The Elephant in The Room … Risk Management TNT (tools and techniques)

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Presenters

- Wes Frick
- Darin Hendry
- Mike Whitmore

- “Risk is all about uncertainty or, more importantly, the effect of uncertainty on the achievement of objectives. The really successful organizations work on understanding the uncertainty involved in achieving their objectives and ensuring they manage their risks so as to ensure a successful outcome.”

-Kevin Knight, International Organization for Standardization (ISO)

What is Risk Management?

- The objective of risk management is to increase the probability and impact of positive events and decrease the impact and probability of negative events

- Good risk management helps a project's stakeholders define the strengths and weaknesses of a project, promoting awareness.

Attributes of Risk Management

- Ignoring risks does not make them go away
- Invest in risk management like you would insurance
- If it’s a fact, it’s not a risk
  - Facts require immediate action; risks require planning
- If it’s an issue, it’s not a risk
  - Issues are problems that have occurred and require action; risks might occur

Risk Management Process

- Project Risk Management Process
  - Project Risk Identification
  - Project Risk Analysis
  - Project Risk Response
  - Project Risk Monitoring and Control

- The PMBOK® identifies six steps in the risk management knowledge area
  - Plan risk management
  - Identify risks
  - Perform qualitative risk analysis
  - Perform quantitative risk analysis
  - Plan risk responses
  - Monitor and control risks


Change Order

Risk comes from not knowing what you’re doing.

- Warren Buffett

Risk Identification

- Risk identification is the process of understanding what potential events might hurt or enhance a project
- Identifying risks is an **iterative process** because new risks may evolve or become known as the project progresses through its life cycle
- Participants in risk identification activities includes the project manager, project team members, customers, subject matter experts from outside the project team, end users, other project managers, stakeholders, and risk management experts

What Goes Into Identifying Risks?

- Risk management plan
- Activity cost estimates
- Activity duration estimates
- Scope baseline
- Stakeholder register
- Cost management plan, schedule management plan & quality management plan
- Project documents
- Enterprise environmental factors

Identifying Risks Tools & Techniques

- **Documentation reviews:** Project management plans, assumptions, previous project files, contracts
- **Information gathering techniques:** Techniques include:
  - Brainstorming
  - Delphi technique
  - Interviewing
  - Root cause analysis
- **Checklist analysis:** based on historical information and knowledge that has been accumulated from previous similar projects

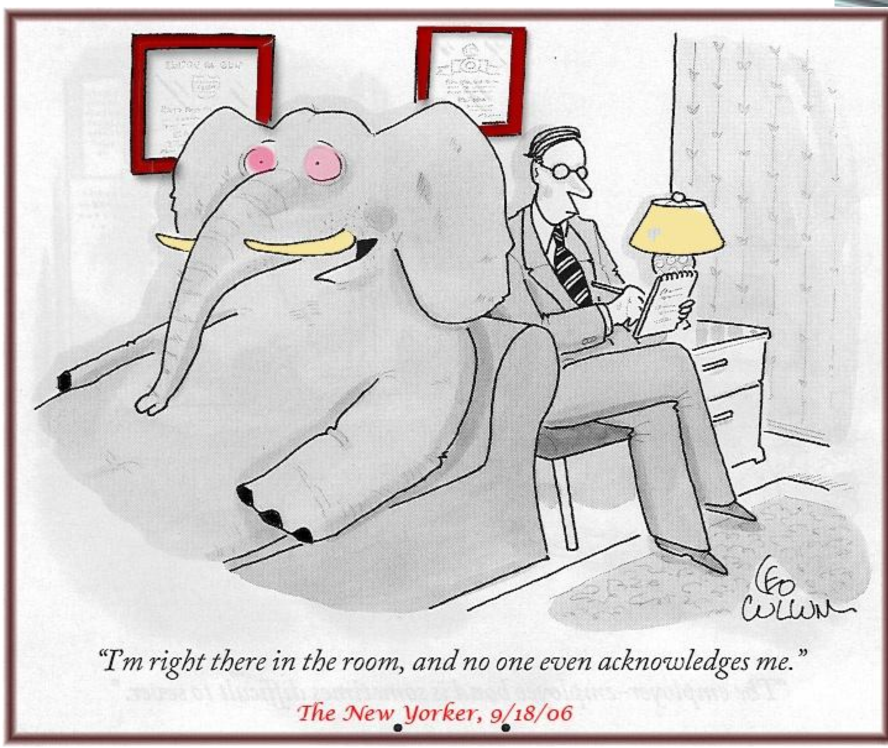
Identifying Risks Tools & Techniques (2)

