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ENHANCEMENT OF DECOMMISSIONING TRAINING IN THE IAEA

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ABSTRACT

Significant progress has been made in recent years in improving the quality of decommissioning training and expanding the training options available to those in IAEA MS with developing programmes. In this paper we examine the issues and challenges associated with such training, and the initiatives being taken to address them, especially those to improve hands-on opportunitites aimed at improving decommissioning planning and the physical execution of decommissioning activities. The important role played by the IAEA waste management Networks in providing training opportunitites and facilitating the exchange of knowledge and lessons learned is discussed. Expectations and initial steps to create a powerful web-based platform (CONNECT) providing the Network participants with efficient means of access to each other, to qualified experts on specific topics, and to high quality training materials is described. The essential role played in the success of these initiatives by the generous contributions of professionals and organizations in Memebr States with developed programmes is identified and acknowledged.

1. BACKGROUND

Training (in the various disciplines associated with the Nuclear Industry) of professional and managerial staff from the Member States (MS) of the IAEA has long been a key element of the Agency's mission [1]. Furthermore, in a world of continuous learning, the distinction between training and exchange of information becomes blurred. Training, in the broadest sense, involves the investment of a significant portion of the time of each professional staff member, as well as that of support staff, so that enhancing the efficiency and effectiveness of training efforts is an important goal. The transfer of knowledge to a new generation of nuclear professionals (following the long hiatus in the expansion of nuclear facilities) has become a challenge to every MS. Currently training in decommissioning planning and execution supports the IAEA vision of nuclear decommissioning for the second decade of the 21st century, in which all nuclear facilities and other premises utilizing radioactive materials have regulatory compliant decommissioning plans in place and are capable, when required, of implementing these in a safe, timely and effective manner

A well-defined training-scops must take into account the varied needs of MS, the nature of the subject matter involved, and the objectives to be achieved by the training, at both the individual and organizational level.

Training for decommissioning involves several Departments of the IAEA, with the Department of Technical Co-operation(TC) generally taking the lead in organizing and providing the necessary funds for training in MS with developing programmes. The Technical Departments, such as Nuclear Safety and Nuclear Energy, where most of the technical work related to decommissioning occurs, take on the role of developing training materials, defining training programme content and objectives and identifying suitable experts, both those to provide the training and those from the target organizations to receive training. The training process typically involves the following steps with organizations in the MS:

- Assist in identifying training needs and priorities
- Design appropriate training activities for the candidates
- Identify and obtain commitment of suitable candidates for training
- Arrange their nomination to a succession of training activities meeting the needs of the individuals and their organizations
- Retain and guide newly-trained experts in the application of their skills in planning and executing decommissioning tasks in their facilities.
- Assist MS to achieve and maintain a "critical mass" in terms of the numbers of trainees and the distribution of their skills within a country/facility
- Draw-out and share the "lessons-learned" from these application efforts.

A partial list of recent decommissioning training events (courses, workshops, scientific visits) organized by the IAEA is given in Table 1.

Table 1. Decommissioning (D&D) training activities organized for regional and inter-regional participants involving the International Decommissioning Network (IDN) - 2009-2010.

General

- **Training Course on the Decommissioning of Small Facilities (CF) ANL, USA**

- **Regional WS on the Planning and Execution of Dismantlement for RRs and other Small Facilities, ANSTO, Australia (CF)**
- **Manager's Visit to Facilities Undergoing Decommissioning on a Multi-facility Sites, Sellafield and Dounreay, UK (CF)**
- **Annual IDN Meeting/D&D Forum & EPPUNE Workshop on Stakeholder Relationships, Vienna**

Technological Training

- **Workshop on Technologies for Research Reactor Characterization,**
- **Decontamination, Dismantlement and Waste Management, Karlsruhe, Germany (CF)**

Safety-related Training

- **Meeting on Safety Assessment for Decommissioning (in conjunction with the IAEA FaSa Project), Bonn Germany (CF)**
- **Workshop on Activation Calculation, Budapest, Hungary**
- **Workshop on Release of Sites and Building Structures Karlsruhe, Germany (CF)**
- **Workshop on Dose Assessment & Optimization for Decommissioning Purposes Mol, Belgium (CF)**
- **Training Course on Safety Assessment, Risoe, Denmark**

