1.0 INTRODUCTION

1.1 SITE BACKGROUND. This Hazardous, Toxic, and Radioactive Waste (HTRW) Remedial Investigation Report (RI) was prepared in conjunction with the Mississippi River - Gulf Outlet, New Lock and Connecting Channels Feasibility Study. This Remedial Investigation follows the HTRW Initial Assessment previously submitted for the subject study.

This report presents a discussion of site history and features of three investigation areas, investigation methods and results, and identification and evaluation of remedial activities and satisfies the regulation requirements of ER 1165-2-132 (Water Resources Policies and Authorities - Hazardous, Toxic and Radioactive Waste Guidance for Civil Works Projects) dated 26 June 1992. The first area under investigation in this report is the industrialized area on the east bank of the IHNC between Florida and North Claiborne Avenues where excavation of the bypass channel will occur during project construction. Henceforth this area shall be referred to as the "east bank IHNC investigation area" or "ByPass Channel Site". The second area included in this investigation is the proposed disposal area for dredged material to the east of the IHNC, extending into St. Bernard Parish, to be referred to as the "proposed disposal investigation area". The last area under investigation is along the west bank of the IHNC including the Galvez Street Wharf, the Coast Guard site and the IHNC Lock. This last area is referred to as the "west bank IHNC investigation area".

1.1.1 SITE DESCRIPTION. The IHNC opened in 1923, and is located in metropolitan New Orleans connecting the Mississippi River, Mississippi River Gulf Outlet (MR-GO), Gulf Intracoastal Waterway (GIWW) and Lake Pontchartrain for use by barge traffic (Fig. 1.0). This investigation focuses on the industrialized portion of the IHNC east bank between Florida and North Claiborne Avenues along Surekote Road, the proposed disposal area to the east of the canal and the west bank of the canal from Florida Avenue to approximately the intersection with Burgundy Street. There are various active and inactive sites in this area with facility activities including: steel fabricating, trucking, shipbuilding, boat and ship repair, marine supply, towing, marine repairs, chartering, oil and petroleum related facilities, barge leasing, electrical contracting, and others.

The investigation areas are within the New Orleans city limits, with a portion of the disposal area near Arabi in St. Bernard Parish, LA. All surface drainage flows into the Industrial Canal or to the City of New Orleans stormwater collection system which then flows to the GIWW (via the MR-GO), or to Lake Pontchartrain.

Industrialization of the east bank IHNC investigation area began in the 1960s and today approximately 50% of these sites are currently unoccupied or abandoned. The Galvez Street Wharf, which spreads from North Claiborne Avenue to approximately North Rocheblave Street on the west bank of the IHNC, was opened prior to 1940 with major remodelling taking place in 1965. From North Claiborne to St. Claude Avenues, the US Coast Guard is housed, as well as the US Army Corps of Engineers Lock (opened in 1923). The disposal area east of the canal is bordered by the Main outfall canal and Jackson Protection Levee Canal to the north, the railroad and Florida Walk Canal to the south with the BFI Landfill separating the two areas at the Orleans - St. Bernard Parish line.

1.1.2 SITE HISTORY. The land in the investigation areas is owned by the Board of Commissioners of the Port of New Orleans which leases the land to the various entities targeted in this investigation. Information cited in this section was obtained from three sources: (1) federal, state and local agency research, (2) a report titled "A Land Use History of Areas Adjacent to the Inner Harbor Navigation Canal Lock, New Orleans" by R. Christopher Goodwin & Associates, Inc. dated November 1992; and (3) visual site surveys conducted by the U.S. Army Corps of Engineers on numerous dates. The information regarding previous operators was developed using the land use report. There are some discrepancies in the report with regard to the street addresses of some facilities. These discrepancies are noted in the writeup following.

1.1.2.1 EAST BANK IHNC INVESTIGATION AREA: The following information was collected for the east bank of the IHNC from Florida to North Claiborne Avenues. Facilites which are listed in the 1990 - 1991 New Orleans phone directory are included in this section.

1800 Surekote Road: Tables in the above mentioned land use report show Metal Cutting Specialty Co., Inc., and England Transportation Co. at this address from 1962 - 1974 with the Boland Marine and Manufacturing Co. office from 1978 - 1990. This address is the southernmost site on the east bank of the IHNC nearest North Claiborne Avenue. In an earlier section of this same report, the author cites that the address of these above companies is 2500 Surekote Road. It appears that since Boland Manufacturing Co. did occupy the 2500 Surekote Road address, that these two were confused. The 1800 address is correct. The first recorded occupant at 1800 Surekote Road was Metal Cutting Specialty, Inc., which obtained the lease from the Port of New Orleans in 1959. The company, a Louisiana corporation, leased 1.1 acres for 30 years and was in the steel fabricating business.

England Transportation Co., a trucking firm, operated at 1800 Surekote Road somewhere during the time frame of 1962-1974. The facility was involved with maintenance of motorized vehicles.

International Metal Fabricators assumed the lease of Metal Cutting Specialty Co., Inc. in 1969 until 1970. International Tank Terminals, Ltd., metal fabricators, was then transferred the lease along with an additional tract along Jourdan Avenue. Fuel tanks and pumps were installed on site without permission from the Port that same year.

In 1979, Boland Marine and Manufacturing Co., Inc. subleased the area formerly occupied by International Tank Terminals as an office. Boland in turn subleased the area to Charlie White, Inc. in 1983, as a support area for a shipyard. The site was not utilized after 1983 because the shallowness and the narrow locks of the Canal hampered the repair of large, more modern vessels.

1910 Surekote Road: In 1945, the Port granted permission to the Victory Oil Company of Arabi to install a 550 gallon UST at the site. The UST is not registered with LDEQ UST Division and they have no record of its removal.

Inland Waterways Corp. first subleased a portion of the site in 1954. Saucer Marine produced methyl ethyl ketone (U159) as well as a solid waste which exhibited the characteristic of ignitability. Saucer Marine repairs, services, and constructs marine vessels. Sandblasting, painting, and metal works are also performed on site. The address listed in the New Orleans 1990 - 1991 phone directory for Saucer is 1910 Surekote Road. In

October, 1991 an anonymous letter was sent to LDEQ Emergency Response Section concerning the "conditions on site" at the Saucer location. The complainant claimed to be an employee of Saucer and stated that drums with "all kinds of hazardous material" were buried on site and that dirty lube oils and fuels from bilges were pumped directly onto the ground and into the canal. The writer included a diagram of the facility to indicate areas of concern. An LDEQ inspection that followed the complaint noted two air compressors surrounded with oil saturated soil, piles of blast sand, and empty 55 gallon drums and paint cans. The two pits identified by the anonymous writer were not inspected by LDEQ. The analysis of the soil indicated that the hazardous waste constituents were below hazardous waste criteria. A TCLP test for metals on the pile of blasting sand indicated levels below regulatory limits for hazardous wastes. Both were classified as industrial wastes.

2100 Surekote Road: In 1984, M. G. Mayer Yacht Service Inc. acquired the lease of 2.41 acres at 2100 Surekote Road from Delta Steamship Lines, Inc., a company that previously had been drydocking and repairing marine vessels at the site. M. G. Mayer provides yacht repair and maintenance. In 1988, the Port charged Mayer with subletting to Lito's Machine Shop, Inc. and Ocean Technical Services, Inc. without authorization. There was no address listed for M. G. Mayer in the 1990 - 1991 New Orleans phone directory.

M. G. Mayer also subleased to Canal Marine Repairs, Inc., a Division of Delta Steamship, which subsequently went bankrupt. A General Inspection of Canal Marine Repairs was conducted in December, 1991. Large piles of blast sand and dumpsters filled with empty paint cans were left on site by the bankrupt company. The sand tested non-hazardous and the paint cans were determined to be a solid waste to be disposed of in an industrial landfill. The Port of New Orleans stated that since Canal Marine Repair subleased from M. G. Mayer, M. G. Mayer would be responsible for clearing the site. In August, 1989 an emergency response spill report was logged for Canal Marine Repairs and 2 gallons of diesel fuel was removed.

Intercoastal Marine Supply was also located at this address sometime during 1962 - 1974.

