North Carolina Petroleum UST Release Corrective Action Phase Project Management:

A **Calibrated Risk-Based Corrective Action Decision & Implementation Guide**

Executive Summary:

This document was developed to guide corrective action project decisions, typically the costliest phase of release response, by establishing risk determination standards and by using measurable temporal, spatial and quantitative clean up performance goals. Recognizing that the most petroleum releases stabilize and the associated risk decreases over time naturally without intervention, guidance in the form of a calibrated decision making process that fully leverages science, existing statutes and rules to reach the endpoint of no further action was lacking. The ongoing challenge for the Department of Environmental Quality (DEQ) has been to address more sites than is affordable through the Commercial Trust Fund financial assurance mechanism. Once officially put into practice, the stepwise process contained in this document should, on average, reduce the per-site expenditures UST owners incur. Going forward the savings can be redirected to a larger number of sites, maximizing the efficient use of available funding. Lastly the document outlines the collaborative process the Department, consultants and UST owners will adopt that should reduce miscommunication, streamline the approval process, increase the ratio of reimbursement dollars paid to the total amount claimed (fewer denials) as program delivery becomes more transparent and effective.

Introduction:

The core goal of the DEQ UST Section is to oversee prevention and remediation of petroleum releases originating from most all petroleum sources. North Carolina's elected officials and the Federal Government have provided mechanisms to DEQ that help fund staff and remedial tasks working together to accomplish this goal. Since the adoption of this program in the late 1980's, much progress has been made in both prevention and remediation. However, when we look at the current remaining work to be done along with new releases occurring, using the historical average per site cost of remediating a UST release, there is over 800 million dollars in potential outstanding cost. Present annual funding into UST Trust Funds, Federal grants and State appropriations is generally in the low to mid 30-million-dollar range.

The daunting task of managing these sites requires a focused effort to make each dollar spent be done so with maximum efficiency. The UST Section has evaluated how the current project management and per site expenditures can be improved by increased efficiencies. The following sections of this document outline the first phase of our attempt to accomplish these improvements within the area of corrective action decision making. The second phase to be developed will include improvements to site assessment, ongoing monitoring and other site management expenditures (*by December 2016*).

Statutory and Rule Framework Factors:

This section discusses the applicability of several General Statutes and Regulations that play key roles in our decision making process. The following four fundamental factors are the basis for how we guide responsible parties to select the appropriate corrective action approach to address UST releases. These factors have evolved, over time, through a combination of Law and Rule development since the early 1980s.

The First fundamental factor is the use of Risk-based Corrective Actions which are intended to manage UST releases within the state, per **NCGS 143-215.94V(a)**. This statute describes one important premise: releases which pose little risk to human health or the environment should not receive the limited resources that would be otherwise directed to sites that pose an imminent threat. Our goal under this statute is to prevent excessive, unproductive, or unnecessary cleanup efforts and use our limited resources to address the sites that pose an actual risk.

The Second fundamental factor is the method we use to measure and assign the risk posed by a release. Rule **15A NCAC 2L .0406** defines three different risk levels posed at the onset of release discovery. At this early stage in the process we are in an information gathering phase, learning more about the site, the release, and the threat to human health and the environment. As more information becomes available, we begin to develop a conceptual site model that will assist us in long term management of the incident.

The Third fundamental factor is an acknowledgement that site risk is a dynamic variable that will change over time. **NCGS 143-215.94V (c)** and **15A NCAC 2L .0407(a)** provide for obtaining information during assessment, monitoring, and corrective action to allow for ongoing risk reclassification at Trust Fund-eligible sites. In addition, **143-215.94V (b)** was amended in 2011 with the following: *"Rules that use the distance between a source area of a confirmed discharge or release to a water supply well or a private drinking water well, as those terms are defined under G.S. 87-85, shall include a determination whether a nearby well is likely to be affected by the discharge or release as a factor in determining levels of risk."* This requires that any risk analysis must incorporate a more detailed and accurate evaluation of the true threat to water supply wells proximal to a release as information becomes available.

