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DETAILED ANALYSIS OF ALTERNATIVES FOR OPERABLE UNIT 4 TASK 13 PRESENTATION JUNE 1990

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PRESENTATION

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DETAILED ANALYSIS OF ALTERNATIVES FOR OPERABLE UNIT 4

TASK 13 PRESENTATION

FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

REMEDIAL INVESTIGATION and FEASIBILITY STUDY

June 1990

U.S. DEPARTMENT OF ENERGY
OAK RIDGE OPERATIONS OFFICE

DRAFT

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Prepared by

ADVANCED SCIENCES, INC.
IT CORPORATION

June 1990
FMPC-0413-2

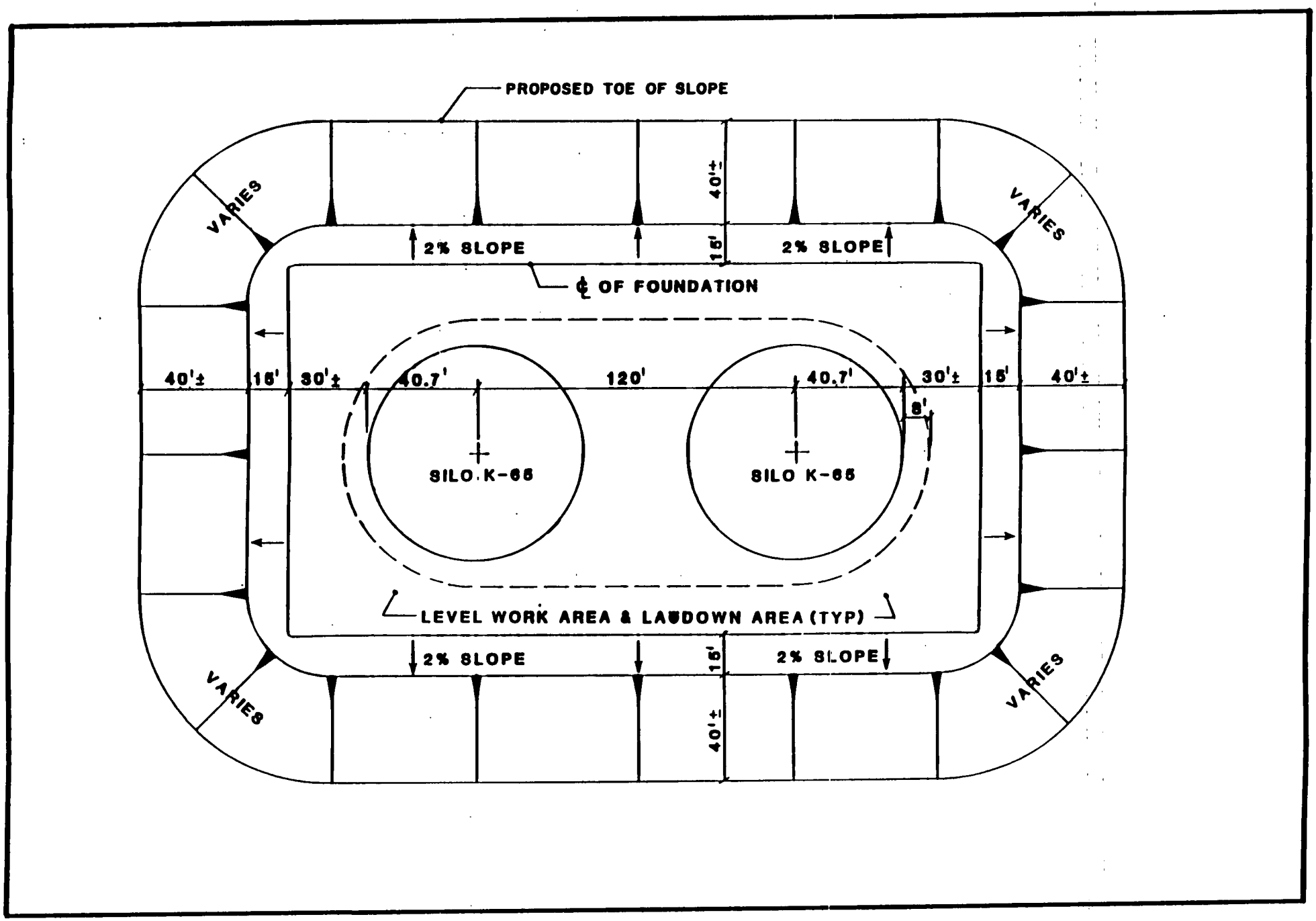
2

INTRODUCTION & AGENDA

- Methodology & Key Assumptions
- Operable Unit 4 Definition
- Task 13 Activities
- ARARs Development
- Description of Alternatives
- Cost & Schedule
- Threshold & Primary Criteria
- Evaluation of Alternatives Versus Criteria

OPERABLE UNIT 4

- Silos 1 and 2 (K-65)
- Silo 3 (Metal Oxide)
- Silo 4 (Never Used)
- Berm Around Silos 1 and 2
- Contaminated Soil Immediately Below Silos (Excluding Aquifer)



PLAN VIEW OF EIE AND
BERM MODIFICATION

4180

RI/FS TASK 13

DETAILED ANALYSIS OF THE ALTERNATIVES

- Agreement with Work Plan
- Agreement with OSWER 9355.3-01
- Alternatives Were Developed and Screened in Task 12
- Further Definition
- Analyzed Against Evaluation Criteria
- Compared Against Each Other

6

GENERAL REMEDIAL ACTION OBJECTIVES FOR OPERABLE UNIT 4

- Prevent Release of Radon Gas from Wastes
- Prevent Migration of Contaminants to Environmental Media that Exceed Public Health or Environmental Standards
- Prevent Direct Contact with Contaminated Structures
- Correct Structural Conditions that Could Lead to Sudden Releases of Chemicals or Radionuclides

GUIDELINES ASSUMED DURING TASK 13

- Waste form meets TCLP/land ban
- On-site operations meet OSHA
- Radiation exposures comply with NRC and ALARA
- Caps meet RCRA
- Radon should be minimized - below 20 pCi/m^2-sec

GUIDELINES ASSUMED DURING TASK 13 (Cont.)

- Annual effective dose from airborne radionuclides should be minimized and <= 10 mrem
- On-site disposal design meets 10CFR61 for Class C waste (5-m criterion)
- Cleanup levels determined by the pathway analysis specific to each alternative

TASK 12 - Initial Screening of Alternatives

- Identify potential ARARs and TBCs

↓

TASK 13 - Detailed Analysis of Alternatives

- List proposed ARARs and TBCs with specified requirements and rationale for implementation for each alternative.

↓

TASK 14 - Selection of Preferred Alternative
TASK 15 & 16 - Feasibility Study Report (Note 1)

- Determine remedial goals and objectives to lead to selection of preferred alternative
- Refine list of proposed ARARs and evaluate alternative with respect to compliance with ARARs

Note 1

Tasks 14 and 15 are performed in parallel. Selection of a preferred alternative will occur after goals and objectives are reviewed to ensure that the overall goal of protection of human health and environment is met. The list of proposed ARARs shall then be developed and incorporated into the final FS report (Task 16).

416

Identification of Potential ARARs and TBCs

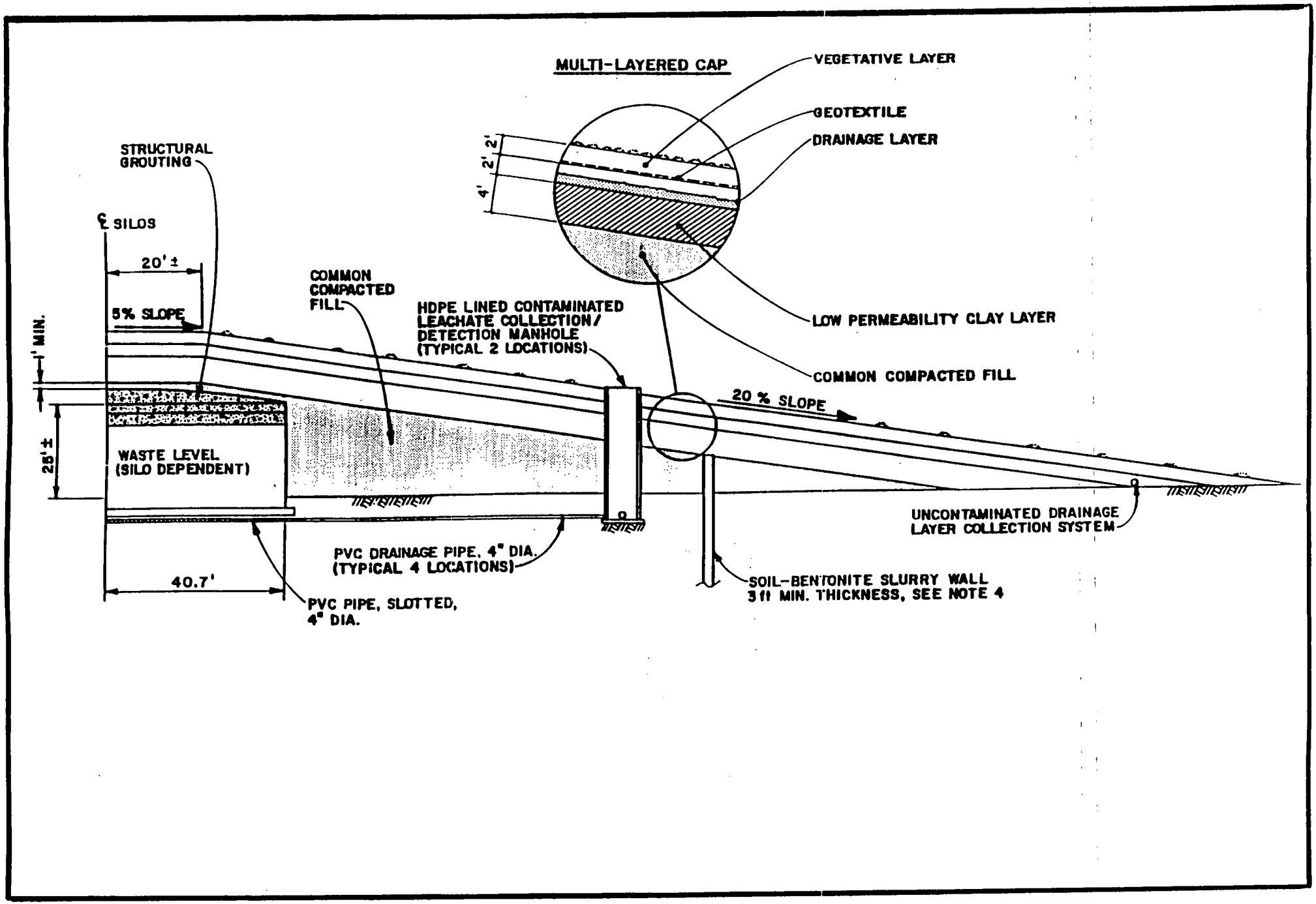
Appendix A - Operable Unit 4, Task 12 Report

