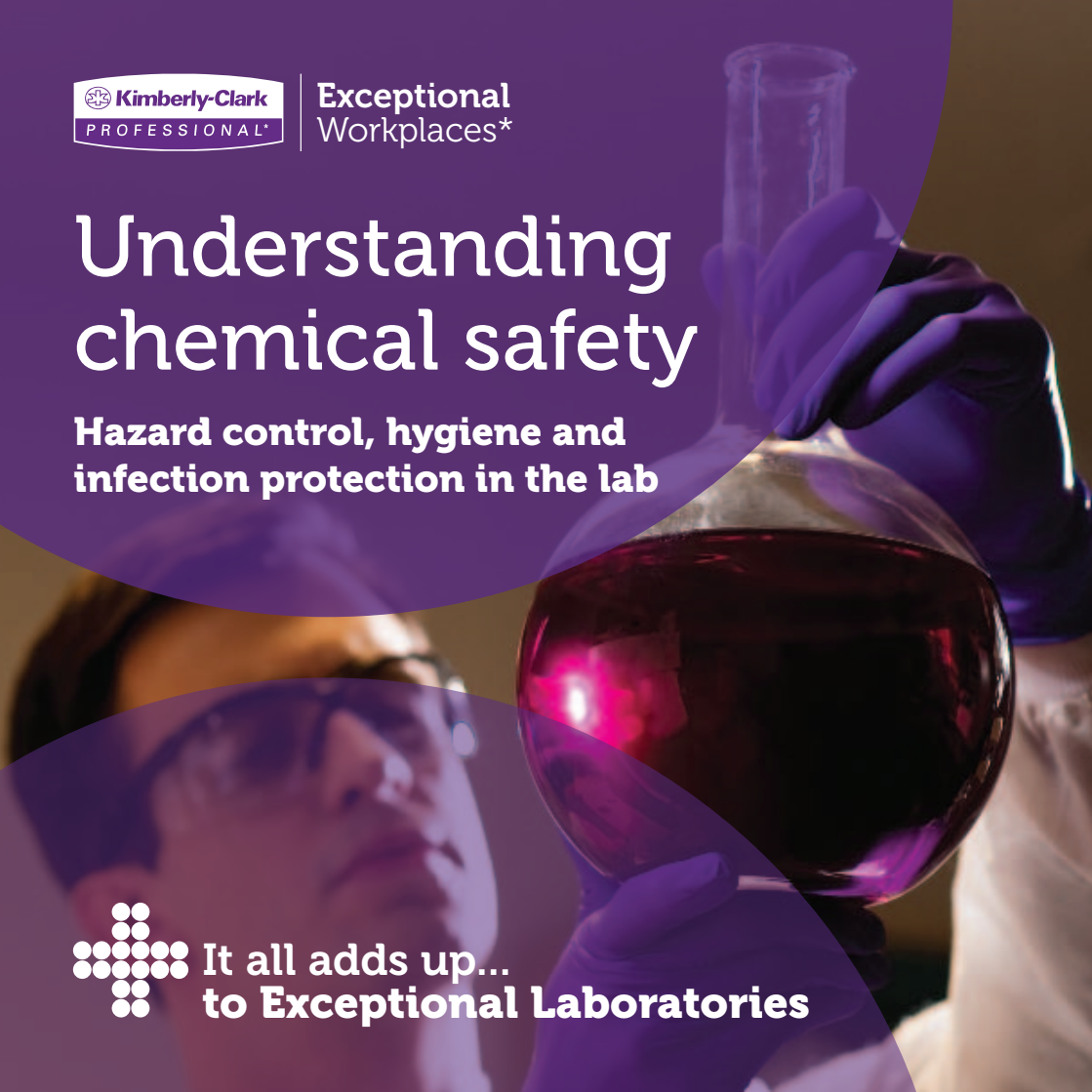
Kimberly-Clark PROFESSIONAL®

Exceptional Workplaces*

Understanding chemical safety

Hazard control, hygiene and infection protection in the lab



It all adds up...
to Exceptional Laboratories

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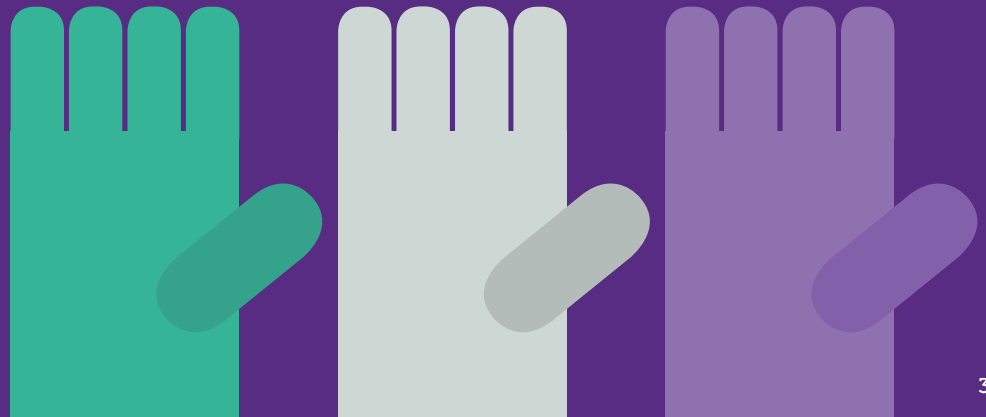
Ensure your personal safety

Understand how to stay safe while handling hazardous chemicals.

Know the risks, ensure the correct controls are in place and select the appropriate personal protective equipment (PPE) to keep you safe, healthy and protected in your laboratory.



What are chemical hazards?

A **chemical hazard** is any substance that can cause harm, primarily to people.

Chemicals can be broken down into hazard classes and exhibit both physical and health hazards.

According to the European harmonised classification system hazardous chemicals can be classified into the following types:

- Flammable
- Corrosive
- Reactive
- Toxics (poisons, carcinogens, mutagens, teratogens, etc.)
- Oxidizers

Factors affecting severity of the response to a chemical include:

- Concentration
- Physical state (solid, liquid, gas.)
- Physical processes involved in use (cutting, grinding, heating, cooling, etc.)
- Chemical processes involved in use (mixing with other chemicals, purification, distillation, etc.)
- Other processes (improper storage, addition of moisture, storage in sunlight, refrigeration, etc.)

Chemical classification

The Organisation for Economic Co-operation and Development (OECD) aims to harmonise the international classification of hazardous chemicals.

Classification divides chemical substances and mixtures into different categories, based on their physical properties and health and environmental hazards. Chemicals are then labelled according to category requirements.

Acute toxicity (Cat 1-3)

