Human Factors in Urban Water System Safety: Initial Findings

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PRESENTATION SCOPE

• This presentation outlines the Stage 1 findings of a project on Human Factors in Urban Water System Safety.

• It also provides details for a proposed Stage 2 extension of the research project during 2011 and 2012.
BACKGROUND

• Work begun in response to priority issues identified by key stakeholders in 2009-10.

• This followed occurrence of well-publicised incidents in South East Queensland where human error was identified as a contributory factor (e.g. cross-connections, fluoride).

• The work was undertaken by Human Factors Researchers at UQ in collaboration with other Alliance partners.
AIMS

• Stage 1 - Scoping out a range of substantive research questions
  – undertaken between September 2010 and February 2011

• Stage 2 - Development of a further research program to address the identified priority questions

• Ultimately the aim of this project is to better understand the role of the human element in the water sector
  – lead to improvements in risk management
  – make a welcome contribution to the research literature
WHAT IS ‘HUMAN FACTORS’

• Human Factors (HF) is concerned with understanding the interactions among people and the other elements of a work system.

• It is applied to issues in system operations in order to optimise human well being, safety and overall system performance.

• An increasingly popular approach in other domains, but very little HF work previously undertaken in the water industry.
Human Factors’ benefits for urban water system safety include:

– increased productivity, efficiency and accuracy of outcomes

– maximising safety and health, maintaining harmony and minimising stress within teams that operate in highly pressured environments.

– may contribute to the development of a more comprehensive risk management approach in the sector by specifically focusing on the human element.
SCOPE OF THE HUMAN FACTORS APPROACH

HF areas in Urban Water System Safety include examining:

- Individual and task factors (e.g. fatigue, workload)
- Equipment interface design (e.g. alarm design)
- Skills, communication and training
- Supervision, rules, responsibilities and procedures
- Wider organisational factors
- Inter-organisational and cross-system factors.
THE RESEARCH: METHODS USED

The research team employed multiple human factors research methods to undertake this Stage 1 work. This included:

- a **targeted literature review** on human factors practices in the water sector (including ‘internal’ water industry documents and incident reports);
- **interviews** with key representatives of relevant water organisations; and
- an **observational tour** (including interviews with two operators) at a treatment plant.
There has been little published research literature regarding human element issues in water systems.

- This gap is very surprising because the work that is available shows that the impact of human error on the water sector is similar to patterns of risk in other high-hazard, high-reliability industries.

- It is possible that the urban water system could learn important lessons from these industries regarding management of the human element.
Good overall impression of the Mt Crosby Eastbank treatment facility

- Some processes not fully automated and/or integrated into supervisory control
- SCADA system appears to be well-designed and easily navigable (even for us)
- Potential for improvement of alarm system
  - Auditory alarm is frequently triggered for conditions which do not require immediate attention
  - May lead to annoyance, distraction and a loss of alarm credibility
- Potential for involvement of end-users in aspects of equipment design and acquisition (participative ergonomics)
EARLY FINDINGS – Human Factors Identified

The interviews, site inspections and analysis of recent incidents revealed several potential areas worthy of more detailed human factors consideration in future research.

These included communications, training and ergonomics issues such as:

1. Organisational culture and learning.
2. Interactions involving people, technology and work:
   • potential problems with the integration of different technologies
   • the appropriateness of alerting systems in control rooms
Communication – within and between entities – emerged as a concern among most of our interview participants

– efficiency of communication protocols in the SEQWGM Emergency Response Plan (ERP)
– distribution and sharing of data across entities
– operational procedures for communication between maintenance and operations staff
TECHNOLOGY-RELATED FACTORS

Potential system vulnerabilities revealed in the variations in age, quality and sophistication of treatment technology

- lack of centralisation/integration in assets
- rapid accumulation and rollout of infrastructure, e.g., fluoride dosing
- potential mismatch of human-machine interfaces to technology, e.g., critical control points not adequately represented in supervisory control
- appropriateness of alarm systems
STAGE 2

• Stage 1 was essentially a broad review of the key human factors issues in the urban water system
  – The research team identified high level ergonomics/human factors deficiencies
  – Due to the limited scope of the current work we did not conduct detailed investigations of these revealed areas

• Stage 2 is planned to deliver more comprehensive exploration and analysis
  – Help to better understand and manage risks associated with the human element
AREAS OF INVESTIGATION FOR STAGE 2

Four areas of research are recommended:

1. Review of best practice in other industries regarding management of human element risks.

2. Review of Emergency Response Plan performance (following January 2011 floods)

3. In-depth investigation of operator and organisational error: both retrospectively and prospectively

4. Analysis and audit of alarm systems and technology integration across treatment plants.
STAGE 2 RESEARCH PRIORITIES

The funding available might only allow one or two of these areas to be researched, so deciding their relative priority is important.

Undertaking the deeper study will deliver a more comprehensive understanding and analysis of key issues

– help to better understand and manage risks associated with the human element
Urban Water Security Research Alliance

THANK YOU

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