A survey of non-radiological risk controls for decommissioning safety assessment

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1. Introduction

The non-radiological risk controls for decommissioning safety assessment need to understand risk assessment methodologies and the thought processes encompassed in hierarchies of control. This paper discusses the recently issued standards and guidelines that require risk assessments and the use of a hierarchy of control, the purpose of a hierarchy of control, risk assessment and a hierarchy of controls are joined with sound problem-solving methods to create a safety decision hierarchy, hazard identification and analysis, and risk assessment methods.

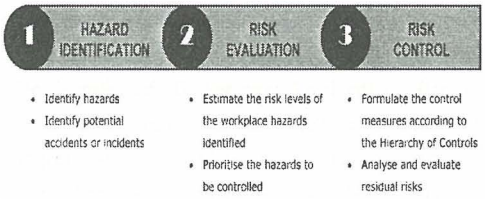

Fig. 1. Generic steps of risk assessment

2. A survey of risk assessment & hierarchy of control in industrial safety

2.1 ANSI

ANSI presents the below hierarchy of controls[1].

- Elimination or substitution
- Engineering controls
- Awareness means
- Training and procedures (administrative controls)
- PPE

2.2 MIL-STD-882D/SEMI

The order of precedence for mitigating hazards is given[2][3].

- Eliminate hazards through design selection
- Incorporate safety devices
- Provide warning devices
- Develop procedures and training

3. Purpose of a hierarchy of control

A hierarchy is any system of actions, things or persons ranked one above the other. For risk practitioners, a hierarchy of controls establishes the actions to be considered in a order of effectiveness to resolve unacceptable hazardous situations. Achieving an understanding of the significance and the rationale for this order is an important step in the continuing evolution of the practice of safety. For many situations, a combination of the risk management methods included in a hierarchy of controls may be applied.

Fig. 2. Actions in order of effectiveness

4. The logic of taking action in an order of effectiveness for risk controls

Safety management requires that one establish the rationale for the order in which the list is presented. Actions described in the first, second and third levels are more effective.

4.1 Action - Level 1

If the hazards are eliminated in the design and redesign processes, risks that derive from those

hazards are also eliminated. The intent is to design to acceptable risk and to minimize the human action necessary in the work process. Examples include designing to eliminate hazards related to falls, ergonomics, confined spaces, noise and chemicals. If no hazards are present, there is no potential for harm, and, thereby, no risk.

4.2 Action - Level 2

By substituting less-hazardous methods or materials, risks can be substantively reduced. Examples include using automated materials handling equipment rather than manual materials handling; providing an automatic feed system to reduce machine hazards; using a less-hazardous cleaning material; and replacing an old steam heating system and its boiler explosion hazards with a hot air system. This reduces the need to rely on the actions of worker, although perhaps not to the same extent as designing out the hazard.

4.3 Action - Level 3

When safety devices are incorporated into the system or product in the form of engineering controls, risk can be reduced, as an reliance on the worker or product user's actions. Safety devices include machine guarding, interlock systems, presence-sensing devices, safety nets, fall prevention systems, and all devices and systems that separate hazardous energy from worker.

4.4 Action - Level 4

Warning systems, through vital in many situations, are reactionary. They alert worker only after a hazard's potential is in the process of being realized. Warning system effectiveness and the effectiveness of instructions, signs and warning labels rely considerably on administrative controls, training, and the quality of maintenance and worker's reactions.

4.5 Action - Level 5

Administrative controls include appropriate work methods and procedures, personnel selection, training, supervision, motivation, work scheduling, job rotation, scheduled rest periods, maintenance, management of change, investigations, inspections and behavior modification. These controls rely on the appropriateness of the particular method in relation to needs, capabilities of those responsible for their delivery and application, quality of supervision and performance of workers. It is difficult to achieve a superior level of effectiveness in all these areas.

4.6 Action - Level 6

Proper use of PPE such as safety glasses, safety shoes, gloves and hearing protection rely on an extensive series of supervisory and personal actions, such as the identification of the equipment needed, and its selection, fitting, training, inspection and maintenance.

5. Conclusion

Ensuring that actions taken accomplish their intended goal is an integral step in an effective problem-solving technique. For safety management purposes, measuring for effectiveness requires verifying whether actions taken have truly reduced the risk to the level expected. If the residual risk is not acceptable, the thought process involved with the safety decision hierarchy must be reapplied, beginning with hazard identification and analysis process.

6. Acknowledgement

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7. References

[1] American national Standard for Industrial Robots, ANSI/RIA, 1999

[2] U.S. DOE Military Standard System Safety Program Requirement, MIL-STD-882D, 2000

[3] Semiconductor Equipment and Materials International, SEMI, 2000