DEMA DANISH EMERGENCY MANAGEMENT AGENCY

Non-target screening: Cases from DK

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Seminar on Non-target screening

Ystad

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DEMA Chemical Division

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

University of Copenhagen
Faculty of Health and Medical Sciences

<u>What we do:</u>

Assistance and counselling:

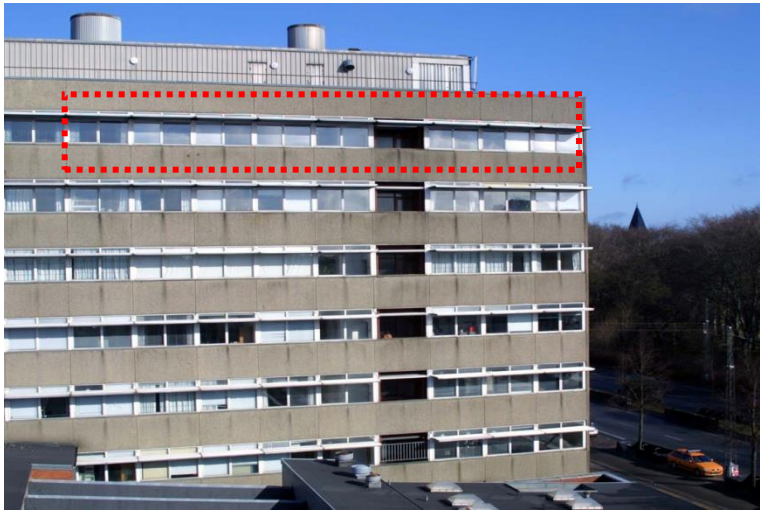
- HazMat incident operations (accidents/terrorism)

Chemical Analysis:

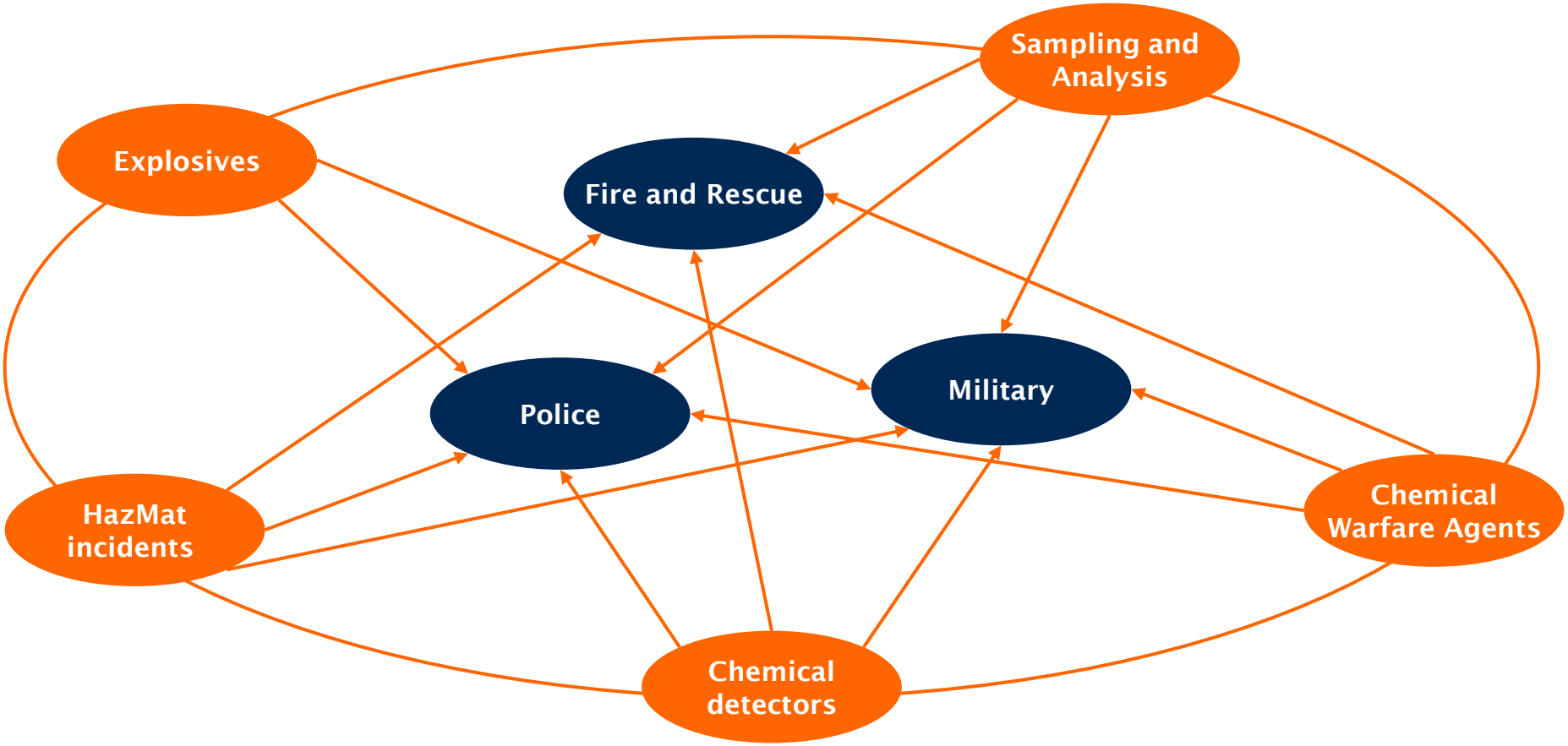
- Explosives
- Chemical Warfare Agents
- Unknown substances

