Center for Disease Control.

LABORATORY SAFETY AT THE CENTER FOR DISEASE CONTROL

TWO SECTIONS

SECTION I
ADMINISTRATIVE ASPECTS OF BIOSECURITY

SECTION II
PREVENTIVE ASPECTS OF BIOSECURITY FOR PERSONS WORKING WITH HAZARDOUS MICROBIOLOGIC AGENTS

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LABORATORY SAFETY

AT THE

CENTER FOR DISEASE CONTROL

SECTION I

ADMINISTRATIVE ASPECTS OF BIOSECURITY

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ADMINISTRATIVE ASPECTS OF BIOSECURITY

PREFACE

This section was prepared under the direction of the Director's Medical Advisory Board, Center for Disease Control, by the Biohazards Control Officer, Dr. R. H. Huffaker, with the co-operation and critical reviews of other members of the board.

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Section I

INTRODUCTION

"Biosecurity" designates a broad program of preventive medicine designed to protect the health of employees who may encounter biological or chemical hazards in the laboratory or field. This manual brings together information that will assist supervisors in carrying out their responsibilities in biosecurity. Pertinent Center for Disease Control (CDC) policy is presented; offices that are available to assist supervisors in biosecurity are described; some specific responsibilities are discussed; and forms for reporting injury or accident or obtaining medical care are shown.

ADMINISTRATIVE RESPONSIBILITY

The success of a biosecurity program depends upon the participants' having the necessary knowledge to carry out the program. An employee who is aware of risks is less likely to be exposed. The same is true if he has been trained in safe laboratory procedures, good biological techniques, and appropriate laboratory surveillance. Everyone who works in a biological laboratory should have such knowledge. He must know how to protect those with whom he comes in direct or indirect contact. He should also know how to deal with laboratory emergencies—both exposure of an individual to a dangerous agent and contamination of the physical environment. The likelihood of severe injury or infection is reduced if plans for such emergencies are established and well known to those who need to know them.

The responsibility for enforcing and regulating the biosecurity program ultimately rests in the Office of the Center Director. Immediate responsibility is with the employees themselves, their supervisors, and organizational units.

The Biohazards Control Office and the Safety Office support the Center Director in matters relating to their respective areas, and these offices assist laboratory personnel and others in interpreting and managing hazards. The biosecurity program conducted by these two offices is not punitive. It is preventive, protective, and educational.

SAFETY OFFICE

The Safety Office is primarily concerned with accident prevention and the health safeguards usually described as Industrial Health. The Office emphasizes control of environmental factors.

Services include the monitoring of air for directional flow, velocity, and volume as well as for contaminants such as chemicals, dust, noise, and the more common gaseous contaminants, i.e., sulfur dioxide, carbon monoxide, mercury, ammonia, and chlorine. National standards of permissible tolerances for such items are kept on file for ready comparison and reference.

The Safety Office conducts a fire prevention and protection program. As part of this program, the Office inspects all emergency equipment, such as detection systems, alarm bells, and fire pumps. It conducts periodic fire drills. It places, inspects, and recharges fire extinguishers, evaluates fire hazards, and recommends protective measures. Another function of the Safety Office is to recommend special protective equipment and, if necessary, to provide it. This equipment includes safety glasses or goggles, safety shoes, and other protective apparel.

The Office also measures light levels in work areas to determine if they are adequate and safe. It pays particular attention to ultraviolet light levels in laboratories and animal holding areas. It supervises safe disposal of chemical and radiological wastes and coordinates Civil Defense activities.

The Safety Office receives both personal and motor vehicle accident reports, investigates accidents, and prepares necessary reports for management. Claims arising from accidents and occupational illness are also handled in the Safety Office.

The Office conducts training in safety as part of the CDC in-house development program. It cooperates with various CDC efforts to incorporate safety training into regular training programs.

BIOHAZARDS CONTROL OFFICE

The Biohazards Control Officer works closely with the Safety Officer, providing special competency in containment of infectious material and the management of chemical hazards. He gives technical guidance to the staff of the Center's laboratories and to all supervisors on the control and containment of etiologic agents, chemicals, and other hazards. Protecting laboratory workers, other Center employees, and the surrounding communities from hazardous agents has the highest priority. The Biohazards Control Officer develops methods to prevent cross-contamination, assure the sterility of equipment, and evaluate the safety of technical procedures.

The Officer coordinates the immunization of persons at risk. Another important part of his work is providing information about technical activities at the Center to the Center's nontechnical staff.

CDC SAFETY COMMITTEES

All CDC facilities, depending on their size, have either safety committees or designated senior officials who

serve as safety officers. The safety committees in the field installations are conventional in that they are composed of management-level officials. The headquarters' Committee is different in that all members are volunteers who have indicated a strong interest in safety matters and have direct and immediate access to top management through the Committee chairman, a senior official on the Director's staff. The CDC Safety Officer and Biohazards Control Officer are ex-officio members of the Committee and participate in all meetings. Membership is rotated annually to give interested employees an opportunity to participate and to contribute.

PROTECTIVE CLOTHING

The Center provides some categories of personnel with surgical caps and masks and complete changes of laboratory clothing, including shirts, trousers, shoes, coats, and smocks. This clothing helps protect against agents present in the work areas. Because these garments are associated with work hazards, especially infectious agents, wearing them away from Center facilities—such as to and from work or to the bank during the lunch period—is prohibited. Using laboratory coats as all-purpose wrappers in areas used by visitors and the nonlaboratory staff, such as the cafeteria, library, and administrative offices, is unnecessary and causes concern that the coat may have been exposed to hazards in the work area. Such use is not authorized.

PREVENTIVE MEDICAL SERVICES

The Center's health policy for employees is based on good preventive medical practice and the specific needs of persons working in areas of increased risk. The activities which make up the CDC program of preventive medicine fall into three general categories: (1) general requirements, (2) special requirements, and (3) emergency and voluntary health services.

(1) General Requirements

Medical examinations of new employees selectively include a medical history, physical examination (includes Pap smear for females), skin test for tuberculosis, serology plus serum specimen for CDC serum bank, selected biochemical tests, a complete blood count, urinalysis, needed immunizations, X-ray and electrocardiogram (EKG) as indicated, and an audiometric examination.

This data provides a basis for comparison in the event a job-related disease occurs and encourages good preventive medical practice.

(2) Special Requirements

Special examinations and immunizations are required for some positions as a *condition of employment.* For example, a job may require the worker to lift heavy objects or to be exposed to animal dander. Work in some areas may involve exposure to hazardous microbiological agents and thus may require prior immunization. Since requirements for persons at special risks vary, the Center Director establishes these requirements. Recommendations for special immunizations appear in Section II, "Preventive Aspects of Biosecurity for Persons Working with Hazardous Microbiologic Agents." Whenever possible, evidence of antibody response should be demonstrated before exposure to infectious agents. The employee's supervisor is responsible for implementing the requirements. Arrangements for their implementation must be made with the Clinic.

(3) Emergency and Voluntary Health Services

The USPHS Outpatient Clinic at CDC provides emergency medical care for all CDC employees in the Atlanta area. In addition, many voluntary health services are provided, such as the Federal Employee Health Program in which biennial examinations are offered to all employees over 40 years of age. From time to time, immunization campaigns, tuberculosis screening programs for employees and their families, blood typing and donation services, and other special health activities are offered.

General immunization recommendations are given in Section II "Preventive Aspects of Biosecurity for Persons Working with Hazardous Microbiologic Agents."

REPORTING

The prompt and proper reporting of hazards and accidents is essential to an effective biosecurity program. In general, when a problem arises, the employee must notify his supervisor immediately. The supervisor determines whether to request assistance from the CDC Biohazards Control Officer or CDC Safety Officer. Written reports must follow. Details on making reports are described in "Laboratory Exposure to Dangerous Chemicals or Infectious Agents" (NCDC Guide 5, Safety Management, 8/8/69); "Occupational Injuries and Illnesses" (NCDC Memorandum, Unnumbered, 8/15/67); "Compensation for Injury" (NCDC Guide 8-1, Chapter IV, "Conditions of Employment," Personnel Guide for

Supervisors, 8/15/67); "Supervisor's Record of Injury or Exposure to Infectious Material" (PHS 0.304–NCDC); and "Request for Examination and/or Treatment" (Form CA-16). These materials are among the manual guides, policy statements, and forms included in Section I of this manual.

RESTRICTED AREAS

Biological and chemical laboratories and all other potentially hazardous areas are off bounds to anyone who is not assigned to that area and who does not need to be there. A laboratory cannot be completely isolated, however, and a reasonable amount of personnel movement is essential. At CDC, certain areas are designated as "restricted areas." Door and wall signs and other markers indicate the degree of restriction (see pages I-7 through I-27).

Persons are authorized to enter laboratories if they are properly immunized, understand inherent risks, and need to be in the areas. Official visitors, including students, are authorized to enter the Center's restricted laboratory areas on the same basis; their safety, however, is a responsibility of the laboratory supervisor. The supervisor determines if a given person may enter a restricted area, and he sees that the visitor receives appropriate instruction. Visitors who do not meet the requirements for entry are met in unrestricted parts of the Center.

SIGNS DENOTING RESTRICTED AREAS

The degree to which access to CDC facilities is limited depends upon the risk associated with being in an area–the greater the hazard, the more stringent the entrance requirements.

Corridors are the least hazardous of any locations in restricted laboratory areas. Personnel not assigned to the laboratories are asked not to use the "L" (laboratory) corridors of Building 1, or to enter Buildings 4, 5, or D unless they have business in a laboratory.

Areas in which the work is associated with a greater degree of risk are marked by signs reading "Caution, do not enter without permission of (name of investigator)" or "Caution, do not enter without current immunization against (name of disease)." These signs are posted only while risk is present. The location of the areas varies with the work and, with one exception, is not static. The exception is Building 5, which only persons who have current immunization against yellow fever and smallpox may enter.

Access to the infected animal holding areas of Building E (all of the building except the first and second floors and the cage washing area in the subbasement) requires certain immunizations and permission from the Chief of the Research Animal Unit. Access to the Animal Breeding and Holding Facility at Lawrenceville is by invitation of the Chief of the Unit. The purpose of this restriction is to protect the breeding stock against infections introduced by man. Access to some areas is restricted to the staff assigned to them. These are the Smallpox Laboratory on the fourth floor of Building 5, the High Security Laboratory in the penthouse of Building 5, the Maximum Security Laboratory in Building 5A, the culture transfer rooms of the Tuberculosis Laboratory on the third floor of Building 5, the animal holding areas of Building B at Lawrenceville, and the large animal isolation barn at Lawrenceville.

Visitors may see these facilities only when the areas have been completely decontaminated and no work is underway.

No-access areas are marked with signs reading "Warning, highly infectious material–*Keep Out.*" In temporary situations, such as following an accident, a large sign with "Danger, DO NOT ENTER, Contaminated Areas," printed in bright red, is posted. Areas posted with either of these signs are off limits to *all* personnel except the investigator who posted the sign. One should not pass these signs for *any* reason, not even to fight fire. These signs are seldom used. The exception is that the "Warning–highly infectious material–*Keep Out*" sign is permanently posted on a few deep freezers used to store very dangerous agents.

Questions about the location of restricted areas, the hazards and the risks of infection in the areas, times when restricted areas can be visited, and immunizations should be directed to the Biohazards Control Officer: telephone 633-3311, extension 3883. (See also Manual Guide - Safety Management NCDC-2, pages I-7 through I-27.)

STANDARDS FOR HANDLING NONHUMAN PRIMATES

Section I. Introduction
II. Standards

I. INTRODUCTION

Nonhuman primates are dangerous to handle. They not only may injure personnel who are working with them but they may also carry serious diseases which can be contracted by man (e.g., shigellosis, hepatitis, tuberculosis, monkey B virus, green monkey disease, and others). Infectious agents can be spread by many routes - through air, from objects soiled with excreta, and from scratches and bites.

The standards prescribed in this Guide are designed to reduce the risk from working with nonhuman primates. Supervisors are responsible for ensuring that employees under their supervision who work with these animals are aware of and comply with these standards.

II. STANDARDS

A. This Guide sets forth minimum standards for NCDC employees who work with nonhuman primates or nonhuman primate tissues. Each division or program which has employees working with nonhuman primates is expected to develop specific safety procedures designed for its particular situation to supplement these standards. In any case where there is need for exceptions to the standards in this Guide, a written request describing the circumstances and alternate procedure should be sent to the Center Biological Hazards Control Officer for action.

B. Minimum standards for working with nonhuman primates or nonhuman primate tissues are as follows:

1. Only experienced animal handlers are qualified to and will transfer, restrain, or handle nonhuman primates. The animal handlers will wear heavy gloves and longsleeved protective clothing. Under no circumstances will anyone place bare hands in a cage containing the nonhuman primates.

(II continued)

2. Laboratory technicians, animal handlers, and all others will wear face masks and protective clothing while working with the nonhuman primates. Each holding area will provide the necessary masks and operating gowns or equivalent protective clothing. Due to the high rate of intestinal infections of nonhuman primates with pathogens also common to man, it is important that all employees thoroughly wash their hands and forearms after working with these animals.

3. Animal handlers who are initially negative to the tuberculin test should be retested every six months until they become positive to the skin test and, thereafter, should have a chest X-ray once each year.

4. When employees are scratched or bitten by a nonhuman primate, the wounds (even superficial ones) must be scrubbed for three minutes with soap and water, then thoroughly rinsed with warm water, dried with clean absorbent cotton or a surgical sponge, and swabbed with a 1% solution of Zephiran chloride. These injuries should be promptly reported to the employees' supervisors who will immediately arrange for medical care at the Outpatient Clinic at the Clifton Road Facility or at another appropriate medical authority.

5. Necropsies on nonhuman primates should be performed only by professionally trained employees who are protected by gloves, masks, and gowns. These necropsies should be done only in a special area designed for the containment of potentially virulent and communicable micro-organisms. The necropsy area and all instruments and equipment should be thoroughly cleaned and decontaminated after each use.

6. Nonhuman primates that cannot be necropsied under the recommended conditions in 5. above should be carefully placed in plastic bags to prevent contamination of the exterior of the bag and then should be incinerated.

7. All nonhuman primate tissues and fluids, particularly tissue cultures prepared from organs of nonhuman primates, should be handled as if infected with agents transmissible to man.

8. Employees who work with nonhuman primates or their tissues and who have a fever or have other symptoms that may be associated with infections must promptly notify their supervisors who will immediately arrange for medical care at the Outpatient Clinic at the Clifton Road Facility or at another appropriate medical authority. Regardless of the reason for visiting the Clinic or other medical authority, these employees must always tell the physician or nurse that they work with nonhuman primates. It is equally important that physicians caring for NCDC employees be aware that exposure to nonhuman primates or other unusual sources of infection may have occurred and that patients be questioned to establish these relationships.

NCDC HAZARD WARNING SIGNS

Section I. Purpose
II. Description
III. Policy
IV. Method of Posting
V. Availability of Signs and Frames

I. PURPOSE

In an effort to bring uniformity to the system of signs used in the National Communicable Disease Center to warn of danger and to direct "pedestrian traffic" away from laboratory work areas, a new group of hazard warning signs has been designed. This Guide describes the signs and sets forth the conditions under which the signs are to be posted. It is important that all NCDC employees and visitors comply with the policy for entering areas where these signs have been posted.

II. DESCRIPTION

NCDC hazard warning signs are illustrated in Exhibits 1-9. The signs inform NCDC personnel and visitors that a hazard exists in an area. The degree of danger is indicated by the sign. In high risk areas, admission is forbidden to all except those assigned to that area; in lower risk areas, visitors must secure permission to enter from the investigator in charge of the work. Other signs warn that one must have special immunization before entering the area.

III. POLICY

Exhibits 1-9 specify the conditions under which the hazard warning signs will be posted. The investigator in charge of the laboratory is responsible for posting the signs in accordance with policy set forth in this Guide. Upon request, the NCDC Biological Hazards Officer will assist investigators in determining the need for posting warning signs.

The signs will be posted only while a hazard exists and must be taken down as soon as the source of danger is removed. Hazard signs will not be posted when no hazard exists, i.e., to discourage traffic through an area.

(III continued)

At the end of working hours, laboratory work areas should be decontaminated so that janitors, plant engineers, firemen, and others can safely enter the areas. If this is not done, a special "DANGER - DO NOT ENTER" sign (Exhibit 9) must be posted.

Hazard warning signs will show the names of the hazard(s) and the investigator and his alternate and their home telephone numbers. When appropriate, similar signs will be posted on both the laboratory and animal holding rooms.

The investigator named on the hazard sign will determine when visitors can be allowed in the laboratory. He is responsible for their safety while they are there. Visits are restricted to those who have a need to observe laboratory procedures. Social visits by NCDC staff and visitors are prohibited while a biohazard exists.

IV. METHOD OF POSTING

Signs that are to be used permanently will be posted only in permanent frames. At headquarters, the frames will be installed only by Engineering Services Branch. (Requests for installation will be submitted to Engineering Services Branch on Form PHS 0.362 (NCDC). The form is available from the NCDC Warehouse and the Self-Service Store at the Clifton Road Facility.) At installations outside the headquarters area, the frames will be installed on a uniform basis by a qualified maintenance employee. The investigator in charge of the laboratory is responsible for requesting the installation of the frames.

Signs that are to be used on a temporary basis (less than one month) will be posted in permanent frames if they have been installed. If frames have not been installed, these signs will be posted with masking tape on a glass surface or, if more appropriate, on refrigerators, freezers, doors, etc.

Signs will not be posted with tacks, pins, and various adhesive materials that will damage the doors, walls, or building when the signs are removed.

V. AVAILABILITY OF SIGNS AND FRAMES

The Safety Office will maintain the supply of the NCDC hazard warning signs and frames. Plastic fronts will be available for signs to be posted on outside doors.

(V continued)

The investigator in charge of the laboratory is responsible for securing the appropriate signs and frames. He should submit a memorandum of request to the NCDC Safety Officer (Chief, Safety and Plant Security Section, Engineering Services Branch).

CAUTION

CHEMICAL HAZARD

The sign illustrated in Exhibit 1b will be posted when an unusual chemical hazard exists.

Gum-backed stickers are available from the NCDC Safety Office for adding to the signs the following information:

Danger - Acid

Danger - Caustic

Danger - No Smoking

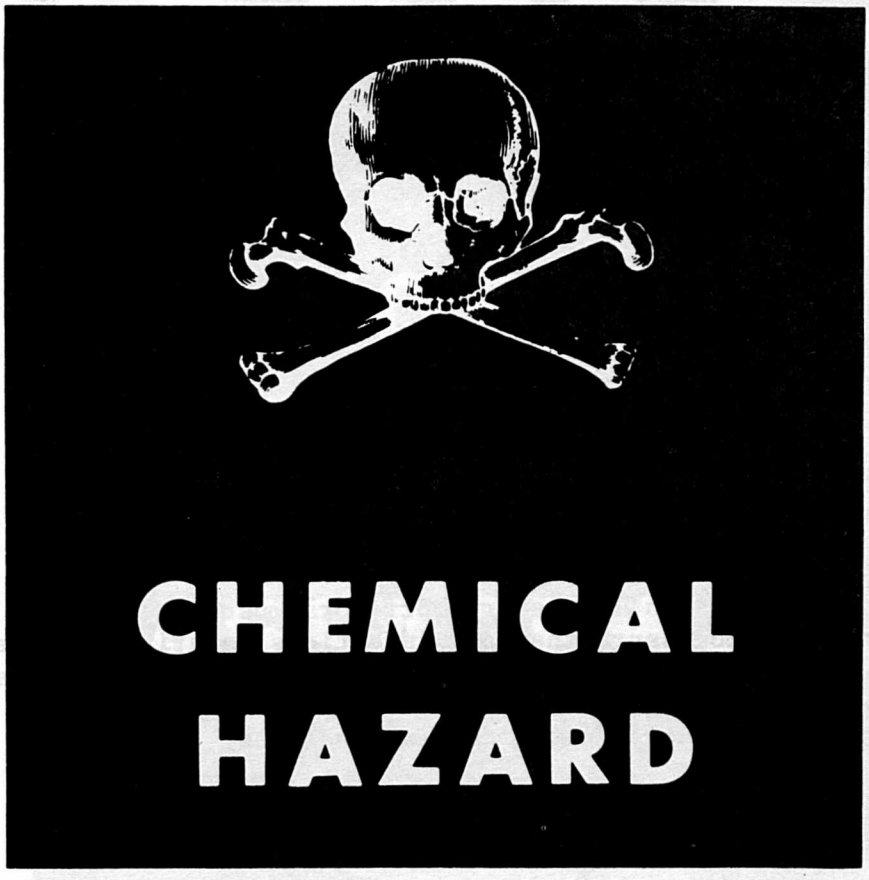
Danger - Poison

Danger - Corrosive Liquids-Use Personal Protective Equipment

Danger - Flammable-Keep Flames and Heat Away

The sign informs that a hazard exists and that visitors to the laboratory should take appropriate caution.

CAUTION



Contains:

- ☐ **Caustic**
- ☐ **Corrosive**
- ☐ **Explosive**
- ☐ **Flammable**
- ☐ **Toxic**

Chemicals

NCDC – SAFETY OFFICE

NOTICE

NOT A
THROUGH
PASSAGEWAY

PLEASE USE
OUTER
CORRIDOR

The sign illustrated in Exhibit 2b will be posted to discourage traffic through laboratory corridors.

Air supplies in laboratory corridors must be carefully balanced to assure that any infectious material released in the laboratories is swept into the exhaust air ducts and not back into the corridors. Opening the doors at the ends of the corridors upsets this air balance.

Only persons going to a laboratory on the floor should use the laboratory corridor.

NOTICE

NOT A THROUGH PASSAGEWAY

PLEASE USE OUTER CORRIDOR

NCDC - SAFETY OFFICE

NOTICE

NO
PASSENGERS

SERVICE
ELEVATORS

The sign illustrated in Exhibit 3b will be posted to keep service elevators free of passenger traffic.

Certain elevators were designed as supply routes to the laboratories from central service areas. Employees must use service elevators for moving media, glassware, and other equipment. Passenger elevators cannot be used for this purpose. Service elevators must be kept free of passenger traffic.

NOTICE

NO PASSENGERS

SERVICE ELEVATORS

NCDC - SAFETY OFFICE

CAUTION

BIOLOGICAL
HAZARD

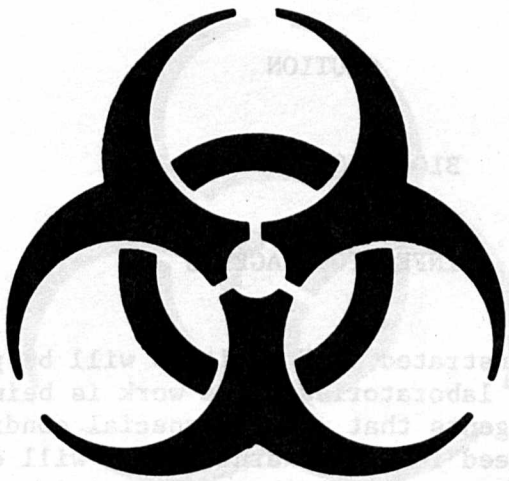
DO NOT ENTER
WITHOUT CURRENT
IMMUNIZATION
AGAINST:

The sign illustrated in Exhibit 4b will be posted on the doors of areas where infectious agents that require immunization of personnel are being used.

Every attempt will be made to limit the restriction to as small an area as possible and the sign will be posted only when a hazard requiring immunization exists.

It is important the non-immunized personnel or personnel whose immunization has expired not enter any area where this sign is posted. Violations of this regulation may result in exposure of susceptible persons to agents capable of causing serious disease and can be the basis for disciplinary action.

CAUTION



BIOLOGICAL HAZARD

DO NOT ENTER

Without Current Immunization Against:

_____

_____

_____

_____

NCDC - SAFETY OFFICE

CAUTION

BIOLOGICAL HAZARD

INFECTIOUS AGENTS

The sign illustrated in Exhibit 5b will be posted on the doors of laboratories where work is being done with infectious agents that require special conditions for containment. The need for this warning sign will depend on the kind of study as well as the pathogenicity of the agent.

Laboratory supervisors are responsible for assessing the risk and the need for warning signs. The NCDC Biological Hazards Officer is available to assist in making this determination.

Visits in these areas are prohibited unless the visitor has permission from the investigator in charge, who is responsible for the safety of the visitor while he is in the area.

