

## Quality Manual for Maintenance

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A quality document for maintenance was developed to assist project managers for a contract maintenance provider to understand the requirements for the delivery of their services. The manual was intended to form part of the quality system of the company, bridging between the general procedures observed under ISO9000 and the day-to-day running of the operation. The methods and systems incorporated into the document cover work flow, reliability analysis, inspections, the CMMS and financial management.

### 1. Introduction

The provision of maintenance services needs to be proactive in telling the production or service client what they need with respect to service reports on maintenance and call out work. Their trust in the maintenance provider's analysis of conditions is important. In the not too distant past people did not worry about the failure rates and relied on maintenance staff to keep them informed about the condition of the equipment. This has to change with more sophisticated maintenance offerings as equipment operators need to be more informed regarding the possible future threats to their business.

The key elements of a technical policy which can also be employed as a quality manual include:

1. Cost improvement and reliability targets
2. Compliance with OH&S and environmental requirements
3. Interaction through the computerised maintenance management system (CMMS)
4. Work order management and the flow of work: how it is raised, allocated and reported
5. Reporting of weekly and monthly work
6. Key performance indicators (KPI's):
  - Breakdown work hours
  - Total maintenance work hours
  - Mean cost of labour and material
7. Management of technical information, possibly including drawings, PLC programs, work history and technical data

It can be seen that the key elements of such a policy support the primary objective introduced above for the maintenance provider to keep the equipment operators informed with respect for the capability of their assets to support the business.

### 1.1 Quality Manual Background

Sound maintenance procedures are essential for a facility management company that services a diverse group of customers. From past experience it was apparent that each site developed their own set of procedures and rules. This was in part driven by customer demands as well as the lack of a deeper understanding of modern maintenance procedures by the maintenance staff.

The quality manual was developed to assist all project managers and their staff to understand the requirements of maintenance delivery, build a site- specific system and prepare reports that offer effective information. The manual was formatted in way that allowed it to be included as part of the company management system. Methods and procedures included in this manual were modelled around information gathered from a number of sources in order that the most effective practices could be applied as a standard, [1].

## **2. Work Flow Management**

The procedure and instructions are designed to assist in the proper and efficient management of maintenance. They have been written to conform with and should be applied in conjunction with the complete management system. Responsibility profiles and workflow methods are an important factor affecting the successful outcome of maintenance.

Key personnel at each site must be identified in a responsibility matrix. The information contained in the responsibility matrix should not be a copy of the company job description. All the tasks described below form the basis of responsibility but do not limit the actions of the nominated personnel. This table should be amended on a site by site basis to ensure that all requirements are catered for.

<b>Person</b>	<b>Objectives</b>	<b>Tasks &amp; Responsibilities</b>
Corporate	Support operation strategically and financially.	Liaise with customer board or senior management team Supply support in industrial relations matters Offer and support an adequate management system
Project Manager	Lead a maintenance team in the supply of maintenance services to the customer	Liaise with senior customer rep Report to corporate office Develop plant maintenance strategies Lead in matters involving industrial relations, Quality & environmental issues All financial matters
Maintenance Manager	Coordinate tradesmen and spare parts supply to ensure maximum equipment utilisation	Liaise with production managers Review work orders and PM's as per work flow charts Plan work and coordinate work flow process
Maintenance Staff	Operate in a manner guaranteed	Carry out assigned tasks as requested by Maintenance

	to supply quality trade support in the maintenance of plant & Equipment	Manager
Procurement Officer	Support trades & staff in the supply of all parts & materials required to effectively maintain the plant	Purchase materials, spare and services at the best prices available Coordinate delivery to areas Maintain stores holding Stock take
Support Staff	Provide all ancillary support	Supply any support required by the maintenance team

Work should be grouped in two categories, maintenance and plant improvement. A clear understanding of the division is important because if plant improvement jobs are considered as part of maintenance there can be no clear understanding of actual maintenance costs. For all processes it is important to raise a work order. This work order will take the form of a request and authorisation to carry out the specified work.

