BROOKHAVEN NATIONAL LABORATORY

BNL Handbook on

Personal Protective Equipment (PPE) Selection and Use

BNL Handbook on PPE Selection and Use

Date: **DRAFT**	*Contact:* **PPE Subject Matter Expert**

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Introduction

This document is an accompanying reference to the Personal Protective Equipment Subject Area. It provides information for selecting PPE for generic and some specific work scenarios at BNL. The recommendations in this handbook are based on historical experience, professional judgment of the Personal Protective Equipment Subject Matter Expert, and published references.

Personal Protective Equipment is a component of the "hierarchy of controls" used to eliminate or reduce hazards in the workplace. The order in which the controls should be evaluated and used is:

1. **Eliminate the hazard**, examples
   - Use a different less dangerous piece of equipment
   - Fix faulty machinery
   - Redesign the workplace
   - Use safer materials or chemicals
2. **Engineering Controls** (isolate the hazard from the people), examples
   - Use guards around moving parts
   - Remove dust or fumes with an exhaust system
   - Use lifting equipment
3. **Administrative Controls** (change the way the job is done), examples
   - Rotate workers to shorten the time of exposure to any one employee
   - Spread the work out over more days to lessen the daily exposure
   - Provide training, information and signs
4. **Personal Protective Equipment** (PPE)
   - Wear PPE to isolate the worker from the hazard while other controls are being implemented.
   - Wear PPE to isolate the worker from the hazard when other controls are not feasible.

The least desirable and usually the least effective method of controlling a risk is the wearing of PPE. This method relies on employees wearing the equipment and then on the equipment always being available in good condition. Because the hazard has typically not been removed, the employee may be exposed to the potential danger if the PPE fails or is improperly used.

1. Body Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For guidance on selection of suit material, see Polymer selection guidance in *Section 5 Hand Protection.* For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

1A: Types of Protective Equipment

Equipment Title	Description	Illustration
Casual dress clothing	Short pants, short sleeve shirt, short dresses, etc. Exposed parts of body are arms and legs. Offers very minimal to no protection level for incidental exposure hazards .	
Low-hazard protective clothing	Provides a minimum protection level for incidental exposure hazards. Consists of long pants and long or short sleeve shirt. Also meeting this category is a long dress or skirt to the ankles. Long sleeves or lab coat are **needed** when **corrosive or high hazard** chemicals are handled.	
Lab coat	Cotton or synthetic fiber long sleeve coat, open at the collar, covering to knee length. Provides initial splash protection, minimal thermal protection, and some abrasion protection. Must be removed immediately if contact with a hazardous substance occurs that can transmit the hazard to the underlying skin. Lab coats with red collars **and yellow colored lab coats** are reserved for work with radiological hazards.	

1A: Types of Protective Equipment		
Equipment Title	Description	Illustration
Coveralls	Reusable or disposable one-piece suit. Provides initial splash protection, some thermal protection, and some abrasion protection.	
Encapsulating Suit Level B, C, D	Reusable or disposable one-piece suit. Typically disposable suits are coated with polymer to increase chemical permeation resistance. Provides splash and some sustained chemical contact protection, some thermal protection, and some abrasion protection. Reusable suits provide sustained chemical resistance when the polymer of construction is appropriately selected.	
Total Encapsulating Suit Level A	Reusable or disposable one-piece suit. Always coated with polymer or constructed of polymer. Provides maximum degree of chemical permeation resistance. Provides some thermal protection and abrasion protection. The suit is airtight thus requiring breathing-grade supplied air to be provided into the suit.	
Laboratory apron	Apron provides protection from abrasion and splash to front of body, where the maximum potential for exposure occurs. Should be used in conjunction with a lab coat, coverall, or other protection for unprotected areas of the body. Typically manufactured in polyethylene (low cost), vinyl (flexibility and resistance to chemicals, fats, oils, grease, etc.), and rubberized fabric (acid resistant).	

1A: Types of Protective Equipment		
Equipment Title	Description	Illustration
Flame-resistant clothing	Suit worn for minor electrical operations for protection from accident hazards that create a hot metal. Protective clothing includes shirts, pants, coveralls, jackets, and parkas worn routinely by workers who, under normal working conditions, are exposed to momentary electric arc and related thermal hazards. Arc- and flame-resistant rainwear worn in inclement weather is included in this category of clothing. Layering of flame-resistant and natural fiber garments is used for added protection. A typical layering system may include an undershirt, a shirt, trouser, and coverall. Loose fitting clothing provides additional thermal insulation due to air spaces.	
Electrical flash suit	Suit worn by electricians for protection from electrical flash accidents hazards that create a large fireball, sending hot metal flying through the air. ASTM F1506-00 is used to assign the garment with an arc rating. Face shields made of polycarbonate material are more appropriate for use in situations with relatively low radiation exposure.	
Gauntlets/ sleeves	Gauntlets provide protection from abrasion to the forearms, for uses where the maximum potential for exposure occurs in that area. Typical uses are chain saws and knife cutting operations.	

1B: *ELECTRICAL Safety Hazard Body Protective Equipment*

Clothing Material Characteristics:

- Flame-retardant treated cotton, meta-aramid, para-aramid, and poly-benzimidazole (PBI) fibers provide thermal protection.
- Synthetic materials, such as polyester, nylon, and synthetic-cotton blends will melt into the skin when exposed to high temperatures and aggravate the burn injury. Clothing made from synthetic materials such as acetate, nylon, polyester, rayon, either alone or in blends with cotton, should not be worn.
- Cotton and polyester-cotton, silk, wool, and nylon fabrics are flammable. Flame-retardant treated cotton, meta-aramid, para-aramid, and PBI fabrics may ignite but will not continue to burn after the ignition source is removed. Clothing made from natural materials, such as cotton, wool, or silk is acceptable if it is determined by flash hazard analysis that the fabric will not ignite and continue to burn under the arc conditions to which it will be exposed. NOTE: The weight of the fabric is a factor in meeting this requirement.

