Risktec

TÜV Rheinland Group®

risk management and assessment for business

Risk Reduction – Practical Solutions

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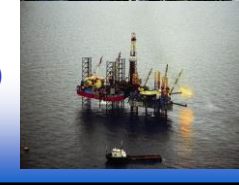
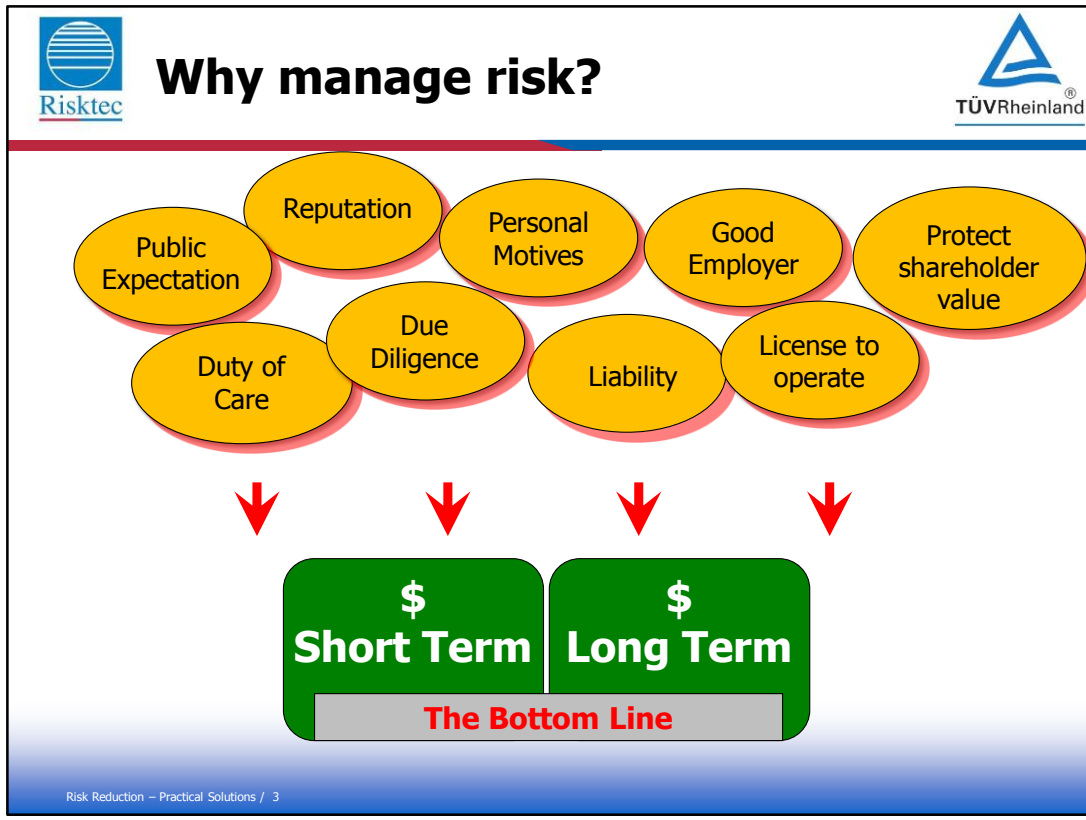
Risktec Solutions

- Independent and specialist risk management consulting and training provider
- Part of the TÜV Rheinland Group
- We focus on:
  - Safety & risk assessment (what are the risks?)
  - Management systems (how are they managed?)
  - Culture & behaviour (what really happens!)
  - Training & education (knowledge transfer)
  - Resource solutions (specialist, flexible support)
- 230+ personnel across 15 offices world-wide
- 70+ associates embedded in client organisations
- …working in 7 diverse market sectors
- …delivered over 3100 projects to over 800 clients in over 50 countries
- …providing solutions (no two assignments are the same!)

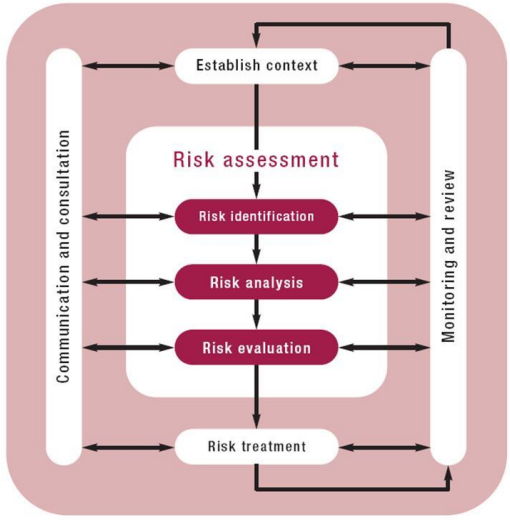




1. Let's start with a quick recap.
2. We've heard this morning about some exciting new developments to manage risk, but why do we need to manage risk? What are the key drivers?
3. This slide gives examples of drivers for managing risk - there are many more.
4. The drivers vary between different companies, industry's and regions.
5. What are the key drivers in your organisation?
6. Many of these drivers can be reduced to the common underlying driver of reducing costs and financial losses - protecting business reputation, avoiding loss and creating & protecting value.
7. So put simply good risk management is about good business.

