Total Cost Assessment Method and Applications

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TCA Project Collaborators

- AIChE Center for Waste Reduction Technologies
- Arthur D. Little
- Bristol Myers Squibb
- Dow
- Eastman Chemical
- Eastman Kodak
- Georgia Pacific
- Monsanto
- Owens Corning
- Rhom & Haas
- Smith Kline Beecham
- US Department of Energy

Collaborator Motivation

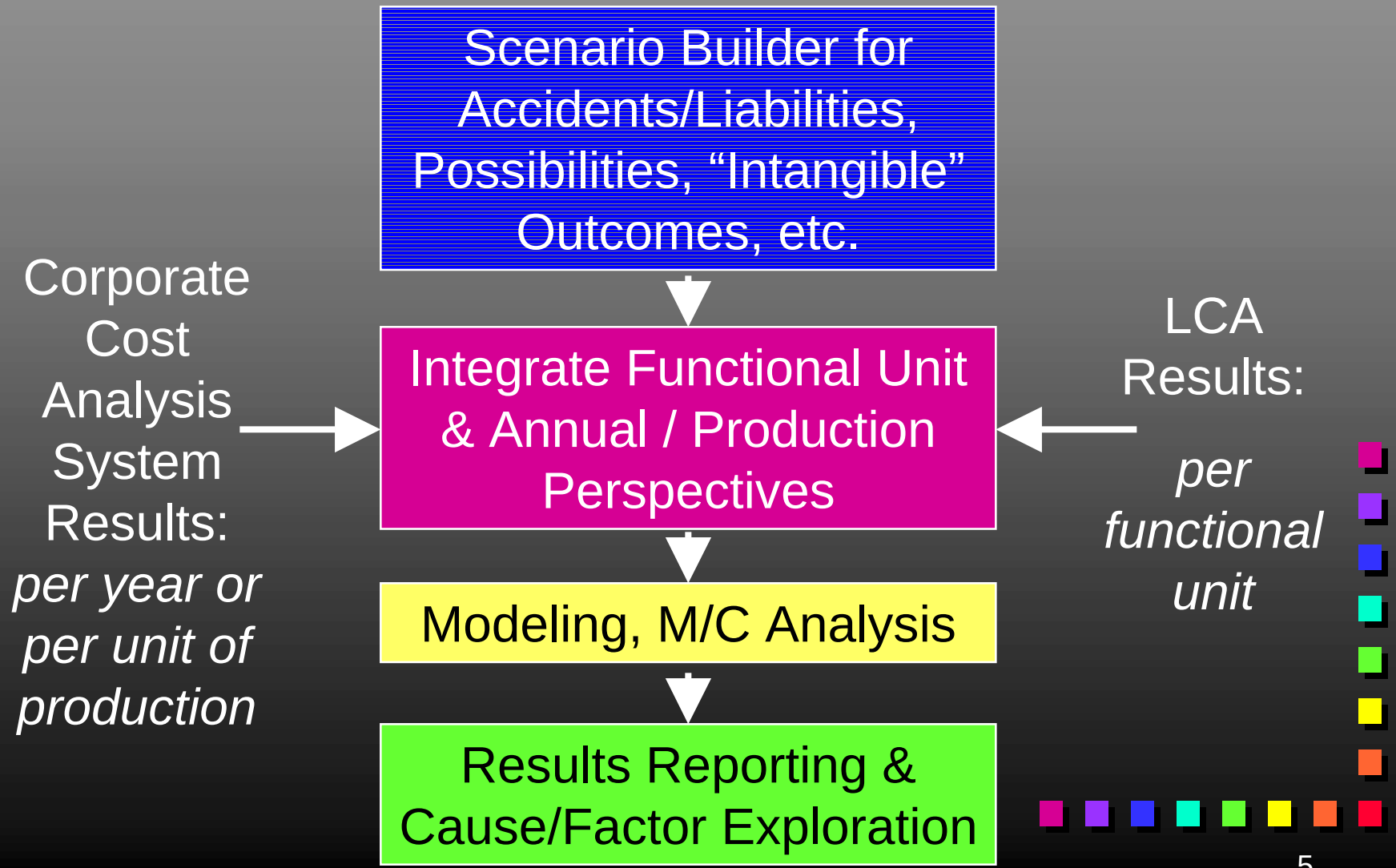
“The FULL monetary costs and benefits of EH&S issues historically have NOT been presented in an economic format to business leadership for decision making.”

