ENHANCING DEVELOPMENT OF NON-TIME-CRITICAL REMOVAL ACTIONS UNDER CERCLA THROUGH THE APPLICATION OF VALUE METHODOLOGY

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ABSTRACT

The U.S. Department of Energy (DOE) requires use of the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) process to demonstrate compliance with the DOE Order 5820.2A (*Radioactive Waste Management*), particularly with regard to the safe onsite management and disposal of low-level waste (LLW) resulting from environmental restoration (ER) activities. The CERCLA process satisfies the requirements and intent of DOE Order 5820.2A through compliance with identified Applicable or Relevant and Appropriate Requirements (ARARs) of federal and state environmental laws.

For non-time critical removal actions, on-scene coordinators (OSCs) would be required to consider as many federal and state ARARs as practical for removal actions. However, to keep the cost of site remediation as low as possible, it would be prudent for OSCs to identify only those ARARs of federal and state environmental laws that are practicable and cost-effective. As such, it is recommended that a systematic approach including development of criteria for careful evaluation of ARARs be employed for reviewing the applicability and practicability of the ARARs for the selected removal actions. This paper documents how the development of cost-effective non-time-critical removal actions for site cleanup (which comply with properly identified ARARs) can be enhanced through application of Value Methodology techniques.

INTRODUCTION

The DOE requires compliance with the requirements and intent of the DOE Order 5820.2A, *Radioactive Waste Management* (Ref. 1), for safe management and disposal of low-level waste resulting from ER activities. To demonstrate compliance with DOE Order 5820.2A, the DOE has accepted the CERCLA process for identifying methods to comply with ARARs for federal and state environmental laws for given removal action. Superfund removal procedures for site remediation (Ref. 2) require identifying and evaluating ARARs for federal and state environmental laws during removal actions. This is needed for proper site stabilization, and for the protection of public health and the environment.

Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal and state environmental laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstances found at a CERCLA site.

Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal and state environmental laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and, as such, are well suited to the particular site.

TYPES OF ARARs

The Environmental Protection Agency (EPA) has divided ARARs into three categories:

- **Chemical-specific ARARs** are usually health- or risk-based numerical values (or methodologies) used to determine acceptable concentrations of chemicals that may be found in or discharged to the environment (e.g., Maximum Contaminant Levels [MCLs] that establish safe levels in drinking water).

- **Location-specific ARARs** restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present.

- **Action-specific ARARs** are usually technology- or activity-based requirements or limitations on actions (or conditions) involving specific substances.

Chemical- and location-specific ARARs are identified early in the CERCLA process, generally during the site investigation, while action-specific ARARs are usually identified during the conduct of a feasibility study (FS) or as part of the detailed analysis of alternatives.

TYPES OF REMOVAL ACTIONS

Normally, three types of removal actions are associated with site cleanup: Emergency, Time-Critical, and Non-Time-Critical.

For emergency removal actions, OSCs should respond first and then identify ARARs for subsequent future actions.

For time-critical removal actions, OSCs may identify ARARs at several different stages of the process, due to the need for quick response, and may even alter the selected response to comply with newly identified ARARs.

During non-time-critical removal actions, sufficient time is available for OSCs to ensure that ARAR determinations are based on a reasonable understanding of site characteristics and acceptable risk levels. In this case, preparation of the engineering evaluation and cost analysis (EE/CA) should permit OSCs to more fully consider ARARs in developing plans for removal actions.

NON-TIME-CRITICAL REMOVAL ACTIONS

For non-time-critical removal actions, OSCs are required to consider compliance with more ARARs than is the case for time-critical removal actions. Therefore, it is important that OSCs adopt sufficient measures and tools for the evaluation and selection of removal actions (and corresponding ARARs), such that the combination thereof meets the regulations and is cost-effective. The process for preparing an EE/CA and, subsequently, developing non-time-critical removal actions can greatly benefit by applying Value Methodology (VM), since VM provides necessary measures and tools to evaluate removal actions and corresponding ARARs.

ADOPTING VALUE METHODOLOGY

VM provides effective techniques for reducing costs, increasing productivity, and improving quality. To obtain significant results, an organized phased approach similar to the VM "Job Plan" should be implemented for non-time-critical removal actions. Fig. 1 shows the CERCLA process (Ref. 3) for identifying various activities associated with non-time-critical removal actions. Fig. 2 shows a VM Job Plan (Ref. 4) that outlines various associated phases and corresponding activities. Fig. 3 shows how the CERCLA process activities can be grouped into phases similar to those for a VM Job Plan.

