

DEPARTMENT OF NUCLEAR TECHNOLOGY
CHULALONGKORN UNIVERSITY, BANGKOK, THAILAND

CIDA COURSE ON QUALITY MANAGEMENT

"QUALITY in OPERATIONS "

Presentation 8 - NOV. 1996

by G. WIECKOWSKI, Operations Quality Corp. Canada

1. Objective Of Presentation :

This presentation will discuss the key prerequisites for establishing and maintaining Quality in operating and maintenance activities.

Specifically, the following will be discussed :

- concept and application of Safety Culture
- operational surveillance
- management of operating activities
- management of maintenance activities

Definitions : "*operations (operations personnel)*" : all activities performed to achieve the purpose for which the plant was constructed, including maintenance, refueling, chemical control and other associated activities

" *operating (operating personnel)*" : the actions of performing operational, as distinct from say, maintenance, activities

2. Introduction.

2.1 The achievement and maintenance of **Quality in Operations** is the most important issue facing management of the plant. Without it, the plant will not achieve satisfactory long-term operations and will be constantly plagued by crisis.

2.2. In the absence of Quality, management will likely operate in a "fire fighting"ⁱ mode, moving from one crisis to the next and never taking time and corrective action to permanently resolve emergent problems.

2.3 **Quality Management**, applied to operations and throughout the plant, supported by QA and QI is a technique which, when rigorously applied, will enable plant management to focus on the longer term and lead the plant towards excellence.

ⁱ "*fire fighting* " : a colloquial expression indicating a continuous state of crisis and moving from one urgent matter to the next, without taking the time to permanently resolve any of them

3. Quality Culture and Quality Management.

3.1 Quality Culture is a frame of mind prevailing at a plant where all staff set the achievement of excellence as their primary priority. Quality Culture encompasses Safety Culture as well as other characteristics of the work environment.

3.2 Management must ensure that all employees understand the concepts and importance of Quality Culture, in order to translate this phrase into a practical guideline for action. Employees must have a firmly embedded sense of responsibility for quality of performance and be able to integrate quality requirements into daily work activities, over the long term. Without that, quality of performance in all areas and functions at the plant will not be achieved.

3.3 Pre-requisites for achieving quality culture are :

A) effective **Quality Management program** which encompasses :

- definition of responsibilities
- definition and control of working practices
- qualifications and training
- identification and correction of deficiencies
- verification and accountability
- audit, review and comparison

B) strong, **dedicated and visible management support** for quality concerns at all levels, as demonstrated by :

- allocating of adequate human and financial resources
- setting and communicating the expected standard of performance, such that continuous improvement is encouraged
- encouraging employees to continuously look for ways to improve quality
- encouraging individuals to immediately deal with problems, within their area of competence
- routinely including quality objectives in plant performance goals and measures
- involving workers in identification and removal of obstacles to excellent performance
- effective monitoring, by managers of performance of plant activities

3.4 Management style, behavior and example are the key influence on attitudes of staff. Management should reinforce attitudes which contribute to good working relationships within the plant and acceptance of concepts of Quality Culture. These attitudes come under following headings:

3.5 Professionalism, such that :

- staff accept personal responsibility and ownership for the quality of work they do, both as individuals and as members of a team
- staff understand the limitations of their activities and the consequences of not carrying them out correctly i. e. they know when to call for help
- a feeling of pride and ownership in the plant exists without there being any complacency

3.6 Open communication throughout the plant, such that :

- problems are brought to light and not minimized
- managers are available to talk and to listen to staff
- good teamwork and crisp communication exist among the staff

3.7 When mistakes occur, their analysis should include should consider "human factors"² and ergonomic considerations as contributors.

When analyzing mistakes, it is important to keep the following in mind:

- do attitudes prevailing in the plant accept human error as the natural and inevitable part of human viability ?
- is assigning blame, which certainly have a place in any organization, used constructively and with discretion ?
- do the proposed solutions address the cause of human errors, rather than the symptoms ?
- are the situational factors³ compatible with the capabilities and limitations of humans ?

3.8 Encourage and reward for innovation, such as :

- developing a trusting, open and professional relationship with staff
- creating a working environment which is supportive but at the same time requires accountability
- demonstrating tolerance for honest mistakes, by focusing on facts and learning, rather than on the individual
- adopting constructive attitude towards corrective measures i. e. improving the process to avoid similar mistakes in the future
- having an effective suggestion program in place

² *human factors* : the physical characteristics of the work place and psychological influences on workers, which affect their performance

³ *situational factors* : circumstances which reduce the number of opportunities for error by minimizing situations likely to induce errors

3.9 Individually accountability for quality of performance.

Accountability requires:

- having an information system in place which provides facts with respect to performance. Such "system" can be very simple, for example a schedule with dates for achieving significant milestones in a project provides an evaluation point for performance. Similarly, for costs or the amount of field modifications necessary.
- providing constructive and prompt feedback recognizing successes or lack of them, based on facts and performance measures . This must be a balanced approach - tolerant of honest and occasional mistakes but at the same time requiring individual or team acceptance of responsibility.
- staying in touch with personnel to clearly define expectations and to be aware of difficulties encountered in job execution. Personnel must be fully cognizant of the expectations of their job.
- including an assessment of personal/team contributions and achievements towards plant operating performance, in personnel appraisals and promotions
- refusing to accept excuses for inadequate performance, but instead focusing on facts, processes and attitudes which contributed to it.

