VALVE MAINTENANCE AND DIAGNOSTICS

1. Elements of a Total MOV Maintenance Program, *William L. Lavallee, Roger W. Carr, Stanley N. Hale (MOVATS, Kennesaw)*

INTRODUCTION

Establishing a good preventive and predictive maintenance program for motor-operated valves (MOVs) is an especially challenging task for nuclear power plants. Because of the sheer number of MOVs involved, all with somewhat different characteristics and requirements, and the extremely critical functions that some of the MOVs perform, the maintenance program quickly becomes a major exercise in coordination.

Some nuclear plants have over 500 MOVs per unit, with as many as 50% of these being classified as safety related. All of these MOVs typically have different control settings, and many have different design bases. The maintenance process is further complicated by the fact that these MOVs are susceptible to a wide array of failure modes that can render them completely inoperable or reduce their capability to perform under design-basis accident conditions if they are not properly set up and maintained. There are also numerous regulatory and industry requirements and recommendations that apply to MOVs, and many of these should be factored into the maintenance program. An effective maintenance program also requires interfacing with numerous other plant disciplines, including engineering, licensing, operations, training, outage planning, procurement, and quality assurance. All of this requires a significant amount of coordination, planning, and record keeping.

This paper outlines a three-phase approach to achieving a comprehensive MOV maintenance program. It is based on experience in assisting nuclear plants with their MOV programs and encountering many of the pitfalls that can hamper these programs. The three phases include up-front engineering preparation, field diagnostic testing, and maintenance follow-up and trending. Each of these phases is discussed, and a flowchart describing the individual elements of each phase is provided (see Fig. 1 on next page).

PHASE I: ENGINEERING

The importance of proper up-front preparation cannot be overemphasized. It is essential to the success of any good MOV maintenance program. Problems caused by overlooking any of the steps shown in phase I of the flowchart or by failure to plan them far enough in advance can be extremely difficult and costly to overcome in the later stages of the program.

One of the first steps is deciding on the scope of the MOV maintenance program. Will it cover all the MOVs in the plant, only the safety-related MOVs, or some combination of the two groups? The flowchart is based on a program for safety-related MOVs because it would be the most comprehensive. Some of the steps might be omitted or reduced in scope for non-safety-related MOVs.

Another key initial step is assigning an MOV program coordinator and staff. This should not be a collateral duty or part-time job. The charter of this group should be fully understood and supported by management if it is to succeed.

Before any testing or maintenance of MOVs begins, MOV procedures should be thoroughly reviewed and upgraded as necessary to reflect the latest regulatory and industry requirements. Failure to do so may result in costly retesting or rework. Assembly of MOV engineering records should begin well in advance. Depending on how good the plant's records are on installed equipment design data, it may be necessary to obtain much of the MOV engineering data from the original equipment manufacturer. This can be very time-consuming.

Other steps in the up-front engineering phase are equally important, such as establishing the design bases for the systems in which the MOVs are installed, establishing a sound MOV control switch setting policy, specifying switch settings for each MOV, and implementing a good computer data base to track all of this information.

PHASE II: FIELD IMPLEMENTATION

When the time comes to begin MOV testing and maintenance, all plant personnel involved in the program, including the coordinator, staff, crafts, and operations, should have varying degrees of training on testing and maintenance techniques relative to their job responsibilities. This holds true even if the work is being done by outside contractors. Numerous misunderstandings among the parties involved and unnecessary work delays can be avoided with the proper training.

Baseline diagnostic testing is recommended to establish the mechanical and electrical condition of the MOV to ensure proper control switch settings for design-basis conditions and to provide a baseline for periodic long-term testing. Even if differential pressure testing is performed to demonstrate MOV operability, diagnostics are recommended to ensure adequate operability margin. Test results should be used to update the MOV computer data base and MOV setpoint documents (see Fig. 2 on p. 64).

PHASE III: TRENDING

Following proper setup of the MOV and establishment of baseline test results, long-term care of the MOV should include scheduled preventive maintenance, postmaintenance testing, and periodic testing. Good preventive maintenance procedures based on manufacturers' recommendations, industry experience, and regulatory requirements significantly reduce the potential for failure. Again, diagnostic techniques can play a major role in long-term care. By trending diagnostic test results, minor degradations in an MOV's performance can be identified and corrected before the degradations result in MOV failure.