The subsequent discussion shows that, by following this phased approach and using VM techniques, a systematic, efficient, and consistent process can be implemented for review and development of cost-effective, non-time-critical removal actions.

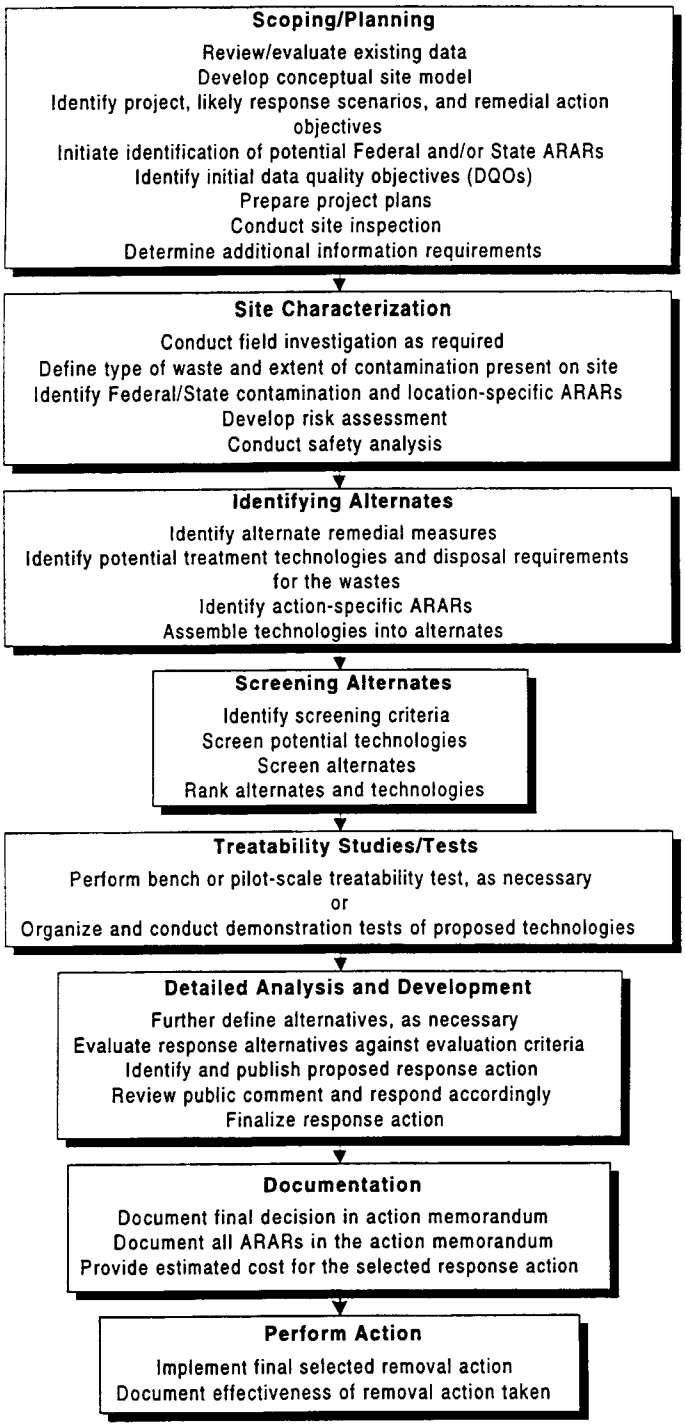

Fig. 1. The CERCLA Process. (Ref. 3)