<u>Staff:</u>

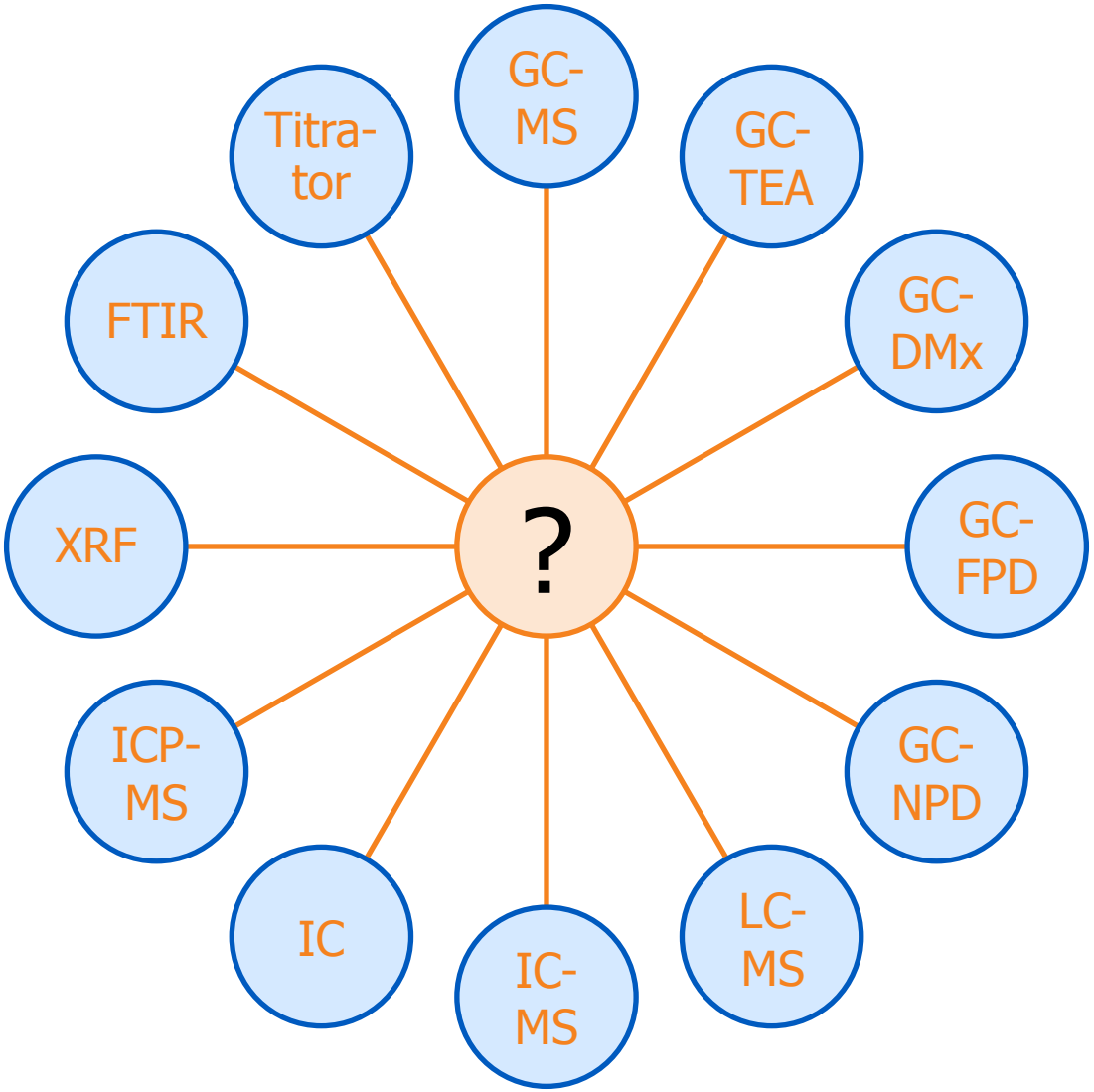
1 Head of Division
1 Deputy Head of Division
8 Scientists
1 Laboratory Technician
1 Support Staff