Chemical, Action, and Location Specific ARARs

Applicable, Relevant, and Appropriate, and TBCs

ALTERNATIVE 1
NONREMOVAL, SILO ISOLATION
SILOS 1, 2 & 3

- Fill Silo Void Space With Grout
- Install Slurry Wall to Isolate Silos from Groundwater
- Install Multilayer RCRA-Type Clay Cap Over All Three Silos to Intersect the Slurry Wall



CAPPING PROFILE

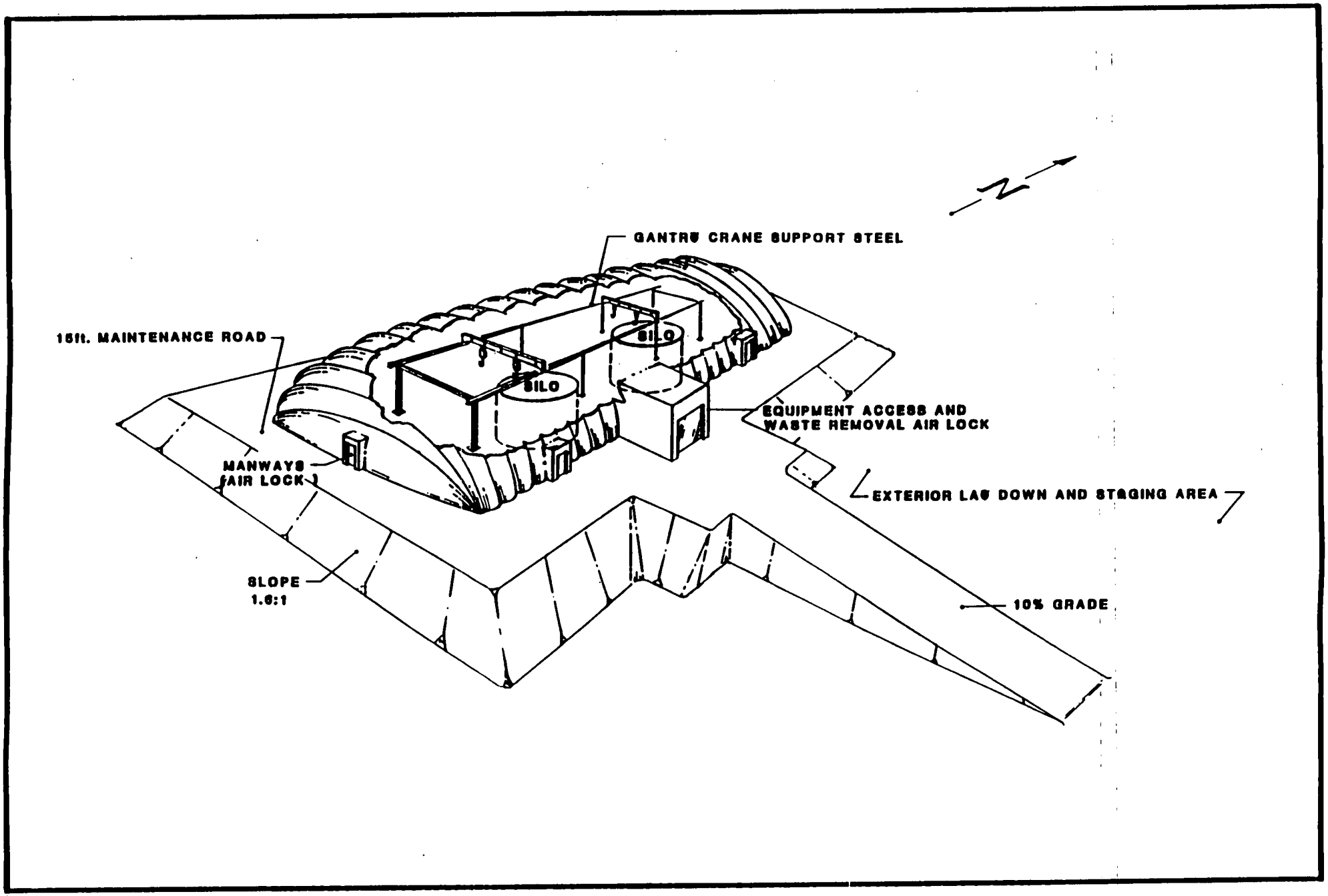
ALTERNATIVE 2
NON REMOVAL - IN SITU STABILIZATION
SILOS 1, 2 & 3

- Identical to Alternative 1 Except Wastes are Stabilized In Situ
- Environmental Isolation Enclosure (EIE) Over Silos to Isolate Remediation Activities from Workers, Public, & Environment
- Silo Domes Removed Inside EIE
- Stabilization In Situ by Shallow Soil Mixing

ALTERNATIVE 2 (continued)

ENVIRONMENTAL ISOLATION ENCLOSURE

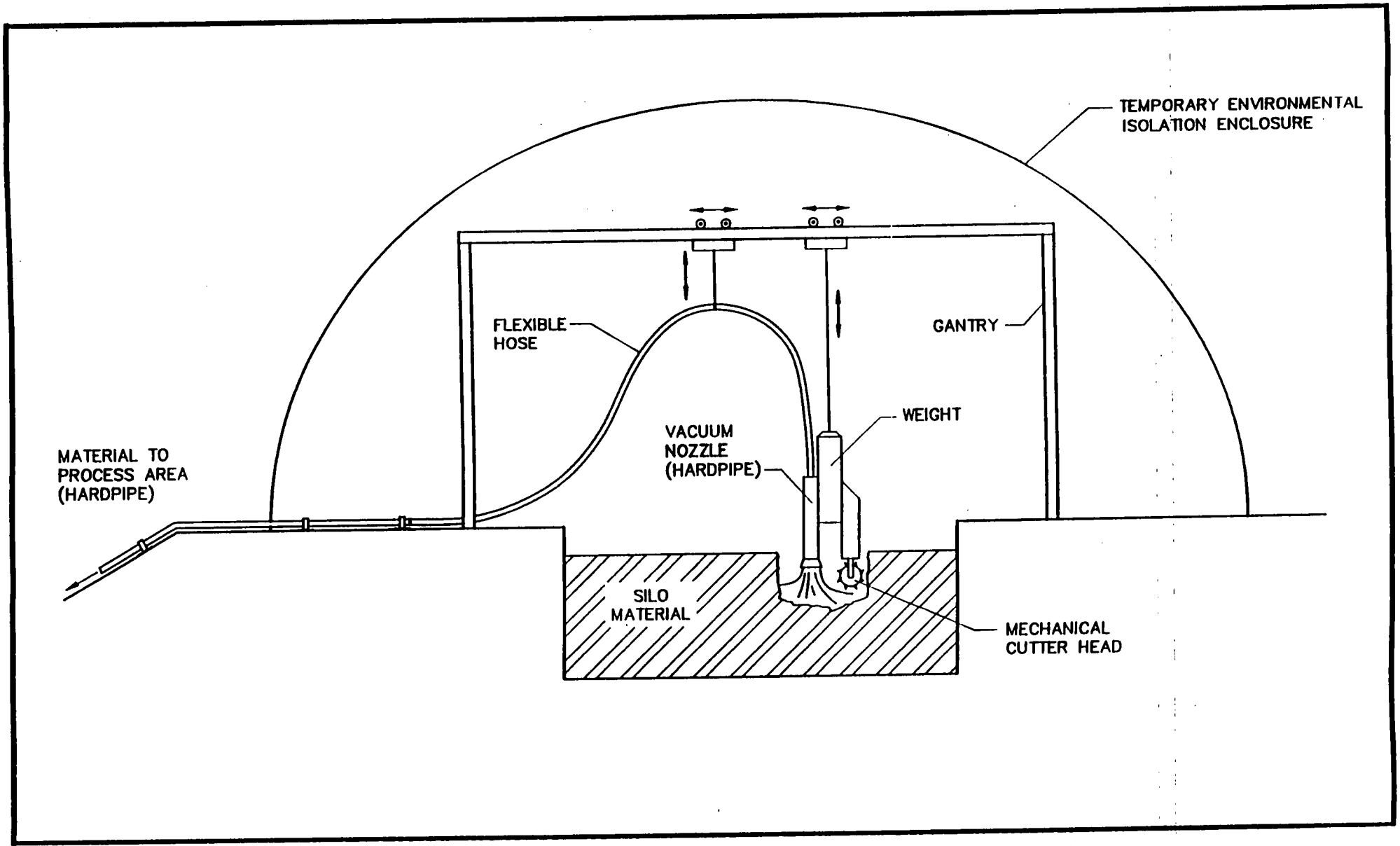
- Encloses the Silos and Surrounding Area, Isolating Remediation Activities from Workers, Public, and Environment
- Tension Arch Structure
- Negative Internal Pressure
- EIE Will Require/Possess the Following:
  - Silo berm modifications
  - HVAC system including air treatment (particulate and radon)
  - Central control station
  - Remote controlled travelling bridge crane



