CHAPTER 3

Technical Project Planning (TPP) Approach to Managing Sites Contaminated with Radioactive and Mixed Waste

3-1. TPP Section 1.1 Phase I - Prepare Team Information Package. In addition to the TPP guidance, there are a number of guidance documents on various aspects of working with radioactive materials. The Project Manager's (PMs) guides for TPP, and Radioactive Materials and seven Engineer Pamphlets (EPs) specifically address work with radioactive materials. While the Engineer Circulars (ECs) are specifically oriented toward Formerly Utilized Sites Remedial Action Program (FUSRAP) site remediation, the guidance will help ensure that sound radiation safety principles are applied at any site. The following Engineer publications address work with radioactive materials. A brief description of each is included.

a. EM 200-1-2 Technical Project Planning Process. Describes the process for identifying project objectives and designing data collection programs at all Hazardous, Toxic and Radioactive Waste (HTRW) sites.

b. ER 385-1-80 Ionizing Radiation Protection. This is the Engineer Regulation for working safely with radioactive materials.

c. EM 385-1-80 Radiation Protection Manual. Provides explanation and guidance on methods of complying with ER 385-1-80.

d. ER 385-1-92 Safety and Health Requirements for HTRW Sites. Identifies documents and procedures required for executing HTRW projects.

e. EP 415-1-266 Resident Engineer Management Guide (REMG) For Hazardous, Toxic, And Radioactive Waste (HTRW) Projects. Provides requirements of which resident engineers must be aware regarding remedial design activities and response actions involving HTRW, and ordnance and explosives response actions.

f. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose or risk based regulation. It is a consensus document prepared with concurrence of the EPA, NRC, DOE, and DOD.

3-2. TPP Section 1.1.1 Phase I - Identify the Team Members.

a. A diverse group of USACE Technical, Management, Legal, and Public Affairs personnel, as well as stakeholders, regulators, and contractors, are required for the Project Delivery Team (PDT). Guidance on establishing the team is provided in the Project Management Business Process (PMBP) Team Establishment procedure. The PM will need to identify the decision makers, the data users, and the data implementers needed for the project. The decision makers may include the PM, the customer, and the regulators. Regulators may include Federal agencies: the Nuclear Regulatory Commission (NRC), the Environmental protection Agency (EPA), or the Occupational Safety and Health Administration (OSHA). Twenty-nine states are NRC agreement states, in which the state office performs the oversight duties of the NRC. Most states also have a Department of Environmental Protection and Department of Health, which are concerned with radioactive materials in the environment and potential human exposure to radiation. State regulatory agencies do not usually have jurisdiction to regulate Federal facilities, but the final disposition of the property may be subject to state regulatory oversight. Ensure that the USACE Office of Counsel is included in the TPP team to determine which regulatory agencies have which oversight responsibilities.

b. The data users may include a radio-chemist, a health physicist (HP), an Industrial Hygienist (IH), a risk assessor, and quality assurance personnel for each discipline.

c. Stakeholders may include the local city, county, and state community, site owners, site workers and contractors, and trade unions, as well as local and national environmental organizations.

3-3. TPP Section 1.1.2 Phase I - Identify the Customer's Goals.

a. Once the customer has been identified, ensure that the entire TPP team understands exactly what the customer envisions at the completion of the project, and what the customer sees as the role of USACE in the project.

b. The customer's concept of site closeout may range from removal and disposal of all radioactive and hazardous materials and a survey to allow the site to be released without restrictions (unrestricted release), to treatment, on-site storage, or on-site disposal of the materials to allow for limited reuse of the site (restricted release). When a restricted release is contemplated, land use controls (LUCs) must be considered. The objective when implementing LUCs is to ensure that land use remains compatible with the remedial action goals, and that the remedy remains protective of human health and the environment. The customer's schedule requirements and site budget must also be considered at this time.

3-4. TPP Section 1.1.3 Phase I - Gather Existing Site Information. This operation, coupled with Paragraph 3-5, is the equivalent of the MARSSIM Historical Site Assessment, and the CERCLA Preliminary Assessment. In addition to the normal avenues, site information may be obtained from a wide variety of other sources. Atomic Energy Commission or Nuclear Regulatory Commission licenses and amendments, Army radiation authorizations, Air Force radiation permits, local land use permits, as well as the site owner or operator's records may provide information on the past activities at the site. Additionally, USACE archivists are available who are experienced in gathering documents relating to sites. If possible, attempt to obtain facility operating procedures and inventories, and define the receipt, use, storage, and disposal areas for the hazardous and radioactive materials on the site. Capture a description of all the background literature into a single document, and ensure that the background information is available to all data users and implementers. Appendix D lists contaminants of concern and items of interest on some typical sites where remediation may take place.

3-5. TPP Section 1.1.3.5 Phase I - Conduct Site History Interviews. Consider not only former and present site workers, but also past and present regulators and inspectors. Many sites using radioactive materials also had some form of area dose monitoring. These records may also prove valuable in estimating potential hazards at the site.

