

# Managing Chemical & Material Risks

Acquisition, Technology and Logistics

## What's Up With Emerging Contaminants?



Briefing for EDQW Workshop

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# Part 1 – Emerging Contaminants (ECs) “Refresher” & Program Structure



# Emerging Contaminants Program Genesis

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- **~2004 – Perchlorate<sup>1</sup> detections in groundwater & drinking water cause national concern**
  - Disputes between DoD and regulators over response actions
  - Training/testing on 2 ranges curtailed
- **2005/6 – DoD forms EC Work group with EPA & Environmental Council of States**
  - EC Definition agreed & three policy papers developed
- **2008 – DoD creates EC funding line in budget**
- **2009 – DoD issues EC policy instruction**

<sup>1</sup> An oxidizer chemical found in munitions, pyrotechnics, and rockets

# What is an Emerging Contaminant?

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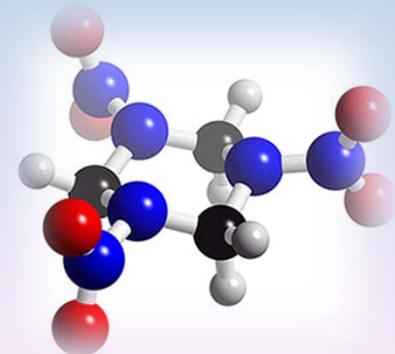
- Chemicals & materials that have pathways to enter the environment and present real or potential unacceptable human health or environmental risks...

