Study for Obsolescence Problem of EQ Equipments

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1. Introduction

Construction of nuclear power plant in USA and European countries has been decreased since the TMI and the Chernobyl accident. Manufacturers decided to stop nuclear QA program due to low demand of equipments in nuclear power plant. No further support for old model is anticipated. Since the equipment model has been upgrading in short time interval due to rapid development of new technology, nuclear plant can hardly find proper substitute items[1].

If this substitution is proceeded in old nuclear power plant, you may not possible to contact same manufacturer due to bankruptcy or M&A. When the size and weight of old model and new model are different, you have to pay big money for stress analysis of plant piping and pipe support. If there is any serious obstacle to replace with new equipment, we have to find solution of obsolescence problem by ourselves.

In this paper, process of obsolescence solution and actual experience are described.

2. Methods and Results

2.1 Solution of obsolescence problem

2.1.1 Process of obsolescence solution

Fig. 1 shows process to find a solution of obsolescence problem. Substitution, refurbishment and CGI dedication methodology will be applied based on the availability of replaceable equipment.

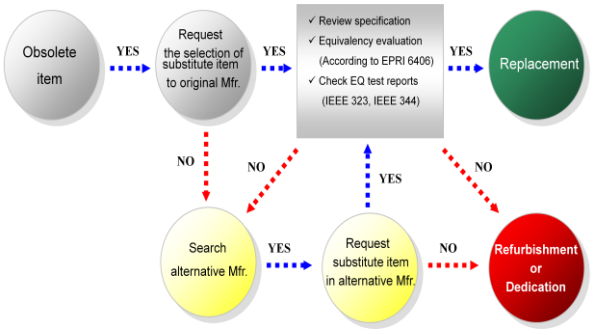

Fig. 1 process of obsolescence solution

2.1.2 Substitution

Substitution is one of solutions when you can get an equivalent item from current available manufacturer. This method is the best way when the equipment is easy replaceable. It will give a small impact to adjacent equipment or system. Evaluations on function, figure and weight are required to decide the interchangeability of substitute item. Even this solution have benefits of quick and less engineering, you may meet an obstacle when the original vendor does not exist due to bankruptcy or M&A. It is difficult to find equivalent items in the current available vendor catalogs by yourself. You have to ask vendor for evaluation of function, figure and weight by call or e-mail.

2.1.3 Refurbishment

Refurbishment is one of solutions when you can't get equivalent item of the obsolete equipment. Refurbishment will be focused on the replacement of non-metal parts in the equipments. Some reverse engineering work has to be performed if there is no replaceable part in the production by NQA program[2]. Some CGI dedication program will be applied for new part manufacturing. If you have big size equipments such as valve actuator and motor, refurbishment will give you a benefit of no pipe & pipe support stress analysis required when you replace them with different size or different weight models. You have to complete EQ test after fabrication of replaced parts.

Since wearing problem of active parts such as gears and switch may not be detected during EQ test, long term durability test at the amount of cycles occurred during normal operation is recommended after EQ test.

2.1.4 CGI dedication

CGI dedication is a solution when you can't get equivalent item of the obsolete equipment. The root of problem is similar with refurbishment but the application scope is a little different. Major difference between refurbishment and CGI dedication is complexity of equipment composition. CGI dedication can be applied for small and single composition equipment while refurbishment is for equipment of complex composition. CGI dedication is useful when manufacturers still produce the equipments even they quitted the NQA program.

2.2 Experience of obsolescence solution

2.2.1 Substitution of motor

We had LAC motor 364T-FGSM and 365T-FGSM supplied from Brown-Boveri. They stopped the production of this old model after merged to ABB. We have checked the availability of similar motor in the alternative manufacturer catalogs. ETI, LAC motor supplier of Pt. Lepreau NPP, was one of choices. After previous checking of EQ test condition, we found radiation level(1.0E+07rad) during the EQ test was lower than total integrated radiation dose of Wolsong-1(2.0E+07rad. Finally, we chose the Chun-in motor as alternative motor. Fig.2 shows the flow of substitution process.

