Aluminium exceedence in drinking water

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Drinking Water standards

Chemical parameters

- 1,2-dichloroethane
- Antimony
- Arsenic
- Benzene
- Benzo(a)pyrene
- Boron
- Bromate
- Cadmium
- Chromium
- Copper
- Cyanide
- Fluoride

Indicator parameters

- ***Aluminium***
- Ammonium
- Chloride
- Iron
- Manganese
- Sodium
- Sulphate
- Total organic carbon
- etc

Indicator parameter- Al

- “a diverse group of parameters designed to provide information on the management of the treatment process and the organoleptic and aesthetic quality of drinking water”
- “a value reported above the indicator parametric value should not, *de facto*, be considered a cause for concern…guide .. investigation .. cause .. elevated value”
- Control over addition of treatment chemicals
  - Naturally high in raw water
  - Management and design of treatment plant

Why concern about aluminium?

- 1972 Denver cluster of 5 cases of progressive fatal encephalopathy
- All 5 chronic dialysis patients
- Brain aluminium content
- Aluminium content of dialysate

- Dialysis encephalopathy syndrome
- Dialysis osteodystrophy

Aluminium & drinking water Sentinal incident: Camelford

- Camelford, Cornwall 1988
- Drinking water accidentally contaminated with 20 tonnes of aluminium sulphate
- No acute effects, no chronic effects expected
- 2 years later 400 with illnesses the patients attributed to incident
- No biochemical explanation
- “real mental and physical suffering” - anxiety
- Sustained (over 5 years) rise in hospital admissions
- Renal and neurological investigations

Public health risk assessment

- Source – ***Pathway*** – Exposure
- The incident involves a HAZARDOUS SUBSTANCE
- AND
- There is a ***route for EXPOSURE*** of the public
- WITH
- People at potential risk of HARM if exposed
- OR
- People exhibiting SYMPTOMS compatible with exposure

Chemical incident
Nature of health effects

3 types of health effect

- Physical injury due to accident itself
- Toxicological effects due to exposure to noxious substance
- Psychotrauma

Aluminium & drinking water Scenario 1 - acute

- Lunchtime spill of aluminium sulphate at water treatment plant 4pm test result 1.2mg/l in treated water
- MAC for aluminium (Al) 0.2mg/l
- Plant shut down at 6pm
- Consumer complaints
  - Water discoloured
  - Tea coloured pink
  - Milk curdled in tea

Scenario 1 – acute Risk assessment

- Source
  - Al above MAC in public drinking water supply
  - Time limited exposure (noon to 6pm) 6 hours
  - Source of contamination identified & stopped
- Pathway
  - ingestion of drinking water assumption that 70 kg adult drinks 2 litres per day
- Receptor
  - Population of two county towns and hinterland served by the drinking water supply
- Dose
  - Worst case scenario 2l X 1.2mg/l = 2.4mg Al; average daily intake 5-20 mg/day; ATSDR PTWI 7mg/kg
  - No health effects expected

Aluminium & drinking water Scenario 2 - chronic

- Public drinking water supply to large county town
- 12 test results ‘07, 10 results from ’08
  - 10 exceedences
  - (7) >200 & <500 μg/l
  - (3) >500 & <1000 μg/l
- ATSDR MRL (>365 days) 1mg/kg/day
- Management of supply
  - Turbidity / high particulate effect on disinfection
  - Check microbiological parameters