

D&D Experiential Learning Achieves Better Alignment with D&D Mission

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Objective: The skill requirements of decontamination and demolition (D&D) workers are radically different from the normal production worker skills available at the DOE facilities that are transitioning to D&D. A study performed at Rocky Flats determined that current training is structured around individual subject courses that are not integrated nor efficiently coordinated, with high-reliance on a poorly defined on-the-job training program. The study also found that the rapid growth in D&D worker numbers would severely tax the ability of the current system to deliver qualified workers. This paper discusses the integrated experiential learning structure that was subsequently developed to train and qualify D&D workers at Rocky Flats

Workshop Relationship: Areas addressed by the paper include:

- Authorization Basis – Emphasizing the D&D worker role in maintaining the Authorization Basis
- Facility Management - Transitioning the Facility Training Programs from the silo based (vertically isolated) training to an Integrated Experiential Learning Program
- Risk Management - Maximizing the contribution of the D&D work teams to minimize risks and uncertainties
- Safety Management - D&D work teams and the focus on ISMS.

Description: The paper summarizes the development and implementation of an Integrated Experiential Learning Program for D&D workers at Rocky Flats. The paper discusses the following elements of the program:

- Summary of the drivers for the program
- Comparison of traditional “silo” based training and the new D&D curriculum
- Methods used to develop the D&D training program
- Benefits from training; safety and cost perspectives
- Potential application to other training programs

Results: The approach used has reduced the cost of training and qualification by significantly reducing both seat time and the overall time period required to qualify personnel. Training with the focus on experiential learning is also expected to produce a team of personnel that will arrive in the buildings qualified and ready to perform work safely and effectively. This is expected to support the conduct of more complex D&D operations with improved safety performance.

Abstract for SAWG Workshop 2000

Benefits to Others: The integrated experiential learning approach has direct application to all DOE D&D programs and offers an alternative to traditional training programs. The approach offers improvements in training time, improved teamwork, and increased efficiency and safety performance.

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Introduction

The Rocky Flats Environmental Technology Site (RFETS) has set its sights on closure by 2006. This is an ambitious schedule that will result in the deactivation and demolition (D&D) of production and support facilities that cover a 1-1/2 million square foot footprint. One of the central concerns in reaching this goal is having sufficient resources, especially trained personnel. The area of greatest concern is having workers with appropriate skills who can perform the labor-intensive tasks involving decontamination, strip out, size reduction, and packaging of waste in a plutonium-contaminated environment.

This paper addresses the research that has been performed and the current effort to address the training needs of the skilled D&D worker.

Background

Building 779 was the first plutonium facility at RFETS to undertake full-scale D&D. D&D-related tasks started in January 1998; completing building demolition to the ground in January 2000. Although this was a major accomplishment in a short timeframe, there was time within this schedule to use a conservative approach to slowly train D&D personnel and to introduce and apply various D&D techniques to the project in an evolutionary fashion. On-the-job (OJT) training was the primary training method that proved effective for two reasons. First, the project benefited by selecting a group of workers who had extensive backgrounds in plutonium operations, maintenance, and decontamination tasks. Second, the workers incrementally used their previous skills and experience to develop the basic D&D methodology that could be applied elsewhere on the site. However, it was anticipated that the next series of buildings would not have the benefit of this staffing approach. To address this concern, a study was initiated in January 1999 to examine the growth rate of D&D personnel and to make recommendations regarding training of such personnel.

The first outcome of the study was to extrapolate the D&D worker staffing requirement. *Figure 1, Rapid D&D Worker Staffing – 2006 Closure*, reflects the anticipated growth rate. There are several factors that have a direct influence on the site's ability to satisfy this rapid buildup of workers:

- The growth of D&D work scope at RFETS will exceed the site's ability to provide qualified workers who are currently on site. The scope of D&D activities requires specialized skills and experience for working in a highly hazardous environment that has an extensive set of uncertainties and risk. Workers with this skill base are not available and do not exist elsewhere in the industry.
- The current on-the-job (OJT) training approach for D&D will not accommodate the large influx of new workers. This approach worked for Building 779 because the best available workers on site were selected, and they had related skills and experience to build upon. The site will not have this resource to draw from in the future.

