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**DOCUMENT CHANGE REQUEST FOR WORK
PLAN FOR THE FEASIBILITY STUDY - TASK 14
EVALUATION AND SELECTION OF PREFERRED
ALTERNATIVE**

07/02/93

**DOE-FN/EPA
DOE-2287-93
15
DCR**



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Department of Energy
Fernald Environmental Management Project
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JUL 02 1993
DOE-2287-93

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Graham E. Mitchell, Project Manager
Ohio Environmental Protection Agency
40 South Main Street
Dayton, Ohio 45402-2086

Dear Mr. Saric and Mr. Mitchell:

**DOCUMENT CHANGE REQUEST FOR WORK PLAN FOR THE FEASIBILITY STUDY - TASK 14
EVALUATION AND SELECTION OF PREFERRED ALTERNATIVE**

Enclosed for your approval is the subject Document Change Request (DCR) as discussed in the June 22, 1993 Operable Unit (OU) 4 Technical Information Exchange (TIE). Approval of this DCR will amend the Work Plan to allow a qualitative comparison of alternatives for each OU. This methodology will replace the Analytical Hierarchy Process now specified in the Work Plan. The limitations of the existing methodology and benefits of the proposed qualitative comparison are addressed in the attached "Comparative Analysis Methodology" presentation, as presented during the OU 4 TIE.

OU 4 is proceeding with the proposed qualitative comparison of alternatives in the Feasibility Study/Proposed Plan. Therefore, we are requesting your review comments and/or approval as soon as possible.

If you or your staff have any questions, please contact Randi Allen at (513) 648-3102.

Sincerely,

Jack R. Craig
Assistant Manager
Environmental Restoration

FN:Allen

Enclosure: As Stated

cc w/ enc:

K. A. Chaney, EM-424, TREV
D. R. Kozlowski, EM-424 TREV
G. Jablonowski, USEPA-V, AT-18J
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FEMP SCQ
DOCUMENT CHANGE REQUEST

REQUEST #: RI/FS:93:002A

Issue Date: July 02, 1993

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This form is used to initiate permanent change to controlled distribution project-specific procedures.

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REQUESTOR: FERMCO - Dennis J. Carr PHONE #: (513) 738-0003 REQUESTED DATE: July 02, 1993

DCR TITLE: MODIFICATION TO FS WORK PLAN - ADOPTION OF EPA COMPARATIVE ANALYSIS GUIDANCE
SECTION/PAGE #: 3.6 / p.16 REV. DATE: November 01, 1990

CHANGE JUSTIFICATION: Approved FS Work Plan presents a departure from EPA RI/FS guidance (OSWER Directive 9355.3-01, October, 1988). Change Request proposed to modify the FS Work Plan to adopt EPA guidance regarding the Comparative Analysis of Alternatives.

CONTENT OF CHANGE: Approved FS Work Plan departs from EPA guidance in the following areas: 1.) Employs a Analytical Hierarchy Process to derive weighting factors to be applied to the five balancing criteria during the comparative analysis phase; and 2.) Specifies that the FS Report should identify a preferred alternative. Guidance for conducting RI/FS under CERCLA (USEPA, Oct., 1988) identifies that: 1.) Comparative analysis be completed through the use of summary tables and text so as to document the relative strengths and weaknesses of each alternative, highlight the differences among alternatives (using quantitative data where available), and discuss the affects of the key uncertainties on this analysis; and 2.) The preferred alternative be identified post-RI/FS and documented in the proposed plan. This change request adopts USEPA guidance for the conduct of the FEMP operable unit FS Reports.

IMPLEMENTATION DATE: Submittal of draft FS Report for each operable unit.

