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Solid Waste and Emergency Response (OS-240)

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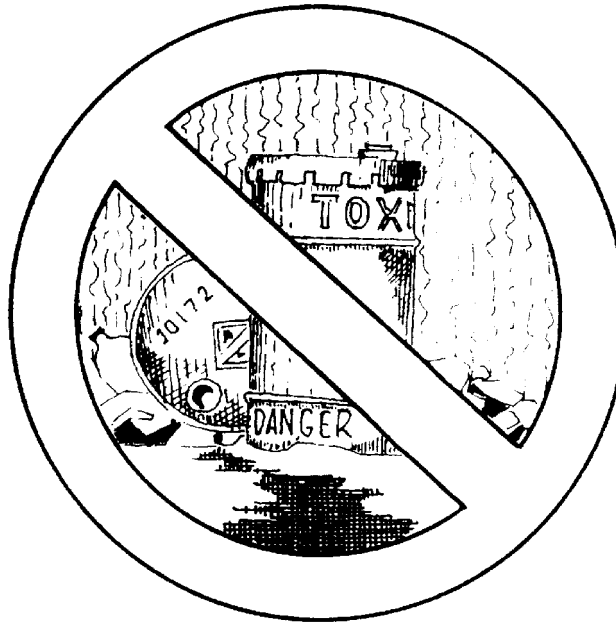
SCOPER'S NOTES

An RI/FS Costing Guide



Bringing in a Quality RI/FS On Time and Within Budget

INTRODUCTION

What

This handbook is intended for use by RPMs during RI/FS scoping activities to assist them in identifying those options and decisions within the scoping process that may have significant impact on project budgets.

Why

The Oaverage@ cost to complete an RI/FS has more than doubled over a three year period. Some of this increase is no doubt justified, but some of the change may be the result of duplication through minimal use of existing resources, incomplete project planning, and insufficient schedule and financial control. In fact, past RI/FS costs have occasionally appeared excessive because projects were unnecessarily rated as complex, excessive studies were performed, and/or sampling and analyses requirements were in excess of the actual needs.

As a Project manager it is your responsibility to provide the **project supervision, schedule maintenance,** and **financial control** of the RI/FS project. As an RPM, you should understand the basis and rationale for project design and be in a position to justify the project budget in a professional manner.

How

The following pages outline the tasks and sub-tasks typically conducted as part of an RI/FS, and present a strategy based on site complexity and task difficulty for estimating a project=s cost. You can use the cost guidelines to estimate funding needs in advance of issuing a work assignment and to evaluate contractor proposals to do the work.

RI/FS SCOPING IN A NUTSHELL

The objective of the scoping process is to develop a conceptual understanding of a site's based on existing information's so that a sufficiently detailed workplan for conducting the necessary investigative and analytical tasks can be prepared. Although site specific conditions will govern the types of investigations and level of effort required for any given site's five basic questions need to be answered at all sites:

1. What type and in what quantities are hazardous materials present?
2. Where are the hazardous materials physically located?
3. What are the potential routes of migration and exposure pathways?
4. Who and what are potentially at risk through exposure?
5. What remedial strategy(ies) will best reduce or eliminate the existing and/or potential risk?
6. What are your data needs?

Experience has shown that despite how much money and time is spent on an RI/FS's some degree of uncertainty concerning the nature and extent of contamination and/or the expected performance of a remedial technology will remain. You should keep in mind that the objective of the RI/FS is not to remove all uncertainty's but to gather information sufficient to support and informed risk management decision regarding what remedy appears to be most appropriate given what is known about the site.

Resources you will need:

1. Hazard Ranking System (HRS) Report
2. Other reports from previous site work (if any)
3. Notes from site visits(s)
4. Potential Responsible Party (PRP) Search Report
5. Solutions used at other sites
6. Guidance pertaining to site situation