CAUTION

BIOLOGICAL HAZARD

INFECTIOUS AGENTS

_____

_____

_____

_____

Do Not Enter Without Authorization From:

_____

Day: _____ **Night:** _____

NCDC – SAFETY OFFICE

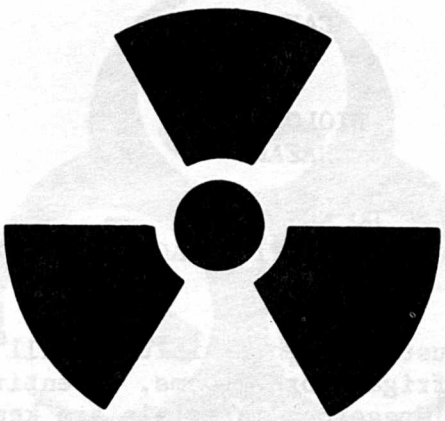
CAUTION

RADIATION
AREA

The sign illustrated in Exhibit 6b will be posted when necessary to warn that radiation sources are present in the laboratory and that persons should, therefore, be cautious.

Additional information such as "DO NOT ENTER," "CONTACT DR._____for permission to enter," etc., may be added by the investigator.

CAUTION



RADIATION AREA

_____
Source

In Emergency Call:

_____

Day: _____ **Night:** _____

NCDC - SAFETY OFFICE

CAUTION

BIOLOGICAL
HAZARD

DO NOT ENTER
HIGHLY INFECTIOUS AGENTS

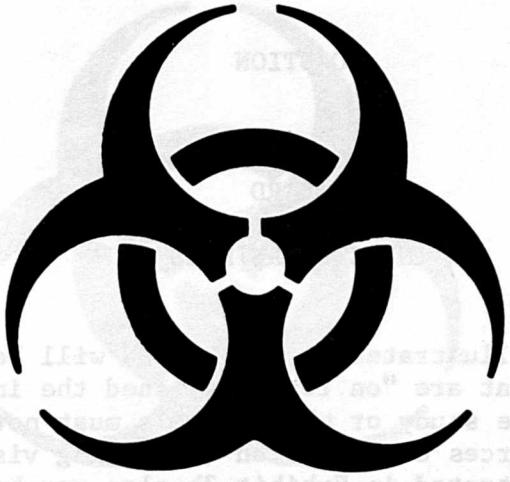
The sign illustrated in Exhibit 7b will be posted on freezers, refrigerators, rooms, or entire work areas where highly dangerous materials are kept or are being used. The sign will be removed when the hazard no longer exists.

Only persons who work in the laboratory may enter the area when this sign is posted.

Service personnel such as janitors, engineers, repair crews, firemen, etc., will not enter unless accompanied by the investigator in charge of the area. Fire, flooding, or mechanical failures in such an area will be left alone until investigators named on the sign are present to determine that the area can safely be entered.

Failure to observe this sign may result in exposure to extremely pathogenic agents and can result in disciplinary action.

CAUTION



BIOLOGICAL HAZARD

DO NOT ENTER

HIGHLY INFECTIOUS AGENTS

In Case of Fire or Mechanical Failure

Call: _____

Day: _____ **Night:** _____

NCDC – SAFETY OFFICE

CAUTION

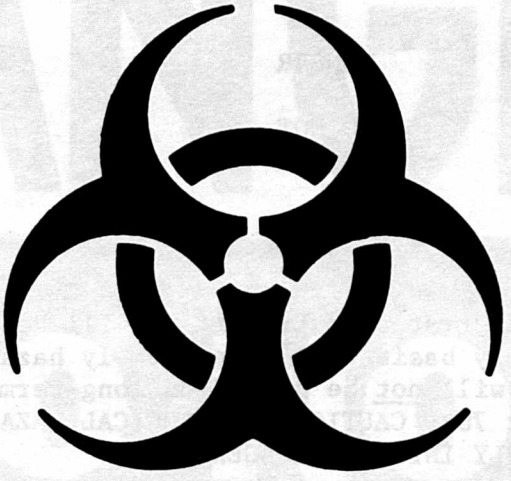
BIOLOGICAL
HAZARD

INFECTED ANIMALS

The sign illustrated in Exhibit 8b will be posted when animals that are "on test" may shed the infectious agent used in the study or when animals must not be exposed to any sources of infection (including visitors). The sign illustrated in Exhibit 7b also may be used to warn of infected animals.

Visitors to the animal quarters must be accompanied by personnel assigned to the area.

CAUTION



BIOLOGICAL HAZARD

INFECTED ANIMALS

Visitors and NCDC Personnel not Assigned to this Area Contact:

_____

Ext: _____ Before Entering.

NCDC – SAFETY OFFICE

DANGER

DO NOT
ENTER

CONTAMINATED AREA

The sign illustrated in Exhibit 9b will be posted only on a temporary basis when an extremely hazardous condition exists. It will <u>not</u> be posted on long-term hazardous areas (See Exhibit 7b - CAUTION - BIOLOGICAL HAZARD - DO NOT ENTER - HIGHLY INFECTIOUS AGENTS.)

Normally, each laboratory will be "secured" at the end of each work day. Infected materials will be stored in refrigerators, incubators, etc.; table tops will be wiped down with an appropriate disinfectant; contaminated glassware and equipment will be in covered disposal pans ready to go to the autoclave. The area will be safe for entry by the night cleaning crews and other service personnel; all hazard sources will have been contained for the night.

However, if it is not possible to "secure" the laboratory because of the work being done or if a spill has occurred and the laboratory (or other area) is contaminated and is not safe to enter, this sign will be taped on the door and left up until the hazard is removed.

<u>No one except the investigator</u> will enter while this sign is posted.

DANGER

DO NOT ENTER

CONTAMINATED AREA !

POSITIVELY NO ADMITTANCE
WITHOUT PERMISSION FROM PERSON LISTED BELOW

1	NCDC	HOME
2	NCDC	HOME
3	NCDC	HOME

DANGER

DO NOT ENTER

CONTAMINATED AREA

POSITIVELY NO ADMITTANCE
WITHOUT PERMISSION FROM PERSON LISTED BELOW

1	NCDC	HOME
2	NCDC	HOME
3	NCDC	HOME

STANDARDS FOR HANDLING COMPRESSED GASES IN CYLINDERS

I. INTRODUCTION

Users of compressed gases should be familiar with the pertinent equipment and the characteristics of the gases. The Safety Office and the Biological Hazards Control Office have information available on most of the gases likely to be used in CDC laboratories. Detailed information is available on detecting leaks, selecting needle valves and regulators, toxicity, explosion hazards, chemical incompatibilities, etc.

II. GENERAL STANDARDS

A. Cylinders of compressed gas must be secured at all times so they cannot fall.

B. Valve safety covers should be in place until pressure regulators or needle valves are ready to be attached.

C. The names of the cylinder contents must be permanently attached to the cylinders. Color coding alone is not acceptable.

D. Cylinders may be moved on hand trucks, carts, dollies, etc.; they must never be rolled or dragged.

E. Employees must not attempt to repair cylinders or cylinder valves, or to force stuck or frozen cylinder valves.

III. RESTRICTED PRODUCTS

A. The purchase and use of highly toxic gases are controlled. The Biological Hazards Control Officer must be notified of intent to work with highly toxic gases prior to their proposed use to allow time for making necessary safety preparations. Large cylinders of toxic gases should not be purchased if it is possible to use small cylinders.

(III. continued)

B. Laboratories using toxic gases should have gas masks available that are effective against the agent. The supervisor is responsible for employees' instruction in how to use masks and other protective equipment. The following gases are controlled:

1. Boron trifluoride
2. Chlorine
3. Dimethylamine
4. Ethylene oxide
5. Fluorine
6. Hydrogen bromide (hydrobromic acid)
7. Hydrogen chloride (hydrochloric acid - gas)
8. Hydrogen fluoride (hydrofluoric acid - liquid or gas; boils at 67°F)
9. Hydrogen sulfide
10. Iodine pentafluoride (liquid shipped in gas-type cylinders)
11. Methyl bromide (bromomethane)
12. Methyl chloride
13. Nitric oxide
14. Nitrogen dioxide (nitrogen tetroxide - liquid or gas; boils at 70°F)
15. Nitrogen trioxide
16. Nitrosyl chloride (nitrogen oxychloride)
17. Phosgene
18. Silicon tetrafluoride (tetrafluorosilane)
19. Sulfur dioxide

C. The Biological Hazards Control Officer will notify investigators in charge of laboratories as soon as it is determined that the gas can be used safely. Some of these gases are extremely toxic and may require isolated laboratory space and equipment not immediately available. For this reason, clearance should be requested well in advance of the proposed use.

IV. ACCEPTANCE OF CYLINDERS FROM VENDORS

A. The contents of cylinders must be identified with decals, stencils, or other markings on the cylinders. Color codes alone or tags hung around the necks of the cylinders are not acceptable. Cylinders lacking proper identification must not be accepted from the vendors.

B. Cylinders must not be accepted from the vendors unless the valve safety covers are in place and properly tightened.

C. Vendors moving cylinders in CDC buildings must use hand trucks, carts, or dollies. Cylinders must not be dragged or rolled.

V. HANDLING AND STORAGE OF CYLINDERS

A. Cylinders should never be dropped or permitted to strike each other violently.

B. The valve safety covers must be left on the cylinders until they are secured to walls, benches, or stable pieces of equipment, or until nontip bases are attached.

C. Cylinders must be transferred only by carts, hand trucks, or dollies. They must not be rolled or dragged. The valve safety covers must be in place and the cylinders secured to the carts during transport.

D. Empty cylinders must be marked "EMPTY" or "MT" with grease pencils. Empty cylinders must not be stored with full cylinders. Some cylinders have tags identifying their contents; tearing off the bottom half of this tag indicates an empty cylinder.

VI. PRESSURE REGULATORS AND NEEDLE VALVES

A. The valve fittings of cylinders used to store different families of gases are different and will only allow regulators or needle valves to be attached that are safe for use with those gases. Use of adapters to connect regulators to cylinder valves defeats this safeguard and is not authorized. Only pressure regulators and needle valves approved for the gases may be used.

B. Threads and points of unions must be clean; these surfaces must be inspected before they are connected. If the gases are not toxic, the cylinder valves may be opened for a very brief period to blow dust and foreign materials out of the cylinder valve fittings.

C. When attaching regulators or needle valves, the connections must be tightened firmly. Nonadjustable wrenches of the proper size should be used. Pliers or adjustable wrenches should not be used, as they damage the nuts, most of which are brass and rather soft. Need for excessive force often indicates that the regulators or needle valves do not fit the cylinders. Leaks at the unions between the regulators and the cylinder valves are usually due to damage to the faces of the connections. Attempts to force a tight fit may damage the previously undamaged half of the connection. If the cylinder valve faces are damaged, the cylinders shall be returned to the vendors. Employees shall not attempt to repair them. Damaged regulators shall not be used until repaired.

(VI. continued)

D. After attaching the pressure regulator to the cylinder, the delivery pressure adjusting screws of the regulators should be turned out until they turn freely. The cylinder valves should be opened slowly. Laboratory personnel should avoid standing directly in front of the regulators at this time as the pressure of the cylinders may blow the glass from the front of a faulty gauge. After the valves are opened, the regulators and fittings should be checked for leaks. The cylinder valve handles should be left attached to the valves while the cylinders are in use. Cylinder valves that "stick" and do not open when the usual amount of force is applied may be damaged. Personnel must not attempt to force them open, but should return these cylinders to the vendors, stating on the cylinders that the valves are stuck.

E. Pressure in full cylinders should be as indicated on the cylinders or labels. Lack of full pressure may indicate leaks at the connections between the cylinders and regulators, damaged regulators, or incompletely filled cylinders.

F. Employees should connect delivery lines to the low pressure outlets of the regulator valves or to the needle valves. Where low pressure lines are used, their valves should be closed and line pressures adjusted by turning the regulator delivery pressure adjusting screws until the desired pressures are shown on the delivery pressure gauges.

G. If the gases are not to be used over a considerable length of time (i.e., 24 hours), the cylinder valves should be closed, the lines bled, and the pressure adjusting screws turned back until they turn freely. Damage to the gauges may result if pressure is left on the gauges during extended periods of nonuse.

VII. CYLINDER LEAKS

A. Unless there are reasons to believe that cylinders are leaking, testing for leaks may be done after the pressure regulators are attached to the cylinder valves and the valves opened. Soapy water painted over the valves and connections will indicate most gas leaks; however, other more specific methods are recommended for some gases. This information is available from the Safety Office or the Biological Hazards Control Office.

B. Compressed gas cylinders are tested for leaks when they are filled; however, leaks have been detected when cylinders were connected in CDC laboratories. Personnel should not attempt to repair leaks caused by loose valve stem packings. Leaking cylinders of nontoxic, nonflammable gas may be taken to a loading dock or other place having suitable air flow for the vendors to pick up. Leaks from cylinders of toxic or flammable gases require immediate attention. Decisions of how to handle the problem will depend on the kind of gas, the size of the leak, the area where the cylinder is located, and other factors. Personnel must wear gas masks and appropriate protective clothing when attempting to move leaking cylinders of toxic gases. Assistance can be obtained from the CDC Safety Office, the Biological Hazards Control Office, local fire departments, or nearby military bases - depending on the location of the laboratory and the hazard.

VIII. EMPTY CYLINDERS

A. A small amount of gas must be left in the cylinders and the cylinder valves must be closed to prevent contamination of the inside of the cylinders.

B. Empty cylinders should be marked "EMPTY" or "MT" and stored apart from full cylinders.

C. Valve safety covers and the labels showing contents must be in place.

ULTRAVIOLET LIGHTS - USE AND MAINTENANCE

Section I. Introduction
II. Guidelines
III. Radiation Exposure

I. INTRODUCTION

Ultraviolet radiation includes that portion of the radiant energy spectrum between visible light and X-rays (approximately 3900 to 136 angstrom units). Under certain conditions, including radiation intensity and exposure time, ultraviolet radiation will kill many kinds of microorganisms, its greatest effectiveness being against vegetative forms. Ultraviolet light is not a sterilizing agent, however, except in certain exceptional circumstances. Rather it is used to substantially reduce the number of microorganisms on surfaces and in the air.

II. GUIDELINES

Low pressure mercury vapor lamps which emit 95 percent of their radiation in the 2537 angstrom units region are generally used for germicidal purposes. These lamps are used in many locations in the NCDC to reduce the numbers of pathogenic microorganisms on exposed surfaces and in the air. Since such factors as lamp age and dust accumulation contribute to decreased efficiency of these lamps and since care is required to maintain and use them properly and safely, the following guidelines have been developed:

A. The NCDC Safety Office is responsible for periodic intensity testing of all ultraviolet installations. Ultraviolet lamps will be replaced when they emit 70 percent or less of their rated initial output. This figure is higher than the manufacturer's suggested cutoff point. The safety factor thus provided permits semiannual testing and virtually eliminates the possibility of complete failure within a short time after passing a satisfactory intensity test.

B. Ultraviolet lamps in air locks and door barriers will be turned on continuously. Skin or eye protection is not usually required for persons walking through these areas. Protection is required, however, for persons exposed to the radiation for longer than a few seconds.

(II continued)

Ultraviolet lamps in Biological Safety Cabinets (BSC) will be turned on only when the cabinet is not in use. (The lamps in the BSC lethal chamber above the filters are turned on automatically when the blower is turned on.)

Personnel must wear protective equipment (goggles, caps, gowns, and gloves) or turn off the lights before entering laboratories, animal rooms, etc., which have ultraviolet installations.

C. All ultraviolet lamps except those located in the BSC lethal chamber (above the filters) must be cleaned at two-week intervals, or more often, if located in an unusually dusty area. The lamps should be turned off and wiped with a soft cloth pad moistened with alcohol. Cleaning is the responsibility of the personnel in charge of the laboratory. Cleaning dates should be noted on a card attached to the installation.

D. Special problems concerning use, cleaning, or installation of ultraviolet lamps should be referred to the NCDC Safety Officer or the NCDC Biological Hazards Officer.

III. RADIATION EXPOSURE

The eyes and skin should not be exposed to direct or strongly reflected ultraviolet radiation. The effect of radiation overexposure is determined by such factors as dosage, wave length, portion of body exposed and the sensitivity of the individual.

Overexposure of the eyes will result in a painful inflammation of the conjunctiva, cornea, and iris. Symptoms will develop 3 to 12 hours following exposure. There is a very unpleasant foreign body sensation accompanied by lacrimation. The symptoms usually disappear in a day or two.

Exposure to the skin will produce erythema (redding) 1 to 8 hours following exposure.

Adequate eye and skin protection must be worn when working in an irradiated area. Safety glasses with side shields or goggles with solid side pieces should be worn. The side pieces prevent the entrance of reflected radiation and direct radiation from a side source. Skin protection is afforded by face shields, caps, gloves, gowns, etc.

Overexposure to ultraviolet radiation should be reported in accordance with procedures in Personnel Guide for Supervisors, Chapter IV, NCDC Guide 8-1.

LABORATORY EXPOSURE TO DANGEROUS CHEMICALS OR INFECTIOUS AGENTS

Section I. Introduction
II. Dangerous Chemicals
III. Routes of Infections
IV. Policy
V. Procedures Following Exposure or Accident

I. INTRODUCTION

Safety is an intrinsic part of each laboratory operation; work is planned so that exposure to hazardous agents will not occur. In spite of this, accidents that create hazards do occur. These often involve spills or area-wide contamination with dangerous chemicals or infectious agents. Likelihood of severe injury or infection can be reduced if plans for such emergencies are established and are well known to all who need to know.

II. DANGEROUS CHEMICALS

Dangerous chemicals may be of several types. Special care must be taken when large quantities of these materials must be handled or stored.

A. Caustic or corrosive. Examples: Acids or bases which may burn or otherwise damage the skin and other human tissue. Consideration also must be given to corrosion of equipment.

B. Poison. In this category are substances which are so poisonous that inhalation or ingestion of relatively small amounts will produce death or other serious effects. These may be solid, liquid, or gas.

C. Flammable. Such materials that will easily ignite, burn, and serve as fuel for a fire.

D. Explosive. Although many explosive materials are also inflammable, these substances will explode under special conditions. Such materials must receive handling designed to eliminate exposure to or attainment of those conditions.

III. ROUTES OF INFECTIONS

Exposure in the laboratory to pathogenic microorganisms can occur in a number of ways. Most pathogenic organisms have a usual route of infection which produces the characteristic disease. However, when some agents are introduced by another route of infection, the disease produced may be atypical for that organism and difficult to diagnose unless the type of exposure is known by the attending physician. Exposure to infectious agents may occur in the following ways:

A. Airborne. Pathogenic agents may become airborne through laboratory accidents, such as spills or breaking of containers. Some agents may become airborne simply by removing the caps or cotton plugs of culture tubes.

B. Ingestion. The undesirable practice of mouth pipetting frequently results in exposure to pathogenic agents. Failure to wash hands after handling cultures or specimens may result in ingestion of the organism.

C. Direct inoculation. Direct inoculation of agents sometimes occurs through accidents involving needles and syringes and broken glassware. Also, scratches or bites of laboratory animals may result in direct inoculation of pathogens.

D. Skin contact. Some infectious agents can penetrate intact skin, while others may enter through the conjunctiva of the eye. Small cuts and scratches on the hands are very common and may provide a point of entry for pathogenic organisms.

E. Vectors. Mosquitoes, ticks, fleas, and other ectoparasites are potential sources of laboratory infection unless properly contained, whether they are being used in laboratory transmission studies or happen to be present on wild animals brought into the laboratory for examination.

IV. POLICY

It is essential that every laboratory develop an emergency plan which covers contingencies which may arise from its use of dangerous materials.

The laboratory supervisor is responsible for the safety of all who enter his laboratory -- employees and visitors during the workday and building service personnel at other times. When work is hazardous, employees must be well trained in carrying out the laboratory's emergency plan, visitors must be kept out of dangerous areas, and service personnel must be assured that the laboratory is safe for them to enter and do their work. If the laboratory is not safe at the end of each day, signs prohibiting entry must be posted.

(IV continued)

Since action must begin immediately following an accident, it is important that everyone in the laboratory be familiar with hazards that may accompany their work and with the laboratory's emergency plan developed as a safeguard in case of an accident. Supervisors are responsible for notifying employees accordingly.

V. PROCEDURES FOLLOWING EXPOSURE OR ACCIDENT

Because a detailed course of action could not be developed that was applicable in all situations, the procedures in this Guide are general and provide a foundation for division/program, branch, section, and unit levels to use in developing more specific procedures.

If assistance or additional information is needed, the NCDC Biological Hazards Officer or the NCDC Safety Officer should be contacted. The NCDC Biological Hazards Officer is Dr. R. H. Huffaker, telephone numbers: Extension 3862, home, 636-5885. The NCDC Safety Officer is Mr. James A. Johnson, telephone numbers: Extension 3837, home, 938-7824.

When accidents occur that could contaminate an area with dangerous chemicals or infectious agents, it is important that the following be done:

A. Get everyone out of the affected area at once.

B. Do not reenter until the extent of the hazard is determined.

1. Everyone must KEEP OUT of the affected area until there is no doubt concerning the safety to reenter. The employee must immediately notify the supervisor of the problem. The supervisor will determine if it is necessary to request assistance from the NCDC Biological Hazards Officer or the NCDC Safety Officer. If a hazard exists and the area must be entered, personnel from the NCDC Biological Hazards Office and the NCDC Safety Office can do so in protective clothing that allows them to work safely in contaminated environments.

2. The importance of keeping everyone out of the room where the accident occurred cannot be over emphasized. The only justification for immediately reentering such an area would be to save life or prevent a fire or explosion. In almost every instance, the hazard in the room will decrease as time passes.

3. If infectious agents are involved, at least one hour should be allowed for aerosols to be carried away and heavier particles to settle.

4. Chemicals spills may evaporate and be swept away rapidly, or may remain for a long time. Probability of fire or explosion is high when flammable solvents are spilled and ignition sources are present.

C. Determine the necessity for treating persons exposed to the dangerous agents. In addition to the usual first aid measures, treatment may be necessary to:

1. Limit the damage due to chemicals or to terminate exposure to pathogenic organisms.

2. Decontaminate exposed personnel.

3. Restrict contamination to the smallest area.

Supervisors are responsible for referring persons exposed to pathogens to a PHS Outpatient Clinic, to a contract medical facility, or to another appropriate medical authority. The immediate supervisor of the person being treated is responsible for submitting appropriate forms and for ensuring that all information regarding the specific agent or isolate involved in the exposure is made available to the physician at the medical facility when the patient is admitted. (See Personnel Guides for Supervisors, Chapter IV, Guide 8.)

D. Post signs "DANGER, DO NOT ENTER, CONTAMINATED AREA" as described in Manual Guide--Safety Management No. NCDC-2. Notify the NCDC Biological Hazards Officer or the NCDC Safety Office of the circumstances and that the sign has been posted.

E. Decontaminate the affected area. This may be carried out by the laboratory staff, or it may require special equipment and personnel from the NCDC Biological Hazards Office or the NCDC Safety Office. The laboratory supervisor is responsible for requesting needed assistance. The supervisor must request assistance if there is any doubt regarding the extent of the hazard, or if there is any reason to believe that those persons doing the decontamination and clean-up will be in a hazardous situation.

EXPOSURE TO TERATOGENIC AGENTS IN LABORATORIES

I. PURPOSE

This Guide sets forth policy regarding exposure to teratogenic agents in laboratories.

II. FEMALE EMPLOYEES OF CHILDBEARING AGE

A. General

Women of childbearing age, particularly women who are pregnant, must not be subjected to increased risk of exposure to possible or real teratogenic agents while employed or in training at CDC. In those circumstances where a risk exists, the woman is responsible for reporting pregnancy to her supervisor so that appropriate action can be taken.

B. Restrictions

1. All Women of Childbearing Age

Women of childbearing age, regardless of marital status, must present positive serologic evidence of past rubella infection or successful immunization to rubella before they shall be permitted to work in laboratories where live rubella virus is being used.

Similarly, women of childbearing age must possess positive serologic evidence of previous cytomegalovirus (CMV) infection before working in laboratories where CMV is being used.

(II. continued)

2. Pregnant Women

No live virus vaccine should be administered to a pregnant employee. If a pregnant woman is required to receive a live virus vaccine to perform her duties, she should be excluded from these duties during her pregnancy.

Laboratory exposure to radioactive materials should be avoided completely during pregnancy.

Since no information on the potential teratogenic effects of most microorganisms is available, the risk of laboratory infection with any microorganisms should be kept to a minimum during pregnancy. This restriction also applies to exposures to Australia Antigen (Hepatitis Associated Antigen - HAA) containing materials from which hepatitis infection might result. Those viruses to which the woman is known to be immune (that is, by serologic testing) can be safely worked with. Viruses or other microorganisms to which the woman is not known to be immune should be handled only under generally acceptable safe conditions (that is, inoculation of in vitro cultures, serology, etc.). Depending on the agent involved, work with such microorganisms which involves animal inoculation or infectious aerosols should be kept to a minimum or entirely eliminated.

III. ALL OTHER EMPLOYEES

No restrictions need be imposed on male employees or postmenopausal female employees for assignment to work areas where exposure (real or potential) to teratogenic agents exists. It is desirable, however, that these employees be tested serologically for evidence of past infection with the agents involved and that they promptly report to their supervisor any illness possibly related to their work assignment.