CONCEPTUAL VIEW OF ENVIRONMENTAL ISOLATION ENCLOSURE
(EIE) OVER K-65 SILOS

ALTERNATIVES 3 & 4
REMOVAL, PACKAGING, ON/OFF-SITE DISPOSAL
SILO 3 ONLY

- Alternative 4 Is Identical to Alternative 3 with the Exception of Off-Site Disposal
- EIE and Waste Packaging Building
- Dome Removal, Pneumatic, or Hydraulic Removal
- Waste and Silo Debris Packaged for Final Disposal
- Disposal in On-Site Tumulus/Disposal Vault (Alternative 3)
- Transportation to Off-Site Disposal Facility (Alternative 4)

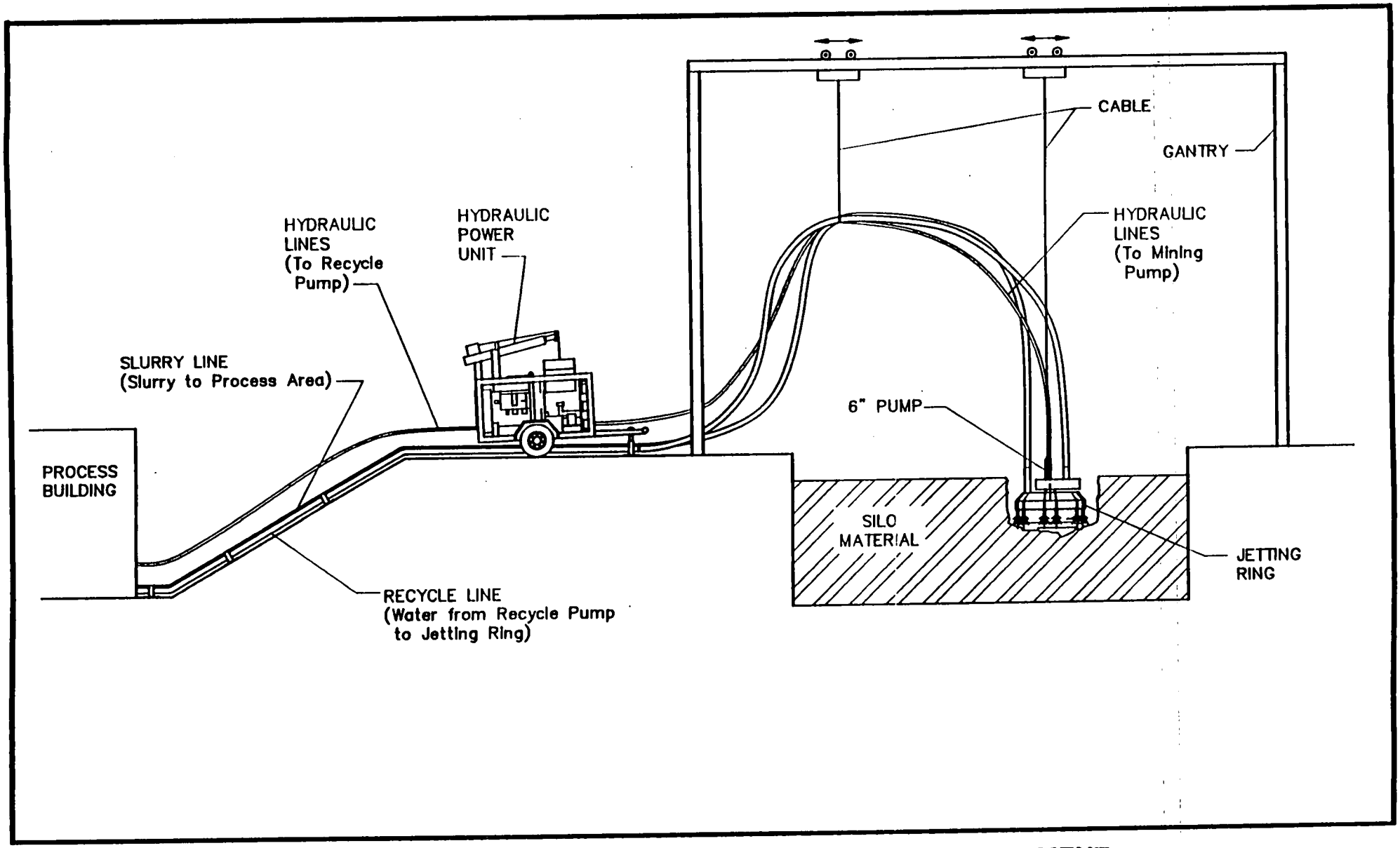


PNEUMATIC REMOVAL SYSTEM - GENERAL ARRANGEMENT

ALTERNATIVES 3 & 4 (continued)

HYDRAULIC

- Water Addded to Achieve Slurry Consistency
- Slurry Removed By Suction Line Connected to Combination Blasting/Suction Hydraulic Mining Tool
- Slurry Pumped to Solid/Liquid Separation System
- Sized to Remove 2 cu.ft./hr

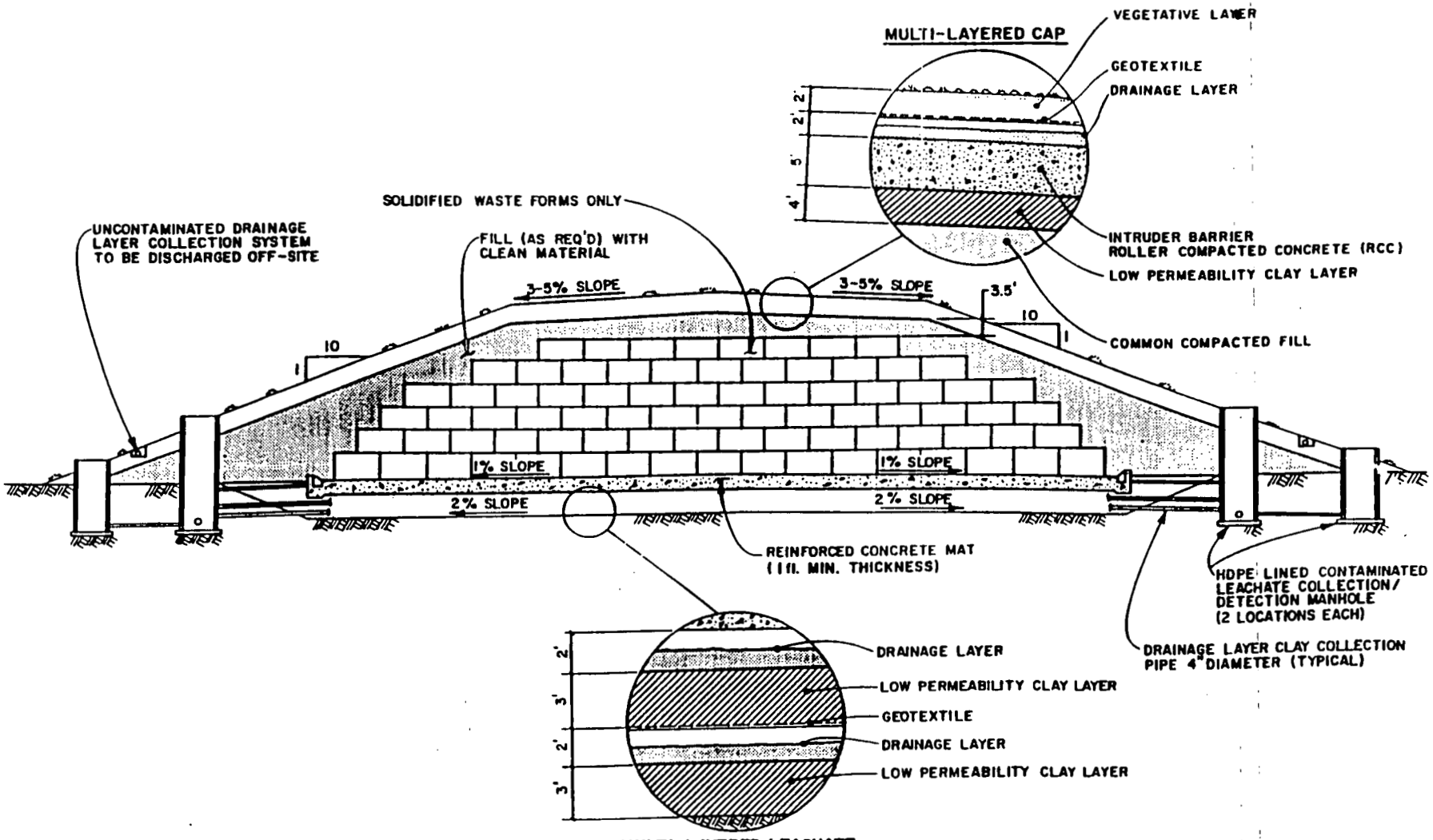


HYDRUALIC MINING SYSTEM - GENERAL ARRANGEMENT

ALTERNATIVES 3 & 4 (continued)

TUMULUS

- Concrete Structural Pad
- Leachate Collection System
- Impermeable Liner Underlayment
- Impermeable Clay Cap
- Stabilized Waste Only (Structurally Rigid, Noncorrosive Waste Containers)
- Twelve Acres



NOT TO SCALE

TUMULUS SECTION

ALTERNATIVES 6 & 7
REMOVAL, TREATMENT, ON/OFF-SITE DISPOSAL
SILOS 1 AND 2

- Alternative 7 is Identical to Alternative 6 with Exception of Off-Site Disposal
- EIE, Waste Processing, and Packaging Building
- Dome Removal
- Hydraulic Removal

ALTERNATIVES 6 & 7 (continued)

- Physical Stabilization or Vitrification
- Waste and Debris Packaging for On-Site or Off-Site Disposal
- Tumulus Construction (Alternative 6)
- Transportation to Off-Site Disposal Facility (Alternative 7)

ALTERNATIVES 8 & 9
REMOVAL, TREATMENT, ON/OFF-SITE DISPOSAL
SILOS 1 AND 2

- Alternative 9 is Identical to Alternative 8 with Exception of Off-Site Disposal
- EIE, Waste Processing, and Packaging Building
- Dome Removal
- Hydraulic Removal
- Contaminant Separation

ALTERNATIVES 8 & 9 (continued)

CONTAMINANT SEPARATION

LITERATURE REFERENCES

- Seely, 1977, ORNL ... 3 stage, 3M nitric acid leach removes 95% of radium and 98-99% of uranium & thorium from uranium mill tailings

- Mound Laboratories, 1951, ... removed lead, radium & barium from K-65 material. Uranium & thorium were not mentioned

- Battelle, 1981 ... Oak Ridge.. proposed 6 stage nitric acid leach... dissolving both radium and uranium... while not thoroughly investigated... the nitric acid leaching should be considered in designing a process...

