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Nuclear Safety via Commercial Grade Dedication – Hitting the Right Target – 12163

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ABSTRACT

S.A.Technology has developed and implemented a highly effective Commercial Grade Dedication program that has been used to qualify a variety of equipment to the rigorous requirements of ASTM NQA-1. In specific cases, S.A.Technology personnel have worked closely with clients to develop complex Commercial Grade Dedication plans that satisfy the scrutiny of the US Department of Energy. These projects have been as simple as Passive Mechanical systems, and as complicated as Active Mechanical and Electrical systems. S.A.Technology's Commercial Grade Dedication plans have even been used as presentation materials to a client's internal departments encompassing Engineering, Quality and Procurement.

INTRODUCTION

When it comes to nuclear site safety, Commercial Grade Dedication (CGD) is becoming an increasingly important part of the equipment procurement process. Where CGD could once be easily addressed as a minor, technical point of procurement, it now must be considered as an integral part of the procurement scope.

The driving force is the requirement to keep the general population, site workers and environment safe from hazardous and radioactive material accidents. With exposure accidents occurring around the globe, the US Department of Energy (DOE) is continuously seeking to improve the confidence of the public with regards to nuclear safety. Because of this push to improve public confidence, the development and implementation of CGD plans have changed dramatically. Today's CGD goal is to provide enough information to satisfy the questions and concerns of the DOE, while maintaining a reasonable approach to safety verification through the CGD process.

This has always been the target of CGD: to provide reasonable assurance that the equipment being used is safe, reliable and robust enough to withstand the rigors of the nuclear environment into which it is being placed. For most of us, this target has been easy to hit, as a simple verification of material or sampling of part reliability is enough to satisfy the unknown. Today, however, the target has changed. While verification and sampling are still important aspects of any CGD plan, we must now include additional information that addresses not only

more rigorous acceptance criteria, but also concisely explains how we arrived at those determinations. It is now much more difficult to hit the target, and in some cases it is difficult to even understand where the target is located.

PROCESS

CGD began as a relatively simple process, where materials could be verified as "safe" if they met certain chemical and mechanical criteria, while purchased items could be validated as "safe" if the met certain manufacturing and reliability criteria. However, compared to what has been previously considered as acceptable, today's nuclear cleanup and decommissioning projects need to be viewed with extra scrutiny towards equipment safety. It is no longer sufficient to apply the same simple review process to all items being considered under a CGD plan. Today's CGD author has to approach each project with the questions, "How would I feel if I lived next door to this equipment? Which items would I consider to be Important To Safety? Would I worry about any 'cascade' effects if the equipment failed?" The resulting CGD needs to answer these questions completely enough so that any reviewer has enough information to understand how each decision was made along the way.

At the heart of today's CGD process must be a willingness to dig deeply into a project's application, and to fully consider the impact of the proposed equipment within the project's scope. Today we need to consider, and understand, the intricacies and nuances that are affected by all aspects of the proposed equipment's operation. This is necessary for determining which characteristics are critical to the equipment meeting its intended safety function, and also for determining which characteristics are not critical. Both aspects are crucial to developing a CGD plan which is detailed enough to adequately address safety concerns. This process should not be overly critical in areas that are handled with simple verifications or areas not safety related. It is here that we need to fully understand the safety requirements being placed upon the equipment. It is this safety function that will drive the rest of the CGD process.

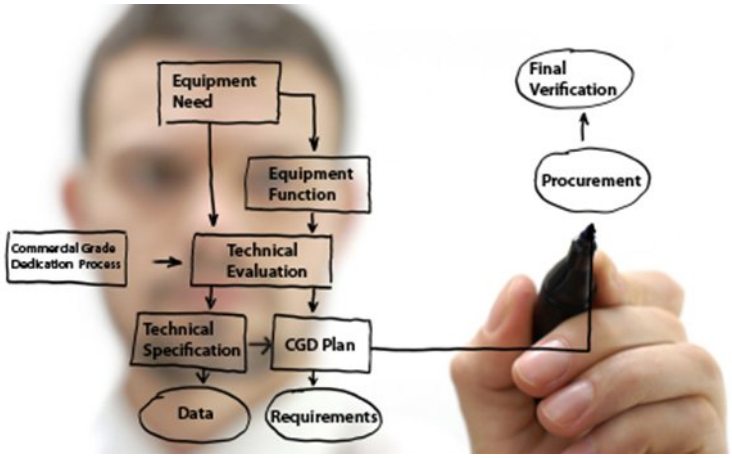

Fig. 1 Drawing Out Commercial Grade Dedication Process

This approach becomes even more important when we start evaluating equipment within systems. The equipment being dedicated may not be especially complex, but the system it's a part of adds complexity to the evaluation process. While the system will not be commercially dedicated, the effect it has upon the reliability of the equipment must be considered. That