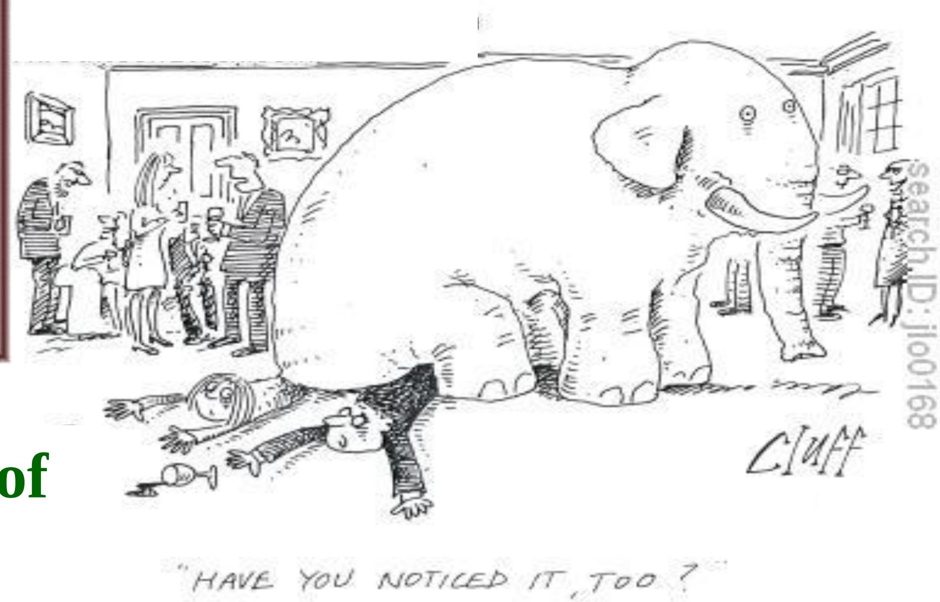
- **Assumptions analysis:** Explores the validity of assumptions as they apply to the project
- **Diagramming techniques:** In the form of:
  - Cause and effect diagrams
  - System or process flow charts
  - Influence diagrams
  - SWOT analysis (strengths, weaknesses, opportunities, threats)
- **PDRI:** The Project Definition Rating Index is a Construction Industry Institute (CII) standard and a powerful and simple tool that helps measure project scope definition for completeness.

Identify Risks Output

- The main output of the risk identification process is a **list of identified risks** to begin creating a risk register
- A risk register is:
  - A document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format
  - A tool for documenting potential risk events and related information
  - A good rule of thumb is to update the risk register at least at the 33% and the 66% complete points as a minimum

Why do Risk Analysis?





To gain a better understanding of the Project's Risk…

What is Risk Analysis?

- Process of examining each identified risk and estimating the probability and impact on the project
- The objective is to determine which risks warrant a response (i.e. develop a “short list”).
- Decide whether a quantitative analysis is necessary
- Determine overall project risk score
- Evaluate the probability of meeting the project objectives

Qualitative Risk Analysis

- Who does the Analysis? Risk Owner? PM? Both?
  - PMBOK assigns owners during risk response planning
  - Usually, the risk owner is the "expert" and they have valuable insight into the risk analysis as well as the response planning
- Gather data…how well do you understand the risk?
- Determine risk scales – if risk scales are not standardized in your company, you must decide which scales to use
- Subjectively evaluate the probability and impact of each risk

Qualitative Risk Analysis

- Determine likelihood and impact of risk events, expressed as number 1 through 5.

Risk Level = Probability x Impact

Probability Impact Matrix

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Levels	
16 through 25	High
8 through 15	Medium
1 through 7	Low

- Evaluation includes applicable prior experience of internal or external personnel, past performance, technological maturity, scope definition, etc.

Risk Register – Tracking & Categorization

Item	Risk Status	*Risk*	*Potential Impact (Cause and Effect)*	Baseline Risk Scoring						Heat Map Risk Category	Heat Map Risk Sub Category	Action Owner(s)
				Impact								
				Tech Perf	Schedule	Cost	Safety	Probability	Risk Ranking			
70	Open	Company misses out on either existing or new tax credit opportunity	Missed accretive financial opportunity		3	5		3	15	Schedule	Schedule Requirements Addressed	Wibbenmeyer
85	Open	ED Construction crew is unable to get outage scheduled with dispatchers	Project delays and cost increases		2			2	4	Schedule	Schedule Requirements Addressed	Hunt
26	Accepted	Weather induced construction delays	Project is subject to increased cost, lost revenues, and penalties		5			5	25	Schedule	Weather, Site Conditions, Essential Services	buehler
165	Accepted	SOIL SETTLEMENT PERIOD exceeds engr expectations	POSS DELAY BEYOND CONTINGENCY IN SCHED	2	4	3	1	4	16	Schedule	Weather, Site Conditions, Essential Services	HRG Wibbenmeyer
21	Accepted	Plant is unable to process and burn LFG gas because it is outside of design specifications	Plant is unable to operate or operates outside design specifications	3		2		2	6	Technology	Fuel Flexibility and Impacts	HRG Corder
90	Accepted	Landfill availbitlity impacts LFGTE Plant LFGTE design impacts landfill prodcution	Reduced production and operating performance	3		3		2	6	Technology	Fuel Flexibility and Impacts	HRG Corder Bradley
190	Accepted	LFG COMPOSITION CHANGES TOO FAST	REQUIRES RAPID CHANGE IN TURBINE INLET PRESSURE/FLOW	3				2	6	Technology	Fuel Flexibility and Impacts	HRG Corder Whitmore
46	Open	Design conflicts due to final equipment specifications changes	Design re-work, schedule delays, and cost	2	1	3	1	4	12	Project Development	Scope is Complete	HRG Corder
5	Open	Lack of engineering and technical support	Results in poor operations	2				1	2	Technology	Technology Maturity	HRG Corder
10	Accepted	Technology does not operate as desired	Plant is unable to achieve production levels, loses revenues, and incurrs cost to repair/replace turbines	3		2		3	9	Technology	Technology Maturity	HRG Corder