The risk management process



The objective of any risk assessment is to **treat** the risk to a level we can **tolerate**

Risk assessment should be an input into a decision making process **NOT** a justification for a decision already made

Ref. A structured approach to Enterprise Risk Management (ERM) and the requirements of ISO 31000, IRMIC, Alarm, IRM, 2010

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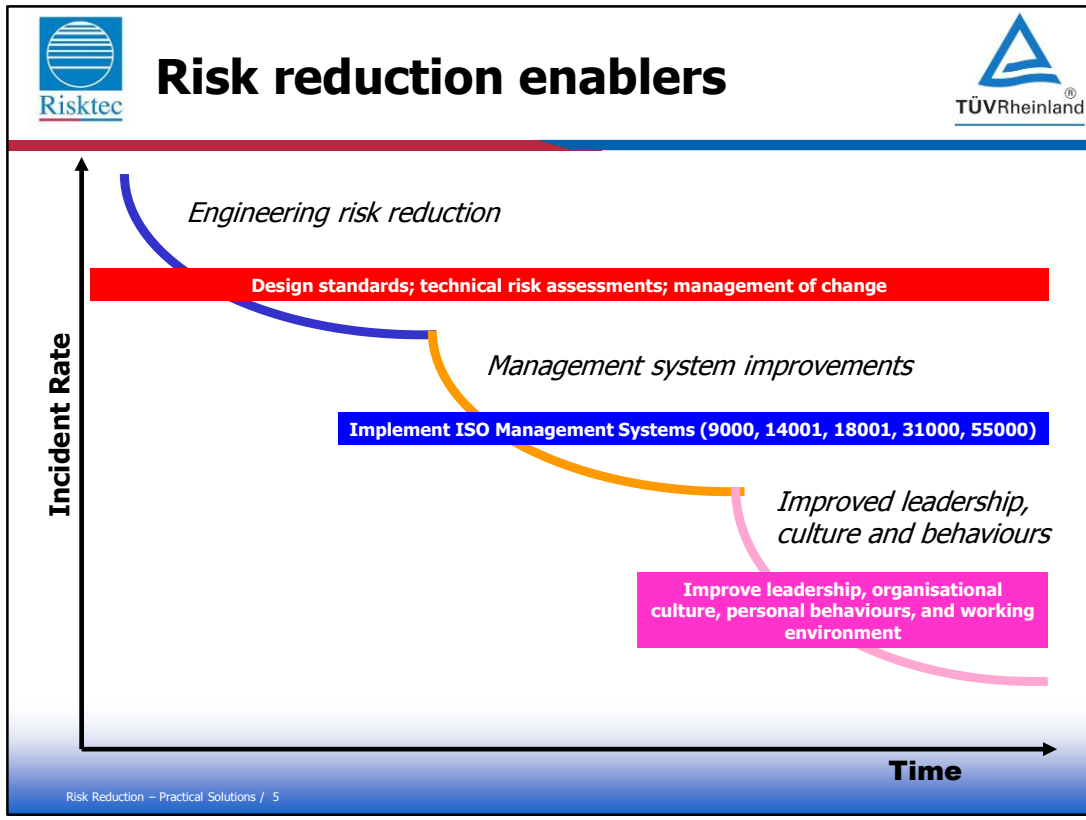
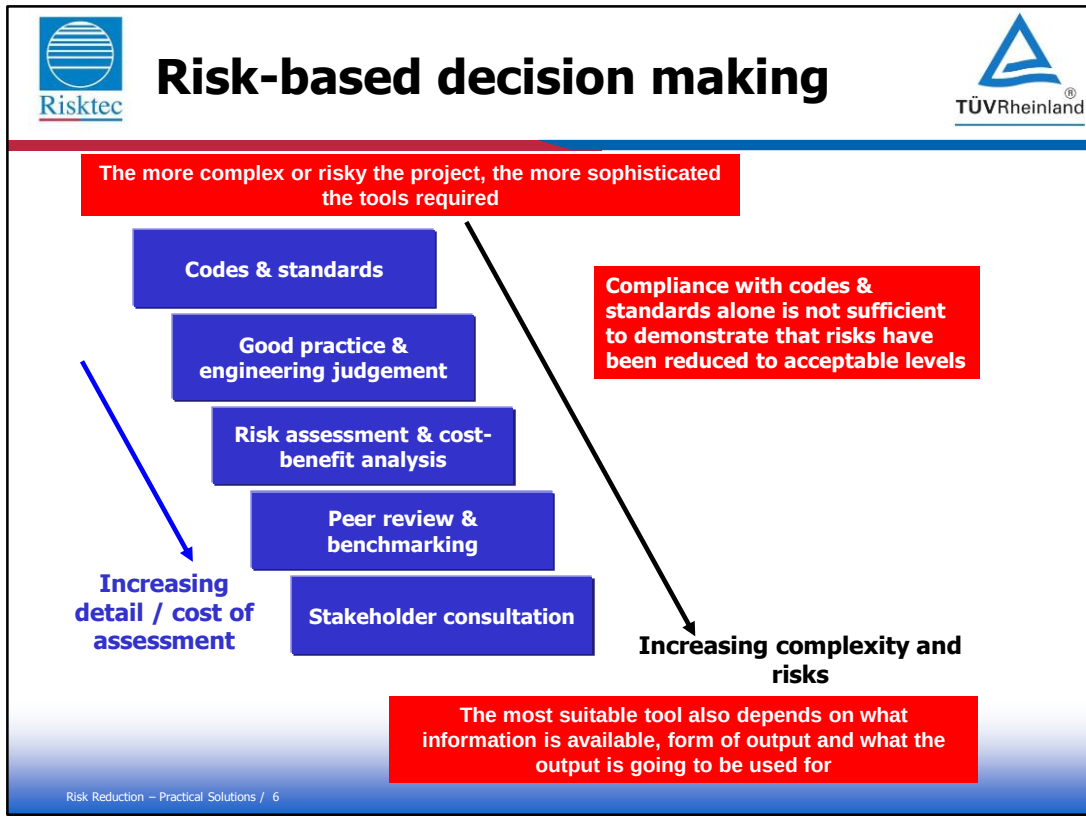
1. So how do we do this?
2. This slide shows a typical risk management process. This is taken from the ISO 31000:2009 Risk Management Standard. Most risk management processes include the same basic steps.
3. The focus of my presentation is the "risk treatment" activity in this process – i.e. what, how many, what type of risk reduction measures are necessary to reduce risks to acceptable levels. This is the main objective of any risk management process.
4. The basic idea that should be retained though, is that at some point we have to be in a position where we can say "enough is enough – we are managing our risks to the best of our ability to an acceptable level". The questions that then arise are:
    - What is acceptable?
    - When is enough, enough?
    - How do we decide?
5. The risk assessment process should be used as in input to a decision making process not to justify a decision that has already been made.
6. A final thought – until you treat (reduce) the risk by implementing effective risk reduction measures the risk does not change. Simply identifying measures is not enough they need to be implemented.

