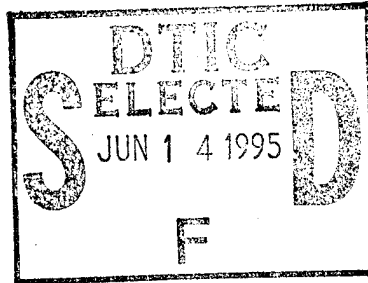


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MODIFIED BASIN F CLOSURE PLAN

1 October 1986



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# REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words)  IN MAY, 1986, THE COLORADO DEPT. OF HEALTH PROPOSED A PARTIAL BASIN F CLOSURE PLAN THAT WOULD HAVE REQUIRED THE EXPEDITIOUS REMOVAL OF THE LIQUIDS, SOLIDS, AND OVERBURDEN TO AN OFF-POST WASTE DISPOSAL FACILITY. SUBSTANTIAL COMMENTS WERE RECEIVED FROM THE ARMY, INCLUDING A PROPOSAL FOR ON-POST INTERIM STORAGE OF THE BASIN F WASTES PRIOR TO FINAL TREATMENT AND CONSTRUCTION OF AN INTERIM GROUND WATER TREATMENT SYSTEM. THIS MODIFIED CLOSURE PLAN NOW INCORPORATES THE ARMY'S PROPOSAL AND ALLOWS FOR STORAGE OF THE LIQUID WASTES IN ON-POST TANKS AND SOLID WASTES IN AN ON-POST WASTE PILE PRIOR TO FINAL TREATMENT AND DISPOSAL. ALL HAZARDOUS WASTES FROM THE BASIN MUST BE FINALLY TREATED AND/OR DISPOSED OF WITHIN FIVE YEARS OF THE EFFECTIVE DATE OF THE FINAL CLOSURE PLAN.  THE PLAN IS DIVIDED INTO THE FOLLOWING SECTIONS: <ol style="list-style-type: none"> <li>1. INTERIM REMEDIAL ACTIONS</li> <li>2. TREATMENT AND FINAL DISPOSAL</li> <li>3. MONITORING AND MAINTENANCE DURING CLOSURE</li> </ol> <p style="text-align: center;"><b>DTIC QUALITY INSPECTED 3</b></p>				
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MODIFIED BASIN F CLOSURE PLAN

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## MODIFIED BASIN F CLOSURE PLAN

### 1. INTRODUCTION

#### 1.1 BACKGROUND

Basin F was constructed in 1956 to receive wastes from the military and industrial operations at the Rocky Mountain Arsenal (RMA). The basin was designed with a capacity of approximately 240 million gallons, was lined with a 3/8-inch asphalt membrane and covered with one foot of soil. The life expectancy for the asphalt membrane was projected to be a maximum of 15 years. Inorganic and organic hazardous wastes, including chemical nerve agent waste residues and pesticide waste residues from the U.S. Department of the Army (Army) and Shell Chemical Company activities were discharged to the basin from 1956 through 1982.

Studies of liquid levels in Basin F and evaporation rates indicate that the asphalt membrane may have ceased being an impermeable barrier as early as 1965. Photographs of exposed sections of the liner taken in 1969 showed that sections of the asphalt membrane had liquified and had little or no physical integrity. Data collected from 1969 to 1974 showed a strong correlation between the waste volume in Basin F and chloride levels in groundwater near the basin, indicating that substantial leakage was occurring. In September 1978 an Army report ("the Buhts report") summarized earlier studies, stating that, "the evidence is substantial and unambiguous that Basin F is a principal source of groundwater contamination."<sup>(1)</sup> The Buhts report also concluded that the Army should quickly begin to contain, treat and/or dispose of the Basin F waste and resulting contamination.

Hazardous wastes were disposed in the basin until mid-1982. In July 1983, the Army submitted a closure plan to EPA under the Resource Conservation and Recovery Act (RCRA). This same plan was re-submitted to the Colorado Department of Health (CDH), Waste Management Division in November, 1984 upon Colorado's assumption of the federal hazardous waste regulatory program. The plan proposed the removal and solidification of Basin F liquids, stabilization of the overburden material and liner, excavation of between six inches and six feet of the subsoils beneath the basin and disposal of the solidified wastes in a proposed on-site hazardous waste landfill.

(1) Buhts, R.E. and N.R. Francingues, "Basin F Investigative Studies; Phase I: Problem Definition," Draft Final Report, September, 1978.

In October 1985 CDH sent a Notice of Disapproval of the proposed closure plan to RMA, noting several types of inadequacies including lack of immediate steps to remove the hydraulic head (liquid level) in the basin and a schedule for completion of closure which extended beyond the regulatory time frame of 180 days by several years (6 CCR 1007-3, Section 265.112(c)). The Army's Basin F closure plan was re-submitted in December 1985 and again did not address the schedule problem or provide for adequate interim actions to prevent the further release of contaminants to the environment. The Army's plan proposed to begin waste removal and treatment in 1989 with subsequent burial of the treated wastes in a yet to be permitted or constructed on-site hazardous waste landfill.

Due to the continued threat to public health and the environment through groundwater contamination from Basin F, and since the Army did not propose an acceptable way to remove the source of contamination within a reasonable time frame, CDH proposed a partial Basin F Closure Plan in May 1986 in accordance with Section 265.112(d) of the Colorado Hazardous Waste Regulations. The CDH partial closure plan would have required the expeditious removal of the source of contamination at Basin F including the liquids, overburden material, and contaminated soil, and subsequent shipment of the material to an off-site hazardous waste disposal facility.

Substantial comments were received by CDH on the proposed plan, including a proposal by the Army for on-site interim storage of the Basin F wastes prior to final waste treatment and disposal and construction of an interim groundwater treatment system. This closure plan now incorporates the Army's proposal and allows for storage of the liquid wastes in on-site tanks and solid waste in an on-site waste pile prior to final treatment and disposal. All hazardous wastes from the basin must be finally treated and/or disposed within five years of the effective date of this final closure plan. The Army must also address any groundwater contamination through a post-closure plan and permit application.

#### 1.2 EFFECTIVE DATE

The Basin F Closure Plan shall become effective on the date of receipt by the Army.

### 1.3 OUTLINE OF CLOSURE STEPS AND SCHEDULE

The closure activities will occur in three parts. In the first part, all liquids must be removed from Basin F within twelve months of the effective date of this closure plan and may be stored on-site in tanks. Within twenty-four months of the effective date of the plan, all Basin F liquids must be treated to be nonhazardous, treated to eliminate all free liquids and stored in an interim waste pile storage facility, or shipped off-site to an approved hazardous waste treatment or disposal facility.

In the second part, within twelve months of the effective date of this plan, the Army must propose a final excavation plan for cleanup of contaminated soils. Within eighteen months of the effective date of the plan, all sludges, overburden, the liner, and contaminated subsoils must be removed from Basin F and stored within the confines of Basin F in a newly constructed interim storage waste pile. The waste pile must be designed with an impermeable cover, a leachate collection system and a lower liner to assure that no hazardous wastes can escape to the surrounding environment during storage.

In the third part, within five years of the effective date of the closure plan, all solids generated from either the treatment of liquids or the excavation of sludges and soils from the basin area must be either treated to be nonhazardous, treated and disposed on-site as hazardous waste in a permitted hazardous waste landfill that has siting approval in accordance with C.R.S. 25-15-201, et seq., or shipped off-site for treatment and subsequent disposal.

Concurrently with the removal and interim storage of the liquid and solid hazardous waste, identification of the extent of waste migration beneath the liner must be made through the sampling and analysis of the underlying soil, and through the groundwater assessment monitoring which must be continued through the closure period. Within 12 months of the effective date of this plan, an interim groundwater containment/treatment system will be constructed and operated immediately north of Basin F. This system will be upgraded as required prior to final closure or during the post-closure period. A post-closure plan and permit will be required if further remediation of groundwater in the Basin F vicinity is necessary. A more detailed schedule of closure activities is given in Tables 1A-1D.

# Schedule of Closure Activities

## Table 1A - Liquids Interim Storage

Event	Completion Deadline from Effective Date of Closure Plan
Prepare and submit scope of work for liquids removal and interim storage (See section 1.4.1)	2 months
Announce in Colorado Business Daily (CBD)	2 months
Prepare and submit final tank inspection and evaluation report (See section 1.4.3)	3 months
Select best and final list of firms	4 months
Award contract	5 months
Submit operations plan (See section 1.4.5)	6 months
Begin mobilization	7 months
Begin transfer operations	9 months
Complete transfer operations	12 months
Demobilization	13 months
Final liquids removal inspection	13 months

Schedule of Closure Activities

Table 1B - Solids Interim Storage

Event	Completion Deadline - From Effective Date of Closure Plan
Prepare and submit sampling and analysis plan for Basin F soils (See section 1.4.2)	2 months
Prepared and submit scope of work for solids excavation and interim storage, including conceptual design of waste pile. (See section 1.4.6)	6 months
Announce in CBD	7 months
Select best and final list of firms	9 months
Award contract	10 months
Submit excavation plan (See section 1.4.7)	12 months
Begin mobilization	13 months
Begin operations	14 months
Complete operations	18 months
Demobilization	19 months
Inspection of Basin F area and waste pile	19 months



Schedule of Closure Activities

Table 1C - Interim Groundwater Treatment

Event	Completion Deadline from Effective Date of Closure Plan
Prepare and submit scope of work for interim groundwater treatment (See section 1.4.4)	3 months
Announce in CBD	4 months
Select best and final list of firms	5 months
Award contract	6 months
Submit final design (See section 1.4.4)	7 months
Begin installation	9 months
Complete installation and begin operation of system	12 months

Schedule of Closure Activities

Table 1D - Final Disposal, Final Closure, and Post-Closure

Event	Completion Deadline From Effective Date of Closure Plan
Prepare and submit scope of work for treatment or disposal of liquids (See section 1.4.8)	14 months
Prepare and submit technical plan for treatment or disposal of liquids (See section 1.4.8)	18 months
Prepare and submit groundwater evaluation (See section 1.4.9)	24 months
Prepare and submit post-closure plan and permit application (as required)	24 months
Complete final treatment/disposal of liquids	24 months
Prepare and submit technical plan or permit applications for final treatment/disposal of solids (See section 1.4.10)	24 months
Complete final treatment/disposal of solids	60 months
Final equipment decontamination and residuals disposal	64 months
Final closure certification	66 months

#### 1.4 REQUIRED SUBMITTALS

The Army must develop and submit to CDH the following additions to the plan by the dates indicated. These submittals must be approved or modified by CDH, prior to implementation of the proposed activities. CDH review and responses to the Army's submittals will be expedited to the extent possible. If CDH review of "complete" submittals results in a delay in meeting deadlines, the specified deadlines may be adjusted by CDH.