2200 Surekote Road: Canal Marine Repairs was also listed in the report as acquiring a lease in 1951 and doing business for many years at 2200 Surekote Road. In 1977, Canal Marine Repairs subleased a portion of the property to Delta Steamship Lines, Inc. for use as a ship repair facility. Three years later Canal Marine Repairs became Petroleum Products, an affiliate of ARCO. The Port authorized use of the site as a fueling dock. In 1982, Petroleum Products liquidated its business and assigned its lease to Distributors Oil Co., Inc. of Baton Rouge, a jobber of petroleum products. The site continued to be used as a point for fueling marine vessels and for the commercial distribution of fuel. Sanborn maps from 1978 depict four fuel oil tanks at the Petroleum Products site. Canal Marine Repairs is listed in the 1990 - 1991 New Orleans phone book at 2100 Surekote Road, and Distributors Oil Co. is listed at 2100 Surekote Road. A May, 1989 Emergency Response Spill of acetylene was logged for Distributor's Oil. Distributors Oil was cited in 1989 for improper storage of 60 drums of motor oil, among other minor bookkeeping infractions.

Also listed at 2200 Surekote Road is Indian Towing Company, a Louisiana corporation, which first obtained a lease of 2.0 acres from the Port in 1954. Although this site and the last one share the same address, the sites are different. Indian Towing Co. was associated with Indian Boat

Co., Inc. and Acadian Supply Co., Inc (a distributor for Standard Paint Inc.). The facilities are used for the storage and repair of floating equipment and the storage and sale of marine supplies. Indian Towing is listed at 2200 Surekote Road in the 1990 - 1991 New Orleans phone directory.

In 1954, Standard Paint and Varnish Co., Inc. and Marine Paint and Varnish, Inc., subleased 1.1478 acres from Indian Towing for the purpose of manufacturing paint and handling vegetable oils. It was noted in the land use history report that the paint and varnish industry traditionally has utilized hazardous substances including barium, barium sulfate, benzene, carbon tetrachloride, chromium, manganese, mercury, toluene, uranium, and xylene.

Indian Towing Co. and Standard Paint and Varnish, Inc. acquired the stock of Marine Paint and Varnish, Inc. in 1959; the paint manufacturing equipment then was leased to Standard Paint and Varnish. Standard sold paint to Marine, which in turn marketed it.

In 1980, Indian Towing violated its lease by subleasing a portion of its facilities to Fosti Fueling Services.

In 1983, Indian permitted M/V Skycliffe and other barges to moor on its premises for the purpose of discharging ferro manganese ore onto its barges, although Indian's lease did not approve handling cargo.

In 1988, the Port again charged Indian Towing with unlawfully subletting to Marsh Master Classic Lafitte Skiffs, a boat manufacturing company. This same year a Real Estate inspector for the Port reported that the shell surfacing was soaked with waste oil and a partially submerged tank car body was observed floating on the waterfront.

There were other companies also listed as doing business at 2200 Surekote Road: Marine Service Corp., River Service Corp., and Mississippi Towing Co. These companies seemed to have been engaged exclusively in towing.

<u>2300 Surekote Road:</u> McDonough Marine Service first signed a 10 year lease for 3.0 acres on April 4, 1951. Marmac Corp., a division of McDonough Marine Service, is located at 2300 Surekote Road. The site is used for storage, servicing, and repair of marine equipment. The Marmac Corporation developed from the former McDonough Construction Co., the name was changed in 1972. McDonough is listed by LDEQ UST Division as owning an UST at this site.

<u>2500 Surekote Road:</u> Boland Marine and Manufacturing Co., Inc. was located at this address until its lease was terminated by the Port in 1988. The site has been unoccupied since this time. The RCRA listing shows Boland Marine as producing EP toxic waste (D000), ignitable solid waste (D001), and lead (D008). A May, 1989 RCRA Inspection noted no items of non-compliance at the Boland site.

Gulf Best Electric, electrical contractors, was the predecessor to Boland at this site. The LDEQ UST Division shows a tank owned by Gulf Best Electric at this site.

1.1.2.2 <u>PROPOSED DISPOSAL INVESTIGATION AREA.</u> As mentioned earlier, the proposed disposal area is in Orleans and St. Bernard Parishes, divided by the BFI Landfill at 6699 Florida Avenue. To the north of the site in Orleans Parish is the Main Outfall Canal into which stormwater runoff is pumped from the Orleans Parish stormwater drainage system. The railway line just north of Florida Avenue borders the site to the south in Orleans Parish with the Florida Walk Canal to the south in St. Bernard Parish. The Jackson Protection Levee Canal is to the north of the site in St. Bernard Parish. Also, a sewerage disposal plant is located near the landfill along Florida Avenue. The area is mostly open water and has no historic land use with the possible exception of recreational uses.

1.1.2.3 WEST BANK IHNC INVESTIGATION AREA. Information which follows is from the land use document referenced previously.

Galvez Street Wharf: Little information about the wharf is included in the Port of New Orleans files. In 1940, Coastal Transportation Company and Commercial Transportation Company leased space at the Galvez Street Wharf. Commercial Transportation Company provided river steamers and barge lines for local waterways. In 1946, Luckenbach Steamship Co. held a lease at the wharf, along with an adjacent storage yard. It was noted in the land use history report that oil was transported from this wharf during World War II.

In 1965, the expansion of the dock was completed. Delta Steamship Lines signed a lease at the wharf not long after the remodelling was completed. Delta utilized Sections 25-119 of the wharf for cargo and passenger ships. In 1970, 50% of the utility building adjacent to the wharf was rented to MetFab, metal fabricators. Holiday Inn bought Delta Steamship Lines in 1969, Crowley Maritime acquired Delta from Holiday Inn in 1982, Delta went out of business in 1985. In that year, US Lines took over Delta's operation in New Orleans.

In 1967, outside vessels used Sections 1-24 of the wharf primarily for rubber and steel cargos. In 1975, Central Gulf Lines leased Sections 32-45; Uterwyk leased Bays 57-76. In 1978, Uterwyk leased Sections 86-113; and in 1982 Uterwyk terminated its lease and went into bankruptcy.

In 1984, Coastal Cargo utilized the wharf to warehouse coffee. In 1986, Nexos Lines signed a lease at the wharf and unsuccessfully tried to compete in coffee importation and caradom seed. Coastal Cargo continues its lease at the wharf, utilizing Sections 51-110.

US Coast Guard. The Coast Guard currently operates a wharf at 4640 Urquhart Street on the west side of the IHNC below North Claiborne Avenue. The site is used for mooring US Coast Guard vessels, and is immediately adjacent to the existing IHNC lock. EPA indicated that in May, 1992, the Coast Guard removed a "minor threat" in the vicinity of its facility. The Coast Guard site is also listed on the Superfund CERCLIS listing. The information in the file indicated that the site is a small quantity generator beginning in 1934. Lead acid batteries, spent paint/thinner, waste oil/bilge, spent solvents/degreasers and fluids are included in the listing of substances possibly present.

The Department of Commerce Lighthouse Service operated a garage and machine shop which was involved in the maintenance of motorized vehicles. The Lighthouse Service was the predecessor of the Coast Guard at the site.

US Army Corps of Engineers IHNC Lock. First opened in 1923, the Corps of Engineers operates and maintains the lock. The address provided in the land use report is 4611 St. Claude Avenue, it is also noted that an alternate address is 4635 Urquhart Street. An UST is listed at LDEQ UST Division at this alternate address.

Other sites on the west bank of the IHNC. South of St. Claude Avenue, a metal fabricating company named MetFab operates near the IHNC. MetFab's address in the 1990 - 1991 phone directory is listed as 4566 St Claude Avenue.

An oil house apparently related to the New Orleans Public Belt Railroad was noted in the land use report. This site is on the west bank of the IHNC south of Claiborne Avenue.

An item of note not within the Right-of-Way or area to be disturbed is an asbestos mill previously located at 4500 North Galvez Street, between North Galvez and North Prieur Streets on the IHNC west bank just west of the North Prieur Railyard. This site manufactured roofing materials, dry felt, and industrial asphalt. Asphalt storage tanks, emulsion tanks, silos, fuel tank, and storage tanks were on site. Flintkote Flooring and Richardson Roofing, both divisions of Flintkote spread through several city blocks.

1.1.2.4 OTHER AREAS OF CONCERN IN OR NEAR THE PROJECT AREA

Munitions: During the site visit conducted in July 1992, Port of New Orleans personnel stated that munitions were handled at the Boland Marine and Florida Avenue Wharfs during World War II. They stated that munitions were shipped out from these sites, and some had fallen into the canal and may still be there. It was also stated that during recent sewer/utility work at the Florida Avenue Wharf site a contractor encountered such munitions.

