PK8200 - Human error classification and probabilities

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Human error

Human error is defined by Reason (1990): *The failure of planned actions to achieve their desired ends - without the intervention of some unforeseeable event*. This definition does not really elaborate on different aspects, so therefore a classification regime is often introduced.

Failure of omission and failure of execution

A failure of an activity may further be divided into failure of omission and failure of execution. Failure of omission denotes whether or not the prescribed activity is carried out. Failure of execution denotes inadequate actions that may cause failures, e.g., acts performed in a wrong sequence, at the wrong time, without the required precision, etc.

Failure of execution is seen as results of violations or human errors (Reason, 1990). Violations refer to both deliberate and unintentional omissions of one or several steps within a work task.

Human error is further divided into mistakes and slips & lapses, where mistakes involve actions that are based on failure of interpretation of procedures, and/or failures of judgmental/inferential processes involved in the prescribed activity. Slips & lapses involve actions that represent unintended deviation from those practices represented in the formal procedures. To summarize we have for the failure of an activity:

- Omission failure
- Execution failure
  - Violation failure
  - Human error
    - Slips & lapses
    - Mistakes

Figure 1 shows the corresponding fault tree with the RIF structure. Note that in Risk_OMT the RIF structure is only developed for execution failures.

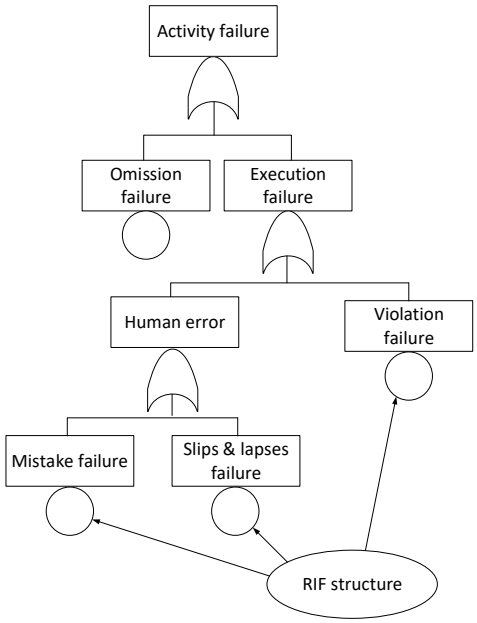

Figure 1: Structuring activity failure and RIF structure

Generic RIF model for execution and control activities

In Risk_OMT a generic RIF structure is developed. The level two RIFs are management RIFs related to:

- Competence
- Information
- Technical issues
- General issues
- Tasks

For each level two RIF there is one more level one RIFs. In In Risk_OMT there is one generic model for execution and control activities as shown in Figure 2, and one generic model for planning activities shown in Figure 3. This means that the type of activity determines the qualitative nature of the RIF structure.

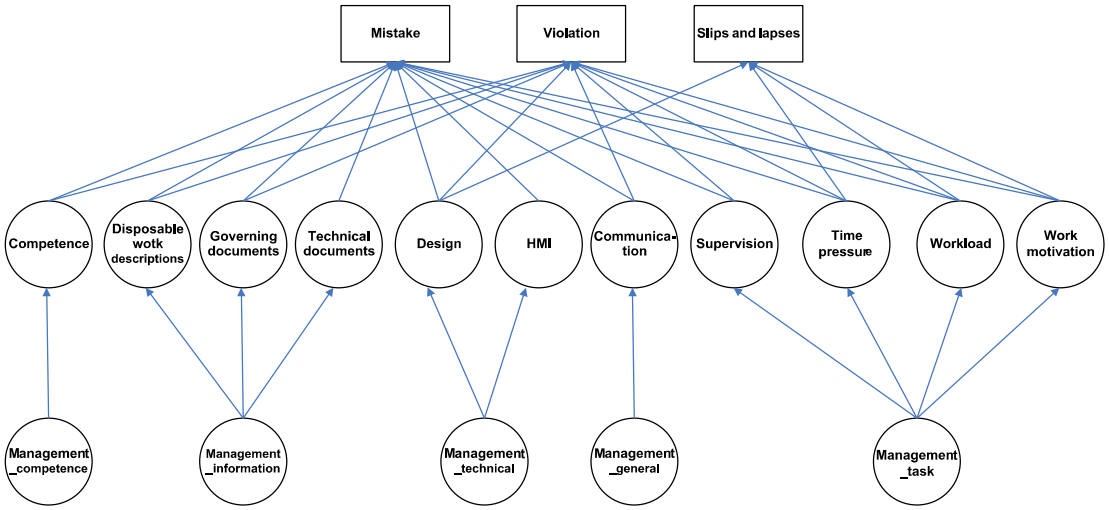

Figure 2: Generic RIF model for execution and control activities

Weights and "variances"

