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Forensic Science Northern Ireland (FSNI)

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FSNI Introduction

- FSNI is a government body that delivers multidisciplinary forensics, all performed under one roof.
- We work mostly with customers in Northern Ireland but occasionally other parts of the UK and further a field.
- We are a small organisation with 200 staff in total.

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FSNI Forensic Scope

- Forensic disciplines within FSNI include:-
  - Biological Evidence Recovery
  - DNA Analysis
  - Explosives & Trace Microchemistry
  - Expert Fingerprint Recovery
  - Firearms
  - Physical Methods –footwear, paint & glass
  - Documents
  - Electronics
  - Alcohol, Drugs & Toxicology (AD&T)

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AD&T

- Alcohol drugs and toxicology are one team within FSNI. We have cross skilled laboratory and reporting staff .
- To avoid contamination concerns all three laboratories are physically separated with certain movements between them restricted.
- We have a small instrument team dedicated to routine maintenance of complex analytical equipment, validation projects and R&D.

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AD&T Staff

- Laboratory Staff (25)
  - 2 Laboratory attendants
  - 8 Assistant Scientific Officers
  - 11 scientific Officers
  - 3 Higher Scientific Officers:
    - 1 x Tox/Alc manager
    - 1 x Drugs manager
    - 1 x Instrument team manager
  - Section manager

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- Reporting Staff (12 Reporting Officers)
  - 8 Alcohol & Toxicology reporting staff
    - 2 senior reporting officers
    - 5 reporting officer
    - 1 training reporting officer
  - 5 Drugs reporting staff
    - 3 senior reporting officers
    - 2 training reporting officers

A few of the reporting team are crossed skilled to report both tox and drugs cases.

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Quality

- FSNI Quality management system is accredited by UKAS (United Kingdom Accreditation Service) to ISO17025 standard.
- FSNI is in adherence with the UK Forensic Science Regulator's working practices
- FSNI maintains an extensive annual internal audit program across all disciplines and participates in external PT schemes.

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What is Forensic Toxicology?

- Forensic toxicology relates to the detection, measurement and interpretation of the effects chemicals have on the body to aid a medical or legal investigation.

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Toxicology at FSNI

- We work with two main customers:-
  - State Pathologist Department (SPD)
  - Police Service of Northern Ireland (PSNI)

On occasion we take in private work from other customers including, the Police Ombudsman and the Harbour Police Force.

We process approximately 1400 cases a year for toxicology.

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Case Types

- Driving related casework
  - Alcohol and/or drugs
- Death casework (non-suspicious)
  - Suicides
  - Sudden deaths/RTC's
  - Drug related deaths
- Criminal Casework
  - Suspicious deaths/Murders/Fatal RTC's
  - Serious Assaults
  - Sexual offences/Rape
  - Child cruelty/abuse cases

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How do we perform toxicology analysis

- Complex analytical processes involving multiple extraction techniques combined with various instrumental analysis.
- Time consuming process involving a number of analytical stages (largely dependent on number of drugs detected in the case).
- Stringent quality controls to ensure accurate results reported within criminal justice system (much tighter quality controls than clinical toxicology).

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Toxicology samples

- Blood
- Urine
- Stomach Contents
- Vitreous Humour
- Tissue samples (e.g. muscle, organ)
- Hair

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Additional Samples/Information

- Hospital samples (ante-mortem)
- Medicines deceased had access to or was prescribed, including recent prescription/abuse history
- Lists or photographs of branded medicines or packaging at the scene
- Submission of unknown/illicit drugs or associated paraphernalia for analytical identification
- Witness reports of alcohol and/or drug consumption and deceased's behaviours prior to death

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Scope of Toxicology at FSNI

- FSNI routinely screens for approximately 100 drugs using one method with the capabilities to further confirm and quantify these drugs. FSNI's screening is far more expansive than our 'routine' product.
- We cover a wide range of both illicit drugs and pharmaceutical/prescribed medicines.
- FSNI is unique as drugs and toxicology teams are joint and share information on emerging drugs and drug trends to ensure tox analysis is in line with drug culture in NI.

