Seeing Hazards in the Design

Using Visual Literacy to Improve Hazard Recognition in Electric Utility Designs: Fact Sheet

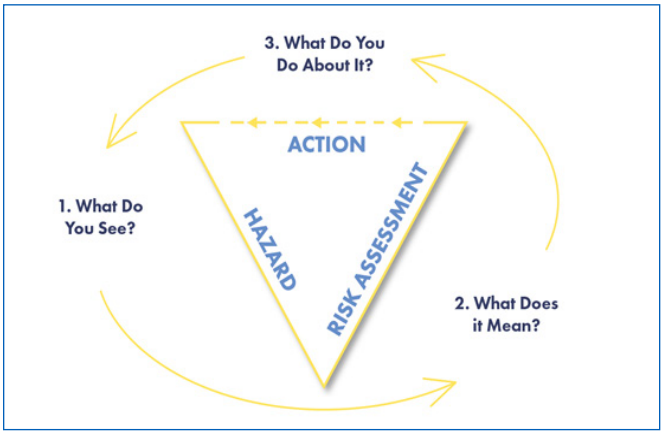
Safety by design (SbD): Anticipating and designing out hazards to workers in facilities, work methods and operations, processes, equipment, tools, products, new technologies, and the organization of work.

Hazard recognition (HR): Recognition of hazards present in a work operation or work environment.

Visual literacy (VL): The ability to read, comprehend, and write visual language, and an approach to processing visual information more efficiently.

Motivation for the Study and Key Research Questions

Hazard recognition is one of the keys to a proactive safety strategy. In everything that we do, we are constantly on alert for potential safety hazards, the risk that they pose, and how to mitigate the possible danger they present. Unfortunately, accidents occur. Similar to many industrial workplaces, in electric power facilities and work sites, the accidents too often lead to injuries and fatalities. In this pilot study, EPRI researchers explored how to improve safety by "seeing" hazards better during the design of electric utility capital assets. The key questions answered by the researchers were: What is the typical design process in the electric utility industry? What hazards can be identified and eliminated during the design of capital assets? How can visual literacy enable improved hazard recognition during design? What guidance can be given to electric utilities to improve hazard recognition in design?

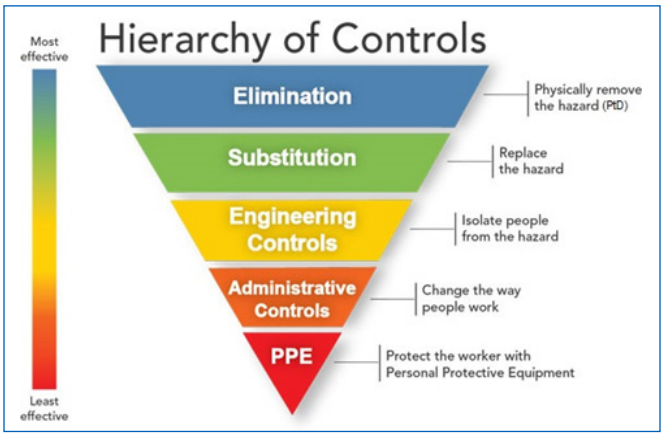


Visual Literacy Applied to Safety (derived from The Art of Seeing Art™)

Study Approach

We began with a comprehensive literature review in three topic areas: safety by design (SbD), hazard recognition (HR), and visual literacy (VL) . Next, we conducted in-depth interviews of eight targeted industry practitioners (design engineers, construction managers, risk managers, and health and safety personnel) in four electrical utilities to gain their insights regarding the typical design process, common types of workplace hazards, impacts of

designs on hazardous exposures, and needs for effective SbD. The researchers then underwent focused VL training. All of the information gained, combined with the VL training, enabled developing practical guidance for electric utilities to enhance hazard recognition in design through improved VL competency. The study topic and guidance are founded on the hierarchy of controls for safety management (illustrated below).