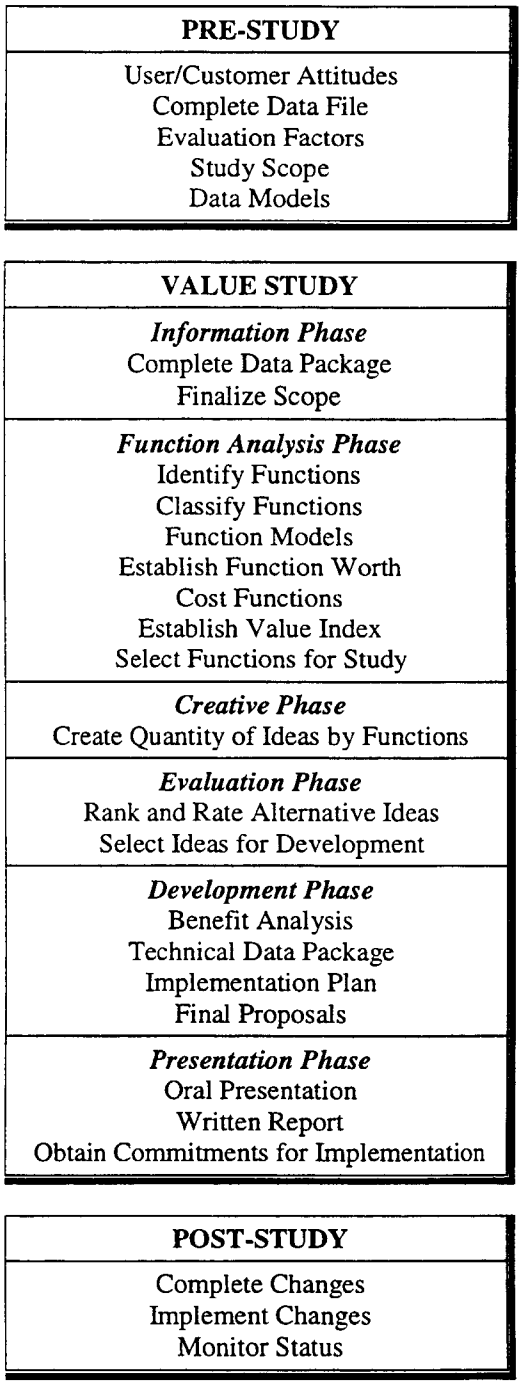

Fig. 2. The VM Job Plan. (Ref. 4)