- 1.4.1 Within 2 weeks of the effective date of this closure plan, the army must provide the most recent estimate (and supporting calculations) of the volume of liquids in Basin F, and all available Basin F liquids analysis and subsoils analysis data generated within the last two years.
- 1.4.2 Within 2 months of the effective date of this closure plan, a scope of work must be provided giving performance specifications and a description of the activities necessary to complete the removal and interim storage of the liquids impounded in Basin F. The scope of work must include:
- a) an analysis of the Basin F liquids conducted in accordance with the procedures described in Appendix 2; and
  - b) an approximate schedule showing the sequencing of activities necessary to complete the liquids removal.
- 1.4.3 Within 2 months of the effective date of this closure plan, a soils sampling and analysis plan must be provided to complete the sampling and analysis of the Basin F overburden material, liner, and contaminated soils. The plan must specify the sampling methods, analytical methods and QA/QC procedures to be used. At a minimum, the samples must be analyzed for total concentrations of the parameters identified in Appendix 2.
- This investigation must provide sufficient data to characterize and quantify the areal distribution of soil contamination found beneath the Basin to at least the uppermost saturated zone or 40 ft. below the surface of the basin, whichever is deeper (see section 2.2.1.1). The soil sampling and analysis results must be submitted to CDH as soon as they are available, but no later than 12 months of the effective date of the closure plan.
- 1.4.4 Within 3 months of the effective date of the plan the Army must compile and submit a detailed history of usage of the tanks, including the most recent tank cleaning operations, for the tanks proposed for on-site storage of Basin F liquids. A report of the tank inspections described in section 2.1.1 must also be submitted at this time. This report must evaluate the need for repairs to the existing tanks and/or the construction of new tanks to meet the requirements of 6 CCR 1007-3, part 265, subpart J.

- 1.4.5 Within 3 months of the effective date of the plan, a scope of work, including the preliminary design and an implementation schedule, must be provided for an interim groundwater containment/treatment system north of Basin F to treat the contaminated groundwater flowing to the north boundary of RMA, as described in section 2.3. The final design of this system must be submitted within 7 months of the effective date of this plan.
- 1.4.6 Within 6 months of the effective date of this closure plan, an operations plan must be submitted for the removal of liquids from Basin F. At a minimum the plan must describe:
- a) contractor mobilization activities including the types of equipment and numbers of personnel to be used;
  - b) health and safety plans for all personnel consistent with the provisions of Appendix 3;
  - c) transportation routes, facilities, and procedures for on-site liquids transfer operation; and
  - d) a detailed tank inspection schedule to be followed throughout the interim storage period which meets the requirements of 6 CCR 1007-3, Sections 265.15 and 265.194.
- 1.4.7 Within 6 months of the effective date of this plan, the Army must provide a scope of work, including performance specifications and a detailed description of activities, for the removal and storage of all solids in the basin. The scope of work must include:
- a) a preliminary estimate of the volume of wastes that will be removed from the basin using the most recent soil sampling data collected as described in section 1.4.2;
  - b) a preliminary location and conceptual design for the interim storage facility (waste pile), meeting the requirements of section 2.2.2 of this plan, showing liner type and thickness, leachate collection system, total estimated capacity, maximum sideslopes, and cap design; and
  - c) an approximate schedule showing the sequencing of the activities, major milestones, and completion date for the removal of solids from the basin.
- 1.4.7 Within 12 months of the effective date of the closure plan, the Army must provide the excavation plan for the removal and storage of Basin F solids as described in section 2.2.1. The excavation plan must include the following:

- a) contractor mobilization and operations;
- b) contractor health and safety plans consistent with the provisions of Appendix 3;
- c) storage waste pile final design, engineering specifications, construction procedures including quality assurance (refer to "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, EPA/530-SW-85-021, October, 1985), and construction schedule;
- d) materials handling procedures, including types and number of personnel and equipment needed for excavation;
- e) depths of excavation within the basin mapped on a grid system, based on the soil contamination assessment and approved soil performance standards determined under section 2.2.1.2 of this plan;
- f) specific treatment methods, including types of sorbents, and mixing procedures that will be used to eliminate free liquid content of solids, as necessary;
- g) methods for placing wastes onto the waste pile, including the number and maximum height of lifts and compaction techniques; and
- h) demobilization, including decontamination procedures.

1.4.9 Within 14 months of the effective date of the closure plan, a scope of work must be provided for the treatment or disposal of the liquid wastes from the basin. Within 18 months of the effective date of the closure plan, a technical plan for the final treatment/disposal of the liquids must be submitted (see section 3.1.).

1.4.10 Within 24 months of the effective date of the closure plan, the Army must provide a groundwater contamination evaluation and a post-closure plan and permit application for upgrading or construction of a final Basin F groundwater treatment system (if required) (see section 2.3).

1.4.11 Within 24 months of the effective date of the plan, a technical plan for off-site shipment or permit applications for the treatment and on-site disposal of solid hazardous wastes from Basin F must be submitted (see section 3.2.).

## 2. INTERIM REMEDIAL ACTIONS

### 2.1 LIQUIDS REMOVAL AND STORAGE

All contaminated liquids within Basin F will be pumped into tank trucks and transported either to off-site treatment/disposal facilities, to new tanks constructed on-site or to the carbon steel, epoxy phenolic resin lined storage tanks that are currently located along December 7th Avenue (see Figure 1).

#### 2.1.1 Storage Tank Preparation

Each of the three tanks has an estimated capacity of one million gallons. A request for an amendment to the Part A application must be made to allow storage of hazardous waste in tanks. Storage in the tanks shall meet the applicable requirements of 6 CCR 1007-3. Tank inspections will be conducted to evaluate the capacity and integrity of the tanks and spill containment berms, tank foundation construction, leak detection capability, cathodic protection, and compatibility of Basin F liquid with existing liner materials. Berms around the tanks must be upgraded to contain all spills and leaks that could occur during storage of the Basin F liquids.

Liner repairs may be necessary to meet the applicable requirements of Subpart J. If new liners are required, the compatibility of Basin F liquids with the proposed new liner materials must be evaluated.

Additional tanks may need to be constructed if: (1) the volume of Basin F liquid exceeds the capacity of the existing tanks; or (2) if existing tanks cannot feasibly be prepared for storage of the Basin F hazardous wastes. These new tanks may be placed adjacent to the existing tanks or may be placed adjacent to Basin F with CDH approval.

#### 2.1.2 Liquids Removal

Pumping from the basin to the tank trucks will be via commercially available sludge pumps (double-diaphragm, corrosion resistant, air-drive pumps with waste compatible piping). A slight depression may be made in the overburden above the liner to facilitate draining of the basin contents to the pump inlet. The existing sump structure used for the enhanced evaporation system may be altered as necessary to serve this purpose.

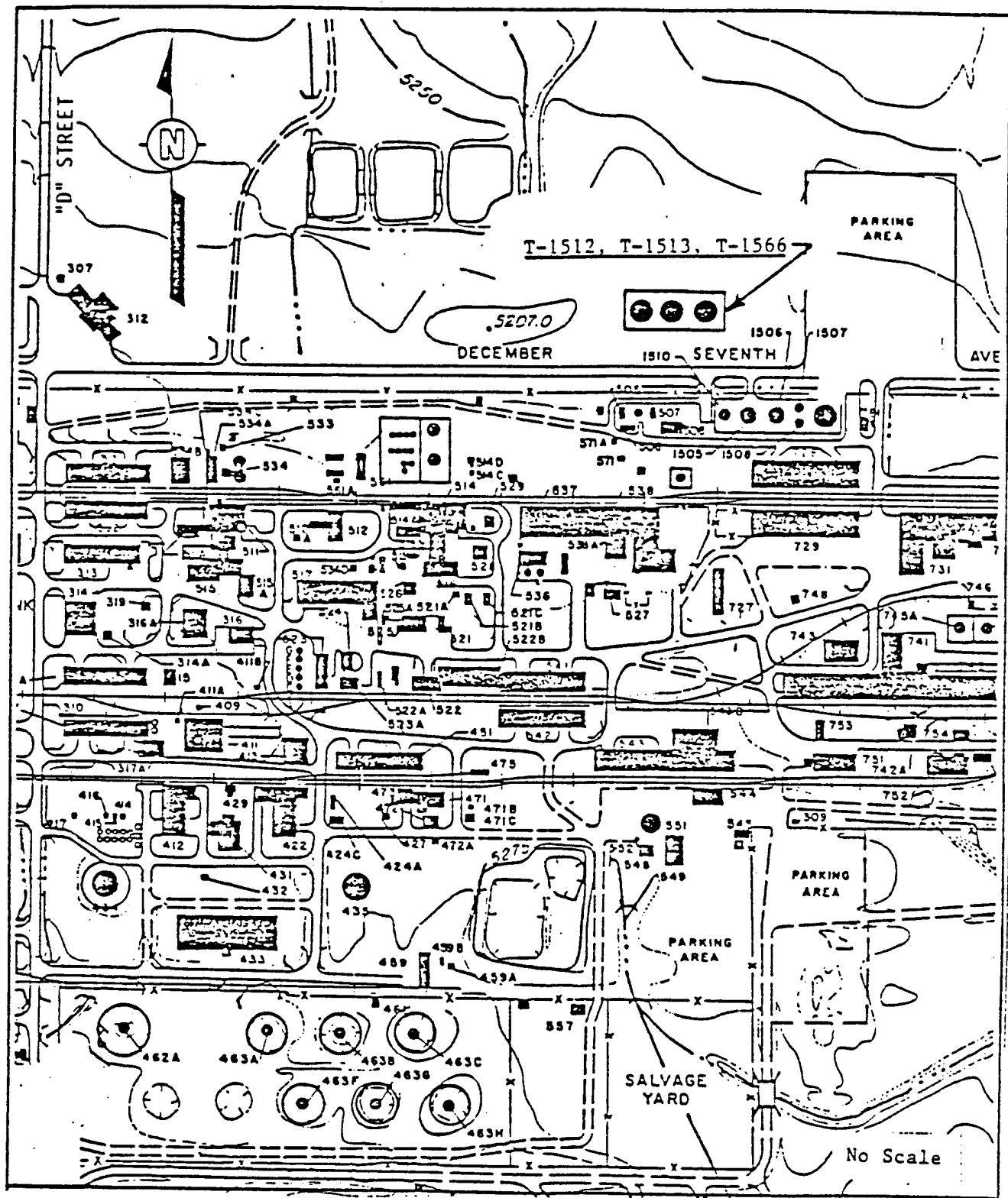


FIGURE 1. LOCATION OF PROPOSED SHELL STORAGE TANKS (T-1512, T-1513, T-1566)