The Fourth fundamental factor is that reimbursement must be limited to the most cost-effective cleanup that addresses threats to human health and the environment, as required by **143-215.94A(2a), 143-215.94V(e1),** and **15A NCAC 02P .0402**. Both short and long-term costs, as well as ineligible expenditures, should be carefully evaluated by the responsible party to determine the most cost-effective path to eliminate or mitigate this threat. Each site will be unique, but the goal of addressing the threat in the most cost-effective manner is constant.

As we work with the regulated community to move sites through the Release-Assessment-Corrective Action-Closure process, we need to be confident that the site risk analysis is reasonably accurate, and that the Risk, Rank, and Abatement values are representative of the

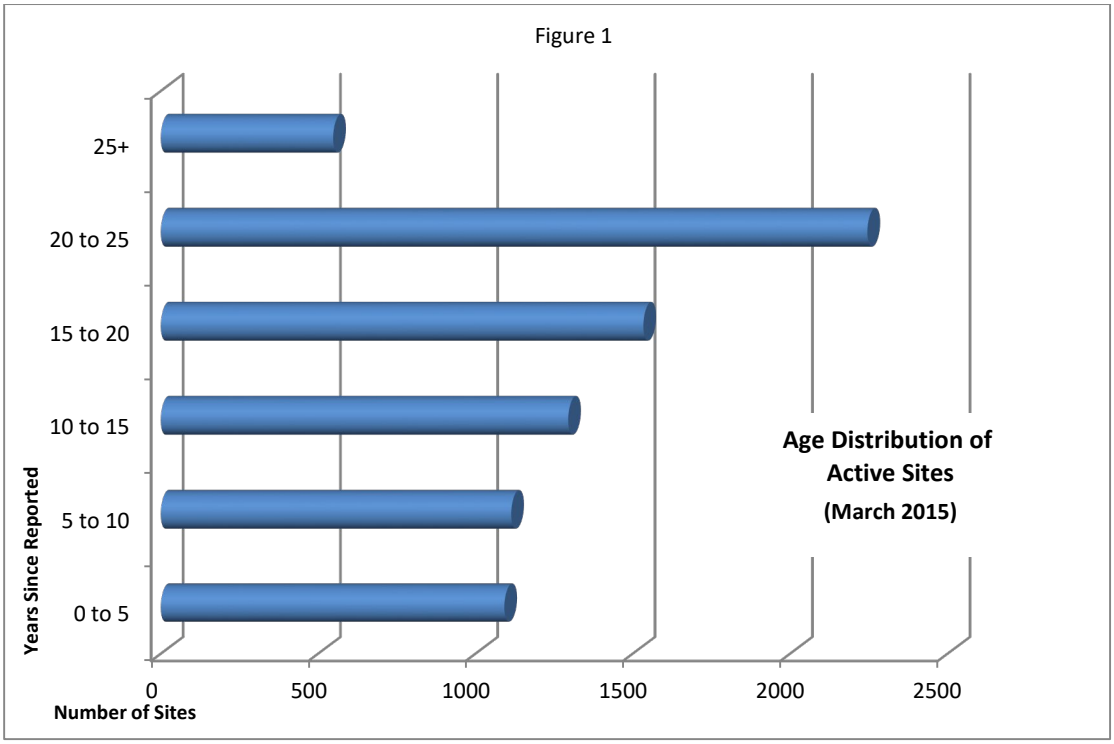
actual site conditions when making decisions regarding the preapproval of tasks and associated expenditures.

With all four fundamental factors in mind, described below is guidance to normalize corrective action phase decision making at petroleum LUST sites as well as other release sources. It is understood that some sites will have conditions and associated complicating characteristics that will require variations to this guidance.

Determining the Release Stage along with the Reasonable & Necessary Corrective Actions

The first and extremely important step of determining the current stage of a release and the appropriate remedial actions for the conditions at each site will directly impact the success of the cleanup effort and the cost effectiveness. Within our large inventory of LUST sites, a majority are 15 to 25 years old. *See figure 1*

Figure 1



There are 3 primary stages by which each site can be categorized that will aid in the decision making process. They are:

(1) **Expanding Stage**-characterized by high concentrations and amounts of petroleum contamination remaining in-situ and the areal extent of the soil or groundwater impact shows signs of expanding.

