OPTIMIZATION OF FLASK MAINTENANCE
A FRENCH EXPERIENCE

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SUMMARY

At any time during operation, transport flasks for radioactive material must remain as safe as they were designed to be. Beyond safety, the maintenance must assure at lowest cost that the flasks stay available and operable without any problem. An optimization is therefore necessary in order to reconcile these constraints.

This paper describes the steps taken by the maintenance company MMT so that experience acquired translates into optimizing the maintenance policy, upgrading maintenance techniques, shortening down-times, decreasing personal exposure doses, and also into upgrading the design and operability of existing and future flasks. It concludes that cooperation between the maintenance company and the designer is essential for optimization.

INTRODUCTION

MMT is a joint venture among COGEMA and TRANSNUCLEAIRE and their subsidiaries. It is entirely devoted to the maintenance of flasks and associated transport equipment. With over 100 workers, MMT maintains about almost 4,000 flasks, practically all of which are type B. These flasks have gone through our La Hague and Marcoule workshops for more than 12,000 maintenance operations. Added to these works are post-incident interventions on site. MMT also physically manages the flask fleet, which allows to follow their use and to count the transport cycles. All this has enabled us to acquire widespread experience, which we use in order to optimize maintenance.

MAINTENANCE POLICY

Several actors are concerned by the flasks: Competent Authorities, designers, owners, users, fleet managers, transport companies, maintenance companies.

Designers define the basic requirements in the Safety Analysis Reports, particularly through evaluating component wear and aging phenomena. Users basically demand flasks that are reliable during utilization, for opening/closing operations and leaktightness tests.By avoiding or not contamination to the flask, they directly impact maintenance costs and flask down-time, due to the time spent in decontaminating to a level where maintenance operators can work.

As for the owners and fleet managers, these demand maximum availability. This availability is overly difficult to specify given the multiplicity of causes for unavailability.

It is clear enough that during the flask study phase, the designer has to make assumptions on the durability of the various components, particularly those safety-related, and to specify periodic inspections and part replacement operations. Unless they can benefit from operational feedback, designers and owners make non-optimized choices.

Maintenance requirements, limited to safety aspects, were generally defined by the designers in the Safety Analysis report, and were thus accepted by the Competent Authorities. These requirements, often taken from state-of-the-art rules, are contained in the maintenance specifications, which include safety requirements and other contractual requirements. Owners of identical flasks sometimes unite in order to define such specifications.

The maintenance company is thus faced with different requirements and objectives. The company then defines working documents that take account of regulatory and contractual requirements. These requirements are often requested by the customer for approval.

In practice, for a new flask, maintenance is reinforced at the outset, to be reduced with the experience acquired; maintenance is adapted according to actual wear observed, by adjusting the type of operations and their frequency, with an on-going aim to reduce the down-time due to maintenance.

MAINTENANCE ORGANIZATION

In compliance with the ISO 9002 quality standard, MMT drafts the Maintenance Technical Files (DTM). Existing per flask type and constantly updated, the files contain all the scheduled preventive and corrective maintenance operations listed in customer specifications. The files are produced by technicians with the operators themselves, their user-friendly presentation (photographs, guidance text, designation of test equipment, qualifications, tools required) guarantees adequacy to the maintenance operators' needs.

Work Orders (OT), serving as quality plans, are drafted for each maintenance and/or work on the flask. These contain a sequential list of works to be carried out, including preventive maintenance and repair of defects already identified during operation or during the preceding maintenance. They are used for traceability of the operations performed and of the problems encountered.

Any deviation with respect to the existing technical definition is formalized by defect sheets when the abnormal situation originates from external causes, or by deviation sheets in case of maintenance deficiency. These sheets are processed in accordance with the contractual and regulatory framework.

MAINTENANCE OPTIMIZATION

The choice of preventive maintenance is generally very conservative. It is difficult enough to work on a flask because of residual contamination; intervention in nuclear installations (power stations, fuel factories, reprocessing plants...) are quite complicated and costly to the operating companies.

Because of over-prevention, interventions on site are not statistically significant, and mostly derive from operating incidents. Curative operations on large flasks at MMT facilities represent only about 4% of maintenance time.

However, maintenance of expensive and contaminated equipment bears a cost in integrated doses and in money. If one admits that 4% in curative maintenance is not readily improved upon, it is still possible to gradually decrease the preventive maintenance without increasing the curative one, while still following the safety criteria.

Optimization also has external constraints. Users hardly ever think of making maintenance easier, by simply being careful about equipment and contamination; yet ultimately they bear the cost of maintenance.

Finally, optimization may derive from various sources:

- adjustment of maintenance frequencies, with approval from Competent Authorities as applicable
- user awareness of flask care
- improvement of maintenance techniques
- improvement of maintenability of existing and future flasks
- follow-up of wear so as to anticipate deficiencies.

All these items are linked in some way to the efficiency of the operational feedback by the maintenance company.

OPERATIONAL FEEDBACK

MMT has set up a system that takes operational feedback into account based on gathering and processing the information originating from analysis of deviation and defect sheets, analysis of work performed (OT) and customer claims. Almost each flask is broken down into:

- technological assemblies: body and fittings, shock absorbers, handling components, tiedown, cavity closing components, orifice closing components, cavity and internals, accessories, etc.
- functionality: containment, radiation shielding, sub-criticality, thermal shielding, heat transfer, mechanical resistance, decontaminability, user interfaces...
- technical nature of deviation: thread, operation, appearance, corrosion, radiation, dimensional, leaktightness, NDT, neutron shielding, thermal...

Statistical analysis of these data enable identification of situations requiring improvement.

The study of the 1991-1996 period shows that two-thirds of the deviations encountered are due to utilization, 20% due to design or manufacturing, and only 15% could be safety-related. Consequently, the actions undertaken mainly relate to:

- monitoring of deformation of flask cavities,
- improvement of leak resistance between trunnion base and screws,
- improvement of basket poison inspection method,
- generalization of inspection of threads and tappings,
- definition of leaktightness tests on dual-envelope flasks.

Simple solutions are often offered to the designer. For instance, excessive thread wear is common. It can be due to excessive tightening torque values on site. MMT has suggested to paint the torque values on the components themselves. Similarly, since the gasket seats are subjected to various damages, the designer was asked to make provision for overthickness and repair dimensions.

Operator exposure is covered by effective and inexpensive actions that have reduced the average annual exposure per operator from 4 mSv in 1993 to 0.15 mSv in 1996 for light-water spent fuel flasks. Analysis resulted in a thorough decontamination prior to intervention, installation of biological protections, and personnel awareness programmes.

This operational feedback, shared by MMT, the flask designers and the owners, and associated to technical-economical studies, prompt MMT to propose modifications aimed at improving safety and availability at the best cost.

RECOMMENDATIONS - CONCLUSION

In order to optimize maintenance, several factors should be highlighted.

First, the designer should take maintenability into account in his flask study, and should use the experience gained by maintenance specialists.

The owner (or his representative) should preferably have his flask maintained always at the same place. This guarantees proper follow-up of wear, actual execution of operations carried over from the last maintenance, a continuity of the documentation. The owner should also inform the maintenance company of the modifications executed elsewhere.

Should incidents occur on site, the user and/or the owner should notify or send the maintenance company, so it can share its knowledge of the flask and see its condition. A rota system should thus be implemented.

Finally, the maintenance company should secure an access to the designer, in order to take advice over non-conformances. It should devise a feedback system useful for itself and the designer.

It is only cooperation that makes possible at the same time flask safety, ease of operation and overall maintenance economy.