CITRIC BLOCK SITE INVESTIGATION
AND
INTERIM REMEDIAL MEASURES
WORK PLAN

Citric Block Site
Williamsburg Facility

ROUX Associates, Inc.
ENVIRONMENTAL CONSULTING & MANAGEMENT

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1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has developed this Investigation and Interim Remedial Measures (IRM) Work Plan to, on a "fast track" basis, complete delineation efforts and remove soil "hot spots" present on the eastern and western portions of the Citric Block (Citric Block Site) located at the Pfizer Inc (Pfizer) Williamsburg Facility, Brooklyn, New York (Figure 1). The Citric Block Site is located in the east-central portion of the facility and is bounded on the north by Gerry Street, on the east by Harrison Avenue, on the south by Flushing Avenue and the northern edge of the three existing buildings, and on the west by Union Avenue (Figure 2).

In July 1995, a subsurface investigation on the eastern portion of the Citric Block (hereinafter referred to as the Citric Block Site Subsurface Investigation Report) was conducted by Roux Associates to determine soil (fill) and perched ground-water quality conditions throughout the areas that included the former Buildings 1D, 3A, 3B, 4A, 4B, 7A and 7B, as well as the former yard in the center of the block (Figure 3). The results of the fill and perched ground-water quality analyses indicate detections of metals and volatile organic compounds (VOCs). In addition, semivolatile organic compounds (SVOCs), specifically polycyclic aromatic hydrocarbons (PAHs), were detected in fill.

The additional delineation efforts proposed in this Work Plan are designed to develop additional Citric Block Site-specific data to supplement the previous subsurface investigation (Roux Associates, 1995a) performed on the eastern half of the Citric Block Site and investigate previously uninvestigated areas (e.g., the western half of the Citric Block Site) in order to fully describe environmental conditions in the media of concern. These additional delineation efforts are scheduled to proceed on a "fast track" basis to enable the implementation of the Citric Block Site IRM to proceed in an expeditious manner.

Specifically, additional delineation efforts will include:

- a soil-quality investigation to determine the nature (e.g., constituents of concern, concentrations, potential for migration) and extent of soil contamination and to identify source area(s) beneath the Citric Block Site;
- a hydrogeologic and ground-water quality investigation in the perched zone to assess the occurrence, continuity, extent and quality of perched ground water beneath the Citric Block Site;

- further assessment of the continuity, thickness and permeability of the thick clay layer separating the shallow, perched ground water and fill from the deeper Upper Glacial aquifer to confirm existing data that indicate that the clay layer beneath the Citric Block Site prevents hydraulic connection between the fill and the deeper water bearing zones (e.g., Upper Glacial aquifer); and
- an on-site sewer investigation to determine if migration pathways exist between the on-site soil/perched ground-water contamination and any adjoining sewer structures.

The IRM for the Citric Block Site will consist of the excavation and removal of soil "hot spots" present in the fill beneath the concrete slab at the Citric Block Site. It is important to note that the Citric Block Subsurface Investigation Report concluded that under *current* conditions (e.g., considering the presence of the thick concrete slab, absence of exposure pathways, 24-hour Citric Block Site security), the Citric Block Site does not pose a significant risk to either public health or the environment. Therefore, this IRM is designed to support Pfizer's plans to rehabilitate this property for potential *future* redevelopment and/or beneficial use. The excavation and removal of soil "hot spots" is considered a conservative remedial approach designed to provide an additional level of site safety above and beyond existing conditions. Additionally, this IRM will ensure that impacted soil beneath the concrete slab that could be classified a Resource Conservation and Recovery Act (RCRA) characteristically hazardous waste is removed in an expeditious manner.

This Work Plan, which describes the methodology by which additional delineation efforts and the IRM will be implemented, was developed based upon a detailed review of existing Citric Block Site-specific data and published information. Included in this Work Plan are the following Project Operations Plans (POPs):

- a Sampling and Analysis Plan (SAP);
- a Quality Assurance Project Plan (QAPP); and
- a Health and Safety Plan (HASP).