Huntsville Ordnance and Explosive Waste (OEW) Mandatory Center of Expertise (MCX), Rock Island District, as well as New Orleans District DEPR-FUDS personnel were consulted on the munitions issue. None of the above entities had any information on shipping of munitions in the IHNC during World War II. In order to search archives more information than what is currently available is needed. OEW personnel indicated that we first must determine if the statement is credible. Without any evidence or inference in real estate or other records, the statement cannot be considered credible and further search is not possible. A review of the "Land Use History of Areas Adjacent to the Inner Harbor Navigation Canal Lock, New Orleans" completed in November 1992 by R. Christopher Goodwin and Associates, Inc. provided no evidence of munition handling at either the Boland Marine site or the Florida Avenue Wharf site. The report provides 50 years of land-use history of the area surrounding the lock (1937-present). In this report, numerous documentation sources were reviewed including the Port of New Orleans lease records which supplied a real estate inventory. Records at EPA, LDEQ, historical maps, city directories, and the Port do not infer that munitions were handled on the IHNC during World War II. Further searches during future phases of investigation may include geophysical surveys of the channel bottom and searches in old newspapers during the years of World War II.

Air Emissions: LDEQ Office of Air Quality and Radiation Protection maintains the Toxic Emissions Data Inventory (TEDI) database. Equitable /Halter located at 4325 France Road, approximately 0.25 miles north of Hwy 90 on the west side of the IHNC, emits 211,397 pounds per year in total toxins into the air. The following chemicals were listed as being emitted from the facility: 1,1,1-Trichloroethane, benzene, carbon tetrachloride, chromium, copper, cumene, ethyl benzene, methyl ethyl ketone, nickel, m-butyl alcohol, toluene, xylene and zinc.

1.2 PURPOSE AND SCOPE OF THE REMEDIAL INVESTIGATION. The primary focus of this Remedial Investigation is to evaluate findings of previous investigations, to collect additional information that will assist in characterizing current and future risks, and to develop and evaluate long-term and permanent remedial action alternatives.

Engineering Regulation 1165-2-132, Water Resources Policies and Authorities - Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works Projects dated 26 June 1992 was used as a guide for this Remedial Investigation. Prior to issuance of this guidance, the Draft Hazardous and Toxic Waste (HTW) Guidance for Civil Works Projects dated 25 July 1990 was the standard. This Remedial Investigation satisfies the requirements of the regulations for a Feasibility Phase project.

The HTRW Remedial Investigation determines the nature and extent of contamination and also includes a qualitative analysis of the impacts of contamination in the absence of response action. This Investigation includes a preliminary identification of potential source areas, contaminant release mechanisms, exposure routes, and potentially exposed populations. Investigation activities may include topographic setting, underlying geology, surface and ground water flow, building and utility layouts, and characterization of chemical constituents of HTRW contaminants.

This Remedial Investigation identifies and evaluates project plan alternatives to respond to verified HTRW problems which cannot be avoided by project design.

The Remedial Investigation has included the following tasks:

- Compile and evaluate existing data regarding the nature and extent of contamination present at the site.
- Collect and evaluate data to determine the extent of surficial contamination present at the site.
- Collect and evaluate data to determine the extent of contamination in subsurface soils and groundwater.
- Collect and evaluate data to characterize the shallow subsurface geology and hydrogeologic conditions.
- Evaluate human health and environmental risks posed by site-related contamination.

This HTRW Remedial Investigation Report incorporates information generated from the above listed tasks except for the last item.

The HTRW Feasibility Study, the next stage of the investigation, shall include the following tasks:

- Evaluate data generated during the RI and risk assessment to determine potential remedial action goals for the site.
- Utilize historical information from other FS reports from similar sites to identify similar site characteristics and areas to build upon existing EPA experience for the evaluation of potential remedial technologies to achieve remedial action goals.
- Identify applicable or relevant and appropriate requirements (ARARs) for possible remedial actions.
- Screen selected media-specific technologies and develop site-specific alternatives, based on previous Records of Decision (RODs) at similar sites.
- Conduct a detailed analysis of a limited group of alternatives to identify prefered alternatives.

A comprehensive sampling program was developed by Foundations and Materials Branch and the Hydraulics and Hydrologic Branch to evaluate the chemical constituents of the suspected HTRW contamination. The responsibilities were divided between the two branches in accordance with technical expertise. Foundations and Materials Branch developed the sampling program for surface and subsurface soil and groundwater testing. Hydraulics and Hydrologic Branch developed the sampling program for sediment sampling as well as water quality 404(b)(1) testing (not included in this HTRW Remedial Investigation Report).

2.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA The New Orleans area is physiographically located within the Central Gulf Coastal Plain. The IHNC project site is on the eastern flank of the Mississippi River Deltaic Plain. The IHNC cuts across the Mississippi River Natural Levee Ridge, the interlevee lowland consisting of inland swamp and marshes, the Metairie Ridge, and then connects with Lake Pontchartrain. At about 2 miles from the Mississippi River, the Canal branches to the Mississippi River Gulf Outlet (MR-GO). The MR-GO continues towards the east parallel to the Metairie Ridge then swings south towards the Gulf. The area is characterized by low relief ranging from a maximum of +10 feet (NGVD) on the crest of the natural levee near the river to a minimum of -2 feet (NGVD) in drained areas and marshes.

The following describes briefly the physical conditions at the project area from the Mississippi through the proposed marsh creation site (disposal site) near the intersection of IHNC and MR-GO then focuses on the New Lock site in the Canal between North Claiborne Avenue and Florida Avenue and the ByPass Channel Site or the east bank investigation area along Surekote Road.

2.1 CLIMATE. The City of New Orleans has a subtropical marine climate. Located in a subtropical latitude, its climate is influenced by the many water surfaces of surrounding lakes, streams and the Gulf of Mexico. Throughout the year, these waterbodies modify relative humidity and temperature conditions, decreasing the range between extremes. When southern winds prevail, these effects are increased, imparting the characteristics of a marine climate. The area has mild winters and hot, humid summers.

Temperature records are available from "Climatological Data" for Louisiana, published by the National Climatic Center. The annual mean temperature, based on the period 1951-1980, is 69.5°F, with monthly mean temperatures varying from 53.6°F in January to 83.0°F in July. Temperature normals are shown in Table 2-1. Extremes since 1951 were 102°F on July 6, 1980 and 10°F on December 23, 1989. All temperatures shown are from Audubon Park, New Orleans.

The annual normal precipitation in New Orleans, based on National Climatic Center records at Audubon Park over the period 1951-1980, is 60.65 inches. Monthly and annual normals are provided in Table 2-2. The maximum monthly rainfall since 1951 occurred during April 1980, with 20.24 inches falling; the maximum one day rainfall for the same period was 9.31 inches on May 3, 1978. The heaviest rainfall usually occurs during the summer, with July being the wettest month (7.17 inches), and October being the driest (2.52 inches).

2.2 SURFACE WATER HYDROLOGY Four waterbodies interact near the project site: the Mississippi River, the Inner Harbor Navigation Canal, the Mississippi River - Gulf Outlet and Lake Pontchartrain. A Corps of Engineers Technical Report published in January 1982 shows that the flow in the IHNC for the segment north of the MR-GO generally flows northerly with a maximum expected velocity of around 2.4 feet per second (fps). This flow is from the MR-GO to the IHNC and to Lake Pontchartrain. Depending upon tidal influences, the direction of flow is sometimes from Lake Pontchartrain, through the IHNC and to the MR-GO, the maximum expected flow in this direction is 2 fps. It can be seen from this report that for the majority of the time the flow is into Lake Pontchartrain, although at times the flow is non-existent in either direction. These velocities are in the absence of a hurricane or other anomalies in the area.

The Mississippi River water surface elevation is normally higher than the IHNC water surface elevation north of the existing lock. Due to the differential head on the lock and dependent upon the frequency of operation of the lock, the water flow through the lock is from the Mississippi River into the IHNC. This flow will either flow into the MR-GO or to Lake Pontchartrain, as described in the above paragraph. But, because the lock is closed when not in operation, the flow through the lock is minimal.

Flow from stormwater pumpage within the City of New Orleans also enters the IHNC north of the existing lock during rain events from the Dwyer Street Pump Station and the newly constructed Florida Avenue Pump Station. This water then flows either into the MR-GO or to Lake Pontchartrain.