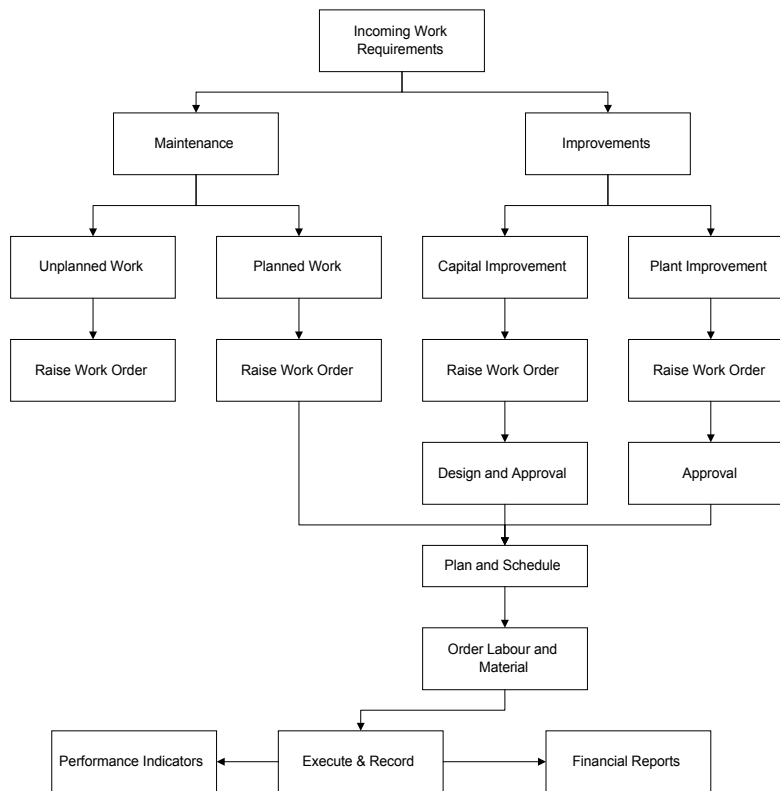


Figure 1 Simple Work Flow Diagram

The flow chart in Figure 1 has been provided as an example of the expansion and issues requiring consideration when developing a workable process. From the work flow chart it is clear that raising and acquitting a work order is a key to the success of the process. Although the system can be fast tracked to complete urgent work the loop must be closed

in order to capture all of the required information that will allow the management team to make valued judgements as to the integrity of the equipment.

Another key issue in the tracking of data via the work order system is that of finances. It is not only important to invoice the correct value to the owner but also to be in a position where the maintenance provider can measure his performance and apply suitable improvement programs.

### **3. Reliability Systems**

A partial loss of availability tracking system is necessary to track every event where a unit cannot provide the output. The recording process requires input from both production and maintenance. Information gathered includes actual stop time, actual restart time, name of reporting party, name of responding tradesmen, reported cause of failure, identified cause of failure, description of repairs, and sign off by both parties, verifying recorded details

The reporting log should be a document specifically designed to record the information required. A process of review and investigation should be carried out attempt to eliminate re-occurrence of breakdown issues, [2]. It should also be made available to all production and engineering groups to assist in optimising scheduling and work practices. It should provide priority setting for inspections and corrective actions, post justification for capital and plant improvement work, identification of major down time and its cost implications, and awareness raising and goal setting for staff.

Risk of death, injury, environmental damage, failure of equipment or total destruction must be carefully considered when taking any action within the maintenance site. In order to reduce risk, consideration must be given to existing conditions and practices. The team should analyse relevant issues and record their findings and subsequent actions on the risk analysis sheet.

The question matrix in Figure 2 should be considered as the basis for the risk analysis sheet. In order to make a decision as to the risks involved in taking a particular action we should be aware of the consequences of those actions. Risk analysis considers probability factors, [3]. In developing the site risk analysis plan it is suggested that the managers read this text in order to understand the factors at stake.