If additional or alternative equipment is used, the wetted parts of the pumps, including the seals, and the piping and/or hoses must be of materials compatible with the Basin F liquids. The pumps must also be able to handle the levels of solids suspended within the liquids, or the pump suction and/or intake hose(s), must be screened to prevent pump failure due to clogging. Liquid loading areas will be established at the basin and at the tank storage area. The loading areas must be designed to capture all spills occurring during the transfer of liquids outside the basin.

A hot zone must be established around these liquid loading areas. Any personnel or vehicles crossing the hot zone must be decontaminated before leaving the area. All contaminated vehicles will be cleaned using the existing decontamination pad in the northeast corner of the basin. A temporary personnel support complex will be established.

Pumping and transportation will be conducted by the Army or a contractor according to the schedule shown in Table 1A. A liquid removal operations plan will be developed specifying in detail the procedures to be for utilized in the pumping and transportation of the liquids on-site and will be submitted as described in section 1.4.6. of this plan.

During the operational phase, pumping at an average rate of 20 - 30 gallons a minute should be achieved with higher rates possible during the early phases when the Basin's liquid head is at its greatest level. Two shifts of operation per day should be conducted seven-days-a-week if necessary to meet the schedule. If any unexpected conditions are experienced during the planning phase or operational phase, the Army and/or the contractor must notify CDH immediately and must take the necessary steps to resolve the problem. For example, if pumping of the liquid is a problem, heat tracing of the pumping lines and/or addition of dilution water may be necessary in order to prevent crystalline formation within the pump parts. If necessary, fallback techniques such as sludge excavation, hydraulic dredging, or belt presses will be made available and implemented upon notification and approval by CDH. Liquids removal must continue until it is no longer feasible. Upon cessation of pumping operations, any residual liquid in the basin will be dried through the addition of sorptive materials prior to its incorporation with the other solids in the basin.

The Army has the option to ship Basin F liquids directly off-site to hazardous waste treatment/disposal facilities instead of storing the liquids on-site. If this option is selected, the details must be included in the liquid removal operations plan (see section 1.4.6).



Comprehensive inspections and monitoring will take place and be documented throughout the removal and interim storage period to assure no spills occur as a result of tank failures (See sections 1.4.6 and 4.4). At the completion of the liquids removal transfer operations, CDH will be notified so that an inspection of the basin and storage facilities can be performed.

## 2.2 SOLIDS REMOVAL AND STORAGE

Contaminated overburden, liner, and subsoils within Basin F will be excavated and brought to an interim solids storage containment facility (waste pile), established within a ten acre area of Basin F. A temporary cap will be placed upon the containment facility and the facility will be monitored for its life.

### 2.2.1 Excavation Plan

An Excavation Plan must be submitted within 12 months of the effective date of the plan in accordance with section 1.4.8 of this plan. The plan shall include the following:

#### 2.2.1.1 Soil Contamination Assessment

A complete assessment of the extent of soil contamination in the Basin F area must be conducted, and the results must be included in the Excavation Plan.

(The scheme to be used for the location and spacing of samples may be consistent with the Army soil sampling and analysis program for the RMA remedial investigation source studies.) Sampling of soils will be performed prior to and concurrently with the liquid removal operations, starting in areas of the basin where the liquids are absent. The last area to be sampled will be the northeast corner of the basin after all the liquids have been removed and the residual liquids have been absorbed.

The soil assessment program must completely define the vertical extent of contamination to at least the uppermost saturated zone or forty (40) feet below the surface of the basin, whichever is deeper. Representative shallow soil samples must be collected outside the perimeter of Basin F to define the extent of any windblown deposition of contaminants from the basin. The soil assessment program must collect sufficient data such that final engineering excavation criteria can be established throughout the basin.

#### 2.2.1.2 Proposed Soil Cleanup Levels to Meet the Closure Performance Standards

The Army must propose final soil performance standards for each major chemical contaminant present within the soils in the basin. These standards must be established such that if all soil contamination above the proposed standards is removed from the basin, the closure performance standard (6 CCR 1007-3, Section 265.111) will be achieved. In setting these levels, consideration shall be given to exposure pathways the toxicity of the substance, its persistence in the environment, and its ability to migrate. Proposed performance standards, including a rationale for their selection, must be submitted to CDH for approval.

Final excavation depths must be based on the soil assessment and must meet CDH approved soil performance standards. In order to certify closure, the excavation depths must be such that all contamination above the soil performance standards is removed from the basin.

#### 2.2.1.3 Operations

Soil excavation to the soil performance standards will begin where all liquids are absent and the soils have had time to drain. The last area to be excavated will be the northeast corner following the liquids removal and sorption of residual free liquids. All materials will be scraped and placed into a waste pile established in a ten acre area of the basin and sloped as necessary for drainage and placement of a cap over the wastes (see sections 2.2.2 and 2.2.3).

If any free liquids are present, the material must be solidified using a non-reacting sorbent material such as Portland cement, kiln dust, fly ash, or commercial products such as "Chemfix" or "Stablex", prior to placement in the waste pile. Additional treatment may be required prior to any on-site disposal (see section 3.2). Sufficient samples must be taken to ensure that wastes placed in the pile contain no free liquids. At a minimum, one sample per 2000 yd<sup>3</sup> must be taken and the results recorded and maintained at the site.

Placement of additional wastes in the waste pile, other than Basin F wastes generated during closure, will only be done after obtaining approval from CDH. Comprehensive inspections and monitoring will take place and be documented throughout the interim storage period at the waste pile to assure no release of hazardous waste occurs as a result of system failure or damage to the cover (see section 4.2).

### 2.2.2 Waste Pile Location

The ten acre area will be established based upon several criteria including construction feasibility, ease of material handling and extent of soil contamination. The waste pile site will be in the vicinity of the southwest area of the basin so that logistical problems with the liquid removal in the northeast section will be minimized.

The existing Basin F liner will not be used for the interim containment facility as the integrity of the liner is in question. Therefore, the selected ten acre area of the basin must be excavated to remove the overburden, liner, and contaminated subsoils (see section 2.2.1.3). If necessary, uncontaminated soil will be placed in the waste pile location as a base. After excavation, the area must be leveled and graded to allow for placement of a liner. The ten acre site will undergo field inspection to identify and remove all visible soil contamination prior to any facility construction.

### 2.2.3 Waste Pile Design

A conceptual design of the facility is described below. The final design must be submitted for CDH approval in accordance with section 1.4.8(c). A request to amend the Part A application must be made to allow storage of hazardous waste in a waste pile.

The waste pile lower liner may be made of either synthetic materials or compacted clays. If on-site clays are used, the liner must be a minimum of 18 inches thick and have a demonstrated maximum permeability of  $1 \times 10^{-7}$  cm/s. Above the clay liner, a leachate collection layer with a drainage field must be installed to collect any leachate generated during storage. The leachate collection system must be graded to drain the leachate to a corner or side sump or an impoundment. Above the leachate collection layer, a geotextile membrane and protective soil cover must be installed to prevent clogging of or damage to the leachate collection system.

The cap will consist of either compacted clays (a minimum of 18 inches thick) or a synthetic liner such as 36 mil chlorinated reinforced polyethylene (CPE) liner, placed in such a way as to prevent infiltration of precipitation into the stockpiled waste.

#### 2.2.4 Post-Excavation Soil Sampling

Once all soil contamination in excess of the approved soil performance standards is excavated, additional soil sampling and analysis must be performed to demonstrate that the soil performance standards have been achieved. Representative shallow soil samples must be collected over the entire Basin after the excavation is completed. If it is found that contamination in excess of the soil performance standards still remains in certain areas of the basin, additional soils must be excavated in these areas, and additional samples must be collected and analyzed until the soil performance standards have been achieved.

#### 2.2.5 Recontouring and Revegetation

When the Army demonstrates that the soil performance standards have been achieved in accordance with section 2.2.4, the basin will be recontoured and revegetated to inhibit erosion, allow natural drainage of precipitation, and prevent ponding. Revegetation must be done using dry land native grasses.

### 2.3 GROUNDWATER TREATMENT

#### 2.3.1 Interim Groundwater Treatment

A scope of work for an interim groundwater containment/treatment system must be prepared as described in section 1.4.5. An interim groundwater containment/treatment system north of Basin F will be constructed and operational within 12 months of the effective date of this plan. This system will be placed directly adjacent to the basin (within Section 26) to treat the contaminated groundwater leading to the north boundary of the RMA. The system will be constructed using modular leased equipment and simplified dewatering wells to facilitate expeditious construction and operation.

Treatment components may include pretreatment through filtration and lime addition, and contaminant adsorption with granular activated carbon at a treatment rate of approximately 100 gallons per minute. The final design of the interim groundwater containment/treatment system must be submitted as described in Section 1.4.5.