3-6. TPP Section 1.2.2 Identify and Document Project Objectives. Most project objectives are a consequence of governing statutes and applicable regulations. Identifying and interpreting these statutes and regulations varies quite widely from site to site, among regulatory agencies, and even among regional offices within the same agency. Chapter 9 looks in depth at the existing statutes and regulations that are commonly applicable to radioactive waste sites. The primary regulations used for remediation of radioactive materials at a site are:

- 10 CFR 20 NRC Subpart E
- 10 CFR 40 NRC
- 40 CFR 300 CERCLA
- 40 CFR 192 UMTRCA
- State Regulations

After review by counsel, the applicable regulations should be included in this document. This document should specifically identify all impacted areas. An impacted area is one where there is a potential for radioactive contamination. These areas need to be bounded, spatially and temporally. The document must also identify the potential radioactive contaminants, and identify the executable project stages to site closeout.

3-7. TPP Section 1.3.2 Define Courses of Action for Achieving Site Closeout. A release criterion is a regulatory limit expressed in terms of dose (mSv/year or mrem/year) or risk

(cancer incidence or cancer mortality). The terms release limit or cleanup standard are also used to describe this expression. A release criterion is typically based on the total effective dose equivalent (TEDE), risk of cancer incidence (morbidity), or risk of cancer death (mortality) and generally cannot be measured directly. Exposure pathway modeling is used to calculate a radionuclide-specific predicted concentration or surface area concentration of specific nuclides that could result in a dose (TEDE) or specific risk equal to the release criterion. This concentration is termed the derived concentration guideline level (DCGL). Exposure pathway modeling is an analysis of various exposure pathways and scenarios used to convert dose or risk into concentration. In many cases screening level DCGLs can be obtained from responsible regulatory agency guidance based on conservative modeling input parameters, while other users may elect to take into account site-specific parameters to determine DCGLs. In general, the units for the DCGL are the same as the units for measurements used to demonstrate compliance (e.g., Bq/kg or pCi/g, Bq/m^2 or dpm/100 cm^2). This allows direct comparisons between the survey results and the DCGL. While exposure pathway models, such as RESRAD or RESRAD-BUILD, can provide a defensible starting point, stakeholders must concur with the exposure model parameters used as well as with the DCGLs determined. Other factors, such as ARARs (applicable or relevant and appropriate requirements), and public opinion, may set DCGLs at different quantities. The TPP and communication processes are meant to ensure that all interests are consulted and a consensus DCGL is reached that is acceptable to all stakeholders.

a. If the site is contaminated above the screening levels, the next step is to determine the DCGLs. Clean-up criteria provided by the EPA are given in units of risk, which cannot be measured. NRC criteria are provided in units of dose. DCGLs are the contaminant concentrations, which can be measured, that, when entered into an exposure model, yield a dose or risk that can be compared to the guidance provided by the regulatory authority. DCGLs are better explained in Paragraph 3-10. These DCGLs are the concentrations of contaminants below which the average concentration must fall for the project to be considered for release and closure. DCGLs will contain four units: an average radionuclide concentration that the site average concentration will not exceed, an area over which this concentration may be averaged, a maximum concentration that hot spots will not exceed, and the maximal area of these hot spots. Note that the DCGLs depend on the site conditions and the exposure models used. DCGLs may not be even in the same order of magnitude between different sites. For example, the DCGL determined for a site located in a residential area was 35 pCi/g while the DCGL for the same contaminant located in an industrial area was set at 1950 pCi/g.

b. For the project to be viewed as a success by all stakeholders, the ideal scenario is reaching a consensus value for the DCGLs. Federal and state regulators, as well as the lead agency at the site, the customer, and the other stakeholders, should all agree on the DCGLs.

c. The most common method of determining a starting point for DCGLs for a site is through the use of the RESRAD and RESRAD-BUILD dose modeling programs. These programs provide a method for calculating the dose to a recipient from the soil or building surface contamination concentrations, or both. The programs provide very conservative default parameters that may be used or modified if site-specific data are available for the parameters. These programs have both been approved for use by the NRC, EPA, DOD, and DOE.

d. When default parameters are not used, documentation explaining why the new value is considered appropriate must be included in the DCGL development report. Many default parameters will be changed on the basis of actual site conditions. For example, area of contamination, depth of cover, depth of contamination, depth to ground water, distance to nearest surface water, etc., can be referenced back to the site description and geological and hydrogeological reports. The report determining those actual site conditions must be referenced in the documentation of the parameter change.

e. NRC and USACE regulations also require all remediation to meet ALARA (doses as low as is reasonably achievable). This means that the DCGL will be the maximally allowed average contamination concentration, but the project will strive to remediate all media to as low a level of residual contamination as is reasonably achievable, taking into account the various social and economic factors affecting the site. However, if a site is remediated to NRC screening levels, it is considered to have met all ALARA requirements. Here, if there is a contaminant on-site that warrants any further investigation or remediation, decisions have to be made on what needs to be determined to select the method of remediation.