(2) **Stable Stage**-characterized by the areal extent of petroleum contamination showing signs of remaining in the same general location, with some minor fluctuations expected in both distribution and concentration.
(3) **Contracting Stage**-characterized by reduction in areal extent of petroleum contamination, with concentrations declining with time.

Obviously the risk level of contaminate exposure to people and other sensitive receptors at each stage will be quite different at a given site. Making the appropriate corrective action decisions based on an accurate risk assessment in line with the release stage will be required and will also be a major factor in our success of the overall effort to increase efficiencies.

Demonstrated by Figure 1, as we "lower the funding bar" and begin working on sites that have been dormant, often for years, we will be faced with making these determinations at each project. Concurrently, we will continue to get new releases reported as well. New releases pose their own set of challenges; therefore, decision making at each stage will obviously differ. More detail on decision making in each of these stages is explained below.

Setting Project Corrective Action Goals

To the extent possible, our sites should have set performance goals before we ever allow initial abatement or corrective action to proceed. Establishing groundwater and soil cleanup goals are necessary in determining the appropriate corrective action decisions. It would be ideal if funding was not an issue and the decision could be based on the best available technology to remediate sites to pre-release conditions as quickly as possible. However, it is certainly not very realistic within the current UST Program framework. What is achievable is setting two important measurable performance goals. The two primary goals are (1) Clean-up levels and (2) Time required to accomplish the tasks.

The risk assessment is the most important site characteristic that drives these goal setting decisions. As mentioned previously in the third fundamental factor, 15A NCAC 2L .407(a) and 143-215 94V (b) & (c) are mechanisms that provide the dynamic nature to our risk analysis process. As specific information is determined about the characteristics of both the release and site, the rule/law explicitly obligates each responsible party to notify the Department of any changes that might affect the risk level. The complexities of establishing the true risk at a site as we apply the contaminate data, hydrogeology, relative location and exposure potential of the various types of receptors into a conceptual site model can be difficult to sort out in some cases. Therefore, it is left up to the UST Section staff to closely screen the corrective action proposals to insure they contain the appropriate necessary and reasonable actions that can effectively address the remedial needs of the site.

The Standard Target Cleanup Level:

Establishing the correct groundwater cleanup level is directly related to the Risk, Rank and Abatement score and 15A NCAC 2L .0406, .0407 and 143-215 94V (b). This fact is why it is so

extremely important to have an accurate, up to date score. The difference in cleanup levels between "High" and "Intermediate & Low" groundwater cleanup concentrations is generally three orders of magnitude. Decisions to treat a site to the conservative levels required by a "High" risk ranking are considerably more expensive.

Over the past 25 years, observations from petroleum contamination & remediation projects have consistently shown that during some point in the life of *most* sites, the release will naturally stabilize, cease expanding and then begin to contract in size through time as discussed previously. Once plume stability is reached, it is quite reasonable to begin to consider receptors such as water supply wells, surface waters, utilities and structures initially thought to be at risk of being impacted, to be at much lower risk than when the release was new and still expanding. What history demonstrates is that given time, the risk at the vast majority of sites will eventually and naturally progress in the order of "High-Intermediate-Low" risk based primarily on plume stability. Using this declining risk trend as the standard progression within site risk analysis, likewise the normal default cleanup standard should reflect this by being established at gross contaminate levels (GCLs).

The Standard Target Timeline:

The type of technologies selected at a given site along with the specific hydrogeological site characteristics play an important role in the duration of a remediation project. One prominent rule that factors into setting this goal is 15A NCAC 2L .0407 which requires the use of natural attenuation to the maximum extent possible in any corrective action plan. To define "maximum extent" the UST Section referred to EPA OUST Publication ***How To Evaluate Alternative Cleanup Technologies For Underground Storage Tank Sites: A Guide For Corrective Action Plan Reviewers*** (EPA 510-B-94-003; EPA 510-B-95-007; and EPA 510-R-04-002). This document details the evaluation of most all the common remediation approaches. Specific to natural attenuation, chapter IX discusses in detail the various considerations that should be taken into account applicable to the use of Monitored Natural Attenuation (MNA) at petroleum releases. Within this chapter, the outcome of the evaluation is that any MNA approach that takes over 10 years to achieve the GCL remediation goal may not be a viable selection for that site. For future project management planning, this 10-year maximum will be one of the design parameters we will be using to designate as the amount of time a MNA approach should take.

