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Accident Analysis Uncertainty Forum

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Regulatory Goals – The Problem

- 10 CFR 50.46 requires determination of analysis uncertainty
- 50.46 does not indicate how uncertainty is to be determined or what constitutes an acceptable approach
- 50.46 wants uncertainty determined at a high level of probability

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Regulatory Goals – The Problem

- Regulatory Guide 1.157 states that a high level of probability is 95%
- Regulatory Guide 1.157 seems to favor response surface as the method to determine uncertainty

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Regulatory Goals – The Problem

- Various approaches have been identified to determine uncertainty, each with advantages and disadvantages

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Regulatory Goals – The Problem

- Response Surface – precise characterization of results with a large number of Monte Carlo trials, each sampled parameter can use a different distribution, but number of runs increases exponentially with number of input parameters, covariance of input parameters has to be established

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Regulatory Goals – The Problem

- Order Statistics – number of random trials is independent of input parameters, no assumption about PDF of output parameter, covariance is inherent in samples, but consistent results may require a larger set of trials, number of trials is a function of the number of output variables

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Regulatory Goals – The Problem

- Order Statistics + Normal Output – number of trials is independent of number of parameters, small number of random trials is needed, covariance inherent, but output variable must be shown to have normal PDF

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Regulatory Goals – The Problem

- Sampling Theory – moderate size set of random trials, covariance inherent, each input parameter can have different PDF, but theory is based on production sampling where every output unit's variance from a specified norm is specified

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Regulatory Goals – The Problem

- IRSN – basically the same as Order Statistics with significantly larger number of random trials resulting in much greater output population density and much lower uncertainty in results, but requires almost a factor of ten more random trials

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Regulatory Goals – The Problem

- How does the regulator determine the acceptability of various methods proposed?

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Regulatory Goals

- A defined set of attributes of uncertainty determination
- Agreed acceptance criteria, i.e., probability and/or confidence

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Regulatory Goals

- The basic goal is regulatory stability.
- The final product will APPLY to the methodology whenever it is applied, that is, it will be old/new plant independent.

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Regulatory Goals

- The resulting “Standard” needs to focus on the attributes of a methodology rather than the “how to do” uncertainty determination.
- Each methodology should be accepted/rejected on its own merits.

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Regulatory Goals

- The “Standard” should address the general points that a methodology must be mathematically sound, and applied in a manner consistent with its underlying hypotheses and assumptions.

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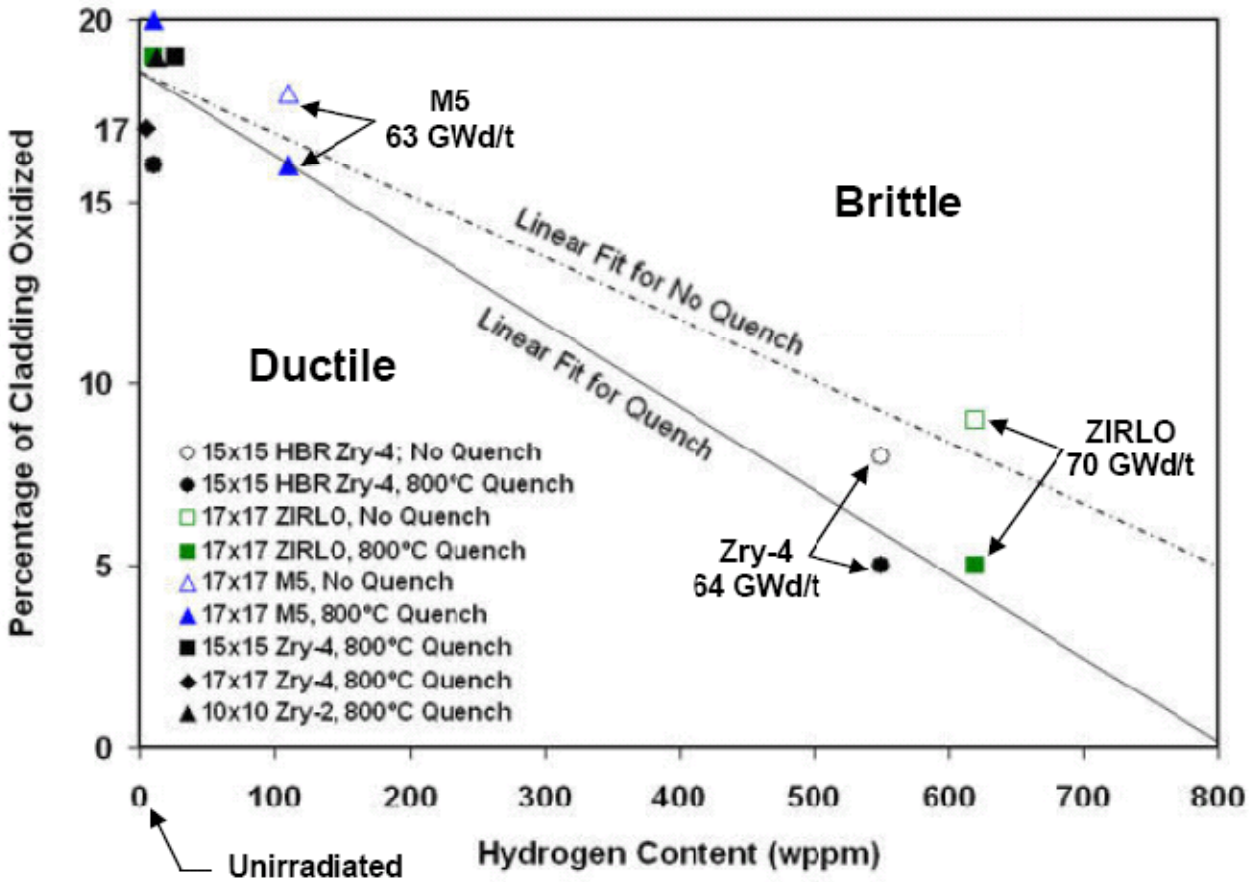
Additional Thoughts - 1