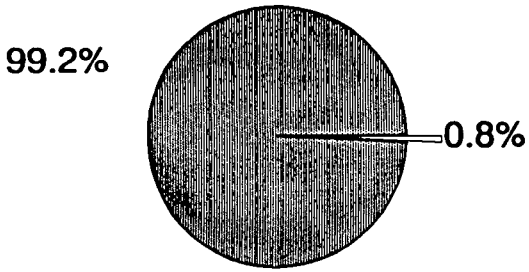
ALTERNATIVES 8 & 9 (continued)

- Physical Stabilization or Vitrification
- Waste and Debris Packaging for On-Site or Off-Site Disposal
- Tumulus Construction (Alternative 8)
- Transportation to Off-Site Disposal Facility (Alternative 9)

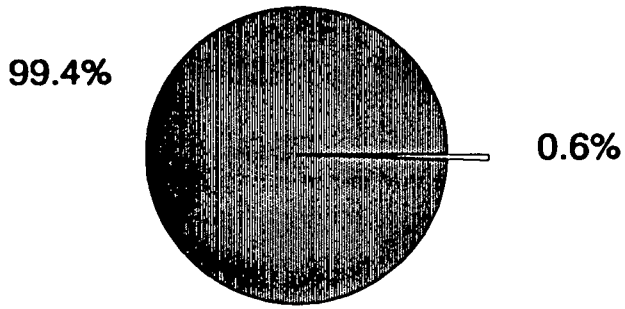
FERNALD WASTES - OFF-SITE DISPOSAL
NEVADA TEST SITE

- Revised RCRA Part B
- NEPA Documentation
- Sufficient Capacity
- Current Cost is $34/cu.ft.
- No Subsidies
- Will Accept Fernald Waste

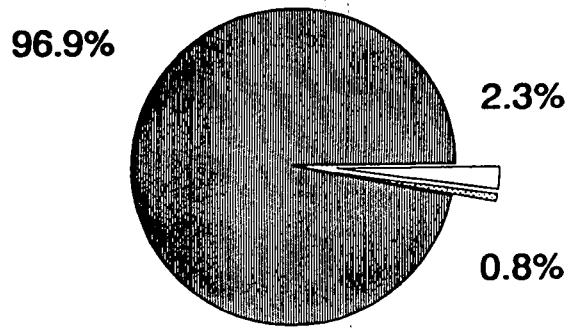
COST BREAKDOWN OF ALTERNATIVES FOR SILOS 1, 2