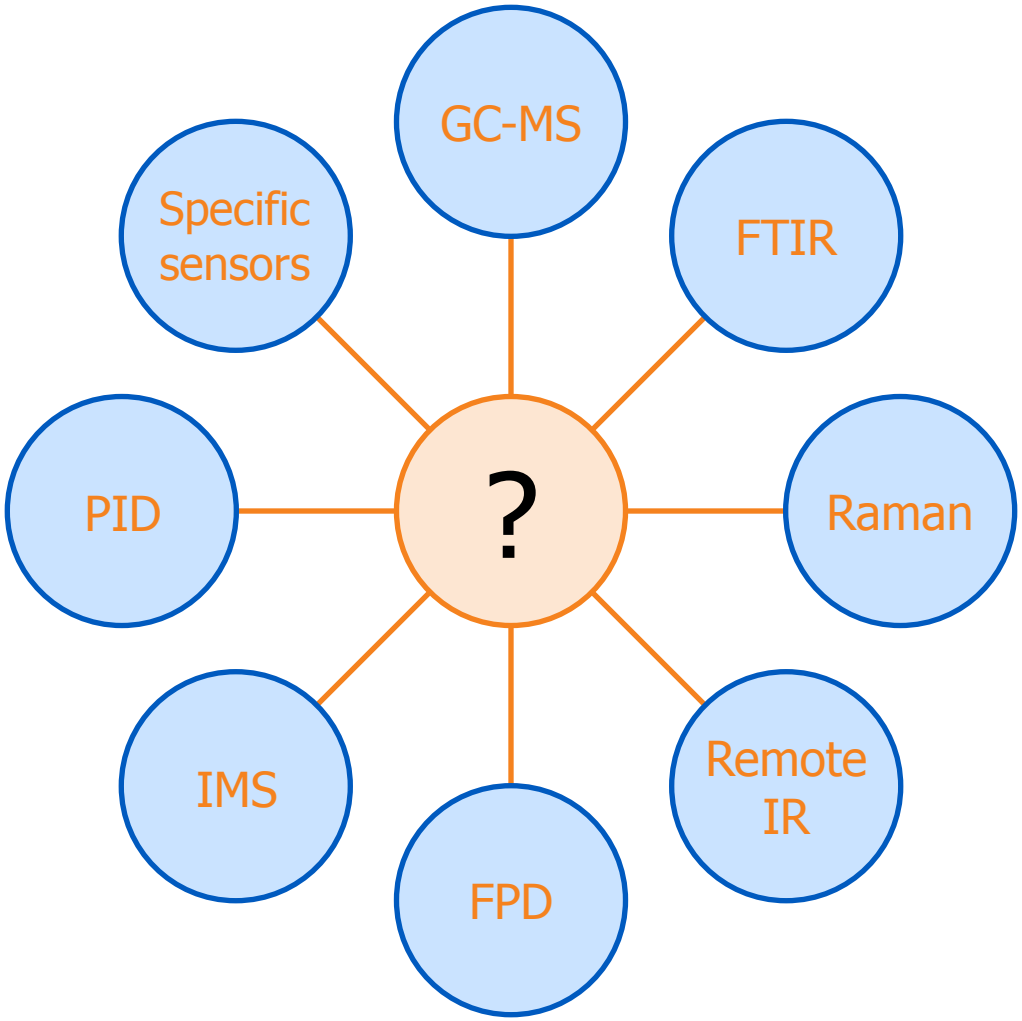
DEMA Chemical Division – Special Areas of Expertise



