



EXPERIENCE OF THE IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM AT THE JOINT STOCK COMPANY “MASHINOSTROITELNY ZAVOD”, ELECTROSTAL

V. MEZHUEV, V. TSIBOULIA, A. KIRUYSHKIN, V. TCHIRKOV
Joint Stock Company “Mashinostroitelny zavod”,
Electrostal, Moscow Region,
Russian Federation

Abstract

The paper describes major steps of development and implementation of Quality Management System (QMS) in nuclear fuel fabrication at Joint Stock Company “Mashinostroitelny zavod”, Electrostal, Russian Federation. Special emphasis is paid to the estimation of QMS effectiveness, current impact of QMS implementation on nuclear fuel quality, sales market and directions for further QMS development.

1. Introduction.

JSC “Mashinostroitelny zavod” (JSC “MSZ”) is one of the major enterprises in the world manufacturing nuclear fuel for nuclear power plants.

The enterprise was set up in 1917 as a factory for the ammunition production and aviation bombs of different caliber. Fabrication of the products for nuclear industry with the use of different chemical-metallurgical processes started in 1945. From 1953, the enterprise started fabrication of fuel rods and fuel assemblies for the nuclear industry.

The list of current products fabricated by the JSC “MSZ” includes:

- Fuel assemblies for different nuclear reactor types including WWER-440, WWER-1000, RBMK-1000, RBMK-1500, EGP-6 (for Bilibino NPP), BN-600, PWR and fleet reactors;
- Metal distilled calcium;
- Anisotropic ceramic barium and high-power magnets;
- Hard alloy tools for metal treatment and rock-cutting machines;
- Tubular heaters for air, water and oil;
- Air conditioners and other domestic appliances.

2. General characteristic of the market and requirements to quality of the products manufactures

The present report contains the review of the market of fuel assemblies because the fuel assemblies contribute mainly to the economics of JSC “MSZ”. JSC “MSZ” delivers the nuclear fuel to 50 power units of NPPs in Russia, Armenia, Kazakhstan, Lithuania, Ukraine, Bulgaria, Hungary, Germany, Slovakia, Finland, Czech Republic.

At present, there is a strong competition on fuel assembly’s market. LWR fuel fabrication capacities are much higher than the annual current demand worldwide. Only in Far East countries, the demand for the fuel fabrication services exceeds the available production capacities. On this basis the fuel manufacturers have to take measures to increase the fuel fabrication effectiveness.

The market dictates the necessity of constant fuel optimization, improvement of commercial terms and conditions, increase of the reliability of the supplied fuel ensuring, at the same time, necessary fuel safety margins for the high burnup operation.

The approach to settling these problems acknowledged worldwide is the set up and optimization of the Quality Management System (QMS). The basis of the QMS most widely used now is the series of the international standards (IS) ISO 9000.

The functioning of the QMS of the nuclear fuel suppliers plays an important role for successful licensing. This has led to the establishment of the requirements on the presence and functioning the QMS in the contracts signed with foreign and Russian customers. Besides, such requirements are put forward by the regulatory bodies of Russia, in particular, by GOSATOMNADZOR of the Russian Federation.

3. History of the QMS

The history of setting up the QMS at JSC “MSZ” includes several stages. They are overviewed below.

3.1. *Pre-history (up to the mid-50s)*

During this period the basis for the responsible attitude to the quality of the work fulfilled and products manufactured was created. The nature of the products manufactured – ammunition and bombs – required high accuracy and responsibility (in the modern quality terms) during the loading process.

3.2. *Stage 1 (end of 50s- beginning of 70s) – creation of quality control system*

At this stage fabrication of new products – fuel assemblies was started, as well as development and implementation of specific inspection methods. The structural formation of the services and departments of JSC “MSZ” took place at this period. Mainly, the formation of the departments included into the quality service was completed during this time period.

3.3. *Stage 2 (end of 70s – end of 80s) – complex (factory) Quality Management System*

At this stage the complete **product** QMS was developed and implemented. The complete product QMS of the JSC “MSZ” was one of the first in the USSR and it was registered in the Moscow Centre of Standardization and Metrology.

