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EPA Superfund
Record of Decision:

HERCULES 009 LANDFILL
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RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

HERCULES 009 LANDFILL SITE

OPERABLE UNIT ONE

BRUNSWICK, GLYNN COUNTY, GEORGIA

PREPARED BY

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA, GEORGIA

DECLARATION
of the
RECORD OF DECISION
OPERABLE UNIT ONE

SITE NAME AND LOCATION

Hercules 009 Landfill Site
Brunswick, Glynn County, Georgia

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected remedial action for Operable Unit One for the Hercules 009 Landfill Site, Brunswick, Georgia, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) 42 U.S.C. Section 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP) 40 CFR Part 300.

This decision is based on the administrative record for the Hercules 009 Landfill site ("the Site").

The State of Georgia has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Hercules site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF SELECTED REMEDY

This operable unit is one of two for this Site. This alternative calls for the design and implementation of response measures which will protect human health and the environment. Operable unit one, which is enumerated by this Record of Decision, addresses the source areas, surface water, and groundwater at the Site. Operable unit two was enumerated in an Interim Action ROD that was signed by EPA on June 27, 1991. Operable unit two addressed the off-site threat of future groundwater contamination by extending the existing municipal water lines in the City of Brunswick, Georgia to residents that live adjacent to this Site.

The major components of the selected remedy for operable unit one include:

- Conducting a field-scale treatability study and implementation of in-situ stabilization of subsurface soils and consolidated surface soils. This remedy is an innovative application of this technology since EPA has minimal information on stabilization of manufactured pesticides;

- Implementation of an ex-situ chemical extraction technology on the soils and sludges at the Site (with onsite disposal of the treated material) in the event the treatability study concerning the stabilization of Site soils and sludges fails to met the required standards and therefore will not be effective if implemented;

- Construction of a cover over the treated soils to reduce rainwater infiltration and direct contact with the treated soil. In addition, areas excavated for consolidation of surface soil would be graded and covered with two feet of clean, compacted, native fill;

- Long-term monitoring of groundwater, as well as surface water and sediment in the onsite pond and the adjacent drainage ditch, with the contingency implementation of a pump and treat system in case any of the following occurs: toxaphene begins to migrate off the Hercules property; if the other contaminants of concern are shown to be migrating from their current positions; if any levels of the contaminants of concern begin to increase over fifty percent of their current value; or in case it becomes apparent that onsite levels of contaminants in the groundwater will not naturally attenuate below MCLs over time;

- Operation and maintenance of the cover for a minimum of thirty years; and

- Institutional controls for land use and groundwater use restrictions.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element. Finally, it is determined that this remedy utilizes a permanent solution and alternative treatment technology to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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1.0 SITE LOCATION AND DESCRIPTION

The Site is located in the eastern portion of Glynn County, Georgia, approximately two miles south of Interstate 95 and one-half mile north of the City of Brunswick as shown on Figure 1-1. Figure 1-2 is a map of the Site. The Site is a 16.5 acre property that is bordered by Georgia State Highway 25 (Spur 25) on the west; an automobile dealership on the north; a juvenile slash pine forest on the east; and several homes, a church, a school, and a strip shopping center to the south/southeast of the property. A shopping mall, built in 1985, a bank, and a restaurant are located approximately 1,000 feet north of the landfill. The property is fenced and has only one entrance through a locked gate.

Seven acres on the north end of the property were operated as an industrial landfill by Hercules between 1976 and 1980 under a permit by the Georgia Environmental Protection Division (GaEPD). The permit allowed for the disposal of wastewater sludge generated from the production of toxaphene at the Hercules Brunswick Plant. Six disposal cells were constructed at the northern end of the property to receive sludge for disposal. During its years of operation, the 009 Landfill was monitored by the GaEPD.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Hercules began manufacturing toxaphene, an agricultural pesticide, in 1948 and continued production through 1980. Toxaphene received wide spread use in the southeastern United States to control boll weevils as well as mites and ticks on cattle, until EPA banned its use in 1982. The Site had been used by the State as a borrow pit for soil during the construction of Spur 25. Hercules was issued a permit in 1975 by the GaEPD to use seven acres at the northern end of the property as a landfill to dispose of wastewater sludge generated during the manufacturing processes.

The 009 Landfill was constructed at the northern end of the property as six cells, each approximately 100 to 200 feet wide (north-south direction) and 400 feet long (west-east direction). The thickness of the toxaphene sludge in the cells was reported to be six to seven feet. Individual cells were reported to be lined with a soil/bentonite clay mixture across the bottom of the cell and along the bermed walls.

The sludge deposited in the 009 Landfill consisted of very fine calcareous particulate, diatomaceous earths and finely crushed limestone material. Toxaphene adsorbed to this material during neutralization of byproduct hydrochloric acid. Reportedly, the wastewater treatment sludge consisted of about one percent toxaphene by weight and 50 percent solids by weight. The sludge was transported to the landfill in bulk by truck. Trucks hauling material to the Site reportedly entered the landfill through two entrances, one from Benedict Road (south side), the other located along Spur 25 (west side). Typically the sludge was placed directly into the landfill. However, sludge was occasionally staged near the southeastern corner of the 009 Landfill prior to placement.

In addition to the sludge, the 009 Landfill was also used for disposal of empty toxaphene product drums, and toxaphene contaminated glassware, rubble, and trash. Disposal of this material was primarily limited to Cell 1. Hercules estimated that approximately 33,000 cubic yards of sludge had been disposed of in the landfill. The cells were covered with a 24 to 30 inches of "stump dirt" mixed with boiler ash. The term "stump dirt" refers to soil that was entrained on pine stumps purchased by the Hercules Brunswick Plant for the extraction of resins and essential oils.

All cells in the landfill were closed prior to 1983 in accordance with existing GaEPD Solid Waste Management Regulations. The final contour of the top of the landfill has a slope of approximately one percent to prevent pooling and to minimize infiltration of precipitation. The sides of the unit have a slope of about ten percent. To control erosion, the earthen cover was seeded with grasses that have proven to grow well in the Brunswick area.

A drainage ditch is located adjacent to the landfill at the eastern edge. To control surface runoff from the surrounding area, Glynn County periodically excavates the sediments from this ditch to ensure adequate drainage capacity. Prior to 1988, sediments from the ditch were stockpiled on the eastern bank of the ditch, but in early 1988, these sediments were removed.

During its operation, the landfill was inspected by GaEPD. In March 1980, GaEPD collected soil and water samples from drainage ditches around the Site. The samples contained toxaphene. As a result, GaEPD canceled Hercules' permit and the 009 Landfill was closed under a plan approved by GaEPD.

EPA calculated a Hazard Ranking Score for the closed landfill. In 1984, the landfill was placed on the National Priority List (NPL). As of July 1, 1991, the Hercules 009 Landfill Site ranked 152 out of 1072 on the NPL (excluding federal facilities). GaEPD began negotiations with Hercules to perform an RI/FS and initiated Site investigation activities under State Superfund authority, then withdrew as lead agency in 1987. EPA assumed primary control of the Site investigation and related activities at the end of 1987. Hercules and EPA entered into an Administrative Order on Consent in July 1988. The Consent Order required Hercules to perform a Remedial Investigation/Feasibility Study (RI/FS) of the Site.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The main branch of the Brunswick-Glynn Regional Library at 208 Gloucester Street in Brunswick, Georgia was chosen as the local information repository for the Site. A public comment period for the proposed plan for operable unit #2 (concerning extension of the municipal water lines) was held from May 13, 1991 to June 12, 1991 with a public meeting being held on May 15, 1991.

The public comment period on the proposed plan preceding this ROD (operable unit #1) was held August 27, 1992 through October 27, 1992. A public meeting was held on Thursday, September 10, 1992 where representatives from EPA answered questions from approximately 150 people regarding the Site and the proposed plan under consideration. The administrative record was available to the public at both the information repository maintained at the Brunswick-Glynn Regional Library and at the EPA Region IV Library at 345 Courtland Street in Atlanta, Georgia. The notice of availability of these documents was published in the Brunswick News-Herald on August 24, and September 4, 1992. EPA received numerous oral and written comments during the comment period. Responses to the significant comments received are included in the Responsiveness Summary, which is part of this ROD and designated Appendix A.

This decision document presents the selected remedial action for operable unit one of the Hercules site, chosen in accordance with CERCLA, as amended by SARA and to the extent practicable, the NCP. The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public and state participation have been met for this operable unit.

4.0 SCOPE AND ROLE OF OPERABLE UNITS

EPA has organized the work at this Superfund Site into two operable units (OUs). These units are:

- OU one: The source area at the Site, including the landfilled sludge, the soils in the sludge-staging area, and the Benedict Road/Nix Lane area. Contamination in the groundwater, surface water, sediment, and soils are addressed in OU #1. Proper abandonment of the private wells replaced during OU #2 is included in OU #1 if the owners will allow abandonment.

- OU two: The extension of municipal water lines to residents adjacent to the Site was specified in OU #2 to address the threat of a groundwater plume that could affect residential drinking wells downgradient of the Site.

OU #1 addresses both the source of contamination in the soils as well as the groundwater contamination underneath the Site. The purpose of this operable unit is to monitor groundwater restoration, treat the source areas at the Site, prevent current or future exposure to the contaminated soils and groundwater, and reduce contaminant migration. OU #1 will be consistent with the actions taken during OU #2, to the extent practicable. The Record of Decision (ROD) governing OU #2 dated June 27, 1991 erroneously was titled OU #1. However, the ROD dated June 27, 1991 documents the remedial action selection for OU #2. This ROD documents the remedial action selection for OU #1.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 GEOLOGY/SOILS

The results of the RI led to the following findings and conclusions:

- The Site lies in the Atlantic Coastal Plain province of Georgia. Surface sediments are described as relatively thin layers of sands, gravels, and clays of Pleistocene age. These sediments, generally less than 150 feet thick, represent the surficial layer. Beneath the surficial layer are Miocene sediments which are represented by the Hawthorn formation. The Hawthorne contains several clay units and is a confining zone between the surficial water-bearing unit and the deeper Floridan aquifer. The Floridan aquifer, at an approximate depth of 500 feet, is separated from the surficial waterbearing unit by approximately 400 feet of the Miocene sediments. The Floridan aquifer is the primary aquifer in the area for large irrigation and municipal supplies, while shallower wells are used for small domestic supplies.

- Soils at the Site consist of coarse to clayey sands, sandy silts, and sandy to silty clays. The soils can be grouped into three distinct hydrogeologic components. From land surface to depths of 25 to 45 feet below land surface is a zone composed of silty sands and sandy silts. Underlying this zone is a clayey sand and sandy clay interval ranging in thickness from 10 to 25 feet. The clayey interval may possibly act as a semi-confining unit within the surficial layer dividing the silts and sands into shallow and deep zones beneath the Site; however, the continuity of this unit to the west side of the landfill is not completely defined due to limited drilling on the upgradient (west) side of the landfill. The material that immediately underlies the clayey zone, representing the third unit, is composed of sands and silty sand to approximately 85 feet below land surface, where a change to a coarse sand containing gravel is noted.

- Site-specific permeability values ranged from $4x10^{-5}$ centimeters per second to $9x10^{-5}$ centimeters per second and correspond to the shallow zone of the surficial water-bearing unit.