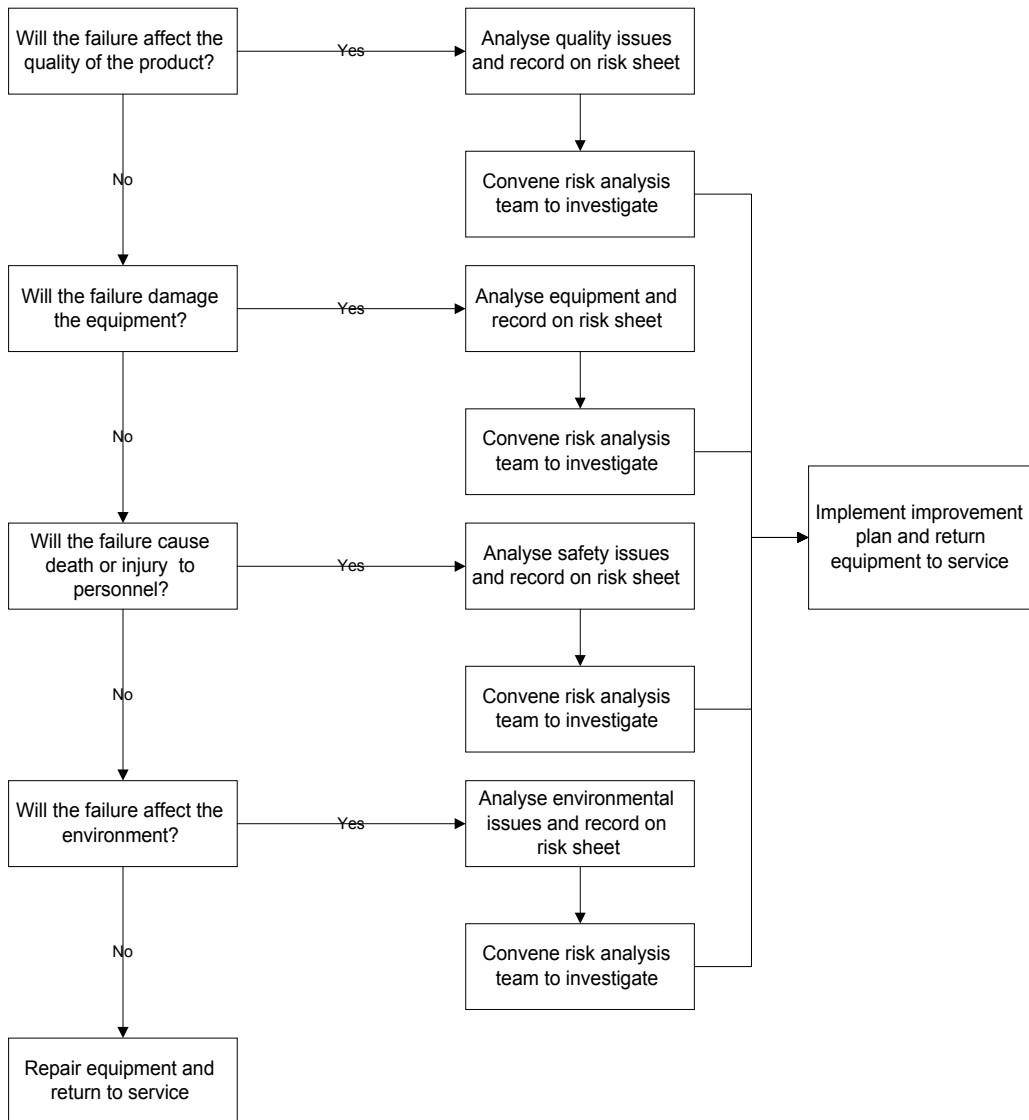


Figure 2 Risk Analysis Flow Chart

#### 4. Computerised Maintenance Management Systems

The selection of a computerised maintenance management system (CMMS) is an important issue, consideration must be given to a number of issues that may affect a successful implementation and operation of the system. The choices will be affected by the size of the operation, the customers preference and the available software on the market at the time of purchase. There are a number of issues that should be addressed when setting a system up or modifying it to suit the requirements of the maintenance team and the customer, [4].

A relational database is defined as a database in which information is stored in tables. Information is stored only once in the tables. Pointers that act as keys are used to define relationships. This allows for efficient and non-redundant data storage and retrieval. Any

CMMS nominated for inclusion in the management system of maintenance projects will have a relational database as the core of the system. A strategy should be developed in order that only the relevant information is requested and retained for future use. A balance is required when considering the opportunities for data capture and the effort required to enter, maintain and reuse the information in a manner that will support for the maintenance decision making process.

The text based system that offers an open database may well be good at what it does. The frustration is not in the information that is in the system but how to extract it. Experience has proved that the work required to retrieve and manipulate the raw data in a consistent fashion requires a lot of work and reliance on a third party reporting system.

The database must also be designed to allow multi-user access to all information retained in the system. By considering the technology available and the cost of implementing stand alone systems throughout the country we should be considering the benefits of installing a single server with all sites linked via a wide area network. Some of the benefits may be:

1. The need to employ only one systems administrator.
2. Reduced cost of user licenses, the sites would hire user access on an as needs basis without the need to pay for more than they needed.
3. All sites would use the same basis for operating their business.
4. Management would have ready access to the information for reporting purposes.
5. Staff could be transferred to different sites without having to adapt to another system.

There are some disadvantages to consider, including the customer may not wish to use the contractor's CMMS, the customer may have concerns over security of data, and there would be a cost of transferring the data to another system if another service provider replaced the contractor.

The core of any CMMS is a logical plant dictionary which forms the basis for all information and decision making processes. When developing a plant dictionary consideration should be given to the following:

- Systematic inclusion of all plant and equipment.
- Hierarchical linking of plant and equipment.
- Correct identification of all assets.
- Logical linking of assets for reporting purposes.
- A review method to remove redundant equipment from service whilst retaining its history.
- Standard asset numbering procedures which make identification simple.
- Use descriptions that are meaningful.

