

EPP-HAZARDOUS CHEMICAL REPLACEMENTS **IN CHRONOLOGICAL ORDER**

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Sorted by chemical type.

Work in Progress:

- Chromic trioxide
- Machine shop chemicals
- MEK
- Methylene chloride
- Ozone depleters

- Various replacement or new EPP applications
 - o Toilet cleaners
 - o Bolt looseners
 - o Light duty cleaners
 - o Solvent 142
 - o Groundskeeping
 - o Bee spraying
 - o Cafeteria
 - o Silver cleaning
 - o Oil spill cleanup

- Chemical inventory reductions

HAZARDOUS CHEMICAL REPLACEMENTS

Work in Progress:

CHROMIC TRIOXIDE REPLACEMENT

- 7/11/03 status: The Hangar (4) needs a **large-job Iridite (chromic trioxide – carcinogen)** replacement. GRC maintains 2 research aircraft (Lear Jet 25 and DeHavilland DHC-6 Twin Otter). Prior to coating application, Iridite 14-2 is used to touch-up small areas. Surface prep is conducted by hand applying with wipes or cotton swaps. ESCTP funded projects involving non-chromate pretreatment, cadmium alternatives, and a hand-held laser. Per the TO Manager for the specifications (AF Corrosion Office), a new replacement product has been approved by the Air Force in December 2003. Prekote contains NMP and a less-hazardous form of butoxyethanol. Once approved by the Hangar staff, will order a sample to test. Involved: Steve Hayes.

MACHINE SHOP CHEMICAL REPLACEMENTS (1,1,1 TRICHCHLOROETHANE ,ETC)

- July 2003: 10 X 10 Wind Tunnel (85): Dan Kovach is testing replacements for **DoAll (with MEK)**. **ROCOL (with acetone)** is being tested as a replacement. 12-9-03 emailed to check status.

- July 2003: 9 X 15 Wind Tunnel: 7-8 email message: What is being used? – No response yet. August: currently involved in Return to Flight. 12-9-03 emailed.

- July 2003: 8 X 6 Wind Tunnel: 7-8 email message: What is being used? – No response yet. August: currently involved in Return to Flight. 12-9-03 emailed.

- July 2003: Materials Research (34): 7-7 emailed Joe Wilson with replacement product info, per his request. Potentially replacing **Osborn (1,1,1-trichloroethane, methyl isobutyl ketone, toluene, xylene)** and **Spray-On Blue Layout Fluid (MEK, methyl isobutyl ketone, toluene, xylene, 1-butanol)**.
12-9-03 mailed Joe Wilson to follow up.

- July 2003: Fab Shop (50) and Machine Shop (14): Emailed Gus Scarpelli, Bob Wells, Peter Tschen, and Elmer Bartels with info on replacement products for **Spray-on Blue Layout Fluid (MEK, methyl isobutyl ketone, toluene, xylene, 1-butanol)**, **Crown Blue Toolmaker's Ink (MEK, toluene)**, **Winbro Tap-Free (1,1,1-trichloroethane)**, and **Tap Magic Cutting Fluid (1,1,1-trichloroethane, dimethoxymethane, 1,2-butylene oxide, tert-butyl alcohol)**. 12-10-03 Peter Tschen is busy with reorg requests.

- July 2003: Electric Power Lab (301): Tom Dorony is testing **Safetap Tapping Fluid** and **Accu-lube LB1100 Metalworking Lubricant** as replacements for **Tap Magic Cutting Fluid Fluid (1,1,1-trichloroethane, dimethoxymethane, 1,2-butylene oxide, tert-butyl alcohol)**. 12-9-03 emailed to check status.

- January 2004 – Once Dana Sanvido in the Garage is finished testing the biobased **MMEP** as a bolt-loosener, we will ask the Machine Shops to test it as a replacement for various machine shop chemicals. Involved: Machine shops, Linda Sekura.

MEK

- October 2001: High Temperature Composites Lab (51 – 110) - **Ceramics density measurements** are being done with **MEK**, for accuracy, since water surface tension prevents total water penetration. Alternatives suggested: n-propanol, ethyl lactate, methanol, ethyl acetate, and cyclopentane. The most likely alternative is n-propanol. The surface tension less than MEK, allowing for increased accuracy; and risk to eyes, skin and respiratory system is much lower. Anna Palczer is testing n-propanol. Involved: Anna Palczer.