- Duane Koch,
Dow Chemical

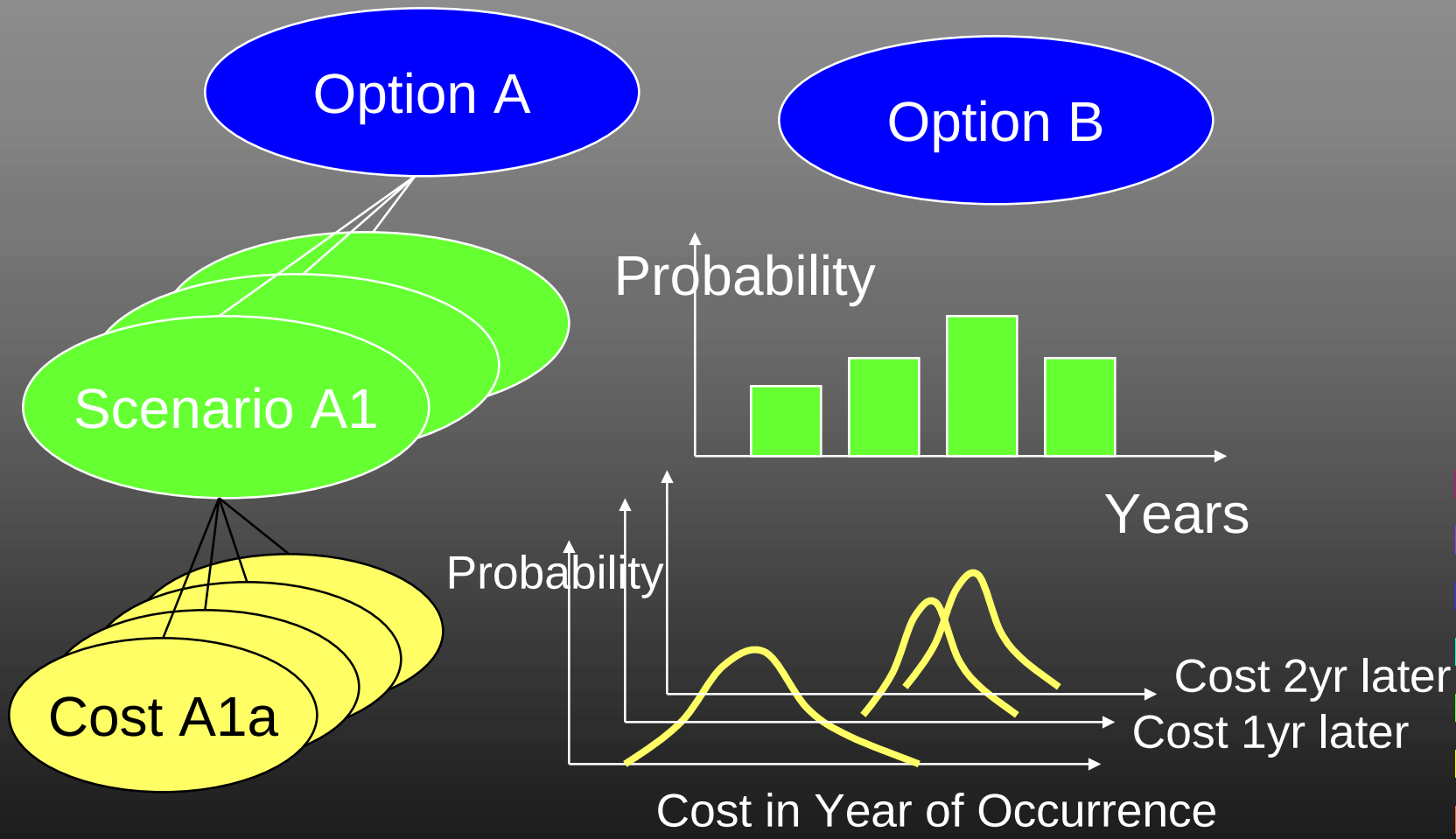
TCA Approach to Non-Conventional Costs: Match Company Conventional Approach

- Follow & Adapt to General and Company-Specific Accounting Conventions
  - Investment costs
  - Depreciation, salvage values
  - Impacts before- or after-tax
  - Discounting
  - Time Horizon

