Older risk perspectives

- Elimination of risk
- Humans make errors and mistakes
  - Forms of errors
  - Types of errors
- Latent system failures
- Automation
  - Reduces total number of mishaps
  - Introduces new, different kinds of problems

A changing society

- "The fifth generation of technology is managed by the second generation of management"
  - Rapid technological changes
  - Large-scale industries more common
  - High degree of system integration
  - Tough competitions on global markets
  - Traditional scientific disciplines are not "on the edge"
New strategies

- Proactive risk management
  - The purpose is to identify and understand the mechanisms that generate actual decisions and judgments on all levels
- Adaptive risk management
  - The purpose is to create a resilient organization that is characterized by fast recovery

Proactive risk management

- Analyses of
  - Normal activities during normal work
    - How is the decisions and judgments shaped?
  - Present information context
    - How is the flow of information from a control perspective?
  - Overview of potential improvements
    - Top-down
    - Bottom-up

Proactive risk management II

- Purpose of the strategies
  - Identifying the borders for safe production
  - Visualizing these limits for managers and decision-makers
  - Implementing adaptive measures against all kinds of threats to these limits
Proactive risk management III

1. Which actors on different levels participate in the production processes in the socio-technical system?
2. What parts of the work domain are they responsible for and what do the criteria for allocating roles- and responsibility look like?
3. What does the structure for the distributed control system (communication network) look like?
4. On each level, questions are asked about what information each decision-maker has
   1. Purpose – are safety-related values communicated?
   2. Status – are the actors informed about the situation? Are the limits for acceptable production contingencies communicated?
   3. Ability – do the individuals have the right competence?
   4. Awareness – are the individual actors aware of the current risks? What about practice in every-day work?
   5. Priority – are decision makers on different levels convinced supporters of the general safety philosophy?

Analyses of accidents

- Chpt 3 is a survey of a number of accidents
  - Identification of all behaviors that contributed to a certain accident
  - Not only the behaviors explicitly being connected to the accident scenario

Different phases of analyses

- Accident analysis
  - A number of representative accidents are investigated
    - Causal relations are analyzed
    - Detailed picture of the accident scenario
    - Result in terms of cause-consequence-charts (CCC:s)
    - This analysis is also used in traditional risk analyses
Different phases of analyses II

- Identification of actors
  - All relevant roles/actors are defined
    - All levels must be represented
    - Result in terms of an AcciMap
    - More extensive than a CCC
    - Considering the rate of change that always is part of the accident scenario
    - Builds on models of normal as well as unusual events

Different phases of analyses III

- Generalization
  - Recommendations based on one accident solely will only result in an ad-hoc solution
  - Result in terms of a Generic AcciMap
    - Analyses from several and similar incidents and accidents
    - Analyses of the normal flow of activities

Different phases of analyses IV

- Work analysis
  - Analysis of communication flow between participating actors
  - Result in terms of an InfoMap
  - Based on the levels of decision-making that affect the final outcome
Categorizing risk contexts

- Chpt 4 tells us that risk management is different in different fields of application and the purpose is to create a taxonomy
  - Knowledge about minor work place accidents is often based on empirical conclusions, statistical correlations, and the measures are often directed toward the explicit causes in the work context
  - Knowledge about middle-size accidents is often of an evolutionary kind, case studies have a large impact on the measures implemented
  - Knowledge about large-scale accidents builds on analytical competence and measures employed are based on complex models of cause-consequence relations

Taxonomy for risk management

- A taxonomy for proactive risk management should contribute with
  - Analyses of accidents with succeeding generalizations in order to identify weaknesses
  - Design of safer systems that builds on the idea of warding off different kind of threats by using different forms control conditions
  - Design of risk management on the management level through vertical and functional flow of information
  - Introduction and acceptance of relevant control (inspection) systems

Representations of systems

- Structural decompositions (DH)
  - Causal explanations
  - The system in wholeness and parts
  - Necessary for learning
- Functional abstractions (AH)
  - Explanations in terms of functions
  - The systems general characteristics
  - Interaction based on experience
Taxonomy of accident scenarios

- Chpt 5 presents a framework for cause-consequence relations in accident scenarios
  - Analytical tools
    - Goal object: What or who can be affected?
    - Source: What systems/processes can be a potential threat?
    - Control strategies: What strategies are there to use?
    - How does the context of the whole accident scenario look like?

Goal object

- What or who can be affected?
  - The individual
  - The staff
  - The context/environment
  - The public
  - The investments

Sources of threats

- What systems/processes can be a potential threat?
  - Accumulation of energy in different forms
    - Liquids with high temperatures and pressures
    - Chemical processes, fires
    - Kinetic energy
  - Accumulation/release of poisonous substances
  - Threats against structures in temporary balance (instability in different forms)
  - Other categories (all kinds of sources)
Control strategies
- What strategies are there to use?
- Prevention by insensibility
  - Most often in design and planning phase
- Measures for potential threats
  - Reliable and redundant equipment
  - Education/training programs, procedures, rules to be followed
  - Barriers
  - Reduce the probability of unwanted events
- Reduce the effects of potential threats
  - Stop the chain of on going events
- Reduce the consequences

Socio-technical control
- Chpt 6 claims that proactive risk management can be viewed as a socio-technical control problem
- Feedback-based control strategies are not enough
  - "Open-loop" direct control problematic
- Feed-forward based models over possible scenarios necessary
  - "Closed-loop" model control with feedback necessary

Taxonomy for risk management II
- Chpt 7 presents a support system for proactive risk management
  - Identification of decision-makers/actors
  - Identification of the different actors roles and responsibilities
  - Structure of the communication network
  - Content of information flow
  - The actors risk awareness
  - The actors ability relative the threats
  - The actors attitudes towards risk
Roles and responsibility

- Functional division of work
  - Communication content affect “bottom-up”
    - Norms and practical experiences
    - Work load
    - Flexibility/agility
    - Competence
    - Available information
    - Safety/trustworthiness

Roles and responsibility II

- Division of work by social norms
  - Communication form affect “top-down”
    - Traditional hierarchical organization
      - Order (military model)
      - Procedures (economical model)
      - Purpose (administrative model)
      - Learning organizations
    - Differences in terms of how the information is communicated
      - Neutral information, advices, instructions or rules?

Information flow

- Purpose and criterias – production goals
  - Product specifications
  - Goals concerning production volume
  - Process optimization
  - Constraints for production
    - Safety
    - Work environment issues
- Changes in production goals
- Information – situation awareness
Actors competence I

- Cognitive aspects
  - All forms of knowledge about the completion of every day work tasks, explicit as well as implicit, regardless of context, situation or person
- Meta-cognitive aspects
  - The culture of knowledge that is developed in any specific work place, for example how to deal with a specific work task

Design of interfaces

- Guide-lines from the socio-technical analysis
  - Conceptual content – functional structure
  - Delimitation of the interface
  - Transformation of relative values into causal object structures – virtual context
  - The form of the representations
    - Knowledge-based reasoning
    - Rule-based judgments
    - Skill-based perceptual-motor actions

TMI, Harrisburg
Gottröra

M/S Sleipner

Sleipner before….

….and after

Tjernobyl

Tjernobyl

36 april 1986
X2000-incident

The shot-down of an Iranian passenger plane

Organizations & Safety cultures