Perform the hazard analysis at the project’s earliest stages using any of the established industry methods described on page 2.

A hazard analysis typically consists of the five major steps shown in the graphic to the right (see Safety Planning Guidance for Hydrogen and Fuel Cell Projects in the list of Helpful Resources on page 2 for more information).

Once the hazards are identified, their risks should be categorized in terms of potential impact (consequence) and probability of occurrence (frequency). For example, a very-low-probability risk might be one that is not likely to occur in the 50-year expected operating lifetime of the process, and a low-probability risk might be one that is likely to occur just once in the process lifetime. A medium-probability risk might be likely to occur a few times in the process lifetime, a high-probability risk might be likely to occur once a year or whenever an operator is working in a highly stressed condition without immediate oversight, and a very-high-probability risk might be likely to occur during every equipment maintenance/repair outage or at least a few times each year. The impact categorization scheme might be in terms of the severity of a potential personnel injury and/or the extent of equipment damage and lost production.

After the risks are categorized, hazard controls should be developed to eliminate or reduce the probability, consequences or both. The highest risks should receive the most attention.

**Tips for a Successful Hazard Analysis**

- Allow ample time over multiple sessions. Don’t rush through it.
- Bring easily accessible data on equipment design and operation, expected range of operating parameters, startup and shutdown procedures, and required maintenance operations.
- Don’t get bogged down by one difficult event or failure mode. Postpone completion of that event or failure mode until additional pertinent resources and information (and possibly another participant) become available.
- Bring plenty of coffee and other refreshments to each session.
- Maintain a spirit of congeniality and interject healthy doses of good humor.
Hydrogen Hazards to Consider

Earlier surveys of hydrogen-related work have elicited a number of common responses on hazard identification as a first step toward managing or eliminating risk. Two questions to consider:

**What hydrogen hazard has the potential to result in the worst consequence?**

This could include uncontrolled hydrogen release from equipment failure (resulting in concentration greater than the lower flammability limit); flammable mixture exposed to ignition source (resulting in fire or explosion); excess pressure buildup inside equipment (resulting in loss of containment and fire or explosion); unexpected rapid reaction with energetic materials that can’t be controlled; etc.

**What hydrogen hazard is the most likely to occur?**

This could include hydrogen leaks, minor burns, exposure of energetic/reactive materials to air or water, etc.

Helpful Resources

- FMEA Info Centre, a non-commercial web-based inventory dedicated to the promotion of FMEA (www.fmeainfocentre.com/)

For Laboratories, Did You Know

NFPA 45, *Fire Protection for Laboratories Using Chemicals*, requires “evaluations be made for hazards that can be encountered or generated during the course of the work”, BEFORE laboratory tests or chemical reactions are begun.

Topic for Next Quarter

Ventilation