Labels – NFPA Diamond

- RED - Flammability
- BLUE - Health
- YELLOW - Reactivity
- WHITE - Special

{NFPA – National Fire Protection Association}

Chemical Safety

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Chemical Exposure Severity & Duration

- “Acute” effects usually occur rapidly as a result of short-term exposures, and are of short duration
- “Chronic” effects generally occur as a result of long-term exposure, and are of long duration

Types of chemical hazards

- Toxic substances
- Solvents
- Corrosives
- Flammables
- Irritants
- Carcinogens
- Teratogens
- Mutagens
- Explosives
- Radiation

  and many, many more

How do toxic materials enter the body?

- By mouth (contaminated fingers!)
- By breathing in gases, aerosols or powder
- By skin contact or damage
- By absorption through intact skin
- By splashes into the eyes

Corrosives

- Typical examples are sulfuric acid, nitric acid, potassium hydroxide (caustic potash), sodium hydroxide (caustic soda), bromine and phenol.

- Corrosive substances causes destructive burns on the tissue by chemical action at the site of contact.

- Corrosive effect can also occur in the respiratory tract in case of inhalation and in the gastrointestinal tract in case of ingestion.

Oxidisers

- Typical examples include hydrogen peroxide, nitric acid, perchloric acid , sulphuric acid, chlorates, chromates, nitrates, peroxides, permanganates and picrates .

- Oxidisers are chemicals which decompose readily under certain conditions to yield oxygen.
- They can cause a fire to burn violently.
- Oxidisers must not be stored with flammables.

Flammables

- Flammable substances are those that readily catch fire and burn in air.

- The vapours released from a flammable liquid are a common fire hazard in a laboratory.

- The degree of hazard associated with a flammable liquid depends on its flash point, flammability limit and ignition temperature.

Potentially explosive chemicals

- Chemicals when subjected to heat, impact, or friction, undergoes rapid chemical change, evolving large volumes of gases which cause sudden increase in pressure.

- Heat, light, mechanical shock and certain catalysts can initiate explosive reactions.

- Shock sensitive substances include acetylides, azides, nitrogen triiodide, organic nitrates, nitro compounds, perchlorate salts and organic peroxides.

Toxic chemicals

- Toxic chemicals produce injurious or lethal effects upon contact with body cells due to their chemical properties.

- The toxic effects depend upon the extent of exposure and the inherent toxicity of a chemical.

- The extent of exposure is determined by the dose, duration and frequency of exposure and the route of exposure.

Toxic chemicals

- Toxic effects of a chemical may occur after a single (acute) exposure or long term repeated (chronic) exposure.

- Examples of acute toxins are sodium-cyanide, sodium azide and dimethyl mercury.

- Benzene is an example of a chronic toxin which can cause damage after repeated or long term exposure.