**and either**

- do not have peer-reviewed human health standards

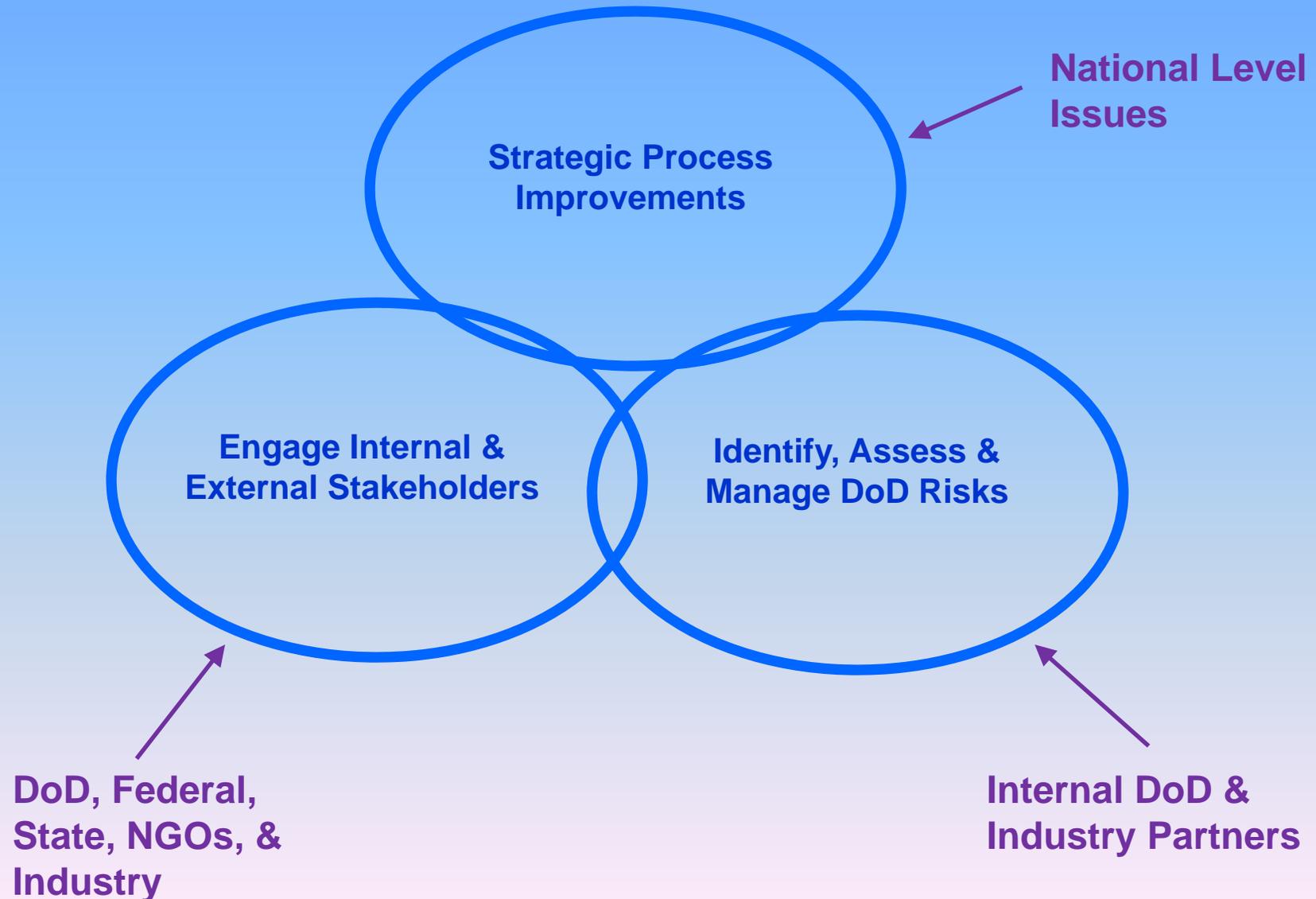
**or**

- Standards/regulations are evolving due to new science, detection capabilities, or pathways.



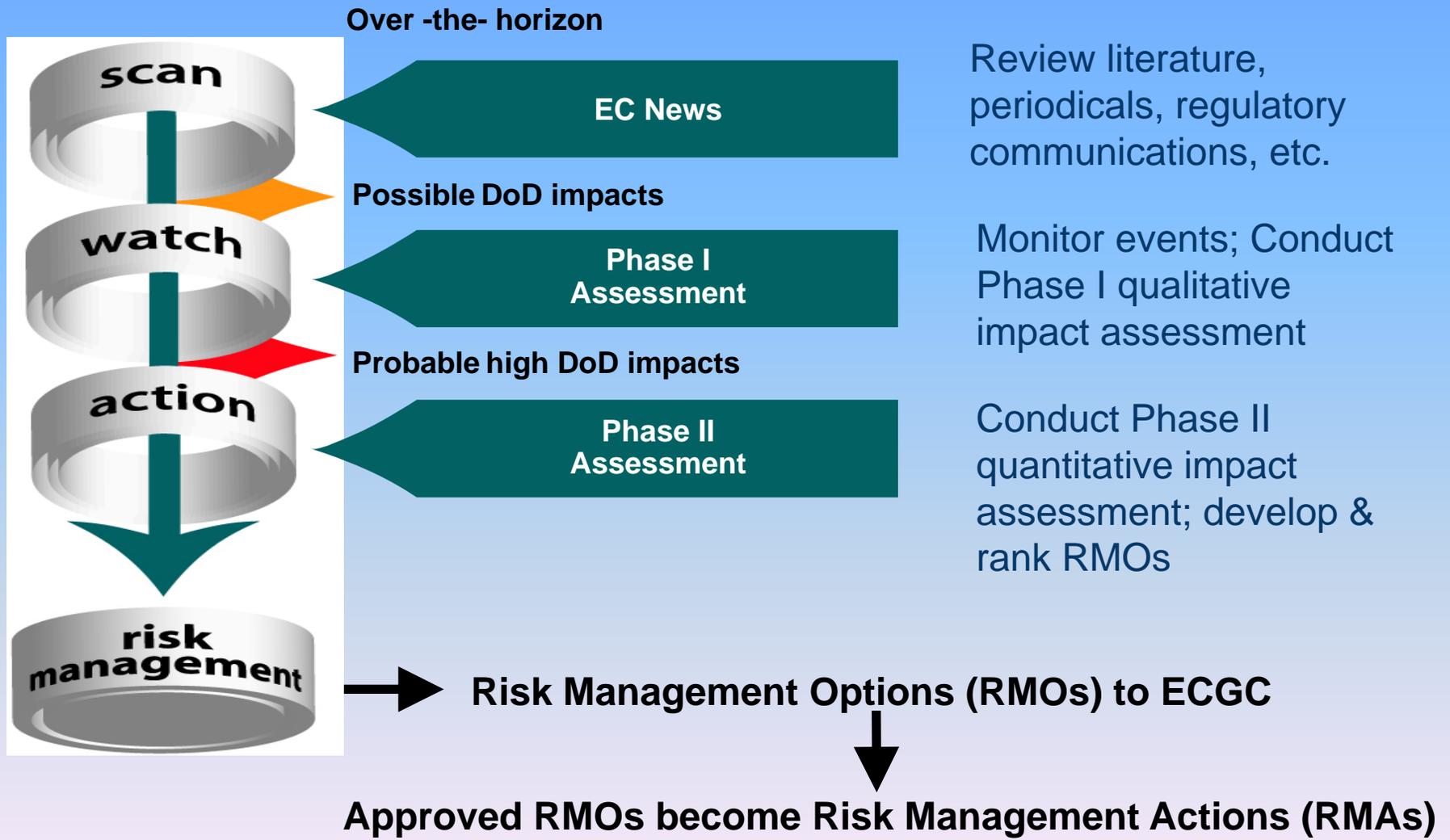
# EC Program Strategic Priorities

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# EC “Scan-Watch-Action” Process