- February 2003: **Icing Tunnel – MEK estane boot removal** – need replacement

- Old boots: Toluene may work (still not very good for health) or PeerCo 321 (biobased) or acetone. Per Betty Hodgson in IH, acetone would be best.

- New boots: Goodrich published a procedure for removal. We're supposed to pull the boot off at a 90° angle to the blade, which tends to break the cement off of the blade and keep it on the boot. They say to use a PVC pipe and roll the boot onto the pipe. The trick is to get the edge up first, using PeerCo 321 or alcohol, then peel, then 321 or whatever to get the rest off.

We can also remove easier if we score the boot down the middle, using hook knives so as not to score the blades.

- Another option is Shell Rubber Solvent 332.

Acetone and PeerCo 321 will be tested once boot replacement needs to be done. Involved: Dave Justavick, Dave Sheldon, Mike Lupton.

- 2/24/03 Betty Hodgson found: Call Henry -77: On a reactor seal, they are using **MEK as a PVC pipe cleaner**, along with TFG and cyclohexane glue. 12-9-03 Sent an email to Luann Keys and Denise Bluell, inquiring.

- February 2003: **Instrument Research (77)**: Usually keeps one gallon of **MEK** on hand to **use as a last resort** for removing adhesives/gaskets/paint when acetone or other chemicals won't work. Need to find a better chemical.

METHYLENE CHLORIDE

- Summer 2002: Garage – **A/C flush** – replace **methylene chloride** with a product that contains **100% plant oils**. Summer 2003, no opportunity to test yet. Will try once the opportunity arises. Involved: Howard Gregory.

- Summer 2002: **Bldg 49 – Epoxy dissolve with methylene chloride** – Need a replacement.

- July 3, 2003 – Samples were sent to an R&D company to try to dissolve epoxy. John Setlock would accept a process that requires heating, so this may be successful. Possibility for different epoxy? Waiting for response from the R&D company.

Involved: John Setlock, Linda Sekura.

- Also - Miles McQuarter – need **epoxy dissolver** like John Setlock. Miles will wait to see what works for John. Involved: Miles McQuarter, Linda Sekura.

- Also - Basic Materials Lab (106 – 133) – **methylene chloride used to remove excess epoxy** from ceramics. Involved: Linda Sekura.

- July 2002: **Hangar – Paint removal with 100% liquid methylene chloride** – Need a replacement. Tried a HQ-suggested product, a gel that contains less MeCl, but the Hangar needs a liquid for small and tight spots.

- One R&D company could only provide an alternative that needed to be heated, which is not feasible for the Hangar.
- Per KSC audit – MEK and MeCl for coating removal may be replaced by:
 - NASA and the DoD with a Class I hand-held laser system. A JTP and PAR were developed. Need to follow-up on status.
 - Another technology is the Boeing FLASHJET pulse optical energy coating removal process. This was beginning to gain acceptance with the DoD, especially at the Naval Air Station-Kingsville for the Navy's T-45 program, and at Army AF, and other Naval installations. . .Also at USA-SRB KSC and NASA Shuttle Logistics Depot at Cape Canaveral.
- 7-31-03 email Shannah Trout @ KSC regarding the laser and FLASHJET technology above – anyone using? Contacts?

Involved: Steve Hayes, Linda Sekura.

- Summer 2003: Gilcrest – **Gasket removal** – Replacing methylene chloride with Stoddard Solvent/n-propyl-bromide temporarily. Looking for a better alternative, though. One gasket adhesive type (RTV) may be replaced. The other two (Permatex and Master Gasket) need a stronger/different formulation. Will submit MSDS's for these two to R&D vendors. Involved: Jim Shultz, Linda Sekura.

OZONE DEPLETERS

- 3-1-03: Refrigeration – GRC uses a variety of refrigerants for facility cooling. **ODCs used in chillers include CFC-12 and HCFC-22**. Walt and Christie are working on these projects through the Life Cycle Analysis program. Involved: Walt Kocher, Christie Myers.

- Spring 2003: Gilcrest – **Defluxer** – Replace HCFC 141b with whatever I can find. Same issues as for electrical contact cleaners – ODCs, flammability, plastic sensitivity, etc. Once we find a good electrical contact cleaner, will find similar product for defluxing. Involved: Jim Shultz, Linda Sekura.

