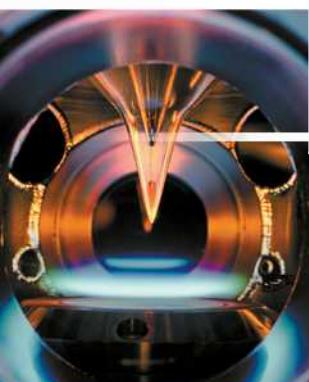


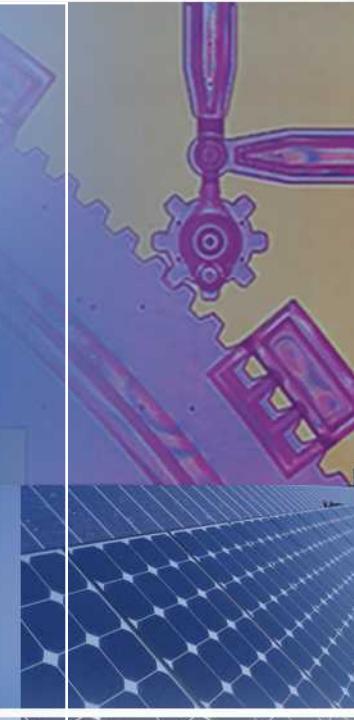
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Nitrated Bitumen Waste

Ideas for Determining the Reactivity of the Waste



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TGA/DSC-GC-MS

- Thermogravimetric Analysis (TGA) can provide information on reactions such as combustion by detecting rapid increases in temperature and weight loss from the sample.
- TGA coupled with Gas Chromatography Mass Spectrometry (GC-MS) will enable quantitative analysis of the evolving gases and bi-products as a result of heating of the nitrated bitumen.
- Destructive analysis technique.



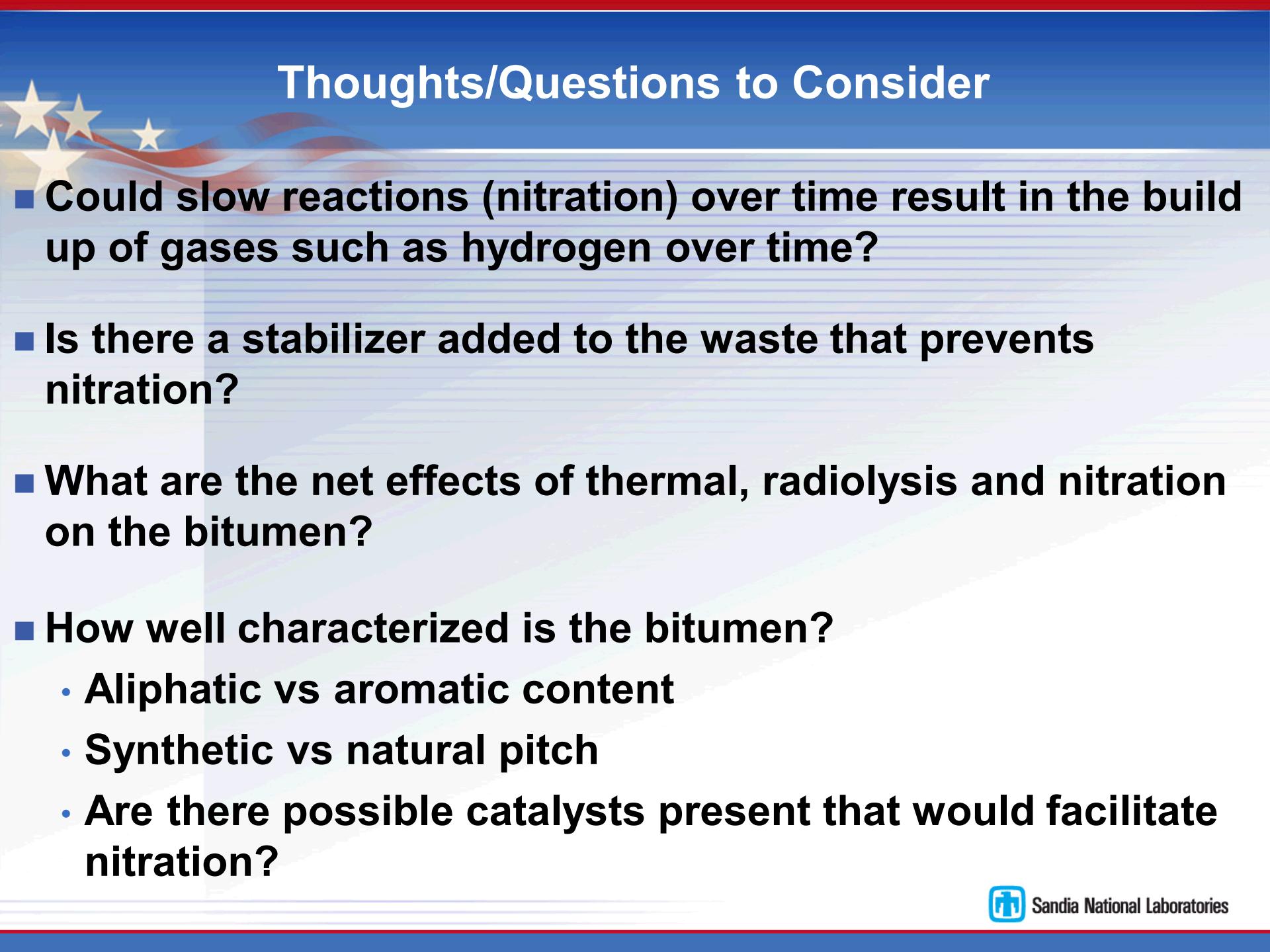
^{13}C - ^{14}N MAS (SPIDER)



- Coupled ^{13}C - ^{14}N Nuclear Magnetic Resonance with Magic Angle Spinning (MAS) can provide information on nitrogen connectivity to carbon in organic solids.
- Saturation Pulse Induced Dipolar Exchange with Recoupling (SPIDER) is a technique that enables the detection of nitrogen connectivity with aromatic carbon.
- Non-destructive Analysis.