The SAP, QAPP and HASP are provided in Appendices A through C, respectively.

2.0 BACKGROUND AND SETTING

The Citric Block Site is located in the Williamsburg section of Brooklyn, New York (Figure 1). Gerry Street, Harrison Avenue, and Union Avenue border the Citric Block Site to the north, east, and west, respectively, while Flushing Avenue and the northern edge of three existing buildings border the Citric Block Site to the south (Figure 2). The Citric Block Site is situated within a high-density, mixed urban residential/commercial/industrial zone, approximately one mile east-southeast of the East River.

Pfizer has decommissioned the Citric Block Site for future redevelopment and/or beneficial use. As part of the decommissioning process, all Citric Block Site buildings were demolished, with demolition activities being completed in August 1995. Presently, the reinforced-concrete-slab foundation is the only aboveground remnant of the former buildings. The concrete slab is continuous throughout the entire Citric Block Site, and varies in thickness between approximately 0.5 and 1.5 ft. The entire Citric Block Site is surrounded by an 8-foot-high chain-link fence topped with barbed wire, and is under continuous security surveillance.

2.1 Citric Block Site History

The Citric Block Site was first developed for chemical manufacturing between 1854 and 1888, during which time Pfizer purchased 72 lots of land surrounding the original Pfizer building on Bartlett Street (Mines, 1978; *p 5*). It is unclear whether or not these lots were vacant at the time of purchase, nor are the exact locations of these lots known (i.e., whether or not some of these lots were located on the Citric Block Site). An 1887 Sanborn fire insurance map shows that Pfizer occupied the entire Citric Block Site by that time, as well as parts of adjacent blocks. According to the 1887 Sanborn map, the following buildings/operations existed on the Citric Block Site:

- a machine shop was located within Buildings 1D and 3A;
- bisulfide of carbon was stored within Building 1A and 1B;
- chloroform stills were located in the southern portion of Building 4B;
- packing and storage was located within the eastern portion of Building 6, while camphor storage was located in the western portion of Building 6;
- the camphor shop was located in Building 7;

- a carpenters shop was located in the vicinity of Building 8;
- the storage of lime, phosphorous and sulphur was located in Building 9;
- kettles (contents unknown) were present in Building 11; and
- the center of the block appears to have been an open yard.

Products produced by Pfizer during this time period include iodine preparations, mercurials, boric acid, camphor, citric acid, tartar derivatives, and chloroform (Mines, 1978; *pp 5, 7, 8 and 9*). According to the 1887 Sanborn map, it appears that the chloroform and camphor were produced at the Citric Block Site in Buildings 4B and 7, respectively. During the same time period; it is unclear to the exact locations (i.e., at the Citric Block Site or at other portions of the Pfizer facility) of the production of the mercurials, iodine preparation, boric acid, citric acid and tartar derivatives.

In the latter part of the nineteenth century and the early part of the twentieth century, Pfizer apparently expanded its operations at the Citric Block Site to include fermentation of citric acid and production of strychnine. However, it is not known of the exact location where the production of citric acid and strychnine occurred. In addition, a 1904 Sanborn fire insurance map shows that Pfizer expanded operations at the Citric Block Site by the addition of many buildings. It is unclear to the exact operation that occurred in each building, however, the following buildings/operations existed or ceased to exist:

- kettles (unknown contents) were now present in the northern portion of Building 1B;
- the chloroform stills located in the southern portion of Building 4B were no longer present;
- the camphor shop located in Building 7 was replaced with a tinsmith and "Japan Manufacturing"; and
- the mercurial building (Building 11) was now present where previously kettles (unknown contents) existed.

As shown in a 1918 Sanborn map, the operations at the Citric Block Site further expanded as follows:

- a nitric acid department was shown to be located between Buildings 1B, 1D and 3A;
- Building 6 was further expanded for storage, shipping and packing. In addition, a laboratory was now present in the northeastern portion of Building 6;
- Building 7 (former tinsmith) was now occupied for tartar emetic manufacturing; and
- the carpenter shop (Building 8) was no longer present.