- Toxaphene concentrations in the soils surrounding the landfilled sludge ranged from below the detection limit to 4,900 ppm. Concentrations of toxaphene were generally highest in the vicinity of the landfill cells and decreased with distance from the cells. An exception was an area near the Benedict Road/Nix Lane entrance to the Site. Toxaphene concentrations of 26 ppm to 92 ppm in this area may be the result of sludge transportation to the landfill.

- Toxaphene was detected in landfilled sludge samples at concentrations ranging from 850 to 15,000 ppm. The average sludge concentration of toxaphene is 6,000 ppm.

- Acetone, carbon tetrachloride, chlorobenzene, chloroform, and xylenes were detected in the landfilled sludge samples, but were not consistently present. No volatile organic constituents (VOCs) were detected in samples from cells 3, 4, and 6. One or more VOCs was detected in samples from cells 1, 2, and 5.

- Arsenic, chromium, copper, lead, manganese, nickel, vanadium, and zinc were detected in sludge samples. Of these metals, only copper and lead exceeded typical background concentration ranges.

- Dioxins and furans were detected in all of the sludge samples. When evaluated based on the Toxicity Equivalence Factor (TEF), by which the concentrations of all isomers are adjusted by their toxicity relative to the 2,3,7,8-TCDD isomer, the concentrations ranged from 3.2×10^{-5} to 3.9×10^{-4} ppm. These concentrations exceeded background concentrations, but were less than the action level of 1×10^{-3} ppm.

5.2 Hydrogeology

- Groundwater in the shallow zone of the surficial water bearing unit flows toward the east at a seepage velocity of 60 to 90 feet per year. Groundwater in the lower zone flows toward the southeast at a seepage velocity of 45 to 65 feet per year.

- Surface elevations at the Site range from 13 to 26 feet mean sea level

- (MSL) Water table elevations at the site range from 14 to 17 feet

- MSL

- Interpretation of data obtained during the drilling of boreholes into the landfill and from piezometer water levels suggest the following: water is perched above the sludge; saturated sludge exists within the landfill cells; and there is an unsaturated zone beneath the sludge at least part of the year in portions of the landfill. Figure 5-1 illustrates a typical landfill cell cross-section. The saturated conditions within the sludge are due to the absence of a clay cap on the landfill, the low permeability ($7x10^{-7}$ cm/sec) of the sludge material, and the bentonite layer beneath the sludge.

- Private water supply wells located near the Site have been sampled annually by Hercules since 1985. Toxaphene has not been detected above instrumentation quantification limits in the private wells.

- Groundwater elevations at the Site exhibit minor cyclical fluctuations that may be attributable to the tidal cycle. However, tidal influences are insufficient to affect basic groundwater flow patterns.

- Toxaphene has been detected in four monitoring wells all located at the southeastern corner of the landfill at concentrations ranging from 0.0056 ppm to 0.076 ppm. During the latest round of sampling, only one well indicated toxaphene contamination, measured at 0.069 ppm.

- Both nickel and benzene have been detected above MCLs in groundwater samples collected adjacent to the landfill.

5.3 Surface Water

- Surface drainage occurs by overland flow at the Site. The flow at the Site is divided by the crest of the landfill with both westward flow toward Highway Spur 25 and eastward flow toward the drainage ditch located immediately east of the Site. The drainage along Spur 25 flows through a 36-inch culvert which connects to the drainage ditch on the eastern side of the Site. This culvert transverses the Site immediately south of the landfill cells.

- Surface drainage from the Glynn Place Mall (approximately 1000 feet north of the Site) enters the east drainage ditch upstream of the Site. The pond at the southern end of the Site receives runoff only from the immediate area surrounding the pond, and has no permanent surface inflow or outflow. This onsite pond is believed to have been formed during the construction of Spur 25 as a borrow pit.

- The water table is generally close to the bottom of the drainage ditch, and groundwater flow from underneath the landfill may seasonally discharge into the drainage ditch. The water table configuration is, however, based on a single set of water table elevations from a single date. Nevertheless, this data indicates that the water table would provide only minor discharge to the drainage ditch located immediately east of the Site.

- Surface water and sediment samples were collected in the onsite pond and in the off-site drainage ditch. Samples in the drainage ditch were collected both alongside the Site and over a mile away from the Site in the estuary. Toxaphene was not detected in any surface water samples. However, toxaphene was detected at a maximum of 0.86 ppm in two sediment samples adjacent to the Site.

- The biological studies conducted indicate that the Site has not adversely affected the tested animal communities within the drainage ditch or the estuary.

5.4 Air Monitoring

- An onsite air quality monitoring program was conducted using four high volume air samplers equipped with polyurethane foam absorbent cartridges located on each side of the landfill cell area. Toxaphene concentrations were below the detection limit of 50 mg/m^3.

6.0 SUMMARY OF SITE RISKS

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for determining whether or not remedial action is necessary and the justification for performing remedial action.

6.1 CONTAMINANTS OF CONCERN

The chemicals measured in the various environmental media during the RI were evaluated for inclusion as chemicals of potential concern in the risk assessment by application of screening criteria. The criteria which resulted in elimination of chemicals included: Site contaminant concentrations below background concentrations; measurements below quantification limits; a combination of low toxicity and low concentration or low persistence and low concentration and low frequency of detection.

Tables 6-1 and 6-2 summarize the maximum detected concentrations of the chemicals of concern in the subsurface soil, surface soil, sludge, and groundwater at the Site. No waste constituents were detected during Site air monitoring.

6.2 EXPOSURE ASSESSMENT

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure, i.e. whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- A source and mechanism of release from the source,
- A transport medium (e.g., surface water, air) and mechanisms of migration through the medium,
- The presence or potential presence of a receptor at the exposure point, and
- A route of exposure (ingestion, inhalation, dermal absorption).

If all four elements are present, the pathway is considered complete.

The four major constituent release and transport mechanisms potentially associated with the Site are as follows:

- The infiltration of precipitation through the wastes and affected soils and the percolation of the resulting leachate into subsurface soils and groundwater, followed by groundwater transport.
- Release of affected surface soil through surface water run-off. Dissolved constituents and constituents adsorbed to soil particles could be conveyed to the drainage ditch on the eastern edge of the Site that runs from the Site, past an elementary school, and through a residential area prior to discharging into the estuary approximately one mile from the Site.
- Release of affected surface soil through wind erosion. Surface soils could be suspended in air and transported from their source by the wind.
- Release of volatile compounds from soils and waste to the atmosphere.

These constituents could be transported and dispersed by the wind.

Because the thick vegetation and ground cover present at the Site will impede volatilization and wind erosion, exposure to constituents in air, either as vapor or adsorbed to dust, is not considered significant at the Site under current land use conditions. The presence of vegetation also minimizes direct contact with surface soils by Site visitors.

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. Four current potentially complete exposure pathways and seven future exposure pathways remained after screening. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change. Exposure by each of these pathways was mathematically modeled using generally conservative assumptions.

The current pathways are:

- potential ingestion of surface soil by a trespasser;
- potential absorption from surface soil by a trespasser;
- potential adsorption from ditch sediment by a trespasser, and
- potential ingestion of sediments and surface water by terrestrial organisms.

The future pathways are:

- dermal exposure to surface soil by potential onsite residents;
- ingestion of contaminated groundwater by potential onsite residents;
- ingestion of soil by potential onsite residents;
- dermal exposure to ditch sediments by potential onsite residents;
- inhalation of airborne dust by potential onsite residents;
- ingestion of soil by an onsite worker; and
- dermal contact with soil by an onsite worker.

The exposure point concentrations for each of the chemicals of concern and the exposure assumptions for each pathway were used to estimate the chronic daily intakes for the potentially complete pathways, with the exception of the groundwater pathway. The chronic daily intakes were then used in conjunction with cancer potency factors and non-carcinogenic reference doses to evaluate risk.

The major assumptions about exposure frequency and duration that were included in the exposure assessment were:

- The most likely trespasser is a child, age 6-12.
- The trespasser will spend equal time on all areas of the Site.

- The trespasser will visit the Site on a routine basis for six years (age 6-12).

- The average body weight of the trespasser over the six year period is 30.5 kg.

- The trespasser will visit the Site 150 days per year (five days per week over the summer and two days per week over the school year).

- The resident will spend 24 hours per day, 365 days per year onsite.

- The resident child lives on the Site for the nine-year period from ages 1 to 10. The resident adult lives on the Site for 30 years.

- The average weight of the child is 20.5 kg over the nine year period. The average weight of the adult is 70 kg.

- The individual expected to have the highest exposure under a commercial-use scenario is a grounds-keeper.

- The grounds-keeper's weight is assumed to be 70 kg.

- The grounds-keeper's exposure period is estimated to be 30 years.

- The grounds-keeper's exposure frequency is anticipated to be 43 days per year (one day per week for a 43 week growing season).

The baseline risk assessment considered three land use scenarios without the added protection of any remedial action: current land use, future commercial land use, and future residential land use. Analysis of current land use examined exposure to a potential adolescent trespasser at the Site. Hypothetical exposure was assumed to occur by direct contact with surface soil and sediments. Analysis of the risk associated with future commercial land use considered potential exposure to a grounds-keeper working at the Site. Hypothetical exposure was assumed to occur by direct contact with surface soil. Analysis future residential land use considered potential exposure to a child and an adult residing at the Site. Exposure was assumed to occur by direct contact with surface soil, inhalation of airborne dust, and use of groundwater. The resident child was also assumed to contact stream sediments.

6.3 TOXICITY ASSESSMENT

Toxicity values are used in conjunction with the results of the exposure assessment to characterize Site risk. EPA has developed critical toxicity values for carcinogens and noncarcinogens. Cancer potency factors (CPFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of (mg/kg/day)[-1], are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this conservative approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

6.4 RISK CHARACTERIZATION

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. Excessive lifetime cancer risks are determined by multiplying the estimated daily intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1x10[-6]). An excess lifetime cancer risk of 1x10[-6] indicates that, as a plausible upper boundary, an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the assumed specific exposure conditions at a site.

EPA considers individual excess cancer risks in the range of 1x10[4] to 1x10[-6] as protective; however the 1x10[-6] risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. The point of departure risk level of 1x10[-6] expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The health-based risk levels for OU #1 are shown in Table 6-3.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants's reference dose). A HQ which exceeds one (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media. The HIs for OU #1 are shown in Table 6-3.

The risk assessment results indicated that the risks due to exposure to toxaphene in surface soil exceeded the 1 x 10[-4] risk level for each land use scenario. Exposure to sediments did not result in risks exceeding the 1 x 10[-6] benchmark. The hazard index exceeded 1.0 and the increased carcinogenic risk exceeded 1 x 10[-4] for ingestion of groundwater.

6.5 ENVIRONMENTAL RISK

Biological assessments included vegetation surveys, an elutriate bioassay, a macroinvertebrate study, and bioaccumulation studies in the ditch and in the estuary.

The vegetation surveys concluded that no adverse effects on vegetation at the Site or in the drainage ditch were apparent. The elutriate bioassay concluded that no significant differences in reproductive responses among the freshwater sampling points were apparent. The macroinvertebrate study concluded that the ditch adjacent to the landfill is a stressed environment, but less so downstream of the landfill than upstream. The ditch is a stressed environment because, as the upper reach of a storm drainage system, it experiences low to no flow with periodic high storm flows, and because it is periodically dredged. Toxaphene was not detected in any test organisms during the bioaccumulation studies. The overall conclusion of the biological assessments was that the landfill had not adversely affected the drainage ditch or the estuary.

