

# **Risk Management in the Energy Industry**

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**Unit 1: The Real Risks -  
Identifying and Quantifying**



# Unit 1: The Real Risks: Identifying and Quantifying

## Unit Learning Objectives

- ◆ Identify risks
- ◆ Break down larger risks in terms of the contributing factors or possible events
- ◆ Define the relative impact of the risk
- ◆ Define the frequency of the occurrence of the risk
- ◆ Construct risk heat maps for risks in the energy industry

# Topics

- ◆ Types of risk
- ◆ What is the data you need to identify risky areas?
- ◆ Risk Ratings
- ◆ Probability
- ◆ Impact
- ◆ Heat Maps – where how to build them  
<https://riskmanagementguru.com/create-risk-heatmap-excel-part-1.html>/<https://riskmanagementguru.com/create-risk-heatmap-excel-part-2.html>

# Example: Upstream oil and gas exploration and development

- ◆ Geological Risk (model, quality of information, imaging)
- ◆ Legal risk (title, etc.)
- ◆ Safety Risks
- ◆ Analytics risk (model, organization of information)
- ◆ Data Acquisition Risk
- ◆ Drilling Risk (out of zone)
- ◆ Hydraulic fracturing risk
- ◆ Completion Risk

# Geological Risk

- ◆ What is the quality of the geological data?
- ◆ How complete is the geological data?
- ◆ Are there potentially unexpected faults?
- ◆ How sure are we of the quality of the reservoir rock?
- ◆ How sure are we of petrophysical data information?
- ◆ Is our geochemical information reliable?

# Legal Risk

- ◆ Leased people or selling to people who are actual owners (mineral take-off, division order)
- ◆ Right of way issues?
- ◆ Environmental liability?
- ◆ Contracts?
- ◆ Working interest owners?
- ◆ Partnerships, etc. ?

# Safety Risk

- ◆ Equipment?
- ◆ Processes and procedures?
- ◆ Appropriate training?
- ◆ Compliance with laws?
- ◆ Monitoring?
- ◆ Attitudinal / a culture of safety?

# Analytics Risks

- ◆ Did you choose the right kinds of data?
- ◆ Is the data reliable?
- ◆ How did you “clean” the data?
- ◆ Did you use the best model to organize your information?
- ◆ Did you choose the correct way to predict conditions?
- ◆ Are the analytics complete?



# Data Acquisition Risk

- ◆ Seismic data? Sensors? Real time? Historical?
- ◆ Complete data set?
- ◆ Acquired data over the correct area?
- ◆ Is the collection / acquisition set large enough?
- ◆ Is the data acquisition procedure appropriate?
- ◆ Is it possible to process the data in the way you need to do it?

# Drilling Risk

- ◆ Mechanical problems
- ◆ Oil field chemicals problems (drilling mud weight, etc.)
- ◆ Geohazard risks
- ◆ Geosteering issues
- ◆ Logging while drilling problems
- ◆ Personnel issues
- ◆ Incorrect monitoring, etc.

# Hydraulic Fracturing Risk

- ◆ Correct stages
- ◆ Proppant
- ◆ Frac fluid
- ◆ Equipment failure
- ◆ Engineering / Frac design

# Completion Risk

- ◆ Hydraulic fracturing
- ◆ Stimulation plan (chemicals, etc.)
- ◆ Equipment
- ◆ Personnel
- ◆ Timing of equipment
- ◆ Sufficient power / energy
- ◆ Etc.

# Solar and Wind Energy Risks

- Site risk
- Infrastructure risk
- Legal risk
- Environmental risk
- Weather risk
- Political risk
- Operational risks

# Ranking the Risks

- ◆ Probability: How likely is the occurrence to happen? How often?
- ◆ Impact: How impactful will it be? Devastation quotient...