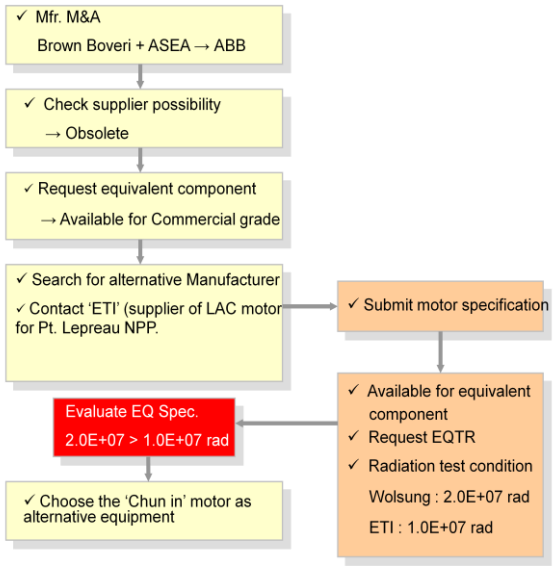

Fig. 2 Flow of motor substitution

2.2.2 Refurbishment of non-metal part in pump

We had main moderator pump, model No. 14*15*23 CVDS, supplied from Bingham-Willamette. Bingham-Willamette was renamed to Sulzer-Pump Canada Inc after combined with Sulzer-Bingham. Gasket and O-ring of this pump had a problem of obsolescence. We have asked the Sulzer-Pump the supply of qualified gasket and O-ring. Fortunately, they could supply the same size qualified parts. Fig. 3 shows the flow of refurbishment process of pump gasket and O-ring. Since the replacement of obsolete pump has many problems at the point of cost and time, parts refurbishment was reasonable choice for economical maintenance. If part supply were not available from original manufacturer, fining of alternative supplier with reverse engineering would be needed.

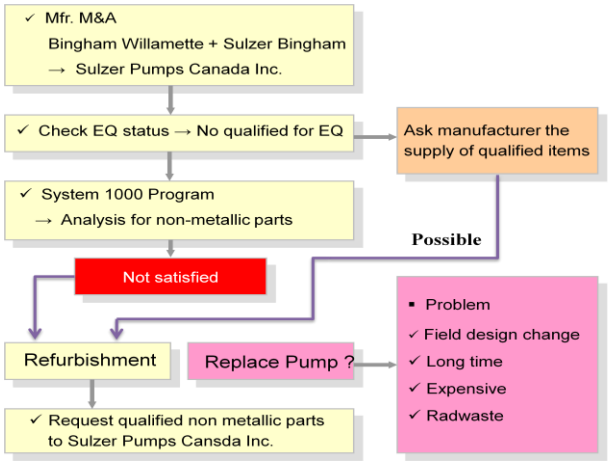

Fig. 3 Flow of pump gasket and O-ring refurbishment

2.3 Scientific approach for refurbishment

For the successful refurbishment, systematic and scientific approach is necessary. Thermal damage of non metal parts, mechanical interference of metal parts and estimation of lifetime should be considered[3].

For the thermal damage evaluation of non-metal parts, we have to search for the maximum resistance temperature of parts. Non-destructive analysis such as FT-IR and material database will be useful for this evaluation. For the reliability of long-term operation, refurbished metal parts should be strong enough to survive in the complex stress during the operation. Interference, stress and fatigue of the parts have to be carefully checked. CAE tools will be useful for these mechanical checks. Estimation of lifetime based on the thermal aging and abrasion critical point is required for determination of maintenance and monitoring interval.

3. Conclusions

Solution of obsolescence problem and several experiences were introduced. Substitution, refurbishment and CGI dedication will be chosen based on the availability of alternative parts. When complex reverse engineering is required for the refurbishment, systematic approach and scientific evaluation for thermal damage, mechanical interference and lifetime should be considered.

REFERENCES

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