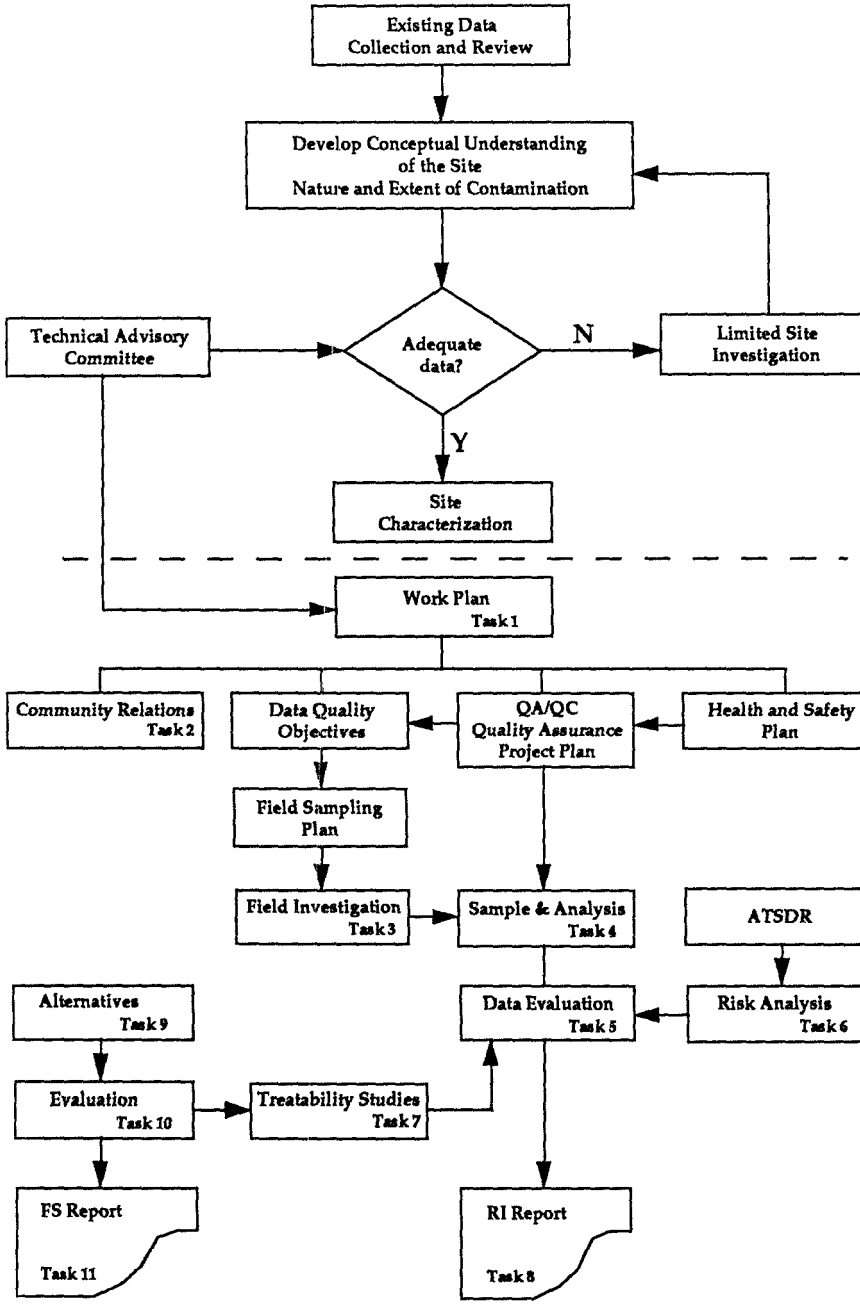
RI/FS PROJECT TASK BREAKDOWN

The RI/FS project has been divided into 14 standardized tasks to facilitate the planning process and serve as a management tool for tracking progress and expenditures during the investigation.

1. Project Planning
2. Community Relations
3. Field Investigation
4. Sample Analysis and Validation
5. Date Evaluation
6. Assessment of Risk
7. Treatability Studies
8. Remedial Investigation Reports
9. Remedial Alternatives Development and Screening
10. Detailed Analysis of Remedial Alternatives
11. Feasibility Study Reports
12. Post RI/FS Support
13. Enforcement Support
14. Miscellaneous Support

Not all tasks may be required for a given site; use only those that are appropriate.

SCOPING THE RI/FS
COMING UP WITH THE WORK PLAN



GETTING STARTED: COLLECTING EXISTING DATA

Spend time researching existing site information. Start with the Hazard Ranking System (HRS) package and the draft PRP Report. The PRP search report is prepared by enforcement personnel and has a lot of useful information on legal property descriptions record of ownerships permitss easementss licensess liens ordinance violationss etc. If you have to, you can chase down the same information from deed bookss the health departments Sheriff's Offices etc.s **but don't if it's already available.** It may even be possible to interview a PRP to obtain useful site data.

Visit the local land records office and examine deed books for ownership history if this information isn't in the HRS or PRP Search Report. Visit the local Agricultural Extension Agents Soil Conservation Service representative; these organizations are great on ground waters aquifers soil types surface drainage etc. The local Health Department will have data on local drinking well water quality. Local well-drilling companies will have a collection of drilling logs for the site area. Local waste haulers may have records of clients that have used the site.

Don't overlook talking to site neighbors or trying to find former employees who can describe work practices on the site. It is much easier to be told about buried drums than it is to go looking for them arbitrarily.

The National Weather Records Centers Asheville N.C. has years of climate data for all sections of the country including the nearest airport and towns.

Be sure and obtain relevant records from previous removal actions or PA/SI material. **Avoid repeating existing work.**

There is a pool of experience from previously completed RI/FS projects. Study good examples of completed RI/FS projects and don't be afraid to use their better features to accomplish the work in a more timely and efficient manner. For similar site types items such as Health and Safety Plans Quality Assurance Plans etc. do **not** have to be re-developed or re-phrased to sound different for each new project. Satisfactory components from successful completed studies should be adopted wherever they can contribute to eliminating the time and expense of the duplication of previous work.

There is no substitute for a personal site visit. After gaining access walk the site respecting safety precautions and make field notes. Take a camera and use it. The information you gain will save time and avoid mistakes and oversights. Keep a good notebook record for yourself.