- Spring 2003: Calibration Lab – **Defluxer** – Replace HCFC 141b with whatever I can find. Same issues as for electrical contact cleaners – ODCs, flammability, plastic sensitivity, etc. Once we find a good electrical contact cleaner, will find similar product for defluxing. Involved: Perry LaRosa, Linda Sekura.

- Spring 2003: Calibration Lab – **Oxygen cleaning of transducers** – using **CFC**. Back burner for now to find a replacement. They are recycling the product.
- Also using **Freon for final flush**. (See also **Recycling**). Involved Perry LaRosa, Linda Sekura.

- July 14, 2003: Energy Conservation Lab (302) – using **Aero-Duster MS-220 with CFC-12** to remove dust from printed circuit boards, computer keyboards and other components. Also, is Aero-Duster being used elsewhere across the facility. P. Antczak received an email to ask if they are still using. Involved: Linda Sekura

- July 24, 2003: Plum Brook is looking at the possibility of disposing of \$15K worth of **1,1,1 trichloroethane** now stored in their clean room. The P2 Team is exploring alternatives for disposal or sale. Most likely possibility: Transfer to another center. Involved: Bob Lallier.

- July 24, 2003: Microgravity Research (110): for ISS components: **Hi purity clean valves, tubing, manifolds, gauges, pressure transducers, etc.**: Need to replace 1,1,1 **trichloroethane** w/HFE-7100 (HCFC-225g possible?). In the meantime, there may be the option to distill 111 for reuse.

- Also must use **CFC-113** for ISS. Need a CFC-113 recovery system.

- Suggestions: Replace CFC-113 with HCFC-225g, HFE-7100, or other EPA-approved.

Rick Czernek is interested in alternatives for both 1,1,1 trich and CFC-113. Suggested DOT 111/113 and HFE-71DE. Need to review detailed correspondence, explaining the various precision applications. Involved: Rick Czernek, Linda Sekura.

- July 24, 2003: **Aircraft oxygen lines, reservoirs and equipment** (on board and in shop) were being cleaned (from contamination with organic compounds) using alcohol, water-soluble solutions, and CFC-113. The Hangar replaced the CFC-113 with ethyl alcohol. But **NASA, USAF, and USN were interested in developing an ODS, HAP, and VOC-free system**. In Nov 2000, the Tinker AFB (OK) demo of SW/HW on a B-1B oxygen line system was done. Can be cleaned for about \$2,500 with materials, labor, and travel. The system is portable, and HFE 7100, HFE 301, and FC-72 are likely alternatives. Need to follow up to see if anyone else is using, and if there are applications here than can use this. Involved: Steve Hayes, Linda Sekura.

- July 2003: Maintenance and Repair Bldg (107) - **Hybond Reducer Cleaner**, a reducer cleaner with **1,1,1 trichloroethane** was being used here and across the facility for carpentry, masonry, and maintenance activities to remove adhesives from equipment and other substrates. Suggested alternatives: **NMP or alcohol**. Per Rich Olinek – a small amount is used as a solvent/reducer for solvent-based contact cement. 7-23 open to trying NMP anyway, since 1,1,1 trich is an ozone depleter. Also the contact cement contains 1,1,1 trich! Need a reasonably fast-drying EPP cement, mainly for cementing laminated pieces like formica to desk tops, normally wood. Several Roo (**synthetic latex**) products were tested. Waiting for results. Involved: Rich Olinek.

- July 2003: Microwave Systems Lab (7) – They **clean microwave system components** by wiping with **CFC-113** and/or **1,1,1-trichloroethane**. (Plus contaminated rags are commingled with no-regulated waste.) 7-18 Per Joe Wilson, this is used for critical cleaning of space flight hardware. 7-23 Emailed Rick Cernec and Jim Mullens – open to trying alternatives? Involved: Rick Cernec, Jim Mullens.

- July 2003: Dan Tyson (49-249) ordered one liter of **tetrachloroethane** (ODC, possible carcinogen, liver/neurological effects, aquatic toxin) to use as a solvent in chemical reactions. Needs a **high-boiling-point solvent**. Dichloroethane can be used. Nitrobenzene can be used also, but it is harder to purify. Dan and Linda both thinking of alternatives. He uses one bottle per year. Involved: Dan Tyson, Linda Sekura.