Risk Visualization Tool

Risk Breakdown Structure – “Heat Map”

Financial/ Regulatory	Project Development	Schedule	Technology	Performance	Construction	Operational Impacts
Investment Evaluations Considered 1	Confidence in Indicative Pricing 25	Schedule Requirements Addressed 4	Technology Maturity 16	Clear Division of Responsibility 1	Ability to Attract Quality Workforce 9	Operational Flexibility 1
Stop/Loss and Off-Ramps Provided 9	Contractor Pricing Transparency 9	Outage Availability Within Fleet Schedule	Fuel Flexibility and Impacts 25	Ameren Role Defined (Quantity and Quality of Personnel) 9	Applicable Prior Experience 25	System Complex or Difficult to Operate 9
Liquidity & Financing Considered 1	Contract Structure Allows for Shared Risks 9	Material Constraints 1	Plant Modifications/ Interfaces Required 1	Means to Track and Measure Project Performance 1	Experienced PM/CM Availability 1	O&M Support Needed 1
Regulatory Assessment Completed 9	Scope is Complete 1	Installation Negatively Impacts Outages and/or Derates	Training of Personnel in Ops & Mtce of Technology 9	Change Mgt Process / Scope Control 1	Contractor Safety Program 1	Reliability, Capacity and Performance (Heat Rate) 9
Key Options Assessed 1	Performance Guarantees 25	Engineering Constraints 1			QA/QC Program 9	Environmental Impacts 1

Qualitative Risk Analysis - Outputs

- Risk score for each risk and task
- Risk ranking for each risk
- Prioritized list of risks
- Overall risk score for project
- Documentation for
  - “Short List” – List that move forward for further analysis
  - Non-top risks
- Further understanding of the risk in the project
- A go/no-go decision about the project

Quantitative Risk Analysis

- Numerically analyzing the probability and impact of each risk and the extent of overall project risk
- In simple terms…we are looking for
  - Probabilities like 20% (rather than a rating of 3)
  - Impacts like $30,000 (rather than a rating of 2)
- More objective concept of Expected Value (EV)

  EV – Probability (%) x Impact ($, weeks, etc)
- Evaluate impacts to all the project constraints – cost, time, scope, quality, risk, and customer satisfaction…usually stated in terms of cost & time

Quantitative Risk Analysis - example

There is a 75% probability that the software will be delayed in its release from the vendor, resulting in an extra $3,000 labor expense and a 56 day delay