- Category 1: substances known to impair human fertility or cause developmental toxicity (i.e. harm the unborn child.)
- Category 2: substances, which should be regarded as if they impair human fertility or cause developmental toxicity
- Category 3: substances which cause concern for human fertility or which cause concern for humans owing to possible developmental toxicity effects.

Acute toxicity (Cat 4)

- Skin and eye irritation. Skin sensitisation, specific target organ toxicity. Respiratory tract irritation. Narcotic effects.

Carcinogenic, Mutagenic, Sensitising and Toxic for reproduction

Respiratory sensitisation, germ cell mutagenicity, carcinogenicity and reproductive toxicity.

Flammable

Flammable gases, aerosols, liquids or solids. Self reactive substances and mixtures. Pyrophoric liquids and solids. Self-heating substances and mixtures. Substances and mixtures, which in contact with water emit flammable gases. Organic peroxides.

Corrosive

Corrosive to metals. Skin corrosion and severe eye damage.

Oxidising

Oxidising gases, liquids and solids.

Explosive

Explosives. Self-reactive substances and mixtures, types A, B. Organic peroxides, types A, B

eChemPortal

In 2004, the OECD initiated the development of eChemPortal, a global portal to information on chemical substances.

eChemPortal is hosted by the European Chemicals Agency (ECHA) and is the preferred worldwide source of information about chemicals and a contribution to the Strategic Approach to International Chemicals Management (SAICM).

The latest version of eChemPortal (http://www.echemportal.org/echemportal/) was made available in December 2010.

This version allows users to search by:

- Chemical identity
- Physical chemical properties
- Ecotoxicity
- Environmental fate and behaviour
- Toxicity

Classifications according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)[1] for the same chemical can differ across countries/regions.