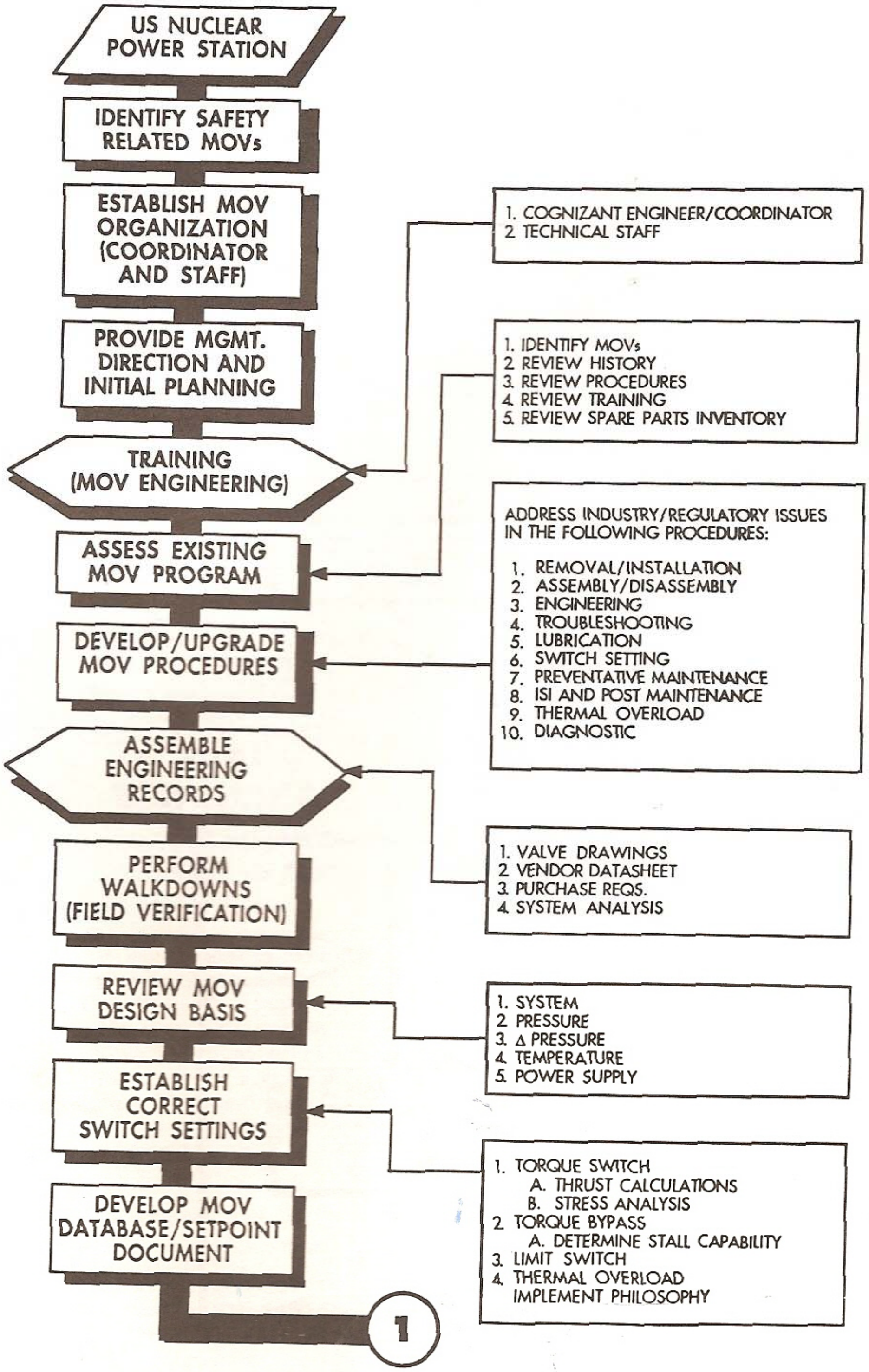

Fig. 1. Phase I: engineering. (Paper 1)