Table 3-3.9.1 Hazard Risk Category Classifications

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
Panelboards rated 240 V and below – Notes 1 and 3	—	—	—
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized parts)	1	N	N
Opening hinged covers (to expose bare, energized parts)	0	N	N
Panelboards or Switchboards rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) — Notes 1 and 3	—	—	—
CB or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
600 V Class Motor Control Centers (MCCs) – Notes 2 (except as indicated) and 3	—	—	—

CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	Y	Y
Insertion or removal of individual starter “buckets” from MCC — Note 4	3	Y	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
600 V Class Switchgear (with power circuit breakers or fused switches) — Notes 5 and 6	—	—	—
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	**Hazard/ Risk Category**	**V-rated Gloves**	**V-rated Tools**
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	N	N

Opening hinged covers (to expose bare, energized parts)	2	N	N
Other 600 V Class (277 V through 600 V, nominal) Equipment — Note 3	—	—	—
Lighting or small power transformers (600 V, maximum)	—	—	—
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
Revenue meters (kW-hour, at primary voltage and current)	—	—	—
Insertion or removal	2*	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
NEMA E2 (fused contactor) Motor Starters, 2.3 kV through 7.2 kV	—	—	—
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2*	N	N
Work on energized parts, including voltage testing	3	Y	Y

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	**Hazard/ Risk Category**	**V-rated Gloves**	**V-rated Tools**
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	3	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open	3	N	N
Insertion or removal (racking) of starters from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	3	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N

Opening hinged covers (to expose bare, energized parts)	3	N	N
Metal Clad Switchgear, 1 kV and above	—	—	—
CB or fused switch operation with enclosure doors closed	2	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	4	N	N
Work on energized parts, including voltage testing	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	2	Y	Y
Work on control circuits with energized parts >120 V, exposed	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	4	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Opening voltage transformer or control power transformer compartments	4	N	N
Other Equipment 1 kV and above	—	—	—
Metal clad load interrupter switches, fused or unfused	—	—	—
Switch operation, doors closed	2	N	N
Work on energized parts, including voltage testing	4	Y	Y
Removal of bolted covers (to expose bare, energized parts)	4	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	**Hazard/ Risk Category**	**V-rated Gloves**	**V-rated Tools**
Opening hinged covers (to expose bare, energized parts)	3	N	N
Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	2	N	N

Insulated cable examination, in manhole or other confined space	4	Y	N
Insulated cable examination, in open area	2	Y	N

Legend:
V-rated Gloves are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.
V-rated Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done.
2* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 3-3.9.2 of Part II.
Y = yes (required)
N = no (not required)
Notes:
1. 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
2. 65 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
3. For < 10 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.
4. 65 kA short circuit current available, 0.33 second (20 cycle) fault clearing time.
5. 65 kA short circuit current available, up to 1.0 second (60 cycle) fault clearing time.
6. For < 25 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.

Protective Clothing and Personal Protective Equipment (PPE) Matrix

Protective	**Protective Systems for Hazard/Risk Category**					
Hazard/Risk	**-1**	**0**	**1**	**2**	**3**	**4**
Untreated Natural	—	—	—	—	—	—
a. T-shirt (shortsleeve)	X			X	X	X
b. Shirt (longsleeve)		X				
c. Pants (long)	X	X	X	X	X	X
FR Clothing	—	—	—	—	—	—
a. Long-sleeve			X	X	X	X
b. Pants			X	X	X	X
c. Coverall			(Note 5)	(Note 7)	X	(Note 9)
d. Jacket, parka,			AN	AN	AN	AN
FR Protective	—	—	—	—	—	—
a. Flash suit						X
b. Flash suit						X
Head protection	—	—	—	—	—	—

Head protection	—	—	—	—	—	—
a. Hard hat			X	X	X	X
b. FR hard hat liner					X	X
Eye protection	—	—	—	—	—	—
a. Safety glasses	X	X	X	AL	AL	AL
b. Safety goggles				AL	AL	AL
Face protection double-layer switching hood				AR (Note 8)	X	X
Hearing protection (ear canal inserts)				AR (Note 8)	X	X
Leather gloves (Note 2)			AN	X	X	X
Leather work shoes			AN	X	X	X
Hazard/Risk Category Number	**-1 (Note 3)**	**0**	**1**	**2**	**3**	**4**

Legend:
AN = As needed
AL = Select one in group
AR = As required
X = Minimum required
Notes:
1. See Table 3-3.9.3. (ATPV is the Arc Thermal Performance Exposure Value for a garment in cal/cm2.)
2. If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.
3. Class -1 is only defined if determined by Notes 3 or 6 of Table 3-3.9.1 of Part II.
4. Regular weight (minimum 12 oz/yd2 fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum ATPV of 5.
5. Alternate is to use FR coveralls (minimum ATPV of 5) instead of FR shirt and FR pants.
6. If the FR pants have a minimum ATPV of 8, long pants of untreated natural fiber are not required beneath the FR pants.
7. Alternate is to use FR coveralls (minimum ATPV of 5) over untreated natural fiber pants and T-shirt.
8. A double-layer switching hood and hearing protection are required for the tasks designated 2* in Table 3-3.9.1 of Part II.
9. Alternate is to use two sets of FR coveralls (each with a minimum ATPV of 5) over untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over untreated natural fiber clothing.