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Scope of Toxicology at FSNI

Routine Screening at FSNI includes:-

- Benzodiazepines (diazepam, alprazolam, temazepam and phenazepam)
- Opiates (heroin, morphine, fentanyl, tramadol and codeine)
- Drugs of abuse (amphetamine, MDMA, cocaine methamphetamine, cannabinoids, cathinones)
- Pharmaceuticals (antidepressants, sedatives, antipsychotics, antihistamines, analgesics)

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Additional Screening

FSNI also routinely screens for an additional 60 substances that fall outside of our routine screen product, including:

- fentanyl
- pregabalin and gabapentin
- additional pharmaceutical medications
- metabolites of common drugs
- a range of newer Psychoactive Substances including ‘designer benzos’ and synthetic cannabinoids
- volatiles (methanol, acetone, butane, propane, toluene)
- cyanide

Hundreds more can be screened for on the basis of their accurate molecular mass

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Current Toxicology Trends

- Designer Benzodiazepines
  - NI has a significant issue with benzodiazepines use, both prescription and illicit preparations.
  - Since 2017 we have seen a steady trend of emerging 'designer benzodiazapines'
  - Alprazolam → Flualprazolam → Flubromazolam → Flubromazepam → Meclonazepam → Bromazolam
  - In the last few weeks FSNI has identified two new 'designer benzodiazepines' – clobromazolam (phenazolam) and bromonordiazepam

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Current Toxicology Trends

- ‘Nitazenes’ – synthetic opioids
  - Multiple alerts across Europe and the UK relating to fatal intoxications and drug detections of various ‘nitazenes’.
  - It has been reported that some ‘nitazenes’ have been detected in tablets with other designer benzo’s and also in illicit oxycodone tablets.

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NPS complications

- No data regarding potency, toxicity or adverse effects (physical or psychological)
- Readily available, e.g. internet
- Access to certified reference standards
- Analytical approach for detection & measurements unknown
- Stability of the drugs in biological samples
- Strength and contents of illicit preparations
- Rapidly changing trends

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Current Toxicology Trends

- Poly Drug Use-
  - FSNI defines Poly drug use as 2 or more DOA
  - In 2021 166 cases were submitted by PSNI related to sudden or drug related deaths
  - 60% of these were identified as poly drug use
  - 17% of these included alcohol
  - 25 % the COD was known toxicity and 75% of the COD's were unknown at the time of submission

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Current Toxicology Trends

- Poly Drug Use
  - Number of parent drugs per case averaged 5 (range 2-11)
  - The top 5 drugs encountered in these cases were diazepam, pregabalin, Cocaine, cannabis and flubromazolam

Diazepam 59	**Etizolam 13**	**Gabapentin 9**	**Bromazolam 4**
Pregabalin 59	**Tramadol 12**	**Alprazolam 7**	**Fentanyl 3**
Cocaine 46	**Methadone 11**	**DHC 5**	**MDMA 3**
Cannabis 46	**Heroin 10**	**Zopiclone 5**	**Amphetamine 3**
Flubromazolam 28	**Morphine 10**	**Oxycodone 5**	**CDZP 3**
Buprenorphine 18	**Codeine 10**	**Ketamine 4**	**Flualprazolam, meclonazepam, flubromazepam 9**

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Case 1 (9)

- Buprenorphine 0.0016 mg/L
- Norbuprenorphine Detected
- Flualprazolam 0.009 mg/L
- Flubromazolam 0.002 mg/L
- Diazepam 0.13 mg/L
- DMV 0.19 mg/L
- Temazepam Detected
- Oxazepam Detected
- Pregabalin 5.4 mg/L
- Zopiclone 0.02 mg/L
- Sertraline 0.26 mg/L
- Norsertraline Detected
- Mirtazapine 0.01 mg/L
- Desmethylmirtazapine Detected
- Carboxy-THC Detected

Case 2 (5)

- Diazepam 0.35 mg/L
- Desmethlydiazepam 0.44 mg/L
- Temazepam 0.01 mg/L
- Oxazepam 0.02 mg/L
- Duloxetine 0.18 mg/L
- Mirtazapine 0.07 mg/L
- Desmethylmirtazapine 0.05 mg/L
- Propranolol 0.05 mg/L
- Risperione 0.008 mg/L

Case 3 (8) – 4 opiates

- Tapentadol 6.6 mg/L
- Tramadol 8.1 mg/L
- Desmethyltramadol 1.8 mg/L
- Oxycodone 0.16 mg/L
- Codeine 0.11 mg/L
- Morphine Detected
- Pregabalin 8.9 mg/L
- Flubromazolam 0.046 mg/L
- Diazepam 0.55 mg/L
- Desmethyldiazepam 1.4 mg/L
- Oxazepam 0.13 mg/L
- Temazepam 0.13 mg/L
- Carboxy-THC Detected (less than 0.01 mg/L)

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GHB (gamma hydroxybutyrate)

- Not detected by routine toxicology screening and requires targeted analysis
- Is associated with abuse and has a prevalence in a ‘chem sex’ setting
- Is produced naturally in the body at lower levels which can complicate interpretation/detection.
- Should be considered in all suspected drug deaths with no cause of death and negative toxicology.

