

Integrated Monitoring Process of System Function and Component Using Performance Criteria of Maintenance Rule

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1. Introduction

The Maintenance Rule (MR) program is an effective tool for performance monitoring and management of the function in the system, which could affect the plant safety and operation performance, based on their importance. And, System Monitoring Plan (SMP) as the part of Equipment Reliability Process is the process to improve the reliability of the component by means of the monitoring for condition and performance of the plant facilities, and the consecutive control of preventive maintenance period and activities. But, those processes share the goal to secure the reliability of the plant facilities by means of monitoring. And, except the fact that the MR focused the functions and the SMP focused the components, there is the process that can be applied in common. Nevertheless, those two processes is implemented in separated ways at present, it becomes the great burden to the plant engineer.

In this paper, the effective integrated monitoring process combined the MR and the SMP to secure the reliability of functions and components is described

2. MR and SMP Process

2.1 Maintenance Rule Process

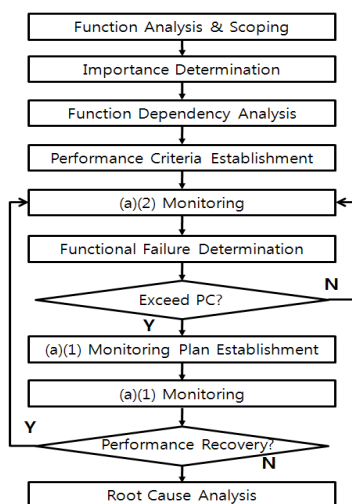


Fig. 1. Maintenance Rule Program Process

As shown in Fig. 1, the MR program select the in-scope function that can be affected the safety and electric production. Then, the Performance Criteria (PC) developed by the importance and dependency analysis of each in-scope functions is monitored.

However, since the MR program monitored the function, the condition and the degradation of the component which is the lower level of the function is not managed. In case of the component failure, if it is not related with functional failure, this failure is not managed. Also, the MR program does not provide the any means for monitoring or predicting the degradation in advance.

2.2 System Monitoring Plan Process

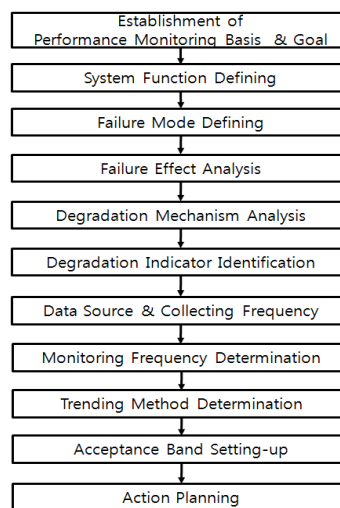


Fig. 2. System Monitoring Plan Process

As shown in Fig. 2, the SMP process selects the key component in each system, and analyzes failure mode and effect of corresponding key component. Also, it supports the preventive maintenance by means of the analysis of degradation mechanism and indicator. Since the monitoring parameters and methods are selected in terms of component, the more specific and detailed monitoring is possible, and there is a merit that the condition of component can be grasped through the trending method before the failure occurred. But, the ineffective factors are existed in the SMP process because the importance is not evaluated systematically.

3. Integrated Monitoring Process

As shown in Fig. 3, this process combined the MR Process and the SMP Process to eliminate the duplicated process, while the merits of two processes are preserved. In this process, the PC of MR Process is firstly selected as a performance goal, and then the

components contained in the PC are managed. Also, this process provides the separated process which can classify and manage the failures and the degradation occurred in the key components. So, both the regulatory requirement in MR process and the improvement of operational performance which is the purpose of SMP Process can be achieved. The major characteristics of this process are described below.

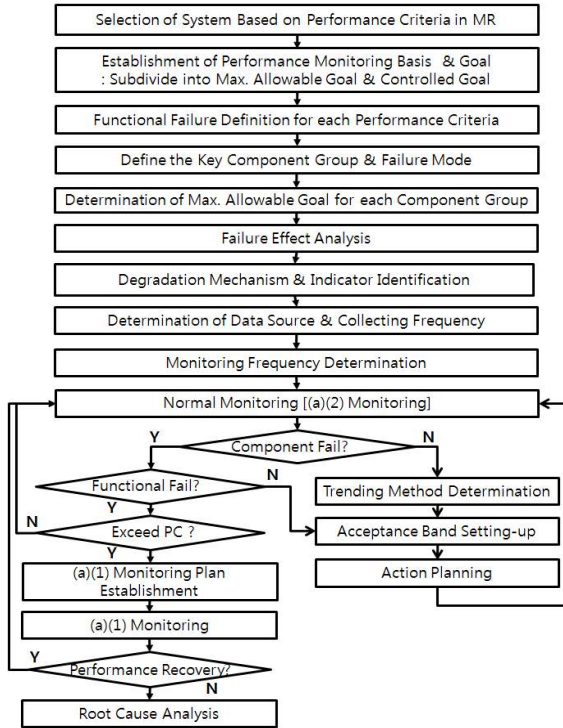


Fig. 3 Integrated Monitoring Process

3.1 Performance Goal Setting

In this process, the system in which PC of the MR program have been already established is selected as target for monitoring. Since the PC contained the functions and the importance of these, it is possible to select the target effectively. Also, it is possible to derive the key components and the failure mode of these based on the functional failure definition.

Since the concept of Performance Goal (PG) of MR Program and SMP is different, it is necessary to combine the concept of Performance Goal in the two processes. In this process, the PG is classified as the maximum allowable goal and management goal. It is suggested that the maximum allowable goal use the PC of MR Program to cope with the future regulation, and that the management goal use the goal of SMP. But, the management goal should not exceed the maximum allowable goal. Actually, the goal of SMP is managed the more conservatively than that of MR.

3.2 Key Component Grouping

Since the PC may contain the some number of functions, there may be a lot of components that caused functional failures. If the PC is directly linked with the SMP at the present state, the work for failure effect analysis and degradation mechanism & indicator identification may be excessively complicated. So, in this process, as the method for linking the PC with the component, it is suggested that the key components listed in the functional failure definition such as valves and circuit breakers are grouped into each component group.

3.3 Performance Monitoring

The normal monitoring is implemented similar to (a)(2) monitoring of MR Program. In the case of component fail, if this failure brings to the functional failure, it is examined that the PC is exceeded. If the PC is exceeded, the (a)(1) process in MR program will be started. In the case of simple degradation not the failure, or if the component failure does not bring to the functional failure, or does not exceed the PC, the process for degradation management will be begin.

3. Conclusion

In this paper, new process combined the MR program and SMP for the purpose of eliminating the duplicated works and, at the same time, securing the goals of the two processes is suggested. In this process, the function management of Performance Criteria in MR program was subdivided, and then linked with component management. And, as the Performance Goal is classified into maximum allowable goal and management goal, it is possible to achieve the objectives of each process at the same time. Also, as the PC contained the importance is linked with the key component, it is possible to reduce the quantity that has to be managed in SMP considerably. So, it is expected that the effective system performance and degradation monitoring is possible.

But, in the selection of target system has to be monitored, it is necessary to investigate additionally whether there is some system important to the plant operation as if the PC is not established. Also, it is essential to examine the actual problems derived from the pilot implementation.

REFERENCES

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