CONTROL OF AIR FLOW IN LABORATORY AREAS

I. PURPOSE

Safety in laboratory areas partially depends upon keeping infectious, toxic and flammable airborne materials in the laboratories where they originate. Controlling air flow helps accomplish this. This Guide provides policy and information pertinent to controlling air flow in CDC laboratory areas.

II. DOORS TO LABORATORIES

Doors to laboratories must be kept closed. CDC laboratory buildings are designed so that air moves from corridors into the labs. When the air flow is correctly balanced, air pressure in the corridor is higher than in the laboratories and the air flows rapidly under the doors and through the door slots into the laboratory. This rapidly moving curtain of air keeps airborne substances generated in the work areas from entering the corridors. This is especially important when infectious, toxic, or flammable agents are present. However, when a laboratory door is kept open, positive pressure in the entire corridor rapidly decreases, allowing airborne materials to be carried out of any laboratory on the corridor and into the hallway.

If the air does not flow from the hall into the laboratory when the door is closed, the Center Safety Officer, ext. 3837, or the Center Biological Hazards Control Officer, ext. 3862, should be contacted.

III. DOORS TO AUTOCLAVE ROOMS

Doors to autoclave rooms must not be blocked open. When these doors are open, odors and heat are released to the discomfort of everyone in the area.

Section I. Purpose
II. Doors to laboratories
III. Doors to autoclave rooms

I. PURPOSE

II. DOORS TO LABORATORIES

III. DOORS TO AUTOCLAVE ROOMS

Doors to autoclave rooms must not be blocked open. When these doors are open, odors and heat are released to the discomfort of everyone in the area.

USE OF LAMINAR AIR FLOW EQUIPMENT

Section I. General
II. Laminar Flow Clean Bench
III. Vertical Laminar Flow Biological Hood

I. GENERAL

Many microbiological hoods employ high efficiency filters and the laminar air flow principle to provide an ultra-clean work environment. Most of these devices are effective when properly used. Two types of laminar flow equipment, the laminar flow clean bench and the vertical laminar flow biological hoods, are discussed in this Guide.

The laminar flow clean bench protects the product from airborne contamination but does not protect the operator.

The vertical laminar flow biological hood protects both product and operator and may be used for agents of special hazard*. Safety and desirability of using this equipment to contain infectious material should be determined on an individual basis depending upon the agent, the proposed activity, and the need to prevent cross contamination.

Manufacturers' catalogs, reports of evaluations of laminar flow equipment and biological safety cabinets, and consultation regarding this equipment are available from the Center Biological Hazards Control Officer. Laminar flow equipment will be leak tested, adjusted or repaired by personnel of the Safety Office, upon request.

II. LAMINAR FLOW CLEAN BENCH

A large number of companies manufacture both vertical and horizontal laminar flow clean benches, intended only to protect the product or research work from airborne contaminants. Although one company may provide a better constructed unit than another, most of the commercially available equipment is adequate when:

-- The High Efficiency Particulate Air (HEPA) filter has been tested and certified. To meet standards this filter should be at least 99.97 per cent efficient in removing particles 0.3 micron or larger by the di-octyl phthalate (DOP) test.

*(See Class 3 agents, Classification of Etiologic Agents on the Basis of Hazard -- DHEW, PHS, CDC Jan. 1970.)

-- The HEPA filter housing has been properly sealed around the edges to prevent unfiltered air from bypassing the filter.

-- The air flow is adjusted to 80-100 linear feet per minute.

-- Proper technique is used to keep contamination generated by the microbiologist out of the research work.

-- The pre-filter is periodically cleaned or replaced.

Because of the risk to personnel, work with infectious material on a laminar flow clean bench is not advisable. Use of clean benches should be limited to the preparation of sterile media, the assembly of sterile components into complete units (for example, membrane filters), the examination of sterilized equipment and materials for possible contamination, and similar operations. Work with live agents should not be permitted.

III. VERTICAL LAMINAR FLOW BIOLOGICAL HOOD

Work, including most microbiological manipulations, with organisms of special hazard*, can be safely performed in a properly designed vertical laminar flow biological hood. This hood, however, cannot replace the standard gastight Class III biological safety cabinet for extremely hazardous work.

Protection to the operator is comparable to what one might receive with an open-face biosafety cabinet with approximately 100 linear feet per minute flow of room air being drawn into the cabinet. (This is about the level of the protection provided in a CDC type biosafety cabinet with the glove panel on but without gloves in place.) The vertical laminar flow biological hood also provides a high degree of protection from contamination to the study material.

Since all biological hoods of this type take from 10% to 20% of the air passing through them from the room, it is necessary to exhaust this same amount from the cabinet. This exhaust air should be piped outside of the building or into the building air exhaust by means of an open thimble** if the building does not recirculate exhaust air. It is important that exhaust air from the biological hood not be vented into the laboratory.

Comments under Section II regarding testing of filters and proper techniques also apply to this equipment.

*(See Class 3 agents, Classification of Etiologic Agents on the Basis of Hazard -- DHEW, PHS, CDC Jan. 1970)

**(See working drawing of Biological Safety Cabinet -- DHEW, PHS, CDC Mar. 1966)

REPORTING ACCIDENTS, INCIDENTS, AND INJURIES

I. PURPOSE

This Guide provides responsibilities and procedures for reporting accidents and incidents which:

- result in injuries, illnesses, or property damage to CDC personnel or property, or
- have potential to cause injury, create occupational hazards, or result in damage to property.

Detailed information is in DHEW Safety Management Manual Part 18 - Accident Reporting and Records, and Personnel Guides for Supervisors, Chapter IV, Guide 8-1, Compensation for Injury. Related materials are also in the DHEW General Administration Manual Part 4, Claims, and the DHEW Personal Property Management Chapter 6, Motor Vehicle Management, and Chapter 14, Property Boards-of-Survey and Reports-of-Survey.

II. GENERAL RESPONSIBILITIES

Responsibility	Action
CDC Safety Officer	1. Receive, investigate, and process all reports of accidents or incidents causing property damage, injury, illness, or having potential to cause property damage, injury, or illness.
	2. Handle any claims for or against the Government arising therefrom (see Manual Guide - General Administration No. CDC-57, Claims).
	3. Prepare summary or other required reports.

(II continued)

GENERAL RESPONSIBILITIES (continued)

Responsibility	Action
Employee (Including those assigned to state and local health departments, regional offices, or other locations in the regions, including CDC field stations)	1. Notify his supervisor as promptly as possible of all accidents or incidents which: - result in property damage, injury, or illness, or - have the potential to cause property damage, injury, or illness. 2. Report required data as follows: - If payrolled by CDC headquarters in Atlanta, report all required data through supervisor to the CDC Safety Officer at headquarters. - If payrolled by a regional office, report to the responsible regional office in the manner prescribed by that jurisdiction and furnish a copy of such reports, through channels, to the CDC Safety Officer.
Supervisor	1. Be knowledgeable of his responsibilities in case of accident or incidents involving employee under his supervision. 2. Assist employee in preparing forms and following other procedures. 3. Report all accidents or incidents before the close of business for the following work day to the CDC Safety Officer and, if Government property has been damaged, to the Custodial Officer or Property Management Officer 4. Report all on-the-job injuries resulting from accidents or incidents in accordance with Personnel Guide for Supervisors, Chapter IV, CDC Guide 8-1.

(II continued)

GENERAL RESPONSIBILITIES (continued)

Responsibility	Action
Supervisor (continued)	5. Take corrective action or advise higher authority of the need for such, when indicated.
	6. Keep a supply of forms available at all times for reporting accidents or incidents.

III. ON THE JOB INJURY

Responsibility	Action
Employee	1. Notify his supervisor immediately for obtaining necessary treatment, reporting the injury, etc.
Supervisor	1. Follow procedures in Personnel Guides for Supervisors, Chapter IV, CDC Guide 8-1, including preparing Form PHS 0.304 (CDC) (in triplicate)
	a. Insure that employee reporting to PHS Outpatient Clinic at Atlanta headquarters has all 3 copies of Form PHS 0.304 (CDC) when entering Clinic (in emergency cases, form may be prepared and distributed within 48 hours following injury).
	b. For other injured employees:
	- Send original of form to Safety Officer.
	- Retain yellow copy for supervisor's record.
	- Destroy blue copy.
	2. Prepare and send to Safety Officer two copies of Form HEW-516 if injured employee misses any time from work beyond the day of the injury.
	- Send initial report as soon as aware that time will be lost.
	- Report total number of days lost (on Form HEW-516 or report by telephone) when the employee returns to work.

(III continued)

ON THE JOB INJURY (continued)

Responsibility	Action
PHS Outpatient Clinic	1. Follow procedures in Personnel Guide for Supervisors, Chapter IV, CDC Guide 8-1, including completing Part II of Form PHS 0.304 (CDC), forwarding original of form to CDC Safety Officer and yellow copy to Supervisor, and retaining blue copy.
CDC Safety Officer	1. Investigate accidents or incidents and report on them as necessary.

IV. MOTOR VEHICLE ACCIDENT (both Government-Owned Vehicles and Privately Owned Vehicles used on Official Business)

Responsibility	Action
Employee (driver of vehicle)	1. Immediately notify: - supervisor or CDC Safety Officer. - state, county, or municipal authorities as required by law. - Interagency Motor Pool if driving GSA vehicle obtained outside Atlanta area. 2. Obtain information and complete forms, at scene of accident to the extent possible, as follows: a. Government owned vehicle (Forms are in a loose-leaf binder in vehicle.) Atlanta area: complete three copies of Forms SF-91, SF-94, and OF-26. Outside of Atlanta area: HEW (CDC) vehicle: complete three copies of Forms SF-91, SF-94, and OF-26. GSA vehicle: complete appropriate forms for Interagency Motor Pool and two copies of Forms SF-91, SF-94, and OF-26 for the supervisor to send to the CDC Safety Officer.

(IV continued)

MOTOR VEHICLE ACCIDENT (continued)

Responsibility	Action
Employee (driver of vehicle) (continued)	b. Privately-owned vehicles - Obtain witness statements at the scene of the accident insofar as possible. - Complete two copies of the SF-91 and OF-26 which are available from the supervisor. 3. Submit completed forms and other pertinent materials to supervisor as soon as possible.
Supervisor	1. Immediately, upon receipt of information that accident has occurred, notify Safety Officer, depending upon urgency of situation: - by telephone/wire, or - forward employee's report 2. In areas outside Atlanta, obtain a copy of investigating police officer's report of the accident. 3. Complete Form HEW-516 (same number of copies as SF-91 completed by employee). 4. If accident involved GSA car obtained outside Atlanta area, send appropriate forms to the Interagency Motor Pool. 5. Immediately send forms (completed by employee and supervisor) and other accompanying reports (including police officer's report and witness statements) to the CDC Safety Officer.

(IV continued)

MOTOR VEHICLE ACCIDENT (continued)

Responsibility	Action
Safety Officer	1. Conduct a thorough investigation of accident or, if more practicable, designate someone to act as Investigating Officer for him.
	2. In Atlanta area, report accident involving GSA vehicle to the Motor Pool Manager.

V. PROPERTY DAMAGE (EXCEPT MOTOR VEHICLE)

Responsibility	Action
Supervisor of area in which accident occurred	1. Complete and send to the CDC Safety Officer an original and one copy of Form HEW-516 when there is damage to private or Government property or an accident involving non-Government personnel.
	2. Report property damage to appropriate Custodial Officer and Property Management Officer in accordance with Manual Guide - Personal Property Management No. CDC-1, Personal Property Management and Control.
CDC Safety Officer	1. Promptly and thoroughly investigate the accident or incident.
Custodial Officers	1. Report the property damage to CDC Personal Property Management Officer, Administrative Services Branch, in accordance with Manual Guide - Personal Property Management No. CDC-1.

(V continued)

PROPERTY DAMAGE (EXCEPT MOTOR VEHICLE)

Responsibility	Action
Personal Property Management Officer	1. Take necessary action in accordance with DHEW Personal Property Management and Materiel Management Manuals.

VI. FIRE DAMAGE

Responsibility	Action
Employee observing fire	1. Extinguish fire, if possible. 2. Turn in fire alarm, if necessary. 3. Telephone CDC Safety Officer as soon as possible.
Supervisor of area in which fire occurs	1. Complete Form HEW-517 in triplicate and forward to CDC Safety Officer. 2. Follow procedures in Section V. for property damage if applicable.
CDC Safety Officer	1. Investigate the fire and report on it as necessary.

VII. SERIOUS DAMAGE ACCIDENT

Responsibility	Action
Supervisor of area in which accident occurred	1. Immediately telephone CDC Safety Officer. 2. Send a message report (in triplicate) within eight hours of accident resulting in: - fatality. - multiple disabling injuries to CDC employees and/or the public.

(VII continued)

SERIOUS DAMAGE ACCIDENT (continued)

Responsibility	Action
Supervisor of area in which accident occurred (continued)	- public damage of $1,000 or more. - all accidents involving leased or chartered aircraft or marine vessels. - radiation over-exposure. - biological exposure resulting in lost time (within 8 hours after lost time becomes known) or accidental release of biologicals where the public may be exposed.

VIII. FORMS

SF-91, Operator's Report of Motor Vehicle Accident

SF-94, Statement of Witness

OF-26, Data Bearing Upon Scope of Employment of Motor Vehicle Operator

Form HEW-516, Accident Report

Form HEW-517, Fire Report

PHS 0.304 (CDC), Supervisor's Report of Injury or Exposure to Infectious Material

Forms Supply: CDC Warehouse and Self Service Store

SF-91, SF-94, and OF-26 are also in a loose-leaf binder in Government-owned vehicles for use in reporting these accidents.

LABORATORY ACCIDENT INVESTIGATION BOARD

I. INTRODUCTION

Accidents in laboratories and infections resulting from work with etiologic agents must be reported to the CDC Safety Office on Form HEW-516, Accident Report, in accordance with Manual Guide - Safety Management No. CDC-8, Reporting Accidents, Incidents, and Injuries. Prompt and thorough investigation of many of these incidents will identify the causes so that appropriate action can be taken to prevent similar accidents.

A Laboratory Accident Investigation Board has been established to investigate these accidents and infections.

II. BOARD MEMBERSHIP

The Laboratory Accident Investigation Board shall consist of three members:

-- Two senior supervisory scientists who do mainly "bench work" -- appointed for two year terms.

-- The Unit or Section Chief of the Organization in which the accident or incident occurred.

The members appointed for two years are:

Dr. Kenneth Walls
Dr. George Morris

III. RESPONSIBILITIES

A. Board

The Board's overall responsibility is to make CDC laboratories safer places in which to work. This will be accomplished by:

-- reviewing techniques, kinds, and uses of equipment involved in the accident;

-- establishing the circumstances leading to the accident;

-- other appropriate means to determine how similar incidents can be prevented from occurring.

The Board will neither assign responsibility nor recommend disciplinary action. Recommendations of the Board will be made to the Director, CDC.

B. CDC Safety and/or Biological Hazards Control Officers

The CDC Safety and/or Biological Hazards Control Officers will aid the Board by:

-- selecting incidents for investigation;

-- assisting in the investigation;

-- serving as Secretary to the Board.

STORAGE OF FLAMMABLE SOLVENTS IN CDC LABORATORIES

I. PURPOSE

This Guide establishes policy and describes cabinets for storing flammable solvents in CDC laboratories. In this Guide, flammable solvents are defined as liquid substances having a flash point below 140° F and having a vapor pressure not exceeding 40 p.s.i.a. at 100° F.

II. POLICY

Effective July 1, 1971, the following items will be stored in National Fire Protection Association approved-type solvent storage cabinets:

- All containers of flammable solvents larger than half-gallon.
- All flammable solvents supplies, when cumulative amounts greater than two gallons are kept in one laboratory room.

III. STORAGE CABINETS

Several sizes of cabinets have been made in the CDC shops, allowing a choice to fit funds and available space. Many laboratories may require storage of only a few solvents and the supervisors may wish to share cabinets with adjoining laboratories.

(III. Storage Cabinets - continued)

NFPA approved-type cabinets made at CDC are on display in the Safety Office (Building 8 at Clifton Road Facility). Information on delivery time, costs, and cabinet capacity is available there. In addition, commercially manufactured flammable solvent storage cabinets are sold by several laboratory supply firms. These larger boxes hold either 30 or 45 one-gallon containers.

Laboratory supervisors should determine their storage needs and order appropriately sized cabinets through regular channels from Engineering Services Branch or commercial suppliers. Cost of the cabinets will be borne by the user. Engineering Services Branch must have orders by April 1, 1971, to deliver the finished cabinets by July 1.

Selected Policy Statements and Forms

Selected Policy Statements and Forms

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration
National
Communicable Disease Center
Atlanta, Georgia 30333

May 12, 1969

NCDC GENERAL MEMORANDUM NO. 69-10

VISITORS IN LABORATORY AREAS

Employees are reminded that it is against Center regulations to take children under 12 years of age into any laboratory area or animal holding area. Recently several employees have brought children to visit the laboratories. Although it is natural for employees to want their families to know about their work and working place, the Center cannot afford to unnecessarily expose anyone to a hazard. This applies most specifically to children, who may readily contact infections or get into dangerous chemicals in laboratories.

Laboratory supervisors are responsible for the safety of adult visitors to their laboratories, including determining that immunization requirements have been met.

Requests for group tours to laboratory areas should be directed to the NCDC Information Officer.

William C. Watson, Jr.
Executive Officer

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION

Date:

Reply to Attn of:

Subject: Notice Of Intent To Work With A Hazardous Biological Agent

To: Biohazards Control Officer, CDC
THROUGH:

Name and strain of agent _____

Inclusive dates of work _____

Brief description (methods, equipment, etc.) _____

_____

_____

Laboratory work will be done in Building _____, Room _____

Animals will be housed in _____.

Animal species to be used _____

Routes of inoculation _____

Will infectious aerosols be used? _____Will arthropods be used? _____ Who reviewed and approved protocol for safety of all personnel? _____ Are human immunizing agents available? _____ Has authorization to immunize your staff been requested from Center Director? _____ Were immunizations authorized? _____ Should other NCDC staff (engineering, technical services, etc.) be immunized? _____ Will terminal decontamination of laboratories and/or animal holding areas be required? _____.

HSM 3.614 (CDC)
3-69

HELP ELIMINATE WASTE HEW COST REDUCTION PROGRAM

This memo must be submitted early enough to allow the Biohazards Control Officer to contact supervisors of all personnel who will be at risk to assure that they will be immunized before work with the pathogenic agents begins. Allow at least three weeks; longer periods may be required for some agents. As soon as immunization completion dates are known, the investigator will be notified.

If immunizations are not required and if work hazards are satisfactorily controlled, clearance to begin work will be sent to the investigator by the Biohazards Control Officer.

The Biohazards Control Officer also will notify the following individuals, as appropriate, of the proposed work:

Chief, Scientific Services Section
Chief, Technical Services Section
Chief, Engineering Services Branch
Safety Officer
Medical Officer, USPHS Clinic

The form, "Notice of Intent to Work With A Hazardous Biological Agent," is to be filled out by the investigator whenever a hazardous new project or procedure is planned. In general, the form should be used when the investigator wants the Biohazards Control Officer to review his safety and containment plans or when work that requires immunization with a new vaccine is planned. The forms may be sent through administrative channels or directly to the Biohazards Control Officer; the route chosen is a matter of organizational policy.

When the Biohazards Control Officer receives the notice, he and the investigator together evaluate the project protocol, equipment, work space, and other pertinent information for safety, and the Biohazards Control Officer writes a report in which conditions for project approval are defined. Copies are sent to all who need information about the work—such as Engineering Services and Scientific Services if their personnel will require immunizations or if their access to an area will be restricted—and to the Medical Officer in Charge (MOC) of the Outpatient Clinic, who is always informed when new agents are to be studied.

The use of the form is not mandatory. However, using it is highly desirable if the possibility of injury to staff members or others is at all greater than for routine procedures.

M E M O R A N D U M

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration
National Communicable Disease Center

TO : All Laboratory Personnel
NCDC Laboratories

FROM : Biological Hazards Officer and Safety Officer

SUBJECT: Storage and disposal of flammable solvents

Storage of solvents

Kitchen type refrigerators are used extensively in NCDC laboratories. Some of these refrigerators have been modified to make them safe for storing flammable solvents; others have not. Non-modified refrigerators must not be used for storing flammable solvents.

If you have any doubts about whether a refrigerator has or has not been modified, ask Engineering Services, Ext. 3216, to examine it. Each refrigerator should have the proper sign on its door. Signs, obtainable from the Safety Office, Ext. 3837, Bldg. B, Room 221, read:

CAUTION. THIS BOX IS NOT EXPLOSION
PROOF, BUT INTERNAL WIRING HAS BEEN
MODIFIED TO PERMIT STORAGE OF WELL-
STOPPERED FLAMMABLE OR EXPLOSIVE
MATERIALS

and

DO NOT STORE ETHER, ACETONE, OR OTHER
VOLATILE OF FLAMMABLE MATERIALS IN
THIS LOCATION

Considerable confusion exists about using refrigerators to store flammable solvents. In many cases it is better to store them on well-ventilated open shelves. A refrigerator provides a cold, relatively safe place to keep some kinds of solvents - but safe only if the flash point of the solvent is above the temperature of the refrigerator. Ethyl ether, for example, has a flash point of -49°F and should not be kept in refrigerators. There are other disadvantages to refrigerator storage. Cold solvents pick up atmospheric moisture much faster when opened than those kept at ambient temperature. Also, cold does not retard the formation of peroxides in ethers. Then there is the problem of leaks or spills in refrigerators.

When these occur, evaporation takes place but the fumes are not carried away. Because the fumes remain in the box, it is very important that no ignition source be present when the door is opened.

Therefore, we do not recommend storing ether or other solvents with flash points below refrigeration temperature in modified refrigerators.

We do recommend:

1. The use of the smallest containers of flammable solvents compatible with your work.
2. Keep only the minimum supply on hand.
3. Anticipate spills and other accidents by removing all ignition sources when using flammable solvents; i.e., turn off burners, disconnect motors, heaters, etc.

Disposal of waste solvents

If waste solvents are miscible in water and the volume is less than a pint, flush down the drain, using large amounts of cold water. If not miscible in water, or in amounts greater than a pint pour waste solvents into a waste solvent can. The cans are listed in the GSA catalogue as items 7240-240-695 and 7240-655-4958. The Safety Office will empty the cans for you, on request.

If you have any questions about storage and disposal of flammable solvents, or other safety problems, call the Safety Office, 3837, or the Biological Hazards Officer, 3883.

James Johnson
Safety Officer

Robert Huffaker, DVM
Biological Hazards Officer

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration
National
Communicable Disease Center
Atlanta, Georgia 30333

July 3, 1969

NCDC GENERAL MEMORANDUM NO. 69-11

LABELING OF EQUIPMENT SENT FOR MAINTENANCE/REPAIRS

To assure that all equipment sent to Engineering Services Branch for maintenance and/or repairs is free from hazardous infectious organisms, Form HSM 0.593 (NCDC) must be signed and affixed to the equipment. A copy of the self-adhesive form is illustrated on the reverse of this page.

If electronic or other specialized complex equipment must be decontaminated by extraordinary methods before repairs or maintenance can be performed, the NCDC Biological Hazards Officer or the NCDC Safety Office should be contacted. The NCDC Biological Hazards Officer is Dr. R. H. Huffaker, telephone extension 3883. The NCDC Safety Office representative is Mr. Lewis Webb, telephone extension 3837.

Copies of Form HSM 0.593 (NCDC) are available at each of the maintenance and repairs shops or by telephone request to Engineering Services Branch.

William C. Watson, Jr.
Executive Officer

This equipment has not been exposed to highly infectious organisms and can be repaired safely without being decontaminated.

_____ (name)

_____ (title)

This equipment was decontaminated with ETO, steam _____

_____

on _____ 19 _____

by _____

(name)

_____

(title)

HSM 0.593 (NCDC)
6-67

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of Disease Prevention and Environmental Control
National
Communicable Disease Center
Atlanta, Georgia 30333

8/15/67

NCDC UNNUMBERED MEMORANDUM

OCCUPATIONAL INJURIES AND ILLNESSES

The attached Personnel Guide for Supervisors, Chapter IV, NCDC Guide 8-1, Compensation for Injury, is furnished for your information and guidance.

A capsule reminder of WHAT TO DO WHEN INJURED AT WORK follows:

1. Know your rights under the Federal Employees' Compensation Act. You, your family, and your family's future may be dependent upon a thorough knowledge of it.

2. Report to your supervisor, without delay, every on-the-job injury. If others were present at the time of your accident, get their names as witnesses.

3. Obtain first-aid treatment immediately. Infection is painful and costly. Even under compensation you lose from 25% to 33-1/3% of your pay check.

