

CREAM - Cognitive Reliability and Error Analysis Method

The text below is a general introduction to CREAM, written about 2002-3. The views expressed were reasonable at the time, but a disclaimer has been added (bottom of page).

Human work can be characterised by a scale going from "doing" to "thinking". Some tasks, such as manual skills and following a procedure, require much "doing" and little "thinking", while others, such as diagnosis, planning, and problem solving, require much "thinking" and little "doing". The development of modern technology has changed the nature of human work from being mostly manual skills to being mostly knowledge intensive functions (usually referred to as cognitive tasks). In present-day industrial environments the amount of "thinking" is increased while the amount of "doing" is reduced. This state of affairs has consequences for both system design and reliability analysis. In system design, for instance, conventional ergonomic aspects must be replaced by cognitive ergonomics. Similarly, in risk assessment and reliability analysis, first generation Human Reliability Analysis (HRA) must be replaced by a second generation, context-dependent cognitive reliability analysis.

CREAM (Cognitive Reliability and Error Analysis Method) is a specific proposal for a second generation HRA. CREAM will enable an analyst to achieve the following:

1. Identify those parts of the work, as tasks or actions, that require or depend on human cognition, and which therefore may be affected by variations in cognitive reliability,
2. Determine the conditions under which the reliability of cognition may be reduced, and where therefore these tasks or actions may constitute a source of risk,
3. Provide an appraisal of the consequences of human performance on system safety which can be used in a PRA/PSA, and
4. Develop and specify modifications that improve these conditions, hence serve to increase the reliability of cognition and reduce the risk.

Steps 1 - 3 are the core of CREAM. Step 4 serves the purpose of ensuring that the proper conclusions are drawn from the analysis, and that the necessary changes to the system are correctly specified.

CREAM can be used in several different ways:

- as a stand-alone analysis method, for either retrospective or prospective analyses, using a consistent taxonomy for error modes and error causes.
- as part of a larger design method for complex, interactive systems
- as an HRA in the context of an Integrated Safety Analysis (ISA) or Probabilistic Safety Analysis (PSA).

CREAM provides the core functionality of these services, i.e., the concepts, the classification system, the cognitive models, and the methods. In order to be properly used it is necessary to supplement with application or plant specific information, e.g. in the form of values for specific performance parameters, detailed operational and process knowledge that defines the context, etc. CREAM has been developed as a written guideline supported by a hypertext tool. A full description can be found in the book "Cognitive Reliability and Error Analysis Method".

A specialised version of CREAM for use in the analysis of traffic accidents has been developed as part of the FICA project. The adapted version was named DREAM, for Driver Reliability and Error Analysis Method. Later, a version was developed for use in

maritime accident analysis. It was appropriately named BREAM - B for the ship's 's Bridge.
CREAM Navigator

From the very beginning, one of the practical problems in using CREAM was the need to keep track of analyses, either going backwards as in accident investigations, or going forwards as in risk and safety assessment. The problem was exacerbated because the method was recursive and because the classification system was non-hierarchical.

- Early on, several hypertext version of CREAM were developed, and these to some extent alleviated the problem.
- More recently, a CREAM navigator has been developed by Esa Rantanen and Roger Serwy at the University of Illinois at Urbana-Champaign (Esa Rantanen is now at Rochester Institute of Technology, NY).
- A fully functional version of the CREAM Navigator can be found here. If you do try this tool, please provide your feedback and experience to the two developers.

Disclaimer (written 2012)

Although CREAM still appears to be used and referenced, it is only fair to point out that the method from my point of view is obsolete. There are several reasons for that. First, because it focuses on how actions can fail, rather than on the variability of performance, i.e., a Safety-I perspective (q.v.). Second, because it focuses on one part or 'component' of the system only, namely the human(s). While this seemed sensible in the aftermath of the debates around first and second generation HRA, it can now be seen as representing a structural rather than a functional viewpoint. Third, because it indirectly lends support to the concept of 'error'. (It doesn't really, of course, but no one seems to have noticed that.)

Seen in hindsight, only the A (for Analysis) and M (for Method) make sense. Cognitive Reliability (the 'CR') is a misleading oversimplification: explaining human performance as based on 'cognitive processes' represents a myopic information processing view, and talking about the reliability of such processes is an artefact of the PRA/PSA mindset. 'Error' is, of course, theoretically vacuous as explained elsewhere. (Not that this has any effect on its popularity.) So CREAM really ought to have been called CVEAM ('V' for Variability), or CVAM (getting rid of the 'E'), or perhaps just VAM. But then it is only a short step to FRAM, which in a way is what CREAM could have been if I had known then what I know now. But I didn't.

Bottom line: CREAM was a good idea at the time, but isn't any longer. Sic transit ...

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