Protective Clothing Characteristics

Typical Protective Clothing Systems

Hazard Risk	Clothing Description (Number of clothing layers is	Total Weight oz/yd2	Minimum Arc Thermal Performance Exposure Value

Category	given in parentheses)		(ATPV)* or Breakopen Threshold Energy (EBT)* Rating of PPE cal/cm2
0	Untreated cotton (1)	4.5 – 7	N/A
1	FR shirt and FR pants (1)	4.5 – 8	5
2	Cotton underwear plus FR shirt and FR pants (2)	9 – 12	8
3	Cotton underwear plus FR shirt and FR pants plus FR coverall (3)	16 – 20	25
4	Cotton underwear plus FR shirt and FR pants plus double layer switching coat and pants (4)	24 – 30	40

***ATPV is defined in the ASTM P S58 standard arc test method for flame resistant (FR) fabrics as the incident energy that would just cause the onset of a second-degree burn (1.2 cal/cm2). EBT is reported according to ASTM P S58 and is defined as the highest incident energy that did not cause FR fabric breakopen and did not exceed the second-degree burn criteria. EBT is reported when ATPV cannot be measured due to FR fabric breakopen.**

Hazard Risk Category 2: This protection level could be obtained with cotton underwear plus FR shirt and FR pants or FR shirt and FR pants plus single layer 4.6 - 9.8 oz. Weave in the form of coverall or lab coat.

Hazard Risk Category 3: This protection level could be obtained with cotton underwear plus FR shirt and FR pants plus FR overall, or FR shirt and FR pants plus single layer 9.8 oz. coverall or 13 oz. FR coat. Face protection would require safety glasses or goggles plus double layer switching hood.

Hazard Risk Category 4: This protection level could be obtained with cotton underwear plus FR shirt and FR pants plus either 31 cal/cm2, 50 cal/cm2 or 100 cal/cm2 double-layer switching jackets and pants plus 50 cal/cm2 or 100 cal/cm2 double layer switching hood. Safety glasses or goggles are still required.

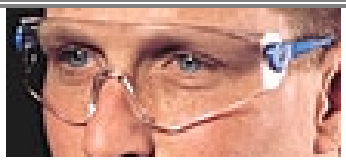
Portions reprinted from NFPA 70E Standard for Electrical Safety Requirements for Employee Workplaces - Second Edition.

2. Eye and Face Protection

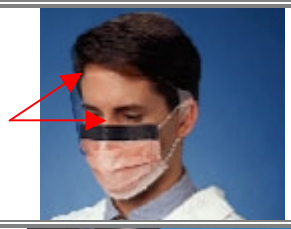
If you have any questions about the appropriate type of protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

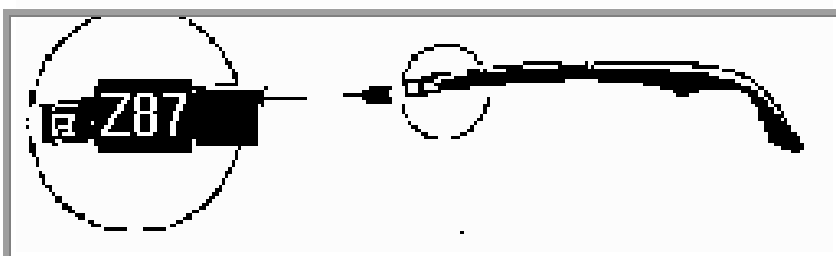
2A: Types of Eye Protective Equipment

Equipment Title	Description	Illustration
Non-safety eye glasses	Includes any glasses without impact resistance lenses and safety design features. Lenses insert into frame from the face (eye) side to minimize the thickness of the frame viewed by others or lenses attach to frame with minimal anchoring mechanisms. Because of these features to enhance the cosmetic appearance, on impact, the lens may disengage from the frame and move toward eye causing injury. The lens is less impact resistant and may fragment on impact causing eye injuries.	
Impact resistant safety glasses with side shields	Lenses insert into frame from the outside with a solid rim on the inner side of frame smaller than the lens. Design may include the lens and frame as one piece. On impact with a flying object, the lens will not disengage toward eye. The material of the lens meets impact resistant standards with built in or add-on clear side shield that guard against impact of flying objects entering from the side of the face. Marked as meeting ANSI Z87.1 standards.	
Prescription lens safety glasses with side shields	Same as above with corrective prescription lenses.	
Add-on side shields	Add-on clear side shield that guard against impact of flying objects entering from the side of the face. Marked as meeting ANSI Z87.1 standards.	
Visitor glasses	Impact Resistant Safety Glasses designed to fit over non-safety glasses. (Red frames glasses in picture are the visitor glasses). Marked as meeting ANSI Z87.1 standards.	
Vented goggles	Frame makes full contact with the face at all points. Vents in frame allow perspiration to vent reducing fogging. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards.	