Diverging classifications can be a result of differences in:

- Underlying datasets
- Interpretation of the underlying data
- Application of the classification criteria
- Substance form/analogous substances

For national variation see the information made available by each individual data provider.[2]

1: http://www.unece.org/index.php?id=24056&L=0

2: http://www.oecd.org/chemicalsafety/risk-assessment/publicavailabilityofnationalregionalghsclassifications.htm

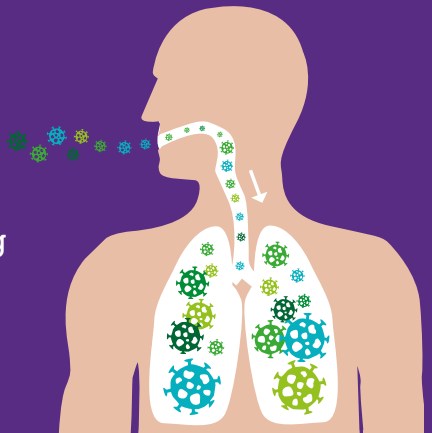
Exposure potential

There are two ways in which you might be exposed to chemicals at work:

1. Chemical laboratory work
2. Incidental exposure to chemicals e.g. cleaning products, solvents, toxic by-products

Chemical exposures may occur through a variety of ways:

- Direct skin contact
- Vapours and Aerosols
- Dust
- Heat-generating processes
- Fire
- Poisoning from accidental swallowing



Assessing chemical risk

Chemical risk is the likelihood that a chemical will cause injury in a given environment or situation.

Chemical health risk is dependent upon the toxicity of the chemical, the types of health effects and the various routes of entry.

Safety Data Sheet (SDS)

Hazardous substances must be sold with a safety data sheet outlining each substance and mixture of hazardous substances. An SDS outlines a substance's physical and chemical hazards that include but are not limited to:

- Identity information
- Hazardous ingredients
- Physical/chemical characteristics
- Fire and explosion hazard data
- Reactivity data
- Health hazard data
- Precautions for safe handling & use
- Control measures

Chemical toxicity

Chemical toxicity is the ability of a chemical to act as a poison or cause injury to tissues.

The degree of hazard depends on how toxic the substance is, how it is absorbed.

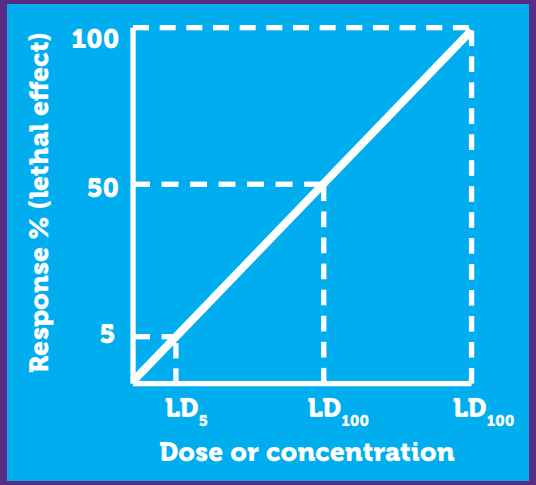
Health effects

- Acute/Chronic exposure
  - o acute exposure – long duration/low concentration
  - o chronic exposure – short duration/high concentration
- Local/Systemic effects
  - o local effects - localised on a specific area of the body such as nose or throat
  - o systemic effects - entire body system and organs are all affected by exposure to the chemical

Dose-response relationship

Toxicological studies show that there is a relationship between the chemical dose and the response produced in the body.

This dose-response relationship can be plotted out.



Target organ effects

There are also chemically caused effects from exposure to a material on a specific listed organ or system such as liver, kidneys, nervous system, lungs, skin, and eyes.

Routes of entry

There are various routes of entry whereby chemicals can gain entrance into the physical body:

- Inhalation
- Skin absorption
- Ingestion
- Injection

Chemical hazard control measures

For basic controls please refer to the 'Understanding laboratory risk management' miniguide.