Representatives from the U.S. Fish & Wildlife Service observed a wood stork at the pond located on the south end of the Site. The wood stork, Mycteria americana, is a listed endangered species protected under the Endangered Species Act of 1973. However, under current Site conditions, environmental receptors are not exposed to excessive increased carcinogenic risk. Hazard indexes for environmental receptors are within acceptable levels.

6.6 CLEANUP GOALS

The establishment of health-based cleanup goals serves as an important means of guiding remedial activities. A health-based approach is warranted when cleanup standards promulgated by state or federal agencies are not available for contaminants in soil, as well as for certain groundwater contaminants. The approach to developing health-based goals is derived from the risk assessment process. The risk assessment is essentially a process by which the magnitude of potential cancer risks and other health effects at a site can be evaluated quantitatively. A cleanup goal is established by back-calculating a health protective contaminant concentration, given a target cancer risk which is deemed acceptable and realistic. The concept of the cleanup goal inherently incorporates the concept of exposure reduction which allows remedial alternatives to be flexible.

Although the contaminants of concern are not the only contaminants at the Site, they were chosen based on toxicity, mobility and frequency of detection throughout the Site. It is anticipated that contaminants at the Site which do not have cleanup levels presented in this ROD will be reduced to acceptable levels when cleanup levels are met for the most toxic and most mobile contaminants for which cleanup levels have been established.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Groundwater

Cleanup goals for groundwater are not presented in Table 6-4 since only single contaminants in separate sampling locations are above MCLs at the Site (See Figure 6-1 for monitoring well locations). Currently, monitoring well N-6SR has indicated toxaphene contamination at a level of 0.069 ppm (the MCL is 0.003 ppm), well N-5 and KV-5 indicate benzene at levels of 0.13 ppm and 0.011 ppm respectively (the MCL for benzene is 0.005 ppm), and KV-3 indicates nickel contamination at a level of 0.186 ppm (the MCL for nickel is 0.1 ppm). The MCL shall be the performance standard for groundwater to meet.

In 1990, toxaphene was detected in monitoring wells N-6S, N-11, N12, and one deep well, N-6D. Detected toxaphene concentrations ranged from 0.0056 ppm at well N-12 to 0.76 ppm at well N-11. It was noted at the time of analysis that the deep well, N-6D may contain toxaphene as an artifact of well construction. To further investigate this, N-6D was abandoned in 1991 and replacement well N-6DR was installed immediately adjacent to the original location. During the sampling conducted in 1991, toxaphene was only detected in N-6S at a concentration of 0.01 ppm. During the round of sampling in November 1991, toxaphene was not detected in groundwater samples collected from wells N-6DR, N-11, and N-12. Since the single confirmed analytical detection of toxaphene could be an artifact of construction of monitoring well N-6S (which was installed at the same time as N-6D), N-6S was abandoned and replacement well N-6SR was installed in March 1992. Toxaphene was detected at 0.069 ppm in the groundwater sample collected in March 1992 from N-6SR. The absence of toxaphene in surrounding monitoring wells indicates that there is no plume of toxaphene within the groundwater.
Benzene was detected in a groundwater sample collected from N-5 at levels of 0.13 ppm and 0.970 ppm. Further evaluation of benzene in the groundwater downgradient of monitoring well N-5 was

performed by the collection of KVA samples KV-5 through KV-8. Benzene was detected in KV-5 at a concentration of 0.011 ppm.

Nickel was detected in KV-3 at 0.186 ppm, which is greater than the MCL of 0.1 ppm. However, samples obtained using the KVA sampling procedure may possibly contain higher levels of suspended solids due to the absence of a sand pack which is normally found with a monitoring well. Suspended solids present in groundwater samples may cause analytical results to reflect higher concentrations that those actually present.

Based on the above, no active remediation is to be immediately implemented for groundwater. However, if contamination in the groundwater does not attenuate to below MCLs, the MCLs would be the cleanup target. The MCLs for toxaphene, nickel, and benzene are listed in Table 6-2.

Soils

Surface soil requiring remediation were determined using risk-based action levels, which are summarized in Table 6-4. The action levels were calculated by using baseline risk assessment exposure assumptions for exposure of a future resident child to surface soil. Action levels for non-carcinogenic constituents were calculated using an allowable hazard index of 1.0. Action levels for carcinogenic constituents were calculated using an allowable increased cancer risk of 1 x 10[-6]. Surface soil remediation target concentrations for toxaphene were exceeded in numerous surface soil sampling locations.

Subsurface soil volumes requiring remediation were determined by two methods. Inorganic constituent (metals) target concentrations were calculated by using baseline risk assessment exposure assumptions for future commercial land use (i.e., limited exposure to the soil). Action levels for noncarcinogenic constituents were calculated using an allowable hazard index of 1.0. Action levels for carcinogenic constituents were calculated using an allowable increased cancer risk of 1 x 10[-6]. Organic constituent target concentrations were calculated using the Summer's model (EPA, 1989) for constituents leaching to groundwater. Drinking water standards were used for allowable groundwater concentrations. Both surface soil and subsurface soil cleanup goals are presented in Table 6-4.

The following criteria were developed to calculate the volume of affected soil.

- In those areas where the deepest soil interval sampled in a boring indicates constituent concentrations exceeding remedial action target concentrations, the remedial action limit is assumed to lie within a distance of two feet below that datum. The rationale for this criterion is based on observations made at several locations across the Site.

- The lower excavation limit has been drawn parallel to the bottom of the wastes where practical. This has been done in a manner to approximate a reasonable excavation plan.

Surface soil sampling results indicate that several areas of the Site contain surface soil with toxaphene concentrations that exceed the surface soil target concentration of 0.25 ppm. Approximate boundaries of the affected surface soil were estimated by evaluating the constituent concentrations in surface soil samples and shallow samples from soil borings. Figure 9-1 is a plan view of the Site showing the area of affected surface soil. Volume calculations were based on excavation to two feet. Volume calculations for surface soil excavation and remediation resulted in an estimate of 13,500 cubic yards.

Sludge exceeds the subsurface soil target concentrations for toxaphene. Sludge volumes were calculated based on historical information about the construction of the landfill and on data generated from landfill borings. Hercules' records indicated that approximately 33,000 cubic yards of material were disposed in the landfill. The quantity is closely approximated by the volume estimates based on field calculations. Table 6-5 presents a summary of the volumes estimated for the sludge and soil.

7.0 DESCRIPTION OF ALTERNATIVES

OVERVIEW

The assembled Site-specific alternatives represent a range of distinct waste-management strategies addressing the human health and environmental concerns. Although the selected remedial alternative will be further refined as necessary during the predesign phase, the analysis presented below reflects the fundamental components of the various alternatives considered feasible for this Site.

GROUNDWATER

Currently, monitoring well N-6SR has indicated toxaphene contamination at a level of 0.069 ppm (the MCL is 0.003 ppm), well N-5 and KV-5 indicate benzene at levels of 0.13 ppm and 0.011 ppm respectively (the MCL for benzene is 0.005 ppm), and KV-3 indicates nickel contamination at a level of 0.186 ppm (the MCL for nickel is 0.1 ppm). See Figure 6-1 for monitoring well locations. Since groundwater contamination is currently limited to a solitary but different contaminant in separate monitoring wells, alternatives for groundwater remediation are not necessary at this time. However, both onsite and off-site monitoring of groundwater, surface water, and sediment (both in the onsite pond and in the adjacent drainage ditch) will continue. Monitoring of groundwater and surface water will be a part of any alternative chosen. If toxaphene begins to migrate off the Hercules 009 Landfill property, if the other contaminants of concern migrate from the current contaminant locations, if any levels of contaminants of concern begin to increase over fifty percent of their current value, or in case it becomes apparent that onsite levels of contaminants in the groundwater will not naturally attenuate below MCLs in a time frame comparable to a pump and treat system, a contingency pump and treat system will be implemented. Measurable attenuation of groundwater contamination must be achieved within 5 years after the completion of the soil remedy for the final operable unit for this Site. During Remedial Design interim goals will be devised for groundwater contaminant levels which indicate at what levels natural attenuation would be expected to reach. Such interim goals will be established for annual intervals. If two consecutive interim goals are not met, a groundwater pump and treat system must be initiated. The groundwater will be pumped to the surface and treated onsite with granular activated carbon. The spent granular activated carbon will be sent to a hazardous waste facility for disposal. The treated groundwater will be discharged to a local publicly-owned treatment works. If a discharge permit cannot be obtained, an NPDES permit for discharge to an off-site surface water body will be obtained. If an NPDES permit cannot be obtained, onsite discharge to the onsite pond will be considered. If MCLs are met for two consecutive annual monitoring periods, groundwater sampling may be discontinued at the discretion of EPA. Proper abandonment of the wells replaced during OU#2 will be implemented if the well owners are amenable to abandonment.

7.1 ALTERNATIVE No. 1 - No-Action

The No-Action Alternative is carried through the screening process as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This alternative is used as a baseline for comparison with other alternatives that are developed. Under this alternative, EPA would take no action to minimize the impact contamination has on the area. Contamination would remain and possibly migrate. The present-worth cost for this alternative is $1,600,000 due to the continued monitoring activities that would occur.

The No-Action Alternative is retained as the baseline case for comparison with other alternatives. No remedial actions would be performed on either of the media of concern (soil or sludge) at the Site. The landfill and affected soil areas, as defined during the RI, would remain in their present condition. The only active component of this alternative is long-term groundwater, surface water, and sediment monitoring. This program would be implemented to assess the effect of waste constituents on the Site.

Groundwater, surface water, and sediment (in both the onsite pond and the adjacent drainage ditch) at the Site would be sampled and analyzed annually for site-specific chemicals of concern. The surface water, sediment, and groundwater monitoring program would be reevaluated every five years to assess the appropriateness of the sampling program. Many of the existing wells at the Site would be used to monitor groundwater quality; however, installation of more wells is probable.

Surface soil monitoring would be performed annually for site specific chemicals of concern to evaluate possible migration of waste constituents. Surface soil samples would be collected from potential drainage areas at the Site. As with groundwater monitoring, a 30-year period has been used as a basis for cost estimation.

7.2 ALTERNATIVE No. 2 - Institutional Controls and Fencing

The Institutional Controls and Fencing Alternative establishes institutional measures to block possible waste constituent exposure pathways through the affected media: soil and sludge. These institutional measures include the following:

- long term monitoring as presented in Alternative 1,
- fencing to limit access to affected solid materials, and
- deed restrictions to control future land use.

Institutional controls for the affected surface soil and sludge at the Site would be implemented by restricting access to affected Site areas with additional security fencing and use of deed restrictions. Those areas of the Site containing surface soil and sludge with waste constituent concentrations exceeding remedial action target concentrations would be re-fenced. The replacement fence would consist of six-foot high chain-link with at least one strand of barbed wire extending along the top. The Site would be posted and gates would be kept locked. In addition to fencing, legal actions would be taken to attach deed restrictions that would control future access and land use in the event the property is transferred to another owner.

Institutional controls for groundwater at and downgradient of the 009 Landfill Site would consist of continued groundwater monitoring as described in Alternative 1 and measures that would limit access to groundwater from the Site. Access to Site groundwater would be restricted by security fencing and deed restrictions that would preclude future use by the current or any subsequent land owners. Analysis of water quality in wells supplying private homes in the vicinity of the Site indicated no hazardous constituents above background concentrations. In accordance with the interim ROD for the Site, public water will continue being supplied to these homes. Long-term monitoring of the Site would be conducted as described in Alternative 1, No-Action.