Total Cost Assessment Method

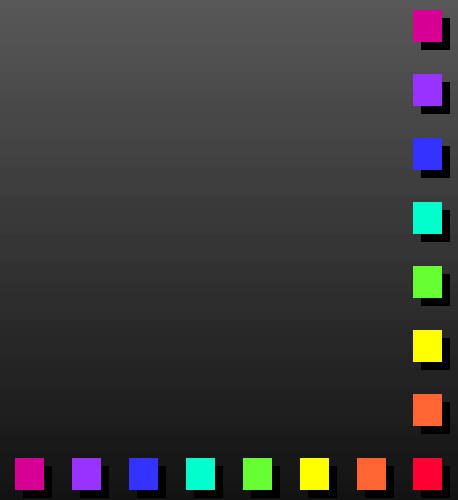


At the Heart: Scenario Analysis

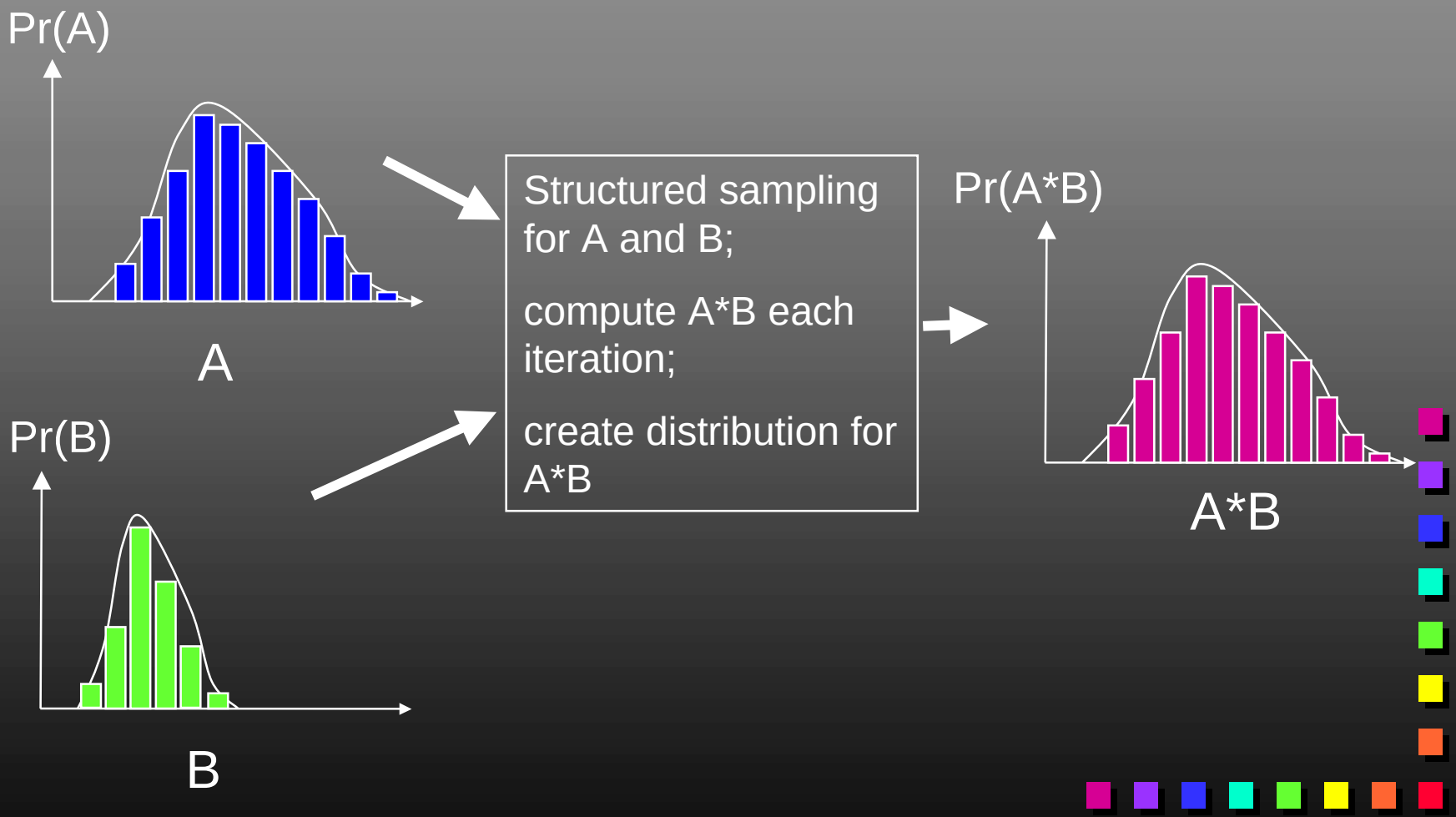


Approach to Uncertainty

- Take blinders off; acknowledge
- Ask subject experts what they know
- Brainstorm
- Model systematically
- Test for possible importance
- Refine if necessary



Monte Carlo Analysis



Optional Spreadsheet Tracking/Recording of Input

	A	B	C	D	E	F	G	H	I	J	K
1	**Use this sheet to store and summarize information about Type 3 and 4 scenarios and costs.**							Cost risk data			
2			Major spill	New Env. Reg.	Green shift	Depreciation Method	Salvage Value ($)	Yrs After Occurrence			
3	Scenario Types	1. Annual Probs, Repeatable	1	0	0						
4		2. Ann Probs, Non-repeatable	0	1	0						
5		3. Overall & Relative Probs	0	0	1						
6	Overall Probablity (For Type-3 Scenarios)		0	0	0.2			0	1	2	
7	Tie Scenarios to Costs	Cleanup, fines, penalties	1	0	0	0	0	Uniform(200000,400000)	50000	0	
8		Install control equipment	0	1	0	10sl	10000	1000000	0	0	
9		Control equipment O&M	0	1	0	0	0	0	100000	100000	
10		Brand value loss	1	0	1	0	0	10000000	-5000000	-3000000	
11	Tie Scenarios to Options	Business-as-usual	1	1	1						
12		Green substitute	0	0	0						
13	Annual Probabilities	2003	0.05	0	0						
14		2004	0.05	0	1						
15		2005	0.05	0.05	1						
16		2006	0.05	0.1	2						
17		2007	0.05	0.15	2						
18		2008	0.05	0.2	3						
19		2009	0.05	0.2	3						
20		2010	0.05	0.2	3						
21											
22											
23	Key:	Scenario names									
24		Scenario cost names									
25		Option names									
26		Scenario horizon years									
27		Years after occurrence									