EV_{cost} = 0.75 times $3,000 = $2,250

$EV_{schedule}$ = 0.75 times 56 days = 42 days

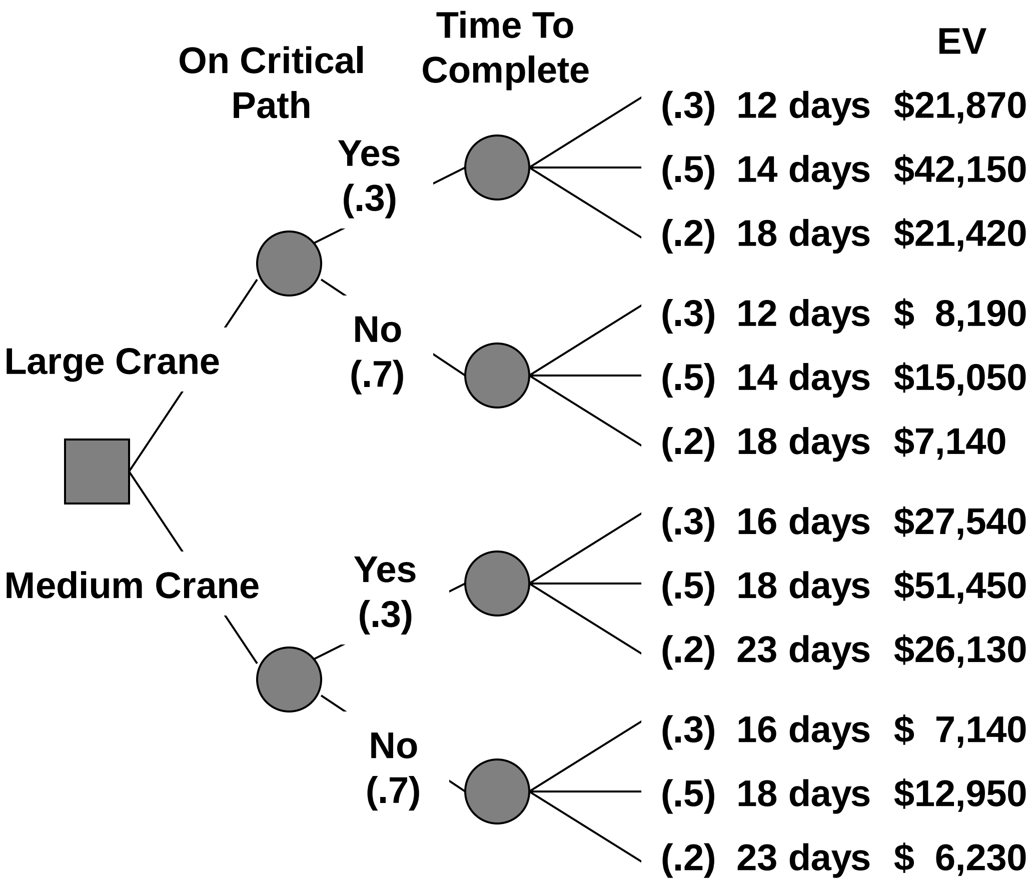
			Cost		Move Into
Risk	**Task**	**Probability**	**Impact**	**Expected Value**	**Response Planning**
14	b	30.00%	$66,000	$19,800	YES
13	c	50.00%	$39,000	$19,500	YES
12	b	50.00%	$22,000	$11,000	YES
8	a	75.00%	$12,000	$9,000	YES
1	a	30.00%	$20,000	$6,000	YES
20	b	30.00%	$8,000	$2,400	NO
21	b	25.00%	$9,000	$2,250	NO
10	e	80.00%	$1,900	$1,520	NO
11	f	60.00%	($1,800)	($1,080)	NO
2	b	10.00%	($22,000)	($2,200)	NO
6	e	15.00%	($35,000)	($5,250)	YES
7	a	15.00%	($66,000)	($9,900)	YES
Total expected value of the cost of risks and opportunities				$56,700	

Quantified probabilities and Impacts

- Gathering data
  - Guess at percentage probability, dollar, or time
  - Interviews
  - Calculate actual cost and/or time impact
  - Use historical records
  - Delphi Techniques
- Modeling
  - Sensitivity Analysis
  - Probability Distribution
  - Decision Tree analysis
  - Expected Monetary Value analysis

Quantitative Analysis is not a Silver Bullet!