- The program assumes that the entry worker to a D&D position will be an off-site hire with minimal or no experience in a radiological environment and possibly without related construction skills experience. This assumption is based on the rapid growth curve for D&D in the next three years and the tight labor market in the Denver metropolitan area. This new-hire pattern is already being experienced for the next major building entering the D&D phase.
- The D&D processes for size reduction, disconnect and other methodologies continue to evolve. A proactive training program is required to capture these changes as quickly as they become a standard practice.

The rapid growth projection, in conjunction with the skills availability of the new D&D worker as outlined above, indicated a need for an aggressive training program. The emphasis on experiential learning turned out to be a central objective of a dedicated program.

Traditional Training Approach

The study examined the training paths used at RFETS and the results achieved. The current basic qualification requirement for a D&D worker requires completion of 33 core courses in a mostly classroom setting, with a total seat time of 200+ hours. These core courses address the general Site access requirements, 40-hour OSHA training, work control, conduct of operations, and related knowledge required to work in a Plutonium facility. These classes are presented in a silo (i.e., vertically isolated) fashion, with little interconnection or association with the actual work scope to which a D&D worker will later be exposed. Once these basics are completed, the traditional D&D trainee completes another series of classes with varied levels of skill requirements and with a higher relationship to D&D tasks. The trainee is eventually assigned to a D&D-mission facility for on-the-job training. This is typically the first time the new trainee is indoctrinated in the D&D work environment and given hands-on experience with the D&D work scope. This process has largely been poorly integrated and requires over 500 hours of training time to complete.

One related problem to the silo approach is the intermittent nature of the training. The formal courses are not continuously offered, nor are they offered in a sequence that logically builds upon previous learning. Major gaps in training result, extending the training over many months. A primary goal of the new curriculum development was to minimize silo training and create an integrated approach with continuous class offerings.

D&D Training Development Approach

The first step in the development process was to evaluate the necessity of the existing courses and to establish the need for specific skills-based training that supports the D&D worker. The training sequence is presented in *Figure 2, Transition to D&D Experiential Learning Process*. The sequence of training supports access to the facilities and provides for increasing levels of complexity and specialty knowledge.

During evaluation of the existing courses and training requirements, two elements became apparent. First, the change in the Site mission has resulting in more focused assignment of personnel. Consequently, the training curriculum can focus on specific work assignments and timelines, which means the previous approach to delivering broad-spectrum training to create a generalist worker is less applicable. Second, based on the expected limited knowledge base of new hire D&D workers, the most effective method of learning for highest retention is achieved through experiential training. The integration of standard course work with experiential opportunities thus became a central objective of curriculum development.

Figure 3, D&D Training Program Development, provides an outline of the training program development progression. An essential part of the development effort was determining the stages and sequencing of typical D&D work as shown in *Figure 4, Stages of D&D Operations*. These

D&D stage definitions were used to evaluate the skills necessary to perform D&D field activities. By breaking these skills into related areas, four representative hands-on mockups were recommended:

- **Fundamental Skills Workbench** – The purpose of the skills workbench will be to provide training for the various hand and power tools that are used in D&D. Safe usage with and without personal protective equipment (PPE), maintenance and actual use of the tools are taught. In addition, specific D&D techniques for applying protective sleeves around disconnect points, disconnecting piping, and routine contamination controls are demonstrated.
- **Glovebox Disconnect** – This mockup uses a typical glovebox to provide training for utility disconnects, fixative application, glovebox maintenance for glove and filter changes, bag-in/bag-out operations, and other skills necessary to prepare a glovebox and related equipment for size reduction. Areas of training include sequence of work, decontamination techniques, disconnect points, disconnect options, lock-out/tag-out application, lift table usage, hoisting and rigging, and tool application.
- **Tank Disconnect** – This mockup is used to demonstrate the hazards associated with liquids in tanks and the techniques for safely removing raschig rings, piping, residual liquids, valves, and sight gauges.
- **Size Reduction** – This is the most heavily used mockup and is configured with a Soft Side Containment (SSC) tent with typical utilities and a breathing air system. Generic size reduction techniques are taught inside the SSC tent using various levels of PPE. Team support is especially important for waste handling, dressing out in breathing air PPE, tent entry and exit, and emergency response. This mockup requires full-time Radiological Control Technician (RCT) involvement in order to simulate proper radiological controls and team support.

Throughout all training in both classroom and mockup environments, emphasis is placed on potential hazard evaluation and response based on Integrated Safety Management Systems (ISMS) principles. Also, the importance of teamwork is stressed in the training, and teamwork is a performance area for evaluation in all mockup simulations.

