# Expedited Release Process for the Decommissioning of Sites with Low Residual Levels

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## ABSTRACT

The decommissioning process for the release of formerly utilized nuclear sites can be a protracted and sometimes arduous process. The path forward typically includes a preliminary assessment of the facility history, followed by a comprehensive characterization of site conditions, and then decommissioning planning, with feasibility studies and input to the National Environmental Policy Act (NEPA) process. The last step is the performance of a final status survey (FSS).

In some cases, a site or a portion of a site may have low concentrations of residual radioactivity that are expected to meet appropriate risk or dose-based health and safety standards. In these cases, the multi-step process that includes remediation and subsequent final surveys would not be necessary if characterization data of appropriate quality and quantity are utilized in place of a separate FSS , thereby streamlining the release process.

At a site that underwent decommissioning in the late 1970's but where the need for additional remediation was questioned, an Expedited Release Process was developed to satisfy FSS requirements using characterization data only. A pre-condition was that the characterization survey be designed to meet data quality requirements applicable to a final status survey. Since there was an expectation that most, if not all, of the areas at the site would meet unrestricted release criteria, the stakeholders agreed to expedite the decommissioning process for these areas, as much as possible.

In order to implement the expedited process at this site, characterization data developed in accordance with final release criteria were applied directly to the closeout assessments in place of a separate FSS. This Expedited Release Process is expected to be effective in accelerating the closeout of the areas, thus conserving time and resources. It may also effectively eliminate the need for an additional mobilization in order to conduct a separate FSS.

## INTRODUCTION

An Expedited Release Process has been employed in the decommissioning of the Diamond Ordinance Radiation Facility (DORF) at the Walter Reed Army Medical Center's (WRAMC), Forest Glen Annex. After removal of major reactor components, much of the remaining land and building surfaces exhibited low residual radioactivity levels when final surveys were performed in the 1970's. While the extent and quality of

those data would not meet the standard of practice expected today, the current stakeholders in the process are reasonably confident that the facility will not require remediation to meet unrestricted release criteria, thus there is a desire to accelerate the formal decommissioning process so that the transfer of the property to new ownership, under the Base Realignment and Closure (BRAC) initiative, can move forward expeditiously.

The Expedited Release Process offers the opportunity to shorten the decommissioning process by eliminating the need to conduct a separate Final Status Survey (FSS) for demonstration of compliance with release criteria. In this case, the plan was to use characterization data in place of a separate FSS, which is consistent with the guidance found in Vol. 2 of NUREG-1757, Consolidated Decommissioning Guidance [1]

However, the data acquired during characterization must be designed to meet the data quality requirements of a FSS. These requirements are more stringent for the FSS than for the traditional characterization survey. In addition, in order for this approach to be successful, the preliminary assumptions about the benign radiological condition of the site must be valid. Therefore, a commitment to employ the Expedited Release Process was made during the planning stages of the decommissioning effort. Good planning and the establishment of Data Quality Objectives (DQO) were essential to the success of the approach, with integrated management of data needs, implementation of an appropriate decision framework, and the management of decision error being key elements in the process.

In addition to the Expedited Release Process, an alternate approach to Area Classification was implemented, which was consistent with the spirit of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) [2] graded approach to conducting the FSS, resulting in designating one Operable Unit (OU) as Class 1 for beta/gamma activity, and Class 3 for alpha activity. The justification for this alternative was based on the expectation that the radionuclides driving the need for alpha-related information had a low probability of being present in comparison to the beta/gamma-emitting radionuclides, and were a result of distinct pathways within the conceptual site model. Since the groups of radionuclides had separate source terms and different measurement methods, dual classifications for survey levels of effort within the same SU, was deemed acceptable. As a result, the lower frequency of data collection requirements for Class 3 surveys allowed the more labor-intensive alpha measurements to be carried-out at reduced cost to the stakeholders.

## DORF DECOMMISSIONING

The Diamond Ordnance Radiation Facility (DORF) is located at the Forest Glen Annex of the Walter Reed Army Medical Center (WRAMC) in Montgomery County, Maryland. The DORF utilized a research reactor with associated experimental equipment to study the effects of neutron and gamma radiation on materials and electronic/electrical components. Reactor operations at the facility ceased in 1977. Decommissioning activities were then conducted from 1979 through 1980 to remove fuel rods, the reactor core, process equipment, and radioactive waste. Under the jurisdiction of what is now

the Army Reactor Council (ARC), the facility was released for unrestricted use based upon survey data showing general consistency with the release criteria in USNRC Regulatory Guide 1.86.

