

INNOVATIVE INTEGRATION OF PEOPLE AND TECHNOLOGY ON A MAJOR D&D PROJECT

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ABSTRACT

The East Tennessee Technology Park in Oak Ridge is a centerpiece for the Department of Energy's reindustrialization program, which seeks to convert formerly used facilities for broad, industrial purposes. BNFL Inc. and its partners have been charged with the decontamination and decommissioning of three large gaseous diffusion plant buildings. The buildings are structurally sound and are prime candidates for industrial re-use. However, there is chemical and radioactive contamination in each building and in much of the equipment – a legacy from past operations. There is approximately 126,000 tons of potentially contaminated metal in the process equipment.

The technical challenge for this project is to link the ability to remove equipment and, in an effort to lower the overall cost to the U.S. government and taxpayer, clean up the buildings with some economically viable recycle of the equipment. BNFL Inc. is in the process of meeting this challenge by employing a people-oriented approach to solving technological problems. BNFL's guiding principles of safety first, teamwork and flexibility have been applied to the development of work standards and processes. Teams of craft workers, engineers, safety personnel and other support personnel participate in enhanced work planning sessions to develop dismantling and decommissioning techniques and equipment which are safe, cost effective, and have complete buy-in from the workforce.

INTRODUCTION

This \$238 million contract is projected to dramatically speed up the pace of environmental cleanup, while saving U.S. taxpayers hundreds of millions of dollars. It requires BNFL Inc. and its partners to dismantle and remove the process equipment and related support supplies in each of the three buildings. BNFL's partners and their responsibilities are described in Appendix I.

Thousands of tons of metals are to be cleaned and recycled to the extent economically practical, and the remaining building cleaned to specific end-point criteria for completely unrestricted re-use. In this process BNFL Inc. will also be cleaning up nearly 3 million square feet of floor space and surrounding walls, ceilings and supporting columns. Appendix II contains a description of the buildings and their contents. An aerial view of the buildings is shown in Figure 1.

BNFL Inc. brings to this project the experience of a similar D&D project at BNFL's Capenhurst Diffusion Plant in the United Kingdom. It also draws on BNFL's many years of experience in the UK in decommissioning and developing safety cultures.

This paper addresses problems associated with managing 'people' aspects of this major D&D project in Oak Ridge. It describes the cultural changes being introduced and the advantages being gained in terms of safety and effectiveness.

NEED FOR CULTURAL CHANGE

People are educated and trained to create, not to destroy or pull down. The decommissioning world generally requires dismantling and size reduction of equipment. This work can be seen as demotivating by the workforce. Historically, government-sponsored projects in both the US and UK have people believing they work for an impersonal bureaucratic "system" for which they have little ownership or input. The "system" appears to lack feelings, identity, accountability, and a real commitment to engender personal responsibility for safety and quality. To counteract these perceptions and motivate people to work safer and more effectively, a cultural change has to be introduced.

Drawing upon BNFL plc.'s many years of experience in the United Kingdom (UK), BNFL Inc. has introduced a comprehensive program to address safety issues. The cornerstone of this program is culture change workshops and ongoing auditing activities that involve the workers and managers. Work planning involving the workers and managers will result in more effective response to instructions. Strong teamwork is stressed between the BNFL Inc. team and the customer, Department of Energy (DOE). Flexible staffing and the active participation of workers in safety programs and productivity issues are part of the program.

SAFETY

The traditional approach to safety that many of our people have experienced has been one of management alone taking ownership of the safety program when there appears to be a problem. This approach does not work. The workers do not own the safety program.

It is essential that each individual within the workforce accepts ownership and commitment to working safely and maintaining a safe environment.

BEHAVIORAL SAFETY

BNFL Inc. has introduced the concept of 24 hour-a-day Behavioral Safety. Behavioral Safety improves safety by changing people's attitude and consequently behavior, therefore preventing accidents. Behavioral Safety challenges people to be more safety conscious throughout the day, both at home and at work. Safety awareness has to become a way of life, not just something required at work.

CULTURAL CHANGE WORKSHOP

The foundation of the safety program is the Cultural Change Workshop (CCW). The Cultural Change Workshop is required of all employees on the BNFL Inc. ETTP project.