7.3 ALTERNATIVE No. 3 - RCRA Cap of Sludge and Consolidated Surface Soil

This alternative combines the actions described in Alternative 2 Institutional Controls and Fencing, with excavation and consolidation of affected surface soil into the existing landfill, followed by the installation of a RCRA Cap. This alternative would contain onsite the total volume of affected solids.

The purpose of containment is to reduce contact by receptor populations and the environment with Site waste constituents. This reduction would be accomplished by minimizing downward vertical migration of waste constituents due to rain infiltration, preventing erosion of affected Site materials, and providing a barrier to direct contact between potential receptors and the affected materials. The cap would cover the consolidated surface soil containing toxaphene at concentrations exceeding the surface soil remedial action target of 0.25 parts per million (ppm). Areas excavated for consolidation of surface soil would be covered with two feet of clean, compacted, native fill. The total area to be covered with a multimedia RCRA cap is approximately 7.5 acres. Approximately 10 acres of the Site would be disturbed by construction activities.

Containment would leave affected subsurface soil and sludge in place with little or no disturbance. A RCRA cap over consolidated surface materials would minimize contact between percolating water and waste constituents, thereby reducing the potential for migration of waste constituents to the groundwater. In addition, a cap installed over the affected materials would prevent erosion of waste constituents by wind or surface water runoff. Areas of the Site requiring containment would be graded to divert surface drainage around and away from the contained solids. A containment cover of this type would require periodic maintenance and inspection.

The following design option considered for containment in this alternative is a multimedia (RCRA) cover over sludge and consolidated soil. The multimedia cover option would include a cap design for the landfill disposal area consisting of the following components:

- 6 inches of topsoil
- 18 inches of clean soil
- 1 layer of geotextile fabric
- 6 inches of drainage material (gravel)
- 1 layer of flexible membrane liner
- 2 feet of clay

The multimedia cover option would include a cap design as described for the areal extent of the existing landfill (approximately 7.5 acres). Surficial soil exceeding target cleanup levels of 0.25 ppm would be consolidated to within the confines of the existing landfill.

The multimedia cover design would comply with GaEPD requirements for hazardous waste cover systems and would be designed to perform in accordance with EPA minimum technology guidance. The multimedia cover would be graded to promote surface drainage and sown with shallow-rooted grasses.

7.4 ALTERNATIVE No. 4 - In-Situ Stabilization of Sludge and Consolidated Surface Soil with Installation of a Cover

Alternative 4 consists of the treatment of affected surface soil and sludge in place by in-situ stabilization. The affected surface soil will be excavated and then consolidated by placing this soil back on the 009 Landfill. This alternative involves the stabilization of subsurface soil, sludge and consolidated surface soil, followed by the installation of a cover.

The surface soil remedial action target concentrations shall be used to determine the vertical and horizontal excavation boundaries for surface soil. The subsurface soil target concentrations were used to establish treatment boundaries for subsurface soil and wastes for cost estimating purposes. A sampling program would be conducted to determine the actual volumes of surface soil and subsurface soil requiring remedial action.

In this alternative, subsurface solids and consolidated surface soil would be treated in place within the landfill. A cover would be placed over the consolidated, stabilized soil to reduce rainwater infiltration and direct contact with the treated soil. In addition, areas excavated for consolidation of surface soil would be graded and covered with clean, compacted, native fill. Treatment boundaries would approximate the remedial action limits shown on Figure 9-1.

The incremental risk after implementation of this treatment option would be 1.0 x 10^{-6} for carcinogenic effects and 0.0003 for the hazard index for a child residing near the Site.

This option includes the use of deep soil mixing equipment that delivers stabilization reagents to the affected solids during mixing operations. The process involves augering into the affected solids to the desired depth using hollow-stem augers. The hollow-stem augers overlap and can vary from two to five augers per assembly. A shallow soil mixing system is also available and uses a single, wide diameter auger rather than an assembly of overlapping augers. Treatment agents are injected into the disturbed matrix through jets constructed in the auger blades. The reagents can be injected in either a dry, liquid, or slurry form.

A system such as this would consist of the following typical unit operations:

- Shallow Soil Mixing Assembly
- Reagent Containers and Feed Systems

Drilling depths are limited, but depths up to 30 feet are reportedly attainable. Treatment duration will vary by depth and by the amount of mixing required to ensure adequate stabilization. Treatability studies would be necessary during the remedial design phase to select the optimal reagent composition and form. Testing of the solidified treatment zones would also be necessary to ensure that performance requirements are being met.

7.5 ALTERNATIVE No. 5 - Excavation, Treatment, and Onsite Disposal of Sludge, Subsurface Soil, and Consolidated Surface Soil Followed by Installation of A Clay Cover

Alternative 5 consists of excavation of affected solid materials; onsite treatment of affected solid materials using chemical extraction; and backfilling of treated residuals into the excavations.

For the solid waste materials, the first step in this alternative would include the excavation of surface soil and sludge having waste constituents exceeding the appropriate surface soil and subsurface soil target concentrations for toxaphene of 0.25 ppm and 76 ppm, respectively. The sludge would be excavated down to the underlying bentonite layers at a minimum. Following excavation, the affected materials would be temporarily stockpiled onsite for processing prior to treatment. The solid waste material requiring treatment is estimated to consist of approximately 42,000 in-place cubic yards of affected soil and sludge. The estimated surface soil, sludge, and subsurface soil quantities are listed in Table 6-5. Since exposure to subsurface soil is limited, the volume of subsurface soil exceeding limited exposure targets is used. A sampling program would be conducted prior to excavation to determine the actual volumes of surface soil and overburden requiring remedial action. Sludge may require dewatering prior to treatment. Treated solids would be disposed of by backfilling the excavations. A layer of clean native soil will be placed over the treated residuals. In addition, areas excavated for consolidation of surface soil would be covered with clean, compacted, native soil.

For cost estimation purposes, chemical extraction is assumed to result in a 35-percent volume increase over the in-place soil volume. Field trials may be required to confirm full-scale treatment effectiveness and to determine the physical and chemical characteristics of the treated residuals.

Each of the treatment process options would require preprocessing of the solids to remove oversized debris and to further reduce the particle size of the matrix. The cost and economic analysis of this alternative is based, in part, on the assumption that a small portion of the total mass of solids would be rejected during preprocessing. A one-percent rejection rate has been used as the basis for this assumption. Because of the uncertain regulatory status of this bulk debris, the assumption has also been made for cost estimation purposes that these rejected materials would require off-site disposal as a RCRA-regulated hazardous waste in an EPA approved landfill.

Chemical extraction is a batch process in which soil or sludge is thoroughly mixed with successive rinse solutions formulated to remove amenable fractions of waste constituents from the soil and inert particles. The aqueous phase is then separated from the solid matrix by decanting. The rinsate from this step is typically treated using conventional wastewater technology for metals removal, such as pH adjustment, flocculation, clarification, and dewatering. Rinse water is typically recycled after completion of the treatment cycle. Rinse solutions for chemical extraction include acid and caustic solutions. An appropriate extraction solution for the 009 Landfill chemicals of concern will be selected during treatability studies.

The permit requirements for a chemical extraction system generally depend on the need for discharging the treatment process rinse water off-site. The solids generated during treatment of the wastewater typically are characterized as a RCRA hazardous waste and must receive further treatment and/or be disposed of as such. Process wastewaters would be temporarily stored in onsite tanks until recycled. Wastewater sludge would be dewatered and stockpiled, if necessary. Dewatered sludge would be transported to an appropriate EPA approved facility for treatment and landfill disposal. Treatment of the process rinse water and dewatered sludge would be further defined during the remedial design stage of the project.

A typical chemical extraction system consists of the following unit operations:

- Material processing/sorting
- Reagent storage
- Solids mixing
- Solids reaction
- Decanting and solids washing
- Reagent recycling and reconditioning

One vendor's estimate of chemical extraction throughput for Hercules was 150 tons per day per module. The overall throughput could be varied by operating several chemical extraction units in series. For 42,000 in-place cubic yards (63,000 tons) of affected solids, a chemical extraction operation of 7 days per week would require 60 weeks of operation.

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in Section 300.430 of the NCP. The major objective of the Feasibility Study was to develop, screen, and evaluate alternatives for the remediation of Operable Unit One at the Hercules site. The remedial alternatives selected from the screening process were evaluated using the following nine evaluation criteria:

- Overall protection of human health and the environment.

- Compliance with applicable and/or relevant Federal or State public health or environmental standards.

- Long-term effectiveness and permanence.

- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants.

- Short-term effectiveness, or the impacts a remedy might have on the community, workers, or the environment during the course of implementing it.

- Implementability, that is, the administrative or technical capacity to carry out the alternative.

- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail.

- Acceptance by the State.

- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) Modifying Criteria - state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative.

Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following analysis is a summary of the evaluation of alternatives for remediating the Hercules Superfund Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

Threshold Criteria

8.1 Overall Protection of Human Health and the Environment

The No-Action Alternative does not modify or reduce the potential for human exposure. Nonetheless, to monitor the potential exposure from ingestion of drinking water, the groundwater, surface water, and sediment sampling and analyses program is established to evaluate potential future exposures. Implementation of this alternative will not result in exposure of neighboring residents to unacceptable risks from the 009 Landfill Site. The estimated upper bound lifetime excess cancer risk calculated for future land use scenarios at the 009 Landfill Site is 3.8 x 10[-3] for the reasonable maximum exposure conditions. The associated hazard indices for noncarcinogenic effects under this same scenario is 6.1. The carcinogenic risk factor exceeds EPA's guideline range of 1 x 10[-4] to 1 x 10[-6] excess lifetime cancers in humans as promulgated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. A hazard index greater than 1.0 for noncarcinogenic health effects indicates that sensitive individuals may exhibit adverse effects after direct contact with the affected soil and use of shallow groundwater at the Site for a drinking water source.

Alternative #2 is protective of human health and the environment at the 009 Landfill Site because future exposure to waste constituents will be reduced by legal restrictions imposed on future land use. The maximum additional risk posed by direct contact with affected soil off-site will be 3.8 x 10[-3] for carcinogenic constituents, and the hazard index will be 0.0003.

Alternative #3 will provide overall protection of human health and the environment. Exposure from direct contact and inhalation with affected soil and dusts will be minimized by a multimedia cap constructed with soil, gravel, a geotextile fabric, and clay. The reasonable maximum exposure after implementation of this alternative at the 009 Landfill Site will be 1.0 x 10[-6]. Incremental risk between 1 x 10[-4] and 1 x 10[-6] is within the range considered acceptable by the EPA. The hazard index for noncarcinogenic constituents will be 0.0003 for the reasonable maximum exposure after capping. A hazard index exceeding 1.0 is considered significant.

The RI indicated that migration of waste constituents from the landfill has been limited to the immediate surrounding soil. Consolidation of surface soil exceeding target toxaphene concentrations of 0.25 ppm will reduce direct contact exposure. Construction of a low-permeability cap over the landfill areas will further decrease the potential for direct contact exposure and the potential for migration from the disposal area by reducing the infiltration of precipitation. Groundwater quality will be monitored by a long-term sampling and analysis program. Similarly, soil samples from drainage areas will be collected during the long-term program to assess the effectiveness of the cap in preventing the migration of waste constituents by erosion pathways.