Ask people with the applicable experience and backgrounds and whose opinion you respects to serve on a Technical Advisory Committee for the project. Your Technical Advisory Committee (TAC) should consist of individuals who have technicals administratives and enforcement experience which can help you learns evaluates and decide. The goal is to increase efficiency and conduct the project more economically by using accumulated experience; that iss to do a professional job within the budget.

For TAC meetingss always distribute an agenda of topics to be presented in advances and clearly state what results you hope to achieve. DonNt call everybody if your questions arenNt of project-wide importance. Make an appointment with individuals to discuss specialized topics. If the results of a decision are importants summarize them in a memo and distribute it so that there is no misunderstanding of what the results were.

DonNt be afraid to ask questions. ThatNs the only way to make sure that you understand. Different people have different understandings of words like Onormals0 Oaverages0 Oadequates0 or Osuitable.0 Be sure there is a common understanding so that what you assume to be perfectly adequate doesnNt turn out in the end to be woefully inadequate in someone elseNs view.

You are not expected to be an expert on all thingss but you should know where you can get expert advice when itNs needed. It is all right to question the advice you get and to decide whether or not to use it on your project. Bounce ideas off your TAC or ask for suggestions. That is what a TAC is for.

Keep in touch with enforcement personnel assigned to your sites and let them know of your progress. Invite them to your Technical Advisory Committee meeting.

ESTIMATING LEVEL OF EFFORT

The cost of an RI/FS project is made up of two categories of expenditure. The principal one is the cost of labor spent on project tasks, known as the level of effort. The other, known as "other direct costs" (ODCs), consists of the remainder of the expenses (e.g., travel, equipment) related to the study.

The Level of Effort (LOE) is the number of work hours devoted to a particular task. The LOE is usually divided into skill levels for costing purposes. For instance, a task might take 40 T2 level hours to locate background materials, 60 P2 level hours to assemble generic materials, 40 P3 level hours to write, 20 hours to type, and 10 level P4 hours to review, a total LOE of 170 hours.

The cost of the LOE is the sum of the costs for each skill level. The total cost per hour is the actual cost of labor, an overhead percentage which covers fringe benefits and other personnel costs, a percentage for general and administrative expenses, and a percentage fee. A base labor cost of 18 dollars an hour can result in a cost to the project of over 50 dollars per hour after the other factors are applied.

To estimate task LOEs, assign hours for each skill level required based on the type, amount, and difficulty of the task. A contingency amount should be included for inclement weather and other delays due to unforeseen factors. Approving skill level assignments that are higher than are reasonably required for the task performed will result in higher costs for no real gain in quality.

OTHER DIRECT COSTS

As a rule of thumb, labor costs add up to about 60 percent of the total cost of an RI/FS project. The remaining 40 percent is made up of items such as travel, communications, equipment rentals or purchases, printing, expendables, subcontracts, etc. These costs are lumped together and called "other direct costs" or ODCs.

Travel costs (including per-diem) can be a substantial project expense and should be monitored carefully. Travel costs incur a G & A charge (General and Administrative expense) and are part of the cost basis used to compute a contractors award fee. The particular G&A charge depends on how the contractor keeps the books but can run as high as 35 percent.

Printed reports that are unnecessarily elaborate are extra expense items as are reports that contain duplicate information. Review any items that are to be reproduced in any quantity to make sure that they are assembled efficiently.

STRATEGY FOR ESTIMATING RI/FS STANDARD TASK COSTS

Upper and lower cost bounds for budget estimates for each of the 14 standard RI/FS tasks have been established (Table I). The amounts shown are in 1989 dollars and are meant to include satisfaction of all current guidance requirements for RI/FS project tasks. The cost ranges have been determined by analyzing technical requirements and past experience records as well as professional judgment. They are considered reasonable and of a broad enough range to serve as a general guideline for RI/FS cost-estimating efforts.

The allocated costs for some tasks vary significantly with site complexity while for other tasks the costs are less affected by site conditions. (Key factors affecting site complexity are found on Page 11.) Following a site examination, an RPM should step through each task, considering the factors listed and the site's complexity, and establish a task cost target. From Table I, the highest allowance (complex) is intended to be applied to those sites where site conditions fully justify the added cost allocation. Average sites should fall somewhere around "Average" costs, and for the simpler sites, it may even be possible to accomplish the task for less than the lower cost bound shown. You should be in a position to justify your estimates on broad terms to your management. If a task is unnecessary and does not need to be conducted in a particular RI/FS, it should be omitted.

The intent of this strategy is not to limit the proper conduct of your study, but to stress the need to conduct the work in an efficient manner. Although each site has unique aspects, it is not necessarily complex. Evaluate your site carefully to avoid excessive expenditures for marginally valuable results.

Using this method as a planning or evaluation tool will help establish an independent estimate which can be used to evaluate contractor proposals.