Cost-estimation Training

- **Workshop on Decommissioning Costing Training for PSL implementation, Slavutich, Ukraine**
- **Practical Workshop on the Application of Software for Costing of Decommissioning using IAEA/NEA PSL, Vienna**

***CF: Offered Cost Free to the IAEA**

The recent emergence of Networks in each of the main programme areas in waste management, decommissioning, and remediation as powerful tools for effective knowledge transfer has been widely recognized and these Networks are rapidly becoming a key mechanism for training and exchange of experience between individuals and organizations [2]. The need for a common web-based platform to support the Networks has given rise to the concept of CONNECT, which will be described further in this paper.

2. TRAINING ISSUES FOR DECOMMISSIONING

While training on the basics of any discipline traditionally involves "classroom" type training and exercises, areas of radioactive waste management such as decommissioning additionally require trainees to acquire a practical understanding of the work to be done in the field. This experience is essential in order for course participants to organize and implement projects in their own countries. Over the years a number of challenges to the existing training approaches have arisen. Some of these challenges are that:

- It is difficult to create formal training documents reflecting candidates' needs, where the formal structure of their organizations is not well defined, or - as commonly encountered in organizations transitioning to decommissioning - in a state of flux.
- Decommissioning training needs to take into account various national codes, standards and regulations. It is not practical to address all of these, but building training around Agency Safety and Technical documents offers a "common denominator" capturing the main aspects.
- Rapid turnover of candidates, due for example to changing responsibilities in their organizations, makes sequential training to the needed level of excellence difficult.

- Traditional one-week training courses and workshops are too short for in-depth treatment of topics, and lack a significant hands-on component.
- Many candidates lack a solid radiation protection foundation, without which they cannot appreciate the course content. Even for those with some radiation protection background, their training is in many cases too academic to be useful for detailed decommissioning planning.
- Without practical radiation protection training, candidates cannot take responsibility for their own radiation protection in the field. As a result they cannot fully take part in (and contribute to) field-work essential for their development.

A "classical" training model from a well-respected nuclear organization is shown in Figure 1 [3]. In decommissioning and waste management, the IAEA's efforts to construct such curricula are at an early stage. The process is somewhat impaired by the difficulties listed above, especially the points noted in the first two bullets. As a result, formal curricula have been generally limited to basic training.

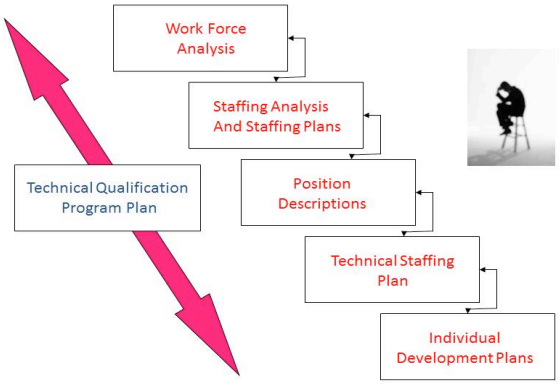

Figure 1. Sequence for identifying training needs of an organization

Additionally, it may not be possible to synchronize the availability of skills with the needs for them in specific national projects. In this case a regional or inter-regional approach may be required, where skilled individuals may travel back and forth between, or even be shared amongst, different facilities with similar challenges. Collaboration, potentially forming the basis for such an approach, has sprung up spontaneously between participants in the IAEA European Regional Project for Decommissioning (RER-3009), involving research reactor specialists in Greece and Bulgaria.

A further issue is that the mechanism used by the IAEA to deliver training courses is currently almost exclusively based on face-to-face events, either in classroom settings or combined with site visits. Training courses are generally run for groups of 15 to 20 people, often travelling from widely separated locations. Travel and accommodation is expensive, and lecturers must usually be employed to deliver the courses. This adds to costs so that every year, there are some individuals who could potentially benefit from such training but are unable to do so due to the limited financial resources available to the IAEA. Reliance on one or two lecturers also restricts the range of topics and viewpoints that can be presented at any given activity, and introduces uncertainties with respect to content and quality.

As a result of these limitations, progress using more traditional means of training has been difficult to achieve. This has led to a number of initiatives in the Agency, employing novel means to tackle the training problem.