By the 1930s, chemicals produced at the facility (of which the Citric Block is a part) reportedly included tartar emetic, mercury salts, bismuth medicinal salts, blueprint chemicals, iodides, synthetic phenolphthalein, tartaric acid, tartrate, citrates, gluconic acid, and gluconates (Mines, 1978; *p 48*). Raw materials reportedly used at the facility reportedly included iodine, ingots of bismuth metal, liquid mercury, iron ore, antimony oxide, and crude camphor (Mines, 1978; *p 48*). Exactly which of these chemical-manufacturing operations took place at the Citric Block Site, and where specific chemicals were handled or stored, is unclear. However, it is known that the Citric Block Site was used for the manufacturing of citric acid, chloroform, tartar emetic (Building 7) and mercurials (Building 11), and for administration and research purposes (Building 6).

According to the Sanborn fire insurance maps, no apparent changes to buildings/operations occurred from 1918 until around 1947. There was only one apparent change to the Citric Block Site by 1947. The laboratory that existed in the northeastern portion of Building 6 had expanded to include the entire building, and also housed an office. It is noted that a building construction date of 1941 is present on the 1947 Sanborn map.

The Citric Block Site remained fully occupied by buildings housing various facility operations until the late 1970s, when the former Building 11 (mercurial building) was demolished. Manufacturing activities ceased at the Citric Block Site around 1985. All buildings at the Citric Block Site were demolished during 1994 and 1995, with the exception of Buildings 1A, 1B and 6. Buildings 1A and 1B constitute the original Pfizer buildings and are being retained for historical purposes. Building 6 was renovated for use as an elementary school. The elementary school opened in 1993.

2.2 Previous Investigation

In July 1995, Roux Associates conducted a subsurface investigation in the eastern portion of the Citric Block Site. The area of investigation included the former locations of Buildings 1D, 3A, 3B, 4A, 4B, 7A, and 7B, as well as the yard located in the center of the block. The scope of work for the investigation included drilling 13 soil borings, collecting soil samples from the borings, and collecting perched ground-water samples (Figure 3). Soil (fill) and ground-water samples were analyzed for VOCs, SVOCs, metals, total organic carbon (TOC), and pH, using the New York State Department of Environmental Conservation (NYSDEC's) Analytical Services Protocol (ASP). Undisturbed soil samples (fill) were also collected for geotechnical analyses, including grain size and permeability. In addition, a preliminary exposure pathways analysis was performed to determine if exposure pathways exist at the Citric Block Site that could lead to risk to public health or to the environment. The results of this investigation were reported in a September 28, 1995 report titled "Subsurface Investigation of the Citric Block, Former Buildings 1D, 3A, 3B, 4A, 4B, 7A, and 7B" (Roux Associates, 1995a), and are summarized in Section 3.2 of this Work Plan.

3.0 SUMMARY OF ENVIRONMENTAL CONDITIONS

The following section provides an overview of physical and environmental conditions at the Citric Block Site, based upon the results of previous investigations at the Citric Block Site and Facility (Roux Associates, 1995a; 1995b). In addition, published information (Baskerville, 1982; Buxton et al., 1981; McClymonds and Franke, 1972; and United States Geological Survey [USGS], 1979) was used for the local and regional hydrogeology.

3.1 Physical Setting

The physical characteristics of the Citric Block Site and the surrounding area are discussed below. Information provided includes a summary of the physiography and hydrogeology of the Citric Block Site and the surrounding area, based upon both published regional information and Citric Block Site-specific data.

3.1.1 Physiography

The Citric Block Site is located along the boundary of the New England Upland and the Atlantic Coastal Plain physiographic provinces (Baskerville, 1982). Local topography and drainage are largely the result of Pleistocene glaciation, which altered the landscape significantly in the area of the Citric Block Site. A long, northeastward trending ridge (where elevations reach 100 to 150 feet above mean sea level [msl]) is located approximately one mile south of the Citric Block Site, and marks the southward limit of glacial advance. North of this ridge, relief is generally low (i.e., less than 50 feet above msl). Several small streams, all of which have been extensively altered (i.e., bulkheaded or filled) during the last two centuries, drain the area north of the ridge and discharge into the East River or New York Bay. The Citric Block Site is located near the former path of one of these streams, Wallabout Creek (USGS, 1979).

