MOUNT SINAI
SCHOOL OF
MEDICINE

GENERAL GUIDE FOR BIOLOGICAL SPILL RESPONSES

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INTRODUCTION

When a biological spill occurs within a building, two major questions have to be answered before any response is attempted:

- **How pathogenic is the organism(s) involved?**
- **How much material is involved in the spill?**

The responses to these two questions will dictate the best course of action to take with respect to response.

A. HAZARD EVALUATION PRIOR TO RESPONSE

1. Classification of Risk

Most pathogens have been evaluated and assigned to a risk group (RG) depending on he predicted outcome of an infection with that agent in a normal individual.

There are principally three RG's that Laboratory personnel need to be aware of, since the RG 4 and RG 5 agents are very restricted agents, and are not handled at Mount Sinai School of Medicine.

RG1: *Agents that are not associated with disease in healthy adult humans.*

RG2: *Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available*

RG3: *Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk).*

As with any hard and fast rule, there are the inevitable exceptions that defy classification. Certain strains may develop the ability to become more pathogenic, i.e. ***E. coli*** OH 1357, the "Death-in-a-Box" bacteria that caused food poisoning, and the drug-resistant strains of ***Mycobacterium tuberculosis*** that cannot be treated as easily as the non-resistant strains. These exceptions require assessment and assignment by Biosafety Professionals. The most recent edition of the NIH "***Guidelines for Research Involving Recombinant DNA Molecules"*** contains a listing of all known agents and the Risk Groups each is assigned to at the time of publication. Additionally, the Biosafety Officer can offer advice for risk assessment and decision making for selecting appropriate containment levels and PPE selection.

2. Quantity and Nature of Release:

The second question and its answer will determine whether occupants in the laboratory can effect the decontamination procedure themselves, or whether the Biosafety Officer should assist or intercede completely in the incident. The amount of material released, and its form coupled with the pathogenicity of the agent as described above has to be considered.

Large amounts of material containing a **RG1** agent are more serious than a small spill of the same agent.

Of secondary importance is the location of the spilled material. If the material is contained inside a piece of equipment or within a vessel, this is a less-hazardous situation than if it is spread out all over a surface in an uncontained manner.

Small spills occurring inside a Biological Safety Cabinet or sealed centrifuge buckets and rotors pose little hazard to personnel in the laboratory **if a planned, written standard operating procedure is prepared and followed** for that specific pathogen. This is required by OSHA, the CDC and NIH for any Principal Investigator and his / her research staff working with a known pathogen to prepare a response procedure similar to the chemical SOP's described in the OSHA Laboratory Standard. To be outlined in this procedure are the disinfectants, PPE, sterilizers, Biosafety Cabinets, and emergency medical procedures and follow-up procedures that are to be used by the laboratory staff. Everyone in the lab must receive training with that SOP.

Large releases of media, blood or other fluids that cannot be handled with absorbent toweling and disinfectants should not be handled by the Laboratory staff without obtaining assistance from Laboratory personnel.

For releases of **RG2** and **RG3** agents, depending on the nature of the spill (i.e. liquid, aerosol or vapor releases) respondents should follow the procedure outlined in the **MSSM *Biosafety Manual,*** which is repeated here:

1. Spills that can be handled with absorbent pads and disinfectants on hand should be contained by lab personnel as directed by the Principal Investigator.

2. Spills of extremely hazardous agents should not be handled by laboratory personnel. Exposed individuals should hold their breath and leave the laboratory immediately. Once in a safe area, the Biosafety Officer has to be notified (ext.41451) at once so that the area can be isolated. Exposed individuals should report to the EHS or MSH-Emergency Department for medical treatment.

3. **DO NOT** re-enter the area of the spill under any circumstances, until given clearance to do so. Decontamination personnel should not enter the area until a period of at least 30 minutes has elapsed.

4. Contaminated clothing is to be removed and autoclaved, with no exceptions! If a shower area is available, the exposed individual(s) should wash down with a germicidal soap.

5. Spills in a BioSafety Cabinet (BSC) pose little hazard to personnel; a wipe down with 3% Wescodyne or 70% Ethanol can be used to disinfect the internal work surfaces.

