

Liquid Scintillation Users' Forum

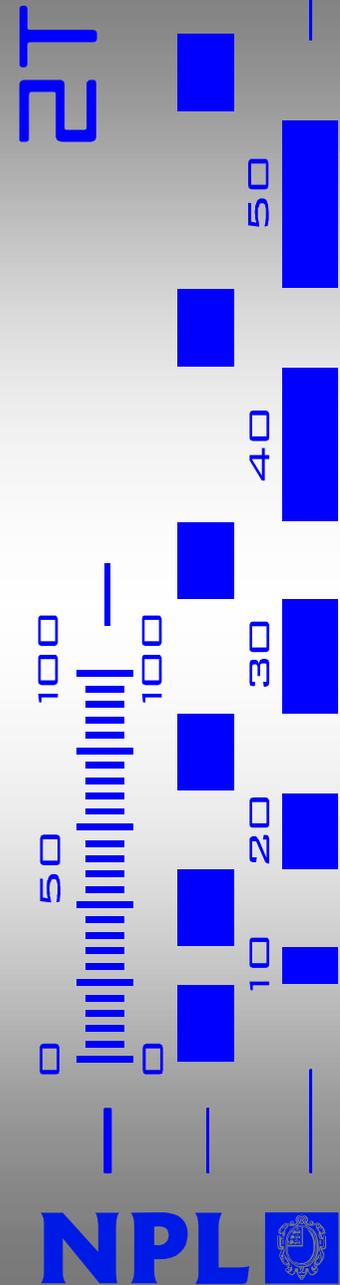
A Study of Options for LSC Waste Management



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Background

- Increased use of LSC at NPL → Increased levels of waste
- Cannot dispose of on-site - can consign but expensive for α -waste
- Identify commercial plant – also expensive!
- ∴ Examine all options for waste management
- Presentation will describe
 - project plan
 - progress to date

Project plan

1. Define α -waste
2. Identify disposal options
- unprocessed/processed waste
3. Identify processing options
and conduct initial trials
4. Review source preparation
and scope for other techniques
5. Develop procedures / implement changes



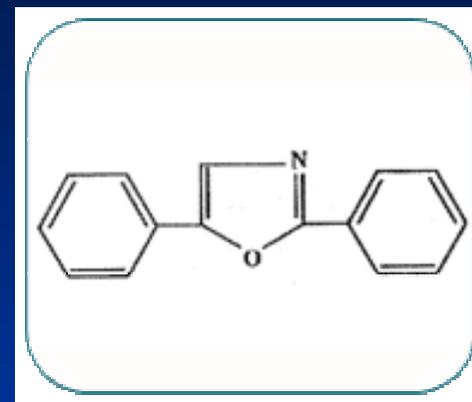
1. Define α -waste

- LSC α -sources made in 2003:
 - 6 nuclides (^{208}Po , ^{222}Rn , ^{223}Ra , ^{236}Pu , ^{241}Am , ^{243}Am)
 - 4 matrices (water, HNO_3 , HCl , sodium citrate solution) in various concentrations
 - 6 scintillants (Ecoscint H, Mineral Oil Scintillator, Picofluor, Readysafe, Ultima Gold AB, Uniscint BD)

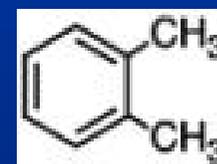
1. Define α -waste (cont.)

Basic composition of scintillant

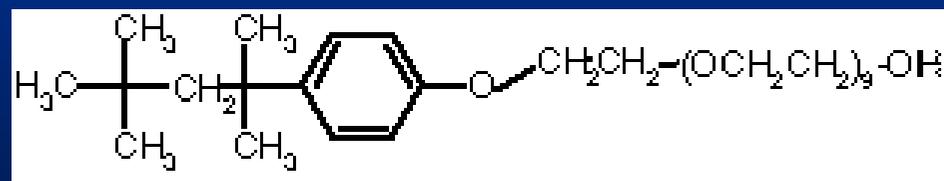
- ◆ Scintillator solute(s) (e.g. 'PPO'):



- ◆ Primary solvent (e.g. xylene):

