American Tools and REACH

Use Tools You Know To Fill The Knowledge Gaps REACH Requires

WASHINGTON STATE DEPARTMENT OF ECOLOGY

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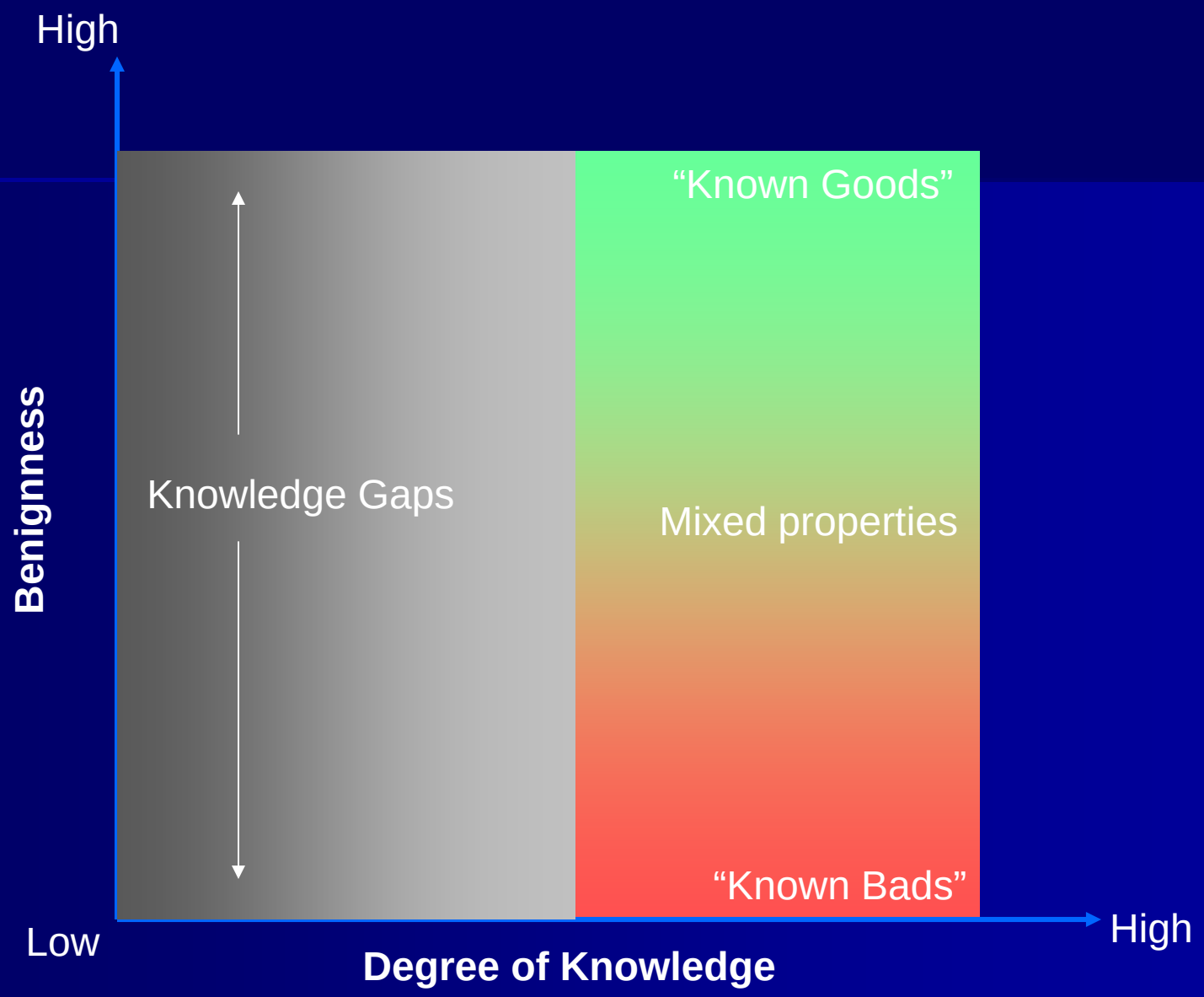
High
Benignness
Knowledge Gaps
"Known Goods"
Mixed properties
"Known Bads"
Low
High
Degree of Knowledge

Steps to Implementing Green Chemistry

Chemical Inventory

- Strategies for chemical inventorying
  - MSDS
  - Full ingredient disclosure
    - 1000ppm
    - 100ppm or less
  - Restricted substances lists (affadavit)
  - Selected preferred materials

Steps to Implementing Green Chemistry

Assessment & Evaluation

- Identify “Known Bads”
- Screen against policy and regulatory lists
- Screen against chemicals of concern targeted by NGOs or other non-regulatory bodies
  - E.g endocrine disruptors (bisphenolA, phthalates)
  - pvc
- PBT Profiler

