TUR Options Identification and Evaluation

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Linda Swift, Capaccio Environmental Engineering

Pam Eliason, Toxics Use Reduction Institute

Capaccio Environmental Engineering, Inc.

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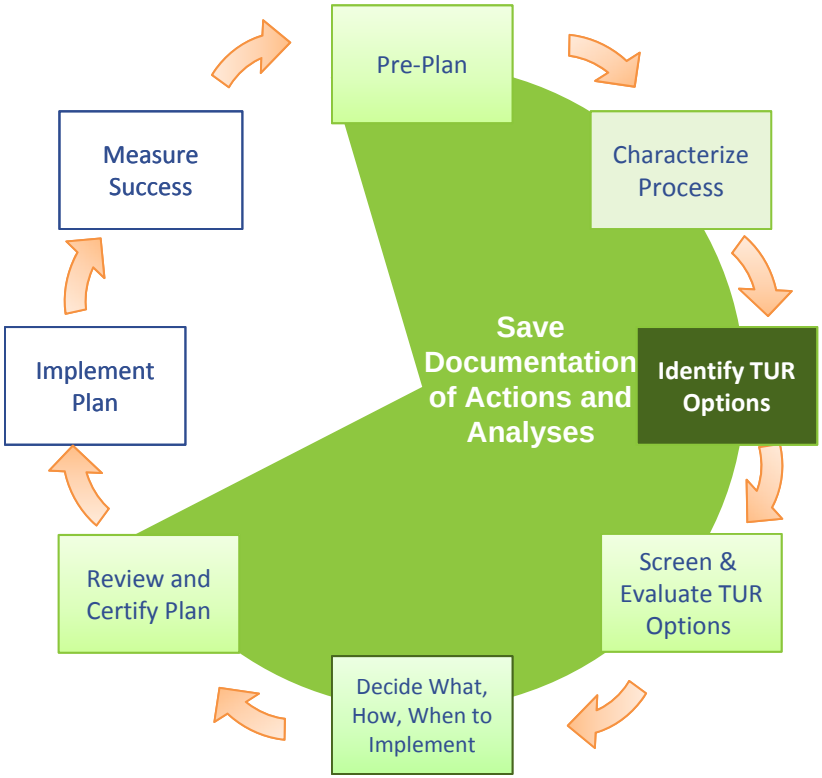
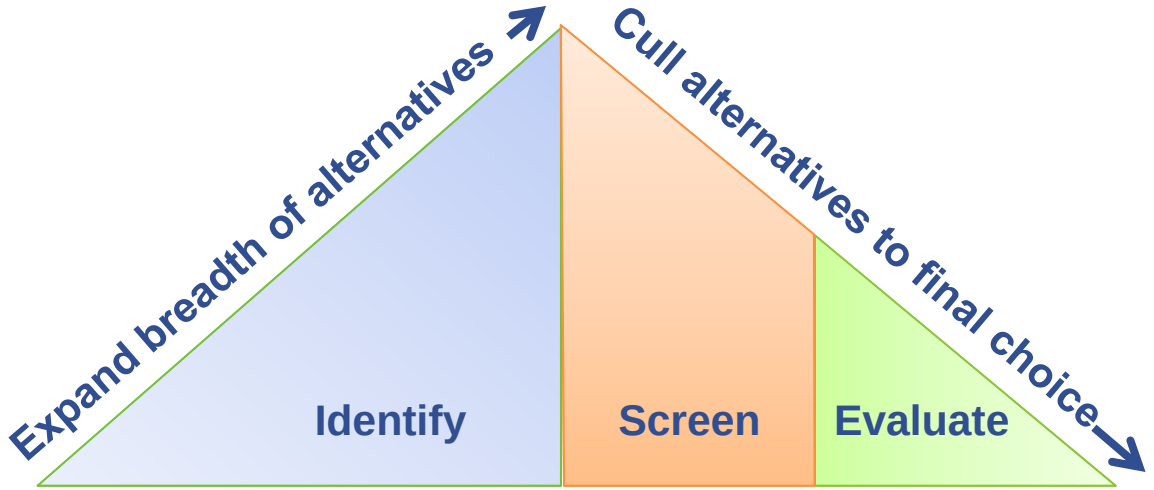
Overview

- Options Identification
  - Exercise using Acme Electronics
- Options Evaluations
  - Screening
  - Feasibility
  - Exercise using Acme Electronics
- EH&S Evaluation Tools
- Take Aways



TUR Option ID and Evaluation Process

For *each* toxic in *each* production unit:



Brainstorm TUR Options

- Use 6 TUR techniques
- Generate lots of ideas

Eliminate Options

- Technically or economically infeasible
- Not TUR

Evaluate remaining Options

- Technical evaluation
- Economic evaluation

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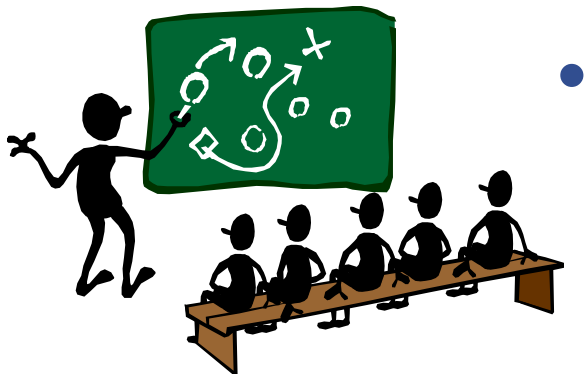
Before You Start the Options Identification Process …

- Who's on the Team?
- How are you going to capture everything?
- What are your goals?