2.3 GEOLOGY

2.3.1 REGIONAL GEOLOGY Only recent geologic events are pertinent to this project. About 4,500 years ago, the first Recent deltaic sediments were carried into the project area when the Mississippi River was depositing the St. Bernard Delta sequence. Several cycles of deposition and erosion have occurred in the project area as the Mississippi River shifted back and forth across the deltaic plain. At about 2,000 years ago the Mississippi River shifted west and began building the LaFourche Delta sequence. The project area was not subjected to heavy influx of sediments again until approximately 1000 years ago when the River shifted eastward to its present position. Construction of levees and other development has eliminated any further deposition of fluvial / deltaic sediments in the project area.

Since the end of the Pleistocene, regional subsidence and geosynclinal downwarping have been occurring in the area. The long-term rate of subsidence in the project area is approximately 0.48 feet per century. In addition, man induced subsidence of the ground surface has occurred in reclaimed marsh and swampland due to the shrinking of highly organic soils after drainage.

2.3.2 SITE GEOLOGY The ByPass Channel excavation site is within a 32 acre land located on the east bank of the Canal. The area investigated for HTRW is about 4200 ft long and about 400 feet wide and is roughly bounded by the Canal, the floodwall, Florida Avenue and North Claiborne Avenue (Fig. 2.1). The project area cross-sections (AA', BB', CC' and DD') presented in Fig. 2.2 are constructed from six (6) 35-foot deep soil borings taken recently for analytical sampling and from eleven (11) deeper geotechnical borings taken from 1968 thru 1992 in the Canal and the eastbank. These geotechnical borings range in depths from 70 to about 230 feet and penetrate through the Pleistocene formations.

The ByPass Channel site is principally underlain at the near surface by fill material. As shown in cross-sections of the area, the fill unit has variable thicknesses ranging from 14 feet to 16 feet on the Canal side (sections BB' and DD') and average 4 feet on the land side of the floodwall along Jourdan avenue (section CC'). The channel fill on the Canal bottom is estimated to average about 8 feet (section AA').

The fill unit consists of variable mixtures of shell (SI), limestone gravel, sand (SP and SM), clay and silt (CH, CL and ML). Gravel, shell and sand, including blasting sand, are irregularly distributed throughout the industrialized areas of the site, however they usually constitute the ground surface of work areas, parking lots and roadways. Concrete pads constitute the foundation of buildings, ramps, and wharfs. In places, as intercepted in soil borings, the fill material may include buried concrete blocks, metallic rods, wires and sheets, blasting sands, drainage and utility pipes, wood blocks, and tree trunks.

Below the coarser grain soils at the near surface, the fill unit grades to more clayey soils towards its contact with the original natural ground (i.e. pre-IHNC). The relationship of the fill material and the subsurface soils is shown by the soil boring logs (Fig. 2.3) and by the cross-sections of the site (Fig. 2.2). The contact between clays of the fill unit and the original natural ground is not well defined and can only be estimated to range in elevations from +7 to -12 feet (NGVD). The clays excavated during the construction of IHNC were most likely used as fill material. Coarser material such as gravel, shell and sand are probably not original site material. Some offsite silts and clays particularly those used for levee construction and modification may also have been added to the fill unit.

Underlying the fill material are interbedded soft organic-rich clays of high moisture contents typical of deposits in swamp environments. This organic-clay unit averages about 8 feet thick at elevations ranging from +1 to -34 (NGVD). Below the organic-rich clay unit are interdistributary deposits consisting of interbedded fat clays with occassional small lenses and layers of silt, silty sand, and sand. These interdistributary unit ranges in thickness from 30 to 40 feet thick and are intercepted at elevations -26 to -66 feet (NGVD).

Beneath the interdistributary deposits are thin layers of prodelta and near shore gulf deposits. The prodelta deposits consist of homogenuous fat clays that range in thickness from 4 to 10 feet at about elevations from -47 to -63 (NGVD). The prodelta unit pinches out towards the north and south ends of the study area and appears to thin towards the west. The near shore gulf deposits generally underlie the prodelta and interdistributary deposits. These deposits consist of interbedded sand and silty sand with occassional layers of clays, silts and shells. They average 7 to 8 feet thick but reach a maximum of 19 feet between elevations -41 to -67 feet (NGVD). The Pleistocence deposits underlying the near shore gulf and, in places, interdistributary deposits extend from -61 to -68 feet (NGVD) to an unknown depth. Below the project site, the Pleistocene deposits consist of interbedded clays with occassional lenses of silt and silty sands.

There are stability and settlement concerns in surface-subsurface soils underlying the study area. The soils are generally characterized with low shear strength and high compressibility. Because of urban development and drainage in much of the study area, settlement is generally higher than the natural rate of subsidence. The existence of sand deposits in the subsurface (e.g. at elevations -45 feet (NGVD) is conducive to seepage and uplift problems.

2.4 HYDROGEOLOGY The principal source of drinking water in the New Orleans metropolitan area is the Mississippi River. However, there are several underlying aquifers used as groundwater sources for various industrial, commercial and irrigation purposes.

2.4.1 REGIONAL HYDROGEOLOGY The aquifer systems in the New Orleans area were subdivided into two major groups: the shallow aquifers and the deep aquifers (Rollo, 1966; Dial, 1983). The shallow Holocene aquifers consist of near surface sands, point bar sands and distributary channel sands formed during the river migration and delta building events discussed above. These aquifers are generally of a discontinuous limited extent and are considered to be of little importance as groundwater sources. Four deep aquifers consisting of the Gramercy ("200-foot" sand), Norco ("400-foot" sand), Gonzales-New Orleans ("700-foot" sand) and "1200-foot" sand are the major groundwater sources in the New Orleans area. Among the deep aquifers, the "700-foot" sand aquifer is the principal source of water for commercial and industrial use. The top of the major deep aquifer systems ranges from 125 to 1200 feet below the ground surface.

2.4.2 SITE HYDROGEOLOGY The shallow water table aquifer between the floodwall and the IHNC at the ByPass Channel excavation site is essentially a perched aquifer. Depths to the shallow water table ranges from 0.1 foot to 3.25 feet during the period of the field investigation. Using the water table elevations in Table 2.3, interpretation of the groundwater flow show complex flow lines as a result of continued urban development at the site (Fig. 2.4a and Fig. 2.4b). The present shallow groundwater flow is basically influenced by the physical conditions at the site including : the topography of the ground surface, the nature of the contact between the coarse gravel-shell-sand and the fine grain clays and silts within the fill unit, the partly buried building foundations, drainage systems in the industrial area (e.g. open ditch west of Surekote Road), the floodwall with a sheet pile apron surrounding the site, the Canal, and pumping activities at the Florida Avenue pump station.

To date, no data is available to observe the deeper groundwater flow regimes directly underlying the excavation site. The deeper groundwater flow in areas adjacent to the Canal may be influenced by flow in the Canal, particularly till Canal depths of about 30 to 40 feet. Potentiometric surface information of the deeper groundwater (i.e. up to project depths of 35 feet below NGVD) will be acquired during any groundwater sampling required of the deeper aquifers.

The hydrogeology at the excavation site is generally similar to areas adjacent to and along the IHNC and MR-GO waterways. A detail hydraulic conductivity study was conducted by GWL, Incorporated (1991) on surface and subsurface soil materials at the CSXT Gentilly Yard located at the north bank of MR-GO about 2.5 miles northeast of the IHNC project site. The results from the CSXT Gentilly Yard soil study show hydraulic conductivities of 7.4×10^{-4} ft/min or 1.1 ft/day in the coarse gravel, shell and sand fill material, 1.8×10^{-8} cm/sec in organic-rich clays, and 1.2×10^{-8} cm/sec in silty clays (GWL, Inc., 1991). Similar hydraulic conductivities are expected for the ByPass Channel soils.

2.4.3 WELL INVENTORY An inventory of registered water wells was conducted through the Louisiana Department of Transportation, Water Resources

Section, to determine the location and use of wells within a 2 mile radius from the site. The wells in this inventory list are shown in Annex-1. The list includes a total of 83 registered wells in Orleans Parish and 27 registered wells in St. Bernard Parish. All of the 12 industrial, commercial and irrigation wells identified in both Parishes tapped the Gonzales - New Orleans aquifer. The screen intervals in these wells range anywhere between 644' and 800' below the ground surface. Six other industrial and commercial wells were abandoned. The remaining 91 wells are shallow and are used principally to monitor the surficial confining unit. Most of these monitoring wells are related to the BFI landfill and several petroleum fuel storage stations.