Based on the D&D team makeup in active D&D facilities, a typical team will consist of 2 to 4 RCTs (depending on job scope and radiological hazards), 2 dedicated waste workers, 7 to 9 D&D workers, and a foreman. It became evident early during the study that all D&D workers on a team need basic D&D training; however, certain specialized training, such as forklift operation, hoisting and rigging certification, and fixative application, will be required for only selected members of the team. This concept is shown in *Figure 2*, where basic training is identified for all members, and specialized training is reserved for a few depending on job assignment. This helps reduce the training time and cost, while also spreading specialized expertise among different workers. In all cases, the foreman needs management training plus a high level of awareness for all work performed by his/her team, but not necessarily to the same level of detailed training a worker needs for each area of specialization.

Once the basic training progression and training concepts were established, a detailed curriculum was developed that integrated all aspects of learning. The detailed description for each block of training included training objectives, breakdown between formal classroom or computer based training, simulation and team training, the training environment (e.g., classroom, workbench, mockup, etc.), and success measures.

During the development of the basic D&D training concepts, knowledgeable D&D personnel and managers were frequently contacted to obtain input for the study and to ensure that interim study results would satisfy the field need for qualifying workers. Once the primary objectives and

curriculum were globally defined, the study team conducted a two-day workshop with a select group of D&D-experienced participants. The following objectives were presented to the participants of the workshop:

- Review & establish D&D training objectives and activities
- Define conditions to demonstrate proficiency for each objective/activity
- Develop standards of performance for each objective/activity
- Determine supervisory training objectives, conditions and standards of performance.

The workshop involved 14 people and covered all aspects of D&D expertise. The workshop greatly assisted in the final study results and provided for refinement of D&D training objectives and curriculum. The on-site training department later expanded the curriculum into final course outlines, course materials, and instructor guidebooks.

Training Facility Requirements

Since an on-site facility did not exist, several delivery options and facility locations were explored. The training facility requirements are dependent on the course configuration, hands-on training and mockup requirements, student throughput rates, and basic support requirements such as restrooms and locker/change areas. The following high-level objectives and criteria were established for the facility:

- The facility should accommodate all training, from beginning to end, thus allowing the student to complete all basic D&D training at one location.
- The classrooms, pre-evolution briefing space, and mockups should be integrated in the facility, such that the training development can maximize and integrate their use in the detailed training development effort.
- Restrooms, locker rooms, change areas, and other student support functions should be adjacent to and immediately accessible by the students and instructors.
- In order to provide an appropriate simulation, all specialized utilities must be available in the facility, such as breathing air, plant air, temporary air movers, etc.
- The facility mockups should be easily configurable to allow changes in technology and D&D approaches that will evolve over the next several years.

Design for this facility was completed for installation in a dedicated space of 10,000 sq. ft. in an existing warehousing area in an on-site facility. Currently, construction has not started, and negotiations with the on-site union may result in construction of a training facility at an off-site location. In either location, the facility is planned for completion by the end of 2000.

The Final Curriculum and Its Benefits

Although the D&D training program has not been formally implemented at RFETS, senior management has enthusiastically supported development and implementation of the program. The training department has completed course development, and design of a dedicated training

facility is complete. Final location of the facility is the next step, and construction will quickly follow. Some elements of the curriculum are already being taught, but the integrated nature of the program cannot be fully realized until an appropriate facility that provides hands-on simulation and mockup capability is in place. The major result of eliminating the silo training and emphasizing experiential training is illustrated in *Figure 5, Current and Proposed Training Progression*. This figure summarizes the current training requirements, totaling 533 hours per student, versus the new experiential learning progression, totaling 313 hours. This represents a significant savings in both cost and time. However, the ultimate benefit is expected to be in the higher quality of learning, the gaining of team experience, and the delivery of new D&D workers to the field with tested experience and skills that align with the actual work requirements in D&D facilities.