Prior to 1998, the building that housed the former reactor began to be used for the storage, processing, and packaging of short-lived radioactive waste from research and medical operations that were ongoing at the WRAMC. Those operations were authorized under the provisions of a USNRC radioactive materials license. All containerized medical waste has since been removed from the facility.

In the late 1990's, the ARC requested a survey of the ambient photon radiation levels in the DORF Exposure Room for comparison to limits applicable at that time (five microR per hour at a height of one meter). The survey results demonstrated ambient rates ranging from 25 to 30 microR per hour, thus the ARC issued a permit for the residual contamination/activation products to ensure future decommissioning consistent with current standards.

As a result of the BRAC initiative, the DORF was identified for property transfer to the Ft. Detrick Command. The various stakeholders were interested in creating the appropriate health and safety conditions at the site that would allow termination of existing permits and licenses prior to the transfer of ownership. The ultimate objective was to release the DORF for unrestricted use, with regards to residual radioactivity, and deliver it to Ft. Detrick once the site is removed from regulatory control.

The residual radioactivity, on land areas and building surfaces at the DORF are the result of former Army reactor operations and the interim storage of USNRC-licensed medical waste. The Radionuclides of Concern (ROCs) from reactor operations include Mn-54, Co- 60, Fe-55, Cs-134, Eu-152, Eu-54, and H-3 (tritium). The ROCs associated with the medical waste stored at the facility are C-14, tritium, Eu-152, and depleted and natural uranium. The levels of residual radioactivity at the DORF, based upon primarily historical information and limited survey data, were expected to be well below the criteria for free release of the facility. Consequently, a plan was put in place to use characterization data in accordance with the FSS for expedited release, an approach that is consistent with the MARSSIM guidance. The success of the approach depends on the validity of assumptions about the radiological conditions of the site.

## OVERVIEW OF THE RELEASE PROCESS

Decommissioning at sites in the U.S., that have handled radioactive materials, are carried-out under the auspices of the Department of Energy (DOE), the Department of Defense (DOD), the Nuclear Regulatory Commission, (NRC), and the Environmental Protection Agency (EPA). The DORF decommissioning had multi-agency involvement, wherein the Department of Defense, the Department of Army, and the USNRC have jurisdiction. Fortunately, the Army elected to rely on USNRC guidance to meet its internal regulatory requirements, which simplified the process a great deal.

The USNRC regulates decommissioning under 10 CFR Part 20, Subpart E, Radiological Criteria for License Termination. These rules are supported by the guidance found in NUREG-1757 and NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

USNRC guidance generally describes a decommissioning process with identifiable steps that lead to regulatory release of the site. The process utilizes data sources, such as the Historical Site Assessment (HSA), Scoping Survey, Characterization Survey, Remedial Action Survey, and the Final Status Survey (FSS), to provide data and information on the radiological conditions of the site and as input into its Deactivation and Decommissioning (D&D) decision-making. The data and information are utilized to develop remediation strategies and choices of remediation technologies, decommissioning plans (DPs), waste management plans, and dose assessment options. This information is also utilized to develop FSS plans, under MARSSIM, as part of the closure phase in the process. The Data Quality Objectives (DQO) process [3] is instrumental in identifying data quality requirements for these data sources and in the management of decision error.

The traditional approach to decommissioning is to develop a Conceptual Site Model (CSM). The ROCs that are expected to be present at the site are extracted from a master list of radionuclides associated with the facility operations and the processes that took place at the site. Radionuclides are eliminated from the master list by considerations of half-life, insignificant contributions to dose, and other operational information such as records on accidents, spills and releases.

In the CSM, the site is partitioned into OUs according to the best approach to managing the decommissioning activities. The OUs, selected according to past facility operations, land and building usage, and special use areas, are further partitioned into Survey Units (SUs), which are regulatory units for which compliance with release criteria must be demonstrated. SUs should match the footprint of the reuse scenario employed for dose assessments. Full release of the site is a culmination of the release of areas based upon the regulatory release of each SU. As a decommissioning strategy, partial release of areas can occur in an interim period prior to full release of the site.

Remediation strategies and technologies are developed based on the extent of cleanup required to meet health and safety standards for release. Remediation plans are generally included as part of the DP, and are usually not carried-out until an approved DP is in place. National Environmental Policy Act (NEPA) process requirements for ensuring public input into the process are also described in the DP. Certain cleanup efforts of limited scope and supporting the investigation process may be incorporated into the characterization and measurement phase of the decommissioning effort without having an approved DP. For example, a test-decon approach may be applied with the purpose of identifying appropriate remediation technologies available.