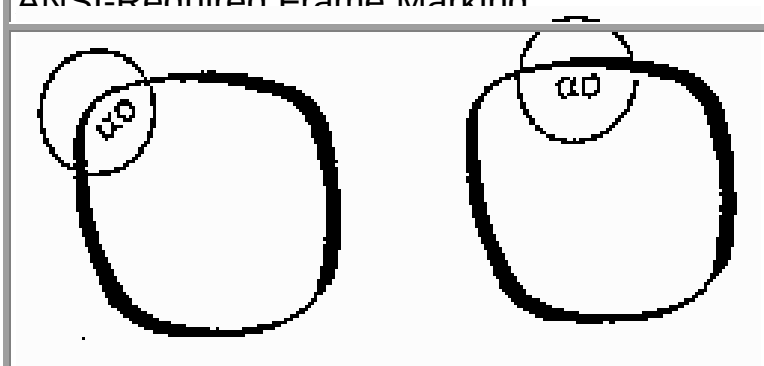
2A: Types of Eye Protective Equipment

Equipment Title	Description	Illustration
Non-vented goggles	Frame makes full contact with the face at all points. No vents in frame prevent entry of hazardous vapors, mists, fumes or aerosols. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards.	
Face shield	Face shield has impact resistant crown and window for protection from flying particles. Marked as meeting ANSI Z87.1 standards.	
Full-face respirator	Face piece makes full contact with the face at all points. No vents in facepiece prevent entry of hazardous vapors, mists, fumes or aerosols. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards. See the Respiratory Protection Subject Area. Acceptable for uses requiring safety glasses, face shield, and non-vented or vented goggles.	
Biohazard face masks	Shield provides droplet barrier for added security against bloodborne pathogens. Provides protection from biohazard splashes as well as both inhaled and exhaled microorganisms. Filters particulate matter at greater than 95% efficiency.	
Welding helmet	Provides multiple types of protection (eye and face protection). Acceptable for uses requiring safety glasses or face shield.	
Combo hard hat and face shield respirator	Provides multiple types of protection (head, respiratory, and face protection). Acceptable for uses requiring safety glasses or face shield.	
Electrical flash eye protection	Safety glasses and goggles provide lesser protection, but in low risk tasks they may be justified if the task involves substantial physical work in combination with good visual requirements. Eye protection (safety glasses or goggles) is worn under face shields or hoods.	

2B. Markings for ANSI-Compliant Eye Protection



ANSI-Required Frame Marking



ANSI-required lens marking (manufacturer's insignia)

ANSI-required side shield marking

2C. Filter Lenses for Protection Against Radiant Energy

Type of Operation	Electric Size 1/32 in.	Arc Current (Amp)	Minimum Protective Shade [a]
Shield metal arc welding	Less than 3 3 to 5 5 to 8 More than 8	Less than 60 60 to 160 160 to 250 250 to 500	7 8 10 11
Gas metal arc welding and flux-cored arc welding		Less than 60 60 to 160 160 to 250 250 to 500	7 10 10 10
Gas tungsten arc welding		Less than 50 65 to 150 150 to 500	8 8 10
Air carbon arc cutting	(light) (heavy)	Less than 500 500 to 1000	10 11
Plasma arc welding		Less than 20 20 to 100 100 to 400 400 to 800	6 8 10 11
Plasma arc cutting	Light[b] Medium [b] Heavy [b]	Less than 300 300 to 400 400 to 800	8 9 10
Torch brazing		NA	3
Torch soldering		NA	2
Carbon arc welding		NA	14

Type of Operation	Plate Thickness		Minimum Protective Shade [a]
	Inches	Mm	
Gas welding			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to ½	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen cutting			
Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 150	5

Source: OSHA 29 CFR 1910.133 Personal Protective Equipment, Eye and face protection

(a) As a rule of thumb, start with a shade that is too dark to see the weld zone. Then, go to a lighter shade that gives a sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

(b) These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

Laser Operations	See the Laser Safety Subject Area

3. Fall Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

Employees who work on elevated surfaces or scaffolding are required to utilize a method of fall protection. Fall protection may include railings, barrier markings, or personal fall-arrest systems. Employees who use personal fall-arrest systems such as body harnesses, lanyards, and hoists should be trained in the proper usage of this equipment.

- ***A fall-restraint system*** *is the equipment used to keep a worker from reaching a potential fall point. Fall restraint includes the use of perimeter cables, guardrails, floor opening covers, scaffolds or work platforms with standard guardrails, or the utilization of a safety harness and lanyard secured to an anchorage point restricting the worker from a fall hazard.*

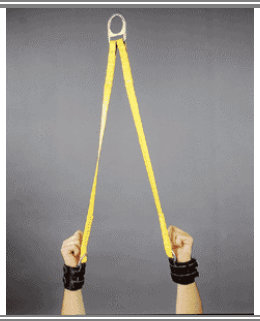
- ***A fall-arrest system*** *is the equipment used to protect a worker from falling more than six feet or from striking a lower object in the event of a fall. This equipment always includes a full-body harness.*

Before starting work above any elevation greater than 6 feet, it is recommended that a fall-protection work plan be developed. Use fall protection at any elevation greater than 6 feet.

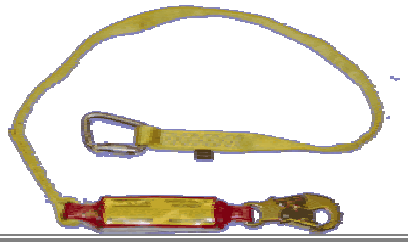
3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Harness with front D-rings	A full-body harness distributes the forces generated during a fall over at least the thighs, pelvis, chest, and shoulders. Front D-ring for ladder climbing, positioning, suspension, rescue, or restraint.	
Harness with back and side D-rings	A full-body harnesses distribute the forces generated during a fall over at least the thighs, pelvis, chest, and shoulders. The standard sliding back D-ring helps to suspend a fallen worker in an upright position after the fall. Must meet or exceed all OSHA and ANSI standards including ANSI Z359.	

3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Fall-protection coveralls	OSHA compliant full-body harness permanently incorporated into coverall. The coveralls come in a range of sizes and since the harnesses is sized to the coverall, no adjustment or adjusting hardware is needed. Inside the coverall, there are no loose straps, making donning fast and simple. A chest pocket holds the lanyard when not in use.	
Fall-protection overalls	Overall is lightweight enough to be worn in almost any climate and features the fall protection of an OSHA compliant polyester full-body harness. The overall is available in a range of sizes and requires only minimal adjustment since the harness is sized to fit the overall. Quick connect buckles at the shoulder straps makes donning fast and simple. The energy-absorbing lanyard fits in a specially designed pocket at the center of the wearer's back. A chest pocket holds the snap hook and web lanyard when not in use.	
Wristlets with yoke lanyard	Wristlets and yoke lanyard are designed for use in confined spaces or tanks with narrow openings where the worker may have to be withdrawn. Each wristlet has a permanently attached 1" wide x 6' long (3' each leg) polyester web yoke lanyard with a D-ring in the center.	
Rope grab system	Rope grab system includes lifeline, rope grab, flexible counterweight, shock absorbing lanyard and tie-off adapter.	
Self-retracting lifeline	Housing with lifeline. Swiveling anchorage loop to prevent twisting of lifeline. Swiveling self-locking snap hook with impact indicator.	