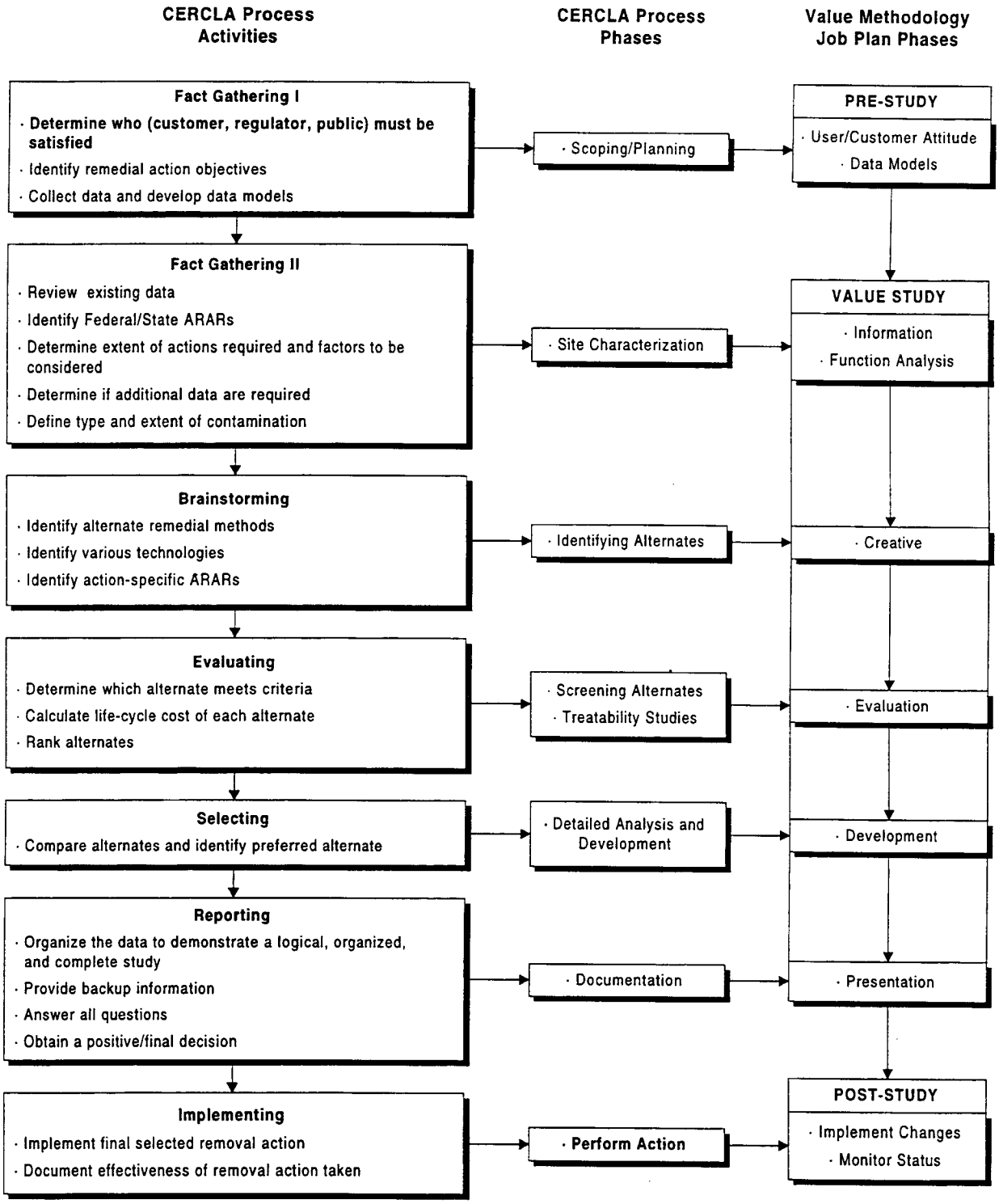

Fig. 3. Grouping of CERCLA Process Activities into Phases Similar to those for VM "Job Plan."

THE VALUE STUDY TEAM AND FACILITATOR

Prior to commencing use of VM, it is customary to form a value study (VS) team. The VS team should include professionals who have sufficient technical credentials, and the size of the VS team should be limited to five to eight members. Each VS team member must be selected from an area of expertise that corresponds with the project type and requirements. The VS team is generally led by a facilitator, who is responsible for guiding the members of the VS team through the VM process.

SCOPING/PLANNING AND CHARACTERIZATION

Subsequent to briefing the project, the VS team should identify Removal Action Objectives suggested below:

- Identify statutory limits on removal action
- Determine removal scope
- Identify an plan removal activities
- Determine removal schedule

Next, the VS team should identify the BASIC and SECONDARY functions of the removal action process. Basically, there are two techniques used to identify poor value functions: cost-modeling, and Function Analysis Systems Technique (FAST) diagramming.

The objective of the cost-modeling technique is to establish cost-to-worth ratios for the functions. Through this cost-modeling activity, the VS team can identify and screen-out poor value functions.

The FAST diagramming technique stimulates organized thinking and facilitates elimination of any unnecessary functions, while adding any necessary (or missing) functions in the removal action process. Using the CERCLA process as a basis (Fig. 1), a typical FAST diagram for non-time-critical removal actions can be developed (as shown in Fig. 4). It should be noted that the FAST diagram would not only identify all important and pertinent functions, it would also provide a sequence in which these functions should be accomplished.

During this phase, all existing data/information pertinent to the site are reviewed for quality and sufficiency. If necessary, additional data/information are obtained through site characterization. Characterization would include conducting field investigations and identifying the type and extent of contamination present at a given site. This investigation, in turn, would assist in identifying chemical-specific and location-specific ARARs.

IDENTIFYING ALTERNATES

The objective of the brainstorming phase is to generate as many ideas as possible that could be developed into alternatives to the original concept. For removal actions, this consists of producing ideas using various remedial methods, as well as various technologies that can be adopted for performing identical functions. Identified methods and/or technologies should then be assembled into alternatives. This brainstorming phase, in turn, would assist in identifying action-specific ARARs.

For this study, "Base Case" and "Alternates" for removal actions for "Contaminated Soils" were identified as follows:

Base Case: Excavate and dispose contaminated soils to Environmental Restoration Disposal Facility (ERDF).

Alternate 1: Place a cap over contaminated site.

Alternate 2: Soil Washing – Wet process to remove contaminated fines.

- Return clean soils as backfill (70% of recovery estimated)
- Transport contaminated soils to ERDF (30% estimated)

Alternate 3: Soil Segregation – Use gamma ray spectrometer (GR-130).

- Better control of excavation of contaminated soils
- Estimated reduction of contaminated soils is 5%

Alternate 4: Rock Screening – Dry process to remove contaminated fines.

- Essentially similar to but not as effective as "soil washing". However, cost of required equipment for this alternate is low.