Figure 1 – D&D Worker Staffing – 2006 Closure

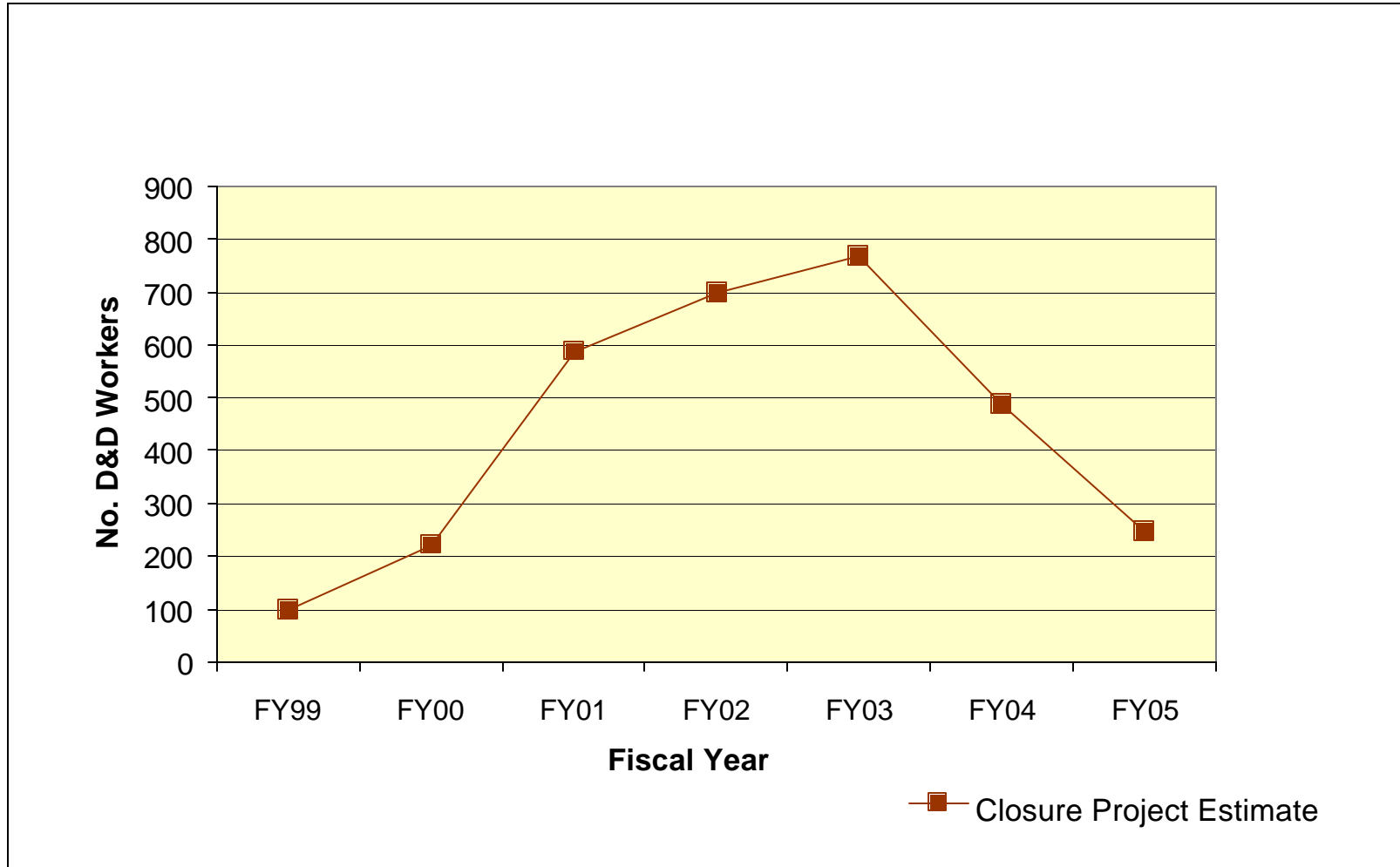


Figure 2 – Transition to Experiential D&D Learning Process