# Risk Heat Map

LIKELIHOOD	almost certain	Moderate	Major	Critical	Critical	Critical
	likely	Moderate	Major	Major	Critical	Critical
	possible	Moderate	Moderate	Major	Major	Critical
	unlikely	Minor	Moderate	Moderate	Major	Critical
	rare	Minor	Minor	Moderate	Moderate	Major
		insignificant	minor	moderate	major	critical
		CONSEQUENCE				

# Risk Heat Map

- ◆ **First You Have to Obtain and Then Restructure the Data**
- ◆ You need to begin with obtaining all the raw data. For instance, we acquired termination and new hiring data from a middle scale retail business. Once your auditors have the data, now restructure it by filtering it to last 12 months only.
- ◆ Now make the columns of 'day' and 'month.' The formula is `=text(b2,"dddd")` to yield weekday, then use this formula `=text(b2,"mmmm")` to yield month.
- ◆ <https://www.latestquality.com/risk-heat-map/>



	A	B	C	D
1	Employee #	Hire Date	Day	Month
2	1	08/26/2013	Monday	August
3	2	02/21/2013	Thursday	February
4	3	05/20/2013	Monday	May
5	4	11/02/2012	Friday	November
6	5	11/12/2012	Monday	November
7	6	08/19/2013	Monday	August
8	7	10/17/2012	Wednesday	October
9	8	06/24/2013	Monday	June
10	9	10/17/2012	Wednesday	October
11	10	01/23/2013	Wednesday	January
12				
13				



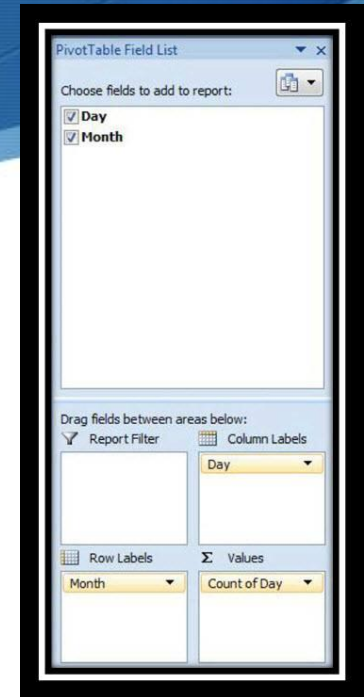
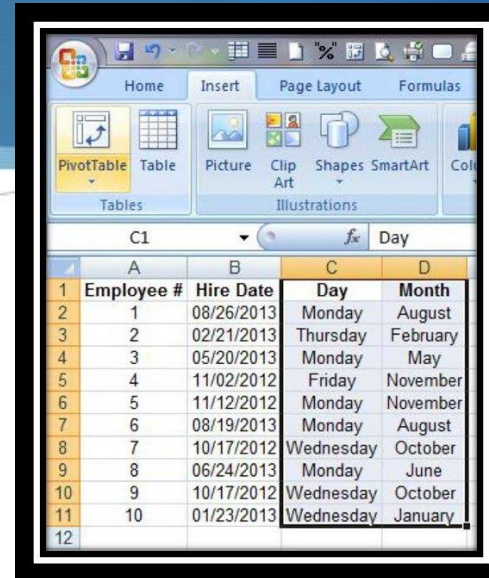
# Heat Map Construction

- Now Make A Pivot Table

- A pivot table is a function of Excel sheet that allows you to summarize the data for analysis in a significant amount. Now make a pivot table by choosing the 'Day' and 'Month' data in C and D columns. (see the image)

- Now go to 'Insert' then in 'Tables,' select 'Pivot Table' from there. The tap will generate a pivot table on a new sheet. Now after the pivot table creation, move the 'Days' section into the 'Values' field of Pivot Table maker. (see the image).