3.1 Developing a basic training strategy

In order to respond to the challenges posed in Section 2, a number of parallel initiatives are underway involving a wide range of players, including the divisions of the IAEA previously noted, as well as a number of external organizations that specialize in training. An effective strategy is emerging which combines the following components:

- Basic training covering all aspects of radioactive waste management (RWM)
- Advanced, e.g. specialist topical training, combined with an intensive "hands on" component
- Field internships (termed "Fellowships" in the IAEA) for further development of specialist skills
- Opportunities for on-going knowledge development through direct (or mediated) exchange of views and experience.

These steps are illustrated conceptually in Figure 2 [4]. For the provision of basic training, a combination of face-to-face and video or e-learning modules are proving to be effective. Basic training can be organized either on individual course/workshop basis, or – as most recently done for geological disposal - as an intensive "summer school" [5] lasting 4-6 weeks . The success of this basic training has been based on development of a comprehensive RWM curriculum that covers aspects of both safety and technology with an appropriate balance and that ensures that the two dimensions are delivered in a complimentary and consistent manner.

For initiatives involving the advanced, specialist, training and Field Internships, we turn in 3.2 to the role of the radioactive waste management networks. Following this, we consider the role of CONNECT in providing both access to e-learning and facilitating the exchange of practical experience and lessons learned in pursuit of "best practice.