f. There are a number of methods that have been used to remediate sites. The primary method found to be cost effective and that meets the expectations of the regulators and the public, so far, is excavation and off-site disposal. A few sites have been allowed to use burial in place. There are also a few innovative technologies that have been investigated at different sites. The most common reduces waste volume using soil sorting and washing or segmented gate systems. Some efforts at bioremediation have been studied and shown to be effective in pilot studies.

g. The basic objective for radioactive waste sites is completion of a final status survey indicating that the Derived Concentration Guideline Levels (DCGLs) have been met at each impacted area. The phases necessary to reach this point will have interim objectives, and the interim objectives will have different data needs. Common problems are overestimating the amount and type of data actually needed for completion of a phase, and not ensuring that all data can be shared between phases for use in the final status survey. Another is project creep, where subsurface radioactive materials not discovered during the initial characterization are found during remediation and the remediation ‘chases’ the contamination into greater than expected volumes of contaminated soils.

3-8. TPP Section 2.1 Determine Data Needs. During the characterization phase, data gathered during the historical site assessment are used to determine potential radioactive and hazardous contaminants, and potentially impacted areas. From these data, a preliminary site conceptual model is constructed. From the site conceptual model, potentially impacted areas are selected. Data gaps will exist and additional information concerning the actual quantity, horizontal and vertical extent of contamination, the radionuclides actually present on-site, and the natural background concentrations of the radionuclide contaminants will be needed. Once samples are gathered and analyzed, and these data are available, the remediation phase data needs change. Isotopic analyses, necessary to determine the radionuclides of concern, may no longer be necessary and less expensive survey and analysis methods can be used. If no site work that could substantially concentrate or dilute the contaminants in the waste stream was done, the data from the characterization sampling and from the remediation surveys and sampling can be used to characterize the waste stream, lowering the total number of samples necessary. During the final status survey phase, the data needs may change again. Surveys and samples from the characterization and remediation phases may be used to show that the potentially impacted areas do in fact meet the DCGLs. Additional survey and samples will be needed to verify screening levels. A number of regulatory agencies have determined screening levels for site evaluations in the PA/SI (Preliminary Assessment/Site Inspection) and RI/FS (Remedial Investigation and Feasibility Study) stages of the investigation. The EPA has developed a web based Preliminary Remediation Goals (PRGs) calculator, and the NRC has released NUREGs providing guidance on using certain computer models to determine surface soil and building surface screening levels.

a. EPA PRGs for radionuclides are tools used to evaluate soils contaminated with radioactive materials at sites with various future land uses. PRGs are not national cleanup standards. PRGs alone do not trigger the need for response actions or define “unacceptable” levels of radionuclides in soil. In this guidance, “screening” refers to the process of identifying and defining areas, radionuclides, and conditions, at a particular site, that do not require further attention. Generally, at sites where radionuclide concentrations fall below the appropriate PRGs, no further action or study is warranted. Where radionuclide concentrations equal or exceed PRGs, further study or investigation, but not necessarily cleanup, is warranted.

b. By their nature these values will always be extremely conservative, sometimes to the point of being a fraction of background concentrations of a radioactive contaminant.

c. For example, uranium has a widely ranging background concentration depending on the rock/soil type. The National Council on Radiation Protection reported an average soil concentration of 1.8 pCi/g in its Report No. 94. The NRC NUREG-1757, Vol. 2 provides a U-238 plus progeny soil screening level of 0.5 pCi/g above background. The NRC assumes parameters based on a residential farmer scenario. Though not necessarily directly comparable to the NRC value, the EPA PRG calculator provides default PRGs for an

agricultural scenario and a residential scenario. The default PRG values for U-238 plus progeny are 0.00147 pCi/g (agricultural), and 0.742 pCi/g (residential).

d. Should the average of all contaminant samples be less than the selected screening value, the site may be ready for closeout with no further action, provided the samples are of sufficient quality and number to meet the statistical tests provided in the MARSSIM.

3-9. Sample Quantity.

a. The number of samples required to adequately characterize a site or an incremental portion of a site, such as an operable unit (OU), depends on a number of variables. The NCP defines an OU as a discrete action that is an incremental step toward comprehensively addressing site problems. If one contaminant is present on-site, or a single decay chain is present on-site, the primary driver for the number of samples required to reach a certain confidence interval will depend on the variance of the total batch of samples. The confidence interval is the range of values with a specified probability (e.g., 90 or 95%) that the set contains the true value of the parameter tested.

b. The variance is the square of the standard deviation of the sample population. In general, the larger the variance is, the greater the number of samples needed. Additionally, as the number of contaminants increase, the number of samples required may also increase. When multiple radioactive contaminants coexist on a site, the clean-up criterion may require that a sum of fractions be used to determine compliance, i.e., for n radionuclides of concentration C:

$$\sum_{x=1}^{n} \frac{C_x}{DCGL_x} \leq 1$$