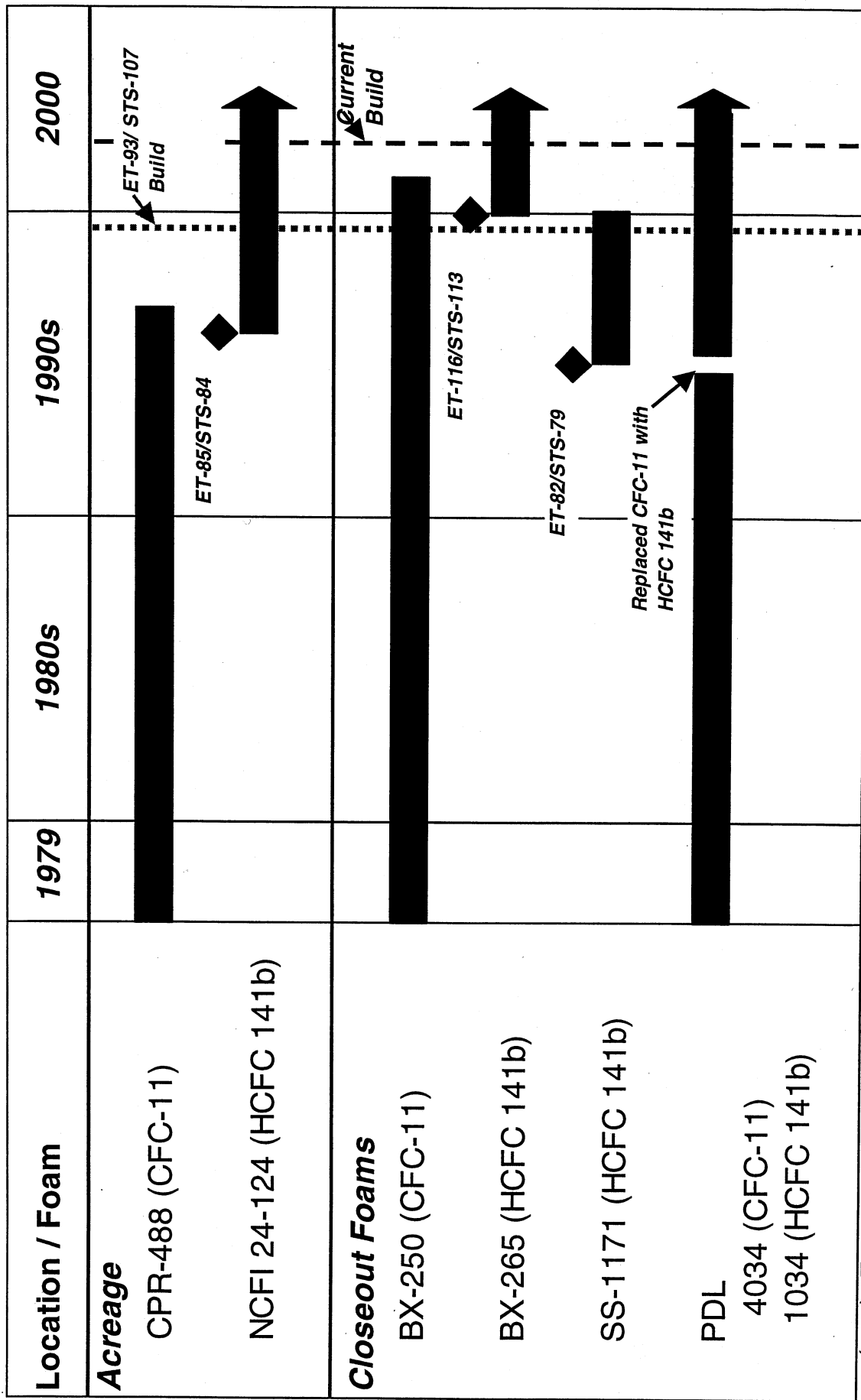




TPS Usage Timeline



(xx) Foam Blowing Agent

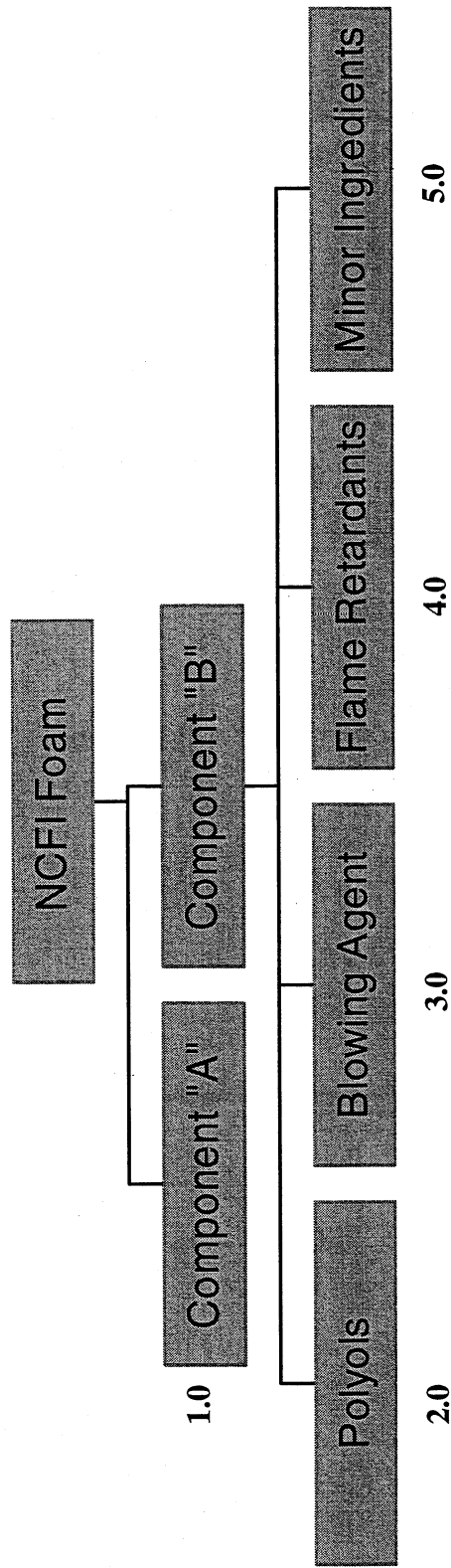


Acreage/Aft Dome CPR/NCFI History

- 1974 CPR 421 Selected for ET application
- 1975 Hooker Chemical (now Oxychem) polyol special arrangement for ET usage
- 1975 Toxicity issue identified with use of CPR 421 (Polyol with Flame Retardant)
- 1976 CPR 488 qualified to replace CPR 421 (Flame Retardant removed)
- 1982 NCFI 22-65 replaces CPR-488/SLA on LH2 Aft Dome
- 1984 UpJohn changes Isocyanate formulation used in CPR 488 (Iso 0414D)
- 1985 Dow acquires UpJohn/production location changed from Torrance to LaPorte
- 1986 1st production at LaPorte, Qualification of facility required
- 1988 UpJohn Isocyanate change #2 (PAPI Lite)
- 1993 CFC 11 blowing agent manufacture discontinued (accelerated EPA date of 1995)
- 1994 Oxychem phases out production of Polyol used in CPR 488, expensive plant upgrades (CPR 488 lost)
- 1995 Qualified NCFI 24-124 to replace CPR 488, NCFI 24-57 to replace NCFI 22-65
- 1995 FR 1138 Flame Retardant discontinued, used in both NCFI 24-124 and NCFI 24-57
- 1995 - LH2 Tank – New Delivery System (NDS) variable proportioner, TPV spray gun, implemented at ET 85. Replaced Binks 43PA gun and standard A/B proportioner.
- 1996 - LO2/Intertank - NDS, TPV spray gun, implemented at ET 90. First Thick/Thin tank was ET 90.
- 1997 IFA issue identified with use of NCFI 24-124 on Intertank
- 1998 Bayer upgrades Texas plant to manufacture Isocyanate vs. Spanish Iso used in NCFI foams