The main components of successful MNA projects are the correct geochemical conditions within the subsurface environment along with conducive types and amount of contaminate mass. Having too much free product, contaminated soil and groundwater with the incorrect geochemical balance will hinder the utilization of MNA. Anthropogenic changes to a release site will routinely be necessary to facilitate the maximum performance of MNA. In order to prepare a site to utilize MNA to its maximum extent, it may be often necessary to divide the corrective action project plans into two phases. The initial preparatory "Active" phase (year 0 to 2) and the "MNA" phase (year 3 to 12). The "Active" phase consists of the most cost effective steps necessary to modify the site conditions to prepare it for the longer "MNA"

phase. Excavation, MMPE, subsurface macro and micro nutrient amendments etc. are just some of the "Active" approaches that will likely be used.

The duration of the Active phase period was selected based on the same EPA technology evaluation document referenced above. Within that evaluation, most all other appropriately designed corrective action technologies reached their effective remediation goals within the first two years.

Going forward, for design purposes, GCLs will become our cleanup standard and the two phase (2+10 year) format will be the base design concept to utilize for cost comparison purposes. Obviously, if an alternate design or approach can be shown to be more cost effective than the base design concept, we should certainly be willing to approve that specific proposal. For example, if a CAP proposal is projected to reach GCLs with an active system running for six years is less expensive overall than the default design described above, we should approve it. This base design concept is being established to help everyone (RP, Consultant, DWM) to "calibrate" our decisions based on tangible and measurable goals.

A minority portion of the sites will remain "High" risk due to lack of plume stability/predictability along with obvious indicators like the number of impacted or threatened water supply wells where no permanent alternate water is available. When that is the case, we will need to consider the necessary and reasonable cost-effective modifications to the base design concept approach. These more complex and problematic sites will likely require a more detailed analysis of various remediation strategies with cost comparisons to establish cost effectiveness.

New Release Corrective Actions (Expanding to Stable Stages)

It has been repeatedly established, from many examples, that petroleum releases can be remediated cost effectively by a combination of source removal and natural attenuation at sites where conditions and risk levels allow. As soon as possible after a release, quickly removing or treating the free phase petroleum product and highly contaminated soil is by far the most cost-effective and risk reducing step to prescribe. Our rules and guidelines already provide for and encourage this important phase in Initial Site Abatement. We need to encourage these activities early in the site management process. In some cases, the ability to access and treat significant portions of contaminate mass may be hindered by existing infrastructure within the release location. If this situation condition applies, the evaluation of the cost of removing the infrastructure, removing the contaminate mass, replacing the infrastructure must be compared to other source removal technology costs and the most cost effective approach must be selected. If the responsible party elects not to remove the infrastructure even though it is the most cost effective approach, the maximum allowable

reimbursement available from the Trust Fund will be capped at that amount. The UST Section will consider forgoing initial abatement steps to allow for the remediation project to coincide with future planned UST system upgrade as long as there is no foreseeable health or safety danger, or exacerbated cost to the Trust Fund for allowing this accommodation.

After the "active" source treatment phase, the corrective action approach will shift to **Monitored Natural Attenuation** (MNA). This shift should be anticipated and planned for within the original CAP design. In some instances, the contamination levels at a site may be low enough that it may not be necessary to conduct any source removal, relying primarily upon MNA to achieve soil and groundwater goals within less than a 10-year period. By pre-planning the incident management to achieve specific measurable goals, progress toward risk-based closure can be tracked by all stakeholders. Again, a clear exception to this shift to MNA exists in cases where there are receptors clearly in harm's way. Groundwater impacts from relatively new releases are generally unstable, still expanding in size causing a level of uncertainty associated with possible impacts to water supply wells and vapor intrusion potential. For new releases, early choices made regarding the "active" phase and its implementation success are critical to the project, protection of public health and the environment.