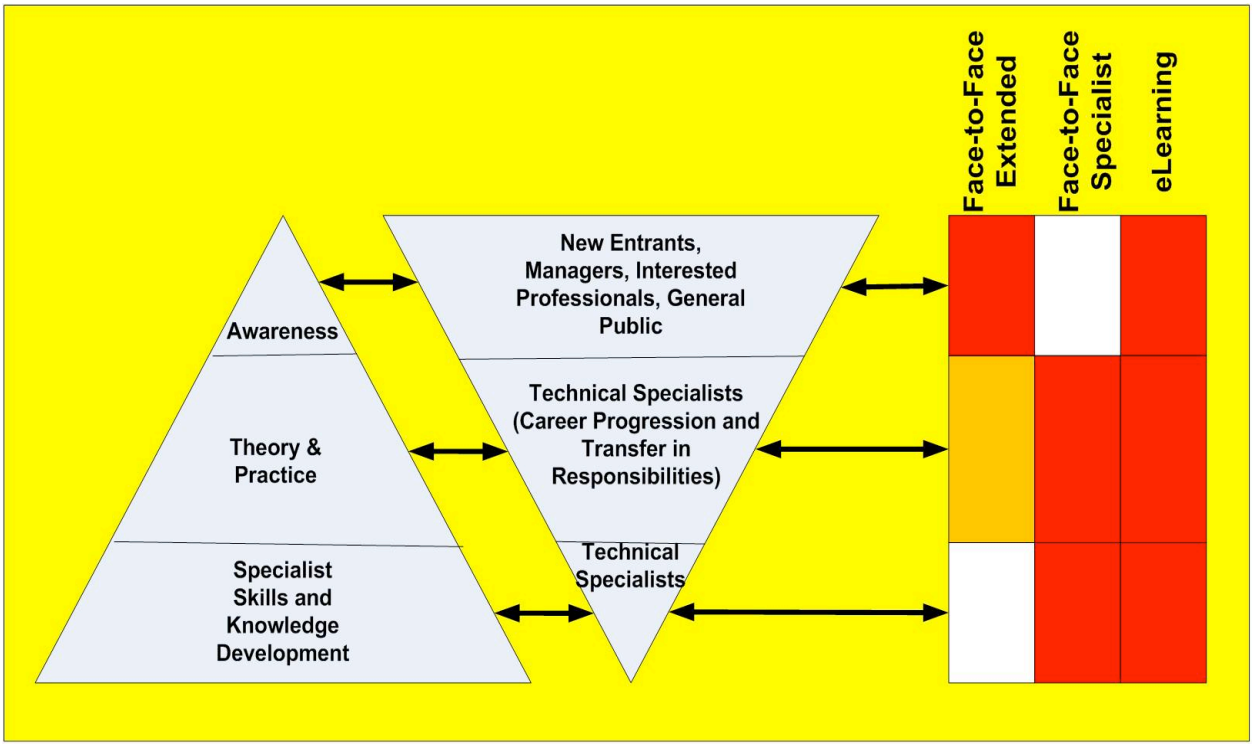

Figure 2. Training levels, audiences and delivery

3. 2 IAEA waste management networks and their role in training

As previously noted, the IAEA has developed and refined the concept of Networks to enhance the effectiveness of its work. The areas of interest covered by the Networks encompass nearly all aspects of Waste Management (Table 2). To date over 100 organisations from more than 40 MS are involved in the Networks as participants. Many Network participants generously donate resources, time and effort to support Network activities, while others with less well developed programmes are still in the process of acquiring experience, capabilities and know-how. Regardless of the stage of development, all Network participants share in the mutual benefits that arise from improved communications with sister organisations and the sharing of experience and knowledge. The Networks share a common focus on continuous improvements in communication and knowledge-sharing between Network participants and the provision of enhanced opportunities for training, involvement in demonstration projects and the development of novel technologies and methodologies.

- Geological Disposal **(URF Network**, established in 2001);
- Decommissioning of nuclear facilities (**IDN**, established in 2006);
- Near-Surface Disposal of LLW (**DISPONET**, established in 2009);
- Environmental Remediation of radioactively contaminated sites and environmental management of active sites (**ENVIRONET**, established in 2009); and
- Characterisation of LILW (**LABONET**, established in 2010).

Table 2. Radioactive Waste |Management Networks

The Network most relevant to Decommissioning is the International Decommissioning Network launched in 2007. The IDN is a joint initiative of the IAEA's Departments of Nuclear Energy and Nuclear Safety to: create awareness of decommissioning needs and priorities amongst organizations worldwide, implement safe, timely and cost-effective decommissioning, and enhance training and the sharing of experience.

Recently, the Scientific Secretaries of the IAEA's Waste Management Networks have pursued the concept of a "Network of Networks", specifically via the use of an internet-based platform which could respond to the growing requirement for communication between members of technical interest groups and also provide for much more effective delivery of training. Named CONNECT, the design of this platform is advancing rapidly with broad support inside and outside the IAEA.

In this Section, we look in detail at the IDN and also the CONNECT platform, and discuss their potential to address the underlying issues for training outlined in 2.

3.2.1 Topical training and experience with the IDN

At the 2009 annual IDN Forum in Vienna, the issue of effective training was a central theme which received extensive attention in break-out discussion groups. The long-standing challenges faced by the Agency in providing effective decommissioning training referred to above were discussed. While these challenges are widely shared by organizations engaged in training, decommissioning training faces additional challenges comprising a lack of:

- Practical field experience amongst candidates
- Venues where candidates can receive hands-on training
- Resources to assign candidates for extended periods
- Mechanisms for sharing of information within and outside organizations

In particular, it was observed that the objective of decommissioning training is not to immediately, or even necessarily, produce expert practitioners able to lead complicated field activities. Rather it is to produce competent professional planners and project managers able to prepare decommissioning plans and to specify and quantify the resource requirements for their particular situations, including the necessary specialty services required. From 2012 onwards, regional and inter-regional training programmes in decommissioning will also address the training of practitioners able to contribute meaningfully to project implementation.

The IDN, with over 50 participating organizations from around the world and it's focus on sharing of practical experience, is in an excellent position to assess and respond to these challenges. During its brief history, the IDN has been supported by the generosity of participating organizations and individuals in decommissioning. Leading organizations in the field have offered to host a wide range of training courses and workshops. Many of these have been held "cost free" to the IAEA and over 200 attendees were accommodated in 2009-2010 alone. Early on, a "formula" emerged amongst the most successful of these events:

- They were hosted by experienced organizations at venues with ongoing decommissioning activities
- The lecturers and discussion leaders were highly engaged practitioners

- Participants were afforded the opportunity to observe and then work directly with equipment and tools used to perform the work, under the supervision of the field technicians.

The last point has been the most challenging to arrange, as considerable imagination has to go into making the experience as realistic as possible, recognizing it is not usually practical to permit visitors to a facility to engage in work which may involve exposure to radioactive materials. Therefore extensive use of video, mockups, and computer simulations has to be employed. Examples of these video materials can be seen on the IAEA's decommissioning web-site at [7]. With the initial use of this video material came the realization that it would be possible to use such material both to enrich face-to-face training, and to use it in the construction of "e-learning" modules for distance-learning. With the support of the Japanese EPPUNE Project, a demonstration film on how to capture decommissioning video in the field was prepared [8]. Video materials and e-learning will be explored further in 3.3, where CONNECT is discussed in further detail.

