Acute risks from soil contaminants: “Blue Billy”

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Introduction

- **HPA were asked for advice by a Local Authority about a contaminated land site**
- **Site was being investigated under Part 2A Environmental Protection Act 1990**
- **Consultant had undertaken a site investigation and risk assessment**

The Site

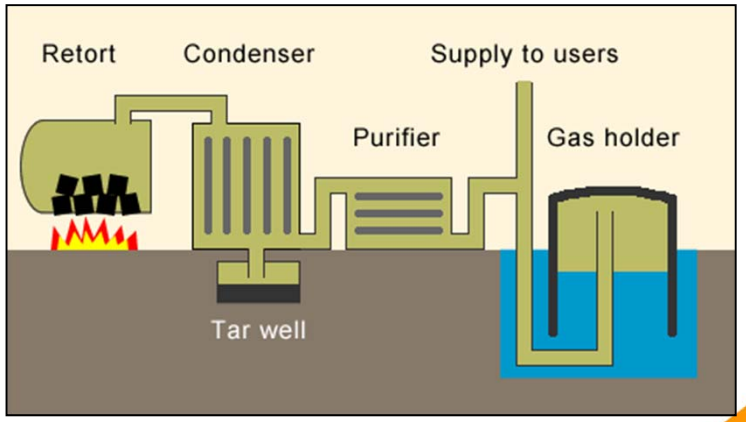
- **Well establish open space in Manchester**
- **Historically part of the site was used for disposal of industrial wastes including gas works waste**
- **Recent years grass/soil eroded by activities such as motor bike scrambling**
- **Number of informal paths across the site**
- **Area used daily by dog walkers and pedestrians**

Site Investigation

- **A site investigation was undertaken by consultants**
- **Distinctive bright blue/greenish deposits on site**
- **Waste product from purification process which was used in gasworks**
- **Recent shallow disturbances of tip surface prompted concern about acute exposure**

Gas works waste products

- **Town gas- purification required to reduce hydrogen sulphide (H_2S) content of the gas**
- **Early gas works:**
- slacked lime to remove H_2S = foul lime ‘blue billy’
- **Later gas works:**
- Iron oxide ‘bog ore’ used
- Also removed hydrogen cyanide
- Spent oxide- complex cyanides which give it distinctive blue colour
- By product often used in dye industry as ‘Prussian Blue’



Assessing risks to health (1)

- **Current contaminated land guidance only for chronic risks**
- **No published approach for assessing acute toxicity**

<u>Consultants approach</u>

- **Identified that most sensitive receptor likely to be 3-6 year old child accompanying dog walkers/pedestrians**

TDI x BW/Dose

Where:

Tolerable Daily Intake (TDI)= 0.012 mg/kg bw/day (published UK Toxicological report- TOX 5)

Bodyweight = 17.2 kg (average bodyweight for 3-6 year old)

Dose = 5g (one off bolus dose, equivalent to a teaspoon of soil)

- **An acute risk screening level for free cyanide in soil was calculated = 41 mg/kg**
- **3 of 12 samples > screening criteria (max concentration-1,384 mg/kg)**

Assessing risks to health (2)

- **Based on chronic toxicological data so unclear if acute risk present**
  - *"The TDIs derived here are appropriate for chronic exposure. When assessing the risks from contaminated soils, it will also be necessary to take account of the risks from short-term exposure to inorganic cyanide, which may be important given its acute toxicity. The lowest reported fatal oral dose for humans is 0.56 mg CN kg^{-1} bw, which is nearly 50 times greater than the recommended TDI oral of 12 µg CN kg^{-1} bw. Given the steepness of the dose–response curve for acute exposure, and the speed and efficiency of detoxification"......"* ***ingestion of a bolus dose of cyanide equivalent to the TDI would not be expected to cause any acute toxicity***"

Why is acute cyanide toxicity a concern?

