Basing Loss Prevention Recommendations on Risk

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Introduction

- Recommendations arise from
  » Underwriters
  » Audit Teams
  » Management
- Fail to consider the Risk
- NOVA Risk Management uses Quantitative Risk Analysis to evaluate
Single Facility or Scenario

- Recommendation aimed at single event
  - Pool fire
  - Jet Fire
  - Explosion
- Can reduce frequency, probability, or consequences
- Calculate difference in expected loss
Example 1 - Single Area

- Fireproofing costing $15,000
- Release frequency = 1 in 500 years
- Ignition probability = 1 in 5
- Damage for existing situation
  - 95% - PD=$90k; BI=90 days @ $10k/day
  - 5% - PD=$25M; BI=16 mo @ $10k/day
- Probable loss = $2,430,500
Example 1 - continued

- Expected annual loss = $972.20/year or about $1000 per year
- Losses with fireproofing = negligible
- Probable savings = $1000 per year
- Probable return on investment = $1000 per year/$15,000 = .067/yr or 6.7% per year.
Probable ROI for a Facility

- Recommendation affects total facility
- Expected losses must be calculated for each area for existing situation
- Calculation repeated with modification
- Expected savings are calculated
- Probable return on investment is calculated
Example 2 - Facility Study

- Recommended a third fire water supply pump
- Installed cost = $200,000
- Reliability of existing pumps is .9 i.e. 1 failure per 10 demands
- Four units within the facility
- Liquid pool fires are the concern
## Existing Situation Data

<table>
<thead>
<tr>
<th>Area</th>
<th>Event Data</th>
<th>Event Data</th>
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<th>Event Data</th>
<th>Event Data</th>
<th>Event Data</th>
<th>Event Data</th>
<th>Event Data</th>
<th>Event Data</th>
<th>Event Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>Ign</td>
<td>PD ($)</td>
<td>BI ($)</td>
<td>PD ($)</td>
<td>BI ($)</td>
<td>PD ($)</td>
<td>BI ($)</td>
<td>PD ($)</td>
<td>BI ($)</td>
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<tr>
<td>Feed Prep</td>
<td>.05/yr</td>
<td>0.1</td>
<td>100k</td>
<td>100k</td>
<td>300k</td>
<td>500k</td>
<td>2M</td>
<td>10M</td>
<td></td>
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<tr>
<td>Reaction</td>
<td>.10/yr</td>
<td>0.05</td>
<td>500k</td>
<td>700k</td>
<td>900k</td>
<td>1000</td>
<td>4M</td>
<td>20M</td>
<td></td>
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</tr>
<tr>
<td>Distillation</td>
<td>.10/yr</td>
<td>0.2</td>
<td>100k</td>
<td>100k</td>
<td>200k</td>
<td>300k</td>
<td>1M</td>
<td>20M</td>
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<td></td>
</tr>
<tr>
<td>Prod Storage</td>
<td>.05/yr</td>
<td>0.05</td>
<td>50K</td>
<td>100k</td>
<td>100K</td>
<td>300k</td>
<td>.5M</td>
<td>20M</td>
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</table>

2 Pps Operate Prob. = 0.80

1 Pump Fails to Operate Prob. = 0.19

2 Pumps Fail to Operate Prob. = 0.01
<table>
<thead>
<tr>
<th>Area</th>
<th>2 Pumps Operate</th>
<th>1 Pump Operates</th>
<th>No Pumps Operate</th>
<th>Total Loss ($)</th>
<th>Freq (fires/yr)</th>
<th>Probable Loss ($/yr)</th>
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</thead>
<tbody>
<tr>
<td>Feed Prep</td>
<td>160</td>
<td>152</td>
<td>120</td>
<td>432k</td>
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<td>210</td>
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<td>76</td>
<td>205</td>
<td>401k</td>
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<td>20,267</td>
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## Data for Modification

<table>
<thead>
<tr>
<th>Area</th>
<th>Event Data</th>
<th>1 Pump Fails to Operate</th>
<th>2 Pumps Fail to Operate</th>
<th>3 Pumps Fail to Operate</th>
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<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>Ign</td>
<td>PD ($)</td>
<td>BI ($)</td>
</tr>
<tr>
<td>Feed Prep</td>
<td>.05/yr</td>
<td>0.1</td>
<td>100k</td>
<td>100k</td>
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<tr>
<td>Reaction</td>
<td>.10/yr</td>
<td>0.05</td>
<td>500k</td>
<td>700k</td>
</tr>
<tr>
<td>Distillation</td>
<td>.10/yr</td>
<td>0.2</td>
<td>100k</td>
<td>100k</td>
</tr>
<tr>
<td>Prod Storage</td>
<td>.05/yr</td>
<td>0.05</td>
<td>50K</td>
<td>100k</td>
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</tbody>
</table>

### Event Data

- **1 Pump Fails to Operate**
  - Prob. = 0.970

- **2 Pumps Fail to Operate**
  - Prob. = 0.029

- **3 Pumps Fail to Operate**
  - Prob. = 0.001

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## Probable Loss - Modified

<table>
<thead>
<tr>
<th>Area</th>
<th>2 Pumps Operate</th>
<th>1 Pump Operates</th>
<th>No Pumps Operate</th>
<th>Total Loss (k$)</th>
<th>Freq. (fires/yr)</th>
<th>Probable Loss ($/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Prep</td>
<td>194</td>
<td>23.2</td>
<td>12</td>
<td>229.2</td>
<td>0.005</td>
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<td><strong>Total</strong></td>
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<td><strong>12,396</strong></td>
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</table>

Expected Loss due to Fire (k$)
Probable Return on Investment

- Probable annual loss - existing = $20,267/yr
- Probable annual loss - modified = $12,396/yr
- Potential savings = $7,871/yr or approximately $8,000/yr
- Probable ROI = 0.04/yr or 4%/yr
Case Study - Nova Chemicals

- Recommended that Nova
  » add a second diesel-driven pump
  » install a supply from the county
- Installed cost of $600,000
- Analysis addressed loss due to fire
- Considered 19 separate systems
- Used plant personnel for data
Case Study - Results

- The existing case represented an average loss of $148k/yr
- The modified case produced an average loss of $114k/yr
- Potential savings of $34k/yr
- Probable rate of return of 6%
- The modifications could not be justified
Case Study - Other Concerns

- Potential failure of the water supply storage tank
- Major source of loss was from the compressor area due to poor drainage
- The deluge at the hexene storage bullet was designed for butene.
Case Study - Recommendations

- Do not install a second diesel-driven firewater pump.
- Install a larger supply from the MOEE
- Provide a by-pass around the water supply tank.
- Install drainage and holding facilities for lube oil spills in the compressor area.
Case Study - Recommendations

- Provide foam protection for the hexene storage area.
- Inspect the bottom of the firewater supply tank at the earliest opportunity.
Follow-up to the Study

• Expected frequency of complete electrical failure was 1 in 50 years when the original study was completed.
• Recent events have resulted in three complete power failures in 3 years.
• Expected losses will be significantly higher given the higher failure rate.
• What will be the result when the calculations are repeated?