



Corrosives

Aim & Objectives

The aim of the session is to introduce the properties, behaviours and types of corrosive substances

Objectives

- Identify corrosive materials
- Describe how corrosivity is commonly measured
- List the general behaviour of corrosives
- Describe the effect different types of corrosives have on the body
- Explore the hierarchy of control for dealing with corrosive substances.

Identification



What are corrosives?

Corrosives are chemicals that have the ability to react and attack other substances without initiation or 'trigger'

Irreversible reaction

Generate heat

Degrade / break other chemicals

Can be slow, can be fast

Some can react with a select group of metals to produce hydrogen

React violently with their 'opposite'

pH Scale

ACIDS

ALKALIS



GHS Corrosive ≤ 2

GHS Corrosive ≥ 11.5

pH Scale

Acidic ←						Neutral	→ Basic						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1M HCl	Stomach Acid	Coke	Beer	Urine	Milk	Water	Blood	Baking Soda	Antacid	Ammonia	Bleach	Oven Cleaner	Drain Cleaner

GHS Corrosive ≤ 2

GHS Corrosive ≥ 11.5

pH checks the condition of water quality to determine if any further action is needed

Extreme pHs do not necessarily mean high corrosivity

The more extreme the pH, the greater the impact and the more difficult it is to deal with.

Effect of corrosives to the body – addition to thermal burns

Acids

- Coagulative Necrosis
 - Forms a ‘jelly’
 - This ‘jelly’ limits body tissue penetration
- Attack of the acid struggles to break down proteins and fats (hence the limited effect on the body)

Alkalis / Bases

- Liquefactive necrosis
- Denatures proteins and fats... but causes a further process called saponification
 - Term used to describe the formation of soap
- Saponification does **NOT** limit tissue penetration

Sensitive areas of the body:

- Eyes
- Mouth / Throat
- Ears

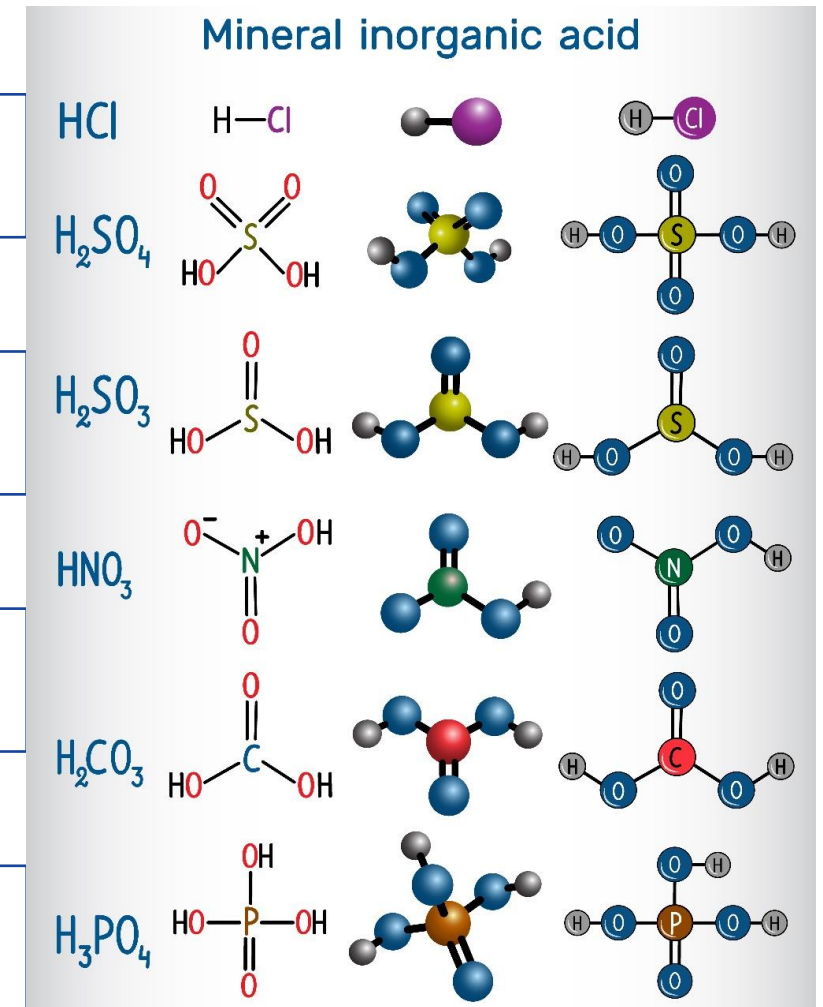
Mineral acids

Acids that do not contain hydrocarbon 'bits'

Often all are strong acids

In general mineral acids are water soluble

Includes: sulfuric, nitric, phosphoric, hydrofluoric and hydrochloric acid.