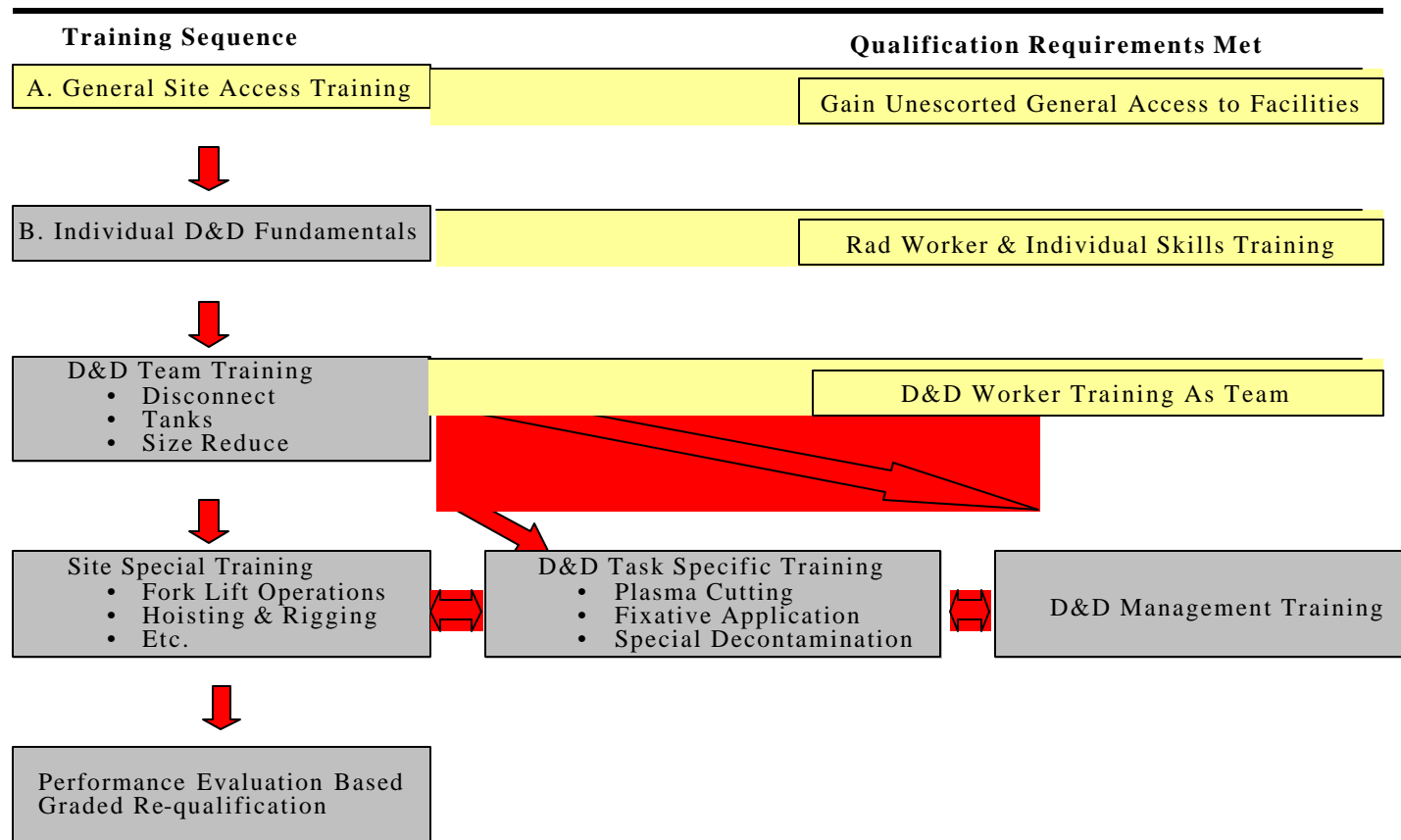


Figure 3 – D&D Program Development

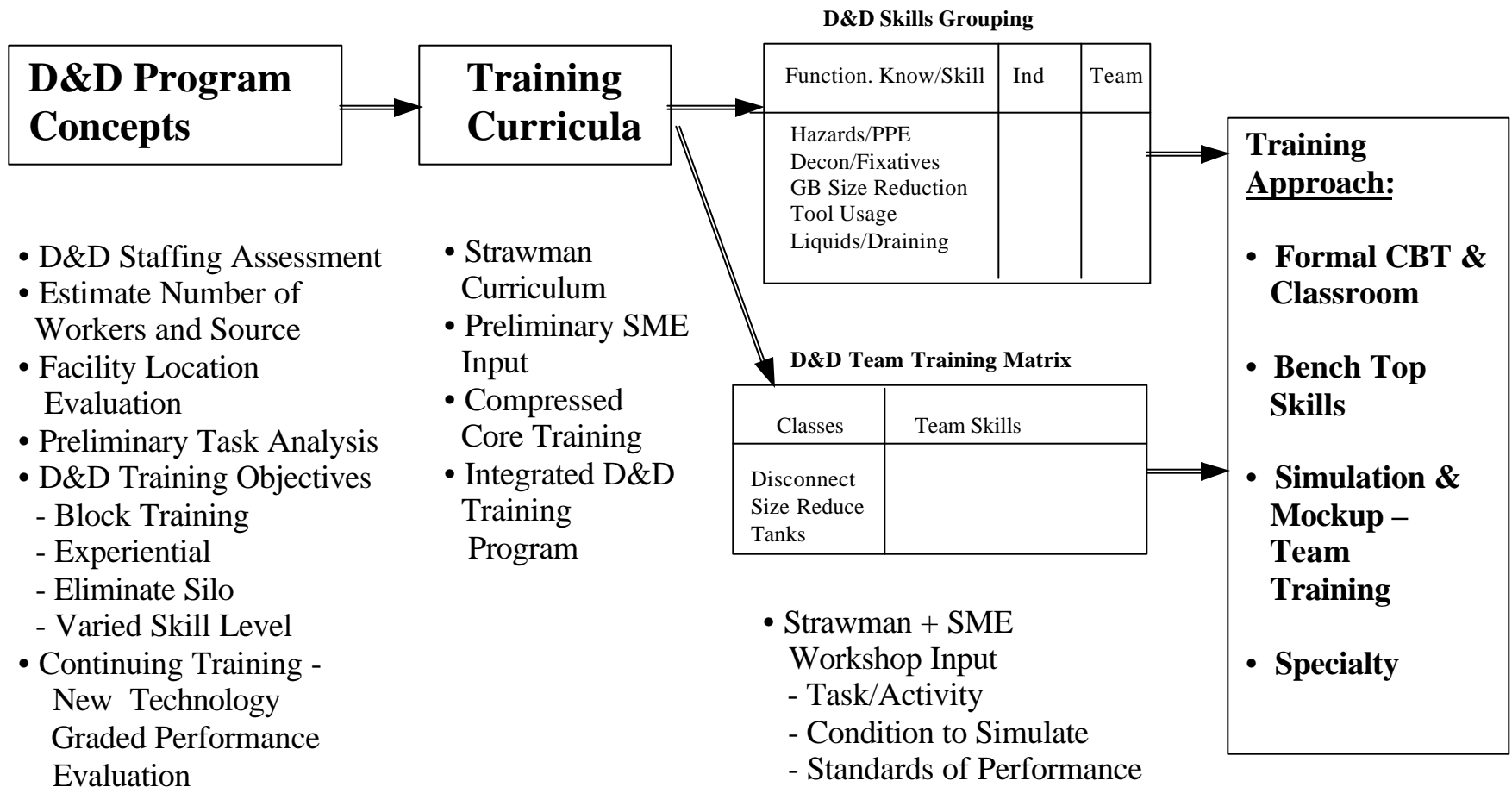