3.10 An important principle : each employee is responsible for the quality of his performance. Supervisors and managers are responsible for quality of performance within their area of control.

3.11 Achievement of Quality Culture manifests itself when :

- management is effectively promoting quality culture
- professionalism and pride of workmanship is evident in all aspects of work
- open communications prevail throughout the plant
- operations are conducted in a disciplined manner
- drive for continuous improvement by small, incremental steps is actively encouraged and publicized
- all duties important to quality are carried out correctly, with alertness, due thought and full knowledge, sound judgment and a proper sense of responsibility.

3.12 Following typical symptoms should alert managers to inadequate acceptance of Quality Culture and a possibility of significant performance problems

- repetitive (routine) failure to comply with standards and regulations
- management failure to include quality objectives within the traditional structure of objectives for the plant
- staff do not understand how excellent performance of their individual jobs impacts on quality
- procedures being out of date, routinely not followed and shortcuts taken
- failure of employees to voluntarily report omissions or mistakes

- failure of employees to resolve known problems in a timely manner, such as equipment or procedural deficiencies.

4. Operational surveillance.

4.1 The objective of operational surveillance program is to detect, and forestall, equipment and procedural degradation , so that satisfactory and reliable operation of equipment and systems is assured over the long term.

4.2 "**Operational surveillance**" consists of monitoring structures, components and systems to ensure they are performing or are ready to perform their function in accordance with design intent and are operated within operational limits.

□

4.3 Operations Dept. is **responsible for execution of surveillance activities** in accordance with instructions.

They will ensure that :

- personnel qualified for surveillance duties are assigned to this work.
- testing or calibration are preferably completed during a single shift.
- risk of common mode failure is reduced. Test design should be such as to guard against "common mode failures" and should contain warnings against conditions which might increase probability of these
- tests are not conducted during plant transients
- all surveillance activities and their results are verified

4.4 "**Operating surveillance**" includes :

- continuous monitoring of the control room panels
- routine monitoring of field panels and equipment
- testing in the control room and in the field of systems and equipment at a frequency to demonstrate system reliability.
- periodic checking of valves and power supply line-up to ensure their proper positioning. This routine check must be called up at frequent intervals for systems essential for safety.
- on-line or manual sampling for the purpose of maintaining control of chemistry.
- routine review of operating documentation. There should be a schedule for review of operating documentation by the various shift crews.

4.5 "**Maintenance surveillance**" encompasses a system of testing and observation of equipment and of reporting of results. Activities should be integrated with operating and technical surveillance .

The framework of the maintenance surveillance is a **call-up system**⁴

⁴ *call-up system* : a listing of routine activities, together with their dates (frequency) of execution, designed to remind plant staff that they must be carried out

4.6 Maintenance surveillance is scheduled using the call-up system and includes :

- routine maintenance activities, such as lubrication, filter changes, elimination of leaks etc.
- equipment testing to ascertain condition. This is the base for "on condition ⁵" component of maintenance program
- calibration of test equipment to ensure accuracy of devices used to maintain equipment in the field
- reporting system to document results, trends and deficiencies and to maintain detailed equipment history.
- routine review of maintenance documentation

4.7 Trending of important operating and maintenance parameters should be routinely done. This action includes trending of important system parameters (flow rates, pressures, temperatures and temp. difference, electric current, usage of consumable etc.) to early identify deteriorating system performance. Significant changes or trends should be evaluated and recommendations made for corrective actions.

4.8 Additional typical performance measures which might be trended on system basis are :

A) operations (No. of events/year)

operating errors

- temporary modifications remaining in place after expiry date
- incorrect equipment identification
- operation procedural deficiencies
- loss of chemical control

B) maintenance (No. of events/year)

- repeated work
 - overhauls
 - welding
 - mechanical pipe joints
- outstanding work requests
- % of time spent on forced, rather than scheduled maintenance
- maintenance deferred as compared to scheduled

5. Management of Operating Activities.

5.1 At all times there shall be one person clearly in charge of plant operations.

5.2 In order to set out the framework within which the operating goals are achieved, it is necessary to set out operating policies.

⁵ *On-condition (predictive) maintenance* : maintenance program based on measurement of equipment condition. Equipment performance and reliability is predicted based on ascertaining its condition through measurement of operating parameters. Corrective action is then taken ahead of predicted breakdown.