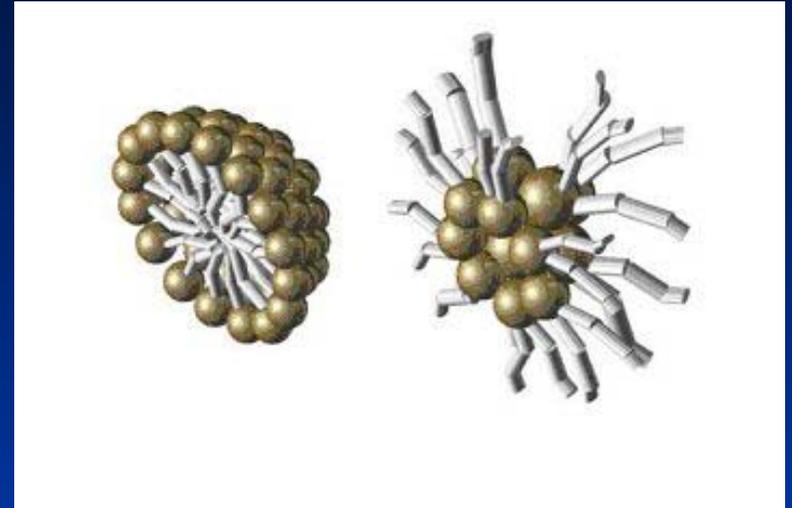


- ◆ Surfactant(s)
(e.g. Triton X-100):



1. Define α -waste (cont.)

- Most sources 'Water-in-oil microemulsions' – fine dispersion of aqueous sample



- \therefore Range of systems - aqueous phase tightly bound to organic phase

2. Disposal options

- a) Consign to disposal company as organic liquid waste**
 - no processing
 - user reliant on service

- b) Discharge directly as aqueous liquid waste**

- c) Consign to Drigg as solid waste**

3. Processing options and initial trials

➤ Aqueous waste

a) Separation of aqueous component (e.g. by using demulsifiers)



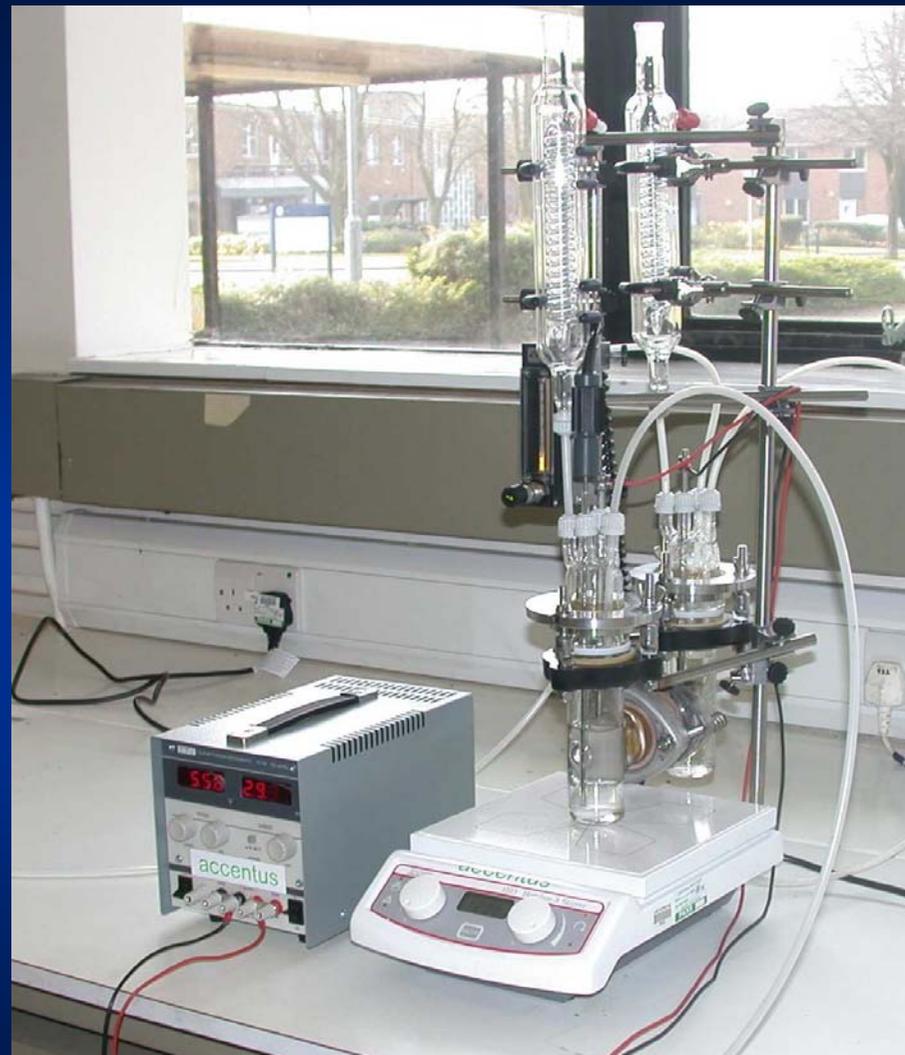
3. Processing options and initial trials (cont.)