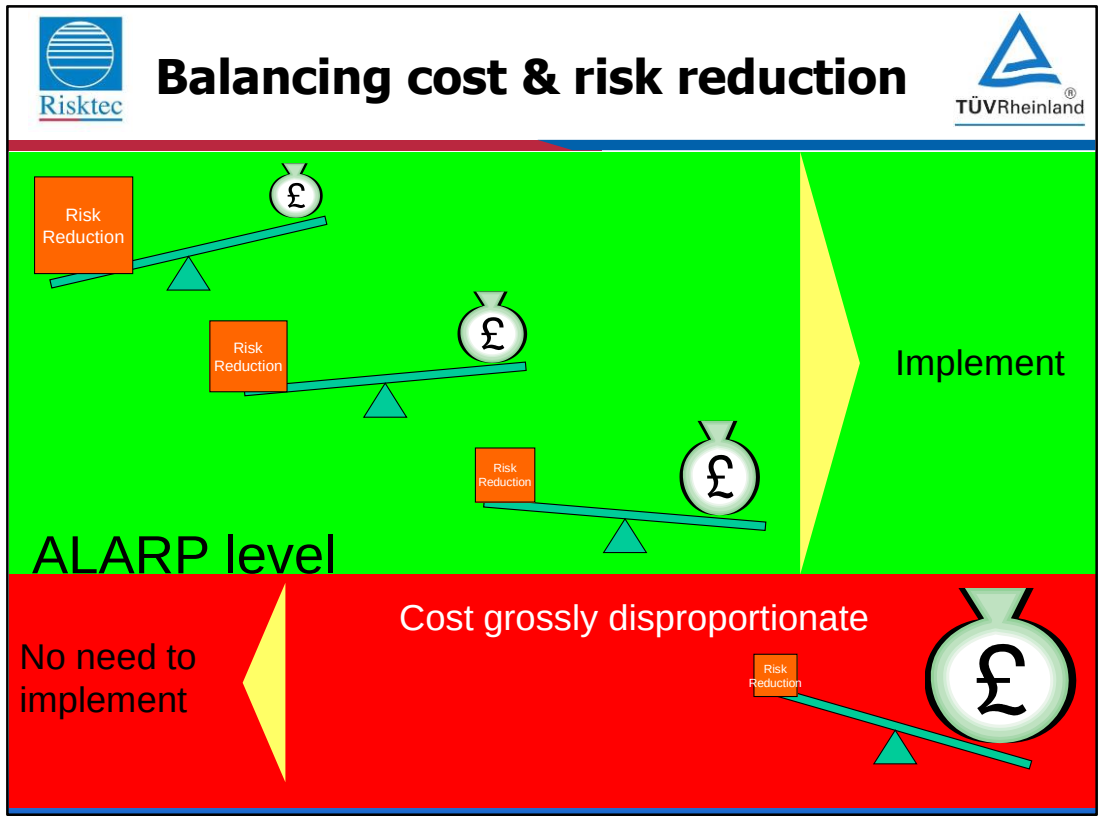


1. Risk reduction measures can, at a very high-level, be grouped into 3 areas, or risk reduction enablers.
2. In the drive to reduce accidents, historically the focus was on improving design codes and standards and technical risk assessments. However, this can only go so far in reducing the number and severity of incidents. In more recent years, as risk management became more sophisticated, further gains were made thanks to developments around creating and auditing compliance with structured management systems including HSE MSs and more recently Risk Management Systems. In terms of approaches which might reduce accidents still further, the latest thinking is in the area of the 'safety culture' and human behaviour.
3. Effective risk reduction needs to consider all 3 areas, for example there's no point delivering a fantastically designed facility unless you have effective management systems and well trained people.



1. There are a range of tools or approaches available to support the decision making process. The more complex or risky the project, the more sophisticated the tools required. Most decisions require a combination of these tools.
2. Let's lake a quick look at 2 of these tools in a bit more detail – codes & standards and engineering judgement, before we move on to look at risk assessment and the contribution it can make.
3. There is an important role played by codes and standards and engineering judgement in decision making. Codes and standards are successfully and appropriately used as inputs to decisions where:
    - risks are well understood and frequently occurring / common across the industry;
    - risks mainly relate to high frequency, low consequence events;
4. Experience and judgement are best used where:
    - risks are well understood and mainly relate to high frequency, low consequence events;
    - there is nothing novel or complex about the process, equipment or activity and there is well-established practice;
    - the output required is a list of hazards, maybe with the major hazards highlighted, and a list of control measures (i.e. there is no need for numerical output, etc.);
    - experienced personnel, familiar with the plant / process, are available to participate; and
    - a quick result is needed.
5. However, codes and standards alone may not be sufficient to demonstrate that risks are reduced to acceptable levels, and for more complex or high risk activities more sophisticated tools, including risk assessment and cost benefit analysis are required.