### 2.3.2 Final Groundwater Treatment

Within 24 months of the effective date of the closure plan, the Army must propose groundwater performance standards for each major chemical contaminant present in the groundwater in the Basin F vicinity which has been or which may have been released from Basin F, to meet the closure performance standard (6 CCR 1007-3, Section 265.111). CDH will approve or modify the proposed groundwater performance standards. Furthermore, all existing on-post groundwater data and the Basin F groundwater assessment described in section 4.1 should be incorporated into an evaluation of groundwater contamination which has resulted or may have resulted from Basin F. The groundwater contamination evaluation must be submitted within 24 months of the effective date of the closure plan.

If groundwater contamination in excess of the final groundwater performance standards is present downgradient from Basin F, the Army must continue operation of the interim system and within 24 months of the effective date of the closure plan must submit an application for a post-closure permit to assure compliance with 6 CCR 1007-3, Part 264 Subparts F and G.

## 3. TREATMENT AND FINAL DISPOSAL

### 3.1 LIQUIDS MANAGEMENT

Within 24 months of the effective date of this closure plan, treatment or disposal of the liquids must be accomplished as described in one of the following three sections.

#### 3.1.1 Treatment to be Nonhazardous

The liquids may be treated to be nonhazardous using techniques such as freeze-thaw processing, incineration, distillation, organic adsorption or other appropriate methods. A technical plan with a schedule for implementation must be submitted to CDH for approval within 18 months of the effective date of this plan, and a request for an amendment to the Part A application must be made.

The liquids may be solidified on-site using appropriate fixation technologies to allow for the interim storage of the solidified hazardous wastes in the waste pile constructed for the Basin F solids. A technical plan for the solidification and subsequent transfer of the wastes to the waste pile must be submitted to CDH for approval within 18 months of the effective date of this plan, and the Part A application must be amended.

### 3.1.3 Off-site Disposal

The liquids may be shipped off-site for disposal at permitted hazardous waste facilities. The alternatives for final treatment/disposal include deep-well injection, incineration, and solidification or other techniques followed by land disposal of resulting solids. A technical plan for the shipment of the liquids to the off-site hazardous waste facilities must be submitted to CDH for approval within 18 months of the effective date of this plan. CDH must be notified of the off-site facilities and final treatment and disposal methods selected prior to implementation of off-site removal.

## 3.2 SOLIDS MANAGEMENT

Within 60 months of the effective date of the closure plan, final treatment/disposal of the Basin F solids must be accomplished as described in one of the following three sections.

### 3.2.1 Treatment to be Nonhazardous

The solids may be treated to be nonhazardous and disposed on-site in a landfill which complies with the requirements of the Colorado Solid Waste Disposal Sites and Facilities Act Sections 30-20-101 et seq., C.R.S. CDH will consider excluding treated wastes from the list of hazardous wastes in 6 CCR 1007-3, Part 261, Subpart D upon petition by the Army pursuant to Section 260.22. (A similar petition may have to be submitted to EPA). A Part B permit application for hazardous waste treatment, with a schedule for implementation must be submitted within 24 months of the effective date of this plan.

### 3.2.2 On-site Treatment/Disposal

The solids may be removed from the waste pile and disposed as hazardous waste in an on-site landfill. The construction and operation of the landfill and pre-treatment of the wastes must comply with the provisions of Parts II and III of the Colorado Hazardous Waste Act, Section 25-15-201 et seq. and 25-15-301 et seq., C.R.S. 1973 as amended, the requirements of the Federal Resource Conservation and Recovery Act (RCRA), and the 1984 Hazardous and Solid Waste Amendments to RCRA. Within 24 months of the effective date of the plan, a complete and adequate Part B permit application and a Certificate of Designation application for hazardous waste treatment and on-site disposal must be submitted.

### 3.2.3 Off-site Treatment/Disposal

The solids may be shipped off-site for disposal at a commercial hazardous waste disposal facility. A technical plan for the shipment of the solids to the off-site facilities must be submitted to CDH for approval within 24 months of the effective date of this plan. CDH must be notified of the off-site facilities selected prior to implementation of the off-site removal.

### 3.3 PRE-TRANSPORTATION REQUIREMENTS FOR OFF-SITE DISPOSAL

For off-site shipment of liquids or solids, tank trucks or railcars must be inspected and decontaminated prior to leaving the site. Each off-site shipment of wastes must be placarded according to the requirements of 49 CFR Part 172, Subpart F. Each shipment must also be accompanied by a completed hazardous waste manifest which meets the requirements of 6 CCR 1007-3, Parts 262 and 263.

## 4. MONITORING AND MAINTENANCE DURING CLOSURE

In addition to the specific requirements in this section, all interim status requirements of 6 CCR 1007-3, Part 265 must be complied with during the closure activities.

### 4.1 GROUNDWATER MONITORING

While the closure activities are being carried out, quarterly sampling and analysis of groundwater must be performed according to a groundwater assessment plan which meets the requirements of 6 CCR 1007-3, Part 265, Subpart F.

### 4.2 WASTE PILE INSPECTIONS AND MAINTENANCE

Inspection of the waste pile must be conducted in compliance with 6 CCR 1007-3, Section 265.15. When materials are being placed into or removed from the pile, or during severe weather, the pile must be inspected on a daily basis. When the material is not being removed from or placed into the pile, inspection frequency must be at least weekly. Inspections must include looking for portions of the cover that are not secured, uncovered areas, and tears or holes in the cover. Inspections must also include checking to see that run-on is prevented from entering the pile and that run-off moves away from the pile without ponding. Any run-off that comes into contact with stored wastes must be captured and managed as hazardous waste.

Problems noted during inspections must be logged and remedied as soon as possible. Records of inspections and repairs must be maintained until final closure. Operating records must also be maintained until final closure, and shall include the quantity and type of material placed in the pile during the closure activities.

At the end of each operating day and when major precipitation and extreme wind events (30 mph winds or greater) require cessation of operations, the working face of the waste pile must be securely covered with 20 mil PVC sheeting or an equivalent material. Sandbags or similar weighted objects must be placed on the sheeting around the pile and over the pile on the overlapping sheet edges to secure the sheeting in place.

#### 4.3 PRECIPITATION RUN-ON AND RUN-OFF CONTROL

Until the excavation is completed, precipitation run-on and run-off at Basin F must be controlled. The dike surrounding Basin F must be inspected weekly to ensure that run-on into the basin and run-off from the basin is prevented, and that all run-off within the basin is directed to the interior pumping area. Liquids must be removed from the pumping area within 72 hours of any storm event of more than 0.5 inches of precipitation (measured at Stapleton International Airport) and be managed as hazardous waste. Liquids must not be allowed to accumulate in other areas of the basin.

#### 4.4. SPILL PREVENTION, RESPONSE AND NOTIFICATION

During the transfer of liquids to and from the storage tanks, and to the tank trucks for on-site storage, treatment, or off-site shipment, care must be taken to prevent and minimize spills. Trucks used in the transfer process must be located either within the basin or within a loading area constructed to contain spills. Any spills must be immediately vacuumed into the tanks or trucks and/or contained with soil or non-reacting sorbent. Contaminated soil and materials from any spill must be completely removed and placed in the interim solids storage waste pile described in this closure plan or managed as hazardous waste. All spills must be documented in the operating record. All spills in excess of 50 gallons must be reported to CDH within 24 hours or on the next working day.



## 5. DECONTAMINATION

### 5.1 EQUIPMENT

All equipment and materials used in the removal of waste materials and contaminated soil must be decontaminated or properly disposed before leaving the "hot zone". In addition, the Army or its contractors have the option of "partially" decontaminating equipment at the end of each day to minimize corrosion and the spread of contamination.

Contaminated equipment must be brought to the decontamination pad and all large soil clumps must be removed using shovels, picks, etc. The removed soil must be transferred to the waste pile or directly to the final treatment/disposal facilities. The equipment or vehicle must be cleaned with steam or high-pressure detergent washing equipment, with particular attention paid to cleats, tires, buckets, and scoops. All other parts of equipment which reasonably may have had contact with the contaminated material must also be thoroughly cleaned. The equipment or vehicle must be thoroughly inspected to ensure that all visible contamination has been removed before it is allowed to leave the pad. The decontamination pad must be wide enough to catch all overspray and drippings from vehicles on the pad.

Personnel decontamination facilities and support facilities must be provided and located in accordance with the exclusion and contamination reduction zones specified in the health and safety plan. Washwater from decontamination must be collected and handled as hazardous waste.

### 5.2 TANKS

After their final use, the temporary storage tanks must be thoroughly decontaminated to remove all hazardous waste residues. At a minimum the tanks must be triple rinsed with high pressure detergent water. The washwater must be collected and managed as hazardous waste. At the completion of closure activities, the tank secondary containment area must be decontaminated by removing the first six inches of the clay liner. This material must be managed as hazardous waste.

### 5.3 PUMPS AND HOSES

Pumps, hoses, and all piping must be managed as hazardous waste or thoroughly cleansed after their final use by pumping detergent water, or having detergent water pumped through them. In addition the external parts of this equipment which could have been contaminated, e.g. submerged sections of pipes or hoses, must be thoroughly cleaned at the decontamination pad with steam or detergent water until no visible contamination remains. The rinse water must be managed as hazardous waste.

#### 5.4 WASTE PILE

After all the Basin F solids have been removed from the waste pile, the area must be decontaminated by removing the leachate collection system, sump, or impoundment, and the waste pile liner. The leachate collection system must be either decontaminated or disposed as hazardous waste. The liner materials of the sump or impoundment and the liner of the waste pile (the uppermost six inches if clay is used) must be disposed as hazardous waste. Soil sampling and analysis must be performed in the area to ensure that all significant contamination is removed (see section 2.2.4). Recontouring and revegetation must be done in accordance with section 2.2.5 of this plan.

#### 5.5 PERSONNEL PROTECTIVE EQUIPMENT

Personnel protection equipment must be decontaminated with detergent water or steam, or managed as hazardous waste.