TUR Planning Team

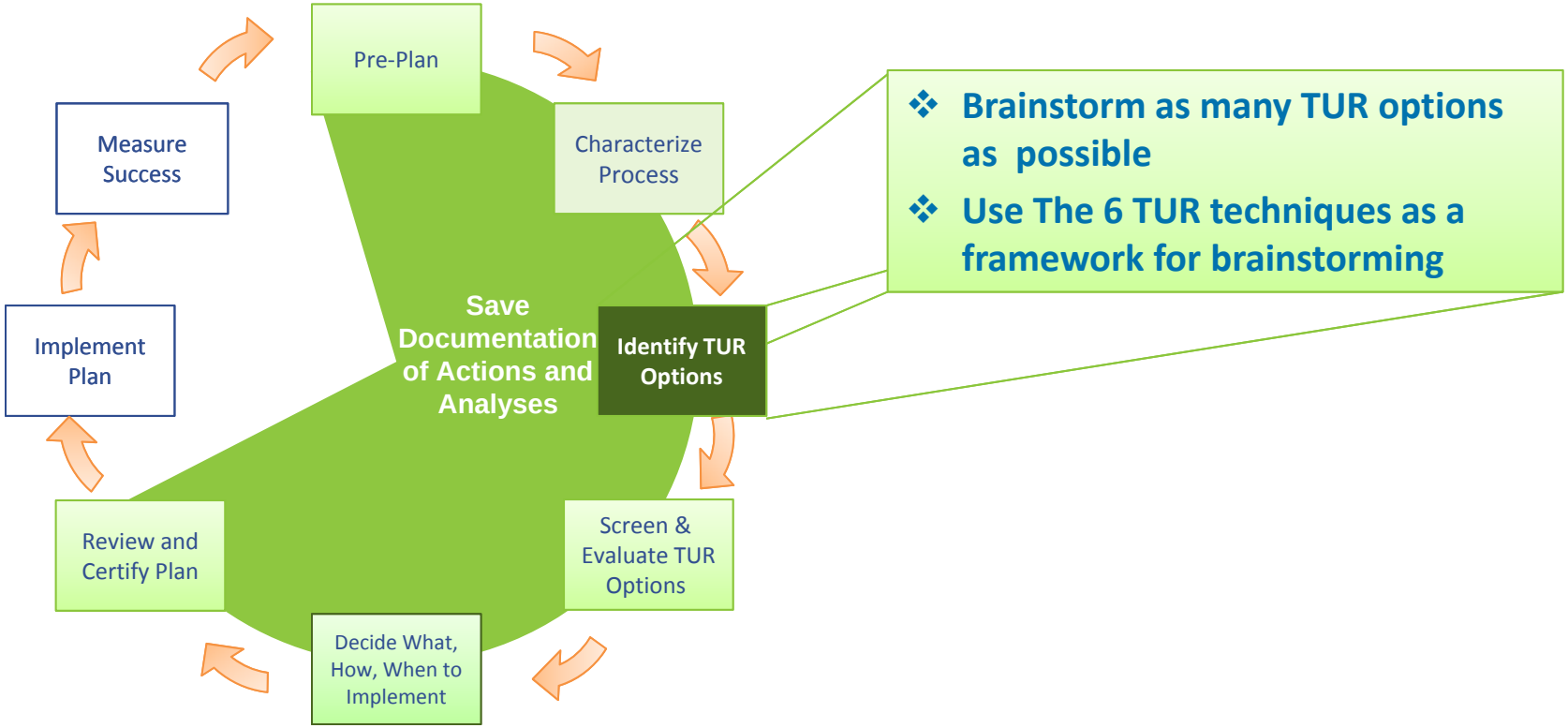


- Who should be on the team?
- When do you engage the various members of the team?
- Create meeting agendas, including objectives of the meeting and anticipated next steps, to help ID who should be in the room

Capturing The Data

- What tool will you use?
  - The list
  - The meeting minutes
- Will you use an identifier for options?
- Be sure that the option is clear/understood by all

Options Identification



TURA Requirements for TUR Option Identification (310 CMR 50.45)

The Toxics Use Reduction Act requires companies to include in their plan a written description of the procedure they used to identify technologies, procedures or training programs for *potentially achieving* TUR for each production unit. The written description of the TUR options ID procedure must include:

- Consideration of the six TUR techniques
- Personnel involved in the TUR options ID process
- Description of information sources consulted
- Description of methods used for gathering information
- List of technologies, procedures or training programs identified