Release criteria applicable to any given site may be based upon dose assessments for one or more end-use scenarios, or conservatively-derived screening criteria, such as those

found in NUREG-1757, may be applied. Screening criteria result from the use of dose models with default input parameters designed to incorporate conservative assumptions with respect to receptor pathways, source term, and other pertinent criteria. Site-specific release criteria are typically more useful when realistic values are desired. However, the use of site-specific values typically requires development and subsequent regulatory approval of a DP, while the use of screening values may not.

The FSS is the acquisition of measurement data for comparison with the approved release criteria. It is generally conducted in accordance with the guidance found in MARSSIM, which addresses DQO requirements, procedures and measurement methods. Area Classifications for the SUs are utilized as a graded approach to determining the level of effort required in the FSS. The level of effort is reflected in the number of samples to be evaluated and the percentage of surfaces or areas that require data acquisition (i.e., scans). If a FSS is performed pursuant to MARSSIM, the resulting data should be of sufficient quality and quantity for decision-making, which includes decisions based on the results of the statistical tests and the elevated measurement comparison (EMC).

Closure activities at a decommissioned site would usually include the termination of permits and licenses. A closure report would document the results of the decommissioning effort and the FSS, thus providing stakeholders and their regulators with sufficient justification to release the site. The site would be released for unrestricted use, meaning it could be put to any purposes without further regard for radiological issues, including transfer of ownership.

## SUMMARY OF THE EXPEDITED RELEASE PROCESS

The Expedited Release Process, described in this paper, was applied to the decommissioning of the DORF. The process was based on the utilization of characterization data, not only for evaluating site radiological conditions, but for the demonstration of compliance with release criteria in accordance with FSS criteria for the site. The Expedited Release Process is applicable to sites such as the DORF where residual levels of radioactivity are low and compliance with applicable release criteria may be met without the need for remediation. The only condition is that the characterization data meet the data quality requirements for the FSS, which are more stringent than those for the typical characterization survey. Characterization data is generally used to provide input into planning the MARSSIM FSS and as input into decommissioning program decision-making.

The assumptions about the radiological conditions of the site, which are made prior to the acquisition of characterization data, are critical to the success of the Expedited Release Process. However, if the data acquired demonstrate the need for remediation before compliance with release criteria can be considered, then the process must be aborted and the typical decommissioning process would ensue. The full process would involve the development of a DP and the performance of a separate FSS after remedial actions are complete. The Expedited Release Process for sites with low residual levels of radioactivity, would therefore eliminate the need for the performance of a separate FSS.

It would also compress the time necessary to achieve site release and result in significant cost savings.

The steps in the Expedited Release Process utilized at the DORF are shown in Fig. 1. This flow chart represents a data life cycle approach that includes planning, conducting, assessing, and deciding phases of the process. In the *planning* phase, documents developed included the Sample Analysis Plan (SAP), the Accident Prevention Plan (APP), the Waste Management Plan (WMP), and the Final Status Survey Plan (FSSP). The SAP is a detailed description of how characterization measurements were to be carried-out. The SAP was developed based on the Historic Site Assessment (HSA) and preliminary judgmental, scoping-type measurements. For the application of the Expedited Release Process, the characterization measurements described in the SAP must meet MARSSIM FSS and DQO requirements. The APP identified hazards and details the safe implementation of the work plan. The WMP identified the materials and equipment to be staged for off-site disposition and described the characterization procedures and methods to be employed.

For the Expedited Release Process described here, the FSSP becomes a second-tier document, with much of its plans and procedures transferred to the SAP. The FSSP and the results generated pursuant to the FSSP will be incorporated into the Site Closure Report. The DORF decommissioning planning package will then be subject to stakeholder review before being finalized and presented to the applicable regulatory agencies. Coordination with various cognizant entities, including the Army, DOD, USACE, State of Maryland, and the USNRC, was an important element of the process.

During the *conducting* phase (Fig. 1), there was a mobilization of resources at the site, including the deployment of personnel to conduct characterization measurements and to remove waste materials and debris from the building. Measurements that were made on land areas and building surfaces included direct measurements, sampling, scans, concrete cores, soil cores, material extractions and surface swipes. Also carried-out were release surveys for materials and equipment staged for removal to offsite dispositions.