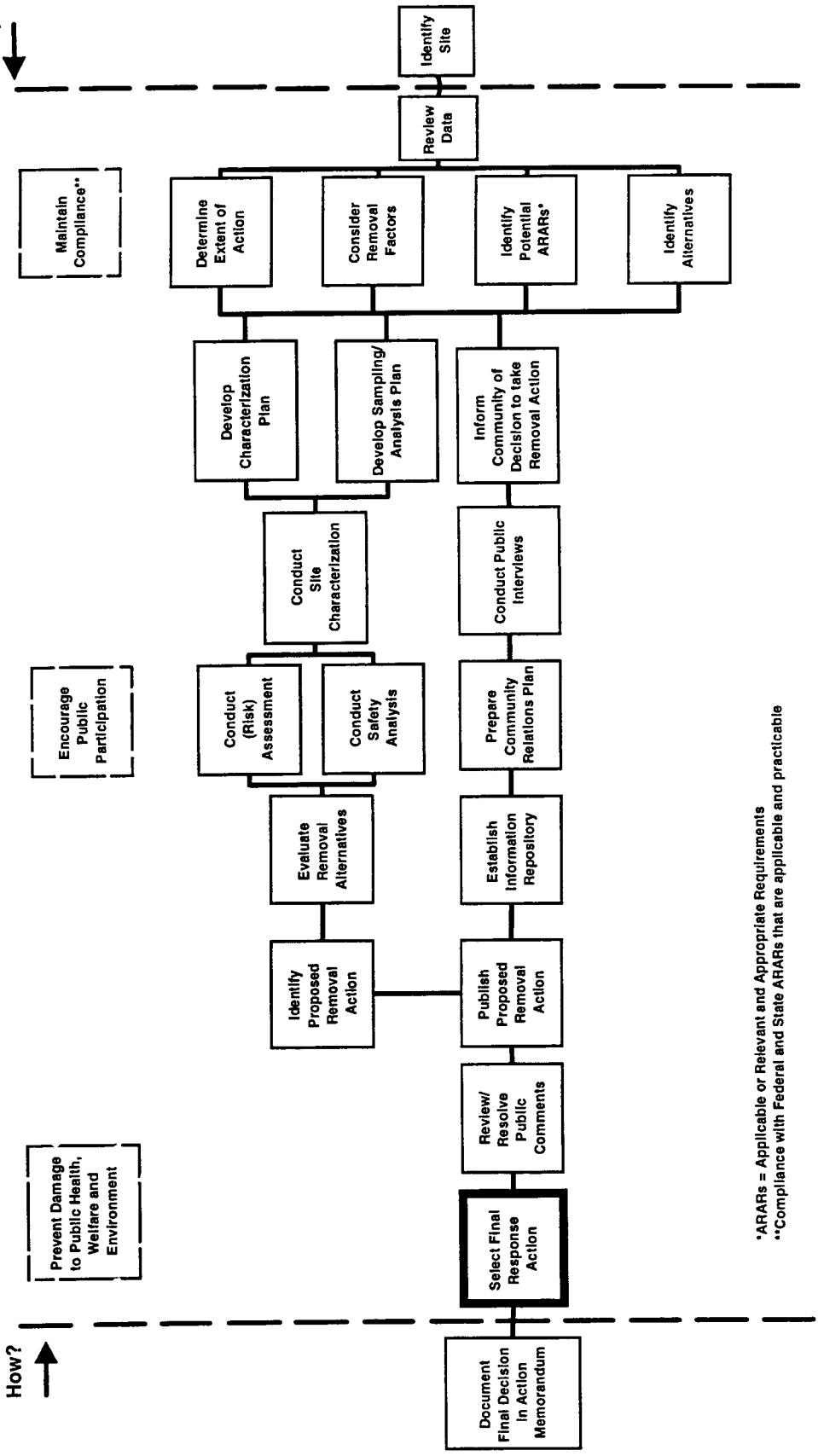

Fig. 4. Process for Development of Non-Time-Critical Removal Actions Under CERCLA.

SCREENING ALTERNATES

During this phase, the team should consider the feasibility and practicality of each of the brainstormed ideas. The objective is to screen the ideas and select those that are most viable. The ideas that pass the screening phase should be carried forward to the detailed analysis and development phases.

