

Y-12's 1958 nuclear criticality accident and increased safety — 1958 brought accidents, more safety

The first X-ray machine was brought to Y-12 in February, 1949. It was a 1,000 KV system installed in Building 9981-1 in the heart of what is known even today as "Area 5." That was but the first of many such X-ray machine purchases. Some of the X-ray machines purchased by Y-12 may well be among the largest and most powerful in the world.

For a few years early in my career I was assigned to the X-ray Crew. That was a good job as the crew was known to be experts in their field. We took a great deal of pride in keeping the X-ray machines in good working order. The high voltage potential in the power supplies of these huge X-ray machines caused us to take great care when working on them. It was not enough to just turn the power off, all the high voltage potential devices had to be shorted to ground before any work could be done.

X-ray machines were not the only complicated equipment at Y-12. Some of the most exotic equipment you can imagine was designed for special purposes at Y-12. Machine tool factories were known to take jobs for Y-12 realizing they would not be able to create machines without extensive design assistance from Y-12.

Over the years, Y-12 has continued to take the state-of-the-art in machining to greater and greater levels of excellence. All because Y-12's mission required the most precise machining capability in the world and to get that level of achievement meant creating those precise machine tools.

Much of the expansion of the 1950's took place in the portion of the Y-12 site known as "Area 5." It is the area where the chemical processing and machining of highly enriched uranium first took place. The main building there is Building 9212 and its many support facilities. As this area expanded, other buildings were added.

It is hard to determine exactly how "Area 5" initially got its name. I have seen references to that designation well before the emergency response program designated the plant site into "areas." If a reader can shed some light on this for me, I would certainly appreciate it. The question of where are the other four "areas" is a good one, if there ever were four more.

The creation of map designations for emergency response came into Y-12 after a fatality in Paducah, Kentucky's Gaseous Diffusion Plant resulted in a reevaluation of the many practices regarding signage, responsibility and programs for increased safety. Signs were required to make workers aware of hazards that had not been used before. Emergency response organizations were formed and safety took a more central role.

There were other safety related incidents at Y-12 during the 1950's that also resulted in heightened awareness and increased emphasis on Safety as a discipline as well as the idea of safety being everyone's business and ultimately the worker being responsible for his or her own safety. Of course, the supervisors were held accountable for safety as well.

The two fatalities from a Zirconium explosion on May 14, 1956, resulted in considerable change in practices. The supervisor of those individuals continued to struggle with that accident and when he was near death himself, he wrote a letter describing the accident and noting the location of the burial of the zirconium powder to keep someone in the future from digging into it unawares.

However, the most significant incident during that time was the criticality accident in 9212's C-1 Wing on June 16, 1958. This was the nation's first industrial related nuclear criticality accident. Eight individuals were exposed to radiation. They quickly evacuated the area limiting their exposure. However, they were hospitalized for 44 days and struggled with radiation related health issues for several months. There were no fatalities and all of the eight people returned to work.

One of the contributing factors to the accident was the use of a 55 gallon drum (an unsafe geometry in that sufficient quantity of material can collect in it to create a critical mass). Obviously, we don't allow those drums in process areas any more.

Peter Angelo, Ph.D., Senior Staff Specialist Nuclear Engineer, at Y-12 has this to say about the Y-12 criticality accident and what has been learned from it:

"In a nutshell, the accident occurred as a result of the inadvertent addition of fissile solution into a 55-gallon drum used to collect water from tanks that were undergoing leak testing. The fissile solution had leaked into one of the tanks from a valve that was thought to have been closed, that separated processing lines."

"The presence of the drum represented an "unsafe geometry" for fissile solutions that was not thought to be present. A criticality accident occurred when approximately 9 inches of concentrated solution drained into the drum. The excursion lasted approximately 20 minutes and resulted in significant radiation exposure to 8 individuals located nearest the event."

"The Y-12 accident was the first recorded process accident and launched development of international standards for nuclear criticality safety. Those at Y-12 involved in the accident recovery were instrumental in development of these standards."

Peter concludes, "Even after 50 years, there is much to learn from the accident. Facilities can be designed to be safe; however, the human element will always be there. The 60 known criticality accidents show a very strong dependence on human factors."

Within a year of the 1958 Y-12 event, there were criticality accidents at Los Alamos and Idaho nuclear facilities.