Decision Tree



Decision Node – Decision Maker Controls

Large Crane	$15,000
Medium Crane	$10,000

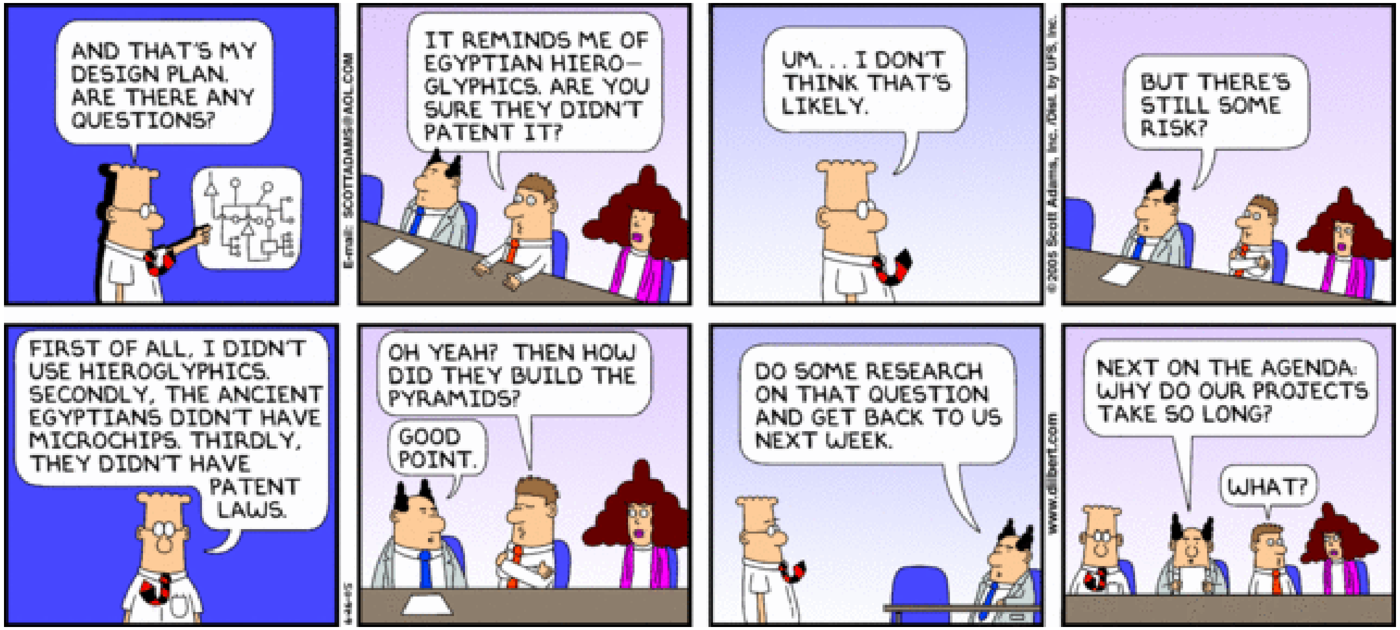
Chance Node – Can Not Be Controlled

On Critical Path	Yes = 30% No = 70%
Time To Complete	12 days = 30% 14 days = 50% 18 days = 20%

Payoff Table – Expected Value

	Initial Crane	Daily Crane	Delay Cost	Days	Total	Probabilities: Crit Path	Probabilities: Time Compl	Probabilities: Total	Expected Value
Large Crane									
Critical + Quick	$15,000	$2,000	$17,000	12	$243,000	0.3	0.3	0.09	$21,870
Critical + Medium	$15,000	$2,000	$17,000	14	$281,000	0.3	0.5	0.15	$42,150
Critical + Slow	$15,000	$2,000	$17,000	18	$357,000	0.3	0.2	0.06	$21,420
Not Critical + Quick	$15,000	$2,000	$0	12	$39,000	0.7	0.3	0.21	$8,190
Not Critical + Medium	$15,000	$2,000	$0	14	$43,000	0.7	0.5	0.35	$15,050
Not Critical + Quick	$15,000	$2,000	$0	18	$51,000	0.7	0.2	0.14	$7,140
								Total Expected Value	$115,820
Medium Crane									
Critical + Quick	$10,000	$1,500	$17,000	16	$306,000	0.3	0.3	0.09	$27,540
Critical + Medium	$10,000	$1,500	$17,000	18	$343,000	0.3	0.5	0.15	$51,450
Critical + Slow	$10,000	$1,500	$17,000	23	$435,500	0.3	0.2	0.06	$26,130
Not Critical + Quick	$10,000	$1,500	$0	16	$34,000	0.7	0.3	0.21	$7,140
Not Critical + Medium	$10,000	$1,500	$0	18	$37,000	0.7	0.5	0.35	$12,950
Not Critical + Quick	$10,000	$1,500	$0	23	$44,500	0.7	0.2	0.14	$6,230
								Total Expected Value	$131,440

Find the “Sweet Spot”



- The trick is to balance the amount of effort with the needs of the project
- More time should be spent on quantitative risk analysis for complex projects and decisions

Quantitative Risk Analysis - Outputs

- Prioritized list of quantified risks
- Forecast of potential schedule and costs for the project – input into development of contingency and management reserves
- Probability of achieving the project objectives:
  - Time, cost, scope, customer satisfaction, quality
- Trends in risk…<u>quantitative risk analysis should be repeated throughout the project</u>
- Documented list of non-critical, non-top risks

Risk Response

- After risks are analyzed qualitatively and quantitatively, the project management team should plan risk responses

- Risk responses can be categorized in four ways:
  - Avoid
  - Transfer
  - Mitigate
  - Accept

Risk Avoidance

- The Business Dictionary defines Risk Avoidance as a technique of risk management that involves:
  - Taking steps to remove a hazard
  - Engaging in an alternative activity
  - End a specific exposure

- As an example, an electric utility may opt to invest in nuclear generation in lieu of coal generation to avoid the foreseen risk of onerous green house gas regulation

Risk Transfer

- Risk can be transferred away from the organization managing the project. Examples of risk transfer
  - Warranty
  - Insurance
  - Contracting to third parties

Risk Mitigation

- Mitigation of risk requires carrying reserves/contingency for when a risk is triggered.
- Ameren's Project Risk Management procedure requires each high and medium level risk identified during the analysis process to have the following:
  - Risk response plan
  - Risk trigger
  - Contingency equal to the probability adjusted estimated exposure

Risk Acceptance

- All businesses accept risk during their operations. Without risk, commerce would cease to exist.