The implementation of the complex product quality management system allowed to optimize the technology and inspection techniques and methodologies, and to improve the quality of the technical documentation.

3.4. *Stage 3 (from the beginning of 90s) – Quality Management System*

Step 1 – is setting up, implementation and certification of the QMS on the basis of IS ISO 9000.

The setting up of the QMS was performed in accordance with the requirements of the IS ISO 9000 using to the maximum the elements of the valid complex product QMS. First, it was decided to spread the QMS for the fuel assemblies production. Within a year, work related to the perfection of QMS was performed, it was documented and the needed arrangement changes were introduced. In November 1995, the QMS was introduced.

Taking into account the opinion of the customers, TUV CERT, an independent German company, was chosen as the certification body. The certification according to model ISO 9002 successfully passed the certification in March 1996 and a certificate for QS was issued. From 1999, the quality system that meets the requirements of the international standard ISO 9001 has been valid.

Step 2 – is QMS re-working, QMS estimating under the **criteria of the Award of the Russian Government**, participation in the competition and obtaining this Award. The second step

became the natural result of the realization of the fact that the existence of QMS meeting the requirements of ISO 9002 confirmed by the certificate for QMS is currently the necessary but not sufficient condition for the effective production.

At present the quality award models become more and more popular. In 1996 the Government of the Russian Federation set up a Quality Award (further- Russian Quality Award).

The structure of this award mainly meets the European Quality Award. The analysis of the award conditions and self-assessment of QMS demonstrated that it is reasonable for JSC "MSZ" to participate in the first competition for this award. During 1997, great work was carried out as to be prepared for the participation in the competition. Upon the results of the first competition, in November 1997, the Quality Award of the Russian Federation was granted to JSC "MSZ". This confirmed the correctness of the way chosen for the QMS optimization.

Step 3 – is QMS development with the purpose to create TQM (Total Quality Management).

4. Estimation of QMS effectiveness

After the enterprise has reached the formal goal – QMS certification, the QMS effectiveness becomes the priority and, consequently, the QMS estimation becomes one of the most important issues. At present, this estimation is carried out by 2 different means that are almost independent of each other. Our purpose is to synthesize them, create one powerful and effective tool for the QMS functioning estimation completely oriented to TQM.

Let's consider these estimation methods in more detail. One of the methods is the fulfilment of the new matters that were introduced in QMS by the IS requirements of ISO 9000. The QMS effectiveness estimation is made at the meeting of the Coordination Board according to the "Methods of the QMS effectiveness estimation" developed on the basis of the quality policy. One of the main constituents of the estimation are the results of the internal QMS – internal audits. Here, the criterion is the conformity of the activity with the normative documentation for QMS and requirements of IS ISO 9000. The departments, on the basis of the estimation results, develop together with the auditors and, under their control, perform corrective and preventive actions in QMS. The other method is the estimation by the criteria of one of the quality awards, for example, Russian. At present such estimation is performed as follows:

- departments of JSC "MSZ" responsible for a certain type of activity estimate this activity ("self-assessment") by the criteria of the Award and they choose the items and procedures that demonstrate the fulfilment of the criteria;
- a final report is prepared on the basis of the estimation results of the departments;
- a group of experts performs the scoring of the QMS effectiveness on the basis of the report.

Both methods have their merits. The task is to use these merits.

On the basis of the experience gained in the "self-assessment", a sufficiently representative and effective set of items and procedures, according to the criteria of the Russian Quality Award, is developed and included in the valid QS normative documentation. The estimation under the award criteria can be carried out by the results of the internal audit – a valid effective tool of direct and objective checking in departments and JSC "MSZ" in general. The expert group can be combined with the group of auditors (really, now it mostly comprises auditors). A representative scoring (1000 - point) methods, oriented to TQM, will be used for the QMS estimation. Here, the almost non-limited possibilities to optimize the methods shall be noted.

5. QMS implementation results

In this section, individual, the most representative results of the QMS implementation are presented.

5.1. *Preservation of sales markets*

This activity aspect is especially important for us as in the situation of general recession, destruction of contacts and removal of Russian goods from the sales markets the preservation of the sales markets, especially foreign, is doubtlessly a real achievement.