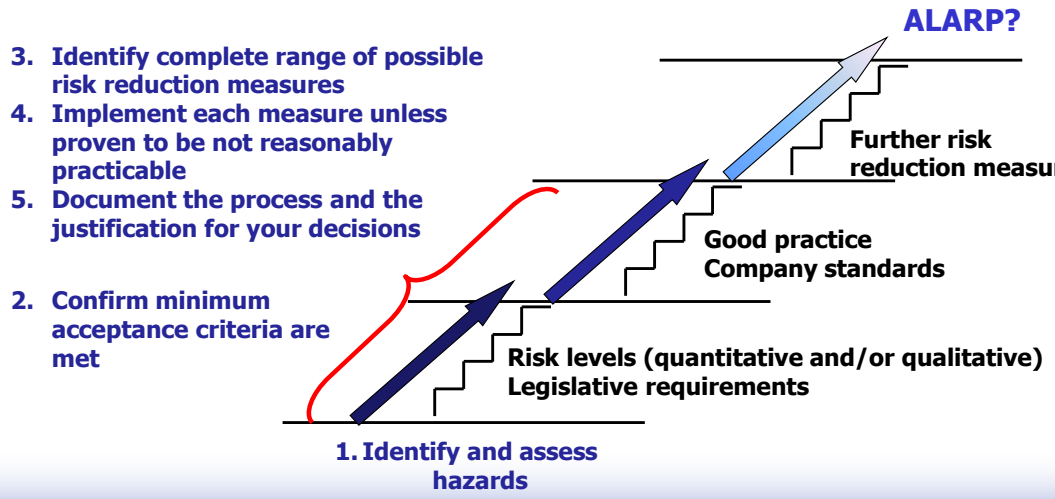
Balancing cost & risk reduction



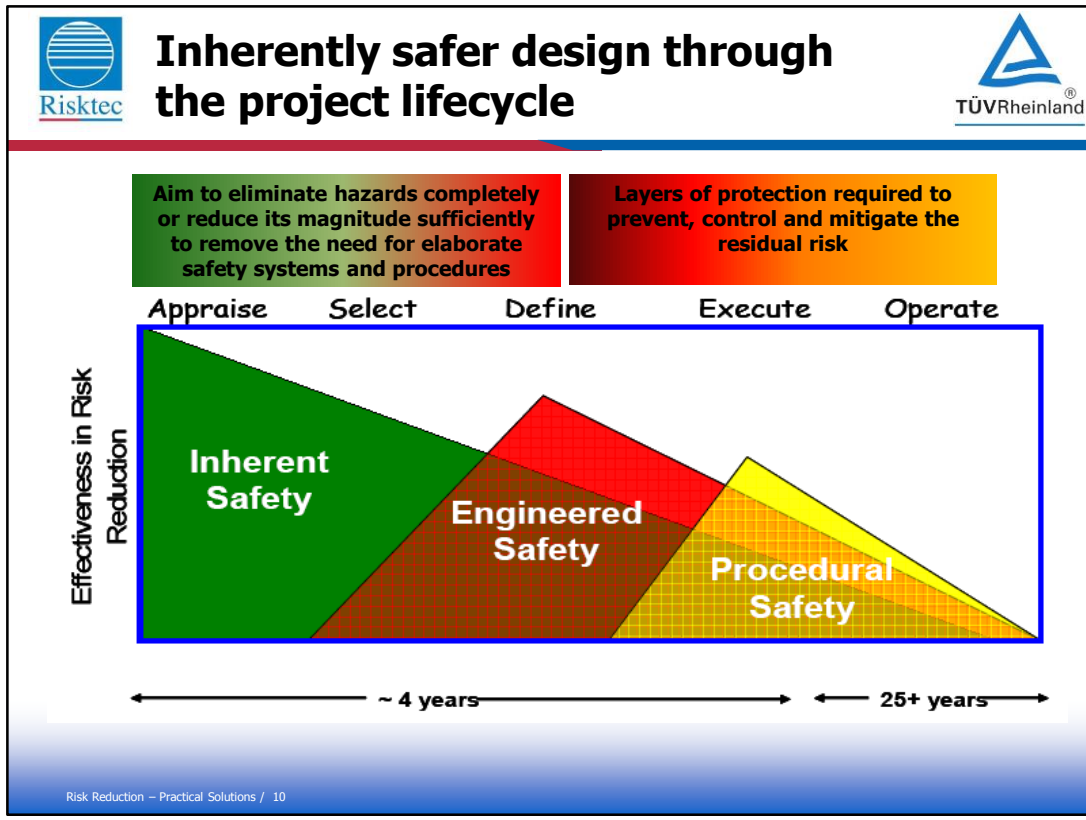
1. This concept can be more easily thought of as a balance between cost, time and effort and risk reduction
2. In this first case we can see a large risk reduction for a small cost, so the balance is clearly in favor of the risk reduction measure.
3. In the next case the balance is still clearly in favor of the risk reduction measure, but the cost has increased.
4. In the third case the balance has tipped slightly in favor of the cost, so we need to think more carefully before implementing the measure – is it warranted.
5. In the bottom case the balance has gone clearly in favor of the cost, so we're going to need to spend a significant amount to achieve a small benefit.
6. So we would implement the first three measure, but not the last as the cost is grossly disproportionate to the benefit achieved.
7. It is this point that we define as ALARP.

Demonstrating ALARP

The risk is only ALARP once every measure has either been implemented or proven to be not reasonably practicable