4. Consult your supervisor for the proper forms needed to obtain adequate medical treatment and to file a notice of injury. Report all injuries. Too often so-called minor injuries develop into serious conditions.

5. Submit promptly claim Forms CA-4 and CA-4A for compensation whenever any loss of pay is involved. Although technically you may have a year in which to present a claim, payment is dependent upon prompt completion of appropriate forms.

6. Abide by the rules and regulations that assure full protection to you and your family.

David J. Sencer, M.D.
Assistant Surgeon General
Director, National Communicable
Disease Center

Distribution: All NCDC Civil Service Employees

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of Drug Abuse Prevention and Environmental Control
National Institute
Communicable Disease Center
Atlanta, Georgia 30333

8/15/67

MCDC UNNUMBERED MEMORANDUM

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6. Abide by the rules and regulations that assure full protection to you and your family.

David J. Sencer, M.D.
Assistant Surgeon General
Director, National Communicable
Disease Center

Distribution: All MCDC Civil Service Employees

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Personnel Guides for Supervisors Transmittal Sheet

PHS, DP, National Communicable Disease Center No. 71 8/15/67

SUBJECT: COMPENSATION FOR INJURY

Remarks

The attached Guide has been revised to bring it up-to-date and to provide instructions for completing and submitting required forms. It is being distributed to all civil service employees for their information and guidance. Supervisors who maintain the Personnel Guides for Supervisors Manual should follow the filing instructions below. All other employees should keep this Guide for future reference.

CHANGES IN MANUAL

Issuance	Remove		Insert	
	Pages	Dated	Pages	Dated
Chapter IV, NCDC Guide 8-1, Compensation for Injury	1 - 3	10/25/63	1 - 4 plus Exhibit	8/15/67

Filing Instructions

Post receipt of this Transmittal Sheet on the NCDC Check List for Personnel Guides for Supervisors.

David J. Sencer, M.D.
Assistant Surgeon General
Director, National Communicable
Disease Center

Chapter IV - Conditions of Employment
NCDC Guide 8-1--Compensation for Injury

Purpose

This Guide supplements Federal Personnel Manual Chapter 810, Injury Compensation, and DHEW Personnel Guides for Supervisors, Chapter IV, Guide 8, Supplement 1, Compensation for Injury. It places responsibilities and sets forth procedures to be followed when an employee is injured or contracts a disease in the line of duty. Additionally, it provides procedures to be followed in obtaining emergency or limited treatment and/or medical care for an employee at the Clifton Road Facility in Atlanta, Georgia, area when he gets sick at work and the sickness is not covered under the Federal Employees' Compensation Act.

Coverage

All employees and officers of the Center except the Commissioned Corps of the Public Health Service are covered by the Federal Employees' Compensation Act. (For Commissioned Corps, see Commissioned Corps Personnel Manual, Sub-Chapter CC26.3b--Officer's Rights; Medical Care.)

The Act is a law to provide compensation for disability and death, full medical care, and rehabilitation service for employees who suffer injuries while in the performance of their duties. All personal injuries sustained at work and diseases proximately caused by the employment are covered, except that no benefits may be paid if the injury or death is caused by willful misconduct of the employee or intention to bring about the injury or death of himself or of another, or if intoxication of the injured employee is the proximate cause of the injury or death.

The Bureau of Employees' Compensation, U.S. Department of Labor, administers the Act. The regulations require that medical treatment be furnished by a Federal medical facility or a physician designated by BEC when available and practicable. Where such services are not available or if first aid cannot be obtained from an authorized facility without dangerous delay, it is permissible to call any duly qualified physician.

General

The term "on-the-job injury" or "work injury" includes exposure to infectious material or disease, injury, and illness proximately caused by employment. If an injury is sustained at work, regardless of whether such injury results in loss of work time, the employee is entitled to first aid and full medical

care, including hospitalization, without cost to him. He must, however, use the Federal medical facility or designated physician authorized, when available and practicable, and submit the required forms. The importance of furnishing complete information is strongly emphasized. (It is preferable that more information than is needed be supplied than too little.)

An employee who is enrolled in a plan under the Federal Employees' Health Benefits program and who suffers a work connected injury or illness, covered by the Federal Employees' Compensation Act, is not entitled to benefits from his Health Benefits Plan even though he does not utilize the medical care available to him under BEC.

A loss of wages or wage earning capacity, due to disability from an on-the-job injury, entitles an employee to monetary benefits at the rate of 66 2/3% of his salary or wage loss if he has no dependents. The rate is increased to 75% when he has one or more dependents; however, the maximum amount shall not exceed 75% of the monthly pay for the highest step of grade GS-15. For total disability, the minimum amount shall not be less than 75% of the monthly pay of the first step of grade GS-2, unless the employee's monthly pay is less. In that case, his monthly rate of disability compensation shall be the same as his regular monthly pay.

If, at the time the disability begins, an injured employee has annual or sick leave to his credit, use of such leave is at his discretion. An employee's pay must have ceased before he is entitled to receive compensation for disability. Where disability lasts less than 22 days, the compensation commences on the fourth day after pay stops. Where disability continues for 22 days or more, no waiting period is required for the commencement of compensation.

Responsibilities

Personnel Offices

Personnel offices shall advise and assist supervisors in the discharge of their responsibilities and insure that:

1. Each supervisor has a copy of this Guide and of DHEW Personnel Guides for Supervisors, Chapter IV, Guide 8, Supplement 1, and is advised of any deviation from the procedures in these Guides.

2. Each employee (a) knows that he is covered by the Federal Employees' Compensation Act and what its provisions are and (b) understands that the provisions under the Federal Employees' Health Benefits Act do not apply when treatment, care or services are covered under the Federal Employees' Compensation Act.

Procedures

In case of injury, illness, disease, or exposure to infectious material or disease:

A. The employee shall:

1. Notify his supervisor immediately.

2. Complete Form CA-1, Employee's Notice of Injury, in quintuplicate, and forward to the supervisor within 48 hours. (The only exception to this requirement is for sickness which is not work connected.)

B. The supervisor shall:

1. Arrange for prompt medical treatment.

2. Authorize medical treatment by completing appropriate Form CA-16, CA-17, HEW-390, or OF-27. (A listing of medical facilities and physicians designated by BEC is in DHEW Personnel Guides for Supervisors, Chapter IV, Guide 8, Supplement 1. In places where there are no government medical facilities or designated physicians, injured employees may be referred to any qualified local physician for treatment.)

3. Prepare and submit forms in accordance with the attached Exhibit.

4. Consult DHEW Personnel Guides for Supervisors, Chapter IV, Guide 8, Supplement 1, and/or your personnel office for more detailed procedures, if needed. Additionally, if an employee's injury is due to a motor vehicle accident, refer to Manual Guide - General Administration No. NCDC-4, Reporting of Accidents or Incidents. If an employee dies as a result of a work connected injury or illness, refer to Personnel Guides for Supervisors, Chapter VII, NCDC Guide 2-1--Death of an Employee - Communicable Disease Center Responsibilities and Procedures.

3. Copies of all forms required by BEC are reviewed for completeness before they are filed in the employees' personnel folders and, if necessary, supervisors are advised to send any needed additional information to BEC promptly.

Supervisors

Each supervisor shall know the name, location, and telephone number of a designated physician and a medical facility or other medical service in the local area to call when an employee under his jurisdiction is injured at work. In addition, each supervisor shall:

1. Insure that an employee receives prompt medical treatment and that his rights to compensation and continued treatment are protected.

2. Authorize medical treatment for the employee.

3. Keep available at all times a supply of forms required for reporting on-the-job injuries and illnesses and for filing claims. (These forms may be obtained through regular supply channels.)

4. Have the employee complete a notice of injury. (If the employee is unable to prepare the form, have someone do it for him.)

5. When required, make a report of the accident.

6. Receive claims for compensation and transmit them promptly to BEC.

7. Assist employees and their dependents in preparing claims.

8. Insure that all completed BEC forms show employment by DHEW, PHS, DP, National Communicable Disease Center (Code 1211).

9. Caution the employee or his survivors in any case where a third party is involved not to sign any papers presented by the third party without getting legal advice. (If the employee or his survivors desire, BEC will provide this legal advice.)

NOTE: Any supervisor who willfully fails, neglects, or refuses to make a report which is required to be filed under the Federal Employees' Compensation Act; or knowingly files a false report; or induces, compels, or directs an injured employee to forego filing of any claim for compensation or other benefits; or willfully retains any notice, report, claim, or paper shall be guilty of a misdemeanor and upon conviction shall be fined not more than $500 or imprisoned not more than one year, or both.

FORMS REQUIRED – INJURY OR ILLNESS (On-the-Job)* EXHIBIT

FORM NUMBER AND NAME	COPIES REQUIRED	PREPARED BY	DISTRIBUTION	SPECIAL INSTRUCTIONS**
CA-1, Employee's Notice of Injury or Occupational Disease	5	*Employee* will complete face of form and see that his witness(es), if any, complete appropriate part(s) on reverse side. *Supervisor* will complete items 14 through 18.	Original to appropriate BEC Office or to personnel office (See Special Instructions.) 1 copy to personnel office maintaining employee's Official Personnel Folder 1 copy to NCDC Safety Officer 1 copy for supervisor's record 1 copy for employee's record	Submit within 48 hours after the injury. Send original to appropriate BEC office if injury requires medical treatment or absence from work for more than the day or shift in which the accident occurred or if there is likely to be a claim against BEC. If none of these conditions exist, send original with copy to personnel office maintaining employee's Official Personnel Folder.
CA-2, Official Superior's Report of Injury	3***	Supervisor	Original to appropriate BEC Office 1 copy to personnel office maintaining employee's Official Personnel Folder 1 copy to PHS Outpatient Clinic, Atlanta, Georgia, *if used.* 1 copy for supervisor's record	Prepare only if injury requires medical treatment or absence from work for more than the day or shift in which accident occurred or if there is likely to be a claim against BEC.
CA-3, Report of Termination of Total or Partial Disability and Report of Death	3	Supervisor	Original to appropriate BEC Office 1 copy to personnel office maintaining employee's Official Personnel Folder 1 copy for supervisor's record	Complete items 1 through 15 whenever an injured employee is able to return to work after a period of disability caused by the injury. Complete items 16 through 23 in case of death resulting from an injury sustained while in the performance of duty.
CA-4, Claim for Compensation on Account of Injury	4	*Employee* will complete first part of form and get physician to complete second part. *Supervisor* will complete last part	Original to appropriate BEC Office 1 copy to personnel office maintaining employee's Official Personnel Folder 1 copy for supervisor's record 1 copy for employee's record	Submit 14 days after pay stops or when disability ends, if less than 14 days. (If supervisor considers claim unwarranted, he should attach a statement giving his reasons.)
CA-4A, Application for Augmented Compensation for Disability	4	*Employee* will complete first part of form. *Supervisor* will complete last part.	Same as above for Form CA-4	Submit with Form CA-4 regardless of whether or not an employee has dependents. (If he has no dependents, he should draw a line through Items A through D and write "no dependents".)
CA-8, Claim for Continuance of Compensation on Account of Disability	4	Same as above for Form CA-4	Same as above for Form CA-4	Complete if disability continues beyond the period covered on the original claim (Form CA-4). Submit on the 1st and 16th of each month, or as soon as possible after each of those dates.
CA-16, Request for Treatment of Injury Under the United States Employees' Compensation Act	4***	Supervisor	All 5 copies to be given to injured employee *when referred to PHS Outpatient Clinic, Atlanta, Georgia,* for treatment. (3 copies will be returned by clinic to supervisor for: submission of 1 copy to appropriate BEC Office, 1 copy to NCDC Personnel Management, and retention of 1 copy for record). *Otherwise,* original to injured employee for medical facility or physician providing treatment, 1 copy to appropriate BEC Office, 1 copy to personnel office maintaining employee's Official Personnel Folder, and 1 copy for supervisor's record.	Prepare to authorize treatment by a Federal medical facility or designated physician when there is *no* doubt that the injury is work connected. Prepare and submit at the time of injury except in a true emergency case, e.g., excessive bleeding or something that could be extremely dangerous to the employee's health or well being. Prepare and submit to appropriate facility or physician as soon as possible after emergency but not later than 48 hours after accident.

FORMS REQUIRED – INJURY OR ILLNESS (On-the-Job)* *Continued* EXHIBIT

FORM NUMBER AND NAME		COPIES REQUIRED	PREPARED BY	DISTRIBUTION	SPECIAL INSTRUCTIONS**
CA-17,	Request for Treatment of Injury Under United States Employees' Compensation Act When Cause of Injury is in Doubt	4***	Supervisor	Same as above for Form CA-16	Prepare to authorize treatment by a Federal medical facility or designated physician when there is a doubt that the injury was work connected or it was a hernia case. Attach to the Form CA-17 a statement (Form CA-32 in hernia cases), giving all the pertinent facts in the case and the reasons for doubting that the injury was work connected. Distribute to BEC at once so that advice may be given promptly on arrangements for continuing treatment.
CA-32,	Report on Hernia	4***	Supervisor	Same as above for Form CA-17	Attach to Form CA-17
HEW-390,	Authorization for Medical Treatment by Duly Licensed Physician	4	Supervisor	Original to injured employee for treatment by a physician other than BEC designated 1 copy to appropriate BEC Office 1 copy to personnel office maintaining employee's Official Personnel Folder 1 copy for supervisor's record	Prepare to authorize treatment by a duly licensed physician when a Federal medical facility or designated physician is not available or practicable. Forward copy to BEC at once so that advice may be given promptly on arrangements for continuing treatment.
PHS 00.304(CDC),	Supervisor's Record of Injury or Exposure to Infectious Material	3	Supervisor	All copies to be given to injured employee *when referred to PHS Outpatient Clinic, Atlanta, Georgia.* The Clinic completes Part II of the form and forwards original copy to NCDC Safety Officer, returns yellow copy to supervisor, and retains blue copy for file. *Otherwise,* submit original copy to NCDC Safety Officer, retain yellow copy for supervisor's record, and destroy blue copy.	Prepare and distribute within 48 hours after injury if employee required no medical treatment; otherwise, prepare when Form CA-16 or CA-17 or HEW-390 is prepared and distribute simultaneously. When employee is referrred to the PHS Outpatient Clinic, Atlanta, Georgia, for treatment, submit form with the authorization form (CA-16 or CA-17, whichever is used).
OF-27,	2-Way Memo	3	Supervisor	Original and 1 copy to PHS Outpatient Clinic, Atlanta, Georgia 1 copy for supervisor's record	Prepare to authorize treatment of an employee located at the Clifton Road Facility when he gets sick at work and the sickness is not proximately work connected or doesn't appear to be an illness caused by employment, e.g., common cold, headache, nausea, upset stomach, etc.

*The Bureau of Employees' Compensation may request the completion of forms not included in the Exhibit. If, at that time, you have any questions, contact the personnel office servicing your station.

**Complete every item on forms. If item is unapplicable, so state. If it doesn't absolutely apply, then qualify answer as necessary. If forms do not supply adequate information, submit supplemental data simultaneously. (Incomplete forms may delay payments of the claims.)

***Prepare extra copy for employees reporting to PHS Outpatient Clinic, Clifton Road Facility, Atlanta, Georgia

DHEW, PHS, DP, NCDC

T.S. 71 8/25/67

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Health Services and Mental Health Administration
USPHS - DDHS - Outpatient Clinic - Atlanta

TO : All Employees - Atlanta Area

DATE: May 16, 1969

FROM : Medical Officer-in-Charge

SUBJECT: Referral of employees injured on the job to US PHS Outpatient Clinic

Certain types of patients treated in Public Health Service hospitals and clinics are required to have documentary evidence of eligibility. One of these types is the civil service employee with a work-connected injury.

To obtain treatment for such an injury, the employee must present to the Clinic a Form CA-16, Request for Treatment of Injury Under the United States Employees' Compensation Act, or CA-17, Request for Treatment of Injury Under United States Employees' Compensation Act When Cause of Injury is in Doubt, filled out by his supervisor and PHS 00.304(CDC), Supervisor's Record of Injury or Exposure to Infectious Material. PHS 00.304(CDC), itself, is not sufficient. This form is for NCDC Safety Unit information only.

NCDC supervisors have repeatedly been informed that it is their responsibility to authorize medical treatment (CA-16 or CA-17) for employees with on-the-job injuries. NCDC memorandum dated August 15, 1967, signed by Dr. Sencer, entitled Occupational Injuries and Illnesses, transmitted to all NCDC civil service employees a copy of Guide 8-1, Chapter IV, Personnel Guides for Supervisors, which listed detailed procedures to be followed in cases of work-connected injuries.

It is unfortunate that NCDC civil service employees and supervisors have not complied with these instructions. As a consequence, Clinic personnel have been told that immediately following the date of distribution of this memorandum:

1. No work-connected injury will be treated in the Clinic unless the injured employee presents a CA-16 or CA-17 completed by his supervisor.

2. Employees who do not have the properly completed forms will be sent back to their supervisors to obtain them.

The procedures outlined above will be waived only in cases in which immediate treatment is needed to save life or limb, or in which pain is very severe.

T. E. Billings, M.D.

HELP ELIMINATE WASTE HEW COST REDUCTION PROGRAM

PHS 0 304 (NCDC)
REV. 2-67

SUPERVISOR'S RECORD OF INJURY OR EXPOSURE TO INFECTIOUS MATERIAL

SECTION I

To be completed in triplicate by Supervisor and delivered by patient, if possible, to clinic or first-aid station.

NAME *(Last, First, Middle Initial)*	CITY & STATE	BLDG & RM #	AGE	SEX ☐ Male ☐ Female

OCCUPATION TITLE	BRANCH & SECTION	DATE & TIME OF INJURY	EXTENSION NO.

HOW DID INJURY OCCUR?

WITNESSES, IF ANY *(Names in Full)*	SIGNATURE OF SUPERVISOR

SECTION II

To be completed by Medical Officer or attendant, and distributed as indicated below.

NATURE AND EXTENT OF INJURY

DISPOSITION *(Check one)*:

☐ Returned to Regular Assignment ☐ Hospital ☐ Sent Home ☐ Other *(Specify)*

ESTIMATED ABSENCE IN DAYS BEYOND DATE OF INJURY	SIGNATURE OF MEDICAL OFFICER OR ATTENDANT

SECTION III

To be completed by NCDC Safety Officer.

INVESTIGATION

2-SUPERVISOR

CLINICAL RECORD

IMMUNIZATION RECORD

SMALLPOX VACCINATION (PRIOR SCAR? ☐ YES ☐ NO)

DATE	ORIGIN	BATCH NO. TYPE	PHYSICIAN'S NAME	NURSE

(HISTORY OF SMALLPOX? ☐ YES ☐ NO)

INSPECTION DATE	RESULT	PHYSICIAN'S NAME	NURSE

DIPHTHERIA-PERTUSSIS-TETANUS *(Combined)*

DATE	DOSE	PHYSICIAN'S NAME	NURSE

POLIOMYELITIS

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TETANUS TOXOID

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TYPHOID AND PARA-TYPHOID

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TETANUS ANTITOXIN

DATE	RESULT OF SKIN TEST	DOSE	PHYSICIAN'S NAME	NURSE

OTHER IMMUNIZATIONS *(Typhus, Plague, Influenza, etc.)*

DATE	NATURE OF VACCINE	DOSE	PHYSICIAN'S NAME	NURSE

CHOLERA

DATE	ORIGIN	BATCH NO. TYPE	DOSE	PHYSICIAN'S NAME	NURSE

YELLOW FEVER

DATE	ORIGIN	BATCH NO.	DOSE	PHYSICIAN'S NAME	NURSE

IMMUNITY TESTS *(Schick, T.B., etc.)*

DATE	TYPE TEST	RESULT	PHYSICIAN'S NAME	NURSE

PATIENT'S IDENTIFICATION

REGISTER NO.

WARD NO.

IMMUNIZATION RECORD

PHS-1595-1
(REV. 4-66)

HEW-Lex

CLINICAL RECORD

IMMUNIZATION RECORD

SMALLPOX VACCINATION (PRIOR SCAR? ☐ YES ☐ NO) (HISTORY OF SMALLPOX? ☐ YES ☐ NO)

DATE	ORIGIN	BATCH NO. TYPE	PHYSICIAN'S NAME	NURSE	INSPECTION DATE	RESULT	PHYSICIAN'S NAME	NURSE

DIPHTHERIA-PERTUSSIS-TETANUS *(Combined)*

DATE	DOSE	PHYSICIAN'S NAME	NURSE

POLIOMYELITIS

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TETANUS TOXOID

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TYPHOID AND PARA-TYPHOID

DATE	DOSE	PHYSICIAN'S NAME	NURSE

TETANUS ANTITOXIN

DATE	RESULT OF SKIN TEST	DOSE	PHYSICIAN'S NAME	NURSE

OTHER IMMUNIZATIONS *(Typhus, Plague, Influenza, etc.)*

DATE	NATURE OF VACCINE	DOSE	PHYSICIAN'S NAME	NURSE

CHOLERA

DATE	ORIGIN	BATCH NO. TYPE	DOSE	PHYSICIAN'S NAME	NURSE

YELLOW FEVER

DATE	ORIGIN	BATCH NO.	DOSE	PHYSICIAN'S NAME	NURSE

IMMUNITY TESTS *(Schick, T.B., etc.)*

DATE	TYPE TEST	RESULT	PHYSICIAN'S NAME	NURSE

PATIENT'S IDENTIFICATION

REGISTER NO.

WARD NO.

IMMUNIZATION RECORD

PHS-1595-1
(REV. 4-66) HEW-Lex

U.S. DEPARTMENT OF LABOR
Wage and Labor Standards Administration
Bureau of Employees' Compensation

REQUEST FOR EXAMINATION AND/OR TREATMENT

PART A – AUTHORIZATION

INSTRUCTIONS TO AUTHORIZING OFFICIAL. This side of Form CA-16 shall be completed in full by you to authorize a medical officer of the United States, a designated medical facility, or other qualified physician to examine and/or treat a Federal employee for a personal injury sustained while in the performance of duty. Where practicable, medical officers of the United States or designated medical facilities shall be utilized. You shall take care to check box "A" or box "B" in item 6. Also, in item 12 the address of the proper office of the Bureau of Employees' Compensation shall be shown. Send an original and one copy of this form to the medical officer or physcian.

1. NAME AND ADDRESS OF THE MEDICAL FACILITY OR PHYSICIAN AUTHORIZED TO PROVIDE THE MEDICAL SERVICE

2. EMPLOYEE'S NAME *(Last, first, middle)*	3. DATE OF INJURY *(Mo., day, yr.)*	4. OCCUPATION

5. DESCRIPTION OF INJURY

6. YOU ARE AUTHORIZED TO PROVIDE MEDICAL SERVICE TO THIS EMPLOYEE SUBJECT TO THE FOLLOWING CONDITIONS.

☐ A–You are requested to provide medical, surgical, or hospital treatment which may be necessary for the effects of this injury exclusive of elective surgery.

☐ B–There is doubt whether the employee's disability is caused by an injury sustained while in the performance of duty. You are requested to examine the employee, using indicated diagnostic studies, and promptly advise the undersigned whether you believe the disability is due to the alleged injury. Pending further advice you may provide necessary emergency treatment if you believe the disability may be due to the injury.

YOU ARE ALSO REQUESTED TO SUBMIT A WRITTEN REPORT TO THE OFFICE OF THE BUREAU OF EMPLOYEES' COMPENSATION NAMED IN ITEM 12 BELOW *(See instruction for completing your report and submitting your charges on the back of this form).*

7. SIGNATURE OF AUTHORIZING OFFICIAL *(Sign all copies)*	8. TITLE

9. LOCAL TELEPHONE NUMBER	10. DATE *(Mo., day, yr.)*

11. NAME AND ADDRESS OF EMPLOYEE'S PLACE OF EMPLOYMENT *Dept.* *Bureau* *Local Address*	12. SEND ONE COPY OF YOUR REPORT TO *(Fill in address):* U.S. DEPARTMENT OF LABOR Wage and Labor Standards Administration Bureau of Employees' Compensation

FORM CA-16
REV. DEC. 1967

PART B – ATTENDING PHYSICIAN'S REPORT

INSTRUCTIONS TO PHYSICIAN. As promptly as possible after you examine this employee (FIRST SEE ITEM 6 ON THE FRONT OF THIS FORM), you are requested to submit a medical report to the Bureau of Employees' Compensation. It may be made on the form provided below or in narrative form. Your itemized bill may also be submitted on the form provided below or on your billhead stationery. If there is prolonged disability, supplemental narrative reports should be submitted at reasonable intervals unless you make periodic reports to the Bureau in some other manner. If additional space is needed, attach a separate sheet. If a narrative report is made, attach it to this form.