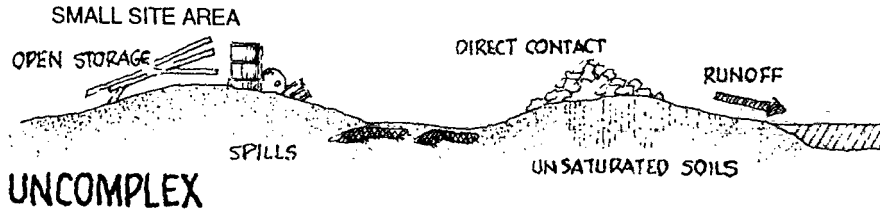
TABLE I
RI/FS ESTIMATED LOE AND COST SCHEDULE

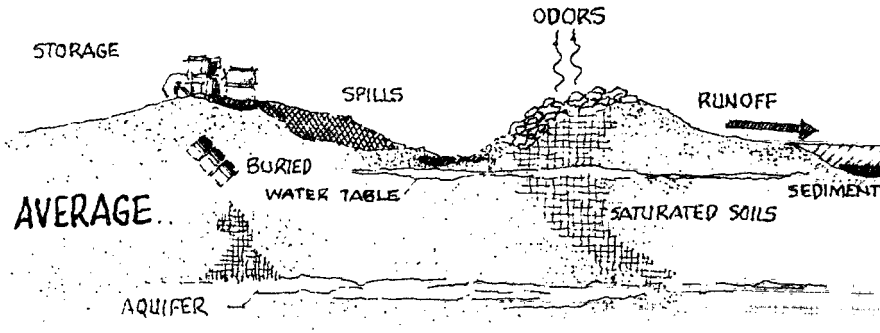
Task	Site Type					
	Uncomplicated		Average		Complex	
	LOE hr‡	Budget k$*	LOE hr‡	Budget k$*	LOE hr‡	Budget k$*
Planning	850	60	1102	97	1500	143
Remedial Investigation						
Field Investigation	2100	158	2714	240	3300	418
Sample Analysis	610	45	709	85	933	120
Data Evaluation	460	30	560	50	665	60
Risk Assessment	360	28	450	40	519	60
Remedial Investigation Report(s)	500	25	600	48	910	48
Treatability Studies**	290	16	390	35	460	80
Feasibility Study						
Remedial Alternatives Development and Screening	260	20	300	25	360	45
Remedial Alternatives Analysis	370	40	450	40	620	100
FS Report(s)	460	25	526	28	845	48
Post RI/FS Support	150	10	300	20	400	40
Community Relations	210	16	210	16	450	25
Other						
Enforcement Support	15	20	200	45/20	200	45/35
Miscellaneous Support	150	10	150	10	150	10
Project Budget Total	6785	503	8661	779	11312	1242

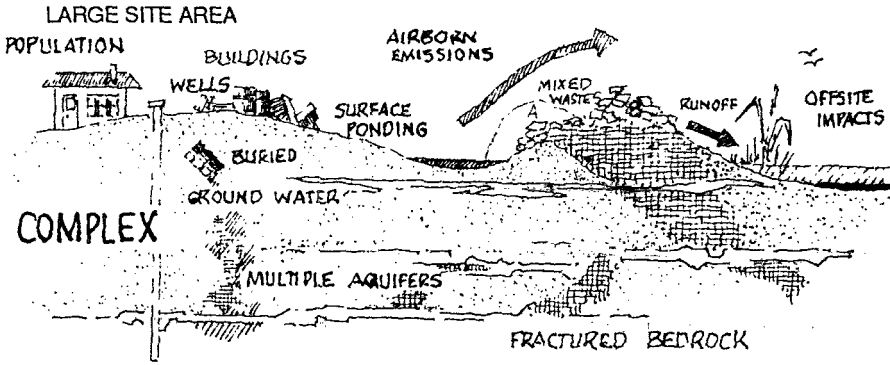
‡ Based on a skill level combination of 6%-P4s 8%-P3s 40%-P2s 30%-P1s 13.5%-T2s 1%-T1s and 1%-clericals averaged over the whole project. The dollar budget to support the task is obtained by multiplying the LOE by an average labor cost for the skill combination shown s and adding an amount for ODCs.

* Figures in 1989 dollars

** Does not include conducting bench tests s only determining their feasibility.


SMALL SITE AREA
OPEN STORAGE
DIRECT CONTACT
RUNOFF
SPILLS
UNSATURATED SOILS
UNCOMPLEX


ODORS
STORAGE
SPILLS
RUNOFF
BURIED
WATER TABLE
SEDIMENTS
AVERAGE..
SATURATED SOILS
AQUIFER


LARGE SITE AREA
POPULATION
BUILDINGS
AIRBORN EMISSIONS
WELLS
MIXED WASTE
RUNOFF
OFFSITE IMPACTS
SURFACE PONDING
BURIED
GROUND WATER
COMPLEX
MULTIPLE AQUIFERS
FRACTURED BEDROCK