Steps to Implementing Green Chemistry

Assessment & Evaluation

- **Assess Alternatives**
  - U.S. EPA DfE Alternatives Assessment protocol (i.e., Table 4.1 of the Furniture Flame Retardancy Report)
  - The Green Screen for Safer Chemicals: hazard assessment framework
  - SC Johnson & Co. Green List™ criteria used for scoring

U.S. EPA Hazard Assessment Matrix

L = Low hazard concern
M = Moderate hazard concern
H = High hazard concern
L, *M*, or *H* = Endpoint assigned using estimated values and professional judgment (Structure Activity Relationships)

N = No
Y = Yes

Chemical	CAS RN	Human Health Effects							Ecotoxicity		Environmental		Potential Routes of Exposure						
													Worker			General Population			
		Cancer Hazard	Skin Sensitizer	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation	Inhalation	Dermal	Ingestion	Inhalation	Dermal	Ingestion	Aquatic
Phosphoric trichloride, reaction products with bisphenol A and phenol	181028-79-5	*L*	L	*L*	L	*L*	M	L	*H*	*M*	H	*L*	N	Y	Y	N	Y	Y	Y
Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester	5945-33-5	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*L*	*L*	*H*	*L*	Y	Y	Y	N	Y	N	N
Phosphoric acid, bis[4-[1-[4-[(diphenoxyphosphinyl)oxy]phenyl]-1-methylethyl]phenyl] phenyl ester	83029-72-5	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*L*	*L*	*H*	*L*	Y	Y	Y	N	Y	N	N
Triphenyl Phosphate	115-86-6	*L*	L	L	L	L	M	L	H	*H*	L	L	Y	Y	Y	Y	Y	Y	Y
Phosphoric trichloride, polymer with 1,3-benzenediol, phenyl ester	125997-21-9	*L*	L	L	L	*L*	M	L	*H*	*M*	L	*M*	Y	Y	Y	Y	Y	Y	Y
Phosphoric acid, 1,3-phenylene tetraphenyl ester	57583-54-7	2.	*L*	*L*	*L*	*L*	*M*	*L*	*L*	*H*	*L*	*M*	Y	Y	Y	N	Y	N	N
Phosphoric acid, bis[3-[(diphenoxyphosphinyl)oxy]phenyl] phenyl ester	98165-92-5	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*L*	*L*	*L*	*L*	Y	Y	Y	N	Y	N	N
Triphenyl Phosphate	115-86-6	*L*	L	L	L	L	M	L	H	*H*	L	L	Y	Y	Y	Y	Y	Y	Y

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The CPA Green Screen for Safer Chemicals

TABLE 3: Threshold Values for Each Chemical Hazard Included in the Green Screen

Hazard	Very High (v)	High (H)	Moderate (M)	Low (L)
Environmental Fate				
Persistence—P (half-life in days)[1]	• Soil or sediment >180 days; or • Water >60 days	• Soil or sediment >60 to 180 days; • Water >40 to 60 days; or • Potential for long-range environmental transport	• Soil or sediment 30 to 60 days; or • Water 7 to 40 days	• Soil or sediment <30 days; • Water <7 days; or • Ready bio-degradability
Bioaccumulation Potential—B[1]	• BCF/BAF >5000; or • Absent such data, log K_{ow} >5	• BCF/BAF >1000 to 5000; • Absent such data, log K_{ow} >4.5-5; or • Weight of evidence demonstrates bioaccumulation in humans or wildlife	• BCF/BAF 500 to 1000; • Absent such data, log K_{ow} >4-4.5; or • Suggestive evidence of bioaccumulation in humans or wildlife	• BCF/BAF <500; or • Absent such data, log K_{ow} <4
Ecotoxicity				
Acute Aquatic Toxicity[1]		• $LC_{50}/EC_{50}/IC_{50}$ <1 mg/l; or • GHS Category 1	• $LC_{50}/EC_{50}/IC_{50}$ 1-100 mg/l; or • GHS Category 2 or 3	• $LC_{50}/EC_{50}/IC_{50}$ >100 mg/l
Chronic Aquatic Toxicity[1]		• NOEC <0.1 mg/l; or • GHS Category 1	• NOEC 0.1-10 mg/l; or • GHS Category 2, 3 or 4	• NOEC >10 mg/l
Human Health				
Carcinogenicity*		• Evidence of adverse effects in humans; • Weight of evidence demonstrates potential for adverse effects in humans; • NTP known or reasonably anticipated to be human carcinogen; • OSHA carcinogen; • California Prop 65; • IARC Group 1 or 2A; • EU Category 1 or 2; or • GHS Category 1A or 1B	• Suggestive animal studies; • Analog data; • Chemical class known to produce toxicity; • IARC Group 2B; • EU Category 3; or • GHS Category 2	• No basis for concern identified or • IARC Group 3 or 4
Mutagenicity/ Genotoxicity*		• Evidence of adverse effects in humans; • Weight of evidence demonstrates potential for adverse effects in humans; • EU Category 1 or 2; or • GHS Category 1A or 1B	• Suggestive animal studies; • Analog data; • Chemical class known to produce toxicity; • EU Category 3; or • GHS Category 2	No basis for concern identified
Reproductive toxicity*		• Evidence of adverse effects in humans; • Weight of evidence demonstrates potential for adverse effects in humans; • NTP Center for the Evaluation of Risks to Human Reproduction; • California Prop 65; • EU Category 1 or 2; or • GHS Category 1A or 1B	• Suggestive animal studies; • Analog data; • Chemical class known to produce toxicity; • EU Category 3; or • GHS Category 2	No basis for concern identified
Developmental toxicity*		• Evidence of adverse effects in humans; • Weight of evidence demonstrates potential for adverse effects in humans; • NTP Center for the Evaluation of Risks to Human Reproduction; or • California Prop 65	• Suggestive animal studies; • Analog data; or • Chemical class known to produce toxicity	No basis for concern identified