- Discussed use of demulsifiers with manufacturers
 - emulsions will be 'very tight'
 - cannot predict which demulsifier to use
 - try a range
 - usually need heating, agitation, etc.

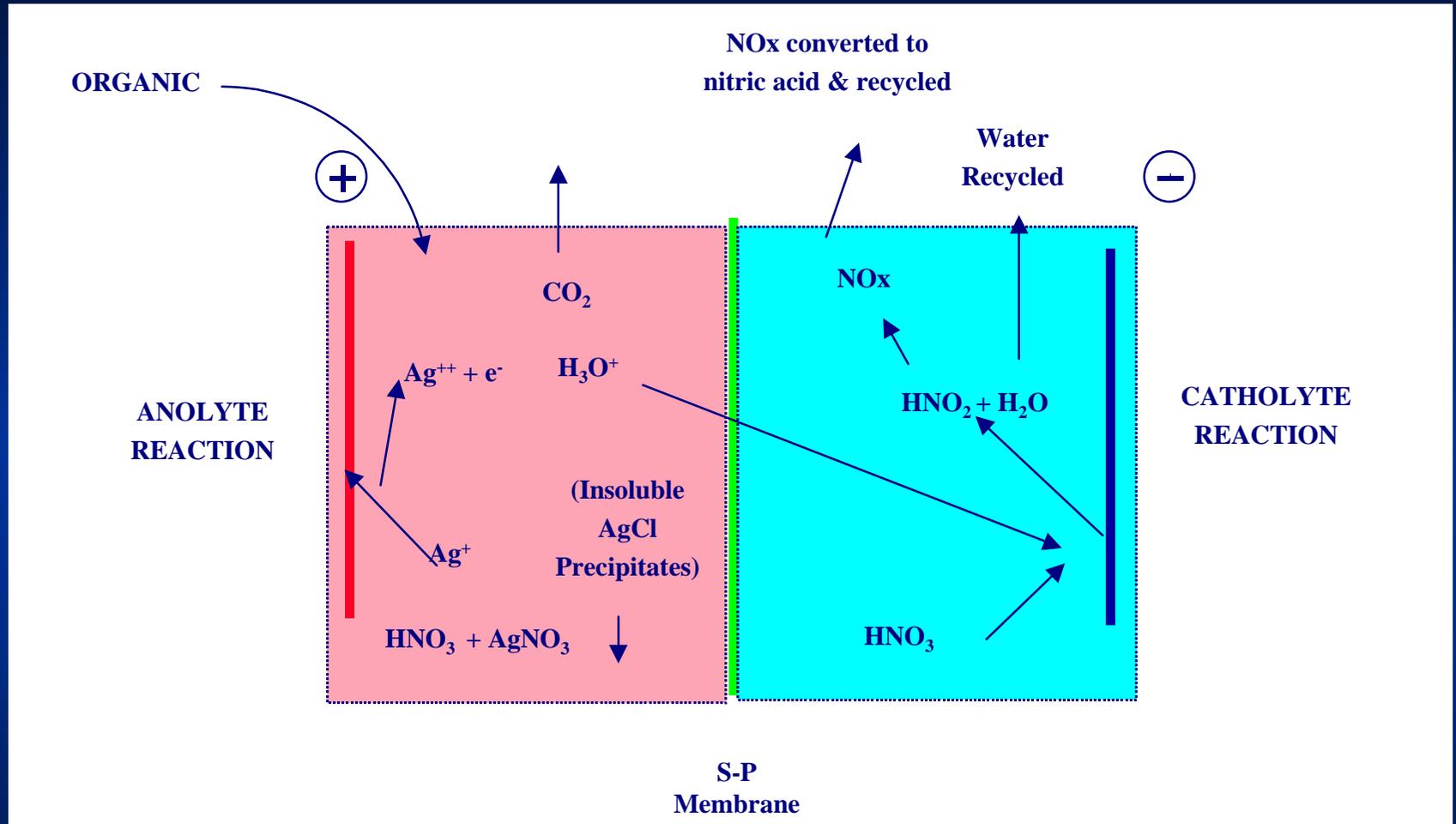
3. Processing options and initial trials (cont.)