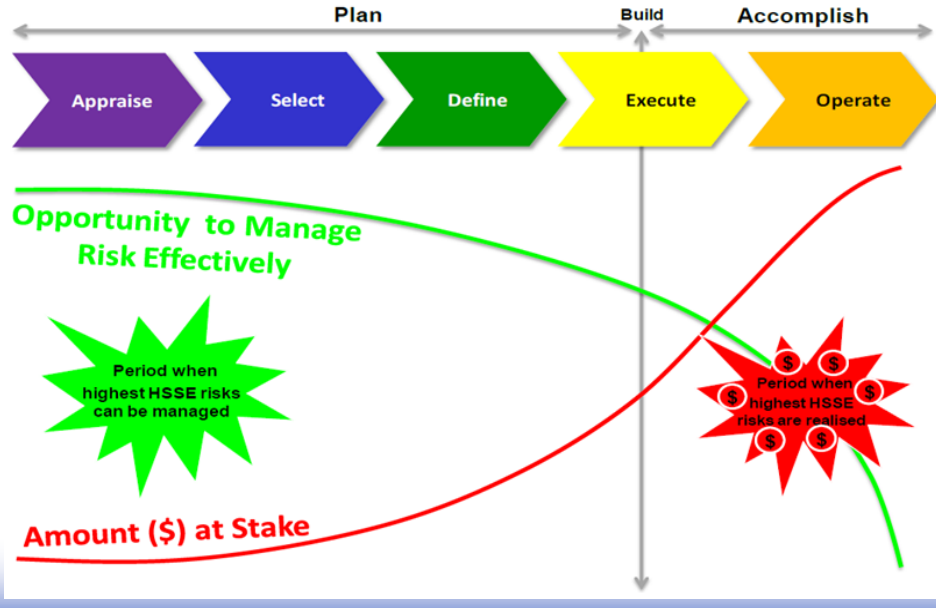


1. Demonstrating ALARP requires a series of steps.
2. We first need to identify and assess our hazards, i.e. the risk assessment process. You can't manage what you don't know.
3. The risk then needs to evaluated against company, industry or legislative requirements. Is this risk within tolerable limits? If no, risk reduction is needed regardless of cost.
4. If the risk is within tolerable limits, have we followed relevant industry codes and standards and good practice? Remembering that codes and standards alone may not demonstrate that risks are reduced to acceptable levels.
5. Once we've confirmed that minimum acceptance criteria are met, we need to consider further risk reduction measures.
6. Identify the full range of potential risk reduction measures. Implement each measure unless proven not to be reasonably practicable and document the decision making process.
7. Only then can we say we are ALARP.
8. And only then once every measure has been implemented or demonstrated to be not reasonably practicable.



