



DoD Chemicals of Concern

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Special Interest Compounds

- *NOT an official DoD list*
- Unique to DoD
 - Energetics
- Used in High Volume
 - Perchlorate
 - 1,4-Dioxane
 - NDMA
- Historically Overlooked
 - AFFF

Perchlorate

Uses

- Solid fuel rockets
- Explosive devices
- Flares
- Fireworks



Perchlorate

- Environmental impact
 - Persistent
 - Water soluble
 - Mobile
 - Affects thyroid behavior
- Challenges/Issues
 - Low regulatory action levels
 - 1 ppb, sub-ppb
 - CA emergent chemical of concern
 - Action level 4 ppb

Perchlorate

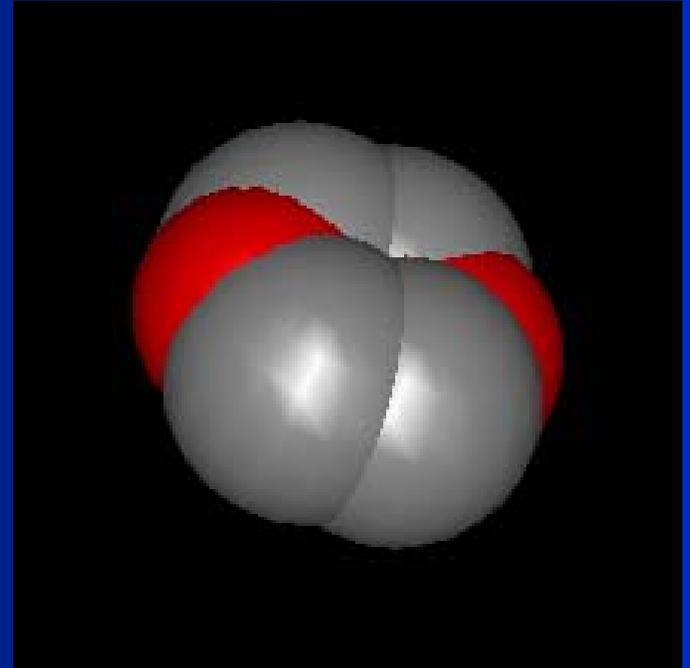
- Analysis - Method 314.0
 - IC conductivity detector
 - RL 4 ppb
- Alternatives
 - IC MS detection
 - IC MS/MS detection
 - Capillary zone electrophoresis
 - ???

Perchlorate

- EDQW initiatives
 - State-of-science roundtable
 - Focus on analysis
 - Participants
 - DoD
 - EPA
 - Laboratories
 - Instrument manufacturers
 - Academics

1,4-Dioxane

- Uses
 - Acid acceptor in 1,1,1-TCA
 - Replacement for TCE
 - Solvents
 - Consumer products
- Environmental impact
 - Volatile
 - Water soluble
 - Mobile
 - Persistent
 - Probable human carcinogen



1,4-Dioxane

- Challenges/Issues
 - Not detected by usual VOC analysis
 - No current MCL, PHG, UCMR values
 - CA emergent chemical of concern
 - Action level 2 ppb
- Alternatives
 - Method 8260 with azeotropic distillation (Method 5031)
 - Method 8270(Mod) with isotopic dilution and SIM

NDMA

N-Nitrosodimethylamine

- Uses
 - Degradation product of 1,1-dimethyl hydrazine
 - UDMH
 - Aerozine 50
 - Liquid fuel rockets
 - Water treatment byproduct
 - Produced in body, foods, smoke



NDMA

- Environmental impact
 - Probable human carcinogen
- Challenges/Issues
 - CA emergent chemical of concern
 - Action level 0.01 ppb
 - Water soluble
 - Difficult to purge or extract
 - Volatile
 - Traditional GC/MS analyses do not work

NDMA

- Alternatives
 - IC PAD detection
 - GC/MS CI SIM detection, large volume injection
 - GC/HRMS with isotopic dilution



Energetics

- Uses
 - Artillery shells
 - Bombs
 - Grenades
- Environmental Impact
 - Unique distribution patterns
 - Chunks
 - Not especially water soluble