Types of toxins - target organ/tissue - examples

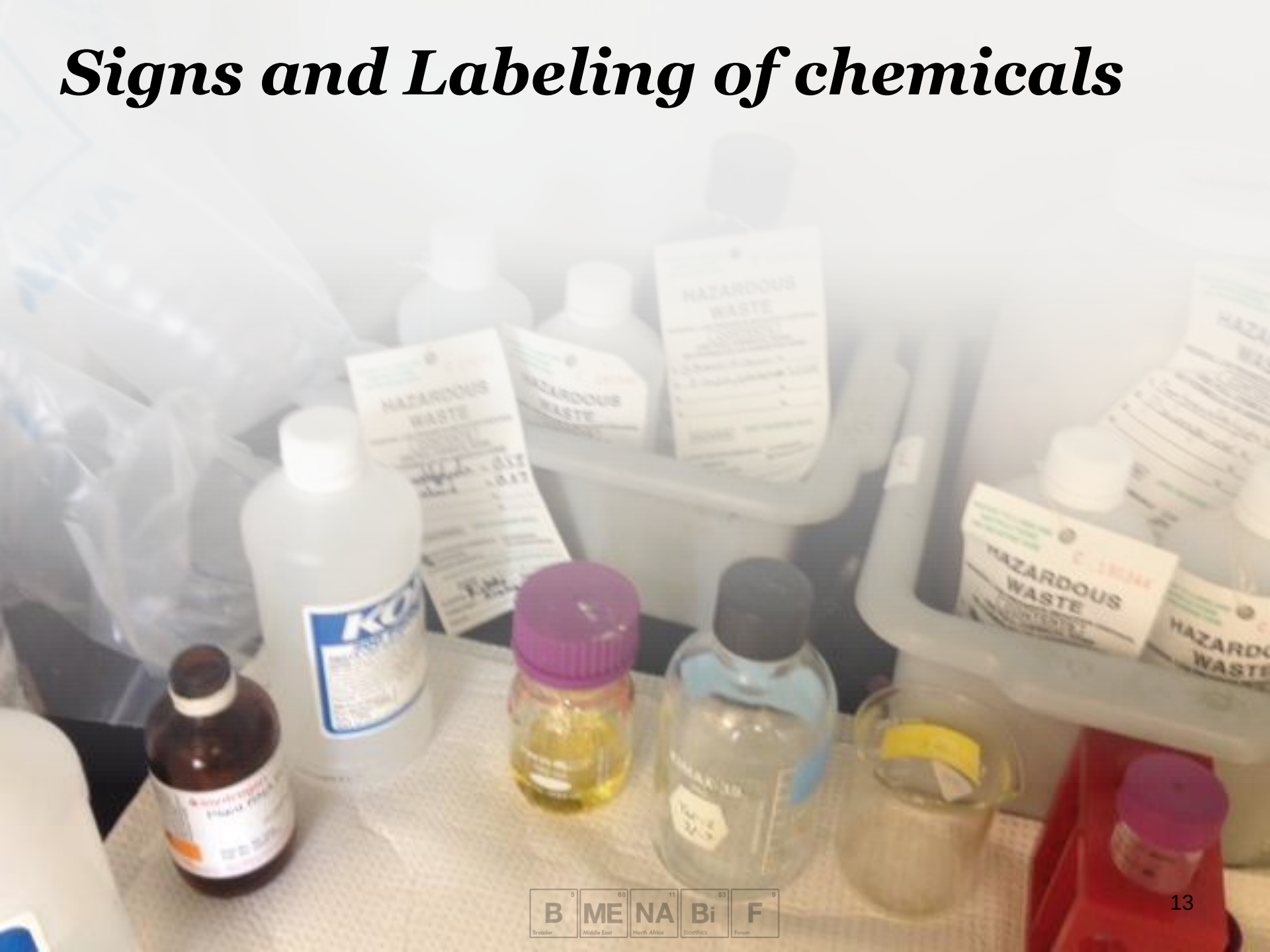
- Neurotoxins (nervous system)- mercury (metallic, inorganic and organic), xylene, carbon disulphide, n-hexane, trichloroethylene.
- Hematotoxins (blood)-carbon monoxide, nitrates aromatic amine compounds.
- Hepatotoxins (liver)- chloroform, dinitrobenzene
- Nephrotoxins (kidney)- cadmium, mercury, carbon tetrachloride
- Dermatotoxins (skin)- organic solvents

Water reactive chemicals

- These chemicals react violently when they come in contact with moisture or water.

- Examples include lithium, sodium, potassium, aluminium bromide, calcium oxide, sulfur trioxide and phosphorus pentachloride.

Signs and Labeling of chemicals



Safety Data Sheets (SDS)

- A Safety Data Sheet (SDS) is a chemical information sheet **provided by the manufacturer or supplier of chemicals**
- It describes the identity, properties, uses, precautions for use and safe handling procedures of a hazardous chemical
- A SDS must be **readily available** at each location where the chemical is used

Labeling of hazardous chemicals

When labeling a hazardous chemical, the minimum requirements on each label are:

- Name of user
- Description of contents
- Concentration
- Appropriate hazard labels
- Date of preparation

Chemicals in the original container, as supplied by the manufacturer, are usually correctly labeled.