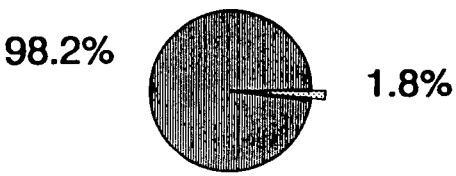
Alternative 1
$59,618 K



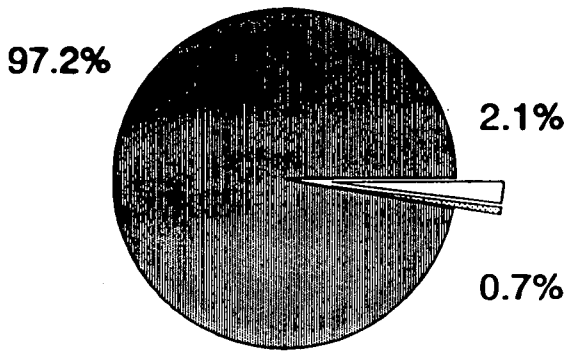
Alternative 2
$75,792 K



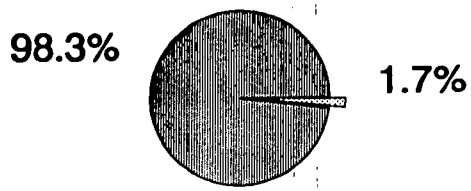
Alternative 6
$84,963 K



Alternative 7
$36,656 K



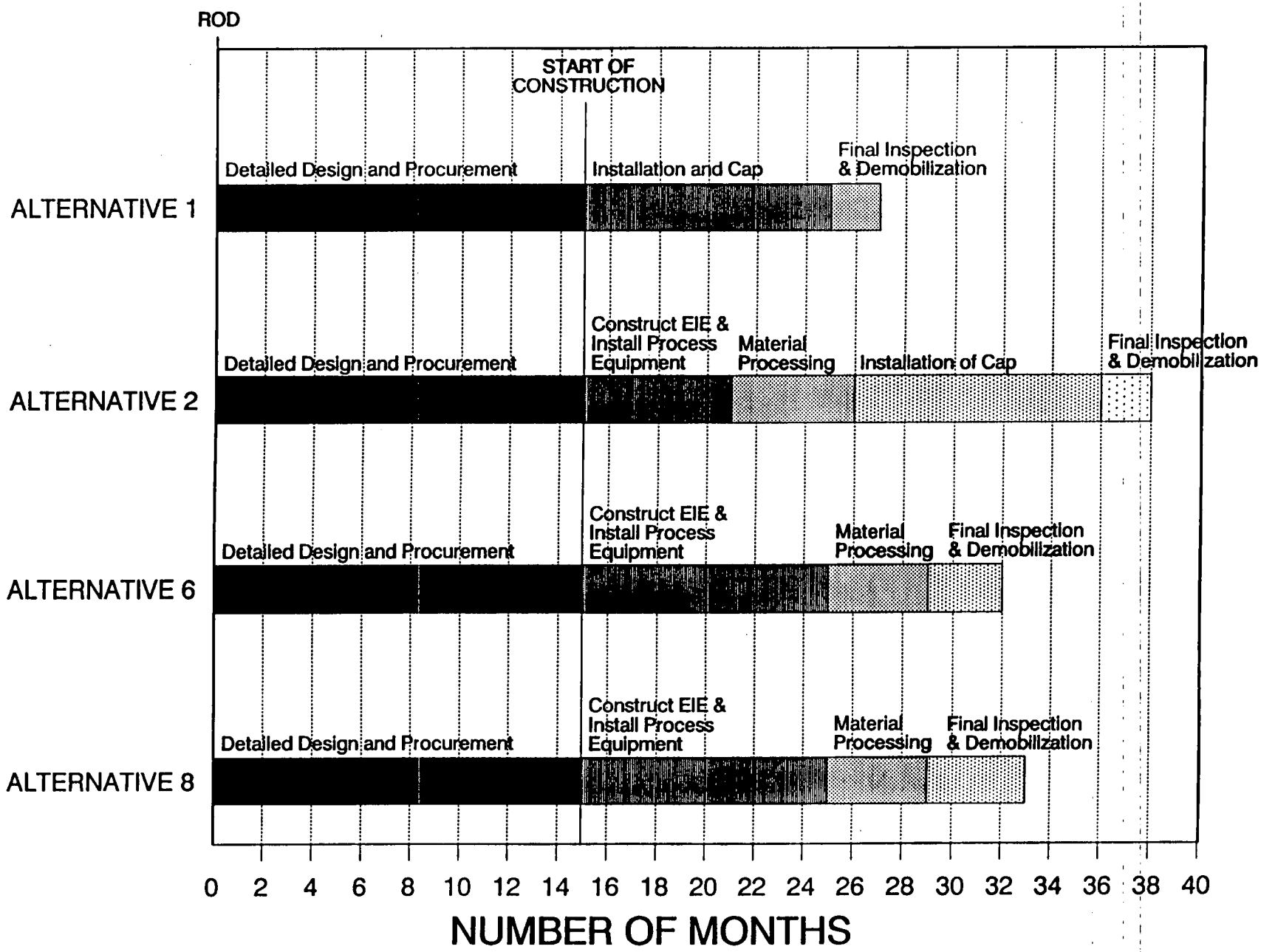
Alternative 8
$89,565 K



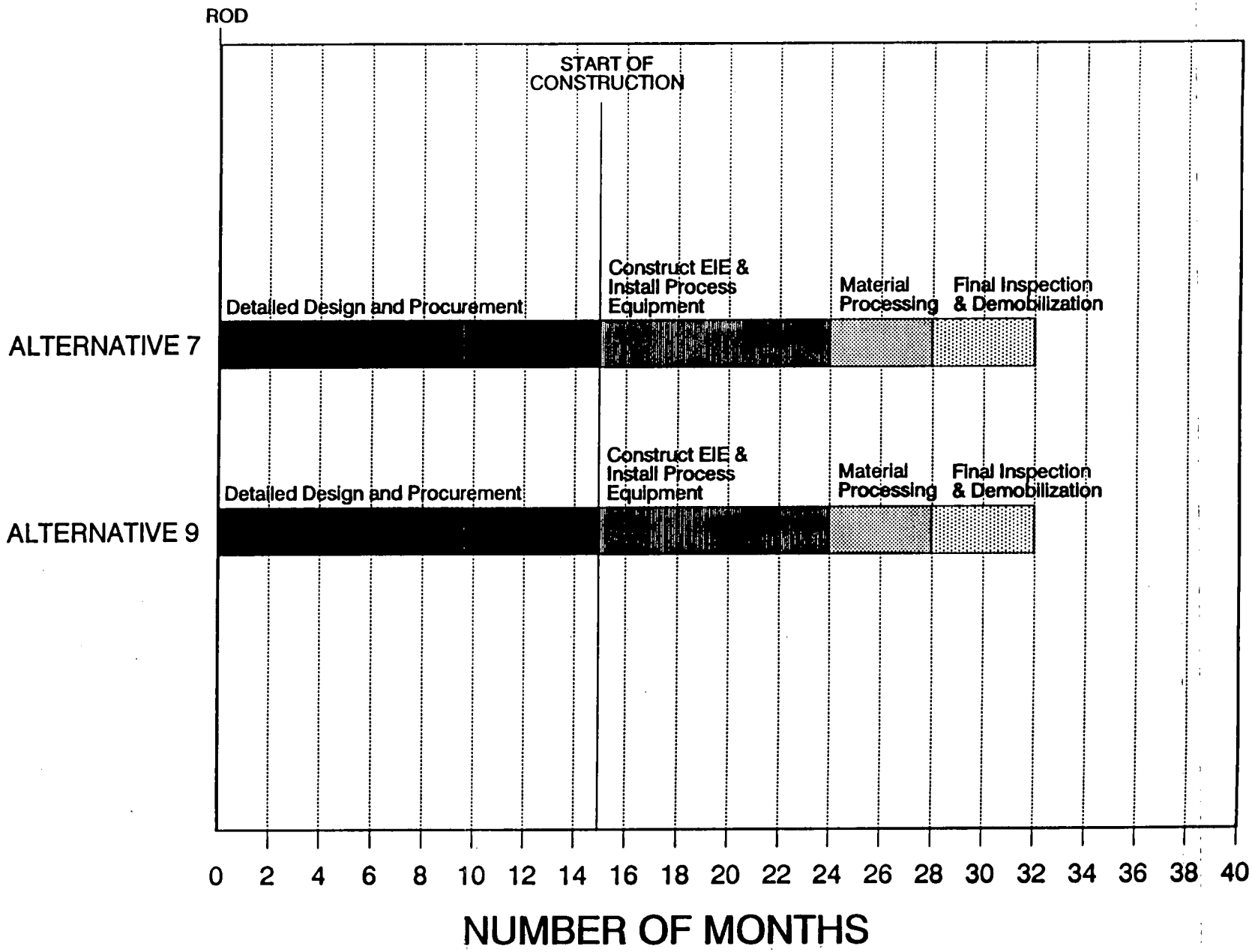
Alternative 9
$38,231 K

Capital Costs | O&M for Processing | Long-Term O&M

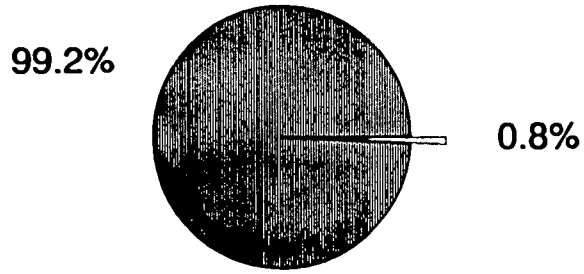
REMEDIATION SCHEDULE - ON-SITE ALTERNATIVES - Silos 1 & 2



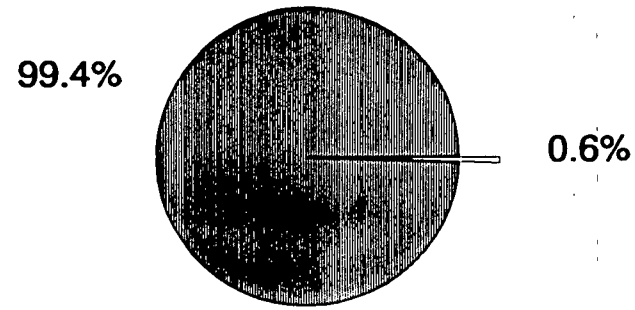
REMEDIATION SCHEDULE - OFF-SITE ALTERNATIVES - Silos 1 & 2



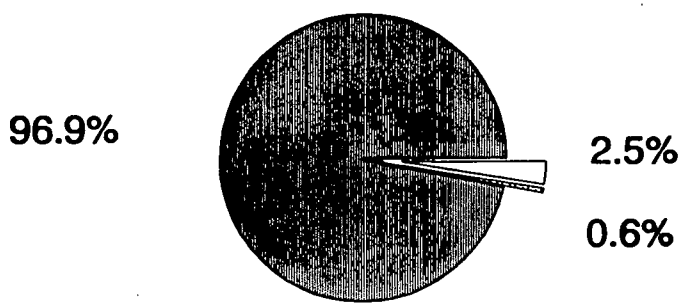
COST BREAKDOWN OF ALTERNATIVES FOR SILO 3