The minimum level of overall protection provided by in-situ stabilization (Alternative #4) is 1.0 x 10[-6] for the lifetime excess cancer risk and 0.0003 for the hazard index. The additional protection offered by in-situ stabilization/solidification is further enhanced by the short-term protectiveness gained from treatment without excavation of waste materials.

Furthermore, the risk of potential releases off-site during transportation to, and disposal at, a TSD facility will be eliminated by this alternative. However, short-term protectiveness will be somewhat diminished during construction activities that consolidate affected surface soil with waste areas.

In-situ treatment could still result in emissions of waste constituents from dust and volatilization due to the treatment process and erosion from areas awaiting treatment. These risks have not been quantified. However, the additional risks would be significantly less than those for alternatives that require excavation. Standard engineering practices for dust and erosion control will be implemented to control these migration pathways.

Alternative #5 will provide overall protection of human health and the environment. Source excavation and treatment will minimize the potential for future migration of waste constituents to human receptors and the environment in and around the 009 Landfill Site. Long-term exposure from direct contact with, and inhalation of, affected soil and dusts will be minimized by treatment of all affected soil and sludge. This alternative would reduce the incremental risk posed by direct contact to 1.0 x 10[-6]. The hazard index would be less than or equal to 0.0003 for any specific constituent, because the removal target levels of the sludge and affected soil limits risk to these values. These risk values are well below EPA's goal of a carcinogenic risk of less than 1 x 10[-4] and a hazard index less than 1.0.

8.2 Compliance with ARARs

The remedial action for the Hercules Site, under CERCLA Section121(d), must comply with federal and state environmental laws that are either applicable or relevant and appropriate (ARARs). Applicable requirements are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. To-Be-Considered Criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding but should be considered in determining the necessary level of cleanup for protection of health or the environment.

While TBCs do not have the status of ARARs, EPA's approach to determining if a remedial action is protective of human health and the environment involves consideration of TBCs along with ARARs.

The affected groundwater in the aquifer beneath the Hercules Site has been classified by EPA as Class IIA for the surficial aquifer. Class IIA groundwater is a current source of drinking water. It is EPA's policy that groundwater resources be protected and restored to their beneficial uses. A complete definition for groundwater classification is provided in the Guidelines for Ground-water Classification under the EPA Ground Water Protection Strategy, Final Draft, December 1986.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely on the basis of location. Examples of location-specific ARARs include state and federal requirements to protect floodplains, critical habitats, and wetlands, and solid and hazardous waste facility siting criteria. Any remedial measures that involve activity in the adjacent drainage ditch would require a wetlands permit, due to discharge of dredge and fill materials in to waters of the United States. Alternatives involving excavation of landfill constituents would likely impact the adjacent ditch given its close proximity. Table 8-2 summarizes the potential location-specific ARARs and TBCs for the 009 Landfill Site. Some remedial alternatives could be limited by the location requirements for new or existing facilities.

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, various requirements can be ARARs. Table 8-3 lists potential action-specific ARARs for the selected remedy for the Hercules 009 Landfill Site, and Table 8-4 lists potential action-specific ARARs for the contingent remedies (for both source control and groundwater) for the Hercules 009 Landfill Site.

The RCRA Land Disposal Restrictions (LDRs) are potential ARARs for remedial actions on the sludge and soil at the 009 Landfill Site. The LDRs are applicable to remedial actions that involve "placement" of restricted RCRA hazardous waste. The area of contamination (AOC) at this Site consists of the Hercules property commonly known as the 009 Landfill, including all of the landfilled sludge cells, the staging area located near the landfilled sludge cells, plus the length of the drainage ditch where the ditch is adjacent to the Hercules property, the soil on the banks of the drainage ditch, the Benedict Road/Nix

Lane area which abuts the Hercules property, and contiguous soils located just southeast of the Benedict Road/Nix Lane area. Land disposal restrictions are not applicable where banned waste is moved, graded, stabilized, or treated in-situ, entirely within the original area of contamination, because placement has not occurred, but may be relevant and appropriate. Toxicity Characteristic Leaching Procedure (TCLP) results indicated toxaphene was below detection limits in the waste extract. The Hercules wastewater sludge generated from the production of toxaphene is exempt from listing as a hazardous wastes under RCRA (40 CFR 261) because the sludge was last handled in June 1980. Although not applicable, pertinent aspects of RCRA closure requirements may be relevant and appropriate in Alternative #4 because a hybrid-landfill closure system will be used. If Alternative #5, chemical extraction, is utilized, then RCRA closure requirements may be applicable.

Chemical-specific ARARs are specific numerical quantity restrictions on individually-listed chemicals in specific media. Examples of chemical-specific ARARs include the MCLs specified under the Safe Drinking Water Act as well as the ambient water quality criteria that are enumerated under the Clean Water Act. Since there are usually numerous chemicals of concern for any remedial site, various numerical quantity requirements can be ARARs. Tables 8-3 and 8-4 list potential chemical-specific ARARs for the 009 Landfill Site.

For Alternative #1, there are no chemical-specific, action specific, or location-specific ARARs for the chemicals of concern in soil, if left in place. Chemical-specific ARARs are listed in Tables 8-3 and Tables 8-4. Groundwater ARARs include Maximum Contaminant Levels (MCLs) that establish chemical-specific limits on certain contaminants in community water systems. Even though the groundwater data suggests that representative concentrations of constituents are above the established MCLs, natural attenuation is expected to achieve MCLs over time due to the treatment of the source area. Long-term monitoring based on annual sampling is included in each of the proposed remedial alternatives. This will allow for a statistical analysis of additional data to further substantiate the presence/absence of a groundwater plume. This long-term monitoring will provide the data necessary for a statistical determination of constituent concentrations in groundwater. If, in EPA's sole discretion, it becomes apparent that MCLs will not be met through attenuation, then a contingency pump and treat remedy will be implemented.

For Alternative #2, there are no action-specific or location specific ARARs for the chemicals of concern in soil, if left in place. Based on the available data, groundwater at the 009 Landfill Site meets ARARs with the exception of chemical specific ARAR of primary drinking water standards (MCLs). Additional groundwater sampling and analysis is necessary to verify that representative constituent concentrations will meet the MCLs.

The multimedia cover (Alternative #3) will comply with the RCRA action-specific requirements for capping solid wastes in place. The cover will be designed to divert surface water runoff from a 24-hour, 25-year storm. The existing six-foot security fence will remain around the cap to limit Site access. A multilayer low permeability RCRA cap topped with a vegetative topsoil layer will reduce erosion and protect the integrity of the clay barrier. Percolation of rainfall from the bentonite layer was calculated to be 0.0000 inches when a layer of geomembrane was included in the design. This analysis was developed using the H.E.L.P. model, which was designed to evaluate the efficacy of landfill caps. Closure caps such as this also meet the EPA remedial action criteria of eliminating the potential for dermal exposure and incidental ingestion of surface soil and sludge.

No definable plume of toxaphene could be identified in groundwater. The remedial actions include further sampling and analysis of both onsite and off-site groundwater to verify that groundwater quality will meet MCLs.

The multimedia RCRA cap detailed in Alternative 3 is consistent with landfill closure requirements. The design will also comply with all other requirements for capping solid wastes in place. Action-specific, chemical specific and location-specific ARARs will be met by this alternative.

In Alternative #4, consolidation of the surface soil prior to insitu treatment of wastes within the area of contamination is not expected to require a waiver for the RCRA Land Disposal Restrictions. Although the soils are not expected to be hazardous wastes, characteristic leaching tests will have to be performed to confirm this expectation. The remedial action will include further sampling and analysis of groundwater to verify that groundwater beneath the Site will meet ARARs through attenuation in a reasonable time frame. Surface water on Site currently meets ARARs.

In Alternative #5, action-specific ARARs, in particular the Land Disposal Restrictions of 40 CFR Part 268, will be met by chemical extraction of contamination from the excavated soil prior to onsite disposal of the treated soil so that regulatory limits for characteristic wastes are met. The remedial actions described in this alternative will include further sampling and analysis of groundwater to verify that groundwater quality will meet ARARs through attenuation. Off-site disposal of the extracted contamination must meet pertinent RCRA ARARs.

Primary Balancing Criteria

8.3 Long-Term Effectiveness and Permanence

The No-Action Alternative #1
Implementation of the No-Action Alternative will not reduce potential risks associated with affected Site materials. Affected Site materials under this alternative may eventually be transported through slow volatilization, fugitive dust emissions, or surface water runoff. No engineering controls designed to prevent exposure to affected materials would be contemplated as part of this alternative. Groundwater and surface water monitoring would be conducted for five years to evaluate potential migration pathways. These measures could indicate possible movement of constituents from the Site but would not result in a reduction in the concentration of toxaphene.

Alternative #2
The potential risk posed by materials containing waste constituents will be reduced after implementation of the Institutional Controls Alternative (Alternative #2). Future land use of

the Site for residential or industrial purposes would not be expected to occur after implementation of deed restrictions. Deed restrictions will prevent development of the Site by current and future owners of the property. The Institutional Controls Alternative will rely on additional security fencing at the 009 Landfill Site to prevent direct exposure to chemicals of concern.

Over time, concentrations of the organic chemicals of concern may be reduced by naturally-occurring microorganisms that degrade the organic wastes. The extent to which natural degradation of organic constituents will occur is difficult to accurately estimate without the results of long-term Site-specific studies. This natural reduction in organic constituent toxicity or volume is not expected to significantly reduce the risk levels calculated for the 009 Landfill Site.

Alternative #3

Implementation of Alternative #3 will result in a decreased longterm potential for migration of constituents from soil or waste to groundwater. The potential for migration will be reduced by two means. A RCRA cap will act to limit infiltration through unsaturated soil/sludge. Source removal of the affected surface and subsurface soils in the southeastern corner of the 009Landfill will eliminate any source of toxaphene external to the landfill. Longterm monitoring will be used to evaluate potential changes in groundwater and surface soil quality.

The risk from direct contact with affected soil or wastes will be minimized. Long-term effectiveness will be dependent on appropriate maintenance of the capped areas. Maintenance of caps has been demonstrated to be straightforward and effective. The long-term adequacy and reliability of the cover will depend on proper maintenance and inspection of the facility. This alternative will require annual inspections to assess and correct any damage to the cap from erosion.

The proposed cover is a well-established, proven technology that has been used for years throughout the RCRA Subtitle C and CERCLA programs. A multimedia cap of soil, gravel, geotextile fabric, and clay reduces infiltration that might lead to possible leaching of the underlying constituents.

Even though future land use is not expected to change from current use, institutional controls at the Site will provide legal restraints to potential development. Failure of the actions included in this alternative will pose an incremental risk equal to the No-Action Alternative, i.e., 3.8 x 10[-3] for carcinogenic risk and a hazard index of 6.1 for noncarcinogenic constituents.

Alternative #4

Long-term effectiveness and permanence will be significantly achieved by consolidation and in-situ stabilization of sludge/subsurface and covering affected surface soil (Alternative #4). The mobility of any untreated soil containing low concentrations of waste constituents will be controlled by covering treated areas with a low permeability, multilayer cover, followed by seeding to establish vegetative ground cover and reduce erosion. The cover will also serve to minimize the effects of weathering on treated materials.