3.1.2 Hydrogeology

The discussion of regional hydrogeology provided below is based largely on published regional information (i.e., Buxton et al., 1981; McClymonds and Franke, 1972). The discussion of local hydrogeology is based on Citric Block Site-specific information, including both the results of a previous subsurface investigation conducted at the Citric Block Site (Roux Associates, 1995a) and drilling records produced during installation of the production and diffusion wells formerly present at the Pfizer Williamsburg facility (Roux Associates, 1989), as well as published information. Geologic logs and geotechnical data from the earlier subsurface investigation are provided in Appendices D and E, respectively, while the well completion reports (i.e., production and diffusion wells) are provided in Appendix F.

3.1.2.1 Regional Geology

The geology of western Long Island (including all of Brooklyn) is characterized by a thick sequence of unconsolidated sedimentary deposits overlying a southeastward-dipping bedrock surface (Buxton et al., 1981; McClymonds and Franke, 1972). The bedrock surface beneath the western end of Long Island ranges in elevation from just above sea level to more than 1,000 feet below msl. Sedimentary deposits overlying the bedrock include the Cretaceous-aged Raritan and Magothy Formations, the Pleistocene-aged Jameco gravel and Gardiners clay, and late-Pleistocene glacial drift. These deposits are characterized by differing lithologies, ranging from sand and gravel to silt and clay. The Lloyd sand member of the Raritan Formation, the Magothy Formation, the Jameco gravel, and the glacial drift constitute major regional aquifers, which have been designated as sole-source aquifers by the United States Environmental Protection Agency (USEPA).

3.1.2.2 Local Geology

The Citric Block Site is immediately underlain by a layer of fill, consisting largely of sand and gravel, with minor amounts of man-made materials (e.g., bricks, cinders, and concrete). The fill ranges in thickness between 3 and 18 feet (ft) at the Citric Block Site. Beneath the fill is an approximately 20- to 30-foot-thick clay unit, apparently deposited in the marshy environs of Wallabout Creek, which formerly flowed through the Citric Block Site area. The clay unit appears continuous throughout the Citric Block Site (Roux Associates, 1989), and serves as a confining unit for deeper deposits due to its low vertical permeability (i.e., hydraulic conductivity). Vertical hydraulic conductivities of the clay unit measured in samples collected during the previous subsurface investigation at the Citric Block Site (Roux Associates, 1995a) range between 8.75×10^{-5} and 1.44×10^{-7} centimeters per second (cps).

Thin lenses of ground water were encountered sporadically (i.e., in only 3 of 13 borings) in the fill during the previous subsurface investigation at the Citric Block Site (Roux Associates, 1995a). This is consistent with the findings of investigations at other parts of the Pfizer Williamsburg facility (Roux Associates, 1995b), where generally 1 to 2 ft of ground water in the fill was sporadically encountered perched on top of the underlying clay unit.

Glacial deposits underlie the clay unit, and range in thickness from 35 to 62 ft beneath the Citric Block Site (Roux Associates, 1989). These glacial deposits consist largely of lodgement till, a dense deposit of sand, gravel, and boulders in a matrix of silt and clay. These glacial deposits constitute the Upper Glacial aquifer, which is the uppermost of western Long Island's three major aquifers. It is noted, however, that the glacial deposits in the vicinity of the Facility are mostly dense till deposits. Although these dense till deposits yield some water to wells, till is generally characterized by low hydraulic conductivity and low specific yield. Therefore, development of the Upper Glacial aquifer for water-supply purposes in the vicinity of the Citric Block Site is unlikely. The poor water-bearing characteristics of the glacial deposits underlying the Citric Block Site are demonstrated by the fact that the production and diffusion wells (Appendix F) formerly present at the Citric Block Site were not screened in the glacial deposits, but instead were screened in a deeper, more prolific aquifer (i.e., Jameco aquifer), lying more than 150 ft below land surface (bls).

