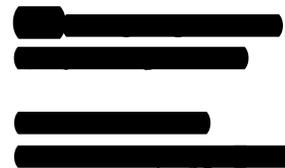


Temple Enterprises, LLC



Assessment Report of JM Eagle's Quality Control and Compliance with Industry Standards

By Major General (Ret.) Merdith W.B. (Bo) Temple

Qualifications

I am the former Acting Chief of Engineers and Acting Commanding General, U.S. Army Corps of Engineers, with command over more than 36,000 employees managing an annual program of more than \$40 billion.

During 26 years of combat and construction engineering experience in support of Army and Joint tactical and operational units in the U.S., Korea, Germany and Turkey, I commanded engineer organizations at all levels from company through brigade.

When I was the U. S. Army Corps of Engineers (USACE) Transatlantic Center commander, I had construction responsibility for more than \$600 million in the Middle East. As the Theater Engineer in Baghdad I provided staff supervision over the combat engineer support efforts country-wide and to development of the initial Master Plan for Army/Coalition installations in Iraq.

As the Corp of Engineers' North Atlantic Division commander, I had programmatic responsibility for more than \$4 billion in construction, both military and Civil Works, in the U.S., Europe and Israel.

In all positions I held with USACE, I was part of and then responsible for the Corps' Quality Assurance (QA), Quality Control (QC) and Quality Management Systems (QMS). I am well versed in International Organization for Standards (ISO) certification standards that establish the processes to help ensure the consistent delivery of products and services that are safe, reliable and of good quality.

- Bachelor of Science in Civil Engineering, Virginia Military Institute, 1975
- Regular Army Commission, Corps of Engineers, 1975 (retired 2012)
- Master of Science in Civil Engineering, Texas A&M University, 1985
- Registered Professional Engineer, Virginia, since April 1982

Assignment

I was asked by JM Eagle to visit three of its major production facilities in California and Texas, and to meet with the director of Microbac Laboratories, Inc.'s Hauser Division Laboratory in Colorado, where many independent tests for the PVC (polyvinylchloride) industry and JM Eagle have been conducted.

I was tasked with assessing JM Eagle's QA and QMS, investigating and assessing its pipe testing protocols and reviewing the company's record of compliance with certifying agencies such as Underwriters Laboratories (UL) and NSF International, American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), etc.

I agreed to this assignment with the understanding that JM Eagle would have no say in the final content and conclusions of my report, whether positive or negative.

Primary Findings

- Based on my observations of JM Eagle plant operations, my visit to Hauser Laboratory, and my discussions with the company's corporate Quality Assurance Managers and Quality Assurance visits with plant and Quality Control managers, I believe the company is doing an excellent job at maintaining a high level of quality in its products.
- JM Eagle makes compliance checks during production, monitors external audits, and sends product samples to independent laboratories to ensure its products meet national standards. In so doing, JM Eagle is following industry-wide Quality Control and Quality Assurance protocols.
- Additionally, JM Eagle's products are certified by numerous independent national standards organizations and subject to independent periodic tests by these organizations, which include an average of 400 such independent, unannounced audits each year.
- During my independent review of JM Eagle's Quality Assurance program, I found it to be very strong and consistent across the enterprise, reinforced by the hundreds of other independent audits of JM Eagle processes and products that are conducted annually by nationally recognized certifying agencies.
- Based on everything I personally observed and learned while conducting my review, I do not believe that any allegations of poor quality products from JM Eagle could be credible or have merit.

Report Narrative

The development of certified and executable Quality Management Systems (QMS) is critical to providing quality products and services consistently across an entire enterprise. Without such systems it is problematic whether any organization can consistently achieve high quality.

During my visits to JM Eagle manufacturing plants, I observed tests being conducted by QC personnel that were to national standards level or in many cases exceeding these levels. For example, some tests are routinely conducted at 6-hour or 8-hour intervals, as opposed to national standards that call for such testing every 24 hours.

Every lot of product coming off the line is tested for size, thickness and dimension, chemical composition, impact, and pressure (as needed) by plant operators and the plant's QC testing personnel to verify that specifications are compliant with national certification standards. If a lot has a problem, then each piece may be tested until the cause is identified or if a lot experiences a second issue, the lot is scrapped. Product failure or scrap rates range from 1%-3%. Sub-standard materials are ground or shredded for reuse, typically for low or no pressure products.

