiple ampules without limit may be stored in inventory. However, certain other restrictions may also apply; for example, if a Company has a specific license from an 'Agreement State' for another application, the possession and use of otherwise EXEMPT quantities MAY be required under that license or an extension thereof. Under its USNRC license to distribute EXEMPT quantities of C-14 label material, ERA Systems, Inc. cannot ship at any one time to a single destination more than a total of 1 milliCurie of MSS-Solution ampules in the aggregate. (Cf. 10 CFR 32.19)

RECOMMENDED METHOD OF USE

Ampules of MSS-Solution are designed for use in the CON-TROL-CURE® INK CURE ANALYZER only. The ampule and its contents of completely volatile chemical constituents are neither knowingly sold nor distributed nor are they authorized for any other purpose by ERA Systems, Inc. The specific uses of these and other formulations are detailed in the TECHNICAL MANUAL OF THE CON-TROL-CURE® INK CURE ANALYZER or in Application Bulletins or their equivalent supplied at various times by CON-TROL-CURE®, Inc. or by U V Process Supply, Inc.

The contents of each ampule are user deposited onto the ink test specimen in 17 microliter aliquots using the precision syringe provided. The additional quantity permits minor evaporation from the opened ampule (always stored within the equipment confines) as well as small quantities for rinsing the syringe when the MSS-Solution is changed from one formulation to another. 1989 OSHA guidelines and regulations may require use of finger cots or rubber gloves during the use of the MSS-Solutions. The exhaust fan at the rear of the instrument case is designed to run continuously during use except under actual testing conditions. The fan should be ducted to the outside or to another exhaust mechanism. Under these conditions with the transparent lid closed less than 1% of the vaporized contents escape to the laboratory environment.

Radiochemical Limits

The amount of radiochemical in each single 17 ul deposition released to the atmosphere within the enclosure is shown in the following table: (In these tables $2 \text{ E-5} = 0.00002$)

AMOUNT OF RADIOCHEMICAL RELEASED PER 17 UL DEPOSITION

	ml (gas)	uCi C14
Tetrabromoethane-C14	2 E-5	.085

Assuming a laboratory of 4 meters x 5 meters x 6 meters dimensions and 20 air changes per hour) ten tests per hour (considered the maximum number of tests possible including analysis and time for sample insertion) released and exhausted to the outside air with an minimal exhaust efficiency of 99% provides no more than the following airborne concentration within the laboratory environment:

Actual	OSHA Standards	Actual*
Air (pps)	8 hr workplace	uCi/ml air
per hour	(pps)	
2 E-9	1	2 E-11

* There are no established minimal standards known to E R A Systems. Inc. for vapor phase levels of carbon-14 when used in LICENSE EXEMPT quantities. The concentrations shown are extremely low.

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Solvent(s)

The amount of solvent (as gas) in each single deposition released to the atmosphere inside the enclosure is shown in the following table.

MAXIMUM AMOUNTS OF SOLVENT RELEASED
(per 17 microliters liquid deposition)

MSS-RED	Trifluorotrichloroethane	ml (gas)
		3.4
MSS-BLUE	Trifluorotrichloroethane	3.2
	Chloroform	0.3
MSS-YELLOW	Trifluorotrichloroethane	3
	Chloroform	0.6

NOTE: Only ca. 0.03 ml of gaseous cyclopentane are released each deposition. Again, assuming a laboratory of 4 meters x 5 meters x 6 meters dimensions and 20 air changes per hour, ten tests per hour-- released within the enclosure and with at least 99% exhausted to the outside air--permits no more than the following airborne concentrations within the laboratory environment:

	Actual ppa Lab Air by volume 1 hr average	1989 OSHA Standards 8 hr workplace TWA (ppm)
Trifluorotrichloroethane	2 E-4	1000 (Z-I-A)
Chloroform	3 E-5	2 do.
Cyclopentane	8 E-7	600 do.

The 1989 OSHA standards (Table Z-1-A) are listed in 29 CFR 1910.

Based on the one hour average concentrations, even if 10 ampules of MSS-YELLOW are inadvertently broken at one time (1.2 E4 times the normal maximal levels cited above) and allowed to evaporate into the atmosphere within the above cited laboratory, the OSHA standards will not be exceeded. However in that event of accidental multiple ampule breakage and spillage into the open laboratory area, E R A Systems, Inc. recommends temporary evacuation of the area until the spilled and exposed liquid contents have evaporated and the airborne concentrations have been reduced to a minimum. This recommendation is based on the thesis that radiation and/or hazardous solvent exposure should be kept to a minimum.

WARNING: DESPITE THE VERY SMALL AMOUNTS OF MSS-SOLUTIONS ENCOUNTERED IN USE OF THE CONTROL-CURE (R) INK CURE ANALYZER, THE MSS-SOLUTIONS MAY BE HAZARDOUS TO HEALTH WHEN ABSORBED THROUGH THE SKIN OR WHEN LIQUID OR VAPOR ARE IN DIRECT CONTACT WITH THE EYE OR WHEN INHALED. BY USNRC (AND/OR AGREEMENT STATE) REGULATIONS, EXEMPT QUANTITIES MAY NOT BE INCORPORATED INTO PRODUCTS USED FOR HUMAN INGESTION.

SECTION I

DISTRIBUTOR: UV PROCESS SUPPLY
ADDRESS: 1229 W. CORTLAND
CHICAGO, IL 60614-4805
TELEPHONE #: (773) 248-0099

IDENTITY: Each MSS Solution is factory preformulated and certified for purity and titre. This document covers MSS Red, MSS-Blue and MSS-Yellow.