INVESTIGATION VERSUS REMEDIATION
A 0FIRST LOOK0 SITE COMPLEXITY RATING

Exposure Risk Factors	Range			Rank L	Rank M	Rank H
significant closest population	(1500ms	500ms	100ms)			
working drinking water wells	(nos		yes)			
offsite sensitive areas	(nos		yes)			
adjacent agriculture land use	(nos		yes)			
Site Surface Factors						
area in acres	(<5s	5-25	>25)			
access (for equipment)	(easys	avgs	hard)			
topographic variation in feet	(<5s	5-20	>20)			
ponds or lagoons	(0s	1s	>1)			
streams on site	(0s	1s	>1)			
soil type	(loams	sandys	rocky)			
rock outcrops	(0s	1	>1)			
vegetation on site	(nos	sparses	heavy)			
evident soil erosion	(nos	somes	heavy)			
utility easements on site	(nos	1s	>1)			
safety precautions necessary	(nos		yes)			
evidence of flooding	(nos		yes)			
Estimated Media Contaminated						
soil stains	(nos	fews	many)			
odors	(nos	somes	strong)			
wind blown particulate	(nos	littles	much)			
buildingss structures	(Nos	fews	many)			
water table depth	(<12s	13-25s	>25)			
offsite complaints (fishskills)	(nos	fews	many			
discolored sediment deposits	(nos	fews	many)			
multiple aquifers	(nos		yes)			
annual rainfall	(<18s	19-30s	>30)			
Waste Conditions						
drums	(nos	fews	many)			
storage tanks	(nos	fews	many)			
container condition	(goods	avgs	poor)			
known high hazard substances	(nos	littles	much)			
contaminants present	(fews		many)			

Site complexity is estimated by the number of checks appearing in each vertical column. Complex sites will rank to the right.

USING THE TASK EVALUATION QUESTIONNAIRE

The following pages present each of the 14 standard tasks of an RI/FS project along with qualitative questions that cover some of the factors that will influence the difficulty of the task and the budgeting of funds to complete the work.

Each task includes a cost range (from Table I) which relates to how difficult the task appears to be at this stage of project scoping. These ranges are provided to be used as a framework against which to judge the reasonableness of bid costs to do the work. Indicate your answers to the questions and use the proportion of "yes" and "no" answers to estimate the likely cost of the task (e.g., 50/50 distribution would suggest using the "Average" cost). Enter the resulting estimate in the "Allocation" box for that particular task. If site-specific factors justify a different level of effort, then alternative cost estimates may be used.

TASK 1 PROJECT PLANNING

ALLOCATION | |

This task is most important since it will determine the course of the project. It is a good idea to return to it as you step through the other tasks to make sure everything that is required is included and that there are no unnecessary steps that consume time and resources. The objective is to clean up a site, not study it unnecessarily.

No	Yes	
		* Does existing site data indicate complexity?
		* Is this one of several OUs?
		* Will pre-sampling be required?
		* Will special maps be needed?
		* Has any site activity occurred?
		* Are there several contaminated media involved?
		* Must Health, QA, FSPs, etc. be developed?
		* Will special analytical techniques be required?
		Other:

Complexity: uncomplicated average complex

60----------97----------143k$

Notes:

TASK 4 SAMPLE ANALYSIS/VALIDATION

ALLOCATION

This task includes the analysis of field samples and the quality control and quality assurance of the analytical procedures. In the past this was almost always handled away from the site using CLP laboratory assistance. If initial analysis can be done on-site with portable or mobile laboratory facilities, satisfactory results can be made available more rapidly and at lower cost.

No	Yes	
		* Must sampling protocols be developed?
		* Are all samples processed in a (remote) CLP lab?
		* Is there more than one medium involved?
		* Are unusually toxic materials known to be present?
		* Will special analysis procedures be required?
		* Do a large number of samples need to be validated?
		* Will expedited CLP turnaround time be requested?
		Other:

Complexity: no uncomplicated average complex

0----------45----------85----------120k$

Notes:

TASK 5 DATA EVALUATION

ALLOCATION

This task accounts for activities related to the evaluation of data for use in calculations, analyses, effects predictions, modeling, and any other types of analysis where specific site data are used.

No	Yes	
		* Must DQOs be prepared and reviewed?
		* Will non-standard analytical methods be developed?
		* Is historical data insufficient or as yet unvalidated?
		Other:

Complexity: no uncomplicated average complex

0----------30----------50----------60k$

Notes:

TASK 2 COMMUNITY RELATIONS

ALLOCATION

This task covers preparation and conduct of community relations services during the life of the RI/FS.

No	Yes		
		*	Is the site reasonably close to a community?
		*	Has there been a high level of community interest?
		*	Has local or State government been closely involved?
		*	Administrative record repository not yet identified?
		*	Key community spokespersons not yet identified?

Interest: uncomplicated average complex

16----------16----------25k$

Notes:

TASK 3 FIELD INVESTIGATION

ALLOCATION

The task includes fieldwork to survey, gather data, collect samples, perform tests on-site, etc. In the typical project, over 50 percent of the RI/FS cost is the result of activities in this task. The activity in this task is especially high (and costly) for complex sites. This task should be analyzed carefully and scoped with care to control sampling duplication, unnecessary drilling and testing, and interruptions to site work requiring re-mobilization.

