

# CHEM 9.4.1 ROLE OF CHEMISTS

Much of the work of chemists involves monitoring the reactants and products of reactions and managing reaction conditions

1.1 Outline the **role of a chemist** employed in a named industry or enterprise, identifying the **branch of chemistry** undertaken by the chemist and **explaining a chemical principle** that the chemist uses

- **Robert Evans, environmental chemist** at Botany's **Orica Ltd** site in Sydney (Botany Industrial Park)

## ROLE

- **Monitoring the environmental aspects** of air, noise, water, soil, groundwater and waste management of the industrial location, to make sure the **site adheres to EPA regulations (Environment Protection Authority)**
  - Disposal of **contaminated waste** (neutralising acidic/basic waste, incinerating toxic waste)
  - Investigating contamination in **soil/groundwater**
  - Regulating **venting and stack emissions** for unacceptable levels of material
  - Organising and writing **reports and presentations** periodically
- **Chemical principle:** monitoring acid and base reactions for neutralising wastes, e.g.:
  - **Groundwater Treatment Plant** in Orica, where Evans was involved as Site Environment Engineer:
    - **Caustic scrubbers** used to **neutralise** residual hydrogen chloride vapour
    - Scrubber washes gas with **caustic water (contains NaOH or KOH)** – converts gas to a salt
    - $H_2(g) + HCl(g) + NaOH(aq) + H_2O(l) \rightarrow H_2(g) + NaCl(aq) + 2H_2O(l)$
    - Monitoring **amount of reactants** is required
  - Other chemical principles – chemical sampling techniques, gravimetric and volumetric analysis, AAS

See <http://www.oricabotanytransformation.com/?page=30> and <http://www.chem.unsw.edu.au/RACI/profiles.html>

1.2 Identify the need for **collaboration between chemists** as they collect and analyse data

- Chemists specialise in particular branches, e.g. environmental, analytical, industrial, food chemistries
- Most chemical problems require expertise from many branches
  - E.g. industrial process requires **physical** (equilibrium), **organic** (how reaction occurs), **analytical** (monitoring products and reactants), **environmental** (disposing waste) **chemists**
- Also require help from **other sciences**, e.g. chemist monitoring waste collaborating with biologist for plants

1.3 Describe an example of a chemical reaction such as **combustion**, where **reactants form different products** under **different conditions** and thus would need **monitoring**

- Monitoring needed for **combustion** – may produce only CO<sub>2</sub>, or mixture with CO and C (soot)
- Example: octane with excess supply of oxygen – products are CO<sub>2</sub> and H<sub>2</sub>O (**complete combustion**)
  - $2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$
- But limited supply of oxygen (**incomplete combustion**) – for example:
  - $2C_8H_{18}(l) + 23O_2(g) \rightarrow 15CO_2(g) + C(s) + 18H_2O(l)$
- Therefore proportions of C, CO, CO<sub>2</sub> **dependent on level of oxygen**, must be monitored
  - Affects health (CO competes with oxygen for haemoglobin – poisonous, odourless)
  - Affects efficiency of combustion – power output of machine
- For example, in **car parks and fuel powered heaters CO** level monitored

1.P1 Gather, process and present information from secondary sources about the **work of practising scientists** identifying:

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#### THE VARIETY OF CHEMICAL OCCUPATIONS

- Several **branches** of chemistry that chemists can work in, mainly:
  - **Analytical** – qualitative and quantitative analysis of what's present in substance
  - **Physical** – physical aspects, e.g. reaction rate, energy, structure of compounds
  - **Organic** – carbon compounds, e.g. hydrocarbons, fats, sugars, proteins
  - **Inorganic** – compounds, e.g. metals and extraction, reactions
- Other new branches for **society** – environmental, polymer, industrial, food, pharmaceutical, nuclear, forensic

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#### A SPECIFIC CHEMICAL OCCUPATION FOR A MORE DETAILED STUDY

- **Environmental** chemist reviews **compliance with government regulations** about:
  - Water treatment systems
  - Environmental noise
  - Contaminated waste – and classifying waste for disposal
- Investigates and determines:
  - Contamination in soil/groundwater
  - Levels of regulated gas stack emissions
- Answers questions and enquiries/complaints

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