The first task in the screening process is to identify screening criteria.

Table I-A illustrates a typical paired comparison technique used in grading the elements of screening criteria for characterization. Once the criteria are developed, the ideas are evaluated and ranked according to these criteria. Table I-B illustrates a typical VM worksheet for evaluating and ranking various technologies available for characterization. Similarly, Tables II-A and II-B illustrate the screening criteria and evaluations for removal actions.

Action-specific ARARs should also be screened, evaluated, and ranked. Recommended screening criteria for these ARARs are as follows:

For Applicability, test if the requirement is:

- Legally enforceable
- Applicable state-wide
- Promulgated
- Timely.

For Relevant and Appropriate, test if the requirement is:

- Meeting goals and objectives of the project.
- Consistent with the purpose of CERCLA action.
- Consistent with media (soil, air, liquid, etc.).
- Compatible with substance(s) at the site.
- Addressing matching activity (disposal, etc.).
- Driven by physical location (flood plain, etc.).
- Consistent with types of structures (buildings, tanks, temporaries, etc.)
- In compliance with cultural restrictions.

While a determination of "Applicability" is primarily a legal one, a determination of whether a requirement is "Relevant and Appropriate" is site-specific and is based on professional judgment. Since the determinations of relevant and appropriate requirements are flexible and discrete, every opportunity should be seized to screen and evaluate them for applicability and practicality.

It should be noted that, even if compliance with an ARAR is determined to be practical, based on consideration of two factors (namely, urgency of the situation, and scope of the removal action), the ARAR may be waived. Factors for applying statutory waivers (Ref. 5) to a removal action are described below:

1. Interim Measures: Compliance with an ARAR is not necessary when the removal action does not involve final cleanup of a site, and when the final cleanup will attain compliance with the ARAR.

2. Compliance Will Result in Greater Risk to Human Health and the Environment: A removal action does not have to comply with ARARs when compliance would present a greater risk to human health and the environment than taking an action that would not attain compliance with the ARAR.

3. Technical Impracticality: Compliance with ARARs is not necessary when compliance would be technically impractical from an engineering perspective.

4. The Inconsistent Application of State Standard: This waiver may be invoked when evidence exists that demonstrates a state standard has not been (or will not be) consistently applied to other remedial sites within the state.

5. Equivalent Standard of Performance: Compliance with an ARAR is not necessary if the removal action could achieve a standard of performance that is equivalent to that required by the ARAR.

6. Fund Balancing: When complying with an ARAR requires an expenditure that jeopardizes the fund's ability to address other sites, the ARAR can be waived. (Note: This waiver is not available at federal facilities.)

If necessary, the above-mentioned waivers can be graded using paired comparison and VM worksheets to arrive at a cost-effective removal actions.

Table I. Development of Criteria and Evaluation of Alternates for Characterization.

A. WEIGHING CRITERIA FOR "CHARACTERIZATION" USING PAIRED COMPARISONS (SAMPLE).

	B	C	D	E	F	G	H	EVALUATION FACTORS (CRITERIA)	Score	Percent
A	A1	A1	A1	A1	A1	A1	A2	Sensitivity	8.0	20
B	B1	B1	B1	B1	B1	B2		Limitations	7.0	17
C	C1	C1	C1	C1	C2			Reliability	6.0	15
D	D2	D1	D2	D2				Turn Around Time	7.0	17
E	E1	E1	E2					Durability	4.0	10
F	F1	F2						Data Interpretation Complexity	3.0	8
G	G3 H2							Ease of Operation	3.0	8
H								Waste Generation	2.0	5

How Important
1. Minor Preference
2. Medium Preference
3. Major Preference

TOTAL 40.0 100

B. EVALUATION OF ALTERNATIVES FOR CHARACTERIZATION (SAMPLE).

VALUE METHODOLOGY WORKSHEET

Project: Non-Time-Critical Removal Actions Under CERCLA

Category: **Characterization**

MATRIX ANALYSIS

List the best ideas from the Suitability evaluation. Determine which one ranks best against desired criteria. Work down, not across.