6. Do not open internal surfaces of a BSC where the filter units are, without prior decontamination of the cabinet by a professional decontamination service. Failure to heed this instruction can expose the individual attempting this to whatever agents may be present on the filter, often in extremely high numbers.

7. An emergency reaction procedure should be drafted by the Principal Investigator for each pathogen in use.

The Biosafety Officer is to be notified in the event of a spill so that all pertinent information is collected. The Biosafety Officer will recommend a course of action based on this information.

B. RESPONSES

1. Standard Responses

A majority of the spills are of the type that will be handled by laboratory personnel. For Laboratory personnel-assisted spills, the range can run from those incidents requiring only the Biosafety Officer to advise laboratory personnel making a response to incidents requiring reporting to the CDC and possible outside assistance.

As stated above, the laboratory staff handling known human pathogens should have the capability and expertise in microbiological practices to design and adhere to an appropriate emergency response procedure for incidents occurring in their own laboratories.

2. Laboratory Personnel Responses

In certain irregular or more markedly hazardous situations i.e. those involving coincidental radiation or toxic chemical release along with the biohazard incident the Biosafety Officer and Radiation Safety / or the Chemical Hygiene Officer will determine which hazard poses the greatest immediate risk to all personnel affected, and together will develop an appropriate response plan to address any and all hazards.

In most situations the response to multiple hazards will be based on the following hierarchy of control unless other risks warrant a change in order:

A. Radiation Hazard

B. Biohazard

C. Chemical Hazard

3. Extreme Hazards

In the event that a response has to be made to an RG3 agent or to a large spill of material, Level B or Level A chemical spill suits will provide barrier protection for the response team. It is critical that the Level B suit allow the containment of the Self Contained Breathing Apparatus within the suit, so that this harness is protected from contamination. The response team should be aware of the danger of solvents that may be present in a multiple material spill scenario in which the protective nature of the suit is degraded to the point that pathogenic agents can breach the suite.

In all cases, a Self Contained Breathing Apparatus or supplied-air respirator must be used in the incipient stages, and the use of HEPA cartridge masks be instituted only when the risk of the hazard has dropped significantly to allow the safe use of this type of PPE.

If there is a condition with a high likelihood of infectious aerosols existing, only Level A suits will be permitted. The decontamination procedures will require total scrub down of the suit with a strong disinfectant and disposal after autoclaving.

4. Containment Strategy

The main approach to a biohazard spill is to reduce/control the hazards of aerosol generation as quickly as possible. This poses the greatest hazard to everyone especially if the agent can be inspired and can produce disease by this route of exposure. This is the concept of the 30-minute wait that is a minimum lapse time recommended in most Biosafety literature that will allow for the settling of any aerosols.

Once the waiting period is over, any free liquid containing the pathogen is adsorbed or absorbed onto an inert material that can be autoclaved safely onsite or incinerated off-site.

Paper toweling or dry absorbent can be laid over the spilled liquid with subsequent retrieval after the spill is contained. If a powder-type absorbent is to be used, pour the material on the floor away from the spill and slowly push the material into spill in order to prevent aerosol generation. Chlorinated cleaners such as *"COMET"* are suitable for this application

Once the liquid has been retrieved, toweling soaked in disinfectant can be laid over the entire spill area. Sufficient contact time is important in order to allow the disinfectant to make contact and inactivate or kill the pathogen. It is recommended that at least a minimum of an hour be allowed for this phase of the clean-up. In most cases, commercial disinfectants have recommendations either in the literature or on the label; follow these instructions *to the letter*.

One method that has existed for decontamination, that of placing dry toweling on the spill, and then pouring or spraying disinfectant on the toweling is unsafe and should not be practiced by Laboratory personnel. Undesirable aerosols can be generated very easily by this procedure, and should be substituted with the method described above.

In limited circumstances laboratory personnel may be called upon to decontaminate large spaces or surface areas of equipment. This will be done with pump-up sprayers and disposable mops along with the appropriate PPE to protect against infectious aerosols and the chemical disinfectants.