Long-term groundwater monitoring will be included as an element of this alternative to ensure that low concentrations of toxaphene remaining in the soil do not enter a pathway for exposure to the environment. This monitoring program, coupled with maintenance of the ground cover, will reduce uncertainties that may be associated with action levels and construction methods.

Alternative #5

After implementation of Alternative #5, risks posed by Site conditions will be reduced. The mobility of organic and inorganic constituents in the excavated sludge and soil will be reduced by chemical extraction and disposal of the treated soil onsite. Since direct contact with the sludge and surface soil posed the primary risk at the Site, the resulting Site risk will be reduced after source removal and treatment is completed. The carcinogenic risk level after implementation of this alternative will be 1.0 x 10[-6], and the corresponding hazard index for noncarcinogenic constituents will be 0.0003. For this risk calculation, it was assumed that the landfill area was backfilled with treated solids and capped with a low permeability clay cover.

Long-term effectiveness is maximized by excavation, treatment, and onsite disposal of all solids treated to achieve waste constituent concentrations at or below remedial action target levels. Fencing and long-term maintenance would be required at the Site after implementation of this alternative, which would provide an additional degree of permanence due to excavating and treating the affected solids. Even though future land use is not expected to change, Institutional Controls at the Site will provide legal restraints to potential future development.

8.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Under the no-action alternative, toxicity, mobility, and volume will not be reduced through treatment. Under Alternative #2, naturally-occurring microorganisms may degrade the organic wastes over time. This may slightly reduce the toxicity and volume of constituents. On the whole, however, toxicity, mobility, and volume will not be significantly reduced by the Institutional Controls Alternative.

Implementation of Alternative #3 will not reduce the toxicity or volume of waste constituents. Mobility will be reduced as a result of a significant decrease in infiltration and erosion.

For in-situ stabilization (Alternative #4), the mobility of chemicals of concern will be greatly reduced. Toxicity will be reduced incidentally during the stabilization process due to the added material. A bench-scale treatability study indicated that the volume of treated material will increase by 25 percent.

The exposure potential of waste constituents will be greatly reduced by a combination of the following factors:

- Sludge and soil treatment in-situ,
- Covering the consolidated, treated, surface soil with a RCRA-like cover,
- Covering the surface with vegetation, and
- Conducting monitoring of groundwater and surface soil.

Implementation of Alternative #5 will reduce the mobility of both the excavated materials and the remaining soil. The excavated materials will be treated with chemical extraction to the extent required to meet hazardous characteristic limits imposed by the LDRs. Treatability studies of onsite waste indicated that the LDR limits are achievable. Toxicity and volume will be greatly reduced following implementation of chemical extraction. This alternative will completely excavate and treat the volume of affected materials exceeding target levels.

8.5 Short-Term Effectiveness

Alternative #1

Implementation of the proposed no-action Alternative will have little or no negative, short-term impact on the local community; the No-Action Alternative offers the least disturbance of the Site. The monitoring wells proposed for sampling already exist. All of the monitoring work required will be completed within the boundary of the 009 Landfill Site. These activities will have a minimal effect on the adjacent residents.

Workers involved with sampling will wear personal protective equipment during operations in the vicinity of the waste management area currently fenced. This will include protective outer clothing, steel-toed boots with protective overboots, and appropriate work gloves. Proper use of protective equipment will help ensure short-term protection of workers.

Because the monitoring wells at the 009 Landfill Site are already in place, there will be minimal negative environmental effects from implementation of this alternative.

Alternative #2

Implementation of the Institutional Controls Alternative (#2) will have little or no negative effect on the surrounding community. Even though fence improvements and construction will take place outside the affected areas, workers installing the fence will wear personal protective equipment, during operations. This will include protective outer clothing, steeltoed boots with protective overboots, and appropriate gloves. Proper use of protective equipment and safe construction practices will help ensure shortterm protection of workers.

Alternative #3

Alternative #3 will result in increased airborne dust during the consolidation of surface soil and construction phases of the project. Dust control by watering, to minimize airborne particulates, will be conducted during construction. Air monitoring will also be conducted duringconstruction to assess the environmental effects of airborne particles. Potential off-site migration of chemicals of concern due to erosion will be limited by the utilization of silt fences during construction. Fugitive dust emissions and erosion are easily managed with standard engineering practices.

Workers involved with construction will wear personal protective equipment during Site operations. This will include protective outer clothing, steel-toed boots with protective overboots, gloves, and respirators. Proper use of protective equipment and safe construction practices will help ensure short-term protection of workers.

Construction of this remedial alternative is estimated to require 15 months to implement, allowing time for design, bidding, construction, and predictable downtime during Site activities.

Alternative #4

In Alternative #4, approximately 73,000 yards of sludge and soil containing toxaphene exceeding remedial action target concentrations will be treated in-situ in conjunction with stabilization of consolidated surface soil. Approximately 13,500 cubic yards of affected surface soil will be consolidated by placing these soils upon the landfill. Consolidation practices that minimize unnecessary releases of waste constituents to the environment will be used. Nonetheless, due to the inherent limitations of dust and erosion control techniques, surface soil consolidation will reduce short-term effectiveness. Standard engineering practices for dust and erosion control will be implemented to control these migration pathways. Transport by surface runoff of sediment containing waste constituents will be controlled by installation of temporary runoff-diversion berms and silt fences.

Workers at the Site will wear protective clothing. This may include protective outer clothing, steel-toed boots with protective rubber booties, rubber gloves, hard hats, and eye protection. If necessary for respiratory protection, the workers will wear face masks equipped with particulate filters.

Alternative #5

Alternative #5 will result in an increase in airborne dust during the excavation and treatment phases of the project. Air monitoring will be conducted during these phases to assess the risks posed by airborne particulates. Potential off-site migration due to erosion will be limited by the utilization of silt fences during excavation and grading. This remedial action will disturb a large area and will be less effective for the short term than Alternatives 1, 2, 3, and 5. Standard engineering practices should be capable of managing off-site migration of dusts and erosion materials.

Workers involved with construction will wear personal protective equipment during Site operations. This will include protective outer clothing, steel-toed boots with protective overboots, gloves, and respirators. Proper use of protective equipment and safe construction practices will help ensure short-term protection of workers.

Excavation, treatment, and grading activities associated with this alternative could take 24 months to implement, allowing time for design, bidding, excavation, and unforeseen downtime during excavating and grading.

8.6 Implementability

For Alternative #1:
All sampling equipment will be available to complete the proposed program for the no-action Alternative. Trained specialists must review monitoring results to properly assess implications of water quality data. It is assumed that adequate analytical laboratory capacity will be available during sampling periods. Currently, technologies required to implement this alternative are available. The tasks required for completion can be provided by more than one vendor to allow for competitive bids.

For Alternative #2:

The construction of additional security fencing is technically feasible. The objective of this alternative is to eliminate the exposure pathway of direct contact. A properly-maintained security fence is a reliable means of controlling Site access. Implementation of deed restrictions should prevent development of the property by current and future owners of the Site. The Institutional Controls Alternative will not be an obstacle to further remedial action. Monitoring will include long-term sampling of groundwater, surface soil, and sludge. If fencing and institutional actions fail to eliminate exposures to waste constituents, calculated potential risks posed by constituents from waste management activities will revert to those calculated for the No-Action Alternative. Implementation of this alternative will require minimal interaction with state and federal agencies.

Acquisition of deed restrictions is administratively feasible. Because numerous fencing contractors operate in the vicinity of the Site, contractor availability will not affect the schedule of response actions. Similarly, the availability of legal assistance for implementing institutional controls will not affect the project schedule.

For Alternative #3:

Construction of a RCRA cap is technically feasible. Construction will require earth-moving equipment for soil, gravel, clay, top soil cover material. This alternative relies on well-established and proven technology. Containment will function reliably, assuming proper operation and maintenance of the cap and fence. The cap will not be a significant obstacle to additional remedial measures in the future, if necessary. Long-term monitoring will be performed on groundwater and surface soil. The Site monitoring program will follow methods that were described for Alternative 1. Monitoring of surface soil is technically feasible and a reliable means of evaluating potential surface migration of waste constituents. This has been demonstrated in numerous settings. Failure of the groundwater monitoring program will not result in a change in the risk to human health or the environment, since public water supplies are currently utilized in the adjoining neighborhood. In the worst case, failure of the surface soil monitoring program to detect surface mobility of affected soil could result in undetected additional risks. However, those risks would be lower than those calculated in the baseline risk assessment, since affected materials will be capped and fenced. Implementation of this alternative will depend on agency approval. The following may be considered:

- Cap design criteria,
- Monitoring wells and surface soil locations proposed for sampling,
- Analyses to be conducted on samples.

Meeting the substantive requirements of federal, state, or local permits would delay the initiation of remedial action far less than for alternatives requiring excavation and/or treatment. No off-site treatment, storage capacity, or disposal (TSD) services will be required as part of this alternative. It is assumed that construction materials will be available at the time of construction. The critical materials will be clay that meets specification, the geotextile material, and equipment necessary for installation. Currently, technologies required to implement this alternative are available. The work tasks required for completion can be provided by more than one vendor to allow for competitive bids.

For Alternative #4:

Uncertainties associated with in-situ stabilization are the variability of treatment throughout the treatment zone and the incapability of the contractor thereafter to monitor treatment results. These concerns will be addressed by requiring sufficient overlap between treatment areas and by post treatment sampling of the treated zone and the underlying soil.

The reliability of in-situ stabilization equipment has been demonstrated at several sites with inorganic contamination. Implementation of the treatment process has some level of technical problems that could lead to schedule delays, especially since the treatment agents must be equally distributed throughout each treatment area. The depths requiring treatment at the 009 Landfill Site are well within the range demonstrated during previous applications of this process at similar sites. However, since organic contamination is present at this Site, further studies are necessary to determine if this treatment process will effectively immobilize the organics at this Site. One benchscale treatability study has been conducted with encouraging results. However, a field scale treatability study is necessary since the average level of toxaphene contamination (approximately 6000 ppm) is greater than the sample used in the bench scale treatability study (1200 ppm). Additional analytical tests will be required.

If treatment results in a solidified mass, additional remedial action, if necessary, may be difficult to implement. Treatment performance testing will be conducted to monitor the effectiveness of the remedy. Long-term groundwater and surface water monitoring will be performed to evaluate future migration.

This alternative will not require permitting or coordinating with other offices or agencies. Off-site TSD services will not be required under this alternative. Special drilling equipment capable of injecting treatment agents during drilling are required for in-situ stabilization. However, several vendors offer the process, so the necessary equipment should be available when needed. Currently, technologies required to implement this alternative are available. The tasks required for completion can be provided by more than one vendor to allow for competitive bids.

For Alternative #5:

Excavation of source material and grading of the remaining soil will require earth-moving equipment. Property lines on two sides of the landfill are within approximately 10 feet of where excavation would occur. OSHA mandated minimum side slopes cannot be achieved within the Site boundaries. This would increase the necessity for use of construction procedures that would complicate the logistics of soil removal. The possibility that contaminated soil or sludge would be dispersed on adjacent off-site land would be increased.

This alternative relies on well-established and proven technologies. Chemical extraction of source material is also technically reliable for the chemicals of concern. A treatability study performed by Resources Conservation Company indicated that in bench-scale evaluations toxaphene was removed from 009 Landfill material at an efficiency of 99.7 percent. If excavation, treatment, and onsite disposal of the affected solids is the chosen alternative, additional remedial measures should not be necessary. If other remedial measures are required, there should be no obstacle.

