SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

MAXEY FLATS DISPOSAL SITE
FLEMING COUNTY, KENTUCKY

PREPARED BY:
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

DECLARATION STATEMENT

RECORD OF DECISION

MAXEY FLATS DISPOSAL SITE
FLEMING COUNTY, KENTUCKY

SITE NAME AND LOCATION

Maxey Flats Disposal Site, Fleming County, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Maxey Flats Disposal Site, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The remedy selection is based upon the Administrative Record for the Maxey Flats Disposal Site.

The Commonwealth of Kentucky has concurred in the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF REMEDY

This final remedy substantially controls and reduces site risks to an acceptable level through treatment, engineering and institutional controls, and containment. The major components of the selected remedy include:

- Excavation of additional disposal trenches for disposal of site debris and solidified leachate
- Demolition and on-site disposal of site structures

- Extraction, solidification and on-site disposal of approximately three million gallons of trench leachate
- Installation of an initial cap consisting of clay and a synthetic liner
- Maintenance and periodic replacement of initial cap synthetic liner
- Re-contouring of capped disposal area to enhance management of surface water runon and runoff
- Improvements to existing site drainage features to enhance management of surface water runoff
- Installation of a ground water flow barrier, if necessary
- Installation of an infiltration monitoring system to continuously verify remedy performance and detect the accumulation of leachate in disposal trenches
- Monitoring of ground water, surface water, air, selected environmental indicators, and rates of subsidence
- Procurement of a buffer zone adjacent to the existing site property boundary, estimated to range from 200 to 400 acres, for the purposes of preventing deforestation of the hillslopes or other activities which would accelerate hillslope erosion and affect the integrity of the selected remedy, and to provide for frequent and unrestricted access to areas adjacent to the site for the purpose of monitoring
- Five year reviews to evaluate the protectiveness of the remedy and to ensure the selected remedy is achieving the necessary remedial action objectives
- Institutional controls to restrict use of the Maxey Flats Disposal Site and to ensure monitoring and maintenance in perpetuity.

The estimated cost of the selected remedy is $ 33,500,000.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to the remedial action, or obtains a waiver of specified requirements, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Maxey Flats Disposal Site. Because treatment of the principle threats of the site was not found to be practicable; however, this remedy does not satisfy the statutory preference for treatment as a principle element of the remedy.

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

Patrick M Tobin / Deputy for
Greer C. Tidwell
Regional Administrator

SEP 30 1991
Date

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MAXEY FLATS DISPOSAL SITE
FLEMING COUNTY, KENTUCKY

SECTION 1.0 - SITE LOCATION AND DESCRIPTION

1.1 Location

The Maxey Flats Disposal Site (MFDS) is located on County Road 1895, approximately 10 miles northwest of the City of Morehead, Kentucky and approximately 17 miles south of Flemingsburg in eastern Fleming County. Figures 1 and 2 illustrate the site location and site vicinity. The MFDS itself occupies 280 acres of land. Approximately 4.8 million cubic feet of low-level radioactive waste is buried in an approximate 45-acre area, designated as the Restricted Area. Approximately 27 acres within the Restricted Area have been used for the construction of 52 disposal trenches. The Restricted Area also contains storage and warehouse buildings, liquid storage tank buildings, gravel driveways and a parking area. Figure 3 depicts the trenches, trench sumps, and structures within the Restricted Area as well as the extent of a polyvinylchloride (PVC) cover over the 27-acre trench disposal area[1].

1.2 Demographics

Approximately 57 residential structures exist within a 1.0 mile radius of the MFDS, housing approximately 152 persons. In an area between 1.0 and 2.5 miles from the MFDS, 192 residential structures house approximately 511 persons. Therefore, an estimated total of 663 persons live within 2.5 miles of the MFDS (This 2.5 mile radius is hereafter referred to as the study area). Of the estimated 663 persons, an estimated 148 (22.3 percent) are women of childbearing age (15 to 44 years old) and an estimated 148 (22.3 percent) are children (under the age of 14).

Within a one-half mile radius of the MFDS, there exist approximately 11 residences. The actual population of this area is 25 people, 14 male and 11 female. Of the eleven females, seven are of childbearing age. Only two children are present in the population.

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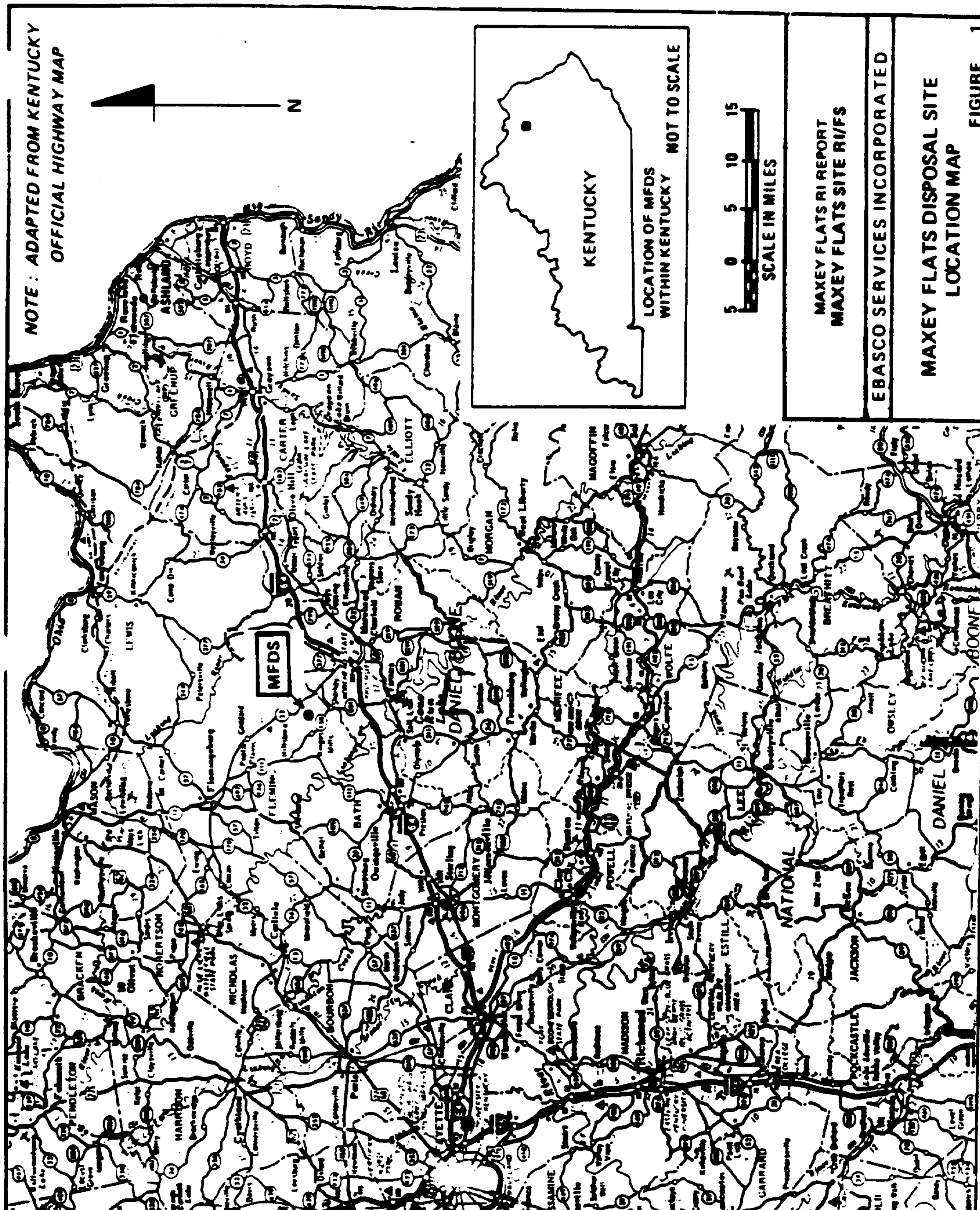
1 - The PVC cover over the trench disposal area currently covers the access road between the trenches; thus, Figure 3 is slightly outdated and does not reflect all of the areas currently covered by the PVC liner.


NOTE: ADAPTED FROM KENTUCKY OFFICIAL HIGHWAY MAP
N
MFDS
KENTUCKY
LOCATION OF MFDS WITHIN KENTUCKY
NOT TO SCALE
5 0 5 10 15
SCALE IN MILES
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
MAXEY FLATS DISPOSAL SITE
LOCATION MAP
FIGURE 1

EXPLANATION

MFDS RESTRICTED AREA

MFDS PROPERTY BOUNDARY

1000 0 1000 2000 3000

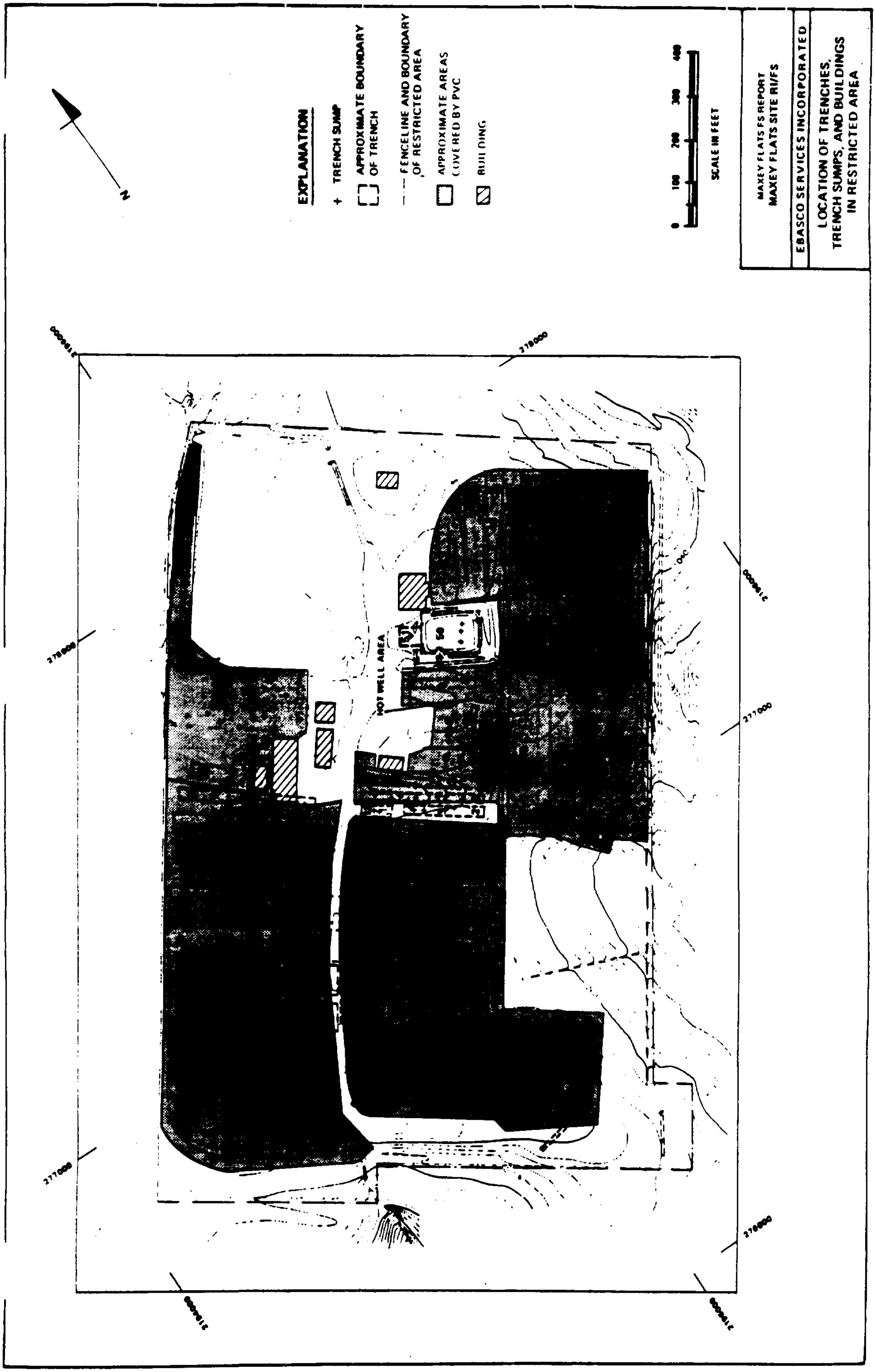
SCALE IN FEET

MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

MAXEY FLATS DISPOSAL SITE
VICINITY MAP

FIGURE 2


N
EXPLANATION
+ TRENCH SUMP
APPROXIMATE BOUNDARY OF TRENCH
FENCELINE AND BOUNDARY OF RESTRICTED AREA
APPROXIMATE AREAS COVERED BY PVC
BUILDING
0 100 200 300 400
SCALE IN FEET
MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
LOCATION OF TRENCHES, TRENCH SUMPS, AND BUILDINGS IN RESTRICTED AREA
HOT WELL AREA

The MFDS study area population represents approximately 5.3 percent of the total Fleming County population. The projected population of the 2.5 mile radius study area will increase from 663 persons in 1985 to a projected population of 767 in 2020, an increase of approximately 15 percent. Additionally, a projected population of 171 women of childbearing age and 171 children will reside in the study area surrounding the MFDS by the year 2020.

1.3 Topography

The MFDS is located in the Knobs physiographic region of Kentucky, an area characterized by relatively flat-topped ridges (flats) and hills (knobs). The MFDS is located on a spur of Maxey Flats, one of the larger flat-topped ridges in the region. The site is bounded by steep slopes to the west, east, and south and is approximately 350 feet above the adjacent valley bottoms.

1.4 Land Use

The land surrounding the MFDS is primarily mixed woodlands and open farmland. A number of residences, farms, and some small commercial establishments are located on roadways near the site.

The two nearest municipalities, the cities of Morehead (approximately 10 miles southeast of the MFDS) and Flemingsburg, Kentucky (approximately 17 miles northwest of the MFDS) have populations of 7,196 and 2,721, respectively. The closest major cities are Lexington to the west, and Huntington, West Virginia, to the east, both about 65 miles from the MFDS.

Transportation in the immediate vicinity of the site is based on a network of secondary roadways, the routes of which are dictated by the local topography of relatively level stream valleys and steep plateau slopes.

The region around the site is rural in character, primarily due to topographic restrictions that limit access to the area and the shortage of land available for development. In the immediate vicinity of the MFDS, within one-half mile, approximately one dozen homes are located along the unpaved roads at the base of the site in Drip Springs Hollow and along Rock Lick Creek, and on top of the plateau along Maxey Flats Road. The slopes in the vicinity of the MFDS are covered mostly with mixed evergreen and deciduous forest land. Wooded areas in the region provide a supply of hardwood timber for the local sawmills and logging industry.

Four small family farms are located within a one-half mile radius of the site. These farms raise beef cattle, swine, goats, and sheep for meat and sale; poultry for eggs; tobacco for sale; and hay and silage as food for their livestock. In addition to the farms, most of the local residences have small vegetable gardens for their private use. Table 1 summarizes the land use within a 2.5 mile radius of the MFDS.

The Maxey Flats region has a public water supply system that is operated by the Fleming County Water Association. Essentially all residents in the area are served by this water system, much of which was installed in 1985. The extent of the water supply system is illustrated in Figure 4.

There are no large-scale commercial and industrial developments, or higher density residential developments in the area within 2.5 miles of the site. In summary, the area surrounding the MFDS is best characterized as a rural, undeveloped area distinguished by low-density housing and rugged topography.

The limited employment base of the area, along with the limited roadway and utilities access, makes large-scale economic expansion in this region unlikely. Future land use can be expected to follow the same historical patterns for the area: small family farms, crop raising, logging activities and moderate growth in population.

1.5 Natural Resources

1.5.1 - Surface Water

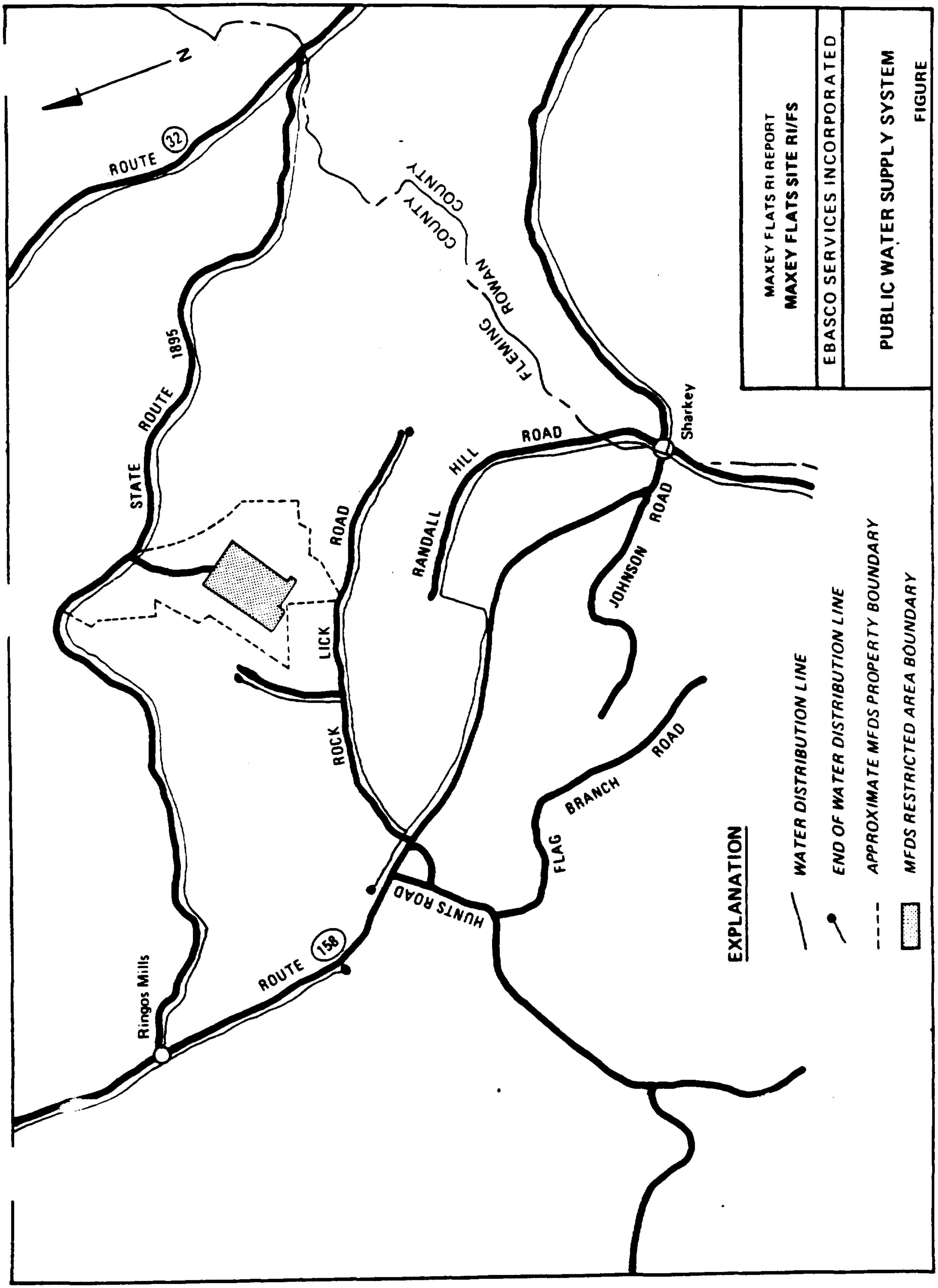
Hillslope runoff at the MFDS typically travels in narrow, high gradient, steep walled channels. These drainage channels connect to the perennial streams that flow along the base of the plateau at the periphery of the MFDS area. These streams, Drip Springs, No Name, and Rock Lick Creeks, flow through relatively level valleys bordered by steep hillslopes. Drip Springs Creek, located on the west side of the site, and No Name Creek, located on the east side of the site, flow into Rock Lick Creek to the southwest of the site. Rock Lick Creek flows into Fox Creek approximately two miles southwest of the MFDS. Fox Creek flows into the Licking River, approximately 6.5 miles west of the MFDS, which in turn empties into the Ohio River near Cincinnati, Ohio, approximately 100 miles from the MFDS.

The perennial streams at the base of the plateau are used as freshwater supplies for livestock raised in the valleys. Fox

TABLE 1

ACREAGE-TABULATION FOR THE AREA WITHIN 2.5 MILES OF THE MFDS

Land Use	Total Acres	Percentage of Primary Study Area
Residential	132	1.0
Other Urban or Built Up Land	44	0.3
Cropland and Pasture	4,885	39.6
Brush Covered Land	167	1.3
Evergreen Forest Land	254	2.1
Deciduous Forest Land	597	4.8
Mixed Forest Land	6,128	49.6
Streams	161	1.3
Primary Study Area	12,368	100


MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
PUBLIC WATER SUPPLY SYSTEM
FIGURE
N
ROUTE 32
STATE ROUTE 1895
ROWAN COUNTY
FLEMING COUNTY
RANDALL HILL ROAD
Sharkey
JOHNSON ROAD
LICK ROCK ROAD
FLAG BRANCH ROAD
HUNTS ROAD
ROUTE 158
Ringos Mills
EXPLANATION
WATER DISTRIBUTION LINE
END OF WATER DISTRIBUTION LINE
APPROXIMATE MFDS PROPERTY BOUNDARY
MFDS RESTRICTED AREA BOUNDARY

Creek is also used for light recreational fishing. The Licking River is used both for recreational purposes and as a source of public drinking water through municipal water systems upstream and downstream of the MFDS. The nearest municipal water intake downstream of the MFDS on the Licking River is located approximately 54 miles from the site.

1.5.2 - Geology and Ground Water

Potential geological resources in the area of Fleming County around the MFDS include building stone, clay and shale, petroleum, oil shale and ground water. With the exception of small amounts of building stone and ground water for private residential use, these geological resources are currently not being exploited.

Ground water resources in the area are very limited, with residential supplies generally available only in the valley bottoms. Ground water quality in the area is generally poor.

Residents in the immediate vicinity of the MFDS have been on public water supply since 1985. Prior to 1985, water was typically obtained from shallow dug wells which reportedly supplied sufficient quantities of water for household use.

1.5.3 - Biota

The region surrounding the MFDS includes many woodlots that are periodically logged for timber. The wooded areas in this region are classified as deciduous, evergreen, or mixed forest land. The hillslopes adjacent to the MFDS are primarily deciduous and include hickories, oak, ash, maple, black gum, tulip-poplar, and beech. Because much of the hillslopes are privately owned, and logging is an active industry in the immediate area, it is possible that the standing timber on these slopes could be harvested in the future.

Wildlife species common to the MFDS area are those associated with the oak-hickory forest of the ridge slopes, the adjacent farmlands, or a mix of these two habitats. This mix benefits such game species as white-tailed deer, woodchuck, opossum, fox squirrel, and migrating woodcock, as well as furbearers such as red fox, gray fox, long-tailed weasel, raccoon, and striped skunk. Rough grouse and gray squirrel are also hunted in the more extensively wooded areas. During late autumn and winter, numerous Canada geese, as well as mallards, wood duck, green-winged teal, and other game waterfowl feed on open crop lands of the region. The acorn and hickory mast produced on the hillslopes of the MFDS probably constitutes an important part of the diet for white-footed mice, deer, squirrel, and turkey.

Several species of sport fish that are native to the Licking River drainage have been collected from Fox Creek including muskellunge, channel catfish, rockbass, spotted bass, largemouth bass, white crappie, various sunfish, and sauger.

There are no federal threatened or endangered species known to exist within the vicinity of the MFDS. Blazing Star, a plant species listed as being of special concern by the Kentucky Preserves Commission, does occur within a 2.5 mile radius of the site, but would not be threatened by any physical activities at the MFDS due to its distance (approximately 1.5 miles) from the site.

1.6 Climate

The climate of the MFDS area is classified as Temperate Continental. The summers are warm with temperatures above 90^{o}F occurring approximately 30 days per year. The winters are cold but not extreme, as temperatures below zero generally occur only a few times per year. Temperatures above 100^{o}F and minimum temperatures as low as -22^{o}F have been recorded in the region.

Average annual precipitation in the MFDS area is approximately 44 inches. A maximum 24-hour precipitation total of 5.8 inches would be expected for a 100-year return period in the area. However, the possibility exists for extreme rainfall events to exceed the 100 year maximum in the MFDS area. Snowfall in the area averages approximately 18 inches per year with the highest monthly average occurring during January.

Wind distribution data for the MFDS area reveals a fairly even annual distribution of wind direction, with the greatest frequency from the south and southwest directions. The average wind speed observed over a 10-year period was 9.7 miles per hour. Average wind speeds are greater during the spring and winter seasons and the greatest percentage of calm wind conditions occur during the summer months. A maximum wind speed of 90 miles per hour associated with a return period of 100 years is estimated for the MFDS area.

SECTION 2.0 - SITE HISTORY AND ENFORCEMENT ACTIVITIES

In 1954, the U.S. Congress passed the Atomic Energy Act which provided for the development and utilization of atomic energy for peaceful purposes. In 1959, Congress amended the Atomic Energy Act of 1954 to provide for State participation in certain regulatory controls on the use of atomic energy. Provisions were made for the federal government to enter into agreements with states on such participation.

As part of a program to encourage nuclear industry in Kentucky, the Kentucky General Assembly created the Division of Nuclear Information in the Kentucky Department of Commerce. The Kentucky General Assembly then passed legislation in 1960 which provided power to the Governor to enter into an agreement with the federal government for the transfer of certain regulatory powers in atomic energy to Kentucky. Also in 1960, the Governor of Kentucky charged the Department of Health with the responsibilities of providing regulations for the licensing of radioactive materials. The Kentucky General Assembly passed legislation in 1962 enabling the Commonwealth of Kentucky (Commonwealth) to purchase lands for the disposal of radioactive waste; the land to be owned and controlled in perpetuity by the Commonwealth. Also in 1962, the Commonwealth became the first state to sign an agreement with the federal government for the transfer of certain regulatory powers in atomic energy and, thus, became what is referred to as an "agreement state". In this agreement, authority was vested in the Commonwealth to license the disposal of low-level radioactive waste. The Atomic Energy Commission retained authority to license the burial of waste from the reprocessing of spent nuclear fuel.

The Kentucky Division of Nuclear Information was succeeded by the Division of Atomic Development, whose responsibilities were then transferred to the newly created Kentucky Atomic Energy Authority in 1962, which eventually became the Kentucky Science and Technology Commission. In 1962 a commercial organization, Nuclear Engineering Company, Inc. (NECO), purchased 252 acres of land in Fleming County, Kentucky, in a knob area known as Maxey Flats and submitted an application to the Kentucky Department of Health for a license to bury radioactive waste at Maxey Flats. Following site evaluations and approval, the Commonwealth issued a license, effective January 1963, to NECO for the disposal of solid by-product, source and special nuclear material at the proposed site, and a contract was negotiated between the Commonwealth (Kentucky Atomic Energy Authority) and NECO. Issuance of this license was contingent upon conveyance of the title of the site to the Commonwealth in accordance with state and federal regulations.

The Kentucky Atomic Energy Authority, in turn, leased this tract of land back to NECO for a twenty-five year period with the option for NECO to renew the lease for another twenty-five year period thereafter. The lease agreement provided for the establishment of a perpetual care fund, requiring a cost per cubic foot of waste disposed, to be paid to the Commonwealth by the operator (NECO).

The first radioactive material was disposed at the Maxey Flats Disposal Site in May 1963. From May 1963 to December 1977, NECO managed and operated the disposal of an estimated 4,750,000 cubic feet of low-level radioactive waste (LLRW) at the MFDS.

In order to protect public health and the environment from exposure, low level radioactive waste must be isolated during the time that its radioactivity is decaying. To achieve this isolation at the MFDS, low level radioactive waste was disposed at the site using shallow land burial. The waste was disposed of in 46 large, unlined trenches (some up to 680 feet long, 70 feet wide and 30 feet deep) which cover approximately 27 acres of land within a 45-acre fenced portion of the site known as the Restricted Area. However, "hot wells" were also used at the MFDS for the burial of small-volume wastes with high specific activity. Most of the "hot wells" are 10 to 15 feet deep, constructed of concrete, coated steel pipe or tile, and capped with a large slab of concrete.

The trench wastes were deposited in both solid and solidified-liquid form. Some wastes arrived at the site in containers such as drums, wooden crates, and concrete or cardboard boxes. Other wastes were disposed of loosely. Fill material (soil), typically 3 to 10 feet in thickness, was then placed over the trenches to serve as a protective cover. After 1977, six additional trenches were excavated for the disposal of material generated on-site, bringing the total number of trenches at the site to 52.

Environmental monitoring, in 1972, by the Kentucky Department of Health (Department for Human Resources) revealed possible migration of radionuclides from the Restricted Area. This monitoring indicated that water entering the trenches had become the pathway by which radioactive contaminants, primarily tritium which is a radioactive form of hydrogen, were beginning to migrate out of the disposal trenches. A special study of the site was conducted by the Commonwealth of Kentucky in 1974 to determine whether the MFDS posed any contamination problem. The study confirmed that tritium and other radioactive contaminants were migrating out of the trenches and that some radioactive material had migrated into unrestricted areas. Various other studies of the MFDS were initiated by the U.S. EPA, U.S. Nuclear Regulatory Commission, U.S. Geological Survey, and the Kentucky Department for Human Resources during the 1970's and 1980's.

The Kentucky Science and Technology Commission was abolished in 1976 and the perpetual care and maintenance responsibilities for the MFDS were transferred to the Kentucky Department of Finance.

In 1977, during construction of Trench 46, it was determined that leachate was migrating through the subsurface geology (approximately 25 feet below ground surface). Subsequently, in December 1977, the Commonwealth ordered NECO to cease the receipt and burial of radioactive waste.

In 1978, the Commonwealth and NECO entered into an agreement under which NECO's twenty-five year contract/lease was terminated. After disposal operations ceased and the lease with NECO was terminated, NECO's license remained in effect, with certain modifications, until 1979 at which time the license was transferred to the Commonwealth. The Commonwealth's operational responsibilities at the MFDS were transferred from the Department of Finance to the Department for Natural Resources and Environmental Protection in 1979, with regulatory responsibilities remaining with the Kentucky Department for Human Resources. Upon transfer of NECO's license to the Commonwealth, private companies such as Westinghouse Electric Corporation (the current site custodian) were hired to stabilize and maintain the site. Stabilization and maintenance activities have included installation of temporary covers over an approximate 27-acre trench disposal area, surface water controls, subsidence monitoring and contaminant monitoring.

From 1973 through April, 1986, an evaporator was operated at the site as a means of managing the large volume of water infiltrating the disposal trenches as well as waste water generated by on-site activities. The evaporator generally operated 24 hours per day, approximately 250 days of the year until 1986, when it was shut down. The evaporator processed more than 6,000,000 gallons of liquids, leaving behind evaporator concentrates which were then stored in on-site, above-ground tanks. Evaporator concentrates were eventually disposed of by the Commonwealth in Trench 50, which was constructed in 1985 and 1986.

In 1981, a polyvinylchloride (PVC) cover was placed over the disposal trenches as a means of minimizing the infiltration of rainfall into the trenches. Liquid storage tanks remained on-site for future storage of site-generated liquids and emergency trench overflow pumping operations. Those steps, however, were temporary.

In 1983, at the request of the Commonwealth, EPA began the process of determining whether the MFDS would be eligible for remediation under CERCLA. In 1984, EPA proposed the MFDS for inclusion on the National Priorities List (NPL) of hazardous waste sites to be addressed under the federal Superfund Program and, in 1986, this listing was finalized.

The MFDS was a primary disposal facility for low-level radioactive waste in the United States during its period of operation. As a result, the list of parties potentially liable for site cleanup, known as Potentially Responsible Parties ("PRPs"), includes more than 650[2] radioactive waste generators and transporters. The generator PRPs[3] include many private companies in the nuclear industry as well as numerous hospitals, research institutions and laboratories. Several federal agencies, including the U.S. Department of Defense (DOD) and U.S. Department of Energy (DOE) are also generators of site waste. The Commonwealth of Kentucky, as the site owner[4] and a generator, is also a PRP.

In 1986, EPA issued general notice letters notifying 832 Potentially Responsible Parties of their potential liability with respect to site contamination and offering them an opportunity to conduct and fund a Remedial Investigation/ Feasibility Study (RI/FS) of the MFDS. In March 1987, eighty-two PRPs signed an Administrative Order by Consent (EPA Docket No. 87-08-C) to perform the RI/FS. This group of PRPs

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2 - If each facility or division of a PRP is treated as a single entity, the number of PRPs totals more than 800.

3 - Some of these radioactive waste generators also disposed of chemical wastes at the MFDS.

4 - The Commonwealth was required by state and federal regulations to own the MFDS property, as is required for all low-level radioactive waste disposal sites.

formed the Maxey Flats Steering Committee (Committee). The Committee has conducted and partially funded the technical work required for the Remedial Investigation/Feasibility Study performed at the site. The largest portion of costs incurred in conducting the RI/FS was paid by DOD and DOE, both named as PRPs but not members of the Maxey Flats Steering Committee.

In November 1988, EPA notified the PRPs of an imminent threat to public health, welfare and the environment posed by the potential release of liquids stored in the on-site storage tanks. The threat arose from the presence of eleven 20,000 gallon tanks in the tank farm building that had been present on-site for 10 to 15 years and whose structural integrity was of great concern. The unstable condition of the filled-to-capacity tanks posed an immediate threat to public health and the environment. The PRPs declined the offer to participate in the removal actions; thus, on December 19, 1988, EPA initiated phase one of the removal.

Phase one consisted of the installation of heaters in the tank farm building to prevent the freezing, and subsequent rupturing, of tank valves and fittings which were submerged under water that had infiltrated the tank farm building. Phase one, which was completed in February 1989, also included the installation of additional storage capacity on-site.

Phase two of the removal was initiated by EPA in June 1989. Phase two began with the solidification of approximately 286,000 gallons of radioactive liquids stored in the eleven tanks and of water that had accumulated on the floor of the tank farm building. Solidification activities were completed in November 1989 and resulted in the generation of 216 blocks of solidified tank and tank floor liquids. Burial of these blocks, which were stored on-site and above-ground, was initiated in August 1991 with completion scheduled for November 1991. Solidification blocks will be disposed in a newly constructed trench within the MFDS Restricted Area.

The Remedial Investigation Report for the MFDS was approved by EPA in July 1989. The Feasibility Study for the MFDS was finalized and, along with the Administrative Record file for the site to date, was submitted to the public in May 1991.

SECTION 3.0 - HIGHLIGHTS OF COMMUNITY PARTICIPATION

Community interest and concern about the MFDS began in 1963 shortly after approximately 252 acres of land was purchased for radioactive waste disposal operations. Area residents reported initially that they were not informed of plans for the property and that authorities provided little or no opportunities for community input to the decision-making process. Area residents also were concerned with methods used to place wastes in the disposal trenches. When the Commonwealth released its 1974 study of the site, findings of elevated radionuclide levels drew the attention of local and national media. In response, citizens in the site community formed The Maxey Flats Radiation Protection Association to investigate site conditions and publicized the need for protection of nearby residents. Organized citizen concern declined for a period after the Commonwealth closed the site to the receipt of wastes in late 1977.

Concern resurfaced in 1979 when area residents learned that tritium was escaping from an evaporator used at the site to reduce the volume of liquids that had accumulated from trench pumping operations. A second group, called the Concerned Citizens for Maxey Flats, formed to organize citizen concerns regarding the tritium releases. This group requested that public water be provided to residents in the Maxey Flats site vicinity. Public water was extended in 1985, by the Fleming County Water Association, after which organized community efforts again subsided. Community members remained concerned, however, that the site should be cleaned up.

The present-day Maxey Flats Concerned Citizens, Inc. (MFCC) has been very active throughout the Remedial Investigation (RI) and Feasibility Study (FS). The MFCC submitted an application to EPA for a Technical Assistance Grant (TAG) in 1988, and on January 13, 1989, EPA provided $ 50,000 to the MFCC for the purpose of hiring technical advisors to help the local community understand and interpret site-related technical information and advise the community on its participation in the decision-making process.

A Community Relations Plan for the MFDS was developed and finalized in 1988, which described the proposed community relations activities, along with a Work Plan describing the technical work to be performed as part of the RI/FS. Pursuant to the Community Relations Plan, information repositories were established into which EPA could place information to keep the public apprised of developments related to the MFDS. Due to the proximity of the site to both the cities of Morehead and Flemingsburg, and the locations of interested citizens, two information repositories were established for the MFDS; one located in the Fleming County Public Library, 303 South Main Cross Street, Flemingsburg, KY 41041; and the second, located in the Rowan County Public Library, 129 Trumbo Street, Morehead, Kentucky, 40351.

Beginning with the Community Relations Plan and the RI/FS Work Plan in February 1988, a number of site-related documents have been placed in the repositories. A draft version of the RI Report was placed in both repositories in November 1988 and the final RI Report was placed in the repositories in September 1989. The revised draft Feasibility Study Report was provided to the MFCC in September 1989; revision pages to the revised draft FS Report were also provided to the MFCC in December 1989, and the final FS Report was submitted to the MFCC and to both information repositories in June 1991. The Administrative Record file, which is a compilation of documents and information considered during the selection of the site remedy, was placed in the Fleming County Public Library on June 12, 1991, and on June 14, 1991 at the Rowan County Public Library.

In addition to the technical reports and documents placed in the repositories, fact sheets summarizing particular site developments have periodically been issued to help keep the public informed about activities at the MFDS. Fact sheets were issued by EPA in September 1987, July 1989 and May 1991. Additionally, fact sheets have been periodically distributed by the MFCC and the Maxey Flats Steering Committee throughout the RI/FS process. On May 30, 1991, EPA mailed more than 600 Proposed Plan Fact Sheets to members of the community, interested parties, and Potentially Responsible Parties, informing them of EPA's preferred remedy and announcing the holding of a public meeting on June 13, 1991.

A number of meetings have also been held regarding developments at the MFDS. EPA held a citizen's information meeting in January 1988, and again in September 1988 at the Fox Valley Elementary School in Wallingford, Kentucky to discuss the activities to be performed as part of the RI/FS. A meeting was held with the MFCC in September 1989 to discuss the development of remedial alternatives in the Feasibility Study. A citizens rally was put on by the MFCC in October 1989 to discuss the RI findings, risk assessment conclusions, and remedy options. In October 1990, the MFCC sponsored a forum on the MFDS (which included EPA, Commonwealth and PRP participation) to discuss the site status. On May 22, 1991, EPA and the Commonwealth of Kentucky held a meeting with landowners adjacent to the MFDS for the purpose of discussing the buffer zone component of the preferred remedy and, on June 13, 1991, EPA sponsored a public meeting at the Ersil P. Ward Elementary School in Wallingford, KY to discuss EPA's preferred remedy for site cleanup as well as other alternatives considered during the FS process. Press conferences and site tours were conducted in October 1987 and June 1991.

The public meeting on the preferred remedy/Proposed Plan, which was held on June 13, 1991, initiated a public comment period which concluded on August 13, 1991. A press release and three local newspaper notices were published announcing the meeting. Prior to the initiation of the public comment period, EPA extended the usual 30-day public comment period on the preferred remedy/Proposed Plan to 60 days due to site complexity, numerous issues involved, number of documents in the Administrative Record file, and a high level of community interest at the site.

A response to the comments received during the public comment period is included in the Responsiveness Summary, which is Appendix A to this Record of Decision. A transcript of the June 13, 1991 public meeting on the preferred remedy/Proposed Plan is included as Appendix C of this Record of Decision.

SECTION 4.0 - SCOPE AND ROLE OF RESPONSE ACTION

The selected remedy presented in this decision document serves as the first and final remedial action for the Maxey Flats Disposal Site. The treatment, containment, engineering and institutional control components of the selected remedy will reduce the potential risks from the site to an acceptable level upon remedy completion. As part of the selected remedy, EPA will require further data collection and analyses to determine the necessity of a horizontal flow barrier as a component of the remedy. If, based on this data collection and analyses, EPA determines that a horizontal flow barrier is necessary, it will be installed as part of this remedial action. The type and location of the barrier will be determined by EPA in consultation with the Commonwealth.

SECTION 5.0 - SUMMARY OF SITE CHARACTERISTICS

The Remedial Investigation (RI), which was initiated at the Maxey Flats Disposal Site (MFDS) in 1987, included the collection of more than 700 samples at, and adjacent to, the MFDS, from environmental media such as trench leachate, ground water, soil and soil water, surface water, and stream sediment. The samples were analyzed for a variety of radiological and non-radiological (chemicals, metals, etc.) constituents. A summary of the sample matrix, number of samples, and type of sample analyses performed during the Remedial Investigation is presented in Table 2.

The environmental analyses conducted during the RI complemented the extensive sampling activities previously performed by the Commonwealth, the United States Geological Survey and national laboratories. The data collected prior to the RI was utilized in the RI to the exent practicable. Sampling activities by the Commonwealth are still continuing.

5.1 Nature and Extent of Contamination

Most of the waste disposed of at the MFDS was in solid form, although some container-enclosed liquids and solidified liquid wastes were accepted during the earlier years of site operation. The wastes were in a variety of containers including cardboard or fiberboard boxes, wooden crates, shielded drums or casks, and concrete blocks. Wastes of low specific activity which were buried in the Restricted Area include paper, trash, cleanup materials and liquids, packing materials, protective apparel, plastics, laboratory glassware, obsolete equipment, radiopharmaceuticals, carcasses of animals, and miscellaneous rubble. Higher activity waste buried in the Restricted Area included sealed sources, irradiated reactor parts, filters, ion-exchange resins, and shielding materials. Transuranic waste, generally associated with glove boxes, gaskets, plastics, rubber tubing, paper, and rags, was also buried at the MFDS.

Information on the types and quantities of chemical wastes buried at the MFDS was generally not recorded at the time of waste burial. However, some Radioactive Shipment Records note the disposal of "Liquid Scintillation Vials" ("LSVs"). LSVs are small vials, generally containing a solvent and a radioactive constituent. LSVs are used in laboratories to count the amount of radioactivity in laboratory samples for diagnostic tests, environmental monitoring and in other industrial and medical applications. The principal hazardous organic constituents associated with liquid scintillation fluids are toluene and xylene.

TABLE 2

REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS PROGRAM

SAMPLE MATRIX	NUMBER OF SAMPLES COLLECTED	CHEMICAL ANALYSES[a]	RADIONUCLIDE ANALYSES[b]
LEACHATE			
15 Trench Sumps	15 + 1 dup[c]	Complete, RCRA	H-3,IG,EXP,C-14
MONITORING WELLS			
8 Producing Wells	16 + 2 dup	Complete, RCRA	H-3,IG,EXP,C-14
2 USGS Wells	4	Complete, RCRA	H-3,IG,EXP,C-14
1 Producing Background Well	2	Complete, RCRA	H-3,IG,EXP,C-14
BOREHOLE SAMPLES			
Soil and Rock	261	none	H-3[t]
SOIL			
Round 1	218 + 12 dup	none	H-3
Round 2	132 + 7 dup	none	H-3,IG
Round 2 (select samples)	16 + 2 dup	Complete, RCRA*	H-3,IG
Food Crop Samples	5 + 1 dup	Complete	H-3,IG
Background	3	Complete	H-3,IG,EXP
SOIL WATER			
1 Producing Well Point	2 + 2 dup	Complete, RCRA	H-3,IG,EXP
SURFACE WATER			
Surface Water	20 + 2 dup	Complete	H-3,IG
Background SW	2	Complete	H-3,IG,EXP
STREAM SEDIMENT			
Sediment	20 + 2 dup	Complete	H-3,IG
Background Sed.	2	Complete	H-3,IG,EXP

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a) Chemical Analyses:
- Complete - Target Compound List (TCL) organic chemicals
  - Target Analyte List (TAL) inorganic chemicals
- RCRA - pH, sulfide screen, ignitability screen
- RCRA* - pH, sulfide screen, ignitability screen, acid reactivity, base reactivity, water reactivity

b) Radionuclide Analyses:
- H-3 - Tritium
- H-3[t] - Tritium analyzed by on-site laboratory
- IG - Isotopic Gamma
- EXP - Expanded: Sr-90 and gross alpha; if gross alpha was greater than 0.015 pCi/ml, then analyses for Ra-226, and isotopic Pu and U were also performed
- C-14 - Carbon-14

c) dup = duplicate sample

The total volume of waste received from off-site and buried at the MFDS has been estimated at approximately 4.8 million cubic feet. Of this volume, the activity of by-product material alone (material that has become radioactive by neutron activation in nuclear reactors), disposed of at the MFDS, has been estimated at 2.4 million Curies. Much of this material was reported as mixed fission products; thus, the total activity from by-product waste may be underestimated. Other wastes disposed of at the MFDS include Special Nuclear Material (Plutonium, Uranium-233 and enriched Uranium-235) and source material (Uranium and Thorium, not including Special Nuclear Material).

In addition to the wastes received from off-site sources, on-site operations have generated material which includes waste from ground surface grading, trench leachate pumping, evaporator operation, and general waste handling. Wastes generated from on-site activities have been disposed of, in solid form, in newly constructed trenches within the site's Restricted Area. Trenches 48 and higher contain waste generated from on-site activities. Trench dimensions and volumes are presented in Table 3.

5.1.1 - Trench Characteristics

The RI estimated that a total of approximately 2.8 million gallons of leachate are in the disposal trenches. The RI, as well as previous investigations, concluded that there is a large range of contaminant concentrations in samples collected from trenches in different parts of the Restricted Area. Additionally, site records indicate that samples (tritium, gross alpha and beta particle analyses) from the same trench sump yield varying concentrations at different times.

Fifteen trench sumps were sampled during the RI. Trench sump sampling locations are illustrated in Figure 5. The trench leachate was found to contain a variety of radionuclides (of which tritium is the most predominant), as presented in Table 4. In general, the non-radiological, chemical concentrations in trench leachate samples were low. The dominant chemical constituents detected were solvents, chelating agents, phthalate esters, hydrocarbons, phenolics, ethers, and carboxylic acids. Concentrations of chemical constituents ranged from non-detect to less than 10 ppm. (See Table 5.) A review of pre-RI trench data indicates that the total organic carbon (TOC) concentration was variable among the trenches sampled, with TOC values ranging from 460 to 3300 ppm. The results of inorganic sample analyses are presented in Table 6. In general, trench leachate appeared

TABLE 3

TRENCH DIMENSIONS, VOLUMES AND BURIAL PERIODS[1]

Trench Number	Dimensions L x W x D (feet)	Trench Volume (cu ft x 1000)	Trench Number	Dimensions L x W x D (feet)	Trench Volume (cu ft x 1000)
1	162 x 10 x 15	24	26	300 x 50 x 10	150
1S	78 x 25 x 15	29	27	350 x 70 x 18[2]	441
2	79 x 25 x 15	30	28	350 x 70 x 18	441
3	275 x 15 x 15	62	29	350 x 70 x 18	441
4L	44 x 15 x 15	10	30	360 x 75 x 22	594
5S	68 x 15 x 14	14	31	360 x 76 x 22	602
6L	44 x 15 x 14	9	32	350 x 70 x 22	539
7	242 x 15 x 15	54	33L	350 x 50 x 10[3]	150
8L	50 x 15 x 13	10	34	140 x 24 x 10[4]	34
9L	32 x 15 x 12	6	35	300 x 70 x 20	420
.0	300 x 30 x 15	135	36	200 x 20 x 18	72
11S	300 x 30 x 12	108	37	200 x 20 x 18	72
12L	35 x 10 x 8	3	38	200 x 50 x 17	68
13L	15 x 10 x 8	1	39	200 x 50 x 16	160
14L	15 x 9 x 5	1	40	686 x 70 x 30	1,441
15	300 x 50 x 12	180	41	255 x 20 x 10	51
16L	15 x 10 x 8	1	42	650 x 70 x 30	1,365
17L	30 x 15 x 10	5	43	614 x 50 x 30	921
18	275 x 40 x 9	99	44	681 x 55 x 30	1,124
19S	300 x 40 x 10	120	45	145 x 55 x 32	255
20	300 x 40 x 12	144	46	190 x 50 x 15	143
21L	300 x 42 x 15	189	47	150 x 34 x 15	77
22	300 x 20 x 12	72	48	100 x 40 x 15	60
23	300 x 60 x 10	180	49	200 x 30 x 15	90
24	300 x 50 x 10	150	50	65 x 45 x 20	58
25	300 x 30 x 11	99	51	43 x 46 x 15	30

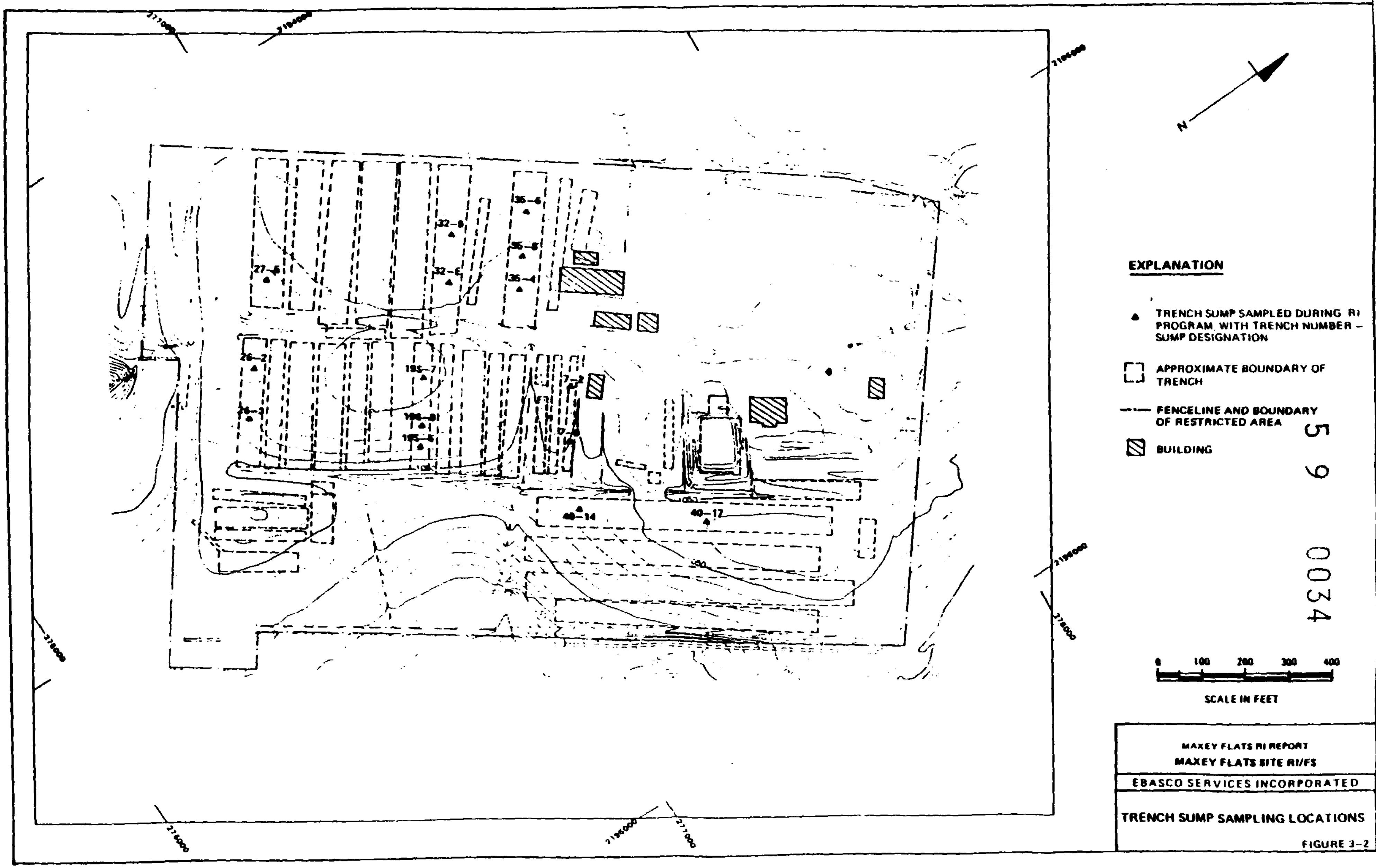
[1] - Source for information on Trenches 1 through 46, except Trench 34, from Westinghouse Hittman Nuclear, Inc., 1984 and Zehner, 1983.

[2] - East end of Trench 27 is deeper than west end.

[3] - Actual trench area is estimated to be approximately 33 percent of the areal dimensions. Depth is based on the average depth of sumps and depth range in Zehner (1983).

[4] - Source: Photo Science, Inc., 1983.

FIGURE 5



59 0034

TABLE 4

RADIONUCLIDES IN TRENCH LEACHATE (RI PROGRAM ANALYSES)
(concentrations in pCi/ml)

SUMP #	TRITIUM	C-14	Na-22	Co-60	Sr-90	Cs-137	Ra-226	U-233/234	U-235	U-238	Pu-238	Pu-239/240
7-2	230000+/- 10000	<10	<0.1	0.4+/-0.1	830 +/- 60	1.5+/-0.1	0.030+/-0.002	0.26 +/- 0.01	0.012 +/-0.001	0.106 +/-0.005	0.042+/- 0.004	0.0009+/-0.0005
7-9	162000+/- 8000	<10	<0.1	1.5+/-0.1	380 +/- 20	9.9+/-0.5	0.161+/-0.008	0.160+/ 0.008	0.009 +/-0.001	0.169 +/-0.008	0.025+/- 0.002	0.0004+/ 0.0002
19S-6	62000+/- 3000	<10	<0.1	0.3+/-0.1	2000 +/-100	<0.1	0.660+/ 0.03	0.05 +/- 0.02	<0.002	0.008 +/-0.005	69 +/- 7	0.07 +/-0.04
19S-7	58000+/- 3000	20+/-10	<0.1	0.5+/-0.1	185 +/- 10	18 +/-4	0.560+/-0.03	0.080+/- 0.004	0.002 +/-0.001	0.003 +/-0.001	7.4 +/- 0.7	0.09 +/-0.01
19S-8	190000+/- 10000	<10	0.07+/-0.02	1.4+/-0.1	190 +/- 10	<0.1	0.320+/-0.02	0.40 +/- 0.04	0.023 +/-0.007	<0.005	92 +/-20	<0.02
26-2	152000+/- 8000	<10	<0.1	0.5+/-0.1	0.07+/- 0.2	4.3+/-0.2	0.050+/-0.003	0.012+/- 0.002	<0.0004	0.0007+/-0.0005	1.6 +/- 0.7	4 +/-2
26-3	260000+/- 10000	<10	<0.1	2.5+/-0.2	144 +/- 72	4.4+/-7	0.350+/-0.002	0.006+/- 0.002	<0.0005	0.0008+/-0.0005	3.1 +/- 0.3	1.3 +/-0.1
27-5	1370000+/- 70000	<10	<0.1	0.3+/-0.1	2.6 +/- 0.2	5.7+/-0.2	0.630+/-0.03	0.26 +/- 0.01	0.0020+/-0.0008	0.0006+/-0.0005	64 +/-22	0.7 +/-0.2
32-9	2200000+/- 500000	<10	<0.1	0.7+/-0.1	3.2 +/- 0.2	<0.1	0.008+/-0.004	9.4 +/- 0.7	0.12 +/-0.03	0.03 +/-0.02	34 +/- 4	1.3 +/-0.2
32-9[d]	2600000+/- 800000	<10	0.04+/-0.02	0.9+/-0.1	2.4 +/- 0.1	<0.1	0.003+/-0.002	9.1 +/- 0.3	<0.02	0.029 +/-0.006	26 +/- 2	1.0 +/-0.1
32-E	6300000+/-1500000	<10	0.05+/-0.03	2.9+/-0.2	68 +/- 4	1.0+/-0.1	0.002+/-0.002	130 +/-12	<0.1	0.18 +/-0.04	32 +/- 5	0.24 +/-0.05
35-4	8700000+/- 400000	<10	<0.1	0.5+/-0.1	3.1 +/- 0.2	30 +/-2	0.042+/-0.004	2.3 +/- 0.1	0.100 +/-0.01	0.77 +/-0.05	320 +/-60	0.6 +/-0.1
35-6	12000000+/-5000000	<10	<0.1	1.0+/-0.1	6.4 +/- 0.3	7.4+/-0.2	0.022+/-0.001	1.18 +/- 0.06	0.022 +/-0.007	0.49 +/-0.02	2.9 +/- 0.2	0.035 +/-0.004
35-8	2100000+/- 100000	<10	<0.1	0.1+/-0.2	14.1 +/- 0.7	0.5+/-0.1	0.005+/-0.003	14.2 +/- 0.7	0.440 +/-0.06	4.00 +/-0.03	0.42 +/- 0.03	0.021 +/-0.005
60-14	3300000+/-1000000	<10	<0.1	1.7+/-0.1	3.7 +/- 0.2	8.2+/-0.2	0.014+/-0.004	0.12 +/- 0.01	0.008 +/-0.004	<0.005	6.2 +/-0.4	0.027 +/-0.007
60-17	2400000+/- 300000	<10	<0.1	4.2+/-0.2	0.96+/- 0.2	7.0+/-0.4	0.037+/-0.002	0.21 +/- 0.01	0.012 +/-0.003	0.075 +/-0.007	90 +/-10	1.6 +/-0.2

d = Duplicate sample

59 0035

TABLE 5

RESULTS OF ORGANIC CHEMICAL ANALYSES FOR TRENCH LEACHATE (RI PROGRAM ANALYSES)
(concentrations in ppb)

Sump	Acetone	Benzene	Toluene	Xylene	Ethyl-benzene	Methylene chloride	Chloro-form	Vinyl chloride	Chloro-ethane	1,1 Dichloro-ethane	1,2 Dichloro-ethene	Phthalate esters	Naph-thalene	2-Methyl phenol	4-Methyl phenol
07-2	<10	<5	<5	51	21	<5	<5	<10	<10	<5	<5	<10	<10	<10	<10
07-9	<10	<5	<5	10	<5	<5	<5	<10	12	<5	<5	<10	<10	<10	<10
19S-6	<10	<5	<5	77[j]	<5	<5	<5	<10	2700	210	<5	<10	<10	<10	<10
19S-7	<10	290	2900	300	<5	120[j]	<5	150[j]	<10	54[j]	75[j]	<10	770[j]	48	100
19S-8	<10	12	6[j]	12	<5	6[j]	<5	12[j]	250	140	11	390	<10	<10	<10
26-2	200[j]	<5	<5	<5	<5	<5	<5	<10	<10	<5	<5	<10	<10	<10	<10
26-3	<10	<5	<5	<5	<5	<5	<5	<10	<10	36[j]	<5	<10	<10	<10	<10
27-5	<10	100	810	400	50	<5	<5	<10	66[j]	<5	<5	<10	300[j]	<10	<10
32-9	130[j]	21[j]	1300	150	<5	<5	<5	41[j]	<10	<5	<5	<10	59	<10	45
32-9[d]	120[j]	29[j]	1700	270	22[j]	<5	23[j]	61[j]	<10	24[j]	<5	<10	58	74	380
32-E	<10	<5	<5	<5	<5	<5	<5	<10	<10	<5	<5	<10	<10	<10	<10
35-4	<10	<5	<5	<5	<5	<5	<5	<10	<10	<5	<5	<10	160	140	320
35-6	<10	22	1500	3100	43	<5	<5	24	<10	13	<5	<10	420	31	<10
35-8	<10	<5	5300	4400	35	<5	<5	<10	<10	<5	<5	<10	280	100	130
40-14	<10	<5	<5	8[j]	<5	17[j]	<5	<10	540	120	<5	<10	<10	<10	<10
40-17	170[j]	48	11	93	10	<5	<5	<10	<10	22	<5	<10	<10	<10	<10

Miscellaneous Organic Chemicals Present in Only a Few Trenches

Sump	Chemical	concentration	Chemical	concentration	Chemical	concentration	Chemical	concentration
07-2	Bis(2Cl-Et)ether	210						
07-9	Bis(2Cl-Et)ether	10	Benzyl alcohol	16				
19S-7	Bis(2Cl-Et)ether	14	1,2-Dicl-benzene	35	2,4-Dimethylphenol	85		
19S-8	Tricl-ethene	10						
27-5	1,2-Dicl-benzene	11[j]	2,4-Dimethylphenol	42[j]	1,4-Dicl-benzene	10[j]		
32-9[d]	Benzoic acid	300[j]						
35-4	2-4 Dimethylphenol	1500						
35-6	Carbon disulfide	11	4-Me-2-pentanone	21	Tetracl-ethene	7	2,4-Dimethylphenol	32
	1,2-Dicl-ethane	6						
35-8	4-Me-2-pentanone	27						
40-14	1,1,1-Tricl-ethane	27						

Note: Cl = chloro Et = ethyl Me = methyl

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.
d) Duplicate Sample

TABLE 6

RESULTS OF INORGANIC ANALYSES FOR TRENCH LEACHATE (RI PROGRAM ANALYSES)
(concentrations in ppb)

SUMP	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	V	Zn
07-2	<200	<60	<10	3310[j]	<5	<5	28910	<10	<50	<25	12280[j]	<5	44540	43	<0.2	<40	156330[j]	5.4[r]	<10	285500	<10	<50	23[j]
07-9	<200	<60	<10	15937[j]	7.6	<5	7350	19	<50	<25	ND	9.2[r]	64190	34	<0.2	157[j]	140630[j]	<5	<10	479800	<10	<50	20[j]
19S-6	<200	<60	<10	1163[j]	<5	<5	30380	14	<50	<25	23120[j]	17.6[r]	139520	50	0.2[jn]	1066[j]	20400[j]	<5	<10	282400	<10	<50	38[j]
19S-7	<200	70	<10	1850[j]	<5	<5	41350	15	<50	<25	27800[j]	6.9[r]	168220	62	<0.2	624[j]	45940[j]	<5	<10	ND	<10	<50	416[j]
19S-8	<200	<60	<10	824[j]	<5	<5	24350	13	86	150[j]	11110[j]	18.0[r]	171020	148	0.5[jn]	1264[j]	23440[j]	<5	<10	ND	<10	<50	206[j]
26-2	<200	<60	<10	994	<5	<5	10220	<10	<50	<25	14910	6.1[j]	90070	42[j]	<0.2	78[j]	39910[j]	<5	<10	290000[j]	<10	<50	279[j]
26-3	<200	<60	<10	457	<5	<5	9670	16	<50	<25	9840	5.2[j]	161750	46[j]	<0.2	253[j]	51410[j]	<5	<10	366000[j]	<10	<50	121[j]
27-5	<200	<60	<10	16270	<5	13[j]	199120	<10	<50	<25	93940	<5	290430	4490[j]	<0.2	118[j]	82480[j]	<5	<10	520000[j]	<10	<50	980[j]
32-9	<200	<60	12[r]	1364	<5	<5	21040	42	<50	<25	9170[j]	7.1[r]	109240	99400	<0.2	63[j]	276090[j]	<5	<10	1591300	<10	<50	223[j]
32-9[d]	<200	<60	<10	1038	<5	<5	18460	45	<50	<25	7810[j]	<5	98600	79	<0.2	63[j]	223270[j]	<5	<10	1593500	<10	<50	176[j]
32-E	<200	<60	20[r]	410	<5	<5	10100	11	<50	<25	1670[j]	<5	177890	62	<0.2	160[j]	129360[j]	<5	17[j]	1649300	45[r]	<50	28[j]
35-4	390	<60	341[r]	1956	<5	<5	24370	13	<50	<25	3580[j]	<5	246090	185	<0.2	76[j]	202370[j]	<5	13[j]	1601100	<10	<50	21[j]
35-6	<200	<60	56[r]	439	<5	<5	26260	<10	<50	<25	1020[j]	<5	218550	300	<0.2	<40	63880[j]	<5	<10	1340500	<10	<50	<20
35-8	<200	<60	72[r]	<200	<5	<5	7000	16	<50	268[j]	7580[j]	19.3[r]	33670	106	<0.2	<40	47840[j]	7.6[r]	<10	2870900	<10	<50	22[j]
40-14	<200	<60	<10	298	<5	<5	23990	<10	<50	<25	11830	6.0[j]	155670	63[j]	<0.2	109[j]	116040[j]	<5	<10	633000[j]	<10	<50	176[j]
40-17	<200	<60	22[r]	2680	<5	<5	19200	11[j]	<50	<25	14900	22.1[j]	106000	67	<0.2	100[j]	150000[j]	<5	<10	866000	<10	<50	<20

RESULTS OF CYANIDE AND TOTAL PHENOLICS ANALYSES FOR TRENCH LEACHATE (RI PROGRAM ANALYSES)
(concentrations in ppb)

Sump	Cyanide	Total Phenolics
07-2	<10	34[r]
07-9	<10	24[r]
19S-6	<10	41[r]
19S-7	10[j]	128[r]
19S-8	21[j]	16[r]
26-2	<10	81[r]
26-3	<10	36[r]
27-5	<10	111[r]
32-9	129[j]	147[r]
32-9[d]	90[j]	31[r]
32-E	179[j]	67[r]
35-4	<10	35[r]
35-6	17[j]	13[r]
35-8	<10	22[r]
40-14	<10	20[r]
40-17	<10	17[r]

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.
jn) Estimated value and tentative identification
r) Rejected result due to exceeding a data validation criterion.
ND) No Data
d) Duplicate sample

to be highly buffered and exhibited near-neutral pH values. The trench samples yielded negative results for RCRA screening tests for sulfide and ignitability. Additionally, organic and inorganic analyses performed on the trench leachate samples indicated that EP Toxicity and Toxicity Characteristic Leachability Procedure (TCLP) test results would also be negative for those samples. Table 7 presents the results of RCRA analyses performed on trench leachate samples.

5.1.2 - Geology and Ground Water

Maxey Flats is located in the Appalachian Plateau, in the Knobs physiographic region of northeast Kentucky. The MFDS lies in a tectonically stable region of North America with few exposed faults and relatively infrequent earthquakes. However, minor damage from earthquakes has been reported in the region from recent earthquakes, one of which occurred in 1988, having a magnitude of 4.5 on the Richter Scale with an epicenter approximately 25 miles southwest of the MFDS.

Figure 6 illustrates the rock units exposed in the area surrounding MFDS which consist of shale, siltstone, and sandstone ranging in age from the Silurian to Mississippian (320 to 430 million years old). In the MFDS area, the rock units dip 25 feet/mile (0.3 degrees); regionally they dip to the east at 30 to 50 feet/mile.

The Nancy Member of the Borden Formation is exposed on the hilltop at the MFDS and is 27 to 60 feet thick. The unit is mostly shale with two laterally extensive siltstone beds, the Lower Marker Bed (LMB) and Upper Marker Bed (UMB). These beds are 0.2 to 2.8 feet thick where encountered during drilling operations at the MFDS.

Underlying the Nancy Member, the Farmers Member of the Borden Formation is characterized as an interbedded siltstone and shale, approximately 29 to 42 feet thick. Underlying the Farmers Member is the four to seven feet thick shale of the Henley Bed, 17 to 18 feet thick Sunbury Shale, and 21 feet thick Bedford Shale.

Fractures are present in all rock units at the MFDS, with fracture sets oriented, in descending order, northeast-southwest, northwest-southeast, and north-south. The fracture sets are generally within 20 degrees of vertical. The weathered shale of the Nancy Member is the most highly fractured. Most ground water available for sampling during the RI was obtained from fractures of geologic units. Figure 7 identifies the location of monitoring wells sampled for ground water.

TABLE 7

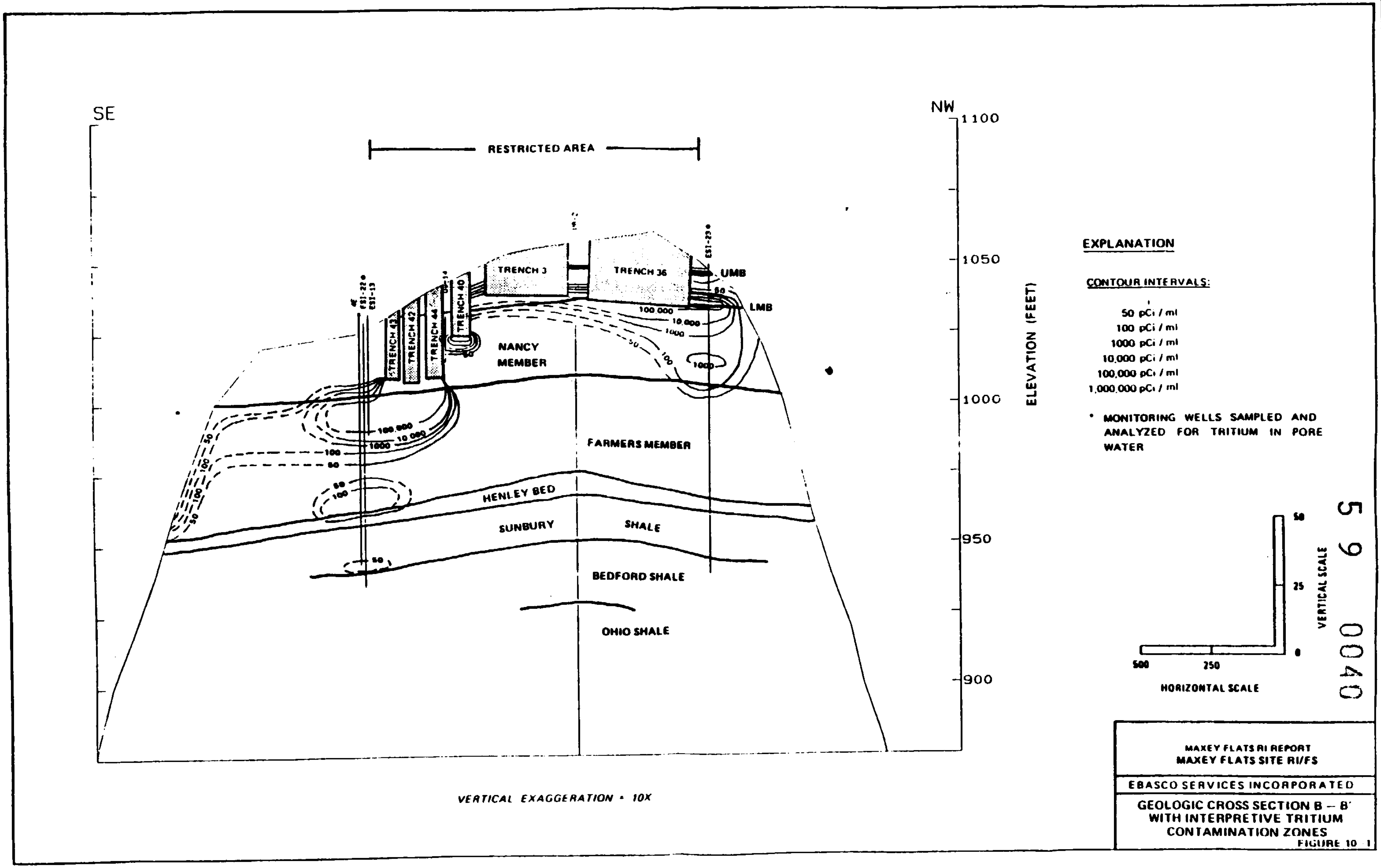
RESULTS OF RCRA ANALYSES FOR TRENCH LEACHATE

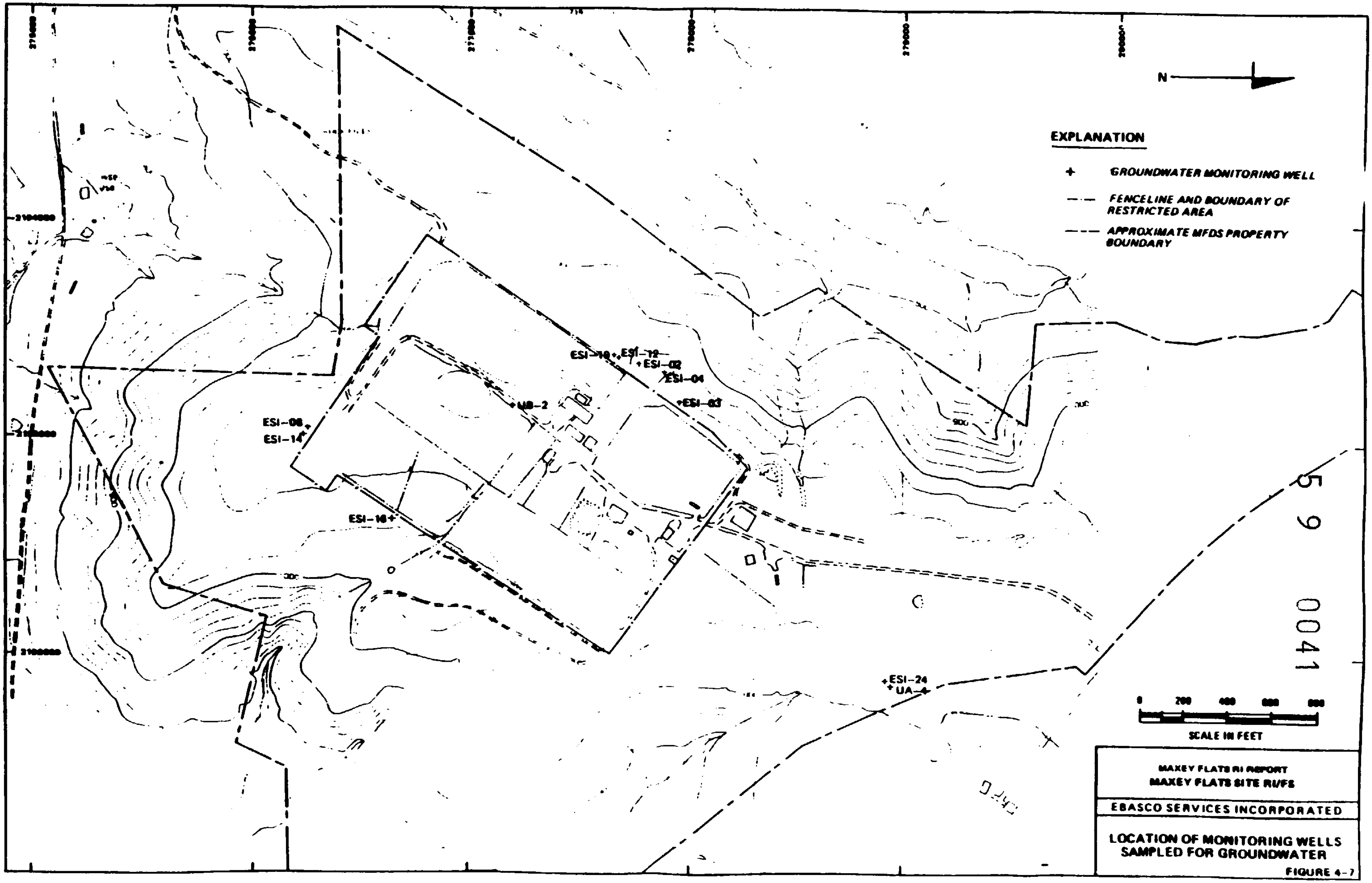
TRENCH SUMP	pH	SULFIDE SCREEN	IGNITABILITY SCREEN
7-2	7.50	Neg	Neg
7-9	7.83	Neg	Neg
19S-6	7.32	Neg	Neg
19S-7	7.33	Neg	Neg
19S-8	7.66	Neg	Neg
26-2	7.80	Neg	Neg
26-3	8.03	Neg	Neg
27-5	5.07	Neg	Neg
32-9	7.83	Neg	Neg
32-9[d]	7.89	Neg	Neg
32-E	8.49	Neg	Neg
35-4	8.05	Neg	Neg
35-6	8.24	Neg	Neg
35-8	8.65	Neg	Neg
40-14	7.57	Neg	Neg
40-17	8.14	Neg	Neg

Neg) Negative results
d) Duplicate sample

Note: Organic and inorganic analyses performed on the trench leachate samples indicated that EP Toxicity test results would be negative.

FIGURE 6


SE
NW
RESTRICTED AREA
TRENCH 3
TRENCH 36
TRENCH 43
TRENCH 42
TRENCH 44
TRENCH 40
UMB
LMB
NANCY MEMBER
FARMERS MEMBER
HENLEY BED
SUNBURY SHALE
BEDFORD SHALE
OHIO SHALE
100,000
10,000
1000
100
50
1100
1050
1000
950
900
ELEVATION (FEET)
EXPLANATION
CONTOUR INTERVALS:
50 pCi / ml
100 pCi / ml
1000 pCi / ml
10,000 pCi / ml
100,000 pCi / ml
1,000,000 pCi / ml
• MONITORING WELLS SAMPLED AND ANALYZED FOR TRITIUM IN PORE WATER
VERTICAL SCALE
50
25
0
500
250
HORIZONTAL SCALE
VERTICAL EXAGGERATION • 10X
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
GEOLOGIC CROSS SECTION B – B' WITH INTERPRETIVE TRITIUM CONTAMINATION ZONES
FIGURE 10 1
59 0040


N
EXPLANATION
GROUNDWATER MONITORING WELL
FENCELINE AND BOUNDARY OF RESTRICTED AREA
APPROXIMATE MFDS PROPERTY BOUNDARY
ESI-10
ESI-12
ESI-02
ESI-04
ESI-03
MB-2
ESI-06
ESI-14
ESI-16
ESI-24
UA-4
SCALE IN FEET
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
LOCATION OF MONITORING WELLS SAMPLED FOR GROUNDWATER
FIGURE 4-7

59 0041

The distinguishing feature of the Nancy Member, and perhaps that of the site's geology, is the Lower Marker Bed of the Nancy Member. The LMB is a thin siltstone layer that is generally flat-lying (some local undulations of the bed are present, however), fractured and weathered, and lies approximately 15 to 25 feet below ground surface. The LMB is the principal leachate flow pathway at the MFDS and underlies or intersects the majority of disposal trenches. Consequently, the LMB is a highly contaminated geologic unit at the MFDS. Another distinguishing characteristic of the LMB is that underlying units are hydraulically connected to the LMB. However, rates and quantities of flow to the underlying units are, most likely, low.

It is estimated that the maximum total flow rate away from the Restricted Area and through the LMB represents 70 percent of the entire flow system at the MFDS. The volume of LMB exfiltration to the hillslopes has been estimated at approximately 159 gallons per day, at a minimum. The total flow from the LMB and lower lying beds has been estimated at 227 gallons per day.

Vertical migration between geological strata is limited by shale layers of low permeability, which act as aquitards. On the west side of the site, trench leachate migrates horizontally through fractures of the Lower Marker Bed, which lies approximately 15 feet below ground surface in that area. On the east side of the site, the 40 series trenches, which commonly bottom near the top of the Farmers Member (approximately 40 feet below ground surface), leach tritium and other contamination to the Farmers Member. Because the MFDS is bounded on three sides by steep slopes, the contaminated leachate migrating horizontally through the fractured siltstone layers generally moves into the bottom of the soil layer on these hillslopes. However, as evidenced by the occurrence of seeps on the east hillside, not all leachate migrates to the bottom of the soil layer on the hillslopes.

Hydrogeologic evaluations of the MFDS indicate that ground water movement through the rock strata to the disposal trenches may be negligible. However, a potential pathway for ground water flow into the trenches would be through the narrow neck at the north side of the site where the MFDS trench area is connected to the main portion of the Maxey plateau. Because of present water mounding at the site (i.e., there is a higher potentiometric surface at the center of the site than at the edges), the tendency is for water/leachate to migrate outwardly from the site rather than into it. Furthermore, even if the trend were reversed, the ground water migration into the trenches is anticipated to be minimal for two reasons. First, the very limited permeability of the various rock strata (except through fractures) would preclude significant migration. Second, due to the natural geological configuration of the MFDS plateau and the narrow land bridge connecting the MFDS to the remainder of the plateau, ground water flowing south toward the trenches would very likely migrate and drain into the natural gullies to the east and west of the connecting land bridge rather than migrate the longer distance into the trenches. Further modeling, monitoring, and data evaluation are planned to assess hydrogeologic conditions at the MFDS.

Tritium is the predominant radionuclide detected in ground water, as confirmed during the RI. Samples taken from monitoring wells in the Lower Marker Bed had higher tritium concentrations (up to 2,000,000 pCi/ml) than samples taken from deeper geologic units, with the highest tritium concentrations detected on the west side of the Restricted Area. Other radionuclides detected include cobalt-60, carbon-14, strontium-90, radium-226, uranium-233/234, uranium-235, uranium-238, plutonium-238, and plutonium-239/240. These tritium concentrations and the presence of other radionuclides indicate that the contamination was caused by trench leachate. Table 8 summarizes the results of radionuclide analyses on ground water samples collected during the RI.

Non-radionuclide analyses in monitoring wells indicate the presence of organics and inorganics such as benzene, toluene, xylenes, arsenic, total phenolics and cyanide. The highest concentrations of non-radionuclides were detected in wells completed in the LMB on the west side of the Restricted Area, which also had the highest radiological contamination. Tables 9 through 11 present the results of organic, inorganic and RCRA analyses on ground water samples collected during the RI.

The LMB and the Farmers Member are the two principal geological formations at the MFDS by which leachate migrates to the hillslopes.

5.1.3 - Soils

Soil cover on the hillslopes in the MFDS area averages five feet thick, but ranges from 0.5 to greater than 18 feet thick. The soil types are generally an upper soil unit of clayey silt, and a lower soil unit of silty clay.

TABLE 8

RADIONUCLIDE CONCENTRATIONS IN GROUND WATER
(concentrations in pCi/ml)

Well	Sampling Date	Tritium	C 14	Sr-90	Co-60	Cs-137	Ra-226	U 233/234	U 235	U 238	Pu 238	Pu 239/240
ROUND 1												
ESI-02	03/05/88	1200000+/-200000	<10	0.03 +/-0.02	0.4 +/-0.1	<0.1	0.0008+/-0.0003	0.025 +/ 0.003	0.0008+/ 0.002	0.0015+/ 0.0006	0.14 +/-0.01	0.002 +/ 0.001
ESI-03	03/03/88	880000+/-120000	<10	0.19 +/-0.01	0.6 +/-0.1	<0.1	0.0008+/-0.0003	0.105 +/-0.007	<0.0008	0.0024+/ 0.0009	0.134 +/-0.009	0.0010+/ 0.0008
ESI-03[d]	03/03/88	880000+/-120000	<10	0.09 +/-0.01	0.5 +/-0.1	<0.1	0.0008+/-0.0004	0.100 +/-0.008	<0.0007	0.0016+/-0.0010	0.14 +/-0.01	0.0024+/-0.0008
ESI-04	03/08/88	300000+/- 40000	<10	0.007+/-0.002	0.5 +/-0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-08	03/02/88	730+/- 100	<10	0.25 +/-0.01	<0.1	<0.1	0.0012+/-0.0003	0.0014+/-0.0005	<0.0002	0.0005+/ 0.0003	0.009 +/-0.002	0.0012+/ 0.0008
ESI-12	03/08/88	11000+/- 2000	<10	0.049+/-0.005	0.004+/-0.02	<0.1	ND	ND	ND	ND	ND	ND
ESI-14	02/24/88	970+/- 100	<10	12.6 +/-0.6	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-16	03/15/88	<10	<10	0.010+/-0.003	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-19	03/06/88	2000000+/-300000	<10	0.013+/-0.007	0.7 +/-0.1	<0.1	0.0007+/-0.0004	0.092 +/ 0.005	<0.0006	0.0029+/-0.0007	0.36 +/ 0.04	0.003 +/ 0.002
ESI-24	03/15/88	<10	<10	0.01 +/- 0.01	<0.1	<0.1	ND	ND	ND	ND	ND	ND
UB-2	03/22/88	<10	<10	0.017+/-0.002	<0.1	<0.1	0.013 +/-0.001	0.010 +/-0.001	<0.0003	0.005 +/ 0.001	<0.003	0.005 +/ 0.002
UA-4	03/20/88	<10	<10	0.027+/-0.002	<0.1	<0.1	0.42 +/-0.02	0.0034+/-0.0007	0.0003+/ 0.0002	0.0018+/ 0.0005	0.00005+/-0.0002	<0.0001
ROUND 2												
ESI-02	04/19/88	960000+/- 50000	<10	<0.004	0.4 +/- 0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-03	04/20/88	660000+/- 30000	<10	0.16 +/- 0.01	0.5 +/- 0.1	<0.1	0.0005+/-0.0001	0.092 +/-0.005	<0.0004	0.0017+/ 0.0005	0.049 +/ 0.004	<0.002
ESI-04	04/19/88	350000+/- 20000	<10	0.005+/- 0.002	0.5 +/- 0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-08	04/20/88	630+/- 30	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-12	04/21/88	14600+/- 700	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-14	04/21/88	620+/- 30	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-16	04/22/88	98+/- 5	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
ESI-19	04/22/88	260000+/- 10000	<10	0.44 +/- 0.03	0.8 +/- 0.1	<0.1	0.00044+/-0.00009	0.091 +/-0.005	<0.0003	0.0024+/-0.0005	0.18 +/ 0.01	0.0012+/ 0.0003
ESI-19[d]	04/22/88	270000+/- 10000	<10	0.18 +/- 0.01	0.8 +/- 0.1	<0.1	0.00048+/-0.0001	0.094 +/-0.006	0.004 +/-0.001	0.0043+/-0.0008	0.20 +/ 0.01	0.0012+/ 0.0003
ESI-24	04/22/88	<10	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
UB-2	04/26/88	<10	<10	<0.005	<0.1	<0.1	ND	ND	ND	ND	ND	ND
UA-4	04/25/88	170[a]+/- 10	<10	<0.005	<0.1	<0.1	0.066 +/-0.003	0.008 +/-0.001	0.0008+/-0.0004	0.0051+/-0.0008	0.0023 +/-0.0007	<0.0004

a) Result suspect; independent analyses performed in the Kentucky Cabinet of Human Resources laboratory on a duplicate sample had a tritium concentration of 2.0 +/-0.2 pCi/ml (Volpe, 1988)
d) Duplicate sample
ND) No Data, analyses not performed for these alpha emitters (Ra-226 and isotopic U and Pu) because gross alpha was less than 0.015 pCi/ml

59 0044

TABLE 9

ORGANIC CHEMICAL CONCENTRATIONS IN GROUNDWATER
(concentrations in ppb)

ORGANIC CHEMICAL	LOWER MARKER BED													
	ESI-3		ESI-3[d]	ESI-4		ESI-2		ESI-19		ESI-19[d]	ESI-8		ESI-14	
	R1	R2	R1	R1	R2	R1	R2	R1	R2	R2	R1	R2	R1	R2
Acetone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzene	86	66	86	<5	9	18	25	65	96	84	<5	<5	<5	<5
Toluene	7	<5	9	<5	<5	<5	<5	<5	6	<5	7	<5	<5	<5
Naphthalene	<10	<10	<10	<10	<10	<10	<10	10[j]	<10	<10	<10	<10	<10	<10
Vinylchloride	76	45	97	<10	<10	<10	<10	29	40	37	<10	<10	<10	<10
Chloroform	<5	<5	<5	24	21	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1 Dichloroethene	6	<5	8	<5	<5	6	6	9	<5	<5	<5	<5	<5	<5
1,2 Dichloroethane	12	12	13	<5	6	<5	<5	5	8	7	<5	<5	<5	<5
1,2 Dichloroethene	57	48	69	6	11	6	9	34	57	52	<5	<5	<5	<5
Trichloroethene	100	93	96	9	17	<5	7	32	63	55	<5	<5	<5	<5
Chlorobenzene	<5	9	11	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

ORGANIC CHEMICAL	LOWER MARKER BED/ LOWER NANCY		LOWER NANCY		UPPER FARMERS		OHIO SHALE		OHIO SHALE	
	ESI-24		ESI-12		ESI-16		UB-2		UA-4	
	R2	R2	R1	R2	R1	R2	R1	R2	R1	R2
Acetone	<10	<10	<10	<10	14[j]	<10	200[j]	2200[j]	<10	<10
Benzene	<5	<5	<5	<5	<5	<5	<5	<5	12	12
Toluene	<5	<5	<5	<5	<5	22	5	<5	12	7
Phenol	<10	<10	<10	<10	<10	<10	<10	500	<10	290
Carbon disulfide	<5	<5	<5	<5	<5	<5	<5	<5	<5	8
Vinylchloride	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroform	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1 Dichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2 Dichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2 Dichloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.
R1) Round 1 Sample
R2) Round 2 Sample
d) Duplicate Sample

59 0045

TABLE 10

INORGANIC CHEMICAL CONCENTRATIONS IN GROUNDWATER
(concentrations in ppb)

LOWER MARKER BED

INORGANICS	ESI-03		ESI-03[d]	ESI-04		ESI-02		ESI-19		ESI-19[d]	ESI-08		ESI-14	
	R1	R2	R1	R1	R2	R1	R2	R1	R2	R2	R1	R2	R1	R2
Al	<200	<200	<200	4100[j]	469[j]	2110[r]	852[j]	<200	<200	<200	1260[j]	<200	<200	<200
Sb	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60
As	57	44[r]	57	25[j]	29[r]	46	60[r]	66	67[r]	90[r]	<10	<10	<10	<10
Ba	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Be	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cd	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5
Ca	150000	147000	149000	151000	156000	139000	143000	109000	98900	103000	64610	62400	63910	61100
Cr	<10	<10	<5	19[j]	<10	17[j]	<10	<10	<10	<10	24[j]	46[j]	<10	<10
Co	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cu	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Fe	5860	5460	5670	5680	1110	19100[r]	12900	3540[j]	3190	3320	2750	661	<100	<100
Pb	<5	<5	<5	<5	<5	46[j]	<5	66	<5	<5	<5	<5	<5	<5
Mg	157000	162000	155000	140000	154000	216000	218000	158000	154000	161000	115000	110000	96440	95900
Mn	4870	4780	4770	282	429	4040	3980	3840	3470	3640	44	29	3615[j]	3680
Hg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4[jn]	<0.2	<0.2	<0.2
Ni	60[j]	61	66[j]	65	55	178[j]	120	<40	<40	<40	<40	59	74[j]	90
K	9780	8610	9800	13300	12900	14600	9820	14900	14300	13700	8380	7020	8690[j]	7290
Se	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ag	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Na	361000	344000	362000	288000	272000	425000	394000	466000	399000	415000	280000	261000	237000[j]	204000
Tl	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
V	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Zn	<20	<20	<20	31	782[r]	<20	<20	<20	65[r]	<20	34	<20	<20	<20
Cyanide	<10	<10	<10	<10	<10	<10	<10	10[j]	12[j]	12[j]	<10	<10	<10	<10
Phenolics	<10	<10	<10	<10	<10	<10	<10	32[r]	17[j]	14[j]	<10	<10	<10	10[j]

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.
jn) Estimated value and tentative identification.
r) Rejected results due to exceeding a data validation criterion.
R1) Round 1 Sample.
R2) Round 2 Sample.
d) Duplicate Sample.