The CCW builds module by module to take the participant from ignorance or apathy toward safety performance through awareness to a point of individual ownership and

commitment. Most workers, while still skeptical as to long-term outcomes, agree that the approach is sound and state that for the first time in their careers they feel a sense of ownership and true inclusion in the safety process. Most comment also on the participation of senior management in their training and the strength of the management commitment that they observe in the Project approach.

SAFE AND UNSAFE AUDITS

The SUSAs technique is a non-threatening method of auditing behavior in the workplace to encourage safe behaviors (and conditions) and to discourage unsafe behavior.

The SUSAs procedure requires personnel to discuss safety with individuals in the workplace and provides a powerful tool for encouraging individuals to consider the possible consequences of their unsafe actions and to modify their behavior accordingly.

The more time spent by the workforce and managers carrying out SUSAs, the more all personnel will truly believe that safety does come first. The documentation is simple and non-bureaucratic, and findings can be shared easily with other potentially affected personnel.

NEAR MISS REPORTING

The Near Miss Reporting System enables all personnel on the project to record an event that did not lead to an accident but could have done so if circumstances had been different. This system provides initial information that is analyzed and then used to enhance the safety program.

ONE MINUTE ASSESSMENT

One Minute Assessments involves an individual simply “stepping back” from the task before they start or resume an activity, then ask themselves, “has anything changed that may create a new hazard in the area and if so, should I take additional precautions?” It may be as simple as a patch of water or oil on the floor or poor housekeeping in an area that could lead to one of the most common forms of accident, the “slip, trip, and fall” scenario.

PROBLEM SOLVING TECHNIQUES

Working Standards and Instructions

Many modern Quality Management Systems are large, unwieldy, often out-of-date, cost a significant amount of money and effort, and potentially lead to noncompliances. In addition, separate systems are often established for quality assurance, safety, and environmental management. These systems frequently do not reflect the real work at the workforce level.

DOE and BNFL Inc. have defined only those standards that apply to the project. Instructions are written using knowledgeable individuals from all levels of the workforce. These instructions are kept as short and concise as possible, containing only relevant information. The Quality Management System assumes that people will be properly

trained and qualified. This allows them some discretion in the way certain activities are being carried out, providing they do not affect safety, environment, or quality. This system is aimed at moving the emphasis from a paperwork-based system to a people-based system in which individuals have better control of how they perform their tasks.

TECHNOLOGY PILOT STUDIES

Having clearly defined a particular technical need, a number of options are considered which are graded with weighted attributes and/or concerns, from both safety and production angles. A basic principle in choosing the most appropriate technique or piece of equipment is not to reinvent the wheel. It is not sensible to re-develop equipment, which either already exists as off-the-shelf items or can be economically modified to meet the project's needs. Initial research into manufacturers' literature and pilot demonstrations is carried out which leads to the preferred technique being chosen.

Full use is made of other D&D databases, particularly those which have been developed by other BNFL projects in both the US & UK. BNFL has built up a comprehensive portfolio of a broad range of D&D experience in the UK including dismantling, size reduction and decontamination.

DEVELOPMENT TRIALS

Having researched and identified techniques/equipment, which appear to fit for purpose, demonstration trials are carried out on site in situations that replicate the work situation. An essential element in planning and setting up these trials is to involve not just the subject matter experts whose roles are to identify and mitigate safety hazards, design and orchestrate the technical issues and to produce instructions for the task to be carried out in a safe and efficient manner, but to also include the hourly paid worker on the team. The benefits of including the people who are "to do the work" at such an early stage in development are 1) to use valuable on-the-job in-house experience and knowledge; 2) the "buy-in" by the craft workers to choice of the appropriate equipment, and 3) the "buy-in" by the craft workers to the instruction to which they have helped develop.

ENHANCED WORK PLANNING

An integral part of this Enhanced Work Planning process is the continual on-the-job review of the safety and effective aspects of each task as it is performed. The reassessment of techniques & equipment by the team of technical, safety experts, combined with open, timely feedback from the workforce leads to further enhancement of the work being carried out in a safe and efficient manner.