Intervention Levels (ILs) were set for characterization measurements where test-decon could be applied to areas that exceed the ILs. Pre and post-data were compared to determine the effectiveness of the test-decon technology. The approach used was that if post data reduction shows the release criteria cannot be met, then the data acquired would be used to develop the DP for the applicable SU(s). In that case, the initial assumptions about the radiological condition of the area would be invalidated and the Expedited Release Process would be terminated for that SU. If test-decon post data indicate a reduction in residual levels below the IL, then the Expedited Release Process would continue.

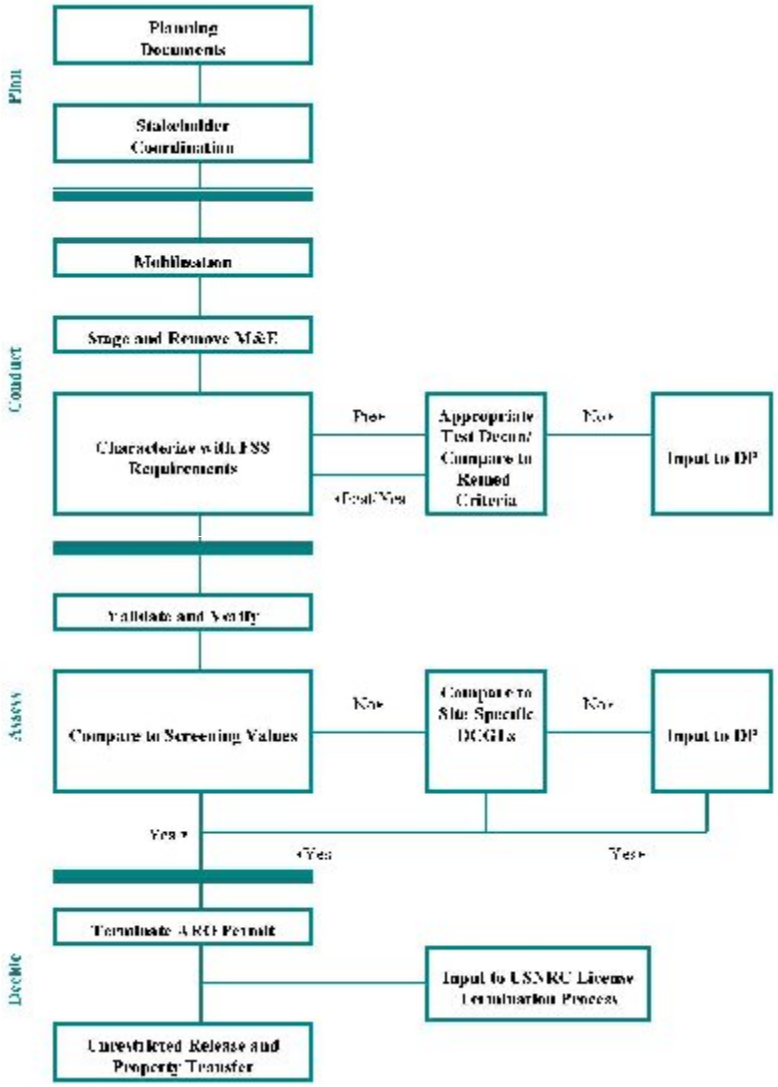


Fig. 1. Expedited Release Process for the DORF

In the *assessment* phase of the Expedited Release Process (Fig. 1), the appropriateness of the program plans is verified. Data are validated and compliance with the plans is documented. For the DORF decommissioning, USNRC screening values were used rather than site-specific release criteria. If the data acquired show a particular SU exceeds the conservatively-derived screening values, then site-specific criteria would be established and presented within a DP. If the comparison is favorable, then the Expedited Release Process can continue to the decision phase for a particular SU. If the data still indicate residual radioactivity above the site-specific release criteria, remediation would then be required, with data used as input to the DP, and the Expedited Release Process being terminated for the SU.[1]

[1] It should be noted that the Expedited Release Process may be terminated in the *conducting* phase, based on individual measurement results, or in the *assessment* phase,

In the *decision* phase of the process, analysis determines whether statistical tests and the elevated measurement comparison tests have met the MARSSIM-based standards for unrestricted release. If so, then permits and licenses may be terminated, subject to regulatory approval. The Closure Report will then be prepared and the site would then be available for transfer of ownership and other uses. The Expedited Release Process for the DORF accomplishes an increased efficiency in the regulatory release process by circumventing the need for a separate FSS.