No	Yes		
		*	Will there be more than one project phase?
		*	Is more than one medium involved?
		*	Will more than one subcontractor be required?
		*	Will weather affect field operation schedules?
		*	Will high protection levels be required for people?
		*	Will there be contaminated waste produced?
		*	Are there surface waters or stored liquids?
		*	Are there buildings on-site?
		*	Will test excavations be required for buried wastes?
		*	Will any off-site work be required?
		*	Are there any problems in physical site access?
			Other:

Complexity: uncomplicated average complex

158----------240----------418k$

Notes:

TASK 6 ASSESSMENT OF RISKS

ALLOCATION

This task provides a determination of the estimated risk to human health and other aspects of the environment due to the hazardous substances present and the potential pathways of exposure.

No	Yes	
		* Is there more than one contaminated medium involved?
		* Is there more than one significant exposure pathway?
		* Will assessment models be developed?
		* Are there known highly toxic or carcinogenic materials present?
		* Has the use of indicator chemicals been rejected?
		* Are significant populations/receptors involved?
		* Are there sensitive environmental issues (e.g.s wetlands endangered species)?
		Other:

Complexity: no uncomplicated average complex

0----------28----------40----------60k$

Notes:

TASK 7 TREATABILITY STUDIES

ALLOCATION

This task includes efforts directed toward the development of site-specific performance data for treatment technologies being considered. These studies can include bench and/or pilot tests. Most commonly pilot tests are used for innovative technologies or conventional methods being applied to a waste type for which performance data do not exist. There should be a reasonable probability of success before a pilot study is initiated.

No	Yes	
		* Are a number of conventional technologies available?
		* Will bench or pilot testing be required?
		* Is the toxicity or volume great?
		* Are potential ARARs severe/numerous/ complex?
		* Will testing be conducted offsite?
		* Will clarification of soil cleanup goals be required?
		Other:

Complexity: no uncomplicated average complex

0----------16----------35----------80k$

Notes:

TASK 8 REMEDIAL INVESTIGATION REPORTS

ALLOCATION

This task covers the preparation of draft and final reports summarizing findings of the data gathering and validation tasks. It is comprised mostly of labor hours in report preparation$ review and revision.

No	Yes	
		* Are more than two review agencies involved?
		* Will new report formats be developed?
		* Have a large number of samples been proposed?
		* Is more than one significant medium involved?
		* Are there several significant pathways?
		Other:

Complexity: no uncomplicated average complex

0----------25----------48----------48k$

Notes:

TASK 9 REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

This task provides for the initial evaluation and identification of the most suitable remediation methods from the set of possible methods applicable to a site. A judgement about the most likely remedial actions appropriate to the site will be of great benefit in planning your project. Only those methods with a solid likelihood of being selected should be considered. (Typically$ no more than three to five alternatives are evaluated in detail under the following Task 10.)

No	Yes	
		* Are there multiple technology and process options?
		* Is more than one medium involved?
		* Are new evaluation criteria required?
		* Are treatability studies proposed?
		* Has any prior site remediation occurred?
		Other:

Complexity: no uncomplicated average complex

0----------20----------25----------45k$

Notes:

TASK 10 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

ALLOCATION

This task is devoted to the detailed evaluation of the most likely remedial methods identified in Task 9.

No	Yes	
		* Is more than one medium involved?
		* Are there multiple exposure pathways?
		* Do any ARARs modify methods or require a waiver?
		* Are there more than five reasonable alternatives?
		* Has there been previous remediation?
		* Are there restrictive climate conditions?
		* Are there innovative technologies proposed?

Other:

Complexity: no uncomplicated average complex

0----------40----------40----------100k$

Notes:

TASK 11 FEASIBILITY STUDY RI/FS REPORTS

ALLOCATION

This task includes the preparation of reports that summarize the various analyses of site conditions and proposed remedial action decisions.

No	Yes	
		* Are more than two agencies reviewing?
		* Are new reporting formats required?
		* Are there potential multi-media remedies?
		* Are there more than five alternatives analyzed?

Other:

Complexity: no uncomplicated average complex

0----------25----------28----------48k$

Notes:

TASK 12 POST RI/FS SUPPORT

ALLOCATION

This task is initiated once the RI/FS is completed. It includes such tasks as preparing the proposed plans pre-design activities and close out of the work assignment.

No	Yes	
		* Will a pre-design report be prepared?
		* Will ROD support be required?
		* Will a responsiveness summary be prepared?
		* Is an addendum to the FS likely?
		* Are there numerous comments from the publics including PRPs?
		Other:

Site type: no uncomplicated average complex

0----------10----------20----------40k$

Notes:

TASK 13 ENFORCEMENT SUPPORT

ALLOCATION

This task includes work done during the RI/FS Project which is for the purpose of supporting enforcement actions (consult enforcement personnel).