There are seven (7) industrial wells on the west bank of the Canal that are less than a mile from the site. These are the closest wells to the project site. They are registered with companies including Flinkote Company, Lone Star Cement, Bulk Transport and Dixie Plastics. Water used in these wells are generally for industrial operations. One public supply well and one industrial well, both registered with Reuther Seafood, are located about 2 miles southwest of the project site. Water derived from one of Reuther Seafood wells is listed as used for food and kindred products. The three industrial / irrigation wells in St. Bernard Parish are located about 2 miles southeast of the project site.

2.5 DEMOGRAPHY AND LAND USE The US Department of Commerce, Bureau of the Census shows an Orleans Parish population East of the Mississippi River of 440,231 in 1990. This is an 11.7% decrease from the 1980 population of 498,807. The population for New Orleans Metropolitan Statistical Area is 1,238,816, which includes the east and west banks of Orleans and Jefferson Parishes. According to recent data from the University of New Orleans Real Estate Market Analysis, the rate of outmigration has lessened for the metropolitan area with improvement in the local economy during the early 1990's. Population growth is expected to continue paralleling the local economic activity.

Land uses in the vicinity of the site are generally industrial uses bordering the canal, with commercial and residential intermixed outside of the project Right-of-Way.

3.0 PREVIOUS INVESTIGATIONS

3.1 PORT OF NEW ORLEANS According to the Port of New Orleans, a previous environmental assessment of the Saucer Marine area was conducted several years ago. The result of this investigation was reportedly lost and was not available to USACE-NOD. Prior to 12 July 1993, an Interim Remedial Action was performed on two (2) underground storage tanks at the Boland Marine area. The excavated areas were filled with new off-site sand fill (SP-SM) materials.

3.2 CORPS OF ENGINEERS A HTRW Initial Assessment of the IHNC project site was completed in July, 1993 and satisfies the regulation requirements for a Reconnaissance Phase project. This assessment included all available EPA and LDEQ investigations for the sites within the project area. The Initial Assessment gathered and evaluated available information through agency record searches, land use history review, and visual site surveys with regard to the existence or potential for HTRW contamination. Review of information provided in the report revealed the high possiblity for finding HTRW contamination within the project area. No definite conclusions other than this were reached as a result of this Initial Assessment.

4.0 REMEDIAL INVESTIGATION

4.1 OBJECTIVES. The objectives of the Remedial Investigation (RI) are as follows:

- To collect information on the types, concentrations, extent and movement of contaminants present in subsurface soils, surface soils, sediments, and groundwater in the project area.
- To provide information for estimating the volume of contaminated soils and groundwater in the project area.
- To provide information on site physical characteristics and site contaminants for use in the Risk Assessment, the Feasibility Study and the Remedial Design.
- To collect data for use in treatability studies during the Remedial Design.
- To collect data on geotechnical properties for use in designing and locating remediation structures during the Remedial Phase.

4.2 SAMPLE DESIGNATIONS AND ANALYTICAL METHODS

4.2.1 SAMPLE DESIGNATION Sample designation of the soil gas samples is discussed in detail in a separate report prepared by Northeast Research Institute, Inc. (NRI) for USACE-NOD. The soil gas samples were collected across a sampling grid with 200-foot centers. Additional samples at an interval of about 100 feet or less were collected at or near suspected waste piles or contaminated soils located in-between the 200-foot grid points. Successive numerals from 1 thru 110 were designated to soil gas samplers as they were installed during the survey.

Each soil and groundwater sample collected from the east bank of the Canal contain a sample designation prefix followed by a number. For example, sample IC-SS-7 represents a hardpoint (disrete) or composite soil sample collected from the Saucer Marine area. The letters "IC" denotes Inner Harbor Navigation Canal or Industrial Canal, the letters "SS" denotes Saucer soil, and the numeral "7" denotes the sample designation number. The corresponding groundwater sample collected from the same general locality is designated IC-SW-7, "SW" denoting Saucer water. Additional samples collected at the same sampling location are denoted with an additional letter as a suffix. For example, IC-SS-7D is another soil sample collected from locality 7 in the Saucer Marine area.

The letter "P", for "Petroleum Product-rich", in samples collected during the Phase 2 survey is specially designated for hardpoint samples in localities where initial (Phase 1) sampling reveal evidence of elevated levels of petroleum product contamination such as at surface / subsurface oil-saturated soils and around fuel storage tanks. The petroleum product contamination is observed either visibly in soil and / or groundwater during initial boring and sampling and / or as a result of laboratory analysis of composited soil samples and / or hardpoint groundwater samples. For example, IC-SS-7P1 is a hardpoint soil sample of an oil-saturated area at locality 7, Saucer Marine area. Additional hardpoint soil samples collected to delimit the horizontal and vertical extension of product-rich soils, and thereby collect data for volume estimates, are then designated as IC-SS-7P2, -7P3, -7P4, etc. and as IC-SS-7P1r (3.0' depth), -7P1s (5.0'depth).

The six (6) 35-feet deep soil borings are designated as: IC-1, IC-2, IC-3, IC-4, IC-5 and IC-6. The letters "IC" denote Industrial Canal or Inner Harbor Navigation Canal while the numerals 1 thru 5 denote the boring number. In cases where an additional boring is drilled usually 3 to 5 feet away in the same locality to re-sample soil at depths lost by the first boring, the new boring is given a letter suffix of A such as IC-1A. Analytical samples collected from boring IC-1 are then designated as IC-1-1, IC-1A-2, IC-1A-3, and so on.

4.2.2 ANALYTICAL METHODS

The soil gas samples collected were analyzed using the Thermal Desorption - Mass Spectrometry (TD-MS) and Thermal Desorption - Gas Chromatography / Mass Spectrometry (TD-GC/MS) procedures developed by Northeast Research Institute, Inc.. TD-MS and TD-GC/MS allow ion count measurements of organic compounds and specific identification of compounds in the soil gas samples. The procedure is very helpful in quickly acquiring an inventory of the various types of organic contaminants present over a very large area such as the IHNC east bank investigation area.

The selection of analytical parameters for the laboratory chemical testing of the soil and groundwater samples was guided by the USACE engineering guidance ER-1110-1-263 and EPA guidelines. The parameters selected were determined using two important considerations: (a) information on suspected pollutants released at the site as derived from historical land use studies, site visits, and later, from preliminary soil gas survey data, and (b) the major objectives of this stage of the project (i.e. inventory of contaminants and preliminary determination of disposal options for excavated soils and dredged sediments). The potential pollutants at the site were intially grouped as follows: (a) volatiles (or lightweigth organic hydrocarbons), (b) semi-volatiles (or heavyweigth organic hydrocarbons), (c) chlorinated hydrocarbons, (d) PCBs and Pesticides, (e) metals, (f) rodenticides (pesticides) / herbicides and (g) asbestos.

Samples were sent to the contract laboratory for determination of the total (or bulk) concentration of target priority pollutants in soil and groundwater. Several samples that are suspected to be highly contaminated such as oil-saturated soils, blasting sands, petroleum fuel contaminated soils and bottom sediments from sumps or secondary containment basins such as Distributor's Oil Tank field, Mayer Yacht's degreaser(?) facility and Saucer Marine's metal work facility were also sent for toxicity (TCLP) and ignitability testing. The TCLP and ignitability results provide information usefull in qualifying or rejecting contaminated soils for land disposal. Table 4.1 is a summary list of the analytical parameters and the matrices of samples collected and sent to the contract laboratory.

4.3 SOIL INVESTIGATION Prior to the field investigation and sampling, a site-specific Chemical Data Aquisition Plan (CDAP) was developed to help guide the IHNC east bank soil sampling and analytical testing program. Investigation of soils underlying the excavation area was conducted in two (2) phases: Phase 1 from 12 April thru 19 May 1993 and Phase 2 from 12 July thru 13 August 1993.

In Phase 1 (surface soils), the objective was focused on acquiring an inventory of contaminants present at the site and on determining the

horizontal distribution of contaminated soils. Soils at the surface and the near-surface (up to 5 feet deep) were examined and sampled for analytical testing. This was accomplished by site visits noting down the location and possible extent of areas of concern (e.g. waste piles, blast sands, fuel tanks, etc.) followed by a passive soil gas survey and actual sampling at and around possible waste sources or contaminated soils. The soil gas survey provides a rapid qualitative to semiquantitative assessment of the whole project site for potential organic contamination. Soil gas distribution maps are useful guides in locating subsequent soil and groundwater sampling points. In addition, soil gas investigation is demonstrated to be most effective in mapping soil and subsoil contamination by chlorinated hydrocarbons such as TCE (e.g. Bishop et al, 1990; Bourg et al, 1992). Historical activities at the site such as metal cleaning and paint / varnish manufacturing strongly suggest the use of chlorinated hydrocarbons.