5 9 0046

INORGANIC CHEMICAL CONCENTRATIONS IN GROUNDWATER
(concentrations in ppb)

INORGANICS	LOWER MARKER BED/ LOWER NANCY ESI-24 R1	R2	LOWER NANCY ESI-12 R1	R2	UPPER FARMERS ESI-16 R1	R2	OHIO SHALE UB-2 R1	R2	OHIO SHALE UA-4 R1	R2
Al	4670	2740	3960[j]	1390[j]	700[j]	2470[j]	<200	2060[j]	50[j]	1960[j]
Sb	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60
As	<10	<10	<10	<10	<10	<10	16[r]	<10	<10	<10
Ba	<200	<200	<200	<200	<200	<200	1140	3380	7270	3770
Be	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cd	<5	<5	<5	<5	<5	<5	<5	<5	8	5[j]
Ca	126000	109000	366000	319000	196000	173000	295000	211000	NA	1800000
Cr	32[j]	23[j]	23[j]	10[j]	<10	13[j]	<10	<10	11[j]	19[j]
Co	<50	<50	<50	<50	<50	<50	<50	66	<50	64
Cu	<25	<25	<25	<25	<25	<25	101	203	1730	974
Fe	11200	6850	7070	3380	1440	5180	2270	40700	34700	54500
Pb	<5	<5	<5	<5	<5	<5	<5	77	107[j]	353
Mg	145000	136000	379000	349000	292000	279000	70900	53600	517000	372000
Mn	406	377	164	127	112	140	235	806	2080	2170
Hg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ni	52[j]	45	<40	<40	47[j]	49	<40	67	54[j]	105
K	21400	11700	16600	13700	26200	23000	28000	19300	70500	53300
Se	<5	<5	<5	<5	<5	<5	110	<5	219	<5
Ag	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Na	268000	222000	295000	264000	279000	251000	3940000	2460000	12900000	9450000
Tl	<10	<10	<10	<10	<10	<10	<10	<10	39[j]	<10
V	73	66[r]	<50	<50	<50	<50	<50	<50	<50	<50
Zn	<20	<20	20	<20	<20	<20	159	384[r]	770	2670[r]
Cyanide	<10	<10	<10	<10	<10	<10	34[j]	56[j]	<10	<10
Phenolics	<10	<10	<10	<10	<10	<10	89[r]	1020[j]	54[r]	487[j]

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.
r) Rejected results due to exceeding a data validation criterion
NA) Not Analyzed
R1) Round 1 Sample
R2) Round 2 Sample
d) Duplicate Sample

59 0047

TABLE 11

RESULTS OF RCRA ANALYSES FOR GROUND WATER

WELL	pH	SULFIDE SCREEN	IGNITABILITY SCREEN
ESI-2	8.13	Neg	Neg
ESI-3	8.04	Neg	Neg
ESI-3[d]	8.08	Neg	Neg
ESI-4	7.61	Neg	Neg
ESI-8	7.20	Neg	Neg
ESI-12	8.00	Neg	Neg
ESI-14	6.85	Neg	Neg
ESI-16	NA	NA	NA
ESI-19	8.02	Neg	Neg
ESI-24	7.26	Neg	Neg
UA-4	6.77	Neg	Neg
UB-2	7.25	Neg	Neg

Neg) Negative Results
NA) Not Analyzed
d) Duplicate Sample

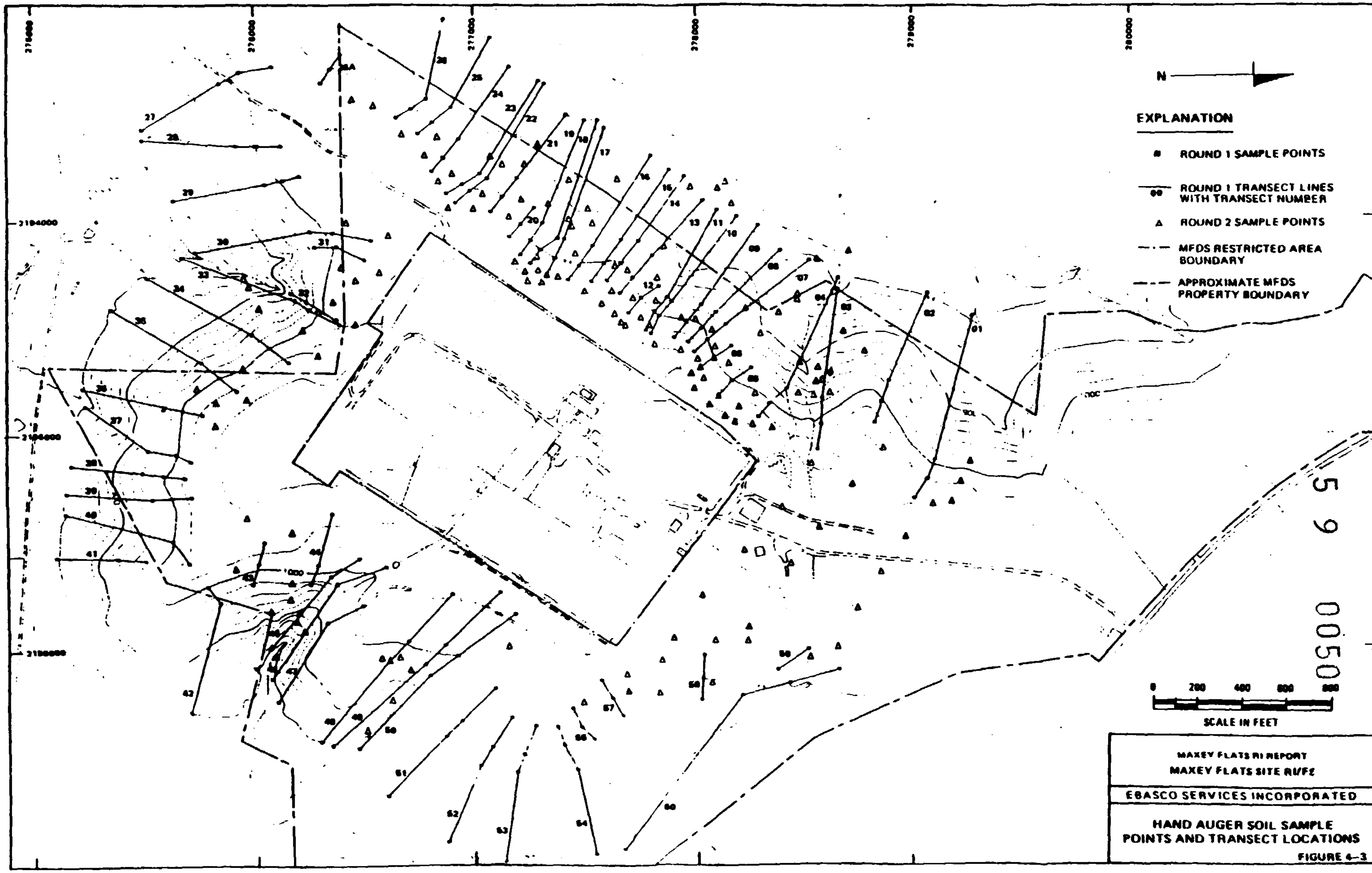
Note: Organic and inorganic analyses performed on these samples indicated that EP Toxicity test results would be negative.

Figure 8 identifies the locations of soil samples obtained from hand augers during the RI. In the soils on the three slopes adjacent to the site, tritium is the predominant contaminant, with the largest contaminated areas and highest levels of tritium contamination on the upper part of the northwest side of the site (north of the Western Series trenches). Tritium concentrations ranged from non-detect to 560,000 pCi/ml. The soil analyses, in conjunction with the ground water and trench leachate analyses, indicate that tritium has migrated through the fractured LMB from the trenches toward the west hillslope and has subsequently migrated down-slope along the soil/rock interface. Additionally, elevated tritium concentrations (50 to 420 pCi/ml) were observed near the center of the east slope, below an outcrop of the fractured Farmers Member. See Figure 9. This tritium originated in the 40 Series trenches on the east side of the site, which were excavated to near the top of the upper Farmers Member. Other site-related radionuclides detected in soils at the MFDS include cobalt-60 (0.3 pCi/gram) and cesium-137 (0.1 - 0.8 pCi/gram). Previous testing along the soil-rock interface by the Commonwealth indicated the presence of additional radionuclides such as strontium-90, carbon-14, and plutonium-238 and -239. Table 12 provides the concentration ranges of radionuclides in RI soil samples.

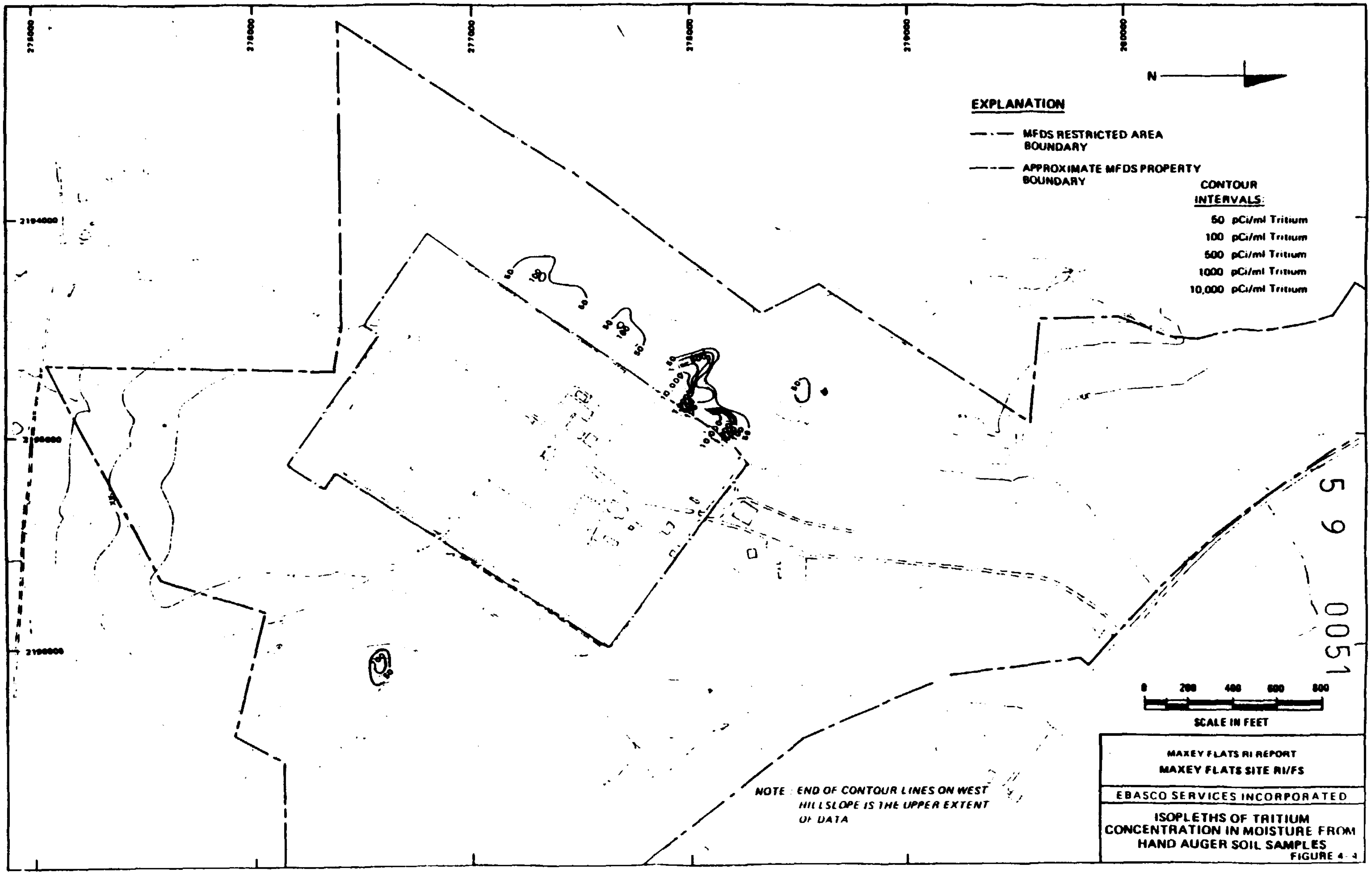
Toluene was the most widely detected chemical contaminant at the MFDS, ranging from 40 to 250 ppb. Other volatile organic contaminants detected in soils include acetone and methylene chloride in low concentrations. Pesticides, PCBs, and semi-volatile contaminants were not detected in soils of the MFDS study area, with the exception of one pesticide, Dieldrin, which was detected in a food crop study area (See discussion below). All soil samples displayed inorganic concentrations within ranges considered normal for soils, with the exception of Arsenic, which was detected at 60 to 106 ppm. Tables 13 and 14 provide the concentration ranges for organic and inorganic analyses, respectively, performed on site soil samples during the RI. As indicated in Tables 15 and 16, negative results were reported for the RCRA parameters tested for soil and soil water. Organic and inorganic analyses performed on these soil samples indicate that EP toxicity and TCLP test results would also be negative.

Samples collected in the food crop study area (See Figure 10 for sample locations) indicate no site-related contamination in these off-site locations. Dieldrin, a pesticide, was detected in one food crop sample but is related to farming activities rather than the site.

FIGURE 8



59 0050


N
EXPLANATION
MFDS RESTRICTED AREA BOUNDARY
APPROXIMATE MFDS PROPERTY BOUNDARY
CONTOUR INTERVALS:
50 pCi/ml Tritium
100 pCi/ml Tritium
500 pCi/ml Tritium
1000 pCi/ml Tritium
10,000 pCi/ml Tritium
SCALE IN FEET
NOTE : END OF CONTOUR LINES ON WEST HILLSLOPE IS THE UPPER EXTENT OF DATA
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
ISOPLETHS OF TRITIUM CONCENTRATION IN MOISTURE FROM HAND AUGER SOIL SAMPLES
FIGURE 4-4

5 9 0051

TABLE 12

CONCENTRATION RANGES OF RADIONUCLIDES IN SOIL
(concentrations in pCi/ml or pCi/gram)

Radionuclide	Background Soil[a]	Food Crop Study Area	Hand Auger Soils
Tritium	<10[b]	<10	<10-560,000
K-40	20.0-26.0	7.0-22.0	<1.0-31.0
Cs-137	<0.1	<0.1-0.30	<0.1-0.80
Ra-226	0.80-1.10	<0.1-0.30	<0.1-9.40
Th-232	1.10-1.40	0.70-1.50	0.50-1.80
U-238	<2.0	<2.0	<2.0-14.0
Co-60	<0.1	<0.1	<0.1-0.3

a) Daniel Boone National Forest
b) One background tritium analysis discounted by laboratory review (Sample BK-3, See Appendix B, Section 4.2.1 of RI Report)

TABLE 13

CONCENTRATION RANGES OF ORGANIC CHEMICALS IN SOIL SAMPLES
(concentrations in ppb)

Chemical	Background Soil[a]	Food Crop Study Area	Hand Auger Soils
Methylene Chloride	<5	<5	<5-6
Chloroform	<5	<5	<5
Toluene	5[j]-35	7-180	<5-250[b]
Acetone	<10	<10	<10-36[j]
2-Butanone	<10	<10	<10
Di-n-octyl phthalate	<330	<330	<330
Dieldrin	<16	<16-290	<16
Phenanthrene	<330	<330	<330
Fluoranthene	<330	<330	<330
Pyrene	<330	<330	<330

a) Daniel Boone National Forest
j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution
b) Estimated value due to the detector's response being outside of the detector's linear range

TABLE 14

CONCENTRATION RANGES OF INORGANIC CHEMICALS IN SOIL SAMPLES
(concentrations in ppm)

Analyte	Background Soil[a]	Food Crop Study Area	Hand Auger Soils
Al	8540-11100	7090-10100	2980-10900
Sb	<12	<12	<12
As	<2-14.6[j]	<2-27.1[r]	6.7[j]-106.0[j]
Ba	45[j]-64	<40-95	<40-163
Be	<1	<1	<1-8.8
Cd	<1	<1	<1
Ca	<1000	<1000-1330	<1000-2180
Cr	15.0-18.4	10.5-16.5	6.4-18.8[j]
Co	11.3-14.6	<10-26.2	<10-25.5
Cu	9.3-15.7	<5-61.2	<5-53.7
Fe	21400-28500[j]	15200-31400	16000-95200
Pb	<1-19.8	12.7-33.2	2.4-39.6
Mg	2770[j]-3030	<1000	<1000-4260
Mn	98[j]-250[j]	371[j]-850[j]	8[j]-538[j]
Hg	<0.04	<0.04-0.06[jn]	<0.04-0.20[jn]
Ni	28-44[j]	<8-22	<8-63[j]
K	<1000-1890[j]	<1000-1280	<1000-2160
Se	<1	<1	<1-4.2[j]
Ag	<2	<2	<2
Na	<1000	<1000	<1000-1880
Tl	<2-5.2[j]	<2	<2-3.4
V	21-28[j]	24-72	<10-276
Zn	49-67	<4-90	6-298
Cyanide	<2	<2	<2
Phenolics	<2	<2	<2

a) Daniel Boone National Forest
j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution
jn) Estimated value and tentative identification

TABLE 15

RESULTS OF RCRA ANALYSES FOR HAND AUGER SOIL SAMPLES (ROUND 2)

LOCATION	pH	SULFIDE	IGNITABILITY	ACID REACTIVITY HCL / H2SO4	BASE REACTIVITY	WATER REACTIVITY
03T-32	3.9	Neg	Neg	Neg / Neg	Neg	Neg
05-10	4.6	Neg	Neg	Neg / Neg	Neg	Neg
05A-35	4.0	Neg	Neg	Neg / Neg	Neg	Neg
06-10	5.5	Neg	Neg	Neg / Neg	Neg	Neg
06-10[d]	5.7	Neg	Neg	Neg / Neg	Neg	Neg
06-20	6.2	Neg	Neg	Neg / Neg	Neg	Neg
11A-00	4.4	Neg	Neg	Neg / Neg	Neg	Neg
12A-30	4.4	Neg	Neg	Neg / Neg	Neg	Neg
12A-30	4.5	Neg	Neg	Neg / Neg	Neg	Neg
13A-38	4.2	Neg	Neg	Neg / Neg	Neg	Neg
17-10	5.2	Neg	Neg	Neg / Neg	Neg	Neg
17-10[d]	4.5	Neg	Neg	Neg / Neg	Neg	Neg
18A-00	4.6	Neg	Neg	Neg / Neg	Neg	Neg
43A-10	4.6	Neg	Neg	Neg / Neg	Neg	Neg
48-30	5.4	Neg	Neg	Neg / Neg	Neg	Neg
50A-05	5.5	Neg	Neg	Neg / Neg	Neg	Neg
58A-05	3.9	Neg	Neg	Neg / Neg	Neg	Neg
58A-15	6.8	Neg	Neg	Neg / Neg	Neg	Neg

Neg = Negative test results
d = Duplicate sample

Note: Organic and inorganic analyses performed on these samples indicated that EP Toxicity test results would be negative.

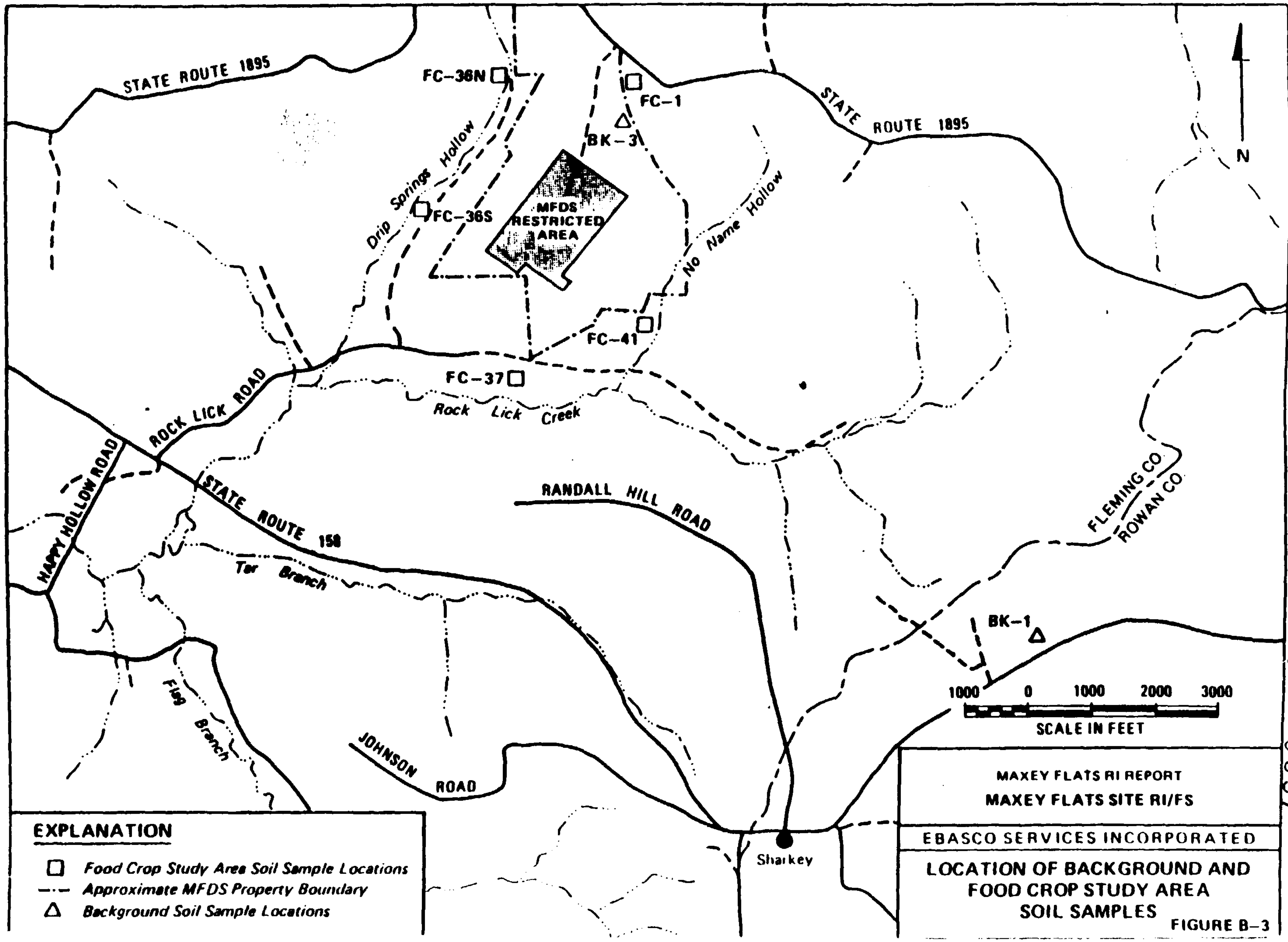
TABLE 16

RESULTS OF RCRA ANALYSES FOR SOIL WATER

	Date Sampled	pH	Sulfide Screen	Ignitability Screen
WP-1	03/07/88	7.39	Neg	Neg
WP-1[d]	03/07/88	7.44	Neg	Neg
WP-1	04/19/88	6.40	Neg	Neg
WP-1[d]	04/19/88	6.30	Neg	Neg

d) Duplicate sample
Neg) Negative results

Note: Organic and Inorganic analyses performed on these samples indicated that EP Toxicity test results would be negative.


STATE ROUTE 1895
FC-36N
FC-1
BK-3
STATE ROUTE 1895
N
Drip Springs Hollow
FC-36S
MFDS RESTRICTED AREA
No Name Hollow
FC-41
FC-37
ROCK LICK ROAD
Rock Lick Creek
HAPPY HOLLOW ROAD
STATE ROUTE 158
RANDALL HILL ROAD
FLEMING CO
ROWAN CO
Tar Branch
BK-1
1000 0 1000 2000 3000
SCALE IN FEET
Flag Branch
JOHNSON ROAD
Sharkey
EXPLANATION
Food Crop Study Area Soil Sample Locations
Approximate MFDS Property Boundary
Background Soil Sample Locations
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
LOCATION OF BACKGROUND AND FOOD CROP STUDY AREA SOIL SAMPLES
FIGURE B-3

5.1.4 - Surface Water and Sediments

Surface water and sediment investigations during the RI involved the collection and analyses of samples from surface water runoff leaving the Restricted Area (which exits through three water control structures located at the periphery of the Restricted Area) and off-site creeks which receive runoff from the MFDS as well as from off-site sources. Figure 11 illustrates the locations of surface water and sediment sample collection during the RI.

Tritium (10 to 60 pCi/ml) and Radium-226 (0.26 pCi/gram [Rock Lick Creek] and 0.29 pCi/gram [Drip Springs Hollow]) were the only radionuclides detected in the surface water samples during the RI. Concentrations of tritium were highest at the water control structures adjacent to the Restricted Area and decreased with distance away from the Restricted Area. The principal sources of tritium entering these structures are contaminated liquids that have migrated from the trenches to the hillslopes through fractured bedrock and atmospheric releases of tritium from the trenches. The concentration ranges of radionuclides in surface water samples are presented in Table 17.

The Commonwealth of Kentucky has detected Strontium-90 in surface water in the East Main Drainage Channel. The Commonwealth has also detected Strontium-90 in the east pond, at the east pond outlet, and in the south drainage area. Additionally, the Commonwealth has detected tritium concentrations in various site drains in excess of 1000 pCi/ml.

Analytical results from the RI indicate low concentrations (ranging from 5 ppb to 98 ppb) of chemical constituents in surface water. Chemical contaminants detected in surface water samples were limited to acetone, 2-butanone, chloroform, toluene, bis(2-ethylhexyl)phthalate, and hexachlorobenzene. Concentration ranges of organic and inorganic chemicals are presented in Tables 18 and 19, respectively.

In conjunction with the surface water sampling program during the RI, sediment samples were collected at the same locations (See Figure 11). Sediment sample analyses indicated tritium in concentrations ranging from 10 to 70 pCi/ml. Tritium concentrations were greater at the water control structures adjacent to the Restricted Area than at the more distant stream sampling stations. Other radionuclide concentrations in sediment moisture were within the range of background concentrations. (See Table 20 for concentration ranges of radionuclides in stream sediment samples.)

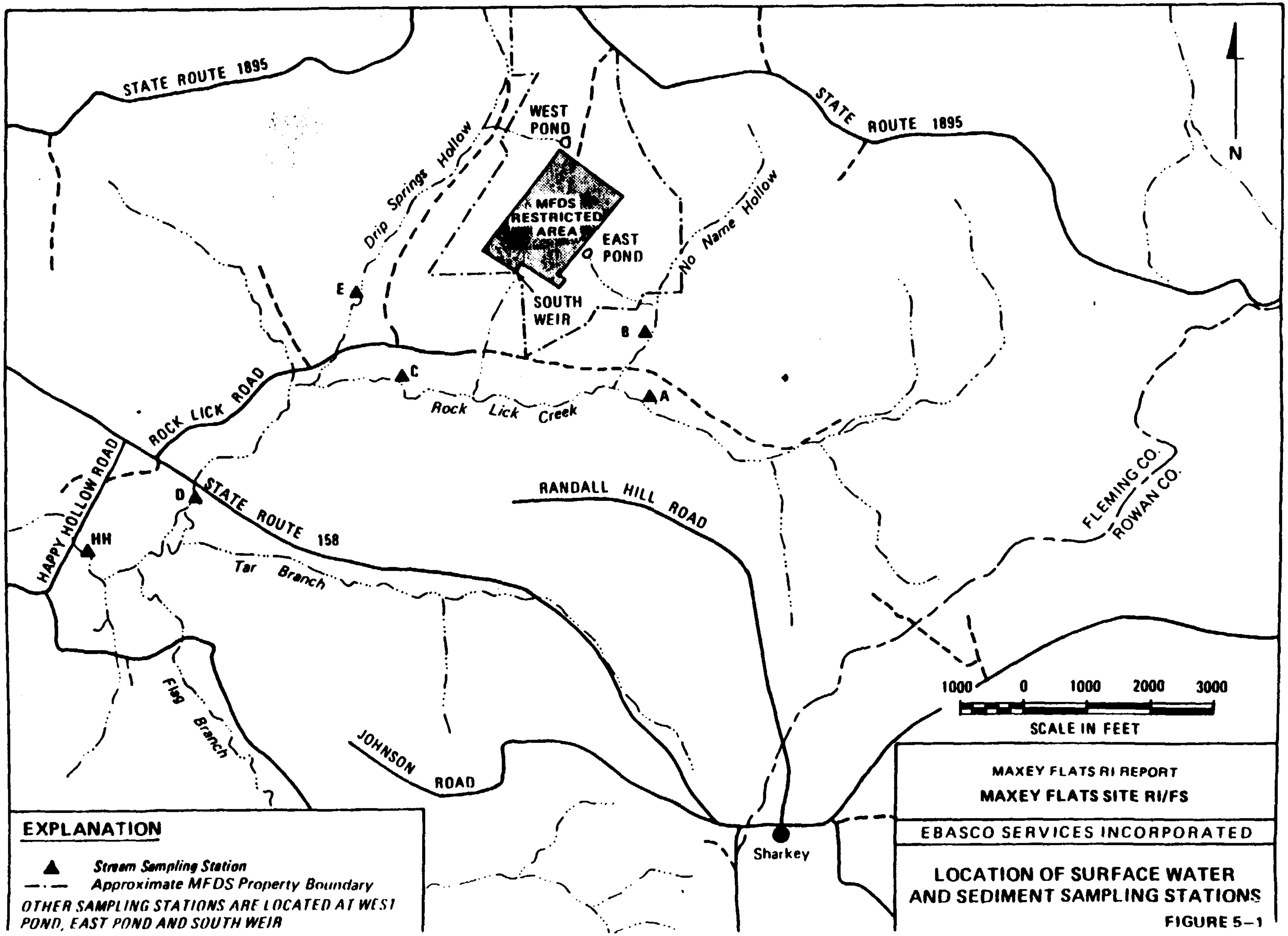

STATE ROUTE 1895
WEST POND
Drip Springs Hollow
MFDS RESTRICTED AREA
EAST POND
No Name Hollow
SOUTH WEIR
STATE ROUTE 1895
N
E
B
C
A
ROCK LICK ROAD
Rock Lick Creek
HAPPY HOLLOW ROAD
D
STATE ROUTE 158
RANDALL HILL ROAD
FLEMING CO.
ROWAN CO.
HH
Tar Branch
Flag Branch
JOHNSON ROAD
Sharkey
1000 0 1000 2000 3000
SCALE IN FEET
EXPLANATION
Stream Sampling Station
Approximate MFDS Property Boundary
OTHER SAMPLING STATIONS ARE LOCATED AT WEST POND, EAST POND AND SOUTH WEIR
MAXEY FLATS RI REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
LOCATION OF SURFACE WATER AND SEDIMENT SAMPLING STATIONS
FIGURE 5–1

TABLE 17

CONCENTRATION RANGES OF RADIONUCLIDES IN SURFACE WATER
(concentrations in pCi/ml)

	Background[a] Surface Water	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Tritium	<10-40[b]	<10-31[b]	<10-30	<10-60
K-40	<1.0	<1.0	<1.0	<1.0
Cs-137	<0.1	<0.1	<0.1	<0.1
Ra-226	<0.1	<0.1-0.29	<0.1	<0.1
Th-232	<0.2	<0.2	<0.2	<0.2
U-238	<2.0	<2.0	<2.0	<2.0
Co-60	<0.1	<0.1	<0.1	<0.1

a) Daniel Boone National Forest and Stream Sampling Station A (upstream of Site Area).

b) High value suspect, see Appendix E, Section 4.1 of MFDS RI Report for discussion.

TABLE 18

CONCENTRATION RANGES OF ORGANIC CHEMICALS IN SURFACE WATER
(concentrations in ppb)

Organic Chemical	Background[a] Surface Water	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Acetone	<10	<10	<10-68	<10-14
Toluene	<5-9	<5-5	<5	<5-42
Chloroform	<5	<5	<5-5	<5
2-Butanone	<10	<10-36[j]	<10	<10
Bis(2-ethyl hexyl)-phthalate	<10	<10	<10	<10-98
Hexachloro-Benzene	<10	<10-29[j]	<10	<10
Heptachlor	<0.05	<0.05	<0.05	<0.05-0.09
Endosulfan 1	<0.05	<0.05	<0.05-0.08	<0.05

a) Daniel Boone National Forest and Stream Sampling Station A (upstream of Site Area)

j) Estimated value because of exceeding a data validation criteria, or below detection limit due to laboratory sample dilution.

TABLE 19

CONCENTRATION RANGES OF INORGANIC CHEMICALS IN SURFACE WATER
(concentrations in ppb)

Analyte	Background[a] Surface Water	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Al	<200	<200-430	<200-880	<200-1820
Sb	<60	<60	<60	<60
As	<10	<10	<10	<10
Ba	<200	<200	<200	<200
Be	<5	<5	<5	<5
Cd	<5	<5	<5	<5-5
Ca	<5000-9540	11700-24400	5390-26200	<5000-40500
Cr	<10	<10	<10	<10
Co	<50	<50	<50	<50
Cu	<25	<25	<25	<25
Fe	<100-660	<100-2490	360-560	<100-1090
Pb	<5	<5	<5	<5
Mg	<5000	<5000-10200	<5000-5260	<5000
Mn	88-341[j]	<15-961[j]	<15-310	<15-172
Hg	<0.2	<0.2	<0.2	<0.2
Ni	<40	<40	<40	<40
[illegible]	<5000	<5000-7450	<5000	<5000
Se	<5	<5	<5	<5
Ag	<10	<10	<10	<10
Na	<5000	<5000-6920	<5000	<5000
Tl	<10	<10	<10	<10
V	<50	<50	<50	<50
Zn	<20-85	<20-43	<20-33	<20-22
Cyanide	<10	<10	<10	<10
Phenolics	<10	<10	<10	<10

a) Daniel Boone National Forest and Stream Sampling Station A (upstream of Site Area)

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.

TABLE 20

CONCENTRATION RANGES OF RADIONUCLIDES CHEMICALS IN STREAM SEDIMENTS
(concentrations in pCi/ml or pCi/g)

Radionuclide	Background[a] Sediments	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Tritium	<10	<10	<10-20	<10-70
K-40	8.0-16.0	12.0-30.0	17.0-22.0	12.0-21.0
Cs-137	<0.1-1.30	<0.1-0.10	<0.1	<0.1-0.40
Ra-226	0.90-2.50	1.50-2.40	1.70-3.70	0.60-1.10
Th-232	0.80-1.20	0.80-1.40	0.80-1.20	1.00-1.30
U-238	<2.0	<2.0	<2.0	<2.0
Co-60	<0.1	<0.1	<0.1	<0.1

a) Daniel Boone National Forest and Stream Sampling Station A (upstream of Site Area)

Volatile organic chemicals (acetone, 2-butanone, methylene chloride, and toluene) detected in sediment samples ranged from 5 ppb to 170 ppb. Semi-volatile organic chemical constituents (phthalate esters, phenol, phenanthrene, fluoranthene, and pyrene) ranged from 5 ppb to 1800 ppb. The highest concentration detected was phthalate esters. Phthalate esters were only detected in samples associated with surface water runoff from the Restricted Area and the probable source of the phthalate esters is the PVC used to cover the trenches. (See Tables 21 and 22 for concentration ranges of organics and inorganics, respectively, in stream sediment samples.)

5.1.5 - Air

Although an air quality investigation was not performed during the Remedial Investigation of the MFDS, atmospheric data is available for the site from 1983 to present. For the years 1983 to 1987, the average gross alpha, gamma, and beta concentrations measured at the air monitoring stations around the perimeter of the Restricted Area were three to five times lower than the maximum concentration permitted by Commonwealth regulations outside the Restricted Area for individual radionuclides. The average tritium activity measured at the air monitoring stations ranged from 240 to 3,000 pCi/m^3 during the years 1983 to 1986, and averaged 275 pCi/m^3 in 1987. For comparative purposes, the average tritium activity for 1987 is less than 0.2 percent of the maximum permissible concentration (200,000 pCi/m^3) for areas outside the Restricted Area. The highest average airborne tritium concentration measured at a single location during 1987 was 1,260 pCi/m^3, 0.6 percent of the average annual maximum permissible concentration.

The primary source of airborne radiation prior to 1987 was the evaporator system. (The site evaporator ceased operation at the MFDS in 1986). The trend of airborne tritium concentrations has closely followed the release of tritium by the site's evaporator system. Tritium concentrations measured at the air monitoring stations markedly decreased during 1983 and 1987 when the evaporator was not operating, and again in 1986 when the evaporator was operating at lower capacities. Other potential sources of airborne radiation are tritium transpired by trees, diffusion of tritium vapor directly through the trench cap, and the ascension of tritium-bearing gases escaping from trench sumps.

TABLE 21

CONCENTRATION RANGES OF ORGANIC CHEMICALS IN STREAM SEDIMENTS
(concentrations in ppb)

Organic Chemical	Background[a] Sediments	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Methylene Chloride	<5	<5-10	<5	<5
Chloroform	<5	<5	<5-10[j]	<5
Toluene	<5-75	<5-10	<5-5	<5
Acetone	<10-72	<10-170	<10-20	<10
2-Butanone	<10	<10-31	<10	<10
Di-n-octyl phthalate	<330	<330	<330	<330-1800
Dieldrin	<16	<16	<16	<16
ʾhenanthrene	<330	<330	<330	<330-510
Fluoranthene	<330	<330	<330	<330-410
Pyrene	<330	<330	<330	<330-380[j]

a) Daniel Boone National Forest and Stream Sampling Station A (upstream of Site Area)

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.

TABLE 22

CONCENTRATION RANGES OF INORGANIC CHEMICALS IN STREAM SEDIMENTS
(concentrations in ppm)

Analyte	Background Sediments[a]	Downstream of Site Area	Site Area Streams	MFDS Ponds and Weir
Al	4800-8140	5820-8390	3750-8230	8000-11400
Sb	≤12	≤12	<12	<12-13
As	13.3[j]-38.9	10.8[j]-59.3	14.2-38.0[j]	<2-39.0
Ba	<40-96	<40-63	43-83	<40-230
Be	<1-1.5	1.3-2.6	<1-1.8	<1
Cd	<1	<1	<1	<1
Ca	<1000	<1000-18200	1250-30800	<1000-39900
Cr	14.3[j]-30.0	16.4-30.7	9.5-24.1	17.2-39.6
Co	<10-59.2	21.4-40	10.5-26.9	<10-65.0
Cu	8.6-27.3	23.2-54.9	23.2-46.7[j]	8.5-41.0[j]
Fe	4300-73200	36600-71300	22300-65400	22200-70700
Pb	19.4-42.1	9.8-30.7	21.2-23.9	<1-46.6
Mg	<1000	<1000-2310	<1000-5070	1240-3940
Mn	261-682	295[j]-999	330-784[j]	92[j]-3530
Hg	<0.04	<0.04-0.07[jn]	<0.04	<0.04-0.07[jn]
Ni	16-42.0	52[j]-86[j]	31-74[j]	14-48[j]
[illegible]	<1000-1570	<1000-1950[j]	<1000-1220[j]	<1000-1500[j]
Se	<1	<1	<1	<1
Ag	<2	<2	<2	<2
Na	<1000	<1000-1390	<1000	<1000-1490
Tl	<2	<2	<2	≤2
V	28-76	62-109	39-81[j]	28[j]-66
Zn	55[j]-163[j]	177-297[j]	<4-236[j]	40-123[j]
Cyanide	<2	<2	<2	<2
Phenolics	<2	<2	<2	<2

a) Daniel Boone National Forest and Stream Sampling Station (upstream of Site Area)

j) Estimated value because of exceeding a data validation criterion, or below detection limit due to laboratory sample dilution.

jn) Estimated value and tentative identification.

SECTION 6.0 - SUMMARY OF SITE RISKS

As part of the RI/FS, an assessment of site risks was performed by the Maxey Flats Steering Committee (Committee) using existing site data and information gathered during the Remedial Investigation. The Committee's Appendix D to the Feasibility Study Report, and EPA's Addendum Report to the FS Report, may be consulted for a more in-depth explanation of both the process and results of the risk assessment for the Maxey Flats Disposal Site. The dose estimates presented in this section are median doses, unless otherwise noted. Additionally, the assumptions employed in the calculation of site risks and resultant dose estimates, provided in this section, are derived from the Committee's final, April 1991 risk assessment, unless otherwise noted.

The risk assessment identified the contaminant sources and exposure pathways which pose the greatest potential threat to human health and the environment and then evaluated the baseline risks associated with a No Action alternative; i.e., a scenario which assumed that the site would be abandoned. The risk assessment assumed exposure scenarios that involved (1) the degradation of the existing soil cap and the subsequent leaching and transport of radionuclides offsite, and (2) individuals trespassing and establishing residence at the site.

Potential contamination sources at the MFDS were determined to include trench material, leachate, site structures, above-ground tanks, ground surfaces, ground water, and soil. Potential routes of exposure to contaminants, called exposure pathways, were developed based on both the current site conditions and future, potential pathways typically examined in a public health evaluation. For the MFDS, two sets of potential pathways were evaluated - intruder (on-site) pathways and non-intruder (off-site) pathways. For the intruder scenario, it was assumed that the site would be abandoned and an individual would occupy an area of the site which is currently known as the Restricted Area. The non-intruder scenario, like the intruder pathways, assumed the site would be abandoned, but involved pathways (primarily off-site pathways) other than those associated with occupying the site.

Of the contaminants identified at the MFDS, two sets of contaminants representing the greatest potential for impacting human health, called indicator contaminants, were developed. Table 23 identifies the two groups of indicator contaminants selected for the Maxey Flats Disposal Site, radionuclide and non-radionuclide indicators.

TABLE 23

INDICATOR CONTAMINANTS

Radionuclides	Non-Radionuclides
Hydrogen-3 (Tritium)	Arsenic
Carbon-14	Benzene
Cobalt-60	Bis(2-Ethylhexyl) Phthalate
Strontium-90	Chlorobenzene
Technetium-99	Chloroform
Iodine-129	1,2-Dichloroethane
Cesium-137	Lead
Radium-226	Nickel
Thorium-232	Toluene
Plutonium-238	Trichloroethylene
Plutonium-239	Vinyl Chloride
Americium-241	

6.1 Off-Site Exposure Scenario

The pathways evaluated for the off-site exposure scenario are listed in Table 24, and described below. In order to evaluate the potential off-site exposure scenario, it was assumed that the site was abandoned and no measures are in place to control or mitigate site releases. Approximately 10% of rainwater was assumed to penetrate deep into the trenches and leach radionuclides from the waste. The contaminated rainwater was assumed to percolate down into the strata underlying the trenches and migrate laterally beneath the trenches to the MFDS hillslopes. From here, the contaminated water was assumed to partially evaporate and partially to be transported down the hillslopes to the valley below. As a result of evapotranspiration, tritiated water becomes airborne and is transported off-site to receptor locations.

6.1.1 - Well Water Pathway

The off-site well water pathway includes the following assumptions:

- A drinking water well in the alluvium becomes contaminated; leachate migrates in ground water from the trenches through the Lower Marker Bed (LMB), lower Nancy and Farmers Members to the hillslope; migration down the hillslope is via surface water runoff in washes; dilution by surface runoff water, evapotranspiration losses on the hillslope, infiltration into the alluvium at the bottom of the hillslope, and dilution in the alluvial ground water by additional recharge and upstream ground water occur.

- The MFDS and surrounding area are divided into eight sub-basin drainage areas, which carry different proportions of runoff and contaminants and are analyzed individually for contributions to alluvial ground water in the stream valleys.

- Individuals use a well in the alluvium for drinking water over a lifetime and consume two liters per day.

- No contaminants migrate via ground water through the colluvium, soil, or bedrock into the alluvial aquifer.

- Radioactive decay reduces radionuclide concentrations over the estimated travel time for the pathway.

TABLE 24

OFF-SITE (NON-INTRUDER) PATHWAYS

- Well Water Pathway -- involves the movement of contaminants in ground water to the hillsides adjacent to the site and into the surface water system moving down the hillsides. At the bottom of the hillsides, the contaminated runoff recharges the alluvium (soils). A well is excavated in the contaminated alluvium and a family uses the well as a source of drinking water.

- Surface Water Pathway -- in this pathway, contaminants move off-site in ground water and enter the surface water system. The stream water is then used as a drinking water and irrigation source for beef and milk cows and their forage. Humans then ingest the animal products.

- Soil Erosion Pathway -- this pathway actually is a combination of pathways. It involves the resuspension in air of soil particles contaminated with radionuclides and the washing of soil into the surface water. It is assumed that the trenches overflow with contaminated liquids. Dry contaminated soil is then suspended in air and carried to a person and inhaled or washed away in runoff. Also, crops are grown in the alluvium contaminated by surface runoff. A person ingests contaminated farm products and is exposed to external radiation.

- Sediment Pathway -- involves the movement of contaminants in ground water to the hillsides adjacent to the site and into the surface water system (streams). As the contaminated surface water moves through the stream bed, some of the contaminants adhere to the soils in the stream bed. Through the course of play in the stream beds, a child ingests the contaminated soils.

- Deer Pathway -- Contaminated water moves through the ground water system to the hillsides adjacent to the site. Upon reaching the hillside, the contamination is incorporated into plants. The contaminated plants are then eaten by deer foraging on the hillslopes. Also, the deer drink contaminated water from the streams. The contaminants are then incorporated into the meat of the deer. A hunter kills the deer and ingests the meat.

TABLE 24 (Continued)

OFF-SITE (NON-INTRUDER) PATHWAYS

- Evapotranspiration Pathway -- this pathway involves the uptake of contaminated liquid into plants; the liquids are released from the plants to the environment. Tritium is the only contaminant to move by this pathway. Once released to the air, the tritium could be incorporated into food and drinking water sources or directly inhaled by a human.

- Trench Sump Pathway -- This pathway involves the escape of tritiated water from trenches via trench sumps and cracks in the trench cap. A person then inhales the contaminated air.

- Radionuclides and other contaminants are subject to retardation by sorption effects.

Figure 12 illustrates the projected extent of potentially contaminated alluvium, under a No Action alternative, used in evaluating exposures associated with the well water pathway.

6.1.2 - Surface Water Pathway

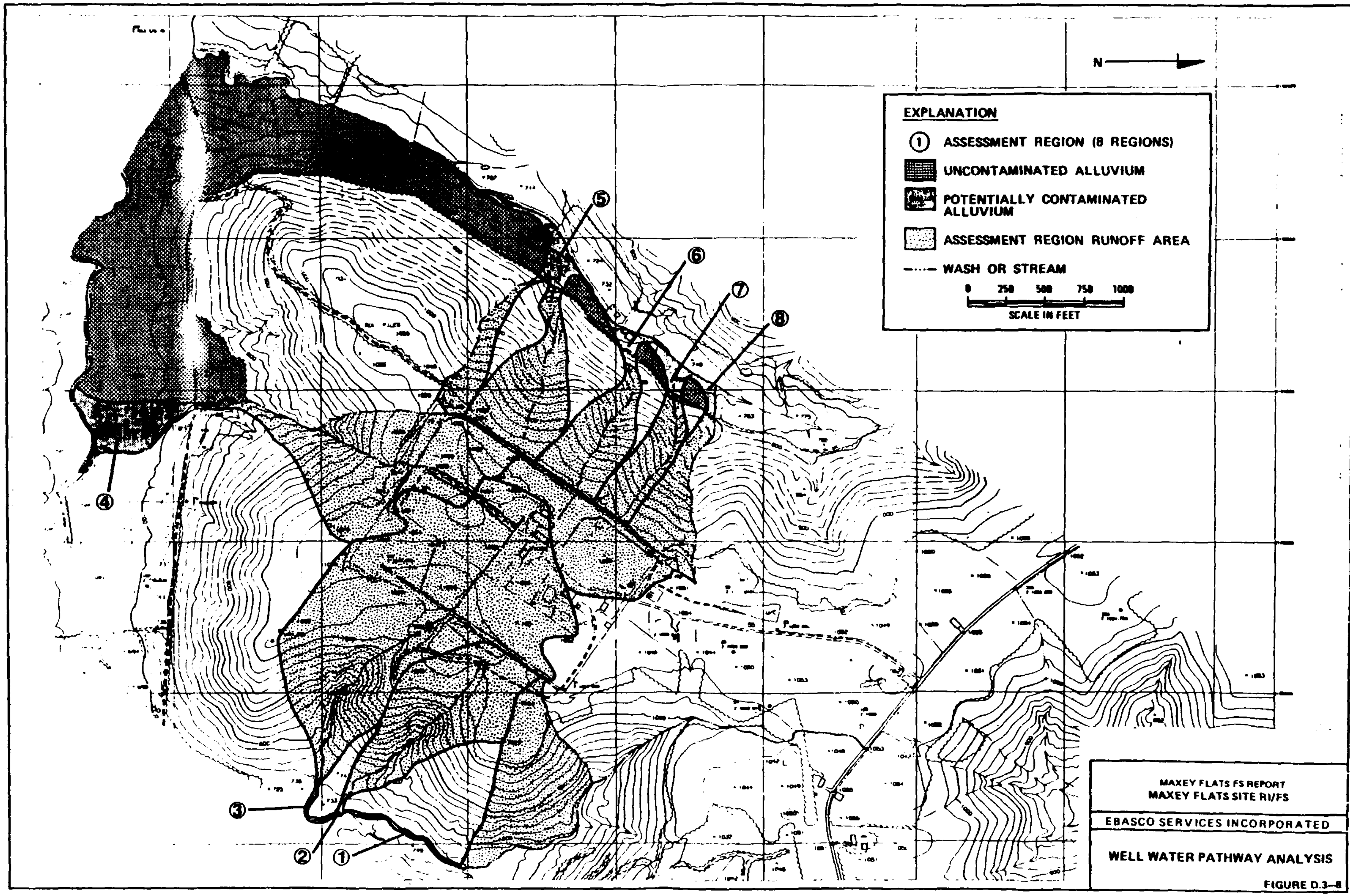
This pathway begins in the same manner as the well water pathway; that is, contaminated runoff travels down the hillslope. However, unlike the well water pathway, where the flow is divided into eight regions, all the radioactivity is assumed to be deposited into a creek, and the creek water is used as a source of drinking water for livestock. In addition, grass in the vicinity of the creek is ingested by the livestock. Humans then ingest the contaminated milk and beef.

6.1.3 - Erosion Pathway

Another pathway included in the off-site exposure scenario is the erosion pathway. The erosion pathway assumed that, without erosion controls, surface and hillslope soil will be transported to the alluvial valley. The analysis is based on the assumption that no steps are taken to prevent the "bathtub" effect or to protect the overlying soil from erosion. As a result of the "bathtub" effect, leachate is assumed to rise up periodically, saturate the overlying soil, and overflow the trenches. The overlying soil thereby becomes contaminated and, when eroded down to the alluvial valley, becomes a source of exposure to individuals living in the valley.

The erosion pathway actually consists of a subset of pathways which include the following: (1) direct radiation from living on contaminated alluvium, (2) the ingestion of contaminated surface water, (3) the ingestion of vegetables grown in contaminated alluvium, and (4) the ingestion of beef and milk obtained from cattle and milk cows raised on water obtained from the creek and fodder from the contaminated alluvial plain.

The drinking water pathway of the erosion pathway is based on the assumption that an individual obtains all his drinking water from a local creek. Doses from the ingestion of vegetables are based on the assumption that all vegetables are obtained from gardens located on the contaminated alluvium. Similarly, milk and beef doses a` ` based on thè assumption that the cattle and cows obtain all their drinking water from the creek and fodder


N
EXPLANATION
① ASSESSMENT REGION (8 REGIONS)
UNCONTAMINATED ALLUVIUM
POTENTIALLY CONTAMINATED ALLUVIUM
ASSESSMENT REGION RUNOFF AREA
WASH OR STREAM
0 250 500 750 1000
SCALE IN FEET
①
②
③
④
⑤
⑥
⑦
⑧
MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
WELL WATER PATHWAY ANALYSIS
FIGURE D.3-8

from grass growing in the contaminated alluvium. The doses also include direct radiation from continual exposure from living on contaminated alluvium. These doses were based on the assumption that the contamination is an effective infinite plane, with no credit taken for shielding.

The exposures associated with the erosion pathways were performed for a range of time periods that reflect a decaying source term and a changing erosion rate. The results of the analyses for the upperbound estimate for the erosion pathway are presented in Table 25. EPA believes that the upperbound estimates are the appropriate values associated with the erosion pathway due to the number of uncertainties in the erosion pathway analysis. See Section 6.3 - Risk Uncertainties, for a discussion of risk assessment uncertainties.

6.1.4 - Sediment Pathway

Another off-site pathway evaluated in the MFDS baseline risk assessment was that of a child ingesting contaminated sediments. Contaminants travel to the hillslopes and into the surface water system. As the contaminated surface water moves over the stream beds, some of the contaminants adhere to the sediments of the stream bed. Then, through the course of play in the stream beds, a child ingests 0.7 grams of contaminated sediments per day. It was assumed that the sediments are approximately 50% water, which contains tritium at the same concentration as the surface water.

6.1.5 - Deer Pathway

This pathway involves the migration of contaminants to the hillslopes. Upon reaching the hillslopes, the contamination is incorporated into plants. Approximately 150 kilograms/year of contaminated plants are then eaten by deer foraging on the hillslopes. Also, the deer drinks 3650 liters/year of contaminated water from the streams. The contaminants are then incorporated into the meat of the deer. A hunter kills the deer and ingests 5 kilograms of deer meat per year.

6.1.6 - Evapotranspiration Pathway

This pathway involves the uptake of contaminated liquids into plants. Through the process of evapotranspiration, which is the release of water vapor from the plants to the atmosphere, tritium is released to the air and incorporated into food and drinking water sources, or directly inhaled by a human. Tritium is the only contaminant to move by this pathway.

Table 25

EROSION PATHWAYS

PATHWAY	DOSE (MREM/YEAR)
External Exposure	160
Drinking Water	440
Vegetables	11
Milk	1.4
Meat	1.9

6.1.7 - Trench Sump Pathway

This pathway involves the escape of tritiated water from trenches via trench sumps and cracks in the trench cap. A person then inhales the contaminated air. Tritium is the only contaminant to move by this pathway.

6.1.8 - Conclusions of the Off-Site Exposure Scenario

The results of the risk assessment revealed that, for off-site exposure pathways, tritium is the critical radionuclide. The well water pathway is, by far, the dominant off-site pathway. If no action is taken at the site, the total dose equivalent from all indicators from all combined off-site pathways to individuals would be 75 mrem per year for the average case, almost half of which is attributable to tritium. The upper bound estimate of exposure from such a scenario would total 4300 mrem per year. For each year of exposure under a No Action alternative, it is estimated that the lifetime risk of fatal cancer would be 3×10^{-5} for the average case (75 mrem) and 1.7×10^{-3} for the upperbound case (4300 mrem). (EPA's target risk range is 1×10^{-4} to 1×10^{-6} which equates to one additional cancer in 10,000 for 1×10^{-4} and one additional cancer in 1,000,000 for 1×10^{-6}.)

The lifetime risk of cancer from prolonged exposure (many years of exposure) from off-site pathways would be approximately 1×10^{-3} (average case) and 6×10^{-2} (upperbound case). The well water pathway contributes the single highest dose among pathways, with soil erosion contributing almost all of the remaining dose. Both the average and upper bound estimates of off-site exposure exceed the MFDS remediation goal of 25 mrem per year for the entire site.

During the 70-year timeframe (the period of time typically used in evaluating risks at Superfund sites) for a No Action alternative, tritium and strontium-90 would exceed drinking water limits in water extracted from wells located at the base of the hillslopes and the 4 mrem/yr Maximum Concentration Limit for beta activity would be exceeded.

Over the 500-year time frame (which is a more lengthy period of time than typically used at Superfund sites, but necessary due to the presence of long-lived radionuclides at the MFDS), tritium, strontium-90, and radium-226 would exceed the drinking water limits in water extracted from wells located at the base of the hillslopes during the initial part of the 500-year timeframe, before tritium and strontium-90 have decayed away.

6.2 On-Site Exposure Scenarios

Table 26 lists the on-site (intruder) pathways evaluated in the MFDS baseline risk assessment, as described below. Evaluation of the on-site exposure scenarios involved the assumption that the site is abandoned and no institutional controls are in place to prevent site access.

For the intruder scenarios, which consist of a number of exposure pathways, a broad range of potential on-site exposures were evaluated in order to gain insight into the full range of potential impacts of the site and how those impacts may change with time.

It is unlikely that the Intruder-Discovery, Intruder-Construction, and Intruder-Agriculture scenarios could occur today or in the immediate future; however, these scenarios were included in the risk assessment to characterize fully the range of potential exposures that could be associated with the site. As time passes, these scenarios would become more likely.

6.2.1 - Intruder-Trespasser Scenario

Under the Intruder-Trespasser Scenario, a trespasser who occasionally gains access to the site would be exposed to direct external radiation and perhaps the inhalation of radioactive particulates that may become airborne through suspension processes. In addition, it is likely that the trespasser would also be exposed to airborne tritiated water vapor due to the evaporation of leachate.

6.2.2 - Intruder-Discovery Scenario

This pathway involves the assumption that no controls exist for the site and an intruder inadvertently occupies the disposal site and begins construction activities. The intruder contacts solid remains of waste or barriers, realizes that something is wrong, and ceases construction activities. Human exposure to radiation is assumed to result for a short time from external exposure to the contaminated soils and inhalation of contaminated air.

6.2.3 - Intruder-Construction Scenario

For the Intruder-Construction scenario, it is assumed that, in the scenario described for the Intruder-Discovery above, the construction worker continues construction activities. In the Intruder-Construction scenario, the builder is assumed to be exposed from the following pathways:

TABLE 26

ON-SITE (INTRUDER) PATHWAYS

- Intruder-Trespasser Scenario: This scenario involves the assumption that no controls exist for the site and a trespasser occasionally gains access to the site.

- Intruder-Discovery Scenario -- This scenario assumes that no controls exist for the site and an intruder inadvertently occupies the site and begins construction activities. The intruder contacts solid remains of waste or barriers, realizes that something is wrong, and ceases construction activities. Human exposure would occur through the external exposure to contaminated soil pathway and through the inhalation of contaminated air pathway.

- Intruder-Construction Scenario: This scenario assumes that, in the scenario described for the intruder-Discovery Scenario above, the construction worker continues construction activities. Construction activities penetrate and expose the waste. Human exposure would occur through the external exposure to contaminated soil pathway and through the inhalation of contaminated air pathway.

- Intruder-Agricultural Scenario -- This scenario involves the assumption that no controls exist for the site and an inadvertent intruder occupies the site. After some construction activities, the intruder (site resident) begins agricultural activities. It is assumed that some percent of the intruder's annual diet comes from crops raised in the contaminated soil and from food products produced by animals. External exposure and ingestion of contaminated ground water from a well are two pathways included in this scenario. It is also assumed that a quantity of contaminated soil is ingested by a child during play or an adult at work in the fields. Inhalation of resuspended contaminated soil and the migration of radon into the intruder's basement are additional pathways of the Intruder-Agriculture Scenario.

- Direct Gamma - Direct radiation from standing in the excavated hole.
- Suspension of Particulates from Construction - Inhalation of particles suspended during construction, external exposure from suspended particulates, and exposure to an area source consisting of particles deposited on the soil following suspension during construction.
- Airborne tritium - Inhalation and skin absorption of airborne tritiated water vapor.

6.2.4 - Intruder-Agriculture Scenario

The Intruder-Agriculture scenario was based on the assumption that an individual builds a home and lives on the site beginning today. It was also assumed that the intruder obtains his food locally and sinks a well into the aquifer underlying the site to obtain drinking water. In the Intruder-Agriculture scenario, the intruder is assumed to live in the house, plant a garden in soil excavated from the waste disposal site during construction, use water from an on-site well, and raise cattle and milk cows on the contaminated soil at the site. In addition, a child in the family is assumed to ingest contaminated soil, and products of radon decay are assumed to build up indoors due to the radium contamination in the waste.

6.2.5 - Conclusions of the On-Site Exposure Scenarios

For the Intruder-Trespasser scenario, the direct external radiation dose rate to a person standing on the trenches depends on whether the soil overlying the trenches is intact and uncontaminated. If the overlying soil becomes contaminated as a result of the "bathtub" effect which is known to occur at the site, the shielding effectiveness of the overlying soil is markedly reduced, resulting in dose rates up to approximately 1.4 mrem/hour. If it were assumed that the trespasser frequents the site, on the average, once per week, spending one hour per visit, the resultant dose from the Intruder-Trespasser scenario would be approximately 73 mrems/year.

If the overlying soil is contaminated as a result of the "bathtub" effect, wind and mechanical erosion processes could cause contaminated soil particles to become airborne. Once airborne, they could cause internal exposures due to inhalation and also external exposures from immersion in the airborne particulates.

Individuals standing in the vicinity of the trenches would likely be exposed to airborne tritiated water vapor. If the trench cap degrades and/or the trench leachate overflows, evaporation processes will result in airborne tritiated water vapor. The dose to a trespasser from airborne tritiated water vapor is presented in Table 27.

For the Intruder-Construction scenario, the results revealed that if a home were constructed at the site today, the dose to the construction worker over the 500 hours required for construction is estimated to be 3.2 rems and the lifetime risk of fatal cancer is approximately 1.2×10^{-3}. Most of this dose and risk is due to direct radiation, primarily from cobalt-60, cesium-137, and radium-226. The doses associated with the Intruder-Discovery scenario are substantially less than the Intrduer-Construction scenario due to less duration of on-site activities.

If a 100-year period of institutional control[5] is assumed, the dose and risk to a construction worker at the site decrease by about an order of magnitude, to 320 mrem. The decrease is due primarily to the decay of cobalt-60 and cesium-137. However, direct radiation is still the major contributor to dose, though the dominant radionuclide is now radium-226.

After a 500-year period of institutional control, the dose and risk to the construction worker decrease further, but by less than a factor of about 2, to 210 mrem. Direct radiation is still the major contributor to dose, and radium-226 is still the dominant radionuclide.

For the Intruder-Agriculture scenario, the results revealed that if a person were to live in a home constructed directly over the waste trenches today, the dose equivalents to an adult from all pathways, not including radon, total 26,000 mrem per year for the average case, with the upperbound estimate totalling 1,000,000 mrem per year. Forty-three percent of the impact would be derived from drinking water, 47 percent from food produced on-site, and 10 percent from external exposure. Tritium, carbon-14, strontium-90, and radium-226 dominate the

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[5] - As it is used here, institutional controls includes access restrictions such as fences, on-site personnel, land use and deed restrictions and maintenance activities such as fence repair and limited custodial maintenance and monitoring activities.

TABLE 27

EFFECTIVE DOSE EQUIVALENTS (MREM/HOUR) FOR TRANSIENT INTRUDER

	1	2	3	4
Years	Direct Gamma		Resuspension	
Decay	Waste	Soil	Inhalation[1]	Immersion[2]
0	4.5E-04	1.4E+00	1.4E-01	4.9E-08
10	1.7E-04	1.3E+00	1.3E-01	4.5E-08
20	9.7E-05	1.3E+00	1.3E-01	4.4E-08
30	7.8E-05	1.3E+00	1.3E-01	4.4E-08
40	7.3E-05	1.3E+00	1.3E-01	4.4E-08
50	7.1E-05	1.3E+00	1.3E-01	4.4E-08
75	6.8E-05	1.2E+00	1.3E-01	4.3E-08
100	6.7E-05	1.2E+00	1.3E-01	4.3E-08
200	6.4E-05	1.2E+00	1.2E-01	4.3E-08
300	6.1E-05	1.2E+00	1.2E-01	4.3E-08
400	5.9E-05	1.2E+00	1.2E-01	4.3E-08
500	5.6E-05	1.2E+00	1.2E-01	4.2E-08

1 Major Contributors are Th-232 and Pu-238
2 Major contributor is Th-232

ingestion doses, with cobalt-60, cesium-137, and radium-226 dominating the external exposure.

For each year a person lives on-site, the average case lifetime risk of fatal cancer would be approximately 1 x 10^{-2}, or one in 100. Under the same scenario, the upperbound case lifetime risk of developing fatal cancer would be 4 x 10^{-1}, or four in 10. Both cases significantly exceed EPA's target risk range.

Prolonged exposures (many years of exposure) result in a lifetime risk of cancer approaching 1. The exposure to radon progeny was conservatively estimated to be 50 WLM per year, which corresponds to a lifetime risk of fatal lung cancer of close to 1.0.

If a period of 100 years of site institutional control were assumed before a person constructs and occupies a home on-site, the dose decreases and the longer-lived radionuclides such as radium-226, thorium-232, and plutonium-238 become the significant radionuclides. Tritium and strontium-90 no longer contribute to the dose because they have decayed away. Cesium-137 will have decayed to less than 90% of its original activity.

Assuming occupancy of the site does not begin for 100 years or more, the doses and associated risks decrease, but by only a small margin since most of the exposure is associated with the relatively long-lived radionuclides. If a 100-year period of institutional control is assumed, the dose associated with an intruder-agriculture scenario decreases by a factor of approximately 3, to 7.2 rem/year. Of this dose, the direct radiation exposures have declined by about a factor of 10, to 780 mrem/year, primarily due to the decay of Cobalt-60. Radium-226 is now the dominant source of external exposure. At 100 years, the lifetime risk of fatal cancer (not including radon progeny) due to continual exposure decreases to approximately 4 x 10^{-2}. The exposures and risks associated with elevated levels of radon progeny indoors decrease only slightly, as expected, given the long half-life of Radium-226.

If a 500-year period of institutional control is assumed, the dose decreases to 5.1 rem/year, and the risk (not including radon progeny) is approximately 3.1 x 10^{-2}. The reason for the small decrease is that the dose from drinking water is dominated by very long-lived radionuclides. If uncontaminated sources of drinking water are used, the dose is approximately 600 mrem/year. This dose is primarily due to direct radiation, which is dominated by Radium-226. The food ingestion pathways contribute less than 100 mrem/year.

Even after 500 years, on-site occupancy would result in risks exceeding the acceptable risk range. See Figures 13 and 14 for an illustration of the decay of radionuclide indicators with time. It can be seen that beyond 100 years the risks associated with the MFDS remain unacceptably high and tend to become constant rather than decreasing significantly; thus, the need for institutional controls, maintenance and monitoring to be implemented and funded in perpetuity is apparent.

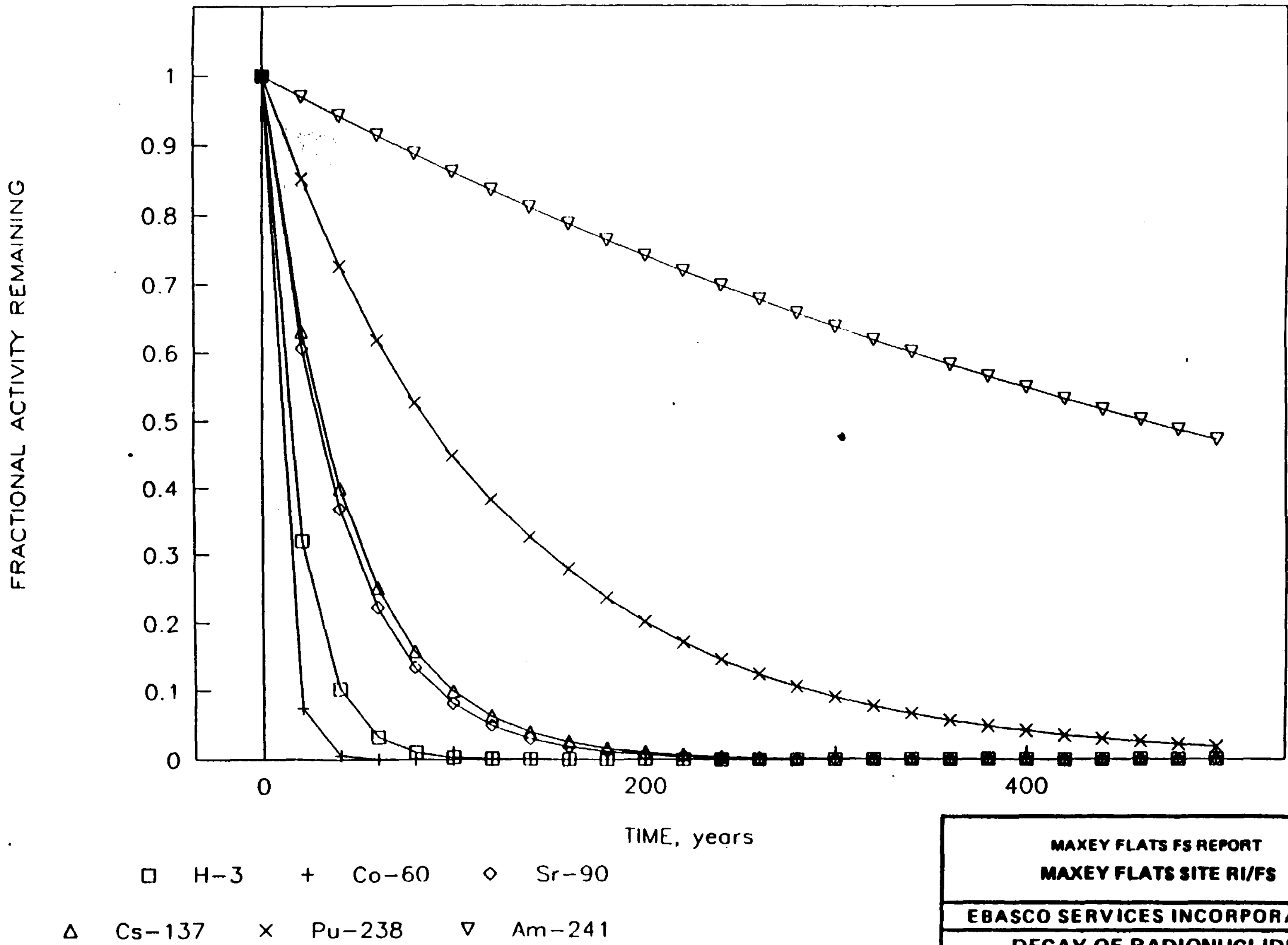
As the foregoing discussion demonstrates, the threatened release of hazardous substances from the MFDS, if not addressed by the preferred alternative or one of the other active measures considered, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.3 Risk Assessment Uncertainties

As with most baseline risk assessments, a number of uncertainties are associated with the MFDS risk assessment. The following discussion describes some of those uncertainties which may have led to an underestimation of the estimated exposures associated with some of the pathways evaluated:

In the April 1991 final risk assessment, in-transit decay is assumed for the transport of the radionuclides from the trenches to the receptor location. The in-transit time for water is assumed to be several years, and the transit time for many radionuclides is much longer due to the radionuclide binding coefficients. For some radionuclides, this in-transit decay assumption results in substantial decay. If the MFDS were to experience "bathtubbing" (trench overflow) conditions under a No Action scenario, the radionuclide transit time would be substantially reduced and, consequently, the concentrations of radionuclides reaching the potential receptors would be much greater.

Additionally, the magnitude of retardation for some of the radionuclides, such as plutonium and carbon-14, may have been overestimated in the risk assessment. Retardation of plutonium is complex and poorly understood. Plutonium is known to be fairly mobile under some conditions of valence, complexation, and colloidal suspension. Plutonium has also been shown to be in a micro-particulate form in the MFDS trench leachates rather than in a typical ionic solution state; this may make it more mobile. Plutonium has also been detected in ground water migrating away from the trenches in the LMB, indicating that plutonium is more mobile than would be indicated by the high Kd values assumed in the risk assessment. Thus, the risk



MAXEY FLATS FS REPORT

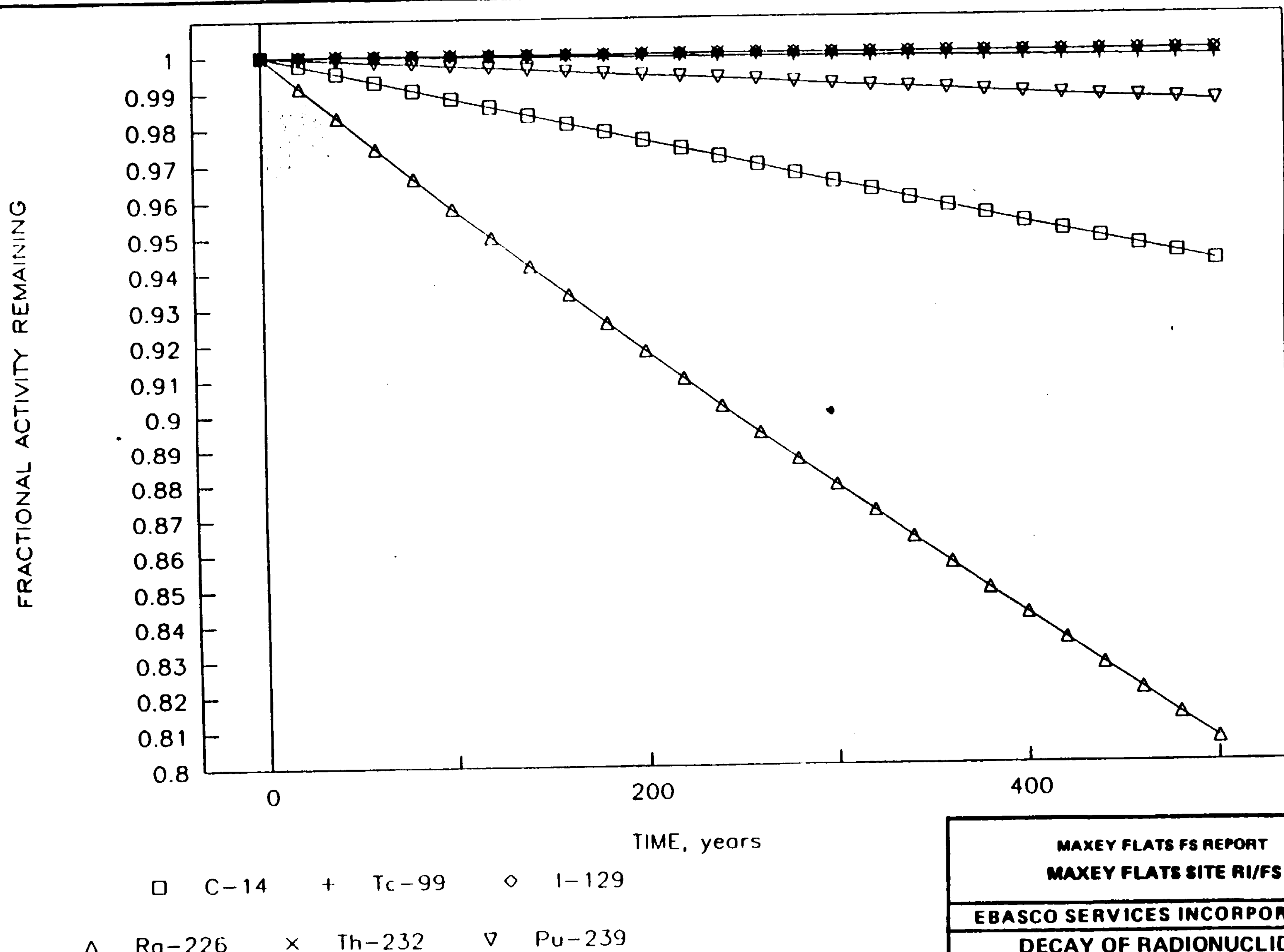
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

DECAY OF RADIONUCLIDE INDICATORS

H-3, Co-60, Sr-90, Cs-137, Pu-238, Am-241

FIGURE D.1-4



MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

DECAY OF RADIONUCLIDE INDICATORS
C-14, Tc-99 I-129, Ra-226, Th-232, Pu-239

5 9 0085

assessment may have underestimated the doses associated with some of the off-site pathways, in particular, the erosion pathway. It is for these reasons that EPA feels that the upperbound dose estimates for the erosion pathway are appropriate.

The risk assessment assumes migration of leachate to the hillslope drainage channels with subsequent migration of leachate to the alluvium, quickly, via surface water runoff. However, it is likely that leachate will also migrate down the entire hillslope through the shallow soil-colluvium layer and enter directly into the alluvial aquifer without major dilution from uncontaminated surface water. The risk assessment also assumes that a significant portion of alluvial ground water is recharged and diluted by stream water. A more appropriate assumption is that no recharge filtration from upstream water occurs to the band of contaminated ground water passing through the alluvium to the creek. This is more appropriate because, in the MFDS hydrogeological environment, alluvial ground water flows from the alluvium into the creek (rather than the reverse, as was assumed in the risk assessment). These factors, as well as the points made previously with regard to the in-transit decay and retardation factors, may have resulted in an underestimation of the potential doses associated with the off-site well water pathway.

The following uncertainties may have led to an overestimation of the exposures associated with some of the pathways evaluated:

The average case values for the Intruder-Agriculture well analysis are all greater than the maximum concentrations detected in the Remedial Investigation (RI) well sampling, with the exception of tritium. The tritium data from the RI may have been skewed by a well near a trench with very high tritium concentrations. Additionally, trench leachate data is also skewed toward high concentrations of certain radionuclides, since specific trenches were targeted during the RI because of the elevated radionuclide concentrations. Since the generation of leachate is a major component of most of the pathways modeled in the risk assessment, the model results may be conservative compared to previous field measurements.

The impacts for individual pathways for the 500-year timeframe are the sums of all radionuclides that impact the receptor at any time during that 500 year span. In other words, impacts seen from tritium in the early part of the time frame are added to those from radium-226, which are seen at the end of the time frame. This approach tends to overestimate the total dose, which is used to estimate exceedance ratios.

Determination - Page 76-A

The I-129 source term has probably been significantly overestimated in the risk assessment. The source of three curies for the MFDS is based on the assumption that I-129 was at its detection limit in the waste. Preliminary results of a recent study indicate that the I-129 source could be as much as 1000 times lower than its detection limit in low-level radioactive waste. The industry is still uncertain about the I-129 source term in low-level waste. However, since I-129 does not contribute significantly to the impacts estimated at the MFDS based on the three curie value, there is no real effect of adopting the overestimate.

Another uncertainty deals with the B_{iv} value for carbon-14. A recent study has shown that the B_{iv} for carbon-14 reported in Regulatory Guide 1.109 is as much as 50 times too high. However, the traditional value was employed in the MFDS risk assessment. It was thought that the traditional value would be used until the recent work becomes more widespread. As a consequence, the dose for carbon-14 from the ingestion of plants and deer meat may be overestimated.

SECTION 7.0 - DESCRIPTION OF ALTERNATIVES

7.1 Remedial Action Objectives

As previously discussed, the primary mechanism for release of contaminants to the environment from the MFDS is the migration of leachate from the disposal trenches, through the underlying, fractured bedrock, to the hillslopes surrounding the site. The major cause of leachate generation is the infiltration of precipitation through the subsided trench cover. Historically, trench leachate pumping operations at the MFDS have been necessary to address trench overflow conditions; thus, trench overflow is a pathway of concern as well.

Trench subsidence is the lowering of the trench caps due to trench waste consolidation over time. Areas affected by subsidence can range in size from a few square feet of a cap to the entire area of a trench or group of trenches. Subsidence can cause cap failures by cracking or deforming of the cap materials. Depressed areas commonly result in ponding of rain water, which would have run off naturally if subsidence had not occurred. Both subsidence and ponding can lead to increased rates of water infiltration into the waste. Subsidence is evident in most waste disposal trenches. After a few years, therefore, soil must be added to the trench surfaces and the caps must be regraded to maintain surface water runoff.

The objectives of remedial action at the MFDS are to:

- Minimize the infiltration of rainwater and ground water into the trench areas and migration from the trenches;
- Stabilize the site such that an engineered cap that will require minimal care and maintenance over the long term can be placed over the trench disposal area;
- Minimize the mobility of trench contaminants by extracting trench leachate to the extent practicable;
- Promote site drainage and minimize potential for erosion to protect against natural degradation;
- Implement institutional controls to permanently prevent unrestricted use of the site;
- Implement a sit. performance and environmental monitoring program;

As with any remedial action under Superfund, these objectives must be met in ways that are protective of human health and the environment and achieve applicable or relevant and appropriate federal and state requirements.

7.2 Alternatives

Eighteen potential remedial alternatives to achieve the remedial action objectives for the MFDS were developed and evaluated during the FS. These 18 alternatives were then screened on the basis of their effectiveness, implementability and cost. This screening produced a manageable group of seven alternatives. Each of the seven alternatives was then subjected to a detailed analysis which applied the nine evaluation criteria established by the Superfund Amendments and Reauthorization Act (SARA).

The No Action alternative, which is required to be evaluated at all Superfund sites, serves as a baseline for comparison against the other alternatives and must be carried through the detailed analysis of alternatives. The No Action alternative is not an action-based alternative but rather consists solely of monitoring and activities in support of monitoring.

With the exception of the No Action alternative, each of the alternatives evaluated incorporates technologies for trench stabilization as well as horizontal and vertical flow barriers. These technologies are discussed in the following sections.

7.2.1 - Stabilization Technologies

Stabilization at the MFDS refers to the consolidation and densification of trench soils and/or waste materials. The purpose of stabilization at the MFDS is to achieve trench stability such that a vertical infiltration barrier (cap) can be placed over the trench disposal area which requires minimum repair and maintenance over the long term.

The dynamic compaction technology is a stabilization method common to Alternatives 4, 10, and 17. The dynamic compaction technology involves the repeated dropping of a large weight on each trench cover (except for those trenches where it is not appropriate) until the waste and trench cover are sufficiently consolidated. The weight, or tamper, is dropped using a crane specially designed for that purpose. As the trench contents densify, backfill soil is added to the resulting depressions. The backfill soil is then compacted so that a stable cap can be constructed over the compacted trenches.

The natural subsidence technology is common to Alternatives 5 and 8. Natural subsidence is the natural densification and consolidation of soils and waste materials in the trenches over time. As the waste mass densifies by natural processes, causing subsidence, the overall rate of subsidence would decrease and the waste mass would become more stable. As natural subsidence continues, depressions would form in the overlying cap and these depressed areas would require backfilling with soil to prevent the ponding of rainwater and subsequent infiltration of rainwater into the trenches. Because of the many physical and chemical variables involved and the limited quantitative information available, it is not possible to predict accurately how long it would take for waste trenches to naturally subside at the MFDS.

Alternative 11 employs the grouting technology as a means of trench stabilization. The grouting technology would consist of injecting grout, a mixture of materials (e.g., cement, bentonite, fly ash, etc.) and water, through specially inserted probes into the majority of trenches to fill voids and other openings in the waste. Grouting would stabilize the trenches by reducing the subsidence that might otherwise occur as the trench contents settle into the voids. Stabilization could be only partially achieved by this technology because, although it might retard deterioration significantly, grouting would not likely prevent the continuing deterioration and collapse of the waste.

7.2.2 - Flow Barriers

Each action-based alternative that is described in the following sections utilizes barriers to prevent (1) vertical infiltration of precipitation to the trench waste, and (2) horizontal infiltration of ground water through subsurface strata to the trench waste.

7.2.2.1 Vertical Infiltration Barriers

The following four types of vertical infiltration barriers are included among the action-based alternatives evaluated: Structural Cap, Initial Cap, Engineered Soil Cap With Synthetic Liner, and Engineered Soil Cap (with all natural materials).

Alternative 4 employs a structural cap for minimizing vertical infiltration. The structural cap would consist of a two-foot-thick reinforced concrete slab over the trenches with a two-foot-thick clay layer elsewhere. The concrete/clay layer would be topped by a drainage layer and a topsoil layer to support a vegetative cover. The topsoil and drainage layers would protect the concrete/clay layer against weathering. They would also control excessive runoff rates which would minimize damaging erosive forces. Prior to placement of an initial layer of compacted soil over the existing trench cover, the trenches would be dynamically compacted to provide a stable support for the structural cap. A structural cap would then be placed over both the compacted trenches and the initial layer of compacted soil.

Alternative 5 employs an initial cap to serve as a barrier to vertical water infiltration while the natural stabilization process takes place, after which a final, multi-media cap would be installed. The initial cap would consist of a compacted soil layer covered with an approximate 30-40 mil thick synthetic cover[6]. The clay and synthetic material cover would cover an approximate 40 to 50 acre area. The intent of this approximate two-foot thick cap is to allow subsidence to occur naturally, while adding backfill material as necessary to maintain proper grading for drainage and repairing the synthetic cover as required. The final cap would be the engineered soil cap with synthetic liner described below.

Alternatives 8, 10, and 11 employ an engineered soil cap with synthetic liner as a barrier to vertical water infiltration. Alternative 5 also employs an engineered soil cap with synthetic liner, to be installed upon completion of the natural stabilization process. This type of vertical infiltration barrier consists (from bottom to top) of an initial layer of compacted soil placed over the existing trench cover, a two-foot-thick clay layer, an 80 mil (or sufficiently similar) synthetic liner, a geotextile fabric layer, a one-foot-thick drainage layer, a geotextile fabric layer, and a two-foot-thick soil layer supporting a vegetative cover. The composition of

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6 - The Commonwealth has proposed use of an initial cap consisting of: compacted soil cover over the trench disposal area, topped with a 25-year life, 60 to 80 mil thick, synthetic liner with a drainage layer/filter fabric on top, followed by a layer of topsoil to support a vegetative cover. As discussed in Section 10.1, the selected remedy includes an initial cap that does not employ a drainage/vegetative cover. However, an alternate design, such as the one proposed by the Commonwealth, may be used if the selected remedy's initial cap can not effectively control anticipated rates of surface water runoff and consequent erosion.

this cap would be designed to provide the most suitable soil properties and conditions to support and maintain a healthy vegetative cover (e.g., provide adequate moisture during prolonged rainless periods). Table 34 provides a description of the contribution of each layer contained in this type of vertical infiltration barrier.

Alternative 17 employs an engineered soil cap consisting of all natural materials as a barrier to vertical water infiltration. This type of barrier consists of several layers of natural materials designed and arranged to promote drainage, minimize infiltration, and provide protection from erosion. The layers (in order of placement from bottom to top) are: a four-foot-thick infiltration barrier consisting entirely of clay or a combination of clay and soil-bentonite (or equivalent) layers with a permeability of 1×10^{-7} cm/sec or less to provide a barrier against infiltration of precipitation; a four-foot-thick drainage layer consisting of a mixture of sand, crushed rock and gravel of high permeability to drain water off the cap into drainage ditches and away from the disposal trenches; and, a three-foot-thick soil layer with an eight-inch topsoil layer which would support a vegetative cover and allow infiltration of water (to be carried off through the underlying drainage layer), thus minimizing surface runoff and consequential erosion problems.

7.2.2.2 Horizontal Flow Barriers

Two types of potential horizontal flow barriers are included among the action-based alternatives evaluated: (1) a lateral drain and cutoff wall combination that encircles the entire trench area and (2) a cutoff wall that extends from the east slope to the west slope of the site, beneath the cap and along its north perimeter (north cutoff wall). Alternatives 4 and 17 employ the lateral drain/cutoff wall combination; Alternatives 5, 8, 10, and 11 employ the north cutoff wall flow barrier.

