



OPERATING EXPERIENCE SUMMARY



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The Importance of Quality Assurance during Work Planning for Preventing Accidents

Introduction

Quality assurance (QA) during the work planning phase of operations, and during all parts of work, is important for ensuring that work is performed in a safe, effective, and efficient manner, thereby reducing the risk of experiencing an accident or injury during work performance.

Integrated Safety Management System

Department of Energy (DOE) Order 450.2, Chg 1 (Admin Chg), *Integrated Safety Management*, provides the system by which DOE work is performed safely.

The first three core functions of the Integrated Safety Management System (ISMS) summarize work planning requirements. The core functions of ISMS are:

1. **Define the Scope of Work:** Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated;



Figure 1. Integrated Safety Management is the system for safe work planning, performance, and continuous improvement at DOE.

2. **Analyze the Hazards:** Hazards associated with the work are identified, analyzed, and categorized;
3. **Develop and Implement Hazard Controls:** Applicable safety standards and requirements are identified and agreed upon, controls to prevent or mitigate hazards are identified, the safety envelope is established, and controls are implemented;
4. **Perform Work within the Controls;**
5. **Provide Feedback and Continuous Improvement:** Feedback information on the adequacy of controls is gathered, opportunities for improving the definition and planning of work are identified and implemented, line and independent oversight is conducted and, if necessary, regulatory enforcement actions occur.

Quality Assurance

In order to prevent accidents, it is necessary for workers and managers to apply QA principles to all core functions of ISMS. QA routine processes must be performed within each core function to ensure that the work planning process is correct and communicated to staff, hazards are all identified and controlled, and work is performed within the controls. DOE Order 414.1D, *Quality Assurance*, defines the programs and processes by which quality work is assured, based on the following principles:

1. All work...is conducted through an integrated and effective management system;
2. Management support for planning, organization, resources, direction, and control is essential to quality assurance (QA);
3. Performance and quality improvement require thorough, rigorous assessments and effective corrective actions;
4. All personnel are responsible for achieving and maintaining quality; and

5. Risks and adverse mission impacts associated with work processes are minimized while maximizing reliability and performance of work products.

Title 10 Code of Federal Regulations (CFR) Part 830.122, *Quality Assurance Criteria*, states the following quality assurance criteria for performance/design:

1. Design items and processes using sound engineering/scientific principles and appropriate standards;
2. Incorporate applicable requirements and design bases in design work and design changes;
3. Identify and control design interfaces;
4. Verify or validate the adequacy of design products using individuals or groups other than those who performed the work; and
5. Verify or validate work before approval and implementation of the design.

It is very important to apply QA criteria to the ISMS process. ISMS is an integrated and effective management system, compliant with DOE O 414.1D. A comparison can be drawn between principle 4 of DOE O 414.1D: “All personnel are responsible for achieving and maintaining quality,” and the purpose of ISMS is to integrate safety into management and work practices at all levels. Application of the performance and design principles in 10 CFR 830.122 help to ensure not only the quality, but also the safety of designs. In particular, implementing these QA criteria during the work planning phase—ISMS core functions 1 through 3: Defining the Scope, Analyzing the Hazards, and Developing and Implementing Controls—will reduce the likelihood and/or severity of unwanted incidents occurring at DOE.



Picture 1. The “Error Lab” at Environmental Management’s Portsmouth Gaseous Diffusion Plant provides a QA check on efficacy of radiological hazards controls training. Trainees observe simulated radiological work (performed using fake radiological materials) and are assessed on their ability to identify procedural errors. Here, trainees prepare to enter the lab.

Accidents within DOE

Numerous occurrences have been reported within DOE in the past several years that highlight the importance of QA during work planning for managing risks associated with all work processes. Since January 2012, 15 percent of ORPS reports were identified with the Headquarters Keyword 1N – Inadequate Job Planning (non-electrical). Below are a few examples to show the failures that resulted when work was not adequately planned by applying QA criteria during the work planning process.