3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Tieback lanyard	Energy absorber with dual layer polyester web tieback lanyard. An integral locking snap hook for attachment to your full-body harness and a captive automatic locking carabiner is fitted at the opposite end for attaching to a suitable anchor. Designed to reduce the possibility of serious injury by reducing the arresting force on a worker to less than 900 lbs.	
Decelerator lanyard	An energy absorbing inner core made of polyester absorbs the arresting forces in the case of a fall while the nylon outer shell protects the core from damage and acts as backup.	

4. Foot Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

4A: Types of Protective Equipment

Equipment Title	Description	Illustration
Casual, open-toed footwear	No impact resistance. None to minimal protection from contact, providing little to no protection from initial brief contact with chemicals and hot objects.	
Enclosed footwear (substantial)	No impact resistance. Minimal protection from contact, providing some protection from initial brief contact with chemicals and hot objects. Worn with socks. Not for use in impact potential areas or for material handling.	
Safety shoe (impact resistant, safety toe)	Structured steel cap capable of withstanding 2500 lbs. of compression. ANSI I-75 for absorbing impact and C-75 for compression. Typically full-grain leather or vinyl uppers, durable nonmarking slip-resistant outsole. Cut, falling object, and impact protection. Worn with socks.	
Metatarsal protection	High impact and falling object protection. Provides protection for front and bridge of foot. Worn with socks.	

4A: Types of Protective Equipment

Equipment Title	Description	Illustration
Dielectric boot	Dielectric – typically 20,000-volt overshoe with adjustable side lace, pole climbing reinforcement patch, antiskid bar tread and heel. Uninsulated. Ideal for utility, power transmission, and horizontal drilling applications. Worn with socks.	
Conductive sole shoe	Resistance range typically under 10,000 ohms for compliance with the ANSI Z41-1999 CD Type 1 standard for conductive shoes.	
Conductive shoe covers	Antistatic covers for footwear.	
Shoe cover	Contaminant protection worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Disposable boot	Boot cover with elastic top, used for particulates including asbestos, lead dust and radioactive dusts. Worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Chemical resistant overboot	Offers protection for hazardous and non-hazardous materials. Seamless waterproof covers provide added layer of chemical and wear protection. Worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Chemical resistant boots with safety toe	Neoprene or other polymer boots are seamless with suction gripping tread pattern for slick floors, cushion insoles. Good against the broadest variety of animal and vegetable fats and fluids as well as the harshest of petrochemical substances. Worn with socks.	

4A: Types of Protective Equipment		
Equipment Title	Description	Illustration
Electrical flash foot protection	Heavy-duty leather work shoes normally provide a significant degree of protection to the feet.	

5. Hand Protection

If you have any questions about the appropriate type of hand protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

5A: Types of Protective Equipment

Equipment Title	Description	Illustration
Splash glove	Disposable, nitrile or natural rubber, ambidextrous gloves are resistant to a broad range of chemicals for brief periods. BNL policy is to dispose of immediately on contact with liquid unless manufacturer rates for sustained contact.	
Sustained contact and immersion glove	Superior chemical and abrasion resistance. For harsh cleaners and solvents, embossed grip, typically flocked or fabric lined, usually 10 to 20-mil thick. Material of construction must be impervious to the challenge chemical. See Table 5C.	
Cryogen glove	Asbestos-free and water-resistant, gloves protect against injury from both cryogenic and hot materials from -160° to 150°C (-260° to 300°F). Abrasion- and cut-resistant gloves let you confidently handle rough and sharp objects. Machine washable/dryable. Not for immersion in liquid nitrogen. Lighter in weight and more durable than comparable gloves.	

5A: Types of Protective Equipment

Equipment Title	Description	Illustration
Thermal burn-protection glove	Woven fiberglass gloves withstand very low to very high (-70° to 600°C). Gloves are soft, flexible, and water resistant. Wool lining enhances user comfort. Aluminized gloves for extra heat reflectivity and molten-splash resistance. Ultra-high temperature Zetex® gloves offer the ultimate protection from intense, concentrated heat. Can also be used for cryogen liquid handling.	
Abrasion resistance (a.k.a. work glove)	Typically a split leather palm, leather index finger and thumb and a leather knuckle strap. Cotton safety cuff.	
Cut-resistant glove	Heavyweight Kevlar-blend knitted gloves offer greater cut resistance than regular knit gloves	
Electrical flash hand protection	Gloves made from layers of flame resistant material provide the highest level of hand protection. Heavy-duty leather gloves also provide good protection. Where voltage-rated gloves are used, leather protectors should be worn over the rubber gloves. The leather protectors also provide good arc-flash protection for the hands.	