The Six TUR Techniques

Input Substitution

Product Reformulation

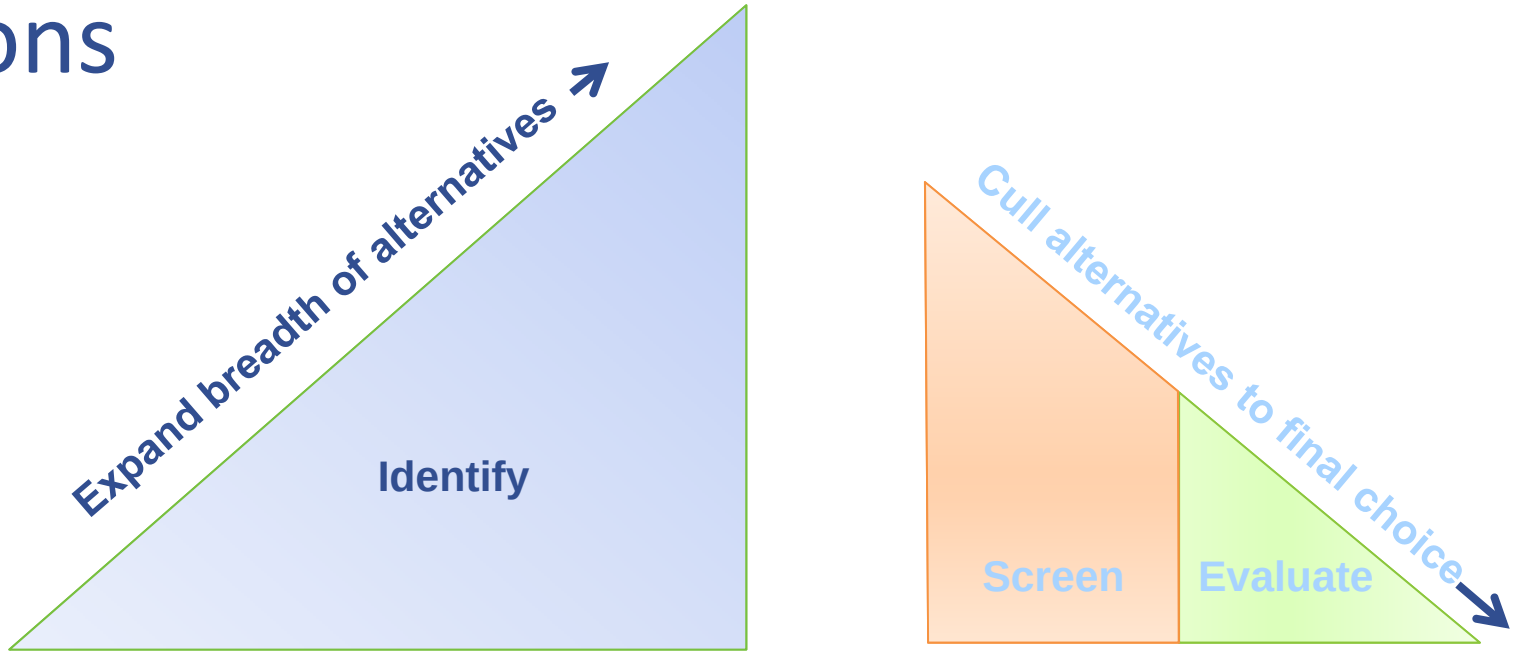
Production Unit Redesign/ Modification

Production Unit Modernization

Improved Operations and Maintenance

Recycling integral to the process

Introduction to Identifying TUR Options



- Creative phase
- Generate complete list of TUR opportunities
  - Obvious opportunities
  - Hidden opportunities
- Document process and ideas

Brainstorming TUR Options

- Open / creative process
- Commonly used to generate ideas
- Encourages creative ideas
- Harnesses collective creativity
- Generates many ideas

Going Further than the Low Hanging Fruit

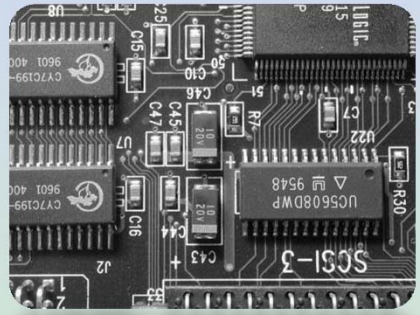
- Be systematic
- Revisit past ideas
- Enlist the right team

Being Systematic

- Example worksheet
- Research/capture what's new
- Meeting minutes
  - Who attended?
  - What options generated?
  - Do we need to do more to find more options?
  - Who's responsible for what?
  - What's the plan for next time?

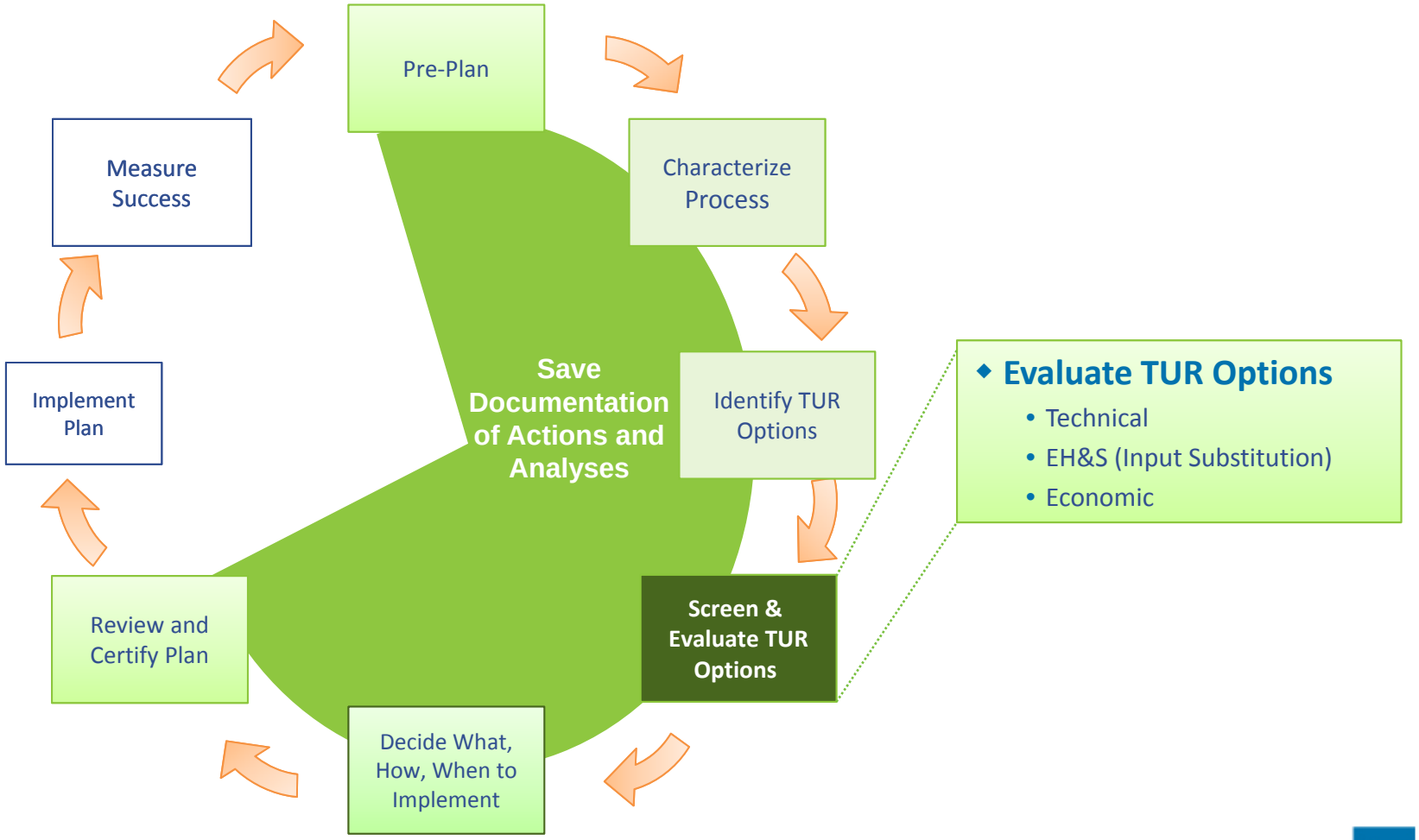
"I thought I'd introduce a little democracy to this department. Bring me your suggestions and I'll vote on them."