Figure 4 – Stages of D&D Operations

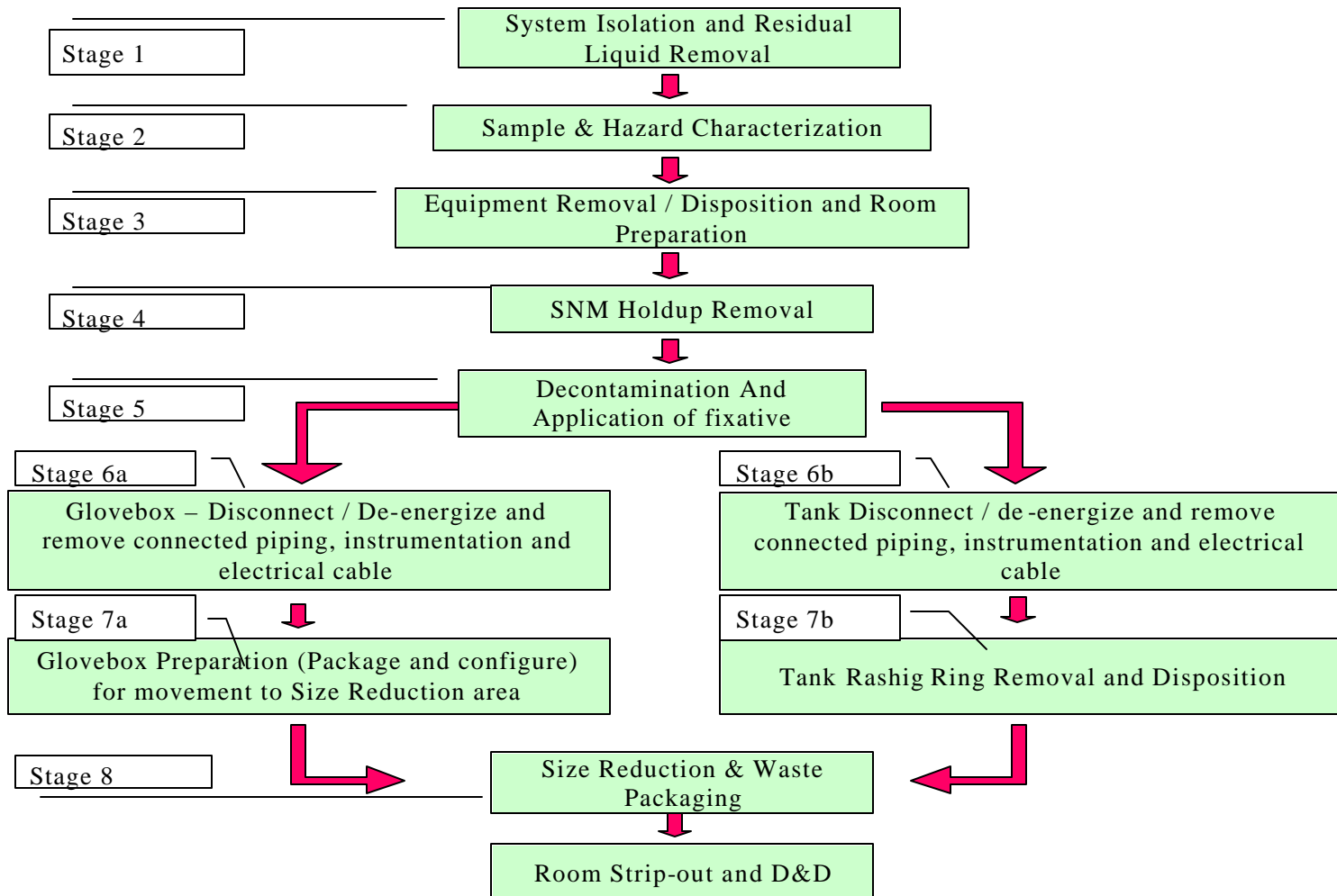
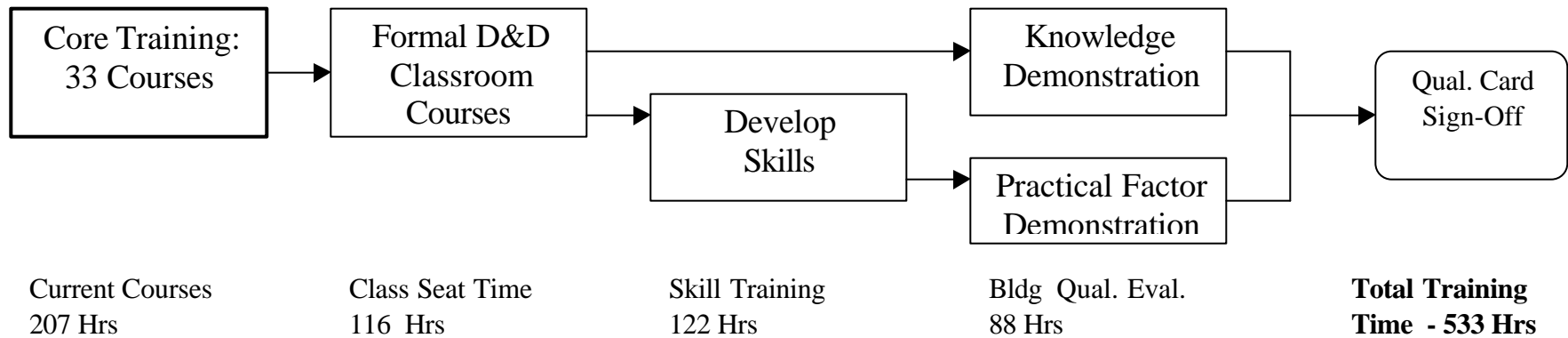


Figure 5- Current and Proposed Training Progression

Current D&D Worker Training Progression:



Proposed D&D Worker Experiential Learning Progression:

