Lifecycle Management for Environmental Remediation Projects – 14084

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ABSTRACT

Are formalized project management and project planning the best solutions to achieving successful environmental remediation? Many of us utilize these approaches, but they do not guarantee that a project will always be a resounding success. Although formalized planning tools will greatly increase the likelihood of success, too many projects are massively overspent, have safety issues, fail to meet the original objectives, or fail to factor in stakeholders concerns.

Getting it right the first time is rarely about merely applying formalized project management approaches: we need to consider the idea of lifecycle from several perspectives. For example, applying Lifecycle Management can, in some instances, help prevent a repeat of many of the legacy situations we are faced with today. There are two components to this idea: the lifecycle of the site or facility to which environmental remediation is being applied, and also lifecycle elements within the remediation project itself. Many different barriers can prevent successful environmental remediation, and each barrier requires upfront consideration prior to project design and implementation. Only by considering the entire lifecycle can each barrier be adequately assessed to evaluate and plan for the most appropriate and sustainable approach to the problem at hand.

When the focus is on solving an immediate problem we may overlook these complexities, not accounting for the intertwined components that a remediation project brings. Further, due to the complexity of these projects, we need to consider better how and when to communicate and involve key players at different times within the remediation lifecycle. Using the longer-term context of Lifecycle Management can help with the process of engaging or involving people to be effective participants, even if their role is not large or continuous.

The lifecycle perspective of a site, a facility, and the various project elements can help everyone to understanding the many necessary interactions among key individuals and with the project's technical, logistical and socio-economic requirements. Some examples of where better interaction within the lifecycle can be of assistance are also provided.

INTRODUCTION

Environmental remediation can on many occasions become a costly and lengthy process, so getting it right first time should be the ultimate project aim. There are generally a multitude of barriers and challenges that can prevent the predetermined objectives and desired site end points following remediation from being achieved. Such challenges might include financial limitations, lack of proven technologies, misunderstanding of regulatory guidelines and requirements, inappropriate stakeholder engagement, and in some cases a poorly constructed initial conceptual site model.

The application of sound project management and project planning will often enhance the chances of achieving a successful environmental remediation project but it is usually a lack of consideration of the lifecycle aspects that ultimately leads to failure. So although formalized planning tools will greatly increase the likelihood of success, too many projects are still often massively overspent, have safety issues, fail to meet the original objectives, or fail to factor in stakeholders concerns. Getting it right the first time is rarely about merely applying formalized project management approaches.

The concept of Lifecycle Management can be described as the process of managing the entire lifecycle of a product from its conception, through design and manufacture to service and disposal. Here, the product is an environmental radiation program.

DRIVERS FOR ENVIRONMENTAL REMEDIATION

The types of sites and facilities which might require remediating may be quite varied, e.g. uranium mining and milling sites, poorly designed waste disposal facilities, NORM related issues, legacy burial grounds and contaminated areas as a consequence of accidents and emergencies. There will be a wide range of drivers for a site operator, problem holder, or in the case of some legacy sites a national Government, to undertake remediation activities. Such drivers include;

- Part of a decommissioning strategy,
- Legislation requirements and enforcement notices,
- Risk to human health and the environment,
- Site de-licensing or partial site de-licensing,
- Contamination problem may be increasing (e.g., an advancing groundwater plume),
- Determination of site end states,
- Stakeholder aspirations or concerns, and
- Desire to reopen and operate a previously uneconomical uranium mining site.

These drivers also have a time component to them. In an example like Fukushima where initially there was an emergency situation, a remediation strategy was required almost immediately. In the case of a decommissioning project however the chosen remediation strategy would usually be implemented once buildings have been removed thus allowing easier access to the ground areas which require remediation. If there is evidence of soil or groundwater contamination on an operating site, the timing of any remediation may in some instances only be in the long term as long as it can be proved that there is no immediate risk to human health and the environment.

The drivers themselves highlighted above are also likely to vary between these different kinds of sites. An operating nuclear licensed site (i.e. Sellafield or Chalk River) will still be under institutional control whereas a legacy uranium mining site or an area impacted by an emergency situation (i.e. Fukushima) may not.

BARRIERS TO SUCCESSFUL ENVIRONMENTAL REMEDIATION

There are often a number of clear barriers to successful environmental remediation. Some of these barriers are technical; others are more of a socio-economic nature, and include:

- Lack of National policies,
- Financial issues,
- Lack of regulatory framework,
- Uncertainty over the end state,
- Lack of technologies,
- Lack of qualified personnel,
- Lack of ownership/responsibility for legacy sites,
- Stakeholder opinion/resistance,
- Lack of waste management infrastructure, and
- Lack of transportation system for radioactive waste.

It is clear that such barriers will vary from country to country, and even between individual projects. Countries with a well-developed nuclear industry are more likely, for example, to have a waste management infrastructure and qualified personnel than those who may only have mining or NORM related radiological contamination issues.

LIFECYCLE CONSIDERATIONS

Traditionally we look to overcome these barriers through the application of our prior experience coupled with the utilization of formalized project management and planning approaches. However, not only do projects still fail but many countries do not have such expertise and in these countries projects not only fail, but some do not even get off the ground in the first place.

Experienced project managers initially construct a risk register in order to highlight the things that could go wrong so that the chances of a risk occurring, the potential severity and how to minimize or prevent the highlighted risk from taking place are clearly mapped out. A well-constructed risk register clearly helps and as long as it is kept up to date can alleviate many risks. However, there is still often a tendency to focus on the more immediate tasks in order to get a project underway, and too many tasks are considered in isolation. Consideration of the entire lifecycle is crucial and in conjunction with formal project planning approaches will enhance the chances of success even further.

Formalized project planning and Lifecycle Management are in some ways not dissimilar but the latter can also catch some of the smaller nuances within environmental remediation as well as those intrinsic in human nature. Applying Lifecycle Management – both to the site or facility to which environmental remediation is being applied and to lifecycle elements within the remediation project itself – can help prevent a repeat of many of the legacy situations we are faced with today.

With the lifecycle of a site, for example (i.e. Sellafield), there may be concurrent operating and decommissioning activities. Setting out the overall long term strategy for meeting the site's desired end state, issues like asset management, waste management, potential site reuse, de-licensing and environmental remediation all need to be factored in. The timing and extent of any environmental remediation will be determined through consideration of the drivers highlighted above but also addressing the interlinked aspects such as decommissioning activities and available waste disposal routes. In many instances the material that requires remediating may actually lie beneath an existing building or facility, and to compound the problem, even when a sound inventory exists, the nature and extent of any contamination may only be understood once the building has been demolished and access can be achieved. If the regulations classify such contaminated land "radioactive waste" for example, then in theory such material if excavated would need to be disposed of accordingly.

The process of environmental remediation itself has its own lifecycle, in which the following kind of issues requiring consideration:

- Understanding the overall project objectives and clean-up targets,
- Developing a robust conceptual site model and refining it as new information arrives,
- Undertaking a suitably phased site characterization program,
- Understanding potential waste streams,
- Establishing an overall funding ceiling and deciding how funding may be phased, and
- Determining which stakeholders will participate, with whom, and when.

Many different barriers can prevent successful environmental remediation, including inadequate funding, insufficient technical capability, lack of waste disposal/storage solutions, poor engagement processes, and/or inadequate regulations. Any one of these factors by itself could prevent successful remediation, but in fact they are all components of – or interactions within – a remediation lifecycle. Each barrier requires upfront consideration prior to project design and implementation. Only by considering the entire lifecycle can each one can be adequately assessed to evaluate and plan for the most appropriate and sustainable approach to the problem at hand.

If we overlook these complexities, we risk failing to account for the intertwined components that are part of every remediation project. It is critical to define sustainable and achievable remediation objectives and site end states that will be approved by regulatory bodies and other stakeholders. Further, in an emergency situation like that at Fukushima, there is sometimes no choice but to adopt a reactive approach (at least at the outset). However, including lifecycle issues in the initial planning approach for remediation projects will reduce surprises and project overruns.