5B. Gloves and Suit Selection Process

The table below provides guidance in the selection of Chemical Protective Equipment for:

- SHSD IH Group
- RCD Facility Support Group
- ESH Coordinators and ESH professional in BNL organizations
- Scientists, Principal Investigators, and Workers (with competency in this area)

Steps in selecting an appropriate glove or suit

1	Choose PPE only after alternative controls have been explored: • Substitute a less hazardous chemical (if practical) • Use hoods, glove boxes, capture ventilation to control vapors, mists, liquids
2.	Evaluate the job and type of exposure: a. Chemical(s) involved (example: benzene) b. Duration of exposure (example: 20 minutes in constant contact with liquid) • How long will contact be in routine use and emergencies? Will the contact be immersion for long periods, splash, or incidental contact? • Chemical(s) attack on the glove (breakthrough time, permeation rate, degradation) must be shorter than the breakthrough time. Be sure to include cumulative time on re-used gloves. Refer to a Chemical-Resistant Table from the manufacturer or Table 5C for chemical-resistance ratings. • **Breakthrough Time:** The elapsed time between initial contact of the chemical on the glove surface and the analytical detection on the inside of the glove. When expressed with a greater than symbol (>), the test was run for “n” minutes and then stopped. • **Degradation:** A change in one or more of the physical properties of a glove due to contact with a chemical. Can appear as a swelling, softening, shrinkage or cracking of the material. A rating of "E" for excellent, means the glove has little or no signs of degradation when exposed to the challenge chemical. **A favorable degradation rating does not guarantee an acceptable breakthrough time.** • **Permeation Rate:** The rate at which a chemical passes through a glove material. This process involves absorption on the glove surface, the diffusion of the chemical through the material, and the desorption on the glove's inside surface. This measurement is given is $\mu g/cm^2$/minute, but is sometimes expressed as "E" to "P" for excellent to poor.

3	Evaluate the material handling aspects of the job: The nature of the job being performed will greatly influence the selection and features of protective clothing. For example, analyzing samples in a laboratory may require light-duty gloves (<10 mils in thickness) that are flexible and have good manual dexterity; while a maintenance project, such as repairing a pump line, may require thicker gloves that are rugged and durable. **Glove Dexterity** - Will a bulky glove cause drops, accidents, or slips? Are small intricate parts handled? **Select the appropriate glove thickness** (example: single-use disposable gloves vs. reusable gloves) • Select a thinner, unsupported glove when you require extra dexterity and tactile sensitivity. When a high degree of manual dexterity is needed with a hazardous substance, use of thin glove with limited protection time may be acceptable *if the gloves are changed with sufficient frequency.* • Select a heavier-gauge, unsupported glove for greater protection and wear. Consider a flock-lined, unsupported glove for extra comfort, insulation, and wear. **Choose the finish** you need for the grip for your application: rough, smooth, wrinkle, embossed, bisque, etc.
4.	Evaluate the physical conditions the gloves will be subjected to and determine which types of resistance are important: abrasion, cut, puncture, temperature, etc. Physical conditions can influence chemical resistance. When possible, choose a supported or cut-and-sewn glove for added cut, snag, puncture, or abrasion resistance.
5	Size the glove: • Select glove length by determining the depth to which your hand and arm will be immersed in a solution and the extent to which you need splash protection. • Select the hand size that gives you the right fit, dexterity and comfort. To determine your size, measure the circumference around the palm area. This is your glove size. For example, 7" is equal to a size 7 glove. (XS = 6-7, S = 7-8, M = 8-9, L = 9-10, XL = 10-11)
6	Factor in the following • Cost of the glove (example: Viton is very expensive). Does a cheaper glove have adequate properties? • Reuse of the glove (example: Can many cheaper disposable gloves be used in place of a more expensive reusable glove? • Storage and decontamination: Storing an exposed glove between uses can shorten the life of protection). Use of disposable gloves and clothing is often preferred, because proper decontamination of reusable items is often difficult.
7.	Document the selection via • Exhibit: PPE Selection Form; • SOP; • Work planning documentation; • Other Department/Division-developed mechanism.

5C. Polymer Selection Tables

The BNL Safety & Health Services Industrial Hygiene web page provides links to several manufacturer's web sites that provide polymer selection and ordering information.

The following table provides guidance for selecting the appropriate glove to be worn in situations involving chemical hazards. This table is not intended to be all-inclusive. If you have any questions about the appropriate type of glove required for your work activity, contact your immediate manager, Facility Support Representative, or the Personal Protective Equipment SME.

(Next page is landscape format)

Recommended Glove Material for common BNL laboratory chemicals

Chemical Name	**Splash Protection** (disposable, exam style)			**Immersion & Sustained Contact**						
				Disposable Nitrile (N-Dex) (unflocked and unsupported)						**Reusable** (typically flocked or fabric support)
				DEGRADATION (MIN)				PERMEATION (MIN)		
	Nitrile (N-Dex, Purple Knight)	Natural Rubber (Latex Exam)	PVC	5	30	60	240	Break-thru time	Rate	
Acetonitrile	**p**	NR	NR	P	P	P	P	4		E= Butyl, Teflon, 4H
Acetic anhydride	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= butyl, Teflon, 4H
ACIDS, dilute	E	F	F	E	E	E	E			Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Hydrochloric Acid 37%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Phosphoric Acid 85%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Viton, 4H
Nitric Acid 30-70%	G	NR	F	G	P	NR	NR	NR	NR	E= Butyl, Neoprene, Viton, 4H
Nitric Red Fuming	NR	NR	NR							E= Teflon
Sulfuric Acid 97%	G	NR	F	G	P	NR	NR	NR	NR	E= Butyl, Teflon, 4H, Viton
Acetic Acid 84%	E	F 1-4 HR	F 1-4 HR	E	P	P	NR	NR	NR	E= Butyl, Neoprene, Viton, 4H
ALKALI, dilute	G	F	F	F	F	F	F			Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ammonium Hydroxide 30-70%	G	NR	P							E= Butyl, Neoprene, Nitrile, Teflon
Potassium Hydroxide (KOH) 45%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Sodium Hydorxide (NaOH) 50%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
ALCOHOLS	G	F	G							Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ethanol	E	NR	NR	E	E	E	G	7	12	E= Butyl, Neoprene, Viton, 4H; F= Nitrile
Iso-propanol (2-propanol)	E	NR	F	E	E	E	E	15	29	E= Butyl, Neoprene, Nitrile, Teflon, Viton, 4H
Methanol	E	NR	NR	E	G	G	F	NR	NR	E = Butyl, Neoprene, Nitrile, Teflon, Viton, 4H
n-Propanol	G	NR	F	G	F	P	P	7	42	E = Butyl, Teflon, Viton, 4H
ALDEHYDES										
Acetaldehyde	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, 4H, Teflon
Benzaldehyde	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, PVA, Viton, 4H
Formaldehyde	E	NR	F	E	E	E	E	ND	ND	E= Butyl, Nitrile, Viton, 4H
Ammonia	NR	NT	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Nitrile, Teflon, Viton
AROMATICS	F	NR	NR	NR	NR	NR	NR	NR	NR	PVA, Viton, 4H
Benzene	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
Toluene	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
Xylene	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
CHLORINATED HYDROCARBONS	P	NR	NR	NR	NR	NR	NR	NR	NR	Butyl, Nitrile, PVA, Teflon, Viton, 4H
Carbon tetrachloride	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Viton, 4H
Chloroform	P	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Viton, 4H, Teflon
Methylene Chloride (dichloromethane)	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, 4H
Trichloroethane, 1,1,1-	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, PVA, Viton, 4H

