SHUTTLE ENVIRONMENTAL ASSURANCE AND THE FUTURE

Steve Glover
Propulsion Systems Engineering and Integration Office (PSE&I)/MSFC
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NASA Langley Research Center, Hampton, Virginia
OVERVIEW

- SEA Team
- SEA Evolution
- Challenges to NASA Program
- Environmental Assurance
- SEA Technical Issues
- Environmental Assurance Implementation Challenges
- Successes
- Benefits
- Unfinished Business
- Lessons Learned
- SEA Future
SEA TEAM
Overview

• Material availability continues to be impacted by domestic and international environmental health and safety (EH&S) regulations, industrial pollution prevention goals and related vendor economics

• SEA is an integrated team that works to identify, communicate and address safety and environmentally driven materials obsolescence issues and pollution prevention opportunities
  – Proactively identifies potential problems, makes efficient use of resources and expertise in mitigation
  – Uses a systems focus on issues driven by current or future EH&S drivers
  – Exercises a Risk Management Approach: evaluate program risk, mitigate, track, and control identified issues
SEA TEAM
Structure

Management Team
Civil Service and Contractor

AFFECTED PROJECTS

Space Shuttle Program
Orbiter Project and Prime
ET Project and Prime
RSRB Project and Primes
SSME Project and Prime
Ground Operations and Prime
Flight Crew Equipment and Prime
Safety & Mission Assurance

INTERFACES

HQ Environmental Office
RRAC
TEERM

Center Environmental Management Offices

Center Engineering Materials

Air Force Space Command
Army Redstone
Others

Tri-Program Supportability Council

CxP/ISS
SPACE SHUTTLE PROGRAM
Shuttle Propulsion Office (MSFC)
NASA Marshall Space Flight Center, Huntsville, Alabama

SEA TEAM
Risk Management Process

IDENTIFY
- HQ/RRAC
- Industry Data
  - Regulatory Review
  - Element Input
  - Notices

ANALYZE
- Data collection
  - Sub-team if needed
  - Evaluate likelihood/impact

COMMUNICATE & DOCUMENT
- Status reports/Boards
- Advisories
- Technical Products
- SIRMA
- Meetings and Telecons

PLAN/MITIGATE
- SEA risk or other owner
- Formal SEA issue?
- SIRMA entry
- Accept/Mitigate/Watch
- Mitigation Plans:
  - regulatory; stockpile, vendor track, replacement, re-qualification
- Collaboration/data sharing

CONTROL
- Close/Accept Risks
- Continue current mitigation plan or replan

TRACK
- Periodic risk review
- Track mitigation plans
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<th>SIRMA #</th>
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<th>SSP 4/07 L x C</th>
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L = likelihood; C = consequence
SEA EVOLUTION

**Pre-SEA**
- Shuttle Replacement Technology Team
- NASA Operational Environment Team
- Regulatory screening
- Common issues
- Data sharing
- Technical expertise
- Grassroots

**SEA**
- Risk Management
- Regulatory Screening
- Interfaces (HQ/RRAC/TEERM/EMOs/DoD)
- Integration
- Documentation
- Enhanced Communication
- Formal processes

**CxP**
- Regulatory screening
- Regulatory exemptions
- Replacement work
- SEA Lessons Learned
- Center support

**HQ Environmental Assurance**
- RRAC
- TEERM
- Emerging contaminants
- HQ Tools
CHALLENGES TO NASA
PROGRAM ENVIRONMENTAL ASSURANCE

• Increase in US and State regulations, complex environment
• Increase in EU regulation and potential for impact to vendors
• Direct impact of regulations on vendors and sub-tier suppliers
• Industry decisions to proactively replace hazardous materials even before regulation, sometimes with little or no notice
• Difficult to identify drivers and evaluate risk
• Change in assumptions and direction due to SSP 2010 retirement
• Supporting Missions: operational vs. development; SOMD vs. ESMD; multiple project life stages
ENVIRONMENTAL ASSURANCE IMPLEMENTATION CHALLENGES

- Confusion: environmental tasks, roles and responsibilities
  1. Environmental Assurance vs. Environmental compliance and NEPA
  2. Environmental Assurance Roles (Program/HQ/RRAC/TEERM/Centers)
  3. Materials vs. Environmentally driven materials obsolescence
- Confusion: SEA work/ownership of issues vs. SEA facilitated communication and discussion
- Many unique environmental assurance products
- Some difficulty getting contractors to share data, SSP elements report relevant work
- Sometimes team is out of the loop until something becomes an issue
- SSP focus is obsolescence – hard to justify Pollution Prevention work (depends on project life cycle)
- Difficulty in identifying if and where an at risk material is used in SSP
- Proactive identification of drivers is difficult (particularly industry drivers)
- Application of risk assessment scorecard and SIRMA process to multiple element, multiple impacts, multiple opinions, long term risk with high uncertainty
- Uncertainty concerning SEA future makes planning difficult
SUCCESSES

• SEA Team: available expertise to address materials and environmental issues, provide technical feedback to SSP, CxP and HQ
• Face to face meetings: communication, data sharing, interfaces, team building
• Interfaces: HQ, RRAC, TEERM, EMOs, AFSC
• Communication: Notices, products, meetings
• Reporting: annual report, status report, monthly updates
• Risk Management approach: standard approach to risk assessment, SIRMA
• Success using technical sub-teams to address specific issues
• Success working with HQ on regulatory input and reviews
• Team is comfortable bringing up any issue; success in communicating to risk owners outside of SEA team
• SEA Issues
  -- HFC 141b: reporting and coordination with HQ, RRAC, CxP, Primes
  -- Lead free electronics: identified SSP risks, element specific mitigation strategies
  -- PFOA: identified vendor-driven risk, sub-team working with industry to evaluate risk
  -- Risks closed: Alternate Dry Film Lubricant
     Hexavalent Chromium in Alkaline Cleaners
     Methyl Ethly Ketone
     Precision Cleaning and Verification Solvents
     Perfluoroalkyl Sulfonates
BENEFITS