Acme Electronics



- Identify potential TUR options for each of the TUR techniques

Evaluate TUR Options



TUR Option ID and Evaluation Process

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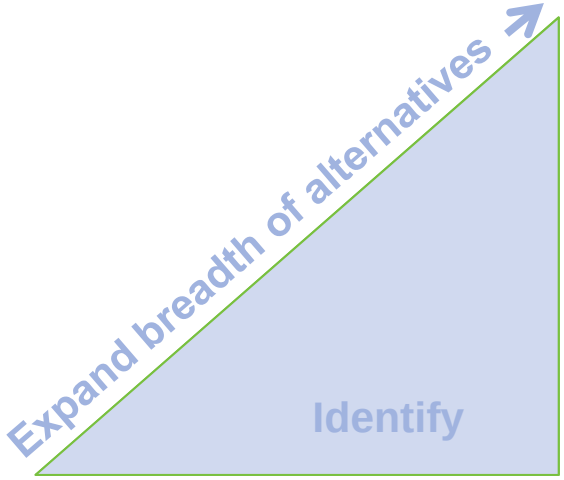

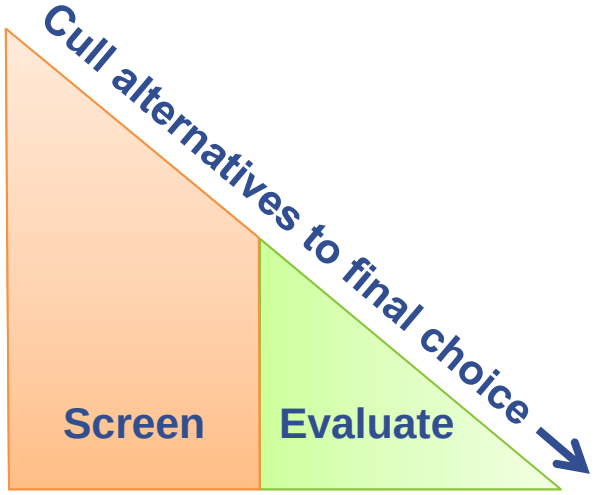

Eliminate Options

- Clearly technically or economically infeasible
- Not TUR

Evaluate remaining Options

- Technical evaluation
- EH&S evaluation
- Economic evaluation

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TURA Requirements for Technical Evaluation of TUR Techniques (CMR 310 50.46)

TURA requires companies to evaluate the technical feasibility of each TUR option listed in the plan

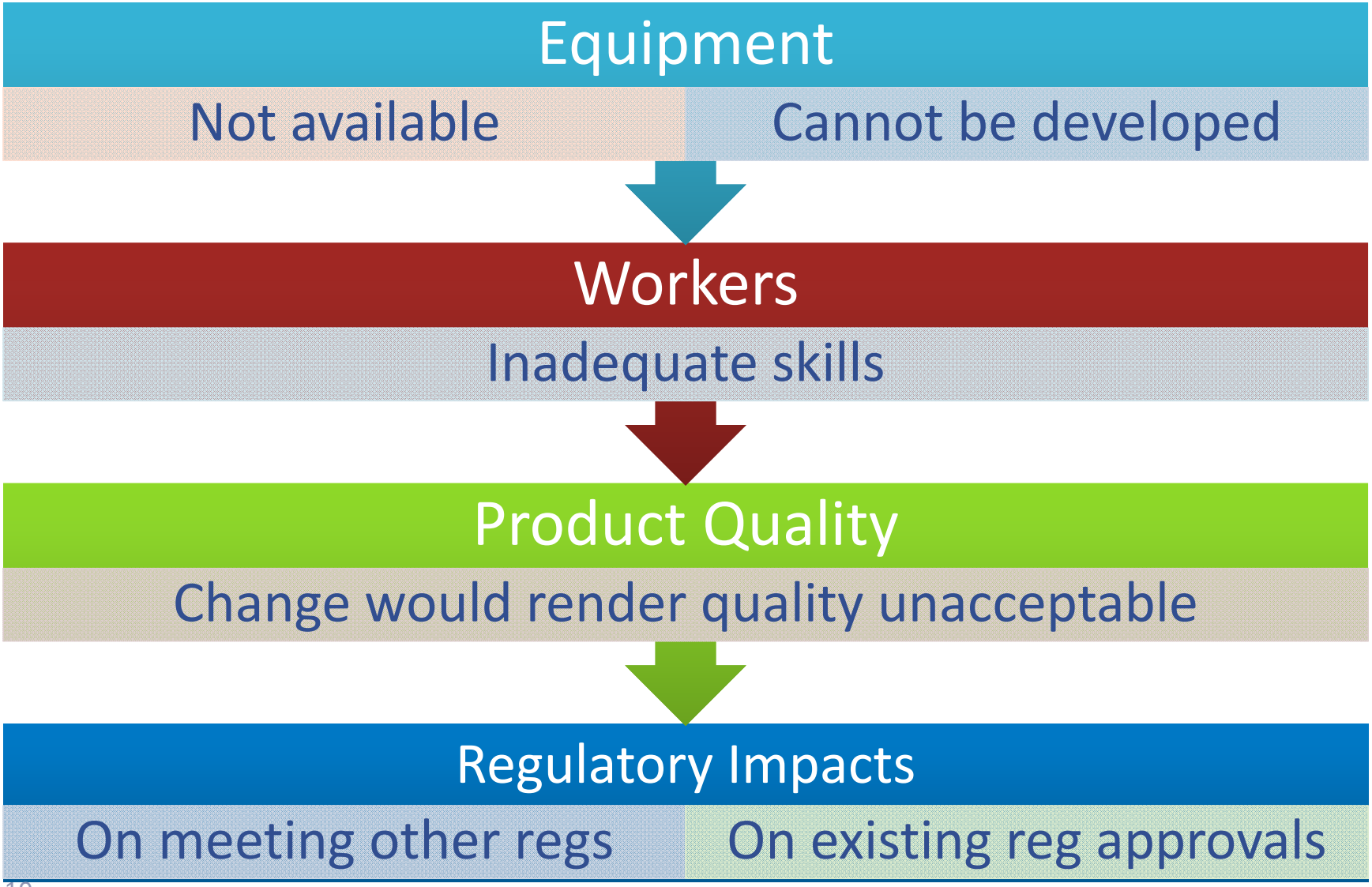
- Evaluate whether the TUR option constitutes toxics use reduction – **Is it TUR?**
- **Calculate the expected reductions** resulting from implementation of the TUR option
  - Amount used in each prod. unit and on a per unit of product basis
  - Amount of byproduct generated in each prod. unit and on a per unit of product basis
- Consider impact on other applicable laws/regs if the TUR option is implemented

Do We Have What We Need To Evaluate?