Lab Equipment Disposal Occurs Before Final Approval Process

On January 31, 2017, a small, out-of-service canopy hood was removed and placed in a metal recycle bin prior to completing the National Renewable Energy Laboratory's (NREL) internal decommissioning and release process. The lab where it originated had previously been used for radiological work, which included small quantities of radioisotopes, such as carbon-14 and tritium. A parent maintenance work order was issued to remove the canopy hood from the lab space. A meeting was held to discuss the work order, and hold points were established to confirm that release criteria were met and disposition procedures were followed. Written instructions, including the hold points for the removal process, were included in a subsequent "child" work order (CWO). The CWO was attached to the "parent" maintenance WO (PWO). However, the technician performing the task only followed the instructions of the PWO and removed the canopy without completing NREL's internal decommissioning and release process.

This incident highlights the failure to properly apply the QA criteria to the work planning phase. The work order process of opening and assigning multiple work orders for the same task produced an error-likely situation. Workers received hardcopy work orders (WOs) with special instructions, which are not common and might not be noticed on subsequent, often-duplicate, attached pages. In this instance, the special handwritten instructions on the Engineering WO were not carried forward and included in the Maintenance WO. The WO package was not reviewed for completeness prior to assigning it to the maintenance technicians, who also did not review the entire package. The technicians, who were used to having WOs with multiple pages that were essentially identical, assumed that the first page of the WO, which basically stated "remove the canopy," was complete and did not think to look on the second

page for additional instructions. One corrective action identified to prevent this occurrence was: "Modify work control process to eliminate multiple-copy work orders and to ensure special instructions are captured on the WO." (ORPS Report EE-GO--NREL-NREL-2017-0006)

X-670 Injured Employee

On December 19, 2016, a ½-inch steel discharge pipe struck an employee on the cheek, causing a fracture of the cheek bone when the employee drained moisture from an air receiver. The discharge pipe had rotated up at a loose tee connection due to the discharging air pressure.

The investigation into this incident determined the root cause of the event was that the work planning process failed to involve the appropriate Subject Matter Experts (SME) to identify pneumatic and lever arm hazards that existed. Work was considered to involve only a drain line extension, not to involve pneumatic hazards, and was not considered as a facility modification. Identification of these hazards requires a close working knowledge of the facility, the air receiver tank, and the moisture trap operations. The first corrective action was to enhance the work planning process to require formal supervisor approval of the determination that work is Dispatch Work, since dispatch work did not require the involvement of a planning team. The supervisor's assessment of the planned work during the approval process would serve as a QA check to ensure that the work was, in fact, dispatch work. The corrective action also stated that SMEs should be involved in making the determination to characterize work as Dispatch Work, when appropriate, which would provide additional QA assessments, which may be independent. (ORPS Report EM--PPPO-FBP-PORTSDD-2016-0025)



Picture 2. Discussions on safety issues are incorporated into simulated work at the Advanced Mixed Waste Treatment Plant, including when workers learn procedures in mockup situations, such as a practice session on solidifying used hydraulic oil, pictured here. Involving SMEs in these observations and discussions is critical to identifying hazards and controls.

Two Operation Technicians Struck by Gantry Crane during Filter Change

On October 18, 2016, two workers were struck by a gantry crane while replacing High Efficiency Particulate Air (HEPA) filters at Oak Ridge. While removing pre-filters, the gantry crane hoist moved, and one leg of the crane dropped into the open filter pit. The tipping gantry crane struck two Operations Technicians (OT): one OT was struck on the upper body by the crane leg; the other OT's Powered Air Purifying Respirator (PAPR) helmet was struck by the crane beam. The Operations Supervisor suspended the work, accepted the workers' reports that they were okay, then proceeded to have the crane leg lifted out of the filter

pit, and repositioned the crane. The technicians were sent to the medical facility to be checked, and both were returned to work without restrictions.