**DATA QUALITY REQUIREMENTS**

The Expedited Release Process is accomplished, most fundamentally, by requiring characterization data to meet the data quality requirements of the FSS. This would allow the characterization data to be utilized in place of the FSS data for compliance purposes. MARSSIM recommends that the characterization survey data be evaluated for potential use in the FSS. FSS requirements specify the quality of data that is acceptable as input into MARSSIM decision-making, with the use of the DQO process. This is incorporated into MARSSIM as explicit DQO requirements. Full compliance with MARSSIM requires a demonstration that these DQO requirements have been met.

In language throughout the text, MARSSIM implies that its intent is to ensure DQO requirements are met. These requirements [4] as stated in the manual are as follows:

- *Data Quality Needs for the FSS shall be identified*
- *Decision Error shall be Evaluated and Managed.*
- *DQOs shall be developed for the FSS on a Site-Specific Basis.*
- *MARSSIM supports the use of the DQO Process to Design Other Surveys.*

The first three statements clearly address the FSS. However, the last statement suggests the DQO process may apply to other surveys such as the traditional characterization survey.

In the Expedited Release Process employed at the DORF, the characterization data must meet the more stringent FSS requirements. Therefore, an additional number of samples, and more stringent scanning protocols were needed in order for characterization data to meet FSS requirements. In this case, the data quality requirements required a factor of two to three times more samples and as much as an order of magnitude larger coverage of scanning surfaces than typically required for traditional characterization measurements. It is therefore important that assumptions about the benign level of residual radioactivity at the site be reasonably likely to ensure that the additional survey effort is not wasted.

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based on the evaluation of the complete data set. In both cases, termination of the Expedited Release Process indicates that the initial assumptions about the radiological conditions of the site were invalid.

Successful implementation of the Expedited Release Process is directly affected by the validity of assumptions.

## DATA QUALITY MANAGEMENT

As part of the Expedited Release Process, MARSSIM data quality requirements, data needs and decision error must be properly managed. An integrated approach to data quality management would address the data needs of D&D programs, such as Remediation, Dose Assessment, Waste Management, Health & Safety, Regulatory Compliance, etc., as well as MARSSIM-process needs. Fig. 2 depicts the model for Integrated Data Management [5]. Key elements of Fig. 2 are the Data Sources, Data Streams, and Decision Points. Data sources are designed to meet all D&D program and MARSSIM data needs in an integrated fashion. Each Data source, including the HSA, Scoping, Characterization, and Remedial Action surveys, provide data streams to specific decision points that meet the DQO criteria established for each decision.