- Have we defined the option clearly?
- Do we have enough information?
- Are the right people at the table?
- Have we defined technical and economic feasibility?
- Have we defined EHS criteria?

Technical Screening

What is "technically infeasible?"



Economic Screening

Use normal business process

Document your process

Factors of infeasibility might include:

- Does not meet investment criteria
- Clearly too expensive
- Availability of capital

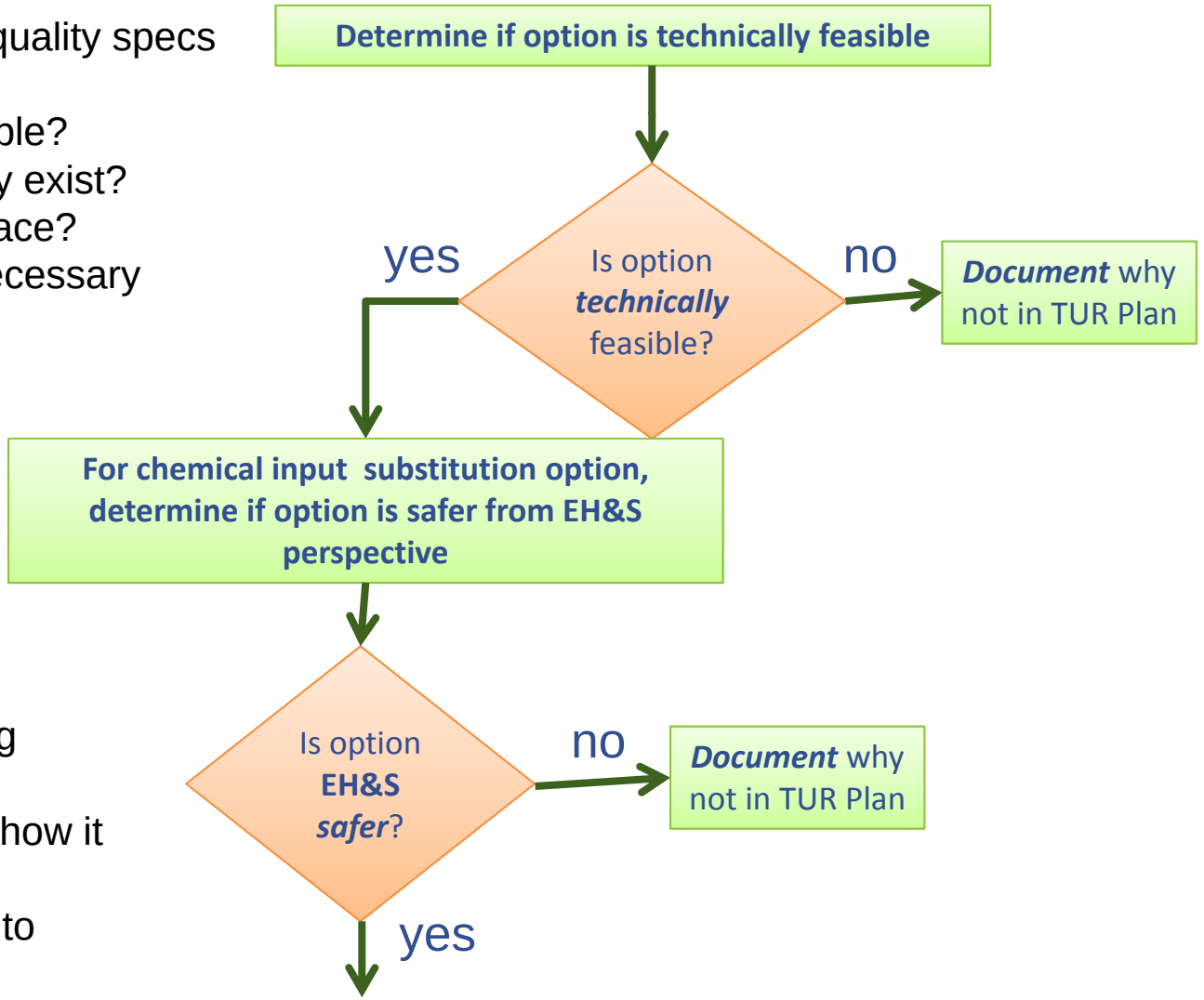
Compare to cost of using toxic chemical

EH&S Screening

What can we do to eliminate regrettable substitutes faster?

- PBTs
- Carcinogens
- CMRs
- Restricted Substances Lists
- Consider criteria for screening contaminants, mixtures, etc.

- Is it TUR?
- Can customer and quality specs be met?
- Is it reliable and stable?
- Does the technology exist?
- Is there physical space?
- Do workers have necessary expertise?



- Is it TUR?
- Does it avoid shifting risk?
- Does data exist to show it is safer?
- Is there information to show it is not a regrettable substitution?