Note the following:

- In Risk_OMT the basic event failure probabilities depend on the *value* of each RIF, and the relative weight of the RIFs
- It is assumed that a particular RIF, e.g., "Technical documentation" is the same for all basic event. This means that we assess the values of the RIFs independent of which basic event is considered.
- The weights of the RIFs could in principle be different for each and every basic event. However, it might be more efficient to give a set of weights for a given type of basic events.
- Referring to Figures 2 and 3, we should as a minimum define 6 set of weights, i.e., for "mistakes", "violations", "slips & lapses" for both "planning" activities and "execution and control" activities.
- In Risk_OMT we define two set of "variances". For all RIFs we need to define the variance of the score given the true underlying RIF. This variance represents how difficult it is to get to know the underlying RIF by the information we have. The second variance is the structural variance, i.e., how much variance it will be in the true value of a first level RIF given a value of the corresponding second level RIF.
- The assessment of these two type of variances are done RIF by RIF, and is common for all basic events.

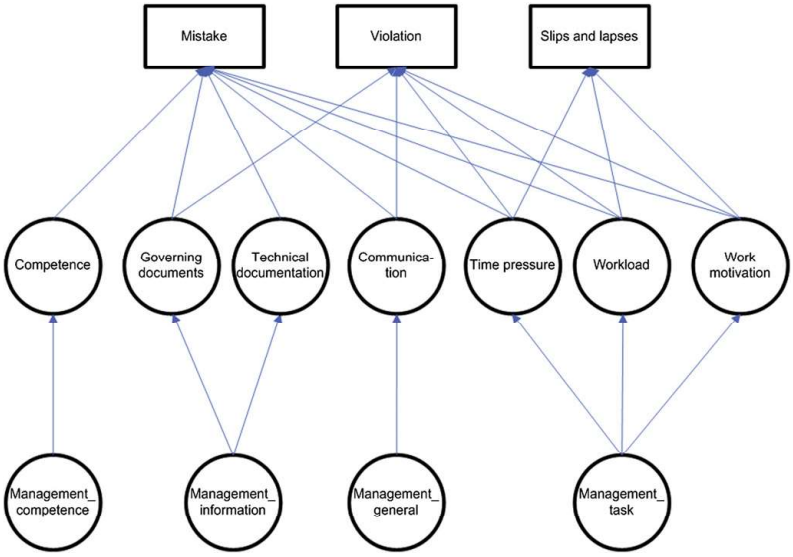

Figure 3: Generic RIF model for planning activities

Nominal human error probabilities

In human reliability analysis we distinguish between human error probabilities (HEPs) and nominal HEPs. The HEPs are the probabilities we will use in a given analysis for a given set of the RIFs assessed. The nominal HEPs are the baseline HEPs. In Risk_OMT and BORA these nominal HEPs are those values for the HEPs we will have in the "average" case, i.e., if all RIFs were on their average, corresponding typically to a C.

In the BORA papers numerical values for nominal HEPs are discussed. The proposed numerical values are those that by the authors are considered relevant for oil and gas, and the type of tasks that are involved in typical maintenance and operation activities. It might be relevant to use these numerical values as starting point also for similar activities in maintenance and operation of e.g., infrastructure systems. However, for tasks that are of more "crisis management" and sharp end operation of equipment it might be required to do further investigation.

In the Risk_OMT papers some more considerations are made to take into account the more detailed model for categorizing the activity failures.

Error factors

In the Risk_OMT an error factor is used to define the spread of the HEPs relative to the nominal HEPs. The error factors are discussed in the Risk_OMT

papers, but no numerical values are given. In the BORA papers the error factors are given for some type of activities, but though not for the different failure categories. Typical values of the error factors are in the order of magnitude 3 to 5.