Product anomalies are investigated and corrected to ensure consistent production of items that meet required specifications. Historically more than half of production issues are caused by human error and the rest by equipment that needs adjusting or replacement when production changeover occurs.

In many cases, plants were performing tests more frequently than required by regulating agency standards, especially at the beginning of new runs of products. For example, at one plant that specializes in pressurized water pipe, initial pieces get a full battery of tests hourly at the beginning of a new run until it is verified that all specs are met. Then a steady state test regimen is implemented at no less than the frequency required by regulating agencies (UL, ASTM, etc).

A total of 70 Quality Control managers are assigned to support all 22 of JM Eagle's plant, with at least one QC manager assigned to cover every shift. The Quality Management System tracks quality issues, improvements and implementation, and ensures that quality updates and lessons learned are published throughout the organization. Most quality control issues are detected and corrected during internal audits and testing, but when issues are detected by an external audit they are immediately addressed with the certifying agency. When corrective actions are taken, the results are published and provided to each plant. Additionally, there is an annual QC/QA meeting to discuss quality issues and to share experiences.

External audits are conducted by certifying agencies at least quarterly at each plant for compliance with certification standards. These audits are conducted by UL, NSF, ISO, AASHTO, IAPMO (International Association of Plumbing and Mechanical Officials), FM Approvals and CSA (Canadian Standards Association). The company estimated that it is subjected to an annual average of 400

such audits with a total of more than 10,000 since the inception of the company in 1983. Typically, the external audits involve unannounced and unscheduled plant visits during which certifying agency representatives select products at random to be tested at independent laboratory facilities. Inspectors for UL and ISO visited one plant while I was on the premises, attesting to the frequency and randomness of such audits.

JM Eagle products and compounds are also tested at third-party laboratories, such as Microbac's Hauser Division Laboratory in Colorado. Hauser, an ISO and American Association of Laboratory Accreditations certified facility since the early 1980's, provides microscopy and failure analysis, cell classification testing, mechanical property, chemical property, pipe pressure testing, impact testing, corrosion testing and conformance testing services.

Hauser Laboratory Director Steve Perry told me that Hauser has conducted more than 1,000 tests since the year 2000 on JM Eagle products submitted to the lab by multiple requestors including not only JM Eagle, but third parties such as regulatory agencies, pipe installers and owners of piping systems, and municipal water utilities. Only one of these tests involved a JM Eagle product failure. In this case, testing revealed that the failure was induced by an installation problem at the pipe joint. Due to a 100% factor of safety in water pressure pipe, the product failure would not have occurred if the pipe joint had been properly installed based on Hauser Laboratory's analysis.

Mr. Perry pulled about 60 JM Eagle test reports at random and found product compliance issues were detected in only two cases (3.3%). He said this rate was consistent with PVC industry wide performance. Although failures for any reason are very infrequent, Mr. Perry said product or material failures make up only 1%-2% of any 100 failures industry wide, and the remaining 98%-99% are installation/construction related.

All of the internal Quality Control activities at JM Eagle, the external process audits, and independent lab testing lead me to believe that the principles of good quality management and continuous process improvements are being used at JM Eagle. The consistency of processes I observed also lends credence to the notion that a robust and mature QMS is well established throughout JM Eagle. This would make systemic production of non-compliant, low quality products highly unlikely. The 1-2% product failure rate is consistent with Hauser Laboratory tests and with my own observations of a 1-3% product failure rate at the plants I visited.

Recommendations

- Given the vast majority of failure issues (98%-99%) are associated with construction/installation, JM Eagle would benefit from a closer partnership with the construction/installation industry to help reduce misunderstandings about PVC products, ensure better installation and use of products, and instill greater confidence with past, current, and future customers.
- JM Eagle should consider strengthening its QMS through additional formal training for its QC community to ensure lessons learned are shared throughout the enterprise and to maintain consistency among its 22 plants.
- JM Eagle should consider digitizing its QA and QC hard copy records to support easier and faster information sorting, trend analysis, and issue resolution across the enterprise.



Meredith W. B. Temple

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