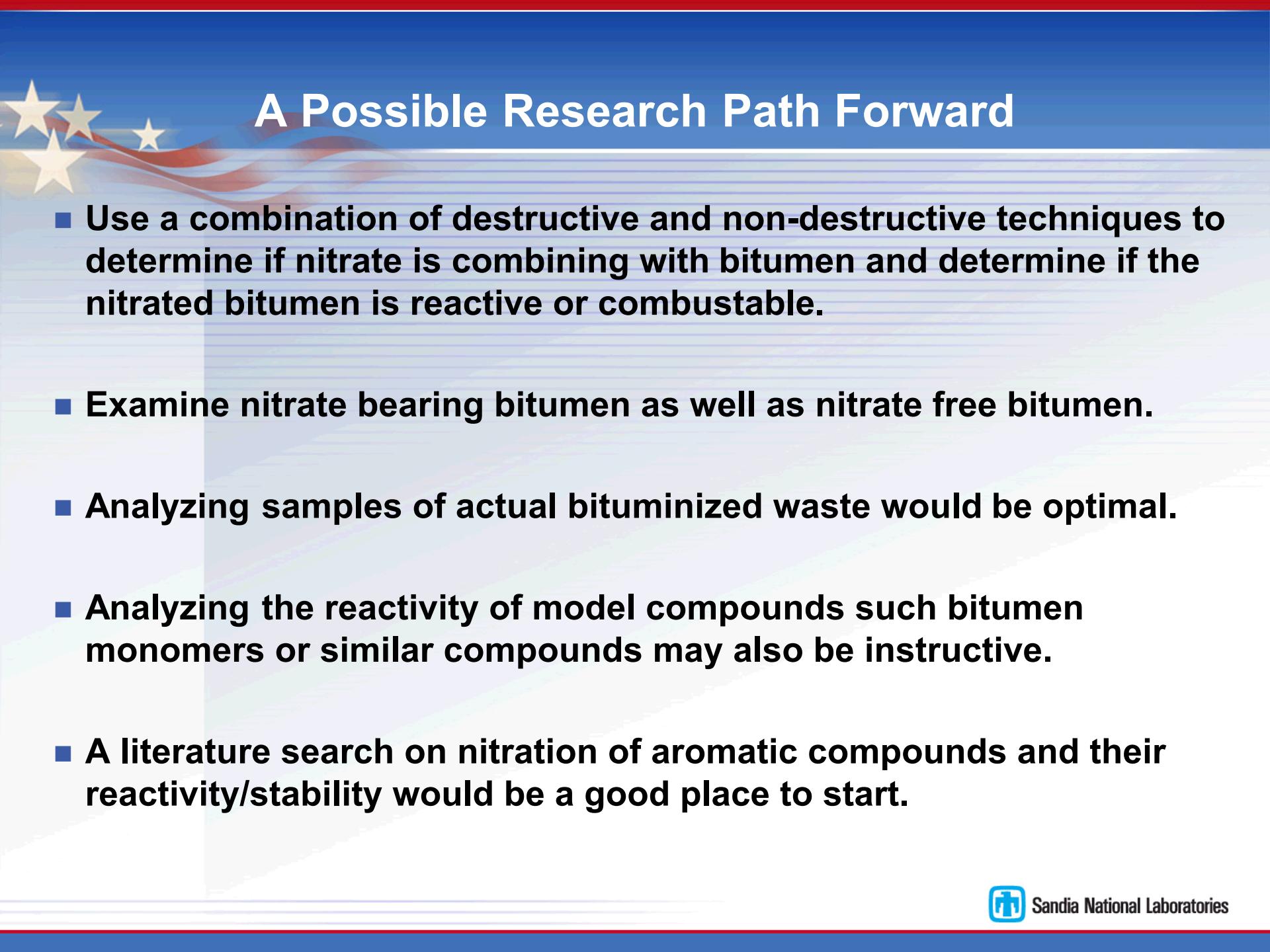
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Thoughts/Questions to Consider

- Could slow reactions (nitration) over time result in the build up of gases such as hydrogen over time?
- Is there a stabilizer added to the waste that prevents nitration?
- What are the net effects of thermal, radiolysis and nitration on the bitumen?
- How well characterized is the bitumen?
 - Aliphatic vs aromatic content
 - Synthetic vs natural pitch
 - Are there possible catalysts present that would facilitate nitration?





A Possible Research Path Forward

- Use a combination of destructive and non-destructive techniques to determine if nitrate is combining with bitumen and determine if the nitrated bitumen is reactive or combustable.
- Examine nitrate bearing bitumen as well as nitrate free bitumen.
- Analyzing samples of actual bituminized waste would be optimal.
- Analyzing the reactivity of model compounds such bitumen monomers or similar compounds may also be instructive.
- A literature search on nitration of aromatic compounds and their reactivity/stability would be a good place to start.