3.2.2 Accelerated field-oriented learning

Addressing the challenges and recognizing the progress to date, participants at the 2009 annual meeting endorsed a three- step programme to increase the effectiveness of training, consisting of:

1. Radiation protection training, to permit candidates to work without a permanent escort in the field
2. Intensive training on specific D&D topics
3. Field internships (Fellowships)

The purpose of the first two bullets is to enable the third: it is **unreasonable to expect a host organization to receive a trainee without the trainee being able to provide value to the host**. The participants also recognized the value of employing an established decommissioning training framework as the basis for intensive training on specific D&D techniques. As an initial step, it was decided to use the existing ANL/ORAU Decommissioning Certificate [6] as a starting point to pursue training of a qualified cadre of trained decommissioning professionals.

During 2010/2011 considerable progress has been made in realizing these three elements. The US Dept of State has supported ANL's efforts to expand its Facility Decommissioning Course to two weeks, and the course in 2011 combines D&D and environmental remediation, with common field practice. ORAU has also indicated its intention to provide a mentored field practice module (or "practicum", placing the students in the field to observe and assist for the portion of the Decommissioning Certificate offered in Oak Ridge. This module would offer extensive hands-on use of radiological instrumentation, complete with calibration laboratory and field survey exercises. The practicum would be geared to current decommissioning challenges and practical solutions.

Sequencing of training is important, and ANL recommends that the Decommissioning Course be taken strategically in the Certificate Programme so as to assist in consolidating the candidate's understanding of the process. For the 2010 Argonne Decommissioning Course the course was structured to maximize practical hands on training. The main observations from this experience included:

- The need to create a sense of realism in the training is paramount. When the participants have the opportunity to use actual field equipment, they begin to understand the

difficulties associated with each piece, and can apply that knowledge to better plan the work processes and time requirements.
- Different teaching and learning styles mean that materials need to be presented in complementary ways by different experts.
- Bringing together trainees from different backgrounds and jobs allows them to network, share their experiences, and help one another to understand and solve problems in creative ways

It is important to note that the level of technical training and field experience varies extensively amongst IAEA decommissioning training candidates. It is important, therefore, to keep the focus of initial training at a basic level, and to match the theoretical content to the actual skills to be developed through field re-enforcement – a well-known training principle. Both ORAU and ANL components of the "Augmented" Decommissioning Certificate Programme as described above fully incorporate these principles.

3.3 CONNECT: CONNECTING THE NETWORK OF NETWORKS FOR ENHANCED COMMUNICATIONS AND TRAINING

As noted above, CONNECT is designed to facilitate the exchange of expertise and knowledge through the use of internet-based technologies and to develop the multimedia content of the Networks for distance training including both activities structured in accordance with formal curricula as well as less-formal "how to" training.

Over time, it is expected that the services of CONNECT will become self-supporting and will expand to become the standard "way of doing business" for the Agency around the world, as its functions replace less efficient and less effective training and assistance with direct support amongst the participants of all IAEA Networks. It is important to emphasize that internet-based training is not intended to fully replace face-to-face training, but rather to complement it.

3.3.1 Scope

CONNECT will provide a common platform suitable for use by all IAEA Networks with similar needs, objectives, activities, and methods of work. CONNECT will focus on meeting the needs of the various Networks based in the Department of Nuclear Energy, including both those addressing Radioactive-Waste topics such as Decommissioning, Environmental Remediation, and Disposal (Table 2) as well as nuclear design topics such as instrumentation and control.

The key functions of CONNECT are to facilitate interactions between Network Participants such as discussion forums and co-operative document production, and provide an e-library of audio-visual material (which will either be created from current or from newly developed training materials as part of the project) and a data-base of concise, structured summaries of the "lessons learned" from successful and unsuccessful projects.

