National Institutes of Health
Guidance for the Selection of Laboratory Coats

Drafted by the Occupational Safety and Health Committee, August 2016

This reference document provides a general overview for selection of laboratory coats. It does not alter or determine compliance responsibilities in OSHA standards or NIH's Manual Chapter 1340. Because interpretations and policy may change over time, you should your consult with your Institute's Safety and Health Specialist. Contact the Technical Assistance Branch, Division of Occupational Health and Safety at 301-496-2960 for technical questions regarding this reference document.

Information on the Selection of Laboratory Coats

A. Examples of laboratory hazards:

In general, there are three types of hazards personnel may encounter while working in laboratories at the NIH.

Possible hazards include:

- Biological Hazards – bloodborne pathogens
- Chemical Hazards – carcinogenic, flammable, or corrosive materials
- Physical Hazards – pyrophoric materials, lasers or radiation.

It is possible, even common, for a single laboratory to have types of hazards associated with more than one of these categories at once. Engineering controls should be used as primary barriers, functioning to contain the hazards. Personal protective equipment (PPE) should be used in combination with engineering controls to reduce the risk of worker exposure to laboratory hazards. A risk assessment should be used to determine the hazards associated with a particular laboratory or laboratory operation, and establishing which engineering controls should be utilized and what PPE should be selected. Information on how to perform a risk assessment is described in Biosafety in Microbiological and Biomedical Laboratories 5th Edition. For assistance with performing a risk assessment and selecting proper PPE, please contact your Institute's Safety and Health Specialist, or the Division of Occupational Health and Safety.

B. Appropriate laboratory attire, laboratory coats and applicable standards:

While in a laboratory at the NIH for any reason, all personnel must wear appropriate clothing attire that prevents direct contact of materials with the skin. Examples of attire that is appropriate includes long pants or leg coverings and closed toe shoes. **In addition, a task appropriate laboratory coat, as determined by a risk assessment, must be worn while performing laboratory operations**. Following a thorough risk assessment, guidance to the selection of laboratory coats can be obtained from Tables 1 and 2. Table 1 lists the three types of laboratory hazards and the applicable laboratory coat material standards. Table 2 provides a more detailed description on the application of these standards and examples of laboratory coats that meet these standards.

Table 1. Summary of laboratory hazards and applicable test standards

Type of Laboratory Hazard	Applicable Test standard
Biological Hazards	ASTM F1670 (penetration by synthetic blood) and ASTM F1671 (bloodborne pathogen exposure)
Liquid or Chemical Hazards	AATCC Method 42 (resistance to the penetration of water by impact) and ASTM F903 (liquid chemical barrier)
Physical Hazards	NFPA 701 or 2112 (flame propagation tests)

The standards listed in Table 2 serve as standardized testing methods to determine protection levels of materials against certain hazardous or hazard surrogates. These standards should be considered when selecting a laboratory coat material when working with the hazards that correspond to the applicable hazard or hazard surrogate tested. These testing methods only test the material and do not test the complete laboratory coat making it important to consider characteristics of the laboratory coat such as seams, stitches and where the openings, snaps or buttons are located when selecting a laboratory coat. A complete description of the standards can be viewed by contacting your Institute's Safety and Health Specialist, or the Division of Occupational Health and Safety.

More information about chemical protective PPE is available in the NIH Chemical Hygiene Plan. Radiological or laser protection is modeled after the ANSI guidelines established under Z.136-2007 and best practices and consultation with the Division of Radiation Safety or the DOHS Laser Safety Program is recommended.

C. Additional task specific PPE:

When performing experimentation in the laboratory, in addition to the proper laboratory attire and a task appropriate laboratory coat, a risk assessment should be used to determine appropriate hand protection, and eye and face protection devices. Task appropriate hand protection is required when performing laboratory operations and the selection is determined by the laboratory supervisor in accordance with the appropriate standard (ANSI/ISEA 105-2011 for laboratory gloves). Eye protection is mandatory when there is a potential for injury. Eye protection (protective glasses, goggles, faceshield) must be appropriate for the type of hazard (chemical splash or vapors, lasers, ultra violet light) and should be selected by the laboratory supervisor in accordance with the appropriate standard (ANSI/ISEA Z78.1-2015 for safety eyewear). More information on hand and eye protection can be found in section IX of the NIH Chemical Hygiene Plan. Any employee needing prescription safety glasses should consult the Safety Glasses Request section of the Occupational Medical Service website. It is important to ensure that safety eyewear selected for use in laboratories where lasers are present is appropriate for the wavelength of the specific laser used. For assistance with laser specific eyewear, please contact the Technical Assistance Branch of the Division of Occupational Health and Safety. In some situations, it may be required for an NIH employee to wear a respirator for work. In accordance with OSHA's Respiratory Protection Standards (29 CFR, 1910.124), the NIH has established a Respiratory Protection Program, and more information can obtained by contacting the Technical Assistance Branch of the Division of Occupational Health and Safety.

Table 3. Standards used to determine barrier properties of materials.