The lateral drain/cutoff wall would block exfiltration of any remaining leachate in the unlikely event that, without a hydrostatic head, the leachate could flow through tight fissures in the rock formations beneath the trenches. Specifically, the barrier would intercept leachate flow originating from shallow trenches and block or contain any leachate originating from deeper trenches. The lateral drain component of this horizontal flow barrier would involve excavation of a trench around the perimeter of the desired trench group and installation of a perforated pipe at the bottom of the trench to collect any liquids flowing into the drain. Crushed rock or gravel would surround the perforated pipe to allow flow into the pipe without clogging from soil particles. Sumps would be placed at specified intervals to collect leachate in the pipe; the leachate would then be solidified and disposed on-site. The lateral drain would be limited to the more shallow trenches in the western and central trench series due to practical equipment limitations.

The cutoff wall component of the lateral drain/cutoff wall barrier would consist of two sections: an upper section cut into the surface soil strata and a lower, much deeper section extending into the rock strata down to the desired depth. The upper section of the cutoff wall would consist of either a compacted clay key trench or a slurry wall with a permeability of 1×10^{-7} cm/sec or less. The upper section would block ground water flow at the interface of the soil cover and the Lower Marker Bed. The lower section of the cutoff wall would consist of a grout curtain utilizing a cementitious grout or a cement/bentonite grout. The lower portion, or grout curtain, would form a barrier against ground water flow into the trenches and/or outflow of leachate from the trenches. The cutoff wall design would include a series of collection wells near the inside of the wall to facilitate the removal of water mounding against the barrier. Water collected from these wells would be solidified for disposal in new trenches.

The second horizontal flow barrier evaluated consists of a cutoff wall without the lateral drain component[7]. The cutoff wall in this barrier is somewhat different than the previously described cutoff wall. This cutoff wall, sometimes referred to as a north cutoff wall, would be a slurry trench (identical to the upper section of the cutoff wall described above, except that a gravel drain would be installed near the bottom along its exterior side) without the grout curtain (lower section of the cutoff wall described above). The gravel drain along the exterior side of the wall (exterior to the trench disposal area)

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[7] - The Commonwealth has proposed the installation of a horizontal flow barrier that would extend down to the Henley Bed if site monitoring data indicates that lateral recharge of the trenches is occurring. The selected remedy does not specify the type, exact location or extent of the horizontal flow barrier, if one [illegible]ded. The Commonwealth's prop[illegible]al will be considered during evaluation of the necessity of a horizontal flow barrier.

would shunt ground water toward the hillslopes and prevent its seepage under the wall. By preventing water from entering the trenches, no new leachate would be generated in the trenches. The wall would be designed for a permeability of 1×10^{-7} cm/sec or less.

7.2.3 - Baseline Features

Each alternative also includes baseline features - features that are common to all alternatives, with the exception of the No Action alternative. The baseline features are as follows:

- Non-functional and unstable site structures would be decommissioned, demolished and buried on-site.

- Additional trenches would be constructed for disposal of solidified trench leachate and/or waste generated during site remediation.

- A buffer zone, contiguous to the existing site licensed property boundary, would be acquired. The buffer zone would encompass an approximate 200-acre area, at a minimum, and would: (1) ensure long-term access for the purpose of monitoring to assess remedy compliance; and, (2) control activities on the hillslopes adjacent to the MFDS to minimize hillslope erosion.

- Institutional controls would be established and maintained in perpetuity to prevent unauthorized and/or inappropriate use of the site.

- Monitoring and maintenance activities would be conducted routinely, and in perpetuity, to assess remedy performance and to preserve the integrity of the remedy, respectively.

- A remedy review would be performed by EPA at least every five years to ensure the remedy continues to meet the remedial action objectives, including compliance with state and federal ARARs and protection of human health and the environment.

The remedial alternatives receiving detailed analysis in the Feasibility Study are summarized in the following sections; estimated costs and design/construction times are summarized in Table 29, following the Description of Alternatives.

7.2.4 - ALTERNATIVE 1 - NO ACTION

Estimated Construction Cost:	$ 636,000
Estimated O & M Cost:	$ 6,167,000
Estimated Present-Worth Total Cost:	$ 6,803,000
Estimated Implementation Time:	6 months

Alternative 1 consists of the following activities:

- Site Monitoring
- Installation of Additional Monitoring Wells
- Repair, Maintenance and Replacement of Monitoring Equipment

Monitoring activities would consist of the installation of additional monitoring wells, sample collection and analyses on a frequent basis, and repair, maintenance and replacement of monitoring equipment as needed. The estimated cost of 6.8 million dollars for an alternative involving only monitoring activities arises from the need to monitor this site in perpetuity. The No Action alternative is not an engineered remedial alternative, and it would not satisfy the remedial objectives. The No Action alternative does not comply with ARARs and would, likewise, not provide overall protection of human health and the environment.

7.2.5 - ALTERNATIVE 4 - STRUCTURAL CAP/DYNAMIC COMPACTION/ HORIZONTAL FLOW BARRIER

Estimated Construction Cost:	$ 59,332,000
Estimated O & M Cost:	$ 6,175,000
Estimated Present-Worth Total Cost:	$ 65,507,000
Estimated Implementation Time:	38 months

Alternative 4 includes the following remedial activities:

- Trench Leachate Removal
- Solidification Of Leachate And Disposal In New Trenches
- Installation Of Horizontal Flow Barrier (Lateral Drain/ Cutoff Wall), If Necessary
- Dynamic Compaction Of Existing Disposal Trenches Concurrent With Addition Of Compacted Soil And Sand Backfill
- Installation Of A Two-Foot-Thick Reinforced Concrete (Structural) Cap Over The Compacted Trenches And A Two-Foot-Thick Low-Permeability Clay Cap Over The Rest Of The Trench Disposal Area.

- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

This alternative combines the technologies of trench leachate removal, dynamic compaction and structural capping. Leachate would be extracted, solidified, and disposed in newly-constructed trenches on-site. After leachate removal and dynamic compaction of the disposal trenches, a reinforced concrete structural slab and several feet of soil cover would be placed over the disposal trenches. The use of dynamic compaction on the trench area prior to placement of the structural cap would provide a stable foundation for the cap and minimize future subsidence. The reinforced concrete cap would not be capable of spanning the wide trenches without the support provided by stabilization.

The lateral drain/cutoff wall, if found to be necessary, would help reduce the off-site migration of contaminants and prevent the infiltration of subsurface water.

7.2.6 - ALTERNATIVE 5 - NATURAL SUBSIDENCE/INITIAL CAP AND FINAL ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER - "NATURAL STABILIZATION"

Estimated Construction Cost:	$ 23,910,000
Estimated O & M Cost:	$ 9,643,000
Estimated Present-Worth Total Cost:	$ 33,553,000

Estimated Implementation Time: 22 Months For Initial Closure Period;

35 - 100 Years For Interim Maintenance Period Following Initial Closure Period;

10 Months For Final Closure Period Following Interim Maintenance Period

The implementation of this alternative would involve the following activities:

- Trench Leachate Removal
- Solidification Of Leachate And Disposal Into New Trenches
- Installation of An Initial Cap And Periodic Replacement Of Synthetic Liner
- Installation of Horizontal Flow Barrier (North Cutoff Wall), If Necessary

- Natural Subsidence With Active Maintenance And Monitoring
- Installation Of A Final Engineered Soil Cap with Synthetic Liner
- Initial and Final Cap Grading And Contouring To Control Surface Water Flow And Erosion
- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

The "Natural Stabilization" alternative[8] combines elements of containment, leachate removal, and treatment. Following leachate extraction, solidification and disposal, an initial cap would be installed over the trench disposal area to prevent infiltration of precipitation into the trenches. The distinguishing feature of this alternative is the use of an initial cap during the period of natural subsidence, estimated to take approximately 35 to 100 years (the Interim Maintenance Period). This cap would be designed to prevent the infiltration of rainfall and surface water into the disposal trenches while subsidence and maintenance are taking place. Cap grading and contouring would be performed to enhance the control of surface water flow, better distribute the flow of surface water, and control and minimize, to the extent practicable, erosion of hillslopes. Improvements to drainage channels would be performed to enhance distribution of surface water runoff and to minimize erosion. Cap repairs and backfilling of subsided areas would be performed during the Interim Maintenance Period.

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8 - The term "closure", in the "Initial Closure Period" and "Final Closure Period" components of the Natural Stabilization Alternative, is used in a generic sense to denote sets of remedial activities to be implemented during those limited time periods. Neither the term closure nor the designations "Initial Closure Period" and "Final Closure Period" are used in any specific regulatory sense (i.e., AEC or RCRA closure).

The type of initial cap utilized would be contingent upon its ability to control surface water runon and runoff. Accelerated rates of hillslope and/or drainage channel erosion would necessitate a modification to the proposed initial cap design.

A final, multilayer cap with synthetic liner would be installed at the completion of natural subsidence, at which time the trenches would form a stable foundation for the final cap.

Additionally, a north cutoff wall would be constructed, if determined to be necessary, to prevent lateral ground water infiltration into the disposal trenches. Other types of horizontal flow barriers, such as a lateral drain/cutoff wall, could also be considered.

Maintenance requirements for this alternative would be significant during the interim maintenance period. Once the trenches have sufficiently stabilized, the final cap would be installed and maintenance requirements would be minimal. The timing of final cap construction would be based upon specific subsidence criteria developed in the remedial design.

7.2.7 - ALTERNATIVE 8 - NATURAL SUBSIDENCE/ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER

Estimated Construction Cost:	$ 34,302,000
Estimated O & M Cost:	$ 13,105,000
Estimated Present Worth Total Cost:	$ 47,407,000

Estimated Implementation Time: 23 months

Alternative 8 includes the following remedial activities:

- Leachate Removal
- Solidification Of Leachate And Disposal In New Trenches
- Installation Of A Horizontal Flow Barrier (North Cutoff Wall), If Necessary
- Installation Of An Engineered Soil Cap With Synthetic Liner
- Cap Grading And Contouring To Control Surface Water Flow And Erosion
- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

Following leachate extraction, solidification and disposal, an engineered soil cap with synthetic liner would be placed over the trench disposal area to prevent infiltration of precipitation into the trenches. The cap utilized in this alternative is identical to the final cap described in Alternative 5. Alternative 8 is identical to Alternative 5 except for the time of placement of the final cap. Alternative 8 places the final cap over the trench disposal area immediately, rather than waiting for subsidence to run its course during the estimated 35 to 100 year subsidence period as in Alternative 5. Trench stabilization would be accomplished by natural subsidence as in Alternative 5 with repairs to the final cap being made over the period of subsidence.

The required maintenance activities for this alternative would be high since trench subsidence and resulting repair of the complex final cap would be significant. Surface water control would be addressed through cap grading and contouring and drainage channel improvements. The north cutoff wall would provide a barrier against infiltration of ground water into the trench area.

7.2.8 - ALTERNATIVE 10 - DYNAMIC COMPACTION/ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER

Estimated Construction Cost:	$ 39,538,000
Estimated O & M Cost:	$ 4,790,000
Estimated Present-Worth Total Cost:	$ 44,328,000
Estimated Implementation Time:	35 months

Alternative 10 includes the following remedial activities:

- Leachate Removal
- Solidification Of Leachate And Disposal Into New Trenches
- Installation Of A Horizontal Flow Barrier (North Cutoff Wall), If Necessary
- Dynamic Compaction Of Existing Trenches With Concurrent Addition Of Compacted Soil And Sand Backfill
- Installation Of An Engineered Soil Cap With Synthetic Liner
- Cap Grading And Contouring To Control Surface Water Flow And Erosion
- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

With Alternative 10, the dynamic compaction technology would be employed to stabilize the trench wastes artificially rather than relying on natural subsidence. Prior to dynamic compaction of the trenches, leachate would be extracted, solidified and disposed on-site in new disposal trenches.

Upon compaction of the trenches, an engineered soil cap with synthetic liner would be placed over the trench disposal area to minimize vertical infiltration of water into the disposal trenches. The cap would be graded and contoured to control the rate of surface water flow and minimize erosion to the extent practicable.

A north cutoff wall (or other sufficient horizontal flow barrier) would be installed, if determined to be necessary, to control the infiltration of ground water into the disposal trenches.

7.2.9 - ALTERNATIVE 11 - TRENCH GROUTING/ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER

Estimated Construction Cost:	$ 61,870,000
Estimated O & M Cost:	$ 6,989,000
Estimated Present-Worth Total Cost:	$ 68,859,000

Estimated Implementation Time: 46 months

Alternative 11 includes the following remedial activities:

- Trench Leachate Removal
- Installation Of A Horizontal Flow Barrier (North Cutoff Wall), If Necessary
- Grouting Of Accessible Voids In The Existing Disposal Trenches With Grout Made From Potable Water And/Or Leachate
- Installation Of An Engineered Soil Cap With Synthetic Liner.
- Cap Grading And Contouring To Control Surface Water Flow And Erosion
- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

Alternative 11 would achieve trench stabilization by injecting grout through lances or probes into the majority of trenches for the purpose of filling voids and other openings in the trenches. Trench leachate would be extracted and would then be used in the grout mix for injection into the trenches. Once injected with grout, the trenches would provide a stable foundation for a trench cover. An engineered soil cap with synthetic liner would be placed over the trench disposal area to prevent infiltration of precipitation into the trenches. The cap would be graded and contoured to enhance control of surface water runon and runoff and improvements to drainage channels would be performed to enhance distribution of surface water runoff and to minimize erosion.

A north cutoff wall (or other sufficient horizontal flow barrier) would be installed, if necessary, to prevent the infiltration of ground water into the disposal trenches

7.2.10 - ALTERNATIVE 17 - DYNAMIC COMPACTION/ENGINEERED SOIL CAP/ HORIZONTAL FLOW BARRIER

Estimated Construction Cost:	$ 51,920,000
Estimated O & M Cost:	$ 4,634,000
Estimated Present-Worth Total Cost:	$ 56,554,000
Estimated Implementation Time:	38 months

Alternative 17 includes the following remedial activities:

- Leachate Removal
- Solidification Of Leachate With Disposal Into New Trenches
- Installation Of A Horizontal Flow Barrier (Lateral Drain/ Cutoff Wall), If Necessary
- Dynamic Compaction Of Existing Disposal Trenches Concurrent With The Addition Of Compacted Soil And Sand Backfill
- Installation Of An Engineered Soil Cap (With All Natural Materials)
- Cap Grading And Contouring To Control Surface Water Flow And Erosion
- Drainage Channel Improvements And Other Necessary Surface Water Control Features
- Baseline Features

Alternative 17 combines the remedial technologies of capping and dynamic compaction to stabilize the trenches. Prior to dynamic compaction of the trenches, leachate would be extracted, solidified and disposed on-site in new disposal trenches. The differences between this alternative and Alternative 10 are the types of horizontal flow barrier and cap employed. This alternative would involve installation of a lateral drain/cutoff wall rather than the north cutoff wall used in Alternative 10 and the engineered soil cap would be made of all natural materials and would not contain a synthetic liner as in Alternative 10.

The cap would be installed over the trench disposal area to minimize infiltration into the trenches. The cap would be graded and contoured to enhance control of surface water runon and runoff and improvements to drainage channels would be performed to enhance distribution of surface water runoff and to minimize erosion.

Table 28 lists the alternatives that underwent a detailed analysis for the MFDS.

TABLE 28

SUMMARY OF ALTERNATIVES
THAT UNDERWENT A DETAILED ANALYSIS

ALTERNATIVE 1	NO ACTION
ALTERNATIVE 4	STRUCTURAL CAP/DYNAMIC COMPACTION/ HORIZONTAL FLOW BARRIER
ALTERNATIVE 5	NATURAL SUBSIDENCE/INITIAL CAP AND FINAL ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER - "NATURAL STABILIZATION"
ALTERNATIVE 8	NATURAL SUBSIDENCE/IMMEDIATE ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER
ALTERNATIVE 10	DYNAMIC COMPACTION/ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER
ALTERNATIVE 11	TRENCH GROUTING/ENGINEERED SOIL CAP WITH SYNTHETIC LINER/HORIZONTAL FLOW BARRIER
ALTERNATIVE 17	DYNAMIC COMPACTION/ENGINEERED SOIL CAP/ HORIZONTAL FLOW BARRIER

TABLE 29

COST/SCHEDULE SUMMARY FOR
REMEDIAL ALTERNATIVES

Alternative	Cost[1]	Implementation Time[2]
1	$ 6,803,000	6 Months
4	65,507,000	38 Months
5	33,553,000	22 Months[a] 35 - 100 Years[b] 10 Months[c]
8	47,407,000	23 Months
10	44,328,000	35 Months
11	68,859,000	46 Months
17	56,554,000	38 Months

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1 - Cost estimates for the alternatives are present worth costs which include capital costs and operation and maintenance costs. All alternatives assume a 4% discount rate for the purpose of alternative comparison. The actual discount rate used to establish the remedy trust fund may differ from the 4% discount rate used here.

2 - Includes design and construction time.

a - The Initial Closure Period would be completed in 22 months.
b - The Interim Maintenance Period would commence upon completion of the Initial Closure Period and would take approximately 35 to 100 years for completion.
c - A 10 month Final Closure Period would follow the Interim Maintenance Period.

SECTION 8.0 - APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

CERCLA Section 121(d)(2) requires that the selected remedy comply with all federal and state environmental laws that are applicable or relevant and appropriate to the hazardous substances, pollutants, or contaminants at the site or to the activities to be performed at the site. Therefore, to be selected as the remedy, an alternative must meet all ARARs or a waiver must be obtained. Tables 30 and 31 summarize the action-specific and contaminant-specific applicable or relevant and appropriate requirements (ARARs) identified for the MFDS. A discussion of how each ARAR applies to the MFDS is also provided below.

8.1 Action-Specific ARARs

An action-specific ARAR is a performance, design, or other similar action-specific requirement that impacts particular remedial activities. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. These requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved. The following are action-specific requirements for the Maxey Flats Disposal Site remedy:

- Occupational Safety and Health (OSHA) Standards (29 CFR Sections 1910.120, .1000 - .1500, Parts 1926.53, .650 - .653)

The OSHA hazardous substance safety standards, 29 CFR 1910.120, .1000 - .1500, are applicable, action-specific requirements for remedial activities at the MFDS. The OSHA standards (1910.120) for hazardous substance response actions under CERCLA establish safety and health program requirements that must be implemented in the cleanup phase of a CERCLA response. Under the regulations, a health and safety program will be required for employees and contractors working at the MFDS. The standards found in 1910.1000 - .1500 govern CERCLA response actions involving any type of hazardous substance that may result in adverse effects on employees' health and safety. These standards also incorporate all of the requirements of 29 CFR Part 1926, the OSHA health and safety standards for construction. The provisions of 29 CFR 1926.650 - .653 are applicable to any excavation, trenching, and shoring that is undertaken as part of the construction of trenches, cut-off walls, etc.

TABLE 30

SUMMARY OF ACTION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Applicable	Relevant and Appropriate
Occupational Safety and Health (OSHA) Standards (29 CFR Parts 1910 and 1926, both in part)	Occupational Safety and Health (OSHA) Standards (29 CFR 1926, in part)
National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61, Subpart I)	Federal Standards for Protection Against Radiation (Allowable Doses in Restricted Areas) (10 CFR Part 20)
Kentucky Standards for Protection Against Radiation (Allowable Doses In Restricted Areas) (902 KAR 100:020)	Federal Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR Part 61)
Kentucky Standards for the Disposal of Radioactive Material (902 KAR 100:021)	Kentucky Licensing Requirements for Land Disposal of Radioactive Waste (902 KAR 100:022)
General Kentucky Requirements Concerning Radiological Sources (ALARA) (902 KAR 100:015)	Kentucky Soil and Water Conservation Requirements (KRS 262)
Kentucky Hazardous Waste Management Regulations (401 KAR Chapter 34, In Part)	Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Standards (40 CFR Part 264, In Part)
Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Standards (40 CFR Part 268)	
Kentucky Fugitive Air Emissions Standards (401 KAR 63:010)	

TABLE 31

SUMMARY OF CONTAMINANT-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Applicable	Relevant and Appropriate
Kentucky Standards for Protection Against Radiation (Allowable Doses in Unrestricted Areas) (902 KAR 100:020, Table II of 902 KAR 100:025)	Federal Standards for Protection Against Radiation (Allowable Doses in Unrestricted Areas) (10 CFR Part 20.105, .106 and Appendix B, Table II)
Kentucky Surface Water Quality Standards (401 KAR 5:026 - :035)	Ambient Water Quality Criteria (Section 304(a)(1) of the Clean Water Act)
Kentucky Hazardous Waste Management Regulations (401 KAR 34:060, Section 5)	Kentucky Drinking Water Standards-Maximum Contaminant Levels (401 KAR 6:015)
	Federal Drinking Water Regulations - Maximum Contaminant Levels and Maximum Contaminant Level Goals (40 CFR Parts 141, 142 and 143)
	National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61.92)
	Kentucky Licensing Requirements for Land Disposal of Radioactive Waste (902 KAR 100:022)
	Federal Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR Part 61.41)
	Federal Standards for Uranium and Thorium Mill Tailings (40 CFR Part 192)

The OSHA standards found in 29 CFR 1926.53 are relevant and appropriate requirements for construction and related activities involving the "use" of ionizing radiation. While the actions to be pursued at the MFDS do not, necessarily, involve the"use" of sources of ionizing radiation or radioactive materials, these standards do pertain to the substances involved at the site and to the activities of the workers in undertaking any part of the remedial action in the restricted area.

- National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61, Subpart I)

The NESHAPS standards found in 40 CFR Part 61, Subpart I, are applicable to those portions of remedial action that would result in fugitive emission of radionuclides into an unrestricted area. Compliance with this applicable requirement is determined by calculating the dose to members of the public at the point of maximum annual air concentration in unrestricted areas, using EPA-approved sampling procedures and computer codes. The air emission standard for NRC licensees, which includes the MFDS, is set at 25 mrem per year to the whole body and 75 mrem per year to the critical organ of any member of the public[9].

- Kentucky Standards for Protection Against Radiation (Allowable Doses in Restricted Areas) (902 KAR 100:020)

The Kentucky regulations found in 902 KAR 100:020 are applicable requirements for any employee performing work and for any other individual occupying the restricted area during remediation of the MFDS. These regulations include: limits to total occupational dose received, limits to airborne exposure in restricted areas, required surveys to establish compliance, and the use of appropriate signs, labels, signals and controls to minimize exposure to radiation.

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9 - A revision to this Subpart, changing the emission standard to 10 mrem/year effective dose equivalent, has been promulgated but the effective date has been stayed.

- Federal Standards for Protection Against Radiation (Allowable Doses in Restricted Areas) (10 CFR Part 20)

The requirements found in 10 CFR 20.101 - .103, .210(b)(1), .202, .203(a) - (c)(5), (d), and Appendix B, Table I are relevant and appropriate for the MFDS. Because Kentucky is an Agreement State, its radiation protection standards for protecting against radiation in restricted areas (902 KAR 100:020 above), as opposed to the federal standards, are the applicable standards.

- General Kentucky Requirements Concerning Radiological Sources (ALARA) (902 KAR 100:015)

The requirement found in 902 KAR 100:015, Sections 1 and 2, which requires that all persons "who receive, possess, use, transfer, own, or acquire" any radioactive sources must make every reasonable effort to maintain radiation exposures and releases in unrestricted areas to "as low as reasonably achievable" (ALARA), is applicable to the MFDS.

- Kentucky Fugitive Air Emissions Standards (401 KAR 63:010)

The fugitive air emissions standards found in 401 KAR 63:010 are applicable to the MFDS remedial activities because they apply to potential operations such as cap installation, excavation of disposal trenches, demolition activities, and other activities that may emit dust and other air contaminants. The standards require individuals to take reasonable precautions to prevent particulate matter from becoming airborne when material is handled or processed, a building is constructed, altered, or demolished, or a road is used. Visible fugitive dust emissions must be contained within the lot line of the property on which the emissions originate.

- Kentucky Standards for the Disposal of Radioactive Material (902 KAR 100:021)

The radioactive waste classification system and the radioactive waste characteristics requirements, found in Sections 7 and 8 of 902 KAR 100:021, are applicable requirements for the waste disposed of during the remediation of the MFDS. Section 7 provides the criteria for classifying waste for near-surface disposal. Section 8 contains minimum waste handling requirements for waste disposed of in new trenches, packaging requirements, permissible waste characteristics, and stability requirements of waste generated during remediation of the MFDS.

- Kentucky Licensing Requirements for Land Disposal of Radioactive Waste (902 KAR 100:022)

Sections 14, 19, 21, 23, 24(1) - (11), 25(3) and 27(2) of 902 KAR 100:022 are relevant and appropriate requirements for the disposal of waste generated during remediation in new units at the MFDS. The Kentucky Licensing Requirements for Land Disposal of Radioactive Waste specify that closure shall be designed to achieve long-term stability and isolation of the radioactive waste, to protect against inadvertent intrusion, and to eliminate, to the extent practicable, the need for on-going, active maintenance of the disposal site so that only surveillance, monitoring, and minor custodial care is required. The regulations further provide for post-closure surveillance of the site, which includes a monitoring system that provides early warning of releases of radionuclides before they reach the site boundary, and institutional control requirements.

- Federal Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR Part 61)

The requirements found in 10 CFR Part 61.29, .42, .44, .51(a), .52(a)(1) - (11), .53(d), .55 and .56 are relevant and appropriate for new disposal units at the MFDS. Section 61.41 will be treated as relevant and appropriate provided the new trenches are located in a manner that allows compliance with the standard to be measured at the boundary of the Restricted Area without interference from radionuclides migrating from existing trenches. Sections 61.42, .44, .51(a), .52(a)(6), .53(d), and .59(b) are relevant and appropriate with respect to the caps, monitoring system and institutional controls at the MFDS.

- Kentucky Soil and Water Conservation Requirements (Chapter 262 of Kentucky Revised Statutes)

Chapter 262 of the Kentucky Revised Statutes, which provides for the establishment of soil and water conservation requirements to prevent and control soil erosion, are relevant and appropriate requirements for the MFDS. Remedial activities could create changes in soil conditions and surface water flow. Thus, the generally applicable requirements for the technologies/actions that could lead to large-scale soil disturbance are relevant and appropriate.

- Kentucky Hazardous Waste Management Regulations (401 KAR Chapter 34)

Federal regulations under the Resource Conservation and Recovery Act (RCRA) establish minimum national standards defining the acceptable management of hazardous waste. States can be authorized by EPA to administer and enforce RCRA hazardous waste management programs in lieu of the Federal program if the States have equivalent statutory and regulatory authority. If the CERCLA site is located in a State with an authorized RCRA program, the State's promulgated RCRA requirements will replace the equivalent Federal requirements as potentially ARAR. If the State is authorized for only a portion of the RCRA program, both Federal and State standards may be ARARs.

Since EPA has delegated the Resource Conservation and Recovery Act (RCRA) program to Kentucky, the Kentucky hazardous waste management regulations are applicable, except for requirements such as those promulgated under the Hazardous and Solid Waste Amendments of 1984 (HSWA), which have not yet been delegated to Kentucky.

Radioactive Shipment Records for the MFDS indicate the disposal of Liquid Scintillation Vials (LSVs) at the site. LSVs, during the 1963 to 1977 site disposal period, typically contained a xylene or toluene solvent base. The fluids from LSVs containing xylene and toluene are considered RCRA spent solvent, listed hazardous waste. Sample analyses detected the presence of low levels of toluene and xylene in trench leachate during the MFDS Remedial Investigation. Consequently, the leachate at the MFDS is considered to be a listed hazardous waste.

Although disposal of the LSVs at the MFDS originally occurred prior to the effective date of RCRA Subtitle C regulations (November 19, 1980), the selected remedy for the MFDS will constitute disposal of a hazardous waste via the extraction, solidification and disposal of approximately three million gallons of trench leachate on-site. Thus, the RCRA requirements, or their Kentucky counterparts, are applicable to the MFDS.

The following Kentucky Hazardous Waste Management regulations are ARARs that must be met by the selected remedy:

- 401 KAR 34:060 - Ground Water Protection: Sections 8 and 9 set forth general ground water monitoring requirements and detection monitoring program requirements. Sections 10 and 11 set forth standards for the compliance monitoring program and corrective action programs which establish how the data gathered will be evaluated and what actions must be taken to eliminate contamination of ground water. Should ground water monitoring in the alluvium indicate Maximum Concentration Limits (MCLs/MCLGs) have been exceeded, the selected remedy must implement corrective action to comply with the MCLs/MCLGs.

- 401 KAR 34:070 (Sections 2, 5, 7, 8 and 10) - Closure and Post-Closure: Section 2 sets out closure performance standards which, among other requirements, are intended to minimize the need for further maintenance and control, minimize or eliminate to the extent necessary post-closure escape of hazardous constituents to ground or surface water or through the atmosphere, to protect human health and the environment.

Section 5 provides for the disposal or decontamination of equipment, structures, and soils. Section 7 requires a survey plat to be submitted to the local zoning authority and the Commonwealth. Section 8 provides for post-closure care and use of property. Section 10 requires a notation on the deed to the property noting the previous management of hazardous wastes thereon and the land use restrictions resulting from that use.

- 401 KAR 34:190 - Tanks: 401 KAR 34:190 regulates tank systems that are used for treatment and storage of hazardous waste.

- 401 KAR 34:230 Landfill Closure Standards: Section 6 provides standards for covers (caps) for sites where waste is left in place. These standards will apply to the design of the final cap at the MFDS.

- <u>Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Standards (40 CFR Part 268)</u>

Although EPA has delegated the RCRA program to Kentucky, those federal hazardous waste management regulations promulgated under HSWA, which have not been delegated to Kentucky, are also applicable to the MFDS. Specifically, 40 CFR Part 268, which sets out Land Disposal Restrictions (LDRs), is applicable to the MFDS. The LDRs require hazardous wastes to be treated to specified levels prior to land disposal. The LDRs are waived for remedial action at the MFDS; see Section 8.3 - ARARs Waiver of this Record of Decision.

The requirements of 40 CFR 264, related to minimum technology trench design requirements, are neither applicable nor relevant and appropriate to the remedial actions at the MFDS for those disposal trenches constructed within the Area of Contamination[10] (AOC) for the MFDS. The RCRA minimum technology requirements are not applicable because disposal of solidified trench leachate will not occur in a new RCRA unit, a lateral expansion of an existing unit, or a replacement unit. The selected remedy presumes that sufficient space is currently available within the AOC for the desired number of new disposal trenches to be constructed. However, if spacial limitations necessitate construction of new disposal trenches <u>outside</u> the Area of Contamination, minimum technology trench design requirements would be applicable requirements. For the MFDS, the AOC is best described as the entire area of the Restricted Area, an approximate 400 foot wide area parallel to the entire western boundary of the Restricted Area, an area 400 feet by 400 feet at the northwest corner of the Restricted Area, and an approximate 700 feet wide area parallel to the entire east boundary of the Restricted Area. The AOC, as illustrated in Figure 15, is subject to redefinition should new information become available, through additional site sampling, which indicates the presence of additional areas of contamination contiguous to the current AOC.

While minimum technology trench design requirements might be considered relevant to the disposal of hazardous waste at the MFDS, EPA does not consider them appropriate for the MFDS based upon such factors as the very low concentrations of chemical constituents relative to the threat posed by the radioactivity at the MFDS; the potentially significant increased infiltration into the trenches as a result of the much greater surface area that minimum technology trenches would require at the MFDS due primarily to the restrictive site geology; and, EPA's assessment that no appreciable additional level of protection to public health or the environment will be gained by imposing these requirements at the MFDS.

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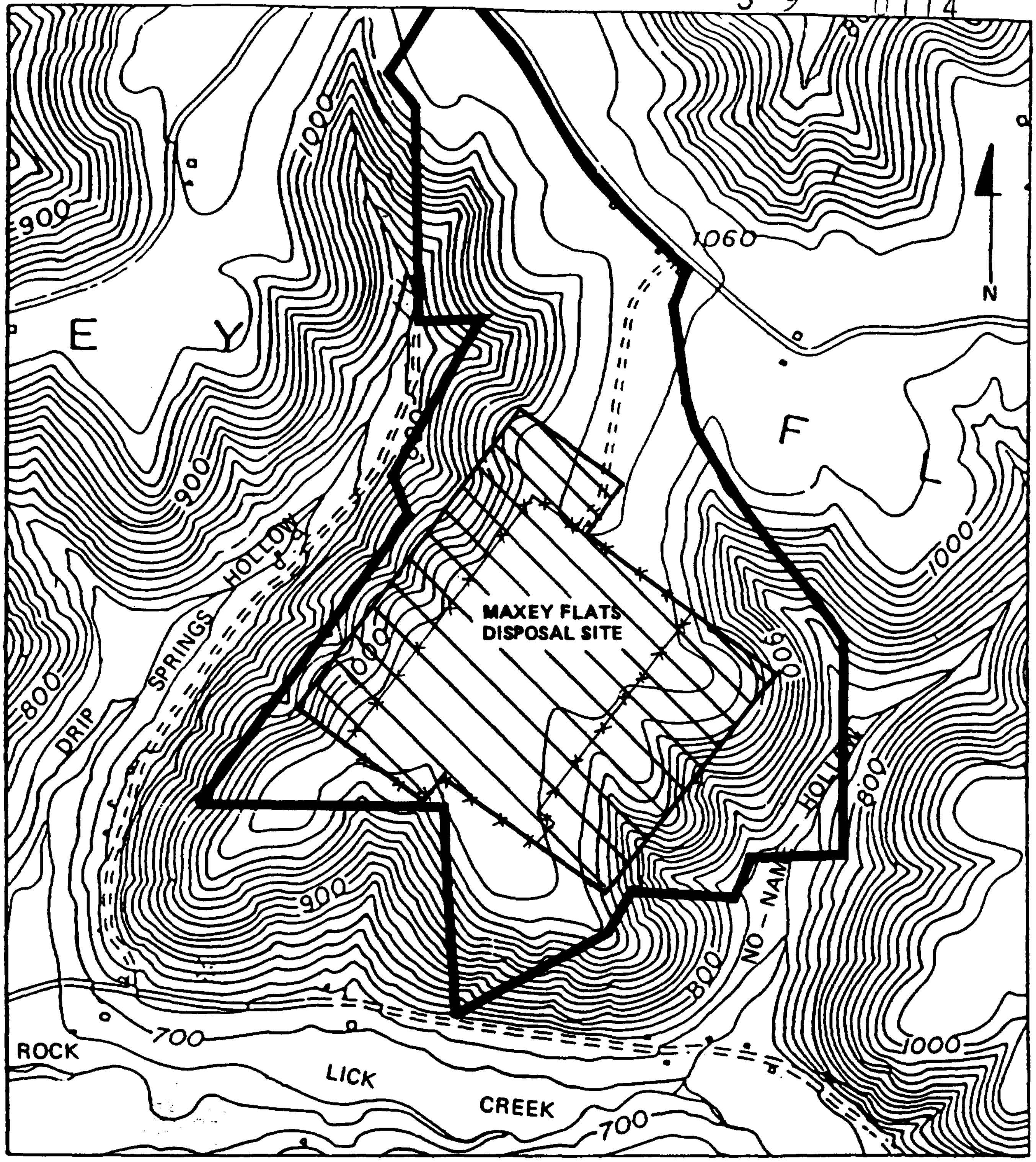
[10] - An Area of Contamination (AOC) is delineated by the areal extent (or boundary) of contiguous contamination. Such contamination must be contiguous, but may contain varying types and concentrations of hazardous substances. An example of an Area of Contamination includes a landfill and the surrounding contaminated soil.

FIGURE 15



500 0 500 1000

SCALE IN FEET

EXPLANATION

-x-x-x-x- *FENCE ENCLOSING BURIAL AREA*

▬▬▬ *MFDS PROPERTY BOUNDARY*

MAXEY FLATS
EXECUTIVE SUMMARY
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

MAXEY FLATS DISPOSAL SITE – SITE MAP

FIGURE 1

8.2 Contaminant-Specific ARARs

Contaminant-specific ARARs set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Examples of such media are air and water. These ARARs set protective cleanup levels for the contaminants of concern in the designated media or indicate an acceptable level of discharge into a particular medium during a remedial activity.

- Kentucky Standards for Protection Against Radiation (Allowable Doses in Unrestricted Areas) (902 KAR 100:020 and Table II of 902 KAR 100:025)

Sections 7 and 8 of 902 KAR 100:020 and Table II of 902 KAR 100:025, Section 2, provide general and isotope-specific radiation protection standards for individuals in unrestricted areas, and are applicable requirements for the radioisotopes at the MFDS. Section 7 requires that individuals in unrestricted areas should not receive a dose to the whole body in excess of 500 mrem in any year. Section 8 establishes limits, on an isotope-by-isotope basis, on the amount of radiation that can be released to unrestricted areas. Specifically, the section provides that radioisotopic concentrations in air and water above natural background cannot exceed the limits in 902 KAR 100:025, Table II.

- Federal Standards for Protection Against Radiation (Allowable Doses in Unrestricted Areas) (10 CFR Part 20.105, .106 and Appendix B, Table II)

Because of Kentucky's Agreement State status, its radiation protection standards provide the applicable requirements for protection against radiation in unrestricted areas at the MFDS. The analogous federal radiation protection standards found in 10 CFR Part 20.105, .106, and Appendix B, Table II are relevant and appropriate contaminant-specific standards for the MFDS. The federal standards were lowered in May 1991 so as to limit the allowable dose in unrestricted areas to 100 mrem/year and to provide specific radionuclide concentrations in Appendix B, Table II. In that these new federal standards are more stringent than the Kentucky regulations, the federal standards shall be the governing ARARs for allowable doses in unrestricted areas.

- Kentucky Surface Water Quality Standards (401 KAR 5:026 - :035)

Kentucky's Surface Water Quality Standards, set out in 401 KAR 5:026 - :035, set "minimum criteria applicable to all surface waters". These criteria include specific limits on radionuclides. These standards are applicable contaminant-specific standards for the surface water streams (i.e., Drip Springs Hollow, No Name Hollow, and Rock Lick Creek) surrounding the MFDS. In addition, to the extent that the site contains surface waters as defined by 401 KAR 5:029 Section 1(bb), including intermittent streams with well defined banks and beds, the surface water standards are, likewise, applicable contaminant-specific standards.

- <u>Ambient Water Quality Criteria (Section 304(a)(1) of the Clean Water Act)</u>

The EPA water quality criteria found in Section 304(a)(1) of the Clean Water Act are relevant and appropriate criteria for the MFDS. The EPA criteria for protection of aquatic life from acute or chronic toxic effects or the human health criteria for consumption of fish, whichever is more stringent, is the relevant and appropriate requirement for the surface waters at and around the MFDS.

- <u>Kentucky Drinking Water Standards - Maximum Contaminant Levels (401 KAR 6:015)</u>

The Kentucky drinking water standards establish maximum concentration levels for a number of inorganic, organic, and radionuclide contaminants. The MCLs established in 401 KAR 6:015 are relevant and appropriate requirements for the MFDS. Compliance with these ARARs will be judged beginning at the contact of the alluvium with the hillside and ending at the streams. Figure 16 provides an outline of alluvial deposits where drinking water standards will be enforced.

- <u>Federal Drinking Water Regulations - Maximum Contaminant Levels and Maximum Contaminant Level Goals (40 CFR Parts 141, 142, and 143)</u>

On January 30, 1991, EPA promulgated the new Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (Phase II). See 56 Federal Register 3526 (January 30, 1991) (to be codified at 40 CFR Parts 141, 142, and 143). The Phase II National Primary Drinking Water Regulations establish Maximum Contaminant Level Goals (MCLGs) and Maximum Contaminant Levels (MCLs) for 31 contaminants, which are effective July 30, 1992. A second regulation, promulgated in July 1991, established MCLGs and MCLs for five additional contaminants. MCLs are enforceable standards that apply to specified contaminants which EPA has determined have an adverse effect on human health above certain levels. MCLGs are non-enforceable health-based goals that have been established at levels at which no known or anticipated adverse health effects occur and which allow an adequate margin of safety.

MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
OUTLINE OF ALLUVIAL DEPOSITS WHERE STANDARDS WILL BE APPLIED AS RELEVANT AND APPROPRIATE
FIGURE A 2

FIGURE 16

59 0117

Under the NCP, EPA requires that MCLGs set at levels above zero (non-zero MCLGs) be attained during a CERCLA cleanup where they are relevant and appropriate. Where the MCLG is equal to zero, EPA sets the cleanup level to be the corresponding MCL. The MCLs and all non-zero MCLGs are relevant and appropriate requirements that must be achieved at the MFDS because ground or surface waters at the site are current or potential sources of drinking water. The recently added MCLs and MCLGs will supplement the Kentucky MCLs as relevant and appropriate requirements at the MFDS, and compliance with these ARARs will be judged at the contact of the alluvium with the hillside and ending at the streams. These criteria are presented in Appendix B to this Record of Decision.

- Kentucky Hazardous Waste Management Regulations (401 KAR Chapter 34)

\- 401 KAR 34:060 (Section 5) - Ground Water Protection: Section 5 establishes maximum ground water concentration limits for certain metals and organic compounds. Given the specific characteristics of site topography and geology, the first point beyond the waste management area boundary at which corrective action would be technically practicable is at the contact of the alluvium with the hillslopes. Given the institutional control and perpetual maintenance features of the remedy to be implemented, this is also the first point at which the public could be exposed to contaminated ground water. Compliance with maximum ground water concentration limits will, therefore, be judged at the contact of the alluvium with the hillslopes.

- National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61, Subpart H)

The NESHAPs for radionuclides in 40 CFR Part 61, Subpart H, establish an effective dose equivalent of 10 mrem/year for Department of Energy facilities. This standard is relevant and appropriate to the MFDS and compliance with this requirement will be judged at the current site licensed property boundary.

- Kentucky Licensing Requirements for Land Disposal of Radioactive Waste (902 KAR 100:022)

The 25 mrem/year dose limit found in Section 18 of 902 KAR 100:022 is a relevant and appropriate requirement for the MFDS. Compliance with the 25 mrem/year standard will be judged on the combined doses contributed by air, water, drinking water and soil pathways. The point of compliance for this requirement will be the current site licensed property boundary.

- Federal Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR Part 61.41)

Because Kentucky is an Agreement State, its radiation protection standards provide the standards for protecting against radiation in the general environment. Nevertheless, the analogous federal standard (10 CFR Part 61.41) to 902 KAR 100:022, Section 18 is relevant and appropriate.

- Federal Standards for Uranium and Thorium Mill Tailings (40 CFR Part 192)

The UMTRCA standard found in 40 CFR Part 192.12(a)(1), which applies to remedial actions at inactive uranium processing sites, limits radium-226 concentrations in soil to 5 pCi/gram in the top 15 centimeters. Radium-226 is present at the MFDS. Therefore, EPA has determined that the referenced UMTRCA standard is relevant and appropriate for the MFDS remedial action and is a contaminant-specific ARAR for soils at the Maxey Flats site.

8.3 ARARs Waiver

CERCLA Section 121(d) provides that, under certain circumstances, an ARAR may be waived using one (or more) of the following waivers:

- Interim Remedy Waiver - The remedial action selected is only a part of a total remedial action that will attain such a level or standard of control when completed. (CERCLA 121(d)(4)(A).)

- Greater Risk to Health and the Environment Waiver - Compliance with such requirement at the facility will result in greater risk to human health and the environment than alternative options. (CERCLA 121(d)(4)(B).)

- Technical Impracticability Waiver - Compliance with such requirement is technically impracticable from an engineering perspective. (CERCLA 121(d)(4)(C).)

- Equivalent Standard of Performance Waiver - The remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation, through use of another method or approach. (CERCLA 121(d)(4)(D).)

- Inconsistent Application of State Standard Waiver - With respect to a State standard, requirement, criteria, or limitation, the State has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial actions. (CERCLA 121(d)(4)(E).)

- Fund-Balancing Waiver - In the case of a remedial action to be undertaken solely under Section 104 using the Fund, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration, and the availability of amounts from the Fund to respond to other sites which present or may present a threat to public health or welfare or the environment, taking into consideration the relative immediacy of such threats. (CERCLA 121(d)(4)(F).)

At the MFDS, fifteen trench leachate samples were collected and analyzed for a variety of organics and inorganics during the RI. Additionally, RCRA analyses (pH, sulfide screen, ignitability screen) were performed on all fifteen samples. All samples tested negative for the RCRA parameters analyzed. Very low levels of organics were detected during the RI (e.g., toluene ranged from not detected to 5.3 parts per million, xylene ranged from not detected to 4.4 parts per million). The organic and inorganic analyses performed on the trench leachate indicate that Extraction Procedure (EP) Toxicity tests and Toxicity Characteristic Leachability Procedure tests would be negative for the fifteen samples. Therefore, RCRA characteristic levels would not be expected in the leachate once it is extracted and batched during RD/RA. Nontheless, the documented disposal of a listed waste at the MFDS (liquid scintillation vials containing xylene and toluene), and the presence of xylene and toluene in trench leachate, triggers RCRA requirements (or their Kentucky counterparts) as applicable to the MFDS.

Based on the very low levels of chemical constituents detected in trench leachate during RI sampling, it is unlikely that batched leachate would contain hazardous waste at levels above those which trigger prohibition of land disposal under Part 268. No further leachate testing for listed constituents or for waste at potentially characteristic levels is planned because, based on factors including those discussed below, EPA has determined that it is appropriate to invoke a waiver at this time.

During remedial action, approximately three million gallons of trench leachate will be extracted, batched, mixed with solidifying agents, and then disposed on-site in new disposal units. The leachate to be solidified includes concentrations of tritium as high, or higher than, 12,000,000 pCi/ml, Strontium-90 up to 2,000 pCi/ml, Plutonium-238 up to 320 pCi/ml, and Uranium-233/234 up to 130 pCi/ml. The objective of the leachate solidification program is to produce a solid, physically stable form of the leachate, thereby minimizing the mobility of radionuclides within the newly-constructed trenches. Treatment processes intended to remove the chemical portion of the leachate will significantly increase site worker exposure to radiation. In addition, by-products from treatment processes would require further handling, treatment and disposal, thereby further increasing worker exposure to radiation.

Risks associated with the MFDS are primarily due to potential exposure to radionuclides rather than the very low concentrations of chemical constituents detected at the site. However, measures taken to contain the radionuclides within the site (e.g., solidification and capping), will be effective in containing the chemical constituents as well. Thus, the implementation of treatment processes to remove the minor fraction of chemical constituents is not necessary to protect human health and the environment.

EPA has determined that compliance with 40 CFR Part 268 during remedial action at the MFDS would result in a greater risk to human health and the environment due to the volume of leachate to be treated and nature of the leachate and is hereby invoking a waiver of these requirements.

SECTION 9.0 - SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

9.1 Evaluation Criteria

Nine criteria are used to evaluate alternatives at Superfund sites. These nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. Generally, the modifying criteria are taken into account after public comment is received on the Proposed Plan. The nine criteria are as follows:

Threshold Criteria:

- Compliance with ARARs - Compliance with ARARs addresses whether a remedy will meet all of the ARARs of Federal and State environmental laws and/or justifies a waiver.

- Overall protection of human health and the environment - Overall protection of human health and the environment addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Primary Balancing Criteria:

- Short-term effectiveness - Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until remedial action objectives are achieved.

- Long-term effectiveness - Long-term effectiveness refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time.

- Reduction of toxicity, mobility or volume - Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

Primary Balancing Criteria (Continued):

- Implementability - Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost - Cost includes estimated capital and O & M costs, also expressed as net present-worth costs.

Modifying Criteria:

- State acceptance - State acceptance indicates whether, based on its review of the RI/FS Reports and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

- Community acceptance - Community acceptance summarizes the public's general response to the alternatives, based on public comments received during the public comment period.

9.2 Comparative Analysis

Compliance With ARARs

All of the alternatives, with the exception of Alternative 1, No Action, comply with all ARARs for the MFDS, or obtain an ARARs waiver as allowed under CERCLA Section 121(d). Since Alternative 1, the No Action alternative, does not meet the threshold criteria (does not achieve ARARs, does not provide overall protection of human health and the environment), Alternative 1 will not be evaluated further in this comparative analysis.

Overall Protection of Human Health and the Environment

All of the remedial alternatives provide overall protection of human health and the environment. However, the remedial alternatives have varying degrees of uncertainty associated with with long-term stability and potential release of contaminants. Alternative 5 provides the best assurance that, once the final cap is installed, cap maintenance will be at a minimum. Additionally, Alternative 5 is the least likely to involve container rupture and subsequent contaminant release.

In that wastes would be left at the site above health-based levels under each of the alternatives, the selected remedy will necessarily undergo an EPA-conducted review every five years following commencement of remedial action. The purpose of this review process is to ensure that the remedy prevents water infiltration into the trenches, mitigates hillslope erosion to the extent practicable, and minimizes the migration of site contaminants. Modifications to the remedy would occur through a Record of Decision amendment process if it were determined during a five-year review, or at any point between, that the remedy was not providing overall protection of human health and the environment.

Short-Term Effectiveness

Alternative 5 provides the greatest short-term effectiveness of the seven alternatives evaluated because it achieves initial capping of the trench disposal area earlier than any other alternative and with less exposure of site workers to radiation. Alternative 8 is only slightly less effective than Alternative 5, the principal difference being the greater amount of materials handling required for Alternative 8. Both of these natural subsidence alternatives (5 and 8) provide greater short-term effectiveness than Alternatives 4, 10 and 17, which use dynamic compaction to achieve stabilization, because dynamic compaction has a greater potential for exposing workers to direct radiation. Alternatives 4, 10 and 17 are roughly equal with respect to short-term effectiveness, but 10 provides a slightly greater degree of short-term effectiveness. The lack of a synthetic liner feature of Alternative 17 and the structural cap component of Alternative 4 make them less effective in the short term.

Alternative 11, grouting, is clearly the most hazardous to implement of the six alternatives and, therefore, is the least effective in the short term. Injecting more than 21 million gallons of grout into LLRW trenches at high injection rates and high pressures would be far more hazardous than any other activity considered for remediation of the site.

Long-Term Effectiveness

Alternative 5 provides a greater degree of long-term effectiveness overall than do the dynamic compaction alternatives even though, during the interim maintenance period of Alternative 5, a maintenance staff would be required to perform frequent inspections and to make prompt repairs following subsidence. This is because when the final cap is installed after an approximate 35 to 100 years, the amount of data that would be available for assessing stability would likely provide more certainty of stability than can be predicted about the dynamic compaction alternatives (10 and 17). Moreover, the dynamic compaction alternatives could result in the release of additional radionuclides due to container rupture during the compaction process, whereas Alternative 5 would allow for continued radionuclide decay and containerization for a longer period of time. Thus, while initial maintenance requirements are more intense for Alternative 5, the dynamic compaction alternatives may result in increased monitoring and maintenance to address the potential increased source term and long-term stability.

Alternative 10 provides a slightly greater degree of long-term effectiveness than Alternative 17 because Alternative 10 has the synthetic liner in the cap to provide a back-up to the clay layer.

Alternative 11 provides less long-term effectiveness than Alternative 5. While grouting (Alternative 11) would provide greater stability than natural stabilization during the early years, and possibly well beyond the early years, ultimately, natural stabilization would provide more stability. Because grout used in Alternative 11 would fill only the accessible voids at the time of grout injection, at some unpredictable time, one or more trenches might have a major subsidence and permit water to infiltrate the trenches. By contrast, Alternative 5 would be easy to repair, and the maintenance staff would likely discover the subsidence before water infiltrated the trenches.

Alternative 8 would require more frequent maintenance than Alternative 4; however, two potential major repair problems with Alternative 4 - concrete cracking and water infiltration - result in it providing a lesser degree of long-term effectiveness.

Reduction of Toxicity, Mobility or Volume

Because radioactivity is an intrinsic property of the nuclides in the trench leachate and other media at the site, leachate toxicity cannot be altered by treatment. Time is the principal means by which the toxicity of radionuclides is reduced. Toxicity is reduced by decay of the radionuclides to concentrations at which they no longer present a threat to human health and the environment. None of the alternatives evaluated employ a treatment technology aimed at satisfying the reduction of toxicity evaluation factor. However, mobility and volume can be addressed by treatment; decreasing mobility has a direct impact on health and safety since decreased mobility results in longer travel times for radionuclides and a decrease in activity resulting from radionuclide decay.

Reduction of the mobility of site radionuclides is achieved in varying degrees by each of the alternatives evaluated. All remedial alternatives involve the extraction, solidification and on-site disposal of solidified trench leachate. The solidification of radioactively contaminated water does not destroy or alter the radioactivity, but changes its form to a physically stable mass which binds the radionuclides so that they are far less mobile than they were in their liquid form. Approximately three million gallons of trench leachate will be solidified and disposed; thus, a significant reduction of the mobility of trench leachate would be accomplished by each of the alternatives. However, other factors, as discussed below, result in some alternatives being more acceptable than others in terms of mobility.

Other than exhumation and off-site disposal of the contaminated media at the site, a significant reduction in volume at the MFDS is not currently attainable. Exhumation and off-site disposal, while physically possible to perform, would result in unacceptably high doses to site workers involved in excavation of the solid wastes in the trenches. Additionally, due to the activity of some of the waste present at the site, and the volume of waste involved, no present-day commercial low-level waste facility would likely accept the waste. Furthermore, exhumation would not meet 902 KAR 100:015 which, as an applicable action-specific requirement for the MFDS. 902 KAR 100:015 requires exposures to be kept to as low as reasonably achievable.

The following factors were used to evaluate the alternatives against the reduction of toxicity, mobility or volume criteria: release of trench contaminants due to waste container rupture, the ability of an alternative to prevent infiltration of water and subsequent generation of new leachate, and the generation of contaminated material (increase in the volume of waste). Alternatives 5 and 8 are the superior alternatives in terms of reducing mobility and volume for several reasons. First, they do not involve the forced consolidation of trench waste;

therefore, the potential for release of radionuclides is not as great as the dynamic compaction alternatives (4, 10 and 17). Second, Alternatives 5 and 8 are superior to the grouting alternative (11) because they do not generate waste grout resulting from grout setup prior to injection or grout break-through, which must then be disposed of on-site.

Alternative 11 is more effective than Alternatives 4, 10 and 17 because the grout would solidify and may fixate the contaminants and would result in a more predictable trench chemistry. Alternatives 10 and 17, which utilize dynamic compaction, result in a more complex trench chemistry with a less than predictable impact on the environment. Alternative 4 is less effective than Alternatives 10 and 17 because it would be more difficult to keep water out of the trenches and to prevent contamination or construction runoff water when installing the structural cap.

Implementability

Alternative 5 would be the easiest to implement because it would be a continuation of the present operation but with improvements. Alternative 8 would be more difficult than Alternative 5 because of the problems associated with repair of the final cap over the period of trench subsidence. Both Alternatives 5 and 8 would be easier to implement than the alternatives involving grouting, dynamic compaction, or structural concrete, all of which are more complicated technologies. The dynamic compaction alternatives (4, 10 and 17) would be more easily implemented than the grouting alternative (11). Nevertheless, dynamic compaction would require pilot scale demonstrations of the suitability of this technology to the MFDS.

Alternative 11 is the least implementable of the alternatives evaluated at the MFDS. High production grouting (large volumes, high injection rates, high pressures), although technically feasible, has experienced difficulties at other similar sites. Additionally, the scale to which it would be employed at the MFDS is much greater than other sites where it has been applied. Significant difficulties could be expected during attempts to drive injection lances into the trenches. Grouting would require additional research and testing at the MFDS due to the complexities associated with grouting in trenches.

Cost

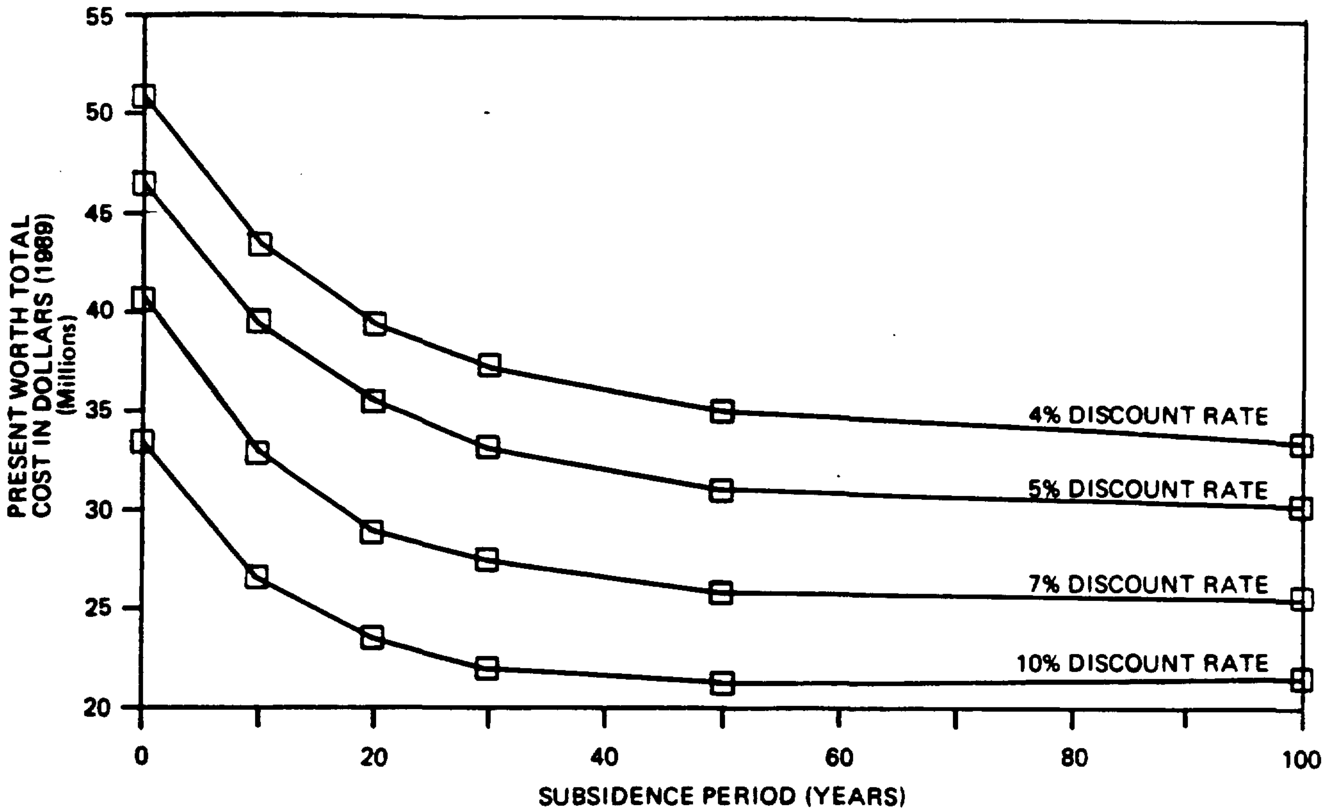
The present worth total cost of Alternative 5 depends on the period assumed for interim maintenance and is a maximum when the interim maintenance period equals zero years. Nevertheless, comparing the maximum present worth total costs of Alternative 5 with those of other alternatives shows that Alternative 5 has the lowest present worth total cost of any alternative regardless of the length of the interim maintenance period. Figure 16 illustrates the differences in total present worth for four assumed discount rates over the projected subsidence period.

Table 32 provides a cost breakdown for Alternative 5 and provides cost estimates for Alternative 5 using four different discount rates, 4%, 5%, 7%, and 10%. The $ 33,500,000 cost estimate for Alternative 5 is based upon a 4% discount rate, which is the most conservative rate of the four rates used in the Feasibility Study. A 4% discount rate was used to compare alternatives. The actual discount which will be used to establish the MFDS trust fund has yet to be determined.

Furthermore, the cost estimate for Alternative 5 assumes a 10% contingency and installation of a North Cutoff Wall. The actual contingency factor employed in the establishment of the MFDS trust fund may be higher than 10%. The necessity of a horizontal flow barrier and type of horizontal flow barrier (i.e., North Cutoff Wall, Lateral Drain/Cutoff Wall, etc.) will be determined during the Interim Maintenance Period; therefore, the cost estimate for Alternative 5 is subject to change.

State Acceptance

The Commonwealth generally endorses the selection of Alternative 5 (Natural Stabilization) as the remedy for the Maxey Flats Disposal Site. The Commonwealth considers trench cover repair and a horizontal flow barrier, if needed, to be integral features of the remedy chosen for the site. The Commonwealth rejects the use of Alternative 10 and 17 (dynamic compaction) for either a site demonstration or for total site remediation due to potential release of contaminants into the environment and uncertainties regarding dynamic compaction's effect on the underlying geologic strata. The Commonwealth also rejects the use of grouting (Alternative 11) for implementation at the MFDS due to potential unacceptable releases to the environment, implementability problems, and required demonstration of this technology prior to implementation.



MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

ALTERNATE 5 SUBSIDENCE PERIOD PRESENT WORTH SENSITIVITY CURVES

040191

FIGURE G-2

ALTERNATIVE-5: NATURAL STABILIZATION (50-ACRE CAP)

CAPITAL COSTS AND COST LAYOUT	Estimated Total	Year 1 1990	Year 2 1991	Year 3 1992	Year 4 1993	Interim Period	Year 103 2092	Year 104 2093
A. Construction Cost								
Site Preparation and Support								
1. Road Construction (Cut, Gravel, Fabric)	$530,000	$0	$0	$430,000	$0		$0	$100,000
2. Decon. Facility(Equip't & Personnel)	$130,000	$0	$0	$80,000	$0		$0	$50,000
3. Utilities	$50,000	$0	$0	$30,000	$0		$0	$20,000
4. Field Offices & Construction Fence	$200,000	$0	$0	$120,000	$0		$0	$80,000
5. Topographic & Bkgd Radiation Survey	$140,000	$0	$0	$70,000	$0		$0	$70,000
6. Ground Penetration Radar Survey	$150,000	$0	$0	$150,000	$0		$0	$0
7. Construction Erosion Control	$200,000	$0	$0	$100,000	$0		$0	$100,000
8. Health and Safety	$2,000,000	$0	$0	$1,000,000	$500,000		$0	$500,000
9. QA/QC	$1,080,000	$0	$0	$450,000	$250,000		$0	$380,000
Sub-total	$4,480,000	$0	$0	$2,430,000	$750,000		$0	$1,300,000
Specific Construction Activities								
1. Leachate Removal	$1,252,000	$0	$0	$1,252,000	$0		$0	$0
2. Contaminated Liquid Handling and Disposal	$4,079,000	$0	$0	$4,079,000	$0		$0	$0
3. Contaminated Soil Disposal	$174,000	$0	$0	$174,000	$0		$0	$0
4. Existing Tank Leachate-Rem'l, Solid'n & Disp'l	$0	$0	$0	$0	$0		$0	$0
5. Horizontal Flow Barrier (North Cutoff Wall)	$1,156,000	$0	$0	$1,156,000	$0		$0	$0
6. Additional Backfill	$0	$0	$0	$0	$0		$0	$0
7. Dynamic Compaction	$0	$0	$0	$0	$0		$0	$0
8. Trench Grouting	$0	$0	$0	$0	$0		$0	$0
9. Site Grading	$160,000	$0	$0	$160,000	$0		$0	$0
10. Demol'n, Material Handling & Decon.	$740,000	$0	$0	$450,000	$0		$0	$290,000
11. Leachate Solidificat'n/Add'l Disposal Trenches	$4,706,000	$0	$0	$4,706,000	$0		$0	$0
12. Drainage Ditches	$889,000	$0	$0	$0	$215,000		$0	$674,000
13. Initial and Final Closure Caps	$17,489,000	$0	$0	$0	$3,449,000		$0	$14,040,000
14. Cap Erosion Control	$1,445,000	$0	$0	$0	$204,000		$0	$1,241,000
15. Long Term Monitoring	$691,000	$0	$0	$0	$626,000		$0	$65,000
16. Security Fence	$120,000	$0	$0	$60,000	$60,000		$0	$0
Sub-total	$32,901,000	$0	$0	$12,037,000	$4,554,000		$0	$16,310,000
Total Construction Cost	$37,381,000	$0	$0	$14,467,000	$5,304,000		$0	$17,610,000
B. Engineering and Management Cost								
1. Engineering & Design (1)	$2,990,480	$0	$1,581,680	$0	$0		$1,408,800	$0
2. Construction Management (2)	$11,214,300	$0	$0	$4,340,100	$1,591,200		$0	$5,283,000
Total Engineering & Management Cost	$14,204,780	$0	$1,581,680	$4,340,100	$1,591,200		$1,408,800	$5,283,000
Total Capital Cost	$51,585,780	$0	$1,581,680	$18,807,100	$6,895,200		$1,408,800	$22,893,000
10% Contingency	$5,158,578	$0	$158,168	$1,880,710	$689,520		$140,880	$2,289,300
Total Capital Cost with Contingency	$56,744,358	$0	$1,739,848	$20,687,810	$7,584,720		$1,549,680	$25,182,300

TABLE 32

ALTERNATIVE-5: NATURAL STABILIZATION (50-ACRE CAP)

PRESENT WORTH CALCULATION - CAPITAL COSTS

Assumptions:
1. Estimated Engineering and Design cost is based on 8% of total construction
2. Estimated construction management cost is based on 30 % of total construction
3. Scheduled construction period for Alternative 5 is 20 months for initial construction and 10 months for final capping.

	Discount Rates			
	4%	5%	7%	10%
PW of Total Capital Costs	$25,900,882	$24,625,424	$22,632,720	$20,147,951

PRESENT WORTH CALCULATION - O & M COSTS

Assumptions:
1. Present worth of O&M costs is based on perpetual annual maintenance and subsidence repair as required
2. All O&M costs include inflation at 0% per year.
3. O&M begins in December of Year 4 (1993).
4. Cost of yearly custodial maintenance excluding subsidence repair is $385,000 for years 1 to 10, $295,000 for years 11 to 100, $240,000 years 101 to 110, and $190,000 years 111 onwards in perpetuity. In addition, $40,000 is applied every 5 years for the first 100 years for leachate pumping and solidification.
5. O&M costs do-not include taxes, insurance and license fees.

	Discount Rates			
	4%	5%	7%	10%
PW of Total O&M Costs	$10,097,549	$7,692,612	$4,924,075	$2,921,415

PRESENT WORTH - TOTAL COST

	Discount Rates			
	4%	5%	7%	10%
PW of Total Cost	$35,998,431	$32,318,036	$27,556,795	$23,069,366

Community Acceptance

Verbal comments received at the Proposed Plan public meeting, held on June 13, 1991 in Wallingford, Kentucky, and on comments submitted to EPA during the public comment period on the Proposed Plan, indicate that the community favors Alternative 5, Natural Stabilization, over the other alternatives considered. However, the community urged inclusion of a number of features in the Record of Decision and RD/RA Consent Decree. The community's comments and suggestions, as well as EPA responses, can be found in the Responsiveness Summary section of this Record of Decision.

The community opposes the dynamic copaction alternative (Alternatives 4, 10 and 17) for the MFDS, primarily because of concerns over accelerated release of contaminants to the environment during the compaction process. The community does not favor the grouting alternative due to concern over potential contaminant release from intact containers during the grout injection process and uncertainties over the ability of grout to adequately fill void spaces within the trenches.

9.3 Conclusions of the Comparative Analysis Summary

Of the nine criteria described above, the differences between the six remedial alternatives evaluated are not great, except with respect to the following four criteria: 1) Implementability; 2) Reduction of Toxicity, Mobility or Volume; 3) State Acceptance, and 4) Community Acceptance. All remedial alternatives provide for roughly the same degree of long-term and short-term effectiveness. All remedial alternatives provide for overall protection of human health and the environment and all achieve ARARs. Although cost estimates differ amongst the remedial alternatives, none differ by more than an order of magnitude.

Therefore, Implementability, Reduction of Toxicity, Mobility or Volume, State Acceptance, and Community Acceptance weighed heavily in favor of selection of Alternative 5. Alternative 5 is the least difficult remedy to implement, utilizing proven and reliable technologies to achieve final remediation, while not requiring time-consuming research and development prior to implementation. It is less likely to result in container rupture and, therefore, benefits from the added protection of containers within the trenches. Both the State and Community favor the Natural Stabilization technology.

SECTION 10.0 - THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined, and the Commonwealth agrees, that Alternative 5, Natural Stabilization, is the most appropriate remedy for the Maxey Flats Disposal Site.

The natural stabilization process at Maxey Flats will allow the materials to subside naturally to a stable condition prior to installation of a final engineered cap. It is not known how long it will take for waste trenches to stabilize because of the many physical and chemical variables involved and the limited trench-specific information upon which predictions are based. However, it has been estimated that this stabilization process could potentially take 100 years before the final cap is placed.

Stabilization of the trenches by natural subsidence over a relatively long time period will virtually eliminate the potential problem of future subsidence expected with other alternatives in which the trenches would be stabilized by mechanical means and a final cap installed within a few years. Therefore, the natural stabilization alternative will reduce the redundancy of efforts necessary to construct and maintain the final cap. Natural stabilization does not disrupt intact metal containers such as 55-gallon drums and, therefore, provides an extra measure of protection to prevent movement of radionuclides to the hillsides. The other alternatives have the potential of rupturing intact containers, thereby releasing radioactive material immediately to the trenches. Additional benefits of the natural stabilization alternative will be the opportunity for continued data collection and analyses and the ability to take advantage of technological advances during the subsidence period.

Alternative 5 can be divided into the following four phases which together comprise the CERCLA remedial action for the MFDS:

- Initial Closure Period (22 months)
- Interim Maintenance Period (35 - 100 years)
- Final Closure Period (10 months)
- Custodial Maintenance Period (in perpetuity)

10.1 - Initial Closure Period

The initial closure period will consist of the design and implementation of remedial activities appropriate to the early stages of site remediation. An Interim Site Management Plan will also be developed to define the maintenance and monitoring tasks to be conducted during the subsequent interim maintenance period.

The following remedial activities will be performed during the initial closure period:

- Baseline Topographic Surveys
- Geophysical Surveys
- Ground Water Monitoring
- Ground Water Modeling
- Trench Leachate Extraction and Solidification
- Disposal of Solidified Leachate Into New Trenches On-Site
- Demolition of Existing Buildings and Structures With On-Site Disposal
- Installation of an Initial Cap
- Grading and Recontouring of the Initial Cap to Enhance Surface Water Flow
- Improvements to Site Drainage
- Installation of Subsidence Monitors
- Closure of Selected, Poorly Designed, Historical Wells
- Monitoring, Maintenance, and Surveillance
- Procurement of a Buffer Zone Contiguous to the Existing Site Property
- Posting and Repairing of Signs and Fences, Road Maintenance
- Development of the Interim Site Management Plan

Baseline Topographic and Geophysical Surveys will be conducted prior to design of the initial cap. Topographic surveys will be performed prior to installation of the initial cap and following construction of the cap to be used as a baseline survey for subsidence monitoring. A geophysical survey will enhance the definition of trench boundaries to ensure that the initial cap will adequately cover the trenches.

Historical site monitoring data, the Commonwealth's site database, and ground water models will be used to determine the appropriate areal extent of the initial cap, to evaluate the need for a horizontal ground water flow barrier, and to develop an effective ground water monitoring plan for the Interim Maintenance and Custodial Maintenance Periods. The ground water monitoring program will involve installation of new monitoring wells, as appropriate, in the alluvium of the surrounding stream valleys, and in other areas as required, to ensure compliance with drinking water standards and to achieve RCRA monitoring requirements.

Trenches will be dewatered to help prevent the migration of contaminants by ground water flow. A trench dewatering test program will be conducted either during the design phase or during initial remedial activities to provide information on the most effective design of the dewatering program, to determine the need for new sumps, and to provide an estimate of the duration of the dewatering program.

Leachate pumped from the trenches will be extracted simultaneously from multiple trenches and batched prior to solidification. Additional sumps will be added in select trenches with significant quantities of leachate in order to facilitate the dewatering of trenches. Trench dewatering is the most time-consuming component of the Initial Closure Period. A minimum of nine months will be required to dewater the trenches.

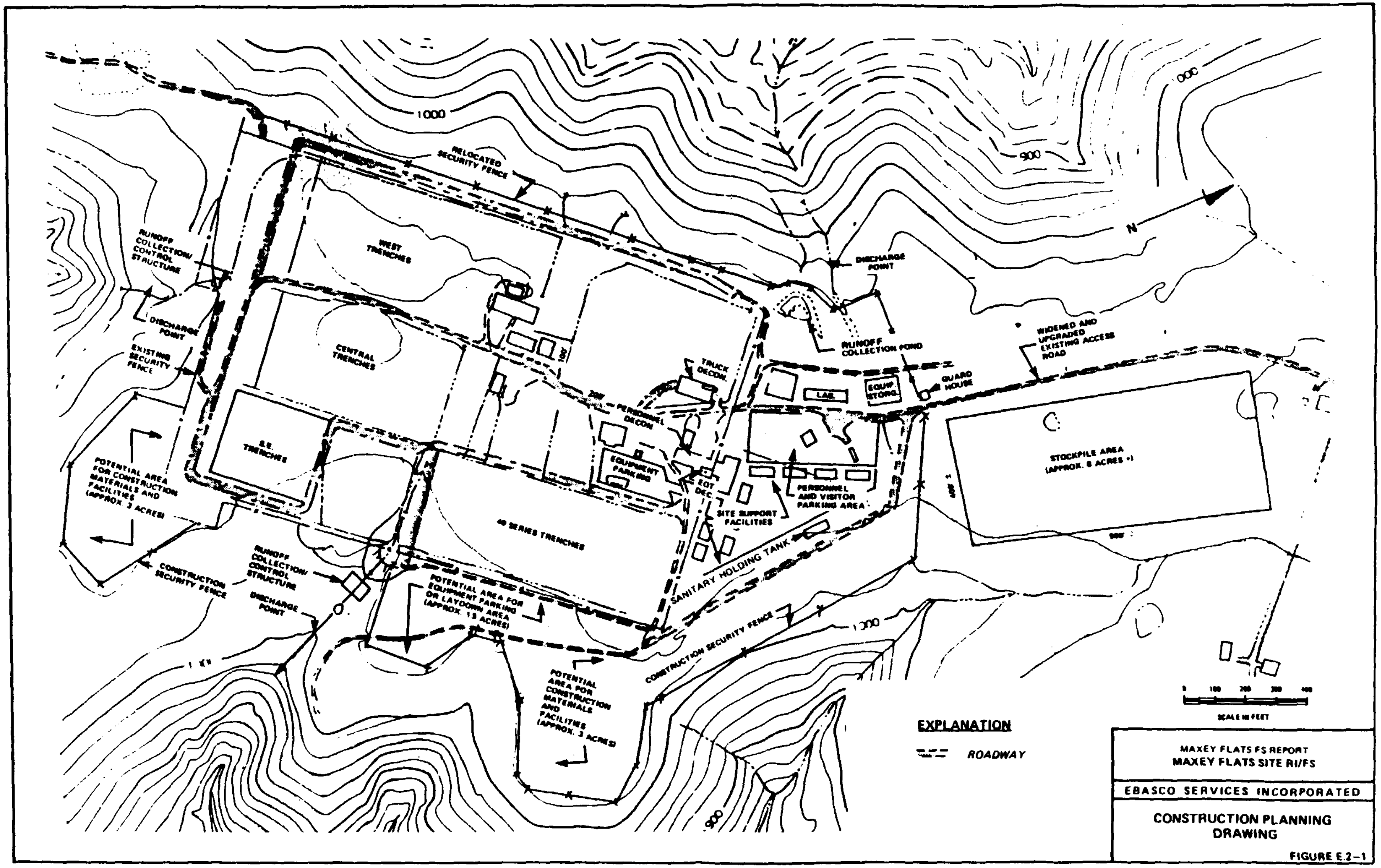
Once batched, the leachate will undergo testing for NRC classification purposes. Once classified, the leachate will be solidified using an NRC-approved mix. The waste form will likely be in block form, provided an acceptable leachability index and cumulative fraction leached can be achieved. However, high activity leachate will be required to be placed in a primary container and solidified. The solidified leachate will also be designed to achieve a sufficient minimum compressive strength. The objectives of the leachate solidification will be to produce a solid, physically stable form of the leachate, thereby minimizing the mobility of the contamination within the trenches. During the leachate solidification operations, external exposure to ionizing radiation will be kept as low as reasonably achievable by using engineering safeguards, such as shielding, and administrative safeguards such as detailed health and safety procedures for all operations. Internal exposure to radioactivity should be insignificant, since the systems that handle radioactivity would be designed to minimize leakage.

The solidified leachate will then be placed into new disposal trenches on-site and within (or in close proximity to) the current Restricted Area. Grout will be used in the newly constructed trenches to fill the void spaces between the solidification forms, in effect, creating a monolith within the trench. Each new disposal trench will, at a minimum, include a sump and a synthetic liner (unless it is later determined by EPA and the Commonwealth that use of a liner is inappropriate).

Non-functional and unstable buildings and structures will be dismantled, decommissioned and buried in a trench on-site during the Initial Closure Period. Such buildings and structures will probably include: the storage building, evaporator building, garage building, radiological control building, the sewage treatment plant, and tank farm buildings. Those buildings necessary to the management and maintenance of the site will be moved to a new location that will not impede remedial activities. Figure 18 is a typical construction planning drawing that may be employed during the Initial Closure Period.

An initial cap, consisting of a soil layer of compacted clay (averaging 21 inches thick) and covered with a synthetic liner, will be installed toward the end of the Initial Closure Period. Soil will be added to the site and graded and compacted in preparation for the installation of the synthetic cover over the trench disposal area. Conceptual cross-sections of both the initial cap and the final cap are presented in Figure 19. The areal extent of the interim cover will be based upon geophysical surveys, ground water modelling and other parameters evaluated during design. It has been estimated that the interim cap will cover approximately 40 to 50 acres. Fugitive dust problems during earth-moving operations will be controlled by using water or other dust suppressants. Kentucky Soil and Water Conservation requirements for controlling soil erosion will be met by designing and locating technologies and activities to minimize potential erosion.

The surface will be graded to design specifications to allow for adequate drainage and to minimize surface water velocities and consequent erosion. Lined drainage ditches will be incorporated in the trench cap to channel the surface water runoff to the three existing discharge basins located along the periphery of the trench disposal area. Improvements will also be made to the existing site drainage channels on the hillslopes. These erosion protection measures could include, but will not necessarily be limited to, stabilization of the drainage channels where necessary by such measures as rock rip-rap or gabions to reduce the velocity of flow. Additional drainage channels in the vicinity of the site may be added if found to be necessary to control, and more equitably distribute, the anticipated increased rates of surface water runoff. Because of the high peak discharge volumes resulting from the initial cap, the capacity of the retention ponds will be increased to improve control of stormwater runoff. Approval of the initial cap design will be contingent upon the ability of the surface water controls to adequately maintain rates of surface water runoff throughout the anticipated duration of the Interim Maintenance Period.


1000
RELOCATED SECURITY FENCE
900
N
WEST TRENCHES
RUNOFF COLLECTION/ CONTROL STRUCTURE
DISCHARGE POINT
EXISTING SECURITY FENCE
CENTRAL TRENCHES
S.E. TRENCHES
POTENTIAL AREA FOR CONSTRUCTION MATERIALS AND FACILITIES (APPROX 3 ACRES)
CONSTRUCTION SECURITY FENCE
DISCHARGE POINT
RUNOFF COLLECTION POND
WIDENED AND UPGRADED EXISTING ACCESS ROAD
TRUCK DECON.
LAB.
EQUIP. STORG.
GUARD HOUSE
PERSONNEL DECON
EQUIPMENT PARKING
EQT DEC.
PERSONNEL AND VISITOR PARKING AREA
SITE SUPPORT FACILITIES
STOCKPILE AREA (APPROX. 8 ACRES +)
40 SERIES TRENCHES
SANITARY HOLDING TANK
RUNOFF COLLECTION/ CONTROL STRUCTURE
POTENTIAL AREA FOR EQUIPMENT PARKING OR LAYDOWN AREA (APPROX. 1.5 ACRES)
DISCHARGE POINT
CONSTRUCTION SECURITY FENCE
POTENTIAL AREA FOR CONSTRUCTION MATERIALS AND FACILITIES (APPROX. 3 ACRES)
1000
900
EXPLANATION
ROADWAY
SCALE IN FEET
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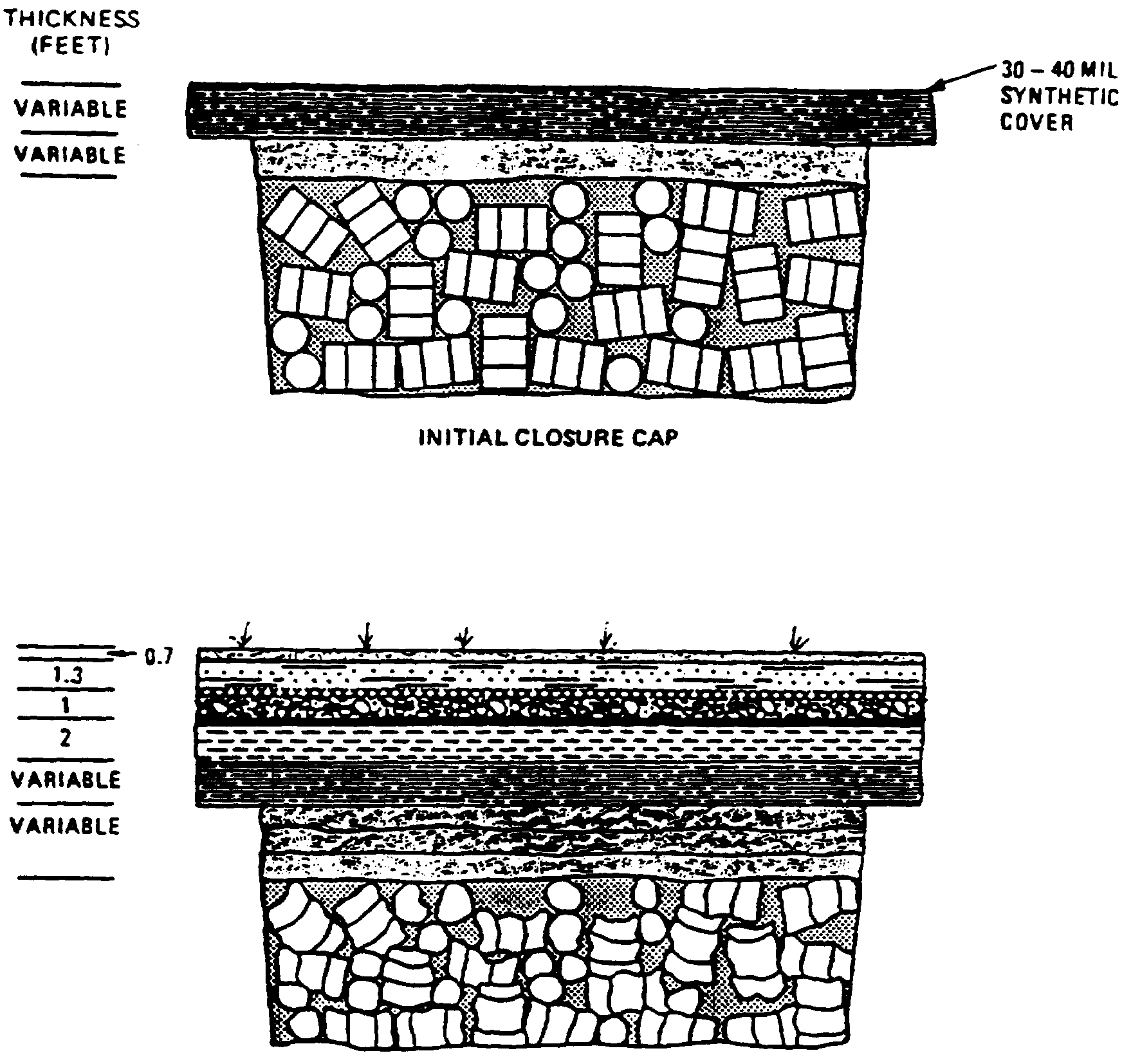
CONSTRUCTION PLANNING DRAWING
FIGURE E.2-1

59 0137

FIGURE 19

5 9 0138



EXPLANATION

- *30 TO 40 MIL SYNTHETIC COVER*
- *TOPSOIL LAYER WITH VEGETATIVE COVER*
- *SILTY SAND*
- *GEOTEXTILE FABRIC*
- *CRUSHED ROCK*
- *80 MIL SYNTHETIC LINER*
- *CLAY LAYER (PERMEABILITY ≤ 1×10^{-7} cm/sec)*
- *COMPACTED SOIL LAYER*
- *EXISTING TRENCH SOIL COVER*
- *TRENCH WITH RANDOMLY PLACED WASTE CONTAINERS*

NOT TO SCALE

MAXEY FLATS FS REPO[illegible]
MAXEY FLATS SITE RI/FS

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ALTERNATIVE 5
NATURAL STABILIZATION

040191 FIGURE 4-3

Subsidence monitors will be installed on the initial cap and on natural soils in the vicinity of the Restricted Area as a method of determining when the trenches have stabilized to an acceptable degree and final cap installation can begin.

A limited number of existing, poorly designed, wells (i.e., E-Wells) could potentially allow contaminants in ground water to migrate downward into the lower geologic units and will, therefore, be decommissioned and sealed. Existing sumps and wells (i.e., UE, UF UG, UK, etc.) that are deemed beneficial to the leachate extraction process, as well as those necessary for trench monitoring, will not be decommissioned.

Water monitoring equipment, as part of an Infiltration Monitoring System, will be installed in trenches, under the cap and within wells, to detect potential accumulation of leachate in trenches. Vibrating wire piezometers, such as the one illustrated in Figure 20, will be installed in riser pipes after construction of the initial cap. Riser pipes will be installed during cap construction and will be used to extend the monitoring wells through the cap. Water level data from the trenches and wells will be collected by data logging equipment located at the site. This data, in conjunction with other information, will be used to assess the degree to which infiltration is occurring, if any.

The monitoring program developed for the MFDS will, at a minimum, include the following objectives:

- Demonstration of compliance with the applicable or relevant and appropriate regulations, environmental standards, and other operational limits.

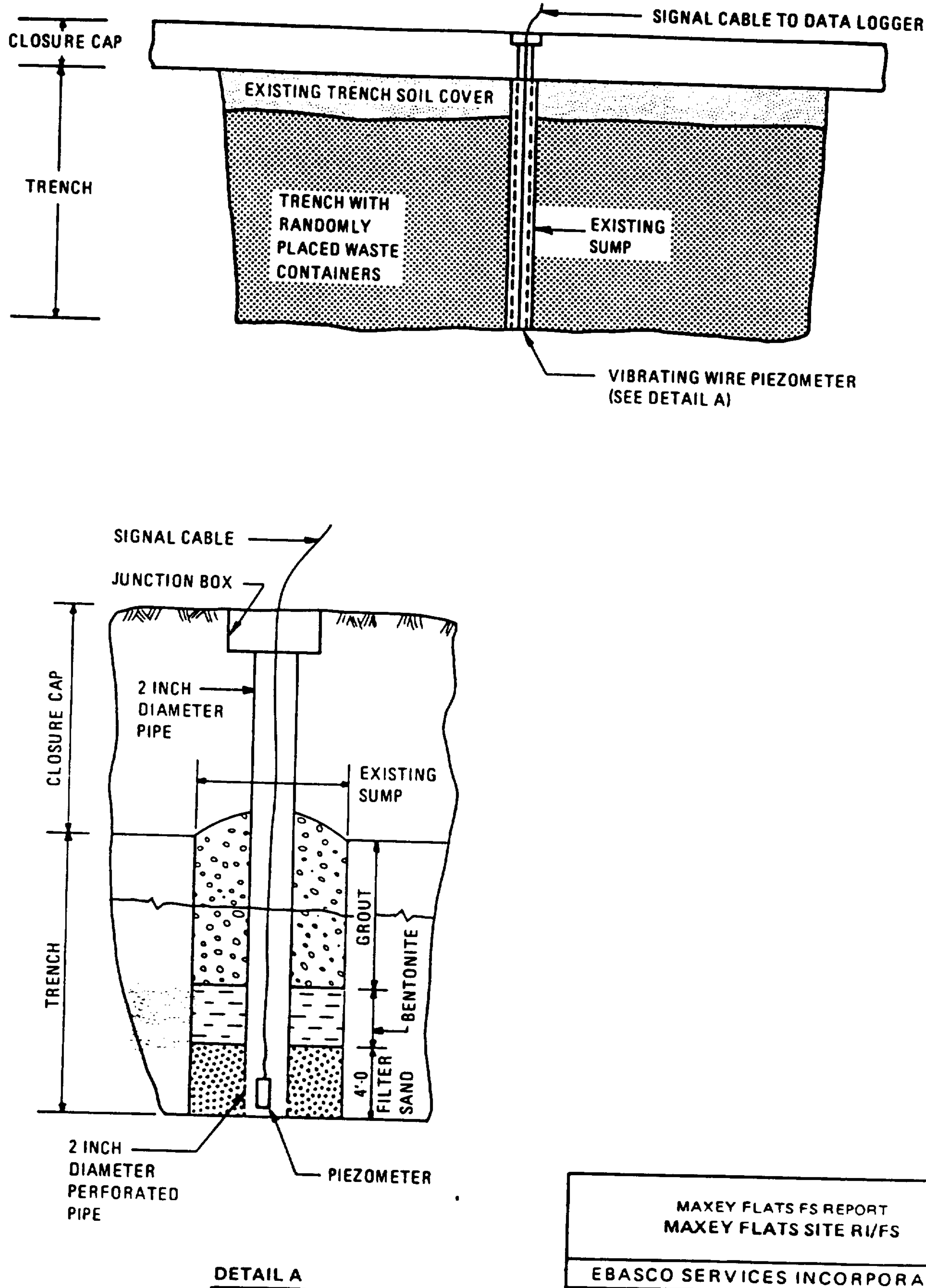
- Assessment of the actual or potential exposure of man to radioactive materials or chemical constituents in the environment.

