On August 6, 2007, a collapse occurred in the Crandall Canyon Mine in Emery County, Utah, trapping six workers inside the mine operated by Genwal Resources Inc. (GRI). On August 16, 2007, the mine collapsed again when one of the walls of a tunnel exploded, killing three rescue workers. The original six workers trapped in the explosion were never recovered.

According to Mine Safety and Health Administration (MSHA) investigators, the original collapse was caused by a flawed mine design. The investigation report stated that the stress level exceeded the strength of the pillars such that when one small failure occurred, it created a ripple effect that caused widespread collapse, leading to the loss of the miners. The MSHA stated that the mine was “destined to fail” because the company failed to heed early warnings and previous failures. For example, on March 10, 2007, one of the pillars burst, leading to a partial collapse of the mine.

The mine was also at risk because its design was based on improper analysis and models. The report stated that GRI’s mine design incorporated flawed design recommendations from its contractor, Agapito Associates Inc. The contractor used two different models for designing the mine. The report stated that the first model was inappropriately applied, and the contractor failed to consider critical factors in its inputs to the model. The second model used inappropriate model input parameters that overestimated pillar strength and underestimated load. Contractor managers did not review input and output files for accuracy and completeness, according to MSHA, and failed to correct significant flaws in the models after the March 10 incident.

**Lesson Learned:** A model is a physical, mathematical or otherwise logical representation of a system, entity, phenomenon or process. A simulation is a method for implementing that model. Some uncertainty is to be expected, but the credibility of those models must be established prior to use. Even valid models and simulations can be misused if those using the models do not understand the limitations of the model, or are not trained to use those models and simulations. Insufficient and inaccurate modeling is a hazard cause that should be considered in system safety analyses, and appropriate controls should be put in place to prevent outcomes such as those illustrated in the mine collapse in Utah.

Readers are encouraged to review the full accident and mishap investigation reports referenced here to understand the often-complex conditions and chain of events that led to each accident discussed here. Additional lessons learned are available at www.systemsafety skeptic.com.

**References**