In Phase 2 (subsurface soils), sampling is focused towards investigating the vertical extent of contamination and examining potential migration of contaminants into the deeper subsurface (i.e. at depths greater than 5 feet). Six (6) soil borings were drilled up to project excavation depths of -35 feet NGVD. Four (4) borings were placed near areas with surficial contamination, organic anomalies or hot spots and along the groundwater flow. Two (2) borings were strategically located near the floodwall to investigate background inside and outside the floodwall. Since these two borings were located along the path of the shallow groundwater flow, data from these soils should also provide information on the potential of contaminants migrating away from the site. Several shallow hardpoint (i.e. discrete or grab) samples of surface soils were taken to further investigate "organic hot spots" as flagged by the soil gas survey. In addition, feasibility studies of six (6) isolated petroleum product-rich areas were initiated.

4.3.1 <u>Surface Soil</u> The soil gas survey at the project site was undertaken by NRI and USACE-NOD. A total of 110 soil gas samplers were installed. The sampling location points are shown in Fig. 4.0. A detailed discussion of the survey, chemical distribution maps, compound specific analytical results (in ion counts) and interpretation of the survey results are presented in the NRI soil gas survey report which is available for inspection at USACE-NOD.

In Phase 1 survey, a total of over 100 shallow soil borings were drilled with a stainless steel handauger at or around suspected waste sources and contaminated soils. The soil samples were screened with a portable organic vapor meter equipped with a photoionization detector (PID). About fifty soil samples were selected and sent for laboratory analysis. The location of these samples are shown in Fig. 4.1. Two (2) samples were collected from the levee at the floodwall and were initially assumed as background samples. Most of the samples are composites of 2 to 6 sampling points, few are hardpoint samples. The samples were collected at depths ranging from about 3 inches below the surface to depths of 5 feet. Table 4.2 lists the samples collected, their soil classification, depths of sampling, and comments on potential sources of pollutants. The soil samples include the following : gravel, shell, sand, silt, and clay; bottom sediments or sludge material from sumps were also collected.

In Phase 2 survey, additional 12 shallow soil samples were collected from "organic hot spots" outlined by the soil gas survey, from the levee inside the floodwall, and from the drainage ditch between Surekote Road and the fence line of the industrial sites (Fig. 4.2). Areas which displayed relatively high level of petroleum product contamination, principally heavy petroleum hydrocarbons, were also sampled in more detail to acquire information for volume estimates of contaminated soils and groundwater. Of about eleven (11) product-rich areas identified during the Phase 1 survey, five (5) areas heavily contaminated with waste oil and one (1) AST area, all at the Saucer Marine site, were collected for hardpoint samples.

4.3.2 Subsurface Soil The location of 35-foot deep soil borings are plotted in Fig. 4.2. These borings are selected on the basis of the results of the Phase 1 survey and the groundwater flow investigation at the site. Four (4) borings, IC-1 thru IC-4, were placed near or at potential waste sources or contaminated soils. The soil gas anomaly maps showed these soil boring points to be "organic hot spots" and preliminary laboratory chemical results show some evidences of contamination in soil and / or groundwater samples at or near these localities. Soil boring IC-1 is located east of the fenced transformer units and within an "organic hot spot" in the Boland Marine site. IC-2 is located within a large soil gas anomaly area and surrounded by potential waste sources including a work / storage building at the Indian Towing site and the fuel tank field of Distributor's Oil. IC-3 is located east of the drum area and waste mounds and along the path of the shallow groundwater flow at the Saucer Marine site. IC-4 at the International Tank site is in the middle of a large "organic hot spot" and south of a concrete pad which reportedly served as a foundation of fuel storage tanks.

The two (2) soil borings, IC-5 and IC-6, were drilled near the floodwall. IC-5 is located on the levee east of Surekote Road but inside the floodwall. Boring IC-6 is located at the toe of the levee outside the floodwall near Jourdan Avenue. IC-5 and IC-6 were placed east of a cluster of soil gas anomalies extending from Saucer Marine site thru Indian Towing site and on the path of the observed shallow groundwater flow. A sheet wall on top of the levee extending up to - 8.0' (NGVD) seperates the two (2) borings. The borings were strategically placed to examine background and to investigate whether the pollutants are contained within the site by the sheet wall or the pollutants have migrated away from the site along potential pathways below the sheet piles.

The deep borings were performed using the undisturbed sampling procedure routinely used by the USACE-NOD. The soil samples were collected with steam cleaned shelby tubes with dimensions 5" in diameter and 4.4' in length. The shelby tubes were tightly sealed at both ends without headspace and were sent to the USACE-NOD soils laboratory for soils classification and analytical sampling. Total organic vapors were monitored with a PID during soil boring in the field and during analytical sampling in the soils laboratory. The analytical samples were collected from the central core of the 5" diameter soil samples. Samples selected for chemical testing were those that showed high total organic vapor readings and/or those that contain coarser soil particles such as sands or silts.

4.4 GROUNDWATER INVESTIGATION A total of about twenty-one (21) shallow groundwater samples were collected for laboratory chemical analysis during the Phase 1 survey (Fig. 4.3). The groundwater sampling points were located near or at potential waste sources such as fuel storage tanks, former paint work / storage facilities, at a drum area, etc. (Table 4.2). Field parameters including pH, conductivity and temperature were also measured during sampling.

The groundwater samples were collected using a hydropunch equipment. The hydropunch tool is pushed through the soil formation using a truck-mounted Failing 1500 drill rig. The hydropunch tool is then retracted to expose a 1.5-inch diameter well-screen to the saturated subsurface soil. Depths to the water table is generally shallow ranging from the surface (i.e. 0 feet) during heavy rains and flooding to depths of about 3.25 feet during the drier periods. The top of the hydropunch screen is usually set at 0.5

foot to 3.0 feet below the ground surface (usually 0.5 foot above the water table) with the bottom of the well screen at about 5.0 feet or deeper. The outside barrel of the hydropunch tool forms a tight seal with the surrounding soil which essentially minimizes or prevents contamination from surface run-off. Some of the water sampled generally represent a portion of water percolating through the thin vadose zone.

During the Phase 2 survey, an additional four (4) shallow groundwater samples were collected, 2 from product-rich areas and 2 from the 35-foot deep borings (Fig. 4.3). Groundwater samples from deeper potential ground water-bearing zones such as coarser sand, organic and silt strata at depths of about 10'to 20' and about 30' to 40' will also be collected at the later part of this year.

Water level data from these groundwater sampling points were likewise utilized to examine groundwater flow. The direction of groundwater flow as interpreted from water table data in the hydropunch wells is generally consistent with the flow direction interpreted from water level data in the 6" diameter groundwater observation wells examined during the Phase 2 field survey.

4.5 SEDIMENT INVESTIGATION. The objective of the sediment sampling investigation was to determine whether the sediments in the IHNC channel or in the proposed disposal area constitute HTRW under RCRA.

A total of seven sediment sampling locations, shown in Figure 4.4, were selected for the project area. Four locations were within the IHNC channel, and three were in the proposed disposal area to the east of the IHNC. Vibracore samples were collected at each of the four locations selected within the IHNC channel. The samples were then analyzed in segments to aid in determining if any contamination was stratified. These four vibracore samples were collected on May 10 and 11, 1993 by NOD personnel. The three samples collected in the proposed disposal area were grab samples. All samples were tested using the Toxic Characteristic Leachate Procedure (TCLP) for metals, volatile organics, extractables, herbicides and pesticides. The sediments were also analyzed for bulk sediment concentrations. After sectioning, but before compositing, samples were taken for volatile analysis. A description of each of the sampling codes are included in Table 4.3. This table also includes the depth or sample name of the portion analyzed for volatiles. The analytical results for the sediment samples are contained in Table 4.4a-4.4n.