The environmental remediation work within the Fukushima Prefecture in Japan is a good example of where lifecycle considerations are crucial. The remediation works are generating large volumes of lightly contaminated soils and organic detritus (the latter from forest clearance, as shown in Fig 1) which requires management, and eventual disposal. The material is currently bagged and moved to temporary storage sites like those in Figures 2 and 3. These storage sites are temporary and only meant to last for a few years until temporary storage facilities, exhibiting a greater level of engineering, are constructed. In this example there is a clear link between the level of remediation being undertaken (to reduce dose levels) and the volume of subsequent waste products requiring management. Ideally these two aspects of the remediation process should not be considered in isolation.

Fig 1 – Remediation of forested areas in Fukushima Prefecture

Fig 2 – Temporary storage sites in Fukushima Prefecture, Japan.

Fig 3 – Temporary storage sites in Fukushima Prefecture, Japan.

Also, in the Fukushima case, the links between remediation and waste management can be considered to have both technical and socio-economic connotations. On the technical side, wastes from the remediation process need to be adequately managed. However, in terms of stakeholder engagement, if the local population is not supportive of the establishment of temporary waste storage sites, then creating further volumes of wastes through greater levels of remediation may not be a sustainable solution and overall progress may actually stall.

In another example, during the design of a site characterization program on a complex nuclear-licensed site in the UK it was necessary to choose the most proficient drilling technique. When drilling operations commenced, large volumes of waste water were produced that were initially held in plastic storage tanks. It was not allowed to return these waste waters back to ground, as in some instances they may have been also lightly contaminated, so it was necessary to find a disposal route.

A discharge route was agreed upon following lengthy consultations with the site operators in general and the plant through which the waters would be discharged in particular. However, as the volumes of waste water built up, it was noticed that fine fraction sediments were not settling out of the water as expected. A number of different approaches to settle out these fines were undertaken without success, but the agreed disposal route did not allow waters containing suspended materials to be discharged. As a result, many containers of drilling waste waters were left sitting around the site adjacent to the drilling areas for over a year, precipitating many questions from the environmental regulators. If the principles of Lifecycle Management had been considered, a different drilling approach would likely have been adopted.

HUMAN INTERACTIONS

Due to the complexity of these projects, it is important to give consideration to how and when to better communicate and involve key players at different times within the remediation lifecycle. Communication, like project planning, sounds straightforward but goes beyond simply communicating with the project team and engaging the well-defined external stakeholders. Do we always consider when and how the client, the regulators, various contractors, managers and workers of the adjacent plants and facilities, and people from environmental conservation groups and waste disposal organizations will be involved?

Some complex sites have a large number of historical plants waiting to be decommissioned. Such plants not only reside adjacent to each other but also, in some cases, adjacent to operating facilities. Sellafield (Fig 4), provides a good example of this situation, which can make logistical operations quite complicated. Each plant will have its own manager whose responsibility may not reach elsewhere, so when undertaking site investigation or remediation work for one particular plant it will be necessary to understand the safety implications (usually residing within a plant's specific safety case) that are relevant to each neighboring plant.