No	Yes	
		* Will additional PRP search work be needed?
		* Is an RI/FS takeover by the Fund possible?
		* Is an RI/FS enforcement action possible?
		* Will preparation for RD/RA special notice(s) be required?
		* Will the PRP be a Federal Facility?
		* Are State issues involved?
		Other:

Site type: no uncomplicated average complex

0----------20----------30----------45k$

Notes:

TASK 14 MISCELLANEOUS SUPPORT

ALLOCATION

This task was established to account separately for minor work effort associated with$ but not directly a part of$ the RI/FS process. **It is not a contingency fund.** The budgeted amount is for allied items like:

No	Yes

* Assistance to ATSDR in review$ update$ etc.
* Support for related State or local projects

Since these costs cannot be estimated at this point$ a nominal amount (10k$) should be budgeted$ unless it is known that there are specific site circumstances that can be expected to occur.

Site type: no uncomplicated average complex

0----------10----------10----------10k$

Notes:

DEALING WITH CONTRACTORS

As RPM you will be dealing with contractors. As in all relationships some work out better than others. What the contractor is contracted to do is specified in the contract Scope of Work. Scope changes (change orders) are expensive and time-consuming actions and should be examined carefully and used sparingly. Only the Contract Officer can change the Scope of Work. Do **not** make verbal commitments about work assignments to contractors. These frequently result in a request for a change order. **Only** the Contract Officer can make commitments.

Be sure that you review all contractor invoices. Make a careful check of hours and skill level versus work accomplished. Compare task actuals against budgets to guard against cost or labor hour over-runs. Catch budget problems early so they can be fixed in time. Resolve to set objectives with costs as well as results in mind. Ask questions and insist on justifications for things that are not clear. After all, it's your project.

Most contracts have incentive award provisions. This is a bonus payable as a percentage of the total contract cost and is for rewarding the contractor for above average performance. In most cases the award will be substantial. This should not be treated as a contractor's "right" but should, if awarded, be fairly earned. You are in a position to influence if and how much of the award fee will be granted. Be prepared to justify your recommendations with facts and figures.

Subcontracts are entered into by the prime contractor who is responsible for screening and selecting appropriate candidates. The sub-contractor will be responsible to the contractor. You are free to look at a subcontractor's work at any time but leave all direction of the sub to the prime. Any comments you have should be directed to your contractor, not the sub.

Avoid asking your contractor to perform personal services such as typing notes for you or writing any report that you as Project Manager are responsible for.

Don't turn over your decisions to a contractor. It is your project and you and your management should assume the responsibility for all major decisions.

PHASING THE INVESTIGATION

Phasing an investigation allows you flexibility in the early stages of the work by not requiring high levels of sampling accuracy or precision while establishing ball-park values. These phase on data then become design parameters for follow-on focused data quality objectives.

To benefit from conducting the RI in "phases", each phase must be designed to use the information developed in prior work. This will improve the design of subsequent steps and improve efficiency. By phasing the work logically, you can identify potential mistakes or faulty initial information and save valuable time and expense by not developing unproductive lines of investigation. Logical phasing allows you to focus on a more narrowly defined objective.

While phasing the work you should not assume that the RI/FS will extend over a longer period of time. If the phasing is done correctly, it should result in efficiencies over a "heads up" approach or study designs that are entered into without valid knowledge about actual site conditions. Examine proposals for phasing the work carefully to make sure it will benefit the progress, not just divide the tasks into sub-tasks which will take longer and result in a higher cost. If a phased study cannot be clearly shown to lead to improved output, less time or lower overall cost, it shouldn't be done.

DRILLING SAMPLING WELLS

A significant cost item in RI/FS projects is drilling and casing test wells for groundwater sampling. In addition to per foot drilling costs, larger diameters and stainless steel casing add considerable expense to installing a well. Small diameter (two-inch) wells are adequate for sampling only. If there is a strong possibility that pump-and-treat will be a potential remedial methodology, installation of a larger diameter well may be justified during the initial Field Investigation sampling.

Casing material should be chosen based upon its chemical and structural resistance to natural groundwater chemistry and the chemistry of the constituents of concern. The materials should retain their structural integrity and neither adsorb nor leach chemical constituents which would bias groundwater samples. Stainless steel casing and screen materials should be used in the saturated zone when sampling for volatile organics. Stainless steel should not be used in acidic, corrosive environments when the constituents of concern are metals rather than organics: under these conditions, PVC or flurocarbon resins are preferable. PVC well casings and screens are appropriate only if trace metals or non-volatile organics are the contaminant anticipated. Composite wells may be constructed with PVC casing materials in the unsaturated zone and more inert materials (such as stainless steel) in the saturated zone.

A large part of well drilling costs is in mobilization to get all of the required equipment on site. Some checking of local climate history will keep from scheduling activities during periods of normally expected inclement weather.