Long-term monitoring will be performed on groundwater. The monitoring program will follow methods that were described in Alternative 1. If a migration from the current contaminant locations begins to occur or the plume does not attenuate below MCLs in a time frame comparable to a pump and treat system, a contingency pump and treat system will be implemented. The implementability pump and treat systems have been demonstrated in numerous settings.

Off-site TSD services may be required as part of this alternative to dispose of sludge and/or treatment water generated during remediation. It is assumed that construction materials will be available at the time of construction. The critical materials will be equipment necessary for installation. It is also assumed that chemical extraction materials and contractors will beavailable at the time of excavation. Currently, technologies required to implement this alternative are available. All of the work tasks required for completion can be provided by more than one vendor to allow for competitive bids.

8.7 Cost

As shown by Table 8-5, the cost ranges from $1.6 million to $31 million for the alternatives described. Costs for operation and maintenance during the implementation of the alternative as well as post remediation monitoring are shown in the table below. Although Alternative #4, In-Situ Stabilization costs $9.9 million dollars and is not the cheapest of the alternatives, this alternative does provide more protection than the cheaper alternatives. In addition, this alternative satisfies the policy for treatment of the contaminated media. However, Alternative #4 is not as expensive as Alternative #5, which is estimated to cost $31 million dollars. Alternative #5 does satisfy the preference for treatment and does reduce the toxicity and

mobility of the contaminated media, but the greater than three-fold cost increase is not warranted since Alternative #4 will also protect human health and the environment.

Modifying Criteria

8.8 STATE ACCEPTANCE

The State of Georgia has concurred with the selection of Alternative #4 to remediate the contaminated soil at the Hercules site.

8.9 COMMUNITY ACCEPTANCE

Based on the comments expressed at the September 10, 1992 public meeting and the outpouring of written comments received during the comment period, it appears that the Brunswick community generally would prefer that Alternative #5, chemical extraction, be chosen instead of Alternative #4,stabilization. The majority of the comments received did favor Alternative #5; however, a significant number of comments did favor Alternative #3, capping. Nevertheless, EPA has determined that Alternative #4 is preferred because it does employ treatment and because it will be done in-situ, which will create less disturbance and emissions than Alternative #5. The increased urbanization of the area is a strong factor to be considered in deciding whether to implement Alternative #5. Alternative #5 would, in effect, mandate that a small to medium sized chemical plant be erected at Site for treatment of the sludges and soils. Emissions would be monitored, but some odor from such a facility is likely to occur. However, EPA has determined that Alternative #5 be kept as a contingency remedy if the field scale treatability study for Alternative #4 does not meet the performance standards.

9.0 SUMMARY OF SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected a source control and groundwater monitoring remedy for this Site. At the completion of this remedy, the risk associated with this Site has been calculated at $1x10^{-6}$ which is determined to be protective of human health and the environment. The total present worth cost of the selected remedy, Alternative #4, is estimated at $9,900,000.

A. SOURCE CONTROL

Source control remediation will address the contaminated soils and sludges at the Site. The area of contamination (AOC) at this Site consists of the Hercules property commonly known as the 009 Landfill, including all of the landfilled sludge cells, the staging area located near the landfilled sludge cells, plus the length of the drainage ditch where the ditch is adjacent to the Hercules property, the soil on the banks of the drainage ditch, the Benedict Road/Nix Lane area which abuts the Hercules property, and contiguous soils located just southeast of the Benedict Road/Nix Lane area. Source control shall include excavation of subsurface soils, sludges and related material in the former sludge staging area to 76 ppm of toxaphene, excavation of the surface soils in the staging area and the Nix Road area to 0.25 ppm, transportation of these soils and sludges to the landfill area, mixing of these soils and sludges with the landfilled sludge, in-situ stabilization of the landfilled sludge as well as stabilization of the soils from the staging area and the Nix Road area, construction of a clay cover over the treated soils to reduce rainwater infiltration and direct contact with the treated soils and sludges, and back filling the excavated areas back up to the original grade. Following source control remediation, deed restrictions, which limit excavation on the Hercules property, will be placed on the Site.

Since this is a innovative use of stabilization on organic contamination, a field-scale treatability study must be conducted early in the remedial design process. If, in EPA's sole discretion, the field-scale treatability study does not indicate that stabilization of the contaminated soils and sludges will achieve the performance standards in paragraph A.3, Alternative #5, chemical extraction, will be used to remediate the Site. The soils in the sludge staging area and the Nix Road area will still be excavated; however, the landfilled sludge will also be excavated. This material will be dewatered and treated by chemical extraction. The treated soils and sludges will be backfilled into the excavated areas.

A.1. The major components of source control to be implemented include:

Based on the comparative analysis summarized in Table 8-1, EPA's preferred cleanup alternative for the Hercules Site is Alternative 4, treatment of affected surface soil and sludge in place by in-situ stabilization. This alternative includes:

- Conducting a field-scale treatability study and implementation of in-situ stabilization of subsurface soils and consolidated surface soils as an innovative application of this technology since EPA has minimal information on stabilization of manufactured pesticides;

- If the treatability study concerning the stabilization of Site soils and sludges fails to meet the required performance standards as set forth in paragraph A.3 and therefore will not be effective if implemented, then implementation of an onsite ex-situ chemical extraction technology on the soils and sludges at the Site (with onsite disposal of the treated material) would occur. This represents Alternative 5 in the ROD.

- For in-situ stabilization, construction of a cover over the treated soils to reduce rainwater infiltration and eliminate direct contact with the treated soil. This cover will meet pertinent RCRA standards. In addition, areas excavated for consolidation of surface soil will be graded and covered with clean, compacted, native fill and brought back up to the original grade. Figure 9-1 indicates (by shading) the major areas to be treated. The landfill cells will be treated in place while the sludge-staging area and the Benedict Road/Nix Road area will be excavated and consolidated into the landfill cells;

- Institutional controls, such as deed restrictions, will be established to preclude any extensive excavation of the Site once the soils remedy is implemented;

- Operation and maintenance of the cover for a minimum of thirty years; and

- Air emissions from the Site will be monitored to ensure compliance with the Clean Air Act. Air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures such as dust suppression or vapor capture will be employed to prevent harmful levels of air emissions from leaving the Site.

The selected alternative for the Hercules site is consistent with the requirements of Section 121 of CERCLA and the National Contingency Plan. The selected alternative will reduce the mobility, toxicity, and volume of contaminated soil at the Site. In addition, the selected alternative is protective of human health and the environment, will attain all Federal and State applicable or relevant and appropriate requirements, is cost effective and utilizes permanent solutions to the maximum extent practicable. The selected alternative for OU #1 is consistent with previous remedial actions conducted at the Site for OU #2.

Based on the information available at this time, the selected alternative represents the best balance among the criteria used to evaluate remedies. Alternative #4 is believed to be protective of human health and the environment, will attain ARARs, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The cost of this alternative is $9,900,000. This alternative will be fully protective of human health and the environment and will meet all Federal and State requirements.

A.2. Treatment of in-situ and consolidated material

Alternative 4 consists of the treatment of affected surface soil and sludge in place by in-situ stabilization. This alternative involves the stabilization of subsurface soil, sludge and consolidated surface soil, followed by the installation of a multimedia cover. The conceptual layout of this alternative is shown on Figure 9-1.

The surface soil remedial action target concentrations were used to determine the excavation locations and boundaries for surface soil. The subsurface soil target concentrations were used to establish vertical and horizontal treatment boundaries for subsurface soil and wastes. A sampling program will be conducted to determine the actual volumes of surface soil and subsurface soil requiring remedial action.

In this alternative, subsurface solids and consolidated surface soil will be treated in place within the landfill. A multimedia cover will be placed over the consolidated, stabilized soil to reduce rainwater infiltration and direct contact with the treated soil. In addition, areas excavated for consolidation of surface soil will be graded and covered with clean, compacted, native fill. Treatment boundaries will approximate the appropriate remedial action boundaries shown on Figure 9-1.

The incremental risk after implementation of this treatment option shall be at least 1.0 x 10[-6] for carcinogenic effects and 0.0003 for the hazard index for a child residing near the Site. Both are within accepted EPA guidelines for risk exposure.

This option includes the use of deep soil mixing equipment that delivers stabilization reagents to the affected solids during mixing operations. The process involves augering into the affected solids to the desired depth using hollow-stem augers. The hollow-stem augers overlap and can vary from two to five augers per assembly. A shallow soil mixing system is also available and uses a single, wide diameter auger rather than an assembly of overlapping augers. Treatment reagents are injected into the disturbed matrix through jets constructed in the auger blades. The reagents can be injected in either a dry, liquid, or slurry form. A system such as this could consist of the following typical unit operations:

- Shallow Soil Mixing Assembly

- Reagent Containers and Feed Systems

Drilling depths are limited, but depths up to 30 feet are reportedly attainable. The specific type of mixing/augering system will be determined during remedial design. Treatment duration will vary by depth and by the amount of mixing required to ensure adequate stabilization. Treatability studies will be necessary during the remedial design phase to select the optimal reagent composition and form. Testing of the solidified treatment zones will also be necessary to ensure that performance requirements are being met. Solidification/stabilization on manufactured pesticides represents an innovative application of this technology since EPA has minimal information on stabilization of manufactured pesticides. The NCP encourages the use of innovative technologies at Superfund Sites. For this reason, and because this application may be effective at the Site, solidification/stabilization treatment will be evaluated during the treatability studies for these waste. If the stabilization process is unsuccessful, alternative #5 (Ex-Situ Chemical Extraction) will be used to treat these wastes. However, implementation of an onsite ex-situ chemical extraction technology on the soils and sludges at the Site (with onsite disposal of the treated material) will occur if the treatability study concerning the stabilization of Site soils and sludges fails to meet the required standards and therefore will not be effective if implemented.

A.3. Performance Standards for Soils

The Performance Standards for this component of the selected remedy include the following excavation and treatment standards:

a. Excavation Standards

Contaminated soils, sludges and related materials shall be excavated from the area of contamination, particularly the sludge staging areas and the Benedict Road/Nix Lane area, and transported to the Hercules 009 landfill for treatment. Excavation shall continue until the remaining soil and material achieve the following maximum toxaphene concentration levels. Testing methods approved by EPA shall be used to determine if the maximum allowable toxaphene concentration levels have been achieved, as follows:

Medium	Performance Goal
Surface Soils	0.25 ppm
Subsurface Soils	76 ppm

b. Treatment Standards

Since the solidification/stabilization technology is not a proven treatment technology for organics, treatment effectiveness will be assessed using the TCLP, Multiple Extraction Procedure and Total Waste Analysis (TWA) methods for the manufactured pesticides at the Site. The stabilized soils from this Site must achieve all of the following four requirements for the technology to be considered effective.

1. The boiling point of the contaminants to be stabilized must be higher than the boiling point of water. During the stabilization process provisions must be made to ensure that none of the contaminants volatilize.The temperature of the process should not exceed 130 degrees F.

2. The TCLP leachate from stabilized/solidified soils would be required to, at a minimum, yield a leachate that does not exceed Maximum Contaminant Levels (MCLs) for the contaminants of concern at the Site.