1. WHEN DID YOU FIRST SEE THIS EMPLOYEE? *(Mo., day, yr.)*

2. HAVE YOU DISCHARGED HIM? ☐ YES ☐ NO
IF YES, WHEN?
IF NO, WHEN DO YOU EXPECT TO DISCHARGE HIM?

3. WHAT HISTORY OF INJURY (INCLUDING DISEASE CAUSED BY THE EMPLOYMENT) DID HE GIVE YOU?

4. WHAT ARE YOUR FINDINGS? *(Please include results of x-rays and laboratory tests.)*

5. WHAT IS YOUR DIAGNOSIS?

6. DO YOU BELIEVE THIS DISABILITY IS JOB RELATED? *(Please explain your answer if there is doubt.)* ☐ YES ☐ NO

7. DID THE INJURY CAUSE DISABILITY FOR WORK? ☐ YES ☐ NO
IF YES, WHEN WAS HE ABLE TO RETURN TO WORK
OR WHEN DO YOU EXPECT HE CAN RETURN?

8. WHAT TYPE AND FREQUENCY OF TREATMENT DID YOU PROVIDE?

9. DID THE INJURY REQUIRE HOSPITALIZATION? ☐ YES ☐ NO
IF YES, WHAT WAS THE DATE OF ADMISSION?
WHAT WAS THE DATE OF DISCHARGE?

10. WHAT ARE YOUR FURTHER RECOMMENDATIONS AND REMARKS?

11. PHYSICIAN'S SIGNATURE	12. ADDRESS OF PHYSICIAN	13. DATE OF REPORT

14. MEDICAL BILL. Charges for your services may be presented in the space below or on your billhead stationery.

Date or period of treatment	Services or supplies must be itemized (Please explain fully reason for any differences in charges on different dates)	Quantity or number	Unit price		Amount	
			Cost	Per	Dol.	Ct.
	TOTAL →					

HEW-Lex

SECTION II

PREVENTIVE ASPECTS OF BIOSECURITY FOR PERSONS WORKING WITH HAZARDOUS MICROBIOLOGIC AGENTS

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or by the U.S. Department of Health, Education, and Welfare.

PREFACE

Section II of this manual is the result of contributions from many of the professional staff of the Center for Disease Control (CDC). It was prepared by or under the direction of the Medical Advisory Committee to the Director, CDC. Grateful acknowledgement is made to James O. Mason, M.D., who served as Chairman of the Committee and provided guidance during many of the stages in the preparation of Section II, and to members of the subcommittee who were directly responsible for its development:

John V. Bennett, M.D., Chairman of the subcommittee and Chief, Bacterial Diseases Branch, Epidemiology Program
George R. Healy, Ph.D., Chief, Helminthology and Protozoology Unit, Parasitology Section, Microbiology Branch, Laboratory Division
Robert E. Kissling, D.V.M., Chief, Virology Section, Microbiology Branch, Laboratory Division
George F. Mallison, M.P.H., Chief, Microbiologic Control Section, Bacterial Diseases Branch, Epidemiology Program
Myron G. Schultz, M.D., D.V.M., Chief, Parasitic Diseases Branch, Epidemiology Program
Peter B. Smith, Ph.D., Chief, Bacterial Reference Unit, Bacteriology Section, Microbiology Branch, Laboratory Division
Fred E. Tosh, M.D., Deputy Director, Ecological Investigations Program.

In addition, the following individuals made substantial contributions to the vaccine section: Philip S. Brachman, M.D.; Eugene J. Gangarosa, M.D.; Kenneth L. Herrmann, M.D.; Roslyn Q. Robinson, Ph.D.; R. Keith Sikes, D.V.M.; and Lowell S. Young, M.D.

Appreciation is also expressed to the innumerable additional persons who assisted in the preparation of Section II.

H. Bruce Dull, M.D.,
Assistant Director
for Program, and
Chairman, Medical Advisory
Committee to Center Director

TABLE OF CONTENTS

SECTION II

*Figures in this column refer to numbers in the center of the bottom of the page.

INTRODUCTION

The Medical Advisory Board to the Director, Center for Disease Control (CDC), has given the name "biosecurity" to the Center's broad program of preventive medicine, which is particularly designed to protect the health of those associated with biological laboratories. The program includes general health care, proper management of biological emergencies, and safe laboratory practices. The laboratory and immunization aspects of biosecurity for hazardous microbiologic agents are presented in this manual. The principles and practices described in this manual are recommended to reduce the risk of laboratory-acquired infections among laboratory workers, their supporting staffs, other employees, and the people who live in communities where laboratory facilities are located.

The prompt and proper identification and reporting of hazards and accidents is essential to an effective biosecurity program. These responsibilities rest mainly with laboratory supervisors. In general, when a problem arises, the employee must notify his supervisor immediately. The supervisor determines whether to request assistance from others such as the Biohazards Control or Safety officers. Supervisors are also responsible for the safety of visitors. They must determine that visitors are properly immunized, understand inherent risks, and need to be in potentially hazardous or restricted areas and that they have received appropriate instructions in safety.

Implementation of an effective biosecurity program depends upon participants' having the necessary knowledge to carry out the program. An employee who is aware of risks is less likely to be exposed. The same is true if he has been trained in safe laboratory procedures. Everyone who works in a biological laboratory should have a sense of responsibility for safety and access to knowledge of safe laboratory procedures. He must know how to protect himself, as well as those with whom he comes in direct or indirect contact.

Operational Requirements for Safe Laboratory Handling of Hazardous Micro-organisms

Operational Requirements for Safe Laboratory Handling of Hazardous Micro-organisms

INTRODUCTION

This section presents certain safety requirements for handling specific hazardous micro-organisms. These requirements derive from judgment based on present knowledge; as further knowledge accumulates and additional vaccines are developed, the requirements for some agents will change. The operational requirements are also based, in part, on the existing facilities and resources at CDC. Similar precautions probably would not be feasible in many other institutions. Information on required vaccines appears on pages II-11 through II-64.

In the following tables on operational requirements for safety in the laboratory, no attempt was made to cover all microbiologic agents. All known micro-organisms that are not listed, however, can be handled safely in the laboratory without special equipment, techniques, or immunization of personnel.

Precautions are indicated only when they are clearly required for the safety of laboratory workers or others. Optional or debatable items have been excluded; only those items deemed absolutely necessary for safety are presented. Thus, the following table of operational requirements presents only minimal safety criteria. For example, it is highly desirable that all laboratories be under negative air pressure; however, the absence of negative air pressure in laboratories working with certain agents may not be associated with an infection hazard.

Several additional operational principles and habits might be routine in laboratories even though they may not be required for safety with all micro-organisms. As a general principle, doors to laboratories should be kept closed except for necessary entrances and exits, and visits by extraneous persons should be discouraged. Eating, drinking, or smoking in the laboratory is undesirable. Handwashing by laboratory personnel should be encouraged, and bulb pipetting, a good laboratory procedure, can be generally recommended. Disinfection of work surfaces after working with a disease agent is strongly recommended as a routine measure. All of these general recommendations are desirable, even if they are not specifically needed for the safe handling of certain agents.

The following index table (Table 1) lists hazardous micro-organisms within the basic categories of Bacteria, Parasites, Viruses (including Rickettsia and Bedsonia), and Fungi. Each agent has been given a number and an alphabetic letter that identifies its "Precaution Category" (PC). The letter appears immediately to the right of the name of the agent. Table 2, the operational requirements table, contains precaution categories in alphabetic order ; the specific requirements for handling a particular agent are indicated by "+" entries under the various columns. Micro-organisms that require the same set of precautions are grouped within the same precaution category and, to conserve space, are identified by their code numbers.

Comments on each column heading in Table 2 follow the table.

Table 1

INDEX TO OPERATIONAL REQUIREMENTS

OID**	BACTERIA	PC***
1	Actinobacillus-all species (except *A. mallei*)	D
2	*Actinobacillus mallei*	BB
3	Antinomyces-all species	D
4	*Aeromonas salmonicida*	D
5	*Arizona arizonae*-all serotypes	D
6	*Bacillus anthracis**	AA
7	Bartonella-all species	N
8	Bordetella-all species	D
9	Brucella-all species	BB
10	*Clostridium botulinum**	AA
11	*Clostridium tetani**	G
12	Clostridia-other species	D
13	*Corynebacterium diphtheriae**	G
14	Corynebacteria-other species	A
15	*Erysipelothrix insidiosa*	D
16	*Haemophilus ducreyi,* *H. gallinarum* *H. influenzae*	D
17	*Herellea vaginicola*	A
18	Klebsiella-all species	A
19	Leptospira-all species	D
20	Listeria-all species	D
21	*Mima polymorpha*	A
22	*Mycobacterium avium, bovis, johnei, tuberculosis*	CC
23	Mycobacteria-all other species	D
24	Mycoplasma-all species	D
25	*Neisseria gonorrhoeae* and *N. meningitidis*	D
26	*Pasteurella pestis,** *tularensis,** *multocida* (Type B)	AA
27	Pasteurella-all other species	D
28	*Pseudomonas pseudomallei*	BB
29	*Salmonella typhi**	G
30	Salmonella-all other species	D
31	Shigella-all species	D
32	*Sphaerophorus necrophorus*	D
33	*Staphylococcus aureus*	D
34	*Streptobacillus moniliformis*	D
35	*Streptococcus pneumoniae*	D
36	*Streptococcus agalactiae* *S. equi, S. equisimilis* *S. pyogenes* of Lancefield's Groups A, B, C, G	D
37	*Treponema pallidum, pertenue, carateum*	D
38	*Vibrio comma**	K
39	*Vibrio fetus*	D
40	*Yersinia enterocolitica*	D

OID**	PARASITES	PC***
41	*Echinococcus granulosus*	C
42	*Echinococcus multilocularis*	C
43	*Leishmania braziliensis*	N
44	*Leishmania donovanii*	N
45	*Leishmania mexicana*	N
46	*Leishmania tropica*	N
47	*Naegleria gruberi*	L
48	*Plasmodium falciparum*	F
49	*Plasmodium malariae*	F
50	*Plasmodium ovale*	F
51	*Plasmodium vivax*	F
52	*Pneumocystis carinii*	T
53	*Shistosoma haematobium*	H
54	*Shistosoma japonicum*	H
55	*Shistosoma mansoni*	H
56	*Taenia solium*	B
57	*Toxoplasma gondii*	T
58	*Trypanosoma cruzi*	N
59	*Trypanosoma gambiense*	D
60	*Trypanosoma rangeli*	B
61	*Trypanosoma rhodesiense*	D

OID**	VIRUSES, RICKETTSIA, BEDSONIA	PC***
62	Adenoviruses-all types	I
63	Arboviruses-general	Y
64	B. virus	CC
65	Coxsackie A & B-all types	J
66	Cytomegalovirus	I
67	Echoviruses-all types	I
68	Encephalomyocarditis virus	L
69	Hepatitis-infectious & serum	I
70	Herpesviruses except B	L
71	Infectious bronchitis-like virus	L
72	*Influenza virus-all types**	I
73	K virus	P
74	Langat	R
75	Lassa virus	EE
76	Marburg virus	EE
77	*Measles virus**	K
78	Murine viruses, including ectromelia, LCM, murine hepatitis, etc.	E
79	*Mumps virus**	K
80	Newcastle Disease virus	I
81	*Polioviruses**	M
82	Psittacosis, LGV	U
83	*Q Fever,* R. prowazeki*, and* all other rickettsia except *R. rickettsii*	Z
84	Rabies-Fixed & attenuated	I
85	*Rabies-Street virus**	S
86	Reoviruses	I
87	Respiratory syncytial virus	J
88	Rhinovirus	I
89	*Rickettsia rickettsii**	DD
90	*Rubella**	K
91	Simian viruses, (except B virus and Marburg)	J
92	*Smallpox virus Major and Minor**	DD
93	Tacaribe group viruses except Tamiami	EE
94	Tamiami virus	L
95	Tick-borne viral encephalitis: *(Russian-Spring-Summer-Encephalitis** and all other viruses of complex except Langat)	X
96	*Vaccinia**	P
97	Varicella	J
98	Venezuelan encephalitis virus-exotic strains	Y
99	VEE-domestic and vaccine strains	W
100	Vesicular stomatis & other rhabdoviruses	V
101	*Yellow Fever**	X

OID**	FUNGI	PC***
102	*Blastomyces dermatididis*	O
103	*Cryptococcus neoformans*	O
104	Paracoccidioides	O
105	*Histoplasma capsulatum*	Q
106	*Coccidioides immitis*	Q
107	*Sporothrix schenckii*	O

*Vaccines for these agents are described on pages II-13 through II-64.

**OID = Organism Identification Number

***PC = Precaution Category

Table 2[1]

OPERATIONAL REQUIREMENTS FOR SAFE LABORATORY HANDLING OF HAZARDOUS MICRO-ORGANISMS

Precaution Category	Geographic Isolation	Controlled Access	Negative Air Pressure	Hoods and Cabinets	Disinfection			Bulb Pipetting Required	Special Protective Equipment			Special Precautions with Work Involving		Special Aerosol Precautions (Centrifuge, Blender, etc)	Immunization Available and Required	Organisms Requiring These Precautions
					Work Surfaces	Entire Work Area	Material Before Leaving Work Area		Gloves	Masks	Other Special Clothing or Guards	Insects	Animals			
A					+											14,17,18,21
B								+								56,60
C													+			41,42
D					+			+								1.3.4,5.8.12.15. 16,19,20,23,24, 25,27,30,31,32, 33,34,35,36,37, 39,40,59,61
E							+	+								78
F												+	+			48,49,50,51
G					+			+							+	11,13,29
H					+			+	+				+			53,54,55
I					+		+	+								62,66,67,69,72, 80,84,86,88
J				+	+		+	+								65,87,91,97
K					+		+	+							+	38,77,79,90
L				+	+		+	+						+		47,68,70,71,94
M				+	+		+	+							+	81
N				+	+			+				+	+			7,43,44,45,46, 58
O		+		+	+		+	+						+		102,103,104,107
P				+	+		+	+						+	+	73,96
Q		+	+	+	+		+	+						+		105,106
R				+	+		+	+				+	+	+		74
S					+		+	+	+				+		+	85
T	+	+		+	+			+	+				+	+		52,57
U	+	+	+	+	+		+	+						+		82
V	+			+	+		+	+				+	+	+		100
W			+	+	+		+	+				+	+	+		99
X	+	+	+	+	+		+	+				+	+	+	+	95,101
Y	+	+	+	+	+	+	+	+	+			+	+	+	+	63,98
Z	+	+	+	+	+	+	+	+		+	+	+	+	+	+	83
AA	+	+	+	+	+	+	+	+	+	+		+	+	+	+	6,10,26
BB	+	+	+	+	+	+	+	+	+	+		+	+	+		2,9,28
CC	+	+	+	+	+	+	+	+	+	+	+		+	+		22,64
DD	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	89,92
EE	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Newly discovered agents and 75,76, 93

1. An explanation of column headings follows this table.

EXPLANATION OF COLUMN HEADINGS IN TABLE 2

Column 1: **Precaution Category** – The explanation is given on page II–

Column 2: **Geographic Isolation** – The action of isolating in a separate room or building in which no other work is concurrently conducted. A ventilating system to the room that prevents recirculation of air is implied. Exhaust air may be passed though **H**igh **E**fficiency **P**articulate **A**ir (HEPA) filters or incinerated. For extremely hazardous agents, an air lock should also be used.

Column 3: **Controlled Access** – The exclusion of extraneous persons from areas where certain agents are being handled. Such control decreases the probability of distractions resulting in accidents and limits the number of exposed individuals should an accident occur.

The degree to which access is limited depends upon the risk associated with being in the area: the greater the hazard, the more restrictive the entrance requirements.

Corridors are the least hazardous of any locations in restricted laboratory areas. Areas in which the work is associated with a greater degree of risk are marked by signs reading "Caution, do not enter without current immunization against (name of disease)" or "Caution, infectious agents, do not enter without authorization from (name of investigator)." These signs are posted only while the risk is present.

Entrance to some areas should be restricted to the staff assigned to it. Access to areas in which very hazardous agents are being used should be controlled with locks and keys. No-access areas should be posted with signs reading "Warning: Highly Infectious Material: *Keep Out.*" In temporary situations, such as following an accident, a large sign with bright red printing reading "Danger: DO NOT ENTER: Contaminated Areas" is posted. Areas posted with either of these signs are off limits to *all* personnel except the investigator who posted the sign. One should not pass these signs for *any* reason, not even to fight fire.

Questions about the location of areas of restricted access, the hazards in the areas and the risk of infection, the times when restricted areas can be visited, or the immunizations required for access should be directed to the Biohazards Control Officer.

Column 4: **Negative Air Pressure** – Ideally, the air pressure in all laboratories should be negative in relation to the pressure in surrounding corridors, thus helping to prevent agents from leaving the work area. When negative pressure is required, as shown in Table 2, it is essential for safety. Even when cultures are manipulated under hoods, negative pressure in the general lab area in relation to that in surrounding corridors is still highly desirable. In addition, doors to all laboratories should be closed except for necessary entrances and exits.

Column 5: **Hood and Cabinets** – These include protected work areas such as the CDC Bio-Safety Cabinet, glove boxes, laminar flow safety cabinets, and gastight isolators.

Column 6: **Disinfections** – Standard methods suitable for disinfection of work surfaces, entire work area, and material before leaving work area have not been presented. Disinfection should routinely take place when work with agents is completed, and each laboratory should be cleaned, work surfaces decontaminated, and all contaminated material either covered in discard pans or autoclaved at the end of the work day. The Biohazards Control Officer should be contacted for specific instructions.

Column 7: **Bulb Pipetting** – This heading is self-explanatory.

Column 8: **Protective Equipment** –

Gloves, including gloves on cabinet or hood ports, should be worn whenever one is handling organisms which call for this precaution. Gloves prevent the direct invasion of micro-organisms through intact skin and greatly reduce the hazards of indirect spread.

Masks should be worn to protect against the aerosol spread of certain organisms. Such masks should be worn except when the work is done in: a) a sealed cabinet in rooms with isolated ventilation systems with exhaust control, or b) effective immunizing agents have been given to all who might be exposed. High efficiency, disposable surgical masks are recommended; they are capable of reducing by 2 logs the number of airborne micro-organisms that are inhaled. Special respirators or supplied air equipment may have essentially complete respiratory protection.

Other Special Clothing or Guards – Face masks or shields, caps, safety gloves, booties, or even complete changes of clothing may be indicated for aerosol work with certain very hazardous agents. No attempt has been made to specify which special equipment may be needed for which special agents. The Biohazards Control Officer should be consulted for advice and guidance.

Column 9: **Special Precautions with Work Involving Insects and Animals** – These precautions have been stipulated for hazardous agents that might be capable of spread to humans through insects and animal vectors. Containment facilities should be secure before work is begun. The excretions and secretions of infected animals and insects may be infectious to humans, and personnel who must come in contact with them should routinely use special protective equipment. In some instances, discharges are capable of establishing disease in nature. These wastes must be decontaminated before they are released from the facility.

Column 10: **Special Aerosol Precautions** – Centrifuges, blenders, and other equipment capable of creating aerosols should be operated in separate "isolation" rooms or hoods. Special care should be taken in loading centrifuges to avoid accidental breakage during operation. Safety equipment to prevent the formation of aerosols is available and should be used. The Biohazards Control Officer should be consulted for further information.

Column 11: **Immunization Available and Required** – Immunization is generally recommended for all diseases against which effective, safe, and licensed vaccines have been developed. However, there are no vaccines against many highly virulent organisms, and some vaccines for such agents are investigational and without clear documentation of efficacy in humans. Nonetheless, in certain circumstances, the seriousness of the disease and the absence of other effective therapy may dicatate their use.

Vaccines and Indications for use in Laboratory Workers Dealing with Hazardous Microbiologic Agents

Vaccines and Indications for use in Laboratory Workers Dealing with Hazardous Microbiologic Agents

INTRODUCTION

This part of Section II contains detailed information on vaccines for each of the 20 agents for which immunization was required in the preceding subsection. It also includes descriptions of BCG and the influenza vaccines, although these were not required. Specific indications for use in laboratory workers have been based on the nature of the anticipated exposure to these microbiologic agents.

Special immunizations may be a condition of employment for individuals working in certain areas or with certain agents. Employee supervisors are responsible for initiating action to assure that employees receive the required immunizations. Arrangements to administer each of the 20 required vaccines can be made through the CDC clinic. The CDC Biohazards Control Officer oversees the immunization of persons at risk.

The composition of each vaccine, its licensure status, storage requirements, supplier, reactions, and efficacy are given. General recommendations for use of the vaccine and the specific laboratory workers that should receive the vaccine are presented along with information on dose, immunity, and laboratory problems. Finally, contraindications and precautions in using each vaccine are given.

A short bibliography of selected references on vaccine efficacy, laboratory accidents, and reactions follows the above information on each vaccine.

ANTHRAX VACCINE

1. Description

1.1 Composition — Anthrax vaccine (Anthrax Protective Antigen, Aluminum Hydroxide Adsorbed) consists of a filtrate factor readily separable from the bacterial cells elaborated during anaerobic growth of an avirulent nonencapsulated strain of *Bacillus anthracis* in a chemically defined medium with aluminum hydroxide gel as an adsorbent, formalin as a stabilizer, and benzethonium chloride as a preservative. Quantitative composition of the drug includes aluminum, 0.17%; aluminum oxide, 0.32%; benzethonium cloride, 1/40,000; and formalin, 0.009%.

1.2 Licence — Licensed.

1.3 Storage — Refrigerate. Vaccine is dated for use within a certain number of years after production.

1.4 Supplier — Immunobiologics Activity, Biological Reagents Section, Laboratory Division, CDC.

1.5 Reactions — Adverse reactions are not a significant problem. The initial evaluation using the vaccine prepared by aerobic cultures revealed that 2.8% of the vaccinees developed moderate local reactions consisting of erythema, induration, edema, and some tenderness. About 30% developed a small ring of erythema 1 to 2 cm. in diameter, with minimal local tenderness, and occasional pruritis at the inoculation site. This type of reaction would not have been noted except that each vaccinee was examined at 24 and 48 hours after vaccination. Both the mild and the moderate local reactions were noted within 24 hours and generally disappeared within 24 to 48 hours. A few vaccinees developed small, firm, painless nodules at the injection site. These persisted for several weeks. There was no correlation between the development of local reactions and successive inoculations. Approximately 0.1% developed more significant local reactions—edema, erythema, and pruritis involving the upper arm—and systemic fever and malaise. The few who developed this type of reaction responded to antihistamines within 24 hours. Since the initial evaluation, the new preparation prepared under aerobic or anaerobic conditions has been used in over 10,000 inoculations. No difference in degree of reactivity has been noted.

1.6 Efficacy — Before release, each batch of vaccine is potency-tested in laboratory animals (rabbits) for conformance with standards established by Wright and colleagues. The human evaluation studies CDC conducted among susceptible employees in a goat hair processing mill revealed the effectiveness to be 92.5%, with a lower 95% confidence limit of 65%.

2. Recommendations

2.1 General — Recommended primarily for persons who work with *B. anthracis* in the laboratory or with materials known to be or very likely to be contaminated with *B. anthracis*. Within the laboratory, persons who work directly with the organism and

those who take care of animals exposed to the organism either by inoculation or by the aerosol route should also be immunized. Persons who work in the same laboratory but not with *B. anthracis* should be immunized because of the possibility of accidental contact with the organism. All equipment in the laboratory in which *B. anthracis* is handled should be disinfected before it leaves the lab. Such disinfection should be mandatory. If such disinfection is practiced, personnel handling the glassware from the laboratories need not be immunized. If glassware is not so disinfected, persons handling these contaminated materials should also be immunized. Nonimmunized persons should not be allowed in the laboratory in which *B. anthracis* is being handled.

Employees in textile mills where imported, raw goat hair is processed should be immunized. The vaccine may also be used among employees who handle imported, contaminated wool, especially that from areas where anthrax is endemic among sheep. In industrial plants where less than 5% of surface swabs are positive for *B. anthracis,* the risk of employees developing anthrax is slight; therefore a mass immunization program is probably not indicated. Such immunization programs are advised where the contamination rate is in excess of 5%.

Veterinarians who are likely to come in contact with *B. anthracis*-infected animals or carcasses should be immunized.

2.2 Dose

Primary: 0.5 ml. subcutaneously at 2-week intervals for 3 doses.

Booster: 0.5 ml. subcutaneously at 6 months and then annually. Individuals who show moderate local reactions to the vaccine have been given 0.1 ml./1:100 dilution of the vaccine without subsequent reactions.

2.3 Immunity

There is no good way to assess an individual's immunity or susceptibility to the disease; however, persons who have had cutaneous anthrax and those with histories of primary immunizations and the requisite booster inoculations are considered immune.

2.4 Laboratory Problems

No laboratory-acquired cases of anthrax have occurred at CDC. However, 26 cases occurred at Fort Detrick during 1944-46, after which there were only five others. Five cases have been reported from other laboratories.

3. Contraindications Precautions

There are no known contraindications or precautions in using the vaccine. In persons who have had the natural disease, moderate local reactions may follow a single inadvertent inoculation of the vaccine. They should not be vaccinated.

