

The Known Unknowns of Quantitative Risk Assessment



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18-19 SEPTEMBER 2019
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My Hypothesis

Because QRA is a quantitative assessment we tend to put too much faith in the numbers!

As engineers our default is to develop everything from first principles!

If a number is in a publication it automatically becomes a fact!

How do the above influence QRAs today?



Main Stages in Quantitative Risk Assessment



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1. Hazard Assessment
2. Consequence modelling
 - I. Physical Effects Modelling
 - II. Impact Assessment
3. Frequency Analysis
4. Risk Assessment & Evaluation



Hazard Assessment

Performed in a workshop setting using structured review techniques such as:

1. HAZOP
2. HAZID
3. ENVID

Highly dependent on the contribution of the participants in the workshop.

Our tendency is to underplay the risks.

We cannot foresee every possible accident scenario.

Superior mindset - It will never happen to us!



Consequence Assessment

Physical Effect Modelling

Predictive modelling of how hazardous substances will behave upon loss of containment and /or ignition.

The above can be verified with experimentation e.g. at Spadeadam test site or Thornton Research Centre.

Effects are highly dependent on geometry, fluid composition, physical properties and other site specific conditions. Testing therefore only gives us reference points and it is unlikely that our specific situation is exactly matched.



Consequence Assessment

Impact Assessment

What effects do these consequences have on materials?
This can be verified through tests by equipment vendors etc.

What effects do these consequences have on people?
Cannot be fully tested! We rely on historical observations and investigations / back calculation.



Frequency Analysis

Failure Frequency

Failure frequency is taken from respected references such as OGP, UKHSE etc. Equipment Reliability data is taken from OREDA, Exida etc.

These sources collate historical failure/ reliability data. The data is based on numerous companies, with varied maintenance regimes, working in many locations around the world.

We know therefore that the data does not represent us exactly – but we take it as fact!



Risk Assessment & Evaluation

Risk is the likelihood of an unwanted negative outcome or consequence.

Multiplying one wrong number by another wrong number magnifies the error!

We then compare this answer against hard pass / fail criteria!



What is the Answer?

Knowing what we don't know, why do we consider the risk result to be accurate?

Suggested Approach

Use past experience to inform future decisions

(Checklists, accident reports, etc.)

Accept that we are doing predictive studies

Accept that there are Unknowns or inaccuracies in the assessments



What is the Answer?

Conduct sensitivity analyses to quantify the effects of any errors in the data

Do not be too literal in evaluating the risk result.
Put yourself in the situation, would you feel safe?

Don't be scared of high risks, they are an opportunity for improvement.

Value experience - yours and others.





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Thanks and Questions



Guidelines for Technical Paper & e-Poster Presentation

1. The templates given above should be used for the presentation
2. The presentation time is limited to maximum of 20 minutes
3. Number of slides to be limited to facilitate presentation within 20 minutes
4. Font size & color:
 - Title of the slides – **Tahoma - 28**
 - Sub-heading – **Tahoma - 24**
 - Content – **Tahoma – 22**
 - Color (titles) – **Blue (as indicated)**
 - Color (content) – **Black**
5. Question & Answers will be at the end of the session
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