These policies may identify such items as:

- accountability of personnel
- interfaces with other groups
- requirements to adhere to procedures
- minimum staffing
- training requirements

5.3 The control room team (operators and supervisors) must establish good communication habits both between themselves and with field operators and maintainers. Many undesirable incidents have occurred due to poor communications. Good operating practice requires that all important verbal communications between operators or between operators and maintainers be repeated by the individual receiving it.

5.4 Work in the plant shall be authorized by the control room operator. All work authorizations shall be made in writing.

5.5. Attention to human factors may enhance the operators ability to operate the plant. The following are examples of human and environmental considerations intended to assist the operator:

- sufficient lighting shall be provided in all rooms and areas of the plant
access, platforms, ladders or remote operators shall be provided for
all difficult-to-reach valves, breakers and other components
- normal operating range or parameter shall be marked on important
indicators
- objects that can obstruct the operator's view of the control; panels shall
be removed

5.6 Responsibility for equipment status and the authority to operate equipment should be understood by all operations personnel, so that activities can be controlled and coordinated and defense in depth can be established and maintained.

5.7 Operators must note any deficiencies or safety hazards existing in the plant during their routine field tours and initiate remedial action to eliminate, control or contain them. The operators are the primary source of identifying these plant abnormalities and must routinely conduct thorough and comprehensive plant tours.

5.8 Effective monitoring of plant equipment is necessary to detect abnormal conditions or adverse trends, so that appropriate action can be taken before equipment malfunction occurs.

5.9 A high level of house keeping and cleanliness shall be maintained throughout the plant

5.10 All equipment in the plant shall be uniquely identified . Identification of components shall be consistent with the nomenclature used in plant procedures and on drawings.

5.11 The control room operator must be attentive to the control panels and must frequently carry out inspections of the status of the displayed parameters. He must be responsive to alarms and must not be significantly distracted from his primary role by other activities , or by inappropriate activities in the control room.

5.12 Operations management must establish good working conditions in the control room, so that operators are not unduly distracted and can conduct themselves in a professional manner.

5.13 Good operating practice requires that the control room operator is aware of all the alarms and of the reasons of them being in the alarm condition.

5.14 In order that this be possible, it is incumbent on the operations management to ensure that :

- maintenance practice must keep the number of out-of-service alarms to a minimum
- operating practices must limit the number alarms in the alarm state
- nuisance alarm must be designed out . This is particularly important, because if spurious alarms are constantly coming in, the operator is distracted from monitoring the panels.
- operating documentation must clearly tell the operator the cause of each alarm and the action to be taken as the consequence of it.

6. Management of maintenance activities.

6.1 Maintenance is considered to be an aggregate of those actions which prevent the degradation or failure of structures, systems or components, as well as those actions which promptly restore these components to their intended function , following breakdown. This includes engineering support of maintenance.

6.2 Effective maintenance can only occur with the support of operations in identifying defects promptly and accurately, and in providing the appropriate conditions for maintenance.

6.3 Key elements of an effective maintenance program include the following:

- organization and administration of maintenance effectively implements and controls activities
- maintenance training and qualification programs develop and maintain the knowledge and skills needed
- facilities, equipment and tools efficiently support maintenance
- a proper balance of preventive and corrective maintenance provides confidence that equipment degradation is identified, corrected , and that equipment life is optimized
- procedures are current, accurate and in the format which promote error free performance

- planning, scheduling and coordination of maintenance activities support optimum materiel condition by ensuring that maintenance is accomplished in a timely manner and in accordance with appropriate priorities
- managerial and supervisory involvement ensures that maintenance practices are effective in supporting safe and economical plant operation
- post-maintenance testing confirms that the maintenance was performed correctly, and the equipment meets the design intent
- the provision of parts and services supports correction of deficiencies and timely return of equipment to service
- proper care of spare parts, materials and equipment occurs from the time they are received at the plant until they are installed in a system
- program for control and calibration of measuring and test equipment ensures accurate performance of plant instrumentation
- equipment maintenance history records provide information for maintenance planning and supports trending of performance
- systematic analysis is used to determine the root causes of unplanned occurrences related to plant maintenance

6.4 Management has to guard against developing a crisis mentality, where the maintenance work force is continuously absorbed with the immediate problems. Such a situation has the inevitable result of perpetuating itself, because activities which would have prevented future crises are not dealt with effectively.

6.5 There must be a balance between the immediate needs and the future needs, so that items which can be left until tomorrow are not forgotten until they become a crisis themselves

6.6 This means that the management must have good information about equipment and maintenance performance, such as :

- backlog of breakdown maintenance
- preventive maintenance call-up backlog
- plant materiel condition
- status of component refurbishing
- tool condition and maintenance
- degree of completion of scheduled training and qualification
- status of calibrations

produced by :
Operations Quality Corp.