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Overview of Hydrazine Fuels Infrastructure

Presented to:

LMP103S Technical Interchange Meeting

By:

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Hydrazine Requirements

- ◆ Most “hydrazine” is, MIL-PRF-26536, HPH-grade
 - No aniline
 - Produced by Arch Chemical (Lonza) in Lake Charles, LA
 - Used by spacecraft for in-orbit propulsion
 - Most are mono-propellant applications
 - HPH/N₂O₄ bi-prop engines are becoming less rare
 - NASA uses HPH most often in its science spacecraft
- ◆ Other “hydrazine” is MPH grade
 - Up to 0.5 wt% aniline
 - Was primarily used by Shuttle for APUs and HPUs
 - No longer in production by Arch
 - Once DLA inventory is depleted, MPH will no longer be available



Equipment

- ◆ Various containers are used in hydrazine service
 - All constructed of 304L SS
 - All pressure load and offload
 - Most containers are covered by various DOT SPs
 - Non-bulk containers
 - No pressure relief devices
 - DOT4BW specification w/ SPs
 - 5-, 30-, 55- and 120-gallon water capacity
 - Bulk containers
 - NASA 500-gallon GPTU
 - Industry-owned DOT110A500W cylinders

- ◆ Similar or identical container designs are used with MMH and N2O4



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Containers - GPTU

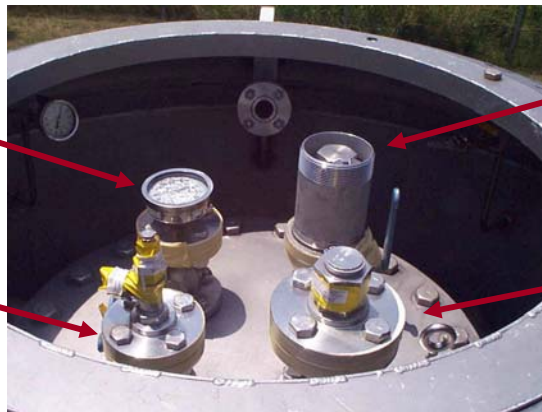


GPTU fluid system access is supported with roll-around platform and stairs



Gauge Valve

Pressurization/
Vent Valve



Relief Valve
W/ Isolation
Valve

Liquid Valve
W/ Dip Tube To
The Bottom
Sump



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Containers - Cylinders



DOT110 cylinder



DOT4BW
cylinder





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Toxic Vapor Scrubbers

- ◆ Hydrazine family fuels and N₂O₄ oxidizers produce toxic vapors
- ◆ Transfer operations use helium or nitrogen to move propellant from one container to another
- ◆ Receiving container must be vented to the atmosphere through a scrubber
- ◆ NASA standard 4-tower wet scrubber
 - Mobile and fixed versions
- ◆ Dry-bed scrubber used at Astrotech





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Personal Protect Equipment

- ◆ Hydrazine is toxic by both dermal and inhalation exposure
- ◆ “Class A” PPE is required
- ◆ NASA developed the SCAPE suit as an alternative to industrially available PPE
 - Fully encapsulated butyl-rubber-based suit
 - Supply breathing air via either back-pack or air-hose
- ◆ Emergency escape device
 - ELSA
 - 10-minute breathing air supply
 - Deployed in operational areas where a potential toxic vapor hazard exists



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PPE - SCAPE



Built-up suit meets the technician's size. The 35-pound liquid air-pack is adjusted for comfort.



The zipper is then closed providing the full encapsulation of the technician.



The suited technician is ready for work. Air-pack has 2-hr capacity. Radio-com allows free mobility.



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PPE - ELSA



ELSA storage box usually
located at evacuation route
exit points



ELSA in use



Summary

- ◆ If NASA were to implement an alternative to hydrazine?
 - Would only reduce (or eliminate) SCAPE for hydrazine replacement
 - SCAPE is required for MMH and N₂O₄ operations
 - May or may not reduce scrubber requirements due to ammonia being present in the LMP103S fuel
 - LMP103S is a blend; volatile components may be lost during transfer operations due to venting

- ◆ Alternative fuels will probably not be a significant cost factor at KSC and CCAFS unless all MMH and N₂O₄ requirements shift to less-toxic alternative propellants



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Acronyms

- ◆ APU – Auxiliary Power Unit
- ◆ DLA – Defense Logistics Agency
- ◆ DOT SP – Department of Transportation Special Permit
- ◆ ELSA – Emergency Life Support Apparatus
- ◆ GPTU – Generic Propellant Transfer Unit
- ◆ HPH – High Purity Hydrazine
- ◆ HPU – Hydraulic Power Unit
- ◆ MMH – MonoMethyl Hydrazine
- ◆ MPH – MonoPropellant Hydrazine
- ◆ N₂O₄ – Nitrogen Tetroxide; also NTO
- ◆ PPE – Personal Protective Equipment
- ◆ SCAPE – Self Contained Atmospheric Protective Ensemble
- ◆ SS – Stainless Steel