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BCG VACCINE

1. Description

1.1 Composition

BCG vaccine is an attenuated live bacterial vaccine. (The initials stand for the bovine tubercle *bacillus* originally isolated by Nocard in 1902 and attenuated by *Calmette* and *Guerin* by repeated passages on a potato medium to which ox bile was added.) attenuation was begun in 1908; in 1920, after more than 200 passages, the bacillus was declared incapable of producing fatal tuberculosis in cattle, monkeys, guinea pigs, and rabbits. For composition and production details, see Rosenthal's book listed in bibliography.

1.2 License

Licensed in the United States.

1.3 Storage

Fresh liquid vaccine deteriorates on storage; use within 14 days of manufacture. Loses viability rapidly at warm temperatures (30°C.) and when exposed to sunlight.

The capacity of freeze-dried vaccine to produce satisfactory tuberculin sensitivity may be retained for long periods, but it is sensitive to heat, although less so than liquid vaccine, and should normally be stored in a refrigerator.

1.4 Supplier

Research Foundation, University of Illinois (Rosenthal vaccine); Eli Lilly and Company (Glaxo vaccine).

1.5 Reactions

Safety of the vaccine has been attested by extensive and prolonged use; however, adverse reactions do occur. Unduly large vaccination lesions and subcutaneous abscesses are not infrequent and are influenced by dose and technique. The local complication most often reported is adenitis of the regional lymph nodes. It occurs most frequently in infants. Frequency is related to dose. Dermatologic complications are rare and seem to be more severe and frequent among persons who have been revaccinated. Systemic complications of BCG are uncommon. Disseminated infection and death have been reported, but are rare.

1.6 Efficacy

BCG vaccination does not necessarily prevent infection with virulent tubercle bacilli, but it is generally agreed that it prevents disastrous complications of primary infection with virulent tubercle bacilli (especially miliary tuberculosis and tuberculous meningitis).

The extent to which BCG vaccine may enhance naturally acquired protection associated with low-grade tuberculin sensitivity is of particular relevance. In trials covering a wide variety of social and epidemiologic circumstances in which the protective effect of the vaccine has been defined by a close follow-up of a vaccinated and control group, BCG has conferred a substantial and similar degree of protection (about 80%). However, a much smaller degree of protection (about 30%) has been found in trials by the U.S. Public Health Service (PHS) in communities known to contain a large proportion of persons with naturally acquired low-grade tuberculin sensitivity.

An adequately performed BCG vaccination undoubtedly provides fairly satisfactory protection against (a) the immediate consequences of a tuberculous infection, (b) serious forms of primary tuberculosis, and (c) early postprimary pulmonary tuberculosis. The protection against late post-primary types of tuberculosis seems to be slighter and more uncertain.

2. Recommendations

2.1 General

The following statement (made in 1966) on the use of BCG vaccination in the United States represents the position of both the American Thoracic Society and the U.S. PHS.

RECOMMENDED USAGE

For the individual: Since modern methods for detection, isolation, treatment, and chemoprophylaxis, when adequately applied, are highly successful in controlling tuberculosis, BCG should be reserved for situations in which these methods cannot be applied. BCG should be used for the uninfected person or small groups of uninfected people living in unavoidable contact with one or more uncontrolled infectious persons who cannot or will not obtain or accept supervised treatment.

For groups: Based on available data, there is no epidemiologic indication for the use of BCG on a group or community basis in the United States. In particular, BCG is not recommended for medical and paramedical personnel and students or for employees and inmates of penal and mental institutions, because the knowledge of tuberculin conversion, if it occurs, is essential to instituting chemoprophylaxis and identifying and treating the infectious source. Moreover, adequate tuberculosis control programs can be developed in such groups with reasonable assurance of cooperation.

A so-called "micro-epidemic" of infection is another situation in which BCG is not recommended. Today, with low rates of transmission and expanded tuberculin testing, such outbreaks will be more easily recognized than in the past. Their management requires the prompt identification and removal of the source of infection and the identification and treatment of the tuberculin converters.

BCG vaccine is intended for use in individuals who have not experienced a prior infection. Therefore, it is not recommended for individuals with a history of natural disease or those who are tuberculin-positive. However, in mass vaccination campaigns, it has been determined that prior tuberculin testing is unnecessary and that vaccine administration to tuberculin-positive individuals under these circumstances does not result in complications of any significance.

BCG vaccination is not recommended for laboratory personnel, including those working with mycobacteria.

2.2 Dose — According to manufacturers' instructions; usually administered by multiple pressure method.

2.3 Immunity — The duration and degree of protection after vaccination may vary in different circumstances. Protection was found to extend for more than 10 years in at least one trial. Protection following vaccination may persist longer than associated tuberculin sensitivity, and disappearance of tuberculin sensitivity is not conclusive evidence that protection is no longer present.

Revaccination has been recommended in the past when postvaccination tuberculin hypersensitivity waned. Current evidence regarding the poor correlation between protective effect and persistence of hypersensitivity suggests that revaccination is unnecessary.

2.4 Laboratory Problems — With proper safety precautions and careful technique, the risk of developing mycobacterial infection in the laboratory is low. Monitoring laboratory personnel with periodic tuberculin testing is recommended so that, if infection with virulent *M. tuberculosis* occurs, treatment with isoniazid can be given to prevent the development of clinically manifest disease. A total of 174 laboratory infections have been reported.

3. Contraindications — There are no specific contraindications to BCG vaccination, although in individuals with impaired host defenses (immunologic insufficiency states) and with severe dermatitis, complications may be more likely.

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BOTULINUM TOXOID, PENTAVALENT (ABCDE)

1. Description

1.1 Composition — Botulinum Toxoid, Pentavalent (ABCDE) Aluminum Phosphate Adsorbed, is a combination of aluminum phosphate adsorbed toxoids derived from formalin-inactivated types A,B,C,D, and E botulinum toxins. Final product contains no more than 0.025% free formaldehyde. Thimerosal 1:10,000 is added as a preservative.

1.2 License — Unlicensed; limited to investigational use. Approved as IND.

1.3 Storage — Store at 2–10°C; do not freeze.

1.4 Supplier — Immunobiologics Activity, Biological Reagents Section, Laboratory Division, CDC.

1.5 Reactions — Mild systemic reactions can be anticipated after 0.5% of injections. Moderate or severe systemic reactions are not anticipated and should be reported by telephone or air mail to the supplier.

1.6 Efficacy — Experience has shown that: (1) botulinum toxoid is effective in protecting animals against intra-peritoneal challenge with *Clostridium botulinum,* (2) the serum antitoxin levels in animals as determined by mouse protection test correlate with protective activity, and (3) the toxoid introduced into man produces levels of antitoxin thought to be protective. These levels are established arbitrarily by extrapolation of data derived from laboratory animals.

In an experimental study with human volunteers, 30 persons were immunized on a 0–2–12 week schedule with the present lot of toxoid (listed in the references as Toxoid ABCDE–6).[1,2] Antitoxin content was determined at 14 weeks, 2 weeks after the initial series was completed. Of the 30 persons immunized, 90% had protective levels of Type A antitoxin; 93%, of Type B; 100%, Type C; 79%, Type D; and 100%, Type E. All titers declined after 14 weeks. Only a small percentage of individuals had measurable titers at 52 weeks, before a booster injection was given. However, 8 weeks after the booster injection, protective levels of antitoxin for all five types were found in 100% of individuals.

2. Recommendations

2.1 General — Recommended only for those whose laboratory activities might reasonably be expected to include direct contaxt with *C. botulinum* under conditions of its toxin production or indirectly with the toxin itself. Not regularly indicated for more casual contacts such as members of maintenance or support staffs.

2.2 Dose — Primary: 0.5 ml. *deep* subcutaneously at 0–2–12 weeks. (The first injection is represented by "0" week. There is a 2-week interval between the first and second injections and a 12-week interval between the first and third.)

Initial Booster: 0.5 ml. *deep* subcutaneously 12 months after the first injection of the primary series.

Subsequent Boosters: 0.5 ml. *deep* subcutaneously at 2-year intervals.

SHAKE WELL before withdrawing each dose. *Do not inject intracutaneously or into superficial subcutaneous structures.*

2.3 Immunity — Antibody responses to toxoid can only be determined by biological tests. Normally, when recommended schedule is followed, the predictability of adequate responses is such that confirmation is not necessary.

2.4 Laboratory Problems — Laboratory accidents involving the toxins of *C. botulinum* are extremely rare. The primary concern is ingestion of toxin, although, theoretically, toxin sufficient to produce illness might be absorbed by inhalation of a heavy aerosol. No laboratory-acquired illness has ever been reported. The toxoid is credited with having protected immunized personnel against known accidental major exposures to cutaneous contact, inhalation, and aspiration.

3. Contraindications Precautions — Toxoid should not be continued in anyone experiencing an unusually severe response to a dose. Reduced dose may be used for one who has experienced only a moderately untoward reaction and requires the toxoid.

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CHOLERA VACCINE

1. Description

1.1 Composition	Cholera vaccine is a phenol-killed suspension containing four billion cells each of classic Inaba and Ogawa serotypes.
1.2 License	Licensed
1.3 Storage	For optimal storage, refrigerate, but refrigeration is not essential.
1.4 Supplier	Several, including Merck, Sharp, and Dohme, Eli Lilly and Co., The National Drug Co., and others.
1.5 Reactions	Adverse reactions of a serious nature are practically unknown. Mild systemic reactions consisting of fever up to 101°, headache, and malaise are common. After 12-36 hours mild to moderate site reactions, consisting of heat, redness, swelling, and tenderness, are very common.
1.6 Efficacy	Efficacy has been documented in several well-controlled studies. See references.

2. Recommendations

2.1 General

There is no known special advantage of any one vaccine over any other.

The vaccine is recommended for individuals who may be exposed to *Vibrio cholerae* in food or fluids, and for laboratory workers and caretakers intimately exposed to the organism.

The vaccine is specifically recommended for:

(a) Persons who work directly with the disease agent in the laboratory.

(b) Caretakers of infected animals.

These groups *need not be* vaccinated:

(a) Persons who work in the same laboratory though not with the specific organism.

(b) Personnel who handle media and glassware.

(c) Laboratory and animal quarter maintenance personnel.

(d) Other persons who enter laboratory or animal-care areas where work is under way with the organism.

2.2 Dose

Primary: two doses, 0.5 ml. and 1.0 ml., subcutaneously, from 1 week to, preferably, 1 month or more apart.
Booster: 1.0 ml. (or dose recommended by manufacturer) at 6-month intervals if there is continuing exposure or at unspecified intervals as needed to protect against exposure.

2.3 Immunity

Immunity can be assessed by quantitative serologic studies. The most feasible test is the vibriocidal antibody titration. The vaccine offers good protection for 3–6 months. No skin tests correlate with immunity.

2.4 Laboratory Problems

Laboratory accidents are extremely rare. Nine cases have been reported. The writer is personally familiar with three laboratory-acquired infections, two of which occurred at

Walter Reed Army Institute of Research (JAMA, *197*:99, 1966) and one at the Colindale Laboratory in London. The latter is unpublished. In the cases at Walter Reed, there is reason to believe that accidental ingestion of broth cultures was responsible. No information is available on the Colindale case. Most laboratory workers agree that the only serious danger to laboratory workers is the possibility of aspirating a broth culture or eating food contaminated by soiled hands.

3. Contraindications Precautions

There are no known contraindications to the use of the vaccine, although some believe that it should not be given to pregnant women because of the unknown risk to the fetus.

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DIPHTHERIA AND TETANUS TOXOIDS

1. Description

1.1 Composition — Diphtheria and tetanus toxoids are prepared by formaldehyde treatment of the respective toxins. The toxoids are available in both fluid and adsorbed forms. All preparations contain comparable amounts of tetanus toxoids, but the diphtheria component of the adult type tetanus and diphtheria toxoids (Td) approximates 10% of that contained in the standard DTP preparations.

1.2 License — Diphtheria and tetanus toxoids are licensed singly and in various combinations. The most important products for practical use are: (1) tetanus and diphtheria toxoids, adult type (Td); and (2) tetanus toxoid (T).

1.3 Storage — Refrigerate diphtheria and tetanus toxoids.

1.4 Supplier — Tetanus and diphtheria toxoids, adult type (Td), are manufactured by Cutter Laboratories, Eli Lilly and Co., Lederle Laboratories, The National Drug Co., and Wyeth Laboratories. In addition, many state health department laboratories produce these toxoids for use in their respective states.

1.5 Reactions — Reactions to diphtheria and tetanus toxoids, given either singly or in combination, are rare. Two general types of reactions occur: (1) a local swelling, pruritus, and tenderness at the site of injection or (2) a more generalized phenomenon such as fever, urticaria, or angioneurotic edema. Reactions are more common in older children or adults, and there is a strong association between reactions and high circulating antitoxin titers.

1.6 Efficacy — Extensive experience has shown that diphtheria and tetanus toxoids decrease the incidence and mortality of these diseases and reduce complications stemming from them.

2. Recommendations

2.1 General — Comparative tests of diphtheria and tetanus toxoids have shown that adsorbed toxoids are clearly superior in antibody titer produced and in the duration of protection achieved. The promptness of antibody responses following the administration of either fluid or adsorbed toxoids as boosters is not sufficiently different to be of clinical importance. Therefore, adsorbed toxoids are the agents of choice for primary and booster immunizations. Based on data about effectiveness, primary immunization of older children and adults, and increasing reactions to full doses of diphtheria toxoids with age, the adult type Td is considered the agent of choice for immunization of persons over 6 years of age. The use of this preparation obviates the need for Schick or Moloney testing before immunization.

All adults should have protection against diphtheria and tetanus. This includes appropriate booster doses at specified time intervals.

2.2 Dose	Primary for unimmunized adults: a single dose of adult type Td given intramuscularly or subcutaneously on two occasions at 4-6 week intervals with a reinforcing dose approximately 1 year after the second dose. Booster: a single dose of this same preparation every 10 years (if a dose is given sooner as part of wound management—see below—the next booster is not needed for another 10 years). More frequent booster doses are not indicated and may be associated with increased reactions.
2.3 Immunity	An important part of *wound management* is the prevention of tetanus. Evidence demonstrates that complete primary immunization with tetanus toxoid provides very long protection. Therefore in such an individual *no* booster is needed for a possibly tetanus-associated injury if the most recent dose of Td was given in the past year or so. In cases where previous tetanus immunization status is questionable or unknown, the outline of procedures recommended by the PHS Advisory Committee on Immunization Practices (August 1969) should be consulted.
2.4 Laboratory Problems	Forty cases of laboratory-acquired diphtheria and six of laboratory-acquired tetanus have been reported.
3. Contraindications Precautions	Although specific contraindications to the use of these vaccines have not been outlined, administration of these agents should be postponed in the face of severe febrile illness. History of severe reaction to a previous dose may argue against continued use of the vaccine. Each such case must be evaluated on an individual basis.

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EASTERN EQUINE ENCEPHALITIS (EEE) VACCINE

1. Description

1.1 Composition — Eastern equine encephalitis (EEE) vaccine is a formalin-inactivated, lyophilized product prepared from the supernatant maintenance fluid of primary chicken embryo cell cultures infected with the Walter Reed Army Institute of Research PE6 strain of EEE virus. Cell cultures are grown in Eagle's basal medium containing 200 units of penicillin and 50 ug. of streptomycin per ml. Twenty-four hours before inoculation of the seed virus, the antibiotic-containing growth medium is replaced with antibiotic-free medium 199. The vaccine contains 0.25% Human Serum Albumin (USP) as a virus stabilizer.

1.2 License — Unlicensed; approved as IND.

1.3 Storage — Store lyophilized product at −20°C.

1.4 Supplier — Immunobiologics Activity, Biological Reagents Section, Laboratory Division, CDC.

1.5 Reactions — Serious local or systemic reactions have not been observed in a limited number (less than 1,000) of vaccinees. A few mild reactions have been recorded. These consisted primarily of local myalgia and malaise and, in a few instances, headaches and arthralgia.

1.6 Efficacy — No published data are available. The U.S. Army has tested the vaccine in several animal species for purity and safety and has tested the vaccine in several hundred humans. It is approved by the U.S. Army for use in military personnel at high risk (18th Meeting of the Committee on Immunizations, Oct. 24, 1967, Department of the Army, Fort Detrick, Frederick, Maryland).

2. Recommendations

2.1 General — Recommended for individuals who may be exposed to EEE virus and personnel who are at high risk because of their laboratory or field studies.

The vaccine is specifically recommended for:

(a) Persons who work directly with the disease agent in the laboratory.

(b) Persons who work in the same laboratory though not with the specific organism.

(c) Caretakers of infected animals.

(d) Personnel who handle contaminated media and glassware before autoclaving.

Other persons who enter laboratory or animal-care areas where work is underway with the organism *need not be* vaccinated.

2.2 Dose — Primary: two doses of 0.5 ml. each administered subcutaneously 29 days apart.

	Booster: 0.1 ml., administered intradermally, annually.
2.3 Immunity	Immunity can be assessed by quantitative serologic studies. The most stringent test is the constant serum-virus dilution test conducted by the intracerebral inoculation of 3-week-old mice. A circulating antibody titer of ≥ 2.0 logs virus neutralization is considered good evidence of significant immunity.
2.4 Laboratory Problems	Laboratory accidents with EEE virus are rare. The writer is aware of only two reported cases, neither of which was fatal. However, the potential of EEE virus producing severe or fatal infection makes it desirable to vaccinate for this virus.
3. Contraindications Precautions	The vaccine may be contraindicated in persons with high sensitivity to egg material.

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INFLUENZA VACCINE

1. Description

1.1 Composition — Presently available influenza vaccine is a formalin-inactivated product of varying composition, depending on the influenza virus strains forecast to be prevalent. Standard vaccine is prepared from a concentrated suspension of virus grown in embryonated chicken eggs. Highly purified products are prepared by zonal-centrifugation or other processes.

1.2 License — Licensed.

1.3 Storage — Refrigerate at 2° to 8°C.

1.4 Supplier — Multiple producers in the United States.

1.5 Reactions — Local reactions of tenderness and induration are reported in 25 to 50% of adult vaccinees, depending on the product administered. Highly purified vaccines produce considerably fewer reactions. Systemic complaints of malaise, myalgias, and fever are less common, but do occur in a small proportion of adult vaccinees following administration of standard vaccines. All reactions are more common in children than in adults.

1.6 Efficacy — Efficacy of properly constituted, potent, inactivated influenza vaccine has been shown to be, at best, moderate under field conditions. Vaccines commonly contain both types A and B influenza virus antigens, selected annually to represent contemporary strains. A precise relationship between vaccine strains and those which may occur is at times problematic. The relationship directly influences vaccine effectiveness. Under favorable conditions, inactivated vaccines achieve up to 70% clinical effectiveness. Lower levels are commonly observed.

2. Recommendations

2.1 General — Because of technological limitations in achieving satisfactory results with currently available inactivated influenza vaccines, annual immunization is generally recommended only for high risk populations. These include patients with chronic debilitating illnesses, particularly of the cardio-respiratory system, and persons in older age groups.

Risk in the influenza virus laboratory is not sufficient for regular vaccination of the staff.

2.2 Dose — Primary for adults: one full dose (volume specified by manufacturer) subcutaneously on two occasions, preferably 6 to 8 weeks apart.

Primary for children: smaller dose than for adults; specified in the manufacturer's labeling.

Booster: when no substantial change has occurred in vaccine composition, individuals who should receive vaccine and who were vaccinated in the preceding year need only a single dose subcutaneously.

2.3 Immunity	Immunity following influenza vaccine is difficult to assess because of the continual drift in prevalent viruses. The vaccine apparently induces immunity for at least 6 months.
2.4 Laboratory Problems	Laboratory accidents can occur, but apparently pose no significant problem. Only seven laboratory infections are known.
3. Contraindications	On theoretical grounds, influenza vaccine should not be administered to anyone who has had clearly documented hypersensitivity to egg protein. With highly purified vaccines, the justification for this precaution is more tenous.

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MEASLES VACCINE

1. Description

1.1 Composition	Measles vaccines currently in use in the United States are live, attenuated, and further attenuated virus vaccines propagated in either chick embryo (attenuated and further attenuated) or canine renal cell (attenuated) culture.
1.2 License	Licensed for general use.
1.3 Storage	Refrigerate live measles virus vaccines in the lyophilized state.
1.4 Supplier	Live attenuated measles virus vaccines are manufactured by Charles Pfizer and Co., Inc., Eli Lilly and Co., Lederle Laboratories, Merck, Sharp, and Dohme, Parke, Davis and Co., and Philips Roxane, Inc. Further attenuated measles virus vaccines are manufactured by Pitman-Moore and Merck, Sharp, and Dohme.
1.5 Reactions	Live attenuated measles virus vaccines administered with Measles Immune Globulin produce fevers of 103°F (rectal) in 15% of recipients beginning on or about the sixth day after vaccination and lasting no longer than 5 days. Similar febrile reaction rates are reported for the further attenuated vaccines. About twice as many (30%) of those receiving attenuated vaccines without Measles Immune Globulin have similar responses. Characteristic measles rash has been reported in 5-10% of recipients. The vaccinee with rash is not considered infectious. Other serious reactions associated with vaccine usage have been rare.
1.6 Efficacy	Vaccine safety and efficacy have been well documented in controlled field observations.

2. Recommendations

2.1 General	Both attenuated and further attenuated vaccines offer satisfactory protection. When using attenuated vaccines, follow the manufacturers' recommendations pertaining to simultaneous administration of Measles Immune Globulin. Immunization is recommended for all measles-susceptible individuals 12 months of age or older. Vaccination of adults is rarely necessary; nearly all individuals are immune by age 15. Susceptible individuals working directly with the agent in the laboratory should be vaccinated. Because of the high level of immunity in adults, the risk of acquiring disease for other persons in the laboratory or persons who enter the laboratory or animal care area is extremely low.
2.2 Dose	Primary: needs to be given only once; administer according to the manufacturer's directions. Booster: not needed.
2.3 Immunity	Disease history is a relatively reliable single indicator of an individual's susceptibility. Documented history of immunization is satisfactory. Serologic tests, specifically complement fixation or hemagglutination

	inhibition, are useful in documenting an individual's immunity status.
2.4 Laboratory Problems	Laboratory accidents with this agent are extremely rare. Only one laboratory-acquired case has been reported.
3. Contraindications Precautions	Live measles virus vaccines are contraindicated in individuals with leukemia, lymphoma, and other generalized malignancies; individuals with altered immunologic competency (that is, individuals on steroids, alkylating agents, antimetabolites, and radiation therapy); and pregnant women. Vaccination should be postponed if the prospective vaccinee has a severe febrile illness or has received immune globulin within the past 3 months. Any individual with known active tuberculosis should be under treatment when given measles vaccine.

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PLAGUE VACCINE

1. Description

1.1 Composition — The plague vaccine produced for use in the United States is prepared from *Pasteurella pestis* grown in artificial media, inactivated with formaldehyde, and preserved in 0.5% phenol. Live attenuated vaccines are produced in other countries, but are not commercially available in the United States.

1.2 License — The inactivated vaccine is licensed for use in the United States.

1.3 Storage — Refrigerate at 4°C.

1.4 Supplier — Inactivated vaccine is produced by Cutter Laboratories.

1.5 Reactions — Adverse reactions consisting of pain, reddening, and swelling at the injection site are frequent. With repeated doses, systemic reactions of fever, headache, and malaise occur more often and tend to become more pronounced. Sterile abscesses are reported to occur rarely. No fatal or disabling complications have been observed.

1.6 Efficacy — No field trials have been conducted. Experience among immunized U.S. personnel in Vietnam has been favorable.[2,3]

2. Recommendations

2.1 General — Recommended for all persons traveling to Vietnam, Cambodia, and Laos and for all persons who have field work or vocations which bring them into frequent and regular contact with wild rodents in plague enzootic areas of the western United States, South America, Africa, or Asia.

Routine vaccination is not indicated for persons simply living in plague enzootic areas of the western United States or for travelers going to most of the countries reporting cases.

The vaccine is specifically recommended for:

(a) All laboratory personnel working with the *Pasteurella pestis* organism or plague-infected rodents.

(b) Caretakers of infected animals.

These groups *should not be* vaccinated.

(a) Personnel in a laboratory where work with *Pasteurella pestis* is done but who do not work with the organism.

(b) Personnel who handle decontaminated media and glassware.

(c) Laboratory and animal quarters maintenance personnel.

2.2 Dose — All injections should be given intramuscularly.

Primary for adults and children over 10 years old: two doses, 0.5 ml. each, 4 or more weeks apart, followed by a third dose, 0.2 ml., 4 to 12 weeks after the second injection. When less time is available, satisfactory, but less than optimal, results can be obtained with two 0.5 ml. injections administered at least 3 weeks apart.