Engineering controls

- Substitution of a less toxic material
- Change in process to minimise contact with hazardous chemicals
- Isolation or enclosure of a process or operation
- Use of wet methods to reduce generation of dusts or other particulates
- Airflow control
  - dilution ventilation
  - chemical fume hoods
- Contamination control:
  - appropriate PPE
  - surface disinfection
  - autoclave
- Safety equipment:
  - eyewash
  - safety shower
  - fire blankets/extinguishers

Reportable chemical incidents are those that:

- Result in significant morbidity or mortality
- Result in severe burns
- Cause loss of consciousness
- Cause an accidental leakage of gas
- Require control measures that have an impact on other employees

Special chemical safety considerations

- Chemical hygiene plan (CHP)
- Good laboratory practice (GLP*)
- Spill prevention & response plan
- Respiratory protection

*http://ec.europa.eu/enterprise/sectors/chemicals/documents/specific-chemicals/laboratory-practice/index_en.htm

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Working with chemical hazards

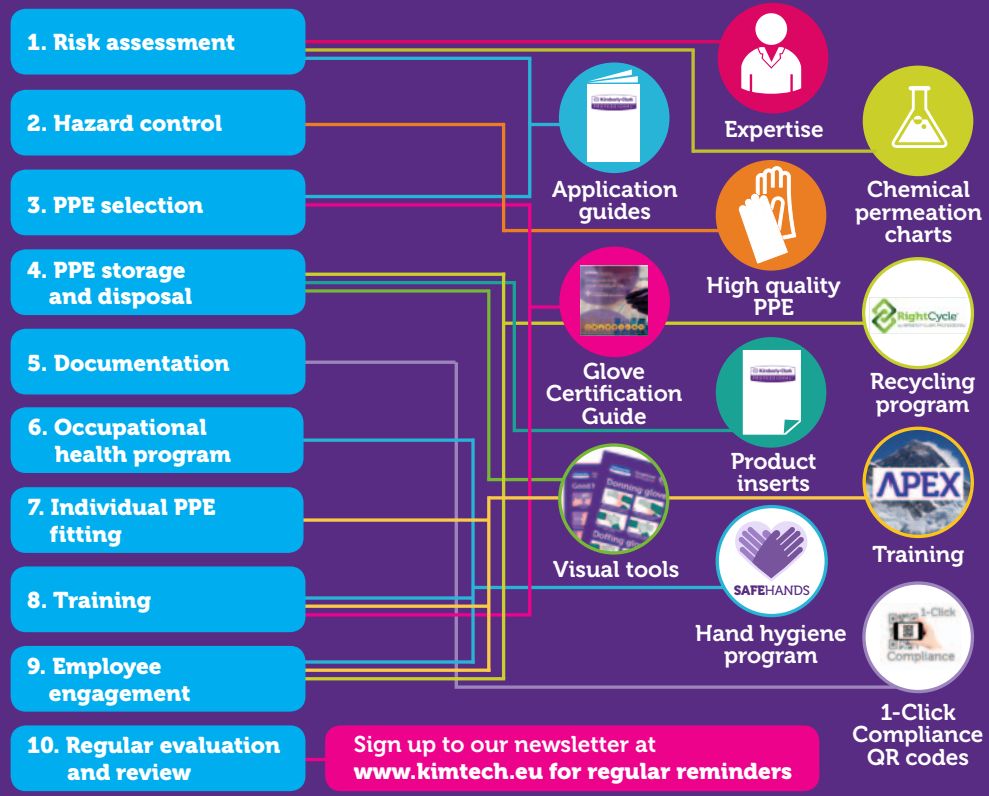
Facilities

Laboratories designed for working with chemicals might include:

- Solvent resistant coved flooring
- Chemical resistant, smooth, and readily cleanable surfaces
- Chemical storage solutions to include:
  - solid, sturdy shelving
  - ventilated storage
  - flammable liquid storage
  - low level storage for corrosives
- Space for chemical waste storage
- Stainless steel hood with washdown system for Perchloric Acid handling
- Handwashing sinks with elbow or electronic controls for highly toxic chemicals
- Equipment for handling highly toxic gases
  - vented gas cabinet
  - coaxial tubing
  - alarmed vapour sensors

An effective PPE program engages employees with great tools and great training.