SOME TECHNOLOGIES EMPLOYED

The process equipment removal phase of the project involves dismantling the large, uranium-enrichment equipment and removal of the associated support systems (Fig. 2). Cold and hot cutting are the primary methods for dismantlement (Fig. 3).

The metal decontamination, recycling and waste disposal phase of the project often uses specially developed hot cutting techniques for disassembly of the process equipment and subsequent size reduction of equipment components. A dedicated facility is being

constructed in the K-33 building to house these systems with remote operations being the fundamental design criteria to ensure maximum protection to the worker. Radioactively contaminated metal will be processed in an off-site facility using dry techniques for surface cleaning and wet chemistry to decontaminate metal with sub-surface contamination. An electro-refinement process will be used to recover uranium-contaminated nickel components from the uranium enrichment process equipment.

To determine the optimum sequence of work activities, the dismantlement and disassembly activities are being evaluated using an operational research model. Equipment transport times, interactions among production steps, craft utilization, and timing of activities will be assessed to reduce downtime, approve space utilization, reduce conflicts among work activities, schedule equipment movement, and evaluate process interfaces between the dismantlement, disassembly, and recycle operations.

PROJECT SCHEDULE

The schedule for the project is shown in Table II.

Table II

Activity	Date
Takeover Bldg. K-33, K-31	January 1998
Takeover Bldg. K-29	May 1998
Complete Clean Up of K-33	March 2001
Complete Clean Up of K-31	November 2002
Complete Clean Up of K-29	September 2003

CONCLUSIONS

The approach to safety at the BNFL Inc. ETTP Project is unique among DOE contractors. The basis for the program is the same cultural change approach to behavioral safety as designed and implemented in the UK with great success. It is the belief of BNFL Inc. ETTP management, that with their active involvement and continual reinforcement the described method of implementing behavioral safety will achieve very favorable results on this project and serve as a model for other US enterprises as well.

Involving people and the customer early on in the decision-making process and using their continued input is leading to a motivated workforce that takes pride in its safety and productivity.

The tools and techniques referred to in this paper continue to gain buy-in from the workforce and contribute to BNFL Inc.'s and DOE's future success.

This large-scale ETTP decommissioning project, with its added value of reusing the buildings for industrial purposes (Fig. 4), is considered to be a major DOE initiative. The philosophy and techniques described in this paper are very relevant to a wide range of

nuclear processing plants throughout the world, particularly large plants such as those at K-25.

APPENDIX I

The BNFL Inc. Team

The BNFL Inc. team consists of employees from BNFL Inc., Manufacturing Sciences Corporation (MSC), Science Application International Corporations (SAIC), American Technologies Inc. (ATI), and IDM Environmental Corporation.

The prime responsibilities of the partners are:

BNFL Inc. – Overall project management, technical leadership, and dismantling activity

MSC – Metals decontamination and recycling

SAIC – Technical and safety support

ATI – Surveillance and maintenance and support services

IDM – Switchyard removal

APPENDIX II

Description of buildings and their contents

The K-33 building contains eight inactive gaseous diffusion process units consisting of ten cells each. Each cell contains eight stages, with each stage consisting of process equipment, including an electric motor, axial flow compressor, a converter containing a large surface area barrier material, associated process piping and valves, and support equipment on the operating floor. Thus, the K-33 building has a total of 640 stages requiring removal. The K-31 building contains six inactive gaseous diffusion process units consisting of ten cells each. Each cell contains ten stages, resulting in a total of 600 stages requiring removal. The K-29 building contains three inactive gaseous diffusion process units consisting of ten cells each. Each cell contains ten stages, resulting in a total of 300 stages requiring removal. The three process buildings house a total of 1,540 stages.

The building sizes for K-33, K-31, and K-29 are 2,780,104 sq. ft., 1,659,626 sq. ft., and 451,000 sq. ft., respectively. The three process buildings hold an estimated 126,100 tons

of contaminated and potentially contaminated metals including iron, nickel, aluminum, and copper. Approximate quantities of each are indicated in Table I.

Table I

Metal	Quantity (Tons)
Iron	102,000
Nickel	6,000
Aluminum	7,300
Copper	10,800
Total	126,100

The switchyards contain approximately 8500 tons of metal and building debris.