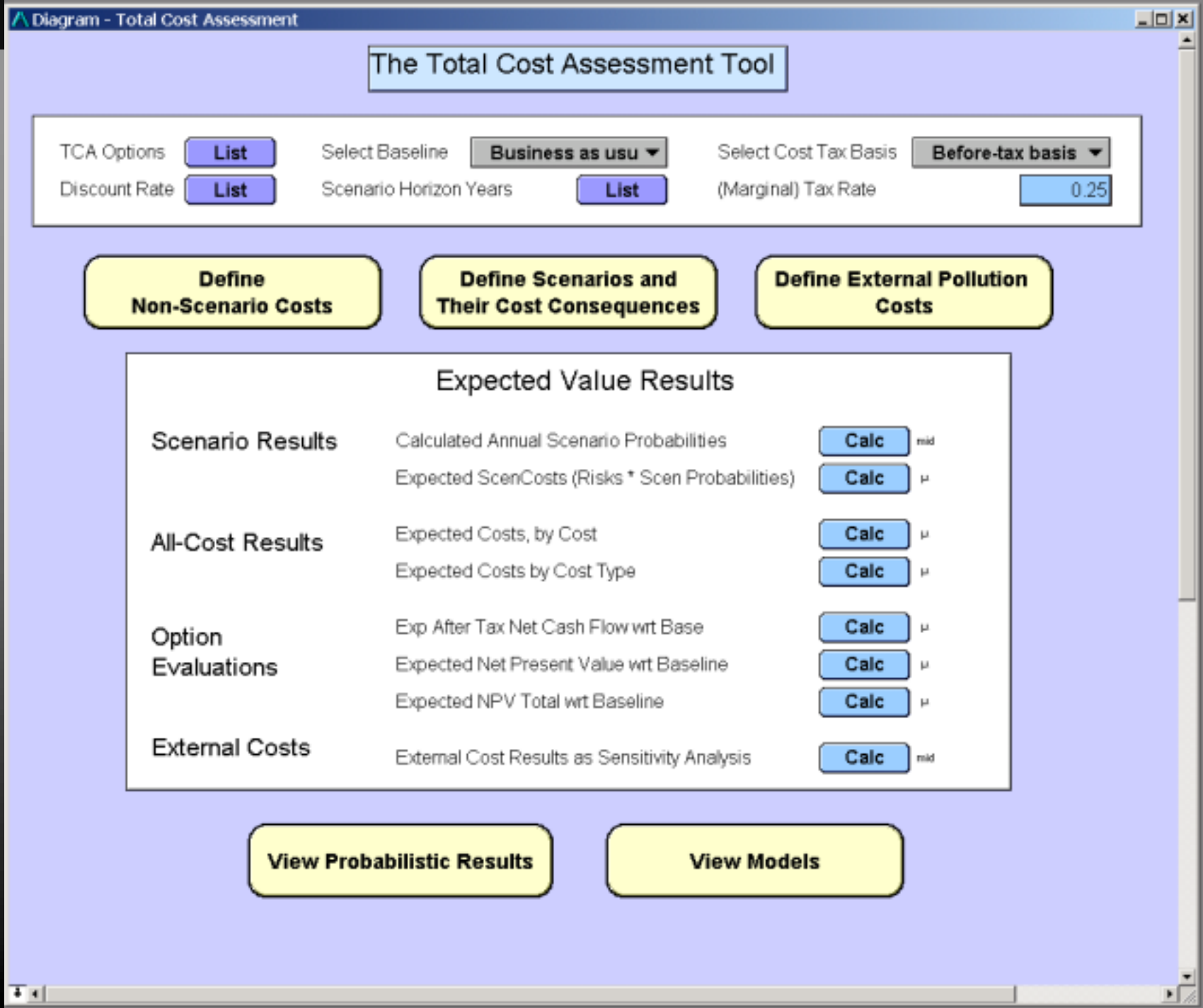
