Chapter 7
Step 5: Monitoring and Reporting

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Abstract Although not a component of equivalency analysis, per se, monitoring and reporting of the progress and efficacy should be an integral aspect of an overall liability assessment. Key steps in the monitoring and reporting phase of a project include remediation planning and implementation, monitoring, and reporting. These steps are described in this chapter.

Keywords Monitoring · Program reporting · Remediation implementation

7.1 Remediation Planning and Implementation

After the equivalency analysis has been performed and remediation projects are selected and scaled (see Chap. 6), a remediation plan is prepared. This plan, which builds on information gathered during the equivalency analysis, should include project goals, implementation details, engineering plans and designs, and biological plans and designs. Development of remediation plans may be iterative and may include (see Fig. 7.1 for simplified steps):

- Initial planning-level design plans;
- Initial site inspection, monitoring, or measurements needed to refine design plans;
- Full implementation plans and design drawings;
- All necessary health and safety plans;

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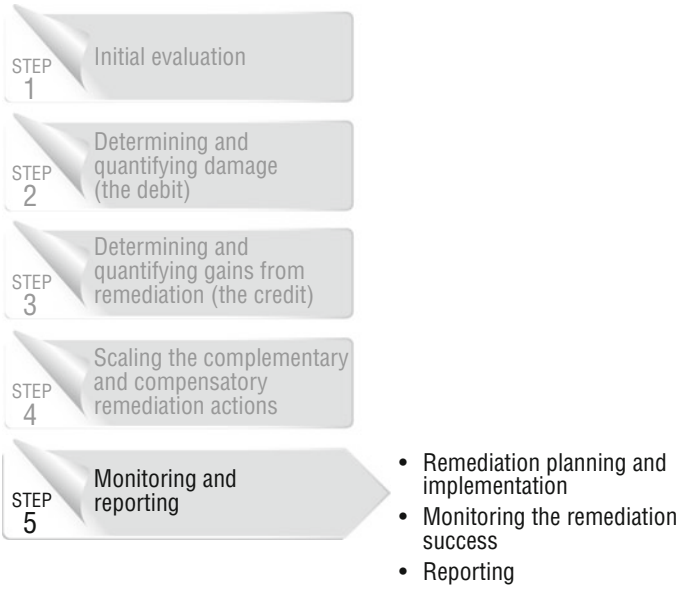

Fig. 7.1 Step 5 of equivalency analysis

- Quantitative performance measures and plans for corrective actions, if needed; and
- Monitoring, adaptive management, and reporting and communication.

In the United States, the usual practice is to first develop a draft remediation plan and then subject this to a review process. Ideally, the process also allows the general public to review the plan and provide suggestions and comments. Following this review process, a final remediation plan should be developed for implementation. Whether such a plan is required and its details will be determined by the official guidance in each Member State. The content of a remediation plan is likely to vary depending on the nature of the remediation actions and the specific phase of remediation. Generally, remediation plans should contain information regarding:

- Intended outcome(s) of the remediation (project goals);
- How the specific activities will contribute to the intended outcomes (including engineering and biological plans and designs);
- The anticipated time period of remediation actions;
- The anticipated duration of ecological recovery;
- The performance standards to be used to gauge project progress and success;
- Monitoring plans;
- Any potential risks to human health, society, culture, or the environment;
- How corrective actions will be taken, if necessary;
- Any necessary ongoing operations and management necessary to ensure project objectives; and

- Project costs, including monitoring, oversight, operations, and management.

Specialised literature, existing general guideline documents, and Member States' requirements should be consulted for additional information on the preparation of remediation plans (e.g., Reinharz and Burlington 1996).

7.2 Monitoring Efficacy of Remediation

Monitoring should be conducted at intervals that are determined based on biological, chemical, physical, social, or economic factors important to the determination of success, including both performance metrics (such as plant cover on revegetated sites) and desired outcomes (e.g., utilization of habitat by birds, changes in fish populations). The metric originally used to quantify debit and credit should still be of value in evaluating project success and benefits achieved, but need not circumscribe all monitoring needs. Typically, monitoring and post-monitoring reporting will be an essential part of remediation plans. Monitoring is undertaken to:

- Gauge the nature, extent, rate, and efficacy of remediation benefits;
- Enable plan modifications, corrective actions, or other adaptive management interventions;
- Protect human health, welfare, or ecological resources from unintended consequences, as well as from predicted near-term risks during stabilisation of remediation actions (e.g., during certain types of remediation projects, such as contaminant dredging, contaminant concentrations may initially increase prior to decreasing);
- Enable more efficient management of natural resources in recovery areas; and
- Contribute to an expanded database of remediation project efficacy and recovery outcomes.