- **Younger children could be attracted to the blue coloured deposits**
- **Well know that cyanide compounds acutely toxic to humans**
- **Lethal effects can occur quickly after ingestion of relatively small amounts**
- **Sub-lethal doses can produce dizziness, headache, confusion, nausea and numbness**
- **Limited sampling from initial investigation**
- **HPA recommended targeted sampling to assess risk from children picking up blue deposits and accidentally/deliberately ingesting**

HPA Approach

- **Local Authority undertook more sampling- specifically of blue deposits**

Sample colour intensity (subjective)	Total Cyanide mg/kg	Free Cyanide mg/kg	Percentage of free cyanide to total cyanide
'Light'	4803	1545	32%
'Medium'	2741	702	26%
'Dark'	8904	1044	11%

- **Free cyanide deposits ranged from 702-1545 mg/kg**
- **~15 to 35 times initial screening level (41 mg/kg)**
- **Reviewed published toxicological data to determine level at which potential acute harm could occur**

Risk Assessment

- **Very little toxicological data on lowest known acute dose of cyanide:**
  - 400 µg/kg bw/day acute oral LOAEL identified for risk assessment
  - 5g selected as dose (USEPA studies supported selection)
  - 10 kg used as bodyweight- default for young children in environmental risk assessment
- **5 g of a deposit with 1545 mg/kg free cyanide = dose of 750 µg/kg bw/day for a 10 kg child**
- **Well above acute reference dose of 400 µg/kg bw/day**
- **Plausible hazard of ingestion of harmful or fatal dose**
- **Control measures required**
- **Site determined as "contaminated land" based on acute risks**

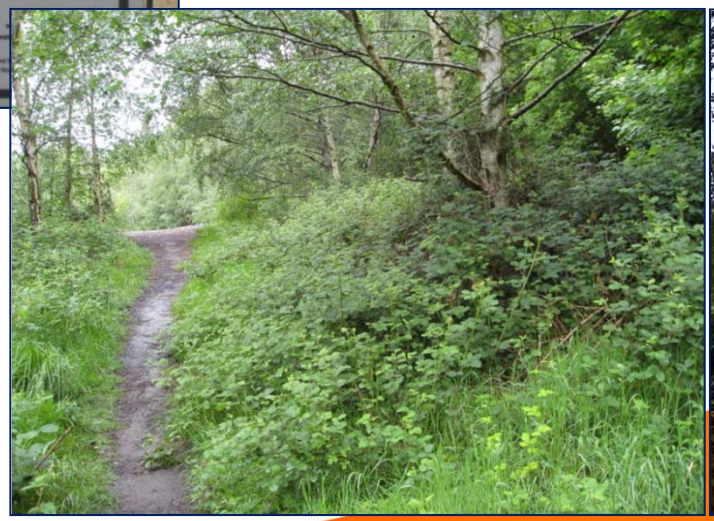
Temporary Remedial Action

- **Acute SPOSH: temporary priority- interim remedial action:**
  - Warning signs
  - Clean cover, grass-seeded
  - Fencing

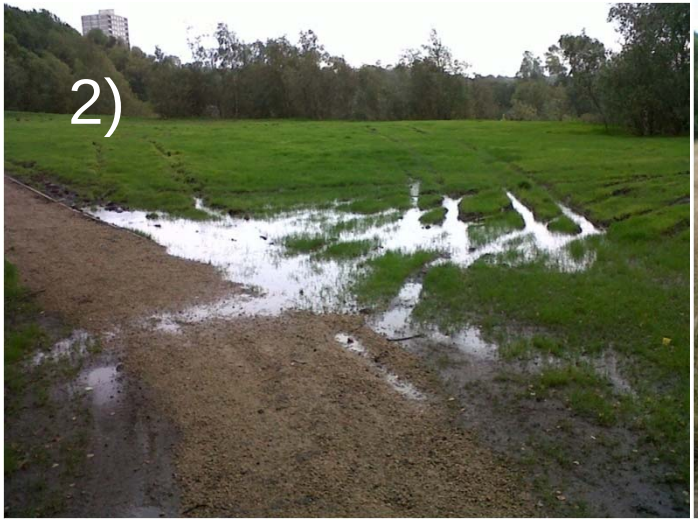
- **CLCP funding**

- Permanent remediation solution for human health and controlled waters:
  - Remedial Options Appraisal
  - Outline Design & Remediation Strategy
  - Additional water sampling – lower reservoir

Risk Management



Main tip area: 1) before remediation 2) after path formed and seeded soil down 3) ~ year later



Acknowledgements

- **Greater Manchester Health Protection Unit, HPA**
  - Rosemary McCann
  - Mark Brown
  - Will Welfare
- **HPA Centre for Radiation, Chemical and Environmental Hazards (CRCE)**
  - George Kowalczyk
- **Manchester City Council**
  - Rebecca Twigg

Any questions?