means a thorough understanding is required of how the equipment fulfills its role in the project. Looking at what can impact your equipment from an upstream failure is very important. Likewise, considering what can happen downstream if a failure occurs is equally important. Of course, we must always keep in mind that we're looking for "reasonable assurance" in any scenario. If we're looking at how our specific piece of equipment might be affected by a failure upstream, we must evaluate how that failure might reasonably occur. That is, many potential scenarios can be imagined, but which ones are actually feasible? The same objective evaluation must be applied to the equipment being dedicated.

It is at this point where we begin to apply critical analysis to the equipment to determine what does, and does not, reasonably assure a safe project. We must decide which aspects are necessary to the continued, safe operation of the process. Determining what has to happen with the equipment, in order to guarantee the process remains safe, will help us to understand which areas need verification. Does the equipment have to continue to operate normally? Can it continue to operate at a reduced level of effectiveness? Can it cease to operate entirely, and only have to remain intact? The answers to these questions about safety will drive our next level of inquiry into the CGD process.

Fig 2. Thinking Safety

Usually, not every piece within the equipment needs to be scrutinized to the same degree. By understanding the safety function required of the equipment, we can categorize the various parts as being either Important To Safety (ITS) or as Commercial items (CM). It is here that the appropriateness of each item's placement into either of these categories is considered. With a correct understanding of the safety function required of the equipment, much time and expense can be saved at this stage of the CGD process. If we categorize items as ITS that really don't impact the safety function of the equipment, then we're spending extra time and money providing data of no benefit. Conversely, if we fail to properly categorize items that should be ITS, then we risk delaying the project when those items are later discovered, or worse, risk building equipment that does not meet its intended safety function.

Within the CM category, there is nothing that needs to be verified; it is only in the ITS category that safety verifications are required. It is at this stage where credible failure mechanisms must be evaluated for their impact on the equipment. It is the identification of these failure mechanisms that will help to define the critical characteristics of the equipment. The effects of stress, fatigue and wear are obvious failure mechanisms and can be addressed with common material tests. Some less obvious failure mechanisms might arise from the effects imposed upon the equipment by the surrounding conditions. Will the equipment come in contact with particles that will erode the materials? Will it come in contact with chemicals that will corrode the materials? More complex failure mechanisms can arise from equipment configurations, differential movement between parts, and upstream failures. Under these kinds of conditions, it takes a wider view of the system and where the equipment is placed in it to provide reasonable assurance of safety.

Once the credible failure modes have been identified, the process of identifying critical characteristics begins. Some characteristics critical to the equipment performing properly might be of the material itself; things like strength, hardness, toughness, or corrosion resistance. Other characteristics might be related to fabrication quality; things like weld integrity, material thickness, or finished dimensions. Often over-looked characteristics might be related to proper assembly; things like part alignments or secure fastening mechanisms.

Some of the characteristics will only require simple verifications of condition. For example, if we are trying to show that a part is made of a specific material or is specially processed, then a test for chemical composition or mechanical properties might be enough. Similarly, many fabrication and assembly questions can be answered by inspections. Unfortunately, system issues that might influence the proper performance of the equipment can be more difficult to qualify. Here we will have to learn enough details about the system so that we can provide reasonable assurance as to why the system cannot negatively impact the safety function of the equipment.

We must keep in mind that, in many cases, the reader of the CGD may not be familiar with the particular project. Because of this, it becomes very important to convey the thought process involved in the decisions. Enough information should be provided to the reader to allow a clear understanding of the reasoning behind the choices. In all decisions, it takes descriptive technical justification of why those choices were made. That means not only stating why a particular path was followed, but in many cases why a particular path was discarded. It is only when both sides of the decision are presented that a true picture of the thought process is revealed.

CONCLUSION & RESULTS

This is the new target of today's CGD: exposing the reasoning behind the dedication process. Previously, only test and inspection results were expected. Today's CGD now needs to show how the decisions presented are the right decisions to make. We must be willing to undergo the process of learning how each new piece of equipment is affected by the system it is placed into, as well as understanding how that equipment can affect the system itself. It is a much more complicated and time-consuming endeavor to undertake. On top of it all, we must be able to voice those discoveries and rationalizations in a clear and concise manner. Unless we effectively communicate our intentions to the reader, we will not be understood.

If researched correctly and presented properly, today's Commercial Grade Dedication plans will answer the appropriate questions before they are asked.

REFERENCES

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