- December 2003: Gilcrest – **Electrical contact cleaner** – Replace **CFC-113 and HCFC-141b** with non-ODC, **nonflammable, low hazardous chemical** (t-DCE), low residue, quick dry product that doesn't hurt plastics. They need nonflammable due to old equipment. They will be testing a product that had success in the Calibration Lab. Involved: Jim Shultz, Linda Sekura.

- December 2003: Stock – **Electrical contact cleaner** – Replace **CFC-113 and HCFC-141b** with non-ODC, **nonflammable, low hazardous chemical** (t-DCE), low residue, quick dry product that doesn't hurt plastics. Jeanine Hanzel in the stock area will be ordering the replacement that the Calibration Lab liked, to be used as the new stock contact cleaner. Jeanine will contact us once this has been ordered. Involved: Jeanine Hanzel, Linda Sekura.

VARIOUS REPLACEMENTS - OR - NEW APPLICATIONS WITH EPP PRODUCTS

- Summer 2002: **Plum Brook – Toilet cleaners and Garage degreasing** leftovers.
- June 30, 2003 - Waiting to hear from PB contact about getting Garage degreasing samples transferred, per Bob Lallier
- July 8, 2003 emailed Joe Moore to find what toilet cleaners he tested/is using.
Involved: Bob Lallier, Linda Sekura.

- Spring 2003: **Home Products and Janitorial** – Create listings. On back burner for now, but keeping records of “finds.” – Pest control, cleaners, paints, removers, etc.

- **Toilet bowl cleaner** – Waiting to see what worked for Plum Brook.
Involved: Linda Sekura.

- May 03 – Dana Sanvido in the Garage needs a replacement for Red Lion Penetrating Oil **bolt loosener**. It contains carcinogens, chemicals with birth/reproductive effects, and possibly causes brain and nerve damage. Suggested **Kroil** for now – the only “hazardous” chemical is **butoxyethanol** – which is widely used at GRC. But another, non-butoxyethanol product was found, that is biobased: MMEP from Pantera another machine shop chemical that has a dual purpose. Dana Sanvido is testing. Involved: Dana Sanvido.

- Summer 2003: Janitorial and stock – **Light duty cleaner – butoxyethanol** issue (concerns about it possibly being carcinogenic).

- Several products being reviewed. One has come in for testing. Solution 2000 tested well for general cleaning and windows when Linda tested. Did not test well with cleaning staff – residue and window streaking. Will try different dilutions. Also two more products to try – premixed (parsley and lavender products) vs concentrate (Solution 2000).

- Another suggestion from KSC audit – clean glass with detergent.

Involved: Lorraine, Linda Sekura.

- July 2003: **Bigger fish chemical issues** – Betty Hodgson will pass along as they come up. Mainly chemicals ordered for Bldg 49 are hazardous, but they are usually one-shot projects. Involved: Betty Hodgson.

- July 24, 2003: Central Air Equipment (64): (supplies compressed air to testing facilities). **Solvent 142 is used to clean/degrease mechanical parts** and components. Options: Recycling, and parts washers. Dick Kearney is open to alternatives. Need good parts cleaner that doesn't evaporate too quickly. Involved: Dick Kearney.

- July 2003: **Groundskeeping** – We are looking into possibly replacing ChemLawn practices with an organic lawn care company. One company uses a nontoxic sugar beet protein herbicide. 8-21 Good Nature organic lawn care company came in to look at entire 350 acres, and especially the Day Care area. They will submit a quote for possibly replacing ChemLawn for seasonal lawn treatments. (See also Sustainable Design Projects.)
Involved: Don Musick, Bonnie Hassel, Rich Olinek.

- July 2003: The groundskeeping staff currently performs mowing only, with **bee spraying** only upon request. We are reviewing GRC's bee spraying chemicals, and will submit suggestions for alternatives. Involved: Don Musick, Bonnie Hassel, Rich Olinek.