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# Functional Areas Assessed

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**Acquisitions / Research, Development, Testing, and Evaluation**



**Environment, Safety & Health**



**Production, Operation, Maintenance, and Disposal of Assets**



**Cleanup/Remediation**



**Training & Readiness**

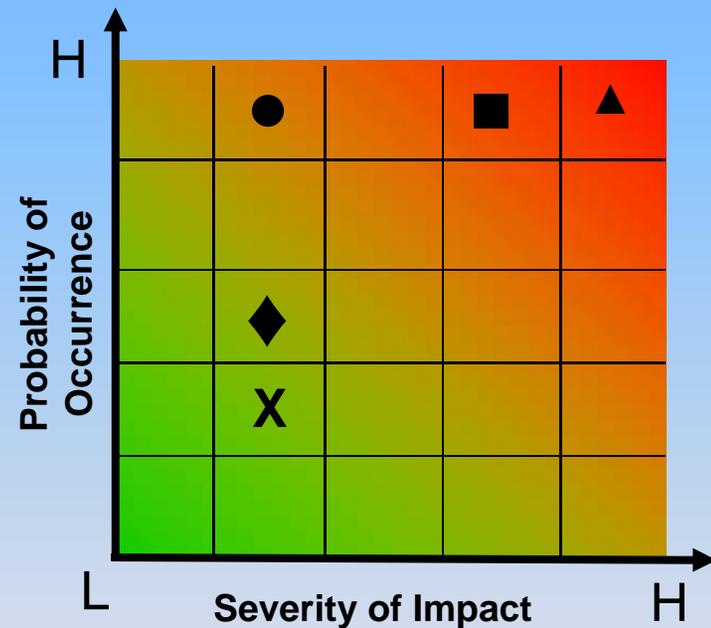
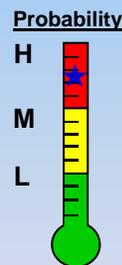
# SF6 Phase I Impact Assessment

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Sulfur Hexafluoride (SF6) is used in radar systems (e.g., AWACS aircraft); helicopter rotor-blade leak tests; discharge testing in fire suppression systems; electrical switch gear; and propulsion systems for specific weapons (e.g., MK-50 torpedo) in service and under design.

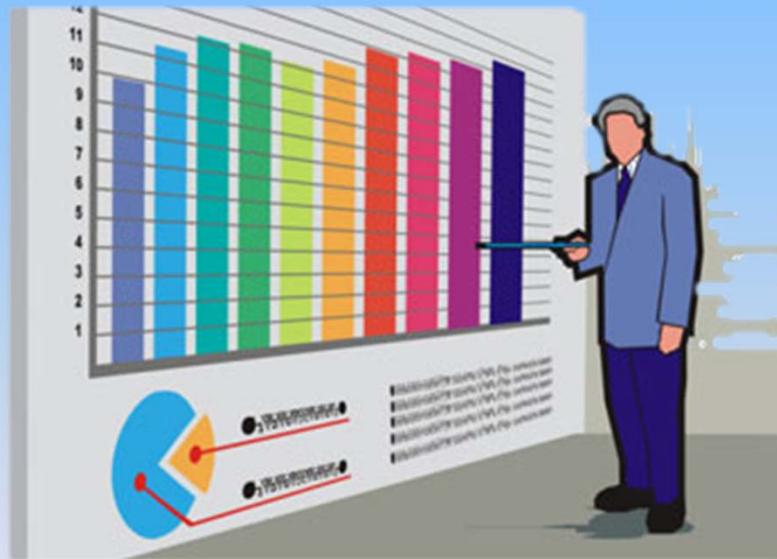
## Likelihood of Toxicity Value/ Regulatory Change

1. Probability that Greenhouse Gas emission initiatives will restrict use/availability of SF6



- ◆ ES&H
- PO&MD of Assets
- Training & Readiness
- X Cleanup
- ▲ Acquisition/RDT&E

# Part 2 – Progress Report



# Program Scorecard – Cumulative

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- **Potential ECs screened --- over 600**
- **Phase I Impact Assessments completed --- 35**
- **Phase II Impact Assessments completed --- 10**
  - All current/former action list chemicals completed.
- **60 Risk Management Options (RMOs) developed & turned into Risk Management Actions (RMAs)**