Existing Site Corrective Actions

At existing active phase sites, MNA remediation sites and dormant sites currently below the funding bar, as these sites age and become more predictable, there comes a point when re-evaluation of the site risk should be completed. This is necessary to reaffirm we are complying with the "cost-effective" intent of 143-215.94V(c). Two triggers to conduct this evaluation are (1) when we get prompted to change the corrective action approach through a Task Authorization (TA) request; or (2) when the Risk, Rank and Abatement score (RRA) is over five years old.

When a plan to modify the corrective action approach or a PATA is submitted, confirm the current Risk, Rank and Abatement score (Appendix 1). Confirm also the analytical data being used to guide the project decisions is less than one-year-old. If these two conditions aren't able to be met with existing data, direct the collection of new information about the site prior to approval of any new corrective action approach. The RP should provide the necessary data to re-rank the site and determine if the proposed approach will be in line with the earlier corrective action decision targets. The obvious exception will be if it is clear to the incident manager that the proposed change will be more cost-effective (ex. changing from an ineffective active system to short-term MNA).

Meeting the "Reasonable & Necessary" Test

Determining the cost-effectiveness of a proposal will require some level of both estimation and projection. These analyses can be simple cost comparisons or include complex computer modeling. To be consistent in this analysis across the program (1) the incident manager

should be highly confident that the Risk, Rank and Abatement score is representative of current site conditions, (2) most sites should default to targeting GCLs as previously mentioned, (3) there should only be a very small percentage of sites targeting 2L standards. At this point in project management, the RP should compare all corrective action decisions to the base design concept (2 yr. Active + 10 yr. MNA) and propose the most cost effective approach. If this determination is properly documented, the vast majority of the technical audits conducted by Trust Fund Branch for reasonable, necessary and efficiency purposes should be approved without need for additional information.

Collaboration to Establish Project Consensus

As often as is possible, we need to have all stakeholders including the RP, CAB, TFB and the Consultant providing input into the decision making for each site. The utilization of the Division's WebEx Licenses, conference calls or face to face multi-party meetings to go over the plans for a site will be required for key project decision points identified in the 10 Step Process below. Before the RP and Consultant make decisions to proceed with system/project planning or design and implementation, the stakeholder group will have a scoping meeting which will address the evaluation of the "cost-effectiveness" and the "reasonable and necessary" characteristics of expenditures prior to seeking any PATA approvals. The CAB, TFB as well as the RP and Consultants all have a stake in these approvals. The new process will entail the following steps described in the section below.

Process Steps for Corrective Action Implementation

Prior to beginning this process, (A) a Comprehensive Site Assessment must be complete enough to: know the location of the contaminated zone and how much of the contaminate mass needs to be treated or physically removed (if any) and develop a representative Conceptual Site Model; (B) the RP/Consultant should have proposed a conceptual corrective action approach to the Incident Manager; (C) the UST Section Incident Manager and a Trust Fund Representative should have discussed the site and establish a unified stance on the proposed project and specific site needs.

Feasibility Study (Steps 1-4)

Step 1: Is MNA viable? If so, begin planning MNA then proceed to Step 3. If not, proceed to Step 2.

Step 2: From the subsurface data generated in CSA phase (including subsequent pre-CAP monitoring and/or field screening events):

1- Does the geotechnical or hydrogeological data indicate that the contaminated zone is located in geologic material that lacks adequate permeability or other in-situ characteristics not conducive for a mechanical remediation system; or

2- Is the contaminated zone located and distributed such that it is simple to deduce excavation is the most logical and cost effective approach?

If the answer is yes to either, begin planning excavation and proceed to Step 3.

If the answers to both are no, begin planning how to select best fit technology and proceed to Step 3.