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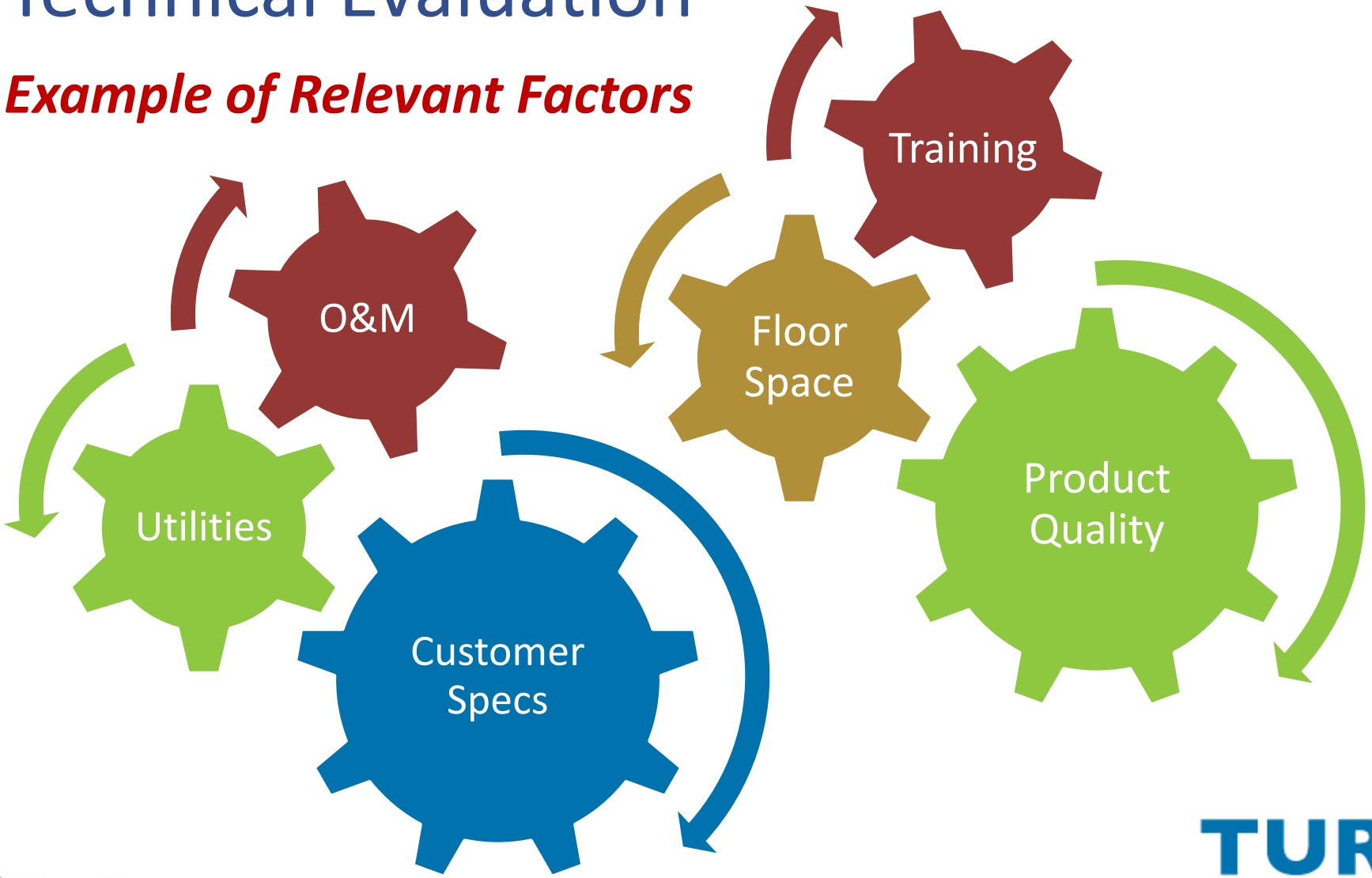
Technical Evaluation

Example of Relevant Factors



Qualitative Issues

- Productivity
- Product Quality
- Market Share
- Employee Health and Safety
- Stakeholder Relations
- Public Image
- Criminal Liability
- Financial Liability

- Storage and Disposal
- Real Property Damage
- Civil Actions/ Toxic Tort Suits
- Fines and Penalties
- Regulatory impact

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TURA Requirements for Implementation of TUR Techniques (CMR 310 50.46)

For those TUR options that the company chooses to implement, TURA **requires** that the TUR Plan include:

- A description of the TUR option
- The anticipated costs and savings
- The expected reductions in amounts used and byproduct generated
- An implementation schedule

EH&S Assessment Considerations

Is this a preferable solution/material?

- Comparison with existing material
- Comparison with corporate/organizational criteria
- Benchmarks

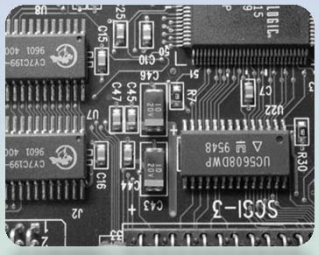
Health and environmental effects

Significant life cycle effects (qualitative)