The Gardiners clay is present beneath the glacial deposits, and consists of a characteristically-blue clay containing many fossil shells and foraminifera. The Gardiners clay is relatively thin beneath the Citric Block Site (between 3 and 9 ft), as the Citric Block Site is situated near the northern limit of the Gardiners clay. The Gardiners clay acts as a confining unit for the underlying Jameco gravel, a mixed deposit consisting mostly of sand and gravel. The Jameco gravel was the main water-bearing unit for the Citric Block Site (i.e., all of the former production wells at the Citric Block Site were screened in the Jameco aquifer [Roux Associates, 1989]). The bedrock surface is located beneath the Jameco gravel, at a depth of approximately 200 ft bls beneath the Citric Block Site (Buxton et al., 1981).

The Magothy and Raritan Formations, and their associated aquifers, are not present beneath the Citric Block Site, due either to non-deposition or to pre-Pleistocene erosion (Roux Associates, 1989).

Potable water is supplied to the Facility by the New York City Department of Environmental Protection; however, ground water has historically been used in the area for industrial processes (e.g., cooling). A well search performed by Roux Associates in 1991 indicated that 35 wells had been installed within a 2-mile radius of the Citric Block Site (Roux Associates, 1991). However, it is not known whether these wells still exist.

3.2 Environmental Conditions

The following summary of environmental conditions at the Citric Block Site is based on data developed during the subsurface investigation conducted previously in the eastern portion of the Citric Block (Roux Associates, 1995a). The investigation included the areas of former Buildings 1D, 3A, 3B, 4A, 4B, 7A and 7B, as well as the former yard in the center of the block. A summary of the analytical results are provided in Tables 1 through 8 and Figures 4 and 5.

3.2.1 Soil (Fill) Quality

It is important to note that all soil samples were collected from the fill underlying the Citric Block Site, and not from natural indigenous soil. Therefore, soil data are representative of the quality of the fill materials and not of the deeper, naturally occurring low permeability sediments (clay) of the former Wallabout Creek.

A description of the soil-quality conditions is provided below.

All 23 Target Analyte List (TAL) metals were detected in the fill beneath the eastern portion of the Citric Block. However, only 13 of these metals were detected at concentrations exceeding the NYSDEC Recommended Soil Cleanup Objectives (RSCOs). The metals detected above the RSCOs are:

- arsenic;
- barium;
- iron;
- lead;

- beryllium;
- cadmium;
- chromium;
- cobalt;
- copper;
- mercury;
- nickel;
- selenium; and
- zinc.

Iron and mercury were the primary metals detected in the fill in terms of frequency of RSCO exceedances (i.e., the concentrations of these metals exceeded their respective RSCOs in all soil samples). Iron, lead, and mercury were the primary metals detected in terms of concentrations measured. A summary of the metals data is provided in Table 1. The distribution of metals detected above their respective RSCOs is shown in Figure 4.

Twenty-four SVOCs were detected throughout the eastern portion of the Citric Block Site. The SVOCs detected are primarily PAHs. Seven of the 24 SVOCs detected (all PAHs) were present at concentrations exceeding RSCOs, with benzo(a)pyrene being the primary SVOC detected in terms of frequency of RSCO exceedances, while chrysene was the SVOC detected at the highest concentrations. SVOCs were detected in the fill at concentrations exceeding RSCOs throughout the eastern portion of the Citric Block Site, and their distribution is shown in Figure 5. A summary of the SVOC data is provided in Table 2.

Although many metals and SVOCs were detected in the fill in the eastern portion of the Citric Block Site in excess of NYSDEC RSCOs, the significance of the metals and SVOC data cannot be determined at this time, due to the absence of site- or area-specific background data.

Volatile organic compounds (VOCs) were detected at low concentrations (i.e., generally below 10 micrograms per kilogram [μg/kg]) sporadically throughout the eastern portion of the Citric Block Site. However, none of the VOCs were detected at concentrations exceeding RSCOs. A summary of the VOC data is provided in Table 3.