Energetics

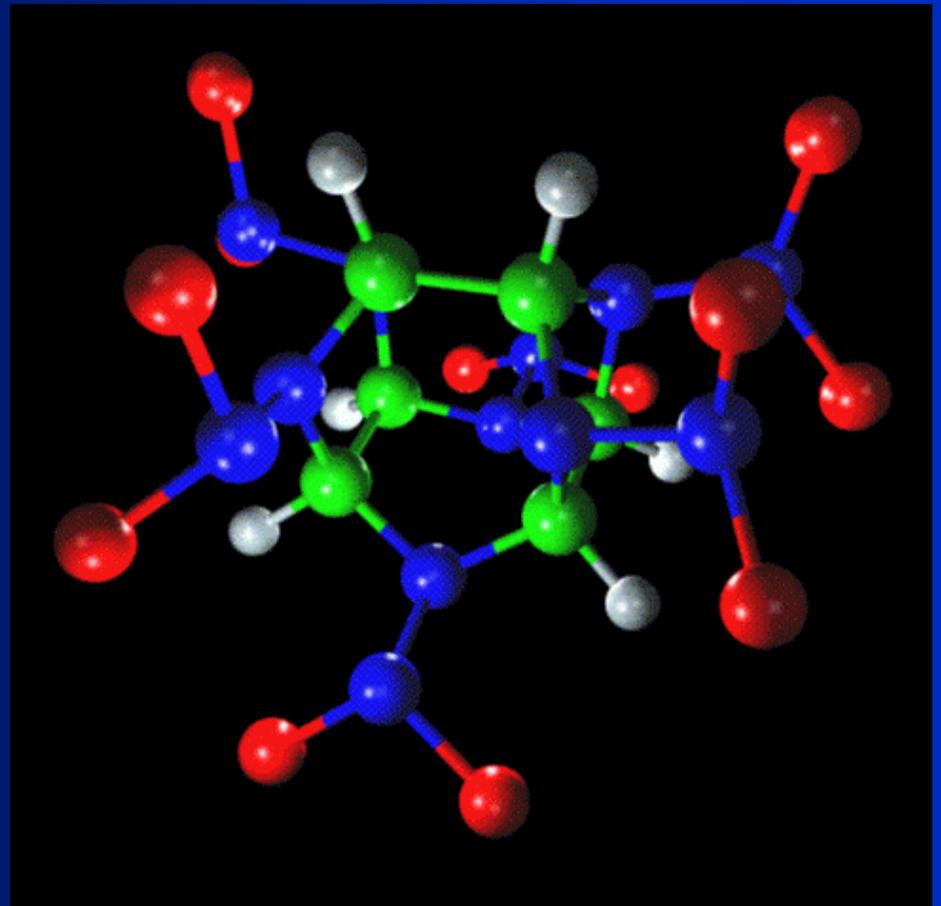
- Challenges/Issues
 - RDX on Contaminant Candidate List (CCL)
 - States are adding to toxic pollutant lists
 - Pushing for lower detection levels
 - Tetryl identified as a “poor performer” in solid matrices
 - DoD LCS study
 - **Mean recovery: 80%**
 - **Standard deviation: 23%**
 - Conventional analysis
 - HPLC UV detection

Energetics

- DoD initiatives
 - LCS study identified SPE as superior method of extraction from aqueous matrices
 - Mean recoveries 88 – 106%
 - Standard deviations 6 – 18%
(Tetryl 25%)
 - Range sampling studies identified composite sampling as preferred approach
- Alternative analysis
 - HPLC MS detection

Energetics – CL20

- Hexanitrohexaazaisowurtzitane (HNIW)
 - Low signature propellant
 - Tomorrow's HE



Energetics – CL20

- Challenges/Issues
 - Evaluate potential impact prior to widespread use



Energetics – CL20

- DoD Initiatives
 - Environmental impact
 - Fate and transport investigations
 - Toxicity investigations
 - Biodegradation investigations
 - Analytical Method
 - Identical to Method 8330
 - **HPLC UV detection**
 - SPE for aqueous samples
 - Ultrasonic extraction for soils
 - MDLs
 - **0.1 ppb (water)**
 - **35 ppb (soil)**



AFFF/PFOS

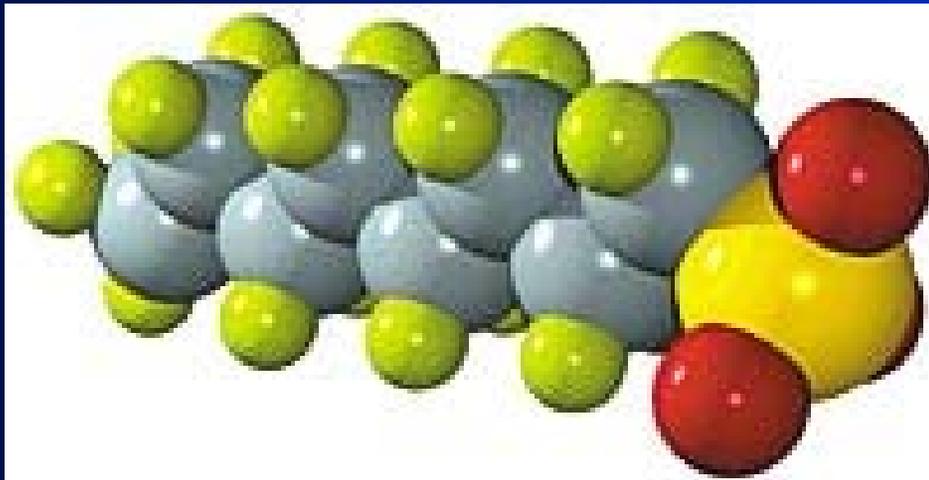
(Aqueous Film Forming Foam)



- Uses
 - Fire suppression systems
 - Hangars
 - Fire trucks
 - Other products
 - Scotchgard
 - Gore-Tex

AFFF

- Environmental Impact
 - Contains perfluorinated sulfonates (PFOS)
 - Persistent
 - Bioaccumulative
 - Ubiquitous
 - 3M ceased production Dec 2000



AFFF

- Challenges/Issues
 - Traditional focus on TOC
 - EPA risk assessment for related compound (PFOA)
 - Nonstandard analysis
 - Research laboratories
 - SPE for aqueous samples
 - HPLC MS
 - HPLC MS/MS (confirmation)
 - F-19 NMR
 - Avoid Teflon

Summary

- Variety of unique challenges/opportunities exist
- Need to partner and cooperate to find solutions