- For good risk management it is important to determine a quantified level of risk the project is willing to take.
  - For instance, your project may be sensitive to future price adjustments in the market in which you compete. If the volatility of prices is expected to be under a threshold defined by management, management may accept the risk and proceed with the project.

Control Risk Management

How do you monitor and control project risks?

- Reserves ?
- The risks themselves ?
- Risk Triggers ?
- Lessons Learned ?

Risk Triggers

- Early Warning Sign
  - ➢ Tells Owners & PM When to Implement Contingency or Fallback Plans
- How to Determine
  - ➢ Consider Answers to:
    - ✓ What will happen just before risk occurs?
    - ✓ What can we measure to discover risk is about to occur?
    - ✓ How will we know right away when it occurs?
- Document in Risk Response Plan
- This is your early warning system.

Monitor Your Risk Triggers

- Candidate Metrics
  - Cost Variance
  - Schedule variance
  - Slips
  - Excessive float
  - Burning thru MR faster than schedule or hours
  - Changing stakeholder attitudes
  - Critical path problems

Create Reserves

- **Project Schedule** = Critical Path + Contingency Reserve + Management Reserve
- **Project Budget** = Cost of Tasks + Contingency Reserve + Management Reserve
- Reserve = Amount of Time &/or Cost Added to Account for Risks
- Two Types:
  - Contingency Reserves – Known Unknowns (Identified Risks or Residual Risks)
  - Management Reserves – Unknown unknowns (Risks That Have Not Been Identified)
- **<u>Your Project Should Have Both!!!</u>**

Manage Reserves

- Contingency: For ID’d Risks That Occur
- Management: For Risks That Have Not Been ID’d

- PM Must Control Both!

- If you Run Out, What Do You Do?
- Ensure Stakeholders Understand Reserves & Why They Are There!!
  - Not Pad!

Manage Your Reserves

Situation	Change Order Outside Scope	Contingency Reserve	Management Reserve
ID’d a Risk That Deliverable Will Be Late Costing $200K. Risk Occurs.		X	
New Risk ID’d & Response Plans Need to Be Added.			X
In Middle of Project, Management Wants to Complete 3 Wks Ahead of Plan.		X (if ID’d)	X (if not ID’d)
Management Adds Scope of Work to Project.	X		
Risk ID’d But Probability & Impact Could Not Be Determined. Risk Occurs.			X

Watch List

- A **watch list** is a list of risks that are low priority, but are still identified as potential risks
- These might be risks that fell off earlier, or new things that might arise

Example of Top Ten Risk Item Tracking

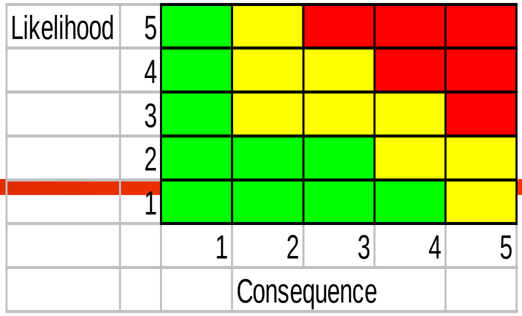
	MONTHLY RANKING			
RISK EVENT	RANK THIS MONTH	RANK LAST MONTH	NUMBER OF MONTHS IN TOP TEN	RISK RESOLUTION PROGRESS
Inadequate planning	1	2	4	Working on revising the entire project management plan
Poor definition	2	3	3	Holding meetings with project customer and sponsor to clarify scope
Absence of leadership	3	1	2	After previous project manager quit, assigned a new one to lead the project
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Refine & Update Risk Response Plan

- Topic Team Meetings!
- Things can and do change during a Project
- Iterative Process
- Risk Reviews
  - During Regularly Scheduled Meetings
  - Monitor Control Risks
  - Manage Changes
  - Identify New Risks
  - Ensure Everyone Understands Contingency & Fallback Plans
  - Project Team, Risk Owners & Stakeholders

The Road to Green

Industry Example



- What multiple steps can be taken to improve the situation or take advantage of the opportunity
- Define discrete events with schedules
- Track these at the regular reviews done with management and the customer
- Define metrics that can track progress over time