- The following pivot table should look a lot like the illustration



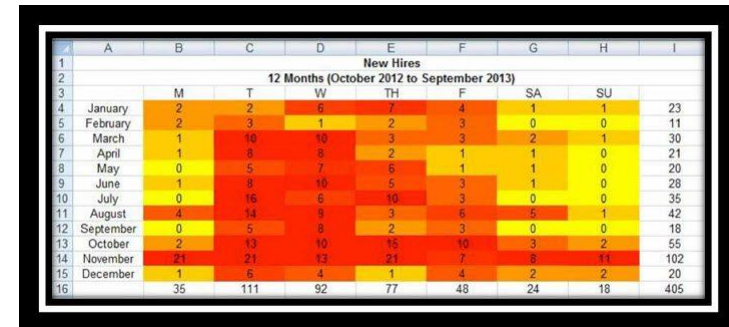
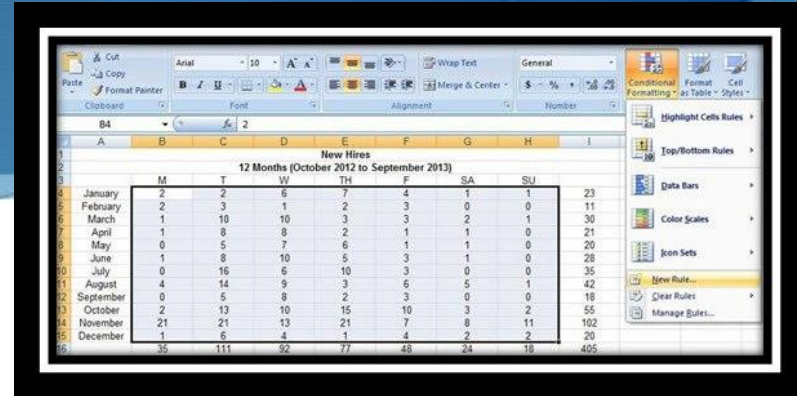
Count of Day	Column Labels	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday (blank)	Grand Total
Row Labels	Sunday							
January		2	2	6	7	4	1	23
February		2	3	1	2	3		11
March		1	10	10	3	3	2	30
April		1	8	8	2	1	1	21
May		1	5	7	6	1	1	20
June		1	8	10	5	3	1	28
July			16	6	10	3		35
August		4	14	9	3	6	5	42
September			5	8	2	3		18
October		2	13	10	15	10	3	55
November		21	21	13	21	7	8	112
December		1	6	4	1	4	2	20
(blank)								
Grand Total		35	111	92	77	48	18	405

# Ranking the Risks

- ◆ Risks: How likely is the occurrence to happen? How often?
- ◆ Risk Intensity: How impactful will it be? Devastation quotient...

# Build the Heat Map

- Now copy all the data in a new sheet, fine-tune the column widths and row heights, and add headings of day and month. Go to Home, highlight data and then choose 'Conditional Formatting.' (See the image)
- Choose the 'Rule Description' and 'Rule Type' options presented in the next picture and click OK:
- Now the risk heat map will resemble with the illustration.



# An Alternative Heat Map

- 1: Risk Data Setup
- 2: Understanding Sheet “Risk Ratings”
- 3: Fill in sheet “Risk Assessment Data”
- 4: Understanding sheet “Heatmap Table”
- 5: Update Chart Data and Labels
- <https://riskmanagementguru.com/create-risk-heatmap-excel-part-2.html/>

PROBABILITY		
Score	Description	Probability
10	Rare: very small chance of happening	Every 25 years or less frequent
20	Unlikely: small chance of happening	Every 5 - 25 years
30	Likely: Likely to happen	Quarterly to annually
40	Expected: very high chance of happening or even certainty – this will happen	At least Quarterly (or a one-off event)

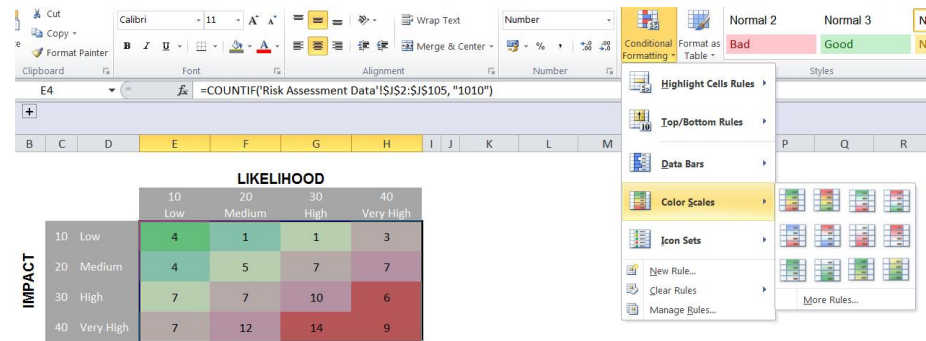
Correspondence to the Risk Matrices	
	%
Low	25%
Medium	50%
High	75%
Very High	100%

IMPACT		
Score	Description	Monetary impact
10	Minor: very small impact. Even if the risk becomes reality, there will be negligible effect on the RF	< £250k
20	Moderate: impact is significant and noticeable. If financial risk, Sterling/Euro amount is significant but fixable with current resources; if strictly operational, it will affect operations but can be worked around.	£250k - £500k
30	High: serious impact; challenges with working around it.	£500k - £1m
40	Critical: critical impact; business reputation and income effectively being threatened, can prevent RF mission from being realized	> £1m