Significant potential exposure

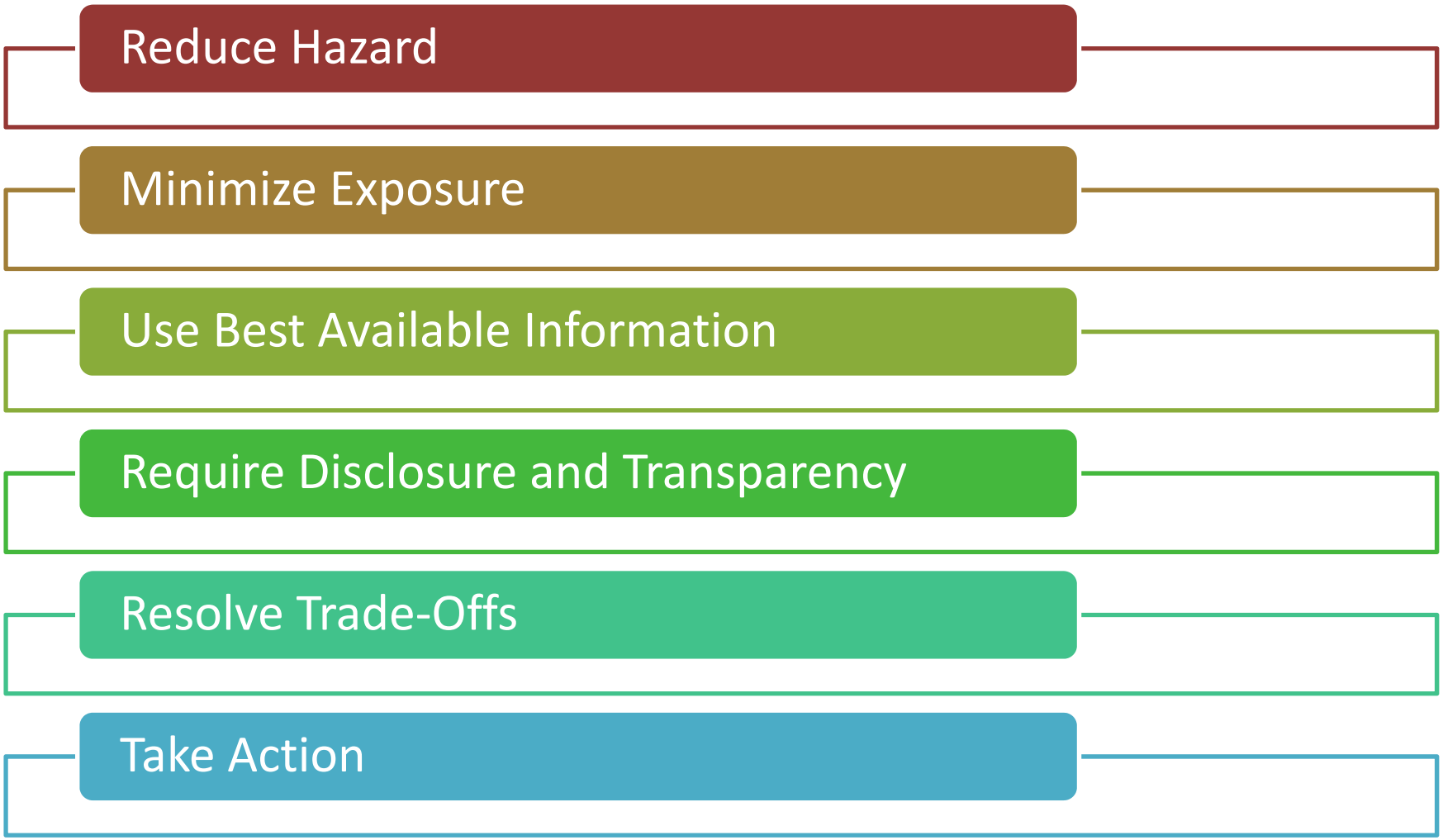
Uncertainty

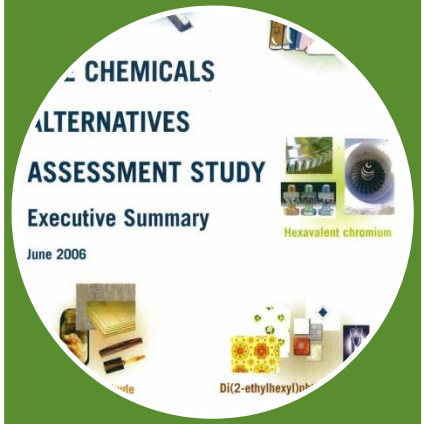
Acme Electronics



- In small group, consider the following:
  - How you define “technically infeasible”
  - What info you need to fully characterize options
  - Who should be participating at this point
  - What system you’ll use to rate options
- With large group:
  - Present options you recommend be implemented
  - Discuss your reasons for excluding any options on the grounds of being “clearly infeasible”

Principles for Alternatives Assessment





TURI Alternatives Assessment Method

Green Screen

EPA Design for Environment

Pollution Prevention Options Assessment System (P2OASys)

Tools to Avoid Regrettable Substitutes

TURI Alternatives Assessment

Screening criteria include: PBT, carcinogenicity, SAB listing of more hazardous chemicals

Additional environmental, health and safety data was collected for alternatives

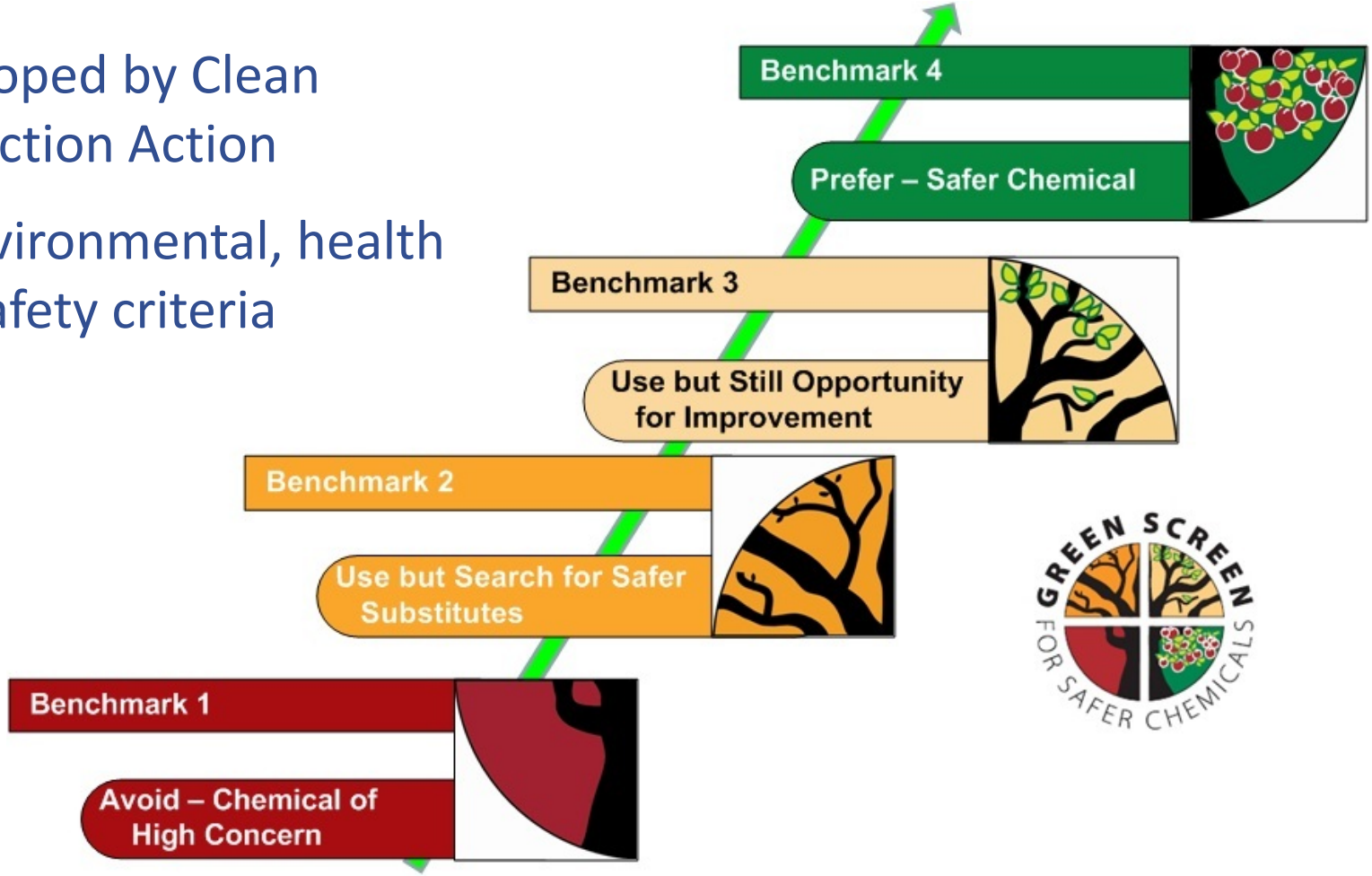
Additional research into technical and economic feasibility conducted