#### 6. CLOSURE CERTIFICATION

At the completion of all the closure activities described in this plan, the Army and an independent registered professional engineer shall submit to CDH certification that the facility has been closed in accordance with the requirements of this closure plan (6 CCR 1007-3, Section 265.115).

#### 7. POST-CLOSURE CARE

If residual contamination from Basin F in excess of the approved groundwater performance standards remains, a complete and adequate post-closure plan and Part B permit application must be submitted. The post-closure plan and permit application must meet the requirements of 6 CCR 1007-3, Part 100, Part 264, Subparts F and G and must be submitted within 24 months of the effective date of the closure plan.

Appendix 1  
The Colorado Department of Health's General Rationale  
for the Modified Closure Plan

The Modified Closure Plan significantly modifies the Army's December, 1985 Basin F Closure Plan. The rationale for the major modifications to the Army's proposed plan are discussed below.

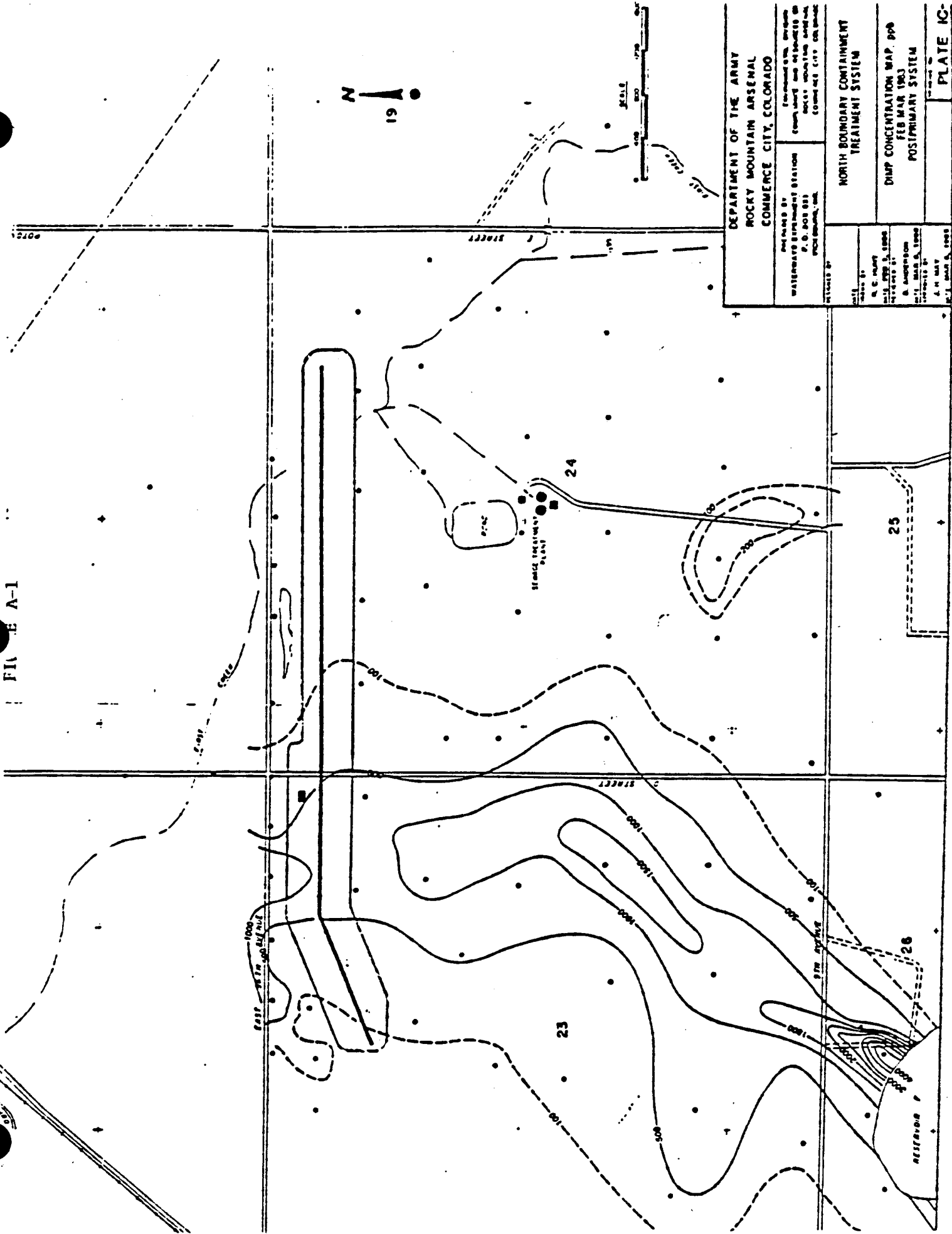
In the December 1985 closure plan, the Army proposed to study treatment and incineration alternatives for the liquid hazardous wastes and hazardous waste sludges and contaminated soils for 1-2 more years. The Army has proposed to apply for permits necessary to construct an on-site hazardous waste landfill for the disposal of the treated wastes in the summer of 1987. The Army's December Basin F Closure Plan proposed no removal of hazardous wastes from Basin F until 1989, and proposed no specific interim actions to contain the wastes and prevent further contaminant migration. That plan failed to comply with the hazardous waste regulations which require treatment or removal of hazardous wastes from a site within 90 days, unless adequate interim actions are taken to protect public health and the environment (6 CCR 1007-3, Section 265.113).

CDH proposed a partial closure plan for Basin F in May 1986 which would have required expedited removal of liquid and solid wastes from Basin F to prevent the further spread of contamination, mainly into the groundwater flowing to the north (see figures A-1 thru A-4). The CDH May 1986 plan would have required the subsequent shipment of the Basin F wastes off-site to hazardous waste treatment or disposal facilities.

In response to the CDH proposed partial closure plan, in July 1986 the Army submitted an interim action plan for immediate removal of the Basin F wastes with subsequent on-site storage rather than off-site shipment. While the wastes are being stored on-site under the interim action plan, the Army proposes to continue its investigations into the options for treating and finally disposing the Basin F wastes. In the July 1986 interim action plan the Army is apparently proposing that their December 1985 closure plan be abandoned. The Army is proposing that the final treatment and disposal of the Basin F wastes be accomplished through the CERCLA RI/FS process and the National Contingency Plan rather than through a closure plan approved under the Colorado Hazardous Waste Regulations.

CDH finds the July 1986 interim action plan generally acceptable, since the interim storage of Basin F wastes could be performed such that harm to public health or the environment is minimized even though more than 90 days for removal of the Basin F wastes is allowed. However, CDH disagrees with the Army's legal conclusion that closure of Basin F should be performed solely through the CERCLA process. The closure must be done in compliance with the Federal Resource Conservation and Recovery Act and the Colorado Hazardous Waste Act. Therefore, CDH is issuing the modified closure plan for Basin F which incorporates the Army's July 1986 interim action plan with only minor modifications. The safe treatment and final disposal of the Basin F wastes is an important part of the closure process. Therefore, the proposed closure plan includes several deadlines for final disposal actions, consistent with proposed deadlines in the Army's December 1985 closure plan. It is important for these deadlines to be in the closure plan so that the safe operating lives of the interim storage facilities are not exceeded.