- Detection of any possible long-term changes or trends in the environment resulting from the site.

- Assessment of the performance (adequacy) of design features that limit the release of radioactive materials to the environment.

Radionuclide and chemical constituent testing of ground water, surface water, soil, sediment and air will be performed, as appropriate and on a routine basis, to ensure that the remedy

FIGURE 20



MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS

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VIBRATING WIRE PIEZOMETER THROUGH TRENCH SUMPS

FIGURE E.11-1

for the MFDS is achieving all ARARs and continues to be protective of human health and the environment. Monitoring of leachate levels in trenches, subsidence monitoring and erosion and siltation monitoring will be routinely conducted. A program will be established to assess and track the impact of site remediation on local wildlife and vegetation and to confirm the assumptions and conclusions of the MFDS risk assessment. These monitoring programs will be established during the Initial Closure Period (as specified in the Interim Site Management Plan) and continued through the Interim Maintenance Period and on into the Custodial Maintenance Period.

A buffer zone, adjacent to the existing site property boundaries, will be acquired. The primary purpose of a buffer zone is to protect environmentally sensitive areas such as the hillslopes from detrimental activities such as logging. Without control of activities on the hillslopes, increased erosion due to deforestation could severely affect the integrity of the remedy.

The buffer zone will not extend the current licensed site property boundary, although control over the property would likely be in the hands of the Commonwealth of Kentucky. Moreover, the points of compliance for ARARs will not be extended by procurement of the buffer zone. Monitoring of streams, ground water and other media will be conducted in the buffer zone and other areas deemed necessary to assure that the selected remedy achieves ARARs. Indeed, the secondary purpose of the buffer zone is to ensure unrestricted, long-term access to areas necessary for full and effective monitoring.

At a minimum, the buffer zone will extend from the current site property boundary to Drip Springs, No Name, and Rock Lick Creeks to the west, east, and southwest of the site, respectively. The tentatively identified Buffer Zone, illustrated in Figure 21, is a conceptual delineation of the minimum boundary of the buffer zone.

Signs will be posted warning potential trespassers of the presence of site contaminants. Fences will be constructed, repaired and/or re-aligned as needed to prevent unauthorized access to the capped trench disposal area, construction areas established during the Initial Closure Period, and other areas deemed inappropriate for access. Access to the MFDS from Interstate 64 is via State Road 32 to County Road 1895, which runs to the entrance of the MFDS. County Road 1895 is a two-lane paved road suitable for the maximum legal load allowed

FIGURE 21

5 9 0142

EXPLANATION

MFDS RESTRICTED AREA

MFDS PROPERTY BOUNDARY

PROPOSED BUFFER ZONE

MAP PRODUCED BY EBASCO SERVICES INCORPORATED AND LABELLED FOR THIS REPORT BY BOOZ, ALLEN & HAMILTON, Inc.

MAXEY FLATS DISPOSAL SITE
PROPOSED BUFFER ZONE MAP

MAP 6

by Kentucky's Department of Transportation and appears to be in good condition. Well in advance of construction activities, the need to upgrade County Road 1895 will be discussed with Fleming County officials. Should it be determined that site activities are having a detrimental effect on County Road 1895, the authority(ies) responsible for remediation of the MFDS will be responsible for funding such repairs.

A comprehensive Interim Site Management Plan will be developed during the Initial Closure Period to define the maintenance and monitoring tasks to be conducted during the Interim Maintenance Period.

10.2 Interim Maintenance Period

Upon installation of the initial cap, the Interim Maintenance Period will commence. The primary objective of the Interim Maintenance Period is to let the trenches stabilize by natural subsidence. The Interim Site Management Plan will provide the basis for work activities during the interim maintenance period. During this period, the initial cap will continue to be maintained to prevent infiltration of water into the trenches, maintenance of the site will continue, and the site will be monitored by an enhanced monitoring/surveillance program.

During the Interim Maintenance Period, the following activities will be performed as prescribed by the Interim Site Management Plan:

- Periodic Topographic Surveys and Subsidence Monitoring
- Initial Cap Maintenance
- Continuing Assessment of the Adequacy of the Initial Cap, Surface Water Control Measures and Erosion Control Measures
- Improvements to Site Drainage Features, As Needed
- Trench Leachate Management and Monitoring
- Monitoring, Maintenance, and Surveillance
- Enhanced Ground Water Monitoring
- Installation of a Horizontal Flow Barrier, As Required
- Five Year Reviews

Topographic surveys and elevation surveys of the subsidence monitors will be conducted routinely to evaluate subsidence. Settlement plates and slope inclinometers (and/or other subsidence monitoring instruments) will be installed at the MFDS to measure vertical movement, tilt or subsidence of the trench contents and trench cap over time. This information will form a database to be used to assess cap stability and the degree to which trench subsidence has occurred.

The initial cap will be routinely inspected to ensure that it has not failed and it is effectively controlling surface water runoff. As needed, the cap will be repaired and the synthetic liner replaced in accordance with the Interim Site Management Plan. Currently, it is anticipated that the synthetic liner will require replacement at 20-25 year intervals. Liner replacement will be performed in response to liner condition and the manufacturer's warranty and specifications. The specific liner type will be determined during development of the Interim Site Management Plan; however, the liner will be of the type to require replacement no more often that the afore-mentioned 20-25 year interval. The drainage ditches and retention ponds will also be cleaned and maintained as needed. Erosion damage to the cap and drainage systems will be repaired as needed.

The Infiltration Monitoring System, installed during the Initial Closure Period, will detect the accumulation of leachate in the trenches and provide a warning if leachate begins to accumulate in the trenches. This monitoring system will be used as a supplement to the Commonwealth's current trench leachate monitoring program. Measures could then be taken to eliminate the cause of the infiltration. If trench recharge is occurring, the leachate management plan, developed as part of the Interim Site Management Plan, will be implemented to remove, solidify, and dispose of the leachate. The data from the monitoring and leachate extraction program will be used to adjust the frequency of inspections, data collection, sample analyses, and planned leachate pumping and solidification.

Trench leachate recharge should be kept to a minimum, once the disposal trenches have been pumped to the extent practicable and the initial cap has been placed over the disposal area. However, should conditions warrant re-initiation of a trench leachate extraction program, trench leachate will be solidified and disposed in on-site trenches. On-site activities during the Interim Maintenance Period may generate additional wastes requiring disposal. Liquids will be temporarily stored until sufficient quantities have accumulated to warrant resumption of solidification processes. Once liquids have been solidified, a new disposal trench will be constructed to dispose of the solidified liquids and any solids generated during on-site activities.

Site monitoring activities will be performed as defined in the Interim Site Management Plan and established during the Initial Closure Period. Site maintenance activities will include custodial care such as grass cutting, ditch cleaning, and fence repairing. On a less frequent basis, repairs will be made to the erosion control system, the initial cap, and monitoring instruments. Additionally surveillance activities will be performed on a routine basis to inspect the site. Maintenance and monitoring activities will be conducted in compliance with the Federal and Kentucky Licensing Requirements for Land Disposal of Radioactive Waste.

For those remedial actions that allow hazardous substances to remain on-site, Section 121(c) of CERCLA requires EPA to conduct a review of the remedy within five years after initiation of remedial action and at least once every five years thereafter. The purpose of this review is to evaluate the remedy's performance - to ensure that the remedy has achieved, or will achieve, the remedial action objectives set forth in the Record of Decision and that it continues to be protective of human health and the environment. Additionally, the Commonwealth will continue an environmental program to evaluate all aspects of the remediation during the five year review periods.

During any of the five year reviews, or at any point between the five year reviews, if the remedy is not meeting the defined remedial action objectives, a more detailed sampling program will be undertaken to determine the cause of the failure. Specifically, the reviews may focus on, among other things, the selected remedy's ability to prevent entry of water into the disposal trenches, to mitigate erosion to the extent practicable, and to minimize migration of radionuclides and chemicals.

Should site monitoring and surveillance demonstrate a failure of the remedy to achieve ARARs or remedial action objectives (e.g., alluvial ground water monitoring indicates Maximum Concentration Limits have been exceeded), the appropriate remedial steps will be taken, such as notification of regulatory agencies, public safeguards, repair of the remedial technology, or cleanup of the environmental medium.

The uncertainties of hydrogeologic flow conditions at the MFDS (as discussed in the RI Report for the MFDS and Section 5.1.2 - <u>Geology and Ground Water</u> of this document), as well as the uncertainties related to the impact of the leachate extraction operations on the hydrogeologic flow conditions, necessitate further evaluation of data in order to assess the necessity and likely effectiveness of a horizontal flow barrier. Sufficient data should be available from the trench dewatering program, information contained in the Commonwealth's historical leachate level database, the Infiltration Monitoring System, ground water monitoring, and the ground water modeling program to determine the necessity of a horizontal flow barrier before or in conjunction with the first five year review. If statistical analysis of trench data (to include water level data, regression slopes, etc.) indicates that lateral recharge of the disposal trenches is occurring, a horizontal flow barrier will be installed to curtail ground water recharge of the disposal trenches. The necessity, location, depth, and extent of this horizontal flow barrier will be determined through ground water modeling and review of historical site monitoring data.

Two types of horizontal flow barriers were evaluated in the Feasibility Study, as discussed in Section 7.2.2.2 (Horizontal Flow Barriers of this document), and illustrated in Figures 22 through 24; a north cutoff wall and a lateral drain/cutoff wall. The type of horizontal flow barrier installed at the site will be one of the two described barriers or another design determined to be sufficient for prevention of lateral infiltration.

The decisions as to whether and what type of horizontal flow barrier to construct will be made by EPA, in consultation with the Commonwealth of Kentucky.

10.3 Final Closure Period

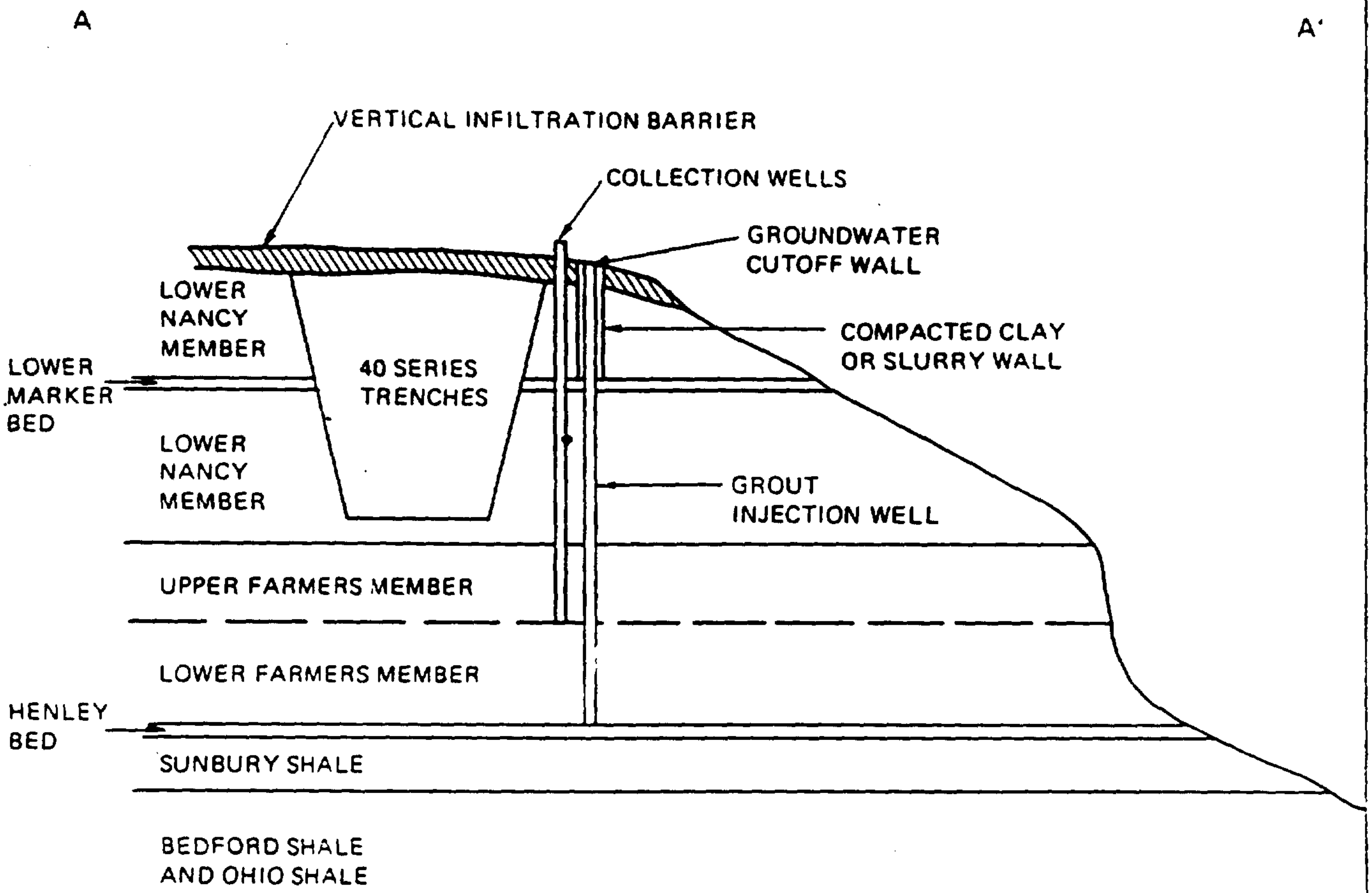
The end of the Interim Maintenance Period and the beginning of the Final Closure Period is defined as the time when subsidence of the trenches has nearly ceased and final cap installation can begin. The criteria for determining when this time has come could include such factors as acceptable void fraction, defined rate of minimal subsidence, defined backfilling rate to maintain design grade, etc. EPA, in consultation with the Commonwealth, will determine the acceptable subsidence criteria during remedial design and/or development of the Interim Site Management Plan.

The following activities will be undertaken during the Final Closure Period:

- Waste Burial
- Installation Of Final Cap
- Installation Of Permanent Surface Water Control Features
- Installation Of Surface Monuments

Prior to installation of the final cap, contaminated materials at the site will be buried in a new disposal trench on-site. These materials could include solidified leachate, leachate storage tanks, and on-site buildings which will be demolished during final remediation.

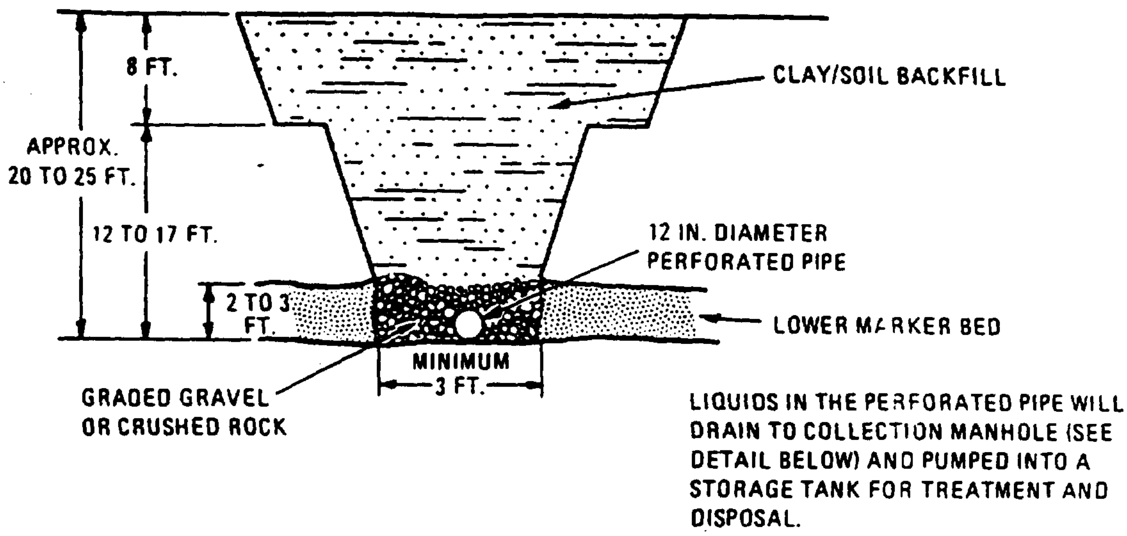
FIGURE 22



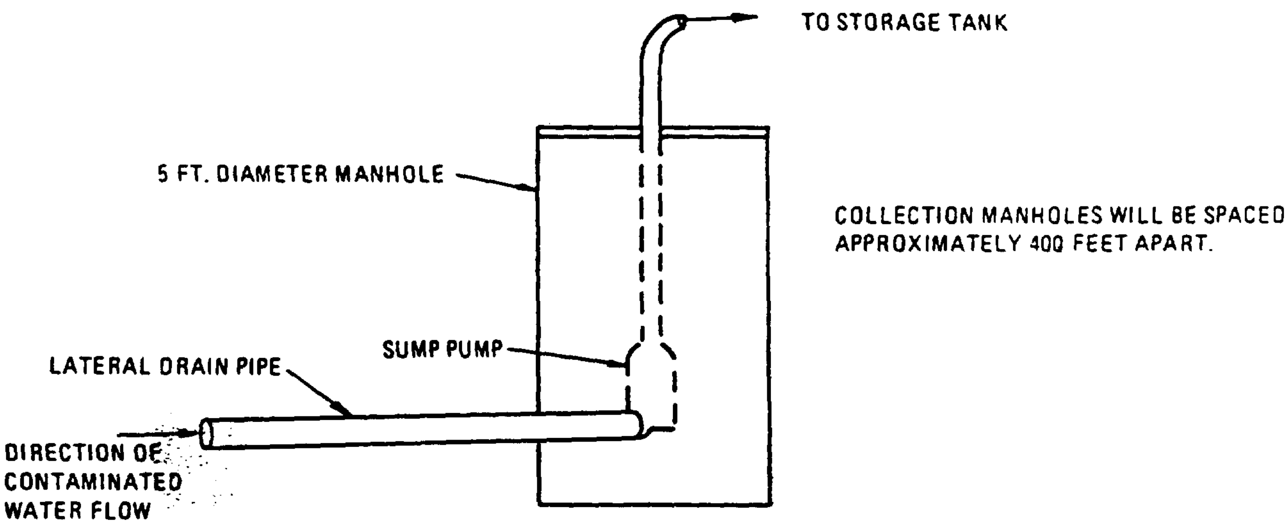
DIAGRAMATIC CROSS SECTION A – A'

LOCATION OF CROSS SECTION SHOWN ON FIGURE 3-2

MAXEY FLATS FS REPORT MAXEY FLATS SITE RI/FS
EBASCO SERVICES INCORPORATED
GROUNDWATER CUTOFF WALL AND COLLECTION WELLS FOR 40 SERIES TRENCHES FIGURE 3-4



DETAIL 1



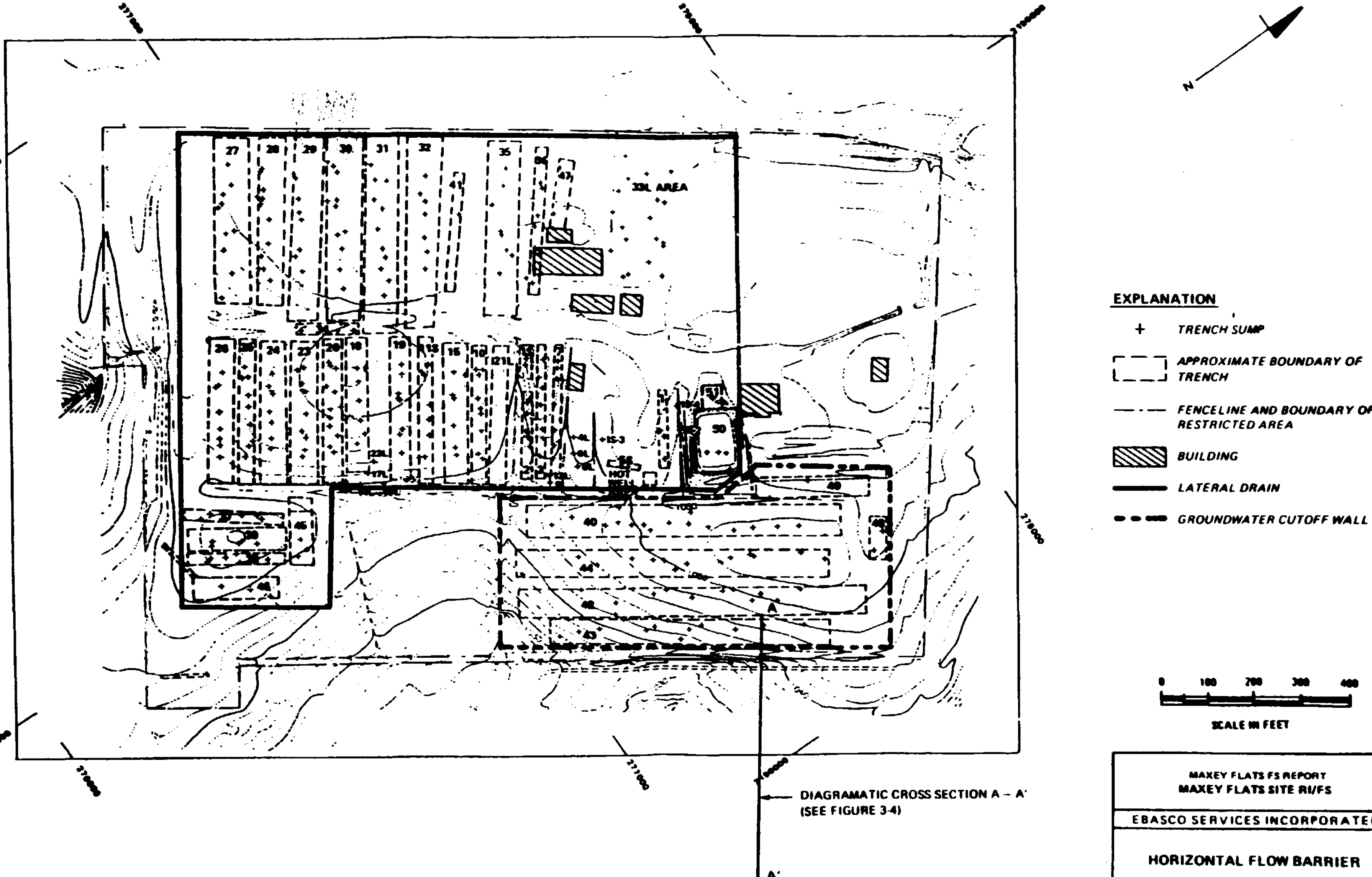
DETAIL OF COLLECTION MANHOLE

MAXEY FLAT[illegible] REPORT
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

LATERAL DRAIN

FIGURE 3-3



MAXEY FLATS FS REPORT
MAXEY FLATS SITE RI/FS

EBASCO SERVICES INCORPORATED

HORIZONTAL FLOW BARRIER

FIGURE 3-2

FIGURE 24

Because the selected remedy involves disposal of a RCRA listed hazardous waste, the RCRA Subtitle C closure standards are applicable to the MFDS. Consequently, the final cap will be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids. The design criteria and allowable soil loss for the final cap will conform, at a minimum, to the standards established in EPA's "Cover for Uncontrolled Hazardous Waste Sites", EPA/540/2 - 85/002 (USEPA, 1985).

The trench disposal area and appropriate areas contiguous thereto will be covered by an engineered soil cap with a synthetic liner. It is expected that this cap, as described in Table 33, will consist of (from top to bottom) an initial layer of compacted soil placed over the existing trench cover, a two-foot thick clay layer, an 80 mil (or sufficiently similar) thick synthetic liner, a geotextile fabric layer, a one-foot-thick drainage layer, a geotextile fabric layer, and a two-foot thick soil layer supporting a vegetative cover. The compacted clay layer will have a permeability of 1×10^{-7} (0.1 feet/year) or less.

The final cap will be constructed primarily of naturally occurring materials that are stable in the Maxey Flats environment. To provide additional protection against vertical infiltration of water and to provide additional durability during the first few decades following installation, some synthetic materials will be integrated within the multi-layered structure of the final cap. The engineered soil cap with synthetic liner, when installed, will provide an effective barrier against vertical infiltration of water. The cap should last for a long period of time if (a) repairs are performed promptly, as needed, during the first few decades following installation, and (b) minor custodial maintenance is provided. The cap will direct percolating water away from the disposed waste by drainage layers and its sloped design. The multi-layer construction will resist degradation through geological processes and biotic activity. Additionally, the seeded topsoil layer will enhance erosion control. Erosion control will be an integral component of the final cap design. Cap erosion, hillslope erosion, and rates of surface water runoff to downslope areas will be considered during final cap design.

Effective, permanent surface water control systems will also be installed to limit infiltration and control surface water runoff and minimize hillslope and cap erosion to the extent

TABLE 34

FINAL CAP COMPONENTS

- Vegetative Cover: Erosion control
- Geotextile Fabric: This fabric beneath the upper soil layer will keep soil fines from settling in the drainage layer and, thus, reducing the effectiveness of the drainage layer
- Drainage Layer: This will consist of suitably graded crushed rock with a minimum permeability of 1×10^{-3} cm/sec; will provide a stable drainage path to erosion control drains
- Geotextile Fabric: This fabric between the drainage layer and synthetic liner will protect the liner from puncture during installation of the drainage layer
- Synthetic Liner: Will provide a backup to the clay infiltration barrier for the purpose of minimizing infiltration of water to the disposal trenches
- Two-Foot-Thick Clay Layer: Will provide a barrier with a permeability of 1×10^{-7} cm/sec or less.
- Initial Soil Layer: Will provide support and establish the desired design grade for subsequent layers

practicable. After the final cap is constructed, channels and drainage ditches carrying storm water runoff from the site will be improved to ensure stability for runoff events up to that which would result from a 100-year, 24-hour storm. It is expected that a significant amount of research data and information on new technologies will be developed throughout the Interim Maintenance Period. Thus, the design of the final cap and surface water control features may reflect these technological advances.

The monitoring and surveillance program, established in the Initial Closure Period, will continue to ensure compliance with state and federal regulations, to ensure the remedy is meeting the remedial action objectives, and to ensure that the remedy continues to provide protection of human health and the environment. Surface monuments will be erected at the site to notify persons of the presence of site contaminants and the dangers posed by site contaminants if the site is disturbed.

10.4 Custodial Maintenance Period

After the final cap has been constructed, the Custodial Maintenance Period will begin. The following activities will be performed during the Custodial Maintenance Period:

- Monitoring and Surveillance
- Five Year Reviews

The monitoring and surveillance program will continue to be implemented at the site. The frequency of monitoring activities described for the Interim Maintenance Period will likely be reduced during the Custodial Maintenance Period due to the presumed reduction of water infiltration into the trenches (i.e., reduced contaminant mobility) and reduced radionuclide activity. Site monitoring and surveillance will be carried out in perpetuity. Maintenance activities will be carried out, as necessary, to preserve the integrity of the remedy.

The Custodial Maintenance Period will initiate the institutional control period which must be maintained for at least 100 years following completion of the site closure as required by 902 KAR 100:022 and 10 CFR part 61 for all low level radioactive waste disposal sites. In addition, the perpetual maintenance fund will ensure that institutional control activities, including fencing and other activities to control access to the MFDS, periodic surveillance, custodial care, and filing of notices, survey plats, and deed restrictions with the appropriate authorities, will accomplish the goal of preventing inadvertent intrusion onto the MFDS and providing of custodial care in perpetuity. The fund will also provide for collection and analysis of samples and data.

SECTION 11.0 - STATUTORY DETERMINATIONS

Under its legal authorities, the U.S. EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. One of the requirements specifies that, when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost effective and must utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment technologies 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.

11.1 Protection of Human Health and the Environment

Protection of human health and the environment will be achieved through the treatment, containment, engineering and institutional control components of the selected remedy.

Based upon the site risk assessment, unless remedial action is taken, exposure to drinking water, surface water, soil and sediments at, and in close proximity to, the site in the future would pose an unacceptable risk to human health. The risk assessment estimates that the risk from all combined on-site pathways at the MFDS, if no action is taken, could approach 1 (i.e., one additional case of fatal cancer for each person who would reside on-site). The risk assessment estimates that the risk from all combined off-site pathways at the MFDS, if no action is taken, could approach 6×10^{-2} (i.e., six additional cases of fatal cancer for every 100 persons engaging in the off-site exposure pathways as described in Section 6 of this document). The selected remedy will reduce these risks to a risk of 1×10^{-4} or less. EPA deems a risk of 10^{-4} to be generally protective of human health and the environment.

The extraction, solidification, and re-disposal of trench leachate will significantly reduce the mobility of radionuclides. Initial and final caps will significantly reduce the amount of vertical infiltration into the disposal trenches, thereby minimizing the production of leachate, thereby minimizing the migration of site contaminants into the environment. Surface water drainage improvements will help maintain the integrity of the remedy by controlling the rate of site erosion. Site monitoring and maintenance and institutional controls, funded and conducted in perpetuity, will prevent unintended use of the site, minimize the amount of exposure to site contaminants, and maintain the integrity of the remedy.

There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

11.2 Compliance With ARARs

The selected remedy will comply with all applicable or relevant and appropriate requirements (ARARs) except for the RCRA Land Disposal Restrictions which are being waived pursuant to CERCLA Section 121(d). ARARs identified for the MFDS are presented in Section 8.0 of this document.

11.3 Cost Effectiveness

The selected remedy provides overall effectiveness in proportion to its cost. Alternative 5 is the least costly of the seven alternatives that underwent a detailed analysis, with the exception of the No Action alternative.

11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable and Statutory Preference for Treatment as a Principle Element

EPA and the Commonwealth of Kentucky 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 remedy at the Maxey Flats Disposal Site. Of the alternatives evaluated and presented in this decision document, EPA and the Commonwealth have determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

While the selected remedy does not reduce the volume of waste present at the site, or offer treatment as a principal element, Alternative 5 does address the primary threat associated with the site; that of the migration of contaminated leachate into the environment. The selected remedy will achieve a reduction of the mobility of the contaminated leachate through solidification and prevention of the generation of new leachate, and will minimize erosion to the extent practicable to preserve the integrity of the remedy. The initial and final caps, surface water control features, monitoring and maintenance components, and other engineering features, as well as institutional controls will reduce or control site risks to the extent practicable.

Treatment of site wastes is not practicable at the MFDS due to the nature and volume of waste involved. Excavation and off-site disposal are not feasible at the MFDS due to the lack of facilities that could accept the volume and activity of the waste present at the MFDS and the greater risk to human health and the environment which would be associated with such activities. Furthermore, excavation of site wastes would not achieve the Commonwealth's applicable requirement - 902 KAR 100:015, which requires exposures to be kept to "As Low As Reasonably Achievable".

APPENDIX A

RESPONSIVENESS SUMMARY

EPA's selected alternative, Alternative 5 - Natural Stabilization, includes:

- Installation of interim trench covers over the trench disposal are;
- Extraction, solidification, and disposal of trench leachate;
- Construction of a horizontal ground water flow barrier, if needed;
- Installation of a multi-layer engineered soil cap with synthetic liner after the natural subsidence process is completed;
- Maintenance and monitoring and institutional controls.

EPA selected this alternative for several reasons, including the advantage it offers for implementation of the initial phase of the remedy quickly, using reliable and proven technologies. The selected alternative allows materials in the disposal trenches to subside naturally, without forced consolidation and subsequent release of radionuclides. The alternative provides for flexibility in the type of interim trench cover and the necessity, type and location of the horizontal ground water flow barrier used at the site. Finally, several components of the alternative -- including site monitoring, remedy reviews, and site maintenance -- assure that the remedy is adequate, protects human health and the environment, and complies with all applicable or relevant and appropriate Federal and State requirements.

BACKGROUND

Community interest and concern about the MFDS began in 1963 shortly after approximately 260 acres of land were purchased for radioactive waste disposal operations. Area residents reported initially that they were not informed of plans for the property and that authorities provided little or no opportunities for community input to the decision-making process. Area residents also were concerned with methods used to place wastes in the disposal trenches. When the State released its 1974 study of the site, findings of elevated radionuclide levels drew the attention of local and national media. In response, citizens in the site community formed The Maxey Flats Radiation Protection Association to investigate site conditions and publicized the need for protection of nearby residents. Organized citizen concern declined for a period after the Commonwealth of Kentucky closed the site to receipt of waste in late 1977.

RESPONSIVENESS SUMMARY
MAXEY FLATS DISPOSAL SITE

This community relations responsiveness summary is divided into the following sections:

<u>Overview:</u> This section discusses the U.S. Environmental Protection Agency's (EPA's) selected remedy for the Maxey Flats Disposal Site, also referred to in the Proposed Plan as the preferred remedy or proposed remedy.

<u>Background:</u> This section provides a brief history of community interest and concerns raised during remedial planning activities at the Maxey Flats Disposal Site.

<u>Part I:</u> This section provides a summary of commentor's major issues and concerns, and expressly acknowledges and responds to all comments raised by the local community. This section also responds to major comments submitted by other parties, which includes municipalities, businesses and potentially responsible parties.

<u>Part II:</u> This section provides a comprehensive response to all significant comments submitted during the public comment period on the preferred remedy. Where necessary, this section elaborates, with technical details, on answers covered in Part I.

Any points of conflict or ambiguity between information provided in Parts I and II of this responsiveness summary will be resolved in favor of the detailed technical and legal presentation contained in Part II. EPA responses in this document to questions posed at EPA's June 13, 1991 public meeting on the Proposed Plan include, or expand upon, those given at the meeting. Attachment A to the Record of Decision presents a copy of the meeting transcript.

<u>OVERVIEW</u>

In June 1991, EPA announced its preferred alternative for the Maxey Flats Disposal Site (MFDS), located in Fleming County, Kentucky. In the same announcement, EPA informed area residents and interested parties of a public meeting to present the preferred alternative on June 13, 1991, and that the EPA would hold a 60-day public comment period on all the alternatives considered. The comment period ran from June 13, 1991 to August 13, 1991.

Concern resurfaced in 1979 when area residents learned that Tritium was escaping from an evaporator used at the site to reduce the volume of liquids that had accumulated from trench pumping operations. A second group, called the Concerned Citizens for Maxey Flats, formed to organize citizen concerns regarding the Tritium releases. This group requested that public water be provided to residents in the Maxey Flats site vicinity. Public water was extended in 1985, by the Fleming County Water Association, after which organized community efforts again subsided. Community members remained concerned, however, that the site should be cleaned up.

In 1986, EPA added the MFDS to the Superfund National Priorities List (NPL), making it eligible for Federal funding and EPA oversight of a Remedial Investigation/Feasibility Study (RI/FS) and remedial activities. Eighty two Potentially Responsible Parties (PRPs) subsequently organized a steering committee which entered into a Consent Decree with EPA in 1987 to perform the RI/FS under EPA oversight. EPA initiated community relations activities in the summer of 1987, coinciding with the PRPs' development of the RI/FS Work Plan. Between June 1987 and February 1988, EPA prepared a site-specific Community Relations Plan, which gathered information from personal interviews with area residents, local officials, and Federal, State, and local resource specialists.

PRP contractors performed the RI/FS between 1986 and 1989 and, in 1989, the Remedial Investigation was approved by EPA. By June 1991, the Feasibility Study was completed and submitted to the public. A removal action was initiated at the site in late 1988 to address the threats associated with liquids stored in above-ground storage tanks at the site. This action consisted of the solidification of radioactive water and disposal of the solidified liquids in a new trench constructed on-site. The removal action is expected to be completed in November 1991. Upon completion of the RI and FS Reports, EPA and the Commonwealth reviewed and considered options for long-term remediation of the site. EPA completed and released the Agency's Proposed Plan in June 1991.

Stemming from EPA's community relations planning effort, EPA Remedial Project Managers and Community Relations Coordinators worked with local residents and Commonwealth representatives to facilitate ongoing communication with the area residents, among them the Concerned Citizens for Maxey Flats. EPA also established information repositories to house site documents for local review at the following locations:

- Fleming County Public Library
  303 South Main Cross Street
  Flemingsburg, Kentucky 41041

- Rowan County Public Library
  129 Trumbo Street
  Morehead, Kentucky 40351

EPA placed the RI/FS, other technical documents, Community Relations Plan, and site fact sheets in the repositories. EPA also forwarded its Administrative Record file, the legal file of documents the Agency used specifically to consider remedial options and to select the remedy, to each repository.

In addition, the EPA held press briefings, attended meetings sponsored by the Maxey Flats Concerned Citizens Group (MFCC), held formal and informal meetings with the community throughout the RI/FS, visited informally with area residents throughout the RI/FS process, developed and used a site mailing list to send fact sheets and notices of meetings to interested parties; and assisted the MFCC in applying for an EPA Technical Assistance Grant (TAG), which EPA awarded on January 13, 1989. The group hired technical advisors to help interpret site-related information and advise the community on participating in the RI/FS decision-making process.

Upon issuing the Proposed Plan, EPA distributed it to addressees on the Agency's mailing list and announced the plan in news display ads in the June 8, 1991 editions of The Maysville Independant, The Morehead News, and The Lexington Herald-Leader. The news display ads also announced EPA's 60-day public comment period on the Proposed Plan and EPA's public meeting to present the plan. EPA worked closely with local citizen leaders, the Maxey Flats Concerned Citizens Group, the TAG Technical Advisor, and Commonwealth representatives to prepare for the meeting, which took place at the Ersil P. Ward Elementary School in Wallingford, Kentucky on June 13, 1991. EPA project staff also met informally with local officials, TAG Advisors, and citizens throughout the RI/FS process.

PART I: SUMMARY OF COMMENTOR'S MAJOR ISSUES AND CONCERNS

This section provides a summary of commentor's major issues and concerns, and expressly acknowledges and responds to those concerns raised by the local community. The major issues and concerns on the proposed remedy for the Maxey Flats site received at the June 13, 1991 public meeting, and during the public comment period, can be grouped into seven categories:

A. RI/FS Findings

B. Risk Assessment

C. Applicable or Relevant and Appropriate Requirements (ARARs)

D. Selection of Remedy

E. Financial Concerns/Institutional Controls

F. Environmental and Public Health Concerns

G. Public Involvement

A summary of the comments and EPA's responses to them is provided below.

A. RI/FS Findings

(1) An attendee at the June 13, 1991 public meeting inquired about the percentages of water infiltration to the trenches from the lateral sources and from rain.

EPA Response:

The significant work performed by the U.S. Geological Survey (USGS), the PRPs, and the Commonwealth, indicates that approximately 70 to 80 percent or more of the infiltration to the trenches is by the vertical route, or through the trench cap. The remainder of the infiltration is potentially from lateral infiltration. (See Part II, Comment 1 - RI/FS Findings, for a more complete response).

B. Risk Assessment

(1) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"From radiation dose estimates, the EPA calculates the lifetime risk to an individual. This calculation assumes a relation between radiation dose and the number of expected cancers and genetic effects adopted recently by the National Academy of Sciences. But this does not reflect the range of scientific opinion on this controversial issue. This dose-effect relationship is undergoing change due to recent data from Japanese bomb survivors which indicate the number of expected cancers at low radiation doses is greater than previously understood. To take this recent data into account, the risk estimates developed by the EPA should have a greater uncertainty range."

EPA Response:

The comment is correct in that the risk estimates prepared by the EPA do not address the uncertainty in the risk coefficients. However, the risk coefficient does consider the new risk coefficients provided in the BEIR V Report, the most recently prepared report on the biological effects of ionizing radiation, as prepared by the National Academy of Sciences. The BEIR V Report recommends a revised risk coefficient of 8.0E-04 lifetime risk of fatal cancer for acute exposures in excess of 10 mrem. For protracted exposures of low LET radiation, BEIR V recommends a dose rate reduction factor of at least 2. Accordingly, as applied to the exposures calculated in the Maxey Flats risk assessment, a risk coefficient of approximately 4.0E-04 fatal cancers per rem is appropriate. In the Maxey Flats risk assessment, EPA used the risk coefficient developed in support of the Radionuclide NESHAPS of 3.92E-04 fatal cancer risk per rem of low LET radiation. Accordingly, the approach used by EPA is in accord with the recent BEIR V recommendations.

Though the risk assessment does not explicitly address uncertainty, a thorough review of the uncertainty in the risk coefficient is provided in Chapter 6 of Volume 1 of the Background Information Document provided in support of the Radionuclide NESHAPS (EPA/520/1-89-005, September 1989). In summary, the range for low LET radiation is 120 to 1200 fatal cancers per rem. In other words, if the upper bound risk coefficient were used instead of the nominal value of 3.93E-04, the estimated risks would increase by a factor of about 3. Alternatively, if the lower bound risk coefficient were used, the risk estimates would decrease by about a factor of 3.

(2) A concerned party stated at the June 13, 1991 public meeting that no safe level exists for radioactive material and that radioactivity can last for 24,000 years. He suggested that the risk assessment should inspect an area within a several-mile radius of the site because exposed animals and birds leave droppings everywhere

EPA Response:

EPA does not concur with the comment that no safe level for radioactive material exists. EPA fully recognizes the half-lives of the radionuclides present at the site and, accordingly, the remedy is structured to provide for maintenance, monitoring and implementation of institutional controls in perpetuity.

The Remedial Investigation involved the collection of surface water, sediment and soil samples in off-site locations, among other pathways and locations. Additionally, the Commonwealth has routinely collected numerous samples from off-site locations in their efforts to evaluate site impacts. Monitoring data indicates that radiation levels do not exceed background values beyond 1.5 miles from the site. RI samples from the food crop study area and off-site streams indicate no site related contamination in the food crop soil samples, and very low concentrations of contaminants in surface water and stream sediment samples.

(3) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"Though the iodine doses are supposedly calculated by the PRPs, it is curious that I-129 does not appear in the tables which must be employed to perform these calculations. In the Risk Assessment, I-129 does not appear in the table of transfer factors to calculate doses from eating deer, drinking milk or eating vegetables. Similarly, I-129 is not included in the worksheets for radionuclide contaminant concentrations in environmental and trench media. Thus, it is not clear how I-129 is included in the calculations."

EPA Response:

Tables D-A4 and D-A5 of the risk assessment present the ingestion and inhalation age dependant dose conversion factors used in the analysis for I-129. Table D.3-12 presents I-129 travel times, and Table D.3-13 presents Child-to-Adult Dose Ration Factors. Page D-88 presents the I-129 retardation coefficient. However, the risk assessment does not provide a number of I-129 parameters, including the transfer factors (page D-114) and the concentration of I-129 in leachate used in the analysis. The values for these parameters were provided to EPA in supporting documentation. Specifically, the PRPs used values suggested by the MFCC's technical advisor, Dr. Marvin Resnikoff for the concentration of I-129 in waste and the following calculational parameters:

Mo	0.115
Fm(d/L)	0.006
Ff(d/kg)	0.0029
Biv	0.02

(4) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"Chemical hazards are inadequately evaluated in the RA. By requiring that hazardous chemicals must be seen in the Lower Marker Bed, a large number of hazardous chemicals present in the trench leachate were thereby eliminated. Over time, and under No Action conditions, these hazardous chemicals would likely move. Further, one well pathway, where an intruder drills a well directly into a trench, therefore does not include the full complement of hazardous chemicals. Thus, the hazardous risk analysis is incomplete."

EPA Response:

Chemicals detected in wells screened within the Lower Nancy Member were also used as part of the indicator chemical selection process. EPA concurs that, over time, and under no action conditions, chemicals would have a tendency to migrate. See EPA responses to comments 5 through 7 below for a more complete discussion of the evaluation of chemicals in the MFDS risk assessment.

(5) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"The chemical trichloroethylene was not detected by the PRP's in the Remedial Investigation We are puzzled why it was included in the [indicator chemicals]."

EPA Response:

Trichloroethylene was detected during the Remedial Investigation in leachate (up to 5 ppb) and in ground water (up to 100 ppb). See Table D-A2 of Appendix D of the MFDS Feasibility Study Report.

(6) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"Two chemicals which appeared in the trench leachate were eliminated as indicators because they had no health-based criteria, according to the PRPs: cyanide and carbon disulfide. Cyanide is a well-known poison. Carbon disulfide can cause permanent central and peripheral nerve damage and is a powerful CNS depressant."

EPA Response:

Well concentrations were compared to health based adjusted water quality criteria or EPA reference dose values. Since these sample locations represent minimal dilution, it is expected that the concentrations at receptor points will be much lower. Therefore, chemicals with concentrations under the criteria levels were eliminated. Cyanide was eliminated from consideration in the risk assessment since the concentrations within the Lower Marker Bed and lower Nancy member ground water for cyanide were below health based adjusted ambient water quality criteria or EPA reference dose values. Furthermore, cyanide was only tentatively identified in both the ground water and trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

Carbon disulfide was eliminated from consideration because of the lack of health based criteria. Without any health criteria levels, the impacts from these chemicals could not be evaluated and therefore are not appropriate for consideration as an indicator. The Superfund Public Health Evaluation Manual (USEPA 1986a), and its addendum of newly revised toxicological data (August 1988) were consulted for health based criteria.

(7) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"A range of chemicals were deleted because they did not appear in the Lower Marker Bed. In the long-term, these chemicals will probably leach from the trenches and should be included in a comprehensive risk analysis. Under various risk scenarios, these chemicals should be added to the [list of indicators]."

Potential Indicator Hazardous Chemicals Found in Leachate

	acetone	
benzoic acid	bis(chlorothyl)ehter	benzyl alcohol
xylenes	1,2 dichlorobenzene	4-methyl-2-pentanone
	1,4 dichlorobenzene	napthalene
	2,4 dimethylphenol	phenol
	ethylbenzene	
	methylene chloride	
	2-methylphenol	
	4-methylphenol	

The chemicals in the first column are considered to be generally less toxic than those in the second column which are less toxic than those in the third column.

EPA Response:

One of the first steps of the risk assessment process is the selection of indicator contaminants. Indicator contaminants are those that may constitute the "highest risk" to the public among the contaminants found at the site. For the MFDS risk assessment, two sets of indicator contaminants were selected: radionuclides and non-radionuclides. The purpose of selecting indicators is to reduce the number of contaminants involved in the analysis to a manageable level, while still including those contaminants that are the greatest contributors to the overall impacts of the site. From the list of chemical contaminants detected during the RI, a select group of 11 were selected for analysis, as was done with the radionuclides. This practice is consistent with risk assessments conducted at all Superfund sites.

By column, and in the order as they appear, the following discussion presents the rationale for non-inclusion of the above-listed chemical contaminants in the MFDS risk assessment:

Benzoic Acid - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for benzoic acid were below health based adjusted ambient water quality criteria or EPA reference dose values.

Xylenes - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for xylenes were below health based adjusted ambient water quality criteria or EPA reference dose values.

Acetone - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

Bis(chloroethyl)ether - Was not considered because it was not detected in ground water.

1,2 dichlorobenzene - Was not considered because it was not detected in ground water. Further, it was only tentatively identified in trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

1,4 dichlorobenzene - Was not considered because it was not detected in ground water. Further, it was only tentatively identified in trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

2,4 dimethylphenol - Was not considered because it was not detected in ground water.

Ethylbenzene - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for ethylbenzene were below health based adjusted ambient water quality criteria or EPA reference dose values.

Methylene chloride - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

2-Methylphenol - Was not considered because it was not detected in ground water.

4-Methylphenol - Was not considered because it was not detected in ground water.

Benzyl Alcohol - Was not considered because it was not detected in ground water.

4-Methyl-2-Pentanone - Was not considered because it was not detected in ground water.

Napthalene - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts. Additionally, concentrations within the Lower Marker Bed and lower Nancy ground water for napthalene were below health based adjusted ambient water quality criteria or EPA reference dose values.

Phenol - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for phenol were below health based adjusted ambient water quality criteria or EPA reference dose values.

Inclusion of the above-listed chemical contaminants in the MFDS risk assessment would not have significantly increased potential site risks. Furthermore, the selected remedy requires attainment of RCRA ground water protection requirements as well as Kentucky and federal drinking water standards, both of which address the presence of chemical contaminants at the MFDS.

(8) The Technical Advisor to the Maxey Flats Concerned Citizens, Inc. (MFCC) provided the following comment regarding the MFDS risk assessment at the June 13, 1991 public meeting, and the MFCC reiterated it in writing during the public comment period on the preferred remedy:

"The MFCC pointed out that the risk assessment was performed using data gathered during the RI and that the RI was conducted under conditions that included Commonwealth site maintenance activities. It was the MFCC's position that data from the RI did not reflect a true No Action situation and, therefore, that the risk assessment calculations, because they are based on RI, data, are not the conservative figures that a true No Action assessment would have provided. The MFCC was also concerned that the risk assessment did not adequately portray site risks because the data employed by the PRPs did not reflect recent seep measurements by the Commonwealth which show high levels of tritium on the east slope."

<u>EPA Response:</u>

EPA's National Contingency Plan (NCP) requires that a baseline risk assessment be conducted at each Superfund site to assess the site risks in the absence of any remedial actions, including maintenance or institutional controls. Neither the NCP nor EPA guidance for conducting RI/FS's require that the Remedial Investigation be conducted under a strict no action condition. It is EPA's belief that the Remedial Investigation does provide a representative characterization of the current nature and extent of site contamination for the purposes of evaluating site risks and remedial alternatives. The risk assessment conducted for the MFDS assumes no action at the site, with the exception of monitoring and activities in support of monitoring. EPA concurs with the MFCC in that the conditions at the MFDS would be markedly different from present-day conditions if Commonwealth site maintenance activities were to cease; however, the risk assessment (Appendix D of the FS Report) and Addendum thereto, fully evaluate site risks under a true no action condition, as required by EPA's NCP and guidance, and assume trench overflow, erosion, and consequent contaminant concentrations.

Appendix D of the MFDS FS Report (Risk Assessment) does not include seep sample data obtained by the Commonwealth and EPA. This is because EPA's seep sample confirmation data was not available at the time of report preparation. However, the risk assessment assumed much higher concentrations of radionuclides in the pathways evaluated than the concentrations actually detected in the seeps. Thus, inclusion of this data in the risk assessment would not have significantly altered the results of the risk assessment.

(9) The Commonwealth commented, during the public comment period on the preferred remedy, that direct contact and ingestion of contaminated soil outside the restricted area pathway should have been included in the risk assessment. The Commonwealth further states "In a "no action" scenario, trench leachate will overflow and soluble and suspended radionuclides will move into the surrounding valleys and contaminate the soil zones. Furthermore, chelated radionuclides will also be carried into these areas; therefore, this pathway should have been included in the risk assessment."

<u>EPA Response:</u>

Both the PRP's risk assessment and EPA's independent analysis of the risk assessment explicitly address the soil ingestion pathway. For example, Table D.3-10 presents estimates of the doses to children in the alluvial valley ingesting contaminated sediment.

The concept of the direct contact pathway is addressed in the analysis, but not in the same way that it is addressed for chemical contaminants. At radioactively contaminated sites, direct contact and absorption of contaminants is not a significant pathway of exposure, as it can be for chemical contaminants. For radioactively contaminated sites, direct exposure to radiation is of concern and has been included in the risk assessment.

(10) The Technical Advisor to the Maxey Flats Concerned Citizens, Inc. provided the following comment on the MFDS risk assessment at the June 13, 1991 public meeting on the preferred remedy, and reiterated in comments submitted during the public comment period on the preferred remedy:

"EPA's use of the term "intruder", as used in the risk assessment, implies that the site is and always will be licensed. EPA should a) define the term "intruder", b) identify who holds the license today and who will hold it in the future; c) establish the point of compliance on the site rather than on the periphery of the exclusion zone, if the site is not licensed."

EPA Response:

a) It is true that the use of the term "intruder" in the MFDS risk assessment arises from the status of the MFDS as a licensed site under the Atomic Energy Act. However, EPA does not agree that its use implies that the site will always be licensed. As required by the NCP and EPA guidance, a true no action condition must be evaluated in the baseline risk assessment. The results of the MFDS baseline risk assessment highlight the need for remedial action, maintenance and monitoring activities, and institutional controls to be funded and conducted in perpetuity. The "intruder" term broadly encompasses residents, trespassers, and construction workers. "Intruder", as used in the MFDS risk assessment, refers to the following:

- A person engaged in construction activities in or near the trench disposal area for the purpose of establishing a residence (Intruder-Construction Scenario).

- A person engaged in the above-described scenario who realizes that something is wrong with the location and ceases activities (Intruder-Discovery Scenario).

- A family that establishes residency in or near the trench disposal area. Crops and animal food-products grown on-site are consumed (Intruder-Agricultural Scenario).

- A person that occasionally gains access to the site for recreational purposes (hunting, exercise, etc.) (Intruder-Tresspasser Scenario).

b) Currently, the Commonwealth of Kentucky, Natural Resources and Environmental Protection Cabinet, holds the license to the MFDS. According to Commonwealth representatives, the MFDS should and will always be licensed. EPA, at this time, cannot state who the specific license-holder to the MFDS will be in the future. Moreover, EPA has not and will not assess the likelihood of Commonwealth and NRC failure to perform specific duties related to the MFDS.

c) The points of compliance for the various federal and state requirements for the selected remedy are provided in Section 8.0 - Applicable or Relevant and Appropriate Requirements of this document. These points of compliance assume that the selected remedy is being implemented and institutional controls are in place to prevent access to the site. Institutional controls will be required regardless of whether the site remains licensed. Therefore, there is no need to condition the points of compliance on the existence of a site license.

In the baseline risk assessment, points of compliance were not considered; rather, exposure to site contaminants was assumed at the location of ingestion, or inhalation, etc., irrespective of where the selected remedy must achieve compliance.

(11) The Maxey Flats Concerned Citizens, Inc. submitted the following comment:

"The intruder agriculture scenario assumes waste from building a home is piled on ground which is then used for farming. But, in addition, breaking through the permanent cover means that water would infiltrate the trenches and the ground would become much more contaminated than assumed in the Risk Assessment which is based on Remedial Investigation monitoring."

EPA Response:

The intruder agriculture scenario in the risk assessment assumes that the waste within the trenches is actually excavated during the construction of a house, commingled with the top 1 meter of cover material, and spread over the area in the vicinity of the house. As a result, the radionuclide concentrations in the soil are assumed to be approximately 50% of the concentrations of the radionuclides in the waste itself. This is considered to be a conservative assumption, since it is unlikely that the radionuclide concentration in the surface soil could exceed that in the waste itself. (For a further technical analysis of this comment, see Part II, Comment 12 - Risk Assessment).

(12) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"Under the intruder scenarios, the EPA adopts assumptions regarding the radioactive waste forms which are inappropriate for the waste buried at Maxey Flats. The EPA assumes that the contact dose to someone who digs into the trenches is limited to a 6-hour period. This depends on the sociological assumption that Class C waste with high dose rates is recognizable as waste and that the discoverer would cease activity. Actually, the opposite may occur. If a discoverer found radioactive tools, or stainless steel, he may continue to explore and possibly sell tools on the open market. This has happened at West Valley. But it is also not the case that high dose rates will necessarily come from easily identifiable waste. That is, Maxey Flats waste predates the 1981 regulations and assumptions. The EPA used 10 CFR Part 61 waste classes A, B, and C adopted in 1981, and adopted calculational assumptions that high hazard class C waste is segregated and in solid form, even though the Maxey Flats waste predates these regulations. All Maxey Flats waste classes were essentially mixed."

<u>EPA Response:</u>

The 6 hour time period of exposure, which is assumed in the intruder discovery scenario, is only one of the intruder exposure scenarios addressed in the risk assessment. The risk assessment also addresses the intruder construction scenario, which assumes 500 hours of contact, and the intruder agriculture scenario, which assumes a lifetime of continual contact. However, the comment is appropriate with respect to recycle and reuse of tools and equipment. The risk assessment does not address recycle scenarios due to a lack of data regarding the levels of contamination of potentially recyclable material. Further, such an analysis is probably not necessary, since the agriculture scenario is likely to be limiting. Note that the risks from the intruder agriculture scenario approach 1, and, even if the data were available to model the recycle scenario, adding recycle doses to the scenarios is not likely to significantly increase the risks.

(13) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"The agriculture well dose, due to a well drilled at the boundary of the exclusion area, from I-129, ranges from 147 mrem/yr median dose equivalents to 210 mrem/yr upper bound. This is the whole body equivalent dose and not the thyroid dose. The thyroid doses will range from 4.9 rems/yr to 7.0 rems/yr, considerably above the regulatory limit of 0.075 rems/yr [75 mrem/yr]. We agree with the EPA that the 75 mrem thyroid dose should be considered an ARAR. This ARAR does not just pertain to whole body dose, but to thyroid dose as well."

<u>EPA Response:</u>

EPA concurs in this comment that the dose from I-129, as calculated by the PRPs, is the effective dose equivalent, and that the dose to the thyroid is higher by the weighting factor, resulting in a thyroid dose of 4.0 and 7.0 rem/yr for the average and upper bound doses, respectively.

(14) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the intruder risks are underestimated because some areas of the site contain levels of radionuclide concentrations that are higher than the average values for the overall site presented in the risk assessment. In addition, new information is continually being acquired regarding the nature and behavior of the radionuclides at the site.

<u>EPA Response:</u>

EPA concurs with this concern. There are a number of alternative scenarios and assumptions that could be postulated that could further increase the possible intruder doses, such as the recycle issue raised by Dr. Resnikoff, and the concerns expressed in the Commonwealth's comments. Specifically, depending on the location on-site that is selected for building a home in the intruder scenario, the doses could be substantially higher or lower than the values in the risk assessment due to the variability of the concentration of the radionuclides in different trenches at the site. However, the purpose of calculating the intruder doses and risks was to provide some insight into the possible magnitude of the impacts if a person were to reside at the site at some time in the future. EPA believes that the risk assessment does provide proper disclosure of this information, even though it does not fully explore all feasible scenarios and assumptions. Further, it should be recognized that the doses and risks presented in the risk assessment for the agriculture intruder are for a lifetime of exposure, whereby the individuals will at some times experience higher or lower levels of exposure. In essence, the intruder exposure will reflect the integration of the temporal and spacial variability at the site. As a result, it is not unreasonable to use average conditions when estimating lifetime risk. As a final point, as indicated in the comment, the calculated risks approach 1. As a result, the use of alternative assumptions would not significantly increase the calculated risk.

Part of this comment also expressed concern over a statement made on page D-31 regarding the location of a well adjacent to a trench, as opposed to placing the well directly into the trench. In the intruder scenario, the risk assessment assumes that the concentration of radionuclides in the well water is the same as in the trench leachate. As a result, the doses would be the same whether the well is assumed to be in, or adjacent to, a trench.

(15) The Maxey Flats Steering Committee and U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"EPA's decision to require the inclusion of the intruder pathways to the "no action" case studied in the RA is not justified for any number of reasons. These include (1) the fact that the site is licensed under the Atomic Energy Act, that Kentucky and/or the federal government have continuing obligations to control access to the site, and that there is no factual basis from which to conclude that Kentucky or the federal government will repudiate these obligations and abandon the site; (2) that EPA's interpretation of the "no action" case is neither required, or even supported, by the new National Contingency Plan (NCP); and (3) that the public interest is not served by focusing the risk assessment on entirely fictional pathways rather than reasonable maximum risk scenarios."

<u>EPA Response:</u>

(a) EPA strongly disagrees with the above stated comments. On April 9, 1990, Agency revisions to the National Contingency Plan, 40 C.F.R. 300, became effective. The revised NCP and its preamble (55 Fed. Reg. 8666, <u>et seq</u>.) discuss the purpose and nature of a baseline risk assessment. These discussions make it clear that "(t)he role of the baseline risk assessment is to address the risk associated with a site in the absence of <u>any</u> remedial action or control, <u>including institutional controls</u>" (emphasis added). Further discussions describe the baseline assessment as "essentially an evaluation of the no-action alternative". (<u>Id</u>. at 8710-11). EPA has determined, and the NCP indicates, that the only action allowed under a <u>true</u> no-action alternative is monitoring. It is precisely this type of no action analysis that EPA required the Steering Committee to use in conducting the baseline risk assessment for the MFDS.

It is true that the site is currently licensed under the Atomic Energy Act and that, as long as it is so licensed and the license is properly enforced, the intruder scenarios are not reasonably likely to occur. However, while the No Action alternative's premise of site abandonment may not be a likely scenario for the MFDS in the immediate future, perpetual site licensing and appropriate enforcement of a license are by no means guaranteed. Implementation and funding of monitoring, maintenance and institutional control will be required in perpetuity if site risks are to be controlled. Any number of factors could influence the "obligations" of the Commonwealth or NRC related to the MFDS over the next 50, 100, 300 or 1000 years. It would not be responsible, and would not be appropriate under CERCLA, for the EPA to assume certainty and stability in such factors as economy, institutional memory of the nature of the site, regulatory structures and obligations, funding mechanisms, etc., all of which, and more, would be required to preclude the site abandonment scenario. Thus, EPA firmly stands by its decision to require a true no action baseline risk assessment of the MFDS.

The purpose of a baseline risk assessment is to fully disclose to the public the potential risks posed by the site under a broad range of potential scenarios, depicting the impacts of the site over time. The EPA would have been negligent in its obligations to the MFDS community and remiss in carrying out its duties in accordance with the National Contingency Plan had it not required that a true no action analysis be made.

Based on comments received at the June 13, 1991 public meeting on the preferred remedy (at which risk assessment conclusions were discussed) and comments received from the community during the public comment period on the preferred remedy, there has been no indication that the interests of the community were ill-served by the assumptions and conclusions of the MFDS risk assessment. It is EPA's belief that the community's diligent efforts in reviewing the RI and FS Reports and risk assessment have resulted in a reasonable and rationale understanding within the community of the risks related to the MFDS.

(16) The Maxey Flats Concerned Citizens, Inc. agreed, in comments submitted during the public comment on the preferred remedy, with EPA's position that an alluvial well cannot be ruled out at some future time.

<u>EPA Response:</u>

EPA has consistently taken the position that the well water pathway is a viable pathway for the MFDS. Residents in the vicinity of the MFDS have, historically, used well water from the alluvium for household purposes. Although public water is currently available to these residents, future use of alluvial water cannot be precluded.

(17) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy with respect to the inclusion of the well water pathway in the off-site exposure scenario:

"As the Committee has previously stated, it is highly unlikely that anyone would construct an alluvial well having an unpredictable supply and very poor water quality when a public drinking water supply is available. As a result, even if EPA continues to maintain that this unrealistic drinking water pathway should be included in the risk assessment, the doses from that pathway should be reduced to account for the likelihood that a well would even be constructed, that if constructed it would be located at exactly the point of highest radionuclide concentrations, and that a regular daily supply of potable water would not be obtained."

EPA Response:

As EPA has consistently maintained throughout the RI/FS, and as reiterated to the Maxey Flats Steering Committee on numerous occasions, the well water pathway analyzed in the risk assessment is a reasonable, potentially complete exposure pathway for the MFDS for the following reasons:

- It cannot be assumed that the public water supply in the immediate vicinity of the MFDS will be available to all areas of potential use in perpetuity;

- It cannot be reasonably assumed that the current residents will continue as the only residents in the area over periods of decades to centuries. In the future, it is likely that additional residents seeking rural living will purchase land and build homes. It is not unlikely that some of those residents will construct and use a shallow well in the alluvium.

- Residents in the area have used shallow wells in the alluvium previously and residents of similar environments in the region continue to rely on these types of private wells.

- Although the quality of water in the alluvial aquifers may not be ideal, it has been used for domestic use in the past.

- Costs of connection to public supply may be an incentive to construct a private well;

- Some people may feel a greater sense of independence by having their own well under their control, rather than depending on a public water supply over which they have no control.

EPA does not agree with the Steering Committee's assessment on the reasonableness of the well water pathway and considers the valley alluvium to be a potential source of drinking water. A potential source of drinking water is one which is capable of yielding a quantity of drinking water to a well or spring sufficient for the needs of an average family. Although all formations in the Maxey Flats area can be considered poor aquifers, domestic water supplies have been obtained from any one, or combination, of these formations. In fact, there are currently residents within three miles of the MFDS (though not in the <u>immediate</u> vicinity of the site) that reportedly obtain water for domestic purposes via hand-dug wells in the alluvium/colluvium.

Section 2.1 of the MFDS Remedial Investigation Report, prepared by the Maxey Flats Steering Committee, contains a projection of the population for the area within 2.5 miles of the MFDS. In 1985, this population was estimated at 663 persons. The RI Report assumes a 15 percent increase in the population between 1985 and the year 2020, resulting in a projected population of 767 persons within 2.5 miles of the MFDS, an increase of 104 persons. If one assumes that an additional 104 persons move in to the 2.5 mile radius area every 35 years, an <u>additional</u> 312 persons would reside in the area of concern by the year 2090. It is <u>not</u> unlikely or unreasonable to assume that a portion of these 312 additional persons could obtain water from the alluvium within the next 100 years. Furthermore, the population within the 2.5 mile radius area can be expected to continue to increase during the 100 to 500 year time frame and beyond in which radionuclides would still be present at significant concentrations and migrating through the environment in the absence of the selected remedy, thereby further increasing the likelihood of use of the alluvium for drinking water purposes. For these reasons, EPA believes that the Steering Committee's comments on the appropriateness of the well water pathway are inappropriate and are primarily aimed at reducing potential risks associated with the MFDS.

Finally, EPA feels that it is not appropriate to reduce the doses from a pathway based upon the perceived likelihood of that pathway.

(18) The Maxey Flats Concerned Citizens submitted the following comment during the public comment period:

"The erosion pathway assumes only that contaminated soil in the restricted area would be washed down the slope. A far worse possibility under the No Action alternative is that erosion eats its way back into the trench area and radioactive waste itself is washed down the hillslopes. This could happen under the N- Action alternative, if the site were not re-contoured, hold-up ponds enlarged, and the flow reduced."

EPA Response:

A study performed by the USGS ("Hillslope Erosion of the Maxey Flats Radioactive Waste Disposal Site, Northeastern Kentucky," Water Resources Investigation Report 89-4199, 1990) indicates that a period of 35,000 to 65,000 years of erosion would be required for the slopes to erode to the burial trenches (however, deforestation was not assumed). Accordingly, the risk assessment did not assume the direct transport of waste from the trenches to the alluvial plain as a result of erosion. However, the risk assessment included an erosion scenario that had almost the same effect. The risk assessment assumed that leachate overflows the trenches and contaminates the overlying soil. This soil is then transported to the alluvial plain where it results in exposures to the local residents by a broad range of pathways. As indicated in EPA's response in Part I, Risk Assessment - Comment 11, and in Part II, Risk Assessment - Comment 12, the radionuclide concentrations in the eroded soil used in the analysis are approximately 10% as close to the same concentrations as those in the waste itself, depending on the radionuclide.

(19) The Commonwealth expressed concern, during the public comment on the preferred remedy, that the risk assessment did not address trench overflow and the resulting transport of radionuclides to off-site locations.

EPA Response:

Both the EPA and the PRPs evaluated the erosion scenario which explicitly modeled the overflow of the trenches and the transport of the soil/water slurry down the hillslopes to the valley, where members of the public may be exposed via a broad range of pathways. The doses presented in Table D.3-10 under "Erosion" reflect this exposure scenario.

The risk assessment does not address the effects of chelation on transport via this pathway because it would tend to reduce the doses. Specifically, chelation would tend to keep the radionuclides in solution and reduce their potential to build up in the alluvial sediment.

With regard to the surface water pathways, EPA concurs that there is a need to address trench overflow, in addition to leachate migration through the colluvium, since the transport times may be shorter resulting in less in-transit radioactive decay. This issue is discussed in greater detail in Comment 20 below.

(20) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the risk assessment did not consider the bathtub effect, and thereby underestimated the doses. The main concern here, is that bathtubbing would result in the rapid release of the radionuclides, without in-transit decay.

EPA Response:

EPA concurs in this comment and agrees that an analysis may be needed to determine if the well water and surface water pathway doses would change significantly under this scenario.

In the risk assessment, the in-transit decay is assumed for the transport of the radionuclides from the trenches to the receptor location. The in-transit time for water is assumed to be several years, and the transit time for many radionuclides is much longer due to the radionuclide binding coefficients (see Table D.3-12). For some radionuclides, this results in substantial decay in transit. If the radionuclides were leaving the site by bathtubbing, with minimal contact with soil, the transit time may be significantly reduced. EPA concurs with this concern and agrees that it may need to be addressed in the future.

(21) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"The RA does not include a population dose assessment, only an individual dose assessment. The population dose assessment is not calculated by the PRPs because so few people live in the area. Since the local streams feed into rivers which impact major population areas, the PRPs are assuming a cut-off value for radiation dose to the public."

EPA Response:

The comment is correct. Theoretically, a very small but finite amount of tritium can reach downstream rivers that are used for drinking water purposes. However, the concentrations would be miniscule and were not addressed in the baseline risk assessment.

(22) The Commonwealth commented, during the public comment period on the preferred remedy, that Section 3.1.1 of Appendix D of the FS Report, Remedial Investigation Results, does not consider Commonwealth data revealing higher levels of radionuclides in the vicinity of the site than those provided in the RI Report.

EPA Response:

The comment is correct in that the risk assessment did not explicitly address these data. However, the risk assessment was not based on measured field data, but instead was a "what if" analysis, whereby a number of "no action" exposure scenarios were defined and then modeled. As a result, though field measurements do not reveal widespread contamination in the vicinity of the site, the risk assessment made a number of conservative assumptions regarding the offsite transport of the waste. Hence, though Carbon-14 and other radionuclides have not been observed above administrative levels, the models attempt to explicitly predict the concentrations of all potentially significant radionuclides in the vicinity of the site assuming the "no action" alternative. Note that the "No action" alternative does not take credit for institutional controls, and assumes that the existing cover degrades and no longer serves as a barrier to water infiltration or erosion.

Based on this comment, there may be a need to compare the modeled radionuclide concentrations to actual measured values during remedial design/remedial action at the MFDS.

(23) The Maxey Flats Steering Committee and U.S. Ecology commented, during the public comment period on the preferred remedy, that the risk assessment and the addendum report to the FS Report greatly overstate the risks, and do not inform the public of the actual risks at the site. The Committee stated that the risk assessment submitted to EPA in December 1988 provides the best representation of site risks.

EPA Response:

EPA strongly disagrees with the comments of the Committee. The purpose of a baseline risk assessment under the Superfund process is to evaluate the potential risks from a site should no action be taken to mitigate or control the threats posed by the site. The final risk assessment submitted by the Committee in April 1991, in conjunction with EPA's Addendum Report to the FS Report, achieved this purpose. The Committee's December 1988 version of the risk assessment took credit for 500 years of institutional controls in addition to limited maintenance activities at the site and, therefore, did not constitute the No Action baseline risk assessment required by the NCP and Superfund risk assessment guidance. It was for this reason that EPA required the Committee to undertake significant revision to its December 1988 risk assessment.

As a part of these revisions, EPA required the Committee to include in its analysis those pathways which the Agency determined were reasonably likely to occur in the absence of perpetual institutional control. The Committee was then required to calculate doses associated with those pathways. The Addendum Report to the FS Report, prepared by EPA, presented the risks associated with those doses. While some of the risk calculations presented in the Addendum Report to the FS Report and in the Proposed Plan are very high, EPA made clear that these risks were based on the premise that the site was abandoned and no institutional controls or access restrictions were in place.

Based on the comments received from the community at the June 13, 1991 public meeting and during the public comment period on the preferred remedy, EPA takes issue with the Steering Committee as to the community's current level of understanding of potential risks associated with the site. EPA has clearly communicated to the community on numerous occasions the current nature and extent of site contamination and has had the Remedial Investigation Report in the local information repositories since July 1989. In addition, the Commonwealth has submitted site monitoring data to the local information repositories and to the Fleming County Grand Jury which support EPA and Commonwealth statements that the site does not currently pose a threat to human health or the environment.

With regard to the current exposures and risks at the site, neither the PRP risk assessment nor EPA calculations address this because the current exposures reflect the presence of institutional controls. However, as EPA pointed out in the Proposed Plan and at the June 13 public meeting, the conclusion to be drawn from the risk assessment is that remedial action, maintenance, monitoring and institutional controls at the MFDS must be funded and conducted in perpetuity due to the significant threat to human health and the environment posed by the site in the future should these activities not be undertaken.

It should be noted that comments submitted on behalf of the Maxey Flats Concerned Citizens, Inc. called for more stringent assumptions in the risk assessment than those used by the Maxey Flats Steering Committee.

(24) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"Implementation of the preferred alternative will reduce any remaining risks at the site by orders of magnitude below the 1×10^{-4} value contained in the Proposed Plan. The reasons for this conclusion are straightforward. By simply maintaining institutional controls at the site, the intruder scenarios would be eliminated, thereby reducing the risk of even the "no action" case to around 1×10^{-4} by EPA's calculation. Footnote. A more realistic assessment, as evidenced by the December 1988 risk assessment, would result in a "no action" risk level at least two orders of magnitude below that calculated by EPA."

EPA Response:

EPA agrees that implementation of the selected remedy may reduce risks below the 1×10^{-4} value provided in the MFDS Proposed Plan. Inclusion of institutional controls in a no action alternative is not allowed by the NCP; therefore, engaging in a response to the Committee's hypothetical "simply maintaining institutional controls" scenario serves no meaningful purpose. The December 1988 risk assessment, referenced in the footnote to the Committee's comment, was deemed inadequate by EPA, the Commonwealth and the Maxey Flats Concerned Citizens, Inc. Consequently, the risk assessment has undergone substantial revision, resulting in the April 1991 risk assessment which, in conjunction with EPA's Addendum Report to the FS Report, provides an adequate representation of site risks.

(25) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"We recommend that:

- the trench chemicals be more fully characterized
- a full RCRA analysis be conducted, including the interaction of chelating agents with trench chemicals, and
- RCRA be accepted as an ARAR"

EPA Response:

As stated in EPA's response to Comment 7 above, the inclusion of Comment 7 chemicals in the risk assessment would not yield significantly higher risks nor would inclusion of these contaminants, even if, in the unlikely scenario, these chemical contaminants did yield a significantly higher risk, alter the remedy.

For reasons discussed in Section 8.0 - Applicable or Relevant and Appropriate Requirements of the Record of Decision, EPA concurs with the MFCC that RCRA should be considered an ARAR at the MFDS. Thus, the selected remedy will be required to achieve the requirements under RCRA that are applicable to the MFDS.

The RCRA requirements were specifically designed for the management of hazardous wastes. RCRA closure requirements will ensure that the final cap is designed and constructed to minimize the need for further maintenance and monitoring, minimize or eliminate to the extent necessary post-remediation escape of hazardous constituents to ground or surface water or through the atmosphere, and to protect human health and the environment. The selected remedy's RCRA ground water requirements establish maximum ground water concentration limits for metals and chemicals, which will be complied with in the alluvium at the base of the hillslopes. The RCRA ground water requirements also establish monitoring requirements for non-radionuclides and corrective action if monitoring indicates ground water concentration limits have been exceeded in the alluvium. EPA believes the selected remedy appropriately addresses the presence of chemicals at the MFDS via these RCRA requirements.

(26) An attendee at the June 13, 1991 public meeting commented on a recent USGS report containing findings of high contamination levels in monitoring wells. The attendee asked if EPA assumes that deer will not drink this water.

EPA Response:

The USGS report presents the levels of tritium in monitoring wells at the site that were installed beneath the ground surface, into the underlying bedrock. The deer of the area do not have access to this subsurface water. Ground water eventually flows through the bedrock fractures and eventually surfaces at the soil/rock interface, or through seeps. Precipitation, dilution, evaporation and decay of the radionuclides affect the ground water as it migrates out of the trench disposal area. Therefore, the highly elevated levels of tritium detected in the USGS monitoring wells have not been detected in surface waters outside the restricted area. These surface waters would be the body of water accessed by the deer. Thus, the answer is yes, EPA assumes that the deer are not drinking water containing levels of tritium as high as that detected in the USGS monitoring wells.

C. Applicable or Relevant and Appropriate Requirements (ARARs)

(1) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"The Committee does not agree that a number of the regulations identified by EPA should be classified as ARARs. The Committee has explained its reasons for opposing the designation of these provisions in earlier filings with the Agency and incorporates those discussions by reference in these comments. In particular, the Committee does not believe that the following regulations should be ARARs:

- National Emission Standards for Hazardous Air Pollutants from DOE facilities;
- The 25 mrem/yr offsite dose standard of 10 CFR § 61.41 and 902 KAR:022, Section 18;
- 40 CFR § 192.32(b)(2)(i) of the Uranium Mill Tailings Radiation Control Act (UMTRCA) standards;
- Kentucky drinking water standards, 401 KAR 6:015; and
- Kentucky surface water standards for radionuclides, 401 KAR 5:031, Section 2(6)

On page 12 of the Proposed Plan and in the footnote on that page, EPA alludes to the possible inclusion of certain RCRA regulations as ARARs without providing any basis for such action. ...'Should the Agency ultimately conclude that RCRA regulations are applicable at the site, then it would (1) need to substantiate that conclusion in writing, (2) describe what effect, if any, those new requirements would have on the remedy and (3) reopen the comment period to allow parties a meaningful opportunity to comment on the Agency's conclusions.'

To the extent the ARARs identified in this section of the Committee's comments would modify the preferred alternative, the Committee believes that EPA should either waive those ARARs or accept the Committee's arguments and delete these regulations from the list of ARARs. To the extent EPA has concluded that all of the ARARs it has identified will be met by the preferred alternative, it should confirm this conclusion in the Record of Decision."

EPA Response:

Per the National Contingency Plan, the lead Agency (EPA) shall determine, in consultation with the support Agency (the Commonwealth of Kentucky), those requirements that are applicable or relevant and appropriate (ARARs) to the response actions at Superfund sites. The ARARs identified in Section 8.0 of this document are the requirements determined by EPA, in consultation with the Commonwealth, to be applicable or relevant and appropriate to the MFDS.

The following discussion addresses each of the ARARs to which the Committee has raised objections:

The National Emission Standards for Hazardous Air Pollutants (NESHAPS) in 40 CFR 61.92 are contaminant-specific, relevant and appropriate requirements for setting emissions levels for radionuclides remaining on-site at Maxey Flats as residual contaminants. The NESHAPs for radionuclides in 40 CFR 61.92 states that emissions of radionuclides to ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/year. A key purpose of the NESHAP for radionuclides at DOE sites is to set standards based on "acceptable risk" to the public (54 Fed. Reg. 51664, Dec. 15, 1989). This is the same purpose for setting remediation goals at Superfund sites. Thus, based on the factors in the 1990 NCP in 300.400(g)(2), EPA concludes that 40 CFR 61.92 is relevant and appropriate for setting emissions levels at Maxey Flats.

As EPA noted in its 1989 ARARs Compliance With Other Laws Manual, although the standards of 10 CFR Part 61 are not applicable to previously closed low-level waste disposal sites, the standards "may be relevant and appropriate to existing CERCLA sites containing low-level radioactive waste if the waste will be left on-site." (CERCLA Compliance With Other Laws Manual, Part II, OSWER Directive 9234.1-02, August 1989, at p. 5-15). EPA has determined that the 25 mrem/yr dose limit set by the NRC in 10 CFR Part 61 is relevant and appropriate to remedial activities at the Maxey Flats Disposal Site. The radiation protection standard of 25 mrem/year dose to the whole body, established in 10 CFR Part 61, Section 41, and 902 KAR 100:022, Section 18, shall be treated as a contaminant-specific ARAR and, as such, be used as the remediation goal for overall exposure to radionuclides after site cleanup. The MCLs/MCLGs, NESHAPs and Kentucky Water Quality Standards are the remediation goals for their specific media. The remediation goal for soil exposure is the difference between the overall 25 mrem/year cap and the combined exposures predicted by the risk assessment for the ground water, surface water and air pathways.

The UMTRCA standard found in 40 CFR 192.12(a)(1), which applies to remedial actions at inactive uranium processing sites, limits radium-226 concentrations in soil to 5 pCi/g in the top 15 cm. Radium-226 is present at the MFDS. Therefore, EPA has determined that the referenced UMTRCA standard is relevant and appropriate for the MFDS cleanup and is a contaminant-specific ARAR for soils at the Maxey Flats site.

The Kentucky drinking water standards found in 401 KAR 6:015 establish maximum concentration levels for a number of inorganic, organic, and radionuclide contaminants in public drinking water supplies. EPA's Groundwater Protection Strategy dictates that Superfund remedial actions affirmatively protect all potential sources of public water supply. The Agency has determined that the aquifers of the MFDS area represent potential sources of water supply and that the federal and state drinking water standards are, therefore, relevant and appropriate at the site.

Compliance with the MCLs established in 401 KAR 6:015 and the MCLs/MCLGs established in 40 CFR Parts 141-143 at the MFDS will be judged beginning at the contact of the alluvium with the hillside and ending at the streams. (See EPA Response to Comment 26 of Part I. B. - Risk Assessment of this Responsiveness Summary for a further response to EPA's position of the appropriateness of the well water pathway.)

Kentucky's Surface Water Standards, set out in 401 KAR 5:026 - 5:036, set "minimum criteria applicable to all surface waters". These criteria include specific limits on radionuclides. These standards are applicable contaminant-specific standards for the surface water streams (i.e., Drip Springs Hollow, No Name Hollow, and Rock Lick Creek) surrounding the MFDS. In addition, to the extent that the site contains surface waters as defined by 401 KAR 5:029 Section 1(bb), including intermittent streams with well defined banks and beds, the surface water standards are, likewise, applicable contaminant-specific standards. The Commonwealth has the NRC's full authority to regulate the land disposal of low level radioactive waste, and the Commonwealth has determined that its surface water standards are applicable to such surface waters.

For reasons addressed in Section 8.1 of this Record of Decision (ARARs), EPA has determined that certain requirements of the Resource Conservation and Recovery Act of 1980 (RCRA), 40 CFR Part 260, et seq., and corresponding Kentucky regulations (401 KAR Chapter 30, et seq., are ARARs for the MFDS.

The impact of RCRA requirements on the selected remedy are not substantial. RCRA closure requirements will have to be met. However, even prior to the determination that RCRA was applicable to the MFDS, Alternative 5 met these closure requirements. The only additional requirements imposed on the remedy by the RCRA determination are the tank requirements and ground water monitoring requirements. The Land Disposal Restrictions of 40 CFR Part 268 would have been a significant new requirement; however, as documented in Section 8.3 of the Record of Decision, these requirements are being waived for the remedial action on the basis that compliance with the requirements would result in greater risk to human health and the environment than would non-compliance.

EPA identified the major ARARs for the MFDS in the Proposed Plan which was released to the public in June 1991 and was the subject of a 60-day public comment period. The Agency indicated at that time that it was considering the addition of RCRA as an ARAR for the site. Thus, the Proposed Plan afforded the public, including the Maxey Flats Steering Committee, an opportunity for meaningful comment and the Agency does not intend to reopen the public comment period.

Moreover, EPA had already made the Steering Committee aware that RCRA was being considered as a potential ARAR in November of 1990, well before the Proposed Plan was issued. EPA kept the Steering Committee informed of developments on the RCRA issue throughout the period leading to this ROD. The Steering Committee was clearly afforded the opportunity to comment on the Agency's final determination of the RCRA issue and took full advantage of that opportunity by submitting the comments on what became the final RCRA ARAR determination as Attachment 8 of the Committee's overall comments on the Proposed Plan.

The Committee's comments on the RCRA issue can be summarized as follows:

(a) That liquid scintillation vials (LSVs) are not spent solvents and should not, therefore, be classified as listed hazardous waste;

(b) That the toluene and xylene at the site could have come from non-listed sources and, thus, RCRA should not be treated as applicable;

(c) That even if the LSVs are listed wastes, the small quantity generator exemption applies and the LSVs would not, therefore, be subject to RCRA regulation; and '

(d) That even if the leachate is a listed hazardous waste, it should be delisted.

EPA's responses to these comments, as previously conveyed to the Steering Committee, are as follows:

(a) EPA disagrees with the Committee's arguments concerning the status of LSVs as listed wastes. It is the Agency's position that the scintillation fluids disposed of at the MFDS were used for their "solvent" properties and are, in fact, listed spent solvents.

(b) When there is a known listed hazardous waste source for a constituent found at a facility, it is not EPA's policy to avoid RCRA requirements by assuming that the constituent discovered came from an unlisted source.

(c) In order to accept the Committee's argument on the small quantity generator exemption, EPA would have to assume that each and every generator of LSVs disposed of at the MFDS were small quantity generators. The Committee advances an argument for why the Agency should do just that. However, for that argument to succeed, the Agency would have to assume not only that all LSVs produced by those generators went to the MFDS, but also that those generators produced no other hazardous wastes of any kind that would have contributed to the total hazardous waste volume generated by them. EPA is simply not willing to make these assumptions.

(d) EPA does not believe that delisting of the leachate is appropriate. First, much more sampling would be necessary to sufficiently characterize the leachate for delisting purposes. Moreover, given the heterogeneous nature of the trenches and the leachate contained therein, it is possible that no amount of additional testing would suffice for this purpose. Finally, even if it could be clearly established that all RCRA constituents in the leachate were below health-based levels, the leachate would remain dangerous due to its high radioactivity. Delisting of this otherwise dangerous waste is not a route that EPA is willing to take at this time.

(2) The Kentucky Resources Council commented, during the public comment period on the preferred remedy, that for areas that will be remediated by removal of contaminated soils or other material, KRS 224.877 is a state ARAR which must be respected by EPA in the development of remedial plans. According to the Kentucky Resources Council, the state statute provides two alternatives with respect to clean-up standards - one, cleaning up to naturally-occurring background; the other, allowing residual contamination provided that the detailed assessments required by the statute are conducted.

EPA Response:

The selected remedy for the MFDS will not involve removal of contaminated soils or other materials. It is a containment remedy which, by its very nature, involves leaving wastes in place above background levels. Moreover, it is EPA's position that KRS 224.877, as amended, is not an ARAR. The substantive provisions of KRS 224.877 which could arguably be applicable or relevant and appropriate requirements are contained in Sections 5 and 10 thereof. As described below, neither Section meets the eligibility criteria for ARARs provided in CERCLA or in the National Contingency Plan.

Section 5 of the Kentucky statute states that persons having possession or control over a hazardous substance, pollutant, or contaminant being released or who caused the release must take "actions necessary to restore the environment to the extent practicable and minimize the harmful effects from any release into the air, lands or waters of the Commonwealth." Such restoration and minimization merely constitute a general goal or legislative intent about a desired outcome or condition rather than a specific cleanup level. The statute does not contain the requirement of cleanup to naturally occurring background levels. That requirement is an interpretation of the statute which is not promulgated and is, therefore, not an ARAR.

Section 10 of KRS 224.877 states that remedial actions "shall protect human health, safety and the environment" considering certain factors outlined therein as appropriate. Section 10 does not constitute an ARAR either because the protection obligation is not more stringent than federal requirements for remedial actions. For example, Section 121(d) of CERCLA provides that remedial actions shall attain a degree of cleanup which, <u>at a minimum</u>, assures protection of human health and the environment. Section 121 of CERCLA, in addition to a multitude of other federal requirements governing remedial actions, is equivalent to or more stringent than the mandate contained in KRS 224.877(10). In summary, KRS 224.877 does not contain any specific, enforceable requirements that are more stringent than provided by federal law and thus is not an ARAR.

(3) The Maxey Flats Steering Committee, during the public comment period on the preferred remedy, commented that the conclusion on pages 4 and 5 of EPA's Addendum to the FS Report, in which EPA states that because of the seeps on the east hillslope, the site is not presently meeting all contaminant-specific ARARs, is incorrect. The Committee feels that EPA's assumption of the point of compliance with 902 KAR 100:025, Table II at the seep location is incorrect. According to the Committee, both Kentucky regulations and the underlying Nuclear Regulatory Commission (NRC) regulations reveal

that the correct point of compliance is the site property boundary. According to the Committee, had EPA focused the proper point of compliance, it would have reached an opposite conclusion. In the Committee's opinion, the seeps are in a "controlled area", not an "unrestricted" one, since the seeps are within the site property boundary where the Commonwealth of Kentucky can limit the public's access. Consequently, the Committee feels that to determine if releases from the seeps cause the Table II requirements to be exceeded it is necessary to determine if those limits are being exceeded at the site boundary. Additionally, the Committee stated that the statement in the Addendum is not supported by the data and that it should be modified or deleted.

