

Quality at Y-12, part 2

Or: Looking at Y-12 weapons quality (title as it appeared in *The Oak Ridger*)

Thanks to Ken Bernander and Bud Leete we continue with the history of Quality at Y-12. Bud Leete, is a Statistician at Y-12 who has been engaged in all aspects of quality analysis and management over the years. He continues the history of that important aspect of Y-12's success over the years:

Quality Management Approaches

When Union Carbide managed the Y-12 Plant, it operated on a "cost plus fixed fee" basis. Managers were given the general freedom to make effective, best-practice decisions. In the days of high volume weapon production, Y-12 worked tirelessly to make quality components and paid significant attention to related aspects like keeping equipment running and calibrated. A number of controls were instituted.

There were numerous measurement control programs to independently assess how well inspection machines or laboratory analysis equipment could repeat measured values on blind samples. For example, a single glass "monitor part" traveled through each inspection area every quarter where it was inspected on all the general-purpose inspection machines.

Evaluations showed which machines were the most repeatable and highlighted any that seemed different from others. There were re-inspection programs where product was routinely selected for re-inspection to collect information on day-to-day inspection performance of the other inspection equipment. Analytical Chemistry had more than 40 measurement control programs where blind samples were routinely submitted, analyzed, and the results reported.

In 1976, the Quality Control Department was restructured to become the Technical Division, and Roger Davis replaced Ed Gambill who was then head of the Quality Control Department.

The primary oversight for weapon production came from the Department of Energy operations in Albuquerque, New Mexico, usually referred to simply as DOE-AL. The concept of "quality" was gaining national focus at the time, and concepts like the "cost of quality" and "conformance to requirements" were generating interest. DOE-AL was interested in management practices at all the contractor sites and Y-12 was often asked for information on quality costs, performance levels, and good practices to reduce scrap.

In time, DOE-AL became somewhat critical of Y-12 because of our organizational structure. After seeing how all the other contractor sites in the Nuclear Weapons Complex were organized, DOE-AL felt Y-12 should have a specific organization called "Quality" and it should bear the responsibility for assuring/coordinating quality activities within Y-12.

They wanted the organization to report to the Plant Manager, just as the production organizations did and be responsible for Plant quality. Y-12 had established a Quality Doctrine stated that "each plant organization is responsible for the quality of its products". Y-12 felt its approach to Quality should be considered acceptable if products and services met the requirements (and their intent) and our costs of doing business were reasonable.

The Quality Division

DOE-AL continued to press for change in Y-12's organization structure. In September 1979 Y-12 received a low rating on a management survey for Quality, and DOE-AL auditors leveraged on the opportunity to force a change. The Quality Division was formed and Charles Holland was named as the Division manager. A new group, Quality Engineering, was formed to bring even more structure and order into manufacturing procedures. Dave Bryant was selected to lead this group.

Quality Improvement Challenges and Activities

In the 1970s, computing capabilities were limited. Y-12 was one of the first companies to get electronic calculators. An early model electronic calculator cost \$2,000 and it had no more functionality than a \$5 calculator you can find anywhere today. Data analysis was done on pencil and paper or with punched cards and computer programs. About 25 statisticians and statistical personnel worked to keep track of production work, write reports on quality to line managers, and monitor the manufacturing and inspection processes.

Moreover, classified computing lagged far behind unclassified computing. Classified jobs were tabulated on data forms and then taken by courier to K-25 for keypunch, job setup and execution. The output was returned by courier, usually within a week. As Y-12 began to get classified computing equipment, much of the analysis was transferred to IBM mainframe equipment here. With help from computer experts like Earl Nall, Y-12 built a Quality Information System that was the best in the Nuclear Weapons Complex. In 1986 Y-12 was awarded a national award for computer integrated manufacturing using this system as a prime component.

Having the data from weapons production in a classified environment that promoted rapid analysis created wonderful opportunities. One of Y-12's innovations was the creation of a "Top 100 List" of problem features. Maybe you have heard of the Pareto principle or the 80-20 stating that, for many events, roughly 80% of the effects come from 20% of the causes.

Y-12 learned that 2% of its dimensional characteristics accounted for more than 40% of Inspection rejections. By focusing attention to the manufacturing of these 100 characteristics, called the "top 100", Y-12 significantly reduced rejections and the associated costs of rework and scrap.

Further, we were in a strong position to compute costs and savings, and in the 1980s Y-12 used these computer evaluations to foster an even greater use of statistical sampling plans.

Next we will look at the history of non-weapons quality at Y-12.