This incident highlights the importance of hazard identification and control in work planning. In this case, a generic identification of hazards and mitigating controls was generated by a purchased software package, and was not supplemented with a job-specific hazard evaluation and controls. The work instructions did not require the installed gantry crane wheel locks to be engaged or the wheels to be chocked to prevent movement of the gantry crane. The review of the work package by responsible personnel failed to catch the weakness, and personnel at all levels failed to properly react to indications of weaknesses in the system. One corrective action was for the Environmental Safety and Health Manager to brief Occupational Safety and Health Engineers on their critical role in work planning. The engineers had a QA role to perform an assessment to verify that the hazard and controls identified by the software were correct. (ORPS Report EM-ORO--ISOT-3019A-2016-0005)

Management Concern – Component Issue Discovered

On April 29, 2015, a Pantex Production Manager was notified of an issue associated with ongoing Joint Test Assembly builds, in which Parent Unit Parts (PUPs) covers and screws for one assembly were previously installed in another assembly. The mix-up began when the tail case of an earlier assembly was non-conformed, and the PUPs that were assembled to that tail case were not removed. Then, the tail case for the next assembly was pulled to be used on the earlier assembly, along with the PUPs assembled to it. This resulted in a “domino effect” that impacted multiple assemblies. When the tail case for the last assembly arrived (without the PUPs), the PUPs had been inadvertently switched, along with the tail cases for all assemblies.



A Corrective Action for this incident was to require work packages to be used in all operations. Some operations were not governed by formal work packages because the scope and complexity of the operation did not merit the issuance of a work package, which provides an opportunity for technician interpretation and variability. Again, this incident reveals the necessity of having a robust risk management system, ISMS, in place with work planning and QA controls to reduce or eliminate the likelihood of experiencing an accident or nonconforming product. Thorough work planning and QA of the planning and work process can identify problems with the process before work is incorrectly or unsafely completed. (ORPS Report NA--NPO-CNS-PANTEX-2015-0018)

The Importance of Work-Planning and QA Controls

The examples highlighted above show the importance of QA during work planning as a crucial component to ensure safe work performance in accordance with ISMS principles. There are numerous other incidents that have occurred across the DOE Complex over the years as a result of inadequate application of QA criteria to work-planning processes. The causes identified for the incidents highlighted above include the following.

- Job scoping did not identify special circumstances and/or conditions
- Inadequate work package preparation
- Appropriate level of in-task supervision not determined prior to task
- Incomplete/situation not covered
- Management policy guidance/expectations not well-defined, understood or enforced
- Risks/consequences associated with change not adequately reviewed / assessed
- System interactions not considered



Picture 3. Work with heavy equipment presents hazards to the operator and bystanders. Pictured here, Savannah River Nuclear Solutions environmental engineers inspect plans for earth-moving work within a basin containing coal ash.

- Ambiguous instructions/requirements
- Tasks and individual accountability not made clear to worker

All of these are important components of QA during the work planning process. Management is ultimately responsible for ensuring that work planning and associated QA functions are performed adequately to promote and ensure safe work. Management has a responsibility for ensuring that QA criteria are applied to work planning processes to ensure that ISMS core functions are being applied and the ISMS principles are being met. Management's actions can influence the success or failure of work planning processes. Adherence to a Quality Assurance Plan, which contains the methods for complying with DOE O 414.1D and 10 CFR 830 Subpart A, in conjunction with ISMS, is necessary to prevent accidents and injuries from occurring due to mistakes made during the work planning process.



The Office of Environment, Health, Safety and Security (AU), Office of Analysis publishes the *Operating Experience Summary* to promote safety throughout the Department of Energy (DOE) Complex by encouraging the exchange of lessons-learned information among DOE facilities.

To issue the Summary in a timely manner, AU relies on preliminary information such as daily operations reports, notification reports, and conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the Summary, please bring this to the attention of Ms. Ashley Ruocco, (301) 903-7010, or e-mail address ashley.ruocco@hq.doe.gov, so we may issue a correction. We would like to hear from you regarding how we can make our products better and more useful. Please send any comments to Ms. Ruocco at the e-mail address above.