Chemical Name	Splash Protection (disposable, exam style)			Immersion & Sustained Contact						
				Disposable Nitrile (N-Dex) (unflocked and unsupported)						Reusable (typically flocked or fabric support)
				DEGRADATION (MIN)				PERMEATION (MIN)		
	Nitrile (N-Dex, Purple Knight)	Natural Rubber (Latex Exam)	PVC	5	30	60	240	Break-thru time	Rate	
Trichloroethylene	F	NR	NR	NR	NR	NR	NR	NR	NR	E = PVA, Viton, 4H
DMF	P	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Teflon, 4H
DMSO	E	NR	NR	E	G	F	P	23	84	E= Butyl, Neoprene, Teflon, 4H
EPOXY RESINS	G	P	F							Butyl, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ethyl ether	G	NR	NR	G	G	G	G	2	495	E= PVA, 4H, Teflon
ESTERS	P	NR	NR	NR	NR	NR	NR			Butyl
Ethyl Acetate	P	NR	NR	NT	NT	NT	NT	NT	NT	E= PVA, Teflon, 4H; F= Butyl
Hydrazine	NT	F	G							E= Butyl, Neoprene, Nitrile, PVC
HYDROCARBONS/ PETROLEUM DISTILLATES	G	F	F							E= Butyl, Neoprene, Nitrile, PVC, PVA, Teflon, Viton, 4H
Hexane	E	NR	NR	E	E	E	E	11	8	E= Nitrile, PVA, Teflon, Viton, 4H
Hydrogen Peroxide 30-70%	G	G	G							Butyl, Nitrile, PVa, Viton, 4H
KETONES										Butyl, 4H
Acetone	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Teflon, 4H
Methyl Ethyl ketone	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Viton, 4H
Mercury	G	G	G	NT	NT	NT	NT	NT	NT	E = 4H **Note:** most gloves afford good protection
OILS, GREASE	E	E	E							E= Butyl, Neoprene, Nitrile, PVC, PVA, Teflon, Viton, 4H
PCBs	F	NR	NR							E = Viton
Tetrahydrofuran	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Teflon, 4H

NR= not recommended **ND**= none detectable (permeation) **NT** = not tested **NA** = not applicable	**E**= excellent **G** = good **F** = fair **P** =poor	Butyl = butylenes/isoprene copolymer 4H = Silvershield = (polyethylene/ethylene vinyl alcohol copolymer) Natural rubber = isoprene from *gutta percha* Neoprene = DuPont trademark for chloroprene	PVA= tradename of Ansell for polyvinyl alcohol PVC= polyvinyl chloride Teflon = DuPont trademark for polytetrafluoroethylene (PFTE) Viton = DuPont trademark for hexafluoropropylene/vinylidene fluoride copolymer

Source: Best Glove 4/98 Degradation/Permeation Table: Forsberg, Krister, & Mansdorf, S. Z. (1997). *Quick Selection Guide to Chemical Protective Clothing* (3rd ed.). New York: Van Nostrand Reinhold.

5D. BNL Guidance on "Splash Protection & Incidental Contact" for laboratory and fine detail work

Background: When selecting chemical protective gloves, a choice must be made regarding thickness and length. Thicker gloves have better chemical resistance than thinner gloves. However, thinner gloves offer better touch sensitivity and flexibility.

Glove thickness is stated in either mils or gauge. A 10-gauge glove equals 10 mils, or 0.010 inches. When choosing your glove, look for the stated thickness on the manufacturer's test data

Thin gloves sacrifice chemical resistance. Generally, doubling the thickness of a glove quadruples the breakthrough time of the chemical (more protective). Because surgical gloves are so thin, the material is easily stretched over the hand, allowing better sensitivity. But this stretching also leaves larger spaces in the glove material polymer. These larger spaces allow many chemicals to permeate through quickly, limiting the amount of time the glove can be worn. Some surgical gloves offer limited splash protection from some chemicals. But almost always, these gloves are not intended for complete immersion in chemicals, and should only be used for a very limited time period. Check the glove manufacturer's recommendations in regards to usage with your chemical.

BNL GUIDANCE

This BNL Guidance is applicable for gloves used in "fine detail" laboratory work for SPLASH PROTECTION & INCIDENTAL CONTACT (i.e., procedures where no contact or very little actual contact with a chemical in use is anticipated). It is NOT applicable where immersion is a factor.

1. Select the best disposable glove polymer - Nitrile, PVC, or natural rubber (Latex). When test data is not available, Nitrile is almost always the best choice.

2. If the glove has a "recommended" rating by the manufacturer (fair/good/excellent) for use with the chemical, use the glove within the guidelines provided by the manufacturer.

