Perspectives on Addressing Cumulative Risk

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What is Cumulative Risk?



Oil & Gas UK Cumulative Risk Guidelines:

- ".... in relation to major accident hazards (MAH). As part of their management, if an item of plant, a procedure, or a person is unable to function as effectively as intended, then this represents a deviation from the norm that needs to be managed. "
- "....There is a recognition that management of each deviation individually may not ensure that the cumulative risk of many deviations acting together is effectively managed."
- "....Cumulative risk management covers the proactive management of multiple deviations and the risks from them including their interaction. Duty holders need to be able to demonstrate to themselves and the regulator how they manage cumulative risk."



Why Cumulative Risk?



Initial concern was the impact on risk when several Safety & Env. Critical Elements (SECEs) are in a degraded state:	Adding Stand Alone Risks	With Inter- dependencies ?
 Limitations of Operational Risk Assessments 		Risk 4
(ORAs):	Risk 4	Dick 2
 Single SECE status focus 		Risk 2
 How effective at addressing multiple 	Risk 3	KISK 2
interdependencies that could increase the risks?	Risk 2	Risk 1
 May not give overall picture? 	Risk 1	

• What about other risk factors that might add to the dependencies and affect the overall risks?

Key Features of a Cumulative Risk Assessment



- Identify any degraded SECEs or other key Major Accident Hazard (MAH) features
 - Review and assessment of SECE status, and status of other risk related activities or conditions present on the installation
- Identify any interdependencies between these, and how they may affect other SECEs, etc.
 - Check how the degradation of one SECE or condition could impact other SECEs or conditions – to what extent could this further degrade the barriers?
- Consider the cumulative impact on the management of MAHs
 - How do the degradations and conditions identified impact the ability to manage the various MAHs – impact on Bow-Ties?
 - How might this affect the overall risks on the installation?
 - Are the risk management arrangements in place still adequate?
 - Are the risks still ALARP?

Practical Approaches

- 1. Review of safety critical maintenance backlogs, ORAs and other asset integrity registers/ data
- Status Assessment of all SECEs on an Installation e.g. Status Dashboards
- Bow-tie or "Swiss Cheese" Barrier presentation of SECEs status/ assessment to show impact on MAH hazard management
- 4. "Hot Spot" assessments taking account of the location of SECEs status and other conditions/ activities
- 5. A combination of these, also taking account of SECE interdependencies (e.g. via a dependency matrix)
- 6. Integrated SECE status, interdependency matrix, Bow-ties and other factors modelling to indicate risk change





Assessment Methods: Basic Information Review





Assessment Methods: Overall SECE Status Analysis





Basic Status Methods



- Review of safety critical maintenance backlogs, ORAs and other asset integrity registers/ data
- Status Assessment of all SECEs on an Installation e.g. Status Dashboards

Pros and Cons.....

- Provide overview of SECE status on an installation or across several installations
- Useful Process Safety Dashboard indicators
- Give overall impression of status of safeguards, but these:
 - May not take account of interdependencies between the SECEs
 - Don't show the overall impact on the management barriers for specific MAHs, hence: Cumulative risk can only be assessed by interpreting and augmenting the data

Assessment Methods: MAH Bow-tie Impact Analysis





Assessment Methods: Hot Spot Mapping of SECE Status





Cumulative Methods



- Bow-tie or Swiss Cheese Barrier presentation of SECEs status/ assessment to show impact on MAH hazard management
- "Hot Spot" assessments taking account of the location of SECEs status and other conditions/ activities

Pros and Cons.....

- These alternative methods show two different windows on the risk profile one based on the measures to manage each specific MAH, and the other based on location hot spots
- Each provides a means to identify the cumulative effects of various SECE degradations or issues with other conditions / activities
 - Bow-tie / Barrier methods are useful as they focus attention on the MAHs
 - Location methods useful to identify "hot spots" e.g. live status map on the installation to help with work planning
- Using these two approaches in conjunction can be very informative!
- However, they may not take account of functional or system interdependencies between the SECEs
- Hence, still needs careful evaluation to interpret and augment the data

Assessment Methods: MAH Risks Impact Analysis





Integrated Methods



- A combination of methods, also taking account of SECE interdependencies (e.g. via a dependency matrix)
- Integrated SECE status, interdependency matrix and other factors modelling to indicate risk change

Pros and Cons.....

- Combining MAH Bow-Tie/ Barrier assessment with a SECE interdependency matrix provides a good basis to assess the cumulative risk for SECE degradation
- Enhancing this by using QRA data on the MAHs to weight the Bow-tie degradation provides a means to turn the static QRA in to a "living QRA", and make it more useful to the offshore and onshore teams
- Use of a mathematical model to underpin the assessment also allows other factors or conditions to be included
- Ability to show key risk drivers (i.e. risk contributions for the various degradations/ deviations) and help users assign priorities for remedial actions

Practical Considerations C ESR Technology

- Frequency of Cumulative Risk Assessments?
 - weekly-monthly? things can change quickly!
- Ability to "horizon scan"?
 - how will things change next week?
 - if we reschedule work, how will this affect the risks?
- The human factor...
 - Whatever method used interpreting the information and decision-making is key, so the people involved really do matter
 - The method needs to be manageable in terms of data inputs, frequency of assessment, time required, etc. (Granularity/ detail vs time)
 - Aim should be to drive behaviors so that the risks are better understood and better managed by management, technical authorities and those at the 'coal face' i.e. improve understanding and decision making







Feedback from Users



- Input should:
 - Be kept to a manageable task <30 minutes
 - Allow access for several users to input data e.g. Operations, Technicians, TAs, etc.
 - Have the ability to take account of SECE deferrals and consider different levels of mitigation in ORAs
 - Use a team approach to the assessment to agree action priorities and check risks still ALARP/ tolerable

Feedback from Users



- Output should:
 - Have a simple visual presentation of outputs e.g. traffic lights, "live" bow-ties
 - Visually present any 'active' interdependencies
 - Have the ability to drill down the causes
 e.g. show cumulative risk contributions against each input/deviation
 - Record the assessment. Important, as it enables targeted discussions with others and provides record of the decision basis

Feedback from Users



- Cumulative Risk Decision support tools have allowed:
 - More relevant discussions both offshore and onshore around MAH and risk, and the influence of different risk drivers and relationships
 - Conversations and decisions to be escalated from offshore to onshore in line with increasing risk output levels
 - Metrics to be tracked in a process safety dashboard at leadership level
 - Focus on timeframe to resolution of impairments, and as such challenges on remedial actions
 - Looking ahead and what-if views of future installation status e.g. shutdown scope conflicts and restart post shutdown.

Looking to the Future...



- Increasing desire for web-based information sharing
 - Central access points for all users, with appropriate access controls
 - Ability to present the information and results in different ways to best suit the type of user (TAs, Senior Management, Offshore Teams, HSE Team)
 - Ease of data storage and analysis for archiving, trending, dashboards, KPIs, etc.
- Data mining to automate data gathering
 - Automatic feed of data from Maintenance Management System, Asset Registers, Activity Logs / PTW into cumulative risk assessment

But...

- Important for the users to retain 'ownership' of the assessment process
- If people do not feel involved in the assessment, then their understanding of the situation and its causes, and the quality of decision-making will decline

Thanks, any Questions? (ESR Technology