Acreage TPS Composition



1.0 Isocyanate, chemical reactive group is -N=C=O . Reacts with itself to make Isocyanurate and with Polyols to make Urethane

2.0 Polyols, chemical reactive group is -OH , reacts with Isocyanate to make Urethane. Polyol blends are used to add flexibility and thermal stability to foam structure

3.0 Blowing agent turns to gas, creates foaming action, when A and B components are mixed and exothermic reaction begins

4.0 Flame retardant blend improves resistance to burning, adds flexibility to foam structure, improves substrate bond

5.0 Minor ingredients (e.g. catalysts, surfactants) control foaming rates and cell size/wall thickness



Closeout BX250/SS1171/BX265 History

- Original ET material, BX-250, Chosen for Ramp/Closeout Applications
- 1993 - CFC 11 blowing agent manufacture discontinued (accelerated EPA date)
- 1995 - SS-1171 (w/HCFE 141b) chosen to replace BX 250
- 1995 - Secured available stock of CFC 11 for use with remaining BX 250
- 1995 - FR 1138 Flame Retardant discontinued in SS-1171 foam – acquired Dead Sea Bromide as replacement
- 1998 - Production issues identified with use of SS 1171 in F/A & Bldg. 420, decision made to continue BX 250 usage
- 1999 - SS 1171 low strength F/A and subsequent acquisition by BASF; usage on ET discontinued
- 2000 - Mondur Dark Isocyanate used in BX 250 phased out of production (secured supply till BX 265 implemented)
- 2001 - BX-265 qualified to replace BX-250
- 2002 - BX-265 Foam Implementation
- 2003 - EPA phase out of HCFC 141b initiated (Waiver Required for Procurement in US)
- 2003 - Waiver approving NASA's HCFC 141b exemption allowance granted on March 5, 2003.



Closeout PDL 4034/1034 History

- Original ET material, PDL 4034 (CFC-11), manufactured by Polymer Development Laboratories in Atlanta.
- 1994 - Urethane Technologies purchased Polymer Development Laboratories. No company name change at this point.
- 1995 - First lot of UTI PDL 1034 (HCFC 141b) intended for production. This lot passed all receiving acceptance testing/ manufactured by existing personnel.
- 1996 – First production lot of PDL 1034 manufactured by UTI with new personnel failed density and fingerprinting requirements
- 1996 - Re-certification plan for UTI PDL 1034 created involving NASA and Lockheed Martin material science engineering.
- 1997 – UTI declares bankruptcy.
- 1997 - Atlanta facility and PDL 1034 formulation rights awarded to Hess Polyurethane's.
- Re-certification of PDL 1034 manufactured by Hess Polyurethane's.
- 1997 - First Production use of Hess PDL 1034.
- 1998 – Verification activities with Hess PDL and Conathane initiated.
- 2000 - BASF Procures Hess Polyurethane's, Inc.
- 2001 - BASF moves production of PDL 1034 to Carrollton, Texas
- 2002 – BASF Carrollton Production Facility conditionally certified pending evaluation of 3 production lots



TPS Tiecoat Isochem/Conathane History

- Original ET Material, Isochem (2 part mica filled polyester) tiecoat system
- 1981 – Isochem cure time fluctuation, catalyst reduction identified
- 1983 - Isochem bought by Rhom and Hass
- 1984 - Isochem debond issue, resin change identified
- 1984 – Ongoing Isochem bond adhesion concerns/catalyst environmental issues lead to replacement studies
- 1989 - Change Summary initiated to validate Conathane
- 1989 - Implemented Conathane, (2 part urethane with 11% MEK)
- 1992 – Production of Conathane catalyst phenyl mercuric acetate (PMA) curtailed due to environmental regulations
- 1992/94 - A new source for the PMA catalyst was identified, Aldrich Chemical Company.
- 1997 – PMA catalyst production discontinued, only stockpiled quantities are available today
- Conathane replacement efforts continuing