3. If breakthrough time (BT) is known, whenever the chemical is contacted always remove the glove sooner than the BT.

4. If BT is not known or the glove does not have a manufacturer's approval, wear the disposable glove with strong adherence to this policy:

"REMOVE THE GLOVE **INSTANTLY** WHEN CONTACTED BY A SPLASH or with RESIDUES of the chemical."

6. Head Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments.*

6A: Types of Protective Equipment

Equipment Title	Description	Illustration
Bump cap	Bump cap is extremely light in weight and features a replaceable suspension and sweatband. Popular where the possibility of a head bump or laceration is possible. Ideal for those working in areas with low head clearance. Four-point easily adjustable plastic suspension with perforated vinyl sweatband.	
Hard hat	A safety cap adjusts from head with 4 to 6-point nylon web suspension system. Hearing, welding, and face shield accessories should be able to be snapped into universal slots. Must meet or exceed OSHA and ANSI Z89.1 standards.	
Helmet respirator	Combination of PAPR respirator built into a safety cap adjusts from head with 4 to 6-point suspension system. Must meet or exceed OSHA and ANSI Z89.1 standards.	

7. Hearing Protection

If you have any questions about the appropriate type of hearing protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

Two main types of hearing protection devices are used to protect workers' hearing from noise in the workplace:

1) **earplugs** that are inserted into the ear canal; and

2) **earmuffs** that are worn over the head to cover the outer ear.

The ability of the hearing protection devices to attenuate (reduce) noise is expressed as a *Noise Reduction Rating (NRR).* The higher the NRR, the more protection the device provides.

The NRR is a theoretical value. OSHA recommends adjusting the NRR to account for variability in the fitting of the devices to the individual. The formula for calculation of the adjusted NRR is:

$$\frac{(NRR_{(EPA)} - 7dB)}{2} = NRR_{(BNL)}$$

Example:

NRR on box of earmuffs is 29 dB

$$\frac{(29dB - 7dB)}{2} = \frac{22}{2} = \mathbf{11\ NRR_{(BNL)}}$$

Example: If a noise area is 93 dBA
Then: 93 dBA **– 11 dBA NRR** = 82 dBA

7A: Types of Protective Equipment

Equipment Title	Description	Illustration
Earplugs	Soft, smooth foam is molded for maximum comfort, Tapered design with rounded tip aids insertion, typically NRR to about 29dB (field use NRR = 11 dB). Fit into and seal the ear canal; generally treated as "disposable" after each use.	
Banded plugs	High visibility headband for easy compliance checks, typically to NRR 22dB (field use NRR = 8 dB).	
Earmuffs	Soft ear cushions improve comfort, typically Dielectric design for use around electrical hazards, Noise Reduction Rating typically range for NRR 20 to 30 (field use NRR = 7 to 12 dB), tested in accordance with ANSI S3.19. Use when frequent removal and replacement of hearing protection is necessary.	
Noise cancellation muffs	Headphones that use a small microphone mounted in each earpiece to monitor the outside noise getting to the ear. A special electronic circuit then creates a signal perfectly opposite to the outside noise so as to cancel it out before it reaches the ear. Typically they are only able to reduce noise by about 10 dB over a limited frequency range. They cancel low frequencies best and typically do not cancel high frequencies effectively.	

8. Respiratory Protection

See the Respiratory Protection Subject Area for program requirements and required procedures.

For selection of Respiratory Protective Equipment, issuance of equipment, and cleaning and maintenance, contact the RCD Facility Support Representative. (((Link)))

8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
Disposable dust masks (filtering facepiece)	The filtering media forms the facepiece to face seal. Used for non-hazardous dusts or worker convenience and comfort. Note: Not permitted for use at BNL in any situation in which a respirator is needed unless written consent is granted by the BNL Respiratory Protection Program Administrator (see the Point of Contact in the Respiratory Protection Subject Area).	
Minimal use dust filtering mask	Used for non-hazardous dusts or worker convenience and comfort. Polymer sealing surface fits user face. Note: Use is limited to operations with written consent is granted by the BNL Respiratory Protection Program Administrator (see the Point of Contact in the Respiratory Protection Subject Area).	
APR half-face	Air Purifying Respirator (APR) - Minimum level of protection at BNL for hazardous situations. Relies on cartridge media to clean the air that will be breathed.	

8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
APR - full face	Air Purifying Respirator (APR) - Moderate level of protection at BNL for hazardous situations. Relies on cartridge media to clean the air that will be breathed.	
PAPR - full face	Powered Air Purifying Respirator (PAPR) - higher level of protection than APR. Relies on cartridge media to clean the air that will be breathed. Air is pressurized by a blower into the mask. Selection of accompanying cartridge is made only by BNL Authorized Issuer.	
Welding helmet	Combines air purification with eye protection from the shaded lenses.	
Military mask	This mask is only for use by the Safeguards and Security Division at BNL.	
Gas mask	APR with high volume canister instead of a cartridge(s).	
PAPR helmet	Provides the minimum level of protection, only for particulates. Does not require a fit test.	
Supplied air hood	Provides clean air from a compressed air source--either a bottle of Grade D breathing air or a compressor tested to provide Grade D breathing air. Does not require a fit test.	

8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
Supplied air- full face	Provides clean air from a compressed air source--either a bottle of Grade D breathing air or a compressor tested to provide Grade D breathing air.	
SCBA	Provides clean air from a compressed air bottle worn by the user. Permitted for use at BNL in situations in which an emergency device is needed. Use is limited to Emergency Services Division Fire Rescue Personnel and other allied organization in emergency response.	
Escape-bottled air pack	Provides a minimal amount of clean air from a compressed air bottle worn by the user. Used for escape only. Can be used for escape from oxygen-deficient areas.	