For material and labour transactions the system must be capable of recording specific costs for multiple tradesmen and material usage against each job. The database must allow for rates to be linked to specific tradesmen, not the trade type. Each tradesmen must have four trade rates, each being configurable and independent from the other. The CMMS must allow for the system supervisor access to modify these rates as required. The rates should be normal hours, time and a half, double time, and special rates.

The materials management system must be capable of tracking materials and spare parts required for the maintenance of the assets. This module should display all facets of a fully integrated stores management system allowing for flexible reporting of stock levels required in the maintenance of effective quantities on hand for use as required. The purchase and sell prices for each item should be configurable. The dynamic costing and stock level adjustments being applied when items are booked out against active job numbers. The system supervisor must have the capability to modify sell prices across the board or by category or individually.

## **5. Inventory Management.**

The inventory management unit within the CMMS will only be as good as the team that operates it. There are a number of issues that need to be considered in the maintenance of spares for the support of a maintenance operation. All decisions made to purchase spares and equipment must be made in accordance the requirements laid down in the procurement manual of the management system.

The first consideration is to decide on the criticality of the spares to be held in the stores, [5]. The importance of holding a spare part in the on site store must be balanced with the costs associated with running the store and the cost of the money invested in purchasing an item that may not be used for twelve to twenty four months. On this basis we will consider a method of deciding what spares to hold as critical spares. In some instances it would be important to get approval of the customer for the decisions. This approval process would make the customer aware of the consequences of each decision.

By considering the purchasing officer to be the key to the process it makes sense that all requests for parts and materials are directed to him. It is the responsibility of the purchasing officer to ensure that the process is followed and that the correct serviceable parts are made available to the person that requested them.

## **6. Commercial Procedures and Reporting.**

The reporting system should be considered to be our eyes into the maintenance world that we are trying to control. Without good information being entered into the system we cannot expect to be able to make educated decisions from the material we are extracting from the CMMS. The CMMS must capture data to satisfy the needs of the maintenance manager, his maintenance team and the owner.

Reporting may be divided into three types: financial reports, safety, risk and environmental reports, and technical reports. In developing the reporting system it is important to consider whom the reports are being produced for and their need for information. It is all too easy to produce masses of data that no one reads or understands. For any reporting system to be effective it is important that reports are only produced if they can serve a nominated purpose and recipients are forwarded the material that directly affects them. There is not only an economy to be gained from producing concise documents but also the reduction of opportunity for confusion.

The financial report for the plant owner should include the following.

1. Overview sheet showing totals for labour and materials for the period and a grand total to equal the invoice value.
2. Labour hours breakdown. This information should be extracted from the CMMS and arranged in a manner that the work done can be traced to a work order that will contain links to any other relevant information.
3. Material transactions. This information should be extracted from the CMMS and arranged in a manner that the spares and consumables can be traced to a work order that will contain links to any other relevant information.
4. Details of work completed that is considered extra to the maintenance contract. This breakdown should show information of labour and materials.
5. Capital purchases made on behalf of the plant owner.

The financial report for the maintenance management team should include.

1. Invoice values for the period.
2. Stores movements.
3. Performance trends. Eg. Profit margin.
4. Projections for the future.
5. Consideration of costs to come.

With the existing CMMS packages there is generally a need to link the data extracted with an accounting package. When considering an integrated system it is important that the financial aspects receive due attention.

Safety, risk and environmental issues are gaining higher priority each day. It is therefore important that the management team is aware of the issues and they have a program in place to address matters arising. Information for these reports is generally obtained from sources other than the CMMS. The reports may take the form of a written report that is incorporated in the manager's monthly report. The information in the report should include.

1. Report on safety meetings with maintenance team.
2. Issues arising from toolbox meetings.
3. Issues addressed in the past month.
4. Accidents or incidents.



5. Hours worked without lost time to injury.
6. Any projects required to minimise a risk situation.
7. Work completed in order to reduce a risk situation.
8. Environmental issues arising.
9. Environmental issues addressed.

The list is not limited to the above and it is the managers duty to ensure that all identified issues are addressed in order to ensure that the work place is safe.

## **5. Conclusion**

Modern maintenance practices will require automation of the assistance provided to asset managers in a wide variety of areas. The critical item in the above list is the management of the work order. This was raised in this paper within the context of a work flow system. Whereas all information pertaining to a facility should be indexed in accordance with a hierarchical plant dictionary, the flow of information is controlled by the issue and receipt of work orders.

With the expanding commitment to the use of contract maintenance labour with partnering arrangements becoming more common, a number of industries will be looking for the specialist maintenance providers to issue common sense, practical quality manuals which provide a useful guide to their field managers as to expectations of best practice. The issues described in this paper have been raised many times during the course of conducting maintenance improvement at a number of sites. Hence such documents in the future will have to address the items as presented here, albeit in the unique and suitable style for a particular company.

## **References**

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