# EC Watch List – May 2015

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- ✓ Tungsten/alloys
  - ✓ 1,4-dioxane
  - ✓ Metal Nanomaterials
  - ✓ Carbon Nanomaterials
  - ✓ PFOS
  - ✓ PFOA
  - ✓ Nickel
  - ✓ Cadmium
  - ✓ Manganese
  - ✓ Dioxin
  - ✓ HFCs
  - ✓ Vanadium & compounds
  - Cobalt
  - Antimony
  - ✓ Flame retardants (6)
  - ✓ Diisocyanates
  - ✓ NDMA
  - ✓ DNT
  - ✓ DNAN
  - ✓ NTO
  - ✓ TCE ...moved from action list
  - ✓ Perchlorate ...moved from action list
  - Strontium...added March 2015
- Energetic Compounds*
- ✓ **Phase I Impact Assessment completed**
- Notes:
- Di-nitrotoluenes (DNT)
  - Perfluorooctanoic acid (PFOA)
  - Perfluorooctyl sulfonate (PFOS)
  - decabromodiphenyl ether (decaBDE)
  - 5-Nitro-1,2,4-triazol-3-one (NTO)
  - N-Nitrosodimethylamine (NDMA)
  - Trichloroethylene (TCE)
  - 2,4 dinitroanisole (DNAN)
  - Hydrofluorocarbons (HFCs)

# EC Action List – May 2015

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- ✓ **Royal Demolition eXplosive (RDX)**
- ✓ **Hexavalent Chromium (Cr6+)**
- ✓ **Naphthalene**
- ✓ **Beryllium**
- ✓ **Sulfur Hexafluoride (SF6)**
- ✓ **Lead**
- ✓ **Phthalates**
- **1-Bromopropane**...added by ECGC on 1 May 2014

✓ **Phase II Impact Assessment completed.**

RDX = Cyclotrimethylenetrinitramine

From the  
Chemical & Material Risk Management Program,  
Office of the Under Secretary of Defense for Acquisition, Technology & Logistics.

## Chemical & Material Emerging Risk Alert

### 1-Bromopropane (1-BP)

*The American Conference of Governmental Industrial Hygienists proposes to lower the threshold limit value-time-weighted average from 10 parts per million (ppm) to 0.1 ppm. If implemented, this change presents a risk to certain DoD industrial operations and may require actions to meet occupational health standards.*

#### What is 1-bromopropane?

1-Bromopropane (CAS #106-94-5) (1-BP; also called n-propyl bromide or n-PB)<sup>1</sup> is a brominated hydrocarbon solvent used in a variety of industrial applications (e.g., metals degreasing, cleaning of electronic circuit boards, formulation of adhesives and aerosols, and dry cleaning).<sup>2</sup> Use of 1-BP increased significantly when halogenated solvents, such as trichloroethene (TCE) and tetrachloroethene (PCE), underwent strict regulation as hazardous air pollutants under the Clean Air Act (CAA). 1-BP was seen as a less hazardous alternative and was used as a drop-in alternative in many applications.

#### How is 1-bromopropane used in the DoD?

The primary uses of 1-BP by the DoD are as a solvent, and degreaser and an ingredient in adhesives, coatings, and aerosols. Examples of shops and operations that may use 1-BP include flight-line and equipment maintenance, engine cleaning/plating, electroplating and fire protective services. 1-BP is also used as a case mount sealant in small- and medium-caliber munition cartridges.

#### What are the emerging health concerns?

Concern over the potential carcinogenicity of 1-BP prompted the National Toxicology Program (NTP) and Environmental Protection Agency (EPA) to assess its human health and environmental risks.

Under the NTP's Report on Carcinogens (RoC) process, the carcinogenicity of 1-BP in humans is being assessed.<sup>3</sup> A panel of experts recently concurred with the NTP's preliminary decision to list 1-bromopropane as a "reasonably anticipated human carcinogen."<sup>4</sup> Under the EPA's Toxic Substances Control Act Work Plan, the

risks from 1-BP to human health and the environment are also being assessed.<sup>5</sup> 1-BP was selected for evaluation due to its potential carcinogenicity, presence in environmental media, estimated high releases to the environment, and wide use in consumer products.