Primary for children less than 10 years old: three doses smaller than those for adults. The manufacturer's guide to proportions

of the adult dose for children is: infants under 1 year, 1/5 adult dose; 1-4 years, 2/5 adult dose; 5-10 years, 3/5 adult dose. The intervals between injections for children are the same as for adults.

Booster: every 6 to 12 months while individuals remain in an area where the risk of exposure persists. Satisfactory doses for children and adults are the same volumes suggested for the third dose in the primary series. The primary series need never be repeated for booster doses to be effective. If a booster dose produces severe local or systemic reactions, subsequent boosters may not be necessary provided immunity is adequate as measured by the tests mentioned under "Immunity" (below).

Summary: The following table summarizes the recommended doses for primary and booster vaccinations:

Dose Number	AGE (YEARS) Under 1	1-4	5-10	Over 10
1 & 2	0.1 ml.	0.2 ml.	0.3 ml.	0.5 ml.
3 & Boosters	0.04 ml.	0.08 ml.	0.12 ml.	0.2 ml.

2.3 Immunity

Immunity can be assessed by a passive hemagglutination test or the mouse protective index.[1.2.,1.3] The mouse protective index is considered the better measure of protection.

2.4 Laboratory Problems

Accidental infection of laboratory workers occurs infrequently; only three such cases have been reported in the United States since 1900.[1.1]

3. Contraindications Precautions

There are no known contraindications to the use of the vaccine, although repeated doses may produce reactions which preclude further injections.

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POLIOMYELITIS VACCINE

1. Description

1.1 Composition

Two basic types of poliomyelitis vaccines are currently in use in the United States. These are: (1) inactivated polio virus vaccine (IPV) and (2) live, attenuated oral vaccine (OPV).

IPV is prepared by formalin-inactivation of the three types of polio virus grown in tissue culture of monkey kidney cells.

OPV is prepared from virus propagated on green monkey kidney cells and is marketed in monovalent preparations of Type 1, Type 2, and Type 3 and in a trivalent preparation.

1.2 License

Both IPV and OPV are licensed.

1.3 Storage

Refrigerate IPV. Store OPV in the frozen state (-20°C.)

1.4 Supplier

IPV is made by Charles Pfizer and Co., Inc., Eli Lilly and Co., Parke, Davis and Co., and Pitman-Moore.

1.5 Reactions

Immediate reactions to poliomyelitis vaccines have not been reported. Very rarely, cases of paralytic poliomyelitis have occurred in recipients of OPV or their close contacts within 30 days of vaccine feeding. Careful analysis indicates no more than one case of "vaccine-associated" paralytic disease for every 3 million doses of OPV administered.

1.6 Efficacy

The efficacy and safety of both IPV and OPV have been well established in controlled field studies.

2. Recommendations

2.1 General

OPV is now more widely used in this country than IPV not only because it is easier to administer but also because it produces an immune response which, without regular booster doses, appears to be similar to immunity induced by natural polio virus infection. Trivalent OPV has largely replaced monovalent forms because it offers simplified scheduling and record keeping. A primary series of trivalent OPV will produce an immune response for all polio virus types in well over 90% of the recipients.

Primary immunization of infants, children, and adolescents should be routine practice. Routine poliomyelitis immunization for adults in the continental United States is not recommended because of the extreme unlikelihood of exposure. However, any unimmunized adult who is at increased risk by virtue of contact with a known case or travel to epidemic or endemic areas should receive trivalent OPV according to the schedule outlined below. Persons employed in medical laboratories may well be considered at increased risk.

All persons working directly with the agent, all persons working in the same laboratory, animal caretakers, and other persons entering the laboratory or animal care areas should be protected with OPV.

2.2 Dose

IPV

Primary for adults: four parenteral doses. The first three are

administered at monthly intervals and the fourth, a reinforcing dose, 6-12 months after the third.

Booster: single doses every 2-3 years to assure adequate levels of antibody. The need for IPV boosters can be obviated by a full course of OPV.

OPV

Primary for adults: three doses, the first two doses given at 6-8 week intervals, and the third, 8-12 months after the second.

Booster: no indication at present for regular or routine booster doses of OPV.

2.3 Immunity — In determining an individual's immunity, a documented history of full OPV immunization is satisfactory. Serologic tests, specifically neutralization titers, are helpful.

2.4. Laboratory Problems — Nine laboratory-acquired cases have been reported.

3. Contraindications Precautions — Pregnancy is not an indication for vaccine administration nor is it a contraindication when immunization is deemed necessary. There are no specific contraindications to the use of poliomyelitis vaccines. The routine immunization for adults in the United States currently is not necessary, and the rare complications of "vaccine-associated" cases have been discussed.

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Q FEVER VACCINE

1. Description

1.1 Composition — Q fever vaccine is prepared from yolk sacs infected with *Coxiella burneti.* It is dehydrated. Two batches are available: one with the organisms in Phase I, the other with them in Phase II.

1.2 License — Unlicensed.

1.3 Storage — For optimal storage, refrigerate, but refrigeration is not essential.

1.4 Supplier — Walter Reed Army Institute for Research.

1.5 Reactions — Severe local reactions with systemic manifestations occur in 1-2% of persons without known history of Q fever or Q fever vaccination; these reactions are much more frequent in persons exposed to Q fever or previously vaccinated with Q fever vaccine. The reaction cosists of swelling and tenderness, often involving the entire upper arm, mild fever, and malaise. Reactions to egg proteins are also possible, and individuals should be questioned about tolerance to eggs.

1.6 Efficacy — No field trials have been conducted. Unpublished human volunteer experiments with Phase II challenge are favorable. Experience in rickettsial laboratories is favorable. Phase I vaccine probably gives somewhat better protection against Phase I organisms (wild type).

2. Recommendations

2.1 General — Recommended primarily for personnel in reckettsial laboratories; not recommended for general use.

The vaccine is specifically recommended for:

(a) Laboratory personnel who work directly with the disease agent.

(b) Persons who work in the same laboratory or whose work brings them into the area.

(c) Caretakers of infected animals.

(d) Laboratory and animal quarters maintenance personnel.

(e) Persons who enter the area where Q fever work is done.

Personnel who handle media, glassware, or laundry *need not be* vaccinated if these materials are autoclaved on removal from the laboratory.

2.2 Dose — Phase II Vaccine

Primary: 0.1 ml., followed in 4 days by 1.0 ml. and in another 7 days by 1.0 ml. Before the second and third injections, the previous site(s) should be palpated, and the vaccinee should be questioned. If swelling, heat, and tenderness are present, no further injections should be given.

Booster: none.

Phase I Vaccine

	Primary: follow the schedule for Phase II vaccine but give 0.6 ml. for the second and third injections. Booster: none.
2.3 Immunity	There are no practical tests for immunity. All persons are considered susceptible unless they have been immunized or infected.
2.4 Laboratory Problems	With 184 reported laboratory-acquired infections, this organism is the third most frequent cause of laboratory infection. The rickettsia of Q fever survives drying and can cause infections in personnel located on other floors or in persons exposed in other buildings to material (such as laundry) from the rickettsial laboratory. Most infections are relatively mild, but about a third of those infected have fever for a week or more, and some are severely ill.
3. Contraindications Precautions	The vaccine should not be given to persons who have been previously infected with Q fever or who have received Q fever vaccine. Neither should it be given to persons who are sensitive to eggs. Each prospective vaccinee should be asked if he can eat eggs.

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RABIES VACCINE

1. Description

1.1 Composition

The two rabies vaccines are Duck Embryo Vaccine (DEV) and Nervous Tissue Vaccine (NTV).

DEV is composed of a 10% suspension of embryonated duck eggs infected with fixed virus and inactivated with beta-propiolactone. The suspending fluid consists of 0.1% gelatin and 0.25% dibasic potassium phosphate. The vaccine is preserved with thimerosal, 1:10,000.

NTV is composed of a 20% suspension of rabbit brain infected with fixed virus and inactivated with phenol at 37°C. (Semple type). It is preserved with phenol, 0.25%, and thimerosal, 1:10,000.

1.2 License

Both DEV and NTV are licensed.

1.3 Storage

Refrigerate DEV and NTV (2-5°C.).

1.4 Supplier

DEV is made by Eli Lilly and Co.

NTV is made by the National Drug Co., Michigan State Department of Health Laboratory, and Texas State Department of Health Laboratory.

1.5 Reactions

Erythema, pruritus, pain, and tenderness at the site of inoculation are common with both DEV and NTV. Systemic reactions, including low grade fever, or, rarely, shock, may occasionally occur late in the course of therapy, usually after five to eight doses of either vaccine. In rare instances, serious reactions have occurred after the first dose of DEV or NTV, particularly in persons previously sensitized with vaccines containing avian or rabbit brain tissue.

Neurologic complications associated with DEV have been reported for one of every 25,000 persons treated. One death, possibly related to the vaccine, has occurred among some 250,000 who have received DEV. Neurologic complications have been reported more frequently with NTV; approximately one person per 6,000 individuals treated in the United States has had neurologic complications with NTV. Death has been attributed to NTV in a ratio of one to every 35,000 persons treated.

When rabies vaccine must be given to a person with a history of hypersensitivity, especially to avian or rabbit tissues, antihistaminic drugs should be used. Epinephrine is helpful in reactions of the anaphylactoid type. If serious allergic manifestations preclude continuation of prophylaxis with one vaccine, the other may be used.

When meningeal or neuroparalytic reactions develop, vaccine treatment should be discontinued altogether. Corticotrophin or corticosteroids are used for such complications.

1.6 Efficacy

In the United States, comparative effectiveness of vaccines can only be judged by frequencies of failure to prevent disease. During the years 1957 through 1967 when both vaccines were

available, there were six rabies deaths among the 117,000 NTV-treated persons (1:19,600) and seven deaths among 172,000 treated with DEV (1:24,500).

2. Recommendations

2.1 General

DEV: Recommended for use in high risk groups of individuals as a preexposure immunizing vaccine and in postexposure prophylaxis.

NTV: Used only as postexposure vaccine. DEV is the usual vaccine of choice in rabies prophylaxis because it produces less severe reactions than NTV.

The relatively low frequency of reactions to DEV has made it more practical to offer preexposure immunization to persons in high risk groups: veterinarians, animal handlers, certain laboratory workers, and personnel stationed in areas of the world where rabies is a constant threat. Others whose vocational or avocational pursuits result in frequent exposure to dogs, cats, foxes, skunks, or bats should also be considered for preexposure prophylaxis.

Persons who work directly with rabies virus in laboratories, those who work in the same laboratories but not with the rabies virus, and caretakers who are in direct contact with animals infected or potentially infected with the disease agent should obtain preexposure immunization and have a detectable serum neutralizing antibody titer to rabies before undertaking such work. They should receive a booster injection of vaccine, preferably DEV, each year.

Persons who handle media, glassware, and other material from laboratories in which the agent is studied and laboratory and other animal maintenance personnel should receive preexposure immunization; a booster every 2-3 years rather than annually is required.

Visitors to areas where rabies studies are conducted should receive preexposure immunization; boosters are necessary for those previously immunized. Only those who have received booster shots every 2-3 years should be allowed continuing entry.

2.2 Dose

Postexposure prophylaxis

Primary: at least 14 single, daily injections in the dose recommended by the manufacturer. These should be given subcutaneously in the abdomen, lower back, or lateral aspect of the thighs; rotation of sites is recommended.

For severe exposures, 21 doses of vaccine are recommended. These may be given in 21 daily injections or as 14 doses during the first 7 days (either in two separate injections or in double doses), the remaining doses being given singly during the next 7 days.

Booster: two booster doses, one 10 days and the other at least 20 days after completion of the primary course. The two booster doses are particularly important if antirabies serum was used in the initial therapy.

Preexposure prophylaxis

Primary: two 1.0 ml. injections of DEV given subcutaneously in the deltoid area 1 month apart followed by a third dose 6 to 7 months after the second dose. This series of three injections can be expected to produce neutralizing antibody in 80 to 90% of vaccinees 1 month after the third dose.

If more rapid immunization is desirable, three 1.0 ml. injections of DEV may be given at weekly intervals with a fourth dose 3 months later. This schedule elicits an antibody response in about 80% of the vaccinees.

Booster: all persons receiving the preexposure vaccination should have their serum tested for neutralizing antibody 3 to 4 weeks after the last injection. Tests for rabies antibody can be arranged with or through state health department laboratories. If no antibody is detectable, booster doses should be given until a response is demonstrated. Persons with continuing exposure should receive 1.0 ml. boosters every 2 to 3 years.

When an immunized individual with previously demonstrated antibody is exposed to rabies, five daily doses of vaccine plus a booster dose 20 days later should be given to those having a severe exposure. A single booster is recommended if exposure is mild or questionable. If it is not known whether an exposed person had antibody, the complete postexposure antirabies treatment should be given.

2.3 Immunity

Immunity of those who received rabies immunization may be assessed by testing their serum serologically. The two recommended tests are the serum neutralization (SN) and indirect fluorescent rabies antibody (IFRA) procedures. The complement fixation (CF) test may also be used to detect rabies antibody, but it is not generally considered as sensitive as either of the other two.

2.4 Laboratory Problems

Although laboratory accidents are reasonably frequent, no cases of rabies developing in laboratory employees have been reported. The most frequent exposures in laboratories include cutting the fingers or hands when the animal head is opened and when pipetting and accidentally injecting the suspension of infected material. In such exposures, one or more booster injections are required.

Contraindications Precautions

Elective preexposure immunization with DEV should not be given to persons with histories of allergy to eggs or egg products. NTV should not be given to persons for preexposure prophylaxis. When rabies vaccine must be given to a person with a history of hypersensitivity to avian or rabbit tissues, antihistaminic drugs should be used. Epinephrine is helpful in reactions of the anaphylactoid type. If serious allergic manifestations preclude continuation of prophylaxis with one vaccine, the other may be used.

When meningeal or neuroparalytic reactions develop, vaccine treatment should be discontinued altogether. Corticotrophin or corticosteroids are used for such complications.

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ROCKY MOUNTAIN SPOTTED FEVER (RMSF) VACCINE

1. Description

1.1 Composition	Rocky Mountain spotted fever vaccine is prepared from yolk sacs infected with *Rickettsia rickettsii.*
1.2 License	Licensed.
1.3 Storage	For optimal storage, refrigerate, but refrigeration is not essential.
1.4 Supplier	Several, including Lederle Laboratories.
1.5 Reactions	Mild, local reactions are fairly common. Severe, sometimes fatal, anaphylactoid reactions may occur in persons sensitive to eggs. Such individuals have histories of intolerance to eggs in food, so each prospective vaccinee should be questioned about this sensitivity.
1.6 Efficacy	No field trials have been conducted. Field experience suggests vaccination ameliorates disease. See references. Experience in reckettsial laboratories is favorable.

2. Recommendations

2.1 General

Recommended for persons who will be significantly exposed to *R. rickettsii* or to the ticks *Dermacentor variabilis* or *D. andersoni* and for those with heavy tick exposure.

The vaccine is specifically recommended for:

(a) Persons who work directly with the disease agent in the laboratory.

(b) Persons who work in the same laboratory or who come into the room while work is being done.

(c) Caretakers of infected animals.

Persons who handle decontaminated media or glassware and laboratory and animal quarters maintenance personnel *need not be* vaccinated.

2.2 Dose

Primary: three 1 ml. doses 7 to 10 days apart.

Booster: one 1 ml. dose after 1 year; repeat only for those with heaviest exposure.

2.3 Immunity

There are no practical tests for immunity. All persons are considered susceptible unless they have been immunized or infected.

2.4 Laboratory

Laboratory infections are frequent and, in the absence of specific treatment, such infections are usually fatal in the unvaccinated. Laboratory infections are acquired from inhalation of aerosol of highly infected materials such as yolk sacs, ticks, or tick feces. Skin contact with such materials has also produced infections. *R. rickettsii* from the usual media used in the laboratory does not survive drying, so danger of infection does not persist in a room more than half an hour after the aerosol is produced.

3. Contraindications
Precautions

Vaccine should not be given to persons who are sensitive to

eggs. Each prospective vaccinee should be queried regarding allergy or intolerance to eggs.

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RUBELLA VACCINE

1. Description

1.1 Composition — The live attenuated rubella virus vaccine now available is prepared from either HPV-77 or Cendehill strain rubella virus in cell cultures of avian (duck embryo) or mammalian (canine kidney and rabbit kidney) tissues.

1.2 License — Licensed.

1.3 Storage — Keep refrigerated or frozen before reconstituting for use. After reconstitution, protect from exposure to bright light and use promptly.

1.4 Suppliers — Merck, Sharp and Dohme (HPV–77–DE5, duck embryo vaccine); Parke, Davis and Co. (HPV–77–DK12, canine kidney vaccine); Phillips–Roxane, Inc. (HPV–77–DK12, canine kidney vaccine); and Smith, Kline & French (Cendehill, rabbit kidney vaccine).

1.5 Reactions — Serious adverse reactions are very rare. Susceptible adult women have frequently reported lymphadenopathy, arthralgia, and transient arthritis beginning 2 to 4 weeks after vaccination; however, fever, rash, and other features of naturally acquired rubella have occurred uncommonly in association with vaccination. All vaccine-related symptomatology has been transient, and no specific treatment has been necessary.

1.6 Efficacy — Efficacy has been documented in several well-controlled studies. See references.

2. Recommendations

2.1 General — Recommended primarily for children between 1 year and puberty in order to eliminate the major source of rubella exposure to pregnant women. Pregnant women *should not be* given rubella vaccine. Routine immunization of adolescent and adult women of childbearing age should be discouraged to avoid inadvertently administering vaccine before pregnancy is evident. Females of childbearing age should be vaccinated only when the possibility of pregnancy is essentially nil.

Rubella is generally a mild illness, but when a woman in the early months of pregnancy acquires the illness, it poses a direct hazard to the fetus. Preventing this complication is the ultimate objective of immunization.

The vaccine is specifically recommended for:

(a) Adults, particularly women, who are found susceptible to rubella by the HI antibody assay procedure and who work in a laboratory where natural "wild" rubella virus is being handled. Obviously, susceptible pregnant women should be excluded from such laboratory areas.

(b) Other susceptible persons who enter laboratory or animal-care areas where work is under way with rubella virus. Any susceptible pregnant woman, however, should avoid contact with these areas.

Caretakers of infected animals should be screened serologically for susceptibility and vaccinated if necessary.

Personnel who handle decontaminated media and glassware and laboratory and animal quarters maintenance personnel (other than those described above) *need not be* vaccinated.

2.2 Dose

Primary: a single subcutaneous injection of vaccine in volume specified by the manufacturer.

Booster: possible need for periodic booster immunizations has not been determined. Present data indicates that immunity from a single dose of vaccine may be long lasting.

2.3 Immunity

Immunity following rubella infection appears to be long lasting, even after mild illness or clinically inapparent infections. Because of the mild nature and clinical variability of rubella, however, a history of rubella illness is usually not sufficiently reliable to insure an individual of natural immunity. Immunity to rubella can be assessed by quantitative serologic studies with the HI technique. Because of the variation among reagents and technical procedures, however, results of serological tests should be accepted only from laboratories of recognized competency that regularly perform these tests.

2.4 Laboratory Problems

Laboratory accidents are extremely rare. Only one laboratory-acquired case has been reported. Although considerable concern has been expressed about exposure of susceptible women of childbearing age to rubella virus in the laboratory, laboratory-acquired rubella infections have rarely been observed or reported. That rubella virus is not highly infectious in the laboratory environment is supported by documented instances of susceptible laboratory workers failing to become infected even after accidental ingestion of virus material. It is not known, however, if pregnancy alters an individual's susceptibility to rubella infection; therefore, avoid exposing pregnant women to laboratory areas where rubella virus is being studied.

3. Contraindications Precautions

Do not give pregnant women rubella vaccine.

Routine immunization of adolescent and adult women of childbearing age should be discouraged to avoid inadvertently administering vaccine before pregnancy is evident.

If there is reason to vaccinate a woman of childbearing age, do the following:

Determine rubella susceptibility by the HI procedure.

If she is susceptible (no detectable antibody), vaccinate her and advise strongly against pregnancy for the next 2 months. Preferably, she should be on a reliable birth control program.

Warn her of the frequent occurrence of self-limited arthralgia and possible arthritis beginning 2 to 4 weeks after vaccination.

Avoid giving rubella vaccine to persons in altered immune states such as might be present with leukemia, lymphoma, or

generalized malignancy or with steroid, alkylating drug, antimetabolite, or radiation therapy.

Be careful in administering vaccines to persons with known hypersensitivity to the species from which the vaccine cell system was derived (indicated on the vaccine package).

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RUSSIAN SPRING SUMMER ENCEPHALITIS (RSSE) VACCINE

1. Description

1.1 Composition — Russian Spring Summer Encephalitis (RSSE) vaccine is a crude formalin-inactivated, 10% mouse brain suspension. No stabilizer or preservatives have been added.

1.2 License — Unlicensed.

1.3 Storage — Store lyophilized vaccine at −20°C. After reconstitution with water for injection, use within a few hours and keep chilled at 4°C. until used.

1.4 Supplier — Walter Reed Army Institute of Research, Washington, D.C.

1.5 Reactions — Severe adverse reactions have occurred with this particular vaccine. A similarly prepared vaccine used in Russia has apparently been responsible for allergic demyelinization encephalomyelitis and has produced infectious encephalitis from incomplete inactivation of the virus.

1.6 Efficacy — The Soviet vaccine has been adequately documented for efficacy; however, the writer is unaware of any published reports on the efficacy of the Walter Reed vaccine. In our limited experience about 15% of persons receiving the initial series of vaccine developed demonstrable neutralizing antibody.

2. Recommendations

2.1 General — Recommended for individuals who must handle virulent virus in other than maximum security facilities. The vaccine currently available from Walter Reed was produced more than a decade ago and, in view of its documented poor efficacy and adverse reactions, it should not be used unless it is *absolutely necessary*. The Soviets have a new, cell-culture-derived formalinized vaccine which has been reported to be safe and effective.[1.1] If it could be obtained, it would undoubtedly be a safer and better vaccine to use.

The use of currently available vaccines may be avoided by conducting all work in equipment tested and found to be secure, so that the worker will not be exposed to the virus.

RSSE virus may be spread by aerosol, ingestion, or inoculation. Any person who may come in contact with the virus, because of lack of adequate facilities, should be vaccinated.

The vaccine is specifically recommended for the following– but *only* if the laboratory facilities are inadequate:

(a) Persons working directly with the virus.
(b) Other persons working in the same laboratory.
(c) Animal caretakers.
(d) Persons handling infected glassware or media.
(e) Maintenance personnel.
(f) Other persons entering the laboratory.

2.2 Dose — Primary: subcutaneous inoculation of 1.0 ml. of vaccine in a series of four doses over a 6-month period.

Booster: annually.

2.3 Immunity — Immunity can be assessed by quantitative neutralization test in mice. A log neutralization index of ≥ 2.0 is considered evidence of protection.

2.4 Laboratory Problems — Laboratory infections with RSSE virus have been fairly common; at least 18 infections and two deaths have been reported.

3. Contraindications Precautions — The vaccine should be given only to healthy adults who are not known to be sensitive to formalin or brain material. As a general rule, continued vaccination of individuals who have received 6 ml. of brain-derived vaccines is hazardous because of the risk of allergic encephalomyelitis.

1. General

1.1 Chumakov, M.P., et al. Apropos of the Rate of Antibody Accumulation in Patients during the Early Period After Vaccination and Revaccination against Tick Encephalitis. VOP Virus *9*:601-604, September-October 1964.

1.2 Hammon, W. Mc.D. *In* Vaccines against Viral and Rickettsial Diseases of Man. First International Conference, PAHO. pp. 252-259, 1967.

2. Laboratory Accidents

Hanson, R. P., et al. Arbovirus Infections of Laboratory Workers. Science *158*(3806):1283-1286, December 8, 1967.

SMALLPOX VACCINE

1. Description

1.1 Composition — Smallpox vaccine is prepared from vaccinia virus-infected calf lymph and is available both in glycerinated and lyophilized form. Various strains of vaccinia virus are currently used in vaccine production.

1.2 License — Licensed.

1.3 Storage — Store purified dried (lyophilized) calf lymph vaccine frozen; before reconstitution, however, it is quite stable at room temperature. The glycerinated vaccine requires constant refrigeration at all stages in its transport and storage at temperatures recommended by the manufacturer. Comparatively minor storage difficulties may reduce vaccine potency sufficiently to decrease efficacy in vaccination, particularly in revaccination.

1.4 Supplier — Dryvax (dried, calf lymph type) and Smallpox Vaccine, Liquid (calf lymph type), Wyeth Laboratories.

Mono-Vacc, Lincoln Laboratories.