EFFECTIVE DATE: _____

OTHER: _____

REQUIRED APPROVALS:

<u>N/A</u> FEMP PROGRAM/PROJECT MGR - ASI	DATE	OTHERS AS REQUIRED	DATE
<u>N/A</u> QA OFFICER - ASI	DATE	<u>[Signature]</u>	<u>7-1-93</u>
<u>N/A</u> FEMP PROGRAM/PROJECT MGR - PARSONS	DATE	OTHERS AS REQUIRED	DATE
<u>N/A</u> QA OFFICER - PARSONS.	DATE	<u>[Signature]</u>	<u>7/2/93</u>
<u>[Signature]</u> FEMP PROGRAM/PROJECT MGR - FERMCO	<u>6-29-93</u> DATE	<u>[Signature]</u> DOE	DATE
<u>[Signature]</u> QA OFFICER - FERMCO	<u>6-29-93</u> DATE		

TO BE COMPLETED BY DOE

- A. Prior EPA notification required? YES NO
- B. Prior EPA approval required? YES NO
- C. Immediate Implementation? YES NO

DOE FO _____ DATE _____

PLEASE DELETE THE BELOW STRIKED-OUT TEXT AND
REPLACE WITH THE INSERT AT THE BOTTOM OF THIS DOCUMENT.

~~3.6 TASK 14 EVALUATION AND SELECTION OF PREFERRED ALTERNATIVES~~

~~This task will consist of alternatives based on the detailed analysis of each alternative with respect to the nine specific criteria. The state and community acceptance criteria are typically accounted for in the alternative selection process; however, the full incorporation of state and community concerns and acceptance is best addressed as part of the Responsiveness Summary for the Record of Decision, following the public comment period on the Proposed Plan. The advantages and disadvantages of each alternative relative to other alternatives will be identified and summarized. The summary will include documentation of relative strengths and weaknesses of each alternative, effects of variations in key uncertainties, and key differences (qualitative and/or quantitative) among alternatives. This analysis will be used as a basis to evaluate the tradeoffs among alternatives. The results of this evaluation will be used to identify the "preferred alternative" for remediation of each operable unit at the FMPG site, subject to the concurrence and approval of the U.S. EPA.~~

~~A key element in both the Detailed Evaluation of Alternatives and the Evaluation and Selection of the Preferred Alternative in Task 14 is the determination of cost effectiveness. A working definition of cost effectiveness is that, if the incremental costs and incremental benefits become highly disproportionate, then the more costly alternative can be eliminated from further consideration. While cost is a quantifiable criterion, a major area of potential criticism for any decision based on this definition is the qualitative, subjective method typically used to rank the effectiveness, implementability, and toxicity/mobility/volume reduction criteria.~~

~~In order to achieve some level of quantification for the latter four criteria, thereby allowing the development of an "effectiveness score" to compare against a "cost score," DOE will incorporate an analytic hierarchy methodology into Task 14. Not only will resultant quantification of the cost effectiveness evaluation provide clarity for justifying the alternative selection, but the application of a uniform methodology across operable units will ensure consistency in the selection of the most appropriate remedial alternative for each operable unit.~~

~~The method to be applied to the alternative selection process is a modification of the Analytical Hierarchy Process (AHP) developed by Saaty (1980). The AHP has been successfully implemented on several Oak Ridge National Laboratory waste cleanup projects (Richter Paek, 1987) and a number of other projects (Golden et al., 1990). A major advantage of the AHP is that it allows for both quantitative input (e.g., chemical and radionuclide concentrations) and qualitative judgment (i.e., professional judgment on the implementability of a remedial action). Application of the AHP will involve four major steps:~~

- ~~1. Develop a hierarchy of criteria to be used to select a remedial alternative.~~
- ~~2. Determine weighting factors for each criterion.~~
- ~~3. Compile information needed to evaluate remedial alternatives with respect to each other and to the criteria.~~
- ~~4. Synthesis input data using AHP to identify the remedial alternative with the most favorable overall ranking.~~

~~Consistent with CERCLA requirements, the criteria mentioned in Step 1 have been defined to be short term effectiveness, long term effectiveness and permanence, implementability, and the reduction of toxicity, mobility, or volume through treatment.~~

~~Step 2 will require that weighting factors be assigned to each criterion to indicate the relative importance of each criterion in the decision process. Using the AHP, quantitative weights will be assigned to the criteria by knowledgeable engineers and scientists with direct, applicable CERCLA experience. In accordance with the NCP [Section 300.430(f)(1)(ii)(E)], the weighting factors will emphasize long term effectiveness and permanence and reduction in toxicity, mobility, or volume through treatment. The criteria will be considered one pair at a time so that only two criteria are being considered simultaneously. A scale of 1 to 9 will be used for the pair wise comparisons, as follows:~~