Only lately we can note the victory in the bid for the fuel supply to Czech Republic (NPP “Dukovany”) and Slovakia (NPP “Bohunice”, NPP “Mohovce”). During the bid the major world nuclear fuel suppliers – “Westinghouse” (USA) and EVF (Germany – France) were our competitors.

5.2. *Coming into new markets*

Here, the strong competition in the market between the leading companies-manufacturers, already mentioned before, shall be noted again. In such situation, some leading foreign companies, acknowledging the reputation of JSC “MSZ” often prefer the mutually profitable cooperation to competition. For example, German company “Siemens” became our major partner. The fuel assemblies fabricated at the enterprise operated successfully during the third campaign at NPP “Obrigheim”. New contracts with “Siemens” are signed for the supply of fuel assemblies for 4 NPPs of Germany and Switzerland. Preliminary negotiations concerning signing contracts for the fuel delivery to other NPPs in Sweden, Holland and Belgium are under way.

Also, successful release of the fuel for WWER-1000 can also be noted for Kalinin NPP.

Active work is performed with a number of foreign companies in other directions as well.

5.3. *Changing the psychology of the management in the system of staff training*

One of the main results of the QMS implementation we consider to be the change of the psychology of the management regarding the staff training approaches.

First, all the staff was trained. More than 100 people underwent training in quality according to European programs for the high and middle level management, promoters, auditors, with the assistance of consulting companies RW TUV and “Intercertifica”. 9 people were trained under the 160 quality management hours course in Germany and Bulgaria. The rest of the staff was trained under the programs developed by JSC “MSZ” for different categories in the Staff training department.

Second, as a result of the direct development, implementation and estimation of QS functioning a group of specialists of all the levels of JSC “MSZ” got the practical experience and improved its qualification in the field of quality management. At present, JSC “MSZ” has the specialists in the field of the quality management possessing the unique, for Russia, experience in the QMS setting up and functioning. Just for the sake of confirmation:

1. JSC “MSZ” has developed and implemented QMS for the magnet production and in April, 1998 TUV CERT has performed its successful certification audit, as well as the certification in accordance with ISO 9001 in June 1999.
2. The self-assessment results according to the Russian quality award almost completely coincided with the conclusion of the experts of this award.
3. The high level of the arrangement and performance of internal audits and audits of the quality system of the sub-contractors, noted during the supervisory audit of TUV CERT in April 1998 and during the qualification audit of “Siemens” company in March 1998.

The availability of such a potential allows us to look into the future without fear.

6. Main directions of the QMS development

As it was noted earlier, now we are developing QMS based on TQM principles. We have already paid certain attention to some work, in particular, we have noted the optimization of procedures of the policy development in the field of quality and QMS effectiveness estimation. Let's briefly consider the most important directions of QMS perfecting.

6.1. Covering all the products manufactured

At present, the work related to the spreading of QMS to all the consumer goods production and fabrication of the equipment for the internal use is under the supervision of GAN. Certain work is planned in relation to spreading QMS to calcium production.

6.2. Involving all the structural departments.

In 1997 the validity of QMS covered the fabrication of thin-walled tubes. The financial department was included into QMS. It is planned to include other workshops and services in it.

6.3. Development and implementation of new QS elements optimization of the procedures under the existing QS elements.

Such work is carried out continuously, in particular, in relation to the estimation of the expenses for quality, design management, etc. At present preparation work for certification in accordance with ISO 14000 "Management for Environment Protection" is underway.

6.4. Annual self-assessment according to the models of national and international quality awards.

To perform the QMS effectiveness estimation the criteria of the Russian quality award can be now used.

6.5. Participation in the European Quality Award

For us it is important to participate in this Award as this will allow to have a look at our QMS with the eyes of the leading European QS experts, find out the weak points and plan further ways of optimization. Having considered the results of the self-assessment and those of the competition within the Governmental Award of the Russian Federation, the Coordination Board of the factory decided to participate in the European Quality Award.

7. Conclusion

As a conclusion, we would like to stress once again that the quality issues related to the products fabricated, that can be settled with the help of QMS, always have been and remain the first priority for the management of JSC "MSZ". We understand that, in the market conditions, this is the basis of our prosperity now and in future.