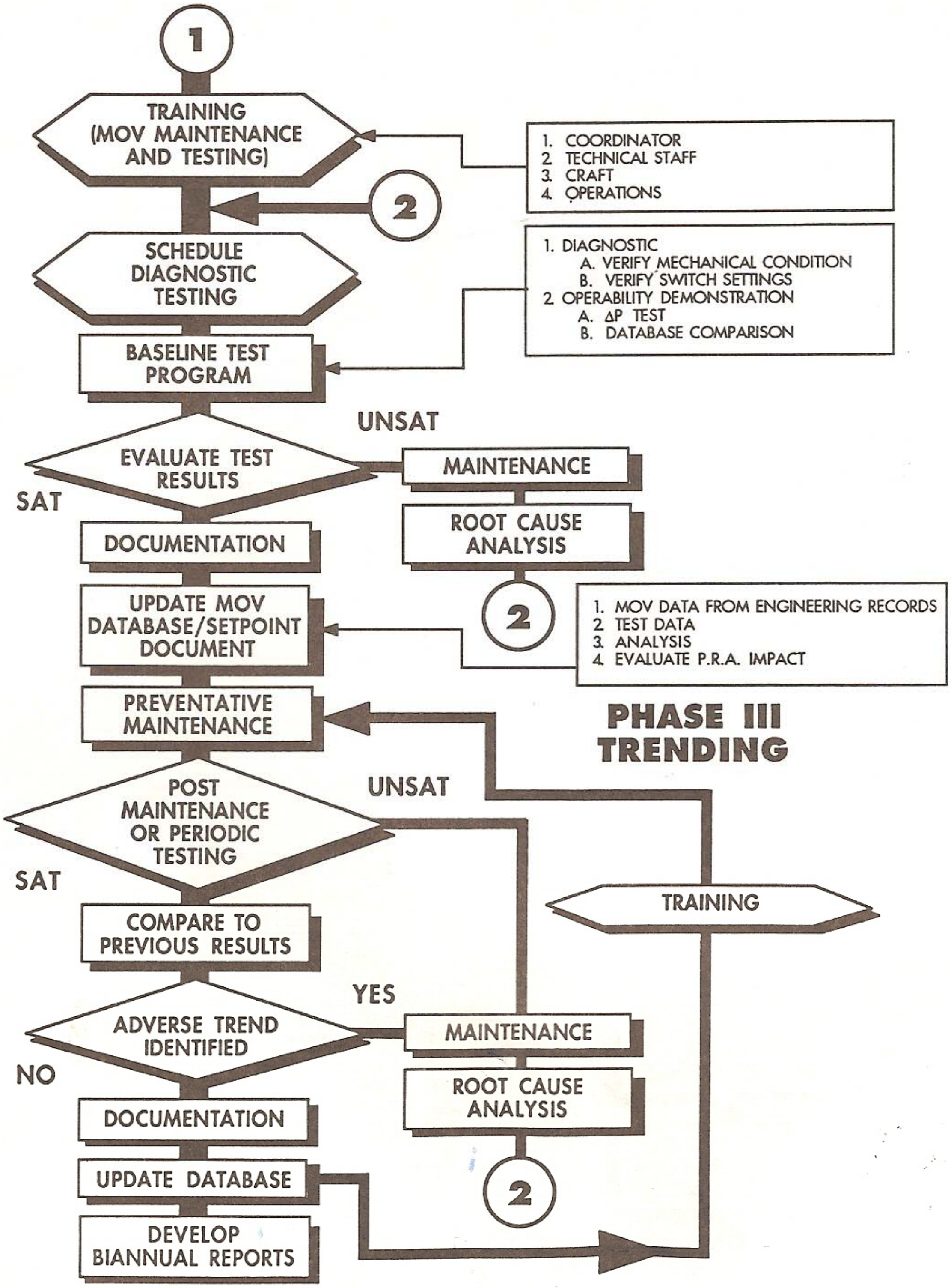

Fig. 2. Phase II: field implementation. (Paper 1)