Laboratory personnel can also retain the services of an external Biohazard Control service with professional expertise in equipment and large-scale space decontamination.

C. WASTE DISPOSAL

Once the biohazard has been inactivated or killed by autoclaving or disinfectant, the disposal practices cited in the MSSM ***Biosafety Manual*** should be followed.

Since most of the material will look like biomedical waste or will actually be biomedical waste, all red bag procedures for Pathological waste and Animal waste will be followed.

LABORATORY PERSONNEL PROCEDURES

SPILL OCCURS

–

SECURE AREA, SEAL WITH PLASTIC OR DUCT TAPE IF

–

SELECT APPROPRIATE DISINFECTANTS / PPE /

–

CHARGE-UP SPRAYERS

WITH PROPER DISINFECTANT

–

CONTAIN AND CONTROL SPILLED MATERIAL ON AUTOCLAVABLE MEDIA

–

DECONTAMINATE SURFACES, INDIVIDUAL(S) AND CLOTHING IF

–

AUTOCLAVE ALL SPILL- CONTAMINATED

AUTOCLAVE ALL SPILL- CONTAMINATED MATERIAL

–

SEND / CHECK-UP ON INDIVIDUALS WHO HAVE GONE TO MSH-ED OR EMPLOYEE HEALTH SERVICES

–

REPORT INCIDENT TO

- LABORATORY DIRECTOR
- INSTITUTIONAL BIOSAFETY OFFICER
- IBC, IACUC, IRB, IF NECESSARY
- GRANTS AND CONTRACTS OFFICE

–

REPORT TO EXTERNAL AUTHORITIES *IF REQUIRED BY LAW*

♦ CDC ♦ NIH ♦ OSHA

PGH: 01/02

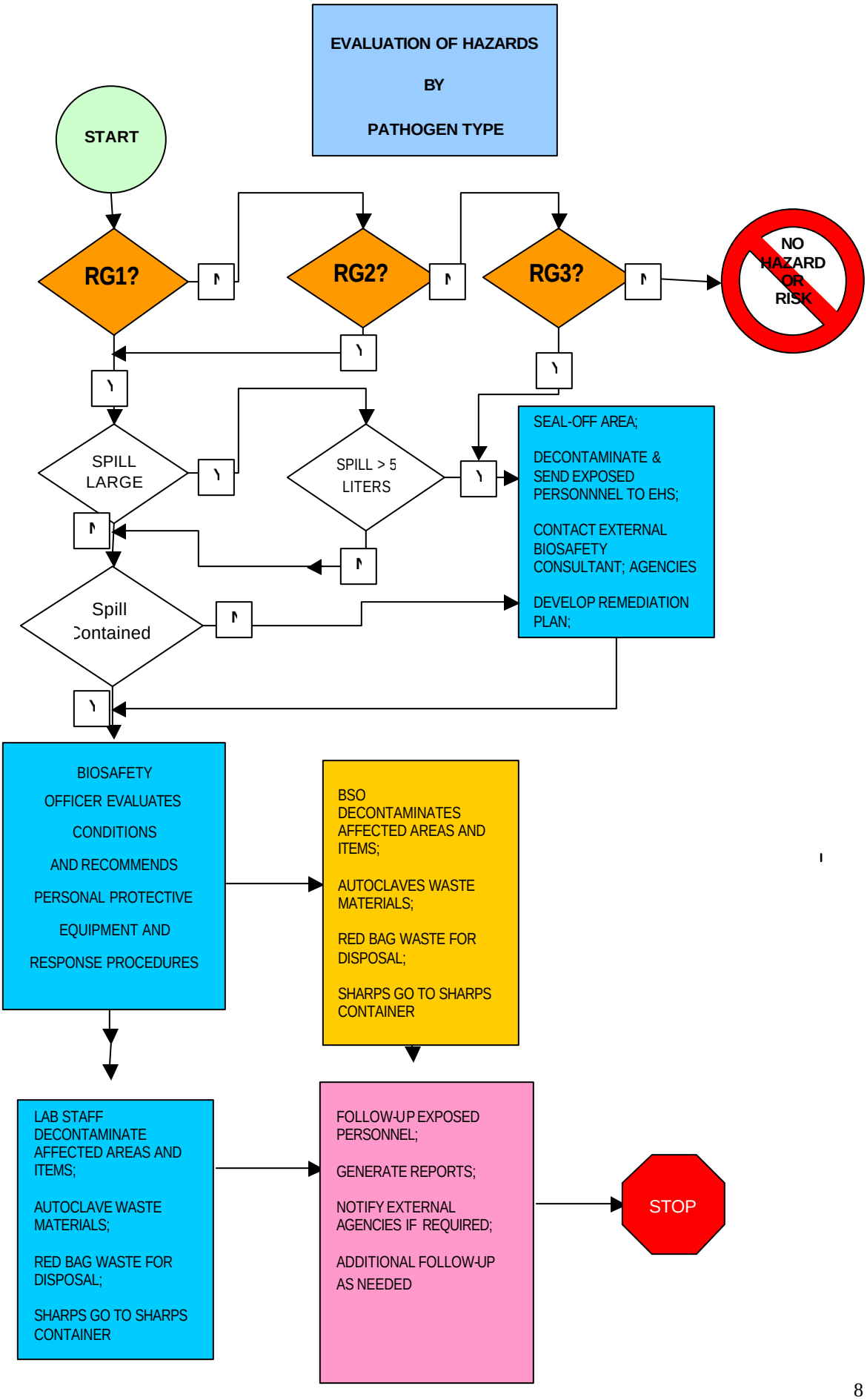
EVALUATION OF HAZARDS
BY
PATHOGEN TYPE
START
RG1?
RG2?
RG3?
NO HAZARD OR RISK