#### How is 1-bromopropane regulated?

There is no Occupational Safety and Health Administration Permissible Exposure Limit for 1-BP. However, the American Conference of Governmental Industrial Hygienists (ACGIH) has adopted a threshold limit value time-weighted average (TLV-TWA) guideline of 10 parts per million (ppm) based on liver damage, embryo/fetal damage, neurotoxicity, and reproductive and developmental toxicity. Policy and guidance documents for DoD Services direct them to consider using TLV-TWAs when evaluating occupational health risks although there is not clear consensus across the DoD on the use of ACGIH TLV-TWAs.<sup>6,7,8</sup>

1-BP is regulated by the EPA as a volatile organic compound in aerosol coatings and as a substitute to ozone depleting chemicals under the CAA and as a hazardous material by the Department of Transportation.<sup>9</sup> A number of states have taken independent action to regulate 1-BP under their environmental and occupational safety and health laws. Additionally, the European Chemicals Agency characterizes 1-BP as a Substance of Very High Concern and has included it in the Candidate List of chemicals requiring authorization for specified uses.

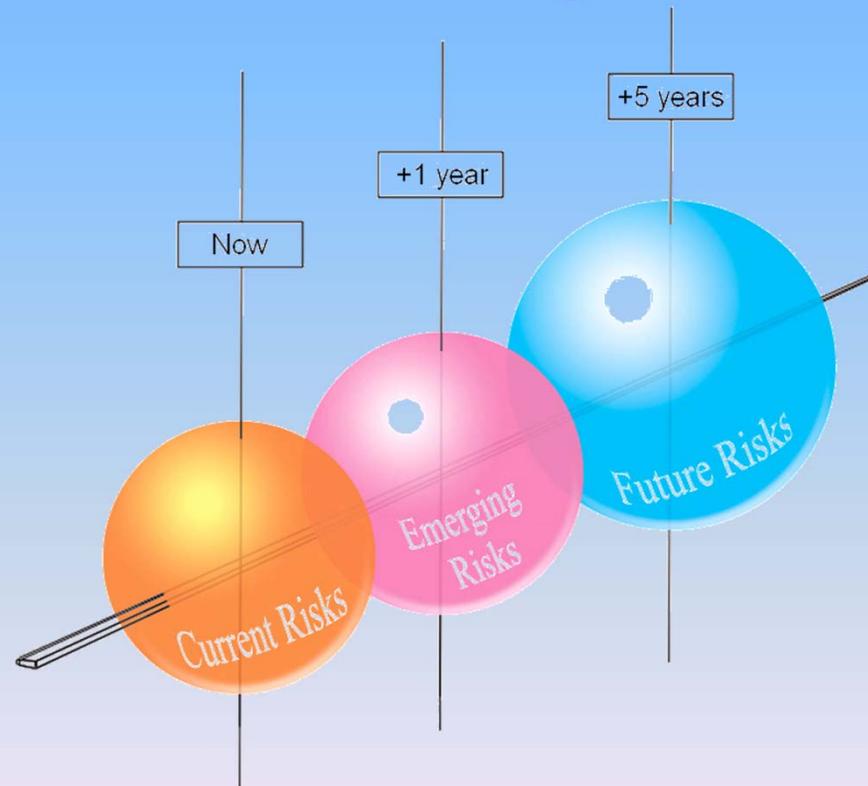
#### What is the emerging risk?

In early 2012, the ACGIH released a Notice of Intended Change to reclassify 1-BP as a "Confirmed Animal  
(continued on reverse side)



For more information about chemical and material risks, please visit us at <http://www.denix.osd.mil/cmrm/>.

## Part 3 – Current Risk Management Actions & Evolving Risks



# decaBDE<sup>1</sup>

## An Example of Material Availability Risk

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- A **flame retardant** used in electronics, wire and cable insulation, textiles, automobiles & aircraft
- EPA: “Studies have shown that decaBDE persists in the environment, potentially causes cancer and may impact brain function.”
- EPA & companies agree to **phase-out production & sales** for most uses 31 Dec 2012 & end all uses by end of 2013
- DoD, FAA, NASA, and industry believe phase-out is premature; substitutes not fully verified for performance or health risks

<sup>1</sup> decabromodiphenyl ether

# Flame Retardants in Aerospace Products Have Increased Survivability

- Assures safety in flight, if fire occurs
- Assures ability to escape, if aircraft crash occurs
- Meets FAA requirements
  - 14 CFR Part 25 regulations:
    - Section 25.853, Compartment Interiors
    - Section 25.855, Cargo/Baggage Compartment
    - Section 25.856, Thermal/Acoustic Insulation
    - Section 25.869, Wire Flammability
    - Appendix F, Detailed Test Requirements
      - Materials and parts must successfully pass test/s in order to show compliance
      - Nine (9) different tests specified; some materials/parts must pass multiple tests
      - Variations of configurations require individual testing