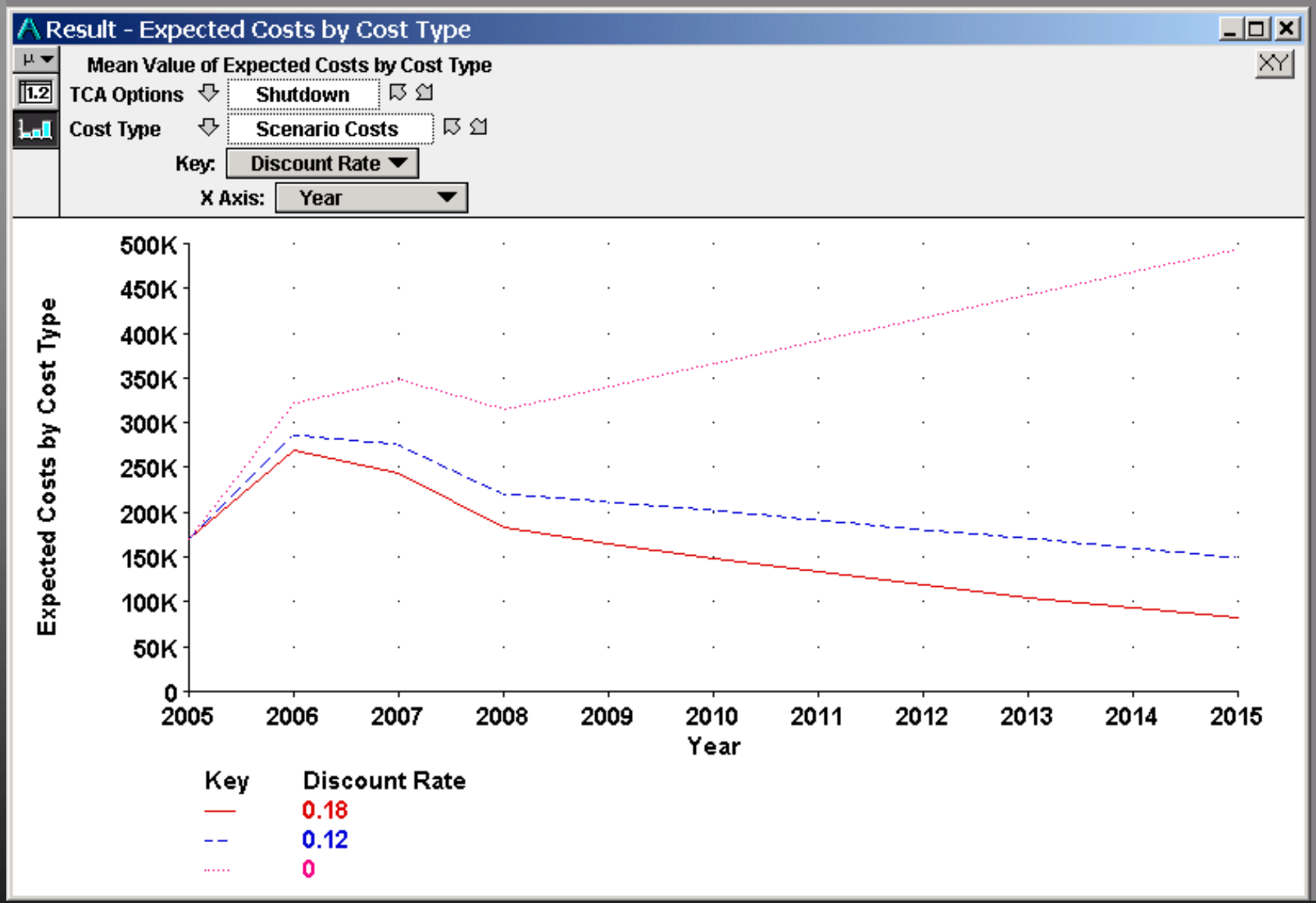