3. TWA will be utilized and compared to the original analysis of waste using the same extraction procedures. A 90 percent reduction in concentration or mobility of the contaminated soil after treatment is the treatment target. However, the 90 percent reduction in contaminant concentration or mobility is a general guidance and may be varied within a reasonable range considering the effectiveness of the technology and the clean-up goals for the Site. Although this policy represents EPA's strong belief that TWA should be used to demonstrate effectiveness of immobilization, successful achievement of other leachability tests may also be required in addition to TWA to evaluate the protectiveness of the treatment.

4. In addition, the solidification/stabilization mixture is required to achieve a minimum of 50 psi compressive strength and must demonstrate a permeability of 1x10[-6] or less. A professional engineer must certify the soils of the Site have sufficient strength to structurally support the stabilized mass.

5. The rate of disintegration for the stabilization mixture must be determined and that rate be acceptable to EPA.

Soil requiring treatment which do not comply with these standards will be excavated and treated by chemical extraction. During the early stages of the preliminary Remedial Design, the treatment standards will be used to determine the effectiveness of the stabilization technology.

c. Capping Standards

Recovered and condensed hazardous substances shall be treated and disposed of in a manner to be determined in the Remedial Design Phase and approved by EPA. Treatment and disposal shall comply with all pertinent applicable or relevant and appropriate requirements (ARARs), including, but not limited to RCRA and TSCA.

B. GROUNDWATER MONITORING/RESTORATION

Groundwater monitoring will be implemented at this Site to assess any movement of contamination through groundwater. If toxaphene begins tomigrate off the Hercules property, if the other contaminants of concern are shown to be migrating from their current positions, if any levels of the contaminants of concern begin to increase over fifty percent of their current value, or in case it becomes apparent that onsite levels of contaminants in the groundwater will not naturally attenuate below MCLs over time, a contingency pump and treat system will be implemented.

B.1. The major components of groundwater monitoring/restoration to be implemented include:

. Long-term monitoring of groundwater, as well as surface water and sediment in the onsite pond and the adjacent drainage ditch, with the contingency implementation of a pump and treat system in case any of the following occurs: toxaphene begins to migrate off the Hercules property; if the other contaminants of concern are shown to be migrating from their current positions; if any levels of the contaminants of concern begin to increase over fifty percent of their current value; or in case it becomes apparent that onsite levels of contaminants in the groundwater will not naturally attenuate below MCLs over time. The decision to implement a pump and treat system will be at the sole discretion of EPA. Measurable attenuation must be achieved within 5 years after the completion of the soil remedy for the final operable unit for this Site or a pump and treat system will be implemented. During Remedial Design interim goals will be devised for groundwater contaminant levels which indicate at what levels natural attenuation would be expected to reach. Such interim goals will be established for annual intervals. If two consecutive interim goals are not met, a groundwater pump and treat system must be initiated. The groundwater will be pumped to the surface and treated onsite with granular activated carbon. The spent granular activated carbon will be sent to a hazardous waste facility for disposal as necessary. The treated groundwater will either be discharged off-site to a local publicly-owned treatment works, discharged onsite to the onsite pond, or discharged off-site via an NPDES permit. The ultimate fate of the treated groundwater will be determined during the design of the pump and treat system. If MCLs are met for two consecutive annual monitoring periods (either by natural attenuation or pump and treat), groundwater sampling may be discontinued at the discretion of EPA;

. Institutional controls, such as deed restrictions, will be established to preclude usage of groundwater and minimize land use until cleanup levels are achieved;

. Proper abandonment of private wells which were replaced by a municipal water source in OU#2 if the owners are amenable.

B.2. Extraction, Treatment, and Discharge of Contaminated Groundwater

If deemed necessary by EPA, the groundwater will be pumped to the surface and treated onsite with granular activated carbon or other treatment. The spent granular activated carbon will be sent to an appropriate hazardous waste facility for disposal as needed. The treated groundwater will be discharged to a local publicly-owned treatment works. If a discharge permit cannot be obtained, an NPDES permit for discharge to an off-site surface water body will be obtained. If an NPDES permit for discharge to an off-site surface water body cannot be obtained, onsite discharge to the onsite pond will be considered as an alternative.

B.3. Performance Standards for Groundwater

a. Treatment Standards

If the following standards are not met by natural attenuation, groundwater shall be treated until the following maximum concentration levels are attained at the wells to be designated by EPA as compliance points.

Benzene	0.005 mg/l
Nickel	0.1 mg/l
Toxaphene	0.003 mg/l

c. Discharge Standards

Discharges from the groundwater treatment system shall comply with all substantive requirements of the NPDES permitting program under the Clean Water Act, 33 U.S.C. 1251 et seq., and all effluent limits established by EPA.

d. Design Standards

The design, construction and operation of any groundwater treatment system shall be conducted in accordance with all Performance Standards, including the RCRA requirements set forth in 40 C.F.R. Part 264 (Subpart F).

C. Compliance Testing

Groundwater, treated soils, and surface water monitoring shall be conducted at this Site. After demonstration of compliance with all Performance Standards, the Site (including soil and groundwater) shall be monitored for at least five years. If groundwater and soil monitoring indicates that the Performance Standards set forth in Paragraph B.3 are being exceeded at any time after monitoring and/or pumping has been discontinued, extraction and treatment of the groundwater will recommence until the Performance Standards are once again achieved. If monitoring of the treated soil indicates Performance Standards set forth in paragraph A.3 have been exceeded, the effectiveness of the source control component will be re-evaluated.

10.0 STATUTORY DETERMINATION

Under CERCLA section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment through isolating and treating a principal threat by in-situ stabilization of the sludges and soils at the Site. If in-situ stabilization is shown not to be effective through a field-scale treatability study to be conducted, implementation of an onsite chemical extraction remedy will occur. The minimum level of overall protection provided by in-situ stabilization is 1.0 x 10[-6] for the lifetime excess cancer risk and 0.0003 for the hazard index. The additional protection offered by in-situ stabilization/solidification is further enhanced by the short-term protectiveness gained from treatment without excavation of waste materials. Chemical extraction treatment will also provide overall protection of human health and the environment. Source excavation and treatment will minimize the potential for future migration of waste constituents to human receptors and the environment in and around the 009 Landfill Site. Long-term exposure from direct contact with, and inhalation of, affected soil and dusts will be minimized by treatment of all affected soil and sludge. This alternative would reduce the incremental risk posed by direct contact to 1.0 x 10[-6]. The hazard index would be less than or equal to 0.0003 for any specific constituent, because the removal target levels of the sludge and affected soil limits risk to these values. The selected remedy provides protection of human health and the environment by eliminating, reducing, and controlling risk through treatment, engineering controls and/or institutional controls.

Groundwater monitoring will be implemented to ensure that no exposure through ingestion of contaminated groundwater occurs. Currently only a single contaminant in three separate sampling locations are above MCLs at the Site. Therefore, no active remediation is to be immediately implemented for groundwater. However, if contamination in the groundwater does not attenuate to below MCLs, the MCLs would be the performance standard, and an active pump and treat system will be implemented.

10.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions performed under CERCLA must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for the Hercules site were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed the following ARARs.

Clean Air Act

Air emissions from the remedial activities at the Site, including thermal treatment, will be monitored to ensure compliance with the substantive requirements of the Clean Air Act. Air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures such as dust suppression or vapor capture will be employed to prevent harmful levels of air emissions from leaving the Site.

Chemical-Specific ARARs

Maximum Contaminant Levels (MCLs) and non-zero MCLGs (where each is available) are the Groundwater Protection Standards set out in Table 6-2 of this ROD as the remedial action goals. If it becomes apparent that MCLs will not be met due to attenuation, a contingency pump and treat system will be implemented to insure that MCLs/MCLGs are met.

Action-Specific ARARs

All pertinent RCRA standards will be incorporated into the design and implementation of this remedy. The RCRA Land Disposal Restrictions (LDRs) are potential ARARs for remedial actions on the sludge and soil at the 009 Landfill Site. The LDRs are applicable to remedial actions that involve "placement" of restricted RCRA hazardous waste. Land disposal restrictions are not applicable where banned waste is moved, graded, stabilized, or treated insitu, entirely within the original area of contamination, because placement has not occurred, but may be relevant and appropriate. Toxicity Characteristic Leaching Procedure (TCLP) results indicated toxaphene was below detection limits in the waste extract. The Hercules wastewater sludge generated from the production of toxaphene is exempt from listing as a hazardous wastes under RCRA (40 CFR 261) because the sludge was last handled in June 1980. Although not applicable, pertinent aspects of RCRA closure requirements may be relevant and appropriate because a hybrid-landfill closure system will be used unless the contingent remedy, chemical extraction, is utilized. If the contingent remedy is utilized, then RCRA closure requirements may be applicable. If a pump and treat systems becomes necessary, all pertinent National Pretreatment Standards will be met before either off-site or onsite discharge of treated groundwater.

Location-Specific ARARs

Both floodplain and wetlands considerations will be incorporated into the design and implementation of this remedy.

Endangered Species Act

The recommended remedial alternative is protective of species listed as endangered or threatened under the Endangered Species Act. Requirements of the Interagency Section 7 Consultation Process, 50 CFR Part 402, will be met. The Department of the Interior, Fish & Wildlife Service, will be consulted during remedial design to assure that endangered or threatened species are not adversely impacted by implementation of this remedy.

Waivers

Section 121 (d)(4)(C) of CERCLA provides that an ARAR may be waived when compliance with an ARAR is technically impracticable from an engineering perspective. No waivers will be invoked at this Site.

Other Guidance To Be Considered

Other Guidance To Be Considered (TBCs) include health based advisories and guidance. TBCs have been utilized in estimating incremental cancer risk numbers for remedial activities at the sites. The risk data is evaluated relative to the normally accepted point of departure risk range of $1x10^{-4}$ to $1x10^{-6}$.

10.3 COST EFFECTIVENESS

EPA believes this remedy will eliminate the risks to human health at an estimated cost of $9,900,000; therefore, the selected remedy provides an overall effectiveness proportionate to its costs, such that it represents a reasonable value for the money that will be spent.

10.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

EPA and the State of Georgia have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final source control operable unit at the Hercules 009 Landfill Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness, and permanence, reduction in toxicity, mobility or volume achieved through treatment, short-term effectiveness, implementability, cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

By treating the contaminated soils and sludges by stabilization, the selected remedy addresses one of the principal threats posed by the Site through the use of treatment technologies. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Hercules 009 Landfill Site was released for public comment in August, 1992. The Proposed Plan identified Alternative 4, in-situ stabilization, as the preferred alternative. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

APPENDIX B
CONCURRENCE LETTER - HERCULES 009 LANDFILL
RECORD OF DECISION

Georgia Department of Natural Resources
205 Butler Street, S.E., Suite 1252, Atlanta, Georgia 30334
Joe D. Tanner, Commissioner
Harold F. Roheis, Director
Environmental Protection Division

March 23, 1993

Mr. Richard Green
Associate Division Director
Office of Superfund
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

RE: Record of Decision
Hercules 009 NPL Site

Dear Mr. Green:

The Georgia Environmental Protection Division (EPD) has reviewed the Record of Decision, Summary of Remedial Alternative Selection, Operable Unit One for the Hercules 009 Landfill NPL site. EPD concurs with the selected remedy.

If you have any questions, please contact Mr. Michael Laney at (404) 656-2833.

Sincerely,

Harold F. Reheis
Director

HFR/mlb

c: Alan W. Yarbrough
file: Hercules 009(B)