TCLP testing utilizes a powerful leaching agent in a procedure which determines if the material is a "characteristic" waste under RCRA. Characteristic wastes are identified by codes beginning with the letter D and are not associated with specific manufacturing processes. The TCLP test contains the following steps. An acetic acid solution is mixed with the solids being tested, the resulting combination is tumbled for 18 hours at 22°C in a zero headspace extractor, an apparatus which prohibits volitization of some constituents. Liquids are taken from the extractor and put into a purge-and-trap device, where helium is bubbled through the liquid to remove volatile fractions which are consolidated on a Tenax Trap. The volatile organics are flushed into a gas chromatography/mass spectrometer when the trap is heated. Semi-volatiles also go through a sample extraction and preparation stage, but are then directly injected into the gas chromatography/mass spectrometer. The values obtained for

the various constituents are then compared to the hazardous waste toxicity characteristic levels to determine whether or not the waste is hazardous.

Site E vibracore samples were taken in the IHNC channel near the turning basin at the Florida Avenue crossing. The sample was collected on May 10, 1993. Two runs were collected, the first run at 3 p.m. and the second run taken at 6 p.m. The first run was divided into two samples for testing purposes. The top sample, ER1-AT, was from the top of the sample to a depth of 1.5 feet. The bottom sample, ER1-AB, was taken from from 1.5 feet to 6 feet depth. These two samples collected from run 1 at Site E were analyzed for volatile organics, bulk sediment analysis and full TCLP analysis. Two other samples were composited for bulk sediment analysis and full TCLP testing, ER2-BT and ER2-BB. ER2-BT was composited from depths 0-8 feet of the vibracore sample. ER2-BB was composited from 8-12 feet depth of the vibracore sample. ER2B-8 was analyzed for volatile organics only and was taken at a depth of 8 feet from run number two.

The Galvez Street vibracore sample was taken adjacent to the Galvez Street Wharf in the IHNC channel on May 10, 1993 at 4 p.m. This site is between the North Claiborne and Florida Avenues and is adjacent to the numerous industrial sites investigated along Surekote Road. The vibracore at this site was divided into three samples for testing purposes. GR1-AT included the top section of the sample with 0-1 foot depth, GR1-AM included the middle section of the sample with 1-4 feet depth, and GR1-AB included the bottom section of the sample with 4-9 feet depth. All three samples were analyzed for volatile organics, bulk sediment and full TCLP.

The Site C vibracore sample was taken in the IHNC channel north of the existing lock and south of North Claiborne Avenue. The sample was collected on May 10, 1993 at 5 p.m. Volatile organics analysis was performed from samples taken at the following depths: CR1A-1 (sample taken between 1 feet depth), CR1A-5 (sample taken at 5 feet depth), CR1A-9 (sample taken at 9 feet depth), CR1A-14 (sample taken at 14 feet depth), and CR1A-18 (sample taken between 14-18 feet depth). Composited samples were analyzed for bulk sediment and a full TCLP analysis. The sample was composited into three sections, CR1-AT (0-1 feet depth), CR1-AM (1-9 feet depth), and CR1-AB (9-18 feet depth).

The Site A vibracore sample was taken in the IHNC channel south of the existing lock between the St. Claude Avenue crossing and the Mississippi River. The sample was collected on May 11, 1993 at 10:30 a.m., the composite sample, AR1-1C was analyzed for bulk sediments and TCLP. One composite sample was obtained from the entire length of the core and four discrete samples from the core were analyzed for volatiles, AR1-1, AR1-2, AR1-3, and AR1-4.

The three sediment grab samples collected in the disposal area were labelled DIS-01, DIS-02, and DIS-03. These three samples were analyzed for volatile organics and full TCLP. DIS-01 is located in St. Bernard Parish east of the BFI landfill south of the Jackson Protection Levee Canal. DIS-02 is located in Orleans Parish south of the main outfall canal and just west of the BFI landfill. DIS-03 is also located in Orleans Parish just above the railroad and is closest to the IHNC.

4.6 <u>DEVIATIONS FROM THE SAMPLING AND ANALYSIS PLAN</u> The sampling and analytical plan described in the CDAP developed for the IHNC eastbank investigation area was generally followed with some deviations. Sampling points were added and, in some places, soil sampling and water sampling points were moved to accommodate either of the following: boring procedure using the drill rig or hand auger, nature of the ground surface or the

subsurface soil, location of suspected waste piles or contaminated soils, underground or aboveground utilities and work activites at active sites.

At about 50% of the boring sites, sampling points have to be drilled twice (or thrice), a foot apart, to collect samples at depths. At areas underlain by very coarse gravel, shell material, concrete blocks, buried metal or plastic materials and buried wood, a drill rig is employed to cut through the top hard surface or section (usually, 1-3 feet thick). Once the drill rig cut through the hard section, the boring is continued with a hand auger. At sampling depths, a stainless steel hand auger is used to collect the sample. To avoid contamination of the hole from the drill rig, a visqueen is placed on the ground surface. The whole drill rig is steam cleaned before and after each of the field investigation. Tools that potentially can come in direct contact with the analytical soil samples, such as drill rods and other sampling tools, go through a decontamination procedure as the hand augers.

During Phase 2 35-foot deep soil borings, large blocks of buried wood, coarse shells and a piece of pvc sewage pipe were encountered at depths of up to 14 feet such as in IC-4 and IC-3 while metallic materials were encountered up to depths of about 8 feet in IC-1. In such situations, the drill rig was move about five feet either for re-sampling at depths missed by the initial boring or to continue boring and sampling to project depths of -35' (NGVD).

Originally thought of as a Hydraulics and Hydrologic Branch's task, sampling of bottom sediments in the Surekote Road ditch and in three (3) waste containment basins or sumps located at Distributor's Oil, Mayer Yacht area and Saucer Marine site were added to the Foundation and Materials Branch's sampling plan.

During the feasibility investigation of the five (5) oil-saturated areas at the Saucer Marine site, the analytical testing program was modified to include oil and grease parameter (EPA Method 9071), polynuclear aromatic hydrocarbon, PNA or PAH, (EPA Method 8100), halogenated hydrocarbons (EPA Method 8021) and other metals such as aluminum and zinc. In the literature, PAHs are also referred to as polycyclic aromatic hydrocarbons. Due to the heavy workload at the contract laboratory at the time of analysis and in order to be within holding times, halogenated hydrocarbons in samples from these oil saturated areas were analyzed using EPA Method 8240 instead of EPA Method 8021. Likewise, aluminum and zinc were not analyzed by the laboratory.

Detail investigation in the oil-saturated areas involved sampling the most oil-contaminated soil at the nearsurface and analyzing the sample for oil and grease, TPH, PAHs, halogenated hydrocarbons, aluminum, zinc and the RCRA-type metals. This sample is from a shallow boring usually at the center of the oil-saturated area. Samples at 3 and 5 foot depths from the same boring were also taken and analyzed to investigate potential vertical migration of specific pollutants of concern including lead, benzo(a)pyrene and trichloroethene. Then the fringe areas of the oil-saturated soils are sampled and analyzed for TPH, oil and grease to delimit the horizontal extent of contaminated soil. TPH, oil and grease are used here as indicator or surrogate parameters for potential BTEX and PAH contamination.

In addition, a dioxin screen-test available at EIRA (EPA 8270) was added to investigate the presence or absence of dioxin in hard point soil samples which may accompany the dibenzofuran detected in a Phase 1 composite soil sample from the Saucer Marine drum area. Because of very high concentration levels of total lead (Pb) in Phase 1 analytical results of sample IC-MS-5 (Pb=4690 mg/kg) and IC-BS-10 (Pb=2420 mg/kg), these samples were re-tested for lead toxicity (TCLP-Pb).

5.0 <u>QUALITY CONTROL / QUALITY ASSURANCE</u> The following describe activities performed during chemical data acquisition at the IHNC project site, summarize the data quality evaluation process used, present evaluation of the quality of the soil and water data by parameter, and discuss the validity and usability of the acquired data.

The QC/QA activities are performed to satisfy the current objectives of the IHNC investigation. The discussion below is a brief statement of the laboratory QC and focuses on the field QC. A relatively rigorous QC/QA activity was performed by the laboratory. At this stage, field QA samples were not collected for analysis by a laboratory other than the contract laboratory. Field QA samples are required however during remedial actions and closure activities.

5.1 <u>DATA ACQUISITION ACTIVITIES</u> The site was investigated for volatile and semi-volatile organics, chlorinated hydrocarbons, polychlorinated biphenyls (PCBs), pesticides, herbicides, metals, oil and grease, total petroleum hydrocarbons, and asbestos. In addition, toxicity (i.e. TCLP) and ignitability tests were performed on selected samples to determine their suitability for land disposal. Sampling protocols including analytical methodologies, nominal reporting units, sample holding times, sample containers, amounts of samples and preservation methods as required according to the USACE guidance document ER 1110-1-263 (USACE, 1990) and incorporated in the CDAP prepared for IHNC were generally followed during the field investigation and laboratory analysis. Environmental Industrial Research Associates, Incorporated and USACE Waterways Experiment Station undertook the analysis of soil and water samples while NRI perform the laboratory analysis of soil gas samples. USACE-NOD was responsible for developing a sampling plan and collection of soil gas, soil and water samples.