<u>Rating</u>	<u>Description</u>
1	A and B "are equally important"
3	A is "weakly more important than" B
5	A is "strongly more important than" B
7	A is "demonstrably more important than" B
9	A is "absolutely more important than" B

~~A variety of experienced professionals involved in the RI/FS process will be used to assign the rating values to the four criteria. The use of a large number of individuals will reduce the effect that biased perspectives might play in the determination of weighting factors.~~

~~Step 3 will be performed by individual operable unit FS teams at this level of the evaluation since detailed, operable unit specific data will be required. All of the alternatives will be compared to each other simultaneously rather than pair wise. It will be possible to rank alternatives on a qualitative basis or on a quantitative basis, incorporating a variety of input data to describe each alternative. This analysis will consider the preference for treatment as a principal element and the bias against off site land disposal of untreated waste as stated in the NCP [Section 300.430(f)(ii)(E)].~~

~~Step 4 will use AHP to perform the necessary numerical operations on: 1.) The previously developed hierarchy of criteria; 2.) the previously determined weighting factors for the criteria; and 3.) the qualitative or quantitative data that describe each remedial alternative. The result is a numerical "effectiveness score" that provides a relative quantitative ranking of the alternatives.~~

REPLACE THE ABOVE TEXT WITH THE INSERT BELOW

3.6 TASK 14 - COMPARATIVE ANALYSIS

Following completion of the detailed analysis of the remedial alternatives against the criteria, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion. The purpose of this comparative analysis will be to identify the advantages and disadvantages of each alternative relative to one another, so that the key tradeoffs the decisionmakers must balance can be identified.

Overall protection of human health and the environment and compliance with ARARs will generally serve as threshold determinations in that they must be met by any alternative in order for it to be eligible for selection. The next five criteria (long-term effectiveness and

permanence; reduction of toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost) will generally require the most discussion because the major tradeoffs among alternatives will most frequently relate to one or more of these five.

State and community acceptance will be addressed in the ROD once formal comments on the RI/FS report and the proposed plan have been received and a final remedy selection decision is being made. Therefore, these modifying criteria will not be addressed during comparative analysis.

The comparative analysis portion of each FS report will include a narrative discussion describing the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance. If innovative technologies are being considered, their potential advantages in cost or performance and the degree of uncertainty in their expected performance (as compared with more demonstrated technologies) will also be discussed to the extent practical.

The presentation of differences among alternatives can be measured either qualitatively or quantitatively as appropriate, and will identify substantive differences (e.g., greater short-term effectiveness concerns, greater cost, etc.). Quantitative information that was used to assess the alternatives (e.g., specific cost estimates, time until response objectives would be obtained, and levels of residual contamination) will be included in these discussions to the extent practical.

*PLEASE DELETE "SECTION 5.0 - IDENTIFICATION OF PREFERRED
REMEDIAL ACTION ALTERNATIVE" OF TABLE 3-1 ON PAGE 22 OF 22*

TABLE 3-1

FEASIBILITY STUDY REPORT OUTLINE
(PRELIMINARY)

EXECUTIVE SUMMARY

1.0 INTRODUCTION

1.1 PURPOSE AND ORGANIZATION OF REPORT

1.2 BACKGROUND INFORMATION (Summarized from RI Report)

1.2.1 Site Description

1.2.2 Site History

1.2.3 Nature and Extent of Contamination

1.2.4 Contaminant Fate and Transport

1.2.5 Baseline Risk Assessment

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 INTRODUCTION

2.2 REMEDIAL ACTION OBJECTIVES -

Presents the development of remedial action objectives for each medium of interest (i.e., groundwater, soil, surface water, air, etc.). For each medium, the following should be discussed:

- Contaminants of interest
- Allowable exposure based on risk assessment
- Allowable exposure based on ARARs
- Development of remedial action objectives

2.3 GENERAL RESPONSE ACTIONS -

For each medium of interest, describes the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.