Step 3: Conduct scoping meeting: discuss and select best fit technology (estimated cost to remove UST System, excavate contamination, replace UST system should be made available to facilitate scoping discussion)

Step 4: If needed, Pilot Test the one selected Technology (If pilot test fails, go back to step 3)

Record of Decision (Step 5-6)

Step 5: RP/Consultant provides specs to DWM

Step 6: DWM approves specs (if not, go back to step 5)

Remedial Design (Steps 7-9)

Step 7: Bid Selected Project Technology

Step 8: Submit final CAP

Step 9: DWM approves

Remedial Action (Step 10)

Step 10: Implement Project

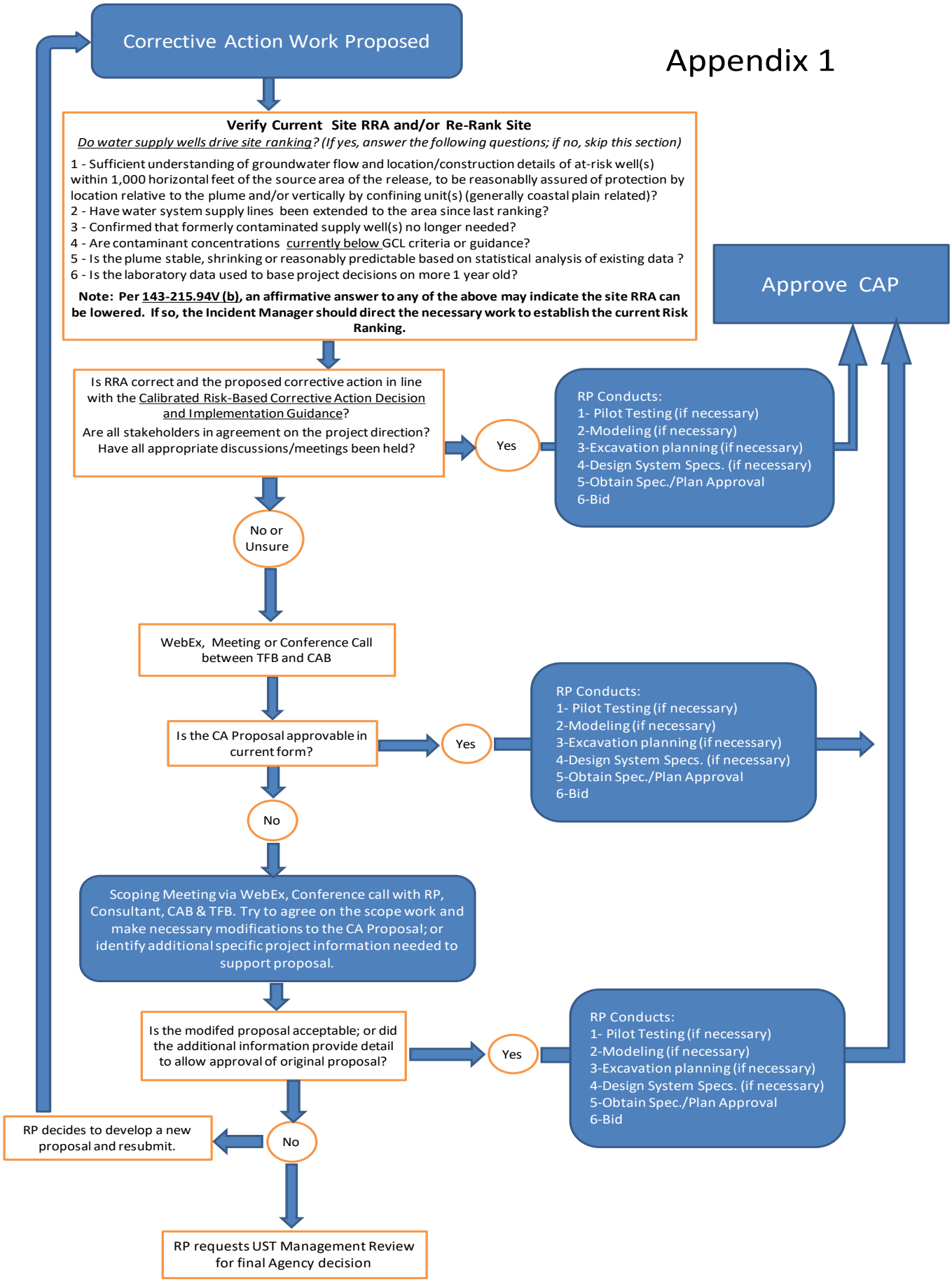
It is a given that there will undoubtedly need to be exceptions to this standardized approach. There will be cases where a viable corrective action approach selection may not be TF eligible. For example, the RP may choose to rapidly clean-up their site with an aggressive Dual-Phase Extraction System in conjunction with soil excavation. If it is not the most cost effective approach but is something the RP wants to do using their own resources the RP, Consultant, Incident Manager and TFB must communicate in these situations and determine a unified strategy. In these instances, the Trust Fund eligible vs. non-eligible expenses should be well documented before the project receives approval.