- Protect your people with our high quality PPE
- Create an effective 10 step PPE program
- Engage your people with our engagement tools and services



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Ensure your personal safety

Select gloves and apparel with the appropriate level of CE certification to address your application risk and performance requirements

- Consult your PPE supplier for chemical permeation results
- Assess chemical splash risk, refer to each chemical hazard classification
- Assess maximum exposure time of each specific chemical
- Select a glove with permeation resistance greater than the exposure time for the specific chemical

Precision in the laboratory is best served by limiting chemical handling to low quantities with the wide-spread use of pipettes, thereby containing chemical hazards to a splash type risk rather than a full immersion risk.

Splashproof garments

Chemical protective clothing is commonly categorized into six standards under EN340:

- Type 1, Gas tight – protects against hazardous gases
- Type 2, Non-gas tight – protects against liquids but not gases
- Type 3, Jet tight – protects against chemicals at higher volume and pressure
- Type 4, Spray tight – chemical spray resistant
- Type 5, Particulate protection – suitable for dust applications
- Type 6, Splash protection – suitable for limited liquid splash protection

Kimberly-Clark Professional's Chemical Apparel solutions offer a combination of durability and comfort as they offer protection from aqueous chemicals and jet liquid spray

KLEENGUARD* A71 Chemical Spray Protection Overalls

KLEENGUARD* A80 Chemical Permeation & Jet Liquid Protection Coveralls

Glove certification

EN374-3: 2003 is the test method used to evaluate whether a glove provides chemical protection. For those that do not pass full immersion, the beaker with the question mark is used to indicate low chemical protection (splash protection only)

EN374-1:2003

Low chemical protection (chemical splash protection only)

Gloves offering Low Chemical Protection are suitable for applications where chemical splash hazards are present. A chemical splash may still permeate through the glove and cause harm to the user, so only use gloves for which the manufacturer can provide chemicals permeation data for the particular chemical you are using.

EN374-3:2003

A, K, L

EN374-1:2003

EN374-3:2003

Protection from Harsh Chemicals (immersion protection)

This standard refers to applications involving risk of full immersion of gloved hands in chemicals, such as industrial chemical handling.

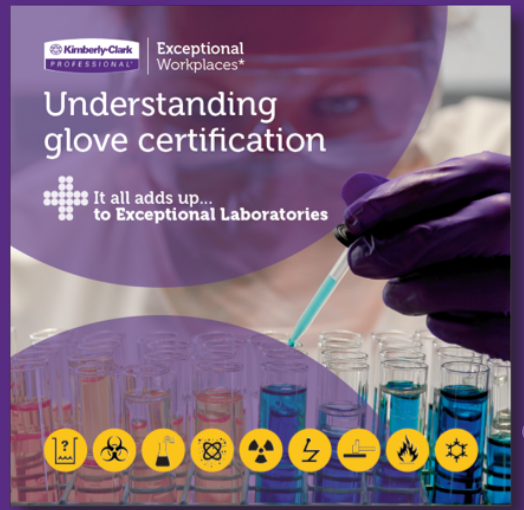
The glove should achieve a breakthrough time of >30 minutes on at least 3 of the folllowing chemicals:	
A: Methanol (100%) (CAS 67-56-1)	B: Acetone (100%) (CAS 67-64-1)
C: Acetonitrile (100%) (CAS 75-05-8)	D: Dichloromethane (100%) (CAS 75-09-2)
E: Carbon Disulphide (100%) (CAS 75-15-0)	F: Toluene (100%) (CAS 108-88-3)
G: Diethylamine (100%) (CAS 109-89-7)	H: Tetrahydrofurane (100%) (CAS 109-99-9)
I: Ethylacetate (100%) (CAS 141-78-6)	J: n-Heptane (100%) (CAS 142-85-5)
K: Sodium hydroxide (40%) (CAS 1310-73-2)	L: Sulphuric Acid (96%). (CAS 7664-93-9)

JACKSON SAFETY* G80 NITRILE Chemical Resistant Gloves provide protection against acids, caustics, bases, solvents and other aqueous solutions.