2008 Continental Airlines 737  
0 fatalities, 115 survivors

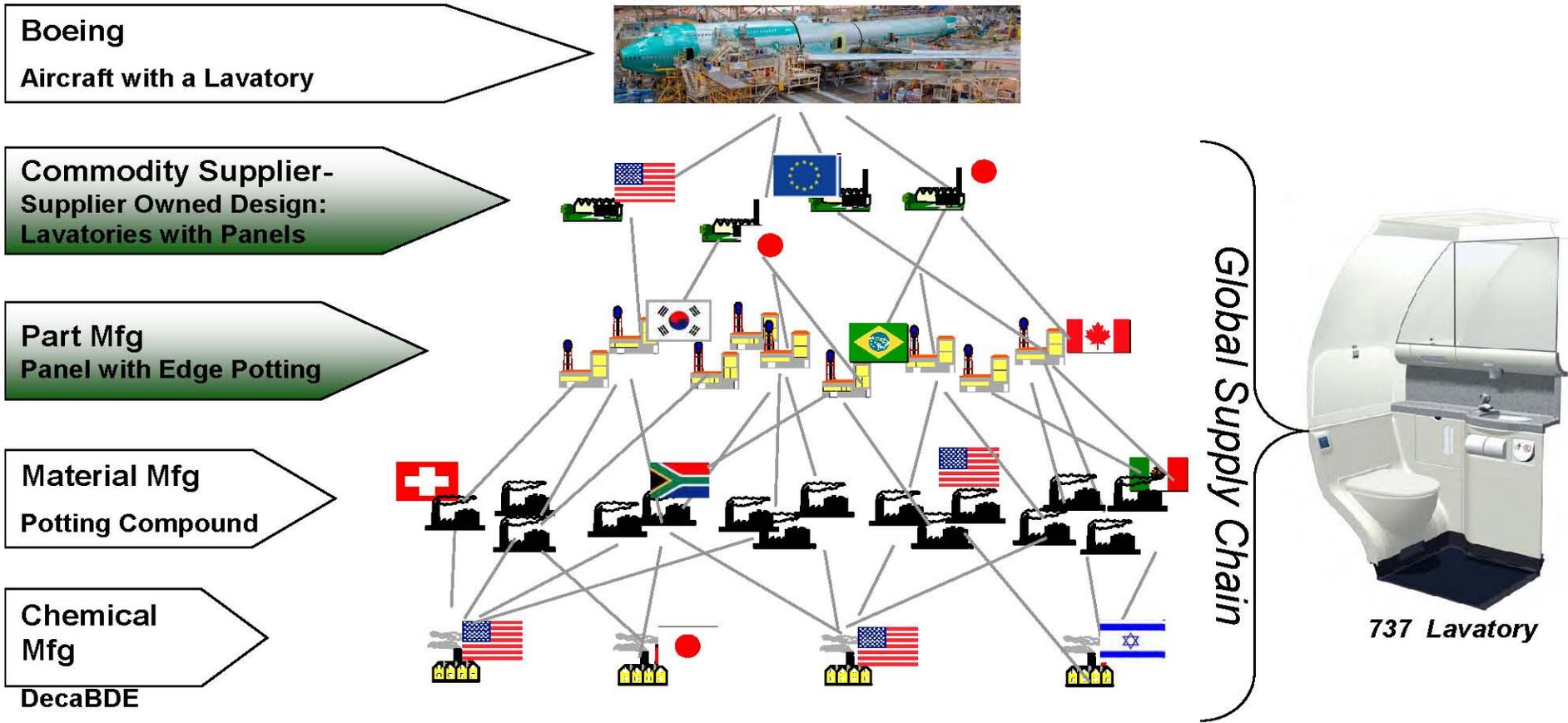
**DecaBDE has become integral to meeting stringent aviation safety requirements**

# DecaBDE is Used in Many Applications in Most Boeing Products

- Adhesives and Tapes
- Composites
- Ducting & Molded Parts
- Electrical/Electronics
- Emergency Equipment
- Fabrics & Films
- Insulation
- Interiors
- Sealants



# Boeing has a Global, Multi-Tiered Supply Chain



**DecaBDE alternative manufacturers & compounders drive the replacement timetable**

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The Boeing Company – Distribution to OIRA – 16 February 2011

# decaBDE Risk Management Actions

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- **Issued “EC Risk Alert” to DoD & prime contractors**
  - Difficult to locate decaBDE in supply chain
- **Working with OMB, EPA, FAA, Aerospace Industries Association on reducing risk and evaluating substitutes**
  - Commented on EPA proposed rule on flame retardants
  - Possible joint testing on substitutes
- **Convened stakeholders roundtable on larger public policy issue of chemical phase-out process**