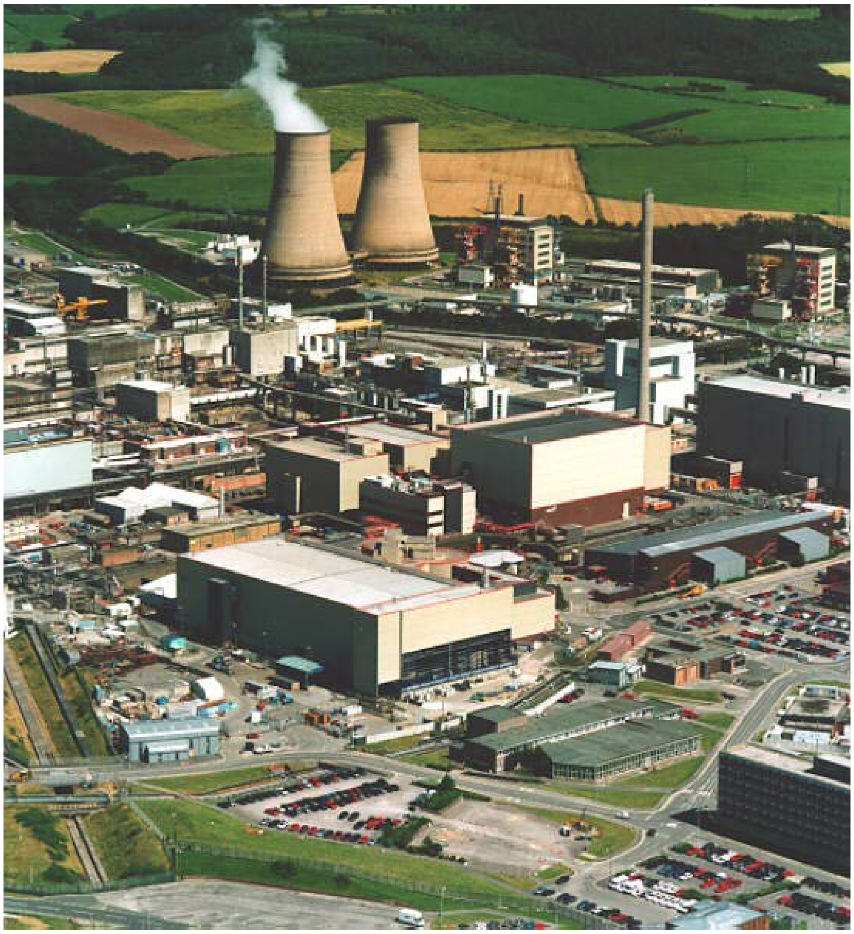

Fig 4 – Sellafield, UK

There are some instances where a nuclear site may have separate licensed areas each under the jurisdiction of a different operator. As each will have their own interests and responsibilities, liaison between the two is crucial if an understanding about responsibility for ground contamination (bearing in mind that moving groundwater does not respect chain link fences) and potential remediation is to be built up. In the UK, sites like Sellafield, Capenhust and Hunterston all historically have had more than one licensee.

Using the longer-term context of Lifecycle Management helps to plan for a more effective process of engaging and involving people to be effective participants, even if their role is not large or continuous. The way individuals are brought into a project affects the quality and reliability of their communication at the times when their input is needed most. People and groups that don't feel they have received the proper respect or have appropriate input may be defensive, perhaps protecting knowledge as a way of protecting their power, or even their job.

The importance of proper engagement also applies to those with a "silo mentality", i.e., those who see themselves accountable for only their particular work and not for interactions with others. Projects can be compromised by a failure to include people who have brief roles at various points in the lifecycle, so the larger lifecycle context can help keep everyone on board as part of the project's "big picture", and its eventual success.

These are just a few examples to show that it is important to consider key individuals within the Lifecycle Management process. Some of these individuals will need to kept involved throughout a project's duration and where applicable may even need to be considered as part of the actual project team. Ignoring the role and communication timing for key individuals as they come in and out of a project during its lifecycle will impact the chances for success.

CONCLUSIONS

Experience has shown that environmental remediation, especially on a complex site, is in many cases a costly and lengthy process. The application of Lifecycle Management facilitates good planning, and allows the various challenges that have a potential impact on environmental remediation to be identified early. Setting clear achievable clean-up targets though a transparent process is crucial, but adding Lifecycle Management takes direct aim at minimizing environmental and socioeconomic burdens associated with a project throughout its entire life cycle and value chain. Importantly, Lifecycle Management is not just about processes and technologies, but also addresses the role of key individuals and groups and the ways they may help or hinder the project's success. It does not replace, but should be considered alongside and/or within, formalized project planning and management processes.