TOC and pH were also measured in soil, and their results are provided in Table 4.

3.2.2 Perched Ground-Water Quality

Perched ground water was encountered in the fill at only three locations in the eastern portion of the Citric Block Site previously investigated (i.e., Soil Borings CB-2, CB-10, and CB-12). Moreover, insufficient volume at one of the locations (Soil Boring CB-12) precluded the analyses of SVOCs and metals at that location. VOCs and metals were detected in the perched ground water beneath the eastern portion of the Citric Block Site, as discussed below. No SVOCs were detected at the two locations from which samples were collected for SVOC analysis (Table 5).

All 23 TAL metals were detected at the two locations that contained sufficient volume for sample collection (i.e., Soil Borings CB-2 and CB-10). It is noted that these samples were not filtered prior to analysis. A summary of the metals data is provided in Table 6.

VOCs were detected at all three locations sampled. Only low concentrations (i.e., in general, less than 10 micrograms per liter [μg/L]) of 11 VOCs were detected in perched ground-water samples sporadically throughout the eastern portion of the Citric Block (Table 7).

TOC and pH were measured in perched ground water at two locations (i.e., CB-2 and CB-10), and their results are provided in Table 8.

3.2.3 Evaluation of Current Potential Exposure Pathways

The results of a preliminary exposure pathways analysis performed during the previous subsurface investigation at the Citric Block Site provided in the Citric Block Site Subsurface Investigation Report (Roux Associates, 1995a) indicate that the fill and perched ground water underlying the eastern portion of the Citric Block do not currently pose a significant risk to either public health or the environment. This conclusion is based primarily on the absence of exposure pathways. Specifically, the Citric Block Site soils are currently completely inaccessible to humans due to the presence of a continuous concrete slab over the entire Citric Block Site, as well as an 8-foot-high chain-link fence topped with barbed wire. Also, the Citric Block Site is under continuous security surveillance. The perched ground water is similarly inaccessible, and is of limited use as a water supply due to its small volume and sporadic occurrence. Moreover, the potential for downward migration of ground water (and any organic and inorganic constituents dissolved therein) from the thin perched zone to deeper aquifers is negligible. This conclusion is based on available Citric Block Site-specific and regional hydrogeologic data, which indicate that the thick and extensive clay unit underlying the fill will limit vertical migration of ground water due to its very low permeability, and will also preclude vertical migration of organic and inorganic constituents due to its high organic carbon content and retardation potential. A demonstration of the low migration potential for ground water and dissolved constituents is provided below.

When low-permeability units (such as the thick clay unit) underlie more permeable units (such as the fill), ground-water flow is dominantly vertical within the low-permeability unit. Citric Block Site-specific and regional hydrogeological data were therefore used to calculate a vertical seepage velocity for ground water potentially migrating downward through the clay unit at the Citric Block Site. (In the absence of Citric Block Site-specific data, reasonable worst-case assumptions were used where necessary.) The seepage velocity was calculated using the following formula from Walton (1991):

$$v_v = K_v I_v / n_e$$

where:

- v_v = vertical seepage velocity;
- K_v = vertical hydraulic conductivity;
- I_v = vertical hydraulic gradient; and
- n_e = effective porosity.

As stated previously, reasonable worst-case assumptions were used wherever necessary in the absence of Citric Block Site-specific data. For example, a significant downward vertical gradient of 0.02 feet per foot was assumed between ground water in the fill and that in the Upper Glacial aquifer (based on a hydraulic head difference of 1 foot and a 50-foot difference in screen mid-points). This assumption is very conservative, considering that available water-level data (Roux Associates, 1995a; Doriski, 1986) indicate that water levels in the fill and the Upper Glacial aquifer are nearly identical, suggesting that the actual hydraulic gradient is considerably lower than 0.02 feet per foot. In addition, the hydraulic gradient may actually be upward, which would preclude any downward migration of ground water. Therefore, the use of a downward vertical gradient of 0.02 feet per foot is very conservative.

