WKM Consultancy

Risk Model Building Process

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Build the Program as You Would Build a New Pipeline

A useful way to view this process is a direct analogy with new pipeline construction. In either case, a certain discipline is required. As with new construction, failures in risk modeling occur through inappropriate expectations and poor planning, while success happens through thoughtful planning and management.

Below, the project phases of a pipeline construction are compared to a risk assessment effort.

I. Conceptualization and Scope-Creation Phase

Pipeline: Determine the objective, the needed capacity, the delivery parameters and schedule.

Risk Assessment: Several questions to the pipeline operator may better focus the effort and direct the choice of a formal risk assessment technique:

- What data do you have?
- What is your confidence in the predictive value of the data?
- What are the resource demands (and availability) in terms of costs, man-hours, and time to set up and maintain a risk model?
- What benefits do you expect to accrue, in terms of cost savings, reduced regulatory burdens, improved public support, and operational efficiency?

Subsequent defining questions might include: What portions of your system are to be evaluated: pipeline only? Tanks? Stations? Valve sites? Mainlines? Branch lines? Distribution systems? Gathering systems? On-shore/offshore? To what level of detail? Estimate the uses for the model, then add a margin of safety because there will be unanticipated uses. Develop a schedule and set milestones to measure progress.

II. Route Selection/ROW Acquisition

Pipeline: Determine the optimum routing and begin the process of acquiring needed ROW.

Risk Assessment: Determine the optimum location for the model and expertise: Centrally done from corporate headquarters? Field offices maintain and use information? Unlike the pipeline construction analogy, this aspect is readily changed at any point in the process and does not have to be finalized at this stage of the project.

III. Design

Pipeline: Perform detailed design hydraulic calculations; specify equipment, control systems, and materials.

Risk Assessment: The heart of the risk assessment will be the model or algorithm—that component which takes raw information such as wall thickness, population density, soil type,

etc. and turns it into risk information. Successful risk modeling involves a balancing between various issues:

- Identifying an exhaustive list of contributing factors vs. choosing the critical few to incorporate in a model (complex vs. simple),
- "Hard" data vs. engineering judgment (how to incorporate widely-held beliefs which do not have supporting statistical data),
- Uncertainty vs. statistics (how much reliance to place on predictive power of limited data), and
- Flexibility vs. situation-specific model (ability to use same model for variety of products, geographical locations, facility types, etc).

It is important that ALL risk variables be considered, even if only to conclude that certain variables will not be included in the final model. In fact, many variables will not be included when such variables do not add significant value but reduce the usability of the model. These "use or don't use" decisions should be done carefully and with full understanding of the role of the variables in the risk picture. Note that many simplifying assumptions are often made, especially in complex phenomena like dispersion modeling, fire and explosion potentials, etc., in order to make the risk model easy to use and still relatively robust.

Both probability variables and consequence variables are examined in most formal risk models. This is consistent with the most widely accepted definition of risk:

(event risk) = (event probability) x (event consequence)

IV. Material Procurement

Pipeline: Identify long-delivery items, prepare specifications, and determine delivery and quality control processes.

Risk Assessment: Identify data needs that will take the longest to obtain and begin those efforts immediately. Identify data formats and level of detail. Take steps to minimize subjectivity in data collection. Prepare data collection forms or formats and train data collectors to ensure consistency.

V. Construction

Pipeline: Determine number of construction spreads, material staging, critical path schedule, and inspection protocols.

Risk Assessment: form the data collection team(s); clearly define roles and responsibilities; create critical path schedule to ensure timely data acquisition; schedule milestones; take steps to ensure quality assurance/quality control.

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VI. Commissioning

Pipeline: Testing of all components, startup programs completed.

Risk Assessment: Use statistical analysis techniques to partially validate model results from a numerical basis. Perform a sensitivity analysis and some trial "what-if's" to ensure that model results are believable and consistent.

Hopefully the risk assessment characteristics were earlier specified in the design and concept phase of the project, but here is a final place to check to ensure that:

- All failure modes are considered,
- All risk elements are considered and the most critical ones are included,
- Failure modes are considered independently as well as in aggregate,
- All available information is being appropriately utilized,
- Provisions exist for regular updates of information, including new types of data,
- Consequence factors are separable from probability factors,
- Weightings, or other methods to recognize relative importance of factors, are established,
- The rationale behind weightings is well documented and consistent,
- A sensitivity analysis has been performed,
- The model reacts appropriately to failures of any type,
- Risk elements are combined appropriately ("and" vs. "or" combinations),
- Steps are taken to ensure consistency of evaluation,
- Risk assessment results form a reasonable statistical distribution (outliers?),
- There is adequate discrimination in the measured results (signal-to-noise ratio), and
- Comparisons can be made against fixed or floating "standards" or benchmarks.

VII. Project Completion

Pipeline: Finalize manuals, complete training, ensure maintenance protocols are in place, and turn system over to operations.

Risk Assessment: Carefully document the risk assessment process and all sub-processes, especially the detailed workings of the algorithm or central model.

Set up administrative processes to support on-going program. Refer to DOT Risk Management Demonstration Program control documents for details on aspects of a good administrative program, including:

- Assigning responsibilities,
- Measuring improvement,
- Re-visiting processes,
- Management of change,
- Etc.