The Road to Green

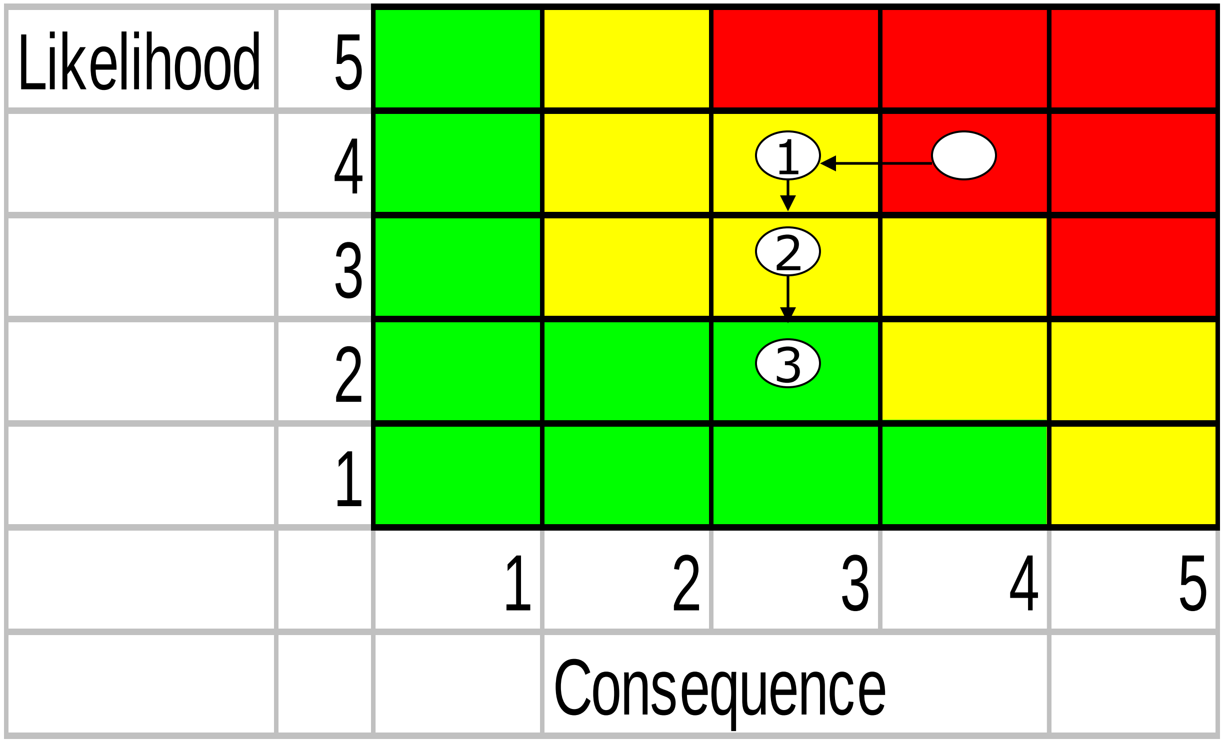
Industry Example

Risk 12
Likelihood4
Consequence 4

<u>Task 1</u>
Add resources

<u>Task 2</u>
Transfer Knowledge

<u>Task 3</u>
Reduce scope



- Schedule the tasks and track
- Measure impact at conclusion of each task

Risk Management

Tracking and review

Risk ID #___12__ RAA___Frick________ Date__2/11/06

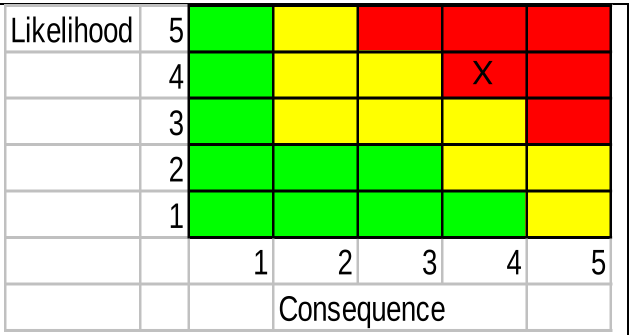
Risk Title__ActiveX Skills___________________ Author_Sumner______

Description

ActiveX being used on a critical development project.