Rate from 10=Excellent to 1=Poor

(2) Technologies ↓ / (3) Weight →	(1) Objectives or Criteria: Sensitivity 20%	Limitations 17%	Reliability 15%	Turnaround Time 17%	Durability 10%	Data Interpretation Complexity 8%	Ease of Operation 8%	Waste Generation 5%	(4) Total	(5) Ranking	(6) Comments
[1] Gamma Ray Imaging Systems	5	7	6	10	6	10	6	9		7	
	1.00	1.19	0.90	1.70	0.6	0.8	0.48	0.45	7.12		
[2] Characterization Data Management Systems	7	7	9	8	8	10	8	10		6	
	1.4	1.19	1.35	1.36	0.8	0.8	0.64	0.5	8.04		
[3] In situ gamma spectroscopy counting systems for samplers or objects	10	8	9	9	8	9	8	10		4	
	2.00	1.36	1.35	1.53	0.8	0.72	0.64	0.5	8.90		
[4] Gamma spectroscopy counting systems for containers & packages	10	10	9	9	8	9	8	10		1	
	2.00	1.70	1.35	1.53	0.8	0.72	0.64	0.5	9.24		
[5] In situ gamma spectroscopy counting systems for soils and surfaces	10	9	9	9	8	9	8	10		2	
	2.00	1.53	1.35	1.53	0.8	0.72	0.64	0.5	9.07		
[6] Automatic conveyor system for soil and debris	10	9	9	9	8	9	8	10		3	
	2.00	1.53	1.35	1.53	0.8	0.72	0.64	0.5	9.07		
[7] Field-protable, energy dispersing X-ray fluorescence	10	10	8	7	8	6	8	8		5	
	2.00	1.70	1.20	1.19	0.8	0.48	0.64	0.40	8.41		

Table II. Development of Criteria and Evaluation of Alternatives for Removal Actions.

A. WEIGHING CRITERIA FOR "REMOVAL ACTION" USING PAIRED COMPARISONS (SAMPLE).

	B	C	D	E	F	G	EVALUATION FACTORS (CRITERIA)		Score	Percent
A	A3 B2	A3 C2	A3 D2	A3 E2	A3 F1	A3 G1	Protectiveness	*Effectiveness*	18	19
B		B3 C2	B3 D2	B3 E2	B3 F1	B3 G1	Ability to Achieve Removal Objectives		17	18
	C		C3 D2	C3 E2	C3 F1	C3 G1	Technical Feasibility	*Implementability*	16	17
		D		D3 E2	D3 F1	D3 G1	Availability		15	16
			E		E3 F1	E3 G1	Administrative Feasibility		14	15
				F		F3 G1	Capital Cost Proportional to Benefits Achieved	*Cost Effectiveness*	8	9
					G		Post-Removal Site Control		6	6
								TOTAL	94	100

How Important
1. Minor Preference
2. Medium Preference
3. Major Preference

B. EVALUATION OF ALTERNATIVES FOR REMOVAL ACTIONS (SAMPLE).

VALUE METHODOLOGY WORKSHEET

Project: Non-Time-Critical Removal Actions Under CERCLA

Category: **Contaminated Soils** — MATRIX ANALYSIS

List the best ideas from the Suitability evaluation. Determine which one ranks best against desired criteria. Work down, not across.

Rate from 10=Excellent to 1=Poor

(1) Objectives or Criteria

	Effectiveness		*Implementability*			*Cost Effectiveness*				
(2) Technologies ↓ / (3) Weight →	Protectiveness **19%**	Ability to Achieve Removal Objectives **18%**	Technical Feasibility **17%**	Availability **16%**	Administrative Feasibili8ty **15%**	Capital Cost Proportional to Benefits Achieved **9%**	Post- Removal site Control **6%**	**(4) Total**	**(5) Ranking**	**(6) Comments**
[1] Alternate – 1: Place a CAP over contaminated site.	7	7	10	8	7	10	7		3	
	1.33	1.26	1.70	1.28	1.05	0.90	0.42	7.94		
[2] Alternate – 2: Soil Washing (wet process).	8	10	8	10	7	8	7		2	Selected for detail study.
	1.52	1.80	1.36	1.60	1.05	0.72	0.42	8.47		
[3] Alternate – 3: Soil Segregation (using spectrometer-GR-130).	10	8	8	8	10	8	8		1	Selected for detail study.
	1.90	1.44	1.36	1.28	1.50	0.72	0.48	8.68		
[4] Alternate – 4: Rock Screening (dry process).	7	7	8	8	7	10	10		4	
	1.33	1.26	1.36	1.28	1.05	0.9	0.6	7.78		