Laboratory instruments



Portable instruments



Case #1: Find of HME during house search

Incident:

House-search resulted in unexpected find of possible homemade explosives (HME) and precursor chemicals.

Possible target analytes:

Multiple types of unknown HME and precursor chemicals.

Case #1: Find of HME during house search

Items analysed:
>100 samples

Case #1: Find of HME during house search

Instrumental methods used:

Presumptive testing on-site:

None due to the high number of different chemicals.

Preliminary screening at EOD:

FTIR → Multiple types of HME

Confirmatory analysis in the laboratory:

Burntest → Multiple types of energetic materials
IC-MS → Multiple types of HME and precursors
IC+ → Multiple types of HME and precursors
XRF → Multiple types of precursors
GC-TEA → Multiple types of HME
GC-MS → Multiple types of HME and precursors
FTIR → Multiple types of HME and precursors

Conclusion:

Several samples contained molecular explosives or fuel-oxidiser mixtures, some of which have never been encountered in DK before.

Case #2: Suspected CWA in Thyborøn

Incident:

Unknown "lump" of reddish solid found on the quay in Thyborøn. Unloaded by trawler. Appearance similar to CWA dumped in the Baltic Sea after WWII.

Possible target analytes:

Mustard gas and organic arsenicals possibly mixed with explosives.

Items analysed:

The unknown red solid.

Case #2: Suspected CWA in Thyborøn

Instrumental methods used:

Presumptive testing on-site:

- CWA detection powder → Red stains indicative of mustard gas
- FPD → Possible presence of sulphur compounds
- FTIR → Naphthalene but with possible absorption bands attributable to mustard gas

Confirmatory analysis in the laboratory:

- ICP-MS → No presence of organic arsenicals
- XRF → No presence of organic arsenicals
- GC-TEA → No presence of organic explosives
- GC-MS → Naphthalene and breakdown products associated with naphthalene

Conclusion:

Naphthalene of unknown origin.
No mustard gas or other CWA's detected.

Case #3: Chemical burn

Incident:

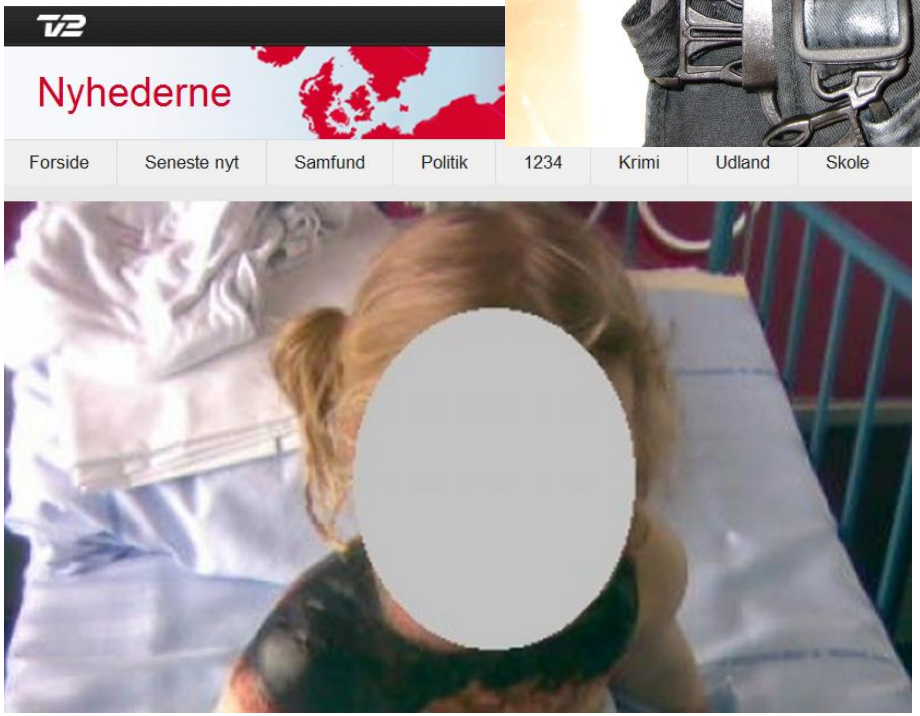
2 year old girl with severe chemical burns.
The girl was drenched in liquid while sleeping in a baby carriage on a balcony.
Circumstances unknown.

Possible target analytes:

Corrosive liquids.

Items analysed:

Safety rein
Baby carriage cover
Baby duvet



Case #3: Chemical burn

Instrumental methods used:

pH sticks → pH >11
IC-MS → No anions
IC → Na^+ and K^+
XRF → No presence of aluminium (theory: use of "Bottle Bomb")
FTIR → Unspecific spectrum similar to NaOH and KOH

Conclusion:

Corrosive liquid containing NaOH and KOH. Most likely drain cleaner or an oven cleaning product.

Case #4: Unknown powder

Incident:

On election day an unknown greenish powder was found at a school. The powder caused illness in several people. Since the school was used as a polling station hundreds of people was expected during the day.

Possible target analytes:

Unknown toxic chemical.
Anthrax was ruled out due to symptoms with fast onset.

Items analysed:

The unknown powder.

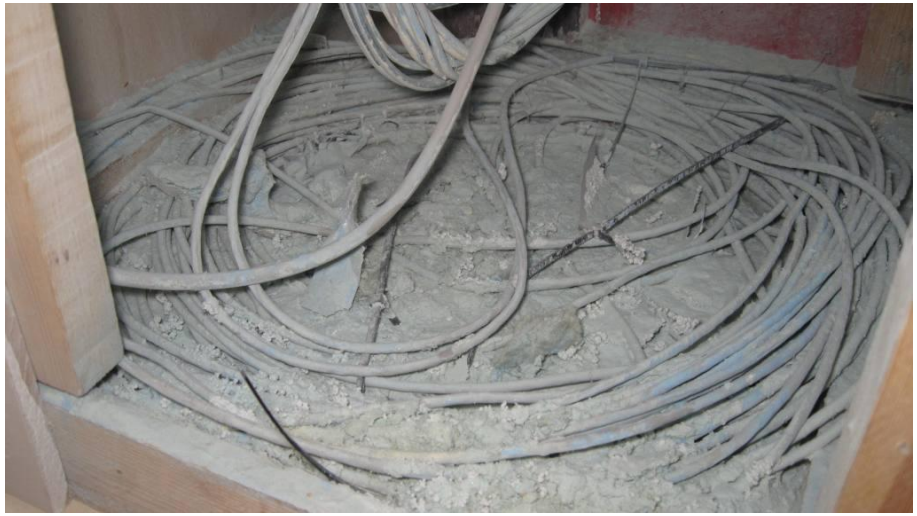
Case #4: Unknown powder

Instrumental methods used:

IC-MS → SO_4^{2-} and PO_4^{3-}
IC+ → NH_4^+
GC-MS → No organic chemicals
FTIR → Spectrum consistent with powder from fire extinguisher

Conclusion:

ABC powder from a dry powder fire extinguishers (mix of ammonium sulphate and ammonium phosphate). No obvious explanation of symptoms.



Questions?

We prefer to be on target...