SPILL LARGE
SPILL > 5 LITERS
Spill Contained
SEAL-OFF AREA;
DECONTAMINATE & SEND EXPOSED PERSONNNEL TO EHS;
CONTACT EXTERNAL BIOSAFETY CONSULTANT; AGENCIES
DEVELOP REMEDIATION PLAN;
BIOSAFETY OFFICER EVALUATES CONDITIONS AND RECOMMENDS PERSONAL PROTECTIVE EQUIPMENT AND RESPONSE PROCEDURES
BSO DECONTAMINATES AFFECTED AREAS AND ITEMS;
AUTOCLAVES WASTE MATERIALS;
RED BAG WASTE FOR DISPOSAL;
SHARPS GO TO SHARPS CONTAINER
LAB STAFF DECONTAMINATE AFFECTED AREAS AND ITEMS;
AUTOCLAVE WASTE MATERIALS;
RED BAG WASTE FOR DISPOSAL;
SHARPS GO TO SHARPS CONTAINER
FOLLOW-UP EXPOSED PERSONNEL;
GENERATE REPORTS;
NOTIFY EXTERNAL AGENCIES IF REQUIRED;
ADDITIONAL FOLLOW-UP AS NEEDED
STOP

Table 1a. Summary of Practical Disinfectants

Practical Requirements							Inactivates			
			Contact Time (min.)							
Disinfectants Type	Category	Use Dilution	Lipovirus	Broad Spectrum	Temperature (^{o} C)	Rel. Humidity (%)	Vegetative Bacteria	Lipoviruses	Nonlipid Viruses	Bacterial Spores
Liquid	Quat Ammon.	0.1-2.0%	10	NE [A]			+	+		
	Phenolic	1.0-5.0%	10	NE			+	+	B	
	Chlorine	500 ppm c	10	30			+	+	+	+
	Iodophor	25-1600 ppm c	10	30			+	+	+	+
	Ethanol	70 – 85%	10	NE			+	+	B	
	Isopropanol	70 – 85%	10	NE			+	+	B	
	Formaldehyde	0.2-8.0%	10	30			+	+	+	+
	Glutaraldehyde	2%	10	30			+	+	+	+
Gas	Ethylene Oxide	8-23 g/ft^3	60	60	37	30	+	+	+	+
	Paraformaldehyde	0.3 g/ft^3	60	60	>23	>60	+	+	+	+

