

Hand Protection for Handling Liquid Pyrophorics Frequently Asked Questions

Background: To resolve a series of Cal/OSHA citations, UC Berkeley entered into a settlement agreement (“FR Glove Settlement”) that requires employees working with liquid pyrophorics outside of an inert atmosphere glove box environment to wear chemically resistant outer gloves on top of flame resistant (FR) inner liners. It is Cal/OSHA’s position that the use of FR gloves or liners in this context is legally required by its Personal Protective Equipment (PPE) and hand protection regulations and the same standard of protection would likely be required by Cal/OSHA at all UC campuses.

What minimum hand protection standards did Cal/OSHA impose as part of the FR Glove Settlement?

For work with liquid pyrophoric chemicals outside of an inert atmosphere glove box, appropriate hand protection must include chemically resistant outer gloves on top of approved flame resistant inner gloves or glove liners. This requirement must also be reflected in the relevant Standard Operating Procedures.

Do the minimum hand protection standards outlined in the FR Glove Settlement apply to my campus?

Yes, Cal/OSHA’s position is that this level of hand protection is legally required. Title 8 CCR Section 3380 (PPE) and Section 3384 (Hand Protection) require appropriate hand protection based on the recognized hazards. Given the broad discretion Cal/OSHA has in interpreting and enforcing these performance standards, it is likely that a required combination of chemically resistant outer gloves and FR inner gloves / liners for such work with pyrophorics would survive a legal challenge.

Is Cal/OSHA’s position on adequate hand protection supported by any national consensus standards?

Yes, Cal/OSHA’s position is supported by the 2015 Edition of the NFPA 45 *Standard on Fire Protection for Laboratories Using Chemicals*. NFPA 45 was updated in 2015 to add requirements for the handling of pyrophoric reagents. In particular, the new Section 6.6.3 and Annex Section A.6.6.3 provide that FR gloves shall be worn whenever possible where pyrophorics “are used outside the inert atmosphere of a glove box” and “in conjunction with appropriate chemically resistant gloves.”

Safety Data Sheets (SDSs) for pyrophoric materials are also increasingly recommending the use of gloves protective against thermal risks.

Why is a combination of both chemically resistant outer gloves and FR inner gloves required?

As outlined in NFPA 45, this is the most appropriate and comprehensive hand protection for use of liquid pyrophoric chemicals outside of a glove box. The chemical resistant outer gloves protect the inner gloves from absorbing the liquid chemical and protect the researcher’s hands from chemical burns and other hazards. The FR gloves provide the researcher protection from thermal burns should the pyrophoric material ignite during the work activity and degrade or burn up the outer chemically resistant gloves.

Are all FR gloves acceptable to Cal/OSHA for this type of work?

No. Cal/OSHA has identified FR gloves by material type and testing criteria that are acceptable. This provided UC with an ability to identify acceptable gloves in the near term by material type and thickness while giving us the flexibility to perform testing on other types of gloves in the future. The ultimate goal will be to have several varieties of gloves available for researchers that are acceptable to Cal/OSHA.

What specific types of FR gloves are currently acceptable by Cal/OSHA?

- Ansell Kevlar® Goldknit® Lightweight 70-200,
- Hanz Extremity Wear Nomex® Utility 2257C and 2259C,
- Other Kevlar® gloves with the fabric basis weight of a minimum of 7.7 ounces per square yard and if one layer of the material has a minimum of 35 mils in thickness (these are effectively the specifications for the Ansell Kevlar® Goldknit® Lightweight 70-200 gloves), and
- Other Nomex® gloves meeting the specifications for Hanz Extremity Wear Nomex® Utility 2257G and 2259C.
- Gloves or glove liners meeting MIL-DTL-81188C

Is there a mechanism for other FR gloves to be tested and approved?

Gloves made of other inherently FR materials (like Kevlar®, Nomex®, Kermel®, PBI®, or a blend of those materials) may be acceptable to Cal/OSHA if they meet a series of testing requirements specified under the FR glove settlement. Specific testing protocols and test data must be approved by Cal/OSHA and be conducted by an approved, independent tester. Gloves merely treated to be FR will not be acceptable to Cal/OSHA. FR gloves that are currently accepted by Cal/OSHA must be used until alternative FR gloves are approved. Please consult with your local EH&S Office to discuss the alternative FR glove approval process.

What type of FR gloves should campuses use in the near term?

To assist campuses that are transitioning to the use of FR gloves and to provide researchers an option for Cal/OSHA-approved FR gloves, UCOP has ordered and distributed Ansell 70-200 Kevlar gloves to the Campus EH&S Offices. The Ansell 70-200 gloves have been deemed acceptable by Cal/OSHA for this research activity, are relatively thin, and provide a cost effective, near term solution for our needs. If the gloves are in good condition and not contaminated, they can be re-used to support these specific research needs for multiple experiments. Contact your local Campus EH&S Office to receive the Ansell 70-200 gloves.

Researchers using other types of Cal/OSHA-approved FR gloves per the Settlement (Hanz Extremity Wear Nomex® Utility 2257C and 2259C or gloves or glove liners meeting MIL-DTL-81188C) may continue to do so.

What if our campus is already using a glove that's stated as FR, fire resistant or fire rated? Is that glove acceptable for use by Cal/OSHA?

Maybe, but more research and testing would likely be required to verify this fact unless the glove is specifically listed in the FR Glove Settlement. Many gloves and materials are currently marketed as FR and the "FR" may stand for fire resistant, fire rated, fire retardant, etc. These terms are not necessarily well defined and used in various ways by different manufacturers. Some FR gloves are not made of inherently flame resistant materials (Kevlar®, Nomex®, etc.), but instead are a different synthetic material treated with some type of flame retardant. Such gloves would not be acceptable to Cal/OSHA.

The most prudent path forward in the near term is to use the Ansell 70-200 gloves provided by UCOP or purchase gloves specifically listed in the FR Glove Settlement. As we continue to address the hand protection needs of researchers working with liquid pyrophorics, we can have other gloves evaluated and tested in the future in accordance with the FR Glove Settlement.

Did Cal/OSHA identify the types of chemically resistant outer gloves that are acceptable?

No. However, flame testing of both nitrile and neoprene gloves indicates neoprene may be a better choice for this particular research activity. When tested, neoprene demonstrates a better propensity to self-extinguish once removed from a flame source. UCOP is purchasing and providing campuses with an initial order of neoprene outer gloves to be worn over the FR liners for this particular research activity.

Are comfort and dexterity significantly impacted by using FR liners with chemically resistant outer gloves?

Our most direct experience with this issue is at UCB where this glove combination is currently in use by researchers in Chemistry and other units that work with liquid pyrophoric chemicals. Feedback from these researchers generally has been positive and there have not been significant concerns raised about dexterity and comfort.

What other steps do the campuses need to do as part of this change in hand protection for pyrophoric research?

All relevant SOPs must be updated to accurately reflect the hand protection requirements for use of liquid pyrophoric chemicals outside an inert atmosphere glove box. The SOPs should state the appropriate chemical resistant outer gloves and fire resistant inner gloves / liners and laboratories must have these gloves available and use them for this specific research activity. These requirements may not be superseded by reference to a Safety Data Sheet.

As part of the glove distribution process, researchers must be provided training on the revised SOP, including how to properly put on (don), take off (doff) and care for the gloves. This training could be part of a larger group training, a lab group meeting or campuses could “train the trainer” by using existing lab safety representative / department safety coordinator models. The training must be documented and maintained with the laboratory safety training records.