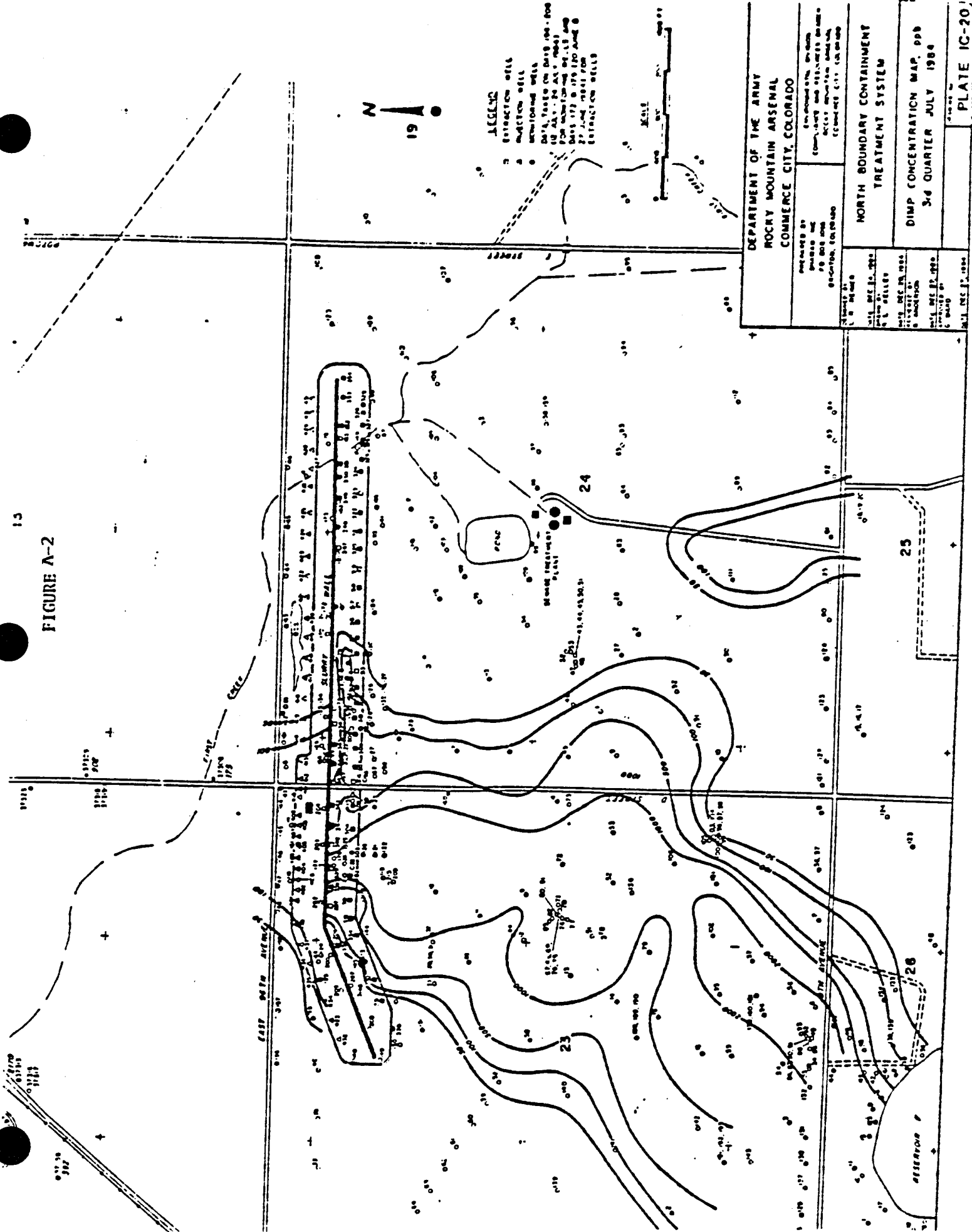
FIGURE A-1



DEPARTMENT OF THE ARMY ROCKY MOUNTAIN ARSENAL COMMERCE CITY, COLORADO	
PREPARED BY WATERWAYS DIVISION P. O. BOX 931 PITCHER, ILL.	EXAMINED AND APPROVED BY ENGINEER COMMERCIAL CITY ENGINEERS
NORTH BOUNDARY CONTAINMENT TREATMENT SYSTEM	
DAMP CONCENTRATION MAP, 900 FEB MAR 1963 POSTPRIMARY SYSTEM	
DESIGNED BY M. C. HARTY MAY 1955	APPROVED BY S. ANDERSON MAY 1955
DESIGNED BY A. H. MAY MAY 1955	APPROVED BY M. J. MANN MAY 1955

PLATE IC-

FIGURE A-2



DEPARTMENT OF THE ARMY  
 ROCKY MOUNTAIN ARSENAL  
 COMMERCE CITY, COLORADO

PREPARED BY  
 ENGINEERING AND RESEARCH CENTER  
 200 WEST 10TH AVENUE  
 DENVER, COLORADO 80202

PROJECT NO.  
 68-000000-0000

DATE  
 1968

SCALE  
 1" = 100'

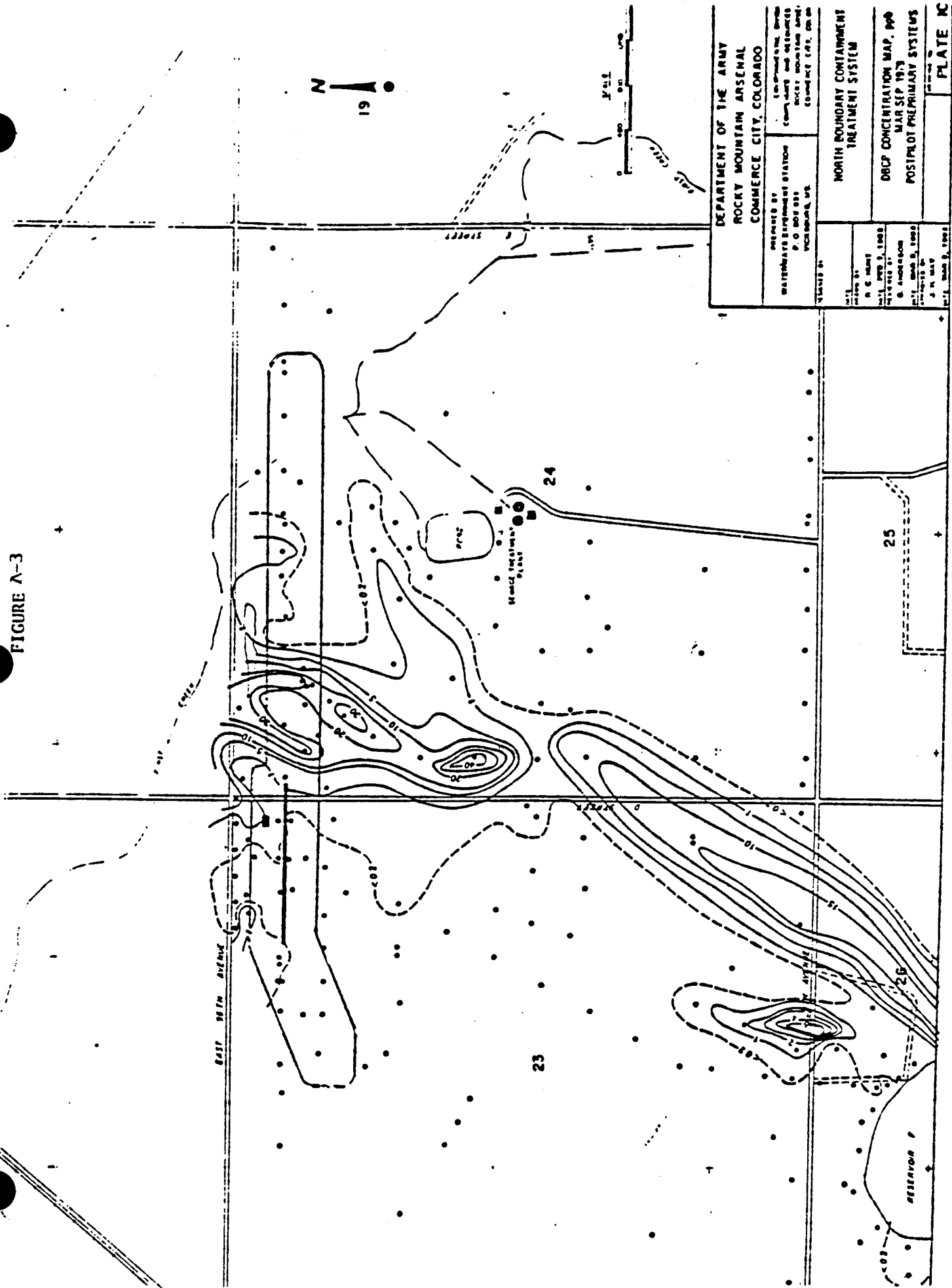
LEGEND  
 1 EXTRACTION WELL  
 2 EXTRACTION WELL  
 3 UNDESIGNED WELL  
 4 DATA TAKEN ON 04/19/68 FOR  
 10 JULY 68 AS A RESULT OF  
 POC MONITORING BY 111 AND  
 112 ON 07/19/68 AND 08  
 27 JULY 1968 FOR  
 EXTRACTION WELLS

NORTH BOUNDARY CONTAINMENT  
 TREATMENT SYSTEM

DIMP CONCENTRATION MAP, 000  
 3-6 QUARTER JULY 1968

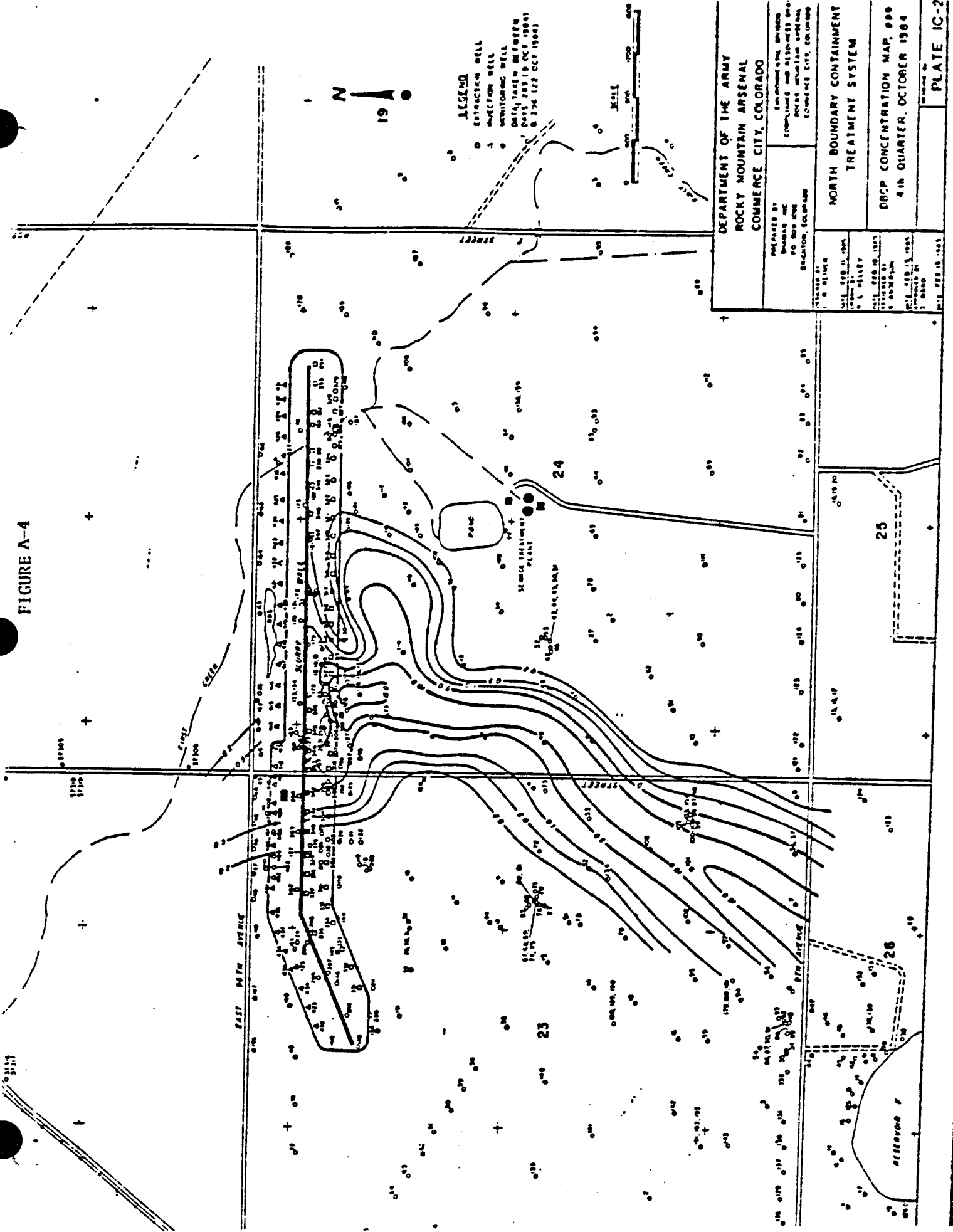
PLATE IC-20

FIGURE A-3



DEPARTMENT OF THE ARMY ROCKY MOUNTAIN ARSENAL COMMERCE CITY, COLORADO		PREPARED BY WATERWAYS EXPERIMENT STATION P. O. BOX 3333 WASHINGTON, DC	CONTRACT NO. 68-01-0001 COMMERCE CITY, CO. 68
DRAWN BY R. E. HUNT 11 FEB 5, 1968 11 FEB 5, 1968	NORTH BOUNDARY CONTAMINANT TREATMENT SYSTEM		
CHECKED BY R. ANDERSON 11 MAR 5, 1968 11 MAR 5, 1968	DRCP CONCENTRATION MAP, P-90 MAR SEP 1973 POSIPILOT PRELIMINARY SYSTEMS		
SCALE 1" = 1000'	PLATE 1C		