- Summer 2003: **Cafeteria – Styrofoam and plastic replacement** – India Pettus obtained pricing from Dixie and others for simulated recycled paper foam and plant starch (corn, potato, wheat, rice) biodegradable, or hemp/sugar cane or lime supplies. Mark Betlejewski is open to discussing alternatives to foam plates, cups, and containers. Some alternatives

may suit their needs, and pricing is being obtained. Testing will begin once funding is acquired from HQ.

- July 2003: Also the water area used to use amber plastic cups, and now use foam. Considering education/posters to resolve issues (if walk-aways), or replacing with EPP products. There is a safety issue with glass and plastic cups. (See also Large Project listing.) Involved: Mark Betlejewski, Linda Sekura.

- July 2003: **Silver cleaning** - Baking soda or salt and aluminum foil can't completely remove 25-year-old tarnish; also the H₂S that is created smells like rotten eggs (plus if strong enough and long enough, you can pass out). Toothpaste/toothbrush may scratch. - Found 2 EPP silver cleaners – suggested by professionals as the best, and suggested by EPP evaluators outside GRC as the best environmentally: Twinkle and Wright's. MSDS sheets will be evaluated. Need to order products for testing. Involved: Linda Sekura.

- August 2003 listed: The WMT has tried several products to replace synthetic spill cleanup products. No alternatives have been successful, but they are open to any new, promising technology.

- 1) Corn cob pads: As the pads were stored, rodents and birds built nests or used as a restroom. This problem also occurred with synthetic pads, but not to the same extent.
- 2) Other plant-based spill pad: A car was leaking gas. A pad was placed on the spill, and the pad fell apart.
- 3) Recycled material pads: The pads are not as durable as new synthetic pads.

When they were thrown on the ground for oil (or other) spills, they fell apart. Also, the biobased pads became moldy if damp. Plus, organic pads don't have as much holding capacity as synthetic pads, and will release fluid prematurely. Further tests will be performed as new technology becomes available. Involved: Mike Bajorek, Mike Hovanic.

- November 2003 to present – **Parts washer study**: KSC is conducting a NASA-wide study to find environmentally preferable parts washers, including the chemicals they contain. At this point, they are gathering an inventory listing of existing and previous washers across all centers. Involved: Matt Rothgeb (KSC), Linda Sekura.

CHEMICAL INVENTORY REDUCTIONS

- February 2003: Need to research **options for Stock (21) items**: Electrical contact cleaners (HCFC-141b), Defluxers (HCFC-141B), Ross Rubber Cement (hexane), 3M Scotch-grip 1357 adhesive (MEK, hexane, toluene), ND Industries Vibratite (MEK), 3M Scotch-grip 4799 adhesive (hexane, toluene), Techspray Tech Hold Cyanoacrylic adhesive (carcinogenic, very toxic aquatic), SparVar Indoor/Outdoor Paint – many colors (MEK, MIBK, Xylene, 1-butanol, etc.), Randolph Mil-Spec 20140 Brown Semigloss + 23690 Beige Semigloss (MEK, toluene), Aervoe Camouflage Paint (Xylene, n-butanol), 3M Scotch-grip #2 solvent (Hexane, toluene), CRC PF Precision Cleaner (HCFC-141b, difluoroethane). The non-ODC contact cleaner which had success in the Calibration Lab was suggested to replace the above contact cleaners and defluxers. Waiting for

confirmation of orders and response as to defluxers in stock. Involved: Jeanine Hanzel, Linda Sekura.

- February 2003: Need to research **options for Tool Crib (55) stock items:** SparVar Indoor/Outdoor Paint (cancer, birth, reproductive effects), 3M Scotch-grip 1357 Hi Performance Contact Adhesive (hexane, MEK, toluene), DoAll Blue Steel Ink (MIBK, MEK, Xylene, toluene), Sprayon Blue Layout Fluid (MIBK, MEK, 1-butanol, toluene, Xylene), 3M Scotchgrip #2 Solvent (hexane, toluene), Randolph Aircraft finish – Clear nitrate dope (MEK, toluene), 3M Industrial Adhesive 4799 (hexane, toluene), 1,1,1 trichloroethane, 1,2 Dichloroethane, Lacquer thinner (MEK, toluene), Envirotech Defluxer 1676 (HCFC-141b), Ruby Fluid (Zinc chloride), Steco Tap Magic (tert-butyl alcohol, butylenes oxide), Ross Rubber Cement (hexane). Involved: Linda Sekura.