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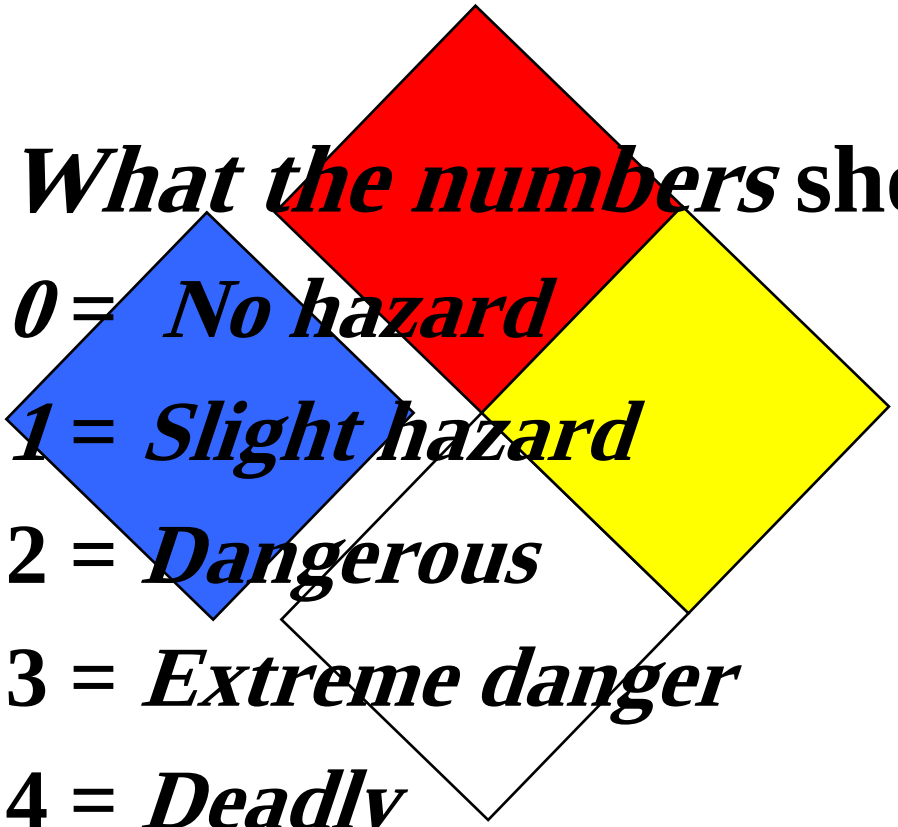
Labels - Health Hazard



- ***What the numbers* show**
  - ***0 = No hazard***
  - ***1 = Slight hazard***
  - **2 = *Dangerous***
  - **3 = *Extreme danger***
  - **4 = *Deadly***