FIGURE A-4



The modified closure plan also specifies the options and requirements for final treatment and disposal of the Basin F wastes. One option is on-site disposal of the Basin F wastes as proposed by the Army's December 1985 plan. For this option the plan requires the Army to submit permit applications to CDH to comply with the requirements of Parts 99, 100, and 264 of the Colorado Hazardous Waste Regulations and Parts II and III of the Colorado Hazardous Waste Act. CDH retains its authority under the Colorado Hazardous Waste Act and Regulations for final approval of the waste management methods chosen for the final disposal options, to assure that the wastes are managed safely and further that environmental damage from Basin F wastes is prevented or minimized.

The CDH plan also includes the Army's proposal for interim groundwater treatment at Basin F prior to certification of final closure. At completion of closure the levels of contaminants left in the groundwater in the Basin F vicinity must be low enough to protect human health and the environment, in order to meet the closure performance standard of 6 CCR 1007-3, Section 265.111, or a post-closure plan and permit application must be submitted to address corrective action for such contamination.



## I. Characterization of Liquids

After consolidation of the Basin F liquids by breaching the existing dikes (see section 1.4 of this closure plan), a minimum of 10 representative samples of the liquids must be collected according to a random sampling scheme (Section 1.1, SW-846, (1), and using the weighted bottle method (Section 1.2.1.2, SW-846). Other methods may be used if approved by CDH. The weighted bottle(s) must be of glass. The ten collected samples may be composited into one sample prior to analysis. A separate representative sample must be obtained for the volatile fraction of the organics analysis.

The samples must be analyzed for the parameters in the table below. The analytical methods of SW-846 or other EPA-approved methods must be used for all the parameters in the table for which such methods exist. Where EPA-approved methods do not exist, certified Army methods must be used.

A quality assurance/quality control program which follows the guidelines of Section 1.3 and Section 10 of SW-846 must be followed for all sampling and analytical work.

Analytical Parameters

Aldrin	Arsenic	Benzene; Benzol
Benzothiazole; BTA	Bromide	Cadmium
Calcium	Carbon tetrachloride	Chloride
Chlorobenzene	Chloroform	Sulfide; CPMS
Sulfone; CPMSO	Sulfoxide; CPMSO <sub>2</sub>	Chromium
Copper	DDE	DDT
DBCP; Nemagon	1,1-Dichloroethane	1,2-Dichloroethane
1,1-Dichloroethylene	1,2-Dichloroethylene	Dicyclopentadiene; DCPD
Dieldrin	DIMP	Dimethyl disulfide; DMDS
DMMP	Dithiane	Endrin
Ethyl benzene	Fluoride	Hexachlorocyclopentadiene
Isodrin	Lead	Magnesium salts
Mercury	Methylene chloride	Methyl isobutyl ketone
Nitrogen	Parathion	Potassium
Sodium	Sulfate	Tetrachloroethylene
Thioxane; 1,4 Oxathiane	Toluene	1,1,1-Trichloroethane
1,1,2-Trichloroethane	Trichloroethylene; TCE	o,m,p-Xylene
Zinc		

(1) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846 (Second Edition, 1982 as amended by Update I (April, 1984) and Update II (April, 1985)).

## II. Characterization of Solids/Soils

Samples collected in the closure program will be analyzed for the following set of constituents. Samples collected from the 0-1 ft. interval are to be analyzed for the analytes listed below, excluding volatile organics. The samples from all intervals deeper than 0-1 ft. (unless otherwise specified) will be analyzed for all of the analytes listed below.

### Analytes

#### Volatile Organics

Chloroform  
1,1-Dichloroethane  
Methylene chloride  
1,2-Dichloroethane  
1,1,1-Trichloroethane  
1,1,2-Trichloroethane  
Carbon tetrachloride  
Tetrachloroethylene  
Trichloroethylene  
Trans-1,2-Dichloroethylene  
Benzene  
Toluene  
Ethylbenzene  
Chlorobenzene  
Methyl isobutyl ketone (MIBK)  
Dimethyldisulfide  
Bicycloheptadiene  
Dicyclopentadiene (DCPD)  
Dibromochloropropane (DBCP)  
m-Xylene  
o- and/or p-Xylene

#### Semivolatile Organics

Aldrin  
Endrin  
Dieldrin  
Isodrin  
p,p'-DDT  
p,p'-DDE  
Hexachlorocyclopentadiene  
1,4-Oxathiane  
Diathiane  
Malathion  
Parathion  
Chlordane  
Supona  
Diisopropylmethyl phosphonate (DIMP)  
Dimethylmethyl phosphonate (DMMP)  
Atrazine  
Dicyclopentadiene (DCPD)  
Vapona  
Chlorophenylmethyl sulfide  
Chlorophenylmethyl sulfoxide  
Chlorophenylmethyl sulfone  
Dibromochloropropane (DBCP)

#### ICP Metals Screen

Chromium  
Zinc  
Cadmium  
Copper  
Lead

Arsenic  
Mercury

## APPENDIX 3

### Health and Safety Plan

The Safety Plans submitted according to section 1.4.5 and 1.4.7 must follow these guidelines and those of Appendix 3A, and follow the format of Appendix 3A.

#### 1) ROUTINE OPERATIONS

As a minimum, the following must be included as part of the site safety plan for routine operations.

- Describe the Known Hazards and Risks

This must include all known or suspected physical, biological, radiological, or chemical hazards. It is important that all health related data be kept up-to-date. As air, water, soil, or hazardous substance monitoring and sampling data becomes available, it must be evaluated, significant risk or exposure to workers noted, potential impact on public assessed, and changes made in the plan. These evaluations need to be repeated frequently since much of the plan is based on this information.

- List Key Personnel and Alternates

The plan must identify key personnel (and alternates) responsible for site safety, including at least one industrial hygienist. It should also identify key personnel assigned to various site operations. Telephone numbers, addresses, and organizations of these people must be listed in the plan and posted in a conspicuous place.

- Designate Levels of Protection to be Worn

The Levels of Protection to be worn at locations on-site or by work functions must be designated. This includes the specific types of respirators and clothing to be worn for each level. No one shall be permitted in areas requiring personnel protective equipment unless they have been trained in its use and are wearing it.

- Delineate Work Areas

Work areas (exclusion zone, contamination reduction zone, and support zone) need to be designated on the site map and the map must be posted. The size of zones, zone boundaries, and access control points into each zone must be marked and made known to all site workers.

- List Control Procedures

Control procedures must be implemented to prevent unauthorized access. Site security procedures - fences, signs, security patrols, and check-in procedures - must be established. Procedures must also be established to control authorized personnel entrance into work zones where personnel protection is required.

- Establish Decontamination Procedures

Decontamination procedures for personnel and equipment must be established. Arrangements must also be made for the proper disposal of contaminated material, solutions, and equipment.

- Address Requirements for an Environmental Surveillance Program

A program to monitor site hazards must be implemented. This would include air monitoring and sampling, and other kinds of media sampling at or around the site that would indicate chemicals present, their hazards, possible migrations, and associated safety requirements.

- Specify Any Routine and Special Training Required

Personnel must be trained not only in general safety procedures and use of safety equipment, but in any specialized work they may be expected to do.

- Establish Procedures for Weather-Related Problems

Weather conditions can affect site work. Temperature extremes, high winds, storms, etc. impact on personnel safety. Work practices must be established to protect workers from the effects of weather, and shelters must be provided when necessary. Temperature extremes, especially heat and its effect on people wearing protective clothing, must be considered and procedures established to monitor for and minimize heat stress.

2) ON-SITE EMERGENCIES

The plan must address site emergencies - occurrences that require immediate actions to prevent additional problems or harm to responders, the public, property, or the environment. Unpredictable events such as fire, chemical exposure, spills, or physical injury may occur and must be anticipated. The plan must contain contingencies for managing them.

- Establish Site Emergency Procedures

-- List the names and emergency function of on-site personnel responsible for emergency actions along with the special training they have.

-- Post the location of nearest telephone (if none at site).

-- Provide alternative means for emergency communications.

-- Provide a list of emergency services organizations that may be needed. Names, telephone numbers, and locations must be posted. Arrangements for using emergency organizations should be made beforehand and described in the plan. Organizations that might be needed are:

- Fire

- Police

- Health (Fitzsimmons Army Hospital or other hospital(s))
- Explosive experts
- Local hazardous material response units
- Civil defense (for evacuations)
- Rescue
  
- Address and define procedures for the rapid evacuation of workers. Clear, audible warning signals should be established, well-marked emergency exits located throughout the site, and internal and external communications plans developed. Also address and define procedures for the notification of local residents and evacuation if necessary. A minimum action plan such as the plan of Appendix 3B must be established, including specific concentration limits for the suggested actions.
  
- A complete list of emergency equipment should be attached to the safety plan. This list should include emergency equipment available on-site, as well as all available medical, rescue, transport, fire-fighting, and mitigative equipment.
  