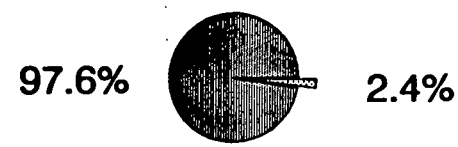
Alternative 1
$59,618 K



Alternative 2
$75,792 K



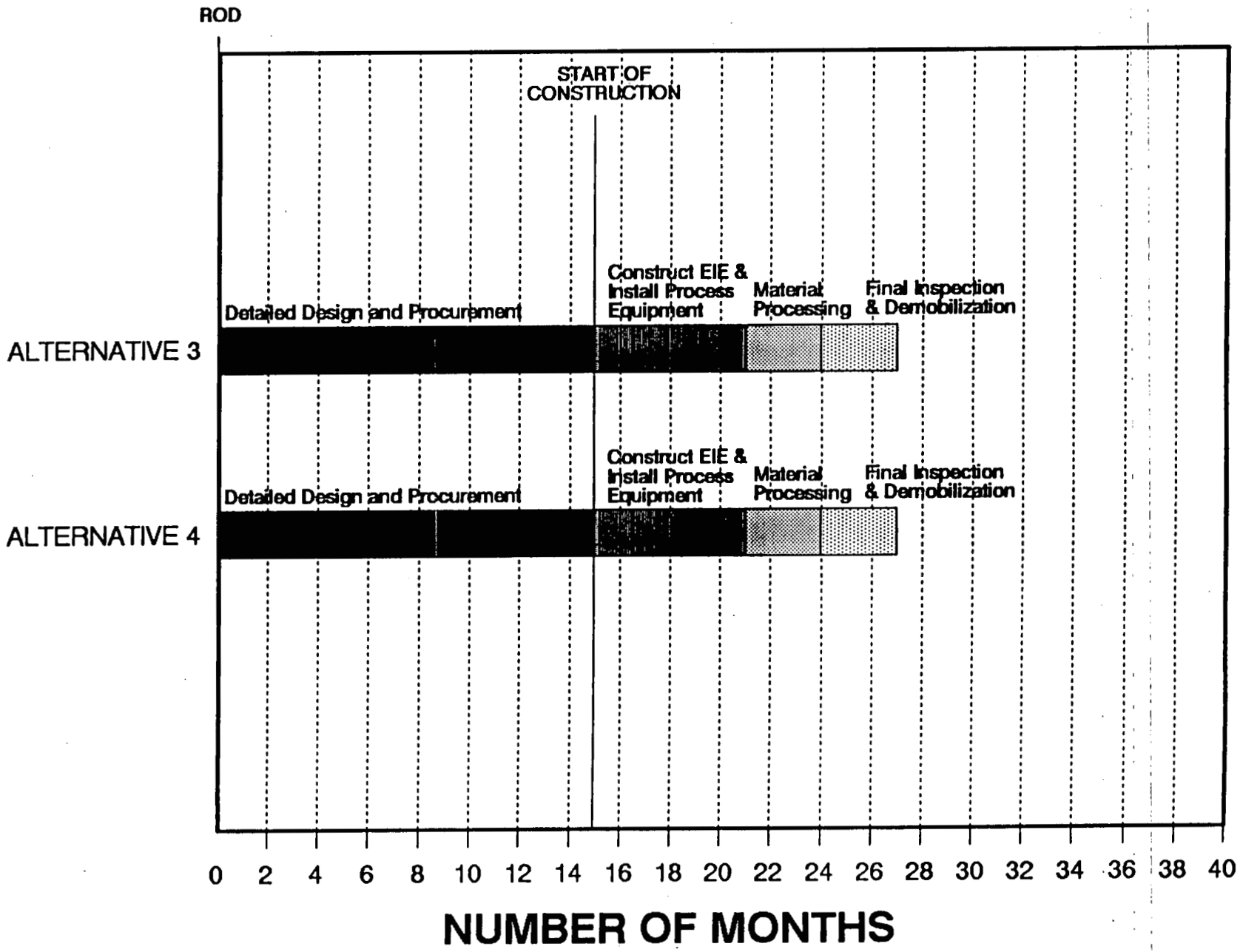
Alternative 3
$73,752 K

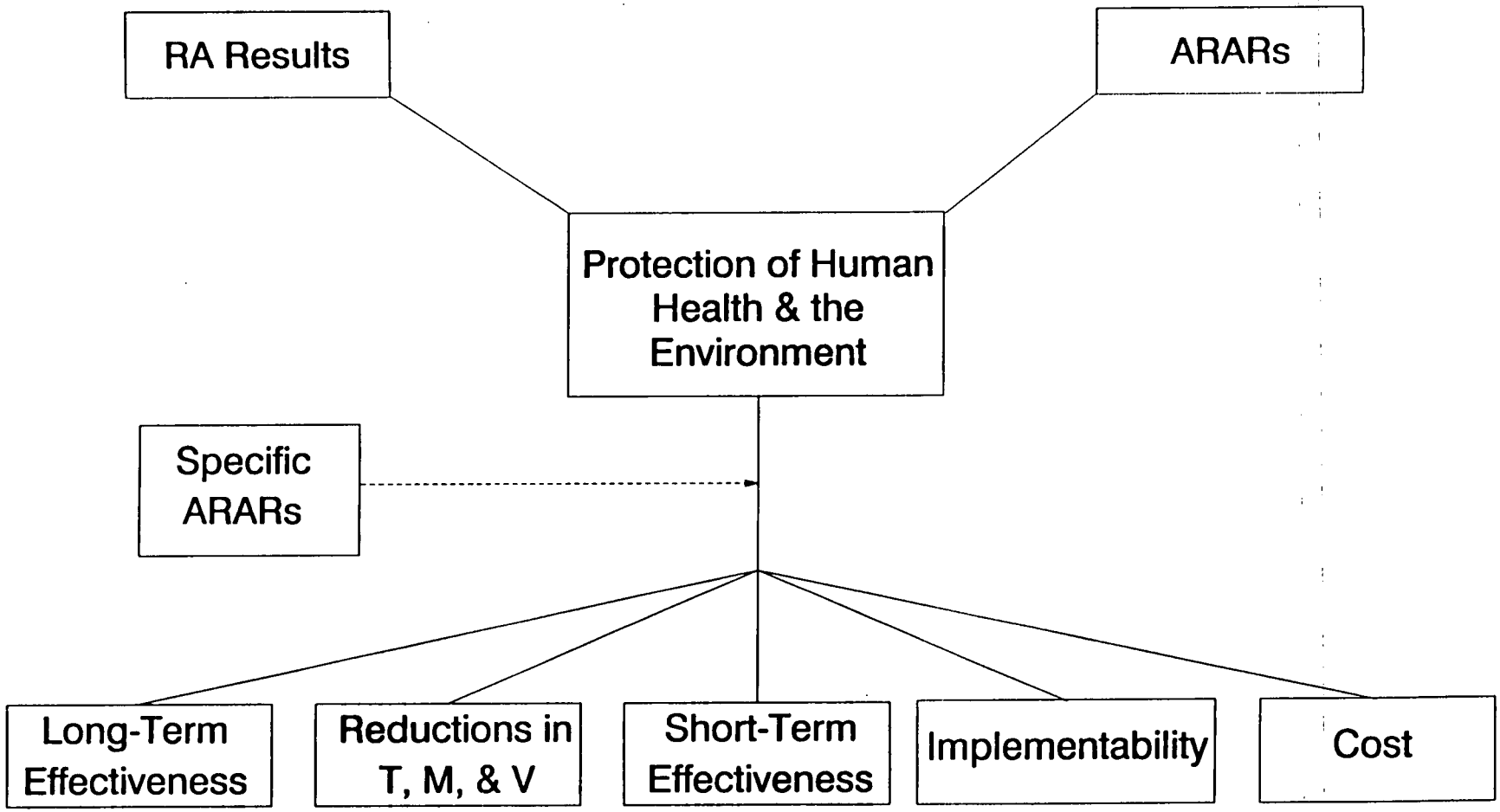


Alternative 4
$18,182 K

Capital Costs | O&M for Processing | Long-Term O&M

REMEDIATION SCHEDULE - Silo 3




RA Results
ARARs
Protection of Human Health & the Environment
Specific ARARs
Long-Term Effectiveness
Reductions in T, M, & V
Short-Term Effectiveness
Implementability
Cost

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude of Residual Risk
- Adequacy and Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY, & VOLUME THROUGH TREATMENT

- Treatment Process
- Hazardous Materials Destroyed or Treated
- Reductions in Volume
- Degree of Irreversibility
- Residuals Remaining After Treatment

SHORT-TERM EFFECTIVENESS

- Protection of Community During Remedial Actions
- Protection of Workers During Remedial Actions
- Protection of Environment During Remedial Actions
- Time Until Remedial Action Is Acheived

IMPLEMENTABILITY

- Ability to Construct and Operate
- Reliability
- Ease of Additional Actions, if Necessary
- Ability to Monitor Effectiveness
- Ability to Obtain Approvals From Other Agencies
- Coordination With Other Agencies
- Availability of Off-Site Services and Capacity
- Availability of Necessary Equipment and Specialists
- Availability of Technologies

COST

- Net Present Worth Basis
- Capital Costs
- Operating and Maintenance Costs for Processing
- Operating and Maintenance Costs - Long-Term

RATINGS OF ALTERNATIVES

- QUANTITATIVE
- PAIR WISE
- WEIGHTED

LIST OF ALTERNATIVES

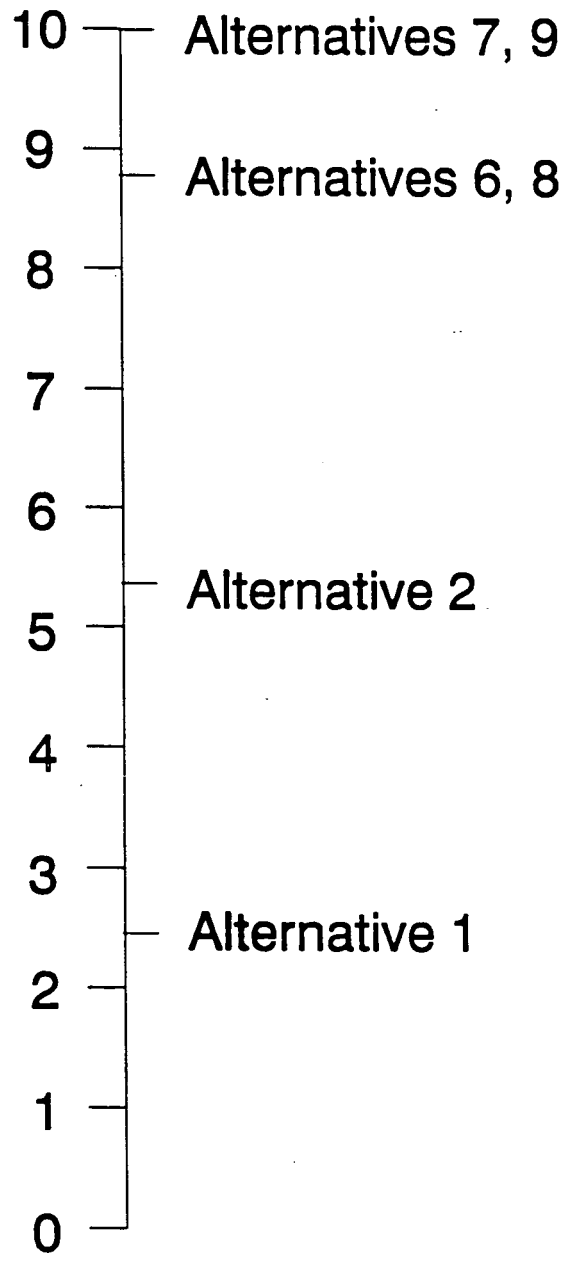
OPERABLE UNIT 4

	Silos 1 & 2	Silo 3
ALTERNATIVE 1 - Slurry Wall, Cap	▲	▲
ALTERNATIVE 2 - In Situ Stabilization, Slurry Wall, Cap	▲	▲
ALTERNATIVE 3 - Silo 3, Remove Contents, Package & On-Site Disposal		▲
ALTERNATIVE 4 - Silo 3, Remove Contents, Package & Off-Site Disposal		▲
ALTERNATIVE 6 - Silos 1, 2, Remove, Stabilize/ Vitrify, Package & On-Site Disposal	▲	
ALTERNATIVE 7 - Silos 1, 2, Remove, Stabilize/ Vitrify, Package & Off-Site Disposal	▲	
ALTERNATIVE 8 - Silos 1, 2, Remove, Separate Contaminants, Stabilize/Vitrify, Package and On-Site Disposal	▲	
ALTERNATIVE 9 - Silos 1, 2, Remove, Separate Contaminants, Stabilize/Vitrify, Package and Off-Site Disposal	▲	