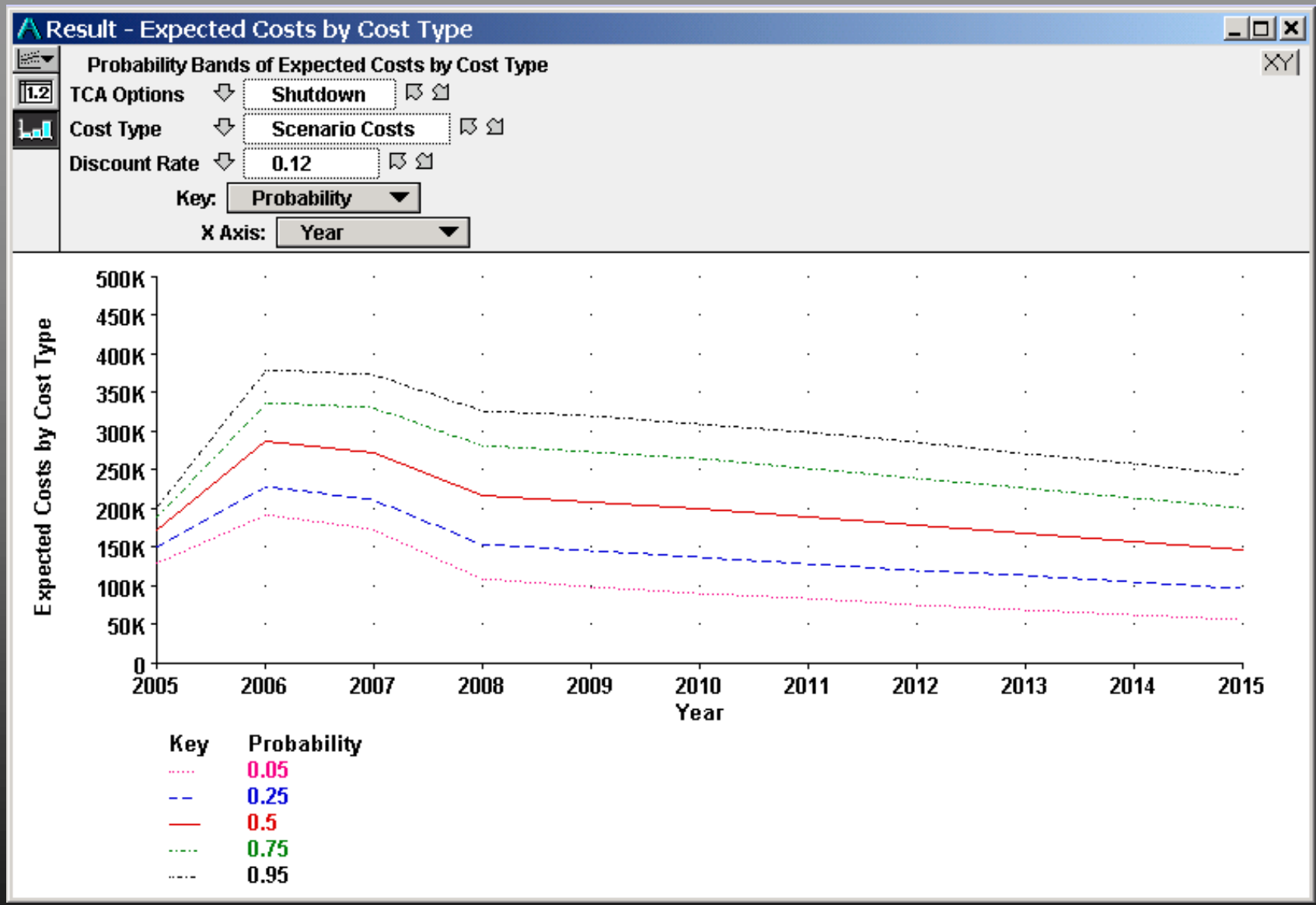