# Evolving Risks/Issues

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- **New science on human health effects of ECs**
  - EPA “IRIS” hazard assessments underway/planned for many chemicals & materials important to DoD
  - New toxicity studies/hazard assessments are a precursor to regulatory changes, restrictions, or bans (e.g., PFOA/PFOS)
- **New explosive compounds are ECs (e.g., DNAN<sup>2</sup>)**
  - Toxicology & fate/effects not fully understood; presents risks to ranges due to residual contamination
  - EC program conducting Phase I Impact Assessments to assess and mitigate risk

<sup>1</sup> National Academy of Sciences    <sup>2</sup> 2,4-Dinitroanisole, an energetic compound replacement for TNT

# Evolving Risks/Issues

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- **Serious chemical availability issues with potential impacts on readiness...hard to quantify impacts**
  - Flame retardants: used in systems, platforms, equipment; phased out prematurely due to EPA pressure on manufacturers
  - Phthalates: used as plasticizers; being phased-out; risks for DoD is use in DoD Chem/Bio protection equipment and munitions
  - Chlorinated paraffins: Used in metal working fluids to manufacture *jet fuel nozzles*; high strength nickel-steel *fuel line tubing* (e.g. for F-35); gear box *control lines* for weapons platforms; *aircraft fasteners*; ship and tank *gun barrels*
- **Lack of supply chain visibility for chemicals/materials**
  - Difficult to assess risk and pinpoint risk management actions

# 2014 EC Governance Council Decisions

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- 1. Elevate 1-bromopropane (1-BP) to EC Action List**
- 2. Issue DoD-specific Blood Lead Levels**
- 3. Explore concept of capturing chemical/material content of supply items (including parts)**
  - Conduct gap analysis of procedures, policies, regulations
  - Conduct feasibility study

# Background for Supply Chain Visibility

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- **We need to know the content of what we buy for risk management & material recovery purposes**
  - Less than 20% of items in supply system with NSN<sup>1</sup> have sufficient data to establish characteristics (chemical/material content)
    - Characteristics are not being identified when NSN assigned
- **Why?**
  - Difficult to identify and recover valuable, strategic chemicals & materials at end of life
  - Difficult to determine risks to system performance for chemicals or materials being regulated or phased-out
  - Difficult to determine risks to personnel during sustainment actions

<sup>1</sup> National Stock Number

<sup>2</sup> Federal Logistics Information System (FLIS)

# Example Issues & Trends

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- **Recent example of lead in C-130 brake assembly with potential harmful exposures**
  - SDS<sup>1</sup> did not specify lead content; SDS exemption for “articles”
- **Beryllium life cycle study uncovered flaws in DoD tracking of strategic, critical materials**
  - Beryllium-containing materials of critical need & high value lost during end-of-life management
- **National Roundtable 22 October 2014**
  - Industries & companies starting to track all chemical/material content

<sup>1</sup> SDS Safety Data Sheet

# What to Watch

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- **EU-REACH Substances of Very High Concern**
  - Chemicals require authorization or no use/import/export
- **EPA'S TSCA Work Plans**
  - 83 high priority chemicals identified for “safety” assessment
  - 4 completed; 1 pending

# EPA Criteria for Chemical Prioritization

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- **Potentially of concern to children's health**
  - reproductive or developmental effects
- **Used in children's products**
- **Neurotoxic effects**
- **Persistent, Bioaccumulative, and Toxic (PBT)**
- **Probable or known carcinogens**
- **Detected in biomonitoring programs**

# EPA's Chemical Safety Assessments

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# TSCA Risk Assessments

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## Completed

- ❖ Methylene Chloride (Dichloromethane)
- ✓ Antimony Trioxide (ATO)
- ✓ HCCB (fragrance in consumer products)
- ❖ Trichlorethylene (TCE)

## Next

- NMP (paint remover)

- ❖ Risk
- ✓ No risk, as used

# TSCA Risk Assessments

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## Underway

- **Medium/long chain chlorinated paraffins**
- **1-Bromopropane**
- **1,4-Dioxane**
- **Brominated Phthalates cluster (TBB & TBPH)**

# What to Watch

Acquisition, Technology and Logistics

- **EU-REACH Substances of Very High Concern**
- **EPA'S TSCA Work Plans**
  - 83 high priority chemicals identified for assessment
  - 4 completed; 1 pending
- **TSCA Reform**
  - Frank R Lautenberg Chemical Safety for the 21st Century Act
  - Conduct “safety assessments” (hazard, use, exposure)
  - Determine if restrictions or bans needed