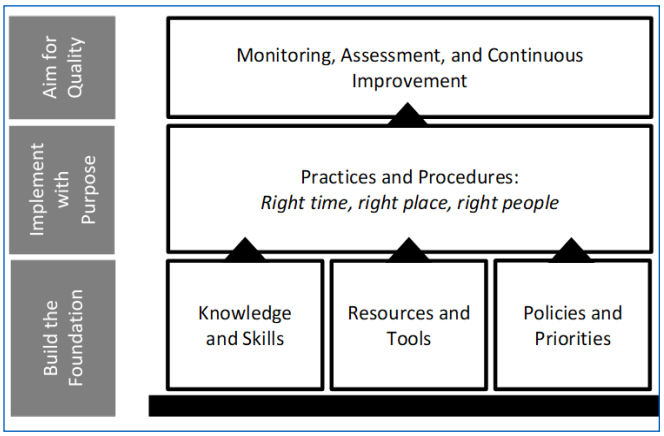
Hazard Elimination: The Goal of Safety by Design (NIOSH, 2015)

Key Findings

Hazard recognition during design is inhibited by large and complex designs, and a lack of exposure to jobsite conditions. VL affects a person's ability to process and comprehend visual information. Enhanced VL competency provides both direct and indirect opportunities to improve hazard recognition in the design of electric utility capital assets. Using VL skills for safety purposes involves: (1) seeing the whole picture associated with a design, (2) understanding basic principles of design and elements of art as they relate to worker safety, and (3) recognition and mitigation of cognitive biases associated with interpreting and acting upon visual information. SbD is enhanced through training on VL concepts and the use of VL techniques when creating/presenting and reading/reviewing design information. Improved hazard recognition in electric utility designs can be facilitated through the application of VL skills in periodic design reviews during the project design and development process.

How to Apply the Results

The study provides recommended practices that an electric power provider can follow to integrate VL into a SbD process across the organization: Step 1 – Build the Foundation, Step 2 – Implement with Purpose, and Step 3 – Aim for Quality. It is recommend implementing each step and building VL competencies and capabilities through training personnel involved in the project development process. By doing so, the resulting SbD process will enhance hazard recognition and ultimately lead to safer designs for those who construct, operate, and maintain electric utility capital assets.



Steps to Implement VL in SbD

Seeing the Whole PICTURE®	Principles of Design	Elements of Art	Mitigating Cognitive Bias
Perimeter to interior (PI)	Movement	Color	Anchoring bias
Contrast (C)	Alignment	Lines	Champion bias
Turn it upside down (TU)	Proportion	Shapes	Ostrich bias
Repeat (R)	Proximity	Space	Recency bias
Explain (E)	Symmetry	Texture	Group think
			Confirmation bias
			Blind-spot bias
			Conservatism bias
			Representative bias
			Overconfidence bias

Visual Literacy Concepts and Practices (COVE)

Expected Outcomes

Through the implementation of a structured SbD process and the application of VL concepts and tools by designers, engineers, safety professionals, and project managers, the following outcomes should be expected:

1. The identification of hazards throughout the design process will increase.
2. Mitigation of hazards will occur at the most cost-effective point in the design-construction-operations-maintenance process. Allowing hazards to be built into the design pushes hazard mitigation to the most expensive, and at times the least effective, part of the asset life cycle.
3. Building competence in VL through training designers, engineers, safety professionals, and project managers provides collateral benefit in all aspects of their work going forward.

Acknowledgements

This study was a collaboration between EPRI, Oregon State University, Center of Visual Expertise (COVE), and the University of Alabama.

EPRI Contact

John Shober, *Principal Technical Leader*
972.556.6528, jshober@epri.com

Source

Program on Occupational Health and Safety, P62: *Using Visual Literacy to Improve Hazard Recognition in Electric Utility Designs: Research Findings and Recommendations.* EPRI, Palo Alto, CA. Product ID# 3002025013.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

3002025014 July 2022

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 • USA • 800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com