Likelihood and consequence if realized

Software will not perform as anticipated



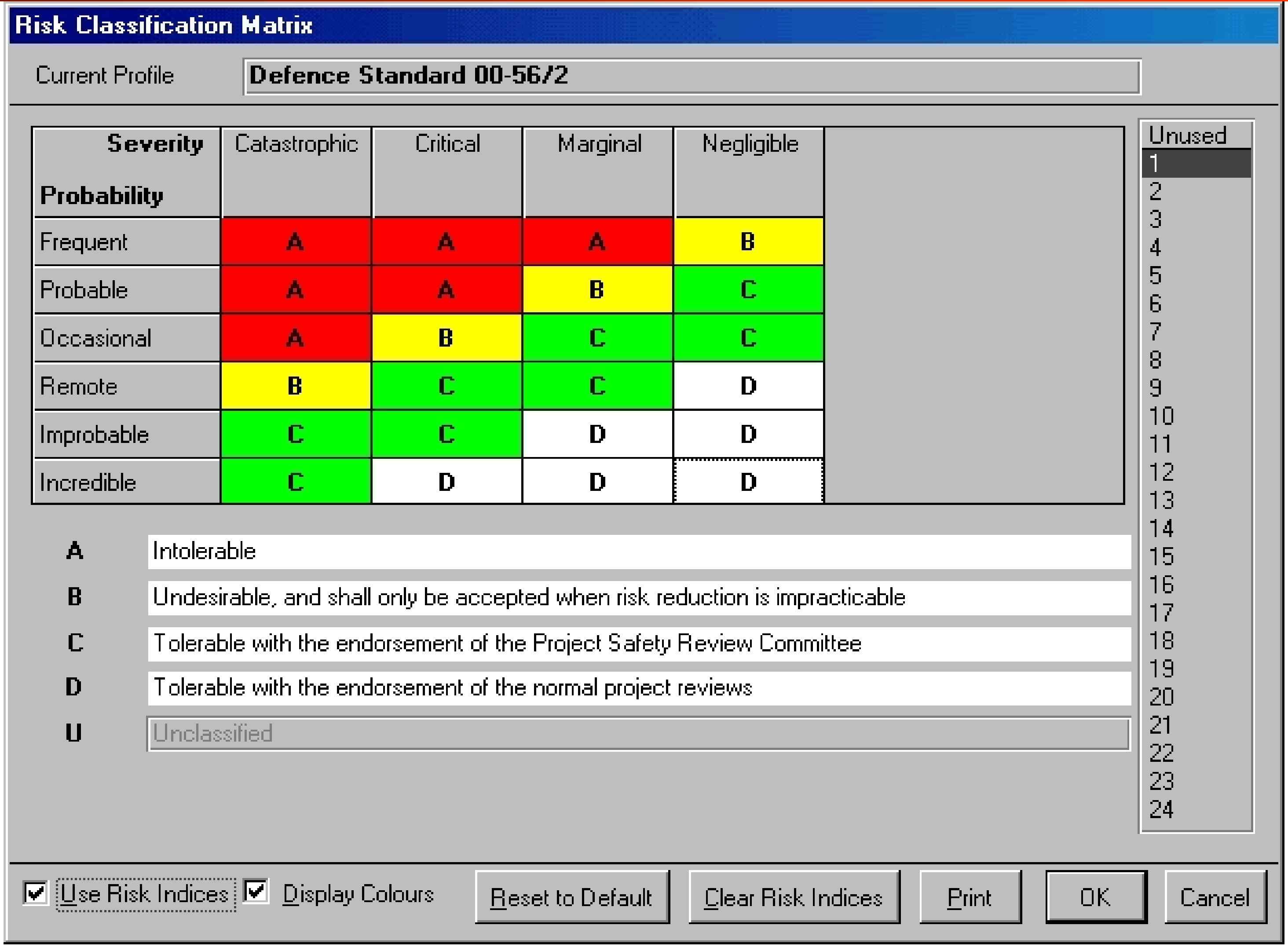
Risk Type Technical X
Schedule
Cost

Risk Reduction Plan

Mitigation Plan	Scheduled	Actual	Success Criteria	Level if Successful	Comments
Hire contractors with requisite Skills	3/2/07		Contractors on Board and working	4/3 - yellow	Reduce Likelihood
Transfer Knowledge internally	6/1/07		2 internal Employees have Demonstrated skills	3/3 - yellow	Reduce Consequence
Reduce scope of the task	8/1/07		Negotiate	2 /3 - green	Reduce Consequence

Commercially Available Tool Example

Active Risk Manager



Risk Classification Matrix

Current Profile: Defence Standard 00-56/2

Severity / Probability	Catastrophic	Critical	Marginal	Negligible
Frequent	A	A	A	B
Probable	A	A	B	C
Occasional	A	B	C	C
Remote	B	C	C	D
Improbable	C	C	D	D
Incredible	C	D	D	D

Unused: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

A	Intolerable
B	Undesirable, and shall only be accepted when risk reduction is impracticable
C	Tolerable with the endorsement of the Project Safety Review Committee
D	Tolerable with the endorsement of the normal project reviews
U	Unclassified

☑ Use Risk Indices ☑ Display Colours | Reset to Default | Clear Risk Indices | Print | OK | Cancel

Tools exist to help manage the process

Commercially Available Tools - others

- WelcomRisk
- Pertmaster
- KLCI Project Self Assessment
- RiskTrak
- Risk Radar
- Active Risk Manager
- Rational Rose

Lessons Learned

- Purpose:
  - Prevent Same Problems From Occurring Again
  - Continuously Improve Project Management Process
  - Save Money & Time
- Looks at Three Areas:
  - Project Management – Relating to Project Management Process
    - Risk Management Process – How Was Risk Effort Handled?
  - Management – Communication, Facilitation, Leading, etc.
  - Technical – Process of Completing Technical Work

Risk Management, for lack of a better word, is good. Risk Management is right. Risk Management works.

-Paraphrasing Gordon Gekko in "Wall Street"