1.5 Reactions — As with other medical procedures, smallpox vaccination is associated with a definite, measurable risk of morbidity and, rarely, death. A comprehensive national survey to ascertain the frequency of complications associated with vaccination in the United States during 1963 has been completed.[1] Among more than 6,000,000 primary vaccinees and nearly 8,000,000 revaccinees and their contacts, 12 cases of encephalitis following vaccination, nine cases of vaccinia necrosum, and 108 cases of eczema vaccinatum occurred. Seven persons died. A substantial number of less serious complications, some of which resulted in hospitalization, were also recorded. All deaths and virtually all complications occurred among those vaccinated for the first time. All adverse reactions to smallpox vaccination in CDC personnel should be reported immediately to members of the Smallpox Eradication Program medical staff who will assist in directing treatment.

1.6 Efficacy — The efficacy of smallpox vaccine has never been precisely measured in controlled trials. It is, however, generally agreed that vaccination with fully potent vaccine confers a high level of protection for at least 3 years and provides substantial but waning immunity for 10 years or more. Protection against a fatal outcome of the disease appears to extend over a longer period, perhaps for decades.

2. Recommendations

2.1 General — Smallpox, particularly variola major, remains a highly virulent disease even with excellent medical care. Recent outbreaks among unvaccinated persons in nonenemic areas following smallpox introductions have resulted in mortality rates of 40% and more. The success of smallpox vaccination is greatly dependent on the potency of the vaccine. Use of the more stable lyophilized vaccine would insure more consistently satisfactory results.

In the United States, routine vaccination of infants and revaccination of older children and adults represents the principal mechanism of defense against the indigenous spread of the disease once introduced. Persons who conceivably might be exposed in endemic or potentially endemic areas by virtue of international travel and persons likely to be exposed by infection newly introduced into the United States (that is, hospital personnel, other medical and public health personnel, and morticians) should be revaccinated every 3 years.

Specific recommendations for the vaccine follow:

(a) All persons (technical staff, visitors, animal caretakers, and maintenance personnel) requiring entry into any laboratory area where variola virus is handled must be revaccinated yearly. Variola virus should be handled only in specific isolation laboratory areas. All glassware, media, or other materials from the smallpox isolation laboratories should be autoclaved or appropriately disinfected before being removed from the laboratory.

(b) All other persons entering the building which contains the smallpox laboratory must be revaccinated at least every 2 years. This includes all secretaries, visitors, and maintenance and service personnel.

(c) All other CDC employees should have valid primary vaccination and revaccination every 3 years.

2.2 Dose

Primary: vaccination or revaccination is achieved either by the multiple pressure method or by jet injection intradermally on the skin over the insertion of the deltoid muscle or on the posterior aspect of the arm over the triceps muscle. Primary vaccinations should be inspected at 8 to 10 days. Revaccinations of previously successfully vaccinated individuals should be inspected at 4 to 7 days. Absence of reaction at these time periods indicates an unsuccessful effort, *not* immunity. Repeat attempt should be made with a fresh lot of vaccine.

Booster: see above.

2.3 Immunity

A history of primary vaccination (with presence of vaccination scar) and/or revaccination within 3 years is satisfactory evidence of immunity. Serologic tests, specifically neutralization titers, are helpful in selected instances.

2.4 Laboratory Problems

Laboratory-acquired infections with the poxviruses, including smallpox (variola), have been reported in unvaccinated or inadequately vaccinated persons. Such laboratory infections are exceedingly rare in adequately vaccinated persons (vaccination within 3 years). Accidental inoculation of variola virus into the eye or skin theoretically might result in a localized infection, but such has not been documented.

3. Contraindications

Eczema and other forms of chronic dermatitis in the individual to be vaccinated or in a household contact are contraindications to smallpox vaccination. If vaccination is required for an individual with dermatitis because of potential exposure in the laboratory or in an endemic area, Vaccinia Immune Globulin

(VIG) should be administered to the affected individual at the same time as the vaccine.

In pregnant women, vaccinia virus may, on occasion, cross the placental barrier during any stage of pregnancy and infect the fetus. Virtually all cases of fetal vaccinia have followed primary vaccination.

Patients with leukemia, lymphoma, and other generalized malignancies and individuals with altered immunologic competency (that is, persons on steroids, alkylating agents, antimetabolites, and radiation therapy) should not be vaccinated.

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TETANUS TOXOID

Information on tetanus toxoid is given under "Diphtheria and Tetanus Toxoids."

TULAREMIA VACCINE

1. Description

1.1 Composition — Tularemia vaccine, live, attenuated, is made with a lyophilized, viable, attenuated variant of *Pasteurella tularensis.* The vaccine is prepared from a broth culture of the organism grown in modified casein partial hydrolysate medium. A sucrose gelatin stabilizer is added to the harvest of the culture, and the vaccine is lyophilized for distribution. No other additives or preservatives are added to the vaccine. When the vaccine is reconstituted, each vial contains 2 ml. with approximately 10^9 organisms per ml. The amount in each vial should be sufficient for vaccinating 50 to 100 people. Diluent and sterile needles suitable for scarifying are provided with each vial.

1.2 License — New drug; limited to investigational use.

1.3 Storage — Store at freezer temperatures (-10° to –20°C.); if kept under refrigeration, vaccine may be used for 8 hours after reconstitution. *Eight hours after reconstitution, any remaining vaccine must be autoclaved and discarded.* Do not use after expiration date.

1.4 Supplier — Immunobiologics Activity, Biological Reagents Section, Laboratory Division, CDC.

1.5 Reactions — The vaccination site should be inspected 7 to 10 days after vaccination. The presence of isolated or coalescing vesicular, pustular, or crusted papules on an erythematous indurated base is indicative of a good "take." Approximately 5% of recipients may have mild systemic symptoms, consisting of malaise, headache, myalgia, and arthralgia, 5 to 7 days after vaccination. Axillary node tenderness may be noted. These symptoms generally subside within 72 hours and may be alleviated by analgesics. No cicatrix forms following use of the vaccine. The vaccine has been safely administered to over 2,000 individuals.

1.6 Efficacy — Eigelsbach[1] and Hornick reported the most recent study of vaccine efficacy. Given in doses of 10^6 - 10^8 organisms by the aerosol route, the vaccine conveyed 100% protection to volunteers challenged with 2,500 times the minimum infective respiratory dose of a virulent strain in man. Protection against intradermal inoculation of a virulent strain was also excellent. The safety and efficacy of the vaccine has also been described by Saslaw and McCrumb.[2]

2. Recommendations

2.1 General — Should be considered for all persons whose vocations or field work brings them into frequent and regular contact with wild rodents in tularemia enzootic areas. All laboratory workers who are likely to have even casual exposure to areas where *Francisella tularensis* is under study should be immunized, because laboratory workers are frequently infected.

The vaccine is specifically recommended for:

(a) Persons working in laboratories where *F. tularensis* or potentially infected material is being investigated.

(b) Caretakers of animals infected or potentially infected with *F. tularensis.* This group includes laboratory and animal quarters maintenance personnel.

These groups need not be vaccinated:

(a) Visitors, secretaries, and other such persons—all of whom should be barred from the specific laboratory area (hood room) where work with *F. tularensis* is under way.

(b) Personnel employed in disposing of decontaminated items, such as glassware, old culture materials, and equipment.

2.2 Dose

Primary: one drop of the reconstituted vaccine applied to scarification.

Booster: duration of protection is unknown; no routine schedule of booster doses has been devised.

2.3 Immunity

Susceptibility or prior exposure to tularemia can be imperfectly assessed by a skin test, antibody titers, and the histories of natural infection and immunization.

2.4 Laboratory Problems

VanMetre and Kadull[3] stated that practically every nonvaccinated individual who consistently works with the organism becomes infected, usually by inhalation.

Most laboratory infections result from exposure to uncovered or spilled cultures; 129 have been reported. In some instances, disease has developed in persons who simply entered the laboratory area. Minor skin injuries from objects contaminated with *F. tularensis* have resulted in the ulcero-glandular form. Serologic studies have demonstrated a number of asymptomatic cases among persons who have either worked with the organism or have simply entered laboratories where the organism was being studied.

3. Contraindications Precautions

The vaccine must be administered by or under the supervision of the physician who requested the vaccine and completed Form FD-1573, "Statement of Investigator."

The vaccine should be administered only to healthy men and women from 18 to 65 years old, since investigations have been conducted exclusively in this population. The effects of administering the vaccine during pregnancy have not been studied, and the vaccine is not recommended for pregnant women.

Patients with eczema or chronic dermatosis should not be vaccinated. Exercise caution in vaccinating persons with normal skin who have direct and frequent contact with eczematous individuals.

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1. Eigelsbach, et al. Live Tularemia Vaccine. I. Host-Parasite Relationship in Monkeys Vaccinated Intracutaneously or Aerogenically. J Bact *84*(5):1020-1027, November 1962.

2. Saslaw, S., et al. Tularemia Vaccine Study. I. Intracutaneous Challenge; and II. Respiratory Challenge. Arch Int Med *107*(5):689-701 and 702-714, May 1961.

3. VanMetre, T. E., Jr., and Kadull, P. J., Laboratory Acquired Tularemia in Vaccinated Individuals: A Report of 62 Cases. Ann Int Med *50*(3):621-663, March 1959.

TYPHOID VACCINE

1. Description

1.1 Composition — Typhoid vaccine is a heat-killed, phenol-preserved suspension of *S. typhi* organisms containing 1,000 million cells and not more than 0.035 mg. per ml. of total nitrogen in phosphate-buffered isotonic saline. At the present time, strain No. 58 (Panama strain) serves as the standard.

1.2 License — Licensed.

1.3 Storage — Refrigerate at 2° to 8°C.

1.4 Supplier — Eli Lilly and Co., Wyeth Laboratories, and other drug companies.

1.5 Reactions — Local reactions of swelling, inflammation, and pain are common. Systemic reactions of malaise, fever, headache, and nausea are relatively common. Serious systemic reactions, especially postvaccinal neurologic disorders, are extremely rare. Reimmunization can cause reactions that are more severe than those due to the primary series.

Intradermal administration of vaccine practically eliminates the possibility of systemic reactions without sacrificing protective antibody levels. The intradermal route should not be used, however, for the primary course.

1.6 Efficacy — Heat-killed, phenol-preserved typhoid vaccine stimulates protective antibody levels in 60 to 90% of recipients, depending upon prior antibody level. The acetone-dried vaccine has been reported to afford protective levels of greater than 90%. Respective vaccine efficacy has been documented in several well-controlled field trials. Results of these trials have made it clear that the acetone-killed typhoid vaccine should be strongly considered as the vaccine to replace the one currently in use. See references.

2. Recommendations

2.1 General — Recommended for individuals who may be exposed to *S. typhi* in any manner permitting oral intake and for travelers to areas where typhoid fever is known to be endemic or hyperendemic.

The vaccine is specifically recommended for:

(a) Persons who work directly with *S. typhi.*

(b) Caretakers of infected animals.

These groups *need not be* vaccinated:

(a) Persons who work in the same laboratory though not with *S. typhi.*

(b) Personnel who handle media and glassware.

(c) Laboratory and animal maintenance personnel.

(d) Other personnel who may enter laboratory and animal care areas where *S. typhi* is being used.

2.2 Dose — Primary for adults: 0.5 ml. subcutaneously on two occasions separated by 4 or more weeks.

Booster: 0.5 ml. subcutaneously or 0.1 ml. intradermally every

3 years. Even if more than 3 years have elapsed, only 0.5 ml. subcutaneously or 0.1 ml. intracutaneously should be used.

2.3 Immunity

Antibody levels against O, H, and Vi antigens can be assessed. Unless definite changes of level are measured, however, they are not diagnostic. Neither do high antibody levels guarantee immunity; anti-O and anti-Vi levels are especially unreliable.

2.4 Laboratory Problems

Although 292 cases of laboratory-acquired typhoid fever have been reported, most of these were acquired in Europe during 1915-1948. In recent years in the United States infections have been rare. The most recent account of laboratory-acquired infection implicated a lactose-fermenting strain of *S. typhi* from a glassware washer.[2] Considering the number of people directly and possibly indirectly involved with various aspects of *S. typhi* over the decades, this is truly a remarkable record. The real hazard among laboratory workers is generally conceded to be carelessness, such as that contributing to the accidental aspiration of a broth culture.

3. Contraindications: Precautions

Contraindications include the presence of any acute illness or exposure to an infectious agent which may produce illness. Neither should typhoid vaccine be given to patients with severe debilitating chronic disease or chronic diseases that require continuous and concomitant administration of cortico-steroids.

Bibliography

1. Vaccine Efficacy

1.1 Ashcroft, M. T., et al. A Seven-Year Field Trial of Two Typhoid Vaccines in Guyana. Lancet *II*:1056-1059, November 18, 1967.

1.2 Ashcroft, M. T., Ritchie, J. M., and Nicholson, C. C. Controlled Field Trial in British Guiana School Children of Heat-Killed-Phenolized and Acetone-Killed Lyophilized Typhoid Vaccines. Amer J Hyg *79*(2):196-208, March 1964.

1.3 Yugoslav Typhoid Commission. A Controlled Field Trial of the Effectiveness of Phenol and Alcohol Typhoid Vaccines: Final Report. Bull WHO *26*(3):357-369, 1962.

2. Laboratory Accidents

Kunz, L. J., and Ewing, W. H. Laboratory Infection with a Lactose-Fermenting Strain of *Salmonella typhi.* J Bact *89*(6):1629, June 1965.

TYPHUS FEVER (EPIDEMIC) VACCINE

1. Description

1.1 Composition	Typhus fever (epidemic) vaccine is prepared from yolk sacs infected with *Rickettsia prowazeki.*
1.2 License	Licensed.
1.3 Storage	For optimal storage, refrigerate, but refrigeration is not essential.
1.4 Supplier	Several, including Eli Lilly and Co., Lederle Laboratories, and Merck, Sharp, and Dohme.
1.5 Reactions	Mild, local reactions are fairly common. Severe, sometimes fatal anaphylactoid reactions may occur in persons sensitive to eggs. Such individuals have histories of intolerance to eggs in food, so each prospective vaccinee should be questioned about this sensitivity.
1.6 Efficacy	No direct field trials have been carried out, but field experience has been favorable. Experience in rickettsial laboratories is also favorable. (See references.)

2. Recommendations

2.1 General

Recommended for persons who will be exposed to *R. prowazeki* or to human lice and for travelers to areas where louse infestation is common; such areas are now, in general, the mountainous tropics.

The vaccine is specifically recommended for:

(a) Persons who work directly with the disease agent in the laboratory.

(b) Persons who work in the same laboratory or who come into the room while work is being done.

(c) Caretakers of infected animals.

(d) Persons who enter laboratory or animal care areas while laboratory work is being done.

2.2 Dose

Primary: two 0.5 ml. (or 1.0 ml., see package insert) doses 1 to 4 weeks apart.

Booster: dose as recommended by manufacturer. A single injection of vaccine at intervals of 6 to 12 months for as long as opportunity for exposure exists. The primary series need never be repeated for booster doses to be effective.

2.3 Immunity

Immunity is best assessed by the neutralization test (of toxic substance), but the test is difficult to perform. All persons are considered susceptible unless they have been immunized or infected.

2.4 Laboratory Problems

Eighty-two laboratory infections have occurred. In the absence of specific treatment, such infections were usually fatal in the unvaccinated. Laboratory infections are acquired from inhaling aerosol of highly infected materials such as yolk sacs, lice, or louse feces. *R. prowazeki* from the usual media used in the laboratory does not survive drying; consequently, danger

of infection does not persist in a room for more than a half hour after the aerosol is produced.

3. Contraindications

Precautions — Do not give the vaccine to persons who are sensitive to eggs. Each person to be vaccinated should be asked if he can safely eat eggs.

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1. Ecke, R. S., Gilliam, A. G., Snyder, J. C., Yeomans, A., Zarafonetis, C. J., and Murray, E. S. The Effect of Cox-type vaccine on Louse-Borne Typhus Fever. An Account of 61 Cases of Naturally Occurring Typhus Fever in Patients Who Had Previously Received One or More Injections of Cox-type Vaccine. Amer. J. Trop. Med., *25*(6):447-462, November 1965.
2. Gilliam, A. G. Efficacy of Cox-Type Vaccine in the Prevention of Naturally Acquired Louse-Borne Typhus Fever. Amer. J. Hyg., *44*(3):401-410, November 1946.
3. Sadusk, J. F., Jr. Typhus Fever in the United States Army Following Immunization. Incidence, Severity of the Disease, Modification of the Clinical Course and Serologic Diagnosis. JAMA *133*(16):1192-1199, April 19, 1947.
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VENEZUELAN EQUINE ENCEPHALITIS (VEE) VACCINE

1. Description

1.1 Composition	Venezuelan equine encephalitis (VEE) virus vaccine is a live virus preparation limited to the immunization of persons at risk to infection with virulent strains of VEE virus. The vaccine is propagated in primary fetal guinea pig heart tissue cultures maintained in Hank's balanced salt solution, supplemented with 0.5% Human Serum Albumin (USP), and without antibiotics.
1.2 License	Unlicensed.
1.3 Storage	Store lyophilized vaccine at −20°C.
1.4 Supplier	Immunobiologics Activity, Biological Reagents Section, Laboratory Division, CDC.
1.5 Reactions	A small but variable percentage of persons administered this vaccine experience adverse reactions of mild to moderate severity. Reactions have been characterized by transient malaise, myalgia, and headache, with or without fever of 12 to 24 hours' duration, occurring 1 to 3 days after inoculation. Less frequently, biphasic or late reactions, for example, between 5 and 10 days after inoculation, have occurred. In such instances, symptomatology has been an extension of that described above. Adverse reactions are treated symptomatically. See references.
1.6 Efficacy	Efficacy has been documented. See references.

2. Recommendations

2.1 General

Recommended only for personnel who are at high risk because of their laboratory or field studies. The vaccine should be administered to individuals who may be exposed to virulent, exotic strains of VEE virus. The vaccine is not recommended for those handling domestic strains, since natural illness with such strains may be less severe than vaccine reactions.

The vaccine is specifically recommended for:

(a) Persons who work directly with the disease agent in the laboratory.

(b) Persons who work in the same laboratory though not with the specific organism.

(c) Caretakers of infected animals.

(d) Personnel who handle contaminated media and glassware before autoclaving.

(e) Laboratory and animal quarter maintenance personnel.

(f) Other persons who enter laboratory or animal-care areas where work with the organism is under way.

2.2 Dose

Primary: a single 0.5 ml. dose of properly reconstituted vaccine subcutaneously.

Booster: routine boosters are not recommended. However, persons who do not develop an HI titer of 1:40 or greater within 4 weeks after the primary inoculation should receive a

second inoculation. If the HI titer following this second viable VEE vaccination does not reach 1:40 or greater, a serum neutralization assay should be done; a log virus neutralization index of 1.7 or greater is considered indicative of adequate protection.

Revaccination: Vaccinated persons at risk should be screened periodically for HI titer. If the HI titer has declined to 1:20 or less, revaccination is recommended.

2.3 Immunity

Immunity can be assessed by quantitative serologic methods. The most indicative is the virus neutralization test performed either in mice or in appropriate cell systems.

2.4 Laboratory Problems

Laboratory infections with VEE virus are very common. One hundred and eighteen cases and one death have been recorded. (See references.) VEE produces more laboratory infections than any other arbovirus reported. As many as 24 cases have been reported as resulting from a single laboratory accident. The virus is infectious by aerosol as well as by inoculation. Infected animals excrete the virus, and animal caretakers have been infected while handling animal litter.

3. Contraindications Precautions

The teratogenic properties of the vaccine for the human fetus have not been characterized. Therefore, the vaccine is not recommended for pregnant females.

Bibliography

1. Vaccine Efficacy

1.1 Allevizatos, A. C., McKinney, R. W., and Feigin, R. D. Live Attenuated Venezuelan Equine Encephalomyelitis Virus Vaccine. I. Clinical Effects in Man. Amer J. Trop Med *16*(6):762-768. November 1967.

1.2 Berge, T. O., Banks, I. S., and Tigertt, W. D. Attenuation of Venezuelan Equine Encephalomyelitis Virus by *In Vitro* Cultivation in Guinea-Pig Heart Cells. Amer J. Hyg *73*(2):209-218, March 1961.

1.3 Feigin, R. D., Jaeger, R. F., McKinney, R. W., and Alvizatos, A. C. Live, Attenuated Venezuelan Equine Encephalomyelitis Virus Vaccine. II. Whole-Blood Amino-Acid and Fluorescent-Antibody Studies Following Immunization. Amer J. Trop Med *16*(6):769-777, November 1967.

1.4 McKinney, R. W., et al. Use of an attenuated Strain of Venezuelan Equine Encephalomyelitis Virus for Immunization in Man. Amer J Trop Med *12*(4):597-603, July 1963.

2. Laboratory Accidents

2.1 Hanson, R. P., et al. Arbovirus Infections of Laboratory Workers. Science *158* (3806):1283-1286, December 8, 1967.

2.2 Slepushkin, A. N. An Epidemiological Study of Laboratory Infections with Venezuelan Equine Encephalomyelitis. Probl Virol *4*(3):54-58, 1959.

YELLOW FEVER (YF) VACCINE

1. Description

1.1 Composition — Yellow fever (YF) vaccine is a live, clarified aqueous-base extract of living chick embryos infected with 17D YF virus. No preservative or protein stabilizer is added.

1.2 License — Licensed.

1.3 Storage — Store in the unopened glass ampule in the freezing compartment of a refrigerator (at approximately −20°C.). At this temperature, the vaccine retains its potency for at least 12 months. The vaccine must be reconstituted with sterile sodium chloride injection, USP, (contains no preservative) immediately before use. Reconstituted virus must be kept cool and used within 60 minutes.

1.4 Supplier — The National Drug Co.

1.5 Reactions — Mild systemic reactions characterized by fever and malaise occur in less than 10% of vaccinated individuals and are rarely severe enough to require medical attention. When the vaccine is given together with smallpox vaccine by the jet injector technique, a typical vaccinial reaction occurs at the site of injection. More severe generalized hypersensitivity reactions may occur in egg-sensitive individuals. See below. Encephalitis has been reported rarely in infants under 1 year of age. A single fatality from encephalitis in a 3-year-old girl vaccinated with 17D virus is on record; virus was isolated from the child's brain.

1.6 Efficacy — Vaccine efficacy, measured by serologic response, approaches 95%. Several large studies have documented yellow fever vaccine efficacy.

2. Recommendations

2.1 General — Recommended for individuals who may be exposed to virulent yellow fever virus under natural or laboratory conditions and for persons traveling to countries requiring an International Certificate of Vaccination against yellow fever and to other areas in which yellow fever is known or suspected to occur.

Laboratory workers and caretakers who may have intimate or chance exposure to yellow fever virus should be vaccinated.

The vaccine is specifically recommended for:

(a) Persons working directly with virulent strains of YF virus and persons working directly with 17D virus who may be exposed to high mouse passage virus that has reverted to virulence.

(b) Persons who work in the same laboratory although not with YF virus.

(c) Caretakers of animals infected with YF virus.

(d) Persons handling infected glassware.

(e) Maintenance personnel.

(f) Other persons entering laboratories where work with the virus is under way.

2.2 Dose

Primary: single subcutaneous injection of 0.5 ml.

Revaccination: required after a lapse of 10 years. More frequent vaccinations at 5-year intervals are advisable for persons working with virulent virus in the laboratory.

2.3 Immunity

Immunity can be assessed by quantitative serologic tests. Only the serum neutralization test adequately reflects immunization with 17D virus. Hemagglutination-inhibiting antibody may not develop in some individuals, and, in most, it is of low titer. Complement fixing antibody rarely develops. Neutralizing antibody lasts at least 16 years after immunization. No skin test is available. History of natural disease, if based only on clinical information, is not reliable because YF infection may mimic a number of other viral diseases, including hepatitis and influenza.

2.4 Laboratory Problems

Thirty-eight laboratory infections with yellow fever virus have occurred. Rarely have these been associated with bites of infective mosquitoes. Most have resulted from contact with or inhalation of infectious material (for example, blood, serum, and mouse brain tissue). Widespread immunization of laboratory personnel has eliminated the danger of infection. Hospital personnel have been infected through contact with the blood of infected patients.

3. Contraindications Precautions

Relative contraindications to the use of 17D vaccine include: history of egg sensitivity; pregnancy; age under 1 year; and concomitant administration of immunosuppressive drugs, corticosteroids, or X-ray therapy.

There are no absolute contraindications to the use of the vaccine. Pregnant women and infants in the high risk areas may require vaccination after the relative risks have been considered. Similar considerations may apply to persons receiving immunosuppressive or steroid therapy. Egg-sensitive or chicken-sensitive individuals should receive an intradermal test with 0.02 ml. of vaccine. A positive test (urticarial wheal) may contraindicate administration of the vaccine. In cases with minimal skin test reactions or with a negative test but a strongly suggestive allergic history, immunization may be attempted by scarification. Two scratches about 1 centimeter long are made and a drop of vaccine is rubbed into each. Epinephrine should be available for use during skin testing and/or scarification.

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