1. The opportunity to reduce risk is greatest early in a project.
2. During the early stages of a project we should aim to eliminate hazards through inherently safe design, e.g. concept selection and plant layout
3. During design we can build in engineered control measures such as detection, shutdown and protection systems.
4. By the time we are ready to start-up and operate a plant we are largely reliant on procedural controls to manage the residual risk from our design.
5. The interesting thing to note here is that the duration we are required to manage the residual risk is significantly greater than the design stage. In other words if we don't get the design right early, we have a significant duration where we are reliant of inherently less effective risk reduction measures.

Business case for risk management



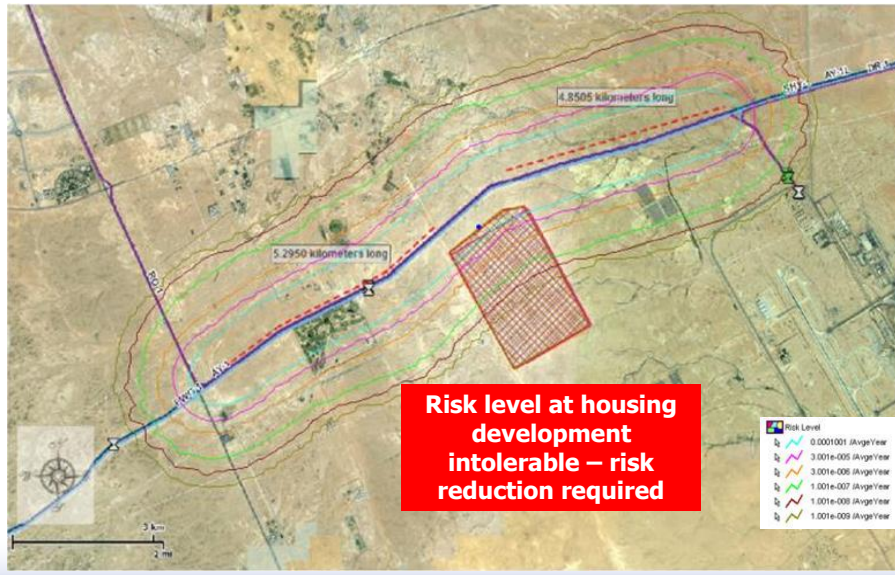
1. This slide shows the same idea.
2. Changes are often cheaper and easier early on in the lifecycle. It's a lot easier to alter the layout of a plant when it is just a layout drawing than to knock a building down and move it when the plant is operational.
3. Considering risks at an early stage allows for a project, a manager, or a company to make informed decisions about whether something is viable.
4. Building in effective risk reduction early reduces the residual risk required to be managed later.