3.3.2 Participation

Connect is designed to serve individuals (users) belonging to organizations associated with the IAEA Networks (Network Participants) indicated above. Individuals seeking to participate actively in CONNECT will be expected to first join one of its associated Networks. In general, such participation requires the participant to be (a) professionally engaged with an organization belonging to one of the Networks and (b) personally willing and able to contribute professionally to the work of the Network in which he/she is enrolled.

The work of the Networks is essentially "non-commercial", and while individuals from private, commercial organizations are not excluded from joining one of the IAEA Networks, their activities are expected to be consistent with the objectives and non-commercial nature of the Networks.

Organizations (such as Sandia National Laboratories which has created the CONNECT pilot platform) with a demonstrated breadth of knowledge and experience with systems like CONNECT, willing to contribute actively in the development and operation of CONNECT, are expected to "partner" in the implementation of CONNECT.

3.3.3 Activities

Creation of CONNECT will involve development of a web-based e-platform application, which will be configured to provide the following functions:

- A streamlined process by which register users can register themselves, providing a complete professional profile of his/her background and technical interests, current challenges, and successful experiences.
- A search capability to permit individuals to find relevant contacts with specific expertise with a minimum of effort (using the above facility), to find reliable information and to efficiently contribute their knowledge and skills to problem solving through the Networks.
- A "workspace" where technical and scientific issues of common concern can be examined
- An e-library of multi-media material, based on provision of new or enhanced training materials (structured in accordance with established radioactive waste management curricula) and suitable for training courses, workshops, post-event review, and other activities.
- Collection of concise summaries (i.e. "lessons learned") from completed activities in a prescribed format documenting the nature of the challenge, approach taken and lessons learned.
- The majority of the work foreseen in creating CONNECT involves the development, upgrading and improving of training materials to permit them to be used as web-based audio-visual materials, and creating and populating the data base of experience summaries noted above.

In this regard, in the 2010 Decommissioning Forum, participants were encouraged to bring and share examples of:

- video clips of relevant decommissioning field activities
- "lessons learned" in a defined format, suitable for inclusion in a data-base
- "photo collages" of important field-sequences of decommissioning work in their facilities

The quality and diversity of contributions demonstrated the willingness of participants to share experience in this way and that, in future, efforts should be made to make these resources available via CONNECT

4.0 CONCLUSIONS

In conclusion, the IAEA is engaging in novel training processes aimed at the accelerated development of competent planners and project managers in Waste Management. The process involves a strong focus on conveying practical understanding of decommissioning tasks and to re-enforcing the personal bonds between practitioners with the aim of sharing experience and knowledge. This process has been enthusiastically supported by participating organizations in the MS. It is anticipated that these training initiatives will bear fruit in the form of accelerated decommissioning activities in many MS.

5.0 ACKNOWLEDGEMENTS

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APPENDIX 1 - accelerated field-oriented learning – a case study

As discussed in Section 3.2.2, to provide training to decommissioning practitioners to enable them to engage in effective decommissioning planning and review requires more than classroom training and field observation. Direct engagement in the field, as a participant in field-teams is required. Only in this way can the candidate acquire sufficient understanding of the work, in particular on a task by task basis: the skills required, durations of activities, optimum number of workers engaged in each, and appropriate radiation protection techniques. Furthermore there is a need for the candidate to gain an appreciation of the manner in which individual tasks fit together to form the overall plan. While many practitioners spend their entire careers perfecting these skills, the limited resources available to the IAEA and the urgency assigned to training candidates to a functional level necessitates that this training be carried out in a compressed manner in a short time span. As noted in the main body of the paper, the ANL/ORAU Decommissioning Certificate (Fig A-1) was considered as a worthwhile point for this compressed training, since it had already been used for this purpose for training candidates from many countries, and ANL and ORAU have been active in supporting IAEA training initiatives. In this instance, the five-week ORAU course in Applied Health Physics was followed by:

- MARSSIM (1 week)(Orau – Oak Ridge, Tennessee)
- Site Characterisation (1 week)(Orau – Oak Ridge, Tennessee)
- Enhanced Facility Decommissioning (2 weeks)(Argonne – Chicago, Illinois)