- The information provided in this table is meant to act as a guideline only. Proper selection of PPE should ALWAYS be determined by a **risk assessment**.
- Information on how to perform a risk assessment can be found in Biosafety in Microbiological and Biomedical Laboratories 5th Edition.
- Other laboratory coat characteristics should be considered such as the presence of seams, integrity of the seams and open front/back.
- Fabrics are **not** flame resistant unless specified. Melting fabric can cause severe burns.

Examples of Applicable Hazards	Relevant Standards	Standard Measurements	Standard Applications and Comments	Measurement Determinations	Material Examples
Non-hazardous materials	None met	Not applicable	Not applicable	Not applicable	• Traditional "white lab coat" • 100% cotton (fire resistant) • Non-disposable polyester/cotton blend (80/20 or 65/35) material (**not** fire resistant)
Small volumes of potentially hazardous aqueous solutions or infectious materials	AATCC Method 42	Resistance to the penetration of water by impact	500 mL of water is sprayed against a material backed by a blotter which is reweighed to determine water penetration.	Results are reported as an increase in mass of the blotter in grams. Values over 5.0 grams may be reported as >5.0 grams.	* Increase in mass is >5.0g[1,2]* • VWR Basic Protection SPP, and SMS materials • DenLine DL3460, DL3660, and DL3630 * Increase in mass is <5.0g[1,2]* • VWR Advanced Protection, Maximum Protection, Maximum Protection Gowns with Fluid-Impervious Fabric • Medline Level 1, Level 2, Level 3, and Level 4 materials • DenLine DL4260, DL4230, DL3760 and DL3730

[1] Greater resistance to the penetration of water corresponds with lower weight reported results.
[2] See manufacturer specifications for the reported results.

The National Institutes of Health does not endorse any brands listed in this table – they are listed solely as reference examples.

Examples of Applicable Hazards	Relevant Standards	Standard Measurements	Standard Applications and Comments	Measurement Determinations	Material Examples
Human or animal blood and body fluids	ASTM F1670	Penetration by synthetic blood	Evaluates the resistance of materials to penetration by synthetic blood under conditions of continuous liquid contact.	A material passes the test if there is no synthetic blood penetration based on visual detection.	• VWR Advanced Protection, Maximum Protection coveralls, lab coats, shoe covers, masks, and frocks • Kimberly Clark Kleenguard A40, A60, A80 Liquid & Particle Protection Apparel • Life Science Products Poly Propylene/Polyethylene coated • Medline polyethylene-coated polypropylene material, microporous breathable white material, Thumbs Up® polyethylene material • DenLine FluidGuard material • Cardinal Health yellow coated-polypropylene material, blue coated-polypropylene material, polyethylene film material, coated-polypropylene isolation gowns, poly-coated SMS chemotherapy gowns

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Examples of Applicable Hazards	Relevant Standards	Standard Measurements	Standard Applications and Comments	Measurement Determinations	Material Examples
Bloodborne pathogens including: • Hepatitis B Virus • Hepatitis C Virus • Human Immunodeficiency Virus	ASTM F1671	Bloodborne pathogen exposure *This is a more stringent standard to pass than ASTM F1670	Measures the resistance of materials against penetration by bloodborne pathogens using a surrogate microbe under conditions of continuous liquid contact.	A material passes the test if no (<1 PFU/mL) phages are detected in the assay.	• Kimberly Clark Kleenguard A60, A80 Liquid & Particle Protection Apparel • Life Science Products Poly Propylene/Polyethylene coated • Medline prevention plus material • DenLine FluidGuard material • Cardinal Health blue coated-polypropylene material, blue polyethylene film material, coated-polypropylene isolation gowns, poly-coated SMS chemotherapy gowns
Chemicals are tested individually	ASTM F903	Liquid chemical barrier	A material used for protective clothing or a specimen from a finished item is subjected to a liquid for a specified time and pressure sequence.	A passing test occurs if a droplet of liquid does not appear and there is no discoloration indicating the presence of the chemical appearing on the viewing side of the specimen.	• VWR Advanced Protection (70% Sulfuric Acid, 85% Phosphoric Acid), Maximum Protection (70% Sulfuric Acid, 85% Phosphoric Acid) *It is important to confirm that the specific chemical being used has been tested on the laboratory coat material intending to be used.

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Examples of Applicable Hazards	Relevant Standards	Standard Measurements	Standard Applications and Comments	Measurement Determinations	Material Examples
Flammable or pyrophoric **liquids**	NFPA 701 or 2112 Flame Propagation Tests	Flammable	Fire resistant	Fire resistant	• DuPont Nomex® • Kimberly Clark Kleenguard A65 Lab Coat • Nylon, polyester, or polypropylene will melt at relatively low temperatures and should **not** be used • Cotton will not deflect flammable or pyrophoric liquids and should **not** be used when working with these hazards
Flammable or pyrophoric **solids**	NFPA 701 or 2112 Flame Propagation Tests	Flammable	Fire resistant	Fire resistant	• Cotton (or other non-synthetic material) • DuPont Nomex® • Kimberly Clark Kleenguard A65 Lab Coat • Nylon, polyester, or polypropylene will melt at relatively low temperatures and should **not** be used

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FAQs:

1) Why do I need to wear a laboratory coat when performing laboratory operations?