SEA is reducing risk to the SSP associated with environmentally driven materials obsolescence by:

- Identifying regulatory impacts
- Working with regulators to minimize the adverse impact of regulatory restrictions
- Maintaining essential use exemption
- Providing notice and technical support concerning vendor changes and materials concerns
- Sharing material replacement data and working mitigation efforts
- Communicating potential issues and risks to management and other technical forums
- Interfacing with DoD and other agencies to share data/collaborate
- Identifying and mitigating environmental and material obsolescence concerns

Constellation, ISS and other Projects have benefited from established SEA activities

- HCFC 141b process and products greatly supported CxP exemption
- Regulatory matrix and review process in place
- Common issues and risk assessments
- Established team of expert contacts
UNFINISHED BUSINESS

• Major replacement work mostly terminated, stockpiling and vendor tracking instead
• Regulatory focus on near-term risks, no review of regulations with potential impact after 2010
• No regulatory mitigation planned past 2010
• Reduced resources, reduced reporting planned through 2010
• Expanding interfaces
• Major risk assessment process improvements
LESSONS LEARNED

• Effective program environmental assurance requires:
  – established requirements and management processes
  – management support and adequate resources
  – proactive, action orientation
  – committed and strong program, management, environmental, material, and regulatory team
  – ongoing documentation

• Effective approach includes:
  – systems focus and dedicated interdisciplinary team
  – risk management approach
  – proactive regulatory processes
  – effective communication and active interfaces
  – materials and environmental technical expertise
  – integrated technical and project management expertise
LESSONS LEARNED

• Multiple programs with interdependent and overlapping issues should coordinate to avoid mission impacts and ensure cost-effectiveness

• All stages of a project life cycle should consider environmental discipline, including design

• Programs should be encouraged to reduce environmental footprint

• SEA identified materials to avoid or address include:
  -- HCFC 141b Blowing Agent
  -- 1,1,1 Trichloroethane
  -- Cadmium Replacement in Plating Applications
  -- Hexavalent Chromium Replacement in Conversion Coatings and Primers
  -- Lead-Free Electronics
  -- Perfluoroalkyl Sulfonates/Perfluorooctanoic acid
  -- Brominated Flame Retardants
SEA FUTURE

• SSP and CxP both carry risks related to loss of SEA capability
• Have had discussions with MSFC Engineering, RRAC, TEERM, HQ Environmental, CxP, SSP Propulsion Office, PSE&I, SSP Transition Team and CxP Transition Manager on need and approach to transition
• Also considered HQ or SOMD/ESMD-level team
• All agree on need for SEA like team to support CxP
• Provided PPBE input to CxP and Human Space Flight Capability exercise
• No current CxP or HQ funding support or commitment
• Current plan is to begin SEA termination along with SSP, provide data and information to CxP
• Draft SEA Transition and Retirement Plan under review
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Accomplished

- Draft SEA Transition Plan
- Begin development of SEA closeout technical documentation
- Include Ares, other CxP Projects and ISS in SEA telecons and meetings
- Share lessons learned with CxP and ISS
- Discussions with RRAC, and MSFC Engineering
- Regulatory Screening Matrix from RRAC
- Proposal and funding requirements provided to SSP, Human Space Flight and CxP management

Next Steps

- Identify responsible organization
- Obtain funding commitment and guidance from CxP or HQ
- Develop Management Plan
- Establish requirements
- Implement activity
  - Identify and begin to work shared issues and evaluate SSP replacement work for application to CxP
  - Review recent RRAC matrices for potential operational impacts
  - Identify issues and roadblocks and begin to address (e.g. allow SSP primes to support joint SSP/Cx work)
  - Clarify HQ involvement, potential to address other programs
  - Decide on organization where team management will reside
  - Identify contract mechanism for SEA support
SUMMARY

- SEA provides benefits to SSP
- CxP has a similar need, identified a risk
- SEA capability to be retired in 2010
- No CxP or HQ funding identified
- Suggestions?
BACKUP
NOTIONAL TRANSITIONAL ENVIRONMENTAL ASSURANCE TEAM

**Management Team**
Civil Service and Contractor

**AFFECTED PROJECTS**

- **Space Shuttle Program**
  - Orbiter Project and Prime
  - ET Project and Prime
  - RSRB Project and Primes
  - SSME Project and Prime
  - Ground Operations and Prime
  - Flight Crew Equipment and Prime
  - Safety & Mission Assurance

- **Constellation**
  - Ares I Upper Stage – Primes; Eng Teams
  - Ares I First Stage – Prime; Eng Teams
  - Ares I J2X – Prime; Eng Teams
  - Ares V – Prime; Eng Teams
  - Orion – Prime; Eng Teams

- **ISS**

**INTERFACES**

- **HQ Environmental Office**
  - RRAC
  - TEERM

- **Center Environmental Management Offices**

- **Center Engineering Materials**

- **Air Force Space Command**
  - Army Redstone
  - Others

- **Tri-Program Supportability Council**

**SOMD/ESMD**
# SSP ENVIRONMENTAL TASKS

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<tr>
<th>Task</th>
<th>Responsible Parties</th>
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<tr>
<td>NEPA (National Environmental Policy Act)</td>
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<td>Environmental Compliance</td>
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<td>Identify Regulatory Changes/Negotiate with Regulatory Agencies</td>
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<td>Identify Industry/Market Changes</td>
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