# DoD Emerging Contaminants Program

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## Questions & Discussion



Harvard University – Innovations in American Government Award

# Backup Slides

# EC Program Governance

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Risk Alert: 15-001

From the  
Chemical & Material Risk Management Program  
Office of the Assistant Secretary of Defense (Energy, Installations & Environment)

## Chemical & Material Emerging Risk Alert Tetrabromobisphenol-A (TBBPA)

*The Environmental Protection Agency (EPA) has identified TBBPA (CAS No. 79-94-7) for assessment under the Toxic Substances Control Act (TSCA) Work Plan effort. This may lead to increased regulation and/or production bans, which could pose risk to DoD supply chains and require actions to identify and qualify suitable alternatives.*

### What is TBBPA?

TBBPA is the most widely used brominated flame retardant,<sup>1</sup> and is considered a substitute for certain polybrominated diphenyl ethers (PBDEs). The main application (~90%)<sup>2</sup> of TBBPA is in the epoxy resin used for printed circuit boards or laminates, where it contributes to the fire safety of consumer electronics, and civilian and defense communication equipment requiring FR-4 protection and V0 requirements of the UL-94 Standard. TBBPA is also used in many polymeric materials and epoxy adhesives. Its role has become increasingly important towards the miniaturization of electronics in which the use of loaded and condensed laminates produce more heat within smaller devices.

### How is TBBPA used in the DoD?

Printed circuit board technologies are critical components to nearly every DoD weapon system. Combined DoD electronics, information technology, and electro-optics are estimated to account for roughly 15% of the total DoD budget. Fundamental to military operations, high-density ruggedized and reliable printed circuit boards are incorporated into all navigation, guidance, surveillance, and communication systems, including severe-service items used in extreme conditions (temperatures, high impact/vibrations, or submerged).

TBBPA may be used as an additive flame retardant in acrylonitrile-butadiene-styrene (ABS) plastics, high-

impact polystyrene (HIP) foams and phenolic resins. ABS resins containing TBBPA are used in automotive parts, pipes and fittings, refrigerators and various commercial-off-the-shelf (COTS) items employed by DoD.

TBBPA is incorporated into products in two-ways (1) reactively – where its molecularly bonded into the matrix of the treated polymer, and (2) additively – where it is physically combined with the material being treated, rather than chemically bonded. Additive flame retardants are considered more likely to leach from the polymer matrix.

### What are the emerging health concerns?

TBBPA reactively incorporated into printed circuit boards is not expected to release into the environment. However, trace amounts of unreacted TBBPA may result in a release to the environment through waste streams. The primary environmental hazard for TBBPA is high-aquatic toxicity, with a moderate potential for bioaccumulation.<sup>3</sup>

Human exposure to TBBPA is possible from inhalation of ambient air and from dermal contact or ingestion of compound dusts from containing products. In both human and animal studies, TBBPA was not a sensitizer.<sup>4</sup> Other animal studies, in vivo and in vitro, exhibited thyroid hormone activity,<sup>5</sup> estrogenic activity,<sup>6</sup> and increased weight of testes and pituitary glands in male offspring.<sup>5</sup>



For more information about chemical and material risks, please visit us at <http://www.denix.osd.mil/cmrmcd/>.

# Trends

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- **Use of Precautionary Principle**
  - Must understand health & environmental effects before using chemicals
- **Biomonitoring – What's showing up in humans?**
  - Centers for Disease Control's national bio-monitoring & California voluntary program
- **Strict Chemical Management & Green Chemistry**
  - Cradle to grave
- **Evolving Risk Assessment Science & Process**
- **International, Federal, & State Toxic Substances Laws**
  - Restrictions or banning of chemicals/materials (e.g., flame retardants)
  - California Green Chemistry Law & Proposition 65 Litigation
  - EU's REACH<sup>1</sup>
  - Pending TSCA<sup>2</sup> reform

<sup>1</sup> Registration, Evaluation, Authorization & Restriction of Chemicals

<sup>2</sup> Toxic Substances Control Act

# Key Risk Management Actions Completed

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- **Perchlorate RDT&E; DoD Policy; Sampling; Congressional Myth-busters brief**
- **Hexavalent chromium RDT&E; USD(AT&L) policy; Defense Federal Acquisition Regulation**
- **SF6<sup>1</sup> policy on capture & recycling**
- **Beryllium life cycle study**
- **Development of innovative naphthalene dosimeter for fuel handlers**
- **RDX<sup>2</sup> toxicological studies**
- **Coordination with PEO/PM for chem/bio protection equipment related to phase-out of phthalates**

<sup>1</sup> Sulfur Hexafluoride    <sup>2</sup> Cyclotrimethylenetrinitramine