2.4 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS - For each medium of interest, describes:

2.4.1 Identification and Screening of Technologies

2.4.2 Evaluation of Technologies and Selection of Representative Technologies

**TABLE 3-1
(Continued)**

- 3.0 **DEVELOPMENT AND SCREENING OF ALTERNATIVES**
 - 3.1 **DEVELOPMENT OF ALTERNATIVES**

Describes rationale for combination of technologies/media into alternatives.
Note: This discussion may be by medium or for the site as a whole.
 - 3.2 **SCREENING OF ALTERNATIVES**
 - 3.2.1 Introduction
 - 3.2.2 Alternative 1
 - 3.2.2.1 Description
 - 3.2.2.2 Evaluation
 - Effectiveness
 - Implementability
 - Cost
 - 3.2.3 Alternative 2
 - 3.2.3.1 Description
 - 3.2.3.2 Evaluation
 - 3.2.4 Alternative 3
 - 3.2.5 Summary of Screening
- 4.0 **DETAILED ANALYSIS OF ALTERNATIVES**
 - 4.1 **INTRODUCTION**
 - 4.2 **INDIVIDUAL ANALYSIS OF ALTERNATIVES**
 - 4.2.1 Alternative 1
 - 4.2.1.1 Description
 - 4.2.1.2 Assessment
 - Overall Protection
 - Compliance with ARARs
 - Long-Term Effectiveness and Permanence
 - Reduction of Mobility, Toxicity, or Volume
 - Short-Term Effectiveness
 - Implementability

TABLE 3-1
(Continued)

- 4.2.1.2 Assessment (continued)
 - Cost
 - State Acceptance
 - Community Acceptance
 - Environmental Impacts (NEPA)

4.2.2 Alternative 2

4.2.2.1 Description

4.2.2.2 Assessment

4.2.3 Alternative 3

4.3 COMPARATIVE ANALYSIS

4.3.1 Overall Protection

4.3.2 Compliance with ARARs

4.3.3 Long-Term Effectiveness and Permanence

4.3.4 Reduction of Toxicity, Mobility, or Volume

4.3.5 Short-Term Effectiveness

4.3.6 Implementability

4.3.7 Cost

4.3.8 State Acceptance

4.3.9 Community Acceptance

4.3.10 Summary of NEPA Compliance Analysis

~~5.0 IDENTIFICATION OF PREFERRED REMEDIAL ACTION ALTERNATIVE~~

BIBLIOGRAPHY

APPENDICES

OU4 - EPA PRESENTATION - JUNE 22, 1993

FEMP

COMPARATIVE ANALYSIS METHODOLOGY

Presenter: Dennis Carr

4569

OU4 - EPA PRESENTATION - JUNE 22, 1993

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PROPOSED DCR TO FS WORK PLAN

Scope of Proposed DCR

- Realign Text of Task 14 - "Evaluation and Selection of Preferred Alternative" to be More Consistent with U.S. EPA Guidance.
- Eliminate Use of Weighting Factors Embodied in the Analytic Hierarchy Process (AHP).
- Adopt Comparative Analysis Methodology in RI/FS Guidance Document.

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PROPOSED DCR TO FS WORK PLAN (cont'd)

Current FS Work Plan

- Adopts Modification of the Analytic Hierarchy Process (AHP). Use of "Expert Choice" Software to Compile the Weighted factors Assigned to Detailed Analysis Criteria by a Panel of Experts.
- Assign Weighted Factors to Indicate Relative Importance of Each Criterion in the Decision Process.
- Result is a Relative "Quantitative" Ranking of the Alternatives.

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PROPOSED DCR TO FS WORK PLAN (cont'd)

Limitation/Constraints of Existing Work Plan Methodology

- Not Used as Typical Methodology in CERCLA Process.
- Difficult to Defend to external Audiences (i.e., Public, etc.) the Derivation of Weighted Factor and Use of Model (i.e., Black Box).
- Incorrectly Conveys the Rigor of Quantitative analysis to Semi-Quantitative Process.
- Potentially Limits Decision-Making as Flexibility, Particularly Regarding Modifying Criteria (i.e., State and Community Acceptance).

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PROPOSED DCR TO FS WORK PLAN (cont'd)

Proposed Methodology for Comparative Analysis

- Use Summary Tables and Text in Comparative Analysis Section to:
 - Document Strengths and Weaknesses of Each Alternative
 - Effects of Variations in Key Uncertainties
 - Highlight Key Differences Among Alternatives Using Available Quantitative Data, e.g., Volume Reduction
- Identify Preferred Alternative on Basis of Trade-Offs Among Alternatives.

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