EPA Response:

By way of definitional interpretations, the Committee seeks to have the area outside the MFDS Restricted Area considered as a "controlled area" rather than an "unrestricted" area. The Committee fails to support its interpretation that the area is a "controlled" area with any facts demonstrating that the public cannot access the seeps. The Committee cannot provide these facts because there are currently no controls in place to limit access to the seeps. The only deterrent to public access at the MFDS is the fence which encloses the 47-acre Restricted Area and the presence of on-site Commonwealth and contractor personnel. There currently is no fence around the entire 280 acres which comprises the MFDS. The Kentucky Cabinet for Human Resources (CHR), which is the authority responsible for administering the Kentucky regulations in question, does not agree with the Committee's interpretations. It is the CHR's position that the access to the MFDS, other than the Restricted Area, is neither limited nor controlled and that the seeps of the east hillslope are, in fact, located in the unrestricted area of the MFDS. For the reasons stated herein, no change has been made to the statement that the MFDS is not presently meeting the contaminant-specific requirements of 902 KAR 100:025, Table II.

(4) The Maxey Flats Steering Committee, during the public comment period on the preferred remedy, commented that, while EPA would require the purchase of the buffer zone and would place control over the properties in the Commonwealth of Kentucky's hands, EPA would act as though these purchases did not change the current site boundaries and hence the location at which compliance with the contaminant-specific ARARs would need to be demonstrated after the completion of the remediation. The Committee states that EPA's position on this issue is neither supported by the facts nor the relevant regulations and should accordingly be modified. According to the Committee, EPA is not free to identify ARARs and then apply them in situations where they have no relevance. In closing, the Committee argues that, while purchase of a buffer zone makes since at Maxey Flats, EPA's attempt to exclude that zone from the site property boundary does not.

EPA Response:

The selected remedy specifies the procurement of a buffer zone for the purposes of ensuring long-term access to areas necessary for monitoring remedy performance and compliance and to protect the hillslopes from activities that may be detrimental to the long-term integrity of the remedy. The buffer zone is not being purchased for the purpose of extending the site boundaries so that ARARs can more easily be achieved.

The Committee places the argument of no "assumed exposures" to the public (within the buffer zone) on the premise of Commonwealth ownership and Commonwealth "control" of buffer zone properties, neither of which is prescribed by the selected remedy, and neither of which can be assumed with any degree of certainty at this time. Private party ownership within the buffer zone cannot be precluded at this time. Although Commonwealth ownership of buffer zone properties may make the most sense at this early point in the process, it cannot be assumed to be a certainty, as the Committee acknowledged in its comment. Buffer zone procurement may include property purchases, but it is not unreasonable to assume that procurement might also include easements and/or land use restrictions. Even if the property were all owned by the Commonwealth, or some other entity associated with remediation of the site, unless the entire buffer zone and the entire area of the MFDS were fenced, "control" over access to the buffer zone properties would be very limited.

It should also be noted that compliance with the standards set out in the NESHAPS and in 902 KAR 100:022, Section 18, is judged, not at the site boundary as described for Superfund purposes, but, rather, at the boundary of the property licensed for radioactive waste disposal pursuant to the Atomic Energy Act. Moreover, compliance with the standard for overall exposure to radiation set forth in 10 CFR Part 20 is judged at the boundary of the restricted area. Commonwealth ownership of buffer zone properties would not, in and of itself, extend either of these boundaries. A modification or amendment to the site license would be required for such extensions. Neither the Commonwealth nor EPA consider such an amendment or modification necessary or appropriate.

Furthermore, it is EPA's responsibility to set the points of compliance at Superfund sites in a way that it deems protective of human health and the environment. It is EPA's determination that extending the points of compliance beyond the currently existing site property boundary would not be protective of human health and the environment.

D. Selection of Remedy

(1) A resident expressed satisfaction, during the June 13 public meeting on the preferred remedy, that EPA, the Commonwealth, and the PRPs are making progress toward remediation of the MFDS.

EPA Response:

EPA appreciates the support of the community and concurs with the commentator that a technical consensus on the remedy is needed for remediation to proceed in a timely fashion.

(2) The Maxey Flats Concerned Citizens, Inc. (MFCC) provided the following opinions on the remedial alternative options at the June 13, 1991 public meeting on the preferred remedy, and reiterated their position in comments submitted during the public comment period:

(a) The MFCC strongly opposed the dynamic compaction technology (included in Alternatives 4, 10, and 17). The MFCC cited potential rupture of waste containers within the trenches, and potential enhanced migration of contaminants through the underlying bedrock fractures. Additionally, surface contamination and worker exposures were concerns of the MFCC with respect to the dynamic compaction technology.

(b) The MFCC does not prefer the grouting technology (included in Alternative 11) at the MFDS due to concern over the potential for release of contaminants via container puncture when the lances used to insert the grout are injected into the trenches. Also, the MFCC expressed concern over the inability of the technology to fill voids within the trenches.

(c) The MFCC supported the natural stabilization technology and Alternative 5, with modifications. (See Comment 11 below).

EPA Response:

As presented in Section 9.0 of the Record of Decision, neither the dynamic compaction alternatives nor the grouting alternative represented the best balance of the nine criteria used to evaluate remedial alternatives under the Superfund program.

(3) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"On page 3 of the Addendum and in several comments on prior versions of the FS Report, EPA has suggested that the closure of the Maxey Flats site is occurring solely as a result of EPA's actions under CERCLA. This suggestion ignores the factual realities of the site. Maxey Flats is licensed and was operated as a low-level radioactive waste site. As indictated by the risk assessment, the risks posed by the site are related to the radiation that is present at the site. As a result, closure activities should be governed by regulations established pursuant to the Atomic Energy Authority Act. The passage of CERCLA does not change this regulatory reality nor the factual reality that the site remains a licensed low-level radioactive waste site."

EPA Response:

The status of the MFDS as a licensed low-level radioactive waste disposal facility necessarily influenced this Record of Decision to a great degree because many of the Kentucky and NRC regulations governing closure of low-level radioactive waste disposal sites constitute ARARs with which CERCLA Section 121(d)(2) requires the remedial action to comply. Nevertheless the fact remains that this Record of Decision addresses remediation of the MFDS under the authority of CERCLA and not the closure of the site under the authority of regulations promulgated pursuant to the Atomic Energy Act (AEA).

Pursuant to CERCLA Section 104, EPA is authorized and obligated to provide remedial action to address any release or threatening release of hazardous substances where the Agency believes the action is necessary to protect human health and the environment. EPA has determined that the protection of human health and the environment requires that the release and threatened release of radionuclide and chemical contaminants from the MFDS be addressed by the remedial action selected herein.

EPA simply does not agree with the implication in the Committee's comment that because closure pursuant to AEA regulations would be appropriate for this site, the remedial authority of CERCLA is somehow preempted.

(4) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"It should be stressed [in the Proposed Plan] the Commonwealth does not endorse Alternative 5 but has determined it represents a starting point for remediation of the site. The Commonwealth's Closure Plan submitted to USEPA differed in a number of respects to Alternative 5 as proposed in the Feasibility Study."

EPA Response:

EPA recognizes the concerns of all parties involved, i.e., the Commonwealth, the PRPs, the community, and EPA itself. EPA believes that the selected remedy provides the best balance of the criteria used to evaluate remedies under the Superfund program, while maintaining the necessary flexibility to accommodate uncertainties and concerns expressed by the various parties. It should be noted here that the selected remedy is not identical to Alternative 5 as presented in the Feasibility Study Report. EPA has the discretion to structure and modify the preferred alternative based upon a variety of factors including state and community acceptance and has done so in the ROD.

(5) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"The Commonwealth's Closure Plan indicated the plastic membrane should be covered by a drainage layer, geotextile and a soil cover with vegetation to prevent erosion. The Commonwealth has concluded this cap may be necessary to prevent erosion of the natural drainage channels."

EPA Response:

EPA recognizes the Commonwealth's concerns in the Record of Decision by not precluding the Commonwealth's preferred design for the initial cap. If surface water runoff cannot be effectively controlled (i.e., rates of erosion are unacceptable) during the Interim Maintenance Period, the five year reviews, or at any point between the five year review, necessary modifications to the initial cap design will be made. Such changes could include design components that the Commonwealth has advanced to EPA.

(6) Representative Pete Worthington, of the Kentucky House of Representatives, submitted the following comment during the public comment period on the preferred remedy:

"I am very pleased to see the adoption of Kentucky's recommendation for natural subsidence as the preferred option. As you know, the dynamic compaction and the grouting option would have caused extreme exposures to the accelerated releases of radioactive materials. I am requesting that the Record of Decision reflect these exposures caused by breaching the integrity of canisters in the trenches and the potential fracturing of shale geology. The books must be closed forever on any consideration of these alternatives to dealing with subsidence in the trenches."

EPA Response:

Section 9.0 - Summary of the Comparative Analysis of Alternatives, of the Record of Decision, reflects the concerns of the commentator.

(7) A concerned party stated, at the June 13, 1991 public meeting on the preferred remedy, his belief that no type of containment remedy will effectively remediate the MFDS. He suggested that the only solution for the site is to excavate the site waste and contaminated soils, place them in containers, and send them to outer space.

EPA Response:

The vertical infiltration barrier (trench cap) and lateral infiltration barrier (horizontal flow barrier) components of the selected remedy, as well as the erosion control measures, leachate extraction and solidification measures, monitoring and maintenance activities, and engineering and institutional control components of the selected remedy are based on reliable and proven technologies. These features are designed to effectively isolate the radioactive contaminants at the site in perpetuity. Additionally, five year reviews will be performed to ensure the remedy's compliance with Federal and State requirements and to ensure that the remedy continues to provide protection of human health and the environment. Institutional controls, maintenance and monitoring will be in place in perpetuity and a trust fund will be established to fund these activities in perpetuity.

Waste disposal in outer space is not a proven and reliable, feasible, cost-effective alternative. Although disposal in outer space was not specifically evaluated during the Feasibility Study process, it can be safely assumed that this proposal would not provide the best balance of the nine Superfund criteria used to select remedies; specifically, the Short-Term Effectiveness, Implementability, Overall Protection of Human Health and the Environment, State Acceptance, Community Acceptance, and Cost criteria would not lend support to selection of this alternative.

(8) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"Rates of subsidence will be difficult to determine, and may be slower than expected. Therefore, 35 years appears to be an underestimation of the time period required for subsidence. Alternative 5 as described in the Feasibility Study does not have a cutoff wall which encircles the trenches. The Commonwealth believes a North Cutoff wall will be insufficient to prevent horizontal flow into the trenches."

The Commonwealth in its Closure Plan suggested a cutoff wall which was different than the two proposed in the Feasibility Study.

EPA Response:

EPA concurs that there is uncertainty with regard to the period of natural subsidence prior to installation of the final cap. Accordingly, the Feasibility Study was revised and the Proposed Plan and Record of Decision reflect the Commonwealth's estimate of 100 years as an estimate of the period of natural subsidence.

EPA also concurs that there is enough uncertainty with regard to the hydrogeological flow conditions at the MFDS to warrant flexibility in this component of the selected remedy. Accordingly, Section 10.2 of the Record of Decision discusses two types of horizontal flow barriers, the North Cutoff Wall and the Lateral Drain/Cutoff Wall, but acknowledges that another type of flow barrier may be used if it is determined that a flow barrier is necessary.

(9) An attendee at the June 13, 1991 public meeting asked how EPA will control the increased water velocity in the existing site drainage channels.

EPA Response:

The remedy will include examination of the existing drainage channels, improvements to the existing drainage channels as needed, and possibly adding drainage channels to regulate the flow from the site. Added drainage channels would ensure that most of the runoff would not flow through one structure. The remedy design also may enlarge the retention ponds to control water volume. Currently, the east drainage retention pond handles approximately 60 to 70 percent of the runoff, and this runoff must be distributed through the other natural channels at the site. If the cap can be integrated into the area's natural drainage system properly, erosion runoff can be effectively controlled.

(10) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The plan for erosion control is quite sketchy. The final detailed plan will have to absolutely assure the protection against the exposure to the opening of any new release pathways over the entire life of the closure time for the site."

EPA Response:

As detailed in Sections 10.1 through 10.3 of the Record of Decision, erosion control will be one of the principal design considerations. The design of the initial cap will be based in large part on the ability to prevent or mitigate to the extent practicable hillslope/drainage channel erosion and prevent downslope flooding. Erosion monitoring is planned to be an integral part of the site monitoring program. Surface water control systems maintenance is an integral part of the overall site maintenance plan. A number of surface water control improvements are included in the selected remedy.

(11) The Maxey Flats Concerned Citizens, Inc. (MFCC) expressed the following concerns, at the June 13, 1991 public meeting and during the public comment period on the preferred remedy:

(a) Concern over the effect of elements (sun, wind, cold) on the initial cap synthetic liner if not protected. Additionally, concern was expressed over the potential for surface water runoff to erode hillslopes and flood downslope areas if a soil cover over the synthetic liner was not used in the initial cap design;

(b) Concern over the lack of threshold criteria for installing a horizontal ground water flow barrier. The question was asked: How much leachate would have to enter the trenches to trigger installation of a barrier? Further, the MFCC inquired about the plan to extract and treat the leachate if it forms in the trenches after being pumped dry;

(c) With regard to erosion, the MFCC suggested that water management systems, including larger ponds to meter the flow, are needed to retard erosion. The MFCC is also concerned that rock rip-rap will not be an effective erosion control and stressed that it is critical that a monitoring and maintenance program be able to detect and repair hillslope damage and that funding for this repair be continued in perpetuity;

(d) The MFCC supported EPA and Kentucky in the need to acquire a buffer zone adjacent to the MFDS. The MFCC suggested that if some landowners are reluctant to sell at this time, that the EPA be flexible and consider allowing local landowners the option of lifetime lease rights, with conditions placed on the lease. It was also suggested that the lease should not be transferable.

(e) Concern that the site monitoring and maintenance program and who should pay for these activities is not well defined. The MFCC requested that EPA require monitoring for radionuclides and hazardous chemicals of the following:

- personnel
- air
- gamma dose
- surface water
- soil pore water
- vegetation
- trench leachate
- erosion

(f) The MFCC also expressed a desire for the following:

- Testing of sump leachate water levels for the first 100 years (to determine if trench recharge is occurring);

- Testing of radionuclide concentrations, ground water, soil contaminants on hillsides, surface water, air, trench stabilization, erosion parameters, silting;

- Installation of surface monuments to notify persons that hazardous chemicals and radioactive waste are disposed on-site;

- Inspection of the trench cap, during the first 100 years, for cracking and subsidence;

- Use of settlement plates and slope inclinometers to determine vertical movements and tilt.

EPA Response:

(a) The selected remedy provides for the installation of a synthetic liner on top of a clay layer over the trench disposal area as an interim cover while the trench contents subside naturally. EPA has not precluded other options for the interim cover, such as placing a soil cover over the synthetic liner, which would slow the rate of surface water runoff and reduce the potential for site erosion.

Erosion control will be used as one of the principal criteria in approving the interim cover design. A soil layer over the synthetic liner adds to the difficulty in backfilling subsided areas during the Interim Maintenance Period. Each subsided area would require excavation of the soil, removal of a section of a synthetic drainage layer to get to the synthetic liner, and removal of a section of the synthetic liner before the subsided area could be backfilled. Should the design not provide a reasonable degree of assurance that rates of erosion will be adequately controlled, other interim cover options will be evaluated and employed. Furthermore, the five year reviews that will be performed following remedial action initiation, will specifically address erosion and the ability of the interim cover to adequately address erosion and infiltration.

Synthetic liners are being used worldwide, in conditions more severe than that of the Maxey Flats area. Therefore, there are manufacturers that produce and warrant synthetic liners to withstand various environmental effects. The liner employed at the MFDS will be required to withstand degrading environmental forces for the specified duration of the cover.

(b) Currently, not enough information is available to assess the need for a horizontal flow barrier. Further ground water modeling data, monitoring data, leachate extraction data, historical Commonwealth monitoring data, and other information will be used during remediation to assess the need for a horizontal flow barrier and, if needed, the location, depth and type of barrier to be installed. At this time, specific numeric criteria have not been established to be used in the decision on the necessity of the barrier. Rather, it is viewed as preferable to conduct a statistical analysis, using the afore-mentioned information that will be collected and analyzed, to assess the need for a horizontal flow barrier. If the statistical analysis concludes that infiltration of the trenches is occurring, a barrier will be constructed. Assigning a numeric infiltration criteria at this juncture could preclude installation of a horizontal flow barrier at some point when in fact one may be necessary.

Should significant trench recharge occur at some point after the trenches are pumped dry, Section 10.2 of the Selected Remedy portion of the Record of Decision specifies that the leachate be pumped, treated and disposed on-site in new disposal trenches.

(c) Section 10.1 - Initial Closure Period, of the Record of Decision, describes the surface water control features anticipated for the selected remedy. These features include improvements to existing drainage channels, use of additional, natural drainage channels, as needed, use of rock rip-rap and gabions, if found to be effective, and increasing the volume of the water retention ponds. EPA and the Commonwealth view the surface water control features to be a critical component of the selected remedy. Downslope flooding and increased rates of hillslope erosion are unacceptable; the initial closure period will focus on the best practicable means available to effectively mitigate potential erosion and downslope flooding.

Sections 10.1 and 10.2 of the Record of Decision specifically address site monitoring and maintenance of erosion control features.

(d) EPA concurs with the MFCC's comment on maintaining flexibility in the buffer zone acquisition. EPA views flexibility in the negotiations as the key to successful resolution of the negotiations. Protection of the hillslopes from detrimental activities which may affect the integrity of the remedy, and access to areas adjacent to the MFDS for the purpose of assessing remedy compliance and performance are essential to the selected remedy.

(e) In an effort to respond to the MFCC's concern regarding the elements of the monitoring and maintenance program at the MFDS, Sections 10.1 and 10.2 of the Record of Decision were expanded to further define the types of monitoring and maintenance planned for the MFDS. It is anticipated that monitoring of those items listed in the MFCC's comment will be performed. Both radionuclides and hazardous constituent testing will be performed, as specified in Section 10.1. Funding details are rarely available at this juncture; it would be premature to specify the entity who will pay for the remedy. It is anticipated that those details will be resolved during, or as a result of, subsequent negotiations with PRPs on the implementation of Remedial Design/Remedial Action.

(f) All of these tasks are included in the selected remedy. The Record of Decision specifies performance of these tasks in Sections 10.1 through 10.3.

(12) The Maxey Flats Concerned Citizens, Inc. (MFCC) submitted the following comment during the public comment period on the preferred remedy:

"Because of the expected heavy road traffic, we recommend that the PRP's finance local highway construction and repair. The PRP's suggest only discussions with Fleming County officials. We also suggest that the EPA give preference to hiring local people for the remediation project."

<u>EPA Response:</u>

In response to the MFCC's concerns over potential road damage during site remediation, Section 10.1 of the Record of Decision was expanded to further specify that "Should it be determined that site activities are having a detrimental effect on County Road 1895, the authority(ies) responsible for remediation of the MFDS will be responsible for funding such repairs." EPA concurs that if road conditions deteriorate as a result of MFDS remediation, that road repairs be funded and implemented by those responsible for remediation. However, at this juncture, the PRP's have not agreed to fund and conduct the remedy; therefore, EPA cannot specify that the PRPs pay for road repairs.

At this stage, the identity of the authority(ies) implementing the remedy has not been determined. However, it is reasonable to assume that some local people will be hired by the authority(ies) during various phases of the remediation project and that the remediation will tend to have a positive effect on the local economy.

(13) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The interim trench site cover boundary must be better defined in the record of decision document. It is to cover the entire boundary of the current security fenced area plus some outside area to the edge of the hillslopes. It is critical that the maximum area be covered with no opening in the cover. This will minimize the exposure to lateral migration of water into the trenches and reduce the chances for having to install a barrier wall. The barrier wall design will be expensive and have exposures to not completely controlling any lateral migration."

EPA Response:

The areal extent of the interim trench cover can best be determined during the remedial design phase of the project, utilizing such information as geophysical survey data which will aid in defining the outer boundaries of the disposal cells and ground water modeling (in conjunction with evaluation of historical monitoring data) to aid in establishing the extent to which the cap can prevent infiltration into the trenches. EPA agrees that it is very important to cover the disposal area to the maximum extent necessary to prevent infiltration. Accordingly, the Proposed Plan and Record of Decision reflect a cap size ranging from 40 to 50 acres, as opposed to the 30 to 40 acre cap envisioned in the Feasibility Study Report.

(14) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The retention of all the existing sumps in the trenches and any new ones installed during the trench dewatering process is absolutely necessary. This is the only way to assure that lateral migration of water into the trenches can be removed effectively. I demand that all of these sumps be left in place and protrude through the site cover to permit access to the sumps for any liquid removal and an absolute reliable measurement of liquids in the sumps wells. The flexible gasket suggested in the Kentucky proposal should be utilized to assure the integrity of the site cover with the event of subsidence in the area."

EPA Response:

EPA equally recognizes the importance and function of sumps and wells for future detection monitoring at the MFDS. Section 10.1 of the Record of Decision specifies the closure only of poorly designed wells (i.e., E-wells) that could allow contaminants in ground water to migrate downward into the lower geologic units. Section 10.1 also specifies that riser pipes will be used, during construction of the caps, to extend wells and sumps through the cap for the purpose of monitoring. Flexible gaskets and other similar devices will be considered during the design phase. EPA agrees that the device used will have to assure the integrity of the site cover in the event of subsidence in the area.

(15) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"I would like to propose the following criteria for evaluating the need to install a barrier wall for precluding lateral migration. Any lateral migration must be less than the amount to raise the water level in any sump by more than "x" feet. This level must be kept to a minimum to assure the hydraulic head is low enough to maintain an acceptable leaching factor. When and if the acceptable water level is exceeded. A cost evaluation should be performed to study the most cost effective option of either installing a barrier wall or the on-going removal of trench water in the same process used in the initial trench dewatering phase."

EPA Response:

EPA and the Commonwealth believe that the decision on installation of the horizontal flow barrier should be based on a statistical analysis of information obtained during the leachate extraction program, from the infiltration monitoring system, and from ground water modeling in conjunction with existing monitoring data. Cost evaluations could also be performed, as suggested, if lateral infiltration is occurring. Placing a numerical value on the acceptable rise of water levels may be premature at this point, and could preclude installation of a flow barrier when in fact one may be necessary. Conversely, unnecessary costs could also be incurred without further information and analysis to support placement of a numerical value.

(16) A local resident suggested, during the public comment period on the preferred remedy, that water control structures such as gabions and subsurface drains be used in the natural drains of No Name, Drip Springs hollows and the Willie Skaggs Rock Lick hollow, and that multi-staged outlets on the retention ponds be used.

EPA Response:

A variety of water control devices will be evaluated and/or used to effectively control surface water runoff and consequent hillslope/ drainage channel erosion. Gabions are mentioned in the Selected Remedy portion of the Record of Decision as a potential device to be used. Improvements to the natural drains is also discussed, with the emphasis placed on adequate control of surface water flow in order to achieve acceptable rates of surface water runoff, equitable distribution of runoff, mitigation of rates of erosion, and prevention of downslope flooding.

(17) A landowner asked EPA, at the June 13, 1991 public meeting, to describe the Agency's plans for the buffer zone during remedial design, specifically asking if EPA will construct earthen barriers in the buffer zone to stop horizontal movement of leachate in the trenches.

EPA Response:

At a minimum, EPA has considered the hillslopes surrounding the MFDS and some additional areas in the direction of Rock Lick Creek for the buffer zone. EPA met with the landowners on May 22, 1991 and informed them that plans for the use of the buffer zone are flexible. Because each landowner's circumstances are unique, EPA will work with the landowners on a one-to-one basis to determine what is best for each. In the coming months, EPA will talk with the landowners individually and as a group to reach agreements regarding access and other needs. EPA and the Commonwealth plan to use the buffer zone as a zone for monitoring and restricted land use purposes. No major construction activities, other than well installation and sampling stations, are planned for the buffer zone.

(18) A citizen, at the June 13, 1991 public meeting, asked EPA to describe the composition and depth of the horizontal flow barrier.

EPA Response:

EPA has not determined the necessity of the horizontal flow barrier, nor the makeup and depth of the barrier, if needed. Typically, the barrier is a mixture of cement, water and other additives such as bentonite or flyash, that would harden after injection into the ground, forming a wall that would serve as a barrier to horizontal ground water flow into the trenches. The Commonwealth has suggested that the barrier be installed down to the Henley Bed, which is approximately 80 to 100 feet deep at the MFDS. This suggestion and other options will be evaluated if and when it is determined that a horizontal flow barrier is necessary at the site.

(19) A resident expressed concern, at the June 13, 1991 public meeting, about the possibility that EPA will not construct a horizontal flow barrier. The Proposed Plan indicated that a horizontal flow barrier will be implemented "if required", and the resident commented that, because of the geology of the region, this barrier, without question, will be needed.

EPA Response:

EPA, the Commonwealth, and the PRPs feel that there is sufficient uncertainty with regard to the hydrogeology at the MFDS to warrant additional data gathering and analysis prior to making a decision on the necessity of a horizontal flow barrier. Previous monitoring and modelling, using the information gathered from numerous studies, have not yielded conclusive information on the nature of lateral infiltration to the trenches. The Agency feels that the prudent approach to this issue is to obtain additional information during the initial stages of site remediation to use in the decision-making process. The selected remedy contains flexibility on this remedy component. A good source of information will be the trench leachate extraction program and infiltration monitoring system that will be in place, as well as historical Commonwealth monitoring data. Once this data is available, a decision can be made.

(20) A resident expressed concern, at the June 13, 1991 public meeting, that the longer EPA waits to make a decision on the horizontal flow barrier, the worse the contamination will get.

EPA Response:

Regardless of the decision on the horizontal flow barrier, one of the initial activities during remedial action will be initiation of the leachate extraction program. Once the trenches have been pumped dry, they should remain relatively dry by keeping vertical infiltration to a minimum through installation of the interim trench cap. Sumps and wells will remain in place in the event lateral recharge is occuring. The sumps and wells would be used to extract and solidify new leachate. Therefore, waiting until adequate information is available on which to base a determination on the need for a horizontal flow barrier will not worsen the contamination problems at the site.

Numerous discussions have been held on the hydrogeological flow conditions at the MFDS and the necessity of a horizontal flow barrier between experts from EPA, the Commonwealth, the United States Geological Survey, and private industry experts over the last four or five years. A strong consensus was never arrived at during these discussions. Therefore, EPA and the Commonwealth believe that it is more appropriate to base the decision of necessity, location, depth, and type of horizontal flow barrier on statistical analyses performed on trench dewatering data, infiltration monitoring data, and other historical monitoring data, rather than basing the decision on the opinion of one or a few.

E. Financial Concerns/Institutional Controls

(1) EPA received a number of comments at the June 13, 1991 public meeting and during the public comment period on funding aspects of the selected remedy. These comments concerned, primarily, such factors as the size of the trust fund, the discount rate used to establish the trust fund, administration of the trust fund and the contingency factor of the selected remedy.

EPA Response:

EPA appreciates the input of the Maxey Flats Concerned Citizens, Inc. and others who submitted comments relating to the financial details of the selected remedy. At this time, the specifics of the MFDS trust fund have not been established. EPA will take the financial comments into consideration during remedial design/remedial action (RD/RA) negotiations. It is anticipated that the financial details will be resolved through the RD/RA Consent Decree for the MFDS, which is subject to a 30-day public comment period as well.

(2) A citizen inquired, at the June 13, 1991 public meeting, if EPA has included or will include a reopener clause in the preferred remedy.

EPA Response:

Yes. EPA provides standard reopener clauses in Superfund cleanup agreements (Consent Decrees). The extent and nature of the reopeners vary, depending on the specifics of the site and terms of the agreement.

(3) The technical advisor to the Maxey Flats Concerned Citizens, Inc. stated, at the June 13, 1991 public meeting and reiterated during the public comment period, that cleanup funds for the site should be sufficient to ensure that future generations can meet site closure needs.

EPA Response:

EPA recognizes that the adequacy of the trust fund to be established for the MFDS remediation, monitoring and maintenance will be a very important part of the Consent Decree and intends to fully address trust funds issues through that process.

(4) An attendee at the June 13, 1991 public meeting asked what will happen if there is not enough money to maintain the site.

EPA Response:

It is difficult to assess certain factors which may influence the availability of funds to cover future monitoring and maintenance needs, especially for a remedy where final construction could be 100 years or more and where monitoring and maintenance are to be carried out in perpetuity. Such factors include interest rates, inflation, administration of the trust fund, etc. EPA intends to draw upon financial experts who engage in these financial issues, and the Agency will be working closely with the Commonwealth, PRPs, and other parties to determine what funds may be needed, how the fund will be administered, etc. In all likelihood, details of the trust fund and administration of this fund will be included in the Consent Decree for the Remedial Deisgn/Remedial Action. Standard reopeners will most likely be included to address the inherent uncertainties associated with a long-term remediation and monitoring/maintenance operation.

(5) The technical advisor to the Maxey Flats Concerned Citizens, Inc. requested at the June 13, 1991 public meeting, and reiterated during the public comment period, that EPA establish funds for monitoring and maintenance activities, which will cover contingencies, local road construction and repairs, inflation and administration costs. The advisor further suggested that EPA calculate the amount of money to be placed in the fund by using a larger contingency factor (25%) and discount rate of 2%.

EPA Response:

Specifics of the trust fund will, in all likelihood, be spelled out in the Consent Decree for the Remedial Design/Remedial Action to be negotiated with the PRPs following issuance of this Record of Decision. The discount rates used in the Feasibility Study ranged from 4% to 10%, with 4% being the most conservative (a larger fund would be required upfront). For purposes of alternative comparison, EPA used a 4% discount rate for the cost estimates provided in the Proposed Plan for each of the seven remedial alternatives. Discount rates and contingency factors may not reflect the actual discount rate or contingency factor agreed upon in the Consent Decree. The primary concern during establishment of the size of the trust fund will be to establish a fund sufficient in size to reduce the likelihood, to the extent practicable, of having to seek additional funds at a later date.

(6) The technical advisor to the Maxey Flats Concerned Citizens, Inc. and a local resident asked at the June 13, 1991 public meeting several questions relating to control of the funds: they wanted to know how the funds would be administered; the cost of administering the funds, and who would be responsible for issuing the fund monies. The technical advisor also asked EPA to identify the site licensees and to state whether or not the parties responsible for the cleanup would have immediate access to these funds.

EPA Response:

It has not yet been determined who will maintain or control the funds. The legal mechanisms for use of funds will, however, dedicate the fund monies for site remediation purposes only. Regardless of who controls the fund, the money will be limited to remediation of the site and will be inaccessible for any other use. Details of fund administration will most likely be spelled out in the Consent Decree.

The identity of the license holder many years from now and well into the monitoring and maintenance phase is not known at this time. Currently, the Commonwealth of Kentucky is the site license holder. Throughout the history of the MFDS, there existed only one other license holder at the MFDS, that being Nuclear Engineering Company during the period of site operation. Since 1979, the Commonwealth has held the license to the site.

(7) The Maxey Flats Concerned Citizens, Inc. submitted the following comments during the public comment period on the preferred remedy:

"The EPA plan does not define the term "institutional controls." Institutional controls should consist of the following: deed restrictions, site security, site maintenance and monitoring and perpetual funding. A perpetual maintenance plan should be established for these purposes.

The deed restriction would inform potential purchasers of the site, and the State itself, that the property had been used for the disposal of radioactive waste and no activities were permitted that would disturb the integrity of the cover, and monitoring and erosion control systems. A survey plat and records of materials buried should be filed with the Fleming County Court and the Commonwealth.

Though not stated in the EPA's Proposed Plan, a site security fence and the posting of signs should also continue in perpetuity. If this is not done, the permanent cover over the site could be damaged and the trenches could again fill with water. As pointed out earlier, it is difficult to see how the state and federal agencies can exercise control over the site unless it were licensed."

EPA Response:

In an effort to respond to the MFCC's concerns over the ambiguity of institutional control activities at the MFDS, Section 10.3 of the Record of Decision has been expanded to accommodate the MFCC's comments.

(8) A resident asked if EPA will compensate landowners whose properties are in the designated buffer zone.

EPA Response:

Compensation will be offered to landowners during negotiations on the buffer zone. The negotiating party, as well as the exact boundaries of the buffer zone, have not yet been determined. However, land cannot simply be taken without some kind of compensation. It is the desire of EPA and the Commonwealth to assess the preferences of the individual landowners and negotiate an agreement that provides fair compensation and meets the buffer zone's objectives of restricting harmful activities on the hillslopes and ensuring long-term access to the buffer zone areas for the purpose of site monitoring. EPA and the Commonwealth will hold additional discussions with the landowners to determine their preferences and the mechanisms for lease, purchase, easements, land use restrictions, etc.

F. Environmental and Public Health Concerns

(1) Two citizens requested, at the June 13, 1991 public meeting, that EPA inform hunters in the Morehead and Flemingsburg area of the radioactive contaminants seeping from the MFDS, and to caution them not to hunt in the site vicinity. They asked if EPA plans to restrict hunting near the site or to issue a warning against eating game obtained in the site vicinity.

EPA Response:

EPA and the Commonwealth intend to further address the concerns regarding hunting and other activities that may be taking place on the hillslopes adjacent to the MFDS. The risk assessment, however, revealed that no significant risk exists from eating deer meat, currently. The risk assessment is a dynamic, on-going process, and the potential risk from the MFDS will be continually evaluated. EPA may sample the deer population, or other wildlife, in the area to confirm these findings. If additional findings show that the area is not safe, EPA and the Commonwealth will inform whomever may be affected and attempt to ensure that no one engages in activities that could put them at risk.

(2) A resident asked, at the June 13, 1991 public meeting, if radionuclides will concentrate in exposed animals or will be released from their bodies to the environment, over time.

EPA Response:

Each radionuclide has its own biological properties, which researchers consider as part of a sophisticated and thorough process of preparing mathematical models. Each mathematical model represents one radionuclide, and analyzes each tissue relative to the animal body. Some radionuclides accumulate, and others do not. Tritium, which is the predominant radionuclide at the MFDS, does not reconcentrate.

(3) A citizen expressed concern at the June 13, 1991 public meeting about the Strontium-90 found at the site, stating that this biochemical enters the food chain and already has appeared in milk and elsewhere.

EPA Response:

The risk assessment for the MFDS modeled 16 radionuclides, including tritium and strontium-90. Strontium-90 migrates more slowly than tritium because strontium-90 tends to react with chemical elements in the soil or to adhere to soil particles. Consequently, its movement is slowed by contact with the soil. In all likelihood, by the time strontium-90 would reach a location, such as in a well, where it could be accessible, the radioactivity would have decayed significantly. In addition, the concentration of strontium-90 in the leachate is much, much lower than in the case of tritium. Tritium is still, by far, the predominant radionuclide at the MFDS.

(4) A resident commented, at the June 13, 1991 public meeting, that she lives about two and one-half miles from the MFDS, and that samples of her well demonstrate that it is contaminated. Because of her rural location, she cannot get water piped to her house, and she has been hauling water from miles away to her home. She asked how EPA could help her family.

EPA Response:

EPA and the Commonwealth pursued the commentor's concerns subsequent to the public meeting. Discussions with the resident indicated that the contamination referred to in the comment was fecal choloform bacterial contamination, most likely due to the source of drinking water (hand dug well) and the presence of animal wastes in the vicinity of the well, as reported by the Fleming County Health Department. The Commonwealth collected and analyzed a sample of the well water for radionuclides; the test results did not reveal the presence of any radionuclides. The resident currently transports drinking water from a county water line tap located approximately one mile from the house. The resident is currently working with various authorities to have the county water line extended to the resident's house.

G. Public Involvement

(1) Representative Pete Worthington asked, at the June 13, 1991 public meeting, two related questions: 1) how carefully EPA will consider the comments expressed at the public meeting and during the 60-day public comment period, and 2) how EPA could consider public comments received in August 1991 carefully when the Agency plans to make a final remedy selection in September 1991.

EPA Response:

Public comments are important to the remedy selection process, and EPA seriously considered every comment received on the Proposed Plan for the MFDS. Where a comment warranted a change in EPA's Proposed remedy, EPA modified the remedy. For instance, commentators brought it to the attention of the EPA that the extent to which monitoring in the buffer zone would be performed was ambiguous, and environmental monitoring was not included in the Proposed Plan alternatives. The Record of Decision was revised to further specify buffer zone monitoring and environmental sampling. These are examples of two good comments that were received in August and subsequently incorporated into the Record of Decision.

(2) A citizen asked, at the June 13, 1991 public meeting, if the Risk Assessment will be available in the Administrative Record.

EPA Response:

Yes. The Risk Assessment is included in the Feasibility Study as Appendix D. The Feasibility Study can be found in both information repositories in the Fleming County Public Library and Rowan County Public Library. Additionally, the Feasibility Study Report (Appendix D included) is contained in the Administrative Record file which is contained in both information repositories. EPA's Addendum Report to the FS Report is also available in the repositories and contains additional information regarding site risk calculations and the risk assessment.

PART II: COMPREHENSIVE RESPONSE TO SIGNIFICANT COMMENTS

This section provides a comprehensive response to all significant comments on the MFDS Proposed Plan received at the public meeting held on June 13, 1991, and during the public comment period. Some information presented in this section elaborates with technical detail on answers covered in Part I of this responsiveness summary. Concerns and questions presented in this section are grouped into seven categories.

A. RI/FS Findings

B. Risk Assessment

C. Applicable or Relevant and Appropriate Requirements (ARARs)

D. Selection of Remedy

E. Financial Concerns/Institutional Controls

F. Environmental and Public Health Concerns

G. Public Involvement

A summary of the comments and EPA's responses to them is provided below.

A. RI/FS Findings

(1) An attendee at the June 13, 1991 public meeting inquired about the percentages of water infiltration to the trenches from the lateral sources and from rain.

EPA Response:

The significant work performed by the U.S. Geological Survey (USGS), the Commonwealth, and the PRPs indicates that approximately 70 to 80 percent or more of the infiltration to the trenches is by the vertical route (i.e., through the trench cap). The remainder of the infiltration is potentially coming from lateral infiltration.

EPA will continue to review the situation to determine the rate and routes of infiltration. USGS and the Commonwealth have been monitoring the infiltration, and a large data base has been developed. EPA will supplement this data base with additional information from the leachate extraction program, the infiltration monitoring system, additional ground water monitoring and modelling and will evaluate this data base, along with the Commonwealth's historical data base. This information will assist EPA in determining the actual percentage of water volumes, if any, entering the trenches from lateral recharge.

(2) U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"Page 7 of the Proposed Plan makes reference to surface water tritium resulting from "atmospheric releases from the trenches". It is far more likely that tritium contamination resulted from the operation of the evaporator at the site."

EPA Response:

The Proposed Plan references atmospheric releases as a potential source of surface water contamination observed during the Remedial Investigation which was carried out during 1987 and 1988. The evaporator ceased operation in April, 1986 and is, therefore, an unlikely source of the contamination observed during the RI. Therefore, the Proposed Plan reference is an accurate one.

(3) U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"In the same discussion as item 3. above [atmospheric releases comment], the Agency seems to conclude that the migration of radionuclides from the trenches was the result of subsidence, water infiltration, etc. In fact, while these items might have been the mechanism for the observed releases, mention should be made of the fact that proper maintenance, and water management would have precluded these occurrences. The releases should be classified as being due in large part to totally inadequate maintenance since the site ceased waste acceptance."

EPA Response:

The wording contained in the Proposed Plan regarding radionuclide migration is accurate to the best of EPA's knowledge. The purpose of this statement was to provide a description of the physical conditions leading to the migration and not to comment on what lead to those conditions. Therefore, the language will not be modified as suggested by the above comment.

B. Risk Assessment

(1) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"From radiation dose estimates, the EPA calculates the lifetime risk to an individual. This calculation assumes a relation between radiation dose and the number of expected cancers and genetic effects adopted recently by the National Academy of Sciences. But this does not reflect the range of scientific opinion on this controversial issue. This dose-effect relationship is undergoing change due to recent data from Japanese bomb survivors which indicate the number of expected cancers at low radiation doses is greater than previously understood. To take this recent data into account, the risk estimates developed by the EPA should have a greater uncertainty range."

EPA Response:

The comment is correct in that the risk estimates prepared by the EPA do not address the uncertainty in the risk coefficients. However, the risk coefficient does consider the new risk coefficients provided in the BEIR V Report, the most recently updated report on the biological effects of ionizing radiation, as prepared by the National Academy of Sciences. The BEIR V Report recommends a revised risk coefficient of 8.0E-04 lifetime risk of fatal cancer for acute exposures in excess of 10 mrem. For protracted exposures of low LET radiation, BEIR V recommends a dose rate reduction factor of at least 2. Accordingly, as applied to the exposures calculated in the Maxey Flats risk assessment, a risk coefficient of approximately 4.0E-04 fatal cancers per rem is appropriate. In the Maxey Flats risk assessment, EPA used the risk coefficient developed in support of the Radionuclide NESHAPS of 3.92E-04 fatal cancer risk per rem of low LET radiation. Accordingly, the approach used by EPA is in accord with the recent BEIR V recommendations.

Though the risk assessment does not explicitly address uncertainty, a thorough review of the uncertainty in the risk coefficient is provided in Chapter 6 of Volume 1 of the Background Information Document provided in support of the Radionuclide NESHAPS (EPA/520/1-89-005, September 1989). In summary, the range for low LET radiation is 120 to 1200 fatal cancers per rem. In other words, if the upper bound risk coefficient were used instead of the nominal value of 3.93E-04, the estimated risks would increase by a factor of about 3. Alternatively, if the lower bound risk coefficient were used, the risk estimates would decrease by about a factor of 3.

(2) A concerned party stated at the June 13, 1991 public meeting that no safe level exists for radioactive material and that radioactivity can last for 24,000 years. He suggested that the risk assessment should inspect an area within a several-mile radius of the site because exposed animals and birds leave droppings everywhere

EPA Response:

EPA does not concur with the comment that no safe level for radioactive material exists. EPA fully recognizes the half-lives of the radionuclides present at the site and, accordingly, the remedy is structured to provide for maintenance, monitoring and implementation of institutional controls in perpetuity.

The Remedial Investigation involved the collection of surface water, sediment and soil samples in off-site locations, among other pathways and locations. Additionally, the Commonwealth has routinely collected numerous samples from off-site locations in their efforts to evaluate site impacts. Monitoring data indicates that radiation levels do not exceed background values beyond 1.5 miles from the site. RI samples from the food crop study area and off-site streams indicate no site related contamination in the food crop soil samples, and very low concentrations of contaminants in surface water and stream sediment samples.

(3) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"Though the iodine doses are supposedly calculated by the PRPs, it is curious that I-129 does not appear in the tables which must be employed to perform these calculations. In the Risk Assessment, I-129 does not appear in the table of transfer factors to calculate doses from eating deer, drinking milk or eating vegetables. Similarly, I-129 is not included in the worksheets for radionuclide contaminant concentrations in environmental and trench media. Thus, it is not clear how I-129 is included in the calculations."

EPA Response:

Tables D-A4 and D-A5 of the risk assessment present the ingestion and inhalation age dependant dose conversion factors used in the analysis for I-129. Table D.3-12 presents I-129 travel times, and Table D.3-13 presents Child-to-Adult Dose Ration Factors. Page D-88 presents the I-129 retardation coefficient. However, the risk assessment does not provide a number of I-129 parameters, including the transfer factors (page D-114) and the concentration of I-129 in leachate used in the analysis. The values for these parameters were provided to EPA in supporting documentation. Specifically, the PRPs used values suggested by the MFCC's technical advisor, Dr. Marvin Resnikoff for the concentration of I-129 in waste and the following calculational parameters:

Mo	0.115
Fm(d/L)	0.006
Ff(d/kg)	0.0029
Biv	0.02

(4) The Commonwealth, during the public comment period on the preferred remedy, questioned the appropriateness of taking credit for radioactive decay. The comment also raises questions regarding the selection of radionuclides for analysis and the impact of in-growth of Np-237 from Am-241 on site risks.

EPA Response:

There are two conditions under which radioactive decay could be an issue. The first is that the retardation coefficient may be smaller than the values used, thereby resulting in shorter travel times. EPA believes the risk assessment is responsive to this concern by using a range of retardation factors in the Monte Carlo analysis. As a result, the upper bound values incorporate the possibility that lower retardation coefficients could result in shorter transport times and less in-transit decay. The second condition is the possibility that due to the bathtub effect, the transport time will be very short, resulting in essentially no in-transit decay. EPA concurs in this latter concern (see response to comment 24 below.)

With regard to the selection of radionuclides for explicit analysis and the in-growth of daughters, the methods used in the risk assessment for selecting radionuclides for analysis is consistent with EPA guidance and has captured the important radionuclides. The fact that uranium is not explicitly addressed appears reasonable because its inclusion would not have changed the calculated doses and risks significantly. The models used to calculate doses provide for the in-growth of daughters. With regard to Am-241, and its decay to Np-237, it is important to recognize that Am-241 has a half-life of 433 years, and its daughter, Np-237, has a half-life of 2.1×10^6 years. As a result, even after Am-241 decays to Np-237, which will take several half-lives of Am-241, the activity of Np-237 will be much smaller than that of its parent due to its much longer half-life. Accordingly, in-growth of Np-237 is not a significant contributor to risk, even in the long term.

(5) The Maxey Flats Concerned Citizens, Inc. submitted the following comments during the public comment period on the preferred remedy:

"Chemical hazards are inadequately evaluated in the RA. By requiring that hazardous chemicals must be seen in the Lower Marker Bed, a large number of hazardous chemicals present in the trench leachate were thereby eliminated. Over time, and under No Action conditions, these hazardous chemicals would likely move. Further, one well pathway, where an intruder drills a well directly into a trench, therefore does not include the full complement of hazardous chemicals. Thus, the hazardous risk analysis is incomplete."

<u>EPA Response:</u>

Chemicals detected in wells screened within the Lower Nancy Member were also used as part of the indicator chemical selection process. EPA concurs that, over time, and under no action conditions, chemicals would have a tendency to migrate. See EPA responses to comments 6 through 8 below for a more complete discussion of the evaluation of chemicals in the MFDS risk assessment.

(6) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"The chemical trichloroethylene was not detected by the PRP's in the Remedial Investigation We are puzzled why it was included in the [indicator chemicals]."

<u>EPA Response:</u>

Trichloroethylene was detected during the Remedial Investigation in leachate (up to 5 ppb) and in ground water (up to 100 ppb). See Table D-A2 of Appendix D of the MFDS Feasibility Study Report.

(7) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"Two chemicals which appeared in the trench leachate were eliminated as indicators because they had no health-based criteria, according to the PRPs: cyanide and carbon disulfide. Cyanide is a well-known poison. Carbon disulfide can cause permanent central and peripheral nerve damage and is a powerful CNS depressant."

EPA Response:

Well concentrations were compared to health based adjusted water quality criteria or EPA reference dose values. Since these sample locations represent minimal dilution, it is expected that the concentrations at receptor points will be much lower. Therefore, chemicals with concentrations under the criteria levels were eliminated. Cyanide was eliminated from consideration in the risk assessment since the concentrations within the Lower Marker Bed and lower Nancy member ground water for cyanide were below health based adjusted ambient water quality criteria or EPA reference dose values. Furthermore, cyanide was only tentatively identified in both the ground water and trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

Carbon disulfide was eliminated from consideration because of the lack of health based criteria. Without any health criteria levels, the impacts from these chemicals could not be evaluated and therefore are not appropriate for consideration as an indicator. The Superfund Public Health Evaluation Manual (USEPA 1986a), and its addendum of newly revised toxicological data (August 1988) were consulted for health based criteria.

(8) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"A range of chemicals were deleted because they did not appear in the Lower Marker Bed. In the long-term, these chemicals will probably leach from the trenches and should be included in a comprehensive risk analysis. Under various risk scenarios, these chemicals should be added to the [list of indicators]."

Potential Indicator Hazardous Chemicals Found in Leachate

	acetone	
benzoic acid	bis(chlorothyl)ehter	benzyl alcohol
xylenes	1,2 dichlorobenzene	4-methyl-2-pentanone
	1,4 dichlorobenzene	napthalene
	2,4 dimethylphenol	phenol
	ethylbenzene	
	methylene chloride	
	2-methylphenol	
	4-methylphenol	

The chemicals in the first column are considered to be generally less toxic than those in the second column which are less toxic than those in the third column.

EPA Response:

One of the first steps of the risk assessment process is the selection of indicator contaminants. Indicator contaminants are those that may constitute the "highest risk" to the public among the contaminants found at the site. For the MFDS risk assessment, two sets of indicator contaminants were selected: radionuclides and non-radionuclides. The purpose of selecting indicators is to reduce the number of contaminants involved in the analysis to a manageable level, while still including those contaminants that are the greatest contributors to the overall impacts of the site. From the list of chemical contaminants detected during the RI, a select group of 11 were selected for analysis, as was done with the radionuclides. This practice is consistent with risk assessments conducted at all Superfund sites.

By column, and in the order as they appear, the following discussion presents the rationale for non-inclusion of the above-listed chemical contaminants in the MFDS risk assessment:

Benzoic Acid - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for benzoic acid were below health based adjusted ambient water quality criteria or EPA reference dose values.

Xylenes - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for xylenes were below health based adjusted ambient water quality criteria or EPA reference dose values.

Acetone - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

Bis(chloroethyl)ether - Was not considered because it was not detected in ground water.

1,2 dichlorobenzene - Was not considered because it was not detected in ground water. Further, it was only tentatively identified in trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

1,4 dichlorobenzene - Was not considered because it was not detected in ground water. Further, it was only tentatively identified in trench leachate. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

2,4 dimethylphenol - Was not considered because it was not detected in ground water.

Ethylbenzene - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for ethylbenzene were below health based adjusted ambient water quality criteria or EPA reference dose values.

Methylene chloride - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts.

2-Methylphenol - Was not considered because it was not detected in ground water.

4-Methylphenol - Was not considered because it was not detected in ground water.

Benzyl Alcohol - Was not considered because it was not detected in ground water.

4-Methyl-2-Pentanone - Was not considered because it was not detected in ground water.

Napthalene - Was not considered because it was not detected in ground water other than tentatively identified. Tentatively identified "hits" were not considered because, according to the Steering Committee, the concentrations are based on a semi-quantitative analysis and are therefore inappropriate for the quantitative assessment of public health impacts. Additionally, concentrations within the Lower Marker Bed and lower Nancy ground water for napthalene were below health based adjusted ambient water quality criteria or EPA reference dose values.

Phenol - Eliminated from consideration in the risk assessment because concentrations within the Lower Marker Bed and lower Nancy ground water for phenol were below health based adjusted ambient water quality criteria or EPA reference dose values.

Inclusion of the above-listed chemical contaminants in the MFDS risk assessment would not have significantly increased potential site risks. Furthermore, the selected remedy requires attainment of RCRA ground water protection requirements as well as Kentucky and federal drinking water standards, both of which address the presence of chemical contaminants at the MFDS.

(9) The Technical Advisor to the Maxey Flats Concerned Citizens, Inc. (MFCC) provided the following comment regarding the MFDS risk assessment at the June 13, 1991 public meeting, and the MFCC reiterated it in writing during the public comment period on the preferred remedy:

The MFCC pointed out that the risk assessment was performed using data gathered during the RI and that the RI was conducted under conditions that included Commonwealth site maintenance activities. It was the MFCC's position that data from the RI did not reflect a true No Action situation and, therefore, that the risk assessment calculations, because they are based on RI, data, are not the conservative figures that a true No Action assessment would have provided. The MFCC was also concerned that the risk assessment did not adequately portray site risks because the data employed by the PRPs did not reflect recent seep measurements by the Commonwealth which show high levels of tritium on the east slope.

EPA Response:

EPA's National Contingency Plan (NCP) requires that a baseline risk assessment be conducted at each Superfund site to assess the site risks in the absence of any remedial actions, including maintenance or institutional controls. Neither the NCP nor EPA guidance for conducting RI/FS's require that the Remedial Investigation be conducted under a strict no action condition. It is EPA's belief that the Remedial Investigation does provide a representative characterization of the current nature and extent of site contamination for the purposes of evaluating site risks and remedial alternatives. The risk assessment conducted for the MFDS assumes no action at the site, with the exception of monitoring and activities in support of monitoring. EPA concurs with the MFCC in that the conditions at the MFDS would be markedly different from present-day conditions if Commonwealth site maintenance activities were to cease; however, the risk assessment (Appendix D of the FS Report) and Addendum thereto, fully evaluate site risks under a true no action condition, as required by EPA's NCP and guidance, and assume trench overflow, erosion, and consequent contaminant concentrations.

Appendix D of the MFDS FS Report (Risk Assessment) does not include seep sample data obtained by the Commonwealth and EPA. This is because EPA's seep sample confirmation data was not available at the time of report preparation. However, the risk assessment assumed much higher concentrations of radionuclides in the pathways evaluated than the concentrations actually detected in the seeps. Thus, inclusion of this data in the risk assessment would not have significantly altered the results of the risk assessment.

(10) The Commonwealth commented, during the public comment period on the preferred remedy, that direct contact and ingestion of contaminated soil outside the restricted area pathway should have been included in the RA. In a "no action" scenario, trench leachate will overflow and soluble and suspended radionuclides will move into the surrounding valleys and contaminate the soil zones. Furthermore, chelated radionuclides will also be carried into these areas; therefore, this pathway should have been included in the RA.

EPA Response:

Both the PRP's risk assessment and EPA's independent analysis of the risk assessment explicitly address the soil ingestion pathway. For example, Table D.3-10 presents estimates of the doses to children in the alluvial valley ingesting contaminated sediment.

The concept of the direct contact pathway is addressed in the analysis, but not in the same way that it is addressed for chemical contaminants. At radioactively contaminated sites, direct contact and absorption of contaminants is not a significant pathway of exposure, as it can be for chemical contaminants. For radioactively contaminated sites, direct exposure to radiation is of concern and has been included in the risk assessment.

(11) The Technical Advisor to the Maxey Flats Concerned Citizens, Inc. provided the following comment on the MFDS risk assessment at the June 13, 1991 public meeting on the preferred remedy, and reiterated it in written comments by the MFCC submitted during the public comment period on the preferred remedy:

"EPA's use of the term "intruder", as used in the risk assessment, implies that the site is and always will be licensed. EPA should a) define the term "intruder", b) identify who holds the license today and who will hold it in the future; c) establish the point of compliance on the site rather than on the periphery of the exclusion zone, if the site is not licensed."

EPA Response:

a) It is true that the use of the term "intruder" in the MFDS risk assessment arises from the status of the MFDS as a licensed site under the Atomic Energy Act. However, EPA does not agree that its use implies that the site will always be licensed. As required by the NCP and EPA guidance, a true no action condition must be evaluated in the baseline risk assessment. The results of the MFDS baseline risk assessment highlight the need for remedial action, maintenance and monitoring activities, and institutional controls to be funded and conducted in perpetuity. The "intruder" term broadly encompasses residents, trespassers, and construction workers. "Intruder" as used in the MFDS risk assessment refers to the following:

- A person engaged in construction activities in or near the trench disposal area for the purpose of establishing a residence (Intruder-Construction Scenario).

- A person engaged in the above-described scenario who realizes that something is wrong with the location and ceases activities (Intruder-Discovery Scenario).

- A family that establishes residency in or near the trench disposal area. Crops and animal food-products grown on-site are consumed (Intruder-Agricultural Scenario).

- A person that occasionally gains access to the site for recreational purposes (hunting, exercise, etc.) (Intruder-Trespasser Scenario).

b) Currently, the Commonwealth of Kentucky, Natural Resources and Environmental Protection Cabinet, holds the license to the MFDS. According to Commonwealth representatives, the MFDS should and will always be licensed. EPA, at this time, cannot state who the specific license-holder to the MFDS will be in the future. Moreover, EPA has not and will not assess the likelihood of Commonwealth and NRC failure to perform specific duties related to the MFDS.

c) The points of compliance for the various federal and state requirements for the selected remedy are provided in Section 8.0 - Applicable or Relevant and Appropriate Requirements of this document. These points of compliance assume that the selected remedy is being implemented and institutional controls are in place to prevent access to the site. Institutional controls will be required regardless of whether the site remains licensed. Therefore, there is no need to condition the points of compliance on the existence of a site license.

In the baseline risk assessment, points of compliance were not considered; rather, exposure to site contaminants was assumed at the location of ingestion, or inhalation, etc., irrespective of where the selected remedy must achieve compliance.

(12) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"The intruder agriculture scenario assumes waste from building a home is piled on ground which is then used for farming. But, in addition, breaking through the permanent cover means that water would infiltrate the trenches and the ground would become much more contaminated than assumed in the Risk Assessment which is based on Remedial Investigation monitoring."

<u>EPA Response:</u>

The intruder agriculture scenario in the risk assessment assumes that the waste within the trenches is actually excavated during the construction of a house, commingled with the top 1 meter of cover material, and spread over the area in the vicinity of the house. As a result, the radionuclide concentrations in the soil are assumed to be approximately 50% of the concentrations of the radionuclides in the waste itself. This is considered to be a conservative assumption, since it is unlikely that the radionuclide concentration in the surface soil could exceed that in the waste itself.

In the above comment, it is stated that water entering the uncovered trenches and then saturating the ground with leachate would result in higher radionuclide concentrations in the surface soil than the values used in the risk assessment analysis. EPA does not agree with this position. The following table presents the radionuclide concentrations in the waste, in the leachate, in the soil contaminated as a result of the leachate saturating the soil, and in the soil due to commingling of the waste with the soil. The latter concentration was used in the risk assessment analysis.

Radio-nuclide	Waste[1] (Ci/m^3)	Leachate[2] (Ci/m^3)	Kd	Soil Mixed in Leachate (Ci/m^3)[3]	Soil Mixed in Waste (Ci/m^3)[4]	Mo[5]
Co-60	3.1E-03	4.0E-05	2.1	8.4E-05	1.5E-03	.013
Sr-90	7.3E-03	3.9E-05	6.9	2.7E-04	3.7E-03	5.4E-03
Cs-137	2.7E-03	1.6E-07	160	2.6E-05	1.3E-03	6.0E-05
Ra-226	4.1E-04	6.8E-06	36	2.4E-04	2.1E-04	1.7E-02
Pu-238	1.5E-03	1.8E-06	510	9.2E-04	7.3E-04	1.2E-03

1. Derived from Table DA-1 of Appendix D of the FS Report
2. Derived as the product of the waste concentration and the waste to leachate transfer factor (Mo) on page D-65 of the Draft FS Report
3. The product of the Kd and the leachate concentration
4. Excavated waste mixed with 1 meter of top soil
5. Derived from the Retardation factors on page D-73 of the Draft FS Report

(13) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"Under the intruder scenarios, the EPA adopts assumptions regarding the radioactive waste forms which are inappropriate for the waste buried at Maxey Flats. The EPA assumes that the contact dose to someone who digs into the trenches is limited to a 6-hour period. This depends on the sociological assumption that Class C waste with high dose rates is recognizable as waste and that the discoverer would cease activity. Actually, the opposite may occur. If a discoverer found radioactive tools, or stainless steel, he may continue to explore and possibly sell tools on the open market. This has happened at West Valley. But it is also not the case that high dose rates will necessarily come from easily identifiable waste. That is, Maxey Flats waste predates the 1981 regulations and assumptions. The EPA used 10 CFR Part 61 waste classes A, B, and C adopted in 1981, and adopted calculational assumptions that high hazard class C waste is segregated and in solid form, even though the Maxey Flats waste predates these regulations. All Maxey Flats waste classes were essentially mixed."

EPA Response:

The 6 hour time period of exposure, which is assumed in the intruder discovery scenario, is only one of the intruder exposure scenarios addressed in the risk assessment. The risk assessment also addresses the intruder construction scenario, which assumes 500 hours of contact, and the intruder agriculture scenario, which assumes a lifetime of continual contact. However, the comment is appropriate with respect to recycle and reuse of tools and equipment. The risk assessment does not address recycle scenarios due to a lack of data regarding the levels of contamination of potentially recyclable material. Further, such an analysis is probably not necessary, since the agriculture scenario is likely to be limiting. Note that the risks from the intruder agriculture scenario approach 1, and, even if the data were available to model the recycle scenario, adding recycle doses to the scenarios is not likely to significantly increase the risks.

(14) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"The agriculture well dose, due to a well drilled at the boundary of the exclusion area, from I-129, ranges from 147 mrem/yr median dose equivalents to 210 mrem/yr upper bound. This is the whole body equivalent dose and not the thyroid dose. The thyroid doses will range from 4.9 rems/yr to 7.0 rems/yr, considerably above the regulatory limit of 0.075 rems/yr [75 mrem/yr]. We agree with the EPA that the 75 mrem thyroid dose should be considered an ARAR. This ARAR does not just pertain to whole body dose, but to thyroid dose as well."

EPA Response:

EPA concurs in this comment that the dose from I-129, as calculated by the PRPs, is the effective dose equivalent, and that the dose to the thyroid is higher by the weighting factor, resulting in a thyroid dose of 4.0 and 7.0 rem/yr for the average and upper bound doses, respectively.

(15) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the intruder risks are underestimated because some areas of the site contain levels of radionuclide concentrations that are higher than the average values for the overall site presented in the risk assessment. In addition, new information is continually being acquired regarding the nature and behavior of the radionuclides at the site.

EPA Response:

EPA concurs with this concern. There are a number of alternative scenarios and assumptions that could be postulated that could further increase the possible intruder doses, such as the recycle issue raised by Dr. Resnikoff, and the concerns expressed in the Commonwealth's comments. Specifically, depending on the location on-site that is selected for building a home in the intruder scenario, the doses could be substantially higher or lower than the values in the risk assessment due to the variability of the concentration of the radionuclides in different trenches at the site. However, the purpose of calculating the intruder doses and risks was to provide some insight into the possible magnitude of the impacts if a person were to reside at the site at some time in the future. EPA believes that the risk assessment does provide proper disclosure of this information, even though it does not fully explore all feasible scenarios and assumptions. Further, it should be recognized that the doses and risks presented in the risk assessment for the agriculture intruder are for a lifetime of exposure, whereby the individuals will at some times experience higher or lower levels of exposure. In essence, the intruder exposure will reflect the integration of the temporal and spacial variability at the site. As a result, it is not unreasonable to use average conditions when estimating lifetime risk. As a final point, as indicated in the comment, the calculated risks approach 1. As a result, the use of alternative assumptions would not significantly increase the calculated risk.

Part of this comment also expressed concern over a statement made on page D-31 regarding the location of a well adjacent to a trench, as opposed to placing the well directly into the trench. In the intruder scenario, the risk assessment assumes that the concentration of radionuclides in the well water is the same as in the trench leachate. As a result, the doses would be the same whether the well is assumed to be in, or adjacent to, a trench.

(16) The Maxey Flats Steering Committee and U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"EPA's decision to require the inclusion of the intruder pathways to the "no action" case studied in the RA is not justified for any number of reasons. These include (1) the fact that the site is licensed under the Atomic Energy Act, that Kentucky and/or the federal government have continuing obligations to control access to the site, and that there is no factual basis from which to conclude that Kentucky or the federal government will repudiate these obligations and abandon the site; (2) that EPA's interpretation of the "no action" case is neither required, or even supported, by the new National Contingency Plan (NCP); and (3) that the public interest is not served by focusing the risk assessment on entirely fictional pathways rather than reasonable maximum risk scenarios."

<u>EPA Response:</u>

(a) EPA strongly disagrees with the above stated comments. On April 9, 1990, Agency revisions to the National Contingency Plan, 40 C.F.R. 300, became effective. The revised NCP and its preamble (55 Fed. Reg. 8666, <u>et seq</u>.) discuss the purpose and nature of a baseline risk assessment. These discussions make it clear that "(t)he role of the baseline risk assessment is to address the risk associated with a site in the absence of <u>any</u> remedial action or control, <u>including institutional controls</u>" (emphasis added). Further discussions describe the baseline assessment as "essentially an evaluation of the no-action alternative". (<u>Id</u>. at 8710-11). EPA has determined, and the NCP indicates, that the only action allowed under a <u>true</u> no-action alternative is monitoring. It is precisely this type of no action analysis that EPA required the Steering Committee to use in conducting the baseline risk assessment for the MFDS.

It is true that the site is currently licensed under the Atomic Energy Act and that, as long as it is so licensed and the license is properly enforced, the intruder scenarios are not reasonably likely to occur. However, while the No Action alternative's premise of site abandonment may not be a likely scenario for the MFDS in the immediate future, perpetual site licensing and appropriate enforcement of a license are by no means guaranteed. Implementation and funding of monitoring, maintenance and institutional control will be required in perpetuity if site risks are to be controlled. Any number of factors could influence the "obligations" of the Commonwealth or NRC related to the MFDS over the next 50, 100, 300 or 1000 years. It would not be responsible, and would not be appropriate under CERCLA, for the EPA to assume certainty and stability in such factors as economy, institutional memory of the nature of the site, regulatory structures and obligations, funding mechanisms, etc., all of which, and more, would be required to preclude the site abandonment scenario. Thus, EPA firmly stands by its decision to require a true no action baseline risk assessment of the MFDS.

The purpose of a baseline risk assessment is to fully disclose to the public the potential risks posed by the site under a broad range of potential scenarios, depicting the impacts of the site over time. The EPA would have been negligent in its obligations to the MFDS community and remiss in carrying out its duties in accordance with the National Contingency Plan had it not required that a true no action analysis be made.

Based on comments received at the June 13, 1991 public meeting on the preferred remedy (at which risk assessment conclusions were discussed) and comments received from the community during the public comment period on the preferred remedy, there has been no indication that the interests of the community were ill-served by the assumptions and conclusions of the MFDS risk assessment. It is EPA's belief that the community's diligent efforts in reviewing the RI and FS Reports and risk assessment have resulted in a reasonable and rationale understanding within the community of the risks related to the MFDS.

(17) The Maxey Flats Concerned Citizens, Inc. agreed, in comments submitted during the public comment on the preferred remedy, with EPA's position that an alluvial well cannot be ruled out at some future time.

<u>EPA Response:</u>

EPA has consistently taken the position that the well water pathway is a viable pathway for the MFDS. Residents in the vicinity of the MFDS have, historically, used well water from the alluvium for household purposes. Although public water is currently available to these residents, future use of alluvial water cannot be precluded.

(18) The Commonwealth commented, during the public comment period on the preferred remedy, that wells could be installed in the colluvium and creek water could be used as a drinking water source during the 500 year time frame, and, as such, the risk increases.

EPA Response:

EPA concurs that a well could be placed in the alluvium, resulting in higher doses. The EPA's independent analysis of the risk assessment addressed this issue. In addition, the upper bound well water doses provided in the risk assessment are consistent with the doses that could occur under this scenario. Also, see response to Comment 22 below).

(19) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy with respect to the inclusion of the well water pathway in the off-site exposure scenario:

"As the Committee has previously stated, it is highly unlikely that anyone would construct an alluvial well having an unpredictable supply and very poor water quality when a public drinking water supply is available. As a result, even if EPA continues to maintain that this unrealistic drinking water pathway should be included in the risk assessment, the doses from that pathway should be reduced to account for the likelihood that a well would even be constructed, that if constructed it would be located at exactly the point of highest radionuclide concentrations, and that a regular daily supply of potable water would not be obtained."

EPA Response:

As EPA has consistently maintained throughout the RI/FS, and as reiterated to the Maxey Flats Steering Committee on numerous occasions, the well water pathway analyzed in the risk assessment is a reasonable, potentially complete exposure pathway for the MFDS for the following reasons:

- It cannot be assumed that the public water supply in the immediate vicinity of the MFDS will be available to all areas of potential use in perpetuity;

- It cannot be reasonably assumed that the current residents will continue as the only residents in the area over periods of decades to centuries. In the future, it is likely that additional residents seeking rural li'ing will purchase land and build homes. It is not unlikely that some of those residents will construct and use a shallow well in the alluvium.

- Residents in the area have used shallow wells in the alluvium previously and residents of similar environments in the region continue to rely on these types of private wells.

- Although the quality of water in the alluvial aquifers may not be ideal, it has been used for domestic use in the past.

- Costs of connection to public supply may be an incentive to construct a private well;

- Some people may feel a greater sense of independence by having their own well under their control, rather than depending on a public water supply over which they have no control.

EPA does not agree with the Steering Committee's assessment on the reasonableness of the well water pathway and considers the valley alluvium to be a potential source of drinking water. A potential source of drinking water is one which is capable of yielding a quantity of drinking water to a well or spring sufficient for the needs of an average family. Although all formations in the Maxey Flats area can be considered poor aquifers, domestic water supplies have been obtained from any one, or combination, of these formations. In fact, there are currently residents within three miles of the MFDS (though not in the immediate vicinity of the site) that reportedly obtain water for domestic purposes via hand-dug wells in the alluvium/colluvium.

Section 2.1 of the MFDS Remedial Investigation Report, prepared by the Maxey Flats Steering Committee, contains a projection of the population for the area within 2.5 miles of the MFDS. In 1985, this population was estimated at 663 persons. The RI Report assumes a 15 percent increase in the population between 1985 and the year 2020, resulting in a projected population of 767 persons within 2.5 miles of the MFDS, an increase of 104 persons. If one assumes that an additional 104 persons move in to the 2.5 mile radius area every 35 years, an additional 312 persons would reside in the area of concern by the year 2090. It is not unlikely or unreasonable to assume that a portion of these 312 additional persons could obtain water from the alluvium within the next 100 years. Furthermore, the population within the 2.5 mile radius area can be expected to continue to increase during the 100 to 500 year time frame and beyond in which radionuclides would still be present at significant concentrations and migrating through the environment in the absence of the selected remedy, thereby further increasing the likelihood of use of the alluvium for drinking water purposes. For these reasons, EPA believes that the Steering Committee's comments on the appropriateness of the well water pathway are inappropriate and are primarily aimed at reducing potential risks associated with the MFDS.

Finally, EPA feels that it is not appropriate to reduce the doses from a pathway based upon the perceived likelihood of that pathway.

(20) The Maxey Flats Concerned Citizens submitted the following comment during the public comment period:

"The erosion pathway assumes only that contaminated soil in the restricted are would be washed down the slope. A far worse possibility under the No Action alternative is that erosion eats its way back into the trench area and radioactive waste itself is washed down the hillslopes. This could happen under the No Action alternative, if the site were not re-contoured, hold-up ponds enlarged, and the flow reduced."

EPA Response:

A study performed by the USGS ("Hillslope Erosion of the Maxey Flats Radioactive Waste Disposal Site, Northeastern Kentucky," Water Resources Investigation Report 89-4199, 1990) indicates that a period of 35,000 to 65,000 years of erosion would be required for the slopes to erode to the burial trenches (however, deforestation was not assumed). Accordingly, the risk assessment did not assume the direct transport of waste from the trenches to the alluvial plain as a result of erosion. However, the risk assessment included an erosion scenario that had almost the same effect. The risk assessment assumed that leachate overflows the trenches and contaminates the overlying soil. This soil is then transported to the alluvial plain where it results in exposures to the local residents by a broad range of pathways. As indicated in EPA's response in Part I, Risk Assessment, Comment 11, and in Part II, Risk Assessment - Comment 12, the radionuclide concentrations in the eroded soil used in the analysis are approximately 10% as close to the same concentrations as those in the waste itself, depending on the radionuclide.

(21) The Commonwealth expressed concern, during the public comment on the preferred remedy, that the risk assessment did not address trench overflow and the resulting transport of radionuclides to off-site locations.

EPA Response:

Both the EPA and the PRPs evaluated the erosion scenario which explicitly modeled the overflow of the trenches and the transport of the soil/water slurry down the hillslopes to the valley, where members of the public may be exposed via a broad range of pathways. The doses presented in Table D.3-10 under "Erosion" reflect this exposure scenario.

The risk assessment does not address the effects of chelation on transport via this pathway because it would tend to reduce the doses. Specifically, chelation would tend to keep the radionuclides in solution and reduce their potential to build up in the alluvial sediment.

With regard to the surface water pathways, EPA concurs that there is a need to address trench overflow, in addition to leachate migration through the colluvium, since the transport times may be shorter resulting in less in-transit radioactive decay. This issue is discussed in greater detail in Comment 24 below.

(22) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that leachate flow down the hillside will increase under the no action alternative because credit for a barrier cannot be taken. In addition, the increased head of water due to the bathtub effect would increase the flow of leachate down the colluvium, thereby creating a situation where well water of sufficient quantity can be withdrawn from the colluvium flow with minimal dilution by overland flow or ground water flow in the alluvial plain.

EPA Response:

EPA concurs with this concern. In the EPA's independent analysis of the risk assessment, VAM2D was used to model these scenarios. The results reveal that a wide range of scenarios are feasible. For some scenarios, the median ground water doses presented in the risk assessment may be overestimated by a factor of about 7, while in other scenarios, such as that described in the Commonwealth's comment, the doses may be underestimated by a factor of 10 to 50. Though the PRP's risk assessment does not explicitly address this issue, the results for the well water pathway in Table D.3-10 give an upper bound dose that is a factor of about 30 higher than the best estimate doses. EPA believes that this wide range of risk indirectly addresses this concern.

(23) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the erosion pathway does not address the trench overflow of soluble or chelated radionuclides down the hillside.

EPA Response:

This comment is correct, but requires some discussion. The erosion pathway is designed to address the degree to which contaminated soil may be transported off-site. Accordingly, it was not designed to look at the amount of soluble radionuclides that may be leaving the site via the bathtub effect. In the current analysis, radionuclides leaving the site in soluble or chelated form are limited to leachate leaving the bottom of the trenches. This is calculated by assuming that, on the average, over the course of a year, 10% of the rainwater falling onto the trench disposal area reaches the waste and the other 90% runs off or evaporates before reaching the waste. The water that reaches the waste becomes contaminated by leaching out the more mobile radionuclides. It is assumed that a quasi equilibrium is established, where the radionuclide concentration in the leachate is a constant fraction of the radionuclide concentration in the waste. This fraction, the partition ratio (see Table D.3-19 of the FS Report), is an empirically determined value that reflects the actual conditions in the trenches as best we know them. Since it was empirically determined, the partition ratio reflects the degree to which the radionuclides are in soluble, chelated, or colloidal form. EPA believes, therefore, that the analysis inherently addresses the degree to which radionuclides may be soluble or chelated.

The question then becomes, has the analysis underestimated the rate at which radionuclides can leave the site, since it is assumed that only 10% of the rainwater falling on the site is contaminated. In theory, if all the rainfall (i.e., 100% instead of 10%) were able to come into intimate contact with the waste, the rate at which radionuclides would be leaving the site would increase by a factor of 10, thereby increasing the doses by a factor of 10. The Commonwealth's comment pertains to the possibility that this scenario may in fact occur if extensive bathtubbing occurs. However, EPA does not believe it is entirely appropriate to make this assumption. Specifically, EPA believes that the assumption that, on the average, 10% of the rainfall reaches deep within the trenches is appropriate. Further, and more importantly, the partition rations were empirically determined under conditions where waste was in intimate contact with the waste for long periods of time. Under different assumptions regarding the throughput of water in the trenches, it is likely that lower partition ratios would be observed (i.e., the additional water would dilute the radionuclide concentration in the leachate). Accordingly, though it is possible for the radionuclide release rate to be somewhat higher than the values modeled in the risk assessment, EPA believes that the judgements made regarding off-site transport are reasonable.

Notwithstanding the above discussion, there are numerous uncertainties in the analysis, which could increase the rate at which radionuclides can leave the site under the no action alternative. It is for this reason that the risk assessment includes upper bound values. EPA believes that the surface and well water pathway upperbound doses reflect these and other uncertainties inherent in the analysis.

(24) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the risk assessment did not consider the bathtub effect, and thereby underestimated the doses. The main concern here, is that bathtubbing would result in the rapid release of the radionuclides, without in-transit decay.

EPA Response:

EPA concurs in this comment and agrees that an analysis may be needed to determine if the well water and surface water pathway doses would change significantly under this scenario.

In the risk assessment, the in-transit decay is assumed for the transport of the radionuclides from the trenches to the receptor location. The in-transit time for water is assumed to be several years, and the transit time for many radionuclides is much longer due to the radionuclide binding coefficients (see Table D.3-12). For some radionuclides, this results in substantial decay in transit. If the radionuclides were leaving the site by bathtubbing, with minimal contact with soil, the transit time may be significantly reduced. EPA concurs with this concern and agrees that it may need to be addressed in the future.

(25) The Maxey Flats Steering Committee expressed concern, through comments submitted during the public comment period on the preferred remedy, that the methods used by EPA to assess the doses from the soil erosion pathway are unrealistic and misrepresent the risks. The first reason given by the Steering Committee for this position is that "the pathway assumes that the entire soil area on top of Maxey Flats is contaminated at levels that are approximately the same as in the trenches." The Steering Committee also states that "the model assumes that all the trenches overflow simultaneously." and, that "the model inappropriately assumes that all of the eroded soil will collect in small areas, rather than being distributed and washed away." Finally, the Steering Committee states that "it is unrealistic to assume that the alluvial plain, where erosion may settle, could be used for farming."

EPA Response:

The activity in the soil is calculated by assuming that leachate saturates the overlying soil and an equilibrium is reached based on the Kd for each radionuclide. The following presents the radionuclide concentration in soil obtained using this method for selected important radionuclides:

Radionuclide	Waste[1] (Ci/m^3)	Leachate[2] (Ci/m^3)	Kd	Soil Mixed With Leachate(Ci/m^3)[3]	Fraction
Co-60	3.1E-03	4.0E-05	2.1	8.4E-05	.03
Sr-90	7.3E-03	3.9E-05	6.9	2.7E-04	.04
Cs-137	2.7E-03	1.6E-07	160	2.6E-05	.01
Ra-226	4.1E-04	6.8E-06	36	2.4E-04	.6
Pu-238	1.5E-03	1.8E-06	510	9.2E-04	.6

As can be seen, for some radionuclides, the concentration in the soil is estimated to be a very small fraction of that in the waste. However, for radionuclides with high Kd values, the radionuclide concentrations approach the radionuclide concentrations in the waste. EPA believes this to be a reasonable approach to modeling this scenario, assuming degradation of the soil cap overlying the trenches and the commingling of leachate with the soil.

The model used is not premised on the assumption that all trenches overflow simultaneously. The model is based on a quasi equilibrium condition arising over a period of time, whereby eventually all the soil at the site becomes somewhat contaminated. At some locations, the contamination will be higher, due to the higher levels of activity in the leachate, and at other locations, lower. EPA believes it is reasonable to assume the average values as calculated.

The model used in EPA's independent analysis of the risk assessment assumes that the soil will be distributed over the alluvial area that receives the runoff, i.e., those areas used in the well water pathway. In addition, the model assumes that the activity accumulating in the alluvial areas is also being gradually eroded away.

The purpose of the risk assessment is to disclose what the doses may be for a broad range of scenarios. Clearly, if it were totally unlikely that farming could take place at locations in the alluvial plain, these scenarios would be deleted. However, this is not the case. The Remedial Investigation Report, produced by the Maxey Flats Steering Committee, includes the following statements regarding farming activities in the immediate vicinity of the MFDS: "Four small family farms are located within a one-half mile radius of the site. These farms raise beef cattle, swine, goats, and sheep for meat and sale; poultry for eggs; tobacco for sale; and hay and silage as food for their livestock (Buffalo Trace Area Development District, 1988). The nearest dairy farm is located within one mile of the site, and several small dairies are located within the study radius.

In addition to the farms, most of the local residences have small vegetable gardens for their private use." (MFDS RI Report, page 2-9.) Clearly, assuming that the alluvial plain could be used for farming in the future was appropriate.

(26) The Maxey Flats Concerned Citizens, Inc. submitted the following comment during the public comment period on the preferred remedy:

"The RA does not include a population dose assessment, only an individual dose assessment. The population dose assessment is not calculated by the PRPs because so few people live in the area. Since the local streams feed into rivers which impact major population areas, the PRPs are assuming a cut-off value for radiation dose to the public."

EPA Response:

The comment is correct. Theoretically, a very small but finite amount of tritium can reach downstream rivers that are used for drinking water purposes. However, the concentrations would be minuscule and were not addressed in the baseline risk assessment.

(27) The Commonwealth commented, during the public comment period on the preferred remedy, that Section 3.1.1 of Appendix D of the FS Report, Remedial Investigation Results, does not consider Commonwealth data revealing higher levels of radionuclides in the vicinity of the site than those provided in the RI Report.

EPA Response:

The comment is correct in that the risk assessment did not explicitly address these data. However, the risk assessment was not based on measured field data, but instead was a "what if" analysis, whereby a number of "no action" exposure scenarios were defined and then modeled. As a result, though field measurements do not reveal widespread contamination in the vicinity of the site, the risk assessment made a number of conservative assumptions regarding the offsite transport of the waste. Hence, though Carbon-14 and other radionuclides have not been observed above administrative levels, the models attempt to explicitly predict the concentrations of all potentially significant radionuclides in the vicinity of the site assuming the "no action" alternative. Note that the "No action" alternative does not take credit for institutional controls, and assumes that the existing cover degrades and no longer serves as a barrier to water infiltration or erosion.

Based on this comment, there may be a need to compare the modeled radionuclide concentrations to actual measured values during remedial design/remedial action at the MFDS.

(28) The Commonwealth expresses concern, in comments submitted during the public comment period on the preferred remedy, that by grouping radionuclide movement from different formations, the doses are underestimated.

EPA Response:

For the purpose of modeling the total quantity of radionuclides being leached from the trenches, the PRPs do not make a distinction in the activity leaving the east and west trenches (see bottom of page D-23 of Appendix D). In addition, for the surface water pathways, the PRPs assume that all the activity flows to the surface water system. This approach is conservative, since all the activity is assumed to be transported to the surface water. If the source term were segregated into east and west, the quantity of radioactivity entering a given surface water body would be lower.

For the ground water pathway, the PRPs assume that once the leachate reaches the hillslopes, it flows down discrete channels to 8 different alluvial regions. This was done to more realistically assess the exposures for this pathway. The PRPs described this pathway conceptually in the following way. (see page D-26 of Appendix D). The leachate percolates through the formations underlying the trenches and surfaces at the hillside. The flow rate of the water that is percolating through the trenches is approximately 10% of the rain that falls onto the 47 acres of the trench disposal area. This is estimated to be 2.2E+07 L/yr. The radionuclide concentration in the leachate is assumed to be the concentration in the waste times the partition ratio. No distinction is made between the concentration of the radionuclides in the waste in the east vs the west trenches. As indicated on page D-23, though such a distinction would further improve the analysis, the data are not available to carry the calculation to this level of detail. Gathering the necessary data would require detailed analysis of waste samples.

The analysis then assumes that the contaminated water discharged to the hillside flows down the hillside via a number of drainage channels, over and under the colluvium, and reaches the alluvial valley where it serves as recharge to the underlying aquifer. This water is then withdrawn and used by nearby residents. The fraction of the leachate leaving the hillside that flows into each of the 8 regions is as follows:

1	.02	5	.05
2	.08	6	.18
3	.40	7	.18
4	.05	8	.04

In addition, a wash intercept factor is assigned to each region to account for the fact that all of the leachate will not necessarily reach the alluvial plain. The wash intercept factor in the 8 regions is as follows:

1	.70	5	.10
2	.70	6	.10
3	.70	7	.10
4	.70	8	.10

The sum of the product of these factors gives the dose reduction that is realized by using this approach.

1	.014	5	.005
2	.056	6	.018
3	.28	7	.018
4	.035	8	.004
		Sum	.43

If credit were not taken for channeling and the interception factor, the doses calculated by the PRPs for the ground water pathway would be higher by about a factor of 2.

(29) The Commonwealth expressed concern, through comments submitted during the public comment period on the preferred remedy, that the risk assessment does not include doses from the ingestion of creek water.

<u>EPA Response:</u>

The comment is correct in that this pathway was not evaluated. EPA believes the doses from this pathway, had it been evaluated, would be comparable to or less than the doses from the ground water pathway. The reason is that the radioactivity leaving the site would be diluted in the creek flow, which is larger than the ground water flow.

(30) The Commonwealth, through comments submitted during the public comment period on the preferred remedy, reemphasized the need to correct and clarify many of the risk assessment issues.

EPA Response:

EPA concurs that some of the above issues may require additional analysis in the future, and some of the assumptions used in the risk assessment may require validation with field data during remedial design and/or remedial action.

(31) The Maxey Flats Steering Committee and U.S. Ecology commented, during the public comment period on the preferred remedy, that the risk assessment and the addendum report to the FS Report greatly overstate the risks, and do not inform the public of the actual risks at the site. The Committee stated that the risk assessment submitted to EPA in December 1988 provides the best representation of site risks.

EPA Response:

EPA strongly disagrees with the comments of the Committee. The purpose of a baseline risk assessment under the Superfund process is to evaluate the potential risks from a site should no action be taken to mitigate or control the threats posed by the site. The final risk assessment submitted by the Committee in April 1991, in conjunction with EPA's Addendum Report to the FS Report, achieved this purpose. The Committee's December 1988 version of the risk assessment took credit for 500 years of institutional controls in addition to limited maintenance activities at the site and, therefore, did not constitute the No Action baseline risk assessment required by the NCP and Superfund risk assessment guidance. It was for this reason that EPA required the Committee to undertake significant revision to its December 1988 risk assessment.

As a part of these revisions, EPA required the Committee to include in its analysis those pathways which the Agency determined were reasonably likely to occur in the absence of perpetual institutional control. The Committee was then required to calculate doses associated with those pathways. The Addendum Report to the FS Report, prepared by EPA, presented the risks associated with those doses. While some of the risk calculations presented in the Addendum Report to the FS Report and in the Proposed Plan are very high, EPA made clear that these risks were based on the premise that the site was abandoned and no institutional controls or access restrictions were in place.

Based on the comments received from the community at the June 13, 1991 public meeting and during the public comment period on the preferred remedy, EPA takes issue with the Steering Committee as to the community's current level of understanding of potential risks associated with the site. EPA has clearly communicated to the community on numerous occasions the current nature and extent of site contamination and has had the Remedial Investigation Report in the local information repositories since July 1989. In addition, the Commonwealth has submitted site monitoring data to the local information repositories and to the Fleming County Grand Jury which support EPA and Commonwealth statements that the site does not currently pose a threat to human health or the environment. With regard to the current exposures and risks at the site, neither the PRP risk assessment nor EPA calculations address this because the current exposures reflect the presence of institutional controls. However, as EPA pointed out in the Proposed Plan and at the June 13 public meeting, the conclusion to be drawn from the risk assessment is that remedial action, maintenance, monitoring and institutional controls must be funded and conducted at the MFDS in perpetuity due to the significant threat to human health and the environment posed by the site in the future should these activities not be undertaken.

It should be noted that comments submitted on behalf of the Maxey Flats Concerned Citizens, Inc. called for more stringent assumptions in the risk assessment than those used by the Maxey Flats Steering Committee.

(32) The Maxey Flats Steering Committee submitted, in a footnote to the above comment, the following comment during the public comment period on the preferred remedy:

"EPA's statement on page 16 of the Addendum that the uncertainties discussion in the Risk Assessment is subjective and represents the Committee's opinions and not necessarily those of EPA is yet another indication that EPA has required revision of the Risk Assessment not to reasonably evaluate the risks posed by the site but to justify its actions under CERCLA. EPA's own risk assessment guidance states that the uncertainties of a risk assessment should be discussed. "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)," EPA/540/1-89/002, p. 6-47 (December 1989). By disavowing the uncertainties discussion in the Maxey Flats risk assessment, EPA is in essence saying that the estimates contained in the risk assessment accurately reflect the risks posed by the site. Such a conclusion is arbitrary and not supported by the Agency's risk assessment principles or those generally accepted in the scientific community."

EPA Response:

EPA is well aware that the 1989 Risk Assessment guidance indicates that risk assessments should discuss uncertainties. Indeed, in discussions with the Steering Committee during the risk assessment revision process, EPA agreed to the inclusion of an uncertainties section in the Maxey Flats risk assessment. However, the specifics of what that section would or should say were not addressed during those discussions.

The statement in the EPA's Addendum Report was not, as the Committee contends, a disavowal of the discussion of uncertainties in the risk assessment. There are uncertainties associated with virtually every risk assessment and the Maxey Flats risk assessment is no exception. However, while, for the most part, EPA agrees with the areas of uncertainty identified by the Committee in the uncertainties section; the Agency does not agree with each and every conclusion or assertion made by the Committee with respect to those uncertainties, (e.g., statements by the Committee, such as those found on page D-52 and D-53 pertaining to the Committee's position on the well water and intruder pathways). Rather than laboring over revisions to the uncertainties language, the Agency decided, in the interest of a more timely conclusion of the FS process, to allow the language to remain and to simply add the caveat in the Addendum on which this comment is based.