EMERGENCY MEDICAL PHONE NUMBER: 615-875-3931

SECTION II Hazardous Ingredients/Identity Information

Radiochemical: Listing not required by OSHA due to concentration (Less than 0.01%)

1,1,2,2-Tetrabromoethane-C14	The most restrictive OSHA
CAS # 79-27-6	limits of exposure are
a.k.a Acetylene tetrabromide	those shown in the Survey
Molecular formula C ₂ H ₂ Br ₂	above.

Solvents:

Trifluorotrchloroethane	do.
CAS # 76-13-1	
a.k.a. Freon 1131, Genesolv D	
PCA, TF	
Molecular formula C ₂ F ₃ Cl ₃	

Cyclopentane	do.
CAS # 287-92-3	
a.k.a. Pentamethylene	
Molecular formula C ₅ H ₁₀	

Chloroform	do.
CAS # 67-66-3	
a.k.a. Trichloromethane	
Molecular formula CHCl ₃	

SECTION III Physical/Chemical Characteristics of Components

Radiochemical:
1,1,2,2-Tetrabromoethane-C14
bp: 243 C with decomp 151 C/54mm
mp: -1 C
d: 2.9639 @ 20/4
Colorless to yellow liquid; pungent odor
Slightly soluble water; soluble most organics

Solvents:
Trifluorotrchloroethane
bp: 47 C
mp: 13 C
d: 1.57
fl p: none
Colorless, volatile liquid
Low solubility water; soluble in most organics

Cyclopentane

bp: 49 C

mp: -94 C

d: 0.75

fl p: 19 F

Colorless, volatile liquid; mild odor Low solubility water; soluble most organics

Flammable

Chloroform

bp: 61 C

mp: -63 C

d: 1.48

Fl p: none

Colorless, volatile liquid; strong, unpleasant odor Somewhat Soluble water; soluble most organics

SECTION IV Fire and Explosion Hazard Data (Components)

Radiochemical:

Due to the extremely small quantity in each ampule, there is no hazard in this category.

Solvents:

There is no appreciable fire hazard in trifluorotrchloroethane or chloroform both of which tend to exclude oxygen and/or air from other combustibles due to their relatively high vapor densities. Since the % cyclopentane is in solution with the nonflammable solvent(s) and has a similar boiling point, there is no subject hazard present.

SECTION V Reactivity Data (Components)

Radiochemical:

Due to the extremely small amounts of radioactive labeled compound) the question of reactivity is insignificant. Nonpolymerizable.

Solvents:

Due to the very limited amounts of these solvents encountered in routine INK CURE ANALYZER™ operations, the reactivity is of very minor significance. Trifluorotrchloroethane and chloroform are subject to dehalogenation with very active metals such as sodium, potassium etc. These materials are not examined using the INK CURE ANALYZER and therefore are not encountered routinely. Both are capable of being oxidized to form phosgene or fluorophosgene under adverse conditions. Cyclopentane is a cyclic, saturated hydrocarbon that is unreactive and will not polymerize. It will oxidize if burned to carbon dioxide, water, and/or carbon monoxide.

SECTION VI Health Hazard Data (Components)

Radiochemical:

Tetrabromoethane-C14

Each molecule may have two C14 atoms.

Potential human carcinogen and mutagen.

In significant concentrations is an irritant and narcotic. (Significant concentrations are not found in INK CURE ANALYZER Operations)

Reported in EPA TSCA Inventory.

Solvents:

Trifluorotrchloroethane
Relatively non-toxic
Reported in EPA TSCA Inventory.

Cyclopentane
Little if any toxicity at low concentration.
Reported in EPA TSCA Inventory.
May be narcotic in high concentrations.
Highly flammable.

Chloroform
Probable human carcinogen.
Reported in EPA TSCA Inventory.
Vapor in higher concentrations irritating to eyes, respiratory tract. Narcotic.
Chronic effects: Damage to liver, kidneys) heart If eye contact, wash eyes copiously with water.

SECTION VII Precautions for Safe Handling and Use (Test Solution)

Steps to be taken in Case Material is Released or Spilled

See survey of use of material in introduction. If solution is spilled on hands, wash with soap and water. Avoid unnecessary breathing of material.

Waste disposal method.

Open ampule within the instrument case (fan on and exhausting), pour out into beaker or Petri dish and permit to evaporate. Close front lid. Leave container for about an hour to insure complete disappearance of components.

Precautions: See survey.

SECTION VIII Control Measures (Test Solution as a Whole)

No respiratory protection is required in routine use.

Ventilation

Attach duct to the outside for exhausting of MESERAN Solution components.

Protective gloves

Rubber gloves or finger cots are recommended when opening and handling ampules and contents.

Wear safety glasses at all times in chemical laboratory environment.

MSS Solutions

Use care when scoring and opening ampules since they are packaged with a slight positive pressure of nitrogen.

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. E R A Systems, Inc. reserves the right to revise the information periodically as new information becomes available. The survey information given in the introductory portions have been thoroughly researched and examined and represent to the best of our ability the actual exposure limits encountered when the CON-TROL-CURE® INK CURE ANALYZER is used in accord with the recommendations and statements of the TECHNICAL MANUAL OF THE CON- TROL-CURE® INK CURE ANALYZER.