Information available at:

www.turi.org/alternatives_assessment

Green Screen

- Developed by Clean Production Action
- 17 environmental, health and safety criteria



http://www.cleanproduction.org/library/Green_Screen_Report.pdf

Green Screen Benchmarking DecaBDE

Chemical	CAS#	% in Formulation	Human Health Effects													Ecotox.		Fate		Breakdown Products	
			Priority Effects																		
			Carcinogenic	Mutagenic	Reproductive	Developmental	Endocrine Disruption	Neurological	Acute Toxicity	Systemic/Organ Effects	Sensitization (skin)	Sensitization(respiratory)	Irritation/Corrosion (skin)	Irritation/Corrosion (eyes)	Immune System Effects	Acute	Chronic	Persistence	Bioaccumulation	Metabolites	Degradation Products
Decabromodiphenyl ether (decaBDE) - CAS# 1163-19-5																					
DecaBDE	1163-19-5	97	**M**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**	nd	**L**	**L**	nd	**L**	**L**	**vH**	**M**	penta- to nona-BDE	tri- to nona-BDE
Breakdown Products																					
PentaBDE	32534-81-9		nd	**L**	**M**	**M**	**H**	**M**	**L**	**H**	**L**	**L**	**M**	**M**	nd	**H**	**H**	**vH**	**vH**		
OctaBDE	32536-52-0		nd	**L**	**M**	**H**	**M**	**M**	**L**	**H**	**L**	nd	**L**	**L**	nd	**L**	**L**	**vH**	**M**	nd	lower PBDEs

Bold text = based on experimental data. ***Black italics text*** = based on analog data or expert judgment.

Design for the Environment

Developed by U.S. EPA

The DfE Safer Product Labeling Program

DfE Screens for Safer Chemical Ingredients

DfE's Alternatives Assessments program

http://www.epa.gov/dfe/

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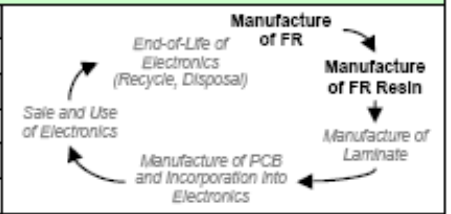
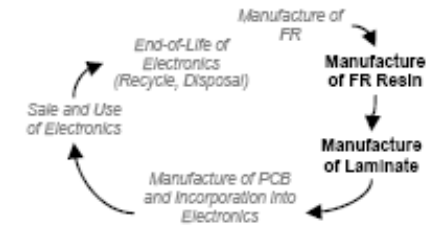
DfE Alternatives Assessment Results

Chemical	CASRN	Human Health Effects									Aquatic Toxicity		Environmental		Exposure Considerations
		Acute Toxicity	Skin Sensitizer	Cancer Hazard	Immunotoxicity	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation	Availability of FRs throughout the lifecycle for reactive and additive FR chemicals and resins[2]
Reactive Flame Retardant Chemicals[2]															
Tetrabromobisphenol A (TBBPA) (Albemarle, Chemtura, and others)[3]															
TBBPA	79-94-7	L	L	L	L	L	M	L	L	L	H	H	M	L	
DOPO (6H-Dibenz[c,e][1,2] oxaphosphorin, 6-oxide) (Sanko Co., Ltd. and others)															
DOPO	35948-25-5	L	L	L	L	L	L	L	L	L	M	M	L	L	
Fyrol PMP (Aryl alkylphosphonate) (Supresta)															
Fyrol PMP	Proprietary	L	L	L	L	L	L	L	L	L	L	L	H	L	
Reactive Flame Retardant Resins[2]															
Reaction product of TBBPA - D.E.R. 538 (Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-, polymer with (chloromethyl)oxirane and 4,4'-(1-methylethylidene)bis[phenol]) (Dow Chemical)															
D.E.R. 538	26265-08-7	L	M	M[0]	L	M[0]	M[0]	L	L	M	L	L	M	L	
Reaction Product of DOPO – Dow XZ-92547 (reaction product of an epoxy phenyl novolak with DOPO) (Dow Chemical)															
Dow XZ-92547	Proprietary	L	M	M[0]	L	M[0]	M[0]	L	L	M[0]	L	L	H	L	
Reaction product of Fyrol PMP with bisphenol A, polymer with epichlorohydrin (Representative Resin)															
Representative Fyrol PCB Resin	Unknown	L	L	M[0]	L	M[0]	M[0]	L	L	M[0]	L	L	H	L	

[1] The moderate designation captures a broad range of concerns for hazard, further described in Table 4-3.
[2] Reactive FR chemicals and resins may not completely react, and small amounts may be available during other parts of the lifecycle.
[3] The EU has published a comprehensive risk assessment for TBBPA in reactive applications. This risk assessment is a valuable source of information for choosing flame retardants for printed circuit board applications.

P2OASys EHS Evaluation

- Pollution Prevention Options Analysis System
  - www.turi.org/p2oasys
- Developed to support TUR Planners in systematically examining potential environmental and worker impact of TUR options
- Compares TUR options with company's current technology based on quantitative and qualitative factors
- Weighted scores to 10 – higher scores are less safe options

Who's Using/Requiring Alternatives Assessments?

Walmart

NIKE

TUR Planners are the Experts!

Alternatives assessment is about identifying safer, effective and affordable alternatives

Manufacturers, retailers and government agencies are requiring alternatives assessments

YOU are the expert in this process – a skilled TUR Planner has very marketable skills!

Thoughts to take away with you

- Always consider all 6 techniques when identifying options
- Have the right people on your team, and use their input wisely
- **Document** all information used to evaluate options, including info used to determine if an option is “clearly infeasible”
- Refer back to past planning notes to reconsider options
- Your expertise as TUR Planners is a marketable skill!

Thank You

Linda A. Swift, CHMM, CET, TURP, RABQSA Auditor

- Senior Associate, Capaccio Environmental Engineering, Inc.
- (508)970-0033 Extension 119
- lswift@capaccio.com

Pam Eliason

- Senior Associate Director, Industry Research Program Manager, TURI
- 978-934-3142
- pam@turi.org