Similarly, a conservative effective porosity of 0.1 was assumed for the clay unit. This value is the approximate mean of the range reported by Walton (1991) for clays (0.01 to 0.2). Under an assumed hydraulic gradient, the smaller the effective porosity, the greater the calculated seepage velocity. Therefore, a porosity of 0.1 is very conservative.

Hydraulic conductivity data developed during previous investigations at the Pfizer facility were used to calculate a representative vertical hydraulic conductivity for the clay unit beneath the Citric Block Site. Vertical hydraulic conductivities measured in 15 samples of the clay during previous investigations at the Pfizer facility range from 4.10×10^{-8} to 8.75×10^{-5} cps, with a geometric mean of 7.72×10^{-7} cps.

Using the assumptions described above, ground water migrating downward from the fill to the Upper Glacial aquifer would seep at a rate of 1.54×10^{-7} cps, or 4.38×10^{-4} feet per day. Based on this *conservative* vertical seepage velocity, it would take approximately 125 years for ground water to migrate downward through the clay unit at its thinnest point beneath the Citric Block Site (i.e., 20 feet). It should be noted, however, that this is a ground-water seepage velocity, and that the actual rate at which dissolved organic and/or inorganic constituents of ground water could migrate through the clay unit is likely to be significantly lower, due to the tendency for these dissolved constituents to adsorb onto organic material and/or mineral surfaces within the subsurface units, particularly those made up of fine-grained materials (e.g., the clay unit). The ratio of the ground-water seepage velocity to the seepage velocity of the constituent of concern is called the retardation factor, and is calculated using the following equation from Walton (1991):

$$R = 1 + (\rho/n_e)\, K_d$$

where:

- R = retardation factor;
- ρ = bulk density of the aquifer matrix;
- n_e = effective porosity of the aquifer matrix; and
- K_d = distribution coefficient of the constituent of concern.

A bulk density of 1.76 grams per cubic centimeter was calculated for the clay unit by averaging the dry densities of the fifteen samples collected from the clay unit during the previous investigations at the Pfizer facility and, as before, an effective porosity of 0.1 was assumed for the clay. Because K_d values are compound specific, it was first necessary to determine the form of mercury present. It is assumed that mercury in the perched ground water is present predominantly in the Hg II oxidation state instead of the elemental form. This assumption is based on the occurrence of mercury in both the underlying soil and perched ground water, coupled with the fact that elemental mercury is only sparingly soluble in water. If elemental mercury was the predominant mercury species, it is unlikely that dissolved mercury would have been detected in the perched ground water at the levels observed. The ability to identify a K_d value for Hg II, which is consistent with Citric Block Site-specific geochemical conditions is tantamount to calculating a useful retardation factor.

A range of K_d values for Hg II from 1 to 143 was applied for mercury (the major constituent detected in perched ground water at the Citric Block Site), the latter of the two (K_d = 143) corresponds to geochemical conditions of the fill at the Citric Block Site (e.g., moderate pH, moderate to high TOC, etc.). The low end of the range (K_d = 0.9) corresponds to conditions of low pH, low total iron and low TOC; these conditions are not consistent with those observed at the Citric Block Site.

Application of these K_d values selected above can be used to determine a retardation factor for Hg II. Retardation is described as physical and/or chemical processes which attenuate Hg II as it migrates through a soil (Walton, 1991). Walton (1991) suggests that a retardation factor of 1 is typically assumed in the absence of site-specific K_d data to develop a conservative migration scenario. As discussed above, a K_d value of 1 represents conditions which are not reflective of Citric Block Site geochemistry, therefore, its use in calculating a retardation factor for Hg II at the Citric Block Site will result in a very conservative migration scenario. Walton further suggests that a retardation factor of approximately 50 is more appropriate for heavy metals (i.e., mercury). Since a Citric Block Site-specific K_d for mercury is not available, the lowest K_d value (one), as suggested by Walton (1991) and consistent with the low end of the range presented above, was used to calculate the most conservative retardation factor for mercury. Subsequently, this minimum retardation factor was used in the equation above to calculate the most conservative vertical migration of mercury through the clay.