Example case study: QRA of existing pipeline corridor close to urban development

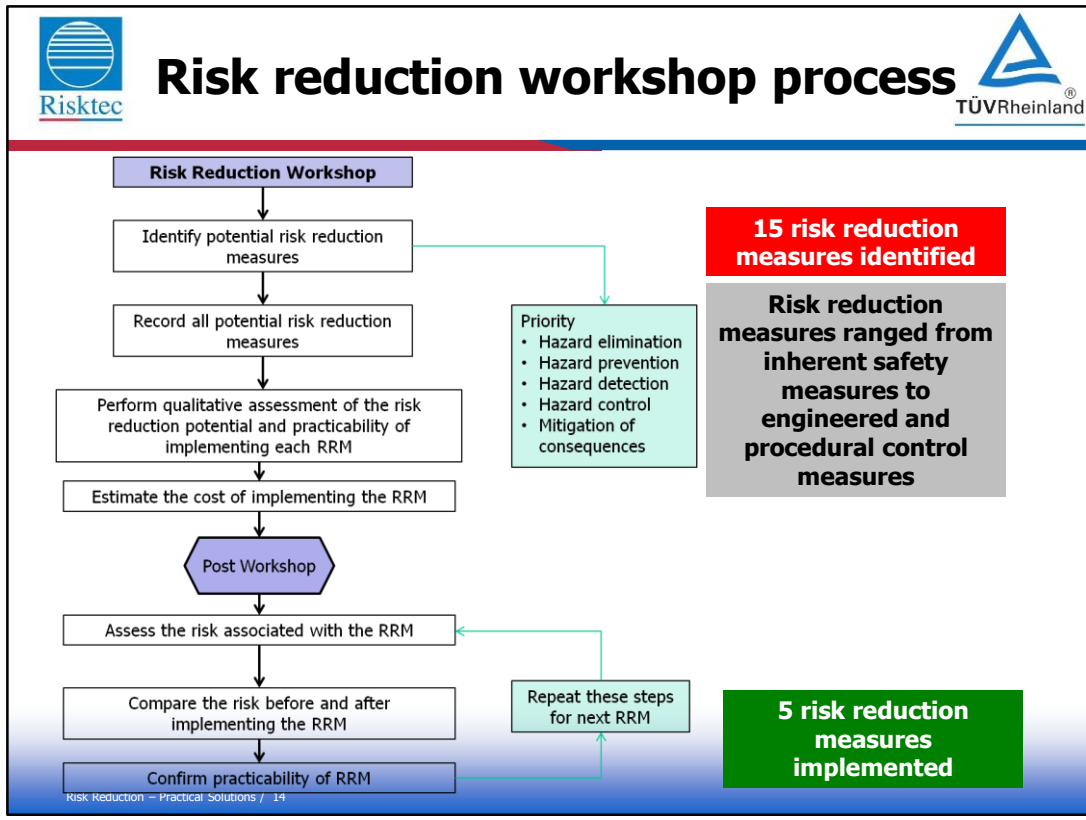
- Due to urban development close to a major pipeline corridor, the risk to people in the new development needed to be assessed
- A Quantitative Risk Assessment (QRA) study was performed with the objective of evaluating the risk at the urban development and identifying potential risk reduction measures to reduce the risk to a level that is tolerable and ALARP

1. Let's look at a real-world case study.
2. This is a QRA for an existing multi-product pipeline corridor close to a new urban development.
3. The objective of the QRA was to evaluate the risk at the new urban development from the pipeline corridor – step 1 in the ALARP demonstration process and identify potential risk reduction measures to reduce the risk to tolerable and ALARP.

Base case risk profile



1. This slide shows the base-case / pre-mitigation risk profile.
2. The lines are risk contours and represent the location-specific individual risk – the risk assuming that a person is in the same location for 24 hrs/day, 365 days/year.
3. The risk level at the new urban development was assessed as being intolerable and risk reduction required.
4. The pipelines had been designed and constructed in line with the relevant codes and standards and good practice.
5. So what risk reduction measures, how many, what is acceptable and how do we decide.



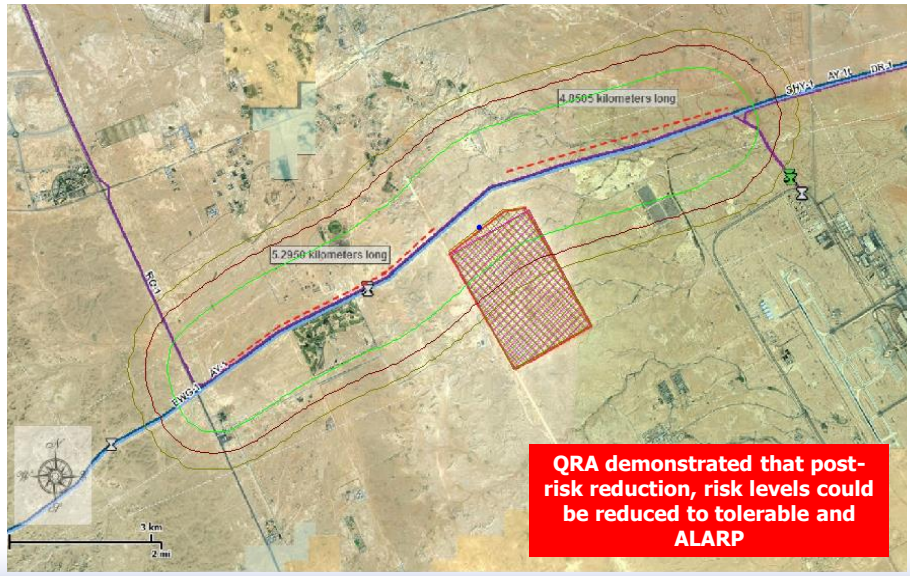
1. A risk reduction workshop was held with the project to identify potential risk reduction measures. Priority was given to measures that would eliminate the hazard or prevent the hazard being realised; lower priority was given to mitigating the consequences. So the hazard hierarchy was applied.
2. The workshop identified a total of 15 measures ranging from inherent safe design – relocate pipeline corridor and/or urban development, to engineering and procedural control measures.
3. Each measure was assessed in terms of the cost, effort and benefit (risk reduction). The QRA model was rerun for each measure, and combination of measures to quantify the benefit.
4. This process led to 5 risk reduction measures being carried forward for implementation (from an initial list of 15).
5. The remainder were 'rejected' on the basis of low benefit and/or high cost and effort. So for example, rerouting the pipelines would have had a high benefit but the cost and effort were also very high.