Monitoring also allows assessment of whether implementing parties are doing what they committed to in the remediation plan. Design and performance criteria included in the remediation plans can help Competent Authorities to assess whether responsible parties meet the set requirements during implementation.

Monitoring should be conducted prior to, during, and following implementation of remediation plans. It must be sufficient to quantify remediation gains for the desired assessment metrics that were used to design the remediation plan. However, monitoring may consist of many different types of actions including:

- Chemical monitoring of media (e.g., water, air, soil, sediments) and biota (e.g., fish tissues);
- Biological monitoring of individuals, populations, communities, or habitats;
- Physical and hydrological monitoring of target attributes (e.g., sediment accretion rates, water flows, etc.); and

- Monitoring focused on specific programmatic or performance measures (e.g., aboveground biomass of planted wetland vegetation; contaminant runoff concentrations, hectares placed into conservation easements).

Monitoring plans should be designed to consider a reasonable range of natural variability, including factors such as seasonal variations in hydrographs, wildlife migrations, growing seasons, tidal cycles, and, potentially, human uses. Design of monitoring plans should be statistically based, with appropriate consideration of necessary design elements to discern changes in environmental variables. Finally, all monitoring should be conducted pursuant to scientifically designed and approved sampling and analysis plans. It is important to keep in mind that the costs of monitoring, including reporting, should be incorporated into remediation costs. An example is provided in Box 7.1.

Box 7.1: A framework for Post-remediation Monitoring

Post-remediation monitoring is a key step in the remediation process. An effective post-remediation monitoring plan will help to:

- Identify problems that could be corrected;
- Quantify benefits realised; and
- Provide information that can be communicated to policy makers and the public about the benefits of remediation.

Before developing a post-remediation monitoring plan, the conceptual model for a project must be specified. This model should clearly delineate the remediation action, the expected intermediate outcome, and the pathway/process by which the intermediate outcome will lead to the desired long-term results.

An effective monitoring framework takes advantage of the conceptual model to provide important information for each step of the remediation process. Ideally, the monitoring framework will include both pre-implementation monitoring to determine initial conditions and reference sites that will be monitored simultaneously with the project site. Because baseline conditions can change over time (e.g., a drought may cause a regional decrease in fish populations), monitoring changes in reference conditions over time allows for appropriate adjustments to be made to baseline conditions.

For each step in the monitoring framework, a plan should be developed that specifies who will be responsible for monitoring, to whom results will be reported, the objective of that monitoring step, the monitoring actions to be taken, the location of the monitoring, the timing of the monitoring, and any benchmarks that will trigger corrective action.

Overview of Monitoring Steps

Step 1: Monitor project sites and appropriate reference sites to establish pre-implementation conditions.

Step 2: Monitor implemented action to determine if the implementation has been successful in terms of both implementation criteria and outcomes. These results should trigger corrective actions to implementation if necessary.

Step 3: Monitor project site and reference sites over the short term (often 1 to 5 years) to determine if the implementation has achieved the intended intermediate outcomes. These results should trigger corrective actions if necessary.

Step 4: Monitor project results and reference sites over the long term (often 3 to 10 or more years) to quantify project outcomes.

7.3 Reporting

Case-by-case reporting is not a requirement of the ELD. However, since monitoring and evaluation are the only means by which Competent Authorities can demonstrate that they have protected the public's natural resources, reporting the results of monitoring and evaluation is crucial. Therefore, authorities may wish to consider making damage assessment reports available for public review at regular intervals and in an accessible format.

Monitoring plans also should provide for post-monitoring reporting. Reporting is a critical means of:

- Communicating remediation plan successes (and failures) to the affected public;
- Communicating necessary alterations in monitoring design or anticipated recovery rates to the affected public;
- Communicating any potential human health risks (or lack thereof) to the affected public; and
- Contributing to scientific knowledge regarding remediation efficacy and recovery rates.

Whether publicly available or not, reports should include a description of the project, project goals, the anticipated recovery and benefits trajectory, data collected as part of monitoring, and a synthesis and interpretation of the monitoring data. Any corrective actions taken or anticipated should be reported. The degree of resources and/or services recovery to baseline conditions, and relative to the anticipated recovery trajectory, should be described. In addition, an efficient European Union level reporting mechanism would allow Member States to learn from remediation experiences in other countries. In this context, ensuring reporting of Member States' follow-up on remediation usage and success (e.g., efficacy, recovery outcomes, key parameters) to a central European Union database might be a valuable contribution.

Reference

Reinharz, E., & Burlington, L. (1996). *Restoration planning: Guidance document for natural resource damage assessment under the oil pollution act of 1990, the damage assessment and restoration program* (National Oceanic and Atmospheric Administration Technical Report).