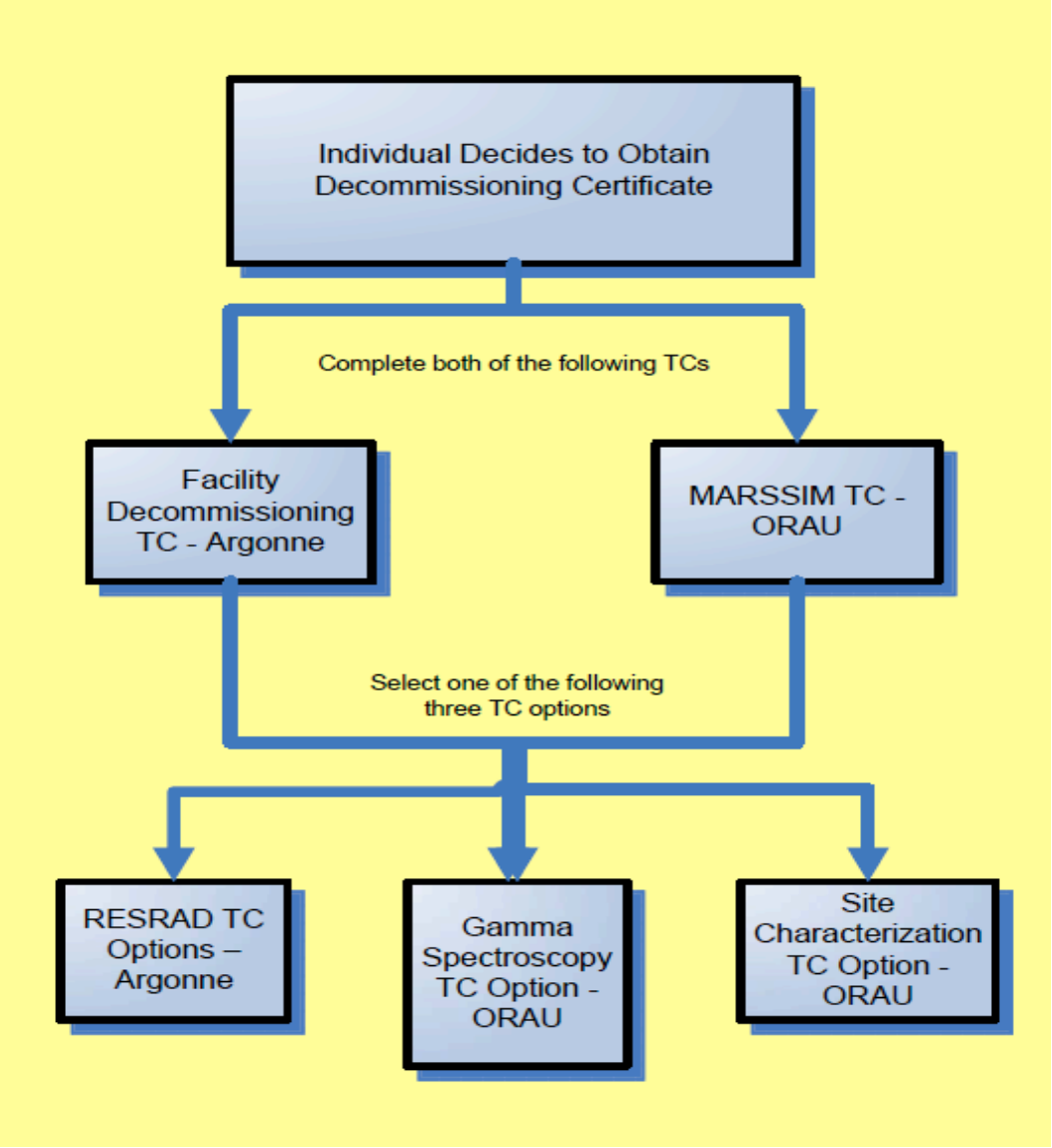

Figure A-2: ANL/ORAU decommissioning certificate programme

In the five (5) week Applied Health Physics course participants were given a foundation of radiological principals and through the practical component incorporated into the course, were given the opportunity to learn about and practice the tools used in the industry.
The MARSSIM (Similar to EURSSEM) course guided participants through the MARSSIM survey and clearance process and calculations. In this one (1) week course an overview of radiological survey types, the data quality objectives process, selection and application of DCGLs, background reference area selection, survey instrument detection sensitivity, area classification, statistical design of surveys, measurement uncertainty, and performance of statistical tests were addressed.
The one (1) week Site Characterisation course, participants were taught site evaluation, data planning, survey implementation and tools, surveys for radiological and chemical contaminants, safety evaluations, planning and budgeting, data interpretation, data quality objectives and assessments, and