Hazard Thresholds

Screening Benchmarks

FIGURE 2: **Green Screen for Safer Chemicals**

Chemical

(+ breakdown products + metabolites)

BENCHMARK 1

a. PBT: high P + high B + high T[1] (high Human Toxicity[2] or high Ecotoxicity)
b. vPvB: very high P + very high B?
c. vPT (vP + high T) or vBT (vB + high T)
d. high Human Toxicity for any priority effect[3]

If this chemical does not pass all of the above hazard criteria then
Avoid—Chemical of High Concern

If this chemical does pass all of the above hazard criteria then move on to Benchmark 2

BENCHMARK 2

a. moderate P + moderate B + moderate T (moderate Human Toxicity or moderate Ecotoxicity)
b. high P + high B? (high P + moderate T) or (high B + moderate T)
c. moderate Human Toxicity for any priority effect or high Human Toxicity
d. high Flammability or high Explosiveness

If this chemical does not pass all of the above hazard criteria then
Use but Search for Safer Substitutes

If this chemical does pass all of the above hazard criteria then move on to Benchmark 3

BENCHMARK 3

a. moderate P or moderate B
b. moderate Ecotoxicity
c. moderate Human Toxicity
d. moderate Flammability or moderate Explosivenesness

If this chemical does not pass all of the above hazard criteria then
Use but Still Opportunity for Improvement

If this chemical does pass all of the above hazard criteria then move on to Benchmark 4

BENCHMARK 4

ready biodegradability (low P) + low B + low Human Toxicity + low Ecotoxicity (+ additional ecotoxicity endprints when available)

If this chemical does not pass all of the above hazard criteria then
Prefer—Safer Chemical

ABBREVIATIONS:
B – bioaccumulation
P=persistence
T=human toxicity and ecotoxicity
vB=very bioaccumulative
vP=very persistent

SOURCES:
1 Toxicity – "T" = human toxicity and ecotoxicity
2 Human Toxicity – priority effects (see below) or acute toxicity, immune system or organ effects, sensitization, skin corrosion, or eye damage
3 Priority Effects = carcinogenicity, mutagenicity, reproductive or developmental toxicity, endocrine disruption, or neurotoxicity

SC Johnson GreenList™:

2005 Presidential Green Chemistry Challenge Award

How the Greenlist™ Works

What do We Screen?

Six categories represent 80% of Kg volume:

- Surfactants
- Solvents
- Propellants
- Insecticides
- Resins
- Packaging

How Do We Screen Them?

- 4-7 unique criteria for each category:
  - ✓ Meaningful
  - ✓ Discriminating
  - ✓ Readily Available (SC Johnson suppliers must have most of the data).
  - ✓ Plus -- Other Significant Concerns

How Do We Rate Them?

- Best (3)
- Better (2)
- Acceptable (1)
- Restricted Use Material (0) - RUM

A FAMILY COMPANY

From: http://www.scjohnson.com/community/pdf/Greenlist_presentation.pdf (March 04 2007)

ISO 14001 Management System Summary

Continuous Improvement

Environmental Policy

Planning

- Environmental Aspects
- Legal and Other
- Objectives & Targets
- Env. Mgmt. Programs

Implementation and Operation

- Structure & Responsibility
- Training, Awareness & Competence
- Communication
- EMS Documentation
- Document Control
- Operational Control
- Emergency Preparedness & Response

Checking and Corrective Action

- Monitoring and Measurement
- Non-conformance and Corrective & Preventive Action
- Records
- EMS Audits

Management Review

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