- Address emergency medical care.
  - Determine location of nearest medical or emergency care facility. Determine their capability to handle chemical exposure cases.
  
  - Arrange for treating, admitting, and transporting of injured or exposed workers at Fitzsimmons Army Hospital or another medical or emergency care facility.
  
  - Post the medical or emergency care facility's location, travel time, directions, and telephone number.
  
  - Determine local physician's office location, travel directions, availability, and post telephone number if other medical care is not available.
  
  - Determine nearest ambulance service and post telephone number.
  
  - List responding organization's physicians, safety officers, or toxicologists names and telephone numbers. Also include nearest poison control center, if applicable.
  
  - Maintain accurate records on personnel exposure or potential exposure of site workers during an emergency (or routine operations).
  
- Advise workers of their duties during an emergency. In particular, it is imperative that the site safety officers, standby rescue personnel, decontamination workers, and emergency medical technicians practice emergency procedures.

- Incorporate into the plan, procedures for the decontamination of injured workers and for their transport to medical care facilities. Contamination of transport vehicles, medical care facilities, or of medical personnel may occur and should be addressed in the plan. Whenever feasible these procedures should be discussed with appropriate medical personnel in advance of operations.
- Establish procedures in cooperation with local and state officials for evacuating residents who live near the site.

### 3) ADDITIONAL CONSIDERATIONS

The site safety plan must be written to avoid misinterpretation, ambiguity, and mistakes.

All agencies and organizations which have an active role at the incident must be familiar with the plan. The plan should be written in coordination with the organizations involved. Lead personnel from these organizations should sign the plan to signify they agree with it and will follow its provisions.

All personnel involved at the site must be familiar with the safety plan, or the parts that pertain to their specific activities. Frequent safety meetings should be held to keep all informed about site hazards, changes in operating plans, modifications of safety requirements, and for exchanges of information. It is the responsibility of personnel involved at the site as workers or visitors to comply with the requirements in the plan.

Frequent audits by the incident manager or the safety designee should be made to determine compliance with the plan's requirements. Any deviations should be brought to the attention of the incident manager. Modifications in the plan should be reviewed and approved by CDH.

(Suggested format for minimum site safety plan)

## SITE SAFETY PLAN

I. General Information

As a minimum, all personnel involved with emergency response, waste site cleanup, drum handling and opening, sampling, site investigations, etc., will follow the applicable Federal/State rules and regulations. In addition, all site personnel will follow, as a minimum, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division's Standard Operating Safety Guides and Chapter 9 Hazardous Substance Response, from the EPA Occupation Health and Safety Manual.

In the event of conflicting plans/requirements, personnel must implement those safety practices which afford the highest personnel protection.

If site conditions change and it is necessary to modify Levels of Protection A, B, or C, the safety designee on-site shall notify the On-Scene Coordinator before making recommendations to site personnel.

## II. APPROVALS

(SIGNATURE)  
 \_\_\_\_\_  
 On-Scene-Coordinator DATE

(SIGNATURE)  
 \_\_\_\_\_  
 Safety Officer DATE

(SIGNATURE)  
 \_\_\_\_\_  
 REVIEW COMMITTEE DATE

(SIGNATURE)  
 \_\_\_\_\_  
 OTHERS DATE

III. Summary of Minimum Requirements

## A. The safety officer/designee shall:

1. Describe chemicals, hazards, and risk involved
2. List key personnel
  - a. Response manager (DSC)/alternate \_\_\_\_\_
  - b. Safety officer(s)/alternate \_\_\_\_\_
  - c. Other responsible site personnel/alternate \_\_\_\_\_
3. Prescribe Levels of Protection
4. Designate work zones: Support area, contamination reduction area, exclusion area.
5. Implement procedures to control site access.

6. Define decontamination procedures.
7. Delineate entry and escape routes.
8. Identify/contact medical facility, etc.:
  - a. Fire \_\_\_\_\_
  - b. Ambulance \_\_\_\_\_
  - c. Police \_\_\_\_\_
  - d. Health \_\_\_\_\_
  - e. Etc. \_\_\_\_\_
9. List responsible parties and emergency contacts:
  - a. Federal Government EPA/USCG/CDC/OSHA
  - b. State Government Environmental/Health Agency
  - c. County/City Government \_\_\_\_\_
10. Establish personnel, air monitoring.
11. Specify routine and special training needed
12. Establish procedures for managing weather-related problems.

**B. Levels of Protection**

1. Level C protection should be used for those job functions listed below where there is no potential for personnel contact with either hazardous materials or gases, vapors, or particulates exceeding requirements for wearing air-purifying respirators.

(Identify job functions in this paragraph:

e.g. - monitoring/surveillance, supervisors, observers, etc.)

(Identify specific type of respirator in this paragraph:

e.g. - approved respirator and type of canister.)

(Identify skin protection in this paragraph:

e.g. - double boots, double gloves, tyvek/saran hooded, disposable coveralls, etc.)

2. Level B protection should be used for those job functions listed below which based either on potential or known site conditions and/or vapor and gas concentrations, Level C is unsatisfactory.

Identify job functions in this paragraph:

e.g. - Heavy equipment operations, samplers, equipment/drum handlers, etc.)



Identify specific respiratory protection in this paragraph:  
(e.g. - self-contained breathing apparatus (SCBA), air-line respirator)

Identify skin protection in this paragraph:  
(e.g. - double boots, double gloves, type of chemical resistant garment, etc.)

3. If Level A protection is applicable, write a paragraph in plan listing where and when it is to be worn.
4. Level D is not adequate protection for any work on-site where potential for exposure is possible.
5. Levels C and B may be modified based on monitoring and sampling data collected on-site. Safety designee should not make any modification to the Level of Protection without discussing it with the On-Scene-Coordinator.

C. Air monitoring - Refer to Standard Operating Safety Guides, Part 8, Air Surveillance.

D. Training

Personnel will have either formal training or prior on-the-job-training for those tasks they are assigned to at the incident. All unfamiliar activities will be rehearsed beforehand.

E. Respiratory Protection Program

All contractor and government personnel involved in on-site activities shall have a written respiratory protection program. All personnel wearing air-purifying respirators on-site are required to be fit-tested. All personnel wearing respirators must have been properly trained in their use. All respirators are to be properly decontaminated at the end of each workday.

Persons having beards or facial hair must not wear a respirator if a proper mask-to-face-seal can not be demonstrated by a fit test. A log of all individuals wearing personnel protective equipment shall be maintained including time in the exclusion zone.

F. All contractor and government personnel who are exposed to hazardous levels of chemicals must be enrolled in a medical monitoring program.

G. General Safety Rules and Equipment

1. There will be no eating, drinking, or smoking in the exclusion or contamination reduction zone.
2. All personnel must pass through the contamination reduction zone to enter or exit the exclusion zone.
3. As a minimum, emergency eye washes will be on the hot side of the contamination reduction zone and/or at the work station.

4. As a minimum, an emergency deluge shower/spray cans are to be located on the clean side of the contamination reduction area.
5. At the end of the work day, all personnel working in the exclusion area shall take a hygienic shower.
6. All supplied breathing air shall be certified as grade D or better.
7. Where practical, all tools/equipment will be spark proof, explosion resistant, and or bonded and grounded.
8. Fire extinguishers will be on-site for use on equipment or small fires only.
9. Since site evacuation may be necessary if an explosion, fire, or release occurs, an individual shall be assigned to sound an alert and notify the responsible public officials if required. For example, the evacuation signal may be two long blasts every 30 seconds until all personnel are evacuated and accounted for.
10. An adequately stocked first-aid kit will be on-scene at all times during operational hours. It is suggested that an oxygen inhalator respirator be available and a qualified operator present. The location of these items and the operator shall be posted.
11. Personnel on-site must use the "buddy" system when wearing any respiratory protective equipment. Communications between members must be maintained at all times. Emergency communications should be prearranged in case of radio breakdown or lack of radios. Visual contact must be maintained between "pairs" on-site and each team should remain in close proximity to assist each other in case of emergencies.
12. Personnel should be cautioned to inform each other of subjective symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract, eyes, or skin.

#### H. Morning Safety Meeting

A morning safety meeting will be conducted for all site personnel and they will sign a daily attendance sheet and should sign a master sheet indicating they have read the site safety plan and will comply. The safety procedures, and the day's planned operations should be discussed.

## Emergency Operation Codes/Minimum Action Plan

CODE DESIGNATIONS1. GREEN

A. Normal operations

2. YELLOW A

A. Cessation of specific work activity on-site because of:

- (1) Continuous organic readings on direct-reading instrument of     \*     ppm above background (measured 20-30 ft. from point of suspected release), and
- (2) Current or projected meteorological conditions indicate a probable impact on work activity.

B. If background readings above     \*     ppm are obtained during cessation of activity, redesign activity to lower releases and/or delay that on-site activity until off-site air monitoring indicates accepted off-site concentration.

C. Site personnel will immediately notify State of site condition.

3. YELLOW B

A. Termination of all work on-site because of:

- (1) Continuous organic readings on direct-reading instrument above     \*     ppm: (measured approximately 1,000 ft. from work area or site property limits), and
- (2) Current or projected meteorologic conditions indicate a potential impact on inhabited areas.

B. Site personnel will immediately notify State of site conditions.

C. State will modify off-site air monitoring to meet the needs of contingency plan.

4. RED

A. Termination of all work on-site because of:

- (1) Continuous organic readings on direct-reading instruments above     \*     ppm (measured downwind at the nearest occupied area off-site, and
- (2) Current or projected meteorologic conditions indicate a potential impact on inhabited areas.

B. Site personnel will immediately notify State of site conditions.

C. Local officials making evacuation/public health decisions will be advised by State to:

- (1) Release a public health advisory to potentially affected areas since on-site control methods will not reduce the source of contamination; and/or
- (2) Implement a temporary relocation plan because on-site activities indicate a potential for continuous above background/acceptable readings at the nearest inhabited area(s).

\*Concentration should be determined by appropriate response personnel.