Guidance for Resolving Differences of Opinion

In anticipation of some occasional project approval issues that are unable to be resolved during the aforementioned 10 step process, the RP/Consultant may request a project evaluation and discussion with the CAB Branch Head, Trust Fund Branch Head and Section Chief. After this review, the UST Section will make their final decision on the matter and provide a written final response to the RP/Consultant from the Section Chief.

Thank you, in advance, for adapting to these significant programmatic changes which, in the long run, will allow us to improve service, address more incidents and strengthen soundness of the Commercial Fund. By incorporating these defined and measurable decision making parameters we believe it will redirect substantial funding to sites currently below the funding bar allowing the UST Section to work on many older, lower and unknown risk sites that need our attention. Appendix 1 contains a process flow chart that captures the guidance contained herein. As always, I am eager to hear your feedback and get your ideas on making the UST Section better able to accomplish its mission and constantly improve our performance with the available resources.

Appendix 1


Corrective Action Work Proposed
Verify Current Site RRA and/or Re-Rank Site
Do water supply wells drive site ranking? (If yes, answer the following questions; if no, skip this section)
1 - Sufficient understanding of groundwater flow and location/construction details of at-risk well(s) within 1,000 horizontal feet of the source area of the release, to be reasonablly assured of protection by location relative to the plume and/or vertically by confining unit(s) (generally coastal plain related)?
2 - Have water system supply lines been extended to the area since last ranking?
3 - Confirmed that formerly contaminated supply well(s) no longer needed?
4 - Are contaminant concentrations currently below GCL criteria or guidance?
5 - Is the plume stable, shrinking or reasonably predictable based on statistical analysis of existing data ?
6 - Is the laboratory data used to base project decisions on more 1 year old?
Note: Per 143-215.94V (b), an affirmative answer to any of the above may indicate the site RRA can be lowered. If so, the Incident Manager should direct the necessary work to establish the current Risk Ranking.
Approve CAP
Is RRA correct and the proposed corrective action in line with the Calibrated Risk-Based Corrective Action Decision and Implementation Guidance?
Are all stakeholders in agreement on the project direction? Have all appropriate discussions/meetings been held?
Yes
RP Conducts:
1- Pilot Testing (if necessary)
2-Modeling (if necessary)
3-Excavation planning (if necessary)
4-Design System Specs. (if necessary)
5-Obtain Spec./Plan Approval
6-Bid
No or Unsure
WebEx, Meeting or Conference Call between TFB and CAB
Is the CA Proposal approvable in current form?
Yes
RP Conducts:
1- Pilot Testing (if necessary)
2-Modeling (if necessary)
3-Excavation planning (if necessary)
4-Design System Specs. (if necessary)
5-Obtain Spec./Plan Approval
6-Bid
No
Scoping Meeting via WebEx, Conference call with RP, Consultant, CAB & TFB. Try to agree on the scope work and make necessary modifications to the CA Proposal; or identify additional specific project information needed to support proposal.
Is the modifed proposal acceptable; or did the additional information provide detail to allow approval of original proposal?
Yes
RP Conducts:
1- Pilot Testing (if necessary)
2-Modeling (if necessary)
3-Excavation planning (if necessary)
4-Design System Specs. (if necessary)
5-Obtain Spec./Plan Approval
6-Bid
RP decides to develop a new proposal and resubmit.
No
RP requests UST Management Review for final Agency decision