(33) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"The Committee can only speculate that the source of the one-in-10,000 figure [used on page 27 of the Proposed Plan] was based on an assumption that the preferred alternative would at least achieve the upper bound of the target risk range contained in the NCP. If EPA's intent was to communicate this assumption in its Proposed Plan, then the language chosen communicates the wrong message."

EPA Response:

The 1×10^{-4} risk (the upper bound of the target risk range of the NCP), provided on page 27 of EPA's Proposed Plan for the MFDS, assumes that the combined off-site dose from air, surface water, drinking water and soil is 25 mrem/year following site remediation. The present combined off-site dose from the MFDS is believed to be 25 mrem/year or less. The combined off-site dose following remediation will, most likely, be substantially less than the 25 mrem/year MFDS remediation goal, as the Committee asserts. The Record of Decision attempts to clarify the confusion which may have resulted from the Proposed Plan language on estimated risks following remediation.

(34) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"Implementation of the preferred alternative will reduce any remaining risks at the site by orders of magnitude below the 1×10^{-4} value contained in the Proposed Plan. The reasons for this conclusion are straightforward. By simply maintaining institutional controls at the site, the intruder scenarios would be eliminated, thereby reducing the risk of even the "no action" case to around 1 x 10^{-4} by EPA's calculation. Footnote. A more realistic assessment, as evidenced by the December 1988 risk assessment, would result in a "no action" risk level at least two orders of magnitude below that calculated by EPA."

<u>EPA Response:</u>

EPA agrees that implementation of the selected remedy may reduce risks below the 1 x 10^{-4} value provided in the MFDS Proposed Plan. Inclusion of institutional controls in a no action alternative is not allowed by the NCP; therefore, engaging in a response to the Committee's hypothetical "simply maintaining institutional controls" scenario serves no meaningful purpose. The December 1988 risk assessment, referenced in the footnote to the Committee's comment, was deemed inadequate by EPA, the Commonwealth and the Maxey Flats Concerned Citizens, Inc. Consequently, the risk assessment has undergone substantial revision, resulting in the April 1991 risk assessment which, in conjunction with EPA's Addendum Report to the FS Report, provides an adequate representation of site risks.

(35) The following comment was submitted by the Maxey Flats Concerned Citizens, Inc. during the public comment period on the preferred remedy:

"We recommend that:

- the trench chemicals be more fully characterized
- a full RCRA analysis be conducted, including the interaction of chelating agents with trench chemicals, and
- RCRA be accepted as an ARAR"

<u>EPA Response:</u>

As stated in EPA's response to Comment 8 above, the inclusion of the chemicals listed in Comment 8 in the risk assessment would not yield significantly higher risks nor would inclusion of these contaminants, even if, in the unlikely scenario, these chemical contaminants did yield a significantly higher risk, alter the remedy.

For reasons discussed in Section 8.0 - <u>Applicable or Relevant and Approrpiate Requirements</u> of the Record of Decision, EPA concurs with the MFCC that RCRA should be considered an ARAR at the MFDS. Thus, the selected remedy will be required to achieve the requirements under RCRA that are applicable to the MFDS.

The RCRA requirements were specifically designed for the management of hazardous wastes. RCRA closure requirements will ensure that the final cap is designed and constructed to minimize the need for further maintenance and monitoring, minimize or eliminate to the extent necessary post-remediation escape of hazardous constituents to ground or surface water or through the atmosphere, and to protect human health and the environment. The selected remedy's RCRA ground water requirements establish maximum ground water concentration limits for metals and chemicals, which will be complied with in the alluvium at the base of the hillslopes. The RCRA ground water requirements also establish monitoring requirements for non-radionuclides and corrective action if monitoring indicates ground water concentration limits have been exceeded in the alluvium. EPA believes the selected remedy appropriately addresses the presence of chemicals at the MFDS via these RCRA requirements.

(36) An attendee at the June 13, 1991 public meeting commented on a recent USGS report containing findings of high contamination levels in monitoring wells. The attendee asked if EPA assumes that deer will not drink this water.

<u>EPA Response:</u>

The USGS report presents the levels of tritium in monitoring wells at the site that were installed beneath the ground surface, into the underlying bedrock. The deer of the area do not have access to this subsurface water. Ground water eventually flows through the bedrock fractures and eventually surfaces at the soil/rock interface, or through seeps. Precipitation, dilution, evaporation and decay of the radionuclides affect the ground water as it migrates out of the trench disposal area. Therefore, the highly elevated levels of tritium detected in the USGS monitoring wells have not been detected in surface waters outside the restricted area. These surface waters would be the body of water accessed by the deer. Thus, the answer is yes, EPA assumes that the deer are not drinking water containing levels of tritium as high as that detected in the USGS monitoring wells.

C. Applicable or Relevant and Appropriate Requirements (ARARs)

(1) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"The Committee does not agree that a number of the regulations identified by EPA should be classified as ARARs. The Committee has explained its reasons for opposing the designation of these provisions in earlier filings with the Agency and incorporates those discussions by reference in these comments. In particular, the Committee does not believe that the following regulations should be ARARs:

- National Emission Standards for Hazardous Air Pollutants from DOE facilities;
- The 25 mrem/yr offsite dose standard of 10 CFR § 61.41 and 902 KAR:022, Section 18;
- 40 CFR § 192.32(b)(2)(i) of the Uranium Mill Tailings Radiation Control Act (UMTRCA) standards;
- Kentucky drinking water standards, 401 KAR 6:015; and
- Kentucky surface water standards for radionuclides, 401 KAR 5:031, Section 2(6)

On page 12 of the Proposed Plan and in the footnote on that page, EPA alludes to the possible inclusion of certain RCRA regulations as ARARs without providing any basis for such action. ...'Should the Agency ultimately conclude that RCRA regulations are applicable at the site, then it would (1) need to substantiate that conclusion in writing, (2) describe what effect, if any, those new requirements would have on the remedy and (3) reopen the comment period to allow parties a meaningful opportunity to comment on the Agency's conclusions.'

To the extent the ARARs identified in this section of the Committee's comments would modify the preferred alternative, the Committee believes that EPA should either waive those ARARs or accept the Committee's arguments and delete these regulations from the list of ARARs. To the extent EPA has concluded that all of the ARARs it has identified will be met by the preferred alternative, it should confirm this conclusion in the Record of Decision."

EPA Response:

Per the National Contingency Plan, the lead Agency (EPA) shall determine, in consultation with the support Agency (the Commonwealth of Kentucky), those requirements that are applicable or relevant and appropriate (ARARs) to the response actions at Superfund sites. The ARARs identified in Section 8.0 of this document are the requirements determined by EPA, in consultation with the Commonwealth, to be applicable or relevant and appropriate to the MFDS.

The following discussion addresses each of the ARARs to which the Committee has raised objections:

The National Emission Standards for Hazardous Air Pollutants (NESHAPS) in 40 CFR 61.92 are contaminant-specific, relevant and appropriate requirements for setting emissions levels for radionuclides remaining on-site at Maxey Flats as residual contaminants. The NESHAPs for radionuclides in 40 CFR 61.92 states that emissions of radionuclides to ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/year. A key purpose of the NESHAP for radionuclides at DOE sites is to set standards based on "acceptable risk" to the public (54 Fed. Reg. 51664, Dec. 15, 1989). This is the same purpose for setting remediation goals at Superfund sites. Thus, based on the factors in the 1990 NCP in 300.400(g)(2), EPA concludes that 40 CFR 61.92 is relevant and appropriate for setting emissions levels at Maxey Flats.

As EPA noted in its 1989 ARARs Compliance With Other Laws Manual, although the standards of 10 CFR Part 61 are not applicable to previously closed low-level waste disposal sites, the standards "may be relevant and appropriate to existing CERCLA sites containing low-level radioactive waste if the waste will be left on-site." (CERCLA Compliance With Other Laws Manual, Part II, OSWER Directive 9234.1-02, August 1989, at p. 5-15). EPA has determined that the 25 mrem/yr dose limit set by the NRC in 10 CFR Part 61 is relevant and appropriate to remedial activities at the Maxey Flats Disposal Site. The radiation protection standard of 25 mrem/year dose to the whole body, established in 10 CFR Part 61, Section 41, and 902 KAR 100:022, Section 18, shall be treated as a contaminant-specific ARAR and, as such, be used as the remediation goal for overall exposure to radionuclides after site cleanup. The MCLs/MCLGs, NESHAPs and Kentucky Water Quality Standards are the remediation goals for their specific media. The remediation goal for soil exposure is the difference between the overall 25 mrem/year cap and the combined exposures predicted by the risk assessment for the ground water, surface water and air pathways.

The UMTRCA standard found in 40 CFR 192.12(a)(1), which applies to remedial actions at inactive uranium processing sites, limits radium-226 concentrations in soil to 5 pCi/g in the top 15 cm. Radium-226 is present at the MFDS. Therefore, EPA has determined that the referenced UMTRCA standard is relevant and appropriate for the MFDS cleanup and is a contaminant-specific ARAR for soils at the Maxey Flats site.

The Kentucky drinking water standards found in 401 KAR 6:015 establish maximum concentration levels for a number of inorganic, organic, and radionuclide contaminants in public drinking water supplies. EPA's Groundwater Protection Strategy dictates that Superfund remedial actions affirmatively protect all potential sources of public water supply. The Agency has determined that the aquifers of the MFDS area represent potential sources of water supply and that the federal and state drinking water standards are, therefore, relevant and appropriate at the site.

Compliance with the MCLs established in 401 KAR 6:015 and the MCLs/MCLGs established in 40 CFR Parts 141-143 at the MFDS will be judged beginning at the contact of the alluvium with the hillside and ending at the streams. (See EPA Response to Comment 26 of Part I. B. - Risk Assessment of this Responsiveness Summary for a further response to EPA's position of the appropriateness of the well water pathway.)

Kentucky's Surface Water Standards, set out in 401 KAR 5:026 - 5:036, set "minimum criteria applicable to all surface waters". These criteria include specific limits on radionuclides. These standards are applicable contaminant-specific standards for the surface water streams (i.e., Drip Springs Hollow, No Name Hollow, and Rock Lick Creek) surrounding the MFDS. In addition, to the extent that the site contains surface waters as defined by 401 KAR 5:029 Section 1(bb), including intermittent streams with well defined banks and beds, the surface water standards are, likewise, applicable contaminant-specific standards. The Commonwealth has the NRC's full authority to regulate the land disposal of low level radioactive waste, and the Commonwealth has determined that its surface water standards are applicable to such surface waters.

For reasons addressed in Section 8.1 of this Record of Decision (ARARs), EPA has determined that certain requirements of the Resource Conservation and Recovery Act of 1980 (RCRA), 40 CFR Part 260, et seq., and corresponding Kentucky regulations (401 KAR Chapter 30, et seq., are ARARs for the MFDS.

The impact of RCRA requirements on the selected remedy are not substantial. RCRA closure requirements will have to be met. However, even prior to the determination that RCRA was applicable to the MFDS, Alternative 5 met these closure requirements. The only additional requirements imposed on the remedy by the RCRA determination are the tank requirements and ground water monitoring requirements. The Land Disposal Restrictions of 40 CFR Part 268 would have been a significant new requirement; however, as documented in Section 8.3 of the Record of Decision, these requirements are being waived for the remedial action on the basis that compliance with the requirements would result in greater risk to human health and the environment than would non-compliance.

EPA identified the major ARARs for the MFDS in the Proposed Plan which was released to the public in June 1991 and was the subject of a 60-day public comment period. The Agency indicated at that time that it was considering the addition of RCRA as an ARAR for the site. Thus, the Proposed Plan afforded the public, including the Maxey Flats Steering Committee, an opportunity for meaningful comment and the Agency does not intend to reopen the public comment period.

Moreover, EPA had already made the Steering Committee aware that RCRA was being considered as a potential ARAR in November of 1990, well before the Proposed Plan was issued. EPA kept the Steering Committee informed of developments on the RCRA issue throughout the period leading to this ROD. The Steering Committee was clearly afforded the opportunity to comment on the Agency's final determination of the RCRA issue and took full advantage of that opportunity by submitting the comments on what became the final RCRA ARAR determination as Attachment 8 of the Committee's overall comments on the Proposed Plan.

The Committee's comments on the RCRA issue can be summarized as follows:

(a) That liquid scintillation vials (LSVs) are not spent solvents and should not, therefore, be classified as listed hazardous waste;

(b) That the toluene and xylene at the site could have come from non-listed sources and, thus, RCRA should not be treated as applicable;

(c) That even if the LSVs are listed wastes, the small quantity generator exemption applies and the LSVs would not, therefore, be subject to RCRA regulation; and

(d) That even if the leachate is a listed hazardous waste, it should be delisted.

EPA's responses to these comments, as previously conveyed to the Steering Committee, are as follows:

(a) EPA disagrees with the Committee's arguments concerning the status of LSVs as listed wastes. It is the Agency's position that the scintillation fluids disposed of at the MFDS were used for their "solvent" properties and are, in fact, listed spent solvents.

(b) When there is a known listed hazardous waste source for a constituent found at a facility, it is not EPA's policy to avoid RCRA requirements by assuming that the constituent discovered came from an unlisted source.

(c) In order to accept the Committee's argument on the small quantity generator exemption, EPA would have to assume that each and every generator of LSVs disposed of at the MFDS were small quantity generators. The Committee advances an argument for why the Agency should do just that. However, for that argument to succeed, the Agency would have to assume not only that all LSVs produced by those generators went to the MFDS, but also that those generators produced no other hazardous wastes of any kind that would have contributed to the total hazardous waste volume generated by them. EPA is simply not willing to make these assumptions.

(d) EPA does not believe that delisting of the leachate is appropriate. First, much more sampling would be necessary to sufficiently characterize the leachate for delisting purposes. Moreover, given the heterogeneous nature of the trenches and the leachate contained therein, it is possible that no amount of additional testing would suffice for this purpose. Finally, even if it could be clearly established that all RCRA constituents in the leachate were below health-based levels, the leachate would remain dangerous due to its high radioactivity. Delisting of this otherwise dangerous waste is not a route that EPA is willing to take at this time.

(2) The Kentucky Resources Council commented, during the public comment period on the preferred remedy, that for areas that will be remediated by removal of contaminated soils or other material, KRS 224.877 is a state ARAR which must be respected by EPA in the development of remedial plans. According to the Kentucky Resources Council, the state statute provides two alternatives with respect to clean-up standards - one, cleaning up to naturally-occurring background; the other, allowing residual contamination provided that the detailed assessments required by the statute are conducted.

EPA Response:

The remedy for the MFDS will not involve removal of contaminated soils or other materials. It is a containment remedy which, by its very nature, involves leaving wastes in place above background levels. Moreover, it is EPA's position that KRS 224.877, as amended, is not an ARAR. The substantive provisions of KRS 224.877 which could arguably be applicable or relevant and appropriate requirements are contained in Sections 5 and 10 thereof. As described below, neither Section meets the eligibility criteria for ARARs provided in CERCLA or in the National Contingency Plan.

Section 5 of the Kentucky statute states that persons having possession or control over a hazardous substance, pollutant, or contaminant being released or who caused the release must take "actions necessary to restore the environment to the extent practicable and minimize the harmful effects from any release into the air, lands or waters of the Commonwealth." Such restoration and minimization merely constitute a general goal or legislative intent about a desired outcome or condition rather than a specific cleanup level. The statute does not contain the requirement of cleanup to naturally occurring background levels. That requirement is an interpretation of the statute which is not promulgated and is, therefore, not an ARAR.

Section 10 of KRS 224.877 states that remedial actions "shall protect human health, safety and the environment" considering certain factors outlined therein as appropriate. Section 10 does not constitute an ARAR because the protection obligation is not more stringent than federal requirements for remedial actions. For example, Section 121(d) of CERCLA provides that remedial actions shall attain a degree of cleanup which, <u>at a minimum</u>, assures protection of human health and the environment. Section 121 of CERCLA, in addition to a multitude of other federal requirements governing remedial actions, is equivalent to or more stringent than the mandate contained in KRS 224.877(10). In summary, KRS 224.877 does not contain any specific, enforceable requirements that are more stringent than provided by federal law and thus is not an ARAR.

(3) The Maxey Flats Steering Committee, during the public comment period on the preferred remedy, commented that the conclusion on pages 4 and 5 of EPA's Addendum to the FS Report, in which EPA states that because of the seeps on the east hillslope, the site is not presently meeting all contaminant-specific ARARs, is incorrect. The Committee feels that EPA's assumption of the point of compliance with 902 KAR 100:025, Table II at the seep location is incorrect. According to the Committee, both Kentucky regulations and the underlying Nuclear Regulatory Commission (NRC) regulations reveal

that the correct point of compliance is the site property boundary. According to the Committee, had EPA focused the proper point of compliance, it would have reached an opposite conclusion. In the Committee's opinion, the seeps are in a "controlled area", not an "unrestricted" one, since the seeps are within the site property boundary where the Commonwealth of Kentucky can limit the public's access. Consequently, the Committee feels that to determine if releases from the seeps cause the Table II requirements to be exceeded it is necessary to determine if those limits are being exceeded at the site boundary. Additionally, the Committee stated that the statement in the Addendum is not supported by the data and that it should be modified or deleted.

EPA Response:

By way of definitional interpretations, the Committee seeks to have the area outside the MFDS Restricted Area considered as a "controlled area" rather than an "unrestricted" area. The Committee fails to support its interpretation that the area is a "controlled" area with any facts demonstrating that the public cannot access the seeps. The Committee cannot provide these facts because there are currently no controls in place to limit access to the seeps. The only deterrent to public access at the MFDS is the fence which encloses the 47-acre Restricted Area and the presence of on-site Commonwealth and contractor personnel. There currently is no fence around the entire 280 acres which comprises the MFDS. The Kentucky Cabinet for Human Resources (CHR), which is the authority responsible for administering the Kentucky regulations in question, does not agree with the Committee's interpretations. It is the CHR's position that the access to the MFDS, other than the Restricted Area, is neither limited nor controlled and that the seeps of the east hillslope are, in fact, located in the unrestricted area of the MFDS. For the reasons stated herein, no change has been made to the statement that the MFDS is not presently meeting the contaminant-specific requirements of 902 KAR 100:025, Table II.

(4) U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"With respect to the point of compliance for the ARARs included in the Proposed Plan, EPA is unclear. The statement that for Drinking Water Standards - "the point of compliance for these standards begins at the contact of the alluvium with the hillside and ending (sic) at the streams; compliance will be based on samples taken in the alluvium" is confusing at best. First of all, a "point' can't begin somewhere and end somewhere else; a point is a point and is specific to a particular place where a sample will be taken. And then, at the end of the EPA statement, it is said that the PRP's will be taking samples for the determination of compliance with drinking water samples from the alluvium. Alluvium is not water, and so it is hard to understand just what is meant. The confusion could be eliminated if EPA would specify that compliance must be demonstrated at a point where water exists, is uncontrolled, and may be drunk. That would seem to be samples of water in the streams, as they exit the site boundaries."

<u>EPA Response:</u>

The term "point of compliance" is a term of art, a term widely used by regulators and the regulated community. Point of compliance refers to the location at which standards must be achieved. For the MFDS, the point of compliance for drinking water standards begins at the contact of the alluvium with the hillsides and is illustrated in Figure 15 of the Record of Decision. As illustrated in this figure, the point of compliance is more of a boundary at the base of the MFDS hillsides where the standards must be achieved.

It has not been determined at this stage of the remediation process who will be implementing the remedy. EPA, in its Proposed Plan, did not state or infer that the PRP's will be taking samples from the alluvium as alleged in the above comment. Alluvium is a general term for deposits laid down by surface water flow, which includes sediments laid down in river beds, flood plains, lakes, fans at the foot of mountains or hills, and estuaries. Samples from the alluvium or in the alluvium refers to samples of water extracted from the alluvium and not samples of the alluvium itself. EPA reaffirms its position that compliance with drinking water standards will be based on ground water samples from the alluvium.

(5) The Maxey Flats Steering Committee, during the public comment period on the preferred remedy, commented that, while EPA would require the purchase of the buffer zone and would place control over the properties in the Commonwealth of Kentucky's hands, EPA would act as though these purchases did not change the current site boundaries and hence the location at which compliance with the contaminant-specific ARARs would need to be demonstrated after the completion of the remediation. The Committee states that EPA's position on this issue is neither supported by the facts nor the relevant regulations and should accordingly be modified. According to the Committee, EPA is not free to identify ARARs and then apply them in situations where they have no relevance. In closing, the Committee argues that, while purchase of a buffer zone makes since at Maxey Flats, EPA's attempt to exclude that zone from the site property boundary does not.

EPA Response:

The selected remedy specifies the procurement of a buffer zone for the purposes of ensuring long-term access to areas necessary for monitoring remedy performance and compliance and to protect the hillslopes from activities that may be detrimental to the long-term integrity of the remedy. The buffer zone is not being purchased for the purpose of extending the site boundaries so that ARARs can more easily be achieved.

The Committee places the argument of no "assumed exposures" to the public (within the buffer zone) on the premise of Commonwealth ownership and Commonwealth "control" of buffer zone properties, neither of which is prescribed by the selected remedy, and neither of which can be assumed with any degree of certainty at this time. Private party ownership within the buffer zone cannot be precluded at this time. Although Commonwealth ownership of buffer zone properties may make the most sense at this early point in the process, it cannot be assumed to be a certainty, as the Committee acknowledged in its comment. Buffer zone procurement may include property purchases, but it is not unreasonable to assume that procurement might also include easements and/or land use restrictions. Even if the property were all owned by the Commonwealth, or some other entity associated with remediation of the site, unless the entire buffer zone and the entire area of the MFDS were fenced, "control" over access to the buffer zone properties would be very limited.

It should also be noted that compliance with the standards set out in the NESHAPS and in 902 KAR 100:022, Section 18, is judged, not at the site boundary as described for Superfund purposes, but, rather, at the boundary of the property licensed for radioactive waste disposal pursuant to the Atomic Energy Act. Moreover, compliance with the standard for overall exposure to radiation set forth in 10 CFR Part 20 is judged at the boundary of the restricted area. Commonwealth ownership of buffer zone properties would not, in and of itself, extend either of these boundaries. A modification or amendment to the site license would be required for such extensions. Neither the Commonwealth nor EPA consider such an amendment or modification necessary or appropriate.

Furthermore, it is EPA's responsibility to set the points of compliance at Superfund sites in a way that it deems protective of human health and the environment. It is EPA's determination that extending the points of compliance beyond the currently existing site property boundary would not be protective of human health and the environment.

D. Selection of Remedy

(1) A resident expressed satisfaction, during the June 13 public meeting on the preferred remedy, that EPA, the Commonwealth, and the PRPs are making progress toward remediation of the MFDS.

EPA Response:

EPA appreciates the support of the community and concurs with the commentator that a technical consensus on the remedy is needed for site remediation to proceed.

(2) The Maxey Flats Concerned Citizens, Inc. (MFCC) provided the following opinions on the remedial alternative options at the June 13, 1991 public meeting on the preferred remedy, and reiterated their position in comments submitted during the public comment period:

(a) The MFCC strongly opposed the dynamic compaction technology (included in Alternatives 4, 10, and 17). The MFCC cited potential rupture of waste containers within the trenches, and potential enhanced migration of contaminants through the underlying bedrock fractures. Additionally, surface contamination and worker exposures were concerns of the MFCC with respect to the dynamic compaction technology.

(b) The MFCC does not prefer the grouting technology (included in Alternative 11) at the MFDS due to concern over the potential for release of contaminants via container puncture when the lances used to insert the grout are injected into the trenches. Also, the MFCC expressed concern over the inability of the technology to fill voids within the trenches.

(c) The MFCC supported the natural stabilization technology and Alternative 5, with modifications. (See Comment 13 below).

EPA Response:

As presented in Section 9.0 of the Record of Decision, neither the dynamic compaction alternatives nor the grouting alternative represented the best balance of the nine criteria used to evaluate remedial alternatives under the Superfund program.

(3) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"On page 3 of the Addendum and in several comments on prior versions of the FS Report, EPA has suggested that the closure of the Maxey Flats site is occurring solely as a result of EPA's actions under

CERCLA. This suggestion ignores the factual realities of the site. Maxey Flats is licensed and was operated as a low-level radioactive waste site. As indictated by the risk assessment, the risks posed by the site are related to the radiation that is present at the site. As a result, closure activities should be governed by regulations established pursuant to the Atomic Energy Authority Act. The passage of CERCLA does not change this regulatory reality nor the factual reality that the site remains a licensed low-level radioactive waste site."

EPA Response:

The status of the MFDS as a licensed low-level radioactive waste disposal facility necessarily influenced this Record of Decision to a great degree because many of the Kentucky and NRC regulations governing closure of low-level radioactive waste disposal sites constitute ARARs with which CERCLA Section 121(d)(2) requires the remedial action to comply. Nevertheless the fact remains that this Record of Decision addresses remediation of the MFDS under the authority of CERCLA and not the closure of the site under the authority of regulations promulgated pursuant to the Atomic Energy Act (AEA).

Pursuant to CERCLA Section 104, EPA is authorized and obligated to provide remedial action to address any release or threatening release of hazardous substances where the Agency believes the action is necessary to protect human health and the environment. EPA has determined that the protection of human health and the environment requires that the release and threatened release of radionuclide and chemical contaminants from the MFDS be addressed by the remedial action selected herein.

EPA simply does not agree with the implication in the Committee's comment that because closure pursuant to AEA regulations would be appropriate for this site, the remedial authority of CERCLA is somehow preempted.

(4) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"It should be stressed [in the Proposed Plan] the Commonwealth does not endorse Alternative 5 but has determined it represents a starting point for remediation of the site. The Commonwealth's Closure Plan submitted to USEPA differed in a number of respects to Alternative 5 as proposed in the Feasibility Study."

EPA Response:

EPA recognizes the concerns of all parties involved, i.e., the Commonwealth, the PRPs, the community, as well as those of EPA itself. EPA believes that the selected remedy provides the best balance of the criteria used to evaluate remedies under the Superfund program, while maintaining the necessary flexibility to accommodate uncertainties and concerns expressed by the various parties. It should be noted here that the selected remedy is not identical to Alternative 5 as presented in the Feasibility Study Report. EPA has the discretion to structure and modify the preferred alternative based upon a variety of factors including state and community acceptance and has done so in the ROD.

(5) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"The Commonwealth's Closure Plan indicated the plastic membrane should be covered by a drainage layer, geotextile and a soil cover with vegetation to prevent erosion. The Commonwealth has concluded this cap may be necessary to prevent erosion of the natural drainage channels."

EPA Response:

EPA recognizes the Commonwealth's concerns in the Record of Decision by not precluding the Commonwealth's preferred design for the initial cap. If surface water runoff cannot be effectively controlled (i.e., rates of erosion are unacceptable) during the Interim Maintenance Period, the five year reviews, or at any point between the five year review, necessary modifications to the initial cap design will be made. Such changes could include design components that the Commonwealth has advanced to EPA.

(6) U.S. Ecology submitted the following comment during the public comment period on the preferred remedy:

"In the discussion of Alternative 5, the chosen alternative, EPA mentions the possibility of including "a north cutoff wall or a cutoff wall which encircles the trenches." In the RI/FS studies, a north cutoff wall was to be considered only if the results of further ground water analysis and modeling during the detailed engineering design phase of the project so warranted. EPA should state this, and reference to a cutoff wall encircling the trenches should be deleted."

EPA Response:

Due to the uncertainties of hydrogeologic flow at the MFDS, and uncertainties regarding the impact of the leachate extraction program on such flow conditions, the necessity, location, type, and depth of cutoff wall will be determined by analyzing data obtained from a number of sources including trench leachate extraction data, historical monitoring data, infiltration monitoring data, modeling, etc. Using a statistical approach to the decision should be an effective method in determining the necessity and type of cutoff wall utilized. The design phase will likely be too early in the process to make these determinations since data will need to be obtained and analyzed after vertical infiltration control measures have been implemented.

(7) Representative Pete Worthington, of the Kentucky House of Representatives, submitted the following comment during the public comment period on the preferred remedy:

"I am very pleased to see the adoption of Kentucky's recommendation for natural subsidence as the preferred option. As you know, the dynamic compaction and the grouting option would have caused extreme exposures to the accelerated releases of radioactive materials. I am requesting that the Record of Decision reflect these exposures caused by breaching the integrity of canisters in the trenches and the potential fracturing of shale geology. The books must be closed forever on any consideration of these alternatives to dealing with subsidence in the trenches."

EPA Response:

Section 9.0 - Summary of the Comparative Analysis of Alternatives, of the Record of Decision, reflects the concerns of the commentator.

(8) The Maxey Flats Steering Committee representative commented, at the June 13, 1991 public meeting, that the Committee is pleased that EPA, the Commonwealth, and the PRPs agree on a preferred remedy, and that the community members indicated their satisfaction with the proposed remedy. He also expressed hope that all parties will move forward quickly and responsibly to reach a Record of Decision (ROD) and to continue negotiations with the PRPs.

EPA Response:

EPA appreciates the support of the Committee and concurs that a t[illegible]nical consensus on the remedy is necessary for remediation to proceed in a timely fashion.

(9) A concerned party stated, at the June 13, 1991 public meeting on the preferred remedy, his belief that no type of containment remedy will effectively remediate the MFDS. He suggested that the only solution for the site is to excavate the site waste and contaminated soils, place them in containers, and send them to outer space.

EPA Response:

The vertical infiltration barrier (trench cap) and lateral infiltration barrier (horizontal flow barrier) components of the selected remedy, as well as the erosion control measures, leachate extraction and solidification measures, monitoring and maintenance activities, and engineering and institutional control components of the selected remedy are based on reliable and proven technologies. These features are designed to effectively isolate the radioactive contaminants at the site in perpetuity. Additionally, five year reviews will be performed to ensure the remedy's compliance with Federal and State requirements and to ensure that the remedy continues to provide protection of human health and the environment. Institutional controls, maintenance and monitoring will be in place in perpetuity and a trust fund will be established to fund these activities in perpetuity.

Waste disposal in outer space is not a proven and reliable, feasible, cost-effective alternative. Although disposal in outer space was not specifically evaluated during the Feasibility Study process, it can be safely assumed that this proposal would not provide the best balance of the nine Superfund criteria used to select remedies; specifically, the Short-Term Effectiveness, Implementability, Overall Protection of Human Health and the Environment, State Acceptance, Community Acceptance, and Cost criteria would not lend support to selection of this alternative.

(10) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"Rates of subsidence will be difficult to determine, and may be slower than expected. Therefore, 35 years appears to be an underestimation of the time period required for subsidence. Alternative 5 as described in the Feasibility Study does not have a cutoff wall which encircles the trenches. The Commonwealth believes a North Cutoff wall will be insufficient to prevent horizontal flow into the trenches.

The Commonwealth in its Closure Plan suggested a cutoff wall which was different than the two proposed in the Feasibility Study."

EPA Response:

EPA concurs that there is uncertainty with regard to the period of natural subsidence prior to installation of the final cap. Accordingly, the Feasibility Study was revised and the Proposed Plan and Record of Decision reflect the Commonwealth's estimate of 100 years as an estimate of the period of natural subsidence.

EPA also concurs that there is enough uncertainty with regard to the hydrogeological flow conditions at the MFDS to warrant flexibility in this component of the selected remedy. Accordingly, Section 10.2 of the Record of Decision discusses two types of horizontal flow barriers, the North Cutoff Wall and the Lateral Drain/Cutoff Wall, but acknowledges that another type of flow barrier may be used if it is determined that a flow barrier is necessary.

(11) An attendee at the June 13, 1991 public meeting asked how EPA will control the increased water velocity in the existing site drainage channels.

EPA Response:

The remedy will include examination of the existing drainage channels, improvements to them as needed, and possibly adding channels to regulate the flow from the site. Added drainage channels would ensure that most of the runoff would not flow through one structure. The remedy design also may enlarge the retention ponds to control water volume. Currently, the east drainage retention pond handles approximately 60 to 70 percent of the runoff, and this runoff must be distributed through the other natural channels at the site. If the cap can be integrated into the areas natural drainage system properly, erosion runoff can be effectively controlled.

(12) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The plan for erosion control is quite sketchy. The final detailed plan will have to absolutely assure the protection against the exposure to the opening of any new release pathways over the entire life of the closure time for the site."

EPA Response:

As detailed in Sections 10.1 through 10.3 of the Record of Decision, erosion control will be one of the principal design considerations. The design of the initial cap will be based in large part on the ability to prevent or mitigate to the extent practicable hillslope/drainage channel erosion and prevent downslope flooding. Erosion monitoring is planned to be an integral part of the site monitoring program. Surface water control systems maintenance is an integral part of the overall site maintenance plan. A number of surface water control improvements are included in the selected remedy.

(13) The Maxey Flats Concerned Citizens, Inc. (MFCC) expressed the following concerns, at the June 13, 1991 public meeting and during the public comment period on the preferred remedy:

(a) Concern over the effect of elements (sun, wind, cold) on the initial cap synthetic liner if not protected. Additionally, concern was expressed over the potential for surface water runoff to erode hillslopes and flood downslope areas if a soil cover over the synthetic liner was not used in the initial cap design;

(b) Concern over the lack of threshold criteria for installing a horizontal ground water flow barrier. The question was asked: How much leachate would have to enter the trenches to trigger installation of a barrier? Further, the MFCC inquired about the plan to extract and treat the leachate if it forms in the trenches after being pumped dry;

(c) With regard to erosion, the MFCC suggested that water management systems, including larger ponds to meter the flow, are needed to retard erosion. The MFCC is also concerned that rock rip-rap will not be an effective erosion control and stressed that it is critical that a monitoring and maintenance program be able to detect and repair hillslope damage and that funding for this repair be continued in perpetuity;

(d) The MFCC supported EPA and Kentucky in the need to acquire a buffer zone adjacent to the MFDS. The MFCC suggested that if some landowners are reluctant to sell at this time, that the EPA be flexible and consider allowing local landowners the option of lifetime lease rights, with conditions placed on the lease. It was also suggested that the lease should not be transferable.

(e) Concern that the site monitoring and maintenance program and who should pay for these activities is not well defined. The MFCC requested that EPA require monitoring for radionuclides and hazardous chemicals of the following:

- personnel
- air
- gamma dose
- surface water
- soil pore water
- vegetation
- trench leachate
- erosion

(f) The MFCC also expressed a desire for the following:

- Testing of sump leachate water levels for the first 100 years (to determine if trench recharge is occurring);

- Testing of radionuclide concentrations, ground water, soil contaminants on hillsides, surface water, air, trench stabilization, erosion parameters, silting;

- Installation of surface monuments to notify persons that hazardous chemicals and radioactive waste are disposed on-site;

- Inspection of the trench cap, during the first 100 years, for cracking and subsidence;

- Use of settlement plates and slope inclinometers to determine vertical movements and tilt.

EPA Response:

(a) The selected remedy provides for the installation of a synthetic liner on top of a clay layer over the trench disposal area as an interim cover while the trench contents subside naturally. EPA has not precluded other options for the interim cover, such as placing a soil cover over the synthetic liner, which would slow the rate of surface water runoff and reduce the potential for site erosion.

Erosion control will be used as one of the principal criteria in approving the interim cover design. A soil layer over the synthetic liner adds to the difficulty in backfilling subsided areas during the Interim Maintenance Period. Each subsided area would require excavation of the soil, removal of a section of a synthetic drainage layer to get to the synthetic liner, and removal of a section of the synthetic liner before the subsided area could be backfilled. Should the design not provide a reasonable degree of assurance that rates of erosion will be adequately controlled, other interim cover options will be evaluated and employed. Furthermore, the five year reviews that will be performed following remedial action initiation, will specifically address erosion and the ability of the interim cover to adequately address erosion and infiltration.

Synthetic liners are being used worldwide, in conditions more severe than that of the Maxey Flats area. Therefore, there are manufacturers that produce and warrant synthetic liners to withstand various environmental effects. The liner employed at the MFDS will be required to withstand degrading environmental forces for the specified duration of the cover.

(b) Currently, not enough information is available to assess the need for a horizontal flow barrier. Further ground water modeling data, monitoring data, leachate extraction data, historical Commonwealth monitoring data, and other information will be used during remediation to assess the need for a horizontal flow barrier and, if needed, the location, depth and type of barrier to be installed. At this time, specific numeric criteria have not been established to be used in the decision on the necessity of the barrier. Rather, it is viewed as preferable to conduct a statistical analysis, using the afore-mentioned information that will be collected and analyzed, to assess the need for a horizontal flow barrier. If the statistical analysis concludes that infiltration of the trenches is occurring, a barrier will be constructed. Assigning a numeric infiltration criteria at this juncture could preclude installation of a horizontal flow barrier at some point when in fact one may be necessary.

Should significant trench recharge occur at some point after the trenches are pumped dry, Section 10.2 of the Selected Remedy portion of the Record of Decision specifies that the leachate be pumped, treated and disposed on-site in new disposal trenches.

(c) Section 10.1 - Initial Closure Period, of the Record of Decision, describes the surface water control features anticipated for the selected remedy. These features include improvements to existing drainage channels, use of additional, natural drainage channels, as needed, use of rock rip-rap and gabions, if found to be effective, and increasing the volume of the water retention ponds. EPA and the Commonwealth view the surface water control features to be a critical component of the selected remedy. Downslope flooding and increased rates of hillslope erosion are unacceptable; the initial closure period will focus on the best practicable means available to effectively mitigate potential erosion and downslope flooding.

Sections 10.1 and 10.2 of the Record of Decision specifically address site monitoring and maintenance of erosion control features.

(d) EPA concurs with the MF[illegible]'s comment on maintaining flexibility in the buffer zone acquisition. EPA views flexibility in the negotiations as the key to successful resolution of the negotiations. Protection of the hillslopes from detrimental activities which may affect the integrity of the remedy, and access to areas adjacent to the MFDS for the purpose of assessing remedy compliance and performance are essential to the selected remedy.

(e) In an effort to respond to the MFCC's concern regarding the elements of the monitoring and maintenance program at the MFDS, Sections 10.1 and 10.2 of the Record of Decision were expanded to further define the types of monitoring and maintenance planned for the MFDS. It is anticipated that monitoring of those items listed in the MFCC's comment will be performed. Both radionuclides and hazardous constituent testing will be performed, as specified in Section 10.1. Funding details are rarely available at this juncture; it would be premature to specify the entity who will pay for the remedy. It is anticipated that those details will be resolved during, or as a result of, subsequent negotiations with PRPs on the implementation of Remedial Design/Remedial Action.

(f) All of these tasks are included in the selected remedy. The Record of Decision specifies performance of these tasks in Sections 10.1 through 10.3.

(14) The Maxey Flats Concerned Citizens, Inc. (MFCC) submitted the following comment during the public comment period on the preferred remedy:

"Because of the expected heavy road traffic, we recommend that the PRP's finance local highway construction and repair. The PRP's suggest only discussions with Fleming County officials. We also suggest that the EPA give preference to hiring local people for the remediation project."

<u>EPA Response:</u>

In response to the MFCC's concerns over potential road damage during site remediation, Section 10.1 of the Record of Decision was expanded to further specify that "Should it be determined that site activities are having a detrimental effect on County Road 1895, the authority(ies) responsible for remediation of the MFDS will be responsible for funding such repairs." EPA concurs that if road conditions deteriorate as a result of MFDS remediation, that road repairs be funded and implemented by those responsible for remediation. However, at this juncture, the PRP's have not agreed to fund and conduct the remedy; therefore, EPA cannot specify that the PRPs pay for road repairs.

At this stage, the identity of the authority(ies) implementing the remedy has not been determined. However, it is reasonable to assume that some local people will be hired by the authority(ies) during various phases of the remediation project and that the remediation will tend to have a positive effect on the local economy.

(15) The Kentucky Resources Council submitted the following comment during the public comment period on the preferred remedy:

The establishment of buffer zones is supported; however, the Council is concerned that within the buffer zone, monitoring must be conducted for water discharged into ephemeral and intermittent stream channels, and for seeps occurring within the area.

EPA Response:

In Response to the Council's concerns over buffer zone monitoring, Section 10.1 of the Record of Decision was expanded to clarify that site monitoring activities will include areas within the Buffer Zone.

(16) The Maxey Flats Steering Committee submitted the following comment during the public comment period on the preferred remedy:

"On page 13 of the Proposed Plan, EPA lists four objectives for any remedial alternative. The last of these, "address site concerns at the community, state and federal levels," is not a technical objective at all and furthermore, has not plainly defined limits. Accordingly, it should not be an objective for the remedial action since it provides a blank check for modifying the preferred alternative."

EPA Response:

The Committee is correct in that "addressing site concerns" is not a technical objective and has not plainly defined limits. Accordingly, this remedial objective was dropped formally from the Record of Decision. EPA feels, however, that community, state and federal concerns should be recognized and addressed as appropriate. EPA believes that the public participation aspect of the remedy selection process has been very effective in communicating community and state concerns with regard to the selected remedy, and EPA intends to continue to respond to their concerns throughout remedy implementation. Moreover, these objectives have been stated in more specific terms in the selected remedy portion of the Record of Decision.

(17) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"Since the RI did not detect major contamination on the east hillside, all analysis of future monitoring well locations must be based on the Commonwealth's data.base for this area. Modeling of the fractured flow at MFDS will provide little useful information; therefore, location of new wells should be based on historical and RI data."

EPA Response:

EPA recognizes the extent to which the Commonwealth has compiled monitoring data for the MFDS and, as specified in the Record of Decision - Section 10.1, intends to utilize this information. However, EPA does not feel it is appropriate to preclude modeling as a tool at this point.

(18) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"Sumps must remain open for monitoring of potential entry of water into the trenches subsequent to remediation. The Commonwealth's present leachate level database must be utilized to evaluate present and future infiltration.

The E-wells and similar wells inside the restricted area should be sealed. However, the UE, UF, UG and UK wells installed by the USGS and monitored by the Commonwealth should be utilized to evaluate future contaminant migration."

EPA Response:

EPA concurs with the Commonwealth's concern over utilizing existing wells and sumps and the Commonwealth's database to evaluate present and future infiltration. Accordingly, Sections 10.1 and 10.2 specify use of the Commonwealth's historical information in evaluating infiltration, and specifies that those wells and sumps necessary for infiltration monitoring will remain open.

(19) U.S. Ecology submitted the following comments during the public comment period on the preferred remedy:

"(a) The geophysical survey should only be run on the outer perimeter of the site to identify outer cell boundaries. The center of the site will be covered with a continuous cap.

(b) There is no need for monitoring wells at the base of the hill in the surrounding stream alluvium.

(c) Final engineering design of the facility should determine the thickness of the cap for interim closure, and should be used to determine the size of the cap. The FS includes a 35 to 40 acre cap, where as the Proposed Plan indicates from 40 to 50 acres."

EPA Response:

(a) Details of the geophysical site survey will be determined during the design phase. EPA is not in a position at this time to preclude certain areas from the survey.

(b) EPA strongly disagrees with this comment.

(C) Final engineering design will further define a number of the stated remedy components, including cap thickness and extent. EPA reaffirms its position as outlined in the Proposed Plan that the cap could encompass 40 to 50 acres.

(20) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The interim trench site cover boundary must be better defined in the record of decision document. It is to cover the entire boundary of the current security fenced area plus some outside area to the edge of the hillslopes. It is critical that the maximum area be covered with no opening in the cover. This will minimize the exposure to lateral migration of water into the trenches and reduce the chances for having to install a barrier wall. The barrier wall design will be expensive and have exposures to not completely controlling any lateral migration."

EPA Response:

The areal extent of the interim trench cover can best be determined during the remedial design phase of the project, utilizing such information as geophysical survey data which will aid in defining the outer boundaries of the disposal cells and ground water modeling (in conjunction with evaluation of historical monitoring data) to aid in establishing the extent to which the cap can prevent infiltration into the trenches. EPA agrees that it is very important to cover the disposal area to the maximum extent necessary to prevent infiltration. Accordingly, the Proposed Plan and Record of Decision reflect a cap size ranging from 40 to 50 acres, as opposed to the 30 to 40 acre cap envisioned in the Feasibility Study Report.

(21) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"The retention of all the existing sumps in the trenches and any new ones installed during the trench dewatering process is absolutely necessary. This is the only way to assure that lateral migration of water into the trenches can be removed effectively. I demand that all of these sumps be left in place and protrude through the site cover to permit access to the sumps for any liquid removal and an absolute reliable measurement of liquids in the sumps wells. The flexible gasket suggested in the Kentucky proposal should be utilized to assure the integrity of the site cover with the event of subsidence in the area."

EPA Response:

EPA equally recognizes the importance and function of sumps and wells for future detection monitoring at the MFDS. Section 10.1 of the Record of Decision specifies the closure only of poorly designed wells (i.e., E-wells) that could allow contaminants in ground water to migrate downward into the lower geologic units. Section 10.1 also specifies that riser pipes will be used, during construction of the caps, to extend wells and sumps through the cap for the purpose of monitoring. Flexible gaskets and other similar devices will be considered during the design phase. EPA agrees that the device used will have to assure the integrity of the site cover in the event of subsidence in the area.

(22) Representative Pete Worthington submitted the following comment during the public comment period on the preferred remedy:

"I would like to propose the following criteria for evaluating the need to install a barrier wall for precluding lateral migration. Any lateral migration must be less than the amount to raise the water level in any sump by more than "x" feet. This level must be kept to a minimum to assure the hydraulic head is low enough to maintain an acceptable leaching factor. When and if the acceptable water level is exceeded. A cost evaluation should be performed to study the most cost effective option of either installing a barrier wall or the on-going removal of trench water in the same process used in the initial trench dewatering phase."

EPA Response:

EPA and the Commonwealth believe that the decision on installation of the horizontal flow barrier should be based on a statistical analysis of information obtained during the leachate extraction program, from the infiltration monitoring system, from ground water modeling in conjunction with existing monitoring data. Cost evaluations could also be performed, as suggested, if lateral infiltration is occurring. Placing a numerical value on the acceptable rise of water levels may be premature at this point, and could preclude installation of a flow barrier when in fact one may be necessary. Conversely, unnecessary costs could also be incurred without further information and analysis to support placement of a numerical value.

(23) The Gateway Health Coalition, Inc. expressed concern, during the public comment period on the preferred remedy, that the preferred remedy may allow ponding of rainwater over the trench disposal area and suggested that the topography of the disposal area be modified to promote drainage away from the waste.

EPA Response:

The selected remedy, as specified in Section 10.1 of the Record of Decision, calls for the re-contouring of the trench disposal area, after the trenches are pumped and while new soil is being placed over the area. Prevention of ponding over the trench disposal area is very important and every effort will be made to divert water away from the waste without accelerating surface water flow to an extent that it causes erosion problems. The cap contours will be based on the consideration of the 40 to 50 acre cap as a whole, rather than contouring individual areas of the cap.

(24) The Gateway Health Coalition, Inc. suggested, during the public comment period on the preferred remedy, that intercept wells be installed between the site and the main plateau, to address potential lateral infiltration of ground water. The Coalition cited concerns with excavation difficulties involved with installation of a cutoff wall.

EPA Response:

Intercept wells can be effective in ground water restoration or prevention of ground water contaminant migration; however, this technology's effectiveness would probably be severely limited due to the difficulties typically experienced in fractured bedrock, such as in the MFDS area.

(25) A local resident suggested, during the public comment period on the preferred remedy, that water control structures such as gabions and subsurface drains be used in the natural drains of No Name, Drip Springs hollows and the Willie Skaggs Rock Lick hollow, and that multi-staged outlets on the retention ponds be used.

EPA Response:

A variety of water control devices will be evaluated and/or used to effectively control surface water runoff and consequent hillslope/ drainage channel erosion. Gabions are mentioned in the Selected Remedy portion of the Record of Decision as a potential device to be used. Improvements to the natural drains is also discussed, with the emphasis placed on adequate control of surface water flow in order to achieve acceptable rates of surface water runoff, equitable distribution of runoff, mitigation of rates of erosion, and prevention of downslope flooding.

(26) A vendor suggested, during the public comment period on the preferred remedy, that EPA not specify a particular thickness (80 mil) for the synthetic liner included in the final cap. The vendor expressed concern that potentially superior liners may be excluded if a thickness was determined at this time. The vendor cited, as an example, that a less thick geomembrane will be commercial within the next 2 years, having a lifespan in excess of 100 years.

EPA Response:

EPA does not wish to exclude a potentially superior liner from use at the MFDS; therefore, the selected remedy will specify that a liner having a thickness of 80 mils, or other sufficiently similar geomembrane, be incorporated into the final cap design.

(27) A landowner asked EPA, at the June 13, 1991 public meeting, to describe the Agency's plans for the buffer zone during remedial design, specifically asking if EPA will construct earthen barriers in the buffer zone to stop horizontal movement of leachate in the trenches.

EPA Response:

At a minimum, EPA has considered the hillslopes surrounding the MFDS and some additional areas in the direction of Rock Lick Creek for the buffer zone. EPA met with the landowners on May 22, 1991 and informed them that plans for the use of the buffer zone are flexible. Because each landowner's circumstances are unique, EPA will work with the landowners on a one-to-one basis to determine what is best for each. In the coming months, EPA will talk with the landowners individually and as a group to reach agreements regarding access and other needs. EPA and the Commonwealth plan to use the buffer zone as a zone for monitoring and restricted land use purposes. No major construction activities, other than well installation and sampling stations, are planned for the buffer zone.

(28) A citizen, at the June 13, 1991 public meeting, asked EPA to describe the composition and depth of the horizontal flow barrier.

EPA Response:

EPA has not determined the necessity of the horizontal flow barrier, nor the makeup and depth of the barrier, if needed. Typically, the barrier is a mixture of cement, water and other additives such as bentonite or flyash, that would harden after injection into the ground, forming a wall that would serve as a barrier to horizontal ground water flow into the trenches. The Commonwealth has suggested that the barrier be installed down to the Henley Bed, which is approximately 80 to 100 feet deep at the MFDS. This Commonwealth's suggestion and other options will be evaluated if and when it is determined that a horizontal flow barrier is needed.

(29) A resident expressed concern, at the June 13, 1991 public meeting, about the possibility that EPA will not construct a horizontal flow barrier. The Proposed Plan indicated that a horizontal flow barrier will be implemented "if required", and the resident commented that, because of the geology of the region, this barrier, without question, will be needed.

EPA Response:

EPA, the Commonwealth, and the PRPs feel that there is sufficient uncertainty with regards to the hydrogeology at the MFDS to warrant additional data gathering and analysis prior to making a decision on the necessity of a horizontal flow barrier. Previous monitoring and modelling, using the information gathered from numerous studies, have not yielded conclusive information on the nature of lateral infiltration to the trenches. The Agency feels that the prudent approach to this issue is to obtain additional information during the initial stages of site remediation to use in the decision-making process. The selected remedy contains flexibility on this remedy component. A good source of information will be the trench leachate extraction program and infiltration monitoring system that will be in place, as well as historical Commonwealth monitoring data. Once this data is available, a decision can be made.

(30) A resident expressed concern, at the June 13, 1991 public meeting, that the longer EPA waits to make a decision on the horizontal flow barrier, the worse the contamination will get.

EPA Response:

Regardless of the decision on the horizontal flow barrier, one of the initial activities during remedial action will be initiation of the leachate extraction program. Once the trenches have been pumped dry, they should remain relatively dry by keeping vertical infiltration to a minimum through installation of the interim trench cap. Sumps and wells will remain in place in the event lateral recharge is occurring. The sumps and wells would be used to extract and solidify new leachate. Therefore, waiting until adequate information is available on which to make a determination on the need for a horizontal flow barrier will not worsen the contamination problems at the site.

Numerous discussions have been held on the hydrogeological flow conditions at the MFDS and the necessity of a horizontal flow barrier between experts from EPA, the Commonwealth, the United States Geological Survey, and private industry experts over the last four or five years. A strong consensus was never arrived at during these discussions. Therefore, EPA and the Commonwealth believe that it is more appropriate to base the decision of necessity, location, depth, and type of horizontal flow barrier on statistical analyses performed on trench dewatering data, infiltration monitoring data, and other historical monitoring data, rather than basing the decision on the opinion of one or a few.

E. Financial Concerns

(1) EPA received a number of comments at the June 13, 1991 public meeting and during the public comment period on funding aspects of the selected remedy. These comments concerned, primarily, such factors as the size of the trust fund, the discount rate used to establish the trust fund, administration of the trust fund and the contingency factor of the selected remedy.

EPA Response:

EPA appreciates the input of the Maxey Flats Concerned Citizens, Inc. and others who submitted comments relating to the financial details of the selected remedy. At this time, the specifics of the MFDS trust fund have not been established. It is anticipated that the financial details will be resolved in the Remedial Design/Remedial Action Consent Decree for the MFDS, which is subject to a 30-day public comment period as well. EPA will take the financial comments into consideration during the negotiations on the Consent Decree.

(2) A citizen inquired, at the June 13, 1991 public meeting, if EPA has included or will include a reopener clause in the preferred remedy.

EPA Response:

Yes. EPA provides standard reopener clauses in Superfund cleanup agreements (Consent Decrees). The extent and nature of the reopeners vary, depending on the specifics of the site and terms of the agreement.

(3) The technical advisor to the Maxey Flats Concerned Citizens, Inc. stated, at the June 13, 1991 public meeting and reiterated during the public comment period, that cleanup funds for the site should be sufficient to ensure that future generations can meet site closure needs.

EPA Response:

EPA recognizes that the adequacy of the trust fund to be established for the MFDS remediation, monitoring and maintenance will be a very important part of the Consent Decree negotiations and intends to fully address trust funds issues through that process.

(4) An attendee at the June 13, 1991 public meeting asked what will happen if there is not enough money to maintain the site.

EPA Response:

It is difficult to assess certain factors which may influence the availability of funds to cover future monitoring and maintenance needs, especially for a remedy where final construction could be 100 years or more and where monitoring and maintenance are to be carried out in perpetuity. Such factors include interest rates, inflation, administration of the trust fund, etc. EPA intends to draw upon financial experts who engage in these financial issues, and the Agency will be working closely with the Commonwealth, PRPs, and other parties to determine what funds may be needed, how the fund will be administered, etc. In all likelihood, details of the trust fund and administration of this fund will be included in the Consent Decree for the Remedial Design/Remedial Action. Standard reopeners will most likely be included to address the inherent uncertainties associated with a long-term remediation and monitoring/maintenance operation.

(5) The Maxey Flats Concerned Citizens, Inc. submitted the following comments during the public comment period on the preferred remedy:

"The EPA plan does not define the term "institutional controls." Institutional controls should consist of the following: deed restrictions, site security, site maintenance and monitoring and perpetual funding. A perpetual maintenance plan should be established for these purposes.

The deed restriction would inform potential purchasers of the site, and the State itself, that the property had been used for the disposal of radioactive waste and no activities were permitted that would disturb the integrity of the cover, and monitoring and erosion control systems. A survey plat and records of materials buried should be filed with the Fleming County Court and the Commonwealth.

Though not stated in the EPA's Proposed Plan, a site security fence and the posting of signs should also continue in perpetuity. If this is not done, the permanent cover over the site could be damaged and the trenches could again fill with water. As pointed out earlier, it is difficult to see how the state and federal agencies can exercise control over the site unless it were licensed."

EPA Response:

In an effort to respond to the MFCC's concerns over the ambiguity of institutional control activities at the MFDS, Section 10.3 of the Record of Decision has been expanded to accommodate the MFCC's comments.

(6) The technical advisor to the Maxey Flats Concerned Citizens, Inc. requested at the June 13, 1991 public meeting, and reiterated during the public comment period, that EPA establish funds for monitoring and maintenance activities, which will cover contingencies, local road construction and repairs, inflation and administration costs. The advisor further suggested that EPA calculate the amount of money to be placed in the fund by using a larger contingency factor (25%) and discount rate of 2%.

EPA Response:

Specifics of the trust fund will, in all likelihood, be spelled out in the Consent Decree for the Remedial Design/Remedial Action to be negotiated with the PRPs following issuance of this Record of Decision. The discount rates used in the Feasibility Study ranged from 4% to 10%, with 4% being the most conservative (i.e., a larger fund would be established upfront). For purposes of alternatives comparison, EPA used a 4% discount rate for the cost estimates provided in the Proposed Plan for each of the seven remedial alternatives. Discount rates and contingency factors may not reflect the actual discount rate or contingency factor agreed upon in the Consent Decree. The primary concern during establishment of the size of the trust fund will be to establish a fund sufficient in size to reduce the likelihood, to the extent practicable, of having to seek additional funds at a later date.

(7) The technical advisor to the Maxey Flats Concerned Citizens, Inc., and a local resident asked at the June 13, 1991 public meeting several questions relating to control of the funds: they wanted to know how the funds would be administered; the cost of administering the funds, and who would be responsible for issuing the fund monies. The technical advisor also asked EPA to identify the site licensees and to state whether or not the parties responsible for the cleanup would have immediate access to these funds.

EPA Response:

It has not yet been determined who will maintain or control the funds. The legal mechanisms for use of funds will, however, dedicate the fund monies for site remediation purposes only. Regardless of who controls the fund, the money will be limited to remediation of the site and will be inaccessible for any other use. Details of fund administration will most likely be spelled out in the Consent Decree.

The identity of the license holder many years from now and well into the monitoring and maintenance phase is not known at this time. Currently, the Commonwealth of Kentucky is the site license holder. Throughout the history of the MFDS, there existed only one other license holder at the MFDS, that being Nuclear Engineering Company during the period of site operation. Since 1979, the Commonwealth has held the license to the site.

(8) The Maxey Flats Steering Committee, during the public comment period on the preferred remedy, agreed with EPA's position that the actual discount rate used in determining the size of the trust fund would be determined during settlement discussions. The Committee offered to provide evidence to support use of the 4% or higher discount rate.

EPA Response:

EPA welcomes the input of the Committee on the appropriate discount rate as well as the input of other parties who feel that a lower discount rate should be used.

(9) The Commonwealth submitted the following comment during the public comment period on the preferred remedy:

"Cost estimates for Alternative 5 are low based on the Commonwealth's analysis of its plan submitted to the USEPA. It should be indicated that these costs were only used by the USEPA to compare alternatives and do not reflect expected cost of remediation and continued maintenance and monitoring in perpetuity."

"The Commonwealth feels a 2% discount rate should have been utilized instead of the 4% used in the Proposed Plan."

EPA Response:

EPA has specified in the Record of Decision that the cost estimates and discount rate of 4% were used solely to compare alternatives and that the actual cost estimate and discount rate used to establish the trust fund may differ.

(10) U.S. Ecology submitted comments, during the public comment period on the preferred remedy, relating to the Commonwealth's liability at the MFDS.

EPA Response:

EPA does not feel it is necessary or appropriate to respond to the liability issues raised by the commentor in this document.

(11) A resident asked, at the June 13, 1991 public meeting on the preferred remedy, if EPA will compensate landowners whose properties are in the designated buffer zone.

EPA Response:

Compensation will be offered to landowners during negotiations on the buffer zone. The negotiating party, as well as the exact boundaries of the buffer zone, have not yet been determined. However, land cannot simply be taken without some kind of compensation. It is the desire of EPA and the Commonwealth to assess the preferences of the individual landowners and negotiate an agreement that provides fair compensation and meets the buffer zone's objectives of restricting harmful activities on the hillslopes and ensuring long-term access to the buffer zone areas for the purpose of site monitoring. EPA and the Commonwealth will hold additional discussions with the landowners to determine their preferences and the mechanisms for lease, purchase, easements, land use restrictions, etc.

F. Environmental and Public Health Concerns

(1) Two citizens requested, at the June 13, 1991 public meeting, that EPA inform hunters in the Morehead and Flemingsburg area of the radioactive contaminants seeping from the MFDS, and to caution them not to hunt in the site vicinity. They asked if EPA plans to restrict hunting near the site or to issue a warning against eating game obtained in the site vicinity.

EPA Response:

EPA and the Commonwealth intend to further address the concerns regarding hunting and other activities that may be taking place on the hillslopes adjacent to the MFDS. The risk assessment, however, revealed that no significant risk exists from eating deer meat, currently. The risk assessment is a dynamic, on-going process, and the potential risk from the MFDS will be continually evaluated. EPA may sample the deer population, or other wildlife, in the area to confirm these findings. If additional findings show that the area is not safe, EPA and the Commonwealth will inform whomever may be affected and attempt to ensure that no one engages in activities that could put them at risk.

(2) A resident asked, at the June 13, 1991 public meeting, if radionuclides will concentrate in exposed animals or will be released from their bodies to the environment, over time.

EPA Response:

Each radionuclide has its own biological properties, which researchers consider as part of a sophisticated and thorough process of preparing mathematical models. Each mathematical model represents one radionuclide, and analyzes each tissue relative to the animal body. Some radionuclides accumulate, and others do not. Tritium, which is the predominant radionuclide at the MFDS, does not reconcentrate.

(3) A citizen expressed concern at the June 13, 1991 public meeting about the Strontium-90 found at the site, stating that this biochemical enters the food chain and already has appeared in milk and elsewhere.

EPA Response:

The risk assessment for the MFDS modeled 16 radionuclides, including tritium and strontium-90. Strontium-90 migrates more slowly than tritium because strontium-90 tends to react with chemical elements in the soil or to adhere to soil particles. Consequently, its movement is slowed by contact with the soil. In all likelihood, by the time strontium-90 would reach a location, such as in a well, where it could be accessible, the radioactivity would have decayed significantly. In addition, the concentration of strontium-90 in the leachate is much, much lower than in the case of tritium. Tritium is still, by far, the predominant radionuclide at the MFDS.

(4) A resident commented, at the June 13, 1991 public meeting, that she lives about two and one-half miles from the MFDS, and that samples of her well demonstrate that it is contaminated. Because of her rural location, she cannot get water piped to her house, and she has been hauling water from miles away to her home. She asked how EPA could help her family.

EPA Response:

EPA and the Commonwealth pursued the commentor's concerns subsequent to the public meeting. Discussions with the resident indicated that the contamination referred to in the comment was fecal choloform bacterial contamination, most likely due to the source of drinking water (hand dug well) and the presence of animal wastes in the vicinity of the well, as reported by the Fleming County Health Department. The Commonwealth collected and analyzed a sample of the well water for radionuclides; the test results did not reveal the presence of any radionuclides. The resident currently transports drinking water from a county water line tap located approximately one mile from the house. The resident is currently working with various authorities to have the county water line extended to the resident's house.

G. Public Involvement

(1) Representative Pete Worthington asked, at the June 13, 1991 public meeting, two related questions: 1) how carefully EPA will consider the comments expressed at the public meeting and during the 60-day public comment period, and 2) how EPA could consider public comments received in August 1991 carefully when the Agency plans to make a final remedy selection in September 1991.

EPA Response:

Public comments are important to the remedy selection process, and EPA seriously considered every comment received on the Proposed Plan for the MFDS. Where a comment warranted a change in EPA's Proposed remedy, EPA modified the remedy. For instance, commentators brought it to the attention of the EPA that the extent to which monitoring in the buffer zone would be performed was ambiguous, and environmental monitoring was not included in the Proposed Plan alternatives. The Record of Decision was revised to further specify buffer zone monitoring and environmental sampling. These are examples of two good comments that were received in August and subsequently incorporated into the Record of Decision.

(2) A citizen asked, at the June 13, 1991 public meeting, if the Risk Assessment will be available in the Administrative Record.

EPA Response:

Yes. The Risk Assessment is included in the Feasibility Study as Appendix D. The Feasibility Study can be found in both information repositories in the Fleming County Public Library and Rowan County Public Library. Additionally, the Feasibility Study Report (Appendix D included) is contained in the Administrative Record file which is contained in both information repositories. EPA's Addendum Report to the FS Report is also available in the repositories and contains additional information regarding site risk calculations and the risk assessment.

APPENDIX B

NUMERIC CRITERIA FOR APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

RELEVANT AND APPROPRIATE CONTAMINANT-SPECIFIC REQUIREMENTS FOR THE MAXEY FLATS DISPOSAL SITE SELECTED REMEDY

Clean Water Act - Water Quality Criteria (ug/l)

Chemical	Aquatic Life: Acute (1-Hour Average)	Aquatic Life: Chronic (4-Day Average)	Human Health[a]: Fish Only
Nickel	790/1400/2500[d]	88/160/280[e]	100
Vinyl Chloride	b	b	5246[c]
Benzene	5300[f]	b	400.0[c]
Chloroform	28,900[f]	1240[f]	157.0[c]
1,2-dichloroethane	118,000[f]	20,000[f]	2430.0[c]
Trichloroethylene	45,000[f]	21,900[f]	807.0[c]
Arsenic	b	b	.175[c]
Lead	34/82/200[d]	1.3/3.2/7.7[e]	b
bis(2-ethylhexyl) phthalate	940	3	b
Chlorobenzene	250[f]	50[f]	488
Toluene	17,500[f]	b	424,000

Notes:

a) Assumed intake is 6.5 grams of fish per day for a 70-year lifetime. EPA assumes an adult body weight is 70 kilograms.
b) Clean Water Act - Water Quality Criteria are not available for this contaminant.
c) The value was calculated assuming risk levels of 10^{-5} per lifetime.
d) Because the toxicity of nickel is dependant on hardness, EPA's acute criterion is expressed as a formula: $e^{(0.8460 [\ln (\text{hardness})]+ 3.3612)}$. The criteria above were calculated using this formula, assuming hardness equal to 50, 100, and 200 mg/l as $CaCO_3$.
e) EPA's formula for calculating chronic criteria is: $e^{(0.8460[\ln (\text{hardness})]+ 1.1645)}$. The criteria above were calculated using this formula, assuming hardness equal to 50, 100, and 200 mg/l as $CaCO_3$.
f) Lowest observed effect level.

TABLE A-1

APPLICABLE ACTION-SPECIFIC AND CONTAMINANT-SPECIFIC REQUIREMENTS FOR REMEDIAL ALTERNATIVES AT MAXEY FLATS

RADIOLOGICAL CONTAMINANTS

Ky Average Radionuclide Concentrations[1]
(uCi/ml)
(902 KAR 100:025)

	Table[2]		Table II[3]	
	Air	Water	Air	Water
Strontium-90	1×10^{-9} (S)[4] 5×10^{-9} (I)[5]	1×10^{-5} 1×10^{-3}	3×10^{-11} 2×10^{-10}	3×10^{-7} 4×10^{-5}
Plutonium-238	2×10^{-12} (S) 3×10^{-11} (I)	1×10^{-4} 8×10^{-4}	7×10^{-14} 1×10^{-12}	5×10^{-6} 3×10^{-5}
Thorium-232	3×10^{-11} (S) 3×10^{-11} (I)	5×10^{-5} 1×10^{-3}	1×10^{-2} 1×10^{-2}	2×10^{-6} 4×10^{-5}
Americium-241	6×10^{-12} (S) 1×10^{-10} (I)	1×10^{-4} 8×10^{-4}	2×10^{-13} 4×10^{-12}	4×10^{-6} 3×10^{-5}
Cobalt-60	3×10^{-7} (S) 9×10^{-9} (I)	1×10^{-3} 1×10^{-3}	1×10^{-8} 3×10^{-10}	5×10^{-5} 3×10^{-5}
Cesium-137	6×10^{-8} (S) 1×10^{-8} (I)	4×10^{-4} 1×10^{-3}	2×10^{-9} 5×10^{-10}	2×10^{-5} 4×10^{-5}
Carbon-14	4×10^{-6} (S) 5×10^{-5} (Sub)[6]	2×10^{-2} -	1×10^{-7} 1×10^{-6}	8×10^{-4} -
Hydrogen-3 (tritium)	5×10^{-6} (S) 5×10^{-6} (I) 2×10^{-3} (Sub)	1×10^{-1} 1×10^{-1} -	2×10^{-7} 2×10^{-7} 4×10^{-5}	3×10^{-3} 3×10^{-3} -

1. For any possession or use of any source of ionizing or electronic product radiation and for regulating the disposal and handling of radioactive waste in restricted areas. Average concentrations of radioactivity in air or water above natural background. Exceptions exist.

2. Used for limiting individual exposure in restricted areas, sanitary sewer releases, and others.

3. Used for exposure to minors (under 18), exposure in unrestricted areas, exposure at the boundary of a restricted area, incident notification, and others.

4. (S) means Soluble.

5. (I) means Insoluble.

6. (Sub) means Submersion.

Source: Radioactive Materials 1986 (possession, use and disposal of radioactive waste and material), 902 KAR 100, Kentucky Cabinet for Human Resources.

CURRENT and PROPOSED MCLs, MCLGs, and SMCLs

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
INORGANICS			
Aluminum (1/91)			0.05-0.2
Antimony (7/90)	* 0.01/0.005	* 0.003	
Arsenic (NPDWR)	0.050		
Asbestos (1/91)	7 million fibers/liter (>10 um)		
Barium (NPDWR)	1.00		
Barium (1/91 **)	* 2	* 2	
Beryllium (7/90)	* 0.001	* 0	
Cadmium (1/91)	0.005	0.005	
Chloride (NSDWR)			250
Chromium (1/91)	0.1	0.1	
Color (NSDWR)			15 color units
Copper (8/88)	* 1.3	* 1.3	1
Corrosivity (NSDWR)			Noncorrosive
Cyanide (7/90)	* 0.2	* 0.2	
Fluoride (4/86)	4.0		2.0
Foaming Agents (NSDWR)			0.5
Iron (NSDWR)			0.3
Lead (NPDWR)	0.050		
(8/88)	* 0.005	* 0	
(6/90)	0.015 (Action Level)		

* - Proposed MCL and MCLG

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
Manganese (NSDWR)			0.05
Mercury (1/91)	0.002	0.002	
Nickel (7/90)	* 0.1	* 0.1	
Nitrite (as N) (1/91)	1	1	
Nitrate (as N) (1/91)	10	10	
Total (as N) (1/91)	10	10	
Odor (NSDWR)			3 threshold odor #
pH (NSDWR)			6.5 - 8.5
Selenium (1/91)	0.05	0.05	
Silver (1/91)			0.1
Sulfate (NSDWR)			250
Sulfate (7/90)	*400/500	*400/500	
Thallium (7/90)	* 0.002/0.001	* 0.0005	
Total Dissolved Solids (NSDWR)			500
Zinc (NSDWR)			5

* - Proposed MCL and MCLG

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
ORGANICS			
Acrylamide (1/91)	TT	0	
Adipates [Di(ethylhexyl)adipate] (7/90)	* 0.5	* 0.5	
Alachlor (1/91)	0.002	0	
Aldicarb (1/91 **)	* 0.003	* 0.001	
Aldicarb sulfone (1/91 **)	* 0.003	* 0.002	
Aldicarb sulfoxide (1/91 **)	* 0.003	* 0.001	
Atrazine (1/91)	0.003	0.003	
Benzene (7/87)	0.005	0	
Carbofuran (1/91)	0.04	0.04	
Carbon Tetrachloride (7/87)	0.005	0	
Chlordane (1/91)	0.002	0	
2,4-D (1/91)	0.07	0.07	
Dalapon (7/90)	* 0.2	* 0.2	
Dibromochloropropane (DBCP) (1/91)	0.0002	0	
o-Dichlorobenzene (1/91,5/89)	0.6	0.6	0.01
p-Dichlorobenzene (7/87)	0.075	0.075	
p-Dichlorobenzene (1/91,5/89)			0.005
1,2-Dichloroethane (7/87)	0.005	0	
cis-1,2-Dichloroethylene (1/91)	0.07	0.07	
trans-1,2-Dichloroethylene (1/91)	0.1	0.1	
1,1-Dichloroethylene (7/87)	0.007	0.007	
Dichloromethane (Methylene chloride) (7/90)	* 0.005	* 0	
1,2-Dichloropropane (1/91)	0.005	0	
Diquat (7/90)	* 0.02	* 0.02	
Dinoseb (7/90)	* 0.007	* 0.007	
Endothall (7/90)	* 0.1	* 0.1	
Endrin (NPDWR)	0.0002		
Endrin (7/90)	* 0.002	* 0.002	

* - Proposed MCL and MCLG

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
ORGANICS			
Epichlorohydrin (1/91)	TT	0	
Ethylbenzene (1/91,5/89)	0.7	0.7	0.03
Ethylene dibromide (EDB) (1/91)	0.00005	0	
Glyphosate (7/90)	* 0.7	* 0.7	
Heptachlor (1/91)	0.0004	0	
Heptachlor epoxide (1/91)	0.0002	0	
Hexachlorobenzene (7/90)	* 0.001	* 0	
Hexachlorocyclopentadiene[HEX] (7/90)	* 0.05	* 0.05	0.008
Lindane (1/91)	0.0002	0.0002	
Methoxychlor (1/91)	0.04	0.04	
Monochlorobenzene (1/91)	0.1	0.1	
Oxamyl [Vydate] (7/90)	* 0.2	* 0.2	
PAHs: (7/90)			
Benzo(a)pyrene	* 0.0002	* 0	
Benzo(a)anthracene	* 0.0001	* 0	
Benzo(b)fluoranthene	* 0.0002	* 0	
Benzo(k)fluoranthene	* 0.0002	* 0	
Chrysene	* 0.0002	* 0	
Dibenzo(a,h)anthracene	* 0.0003	* 0	
Indenopyrene	* 0.0004	* 0	

* - Proposed MCL and MCLG

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
Pentachlorophenol (1/91 **,5/89)	* 0.001	* 0	0.03
Phthalates [Di(ethylhexyl)phthalate] (7/90)	* 0.004	* 0	
Picloram (7/90)	* 0.5	* 0.5	
Polychlorinated biphenyls(PCBs) (1/91)	0.0005	0	
Simazine (7/90)	* 0.001	* 0.001	
Styrene (1/91,5/89)	0.1	0.1	0.01
2,3,7,8-TCDD (Dioxin) (7/90)	* 5x10E-8	* 0	
Tetrachloroethylene (1/91)	0.005	0	
Toluene (1/91,5/89)	1	1	0.04
Toxaphene (1/91)	0.003	0	
2,4,5-TP Silvex (1/91)	0.05	0.05	
1,1,2-Trichlorethane (7/90)	* 0.005	* 0.003	
1,2,4-Trichlorobenzene (7/90)	* 0.009	* 0.009	
1,1,1-Trichloroethane (7/87)	0.20	0.20	
Trichloroethylene (7/87)	0.005	0	
Trihalomethanes (NPDWR)	0.100		
Vinyl Chloride (7/87)	0.002	0	
Xylenes (1/91,5/89)	10.00	10.00	0.02

* - Proposed MCL and MCLG

CHEMICAL	MCL (ppm)	MCLG (ppm)	SMCL (ppm)
MICROBIALS			
Coliform bacteria (6/89)	< 1/100 ml	0	
Giardia lamblia (6/89)	TT	0	
Heterotrophic bact. (6/89)	TT	0	
Legionella (6/89)	TT	0	
Viruses (6/89)	TT	0	
Turbidity	1 TU (up to 5 TU)	(units of turbidity)	
RADIONUCLIDES			
Beta particle and photon radioactivity	4 mrem	0	
Gross Alpha particles	15 pCi/l	0	
Radium-226 and Radium-228 (Total)	5 pCi/l	0	

* - Proposed MCL and MCLG

FOOTNOTES

11/85	50 Federal Register (FR), November 13, 1985
4/86	51 FR, April 2, 1987 - Final MCLs and SMCLs
7/87	52 FR, July 8, 1987 - Final MCLs and MCLGs
8/88	53 FR, August 18, 1988 - Proposed MCLs and MCLGs
5/89	54 FR, May 22, 1989 - Proposed SMCLs
6/89	54 FR, June 29, 1989 - Final MCLs and MCLGs
6/90	Action level for lead in drinking water, June 21, 1990, Memorandum from the Office of Emergency and Remedial Response and the Office of Waste Program Enforcement
7/90	55 FR, July 25, 1990 - Proposed MCLs, MCLGs, and SMCLs
1/91	56 FR, January 30, 1991 - Final MCLs, MCLGs, and Proposed SMCLs
1/91 **	56 FR, January 30, 1991 - Re-proposed MCLs and MCLGs

MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NPDWR	National Primary Drinking Water Regulation
NSDWR	National Secondary Drinking Water Regulation
PAHs	Polynuclear Aromatic Hydrocarbons
SMCL	Secondary Maximum Contaminant Level
TT	Treatment Technique

* - Proposed MCL and MCLG

APPENDIX C

PUBLIC MEETING TRANSCRIPT

FOR THE

JUNE 13, 1991 PUBLIC MEETING

ON THE

MAXEY FLATS DISPOSAL SITE PROPOSED PLAN

The United States Environmental Protection Agency

PUBLIC MEETING

PROPOSED REMEDIAL ACTION PLAN

MAXEY FLATS DISPOSAL SITE

FLEMING COUNTY, KENTUCKY

June 13, 1991
Ersil P. Ward Elementary School
State Road 32

REPORTED BY:
Shirley H. Porter
Official Court Reporter
19th Judicial Circuit
Mason County Courthouse
Maysville, Kentucky 41056
606/564-7322

APPEARANCES & PRESENTERS

MR. ED STORY - President, Maxey Flats Concerned Citizens, Inc.

MR. DAVID KLUESNER - Remedial Project Manager, U.S. EPA

MR. JOHN VOLPE - Kentucky Cabinet for Human Resources

MR. JOHN MAURO - Sandy Cohen & Associates, for U.S. EPA

MS. SUZANNE DURHAM - Community Relations Coordinator, U.S. EPA

MS. MARY WILKES - Regional Counsel, U.S. EPA

MR. MARVIN RESNIKOFF - Technical Advisor, Maxey Flats Concerned Citizens, Inc.

MR. BILL WEBSTER - Representing Potentially Reponsible Parties, Maxey Flats Steering Committee

I N D E X

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(At approximately 7:00 P.M. on June 13, 1991, at the Ersil P. Ward Elementary School, State Road 32, Flemingsburg, Kentucky, the following proceedings were had:)

ED STORY

INTRODUCTION:

MR. STORY: Good evening. We are going to call this meeting to order at this time.

It is my pleasant chore to welcome you to this public meeting concerning the Maxey Flats Disposal Site.

The first thing I would like to say is a special welcome to those of you from out of the Commonwealth. We have people here from all around the south, and we certainly hope you had a nice flight or a pleasant drive into the Commonwealth. It is a beautiful time of year in the State of Kentucky; so we are glad to have you. Those of you from Frankfort and other officials, we welcome you. I think there are people representing just about all phases of this particular problem in the audience tonight, and, of course, a very special welcome to those citizens of Fleming County and Rowan County that are in our audience, because you have a vested interest in this particular problem, and I guess it has been some time since we have been in this particular location at Ersil P. Ward Elementary School in a town or an area - or town meeting, if you please. At that time, we were frustrated and a little bit ragged around the edges, I believe. I think tonight you are going to see a different presentation.

It seems like many times those of you who worked with it closely that this has dragged out forever, and I think those of you who live close to it feel that way, certainly, but we are getting closer and closer, and perhaps, tonight, this will be a refreshing meeting.

We are getting closer to actually making a closure decision, and so with those thoughts in mind, I am going to turn this meeting over to those officials of the Environmental Protection Agency who have worked long and hard on trying to sort through all of the data, and all of the complaints, and all the possible closure strategies and let them inform us now of what the best closure mechanism might be, and it is my pleasure to introduce to you, at this time, David Kluesner.

David has been working with us for the last three or four years, and we have gotten to know each other rather well, and I think that he has a lot of things that he wants to share with all of us, and hopefully, we will be able to live with most of those.

So, at this time, I would like to present David to you. He will introduce all of the speakers who follow. As we get ready for this, if you have - this is going to be a formal presentation, and we have several speakers making presentations; after we have listened to several, we will have a short break, perhaps, whatever David says, and then we will come back and finish those, and then there will be a time of questions and answers, but what I would like for you to do, if you don't mind, is - even on your program there is a place for you to write your thoughts down, and then at the end, you can ask those questions, if someone hasn't covered it, because different speakers will cover different aspects of the program tonight. David.

DAVID KLUESNER

INTRODUCTION:

MR. KLUESNER: Thank you, Ed.

My name is David Kluesner. I am with the Environmental Protection Agency out of our Regional Office in Atlanta, Georgia, and I am the Project Manager for the Maxey Flats Disposal Site for EPA.

Before we get started again, there are just a few ground rules. The local school officials have informed me that we do have a no smoking policy for this room; so, if you have the urge, please step outside, and we would appreciate that.

To my left, we have a court reporter. Her job is to take, verbatim, everything that is said tonight; this is nothing unique to this site. We have court reporters attend each meeting to announce that we have a preferred remedy. This is a - I believe, a first meeting on Maxey that we have had a court reporter, but then, again, this is the first time we have announced a preferred remedy; so, her job is to take down all that is said tonight; more importantly, to put down, in writing, your comments and questions as we get into the question and answer session.

What we do, after we make a final decision, or when we make a final selection is write up what we call a Responsiveness Summary, and this Responsiveness Summary will respond to your questions and comments that we receive tonight, and then the 60 day comment period that will follow, and so it is very important that when we get into the questions and answers that you go up to the microphone and state your questions clearly, so that we can put that down, and I don't care if you give your name or not; that is not important to me; you can give your name if you want to, but that is just what we have the court reporter for.

At the end of the presentation, and we have about 90 minutes of presentations, about an hour and a half; please bear with us on it. There's - we could probably spend hours and hours talking; we don't want to bore you to death; we just want to hit the highlights; we want to get into the - the good part of this presentation, the preferred remedy, and get into the questions and comment period; so, we are going to take a break after that 90 minute period; have a five minute break, and then come back and entertain any questions and comments which you may have. Before we get into the presentations, I would like to introduce to you tonight some speakers.

On my left there is John Volpe, Manager of the Radiation and Control Branch of the Human Resources Cabinet of Kentucky.

John Mauro, on my left. John is with Sandy Cohen & Associates, which is a consultant to EPA.

On my left, we have Suzanne Durham. Suzanne is with the EPA Regional Office in Atlanta, and Suzanne is Community Relations Coordinator.

Again, on my right, is Mary Wilkes. Mary is with our office of Regional Counsel for EPA in Atlanta. Mary is our attorney for Maxey Flats.

There are a few other guests I would like to recognize at this time; behind me is Bob Jordan. Bob is Chief of the North Superfund Branch for EPA in our Regional Office.

And Don Hughes. Don is Director of the Division of Community Safety of the Human Resources Cabinet.

Carl Millanti. Carl is with the Natural Resources Cabinet of Kentucky.

And Kevin Imes, also with the Natural Resources Cabinet.

As part of my introduction, I do want to just sort of tell you where Maxey fits into what we call the Superfund process.

Maxey Flats Disposal Site is on EPA's National Priorities List, and the National Priorities List is a list of sites across the nation that are eligible for federal funds for investigation and cleanup.

The law has given us the authority to investigate and clean up sites on the National Priorities List, and it is called, CERCLA, and CERCLA is Comprehensive Environmental Response, Compensation and Liability Act, and that is a mouthful.

This Act created a Trust Fund which is oftentimes called, Superfund; thus the name that you oftentimes hear, the Superfund Site.

Superfund sites go through a step by step process to finally achieve site cleanup.

First, the site must qualify to be placed on the National Priorities List.

It has to receive certain numerical ranking in order to make this list; once it is on the National - once it is placed on the National Priorities List, we conduct what we call a

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Remedial Investigation and a Feasibility Study, and this is the process or point at which we are about ready to conclude.

After the Remedial Investigation and Feasibility Study, we then get into the selection of remedy and remedy design.

That is a very brief presentation of the outline or the process of which we go through for sites that are on the National Priorities List.

We are here tonight to describe to you the preferred remedy, primarily, and the community's role in the remedy selection process.

We are all here tonight to discuss with you the results of the Remedial Investigation and the Risk Assessment, and the Feasibility Study that were performed for the Maxey Flats Site.

A lot of you in the audience tonight have heard this before; there have been previous meetings; meetings put on by the EPA; meetings put on by the Maxey Flats Concerned Citizens Group, and meetings put on by Potentially Responsible Parties, or the Maxey Flats Steering Committee, that performed the Remedial Investigation and Feasibility Study; so, some of you, when we get into the

Remedial Investigation and Feasibility Study discussion, it might be something that you have already heard before, but just bear with us; I think there are some new people in the audience, and we are trying to hit the highlights of the Remedial Investigation and Feasibility Study.

We are also here tonight to let you know what you can expect out here tonight; we are at an important point in the process of achieving site cleanup. We are at the decision-making point. It is time to make a decision, and it is time to move forward.

We are here to inform, and we are here to listen to you; so, with that, I will hand it over to Dr. Volpe to make a presentation on Site Background and History.

DR. JOHN VOLPE

SITE BACKGROUND & HISTORY:

DR. VOLPE: Thank you, David.

I have been asked tonight to provide a brief overview of the site and history of Maxey Flats.

I will start by saying that in 1962, Kentucky entered into an agreement with the U. S. Ecology

Commission, now the U. S. Nuclear Regulatory Commission, to assume all regulatory authority for low-level waste in the Commonwealth.

In 1962, the Nuclear Engineering Company purchased 280 acres of land at Maxey Flats; the area in brown is the licensed area site.

The sole purpose of this purchase by the Nuclear Engineering Company was to use this land as a low-level disposal site.

In 1963, this land, as shown, was deeded to the Commonwealth, and then leased back to Nuclear Engineering Company, as required by law.

The lease was for 25 years, with an option for an additional 25 years.

In 196--in January of 1963, the Commonwealth issued a license to Nuclear Engineering Company for the disposal of low-level waste at Maxey Flats.

In May of 1963, the site opened for receipt of waste.

During - the - the next slide, this slide, here, basically shows you a picture of the terrain of Maxey Flats which contained approximately four point eight (4.8) million cubic feet of low-level waste, and approximately two and a half (2-1/2) million pico curie for radioacti\

materials.

The central and western series, I will show you, if I may, the central and western series present, these here, were the first trenches constructed at the site; these bottom on the lower sandstone, what we call a lower sandstone marker bed, and I hope that David will get into some of this geology, and if not, we will go through it later on, but it is important to understand that these trenches involved on this fractured geology or this sandstone, because the primary mechanism in moving from the western and central series trenches is by the fracture in that lower sandstone.

The Forty - what we call the Forty-Series trenches were constructed in the early to mid-seventies. These are very long and very deep trenches, and they differ significantly from the central and western series in that they are faced to what we call the Lower Nancy; this is above what is also geology, it is called the Upper Farmers, and again, it is important for you to understand the construction differences in these trenches, because the migration of material from the trenches is different, whether

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it be the central series; whether - or the western series, or the Forty Series, and so that is why I am pointing these historical points out to you.

The next point is the waste form at Maxey Flats, which is very important for you to understand.

The next two slides that I am going to show you are pictures of open trenches at Maxey Flats. This is Trench 35, and it shows how the waste is placed in the trench. It was essentially a heterogeneous mixture of waste; it consisted of cardboard boxes, wooden boxes, and as you can see, it contains some equipment, metal barrels; just about anything you can think of.

The nature of the waste stream at Maxey Flats is very important for you to understand in considering the remedy at this particular site; again, the reason is that we are going to have to deal with it not only with this waste that is in the trenches now, but we are going to have to deal with the three million gallons of leachate that we are going to have to take out of these trenches and solidify or something and dispose of them, and so we are going to increase our volume of waste that we have at the site.

I would also like to indicate - and I will show you one more picture of the waste form so that you will get a real good idea of what we are dealing with here.

What I also would like to point out when you think about Maxey is that liquid waste was also deposited at the site up until 1971, at which time the receipt of this waste was prohibited.

Liquid waste is handled in a significantly different fashion than we saw here. It was solidified and buried usually in large shallow trenches. The amount of radioactive material in these trenches - in these slit - what you call slit trenches was very minimal compared to what was in the Central-Western, and in the Forty-Series trenches. They do not present the hazards that the other trenches would have.

In addition to the trenches that I have mentioned, there are eight hot wells utilized to bury very high specific activity, radioactive material in concealed sources and other types of material.

Okay, what caused our problem at Maxey -

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well, water, basically, accumulated in the trenches by the trench cap; seepage of ground water went through the Upper Nancy and to some of the sandstone bed at the site, or a combination of both. The infiltration of the water resulted in acceleration - or accelerated the decomposition of the material that you saw in the trenches; mainly the cardboard boxes and the wooden boxes; not so much - not so much the metal containers and so forth and so on.

As the water entered the trenches, it didn't leave unfortunately; this is because of the geology.

In 1972, the Commonwealth initiated a plan to pump and treat the water that was in the trenches, and this was done by the use of this evaporator that many of you have seen on the site.

The evaporator was used from 1972 to 1986, and approximately eight and a half million gallons of leachate was processed through this evaporator.

To bring us to where the contamination problems started, in the early '70's, specifically, 1974, the Commonwealth conducted a number of studies surrounding the site; what was shown by these studies that elevated levels were found of radioactive material around the site, itself; within the boundary, and sometimes outside the boundary of the site.

This study set off - set in motion many studies that were conducted during the mid to late '70's, early '80's.

'74 studies, however, concluded by stating that although the levels were elevated, there wasn't a problem with respect to public health and safety and environment.

Okay, and I need to go back to one of the earlier slides, if this will work; get back to the trenches.