The field and laboratory QC/QA activities of the soil gas survey are provided in a separate report. Briefly, field QC/QA involves the use of five time calibration samplers to check loading rates and four travel blanks to check contamination during installation of the samplers at the site and during shipment of samplers between the field and NRI's laboratory in Denver. The soil gas samplers contain two collector wires and approximately ten percent of the samplers contain three collector wires. Within each sampler, the collector wires should have adsorbed identical compounds. The method QA/QC involves the use of one of the collector wires as a QC wire to check the mass spectrometer's operating condition and sensitivity, and, to check reproducibility of detectable compounds.

5.2 <u>DATA EVALUATION PROCEDURES</u> The laboratory and field Quality Control (QC) samples provide information that can be utilized in evaluating the accuracy of data collected in the soil and water samples.

The laboratory QC procedures for calibration, method validation, and performance evaluation involved procedures such as method blank analysis, matrix spike/matrix spike duplicate (MS/MSD) analysis, and assessment of the surrogate analyses. These are inherent parts of the methods used. The laboratory QC data are reported along with the field sample data and provides a measure of evaluating the bias and precision of the data generated by the laboratory.

The laboratory data collected is too voluminuous to be attached in their entirety to this report. The laboratory (raw) data of all the samples sent for analysis are available for inspection at the USACE-NOD. Instead, an example of one complete set of EIRA's laboratory report is attached (Annex-2). This report includes a narrative of significant laboratory conditions during sample analysis, the results of analysis of samples listed in the chain-of-custody, the laboratory QA/QC results, and a summary of the testing procedures performed. Annex-3 is a compilation of the reports for all sampling events, each report includes a narrative, a summary of testing procedures and a sample chain-of-custody.

Field Quality Control (QC) soil and water duplicates were collected to assess the precision of the sampling techniques. They are submitted to the contract laboratory for analysis and are analyzed concurrently along with the field samples. The field duplicates were collected in the same types of sample containers and were treated in the same manner as the field samples. The identity of these duplicates were concealed from the contract laboratory so that they are treated as regular field samples. Table 5.1 summarizes the number of field samples and duplicates collected.

5.3 QC ANALYSIS OF FIELD DUPLICATE SAMPLES

5.3.1 QC ANALYSIS OF FIELD DUPLICATE SOIL SAMPLES The field QC or duplicate soil samples were collected at a frequency of approximately 1 in every 10 to 20 samples. These QC samples represent replicates and/or a second aliquot or split sample collected at the same time as the field samples. The field duplicates are evaluated in a manner similar to that described for the laboratory MS and MSDs using the equation for calculating relative percent difference or RPD. Table 5.2 summarizes the RPD results of field duplicates and provides an indication of the overall precision of the analytical data. A RPD value of 35% in soil (20% in water) is a reasonable goal for MS/MSD RPD calculation (EPA Laboratory Data Validation, 1988) and is adapted in this report for the QC evaluation of the field duplicates. EPA recommends an advisory value of 50% in soil (30% in water) for field duplicates.

The data shows that majority of the results are within a grading scheme of fair to good and are generally of acceptable quality. However, volatile and semivolatile organics also show some poor results, greatly exceeding advisory limits of 35% (and 50%). The data may reflect the heterogenuous nature of the soil samples and the difficulty of keeping the volatiles intact during sampling.

5.3.2 QC ANALYSIS OF FIELD DUPLICATE WATER SAMPLES QC evaluation of the groundwater show a better RPD result for BTEX than the soil samples. This can be attributed to the more homogenuous nature of water as a sample matrix.

5.3.3 QC ANALYSIS OF CANAL SEDIMENT SAMPLES For the TCLP sediment analysis, matrix spikes were conducted for 10% of the total samples collected, as were duplicate samples with 10% duplicated.

5.4 DECONTAMINATION AND TRIP BLANKS As required by the USACE guideline, trip blank and decontamination blank samples were collected and sent for analysis. A trip blank (i.e. de-ionized water) was prepared in the laboratory and shipped to the field with empty sample containers and sent back to the laboratory together with the field samples. In addition, a rinsate sample was collected to check for contamination from the field sampling equipment used and the field decontamination procedure of the field sampling equipment.

Surface run-off from rain water contaminated with oil from nearsurface soils and entering the boring was collected to check drilling-related contamination of soil samples in boring IC-1. Because drilling fluid was used in IC-6, drill fluids were sampled to monitor for drilling-related contamination in soils collected in boring IC-6. Tap water (IC-6-TW) and drill fluid mixtures before (IC-6-DF1) and after (IC-6-DF2) boring of IC-6 were sampled and sent for analysis. IC-6-DF2 was analyzed as a solid sample due to very high sediment content of the sample.

The analytical results of the trip blank and decontamination blank (rinsate sample) as well as other field control samples are summarized in Table 6.2. Only mercury was detected at concentration levels above quantitation limits in both the trip blank and the rinsate sample. Very low levels of chloroform, bis(2-Ethylhexyl)phthalate and mercury were detected in the tap water (IC-6-TW). Very low levels of methylene chloride, acetone, arsenic, barium, chromium, lead and mercury were also detected in the drilling fluid mixtures, particularly in IC-6-DF2. The metal values in IC-6-DF2 maybe related to analyzing the sample as a solid or sediment rather than a liquid sample. The very low concentration levels of contaminants in these QC samples indicate that the USACE-NOD sampling team closely monitored and maintained minimal contamination related to field sampling and decontamination procedures.

5.5 <u>DATA VALIDATION AND USABILITY</u> A review of EIRA laboratory narratives (see Annex-3) and laboratory QC procedures including MS/MSD and surrogate recoveries showed the contract laboratory to have generally performed within recommended EPA analytical guidelines. The RPDs of MS and MSD and the recoveries of surrogates were kept within QC ranges. Departures such as concentration of surrogates and laboratory contaminants were flagged.

EIRA listed several laboratory contaminants such as methylene chloride and alcohol. These two compounds are inherent to the methods, are quantified in the blanks, and are commonly found during the analysis of soil and water. The compound 2-butanone is also method related and is more commonly found in soil analysis and appears periodically in water analysis. EIRA indicated that 2-hexanone and 4-Methyl-2-pentanone detected in Phase 2 samples are due to severe contamination in their volatile organic laboratory during the time of analysis; these compounds may have been introduced to some samples during extraction or analysis. Toluene was not listed by EIRA as a lab contaminant however it is also generally recognized as a common lab contaminant (Sullivan et al., 1992).

Phthalic acid esthers (PAEs) such as bis(2-Ethylhexyl)phthalate have been found as resulting from common laboratory cross-contamination (Lopez-Avila et al., 1990; Sullivan et al.,1992; EPA, 1991). EIRA also flagged bis(2-Ethylhexyl)phthalate as a lab contaminant and was detected in a blank. Other phthalic acids detected in the IHNC samples, though not detected in blanks, should be examined with caution.

Some samples were re-analyzed or re-extracted and re-analyzed to confirm initial results during situations when low recoveries of surrogates or internal standards occurred, when severe uncommon contamination was experienced by the laboratory, and when power failure and other instrumental problems such as breakdown of the auto sampler occurred. Re-extraction and re-analysis usually occurred outside recommended holding times and in such cases, the results, particularly for volatile organics, maybe underestimated.

The analytical results of field QC samples fall under a wide range of RPDs, from good to poor category. Majority of the analytical results are within the good to fair category. Volatiles and some semi-volatile organic compounds yield several poor results that are probably related to the inherent heterogeneity of the soil samples with uneven porosity (e.g. mixtures of sand/silt and clay in fill materials) and the difficulty of preventing possible releases of soil gas during sampling in the field.

With few exceptions, the data including the metal group, semivolatile organics, chlorinated hydrocarbons, pesticides and PCBs, and herbicides are of an average acceptable quality. The volatile organic data are probably underestimated particularly for samples that were re-extracted and re-analyzed. The overall repetitivenes in the detectability of the same elements or compounds in duplicated samples (e.g. IC-IS-4 and IC-IS-7) however suggests the general acceptability of the organic data.