b) Oxidation of organic component

- Preliminary trials on commercial equipment



3. Processing options and initial trials (cont.)



3. Processing options and initial trials (cont.)

- Tried Readysafe scintillant:

1-phenyl-1-xylethane (50 – 80 %)

alkylphenol ethoxylate (20 – 50 %)

- Standard operating conditions:

$T = 80 \text{ }^{\circ}\text{C}$

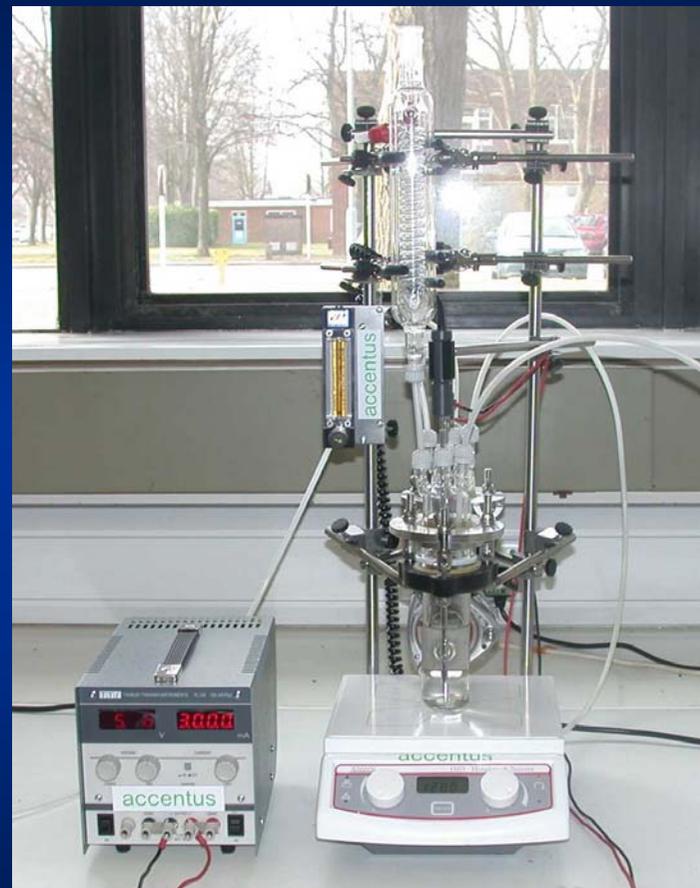
Current = 3 A

$\text{O}_2 = 12 \text{ ml min}^{-1}$

Stirrer = 1200 min^{-1}

3. Processing options and initial trials (cont.)

- **Throughput slow!**
 - approximately 4.5 h g⁻¹ scintillant
 - equivalent to 1 week per sample
 - try to improve by varying conditions



3. Processing options and initial trials (cont.)

➤ Solid waste

c) Solidification of bulk material

d) Ion exchange



4. Source preparation/scope for other techniques

- Little scope for reducing number of sources made
- Very limited scope for alternative methods

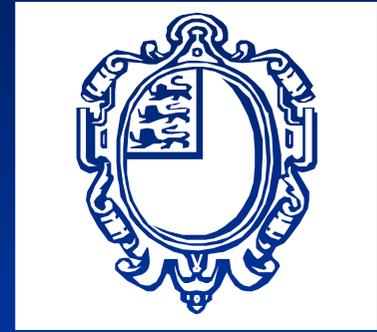
5. Develop required procedures

- Costs of consigning α -waste and of on-site oxidation similar
- Continue consigning as organic liquid waste
- Develop oxidation procedure as contingency
 - ongoing

Summary

- Amounts of LSC waste significant and disposal costly
- Little scope for reducing numbers of sources made
- Can oxidise – slow, but an alternative to consigning waste if needed - being developed
- May look at other processing options in the future

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