To show you why the site was closed - if I can get it up here; well, forget it.

What brought the site to closure was the in 197- - May, 1977, the Trench 46 was opened, and it was noted while opening the trench that at the south end of the trench, seepage was forming along the lower sandstone. This trench was one of the deeper trenches on the site at Maxey Flats and down at the lower end.

It was documented in the summer of that year that this seepage contained radioactive material, specifically, Tritium and Cobalt.

Basically, what this indicated was that the geology was not capable of maintaining the radio-active material within the boundaries of the trenches.

In 19 - in late - in December of 1977, this lead to a modification of the license, which stated you could no longer receive waste, commercial waste for burial at the site.

Since 19 - in 1978, May of 1978, the Commonwealth assumed the responsibility and terminated the lease between NECO and itself.

Since '78, the Commonwealth has maintained the site; maintained and monitored the site in order to protect public health and safety.

In 1981, the Commonwealth, which is another important point that you should understand; what I am trying to do is cover the highlights here; in 1981, the Commonwealth began covering the trenches with this - began covering the trenches with polyvinylchloride membranes to decrease the impact of vertical rainfall infiltrating through the trench caps; as I indicated earlier, this was one of the major problems at the site.

Twenty six - twenty seven acres of the site are presently covered by a PVC membrane.

It is also important for you to understand that although you have the 27 acres covered at present, our Leachate Level Data Base, which we have had in place for approximately 7 - 4 years, 4 years since pumping stopped, indicates that water is still entering the trenches, and this is important for you to - when you look at remediation for this site to understand; although we have it covered, water is still getting into the trenches, and it is also important for you to understand the rate of entry of water in the trenches has decreased with the PVC in place.

Okay, how do we end up at the Superfund Site, and that is what we need to go through right now.

In July of '83, during numerous studies with - by our monitoring of trees, we detected elevated levels of Tritium in water distilled from tree leaves.

These trees were located in the west hillside of the site, and basically, what this told us was that there must be a subsurface source for these trees.

We then - the Commonwealth then set about boring into the soil in the area of these trees and conclusively showed that contamination was moving along the lower sandstone marker bed into this area - into these areas along the west hill-side.

Okay, in 1984, the studies continued, and during the installation of some instrumentation on this west hillside, we intercepted a fracture - the Commonwealth intercepted in the lower sandstone, that yielded water.

This water contained elevated levels of Tritium, Cobalt, Carbon-14, Strontium and Plutonium.

We also detected various organic chemicals, such as Phthalate, Benzene and Toluene.

During the period subsequent to '84 through 1986, the Commonwealth mapped the movement of the contaminants on the west hillside.

In mid '80, in mid 1984, the U. S. Geological Survey began installation of an extensive monitoring well system at the site, which many of you have seen; currently, the Commonwealth uses this system to evaluate the movement of radionuclides in the ground water at the site.

Okay, as a result of these efforts to delineate the movement of contaminants at the site, the - the site was proposed for listing on the National

Priorities List in 1984 by EPA, and it was finally added as a site in 1986.

In November, 1986, EPA notified over 810 Responsible Parties of their possible liability for the stabilization of the site.

82 of the PRPs signed the Administrative Order to conduct - to conduct a Remedial Investigation, which has to this day been completed, and that is, essentially, why we are here, and that brings you up in a very rapid fashion, a quick overview of what has happened in the 28 years since the site was opened - been opened and closed.

David.

DAVID KLUESNER

REMEDIAL INVESTIGATION FINDING:

MR. KLUESNER: As John left off with the signing of an Administrative Order with EPA is kind of where I pick up, and how we actually got into the Remedial Investigation.

In 1987, an Administrative Order was signed with EPA to perform a Remedial Investigation and Feasibility Study; again, these PRPs, as John mentioned, approximately 82 individual companies signed an agreement; they call themselves the Maxey Flats Steering Committee.

EPA allows those potentially responsible for site contamination to conduct the investigation and feasibility study, but under strict agency oversight and adherence to agency guidance.

Going into the Remedial Investigation and Feasibility Study, a plan was developed to provide and guide the course of investigation, and this plan is called a Work Plan.

The development of this Work Plan involved the review of numerous studies conducted previously by the Commonwealth of Kentucky; by the United States Geological Survey, and by national laboratories that have performed studies at the site.

This review was performed to identify what information had already existed on the site; there is a lot of information that exists, and what data gaps were still out there.

The Work Plan defined the objectives of the Remedial Investigation as follows:

1) To characterize the site and waste disposed of in restricted areas;

2) To identify contaminated media and to identify potential pathways of exposure to

humans or the environment.

These were the objectives of the Remedial Investigation that was performed.

Once a detailed Work Plan was developed and the objectives defined, the sampling and field investigation program began at the site.

During 1987 and 1988, more than 700 samples were collected of the soil, surface water, stream sediment, ground water, trench leachate and food crop areas adjacent to the site.
The analyses of these samples included both radionuclides and non-radionuclides, such as chemicals and metals, and a large portion of these samples did involve the analysis of over 150 different - different chemicals in a portion of the samples.

In addition to the sample collection and analysis, the Remedial Investigation involved the study of ground water resources, land use, surface water uses, wind speed and direction, precipitation, and a variety of other factors.

You might ask why is all the attention paid to some of these factors which seemingly don't have anything to do with - with the site, but they do; they are important factors that eventually went into a Risk Assessment which was performed after the data from the Remedial Investigation was received.

I realize you probably can't make heads or tails out of it, but you can see or identify the restricted area in the middle, and what I am going to talk to you about is the soil sampling program of the Remedial Investigation.

In each soil sample collected, it is identified by a dot - or a triangle up there; as you can see, there is a significant number of samples that are reflected all around the site; in fact, there were 375 soil samples that were collected during the Remedial Investigation.

The results showed that Tritium and other radionuclides were found in soil outside the restricted area, but within the current site property boundary.

Some chemical constituents were detected, as well, inside the soil, or in the soil outside the restricted area.

No pesticides or PCBs were detected.

Another aspect of the Remedial Investigation was the surface waters in this sampling program; 22 surface water, and 22 sediment samples were

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collected adjacent to the restricted area and the water control structures which were along the periphery of the restricted area, and also in the streams outside the site boundary, Drip Springs and Rock Lick Creek.

And you can basically see the location of the off-site samples from the triangle identifying them.

The result of the sample analyses indicated that Tritium and Radium-226 were the only radionuclides found in the surface water, and they were highest along - adjacent to the restricted area.

The highest level of Tritium was detected near the restricted area, and also very low concentrations of Tritium were detected in some of the off-site surface water sample locations.

Chemicals were also detected in some off-site surface water and sediment sample locations but not of a level to be considered a health concern.

Food Crop Area which is defined as vegetable gardens, pastures or agricultural croplands was also sampled.

You can - the squares identify where those samples were collected, and the result of the samples showed no contamination was found above the detection limits in the Food Crop Area.

During the ground water investigation program, 24 monitoring wells were installed to supplement the existing USGS wells that were already at the site. High levels of Tritium were detected in the bedrock beneath the trenches, and also a variety of different radionuclides were found.

The ground water investigation concluded that leachate was migrating from the trenches to the fractured bedrock and into the environment - to the hillslopes surrounding the site.

In addition to this sampling program, a historical review of the records was performed on the trench waste that went to the site, and an estimate was approximately three million gallons of leachate or contaminated liquids remain in the 46 some odd trenches at the site.

The Remedial Investigation also determined that there are a variety of radionuclides in these trenches; they are at different concentrations at different portions of the trench, and you can also get different concentrations from the same sample location at different times.

I am not going to stand up here and say that we know everything there is to know about this site. We oftentimes have unknowns remaining after the Remedial Investigation; ground water flow is one of those unknowns, but we intend to address these through further monitoring and modeling as we get into design, but we do have a sufficient amount of information to proceed with the remedy selection and proceed with the design, and I really didn't do the Remedial Investigation justice with this very brief presentation, but due to the time restraints, I just hit the high-lights.

In summary, though, the RI showed trench leachate is contaminated with a variety of radionuclides and chemicals.

(School bell rings) Does that mean my time is up?

The fractures and subsidence has allowed in the past the infiltration of rainfall into these trenches with subsequent migration of leachate through the fractured bedrock into the environment.

High concentrations of soil contamination were detected on both the east and west hillslopes, with the highest level of contamination on the upper part of the west hillslope.

Surface water and stream sediment samples do contain low concentrations of some contaminants; Tritium is the predominant radionuclide with the highest level near the periphery of the restricted area.

The information that was obtained during the Remedial Investigation was used to assess the risks posed by the site.

At each Superfund site, a Risk Assessment is performed to evaluate potential pathways for exposure; the potential populations affected; and the health risks associated with exposure to these contaminants.

A Risk Assessment is used to justify remedial action at a site; if the Risk Assessment concludes that we do, indeed, have an unacceptable level of risk, then we take remedial action.

I am going to leave that to the Risk Assessment Phase, and I will introduce to you, again, John Mauro.

John has been working for EPA as a consultant on Superfund Sites and federal sites, and was brought in as a specialist to review the Potentially

Responsible Parties' work on the Risk Assessment.

John.

Risk Assessment Conclusion

BY JOHN MAURO:

MR. MAURO: Well, when all is said and done, the main concern of all these measurements that have been done and the understanding that has been provided of the transport of Tritium or radioactivity through the trenches and down into the hillsides, the main concern is what is the current, past and possible future radiation doses and health risks that may be associated with this situation that warrants the remedial activity that we are discussing today.

The Risk Assessment is a very important part of the overall process, and it has, basically, three objectives:

The first is to try to best estimate the radiation doses and the associated health risks associated with the doses due to past practices and what is going on right now.

The second part is trying to be a little crystal ball and determine, well, what could happen in the future; especially what could happen

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in the future if nothing was done to remedy the situation, to take action to stabilize the situation; what kind of doses and risks are going to be associated with this, and finally is, once you have estimated what the current and projected future, what-if, doses and risks are, estimated, how do they compare to radiation protection criteria and risk criteria established by the Commonwealth and applied by the EPA?

So, the Steering Committee and the Potential Responsible Parties performed a very comprehensive Risk Assessment, a large document about two or three inches thick, and I was asked, along with a team of other risk assessors to review that report, and in addition, to do an independent evaluation of the risk.

The purpose of my presentation tonight is to try to relay a brief overview of what we found out.

It is convenient to think about risk assessment in two parts:

One is, let's try to estimate what the risks are, right now;

And another is try to estimate, what are the risks, possibly, in the future.

The reason you need to make that split is because there are two different methods used; very fundamentally different methods.

For the purpose of estimating the risk that goes to the risk of the public, now, and of course,in the past, you emphasize heavily the environmental measurement program. You go out and collect samples and determine, based on the result of those samples, what the possible radiation doses are to those who might be exposed to that material, and a great deal of work along those lines has been ongoing for a long period of time.

The Natural Resource Cabinet has had ongoing programs since 1983, and the Human Resources Cabinet has had programs since 1963, and they have been actively collecting samples of various media and took readings to determine what are the levels of radioactivity that were out there.

In addition to those studies, there have been a large number of periodic and special studies performed by a number of federal and state agencies; specifically, the Commonwealth performs audits of those programs. The Environmental Protection Agency, the U. S. G. S., the Nuclear Regulatory Commission and the Steering Committee will all have to perform field measurements programs to try to clarify, as well as possible, current and past situations, and what the radiation doses are.

The bottom line of that is that there is measurable levels of Tritium and traceable radioactivity that is escaping from the site. The levels now in the valley are such a level that they are well below the Radiation Protection Standards.

Now, the real question - are we well below the Radiation Protection Standards, you know, then what is the problem? The problem is having a situation where radioactivity is leaking out, and is something that needs to be gotten under control because of concerns in the future. It needs to be stabilized. And that's the real reason why there is discussion this evening, is to talk to you a little bit about the applicable models and risk assessment performed about what could happen in the future if no action was taken. And so what we are going to be going through are the results of what is called, Baseline Risk Assessment, that was performed independently by two organizations, the Potentially Responsible Parties, and the EPA,

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independently performed, and the evaluation of the baseline risk; that is, what would be the risk if no action were taken, and if, in fact, if the site were abandoned. It's a way to try to estimate where are we right now, and it really communicates why it is important to take remedial action.

I would like you to envision a hypothetical situation where we assume that the site is abandoned, and the trenches are allowed to degrade further; rainfall passing into the trenches, leaching through and moving out the other side and washing its way down into the valley; given that scenario, what would be the projected radiation exposures and associated health risks if that were to occur? It turns out that our models showed that the doses are relatively low for a large number of pathways. Basically, what we did, we said, if the leachate ran down the hills into the valley area where there are individuals living, raising milk cows, beef; hunters hunting deer; possibly children ingesting sediment who swim and play; the evaporation of leachate, associated Tritium; the inhalation of that material, and most important of all, and this I saved for last, the ingestion of well water. As you know, currently, there are no wells in the alluvial plain, but we said, well, sometime in the future, possibly, that could well be a concern. It has been done in the past. It was done in other areas similar to this where there is no public risk defined, and so, it is going to require if we allow the site to degrade, and also if someone drops a well - well, as you can see, by far the most significant dose that was calculated is from the well water, and with that in mind, what we will be talking about are millirem per year, and I will try to put that into perspective for many of you. With the well water, the result might be 60 to 70 millirem per year; by the way, by point of reference, I will be referring to millirem per year as a way of expressing risk or impact.

The EPA Guidelines regarding radiation detection on water guidelines is 25 millirem per year; so, basically, our dose projection showed that if a well were to be dropped, it would likely exceed that 25 millirem per year limit. By the way, on the far right hand corner of this exhibit, I also have risk numbers. Basically, what this says is, if a person were to receive 63 millirem in any given year, his lifetime risk of developing cancer from that is two chances in 100,000; it is a relatively small risk, but that's - to put that in perspective. By the way, Superfund criteria regarding risk is 10 to minus 4 (1×10^{-4}), one in 10,000 to 1 in 1,000,000; so any risk that is below that is on a side that the EPA Superfund considers to be within the safer range. Above that is the range - that is the range that is said to be - a need for remediation is appropriate, and the two - I guess, some numbers I might talk to you about - 25 millirems per year as a radiation protection guideline and risk criteria of ten to minus four (10^{-4}) to ten to minus six (10^{-6}), or 1 in 10,000 to 1 in 1,000,000.

Another scenario that we modeled was to ask ourselves, if you were to abandon the site and let it degrade, one of the things that would happen would be erosion; there would be rainfall carried away through the superficial soil through the trenches that have degraded, and the contaminated soil would work its way down the hillslopes into the valley, and individuals living there now have some of this soil moving down and causing exposures. Our models showed that the approximate dose would be 39 millirems per year to these individuals from these various pathways, and again, the risk in this case is one point six, times ten to the minus five (1.6×10^{-5}), or 1.6 chances in 100,000.

These summary tables really do the overall risk assessment a big injustice; the number of analyses; the number of these tests, or the discussion that developed this qualifies a lot of this baseline information, but you are welcome to take a look at the risk assessment after the discussion, because a lot of effort went into this.

Another scenario that we approximated was, let's assume there's no institutional controls to prevent people from gaining access to the site; the person who would trespass, just walk on it, but don't forget we are also saying that if the trenches are allowed to degrade, that surface soil, because the trenches are allowed to degrade, goes into the area, and in this hypothetical scenario, what would the dosage be to the person who just happened to be walking on the site? We calculated in this case the dose rate of millirems per hour; which for each hour that he would stay on the site, we estimated that he would receive about one point six (1.6) millirems, which is associated with a risk of 6 chances in one million (1,000,000); that is for each hour. If you assume that a person is there ten hours, the dose would be ten times higher, as would be the risk.

Now, we are going to move into a little bit more hypothetical situation; we said, okay, let's carry this a little further; let's assume that there's no institutional control, and sometime in the future a person went on the site and drilled a hole right over the trenches, and the construction worker was suddenly exposed; what kind of radiation dose would he receive? So, what we did, we said, let's calculate that person's dose under three cases; one, as if he did it right now; if someone went out right now and built a house; now that is time zero, and we say, what about a hundred years from now; what about 500 years from now? Basically, this slide shows what we estimate to be the dose to a construction worker who built a home right there in the trenches; excavated and cleaned it out and built a home, and approximately 500 hours doing that, and his dose would be 3,200 millirems, and is associated with a lifetime cancer risk of one point two times ten to the minus three (1.2×10^{-3}), and time is zero; and then seven point six times ten to the minus five (7.6×10^{-5}) for 500 years.

The last scenario we went with, and this brings me close to the end, is, we asked, well, let's take this another step. Someone lives in a house and grows - and now that we have had him to build the house, and he has excavated the dirt out of the hole to build a basement, and he has excavated contaminated soil and spread out in a large area, and a person were to live in the house; grow vegetables and raise cattle and pigs, and drops a well right down into the strip below the trenches, what would that person's risk be? The bottom line would be very high; if he were to do it today, the dose would be anywhere from 20,000 millirems; his lifetime risk of cancer from continuous exposure to that level would be point one two (.12), which is a very high probability to have cancer.

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Bear in mind that these are a whole lot of scenarios, and the purpose of which is to sort of help you get your arms around the problem; how bad could it be, and these are trained assumptions, and then, of course, for you to get a sense of the levels of risk associated with this. This is the time zero. And let's assume that construction - let's assume that he is not there right now, but it is a 100 years from now, the dose comes down by a factor of 3, and you can look at this; again, you could also look at 500 years, and the same type thing, and again, the dose is lower, and as time goes on, it is continually getting - the radioactivity is continuing to decline.

Finally, we have just tried to show visually - let's see if I have that slide - yeah. We said, well, let's make a plot of the radiation dose along the Y axis, and the time of the person actually occupying the house 100 years, 200 years and see, as time goes on, how will these doses decline? It turns out that they decline rather quickly, and there are all the different pathways, by the way; vegetable pathways; well and ground water pathways, and so forth, and the top line is a total from all of those pathways. It turns out that it declines pretty quickly over the first 100 years, and then it levels off, but the risk stays constant. The implication here, by the way, is that management is needed to be in place to maintain control in perpetuity, because, as indicated, over a 500 year period, risks are still very high.

I have one last - just one last point I would like to make that should be mentioned; there is some radium, as part of the waste, that is going to be - is buried in the trenches, and one of the main problems with radium is that it generates radon gas, and you are probably familiar with that as an environmental concern; natural radon builds up in homes, and you see a lot of that in the papers. Well, with radium in the soil, there is potential for radon gas. So, what we did, we modeled what possible radon would be in a home setting on the site, and we determined that level to be very high, 50 WLM/year; about 10 times higher than the Radiation Protection Standards to uranium miners who work in the radium mines, and the lifetime risks to the family who would be living in that condition, as strange as they would be, of course, would be at a very high risk for cancer exposure at that range, and that is the bottom line of what our Risk Assessment has shown.

Feasibility Study Alternatives

BY MR. KLUESNER:

MR. KLUESNER: With the nature and extent of site contamination defined and the Risk Assessment pointing to a definite need for remedial action, the Feasibility Study was performed and alternatives were developed to address the site problems.

Howver, in order to develop alternatives, we need to know what the objectives of remedial action are, and what legal requirements we have got to follow.

The objectives for the Maxey Flats Disposal Site -

First, we need to stabilize the site such that a final cap can be placed over the trenches with minimal long term care and maintenance.

We need to control the infiltration into the trenches and exfiltration from the trenches.

We need to protect human health and the environment, and address state, federal and community concerns.

For Maxey Flats, this development process included the review of over hundreds of different technologies; literature researches were performed. The technologies, such as incineration, excavation and off-site disposal; compaction, grouting and natural stabilization; these technologies were all looked at.

These technologies were evaluated against their performance record; the implementability, and their ability to meet the remedial action objectives that were defined.

These technologies were then screened to a group of remedial alternatives, or for the development of remedial alternatives, and 18 different alternatives were developed. These 18 alternatives were evaluated in terms of implementability; effectiveness and cost.

The first of these alternatives is the No Action Alternative.

The No Action Alternative is an alternative that is evaluated at each Superfund Site. We use this alternative as a method of comparison to the other alternatives that are evaluated.

Under a No Action Alternative, absolutely no action is allowed to be assumed. The only action is that of monitoring, which is not really an action, and those activities in support of monitoring, such as the installation of monitoring wells, and so forth.

For the Maxey Flats Site, No Action has been assessed at six point eight million ($6,800,000), and this seemingly high cost for doing no action arises from the need to collect and analyze samples in perpetuity, and those activities in support of obtaining the samples.

The next alternative that was - as part of this final group of seven, the Structural Cap/ Dynamic Compaction/Horizontal Flow Barrier Alternative; this is Alternative 4.

Alternative 4 involves leachate removal and disposal on site and dynamic compaction of trenches; placing a structural cap over the site; procurement of a buffer zone; installation of a horizontal flow barrier, if needed, and remedy review every five years.

The dynamic compaction - we have had a couple of presentations on this technology; you may not have been able to attend those presentations, but dynamic compaction, in a nutshell, is the forced consolidation of waste in the disposal trenches; you would literally drop a large weight onto the trenches to forcibly consolidate the trench waste before a final cap cou[illegible] placed over t[illegible]t trench.

The structural cap that is part of Alternative

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4 would be a reinforced concrete cap over the trenches, and this cap would have a soil layer over the concrete.

The horizontal flow barrier - let me back up, a buffer zone - and I will get into more detail when we get to the preferred remedy, but the buffer zone refers to the purchase or control of additional properties outside the existing site property boundary, and a buffer zone purpose is two-fold; we need to control the activities on the hillslopes which surround Maxey Flats, in order to prevent erosion.

The second reason a buffer zone is needed is to insure that we have long term access to areas adjacent to Maxey for the purpose of monitoring.

When a remedy is eventually implemented at the site, we need to be able to come back and tell you that, yes, this remedy is working; in order to do that, we need to have proof; we need to show you by monitoring that, that the migration has stopped; that the migration has not gone beyond the site property boundaries, and so, that is what a buffer zone is.

Horizontal flow barrier is a device that would attempt to control the infiltration of ground water into the trenches; once the remedy is in place, we need to get - keep the trenches dry; we need to stop migration and stop the formation of leachate; we need to keep the trenches dry, and a ground water flow barrier, or horizontal flow barrier is one device that may be used in the future if our data indicates that we need a horizontal flow barrier.

When I was talking about the remedial investigation earlier, I was talking about the fact that we have some unknowns remaining after the remedial investigation. The ground water flow situation is one of those components that through future ground water monitoring and modeling, and when the leachate extraction program is initiated, we are going to develop a lot of information to be used as a data base to make a decision approximately five years after remedial action starts, if we need a horizontal flow barrier or some sort of device to keep water out of the trenches.

Alternative 5 is Natural Stabilization Alternative and horizontal flow barrier.

Alternative 5, like Alternative 4, does involve extraction of approximately 3 million

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gallons of leachate from the trenches; the solidification and on-site disposal of this leachate; an interim trench cover would be placed over the site, and this cover would be approximately 50 to 60 acres, and would consist of a two-foot clay layer, followed by a synthetic liner over the clay, and its purpose is to keep infiltration of water out of the trenches.

A horizontal flow barrier would be installed, if needed.

Natural stabilization would continue over an estimated 35 to 100 years; Natural Stabilization for this alternative refers to that time needed for the trench waste to consolidate to a point that we would put a final, multi-layer cap over it with minimal long term care and maintenance.

At the end of the interim maintenance period a final cap would be placed over the site; it would be a cap that has many different layers, and a good example and conceptual design of what a final cap will look like is to my right; this gives you an idea of what a cross section of the cap might look like.

The estimated cost for Alternative 5 is 33.5 million. The implementation time would be in three phases, basically; 22 months would be required for the initial closure period; this is the period where leachate would be extracted, treated and disposed; the interim cap would be placed, and many other activities would be performed; an estimated 35 to 100 years, again, for the natural stabilization process to take place, followed by a 10 month final closure period.

The next alternative that was evaluated, Alternative 8, which is Engineered Cap with Liner/ Natural Subsidence and Horizontal Flow Barrier, and the difference between this alternative and Alternative 5 is that this final cap would be placed over the trenches immediately, rather than waiting the 35 to 100 years. The downside of Alternative 8 is that if you put it on immediately, you are going to have a lot of repair and maintenance to this very complex cap for a very long time.

The estimated cost for Alternative 8 is 47.4 million; the implementation time of approximately 23 months.

Alternative 10, which is the Engineered Cap with Liner/Dynamic Compaction/Horizontal Flow Barrier. It involves the similar components as the previous alternatives, such as leachate extraction; treatment and disposal; horizontal flow barrier, if needed, an engineered cap with liner, but the method for achieving stabilization of the trenches would be through dynamic compaction, which is the artificial acceleration of the waste consolidation, and it costs an estimate of 44.3 million, with an implementation time of 35 months.

Alternative 11 is what we call the Grouting Alternative; also includes leachate removal; grouting; engineered cap with liner, and a horizontal flow barrier. The grouting, for those of you who are not familiar with that term, would involve the injection, under high pressure, of a mixture, which is called, grout, and this mixture would consist of water, cement, bentonite and other mixtures to form what is referred to as grout, and it would be injected, using metal lances or probes, into the trenches; basically injecting this cement to provide a stable foundation for this final cap that would then be placed over the site.

Its cost has been estimated at 68.9 million; implementation time of 46 months.

The last alternative that I will go into detail about is this Alternative 17, Engineered Cap and Dynamic Compaction and Horizontal Flow

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Barrier. The only difference between this one and the previous dynamic compaction alternative, this final cap would not have a synthetic liner, and also the type of horizontal flow barrier is different. Its cost is estimated to be 56.5 million, and the implementation time is 38 months.

As you can see, we have a lot of similarities between the alternatives that are in this detailed analysis; some of the similarities include - each alternative includes - except for the No Action, it does not include a cap and a liner to keep the vertical flow infiltration of water out.

Each alternative involves leachate removal; each alternative involves the disposal of site buildings and structures which are no longer of use at the site. Each alternative involves construction of additional disposal trenches, perpetual monitoring of the site and control; a buffer zone and a remedy review. Each alternative involves stabilization of the trenches.

The difference between these alternatives include the type of cap used; whether it will be a concrete cap; whether it be an engineered soil cap without a liner or with a liner; there's several types of caps that were evaluated.

Another type of difference is the ground water flow barrier that was used, whether it be simply a cutoff wall on one edge of the site, or whether it be a cutoff wall to circle a select group of trenches, but the primary difference in these alternatives is the method of stabilization; either natural stabilization, or grouting or dynamic compaction.

Now that we have identified the alternatives that would meet remedial action objectives, we go through a comparison of the alternatives to arrive at a preferred remedy; however, we need to go through an organized process so that we maintain some sort of consistency at these sites across the country, and we use nine criteria in the Superfund program to evaluate alternatives:

Short-term effectiveness; this refers to the time that is needed to achieve protection and what risks are to the site workers.

Long-term effectiveness - we need to know what risks are after remediation, and ability to maintain reliable protection.

Reduction of toxicity, mobility and volume refers to the performance of the specific technology; how well does this technology redu the volume of the waste, or immobilize the waste or mobilize the - or reduce the toxicity of the waste.

Implementability refers to the feasibility of implementing the remedy, and availability of materials in the area for that remedy.

Compliance with ARARs; ARARs is a nasty Superfund term, and it refers to the legal requirements that we - it is a very complicated process; what legal requirements does the remedy involve; the ARARs stands for, Applicable or Relevant and Appropriate Requirements. By law, the remedy must achieve all legal requirements that are applicable, relevant and appropriate by the end of remedial action.

Overall protection of human health and the environment. How does the remedy eliminate, reduce or control site risks?

Cost - by law, the remedy selected must be cost effective; have state acceptance and community acceptance.

These nine criteria were all used to compare these alternatives, the ones that I just went through, in order to arrive at a preferred remedy.

So now that we have the criteri in place, we can compare the alternatives.

Alternative 1 is the No Action Alternative; it is not protective and it is not an engineered remedy.

Alternative 4, Structural Cap Alternative does provide overall protection, but it would require tremendous maintenance, and is not cost effective, and it is difficult to implement.

Alternative 8, which is very similar to the Natural Stabilization Alternative, provides a lesser degree of protection. It is less cost effective than Alternative 5.

Alternative 17, Engineered Cap and Dynamic Compaction Alternative is also less protective and less cost effective than Alternatives 5 and 11.

The remaining three alternatives, 5, 10 and 11 differ primarily in their method by which they achieve stabilization.

Alternative 10, Dynamic Compaction, accelerates the stabilization artificially and achieves closure quicker; however, it has not been demonstrated at this site, and it could lead to the accelerated migration through increased container rupture, and also, this alternative has been looked at at state and community level, and there has been some bad publicity, to some extent; there is a tremendous level of concern with EPA and state with this alternative.

Alternative 11, the Grouting Alternative has significant implementability problems, and would require significant research and testing at the site before the remedy could be implemented.

Alternative 5, the Natural Stabilization Alternative achieves initial closure quicker; it meets the objectives that were defined for remedial action; and it meets the legal requirements for a remedy. The downside fault to the Natural Stabilization Alternative is the time in which final closure is finally - finally takes place. But it is very important, when you are looking at all of these alternatives, that none of these alternatives allow us to walk away and forget about the site. Each of these alternatives would involve continuous subsidence.

The Natural Stabilization Alternative merely puts the final closure at the end of the natural stabilization process. The majority of the remedy is to be implemented during the initial closure period; during the 22 month period after remedial action is started. We have to look at the primary - what are the primary concerns of this site, that of the migration of the leachate from the trenches; this problem would be addressed through this initial closure period, up front, and not wait for 35 to 100 years; so, for that reason, EPA, at this time, has preliminarily identified Alternative 5 as the preferred remedy.

Let's look again at what the remedial action objectives are, because they are very important.

The remedial action objective for the remedy is to stabilize the site so that we can put a final cap over it without long term care and maintenance, or minimal long term care and maintenance; we need to control the infiltration into the trenches and the exfiltration from the trenches; we need to protect human health and the environment, and we need to address concerns expressed by state, local and federal groups.

Alternative 5 can be divided into four phases, consisting of an initial closure period; an interim maintenace period; a final closure period, and a custodial maintenance period.

The initial closure period would involve the following activities; such as baseline topographic surveys; geophysical surveys; subsidence monitors. These surveys, like the baseline topographic surveys, and geophysical surveys will further enhance our knowledge of the boundaries of the trenches. The subsidence monitors will be a very important piece of information that we need to have. We need to install monitors; we need to know what rates of subsidence occur over the years, so that when we get to a point where we feel that natural - the subsidence process has ended, we will be able to make a decision using this information from the subsidence monitors.

Ground water monitoring and modeling will continue.

The installation of the initial closure cap, again, the cap with the synthetic liner that would be placed over approximately 50 to 60 acre area, and this cap is intended for - for about a 20 to 25 year period; it won't last the entire natural stabilization period, but it is expected that we will have to go in and replace the synthetic liner periodically, and the current manufacturer warrants the device for about 20 to 25 years, and so it would involve the replacement. We would have to maintain that cap; we would have to go in and back fill, put soil back into these subsided areas so that we don't have an accumulation or ponding of water on the cap which could lead to infiltration of water into the trenches.

Surface Water Management and Control - we need to be sure that the remedy has a good handle on the rate of surface water runoff. We need to make improvements to the existing drainage outlets; perhaps add some drainage outlets; we need to make sure that our surface water runoff is not causing erosion of the hillslopes and the potential aggravation of the weather.

Trench leachate removal; treatment and disposal. We would extract approximately 3 million gallons of liquid that is in the trenches, bring it above ground; solidify it, and redispose of it in on site new disposal trenches.

Closure of selected wells; first is the closure of wells no longer of use; monitoring maintenance and surveillance would be performed; on site disposal of existing buildings and structures, and procurement of a buffer zone adjacent to the site property.

The last component that I mentioned, the buffer zone, refers to the additional property that will be necessary - one, to control what the activities are on the hillslopes, and also to allow unrestricted access for the long term purpose of monitoring.

The heavy borderline in the middle, around the restricted area, the border with the Xs is the current site property boundary. The etched area outside of that boundary is the approximate extent of the property that may be needed for this buffer zone, and I say, approximate, because at this point, we have no final decisions. This is the extent of the proposed buffer zone area; basically extending from the current site property boundary down to Rock Lick Creek, and is bordered by Drip Springs Hollow and No Name Hollow, and this area is approximately 200 acres at this time.

Last month we notified nine individuals who reside on or own property in this proposed buffer zone area, and what we wanted to do is meet with them, and we did so on April 22nd; we wanted to meet with them to give them a heads-up as to what we were thinking about, and why we are thinking about a buffer zone, and why it is important to have control over some of the activities on those hillslopes, and we intend to meet with them further;

have additional meetings with them. Each landowner has different circumstances that they are involved with; some may want to live there; some may want to sell. We want to do what is equitable; we want to do what is best for the remedy, and so we are going to work with them and try to reach a solution to this.

The next period is the Interim Maintenance Period; again, during this period, surveys will continue; we will continue the subsidence monitoring; we will continue the ground water monitoring; we will continue to repair the interim cap, as needed; we will continue to look at surface water management and control; we would have the - what we call, infiltration monitoring program in place, which will allow us to detect any liquids that may enter into the trenches. If we find any liquids entering into the trenches, we want to have some sort of measure in place that we can stop and trace those liquids, and that is where the ground water - the horizontal flow barrier comes in. We are going to be conducting a review of this remedy, or whatever remedy is selected, every five years from now on. By law, if we leave hazardous substances in place at a Superfund Site, we are required to review the remedy selected every five years to insure that it continues to protect human health and environment; to insure that it continues to meet remedial action objectives.

During the first five year review period we hope to have enough information from all of the monitoring programs to know if we need to put a horizontal flow barrier in or not; also, during that five year, the first five year review period, we are going to take a good look at what type of erosion, if any, we have going on on the hillslopes. We have proposed as the interim cap, a clay layer followed by the placement of the synthetic liner over that clay layer; if the runoff from that 50 or 60 acre area is very significant; if it is causing accelerated erosion of hillslopes, we are going to have to rethink that decision and possibly put some soil over that liner as a means of slowing down the water runoff. What we are going to do is keep an eye on that and look at that very aspect, very closely during the first five year review period, and if there is a problem that comes up prior to that review period, we will know about it, and make some modifications, and we do have some flexibility with this remedy.

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We have the flexibility to obtain additional information through the various monitoring programs that we have in place to make decisions when we have a little bit more information. All during this period, we are going to be replacing the liner, approximately every 20 to 25 years, and that concludes the Interim Maintenance Period; again, this period has been estimated at 35 to a 100 years, and some of the questions are, why 35 to 100 years? Well, there are a lot of different chemical and physical processes that are going on inside the trenches that make it very difficult to pinpoint the precise time at which final stabilization will, indeed, occur so we can put a final cap over it.

Then we have a Final Closure Period, which after the Interim Maintenance Period, after monitoring during the Interim Maintenance Period shows that the trenches have sufficiently stabilized, final closure will begin.

The Final Closure would consist of the additional waste burial; any remaining site waste, activities enumerated during the previous phase, would be buried in trenches on site. Monitoring and surveillance would continue; five year reviews

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would continue, and a final closure cap would be installed during the period, and again, this is an exhibit of what a sectional - what a final closure cap might consist of, and these are a couple of examples of the before and after look at the difference between the initial closure cap and the final closure cap. The final closure cap being layers of clay; synthetic liner in that cap; sand and gravel to divert any infiltrated water away from the disposal trenches, and then a vegetative topsoil cover so that grass is growing on top.

And the estimated cost for Alternative 5 is 33.5 million; again, with the implementation time of 22 months for the initial closure period, and 35 to 100 years for the interim maintenance period, and a 10 month period for final closure.

Alternative 5 takes a while to achieve final closure. It takes a little while longer than the other alternatives, and that is a fact.

Alternative 5 does not allow us to walk away; nor do the other alternatives, but Alternative 5 uses proven technologies. It is implementable; it meets remedial action objectives; it will provide for the protection of human health and environment, both for the short term and the long term.

Again, Alternative 5 will control the primary site problem, which is that of the migration of leachate from the trenches during the initial closure period; not waiting until the 35 to 100 year process is completed.

Also, Alternative 5 leaves the waste, intact, inside the trenches without the increased risk of the release of radionuclides into the environment as some of the alternatives, other alternatives involve.

So, for these reasons, Alternative 5 has been chosen at this time as the preferred remedy, and now what I am going to do is let Suzanne Durham talk for a few minutes about community involvement.

COMMUNITY'S ROLE

BY SUZANNE DURHAM:

MS. DURHAM: Thank you, David. Good evening. My name is Suzanne Durham, and I am the Community Relations Coordinator for Maxey Flats Disposal Superfund Site.

The goal of our community relations program is to keep you informed and involved about the complex decisions which will affect your community.

I am pleased to report that this is one of the most active communities in Region IV, and you are to be commended for that.

In December, 1988, EPA issued a Technical Assistance Grant to the Concerned Citizens of Maxey Flats. This grant was in the amount of $50,000.00, and with that money, you all have hired a technical advisor, Dr. Marvin Resnikoff, who has received early technical reports from our agency, and has been able to review those and interpret those, and then, in turn, inform the community about the site conditions.

In addition to that, we have had several other meetings in the community with various members of the community to keep you informed about the site condition.

Choosing a final decision, a response action at a Superfund Site is, perhaps, the most important decision ever made at a Superfund Site, because those of you who live in a community are the most affected by hazardous waste conditions and cleanup processes. EPA encourages citizens to get involved in this decision-making process; by

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providing information about site conditions; community concerns, and your preferences. community involvement can influence EPA cleanup decisions.

To keep you informed, we recently issued a proposed plan fact sheet which summarizes the Remedial Investigation and Feasibility Study. We also sent The Administrative Record to the Fleming County Public Library; an additional Administrative Record will be sent to the Rowan County Public Library by the end of this week. The Administrative Record contains all documents we used in the selection of our proposed course of action here.

I hope all of you are part of the Concerned Citizens Group and have been receiving information from Dr. Resnikoff; if not, however, please go by the libraries and review our Administrative Record and do become familiar with the site, so that you can make meaningful comments to the Agency.

The Comment Period begins today, June 13 and runs through August 13, 1991. We normally only offer 30 days to receive comments, but since the community has been so concerned and involved, we thought it would be wise to extend that for an additional 30 days, for a total of 60. This

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Comment Period is important because it allows you to get on the record with your comments and concerns. We encourage you to review and comment on EPA's Preferred Alternative as well as all other alternatives under consideration and their possible effects on the surrounding community.

After the 60 day Comment Period ends, EPA will prepare a document called, A Responsiveness Summary. In that document, we will summarize all your comments, concerns and information and our responses to you.

When the Record of Decision is signed by our Regional Administrator, we will publish a notice in your local newspaper notifying you of actions that we will be taking at the site. At that time, the Record of Decision and Responsiveness Summary become a public document in the Administrative Record at the libraries.

In summary, we want to ensure that you are kept well informed about response actions at Maxey Flats, and also to enable you to play an active role in decisions which will affect you.

David and I are your two contacts with EPA. Our names, addresses and phone numbers are in the Fact Sheet. Feel free to contact either one of us at any time.

And now Mary Wilkes, our attorney, will talk with you about Enforcement Activities at Maxey Flats.

Enforcement Activities

BY MARY WILKES:

MS. WILKES: As Suzanne told you, I am Mary Wilkes, and I am the attorney for EPA working on the Maxey Flats Site, and I have the duty of informing you of what has happened to this point.

As Suzanne explained to you, the 60 day Public Comment Period will allow the public an opportunity to submit their comments to the agency on the preferred remedy that we have identified, and to raise any other concerns or suggestions; anything that you have to tell the Agency about; what you think about the other alternatives that were proposed; whether you think one of them would be better; whether you don't or do like this one, or one of the other ones; anything that is on your mind about the selection of remedy for the site.

After the Public Comment Period is over, EPA will take the comments that we have received from you and consider all of those comments, and only after we receive and consider your comments will a final decision be made on what the cleanup will be for the Maxey Flats Site.

The document that will identify our final decision on the remedy for the site is called, a Record of Decision or ROD. EPA loves to use abbreviation terms, and ROD is the term that was used for the decision document that selects the remedy for the site.

What I am going to try to do is give you a thumbnail sketch of what happens; how do we get from the ROD, the decision of what the cleanup will be, to getting that cleanup implemented, because it is one thing to have a choice of remedy, and it is another thing to get the remedy actually underway;the cleanup done at the site.

The first thing that is done after the Record of Decision is the agency sets about, then, to get a group of identified Potentially Reponsible Parties for the site to become involved in negotiations for site cleanup.

There is a limited amount of Superfund money available to clean up all Superfund Sites throughout the country; therefore, wherever there are identified parties that may be potentially liable for the cleanup cost, it's the Agency's policy to deal with those Potentially Responsible Parties, which are referred to by EPA as the PRPs; so when I say, PRPs, that's what I am talking about. Those - we deal with the PRPs and try to get the PRPs to undertake the cleanup of the site where we have PRPs identified, in order to preserve the Superfund for those sites where there are no PRPs identified, or where the PRPs identified have no resources to carry out the work, or for some other reason are unable to do the work at the site. So, what would happen after the Record of Decision is signed is that EPA will send out letters to all the Potentially Responsible Parties for the Maxey Flats Site encouraging them to group together and come to EPA with a good faith offer to perform the cleanup that has been outlined in the Record of Decision. We are not requesting that they come to us to negotiate what the cleanup will be; the cleanup is outlined; the plans for cleanup is outlined in the Record of Decision, and it is not subject to negotiations. All that we negotiate on is the terms of the agreement by which the parties might conduct the work.

Under Superfund, there are several different categories of Potentially Responsible Parties for each site; the owners or operators of the disposal site are Potentially Responsible Parties, as are parties that transported waste to the site, and the third category and usually the largest in terms of the number of PRPs are those people who arranged for disposal at the site, and those parties who generated the waste that was dumped at the site.

Now, at this particular site, there are over 650 generator PRPs that have been identified at the site, and as David mentioned to you just briefly, there have been a group of 82 PRPs that have already done the RI/FS for the site, and in all likelihood we would be involved in negotiations with them and some of the other PRPs that have not been previously involved, to try to get an agreement whereby those groups would conduct the cleanup at the site.

What generally happens is we send a notice letter, that I mentioned to you, out setting forth a period of time that we will wait to hear from those groups as to whether or not they will submit a good faith offer; now, generally, that is a 60 day period that we allow the parties to come forward with a good faith offer; if during that 60 day period a good faith offer is presented to the Agency, then we undergo a second 60 day period of negotiations with PRPs that have come forward to try and enter into an agreement for the Superfund Site cleanup.

Now, Maxey is a very complex site, and there is a huge number of Potentially Responsible Parties, and it is quite possible that the period of negotiations will be longer than the usual 120 day period recited, but as a general rule, that is how the process works.

Now, if the Agency is able to come to an agreement with the Potentially Responsible Parties to clean up the site, that agreement would be imbibed in a written government document called, a Consent Decree.

Now, a Consent Decree has to be filed with the district court in the district where the site is located, and it can only be filed if the Department of Justice approves it. So, once the parties, the PRPs, and the EPA has signed the agreement, it will go to the Department of Justice for their approval; once they have approved the

Consent Decree, it will be filed wi-h the district court, and the public will, once again, be allowed a comment period on the settlement agreement, this time; just like on the remedy, itself, you will be allowed to submit comments on what you think about the agreement that EPA has reached with the PRPs on the contract to do the work.

After the Public Comment Period is over on the Consent Decree, EPA will look at the comments once again, and unless there are comments that EPA believes warrant a reconsideration of the agreement, the agreement will be lodged by the court and entered and become a final, binding and enforceable agreement between the PRPs and the Agency to conduct the work at the site.

At no time does EPA simply turn over the work to be done at the site to the PRPs; EPA always maintains oversight of the activities that the PRPs perform and would be involved in their cleanup, reviewing and keeping in constant touch of what was going on at the site.

Now if, for whatever reasons, we are not able to reach an agreement with the PRPs to perform the work, then EPA has two real options in terms of getting the site cleaned up:

One, we have a mechanism known as a Unilateral Order that we can issue to PRPs or any group of PRPs, which orders them to the site cleanup, and that order can then be taken to court and enforced; if the PRPs decline or walk out the door, the PRPs would then have an opportunity to contest their liability and go through court, and if they choose to do that, it could get pretty expensive, in terms of time, if dragged out through trial.

The other option that is available is that the Agency can expend Superfund Site money from the Superfund, providing that the required state cost share is provided by the state in which the site is located.

So, that's a real thumbnail sketch of how the process works, but it gives you an idea of where we go from here, and David will pick up at this point; that once we have arrived at the point on how the site cleanup with be implemented, what steps are next; the remedial design; the remedial action stage, and I will turn it back over to David to carry on with that.

FUTURE ACTIVITIES

BY DAVID KLUESNER:

MR. KLUESNER: Thank you, Mary. I just have a few minutes more of presentation, and we will take a break; we are all getting a little tired, and we will take about a five minute break, and we will come back and have a question and answer session.

As Mary mentioned, we are into a 60 day Public Comment Period; after which said time a Record of Decision will be developed and signed by EPA, and we are estimating that that Record of Decision will be signed by EPA by the end of this September.

Once that Record of Decision is signed, unfortunately, we can't get right out and start the preferred remedy. One of the things I asked Mary to talk to you about tonight was the sort of process that we have to go through before we can get into design and cleanup, and sometimes that is a very involved process, but we do have to go through it.

Again, the Record of Decision, we are going to get that signed by the end of September; if we can reach settlement, and negotiations can be completed, as Mary has sort of gone through; if we can complete that by 1992, which I think we can, we can get through the design and started with remedial action in late - either late 1993 or early 1994. That is just sort of a ballpark figure, brief sketch of what is lying ahead; we didn't want to mislead you in terms of thinking something would happen, you know, as soon as the final selection plan is made; we have got a lot of work ahead of us, but we are going to try to get through that as expeditiously as we can, so that we can get on with the final site cleanup.

And I just have a few closing remarks that I want to make. As I look back at almost three years ago when I first became involved at Maxey Flats, I remember hearing about a very active citizens' group; I remember hearing about a technical assistance grant and an advisor to that technical assistance grant, and I was thinking, oh, my gosh, what am I getting myself into; I have never been involved with a group like this before. And I will be honest, I was a little bit nervous. I didn't know what lay ahead of me, but after I attended a couple of public meetings, and after I had met a number of you, and associated some faces with names, I came to realize that these are real people with real families, and with real concerns, and you began to remind me a lot like my family in Missouri. And I thought, these people have some legitimate concerns.

My family would want the same thing as they want. They would want this site to be cleaned up, and I came to understand how important community involvement is. I think the community can and should be a part of the decision making process, an integral part; I think the community can understand complicated, technical issues.

You all have taken time away from your day-to-day activities; time away from your family to review reports; to attend meetings, like tonight; you have taken time away from what is important to you, to become involved; to make a difference, and I respect that, and I commend you for that.

And I know that you all have some frustrations. I know that you are frustrated over how long it has taken for us to get to this point, and you are going to be frustrated about how long it takes to get to the final cleanup.

We had to go back and revise the risk assessment; we had to take a look, again, at the alternatives that were evaluated. We did so, because you all have to live with the remedy that is implemented at the site. We have to make the right decision; so, therefore, we took a little extra time to make sure that we made the right decision.

And your involvement, and I hope it continues, your involvement is important, extremely important in the coming months and the coming years. During the 60 days, I want to offer my assistance to you, if at anytime that you are looking at the Administrative Record that is in the Rowan County and Fleming County Libraries, and we are talking about approximately 56 volumes of information in these libraries that were used or were partially used, or could have been used to arrive at a decision on this site; there is 56 volumes of information in the libraries; there's a lot of documents, and you are going to be going through, and you are going to be thinking, My God, what does this document mean; you know, how does this fit in; I don't understand; if at anytime you want me to come up here and sit down with you and explain anything, call me, and I will be glad to do so, and I offer that to you; I understand what you are going through.

And your involvement is needed and is important after this Comment Period ends; it is important after the Public Comment Period is over.

I want all the parties that are involved in this process, EPA, Kentucky, the Potentially Responsible Parties, I want them to be constantly reminded that you are out there; that you are waiting for something to happen; so that we move forward and do implement this remedy in an expeditious manner.

And I think there is a lot of reason for encouragement tonight; as I look back over the past three years, I can recall certain times over the last three years that EPA had its own preferred remedy, and Kentucky had their own preferred remedy, and the PRPs had their own preferred remedy in mind, and we were all going in diverging directions, and we couldn't come up with the best technical solution to this site. And a remedy doesn't get off the ground if we have all these divergents involved. I stand before you tonight and tell you that tonight, we do have a general consensus among these parties; a general consensus on what the best technical solution should be; we are working together as a team, and that is what is needed. We are going to have differences again in the future, but I hope that we all commit to overcome these differences in the interest of the community.

I hope that all parties involved, again, EPA, Kentucky, and the PRPs, go into the next few months, as we get closer to settlement, and I hope that we all think very seriously at the consequences of our actions, because this - you are affected by the remedy; this is your life. We need to closely examine our responsibilities; examine our conscience and do what is in the community's best interest and put your safety and health concerns first.

Again, I have reason for encouragement. I think we are on a positive path; we are moving forward. We need to work together as a team, but, most importantly, we need your involvement; we hope it continues. Thank you.

What we are going to do now, is break for five minutes, and we will come back in about five minutes, and we will have questions and answers, thank you.

(At which said time, a five minute recess was taken, and thereafter, the following proceedings

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were had:)

QUESTIONS and COMMENTS

BY MR. ED. STORY, MODERATOR:

MR. STORY: Earlier in the year, I talked to Dave quite often. I was pretty down, because you are pretty down, and when you are down, you tell me all that stuff, and I hear it daily, day by. day by day, and that makes me down because things aren't happening. He said, "Ed, hold on. Ed, hold on. There's going to be a ROD this year. There's going to be a ROD. Ed, there is going to be a ROD this year; just think on that." And that Record of Decision, of course, as you hear, that Record of Decision doesn't mean we are there, but we are making progress, and you heard him say that all three groups now are sitting at the same table, and they have got all their hands on the top of the table. I would say they are not squeezing each other's hands, as yet, but we are making some progress. So, I guess that is the reason that I feel a little better tonight.

In response to some of the things that have been said, as you know, as you have already been told, we have a technical advisor, Dr. Marvin

Resnikoff, and Dr. Resnikoff has already had this information for some time. He has looked it over, and he has just a few brief comments. They are pretty much his comments. The Maxey Concerned Citizens Advisory Board has had a chance to interact with him a little bit, but not much, but nonetheless, he wants to say a few words, and then, I think, maybe someone representing the PRPs wants to say a few words, and then we will take your questions. Okay? Dr. Resnikoff.

COMMENTS

BY MARVIN RESNIKOFF:

DR. RESNIKOFF: Thank you, Ed. Thank you, everybody from the local area for staying around so long. It is very difficult to sit here, and this is just going to be a few more minutes. I have a few comments to make, and then it will be your turn.

Maxey Flats Concerned Citizens are going to submit a letter with detailed comments, and I am just going to make a few comments now.

Our purpose is not to delay this remediation of the site. We want this remediation to be carried out. We want the remediation, however, to be done right, and we want there to be sufficient money so that some next generation or two doesn't have to come back and reopen the whole hearing to make sure that there is enough money to finally close the site.

The Risk Assessment which was discussed tonight shows a vast improvement over the earlier Risk Assessments. It shows clearly that the site must be remediated, but we have some concerns about the Risk Assessment that we wanted to lay out:

First of all, you have to understand that the Remedial Investigation that was done at the site was not done under No Action conditions. It was done because - it was done under the conditions where the site was being taken care of by the State of Kentucky. A cover is over the site right now. If the State of Kentucky did not put a cover over that site in 1981, the site would have been leaking radioactivity; a large amount of radioactivity, and that would be a true No Action condition; so, the Risk Assessment which was done isn't - doesn't truly look at the No Action conditions, because it assumes that the site has a cover over it, essentially, and those were the measurements that were taken, and so that is the first concern that we have about the Risk Assessment that was done.

For example, let me give you an example of this; say someone comes onto the site in later years; the intruder/agriculture scenario is involved; someone builds a home on the site and farms the land, and the Risk Assessment looks into what happens if, you know, a person lives there; what kind of doses a person would get, but the Risk Assessment does not assume that if a person comes on the land and punctures a hole through the cover of the site, that the water will then get into the trenches, just like it did at the end of the '70's, and begins to leak out a large amount of radioactivity; that's one way the Risk Assessment doesn't come back to the No Action conditions that is required.

There is a question that I have concerning what exactly is an intruder on the site. People have talked about an intruder, you know, someone who comes on the site is an intruder in later years. This definition of an intruder means that the site has a license; that the site is regulated; that someone is - you know, there is a restricted area at the site which is maintained, but if the site isn't licensed after a hundred years, then how is it regulated? Okay, how is the exclusion area assumed; so, I believe that one has to assume that the site is going to have a license, and that license is going to remain in perpetuity; forever, there is going to be a license on the site. Who is going to hold that license? Is it going to be the State, or is it going to be PRPs, the EPA - I don't know who is going to hold this license.

If there is no license, then I believe the point of compliance of those estimates must be right on the site, itself, and not on the periphery of the exclusion zone.

One concern that I have about the Risk Assessment involves the analysis of chemicals. The Risk Assessment which was discussed today dealt only with the radionuclides; not the chemicals.

The PRPs have assumed that - and have looked at potential indicators; have looked at what they could do to the key chemicals, as those that have already reached down to a certain geological level on the site. But, over the long term, really, everything that is in the trench can be assumed to get down to that level at some later time, and so, I really believe that there needs to be a Risk Assessment of the chemicals in the trenches, and just as there was a Risk Assessment for the radionuclides that are in the trenches, and that Risk Assessment is going to be carried out for a long time.

There are a large number of fairly hazardous chemicals; let me mention a few: cyanide is one chemical; carbon disulfide is another chemical, and then there are chemicals, like benzyl alcohol; phenols; naphthalene; these are very hazardous chemicals, and they should - they are in the trenches now, in the trench leachate, and they should be part of the Risk Assessment.

We support the alternatives. The - the main recommendation that was made by the EPA tonight. This plan of natural subsidence, we support that. We oppose of what has been suggested, this dynamic compaction alternative, or dropping weights on the burial ground to force down the contents of the trenches. So, we support the plan that the EPA has, but we would like several amendments to it. We would like, for instance, for there to be a more substantial cover, a more substantial temporary cover. We are concerned that just laying plastic on the top - the cover may not last for the 25 year period, and will have to be repaired more often; that may be more expensive if the cover has to be repaired more often. Perhaps there should be some protection to that cover; perhaps some earth soil should be put over the top, as was suggested by David Kluesner earlier.

We are concerned about the erosion of the hillslopes, and we are concerned about water infiltration into the trenches. We would like the EPA to set strict criteria for when a barrier will be introduced to prevent this water infiltration. In other words, how much water has to get into the trench for there to be a decision that there be a barrier that is inserted all around the trenches to prevent water from moving laterally into the trenches.

We are concerned about the perpetual monitoring and maintenance cost. We want that to be adequate; to cover contingencies; to cover local road construction and repairs; to cover inflation, and to cover administration costs. We have pointed out at other times that the factor that they used to calculate how much money should be in the fund, remember we are having to calculate a fund that is going to be used 100 years from now; so you need to put enough money in, in order to be ready in a 100 years. You have to take into account the interest rate; you have to take into account the inflation rate, and you have to do that for a hundred years from now; a slight mis-calculation may mean that you don't have enough money, and so you have to err on the side of being conservative. We would choose what is called, the discount factor, the difference between interest and inflation of two percent. The PRPs and the EPA have suggested four percent; that makes a big difference how much money should be put into the fund. It amounts to more than five million dollars that would go into the fund, if you assume two percent versus four percent.

The contingency factor is important. If

you can't readily estimate what the engineering costs are, then you have a fudge factor that you put into it, a contingency factor, which counts for some of these costs that you can't estimate.

The Nuclear Regulatory Commission has assumed a 25 percent contingency factor for burial ground closure, but the EPA is assuming a contingency factor of only 10 percent; that difference of 15 percent is important, again, and again, it would amount to more than five million dollars.

The actual details of how the fund is administered - the costs for administering this fund, and actually who is going to hold the money is a question I have, and who are the licensees and the person who has to do the cleanup have ready access to that money are important question. But there should be some money set aside for administering this money, and we estimate that to be on the order of 15 percent; perhaps another five million dollars should be set aside, and local road construction is an addition, and so it is - other than the 35 millions dollars, we are suggesting that, perhaps, another 20 million dollars has to be included in this fund.

Those are the end of just some short comments that I have, and Maxey Flats Concerned Citizens will submit much more detailed comments on the Risk Assessment, which will, then, be a part of Public Record, but I just want to underline, again, we want this process to proceed as rapidly as possible; we support the proposal method which has - which the EPA has suggested. Thank you.

COMMENTS

BY MR. DAVID KLUESNER:

MR. KLUESNER: Thank you, Marvin, and Bill, would you like to make some comments for the Maxey Flats Steering Committee?

BILL WEBSTER: Very brief.

MR. KLUESNER: Very brief, okay.

COMMENTS

BY MR. BILL WEBSTER:

MR. WEBSTER: I volunteer to hold the money, if anybody would like to give it to me. My name is Bill Webster, and I do appreciate the opportunity of making a very brief statement on behalf of the PRPs. You have heard a lot about PRPs tonight. We do have a Steering Committee that represents about 82 of the 600 or 800, however many PRPs they are. We are some of the larger generators who do represent a significant part of the waste that was disposed at the Maxey Flats.

As you have already heard tonight, in early '86, we formed a Steering Committee; that Steering Committee entered into a Consent Agreement with the Environmental Protection Agency to do the Remedial Investigation and the Feasibility Study.

We worked closely with the Commonwealth of Kentucky and with the Environmental Protection Agency in carrying out that responsibility.

We issued the first draft of the RI/FS in, I believe it was December of 1988. Since that time we have - there have been several reviews. There have been several revisions to both of those documents; in fact, all the documents. We issued the last revisions to the RI/FS in March of this year. So, they have been under continuous review and evaluation.

The RI/FS, or the technical basis supporting the preferred remedy as you have heard tonight, they certainly meet the criteria that David has laid out; they certainly provide complete protection to the health and safety of the public. Although there are some issues that you have also heard that do remain to be resolved, we don't feel that any of these will change the remedy. There are things that do need to be decided. You heard Marvin Resnikoff mention a few of them, and I don't plan to go into those tonight, but I think that by working together, we will be able to resolve those issues.

You have also heard that we have reached a significant milestone. We do have a preferred remedy that the Environmental Protection Agency, the Commonwealth of Kentucky, and the PRPs are in agreement on.

I was pleased Dr. Resnikoff mentioned that he thought it was something that was acceptable to the community; so, we are happy to get that report; to have a preferred remedy that we can all agree with and support.

The other thing I would like to say, I would like to just reiterate what David said;

We, of the PRP organization, think that we should proceed as rapidly as possible to resolve any comments that the community has, so that we can reach a ROD, hopefully, in September; if we do that, we will be able to - well, that will then permit the Environmental Protection Agency to start negotiations with the PRPs and whatever other responsible parties that they can find, and we look forward to that, and we are as interested as anybody or any of the other agencies to see this move forward in a rapid and responsible fashion.

I guess to just kind of summarize, the PRPs are happy that we have reached this milestone. We have a preferred remedy that we can all agree with. We, again, encourage whatever is necessary to reach a ROD and continue negotiations with the PRPs.

And as David has already mentioned, we do have a display here that is actually a full scale model of what we visualize the final cap. There is Dr. Cockrell and Robert Cannon are here with us; afterwards if you have any questions, those two people will be here and answer any technical questions you might have regarding this - that cap and closure. I, personally, will be available and will be happy to try to answer any questions you have concerning the PRP organization, our activities, and hopefully where we are going to be going from here. Thank you.

COMMENTS

BY DAVID KLUESNER:

MR. KLUESNER: Thank you, Bill. Now, we will open it up for questions at large. We are going to try to answer your questions; if you could, walk up to the microphone so that we can hear it up here in the front, and we would appreciate that. I am ready for questions or comments.

COMMENT: I don't think people want to walk up to the microphone.

MR. KLUESNER: Well, if you can holler just as loud as you can.

COMMENT: Well, I can holler loud enough.

MR. KLUESNER: We will let you know if you need to speak a little bit louder; if you don't feel like getting up to the microphone, just speak as loudly as you can so that we can hear you.

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COMMENT BY BILL INGRAM: My name is Bill Ingram. I live in Dayton, Ohio. I was born in Maysville, Kentucky, and I would like to retire back to Kentucky within the next couple of years, but I don't think I want to be too close to Maxey Flats.

On page 9 of your report, you mention about the radioactive deer. I was here for the 1989 meeting, and it was mentioned that there was radioactivity coming out of the ground; deers eating these plants; deer leaving radioactive droppings, and nobody should hunt in this area; nobody should hunt any kind of animal in this area.

In 1990, I was at the Maysville College meeting, and yet, even though many of the people who were speakers at the 1989 meeting were at the Maysville College, nobody would own up to that statement when I asked about it. Here it is in your report for now. I am wondering if, perhaps, radioactivity has had some sort of effect on any of their minds. Whatever, somebody needs to get the word out to the hunters, because I work with a lot of men who come from this area; they come from Morehead;

they come from Flemingsburg, and when they go deer hunting, they come right back here, and until I tell them about it, they didn't know anything about it; nobody has sent word out to these hunters.

The other matter I want to bring up is about containment. I don't believe that any kind of containment is going to work. They showed us this piece of plastic here, and I asked at the Maysville College, I said, "What are you going to do to hold this plastic down?" This is a just a thin piece of plastic, weighs next to nothing, and one of the scientists said, "Well, we will hold it down with concrete blocks." Now, you people have got tornados down here that lift up barns and cows and mobile homes and stables, automobiles; concrete block is not going to hold down a piece of plastic.

A two-foot thick piece plastic is not going to hold down in a tornado.

And then you want to talk about putting grout walls in for a horizontal containment, there is no way you could work enough grout in here to plug up every hole.

Now, the third thing on containment is,

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nobody has said anything about trying to put in a floor - trying to inject a floor under Maxey Flats, and yet you have a cave near Carlsbad Beach or Carlsbad Caverns in New Mexico, and it shows you what water can do to dirt; what water can do to limestone. This is a carbon area; limestone area.

There is no way that containment is going to work.

The answer, I believe, is to dig up everything out there at Maxey Flats and put it in a proper kind of containers and take it out to some desert area where you don't have rain; where you don't have water; you don't have erosion. They have built those cannons now, and you could shoot them into outer space; shoot them clear out of orbit. You can get rid of this stuff.

RESPONSE

BY MR. DAVID KLUESNER:

MR. KLUESNER: Thank you for your comments. I think you brought up a couple of points that are worth consideration. I think that EPA and Kentucky do need to go out and make sure that we know what is going on in these hillslopes

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and work together and make sure certain activities are not going on, and we are able to inform those who may be getting into the wrong area, and so I think that is a good point, and we will certainly try to address that.

And I think another point that you had as far as to some of the specifics of the remedy have not been developed yet. With regards to the synthetic liner over the cap, it has been used in various applications, various types of synthetic liners, worldwide; there is a lot of knowledge on liners, and we acknowledge the fact that a synthetic liner, alone, may not be the answer; that's why we have built into the preferred remedy a review of this particular aspect of the remedy, to make sure that it does not increase the surface water runoff, leading to erosion, and we need to make sure that, yes, it is going to be in place for the desired timeframe. We certainly don't want to have to go in and replace it everytime we get a high wind, and so we are going to get into the details nd a design, and work on this a lot, and I thank you for your comments.

Any other comments or questions? Yes, sir.

COMMENT: The horizontal flow barrier, what would it be made of? How deep would it have to be?

MR. KLUESNER: As far as the makeup and the depth, that is something, again, that we have some conceptual idea as to what it would consist of. It would be, basically, a grout or a mix, and you get into the specifics of what that mixture is as you get into developing that wall, but it would, again, be a combination of cement, water and various other mixtures that would harden after injecture into the ground to form a wall; as far as the depth, there have been some suggestions as to how far to go; I believe that Commonwealth has suggested that it go as far down as to the Henley Bed, which is---

JOHN VOLPE: 80 to a 100 feet.

MR. KLUESNER: ---about 80 to 100 feet. We have - given the fact that we don't at this time know if it is needed, we haven't gotten into the specifics of the depth that is needed for that wall, but, again, the key is if we are getting some lateral recharges in those trenches, that is something that will probably be needed, and that is why we have it in each alternative and recognize, you know, that we could have some lateral recharge going on; we will wait for the trenches to dry and get into that further.

COMMENT: That's my next question. Do you have any rough idea about what percentage of the infiltration is coming from the lateral sources, and what percentage is coming from rain?

MR. JOHN VOLPE: No, no rough idea at all.

COMMENT: Is it about half and half, or is it one more than the other?

MR. JOHN VOLPE: We have no idea. There has been quite a bit of work done by the U. S. Geological Survey; by the PRPs; by the Commonwealth in looking at that particular question. We looked at it on an early basis. It started actively with data in the early '80's, late '70's of leachate being moved through trenches, but since pumping was stopped in 1986, we have a pretty good idea the rate of infiltration based on that date, and the U. S. G. S. data, PRPs' information; it looks like that approximately 70 to 80 percent of the infiltration is by the vertical route, or maybe more than that.

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COMMENT: What route?

MR. VOLPE: The vertical, through the trench cap; that may be a low number, okay? The rest may be coming from the horizontal pathways; that's something that will have to be addressed. We are addressing that at the present time.

MR. KLUESNER: Now, I sort of described the preferred remedy - or the discussion on the horizontal flow barrier, and we are going to continue to add to ground water data base that currently Kentucky has been doing; U.S.G.S. has been doing quite a bit of monitoring for many years, and they have developed a tremendous data base. We intend to supplement that data base with additional information that we get from the leachate extraction program; when we actually pump the trenches dry; that's going to give us a lot of information. The infiltration monitoring system, which will be in place, to detect liquid infiltration into the trenches will give us some information; that's the type of information that we will use to make a decision, and hopefully get a better handle on the actual percentage getting into

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the trenches from lateral recharges, if any. Yes, 'mam?

COMMENT: Has EPA considered a reopener clause; have you considered it, or are you going to include that in your alternative?

MR. KLUESNER: Correct me if I am wrong, Mary, but I think we pretty much have reopener clauses in just about everything that's in the Decree that we sign.

MS. MARY WILKES: There are required reopener provisions in all Consent Decrees; the extent of the reopeners and the nature of the reopeners will vary, depending on what is in question. We will get into more detail when we know what the final remedy is, but there are standard reopener clauses, and we make them in every Superfund cleanup.

COMMENT: That was the first part of my question; the second part is, what will happen if, in time, there is not sufficient money to maintain this the way it is, or you deem necessary; what provisions are - have you made? I guess that we all think that there should be a considerable amount of money in this maintenance fund, and if there is not, what will happen?

MR. DAVID KLUESNER: That is a valid concern, especially so with this remedy where we are talking about monitoring forever and ever; we are talking about final closure 35 to 100 years from now, and we are talking about estimating numbers, and as Marvin Resnikoff talked about the inflation rate and discount rate, and so forth, you have a very valid concern. I hope that we can address that through the Consent Decree, through the legal document which would form the agreement. Do you have anything to add to that, Mary, as far as ---

MS. MARY WILKES: No. I think you properly addressed it. It is certainly hard to know a hundred years from now to know what the costs are going to be. It is also going to be hard to know what mechanisms are going to be in place a hundred years from now, if some of these funds are not sufficient to meet the needs. We are going to do the very best we can there to make sure there is a sufficient buffer in the estimate of the costs, so that that won't happen, but like everything else, you can't tell exactly what the economy is going to do, inflation and everything else.

We are going to do the best we can, and of course, we have got experts dealing with that interest, as far as what needs to be done; working at this point on with the Commonwealth, the PRPs, and are trying to come up with what everyone can agree on as being the best that we can do and what funds will be needed. There's no way, there's no way for us to know, for sure, if that money is all that is required; all we can do is use our resources and come up with the best that we can come up with, and be comfortable that we built in enough for a buffer there to at least to address foreseeable changes.

COMMENT: Will the licensee have control of this fund? I am kind of concerned about this fund; who administers it, and suppose our General Assembly or the governor said, "We need to borrow some money." Can they borrow money from this fund? I mean, you know, could it be something like that?

MS. MARY WILKES: The fund - and it has not been decided, specifically, who will maintain or control the funds; however, there are mechanisms that would make it - where it can only be spent on this site. It won't be set up in such a way that it is accessible to any other program; no matter who is in control it will be limited to remediation of the site.

Now, in terms of, there are other - there are various ways to set up those kinds of funds, and that doesn't bear on what the remedy will be, but we will have to figure out what the best way is, depending on who ends up doing the work and the realities we address when we get there, but no, it will be specified for that purpose and that purpose only, and it won't be accessible for any other purposes.

MR. DAVID KLUESNER: I know that there is probably a lot - a lot of questions on that, but I would like to stress that we are trying to make the best technical decision and make that decision and then get into a lot of those questions. I, you know, I don't think it would be appropriate to get into a lot of those questions while we are trying to decide what the best technical solution is; so, therefore, we don't have all the answers at this time, but we will get them soon. Yes, sir?

COMMENT: In your preferred remedy that

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Marvin has said that we have come to an agreement with, you give very little detail to the buffer zone and what you will do on it. In the pre-plan or pre-design stage, what do you anticipate to do with this buffer zone?

MR. DAVID KLUESNER: We had a meeting with the landowners May 22nd.

COMMENT: Yeah, I am one of them.

MR. KLUESNER: We told them that there is a lot of flexibility in this thing. We know, or have identified, what we consider to be a minimum area which is primarily those hill-slopes, which surround the site, and some of the areas going down toward Rock Lick Creek that may be needed for the purpose of monitoring and an area of the hillslopes for the purpose of protecting those from erosions. As far as a timeframe, we told them that this is some-thing that is going to happen after the Record of Decision; that the precise details are not available to us now; that they won't be avail-able in the Record of Decision. We would like to work with each individual landowner, because each one has different circumstances, and do what is best over 'l; what is best for the remedy; what is fair to them. So, therefore, some of the details have not been defined yet. We are going to be talking to them again, individually, and as groups in the coming months. We know that they have concerns, and there is some uncertainity in their lives right now, but, you know, we are going to try to hammer those details out, so that we can get control or have some sort of agreement with them to - as far as access or whatever. The most important thing is that we have flexibility in this buffer zone.

COMMENT: My question more specifically is, do you anticipate the use of this buffer zone for some sort of construction to stop horizontal movement, which I think some of them that I - which you collected were, actually would be on that property.

MR. JOHN VOLPE: Yes.

COMMENT: That wouldn't be on the site that is owned now?

MR. VOLPE: That is probably pretty far down to the side of the site. We are not going to change the licensed boundary of the site, and I can say that, since we are the regulators, I can say that with some degree of authority, I guess. What we plan - what the Commonwealth envisions using that area is as a restricted zone, to permit access for monitoring, for example, to put in wells and to remove them; so that we would have a monitoring system; to make sure whatever remedy we choose is functioning as we predicted. I don't - the Commonwealth doesn't see major construction activities in that area, except for well installation and that type of - and sampling stations.

COMMENT: When we go into the interim cover that is in the preferred remedy, and we are going - we are going to do our contour toward those existing drains, what do we do - what is the proposal to take care of the velocity - the increased water velocity in those drains? And that is one thing that we looked at before, that volume, and I took a walk up those drains.

MR. DAVID KLUESNER: Yeah, that's a very important consideration; very important point in the remedy is to make sure that we have good control over the rain and surface water runoff. We certainly don't want to - to increase

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or accelerate the erosion of those hillslopes, and so we are going to look very closely at the existing drainage channels and make improvements to those drainage channels, and look very seriously at added drainage channels to sort of make the flow from the site a little bit more equitable and make sure that we don't have a majority of the runoff going through one structure. We may have to increase the capacity of the retention ponds to slow down this large volume of water, and all of these things have been considered, and we need to get into the details of them soon, and that's my response.

MR. JOHN VOLPE: Right now the east drainage retention pond handles about 60 to 70 percent of the runoff; that's one of our problems. So, we have to distribute that through the other natural channels at the site. That should give us some method of control over erosion, if we can integrate that cap into the drainage channel properly, into those various natural hollows. I think that can be done without too much difficulty, and that type of approach will probably, hopefully solve some of the erosion problems that presently exist at the site, by utilizing these natural - three or four of these natural drainage channels that exist at the site.

MR. DAVID KLUESNER: Yes, sir?

COMMENT: Doesn't the Constitution provide just compensation when you take somebody's, a piece of their property, and has to effectively, inadvertently condemn that property already; putting it in the buffer zone; is there going to be a provision in this to pay for this land?

MR. DAVID KLUESNER: That sounds like a question for Mary.

MS. MARY WILKES: Yes, and we went into this with a great deal of detail with the landowners. This is not - we are just going to take a buffer zone. What David was referring to when he said there are different needs; different circumstances with the landowners, but we are going to be dealing with the landowners, individually, over the coming months to talk to them and find out what their preference is in terms of either selling the property for the buffer zone; leasing the property for the buffer zone. We are not going to take it without any kind of compensation; that is not being done. What the uncertainties are is exactly the extent of the buffer zone; we have identified a minimum area. To some landowners maybe nine-tenths of what they own; so, we are going to be dealing with each individual landowner, what their needs and circumstances are in our obtaining the buffer zone, but not for free. But some people may not wish to sell; they may prefer a lease agreement, and we are open to doing that, but we are going to have to figure out a way of ensuring the access that we need, and making sure that whatever arrangements we come up with meet the remediation that we need, but no, by drawing this line, we haven't taken any property, and we are dealing with them on how to either purchase or obtain property from them.

MR. DAVID KLUESNER: Yes?

COMMENT: This fellow back here from Ohio brought up a question I was wondering about; how likely is it that you will, in the future, either restrict hunting in the area, or issue an advisory that game obtained in the area not be consumed?

MR. JOHN VOLPE: That is probably a legal question.

MS. MARY WILKES: Well, I think it is two-prong. First, let maybe, John Mauro address the risk associated with consumption of deer meat, based on the analysis of that dosage, and it is really not very significant, but he can address that aspect of it, and then we can go to the other aspect of it, okay?

MR. JOHN VOLPE: But there is one thing that you can consider, I think you make - you can do the risk assessment on it, but I think what we have to consider from the Commonwealth's point of view, and the PRPs and the EPA, we may have to go out and do some sampling of the population in that area to confirm what the risk assessment says. I think that is critical in making the decision he wants to make, okay, and I don't believe that has been done to a sufficient extent at this time.

MR. DAVID KLUESNER: John?

MR. JOHN MAURO: Yeah, thank you, David. Our risk assessment did calculate that path-way and came up with relatively - very low doses, well below the Radiation Protection Standards; however without confirmation through ongoing diligent sampling and analysis to confirm the reliability of those mesaurements. You do a risk assessment; you monitor; you gather data, and re-evaluate, and it goes on like that. Right now, the best information we have is that the levels of Tritium that has been released from the site, and therefore, accessible to grazing and animals are not high enough to put doses above the Radiation Protection Standard, but that doesn't mean that at sometime in the future those levels will not be observed to be higher, but our best information looks like it is well below the Radiation Protection Standards.

COMMENT: Would these radionuclides tend to concentrate over time in the animal, or would they be discharged; would it be like chemical concentration in the fatty layers of fish, or would it pass through?

MR. JOHN MAURO; Every radionuclide is really an individual chemical; has its own biological properties. When we mathmatically model, we take that into consideration. There are certain radionuclides that do accumulate, and that is factored in. It turns out Tritium, which is the main radionuclide of concern, is effectively like water; so whatever the concentration of the Tritium is in water leaving the site, that's the same concentration the Tritium will be that will leak out into the body of water; so it really does not reconcentrate. However, there are other radionuclides that do have a potential to reconcentrate, and so all of our models deal with each radionuclide uniquely, and not only with the animals but with each tissue relative to the animal body; so it is a fairly complete, sophisticated process.

MR. JOHN VOLPE: John, there is also a clearance time. It's just like for any - calcium, sodium or any other trace metals in the body, there are clearance times for radionuclides, also; so, there is a turnover period within the body, depending on the radionuclide; so that has been factored into any risk assessment. It is critical from a biochemical point of view when you are determining the factor of the safety.

COMMENT: So, you are not going to do a game ban; you are going to leave it open. Is that the answer to his question? No, there is not going to be a game ban?

MR. VOLPE: Based on the risk assessment, it shows there is no - that the levels of millirem from that particular pathway would be about, John, one millirem a year?

MR. MAURO: Yes.

MR. VOLPE: The NCRP, the National Council on Radiation Protection has come out with a suggested potential level, what they call, a negligible individual risk level, of one - below one millirem one does not do anything to correct that situation. You just can't do anything, in other words. It is so low, there, there is some uncertainity that that particular pathway may not be of critical importance. If that pathway, if the Commonwealth, the PRPs and EPA see increases in that pathway, true.

John didn't mention this, but the risk assessment is a dynamic process. It doesn't just stop here. It is an ongoing situation, and we will continually revisit this situation; if we see - if the Commonwealth sees changes, then we will re-evaluate what you are saying.

COMMENT: Will the Risk Assessment, itself, be available in the Administrative Record?

MR. MAURO: It is with the Feasibility Study, about a two inch document. So, it is part of this RI/FS report.

<u>COMMENT</u>: Are its underlying assumptions also included?

MR. MAURO: Oh, yes, everything.

<u>COMMENT</u>: The USGS did a study very recently that showed that there were some series wells, and some of the wells showed a very high level. In your fact sheet you did refer to that pathway; that there were indications of over 1000 pico curie, something on that order, and I believe they were more on the order of 200,000; the assumption is that the deer is not going to drink that particular water, correct?

MR. VOLPE: Is that based on current samplings; is that what you are talking about?

<u>COMMENT</u>: Current sampling from the most recent USGS report.

MR. VOLPE: The USGS wells are relatively high, but the surface waters are what we are discussing here; the levels that the Cabinet for Human Resources have detected are high levels we have seen in the area inside the boundary of the site are in the neighborhood of 1000 pico curie per millirem of Tritium. The wells, obviously, are much higher than that, but I don't know how that would impact a deer; it would, obviously, go through surface water.

COMMENT: Well, nobody - assuming that the deer aren't going to get in the restricted area.

MR. VOLPE: There is deer in the restricted area, obviously; we have seen them.

MS. MARY WILKES: I think the point that John is trying to make is that the wells you are talking about, and the spikes, and those are wells and not surface water where deer would have access to them. The spikes are coming from underground.

COMMENT: And the underground water is connected to surface water farther along. This is Kentucky. We have varied topography. None of the water stays in one place.

MR. VOLPE: We are not arguing that point with you.

MR. MAURO: The levels that are in the immediate vicinity of the trenches, samples

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that are taken from them have a very high level of Tritium. Now, when we model this, we model the factor, what the rainwater that is getting into the well, and that is moving out, leaving the strata and moving down the side of the hill and running down. In the process, it takes some time, and so there is some radioactive decay; there is also a lot more water now that is moving out into the entire watershed from underneath, and then, at some point, it surfaces and it makes its way down to the alluvial plain, and one of my pathways was that if someone would now drill a well down in the valley in which to hold water, that that turned out to be the highest dose for that pathway. So, we did look at that, but bear in mind that the concentration of Tritium in the water, by the time it moves out, and is modeled down the hillslope, down to approximately 300 feet into the valley, the concentration is much lower; still that was a critical pathway. You have got 60 millirems per year. It is acceptable at 25 millirems, so that is a concern, certainly.

MR. VOLPE: John, we have a substantial amount of data on those hillsides, and this has all been published in professional journals of Dr. Taylor's at the University of Kentucky, and we have met with the folks, and we can show you that the levels of Plutonium and the levels of Tritium decreased within the boundary of that site, and obviously we have seeps in the springs, which we monitor constantly, where we see this popping up.

COMMENT: Are there also been plumes for the bio-chemical radionuclides? You mentioned in your report briefly here, Strontium 90. It is well known that gets into the food chain, into the milk and is starting to show up a few places. I understand the Tritium seems to be the larger radionuclide pointed out, but I think the concern here is for what is going to be bio-chemical?

MR. MAURO: There are about 16 radionuclides that were seriously modeled. Tritium turned out to be the leading one, but Strontium-90, Cesium and all the other radionuclides were modeled, and what would happen is, we take into consideration now the fact that when a radionuclide, such as Strontium is migrated, it doesn't migrate as quickly as Tritium. It

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as a tendency to interact with soil and be held up, and so what happens, it is retarded, and as a result by the time it does reach a point where it is accessible for use such as well, there is a significant amount of radio-active decay; in addition, the concentration of the Strontium in the leachate is much, much lower than is the Tritium; so, all these things combined, when we do model the Strontium level, all these related factors, reconcentration factors are all part of the equation, but even with that, Tritium is still, by far, the dominating radionuclide.

COMMENT: There is - there is no safe level of radioactive material. When you find out that something as simple as a mole rubbing up against your clothing can cause cancer, then you can easily see that there is no safe level of radioactive material. There will be radioactive material at Maxey Flats after 24,000 years. When we talk about arranging for financing for 100 years, but radioactivity can last for 24,000 years for some of these materials. Now, in 1989, I ran an advertisement in the papers down here advising people to get hold

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of lawyers to see about forcing the government to buy their homes, because this real estate down here was ruined, and the deers and the birds are leaving droppings all over the place; birds don't have a migratory pattern; they migrate here, there and everywhere, and then the animals, the deer, and you could be talking about an area miles around that needs to be inspected with Geiger counters and checked out for miles around.

COMMENT BY REP. PETE WORTHINGTON: The comments that are to be made in the next 60 days, and you all are going to try to do the Record of Decision by September; what procedure will these comments you are receiving now and in the future be considered in the Record of Decision?

MR. DAVID KLUESNER: In the proposed plan as mailed out to the community, I put my name and address on the back of that proposed plan to send written comments to me. The proposed plan was handed out here at the meeting tonight. What will happen is the comments would be put in writing; sent to me during the Public Comment Period. We would take those comments and respond to each comment; if there are comments that are the same, we will group them together, if they are the same comments. We will respond to those comments in the Record of Decision; put this in the responsive summary section of the Record of Decision, and which is, then, made available to the public. If there is a request for a copy of that document, or so we can make it available to as many people as we can, we will put it in the libraries; if there is a request for us to send a Record of Decision to them once it is signed, we will certainly do so, to let them know that we did respond to it and consider it. Does that answer your question sufficiently?

<u>COMMENT BY REP. PETE WORTHINGTON</u>: Does that say that the comment you think about, does that change the Record ---

MR. DAVID KLUESNER: Well, we are not going to make an assessment of what we think about the comments. We are going to respond to each significant comment, whether it be valid or not; we are not going into that. We are going to respond to each comment. We have some that certain elements of the remedy have changed. We have added - subsequent to the Public Comment Period, we have added certain features to the remedy that were, perhaps, overlooked during our investigation. There is a possibility that we could have a change in some information that was overlooked.

COMMENT BY REP. PETE WORTHINGTON: If there is data available of 3-4 percent discount rate, instead of the 2 percent, I am wondering, would that be considered, or would that be a passing comment?

MR. DAVID KLUESNER: I am trying to think how we would respond in the Record of Decision. I don't think that we could say in our response, yes, we will got with the 2 percent discount rate. I think that to the extent that you have an opinion or suggestion on what to go with, be it a discount rate or who is to hold the license, or implement the fund, we are not going to specify that in the Record of Decision; that is something that is going to be dealt with at a subsequent settlement negotiation and what happens after that, but I would still like to hear what people want in terms of certain aspects of the discount rate, but in terms of

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a response to the amount, I don't think we will be prepared to tell you at that time that we are going to go with the 2 percent versus 4. I don't think we can do that.

COMMENT BY REP. PETE WORTHINGTON: All of the trenches have, I don't know, maybe a 100 sumps for monitoring the water. The proposal I saw before took out the sumps and put in electric monitoring systems in to monitor the water, and I think the Commonwealth of Kentucky objected to that, and if I write, I am going to be making a comment, and is that going to be considered, and how is it going to be considered?

MR. DAVID KLUESNER: I don't think that is what we are advocating or proposing. If there are sumps out there that we need, either for the purpose of monitoring or for the extraction program, I can't imagine why we would want to close them out. I think what you are referring to are some existing sumps that are no longer of use that we would propose to close out in order to eliminate the possibility of some sort of contamination migration down through the sump, but to the extent that we can use what is already out there, we will. We intend to supplement what is out there and close down only those sumps or wells that are no longer of use.

COMMENT BY REP. PETE WORTHINGTON: I was using that as an example. I wanted to make sure that as different people in the community go by and study the plan and make comments, that those comments will be given consideration, because I think there are going to be not major points of contention, but I think there are going to be some points of contention, and I am hopeful that they will be resolved.

MS. MARY WILKES: Every comment will be seriously considered. I think that is the underlying answer. It doesn't matter what the comment is or where it came from, they will all be seriously considered. What David can't tell you is what the result of the consideration will be at this point and their potential, depending on what the comments are, on a Superfund Site, but if a comment is significant, and it warrants a change in the remedy that the EPA has preliminary selected for the site, the remedy will be changed. We aren't going to go with a remedy if we are provided information or comment that that was not the proper remedial action, and to answer your previous question; yes, there is a potential that based on public comment, we could change what our preferred remedy is.

COMMENT BY REP. PETE WORTHINGTON: Well, I hope that is true. I just know that in August, the comments come in, and in September if we move for a Record of Decision, it doesn't give enough time to make those changes.

MS. MARY WILKES: Well, the comments should be coming in over the 60 day period; we are not anticipating getting every comment on the last day of the 60 day period. We will be looking at and considering comments all the way through the 60 day Public Comment Period.

MR. DAVID KLUESNER: Oftentimes they do come in, you know, the last week, and it is a crunch to in a tight timeframe to get those all considered and responded to, but we are certainly gearing up to and in anticipation of quite a few comments, gearing up for support in looking at it and seriously evaluating those comments. We have what we believe to be sufficient support; it is hard to estimate how much we are going to be getting, but you are right; there could be quite a few toward the end, but we do fully intend to review each one and seriously consider it.

COMMMENT BY REP. PETE WORTHINGTON: I think we are all anxious to move forward, but if we move forward at a pace that we don't consider - and a conclusion that we aren't all comfortable with, it would be unjustifiable.

MR. DAVID KLUESNER: Right. Yes, 'mam?

COMMENT: I live approximately 2-1/2 miles from the Maxey Flats site. We have a spring well. We have had this water tested. It is contaminated. So, what are we supposed to do? We never asked for that to be put there. So, they ought to help us out.

MR. DAVID KLUESNER: All right. You are referring to a specific sample data that was collected? I guess I am not quite sure as to what you are asking, or where your information is coming from. We are interested in knowing what data you have. Would you share it with me when you looked at it?

COMMENT: We have had different samples

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taken to the Fleming County Health Department and sent off, and they come back and they say the water is contaminated. We can not get water run to our house, because we live up a holler, and there is one person that lives besides us on that road. So, what are we supposed to do? Are we supposed to haul our water like we have been doing from miles away?

MR. DAVID KLUESNER: I would like to look at the sample data to see what type of contamination there is; if it's radionuclides or it's bacterial contamination; nonetheless, you have got a concern that we need to look at, and so, whatever I can do to help you out and look at the information that you have; I would like to be able to do that.

MR. VOLPE: Send us the data.

MR. DAVID KLUESNER: You can send us the data, or if I could get your phone number or - I could get in contact with you, and I would like to do that. Yes, sir?

COMMENT: My main concern is your all's alternative mentions twice about the horizontal flow barrier and would be constructed, if required, and then the next page, page 16, you say, Installation of Horizontal Flow Barrier, if needed. Why this concerns me, when you try to sum this up, and I have got two semesters' worth of geology, basic principles of geology; if you will look on page 8, it gives you the North-West, South-East of the geology; that view, looking at it, it would be as if you were standing, looking down, as you are going down this ridge line; it's a topographic feature, land form, where you have a valley on one side, and you have a small valley up through here, but this water - now, looking at the latest, and for example, this is how far it is how far it is obstructed, even if you put a cap on top of it.

Okay, in this part, you condense it down to this one layer, which would be probably the Nancy Member, running this horizontal barrier. Or take, for example, upon the east or west side of this waste area, when we are looking at that dump, this ridge line runs down into Rock Lick Creek; look at that side view of that. Here is this big expensive cap; then you are not sure if you are going to put this horizontal barrier in. Well, this

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thing, the law and principles of horizontal geology is a geological principle; now over these millions of years, I am sure, this has tilted just a little bit; that water is going to come down, having a cap or not, and come under and drain this out. And if you don't have this wall coming so far down in these two members right here, you know, it is just going to take it out, and it is going to run out the sides, anyway. Okay, if you do put the wall in there, the water runs under.