COMPARISON OF ALTERNATIVES

Long-Term Effectiveness

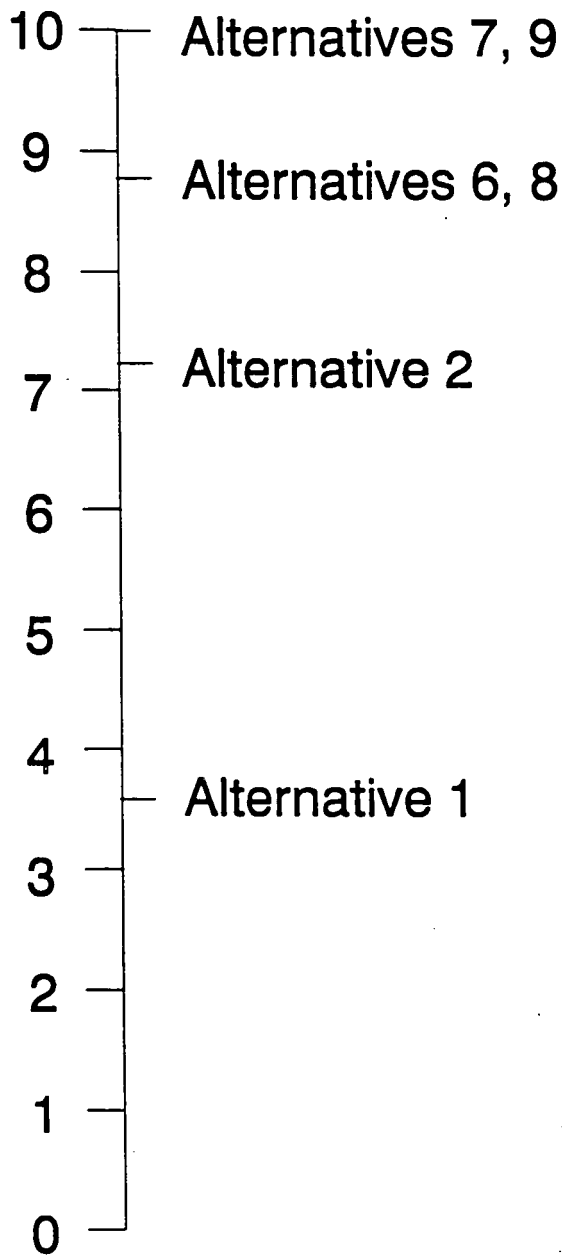
Silos 1 & 2



"Normalized Rank"