Labels – Flammability

- ***What the numbers* show**

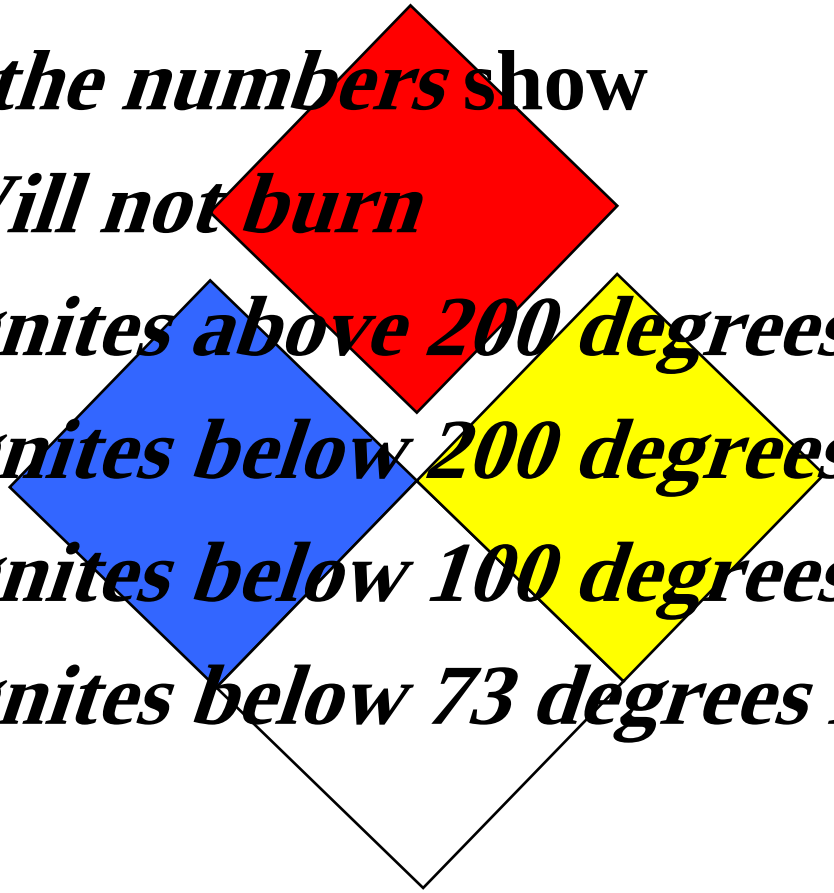
0* = *Will not burn

1* = *Ignites above 200 degrees F

2 = *Ignites below 200 degrees F*

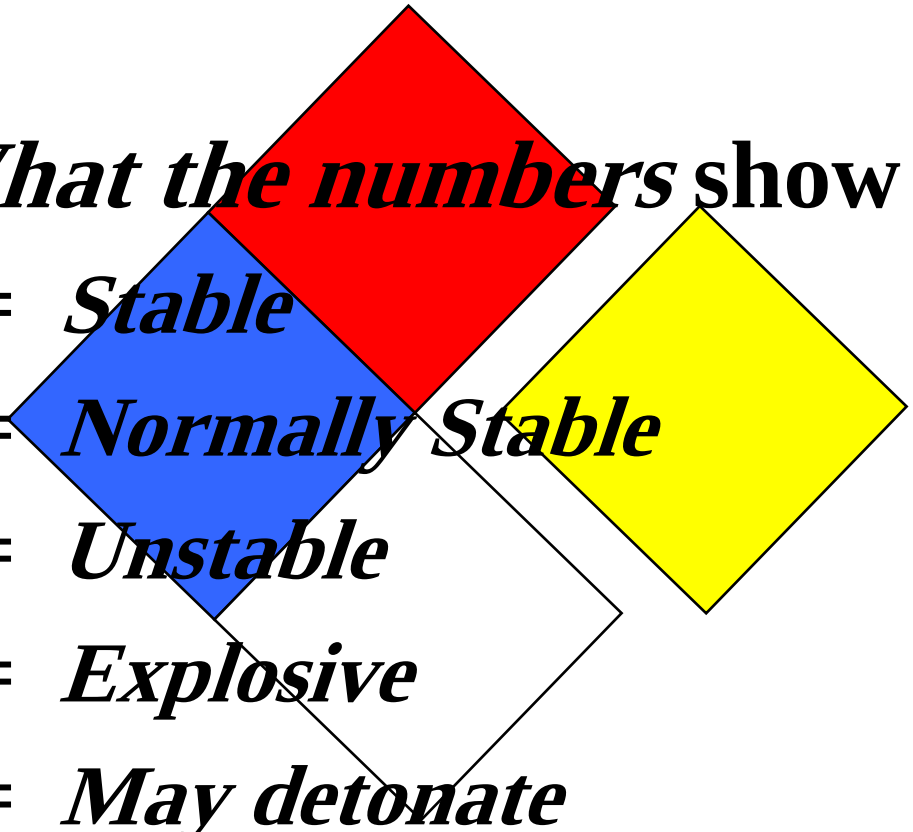
3 = *Ignites below 100 degrees F*

4 = *Ignites below 73 degrees F*



Based on Flash Point {the temperature at which a material gives off enough vapors to sustain ignition}