Risk reduction measures implemented

- Re-coat all pipelines to prevent external corrosion near the housing development (approximately 16km).
- Application of Risk Based Inspection (RBI) program.
- Provide mechanical impact protection (slabbing) for "high-risk" pipelines near the housing development (approximately 16km) to prevent third party intervention.
- Provide mechanical impact protection (deeper burial) near housing development to prevent third party intervention.
- Provide controls against external interference: fencing; increased pipeline surveillance; route marking; one call number; CCTV; and buried warning mesh.

1. This slide summarizes the risk reduction measures implemented by the project.
2. As you can see the measures were focused on reducing pipeline loss of integrity events from corrosion (internal and external) and 3rd party interference. This is because these are statistically the most likely causes of pipeline loss of integrity events.
3. Other measures were demonstrated to be not reasonably practicable either due to low benefit or high costs and effort.

Risk after risk reduction



1. This slide shows the risk profile once the measures have been implemented.
2. The risk at the urban development is now within tolerable limits.

Risk reduction impacts

- 1E-04, 1E-05 and 1E-06 per year contours have been eliminated from the risk profile.
- Distance from the pipeline to the 1E-07 per year contour has been reduced by 585m.
- The total cost associated with this combined option ca. US$ 85 million.
- Compared to the total cost of re-routing the pipeline corridor ca. US$ 1.5 billion.
- Land use within the urban development limited in line with international Land Use Planning criteria (housing near the pipelines, schools, hospitals, etc. away from the pipelines).

1. Measures have essentially removed both the 'Development Proximity Zone' and 'Inner Zone'.
2. However, it is a standard Client requirement to have a minimum of a 500m exclusion zone from the pipeline corridor which must be maintained.
3. Applying LUP criteria, it can be concluded that the development can be safely located 500m from the corridor, with the following restrictions (as per the LUP criteria defined in Reference 6):
4. There will be no 'Development Proximity Zone' or 'Inner Zone'. However, the minimum 500m 'Exclusion Zone' will apply;
5. The Middle Zone will extend from 500m to 1,315m from the corridor and development should be restricted to:
   - •Housing (e.g. two storey houses) with more than 7 occupants and more than 20 dwelling units per km^2);
   - •Small single storey shopping zones (e.g. restaurants, cafes, shops, petrol filling stations, coach/bus/railway stations) with total floor space less than 250 m^2);
   - •Small hotel/hostel/holiday accommodation of less than 10 beds or 3 caravans/tents pitched.
   - •No sensitive occupancies such as schools or hospitals.
6. The Outer Zone will extend from 1,315m to 1,760m from the corridor and development should be restricted to:
   - •All types of residential development (with four or fewer storeys)
   - •Medium shopping zones (e.g. restaurants, cafes, shops, petrol filling stations, coach/bus/railway stations) with total floor space between 250 – 5,000 m2;
   - •Small/medium sized hospitals (e.g. hospitals and nursing homes) for vulnerable people (i.e. children and old people), or that provide a protective environment where the site is 0.25 hectare (2,500 m2) or less;
   - •Small/medium sized schools (e.g. schools, academies for children up to school leaving age) where the site is 1.4 hectares (14,000 m2) or less (including parking and playground areas);
   - •Small/medium wedding places (with less than 100 occupants) and small/medium prisons (with less than 50 occupants);
   - •Medium hotel/hostel/holiday accommodation of up to 100 beds or 33 caravan/tent pitches;
   - •Transport links including Motorway or dual carriageway (this applies to public roads and not to transport links that are an integral part of other developments);
7. There will be no restrictions on the type of buildings after 1,760m from the corridor.

Summary

- It is always desirable to reduce risk, but not always warranted
- The more complex or risky the project, the more sophisticated the tools required to demonstrate that risks have been reduced to acceptable levels or to identify further risk reduction measures
- Compliance with codes & standards alone is not sufficient to demonstrate that risks have been reduced to acceptable levels
- The risk is only ALARP once every measure has either been implemented or proven to be not reasonably practicable
- Practicality & cost considerations may be justifications for not implementing measures
- Documentation of the decision-making process is critical

1. To quickly wrap-up
2. Whilst it is always desirable to reduce risk it may not always be warranted – it will depend on the risk
3. The more complex or high risk a project the more sophisticated the tools required to demonstrate that risks have been reduced to acceptable levels
4. Compliance with codes and standards alone may not be sufficient to demonstrate that risks have been reduced to acceptable levels
5. Demonstration of ALARP requires options to be considered and the risk is only ALARP once minimum acceptance criteria have been met and all measures have either been implemented or demonstrated to be not reasonably practicable.
6. Practicality and cost considerations may be justifications for not implementing measures – it depends on the risk level.
7. Documentation of the decision-making process is critical.

Thank You