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Emergence of Sodium Nitrite in Suspected Suicides

ELSEVIER

Increased prevalence of sodium nitrite suicides in South Australia

Lilli Stephenson [1], Steven Wills [2], Corinna van den Heuvel [1], Melissa Humphries [3], Roger W. Byard [1, 2]

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Sodium nitrite ($NaNO_2$) is a water-soluble, white-yellow coloured crystalline powder with broad industrial applications.[1] In Australia, it has also been used to humanely control growth of feral pig populations.[2] While several cases of accidental consumption have been reported in recently emerged as an increasingly popular m This method has been recommended in The P additional information and 'suicide kits' availa 10 cases of intentional sodium nitrite ingestion Forensic Science South Australia and the Nati All 10 cases occurred in the latter 3 years of the history of depression or chronic illness and de mortem signs of methemoglobinaemia (blue-g dark brown discolouration of blood and intern significant emerging public health issue. Awar abuse trends, clinical symptoms and post-mortem signs by health professionals and forensic pathologists is critical to effectively identifying these cases at presentation and autopsy.

The Journal of Emergency Medicine AAEM

Sodium Nitrite Ingestion: an Emerging Trend in Suicide Attempts Shared via Online Communities

Sean D. McCann, MD • Joseph M. Kennedy, MD • Marit S. Tweet, MD • Sean M. Bryant, MD

DOI: https://doi.org/10.1016/j.jemermed.2020.10.021 Check for updates

Death by Nitrite Intoxication: Report of 14 Cases

Min Jee Park[1], Ock Kim[2], Hongil Ha[1]

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Sodium nitrite intoxication is a primary cause of severe methemoglobinemia, which may be fatal. In the past, nitrite-related deaths were rare, but cases of

ELSEVIER

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A fatal case by a suicide kit containing sodium nitrite ordered on the internet

Carlos Durão [a, b], Frederico Pedrosa [a], Ricardo Jorge Dinis-Oliveira [c, d, e]

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Mother speaks out against suicide forum after son's death

By Emily McGarvey
BBC News NI

8 May

Images in Forensics | Published: 27 November 2020

Another suicide by sodium nitrite and multiple drugs: an alarming trend for "exit"?

Carlos Durão, Frederico Pedrosa & Ricardo Jorge Dinis-Oliveira

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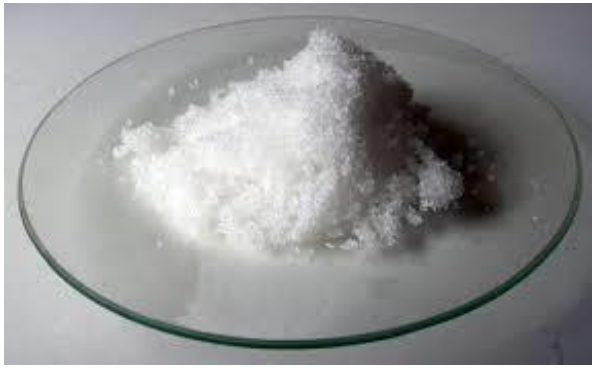
Sodium Nitrite/Nitrate

- Over the two years we have had 5/6 nitrite cases.
- Some cases contained white powder that was labelled.
- Commonly used as a food additive for curing meat.
- Highly soluble in water – Available in “Suicide Kits” online
- Interferes with the haemoglobin in blood cells → Death by asphyxia



- No method within FSNI.
- Through joint discipline investigations we were able to create a method using equipment belonging to the explosives department to confirm elevated levels in the blood and associated powder.
- There is only 1 other lab in the United Kingdom that can perform this analysis at a significant cost due to it being such a bespoke process.

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Thank you

Any Questions ?

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