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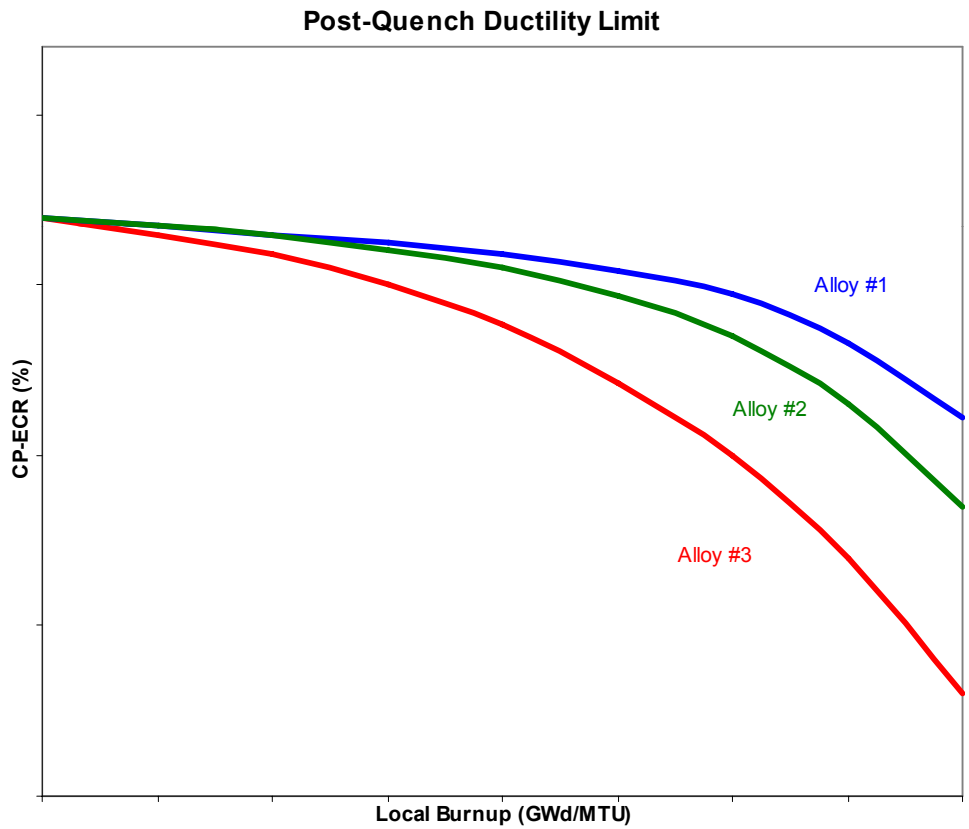
Additional Thoughts - 1



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Additional Thoughts - 1

- Does a performance-based 10 CFR 50.46(b) ductility criterion preclude multivariant uncertainty estimation?
- Can we determine the uncertainty in an output metric that is a function of oxygen and hydrogen pre-event absorption and oxygen absorption during an event?
- What if that output metric is different for different cladding alloys
- Are we forced into a univariant uncertainty?

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Additional Thoughts - 2

- Where does a risk-informed rule take us?
- A non-uniform break size PDF?
- Regionally based acceptance criteria?