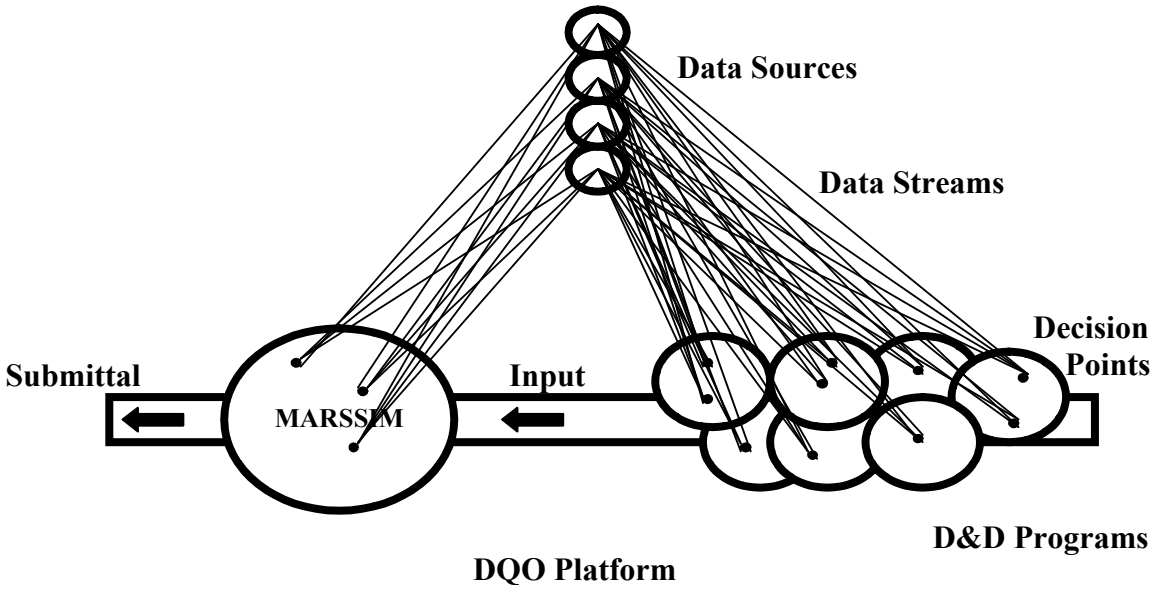


*Fig. 2 – Model for Integrated Data Management*

Since characterization data in the Expedited Release Process is utilized in accordance with FSS criteria, its normal use as input into the planning phase of the MARSSIM FSS, is by-passed. The characterization data have data streams that feed directly into MARSSIM-based decision-making (i.e., statistical tests and the elevated measurement comparisons). Planning the FSS is therefore replaced with assumptions about the type and extent of radiological conditions at the site. Therefore, it is important for residual radioactivity levels to be sufficiently low that assumptions about the site conditions are reasonable.

The network of D&D program decisions and their linkages form the basis of a decision framework. All D&D program decisions are linked to input into MARSSIM-based decision-making. In addition to input from the characterization survey, MARSSIM receives input from D&D program decisions, particularly those concerning dose assessments and the establishment of appropriate release criteria. Decision error can be tracked from the initial data quality and measurement uncertainty in the data sources, through D&D program decision-making to MARSSIM-based decision-making. A main component of a MARSSIM-based decision error is tied to the Type I and Type II errors associated with hypothesis testing. The MARSSIM-based analysis results showing compliance with release criteria, the decisions regarding the release of property, and the associated decision errors are submitted to regulatory authorities in the Closure Report.

## ALTERNATIVE AREA CLASSIFICATION

An alternative to the MARSSIM-based Area Classification scheme was applied to the DORF Expedited Release Process. MARSSIM typically recommends a single area classification (Class 1, 2, or 3) to each SU, with the area classification intended to provide a graded approach to the level of effort applied during the FSS. The level of effort, based on the area classification, is thus utilized in setting data quality requirements for the FSS.

Class 1 data quality requirements for the FSS are more stringent than the requirements for Class 2, and successively less for Class 3. In the case of DORF, many of the SUs had a reactor-based source term as well as a medical waste-based source term. The preponderance of the ROCs for either source term required the performance of straight-forward beta surveys at a Class 1 level of effort. However, there was evidence of the possible presence of uranium isotopes in the medical waste source term as well, meaning measurements of residual alpha activity were required. (Alpha measurements were deemed applicable in this case, in spite of being more labor-intensive than beta measurements, because of their improved detection sensitivity.) On the other hand, that probability was thought to be low. Therefore, the SUs were designated Class 1 for beta measurements and Class 3 for alpha measurements, with the stipulation that, if alpha activity above background was identified, the area would be re-classified.

The MARSSIM protocol of designating a single area classification for each SU does not appear to be a stringent requirement. It is clear that the intention of MARSSIM, in its graded approach to establishing an appropriate level of effort for the FSS, is to match the level of survey effort with the risk of the residual radioactivity exceeding the release criteria. If that risk is low (i.e., near background levels), it is reasonable to require less effort in demonstrating compliance with release criteria than if the evidence supports the presence of elevated activity (i.e., approaching the criteria). The key to the ability to apply this alternative at DORF was based on having separate source terms and independent measurements methods. This alternate MARSSIM area classification scheme was credited with additional time and resource savings on the project.

## CONCLUSION

Viable approaches to accelerating the nuclear facility decommissioning process are often sought by the D&D community. These approaches must have a sound technical basis, reflect a well-defined process, and be consistent with the intent of MARSSIM recommendations. The Expedited Release Process applied to the DORF decommissioning effort has widespread application, particularly to sites that contain low levels of residual radioactivity in land areas and on building surfaces. A more efficient alternative to the traditional decommissioning process of study, characterize, plan, remediate and then perform final surveys is justifiable for fairly clean sites.

The Expedited Release Process discussed in this paper, which was based on the process of study then characterize in accordance with the FSS, is based upon well-defined steps and alternatives. What's more, the approach is consistent with the guidance in NUREG-1757 and MARSSIM. However, management of data quality needs throughout the planning and implementation process is key to this approach, which offers cost savings and reduced project time-lines. Decommissioning managers can use this or similar approaches to show progress towards meeting decommissioning end-points by the early or even partial release of some areas as the project moves towards full release and close-out.

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