Correspondence to the Risk Matrices	
Insignificant	
Significant	

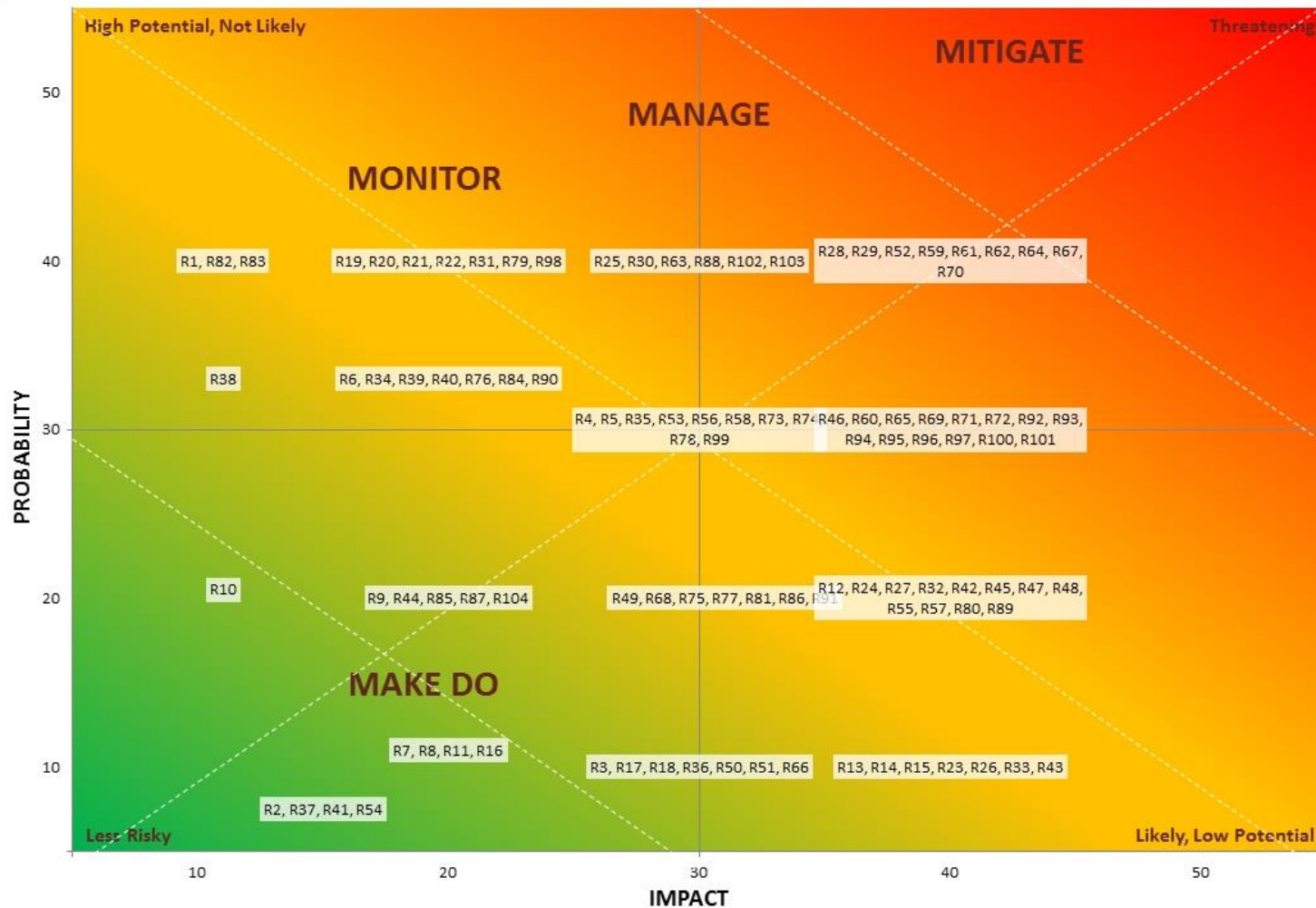


NOTES:  
 - Figures above show the total number of identified risks per probability and impact score (e.g, P=10 and I=10, P=10 and I=20, and so on)



# Decision-Making with Heat Maps

Risk Assessment Heatmap



# Decision-Making with Heat Maps

- ◆ Heat Maps – more sources where and how to build them
- ◆ <https://riskmanagementguru.com/create-risk-heatmap-excel-part-1.html/>
- ◆ <https://riskmanagementguru.com/create-risk-heatmap-excel-part-2.html/>