Organic acids

Acids that contain hydrocarbon chains

Acetic acid (ethanoic acid) – vinegar

Weak acids

Highly concentrated (glacial) can still cause major damage

Organic acids can also be flammable (this is from the carbon)



General Behaviour

Dangerous when wet

Although almost all acids and alkalis (except bases) dissolve in water, they are often sensitive and can react with water exothermically, or endothermically, perhaps even violently



React with opposites

Acids will react with their opposite – alkalis and bases

Can be violent that generates a lot of heat and gas (gas depends on the substances mixing)

- All of the above depends on the type of corrosive, the quantity and concentration
- Corrosives may decompose under high temperatures and release corrosive fumes.

Exceptional Corrosives – Hydrofluoric Acid (HF)

- The liquid solution is Hydrofluoric acid, the gas is called Hydrogen Fluoride
- Although not truly a 'strong' acid, hydrofluoric is the most toxic mineral acid
- HF is used & abused to etch glass
- Seeks out and reacts with minerals in the body (Sodium, Potassium, Magnesium, Zinc, Calcium etc)
- It is imperative that exposure to HF is identified:
 - Antidote (sacrificial material) called Calcium Gluconate available to exposures – paramedics now carry it



26 April 2007 (1 day later)



27 April 2007 (2 days later)



28 April 2007 (3 days later)



30 April 2007 (5 days later)



5 May 2007 (10 days later)



7 May 2007 (12 days later)



Three Months Later



Other examples – Sulphuric Acid


Sulphuric Acid (Fuming)

4WE	
1831	
Specialist Advice	NCEC

X886
1831

**Sulphuric acid is an
exceptional dehydrating
agent**

Sulphuric Acid (96%)

2P	
1830	
Specialist Advice	NCEC

80
1830

Videos

Operational Considerations

Corrosives - Hierarchy of Control

Contain

Absorb

Neutralise

Dilute

CONTAIN

Leak Control Tactics

- Check position of upstream valves
- Check integrity of container openings tighten caps, bungs, lids, etc
- Stand-up leaking container
- Move container so hole is above liquid/solid level

Containment options:

- Remote isolation or valving down
- Site drainage/ventilation shutdown
- Retention, for example drain blocking
- Covering, for example, use salvage sheets or foam
- Damming
- Overpacking
- Patching
- Plugging
- Pressure isolation
- Solidification
- Vacuuming
- Water bottoming
- Decanting

NEUTRALISE

The use of an acid or base to produce a less hazardous material

- Full neutralisation produces non-hazardous products to people and to the environment

Usually limited to small scale spills

Neutralisation requires careful monitoring of pH to ensure that the neutralising agent doesn't overshoot the pH generating the opposite hazard (acid into alkali etc.)

Conditions:

- Corrosive material must be positively identified = corrosive type, quantity and concentration as a minimum
- Containment and control of spill has already been achieved (for a controlled neutralisation process)
- Sufficient neutralising agent on hand = this can be substantial and on the tonnage scale for large spills
- Sufficient mixing to ensure neutralising agent comes into contact with all the corrosive
- The neutralising agent must not adversely affect the environment
- Mild (and weak) alkalis (e.g. sodium bicarbonate) to neutralise acids
- Mild (and weak) acids (e.g. acetic acid) to neutralise alkalis / bases

DILUTE

Requires huge amounts of water

Used with water soluble solutions

Must meet following criteria:

- Is not water reactive
- Will not generate toxic gas upon contact with water
- Will not form a solid or precipitate
- Is totally water soluble

It is a considered as a last option

Decontamination?

Emergency = Use water and dilute by thousands or orders of magnitude

Responders

- Don't get contaminated
- Employ 'RRR' controls
- Assess levels of contamination
- Lightly wash or brush affect areas of PPE (boots and gloves) prior to safe-undress – MINIMISE WATER USE
- Consider further washing (after undress) prior to bagging either for disposal or laundry
- Contain washings – AVOID STANDING IN WASHINGS

Equipment

- Don't get contaminated
- Assess levels of contamination
- Segregate all equipment for washing (consider washing prior to any disposal)
- Wash using minimal quantities of water
- Contain washings



NCEC
HAZMAT
ACADEMY

Any Questions?