Handling

When working with chemical hazards at the bench:

- Wear appropriate Personal Protective Equipment (PPE)
- Select a glove with the appropriate level of CE certification to address your application risk and performance requirements – See our "**Understanding glove certification**" miniguide
- Decontaminate tools
- Wipe down your working surface before and after
- Do not work alone
- Maintain clear access to exits, showers and eyewashes
- Wash skin promptly if chemical comes in contact with skin
- Do not eat, drink or apply cosmetics in lab
- Ensure appropriate transportation or waste management equipment is to hand



Preventing chemical spills

Most spills are preventable. The following tips can help prevent or minimize the magnitude of a spill:

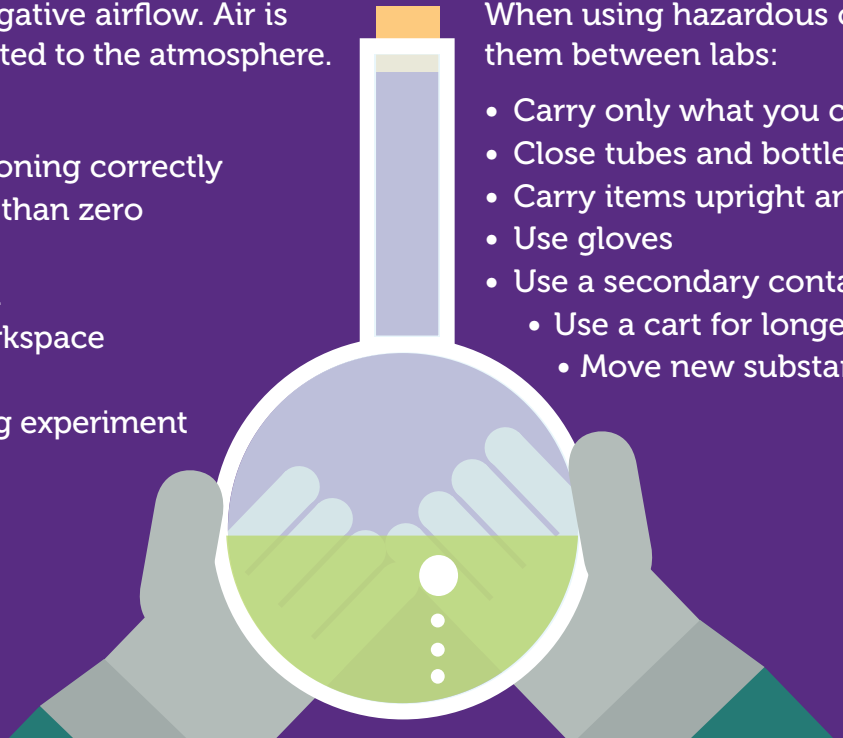
- Place chemical containers in a hood or lab bench area that reduces the possibility of accidentally knocking over a container
- Keep all unused reagents in their appropriate storage area
- Keep work area clean and clutter free
- Plan your movements. Look where you are reaching
- Avoid transporting chemicals between labs during periods of high traffic
- Place absorbent plastic-backed liners or trays on benchtops and in fume hoods

Using a fume hood

A fume hood is an enclosed space with negative airflow. Air is removed from the lab via the hood and vented to the atmosphere.

When using a fume hood:

- Pre-check the hood to ensure it is functioning correctly
- Ensure pressure gauge reading is higher than zero
- Lower sash
- Keep chemicals away from front of hood
- Work neatly and centrally within the workspace
- Keep head outside fume hood
- Leave fan on for several minutes following experiment



Carrying hazardous chemicals

When using hazardous chemicals in the lab, or transporting them between labs:

- Carry only what you can hold comfortably
- Close tubes and bottle tops securely
- Carry items upright and level
- Use gloves
- Use a secondary container
  - Use a cart for longer distances
    - Move new substances in their original packaging

Checklist for good chemical hazard control*

Exceptional Laboratories will:

- Design and run processes to keep the spread of contaminants as low as possible
- Consider all routes of exposure
- Select control measures according to the amount of substance, how it affects the body and how much harm it will cause
- Ensure all measures are effective, easy to use, and work properly
- Issue appropriate Personal Protective Equipment (PPE)
- Check regularly that measures continue to work and keep records
- Inform workers about the dangers and how to use control measures properly
- Avoid increasing the overall health and safety risks when making changes
- Engage employees in safety, health and protection programs
- Employ expert partners in safety, health and protection controls

* This list should not be considered comprehensive

KIMBERLY-CLARK PROFESSIONAL* is an expert supplier of high quality PPE equipment with value added green, lean and protection services

It all adds up... to Exceptional Laboratories

Contact: kimtech.support@kcc.com

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