A layer of protection between your skin and potentially hazardous materials provided by a laboratory coat can prevent painful injuries to your skin. An appropriate laboratory coat will protect you against most hazards in the laboratory.

2) Why is it appropriate to keep all skin below the knee covered while in the laboratory?

If a spill occurs, the lower extremities are protected if they are covered with appropriate clothing. Tights or other thin materials are not recommended because they do not afford proper protection from potentially hazardous materials.

3) Do I need to wear PPE when performing administrative tasks such as working on a computer at my desk?

No. However, it is important to keep in mind that while you may not be working with a hazardous material, the person working next to you may be. Maintain situational awareness at all times to ensure your safety.

4) How do I use Table 2 for the selection of task appropriate laboratory coats?

The hazards associated with a given laboratory operation should be determined by performing a risk assessment – information on how to perform a risk assessment is described in Biosafety in Microbiological and Biomedical Laboratories 5th Edition. Identify which row in Table 2 the identified hazards most suitably fall into, keeping in mind that you may need to consider more than one row. Select a laboratory coat that meets the standards listed in the row(s) you have selected. Contact your DOHS Safety and Health Specialist if you need help selecting an appropriate laboratory coat.

5) Why is a traditional white laboratory coat not appropriate for many laboratory operations?

Traditional white laboratory coats, which are made of 100% cotton, or a polyester/cotton blend have been widely used and are what most people think of when they imagine a lab coat. Although a traditional white laboratory coat can protect against limited splashes and spills when working with non-hazardous materials, it does not offer specific protection when working with infectious materials, chemicals and/or flammable or pyrophoric liquids. A task appropriate laboratory coat, as determined by a risk assessment, must be worn while performing laboratory operations.

6) Why do different laboratory operations require different laboratory coats?

Depending on the laboratory task, an employee may be exposed to different types of hazards, such as chemical, biological, or physical hazards. A task appropriate laboratory coat is determined by a risk assessment based on the nature and quantities of the hazards involved and the circumstances of use. See Table 2 for detailed information on laboratory coat characteristics and selection or contact your DOHS Safety and Health Specialist.

7) What are the differences between ASTM F1670 and ASTM F1671 that should be considered when selecting a laboratory coat?

ASTM F1671 is a more stringent method used to determine the resistance of a material to bloodborne pathogens than ASTM F1670. ASTM F1670 evaluates the resistance of material to penetration by synthetic blood. A material passes the test if no synthetic blood penetrates through the material based on visual detection. ASTM F1671 measures the resistance of a material against penetration by bloodborne pathogens using a surrogate microbe. This standard requires an actual measurement to determine a pass or fail. Laboratory coat material meeting the ASTM F1670 standard is appropriate for research involving blood and body fluids,

whereas those meeting the ASTM F1671 standard are more appropriate for performing research with bloodborne pathogens, pending a comprehensive risk assessment of the work being performed.

8) Why should I consider features such as closed front, snaps, seams, stitches and other when selecting a laboratory coat?

Laboratory coat closures and seams should be considered when selecting a laboratory coat because these openings, when not sealed or double stitched, may serve as entry points for hazardous materials into the laboratory coat. When considering selection of the appropriate laboratory coat for your laboratory's hazards, please contact your DOHS Safety and Health Specialist.

9) Can I clean, wash, or otherwise reuse my laboratory coat?

The reuse or laundering of a laboratory coat is greatly dependent on the material composition. If a laboratory is coated with a material, such as polyethylene, any laundering will remove the protective coating. Do **NOT** bring your laboratory coat home for laundering. Contact the vendor for laboratory coat lifetime and laundering-specific questions.

10) Why should I be inspecting my PPE for defects prior to use?

PPE should be inspected for defects prior to use to ensure that there are no holes, rips, or tears that could allow hazardous substances to enter the coat and come into contact with the person wearing it. If defects are found the PPE should be disposed of appropriately in accordance with the hazards present and the Waste Disposal Guide. A new item of PPE should be selected and inspected.

11) Can I wear my laboratory coat or other PPE outside of the laboratory?

NO! All PPE, including gloves and laboratory coats should be considered contaminated upon donning. All PPE must be removed prior to exiting the laboratory into shared common spaces to prevent contaminating clean spaces. Even if you are working with nonhazardous material, you must still remove all PPE before leaving the laboratory.

12) Where can I get help selecting appropriate laboratory coats taking into account the hazards found in my laboratory?

Refer to Table 2 or contact your DOHS Safety and Health Specialist for any laboratory coat selection inquiries.

13) Why must I consult with the Respiratory Protection manager before wearing any respirator?

The NIH Respiratory Protection Program provides NIH-wide procedures for the proper selection, use and care of respiratory protective equipment. For more information, or to enroll in the Respiratory Protection Program, please visit the Respiratory Protection Program website.