In establishing Data Quality Objectives it is important to distinguish between what is possible, what would be "nice" to have, and what will be adequate. Outline what data you think you will need to have at various decision making stages of the work and determine how confident you need to be about the reliability of the data. Use different data specifications for different data uses. If there is a breakpoint value of 10 and the observation is about 14, then there is nothing added if the measurement were extended to 14.236, especially if it is more costly to to provide the added precision.

Accuracy is more important than precision. A tape measure may allow you to measure with an indicated precision of a hundredth of an inch but it may not be accurate. Initial data used to establish yes or no decisions or ball-park estimates need not be very precise, but it should be accurate.

Some chemical concentrations on site may need to be measured to the parts per billion range. These are difficult measurements to make reliably. If you specify a high level of data quality make sure it will be worth the effort.

Since soils, surface waters, and ground water in different regions contain a variety of "natural" chemicals, be sure to determine the site background before drawing conclusions from sampling results. There are lots of concentrated mineral deposits. A "representative" site sample is not taken after a hard rain or during a hard freeze. There should be "up" grade sampling locations in at least two orthogonal directions unless you're sitting on top of a knoll.

Don't automatically assume that all analyses have to be performed by Contract Lab Program (CLP) services. You can often save time and effort by using portables on-site mobile laboratory services or other fixed labs for rapid results. These results can guide the progress of the work and allow you to send a smaller number of samples to the CLP for confirmation purposes.

Assignment of samples to the CLP for analysis should not be abused. Because this is a service it does not appear on the RI/FS project budget. It is however an expensive procedure and a significant budget item within Superfund. Furthermore CLP resources are limited and excessive testing for one site may preclude needed analysis at another.

A review of FS reports from completed projects often shows that even though round one sampling results are negative the same parameter analyses are requested in each successive round. CLP resources are too valuable to be wasted. Scale back testing requirements by eliminating parameters that were conclusively negative in earlier tests.

Site samples analyzed by CLP services take an average of a few months to produce results. Why not consider at least a "first look" sampling on-site instead of marking time waiting for the results? A well run mobile lab can produce results as good as any other facility and maybe better because the sample isn't "preserved" transported or left sitting on a shelf for a few months waiting to get into the analytical schedule. Samples can change with time as a result of pressure and temperature changes exposure to air or light etc. Besides if you uncover something interesting you can follow it up immediately if you're on site. Mobile lab services can replace CLP service if QA/QC certification is adequate.

HEALTH AND SAFETY

Safety is a full time job and deserves to be foremost in planning site work. After you become familiar with your site conditions, examples of satisfactory Health and Safety Plans used at other sites can be used as guides in adapting them to your site conditions, or evaluating a contractor proposed plan. It isn't necessary to start from scratch every time.

Field Investigation costs are very sensitive to the required worker protection level. Site work should be scheduled with respect to required protection levels because of the reduced efficiency of operations using protective measures. In hot weather, using class B protection can **triple** on-site labor costs because of the reduced time a single worker can perform under the restricted conditions.

ENFORCEMENT CONSIDERATIONS

While the quality of your work should always be as high as it can reasonably be, it is particularly important in defending conclusions drawn from data. A large quantity of sloppy data is no match for a smaller quantity of high quality data when in court. Potential litigation for cost recovery from Responsible Parties need not drive up the cost of your project if the planning and conduct of the work is monitored carefully as the work progresses so that there are no significant omissions that would require costly fixes.

Remember, enforcement is charged with trying to recover the cost of site cleanups from PRPs. You may be called on to defend any action you took during the RI/FS as being **necessary** and **economically** sound.

- People like to be "in" on what's going on
- Always answer inquiries promptly
- Play it straight — tell the truth — don't get angry
- Present your case in layman's terms — the way you would explain activities to your parents
- A readable sign at the point of site access can explain activities to curious locals and help to limit unauthorized access if the site is not fenced
- Utilize your regional office community relations staff resources
- Clear major information releases with other related agencies first
- Keep the public administrative record neat and timely

Inexpensive Community Relations Activities

- Keep Photographic Record of Progress
- Check in with Local Police and Fire Groups
- Volunteer a Short Talk to Service Clubs
- Local Newspapers Thrive on Local Stories
- Meet and Brief Local Politicians
- Visit Local High School Science Classes

REFERENCE DOCUMENTS

The following is a selection of reference material which will provide a great deal of information on conducting RI/FS projects. The first three should be reviewed for overall philosophy and guidance. They will provide some of the professional background for your site planning.

1. The RPM Primer
   EPA 540/G87/005s September 1987

2. Superfund Federal Lead Remedial Project Management Handbook
   EPA 540/G87/001s December 1986

3. Guidance for Conducting RI and FS Under CERCLA
   EPA/540/G-89/004s October 1988

4. Data Quality Objectives for Remedial Response
   EPA 540/G87/003 and 004s March 1987

5. Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites
   EPA/540/G-88/003s December 1988

6. Technology Screening Guide for Treatment of CERCLA Soils and Sludges
   EPA/540/2-88/004s September 1988

7. CERCLA Compliance with Other Laws Manual: Parts 1 and 2
   EPA/540/G-89/006 and 009