decision making processes involved in the historical site assessment, scoping survey, and characterization survey phase of decommissioning. They also were given the opportunity to use some of the computer tools available to facilitate surveying and characterising for MARSSIM and to see how they could be used in the field. In the (2) week Enhanced Facility Decommissioning Course, information was provided on the basic steps in the decommissioning process, the new technology available to assist in the decommissioning process, methods of decommissioning costing, and lessons learned from past experience in decommissioning. As this was the enhanced facility decommissioning course, there was also an opportunity to practice what we learned in the first week and participate in demonstrations of tools and programs.

The training program followed consisted of the above courses, with a three-month internship with NECSA "sandwiched" between the ORAU courses and the two-week "extended" version of the ANL decommissioning training.

At both ORAU and ANL, it was possible to arrange for the candidate to work as a volunteer "field assistant" in course implementation: At ORAU, the candidate assisted with the implementation of a MARSAME course which occurred during the ORAU sojourn, focussing on instructing participants in the practical exercise procedure and preparing survey equipment and materials. During the execution of the exercise, the candidate was able to assist the course participants to identify considerations that might affect their MARSAME surveys. The candidate also participated in a field survey of a wooded area, to become familiar with the use of, advantages and restrictions/disadvantages of GPS equipment in performing field surveys (Fig A-2). An important "take away" from this experience was the knowledge of the amount of time it takes to perform a field survey and analyse the samples. At Argonne, the role was mainly to assist in development of the practical exercises. Three exercises were decided upon: a costing exercise, an interior decontamination planning and implementation exercise, and an exterior survey planning exercise. One of the key aspects of the last two exercises was a hazard assessment. For this internship, the candidate, under the guidance of an experienced IAEA Expert, generated Job Safety and Hazard Assessment checklists for the participants to use to assist them in the completion of the Exercises (Fig. A-3).

Figure A-2: Field Survey utilizing GPS Backpack and Portable NaI detector

Figure A-3: Participants Completing Job Safety and Hazard Assessment Checklists During the ANL Decommissioning Course

The three month internship with NECSA allowed the candidate to "cement" the knowledge gained at ORAU and prepare for the ANL Decommissioning Training. The internship began with "walk downs" of a number of facilities associated with radioisotope production and uranium processing, including the uranium conversion facility currently entering decommissioning (Fig. A-4). All the asbestos has been removed successfully, which took over two months and required a month of training and procedure-development and testing prior to commencing the removal of the asbestos. During this sequence, the chemical as well as the radiological contamination hazards (specially airborne issues) of uranium contaminated facilities were re-enforced for the candidate.

Figure A-4: NECSA Uranium Conversion Facility Awaiting Decommissioning.

Following the "walk downs", the candidate was assigned to work on regulatory comment dispositions, editing and assisting in their preparation for submission to the regulator. This experience provided an overview of the regulatory aspects of decommissioning. While up to this point all the training had been specifically geared to physical decommissioning and surveying, by seeing the projects in written as well as physical form, it was possible to get an overall perspective on decommissioning as a project instead of as specific tasks and thus grasp its extent. With this experience in hand, it was possible to contribute to the logical structuring of decommissioning procedure documents and the drafting of a decommissioning plan for a small chemical facility. The final field activity at NECSA involved participation in the decommissioning of a sources vault that was located in a formerly contaminated facility. Although securing and moving of the sources were the objectives of the activity, the possibly contaminated ducting running through the vault was the primary concern in the dismantlement process. Observing the process used to ensure that the least number of people necessary were exposed to the sources, and that no one was unnecessarily exposed to dust/debris from the dismantlement of the ducting provided an important lesson in the dynamics of a field decommissioning project and the importance of well-structured written procedures.

In summary: through a combination of carefully selected courses, based on the historically successful ORAU and ANL offerings, and equivalent periods of field practice and a three-month internship focused on practical application of these skills, it was possible within seven months to acquire a sufficient working knowledge to participate meaningfully in both planning and field-oriented decommissioning activities.