

Safety Corner

What is ATWS in nuclear safety?

In nuclear reactor operations, a “transient” is a change in a reactor’s power output caused by deviation in temperature, pressure, or both of nuclear reactor coolant system. When a reactor shutdown is needed during a transient, neutron-absorbing control rods will be quickly inserted into the core to stop the chain reaction of nuclear fission, either automatically or manually by reactor operators. This emergency shutdown process is known as a reactor trip or a scram.

An anticipated transient without scram (ATWS) occurs when a reactor shutdown is needed during a transient, but the highly redundant, reliable reactor scram system fails to insert the control rods into the reactor core, possibly due to failure of the rod control or drive system, or a failure of the protection and safety monitoring system. An ATWS is one fo the worst-case accidents in nuclear reactor operations.

As the reactor continues to produce power while the plant is switching into decay heat removal configuration assuming that the nuclear chain reactions have been stopped, an ATWS accident can evolve at a fast and unforgiving speed: there is typically about 30 seconds for reactor operators to take control actions. With no appropriate means for heat removal under a power runaway, nuclear core melt and containment damage are the likely outcome, causing a release of radioactive materials.

All nuclear plants are well-designed to prevent such worst case accidents, and plant operators are trained to address them. There has been no ATWS accident occurred in commercial nuclear operations; however, a few near-misses and latent failures have discovered in the past. Nuclear regulators around the world must closely monitor plant preparedness to prevent and respond to ATWS events. Industry must also be vigilant in all aspects of design, manufacture, installation, operation, and maintenance of nuclear power plants. A continuing strong focus on good practice and safety culture is equally necessary.

Do you have any events similar to ATWs in your business operations, when the most important safety barrier against an undesirable outcome fails to work as designed? Are you well-prepared to respond to such event?

=====
The Safety Corner is contributed by Ir Dr. Vincent Ho, who can be contacted at vsho@UCLA.edu