[A] NE-Not Effective
[B] Variable results dependent on virus
[C] Available Halogen

Table 1b. Summary of Practical Disinfectants

Disinfectants Type	Category	Important Characteristics											
		Effective Shelf Life (>1wk.[A])	Corrosive	Flam-mable	Explosion Potential	Residue	Inactivated by Organic Matter	Compatible for Optics[B]	Compatible for Electronics	Skin Irritant	Respiratory Irritant	Eye Irritant	Toxic[C]
Liquid	Quat Ammon	+					+	+		+		+	+
	Phenolic	+	+			+				+		+	+
	Chlorine		+			+	+			+	+	+	+
	Iodophor	+	+			+	+			+		+	+
	Ethanol	+		+								+	+
	Isopropanol	+		+								+	+
	Formaldehyde	+				+				+		+	+
	Glutaraldehyde	+				+		+		+		+	+
Gas	Ethylene Oxide	NA[D]		+[E]	+[E]			+	+	+	+	+	+
	Paraformaldehyde	NA		+[F]	+[F]			+	+	+	+	+	+

[A] Protected from light and air

[B] Usually compatible, but consider interferences from residues and effects on associated materials such as mounting adhesives

[C] Skin or mouth or both-refer to manufacturer's literature and /or Merck Index

[D] NA - Not Applicable

[E] Neither flammable nor explosive in 90% CO_2 or fluorinated hydrocarbon, the usual form

[F] At concentrations of 7 to 73% by volume in air, solid-exposure to open flame

Table 1c. Summary of Practical Disinfectants

Potential Application												
Disinfectants **Type**	**Category**	Work Sur-Faces	Dirty Glass-ware	Large Area Decon.	Air Handling Systems	Portable Equip. Surface Decon	Portable Equip. Penetrating Decon	Fixed Equip. Surface Decon	Fixed Equip. Penetrating Decon.	Optical and Electronic Instruments	Liquids for Discard	Books, Papers
Liquid	Quat. Ammon.	+	+			+		+				
	Phenolic	+	+			+		+				
	Chlorine	+	+			+		+			+	
	Iodophore	+	+			+		+				
	Ethanol	+	+			+		+				
	Isopropanol	+	+			+		+				
	Formaldehyde	+	+			+		+				
	Glutaraldehyde	+	+			+		+				
Gas	Ethylene Oxide						+			+		+
	Paraformaldehyde			+	+		+		+	+		

+ Very Positive response; + / - Less Positive Response; No entry denotes negative response or not applicable

Table 1.d Summary of Practical Disinfectants

Disinfectants		Vegetative Bacteria	LipoViruses	*M. tuberculosis*	Hydrophyllic Viruses	Bacterial Spores	**Examples of Proprietary Disinfectants**
Type	**Category**						
Liquid	Quat. Ammon.	+	+				A-33, CDQ, End-Bac, Hi-Tor, Mikro-Quat
	Phenolic	+	+	+	+ / -		Hil-Phene, Matar, Mikro-Bac, O-syl
	Chlorine	+	+	+	+	+ / -	Chloramine T, Clorox, Purex
	Iodophor	+	+	+	+ / -		Hy-Sine, Ioprep, Mikroklene, Wescodyne
	Ethanol	+	+	+	+ / -		Fisher, J.T.Baker, Mallinkrodt
	Isopropanol	+	+	+	+ / -		Fisher, J.T.Baker, Mallinkrodt, CVS,
	Formaldehyde	+	+	+	+	+ / -	Sterac
	Glutaraldehyde	+	+	+	+	+	Cidex
Gas	Ethylene Oxide	+	+	+	+	+	Carboxide, Cryoxide,Steroxide
	Paraformaldehyde	+	+	+	+	+	Fisher, J.T.Baker, Mallinkrodt

+ Very Positive response; + / - Less Positive Response; No entry denotes negative response or not applicable
These are a representative few of all the products available for disinfection. The listing or omission of a product neither rejects nor endorses use of the product.

Pgh: 03/02: Source: ***Biosafety Reference Manual***; AIHA Publications ©1995