COMPARISON OF ALTERNATIVES

Reduction in Toxicity, Mobility, & Volume
Silos 1 & 2

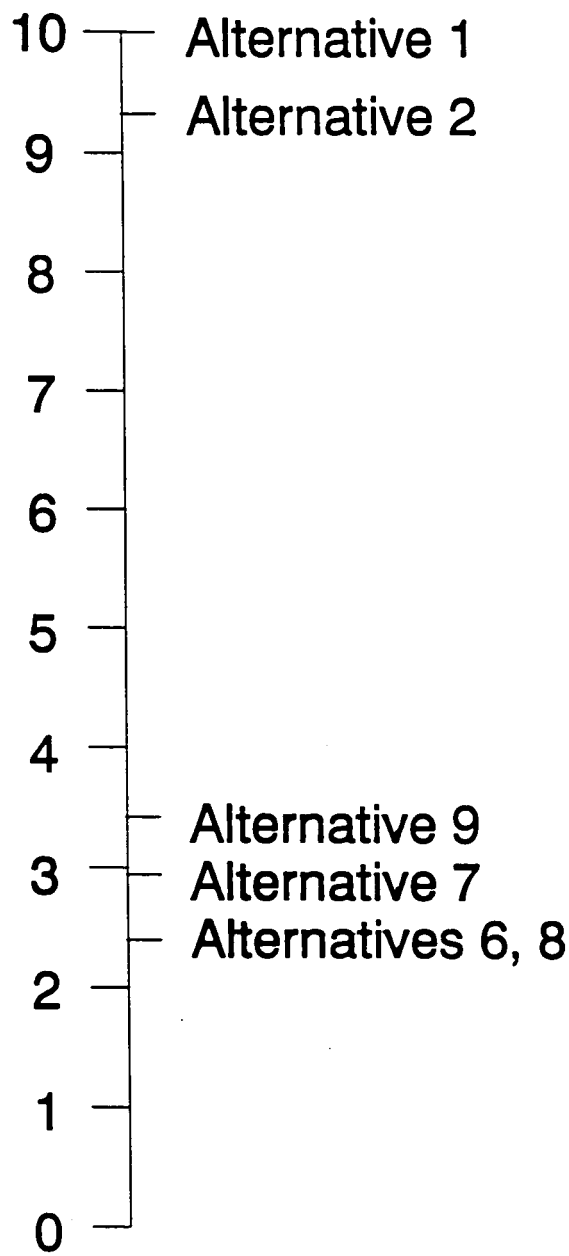


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Short-Term Effectiveness

Silos 1 & 2

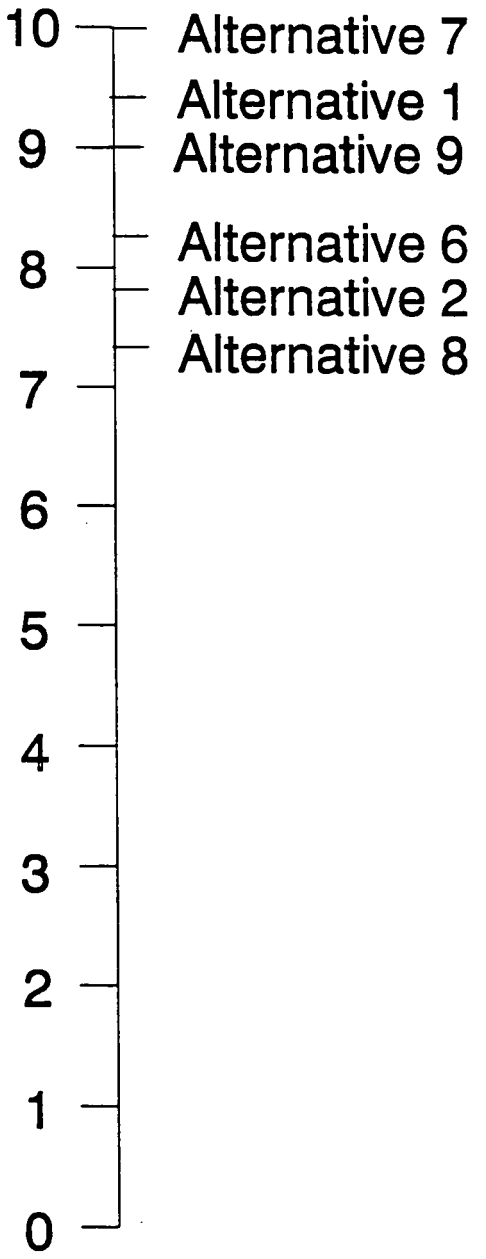


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Implementability

Silos 1 & 2

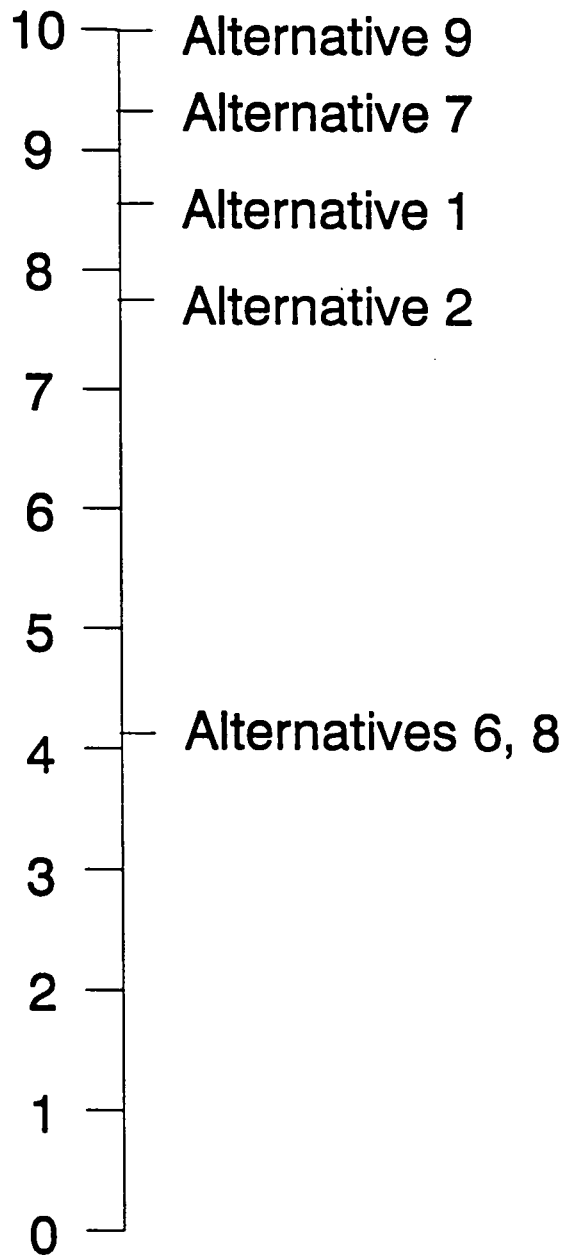


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Cost

Silos 1 & 2

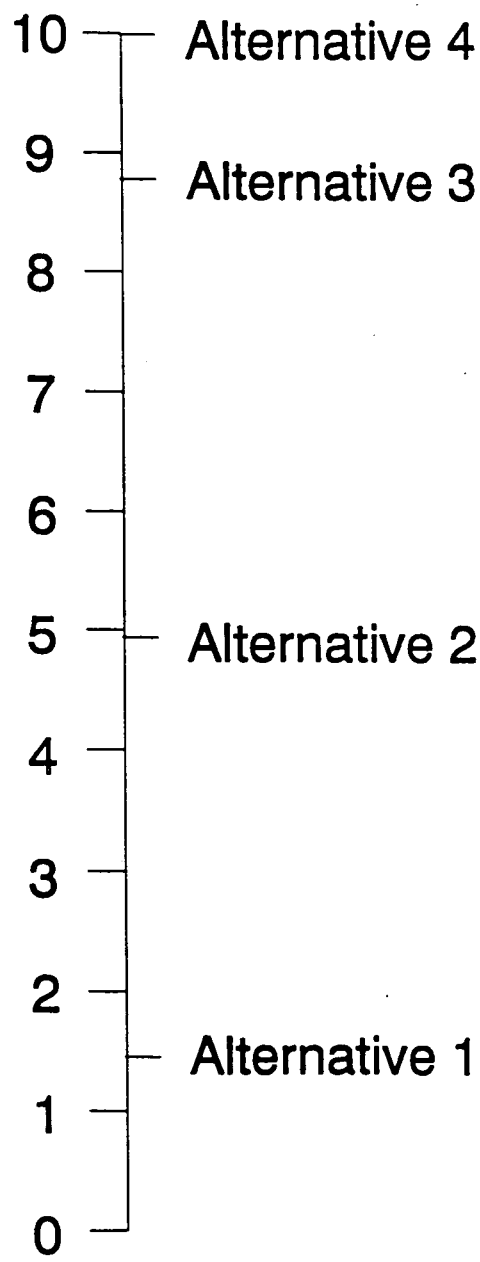


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Long-Term Effectiveness

Silo 3

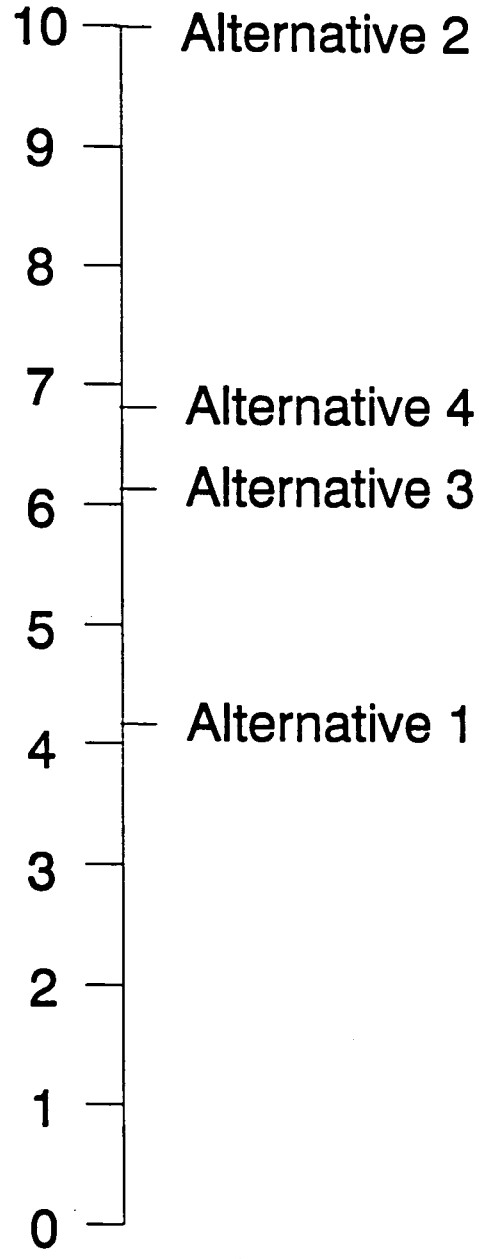


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Reduction in Toxicity, Mobility, & Volume

Silo 3

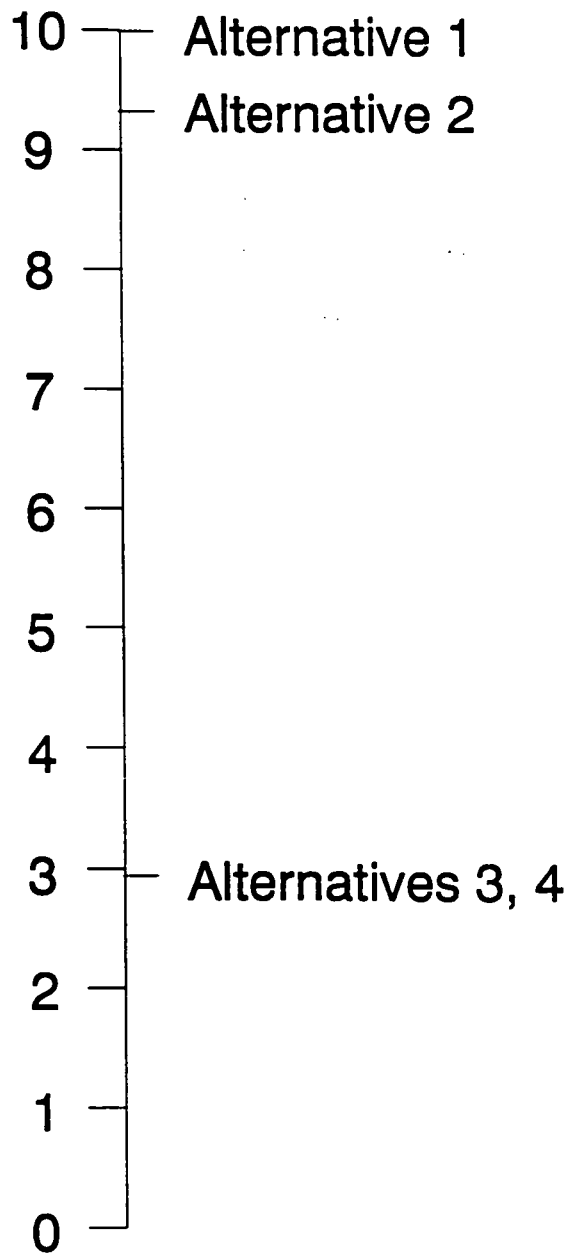


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Short-Term Effectiveness

Silo 3

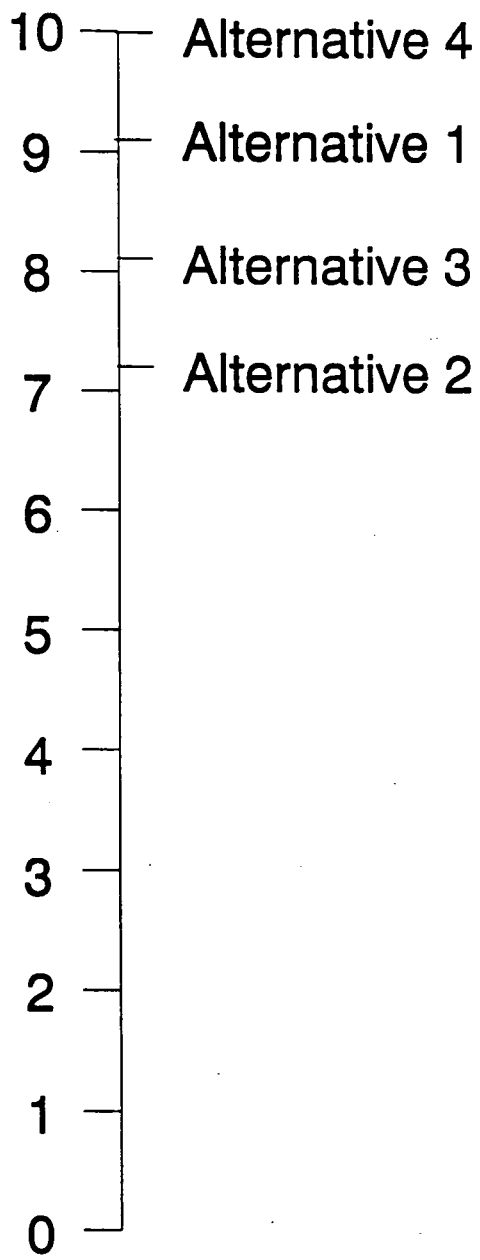


"Normalized Rank"

COMPARISON OF ALTERNATIVES

Implementability

Silo 3



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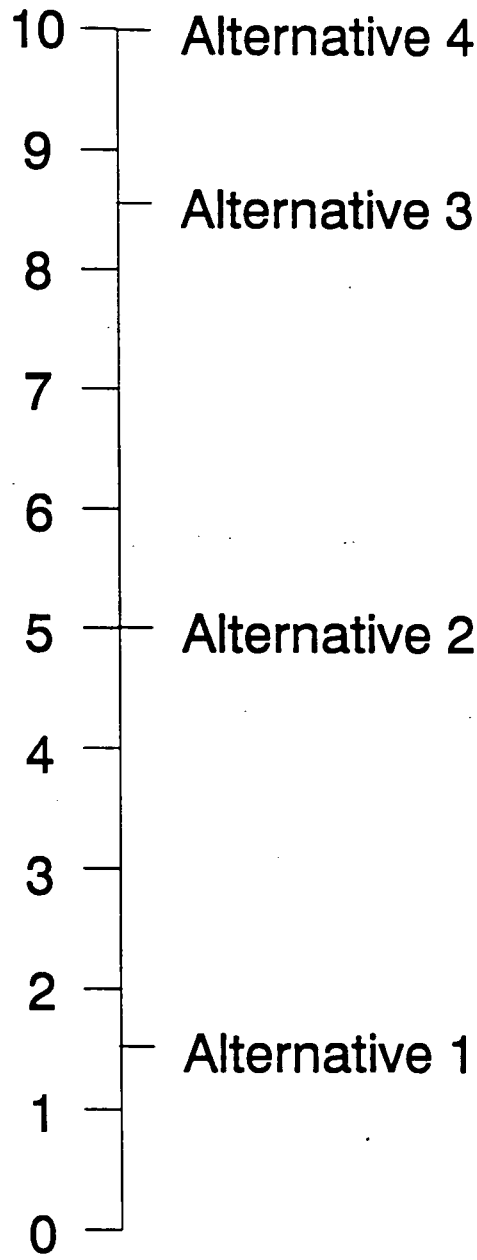
COMPARISON OF ALTERNATIVES

Cost

Silo 3



"Normalized Rank"

RESULTS OF TASK-13

- Alternatives 1-4 and 6-9 analysed in detail
- Assumptions made to allow continuation of task while awaiting more data
- Preliminary ARARs identified
- Comparison made between alternatives as regards ability to fulfill criteria
- Eight alternatives carried into task-14
  - Four on-site options for K-65
  - Two off-site options for K-65
  - Three on-site options for Silo 3
  - One off-site option for Silo 3

SUMMARY

- Results of Analysis
- ARARs Process on Schedule
- Iterative Selection Process
  - Assumptions
  - ARARs
  - Treatability Results