Diagram - Total Cost Assessment
The Total Cost Assessment Tool
TCA Options
List
Select Baseline
Business as usu
Select Cost Tax Basis
Before-tax basis
Discount Rate
List
Scenario Horizon Years
List
(Marginal) Tax Rate
0.25
Define Non-Scenario Costs
Define Scenarios and Their Cost Consequences
Define External Pollution Costs
Expected Value Results
Scenario Results
Calculated Annual Scenario Probabilities
Calc
mid
Expected ScenCosts (Risks * Scen Probabilities)
Calc
μ
All-Cost Results
Expected Costs, by Cost
Calc
μ
Expected Costs by Cost Type
Calc
μ
Option Evaluations
Exp After Tax Net Cash Flow wrt Base
Calc
μ
Expected Net Present Value wrt Baseline
Calc
μ
Expected NPV Total wrt Baseline
Calc
μ
External Costs
External Cost Results as Sensitivity Analysis
Calc
mid
View Probabilistic Results
View Models


Result - Expected Costs by Cost Type
Mean Value of Expected Costs by Cost Type
TCA Options
Shutdown
Cost Type
Scenario Costs
Key:
Discount Rate
X Axis:
Year
XY
Expected Costs by Cost Type
500K
450K
400K
350K
300K
250K
200K
150K
100K
50K
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Key
Discount Rate
0.18
0.12
0


Result - Expected Costs by Cost Type
Probability Bands of Expected Costs by Cost Type
XY
TCA Options
Shutdown
Cost Type
Scenario Costs
Discount Rate
0.12
Key:
Probability
X Axis:
Year
Expected Costs by Cost Type
500K
450K
400K
350K
300K
250K
200K
150K
100K
50K
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Key
Probability
0.05
0.25
0.5
0.75
0.95

Mechanics: “Workshop” Approach

- Workshops configured for 1-2 days - Key business and project people needed for data/analysis have only limited time (current paradigm)
- Highly disciplined process with total focus on TBCA - due to limited time
- Scenarios used to clearly document key issues, data, judgements and decisions

Dow Application Examples

- Report that use of method has lead to decisions “estimated to save/earn hundreds of millions of dollars”
  - > Dozen business examples
  - Evaluate 2005 EH&S Objectives established in 1995
  - “TBCA” = Total *Business* Cost Analysis

Completed Eight TBCA Workshops for Dow EH&S 2005 Goals

- Emissions - Priority and Chemical
- Waste - TTU's and Kilns
- Waste - Landfills
- Wastewater (BOD and Hydraulic)
- Energy
- Loss of Primary Containment + Process Safety
- Personal Injury - Illness/Motor Vehicle
- Transportation

Business Application Examples

- EDC/Vinyl Expansion Alternatives
- Chlor-Alkali Cell Technology Evaluation
- Polycarbonate Technology Route
- New Sustainable Product (Agrifiber)
- Water Systems Optimization
- Compliance Issues
- Integrated Health

Summary

- Total Cost Assessment Method:
  - Multi-national companies incorporating intangibles and externalities into financial evaluations of:
    - Environmental, Health & Safety decisions
    - Capital Investments
    - Corporate Strategy
- Dow applications: Impacting Decisions with benefits estimated ~ $100M's