Labels - Reactivity



- ***What the numbers* show**

0* = *Stable

1* = *Normally Stable

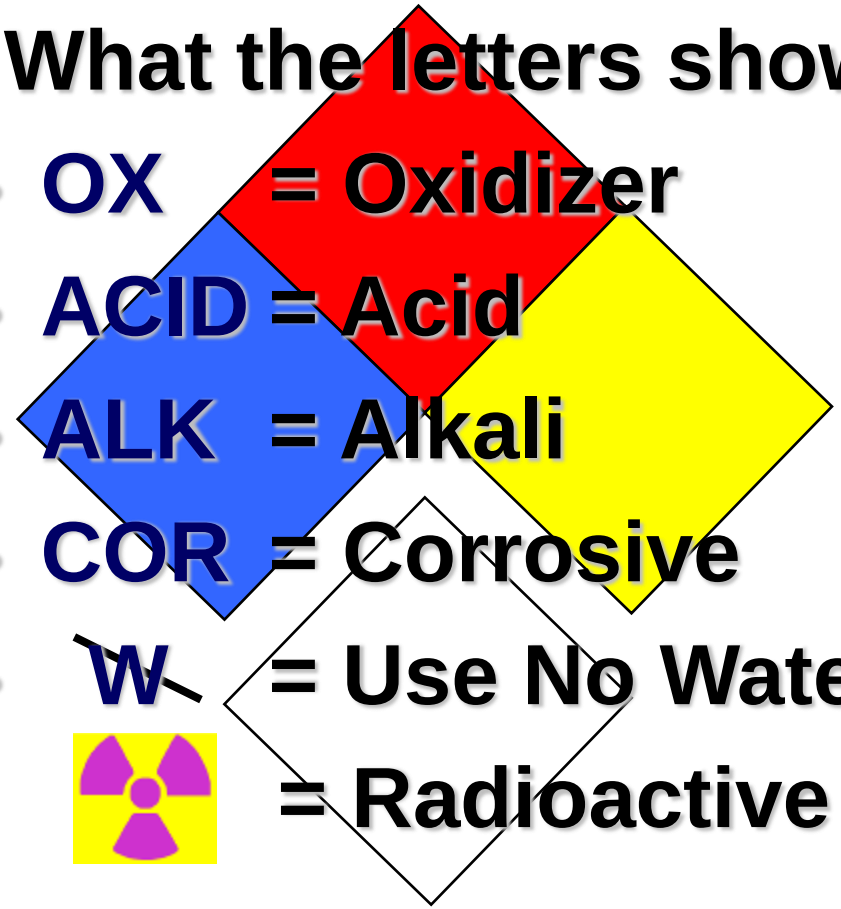
2 = *Unstable*

3 = *Explosive*

4 = *May detonate*

Labels - Special Hazard

- What the letters show
  - OX = Oxidizer
  - ACID = Acid
  - ALK = Alkali
  - COR = Corrosive
  - W = Use No Water
  - = Radioactive



Transporting chemicals

Transporting chemicals inappropriately can result in spills, potential chemical exposures and fire hazards.

- Chemicals should only be transported in containers made of materials that are compatible with the chemical.
- When transported through public corridors, chemicals must be in sturdy boxes or external containers.

Storing chemicals

Storing chemicals

Proper storage of chemicals in the laboratory is *extremely* important.

Improper storage has resulted in fires; explosions; and serious injuries to, and death of, individuals.

General guidelines

- Do not store excessive quantities of chemicals in the laboratory.
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- All chemicals and chemical mixtures must be labeled.

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- Store reagents in cabinets or on shelves.

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- Chemicals requiring refrigeration should be properly labeled and sealed to prevent escape of vapors.

General guidelines, continued

- No chemicals (or waste chemicals) should ever be stored on the floor.
- Flammable liquids requiring cold storage must be stored only in refrigerators or freezers.
- Date bottles of chemicals when they are opened.
- Storage areas should be periodically inspected for signs of damaged containers, and replaced if necessary.
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Reference

1-Astuto-Gribble, L.M. & Caskey, S.A. 2014. Laboratory Biosafety and Biosecurity Risk Assessment Technical Guidance Document (No. SAND2014-15939R). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States).

2-World Health Organization Staff & World Health Organization. 2004. Laboratory biosafety manual. 3 rd. ed. World Health Organization