This remedial investigation was back in '87. You remember in 1988, we had a series of droughts; water tables sink. Okay, you got your wall in here; you have got your cap - you know, I read in the U.S.G.S. reports, but what happens if this - if this, if these two or three shale members, if they are forming an aquifer or a layer of rock that is not permeable, all this other stuff is going to percolate. This type of barrier; you may have different types of rock and geological structure for different members of the soil; that's going to come underneath, eventually; it might take them a while; it's going to come underneath it; it's

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going to come past this wall; it's going to go down; it's going to go under - as you can tell, it has been tested in many different places, all the different members, the Nancy Member, the Farmers Member, the Henley Bed and the Sunbury Shale. If you look at page 8, that's a north-west, south-east view. You are looking down in this bottom, there is a valley on that side; there's a valley on that side. Okay, if you put this wall here, it still comes under. If you draw that - those contaminants underneath, to the next layer; then if it does percolate all the way down to the shale layers, it is eventually going to come on out, and what concerned me was not having the wall at all, because if you didn't have that, it is coming to come underneath this very expensive cap, and like I said, when you crest it with this much area, which would be probably, even with the wall, 50 to 100 feet. This vertical exaggeration is 10 times, I would like to note that, the water will come on through, and then it will pick this stuff up, and it is going to come out the side, eventually, you know?

The Risk Assessment is one thing, but

that - that is going to happen, and that is what kind of bugged me, in your all's alternative, you said twice, if required; you know, if needed. How can you say it is not needed? Even with your percolation rates, I am not exactly 100 percent sure of the percolation rates of that different members of rock, but without - without that north flow wall - if you look on page, I guess it is the main map, the topographic map; it's not a geological structure map, which doesn't take into consideration the hypothetical questions of geological faultlines and other - other things that have to be looked at. You can look, right there on the map. There's a north-west view; here's the waste disposal; this is the valley; this is a valley. The site is on top of an area which is raised up, and I put a purple line, right there, across my map; that would that north - the north flow, and that would be the barrier, but it just - that's all I wanted to add, because it doesn't just concern me; I work in planning and zoning this area, and you know, we are going - there is no way you are going to get rid of all of the contamination, but if you don't have these

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barriers in here; you are going to start doing all this other stuff, it just seems to me that you are just going to get water, and I don't know exactly how, you know, but that subsurface geology, it's going to percolate, and it is going to go right underneath this cap, and I don't know if it is exactly level; I don't know if it is tilted just a little bit, you know it's going - the underground movement of water is going to bring that stuff out, and so that's leachate collection, and it is another matter, and that is all I wanted to say.

MR. DAVID KLUESNER: Thank you for your comment. I think that if you have had a couple of years of geology, and I have a degree in geological engineering and have had a lot of challenging courses; I know that when we all - we sit in the same room, it's kind of like when attorneys get together in the same room, everybody has their own opinion as to what is going on, and sometimes we don't always know everything that we would like to know, and there is some uncertainity out there, and that is why we have, if needed, or if required. What - the overriding concern is going to err on the side of conservatism. If a wall is required; if through the monitoring program, the infiltration monitoring system that we put in place; through the trench leachate extraction program; through additional wells subsequently placed in those trenches, we will get a lot of additional information; use that in connection with the information that we already have, and then try to make that decision. I understand your concern, and what you are saying, there are those who feel the same way that you do. A wall might not be required. We are just looking for a little bit more information to make that decision.

COMMENT: It seems to me like - and I know that it takes time and planning, but the longer you wait, the worse it can get, it seems to me; it just seems logical the worse it will get.

MR. DAVID KLUESNER: Well, one of the most important things to keep in mind is that we are going to pump the trenches dry, and that should cut off the local area from leachate into the environment, and we want to keep them dry, and that is where this wall could come into effect. The bottom line is that we have to keep them dry.

COMMENT: Yes, but once it is dry, the radioactivity that has already went down into the lower members - it's like, you know, a sponge, and I just don't believe you can pull it all out, and you are going to have to deal with the leachate that runs off from the rest of it.

MR. DAVID KLUESNER: Sure, you are right. There is not - there is not an extraction program for the purpose of extraction of all nuclides that are already migrated into the lower strata. The extraction program is designed to dry the trenches out.

COMMENT: It just seems to me that the north wall, you know, it's - you would almost have to consider that.

MS. MARY WILKES: Correct me if I am wrong, David, but the decision on the north cut-off wall - well, and it is way before the final cap; that would be early in the process, and so it wouldn't be after all of this was done and gone.

COMMENT: Whether you have this huge cap with a half inch of plastic over it, the same thing is going to happen to the underground water flow is what I am saying.

MR. DAVID KLUESNER: Any other questions? If not, I certainly thank you. I appreciate you being patient and sitting in, and for all your questions that have come forth. Once again, thanks, and we will look forward to seeing and meeting with you again, thank you.

PUBLIC HEARING CONCLUDED

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STATE OF KENTUCKY
COUNTY OF MASON...SCT.

I, SHIRLEY H. PORTER, Official Court Reporter of the 19th Judicial Circuit, do hereby certify that the foregoing Public Hearing was taken by me at the time and place and for the purpose stated in the caption; that same was transcribed by me, and that the foregoing is a true, accurate and complete transcript to the best of my knowledge and belief.

This 28th day of June, 1991.

SHIRLEY H. PORTER

Shirley H. Porter
Official Court Reporter, 19th Judicial Circuit
Courthouse, Maysville, KY 41056

APPENDIX D

SUPERFUND FACT SHEET PROPOSED PLAN - MAXEY FLATS DISPOSAL SITE

Superfund Fact Sheet — Proposed Plan

EPA Region IV

Maxey Flats Disposal Site
Fleming County, Kentucky — *May 1991*

INTRODUCTION

This Proposed Plan identifies the preferred remedy for the Maxey Flats Low-Level Radioactive Waste Disposal Site (MFDS). In addition, the Proposed Plan includes summaries of other **remedial alternatives** that were analyzed for this site. This document was developed by the U.S. Environmental Protection Agency (EPA), the lead agency responsible for remediation of the MFDS. EPA, in consultation with the Kentucky Natural Resources and Environmental Protection Cabinet and the Kentucky Human Resources Cabinet, will select the remedy for the MFDS only after public comment on this Proposed Plan and the comments submitted during the public comment period have been reviewed and considered.

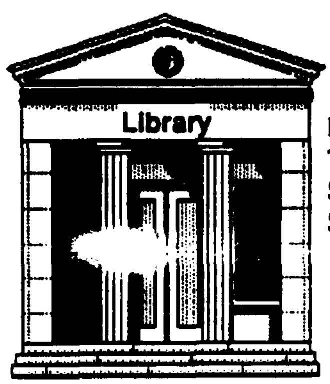
EPA will seek to resolve the question of financial responsibility for site remediation and implementation of **institutional controls** through settlement negotiations with the Commonwealth of Kentucky and other Potentially Responsible Parties (PRPs) after the **Record of Decision** is signed by EPA. Thus, this Proposed Plan is not intended to delineate the mechanism(s) by which a remedy will be implemented or to assess responsibility for site closure. Rather, it is intended to describe, primarily, the preferred remedy and the community's role in remedy selection. For reader information, terms highlighted in **bold** within this document are explained in the glossary at the end of the document.

EPA has issued this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act** (CERCLA). Information contained in this Proposed Plan can be found in greater detail in the **Remedial Investigation and Feasibility Study** (RI and FS) Reports and other documents contained in the **Administrative Record** for this site. EPA encourages the public to review the other documents in order to gain a more comprehensive understanding of the site and Superfund activities that have been conducted thus far at the MFDS. The Administrative Record, which contains the information upon which the selection of a remedy is based, will be available on or before June 13, 1991at the following:

INFORMATION REPOSITORIES

Fleming County Public Library
303 South Main Cross Street
Flemingsburg, Kentucky 41041
(606) 845-7851

Hours: Monday - Saturday 9 - 5 p.m.
Thursday - 9 - 5 p.m. and 6:30 - 8:30 p.m.



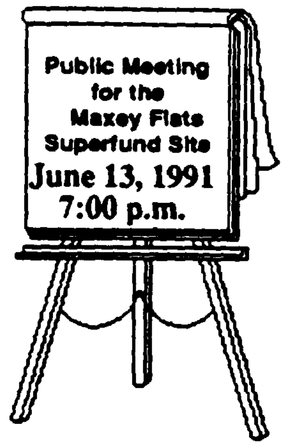
Rowan County Public Library
129 Trumbo Street
Morehead, Kentucky 40351
(606) 784-7137

Hours: Monday, Thursday	**10 - 8 p.m.**
Tues., Wed., Friday	**10 - 5 p.m.**
Saturday	**9 - 3 p.m.**
Sunday Holidays	**Closed**

and

U.S. EPA Records Center
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 347-0506
Hours: Mon. - Fri. 8:OO a.m. to 5: 00 p.m.

EPA may modify the preferred remedy or select another response action presented in this Proposed Plan and the FS Report based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives identified here. A Glossary of Terms can be found at the end of this Proposed Plan to define the highlighted terms used throughout this document.



Dates to remember:
MARK YOUR CALENDAR

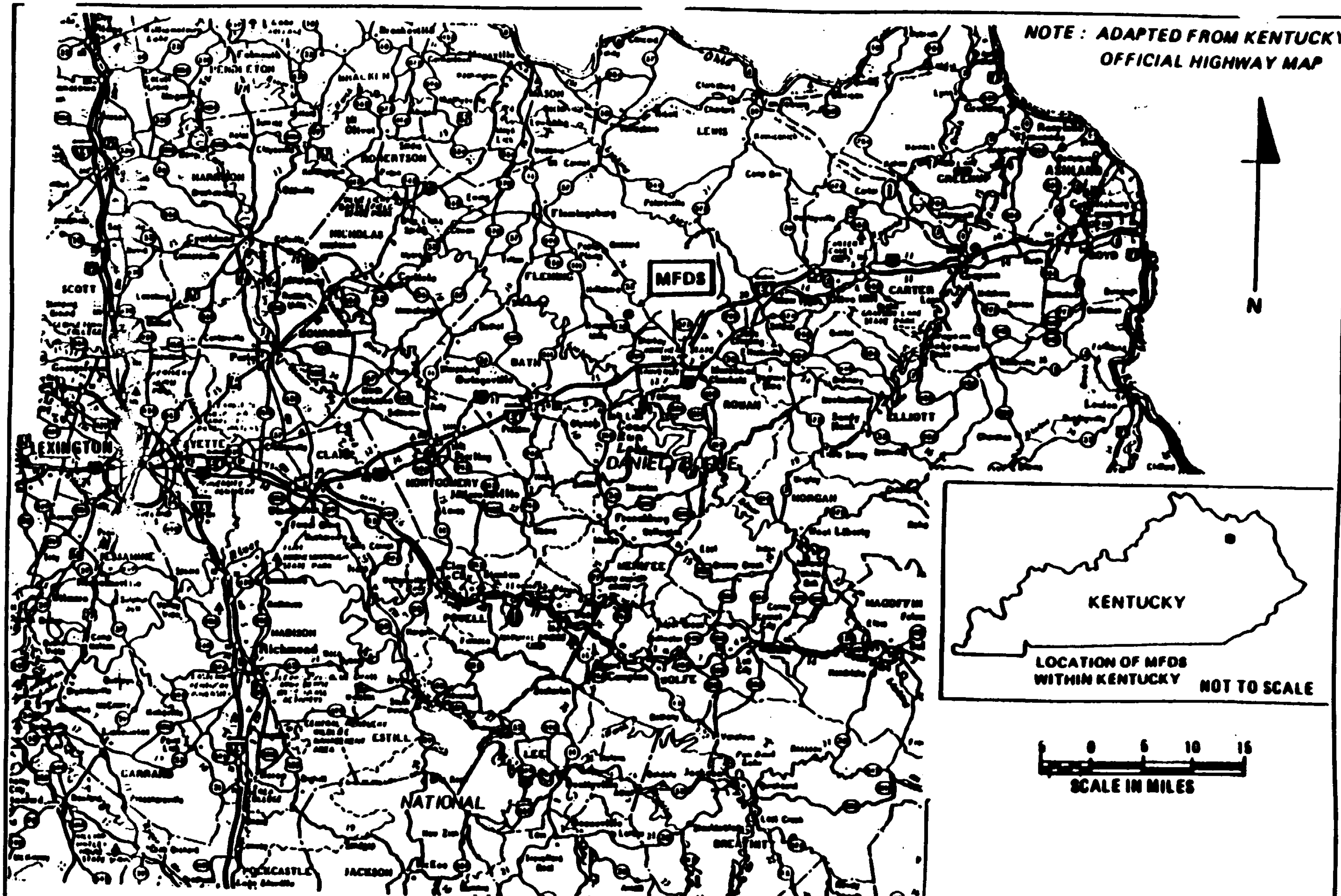
June 13, 1991.
Public Meeting at the Ersil P. Ward (formerly Fox Valley)
Elementary School,
State Road 32, Fleming County, Kentucky
at 7:00 p.m.

SITE HISTORY

The Maxey Flats Disposal Site (MFDS) is located approximately 10 miles northwest of the City of Morehead, Kentucky and approximately 17 miles south of Flemingsburg. The MFDS itself occupies 280 acres in eastern Fleming County and is located on a ridge approximately 350 feet above the valley floor. (See site area maps One and Two on the following two pages.) The site was purchased by a private company, Nuclear Engineering Company (NECO, currently known as U.S. Ecology), and the ownership of the land was transferred to the Commonwealth in 1963. The Commonwealth issued a license, effective January 1963, to NECO to dispose of low-level radioactive wastes, and leased the property to NECO. From May 1963 to December 1977, NECO managed and operated the disposal of low-level radioactive waste at the MFDS. It is estimated that 4,750,000 cubic feet of waste materials were disposed of at the MFDS.

Low-level radioactive waste (LLRW) is material that has come in contact with radioactive material or that is, itself, a source of low levels of radiation. Among other sources, LLRW comes from nuclear power plants in the form of filter materials or protective clothing, from hospitals and universities as laboratory and diagnostic waste, and from diverse industries such as drug manufacturers and producers of well-drilling equipment that utilize radioactive sources. By definition, LLRW does not include spent nuclear fuel or weapons-grade nuclear material.

In order to protect public health and the environment from exposure, LLRW must be isolated while its radioactivity is decaying. To achieve this isolation at the MFDS, LLRW was deposited at the site using the shallow land burial disposal technology. The waste was disposed of in 46 large trenches (some up to 680 feet long, 70 feet wide and 30 feet deep) which cover approximately 27 acres of la[illegible] within a 45-acre fe[illegible]d po[illegible]n of the site known as the [illegible]stricted [illegible]ea. How[illegible] wells" were also used at the MFDS for the burial of small-volume wastes with high specific activity. Most of the "hot wells" are 10 to 15 feet deep, constructed of concrete, coated steel pipe or tile, and capped with a large slab of concrete.



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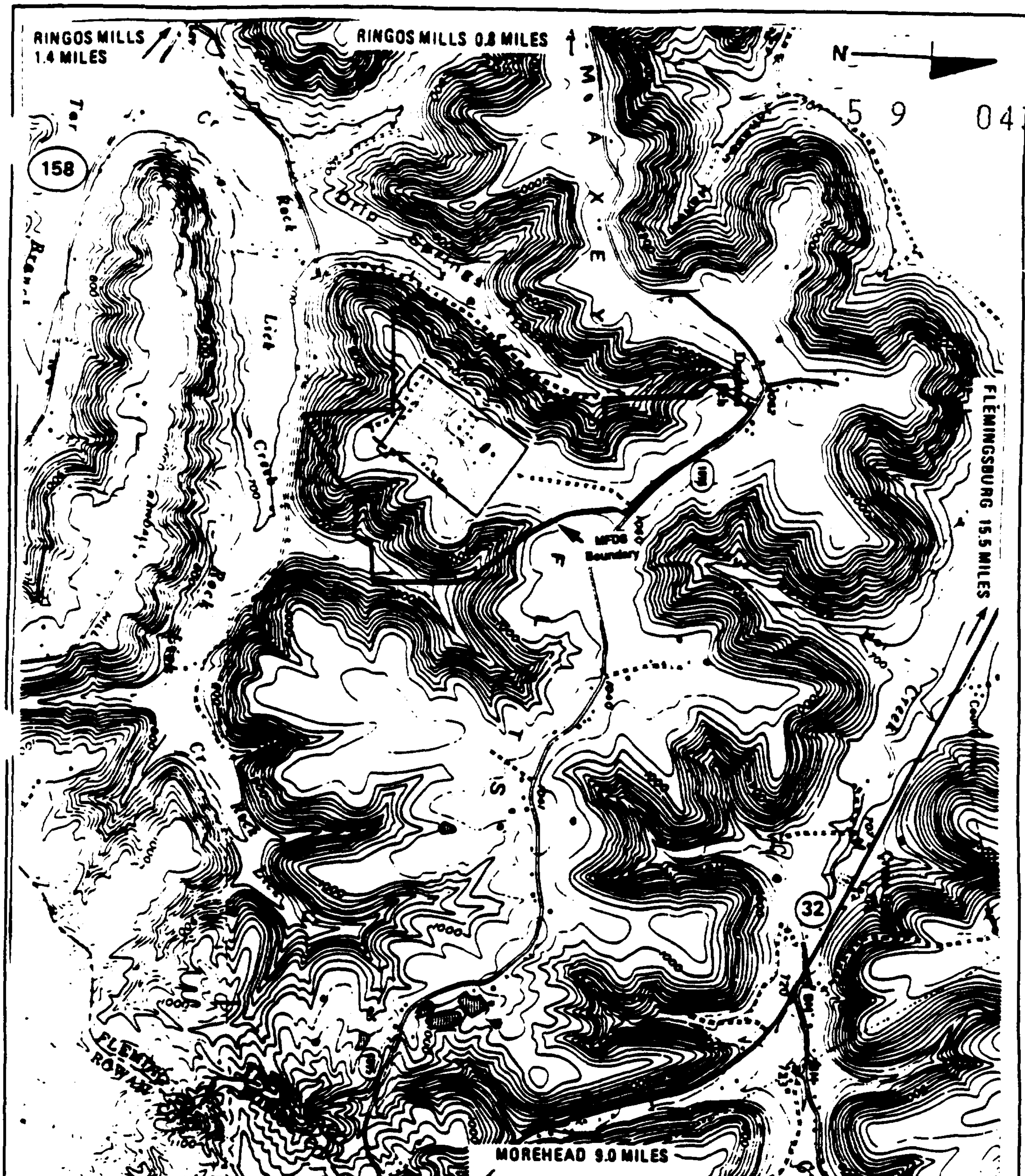
MAXEY FLATS DISPOSAL SITE
LOCATION MAP

MAP 1



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MAXEY FLATS DISPOSAL SITE
VICINITY MAP

MAP 2

The trench wastes were deposited in both solid and solidified-liquid form. Some wastes arrived at the site in containers such as drums, wooden crates, and concrete or cardboard boxes. Other wastes were disposed of loosely. Fill material (soil), typically 3 to 10 feet in thickness, was then placed over the trenches to serve as a protective cover. After 1977, six additional trenches were excavated for the disposal of material generated on-site. (See trench location map on following page.)

Unexpected problems arose at the site in the early 1970s. It then became apparent that water entering the trenches had become the pathway by which radioactive contaminants — primarily Tritium, a radioactive form of hydrogen — were beginning to slowly migrate out of the disposal trenches. The Commonwealth of Kentucky conducted a special study of the site in 1974 to determine whether the MFDS posed a contamination problem. The study confirmed that Tritium and other radioactive contaminants were migrating out of the trenches and that some **radionuclides** had migrated off-site.

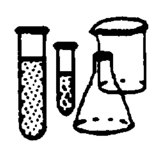
In 1977, while constructing a new trench, it was discovered that **leachate** was migrating through the subsurface geology (approximately 25 feet below ground surface). Subsequently, the Commonwealth ordered NECO to stop receiving and burying radioactive waste. In 1978, the Commonwealth and NECO entered into an agreement under which NECO's lease was terminated. The Commonwealth then hired private companies such as Westinghouse Electric Corporation (the current site custodian) to stabilize and maintain the site.

Those steps, however, were temporary and a final closure plan was needed to correct the problem at the MFDS. EPA, therefore, proposed the MFDS for inclusion on the National Priorities List (NPL) of hazardous waste sites to be addressed under the Superfund Program in 1984 and, in 1986, this action was finalized. A group of organizations who participated in waste disposal at the site (named as Potentially Responsible Parties [PRPs]) joined together as the Maxey Flats Steering Committee (Committee). The Committee conducted and partially funded the technical work required for the Remedial Investigation/Feasibility Study performed at the site. The largest portion of costs incurred in conducting the RI/FS were paid by the Department of Defense (DOD) and the Department of Energy (DOE), both named as PRPs but not members of the Committee. These actions have now culminated in a preferred remedy being prepared by the EPA.

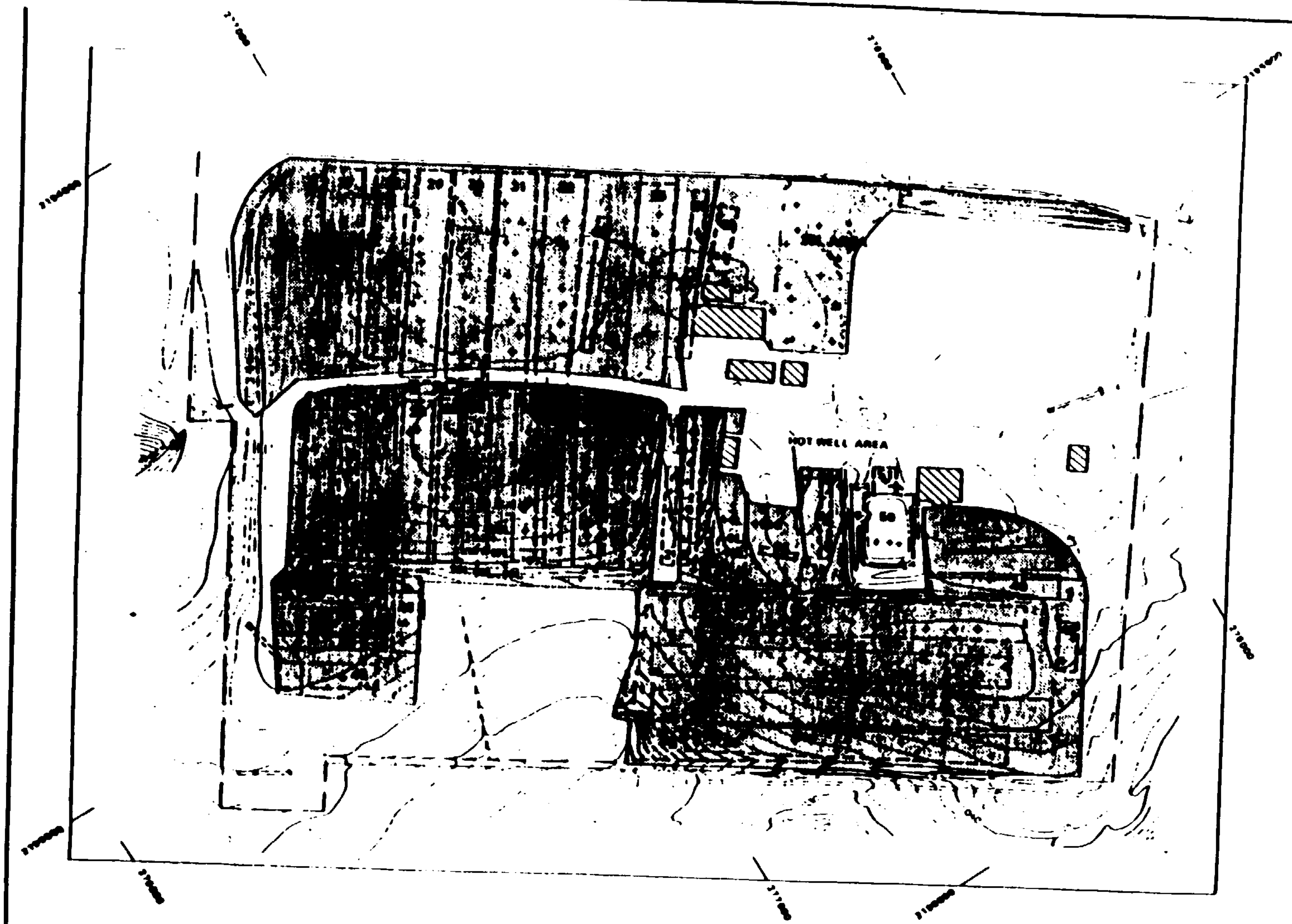
On January 13, 1989, EPA, through the Technical Assistance Grant (TAG) program, provided $50,000 (the maximum available under the Superfund Program) to the Maxey Flats Concerned Citizens (MFCC). This money was granted to MFCC for the purpose of hiring technical advisors to help the local community understand and interpret site-related technical information and advise the community on its participation in the decision-making process.

REMEDIAL INVESTIGATION CONCLUSIONS

The Remedial Investigation (RI), which was initiated at the Maxey Flats Disposal Site (MFDS) in 1987, included the collection of more than 700 samples at, and adjacent to, the Maxey Flats site, from environmental **media** such as trench leachate, **soil**, ground water, surface water, stream **sediment**, and ground water. These samples were analyzed for a variety of radiological and non-radiological (chemicals, metals, etc.) constituents.



The RI identified a large range of contaminant concentrations in samples collected from trenches in different parts of the Restricted Area. In addition, site records indicate that sample analyses (Tritium, gross alpha and beta particle analyses) from the same trench sump yield varying concentrations at different times. Approximately 2.8 million gallons of leachate were calculated to be in the trenches. The trench leachate contains a variety of radionuclides (of which Tritium is the most predominant). In general, the non-radiological chemical concentrations in trench leachate samples were low (less than 10 parts per million for organics) and all samples analyzed in compliance with the **Resource Conservation and Recovery Act** (RCRA) yielded negative results.



EXPLANATION

- TRENCH SUMP
- APPROXIMATE BOUNDARY OF TRENCH
- FENCELINE AND BOUNDARY OF RESTRICTED AREA
- APPROXIMATE AREAS COVERED BY PVC
- BUILDING

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MAXEY FLAT DISPOSAL SITE
TRENCH SUMPS, AND BUILDINGS IN RESTRICTED AREA MAP

MAP 3

The RI demonstrated that on the west side of the site, trench leachate migrates horizontally through fractures in a thin siltstone geologic layer called the Lower Marker Bed, which lies approximately 15 feet below ground surface in that area. On the east side, the horizontal migration occurs in the fractured siltstone layers of another geologic layer, the Farmers Member, which begins approximately 40 feet below ground level. (See Geologic Cross Section of site on following page.) Vertical migration between geological layers is limited by shale layers of low permeability, which act as **aquitards**. Because the MFDS is bounded on three sides by steep slopes, the contaminated leachate migrating through the fractured siltstone layers moves into the bottom of the soil layer on these slopes. However, not all leachate migrates to the bottom of the soil layer on the slopes, as evidenced by the occurence of seeps on the east hillside.

The RI determined that ground water samples taken from monitoring wells in the Lower Marker Bed had higher Tritium concentrations (up to 2,000,000 **pCi/ml**) than samples taken from deeper geologic units. These Tritium concentrations and the presence of other radionuclides indicate that the contamination was caused by trench leachate. On the east side of the site, **the Forty-Series trenches**, which commonly bottom near the top of the Farmers Member, provide Tritium and other contamination to the Farmers Member.

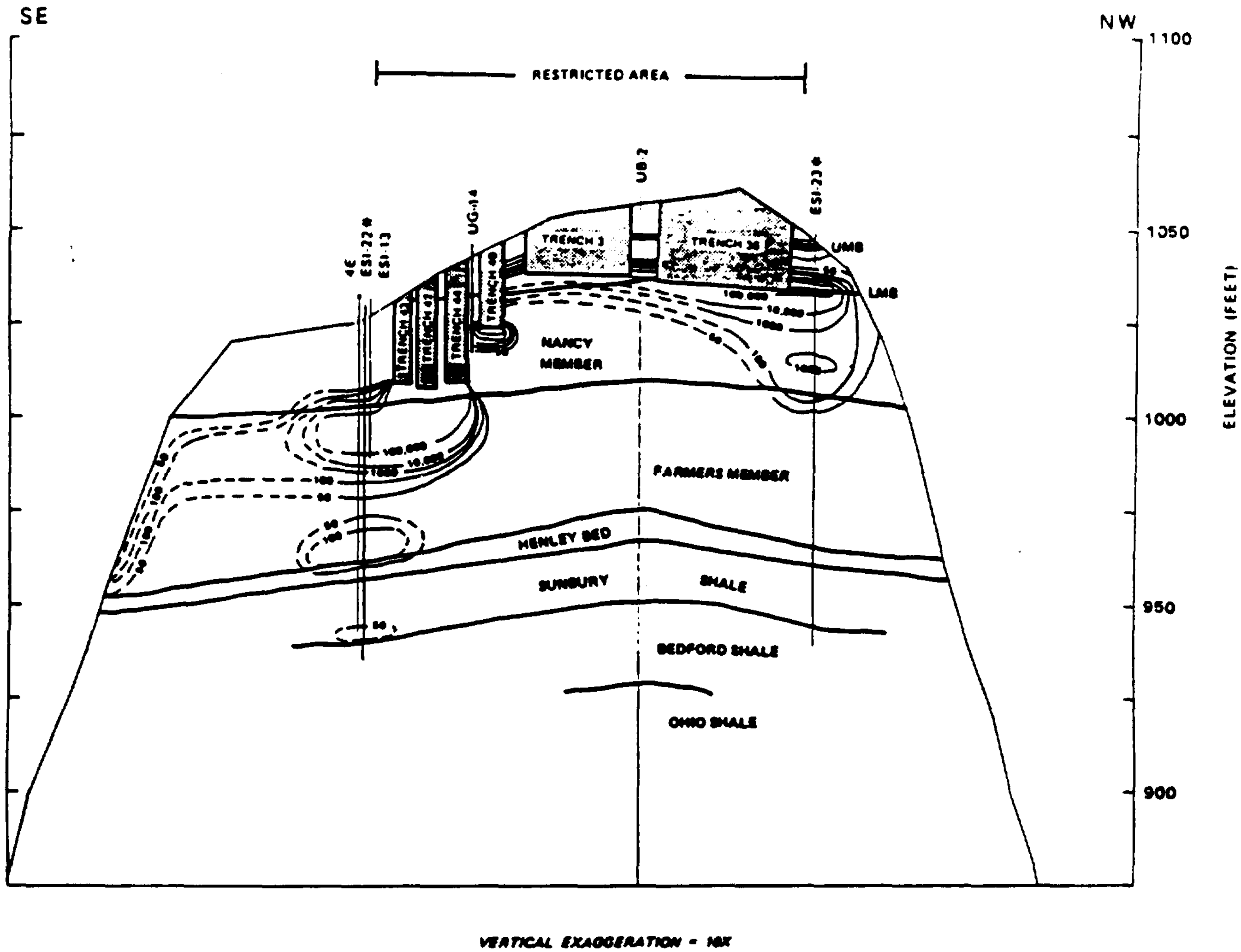
In the soils on the three slopes adjacent to the site, Tritium is the predominant contaminant, with the largest contaminated areas and highest levels of Tritium contamination on the upper part of the northwest side of the site. Other contaminants detected in soils which could be attributed to the MFDS include Cobalt-60, Toluene, and Arsenic. Previous testing along the soil-rock interface by the Commonwealth also indicated the presence of radionuclides such as Strontium-90, Carbon-14, and Plutonium-238 and -239.

Surface water and sediment investigations during the RI involved the collection and analyses of samples from three principal locations: Restricted Area surface water runoff (which exits the site through three water control structures located at the periphery of the Restricted Area), from off-site creeks, which receive runoff from the MFDS, and from off-site sources.

Tritium and Radium-226 were the only radionuclides detected in the surface water samples during the RI. Concentrations of Tritium were highest at the water control structures adjacent to the Restricted Area. The principal sources of Tritium entering these structures are contaminated liquids, which have migrated from the trenches to the slopes through fractured bedrock, and atmospheric releases of tritium from the trenches. Tritium levels in the surface water ranged from less than 10 pCi/ml to 60 pCi/ml. Tritium ranged in concentration from less than 10 pCi/ml to 70 pCi/ml in sediment moisture. Analytical results show low concentrations (ranging from 5 ppb to 98 ppb) of chemical constituents in surface water. Sediment sample analyses indicated chemical constituents ranging from 5 parts of the chemical per billion parts of the unit sampled (parts per billion or ppb) to 1800 ppb. The probable source of the higher concentrations (phthalate esters) is the PVC used to cover the trenches because the concentrations were highest at the sample stations adjacent to the Restricted Area, and the phthalate ester was only detected in samples associated with surface water runoff from the Restricted Area.

The Commonwealth of Kentucky has detected Strontium-90 in surface water in the East Main Drainage Channel. The Commonwealth has also detected Strontium-90 in the east pond, at the east pond outlet, and in the south drainage area. Additionally, the Commonwealth has detected Tritium concentrations in various site drains in excess of 1000 pCi/ml.

In summary, the decay of containers (cardboard, wooden, metal, etc.) over time has allowed the trench cover to settle because the containers no longer provide sufficient structural support for the trench cover. A ponding effect has resulted from the collection of rainfall and snowmelt in the subsided trench cover. The infiltration of precipitation through the cracked and subsided cover generates trench leachate which creates an additional **hydraulic head**, forcing more leachate out of the slopes into the environment. This decay, collapse, and ponding effect, as studied and docu-



EXPLANATION

CONTOUR INTERVALS:

50 pCi/ml
100 pCi/ml
1000 pCi/ml
10,000 pCi/ml
100,000 pCi/ml
1,000,000 pCi/ml

* MONITORING WELLS SAMPLED AND ANALYZED FOR TRITIUM IN PORE WATER

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MAXEY FL TS DISPOSAL SITE
GEOLOGIC CROSS SECTION MAP

MAP 4

mented during the Maxey Flats RI and numerous studies conducted previously, have resulted in the migration of radionuclides from the trench disposal area.

SUMMARY OF SITE RISKS

As part of the RI/FS, an assessment of site risks was performed using existing site data and information gathered during the Remedial Investigation, to evaluate the nature and extent of contamination at the Maxey Flats Disposal Site (MFDS) and to identify the contaminants, transport mechanisms, and exposure pathways which pose the greatest potential threat to human health and the environment. The Risk Assessment evaluated the risk associated with a No Action alternative, which assumed that the site would be abandoned and that no activity would take place, other than monitoring.

Potential routes of exposure to contaminants, or exposure pathways, were developed based on both the current site conditions and the traditional pathways examined for a public health evaluation. The potential contamination sources include trench material, leachate, site structures, above-ground tanks, ground surfaces, ground water, and soil. Potential exposure routes include the ingestion of crops and animal products, including fish, game and livestock; the inhalation of air; and direct contact (e.g., dermal contact, ingestion, intrusion) with contaminated media.

Two sets of potential exposure pathways were evaluated for the MFDS. The first, referred to as non-intruder pathways, assumed that the site would be abandoned, but then an individual would move onto and construct and occupy a dwelling in an area of the abandoned site, currently known as the Restricted Area.

Non-intruder pathways include the following:

- Surface Water Pathway -- In this pathway, contaminants move off-site in ground water and enter the surface water system. The stream water is then used as a drinking water and irrigation source for beef and milk cows and their forage. Humans then ingest the animal products.

- Evapotranspiration Pathway -- This pathway involves the uptake of contaminated liquid into plants and evapotranspiration of the contaminants to the environment. (Note: Evapotranspiration is the release of water vapor from plants to the atmosphere.) Tritium is the only contaminant to move by this pathway. Once released to the air, the tritium could be incorporated into food and drinking water sources or directly inhaled by a human.

- Deer Pathway -- In this pathway, contaminated water moves through the ground water system to the hillsides adjacent to the site. Upon reaching the hillside, the contamination is incorporated into plants. The contaminated plants are then eaten by deer foraging on the slopes. Also the deer drinks contaminated water from the streams. The contaminants are then incorporated into the meat of the deer. A hunter kills the deer and ingests the meat.

- Sediment Pathway -- This pathway involves the movement of contaminants in ground water to the hillsides adjacent to the site and into the surface water system (streams). As the contaminated surface water moves through the stream bed, some of the contaminants adhere to the soils in the stream bed. Then through the course of play in the stream beds, a child ingests the contaminated soils.

- W." Water Pathway -- This pathway involves the movement of contaminants in ground water to the hillsides adjacent to the site and into the surface water system moving down the hillsides. At the bottom of the hillsides, the contaminated runoff recharges the alluvium (soils). A well is excavated in the contaminated alluvium and a family uses the well as a source of drinking water for a family.

- Soil Erosion Pathway -- This pathway involves the resuspension in air of soil particles contaminated with radionuclides and the washing of soil into the surface water. It is assumed that the trenches overflow with contaminated liquids and radionuclides adhere to surface soils adjacent to the trenches. The leachate subsides in the trenches and the surface soils dry. This dry contaminated soil is then suspended in air and carried to a person and inhaled or washed away in runoff. Also, crops are grown on an area of alluvium (base of hillsides) contaminated by surface runoff. A person ingests contaminated farm products and is exposed to external radiation.

- Trench Sump Pathway -- This pathway involves the escape of tritiated water from trenches via trench sumps and cracks in the trench cap. A person then inhales the contaminated air.

The second set of potential pathways, the intruder pathways, also assumed that the site would be abandoned. Non-intruder pathways, however, primarily involve off-site paths of exposure, which are not associated with occupation of the site. The intruder pathways include the following:

- Intruder-Construction Scenario -- This pathway involves the assumption that no controls exist for the site and an intruder inadvertently occupies the disposal site and begins construction activities. Construction activities penetrate and expose the waste. Human exposure would occur through external exposure to the contaminated soil and inhalation of contaminated air.

- Intruder-Discovery Scenario -- This pathway assumes that, during the above-described construction scenario, the intruder contacts solid remains of waste or barriers, realizes that something is wrong, and ceases construction activities.

- Intruder-Agricultural Scenario -- This pathway involves the assumption that no controls exist for the site and an inadvertent intruder occupies the site. After some construction activities, the intruder (site resident) begins agricultural activities. It is assumed that some percent of the intruder's annual diet comes from crops raised in the contaminated soil and from food products produced by animals. External exposure and ingestion of contaminated ground water from a well are also included. It is also assumed that a quantity of contaminated soil is ingested by a child during play or an adult at work in the fields. Inhalation of resuspended contaminated soil and the migration of radon into the intruder's basement is also included in this pathway.

- Intruder-Well Scenario -- This pathway involves an intruder drilling a well near a disposal cell and consuming contaminated ground water.

Of the contaminants identified at the MFDS, a set of contaminants, called indicator contaminants, represent the greatest potential for impacting human health. Two groups of indicators were selected, radionuclides and non-radionuclides. The radionuclides chosen are Hydrogen-3 (Tritium), Carbon-14, Cobalt-60, Strontium-90, Technetium-99, Iodine-129, Cesium-137, Radium-226, Thorium-232, Plutonium-238, Plutonium-239, and Americium-241. The nonradioactive chemical indicators are Arsenic, Benzene, Bis(2-Ethylhexyl) Phthalate, Chlorobenzene, Chloroform, 1,2-Dichloroethane, Lead, Nickel, Toluene, Trichloroethylene, and Vinyl Chloride. These indicators were used in the analyses of potential risks associated with the exposure pathways described above.

Non-intruder Risks

If no action were taken at the site, the average exposure to off-site individuals from all indicators and from all combined non-intruder pathways would be a total dose equivalent of 75 millirems per year (mrem/yr), almost half of which is attributable to Tritium. The upper bound estimate for such a scenario would total 4300 mrem/year. For each year of exposure, under a No Action alternative, it is estimated that the average case (75 mrem) lifetime risk of cancer would be 3×10^{-5} (or three in 100,000) and for the upperbound case (4,300 mrem) it would be 1×10^{-3} (one in 1,000). EPA's target risk range is 1×10^{-4}, or one additional occurence of cancer in 10,000, to 1×10^{-6}, which equates to one additional occurence of cancer in 1,000,000. The average case lifetime risk of cancer from many successive years of exposure would be approximately 1×10^{-3} or one in 1,000, and the upperbound cancer risk would be 6×10^{-2} or six in 100. In both cases, the risk significantly exceeds EPA's target risk range and the MFDS remediation goal of 25 mrem/year.

In addition, during the 70-year time frame, the time frame that is typically used to calculate risks at Superfund sites, Tritium and Strontium-90 would exceed drinking water limits in water extracted from wells at the base of the slopes. Furthermore, Tritium, Strontium-90, and Radium-226 would exceed drinking water limits at this location during the 500 year time frame. Assessments using the 500-year time frame were made for the MFDS because of the long-lived radionuclides present.

Intruder Risks

For the most significant of the intruder pathways, the Intruder-Agricultural Pathway, whereby a person occupies a house on-site, the average case exposure totals a dose equivalent of 26,000 mrem/year under a No Action alternative. Under the same scenario, the upperbound estimate would total 1,000,000 mrem/year. Forty-three percent of the impacts would be derived from drinking water, another 47 percent from food produced on-site, and 10 percent from external exposure. For each year a person would live on-site, under the no action alternative, the average case lifetime risk of cancer would be approximately 1×10^{-2} or one in 100. Under the same scenario, the upper bound case risk of cancer would be 4×10^{-1} or four in 10. Both cases significantly exceed EPA's target risk range. Prolonged exposures (many successive years) would result in a lifetime risk of cancer approaching one additional case of cancer for each person who would reside on the site.

Assuming that occupancy of the site would not occur for 100 years, the doses and associated risks under a No Action alternative would decrease, but only by a small margin because most of the exposure is associated with the relatively long-lived radionuclides. Tritium and Strontium-90 would no longer contribute to the dose because they would have decayed away, and the longer-lived radionuclides, such as Radium-226, Thorium-232, and Plutonium-238 would become the significant dose contributors. Beyond 100 years, the risks associated with the MFDS remain unacceptably high and tend to become constant rather than decreasing significantly. Even after 500 years, on-site occupancy would result in risks exceeding the acceptable risk range. For this reason, the need for implementation and funding of institutional controls, maintenance, and monitoring in perpetuity is apparent.

The threatened release of hazardous substances from the MFDS, if not addressed by the preferred remedy or one of the other active measures considered, may present a potential threat to public health, welfare, or the environment.

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Section 121(d) of CERCLA requires that at the completion of remedial action, the remedy should achieve a level of control which complies with federal and state environmental laws that are applicable or relevant and appropriate to the hazardous substances, pollutants, or contaminants at the site. Therefore, to be selected as the remedy, an alternative must meet all Applicable or Relevant and Appropriate Requirements (ARARs) or a waiver must be obtained. Appendix A of the Maxey Flats site Feasibility Study Report should be consulted for a complete discussion of ARARs that apply to the Maxey Flats site. The following is a list of major requirements that must be met by the selected remedy:

- Occupational Safety and Health (OSHA) Standards (29 Code of Federal Regulations or CFR, Parts 1910.120, .1000 - .1500, Parts 1926.53, .650 - .653)
- National Emission Standards for Hazardous Air Pollutants (40 CFR 61.92)
- Kentucky and Federal Radiation Protection Standards (902 KAR 100:020, :025, Table I, Table II, and 10 CFR 20.105)
- Kentucky Licensing Requirements for Land Disposal of Radioactive Waste (902 KAR 100:022)
- Kentucky Standards for the Disposal of Radioactive Material (902 KAR 100:021, Sections 7 and 8)
- General Kentucky Requirements Concerning Radiological Sources (ALARA) (902 KAR 100:015, Sections 1 and 2)
- Kentucky Fugitive Air Emissions Standards (401 KAR 6:015)
- Federal Drinking Water Regulations (40 CFR Part 141, Subpart G), and
- *Resource Conservation and Recovery Act (RCRA) (currently under consideration as a potential ARAR)

The points of compliance at the Maxey Flats Disposal Site for some of the previously ARARs are as follows:

- National Emissions Standards for Hazardous Air Pollutants - the effective dose equivalent of 10 mrem per year will be judged at the site property boundary
- Kentucky and Federal Drinking Water Standards - the point of compliance for these standards begins at the contact of the alluvium with the hillside and ending at the streams; compliance will be based on samples taken in the alluvium
- Kentucky Licensing Requirements for Land Disposal of Radioactive Waste - the 25 mrem per year dose limit set forth in this requirement will be judged on the combined doses contributed by the air, water, drinking water and soil pathways. The point of compliance for this requirement will be the maximum point of individual exposure which is at or beyond the site boundary.

Under the Superfund program, the selected remedy must meet all applicable or relevant and appropriate requirements (ARARs), which include federal and state standards, or a waiver must be obtained. If a state has a more stringent, promulgated standard than its federal counterpart, the more stringent state standard shall be used. The Commonwealth of Kentucky has identified a state standard, which it considers to be an ARAR: KRS 224.877(4). This is a narrative, non-degradation requirement which requires restoration of the environment to the extent practicable.

EPA considers KRS 224.877 to be a general goal, which does not set out a specific, enforceable cleanup standard that is more stringent than federal law, and which is not a binding requirement. For this reason, EPA does not consider it a cleanup ARAR.

* Because of the possible presence of hazardous waste at the MFDS, EPA currently is considering whether RCRA is an ARAR and if so, EPA is considering the possibility of an ARARs waiverwith respect to the Land Disposal Restriction portion of RCRA. The partial RCRA waiver for the site would be based upon technical impracticability and/or greater risk to human health and the environment. Waivers of ARARs are allowed under CERCLA Section 121(d).

SUMMARY OF ALTERNATIVES

The primary objective of the Feasibility Study (FS) is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can form the basis for remedy selection. The FS describes and evaluates options for mitigating unacceptable levels of current or future potential risks associated with exposure to site contaminants. Information contained in the RI Report, Risk Assessment, and other site data are considered in the FS to develop these options. Subsidence of waste disposal trenches is the lowering of the trench caps due to waste and cap consolidation over time. Areas affected by subsidence can range in size from a few square feet of a cap to the entire area occupied by a trench or group of trenches. Subsidence can cause cap failures by cracking or deforming the cap materials. Depressed areas commonly result in ponding of rain water, which would have run off naturally if subsidence had not occurred. Both of these phenomena can lead to increased rates of water infiltration into the waste. Therefore, subsided areas may require repair to prevent accumulation of leachate in the trenches.

Slow subsidence is evident in most waste disposal trenches at the MFDS. After a few years, therefore, soil must be added to the trench surfaces and the caps must be regraded to maintain surface water runoff. Subsidence results from a complex interaction of physical and chemical processes in the waste mass and, in time, subsidence works to consolidate the waste and trench cap materials into a smaller volume, resulting in a denser, more consolidated mass.

The objectives of any remedial alternative considered for the MFDS are to:

- Stabilize the site such that an engineered cap could be placed over the trench disposal area with minimal long-term care and maintenance;
- Protect human health and the environment (meet all Applicable or Relevant and Appropriate Requirements);
- Control infiltration into the trenches and migration from the trenches;
- Address site concerns at the community, state and federal levels.

Eighteen potential remedial alternatives capable of achieving the remedial action objectives at the MFDS were developed and evaluated. These 18 alternatives were then screened on the basis of their effectiveness, implementability and cost. This screening produced a manageable group of seven alternatives. Each of the seven alternatives was then subjected to a detailed analysis which applied the nine evaluation criteria established by the **Superfund Amendments and Reauthorization Act (SARA).**

The nine criteria used to evaluate alternatives at Superfund sites are as follows:

- Short-term effectiveness -- addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until remedial action objectives are achieved.
- Long-term effectiveness -- refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time.
- Reduction of toxicity, mobility or volume -- is the anticipated performance of the treatment technologies a remedy may employ.
- Implementability -- the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Compliance with ARARs -- addresses whether a remedy will meet all of the ARARs of Federal and State environmental laws and/or justifies a waiver.

- Overall protection of human health and the environment -- addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Cost -- includes estimated capital and operation and maintenance (O & M) costs, also expressed as net present-worth costs.

- State acceptance -- indicates whether, based on its review of the RI/FS Reports and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

- Community acceptance -- Community acceptance summarizes the public's general response to the alternatives, based on public comment received during the public comment period.

Although overall protection of human health and the environment is the primary objective of the remedial action, the remedial alternative(s) selected for the site must achieve the best balance among the evaluation criteria, considering the scope and degree of the site contamination.

Certain components (baseline features) are common to all remedial alternatives in the FS Report for the MFDS, with the exception of the No Action Alternative. Thesebaseline features are as follows:

- Demolition of site structures and **decommissioning** of site facilities

- Construction of additional disposal trenches

- Procurement of a buffer zone adjacent to the existing site property, and

- Institutional controls.

The seven alternatives receiving detailed analysis in the FS Report are described below and the approximate cost figures and design/construction times for each alternative are presented in Table 1on page 18, following the description of alternatives.

ALTERNATIVE 1 - <u>NO ACTION</u>

The Superfund Program requires that the No Action alternative be considered at every site. It serves as a baseline by which other alternatives are compared and it must be carried through the detailed analysis of alternatives. No Action for the Maxey Flats Disposal Site consists solely of monitoring and activities in support of monitoring (e.g., installation of monitoring wells).

The seemingly high cost of 6.8 million dollars for an alternative involving only monitoring arises from the need to monitor this site in perpetuity. This monitoring would involve the installation of additional monitoring wells and sample collection and analyses on a frequent basis. Sample analyses would be conducted using a high level of quality assurance/quality control, thereby increasing the cost of the analyses and the remedy.

The No Action alternative is not an engineered alternative, and it would not satisfy the remedial objectives. The No Action Alternative does not comply with ARARs and would, likewise, not provide overall protection of human health and the environment.

Estimated Construction Cost: $ 636,000
Estimated O & M Cost: $ 6,167,000
Estimated Present-Worth Total Cost: $ 6,803,000
Estimated Implementation Time: 6 months

ALTERNATIVE 4 - STRUCTURAL CAP/DYNAMIC COMPACTION/ **HORIZONTAL FLOW BARRIER**

Alternative 4 includes the following remedial action:

- Baseline features
- Leachate removal from the trenches
- Solidification of leachate and disposal in new trenches
- Installation of horizontal flow barrier (if needed)
- Dynamic compaction of existing disposal trenches concurrent with addition of compacted soil and sand backfill
- Installation of a two-foot thick reinforced concrete cap over the trenches and a two-foot thick low-permeability clay cap over the rest of the closure area. Cap installation would include drainage, vegetative cover, and erosion control, and
- Remedy Review performed every five years.

This alternative combines the technologies of liquid waste removal, dynamic compaction and structural capping. After leachate removal and dynamic compaction, a reinforced concrete structural slab and several feet of soil cover would be placed over the disposal trenches. The use of dynamic compaction on the trench area prior to placement of the structural cap would provide a stable foundation for the cap and minimize future subsidence. Without the support provided by stabilization, the reinforced concrete cap would not be capable of spanning the wide trenches.

The horizontal flow barrier should help reduce the off-site migration of contaminants and prevent the infiltration of subsurface water.

Estimated Construction Cost: $ 59,332,000
Estimated O & M Cost: $ 6,175,000
Estimated Present-Worth Total Cost: $ 65,507,000
Estimated Implementation Time: 38 months

ALTERNATIVE 5 - NATURAL STABILIZATION

The Natural Stabilization alternative combines elements of containment, leachate removal, and treatment. The distinguishing feature of this alternative is the use of an initial closure cap during a period of natural subsidence and maintenance, estimated to be a period ranging from 35 to 100 years (the interim maintenance period). A final, multi-layer cap with synthetic liner would be installed at the completion of natural subsidence, at which time the trenches would form a stable foundation for the final cap. In addition, a horizontal flow barrier would be constructed, if required, to prevent ground water infiltration into the disposal trenches. With this alternative, a horizontal flow barrier could include a north cutoff wall or a cutoff wall which encircles the trenches.

The implementation of this alternative would involve the following activities:

- Baseline Features
- Excavation of Additional Disposal Trenches for Disposal of Solidified Leachate and Site Debris
- Leachate Removal from Disposal Trenches
- Leachate Solidification and Disposal in New Trenches
- Periodic Installation of Interim Trench Cover

- Installation of Horizontal Flow Barrier (if needed)
- Natural Stabilization With Active Maintenance and Monitoring
- Installation of a Final Engineered Cap with Synthetic Liner, and
- Remedy Review Performed Every Five Years.

Alternative 5 provides for the installation of an interim cap over the trench disposal area. Once the trenches achieve the degree of stabilization required, a final cap would be installed. Maintenance requirements for this alternative would be significant during the interim maintenance period. Once the trenches have sufficiently stabilized, the final cap would be installed and maintenance requirements would be minimal. Specific subsidence criteria would be developed in the remedial design.

Estimated Construction Cost:	$ 23,910,000
Estimated O & M Cost:	$ 9,643,000
Estimated Present-Worth Total Cost:	$ 33,553,000
Estimated Implementation Time:	35 - 100 years with 22 months for initial capping, 10 months for final capping

ALTERNATIVE 8 - <u>ENGINEERED SOIL CAP WITH SYNTHETIC LINER/ NATURAL SUBSIDENCE/HORIZONTAL FLOW BARRIER</u>

Alternative 8 includes the following remedial action activities:

- Baseline features
- Leachate removal
- Solidification of leachate into concrete blocks and disposal in new trenches
- Installation of Horizontal Flow Barrier (if needed)
- Installation of an engineered soil cap with synthetic liner, and
- Remedy Review Every Five Years.

Trench stabilization would be accomplished by natural subsidence, assumed to be completed in 35 to 100 years. Subsidence monitoring and water infiltration monitoring would be performed periodically and at other times when conditions are such that the potential for subsidence was high.

The required maintenance activities for this alternative would be significant because trench subsidence and resulting cap repair would be significant. The Horizontal Flow Barrier (assumed to be a North Cutoff Wall for this alternative) would prevent groundwater infiltration into the trench area.

Estimated Construction Cost:	$ 34,302,000
Estimated O & M Cost:	$ 13,105,000
Estimated Present Worth Total Cost:	$ 47,407,000
Estimated Implementation Time:	23 months

ALTERNATIVE 10 - <u>ENGINEERED SOIL CAP WITH SYNTHETIC LINER/ DYNAMIC COMPACTION/HORIZONTAL FLOW BARRIER</u>

Alternative 10 includes the following remedial action activities:

- Baseline features
- Leachate removal
- Solidification of leachate and disposal into new trenches
- Installation of a Horizontal Flow Barrier (if needed)
- Dynamic compaction of existing trenches with concurrent addition of compacted soil and sand backfill
- Installation of an engineered soil cap with synthetic liner, and
- Remedy Review Every Five Years.

Dynamic compaction involves the application of high-energy impacts to the ground surface; its primary purpose is to increase the ability of soil and waste to support a cap. The dynamic impact of a heavy weight transmits shock waves downward through the soil and wastes, rearranging the material into a denser configuration.

Prior to starting dynamic compaction, two feet of silty sand would be placed over the entire area to be dynamically compacted. The silty sand would supplement the existing soil cover over the trenches and prevent it being breached by the weight.

The cap would limit vertical infiltration; the existing contaminated leachate would be removed and immobilized; the cap stability would be established using dynamic compaction to minimize future subsidence; and ground water infiltration would be minimized due to installation of a horizontal flow barrier (it is assumed that a North Cutoff Wall would be installed with this alternative), as needed.

Estimated Construction Cost:	$ 39,538,000
Estimated O & M Cost:	$ 4,790,000
Estimated Present-Worth Total Cost:	$ 44,328,000
Estimated Implementation Time:	35 months

ALTERNATIVE 11 - ENGINEERED SOIL CAP WITH SYNTHETIC LINER/ TRENCH GROUTING/HORIZONTAL FLOW BARRIER

Alternative 11 includes the following remedial activities:

- Baseline features
- Leachate removal from existing trenches
- Installation of a Horizontal Flow Barrier (if needed)
- Grouting of accessible voids in the existing disposal trenches with grout made from potable water and/or leachate
- Installation of an engineered soil cap with synthetic liner, and
- Remedy Review Performed Every Five Years.

Alternative 11 would achieve containment with an engineered soil cap with synthetic liner and Horizontal Flow Barrier (it is assumed that a North Cutoff Wall with gravel drain would be installed with this alternative), as needed, and treatment through leachate removal and grouting. The distinguishing protectiveness feature of Alternative 11 is trench grouting.

Grouting would consist of injecting a mixture of materials (e.g., cement, bentonite, fly ash) and water through specially inserted probes into the majority of trenches to fill voids and other openings in the waste. The primary purpose for grouting at Maxey Flats is to provide a stable foundation for the final closure cap.

Estimated Construction Cost:	$ 61,870,000
Estimated O & M Cost:	$ 6,989,000
Estimated Present-Worth Total Cost:	$ 68,859,000
Estimated Implementation Time:	46 months

ALTERNATIVE 17 - ENGINEERED SOIL CAP/DYNAMIC COMPACTION/ HORIZONTAL FLOW BARRIER

Alternative 17 includes the following remedial activities:

- Baseline features
- Leachate removal
- Solidification of leachate and disposal into new trenches
- Installation of a horizontal flow barrier (if needed)
- Dynamic compaction of existing disposal trenches concurrent with the addition of compacted soil and sand backfill
- Installation of an engineered soil cap, and
- Remedy Review Performed Every Five Years.

Alternative 17 combines the remedial technologies of capping, dynamic compaction, and installation of a horizontal flow barrier to stabilize the site. The difference between this alternative and Alternative 10 is the type of horizontal flow barrier and cap. This alternative would involve installation of a **grout curtain** to encircle the disposal trenches rather than the North Cutoff Wall; the engineered soil cap would not contain the synthetic liner.

Estimated Construction Cost:	$ 51,920,000
Estimated O & M Cost:	$ 4,634,000
Estimated Present-Worth Total Cost:	$ 56,554,000
Estimated Implementation Time:	38 months

TABLE 1

Maxey Flats Disposal Site Present Worth Cost and Remedial Design/Remedial Action Implementation Times for Alternatives

Alternative	Design and Construction Time (months)	Total Present Worth Cost (millions)
1	06	6.8
4	38	65.5
5	22[1]	33.5
8	23	47.4
10	35	44.3
11	46	68.9
17	38	56.5

[1] - Initial closure would be completed in 22 months, followed by a 35 - 100 year Interim Maintenance Period, followed by a 10 month Final Closure Period.

PREFERRED REMEDY - NATURAL STABILIZATION

It is not known how long it will take for waste trenches to stabilize because of the many physical and chemical variables involved and the limited trench-specific information upon which estimates are based. The natural stabilization process at Maxey Flats would allow the materials to subside naturally to a stable condition prior to final closure with an engineered cap. It has been estimated that this stabilization process could potentially take 100 years before the final cap is placed.

Stabilization of the trenches by natural subsidence over a relatively long time period would virtually eliminate the potential of future subsidence problems encountered by alternatives that include mechanical stabilization of the trenches and installation of the final cap within a few years. Therefore, the natural stabilization alternative would reduce the redundancy of efforts necessary to construct and maintain the final closure cap. Natural stabilization does not disrupt intact metal containers such as 55-gallon drums; therefore, radioactive material is not immediately added to the trench. This containment provides an extra measure of protection to prevent movement of radionuclides to the hillsides. An additional benefit of the natural stabilization alternative would be the opportunity for continued data collection and analyses and evaluation of new technologies to optimize the final closure. Thus, EPA has preliminarily identified Natural Stabilization (Alternative 5) as the preferred remedy for the Maxey Flats Disposal Site. Alternative 5 has four key phases as follows:

- Initial Closure (22 months)
- Interim Maintenance Period (35 - 100 years)
- Final Closure (10 months), and
- Custodial Maintenance Period (in perpetuity).

Each of the four key phases is described below.

<u>Initial Closure</u>

This period would include a design phase followed by construction activities. Design of the initial closure would be performed and an Interim Site Management Plan developed for implementation during the Interim Maintenance Period.

During the Initial Closure Period, the following remedial activities would be performed:

- Baseline Topographic Surveys
- Geophysical Survey
- Subsidence Monitors
- Ground Water Monitoring
- Ground Water Modeling
- Initial Closure Cap and Surface Water Management and Control
- Trench Leachate Management and Monitoring
- Closure of Selected Wells
- Interim Site Management Plan
- Monitoring, Maintenance, and Surveillance
- Demolition of Existing Buildings and Structures With On-Site Disposal, and
- Procurement of Buffer Zone Adjacent to the Existing Site Property.

Baseline topographic and geophysical surveys would be conducted prior to design of the initial closure cap. Topographic surveys also would be performed prior to the initial closure cap installation, and following cap construction. The topographic surveys would be used as baseline information for subsidence monitoring. A geophysical survey would enhance definition of trench boundaries and ensure that the initial closure cap would adequately cover the trenches.

Subsidence monitors would be installed on the initial closure cap and on natural soils in the vicinity of the Restricted Area as a method of determining when the trenches have stabilized to an acceptable degree and final closure can begin.

A ground water model would be developed and used, in conjunction with historical RI and Commonwealth data, to determine the extent of the initial closure cap, evaluate the need for a horizontal ground water flow barrier, and to develop an effective ground water monitoring plan for use during the interim maintenance period and after closure. A ground water monitoring program would be developed, based on the results of the model and on existing knowledge of ground water and contaminant flow. In addition, new monitoring wells would be installed, as appropriate, using the results of the above evaluation. New monitoring wells also would be installed in the surrounding stream valley alluvium to ensure compliance with drinking water standards.

Soil would be added to the site, graded, and compacted in preparation for installation of a synthetic cover over the trench disposal area. (See next page for Cross-Section of Natural Stabilization.). The initial layer would have an average thickness of 21 inches. The extent of the interim cover would be based upon geophysical surveys, ground water modelling and other parameters evaluated during design. It has been estimated that the interim cap would cover approximately 40 to 50 acres. The surface would be graded to design specifications for improved drainage. Lined drainage ditches would be installed to channel the surface water runoff to the three discharge basins. Additional drainage channels in the vicinity of the site may be necessary to allow for increased control of the rates of surface water runoff. Because of the high peak discharge volumes resulting from the initial closure cap, the capacity of the retention ponds would be increased to improve control of storm-water runoff.

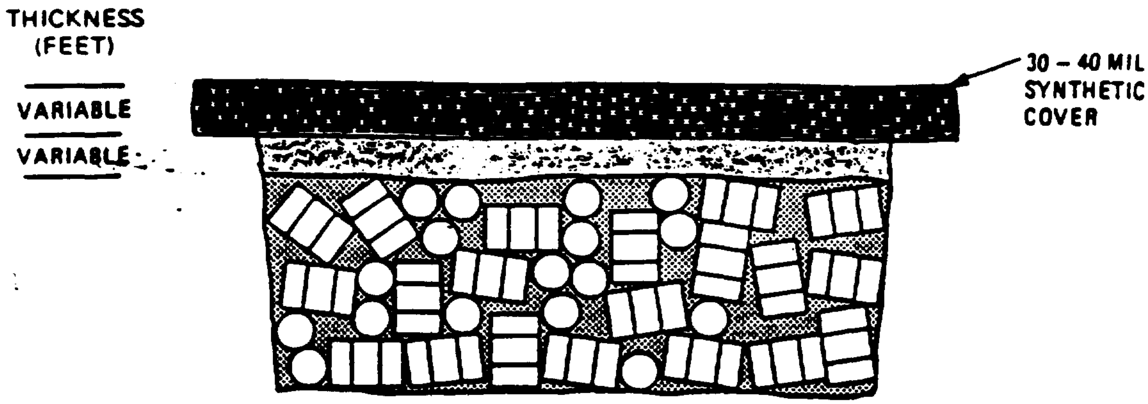
Trenches would be de-watered to control the migration of contaminants by ground water flow. A trench de-watering test program would be conducted either during the design phase or during initial closure activities to provide information on the most effective design of the de-watering program, to determine the need for new sumps, and to provide an estimate of the duration of the de-watering program. Leachate pumped from the trenches would be solidified and buried in new trenches.

Existing, poorly designed wells could potentially allow contaminants in ground water to migrate downward into the lower geologic units and would, therefore, be decommissioned and sealed. Water monitoring equipment, as part of the Infiltration Monitoring System, would be installed in trenches to detect the accumulation of leachate in trenches.

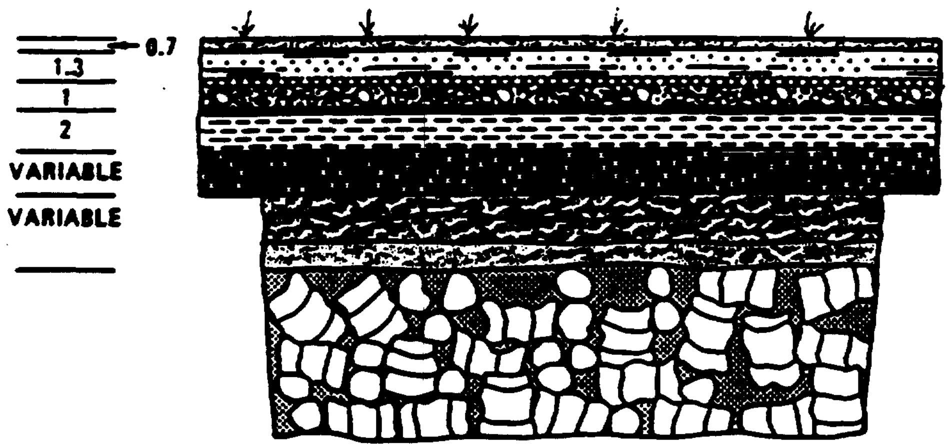
Non-functional buildings and unstable buildings and structures would be dismantled and buried in a trench on-site. Those buildings necessary to the management and maintenance of the site would be moved to a location that would not impede remedial activities. These buildings would then be dismantled, as necessary, during final site closure.

Land would be purchased adjacent to the existing site property boundaries. The purchase of this land would not extend the current site property boundary, although control over the property presumably would be in the hands of the Commonwealth of Kentucky. The purpose of a buffer zone is to protect environmentally sensitive areas such as the hill-slopes from detrimental activities such as logging, and to allow unrestricted access to areas adjacent to the MFDS for the purpose of monitoring. (See map on page 22 delineating buffer zone). Without control of activities on the hill-slopes, increased erosion due to deforestation could severely affect the effectiveness of the remedy. At a minimum, the buffer zone would extend from the current site property boundary to Drip Springs, No Name, and Rock Lick Creeks to the west, east, and southwest of the site, respectively.

A comprehensive Interim Site Management Plan would be developed during the design period to define the maintenance and monitoring tasks to be conducted during the interim maintenance period. A monitoring, maintenance, and surveillance program would then be implemented at the site following initial closure, as defined by the Interim Site Management Plan.



INITIAL CLOSURE CAP



FINAL CLOSURE CAP

EXPLANATION

- *30 TO 40 MIL SYNTHETIC COVER*
- *TOPSOIL LAYER WITH VEGETATIVE COVER*
- *SILTY SAND*
- *GEOTEXTILE FABRIC*
- *CRUSHED ROCK*
- *80 MIL SYNTHETIC LINER*
- *CLAY LAYER (PERMEABILITY $\leq 1 \times 10^{-7}$ cm/sec)*
- *COMPACTED SOIL LAYER*
- *EXISTING TRENCH SOIL COVER*
- *TRENCH WITH RANDOMLY PLACED WASTE CONTAINERS*

NOT TO SCALE

MAP PRODUCED BY EBASCO SERVICES INCORPORATED AND LABELLED FOR THIS REPORT BY BOOZ, ALLEN & HAMILTON, Inc.

MAXEY FLATS DISPOSAL SITE
ALTERNATIVE 5 – NATURAL STABILIZATION

MAP 5

5 9 0449

EXPLANATION

- MFDS RESTRICTED AREA
- MFDS PROPERTY BOUNDARY
- PROPOSED BUFFER ZONE

MAP PRODUCED BY EBASCO SERVICES INCORPORATED AND LABELLED FOR THIS REPORT BY BOOZ, ALLEN & HAMILTON, Inc.

MAXEY FLATS DISPOSAL SITE
PROPOSED BUFFER ZONE MAP

MAP 6

Interim Maintenance Period

Upon construction of the initial closure cap, the interim maintenance period would commence. The Interim Site Management Plan would provide the basis for work activities during the interim maintenance period. During this period, the initial closure cap would continue to be maintained to prevent infiltration of water into the trenches, maintenance of the site would continue, and the site would be monitored by an enhanced monitoring/surveillance program. During the interim maintenance period the following activities would be performed as prescribed by the Interim Site Management Plan:

- Periodic Topographic Surveys and Subsidence Monitoring
- Ground Water Monitoring
- Initial Closure Cap and Surface Water Management and Control
- Trench Leachate Management and Monitoring
- Monitoring, Maintenance, and Surveillance, and
- Five Year Reviews.

The end of the interim maintenance period is defined as the time when subsidence of the trenches has nearly ceased and final closure begins. The criteria for final closure would be developed during the design phase and could include acceptable void fraction, defined rate of minimal subsidence, defined back-filling rate to maintain design grade, etc. The closure criteria would be dependant on the design of the final closure cap and can be based upon engineering evaluations during the development of the Interim Site Management Plan. The primary objective of the interim maintenance period is to let the trenches stabilize by natural subsidence. Thus, the criteria would be dependant on a minimal rate of subsidence and, when a final closure cap could be installed without having to repair it often due to continuing subsidence.

Topographic surveys and elevation surveys of the subsidence monitors would be made periodically to evaluate subsidence. This information would form a database to be used to determine if the trenches have stabilized and the criteria for final closure have been achieved.

The initial closure cap would be inspected periodically to ensure that it has not failed and is effectively controlling surface water runoff. As needed, the cap would be repaired and synthetic liner replaced according to the Interim Site Management Plan. Currently, it is anticipated that the synthetic liner would require replacement at 20-25 year intervals. Liner replacement would be performed in response to the liner condition and the manufacturer's warranty and specifications. The specific liner type would be determined during development of the Interim Site Management Plan; however, the liner would be of the type to require replacement no more often than the previously-stated 20-25 year interval. The drainage ditches and retention ponds would also be cleaned and maintained as needed. Erosion damage to the cap and drainage systems would be repaired as needed.

The Infiltration Monitoring System, installed to detect the accumulation of leachate in the trenches, would provide a warning if leachate began to accumulate in the trenches. This monitoring system would be used as a supplement to the Commonwealth's current trench leachate monitoring program. Measures could then be taken to eliminate the cause of the infiltration. If significant levels of leachate were detected, the leachate management plan, developed as part of the Interim Site Management Plan, would be implemented to remove, solidify, and dispose of the leachate. The results would then be used to adjust the frequency of inspections, data collection, sample analyses, and planned leachate pumping and solidification.

Site monitoring, maintenance, and surveillance would be performed as defined by the Interim Site Management Plan. Ground water samples would be collected periodically from specified monitor wells for analysis and water levels taken.

Section 121(c) of CERCLA requires EPA to conduct a review of the remedy five years after initiation of remedial action and once every five years thereafter for those remedial actions that allow hazardous substances to remain on-site. The purpose of this review would be to evaluate the remedy's performance to ensure that it has achieved, or will achieve, the objectives set forth in the Record of Decision and is protective of human health and the environment. If the remedy is not meeting the defined remedial action objectives during any of the five year reviews, or at any interim point between the five year reviews, or if the remedy fails to be protective of human health and the environment, a focused feasibility study would be conducted to determine available technologies that could be implemented at the site to achieve the defined remedial action objectives and protection of human health and the environment.

During the first five year review, sufficient data should be available from the trench de-watering program, information contained in the Commonwealth's historical leachate level database, Infiltration Monitoring System, ground water monitoring, and ground water modeling program to determine the necessity of a horizontal flow barrier. The decision to construct a horizontal flow barrier would be made by EPA, in consultation with the Commonwealth of Kentucky and industry experts. If analysis of this data indicates that significant ground water is accumulating in the disposal trenches, a horizontal flow barrier would be installed to curtail the ground water recharge. The location, depth, and extent of this horizontal flow barrier would be determined through ground water modeling and review of site data.

Two types of horizontal flow barriers were evaluated in the Feasibility Study. The type of horizontal flow barrier installed at the site, if needed, could include either the North Cutoff Wall or Lateral Drain with Cutoff Wall to encircle the trench disposal area.

Final Closure

When the results from the interim maintenance period monitoring show that the closure criteria have been achieved, indicating that the trenches have sufficiently stabilized by natural subsidence, the trenches would be capped by the final closure cap.

The following activities would be undertaken during final closure:

- Waste Burial
- Site Closure
- Monitoring and Surveillance
- Five Year Reviews

Any contaminated or potentially contaminated materials at the site would be buried in a new trench. These materials would include solidified leachate, leachate storage tanks, and on-site buildings which would be demolished during final closure.

The trenches would be covered by an engineered cap with synthetic liner and effective surface water control systems would be installed to limit infiltration. It is expected that a significant amount of research data and new technologies will be developed throughout the interim maintenance period. Thus, the design of the final closure cap could reflect the most advanced technology for vertical infiltration barriers.

A monitoring and surveillance program would be implemented. The program would be funded in perpetuity.

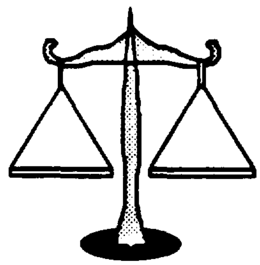
Custodial Maintenance Period

After the final closure cap has been construc**, a monitoring program would be implemented at the site. The frequency of monitoring activities described for the interim maintenance period would be reduced during the post-closure period due to the presumed reduction of water infiltration into the trenches and reduced waste volume. This monitoring would be carried out in perpetuity.

Cost

Cost analyses for Alternative 5 were based upon a discount rate of 4, 5, 7 and 10% over a period of 100 years (the estimated time for which stabilization of the trenches is assumed to occur). This Proposed Plan uses a discount rate of 4% for the alternatives, because it is the most conservative cost figure.

EVALUATION OF ALTERNATIVES



Alternative 1, the No Action alternative, would not comply with all Applicable or Relevant and Appropriate Requirements (ARARs) nor does it provide overall protection of human health and the environment. Alternative 4, which includes a structural cap comprised of a two-foot layer of concrete and a two-foot layer of clay, provides short- and long-term effectiveness relative to other alternatives; however, it is difficult to implement and is not cost-effective. Alternative 8, which is similar to Alternative 5, except that a final multimedia cap is immediately installed over the trench disposal area, provides a lesser degree of long-term effectiveness and is far less cost-effective than Alternative 5. Alternative 17, which includes a 12-foot thick engineered soil cap, is less protective of public health and less cost effective than alternatives 5, 10 and 11. The remaining three FS alternatives (5, 10, 11) differ in their approach toward achieving trench stabilization.

Alternatives 5 and 10 provide for (1) vertical infiltration barriers having permeabilities of 1×10^{-7} cm/sec or less, (2) trench leachate removal with disposal into new trenches, (3) a water management system to prevent contamination of rainwater during construction activities, (4) a horizontal flow barrier, if necessary, to prevent potential horizontal infiltration of ground water into the trenches, (5) environmental and performance monitoring systems, and (6) an operating and maintenance trust fund to ensure site care in perpetuity. Alternatives 5 and 10 differ principally in the means by which they achieve long-term site stability. Alternative 10 uses dynamic compaction to accelerate void reduction to limit significant subsidence in the future. Alternative 5, on the other hand, allows for natural subsidence to occur by providing for an interim maintenance period during which the site would be graded and modified, to provide improved surface runoff conditions, and covered by a synthetic cover that would prevent water from entering the trenches and provides for ongoing repair during the natural stabilization process. After subsidence has abated, a final cap would be installed on the site. Alternative 11 contains protective features similar to Alternatives 5 and 10, except that compaction of the trenches is not included in this alternative. Grout would be injected into the trenches to prevent subsidence.

Alternative 5 (Natural Stabilization) would achieve initial closure sooner than closure using other alternatives; however, final closure would be implemented at a much later date. With Alternative 5, proven technologies would be used during initial closure; new technologies could be considered at the time of final closure to take advantage of advances in research on low-level radioactive waste sites. Major weaknesses of this alternative are the lack of application of an immediate stabilization technology to the disposal trenches. However, this weakness is offset by maintaining the integrity of the waste form. Other technologies could lead to increased release of radionuclides without an alternative means to properly address migration from the disposal area.

Alternative 10 (Dynamic Compaction) utilizes a mechanical method for significantly accelerating trench stabilization. Weaknesses of this alternative include subsidence over trenches not dynamically compacted, minor subsidence over compacted trenches due to continued deterioration of trench waste, and the unproven nature of this technology at the MFDS. In addition, this technology currently lacks community and state acceptance at the MFDS.

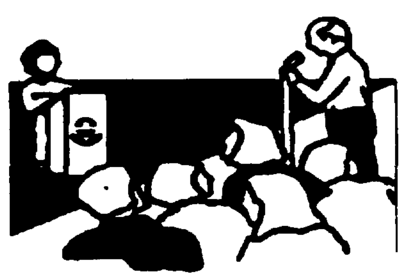
Alternative 11 (Trench Grouting) would achieve stability using the grouting technology that has been applied at low level radioactive waste disposal sites, including Maxey Flats. The technology has not, however, been applied at the scale required for stabilization of the entire site. The major weaknesses of this alternative are the implementability difficulties anticipated at the MFDS, and the lack of a method for determining the location and magnitude of voids before and after injecting grout. Subsidence would also occur over trenches not grouted and minor subsidence over grouted trenches due to continued deterioration of trench waste.

The Commonwealth endorses the use of natural stabilization for the Maxey Flats site. The Commonwealth considers trench cover repair and a horizontal flow barrier, as needed, to be integral features of the remedy to be chosen at the MFDS. The Commonwealth rejects the use of Dynamic Compaction (Alternative 10) for either a site demonstration or for total site remediation due to "potential release of leachate to the environment, potential fracturing of the underlying geologic strata, and lack of substantial information regarding trench waste location, waste condition, and waste contents". The Commonwealth also rejects grouting (Alternative 11) for implementation at Maxey Flats due to potentially unacceptable releases of leachate to the environment and the required, time-consuming demonstration of this technology prior to implementation.

Community responses to the alternatives will be discussed in the Record of Decision which follows the public comment period. Based on information currently available, EPA prefers Alternative 5, Natural Stabilization, as the most acceptable remedy for the MFDS. This preliminary finding was reached after careful consideration of the technologies and remedial alternatives presented in the Maxey Flats FS Report and information contained in the Administrative Record. The preferred alternative is believed to provide the best balance of trade-offs among alternatives, with respect to the evaluation criteria.

FUTURE ACTIVITIES

EPA will hold a public meeting on the preferred remedy for the MFDS on June 13, 1991. This meeting will give the public an opportunity to express their opinions and concerns about the preferred alternative and the other alternatives considered. The meeting also will serve to begin a 60-day public comment period. Due to the complexity of issues involved, the number of documents in the Administrative Record, and the level of community involvement at the site, EPA has granted a 30 day extension to the required minimum 30-day public comment period on the preferred alternative. **Therefore, a 60-day public comment period will be held.**



Issues raised by the public during the public comment period will be addressed by the EPA in a Responsiveness Summary that becomes an official part of the Agency's documented decision on the remedy. The Record of Decision is expected to be issued in late 1991. Negotiations between Potentially Responsible Parties (PRPs) and EPA may lead to an agreement, a Consent Decree, by which the PRPs may agree to design and implement the selected remedy. If a Consent Decree is settled upon, it would be lodged with a federal district court by the U.S. Department of Justice. Once the Consent Decree has undergone a 30-day public comment period and is approved by the Court, design work would commence.

Implementation of Alternative 5 would begin upon entering of the Consent Decree and the completion of the necessary work plan and design documents.

SUMMARY OF THE PREFERRED ALTERNATIVE

In summary, EPA's analysis of the currently available technologies for closure of low level radioactive waste disposal sites and review of information contained in the Administrative Record indicates that natural stabilization is the most appropriate technology for stabilization of the Maxey Flats Disposal Site. Alternative 5, Natural Stabilization, allows for quick implementation of remedial action because it does not require a demonstration of the technology and the actual site preparation presents few difficulties regarding implementation. Natural stabilization will allow settlement to continue in a gradual manner, and allow for timely monitoring and maintenance of the cover, which will be replaced after the synthetic liner is no longer useful.

Alternative 5 provides for flexibility in selecting the optimum interim cover. If, during the first five-year review conducted by EPA, it is determined that a synthetic cover alone is not effective, alternative cover options will be evaluated (e.g., soil cover over a synthetic liner). Alternative 5 also provides for flexibility in addressing the uncertainties associated with horizontal ground water flow. If, during the five-year review, it is determined that ground water is recharging the trenches, a horizontal barrier would be designed and constructed to divert ground water flow, to the extent practicable, away from the trenches.

It is anticipated that subsidence of the disposal trenches at the MFDS will continue to be a controlling factor with respect to installation of a final cap for the next 35 to 100 years. A final multi-layer trench cover with synthetic liner would be installed upon attainment of the stabilization criteria.

Site monitoring, environmental monitoring, remedy reviews, and site maintenance will provide the necessary assurance of design compliance with adequacy, health and safety of the public in the area, and compliance with all federal and state requirements.

Implementation of Alternative 5 would result in the reduction of risk from the approximate risk of 1×10^{-1}, or one in ten, if no action were taken at the MFDS, to an approximate risk of 1×10^{-4}, or one in 10,000.

THE COMMUNITY'S ROLE IN THE SELECTION PROCESS

EPA invites input from the community on the remedial alternatives proposed for each Superfund site. EPA has set a public comment period from June 13, 1991 to August 13, 1991 to encourage public participation in the selection process. The comment period will be initiated by a public meeting at which EPA will present the Proposed Plan, answer questions, and accept oral and written comments.

A public meeting is scheduled for 7:OO p.m., June 13, 1991, and will be held at the Ersil P. Ward (formerly known as Fox Valley) Elementary School in Fleming County, Kentucky, located onState Road 32, between Morehead and Flemingsburg.

EPA will summarize comments and EPA's responses in the Responsiveness Summary section of the Record of Decision (ROD). To send written comments or obtain further information, contact:

Dave Kluesner
Site Project Manager
North Superfund Remedial Branch
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 347-7791

MAILING LIST ADDITIONS

If you did not receive this Proposed Plan by mail, or you know of others who wish to be placed on the mailing list for future publications pertaining to this site, please fill out, detach and mail this form to:

Suzanne Durham
Community Relations Coordinator,
North Superfund Branch,
U.S. Environmental Protection Agency,
345 Courtland Street, Atlanta, GA 30365

Name ______________________
Address ______________________
Affiliation ______________________
Telephone ______________________

GLOSSSARY

Administrative Record: An official compilation of documents, data, reports, and other information that was considered during the selection of response action(s) at a Superfund site. The record is placed in the information repository to allow public access to the material.

Alluvium: Sediment that has been deposited by rivers and streams in comparatively recent time.

Aquitard: A subsurface formation of low permeability which retards the migration of ground water through it to underlying formations.

Compaction: A process designed to increase the density of a substance by reducing voids.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A Federal law passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Act created a Trust Fund, known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Decommissioning: Preparations taken for retiring nuclear facilities from active service. The objective of decommissioning is to place the facility in such a condition that future risk to public safety from the facility is within acceptable limits.

Dose Equivalent: A quantity used in radiation protection standards. It expresses all radiations on a common scale for calculating the effective absorbed dose. It is defined as the product of the absorbed dose in rads and certain modifying factors. The unit of dose equivalent is the rem.

Evapotranspiration: The release of water vapor from plants to the atmosphere.

Exposure Pathways: The paths or routes by which contaminants are transferred from a source to a receptor (a hypothetical or actual individual). Pathways may be quite complex, involving ground water, surface water, the atmosphere, and food chains. Accidental or purposeful intrusion by humans into the waste is also a potential exposure pathway. Humans may have skin contact with, inhale, or ingest contaminants. In the case of radionuclides, a person also may be exposed to the radiation without directly contacting the waste. The path by which the contalso aminant reaches man, and the means by which it contacts or enters the body, combine to form exposure pathways.

Forty-Series Trenches: Refers to trenches 40 through 49 at the MFDS. These trenches can be characterized, generally, as the longest and deepest trenches at the MFDS. Some of the 40-series trenches are up to 686 feet in length, over 30 feet deep and 70 feet wide. The first of the 40-series trenches accepted waste beginning in 1973. Some of the 40-series trenches have individual trench volumes in excess of 1,000,000 cubic feet.

Grout Curtain: A physical barrier buried beneath the ground surface designed to prevent or control ground water flow into designated area. Installation of the grout curtain would involve rock coring into the bedrock followed by the injection of grout, which is a thin, course mortar or cement-mix, under high pressure until enough grout is in place to form a wall, or curtain to curtail ground water flow.

Horizontal Flow Barrier: For the MFDS, this refers to a lateral drain and cutoff wall combination that encircles the entire trench disposal area. The la[illegible]rain component of the horizontal flow barrier would involve excavation of a trench around the perimeter of a group of trenches and installation of a perforated pipe at the bottom of the trench to collect any liquids flowing into the drain. The cutoff wall would consist of an upper section of compacted clay or cement-mix and a lower section, extending down to bedrock, or cement-mix. The purpose of the horizontal flow barrier is to prevent the infiltration of ground water into disposal trenches and the exfiltration of leachate from the disposal trenches.

Hot Wells: Refers to wells at the Maxey Flats Disposal Site that were used for the burial of small-volume radioactive wastes with high specific activity. Eight distinct wells were constructed adjacent to one another, in what is referred to historically as the "hot well area". Several other wells were located against the walls of trenches. The wells in the "hot well area" are vertical, 10 to 15 feet deep, 1 to 2 feet in diameter, and were constructed from concrete, coated steel pipe, or tile. They were capped with one large slab of concrete. Other wells were placed in trenches existing from the ground surface to the bottom of the trenches.

Hydraulic Head: The difference in water elevation between two points in a continuous water table.

Information Repository: A library or other location where documents and data related to a Superfund project are placed to allow the public access to the material. For the Maxey Flats Disposal Site, information repositories have been established at the Fleming County and Rowan County Libraries.

Institutional Controls: Refers to on-site activities and site access which are controlled by some authority. This authority can be state, federal, or local.

Leachate: Liquid that has become contaminated as a result of water coming in contact with wastes or with decomposed solid materials.

Media: Specific environments -- air, water, soil -- which are the subject of regulatory concern and activities.

Mrem: Abbreviation for millirem, which is one thousandth of a rem. Rem is an acronym for "roentgen equivalent man," which is a dosage of radiation that will produce the same biological effect as one roentgen (or type of unit) of X-ray or a gamma ray dosage. Rem is the conventional unit of dose equivalent.

Pico curie: Abbreviate as pCi. A common usage term for a unit of measurement for radioactivity. It represents 0.037 disintegrations of a radioactive atom per second, which equals one ten thousandth of a curie.

Radionuclide: A nuclide is a type of radioactive atom characterized by the number of protons, neutrons and the energy content which characterize its nucleus.

Radon: Radon is a naturally occurring radioactive gas produced by the decay of uranium in rock and soil. As uranium decays, it produced radium, which in turn, releases radon gas. It is invisible, odorless, and tasteless. Once released, this gas migrates through permeable rocks and soil, eventually entering the atmosphere or buildings through cracks in foundations.

Record of Decision (ROD): A legal document prepared by the U.S. EPA that describes the remedial action selected for a Superfund site, why the remedial action was chosen and not others, how much it will cost, and how the public responded to the action selected.

Remedial Alternative: A remedial technology or a combination of remedial action technologies that will prevent or mitigate contaminant problems.

Remedial Investigation/Feasibility Study: A two-part study of a waste disposal site that provides the basis for selection of a remedial action for the site. The first part, or RI, identifies the nature and extent of contamination. The second part, or FS, identifies and evaluates alternatives for addressing site threats.

Resource Conservation and Recovery Act (RCRA): A Federal law that established a regulatory system to track hazardous wastes from the time of generation to disposal. The law specifies procedures to be used in treating, transporting, storing, and disposing of hazardous wastes.

Restricted Area: An area to which access is controlled by the licensee and limited to authorized personnel to protect individuals from being exposed to radiation and radioactive or chemical materials. At the MFDS, this area is the fenced area that includes the burial trenches.

Sediment: Materials that settle to the bottom of a stream, creek, lake, or other body of water.

Solidification: The process by which contaminants are mixed with a hardening agent, like cement.

Sump: An area lower than the surrounding area used to collect liquids. At the MFDS, sumps are pipes from the surface to the base of the trench where the pipes are slotted. They are used to collect and pump leachate from the trenches.

Superfund Amendments and Reauthorization Act (SARA): A Federal law passed in 1986 which modified the 1980 CERCLA Superfund law by strengthening EPA's authority, State involvement and opportunities for public participation. Additional Superfund revenues also were granted.