Based on the assumptions described above, a range of retardation factors from 16 to 2,455 was calculated for mercury migrating downward through the clay unit. This retardation factor results in a seepage velocity of 2.85×10^{-5} feet per day for mercury. At this rate, it would take approximately 2,000 years for mercury to migrate through the 20 feet of clay beneath the Citric Block Site. Therefore, the potential for migration of mercury from the perched zone to the underlying Upper Glacial aquifer is considered negligible.

In summary, the absence of exposure pathways for both soil and ground water precludes contact with contaminants by potential receptors. Since exposures to Citric Block Site-related chemicals are precluded by current Citric Block Site conditions, there are currently no potential risks identified for the Citric Block Site.

4.0 CURRENT AND POTENTIAL FUTURE CITRIC BLOCK SITE USE

Pfizer has decommissioned the Citric Block Site to prepare this property for future redevelopment and/or beneficial use. As part of this process, the Citric Block Site buildings were demolished. (Demolition activities were completed in August 1995.) Presently, the reinforced-concrete-slab foundation is the only aboveground remnant of the former buildings. This slab is continuous throughout the entire block, and varies in thickness between approximately 0.5 and 1.5 feet. The entire Citric Block Site is surrounded by an eight-foot-high chain-link fence topped with barbed wire, and is under continuous security surveillance.

As stated earlier, the Citric Block Subsurface Investigation Report concluded that under current site-use conditions, the eastern half of the Citric Block Site does not present a risk to public health or the environment. This conclusion was based upon the absence of exposure pathways, thereby preventing contact of contaminants with a potential receptor. Since exposures to site-related chemicals cannot occur under current site conditions, there are currently no potential risks identified for the Citric Block Site. It is noted, however, that the Citric Block Subsurface Investigation Report did not address potential future use(s) of the property.

Pfizer is currently contemplating several redevelopment (future-use) scenarios for the Citric Block Site, including commercial, light industrial, or recreational use (i.e., as a park/playground for the adjoining elementary school). Redevelopment of the property would be conducted in such a manner as to preclude *any* exposure of Citric Block Site contaminants to humans (e.g., through capping, barriers, soil excavation, or a combination of these technologies). Therefore, even considering potential future-use scenarios, the Citric Block Site will not present a risk to public health or the environment.

5.0 IRM RATIONALE

Although Citric Block Site soil does not pose a current or future risk while capped with concrete, Pfizer wishes to remove "hot spot" areas of soil contamination as an added safety measure.

Excavation of soil "hot spots" will likely remove any soils that might be considered a potential RCRA characteristically hazardous waste. This conservative, yet aggressive, remediation approach is designed to provide an additional level of safety to the site (the Citric Block Site is already capped with concrete, and is surrounded by an 8-foot-high fence with 24-hour security surveillance), while ensuring that soils that could be characterized as RCRA hazardous are removed in an expeditious manner.

The IRM is designed to proceed in a phased fashion. Specifically, delineation and soil excavation will be implemented first for the eastern half of the Citric Block Site, where significant environmental data are already available. Following completion of the soil excavation efforts on the eastern half of the Citric Block Site, IRM efforts on the western half of the Citric Block Site will commence, beginning with the delineation of soil (fill) quality conditions. In this manner, information developed during IRM efforts on the eastern half of the Citric Block Site can be used to rescope and improve IRM efforts on the western half of the Citric Block Site, if necessary or desirable.

To preliminarily identify "hot spots" in the portion of the Citric Block Site where soil quality data have been already developed, soil quality data for the eastern half of the Citric Block Site were evaluated to preliminarily estimate those locations where soil could be characterized as RCRA hazardous, based upon Toxicity Characteristic Leaching Procedure (TCLP) testing. The results of this evaluation show that for the eastern portion of the Citric Block Site Soil Borings CB-1, CB-3, CB-4, CB-6, CB-8, CB-9, CB-10, CB-11, and CB-12 yield soil concentrations that could potentially "fail" a TCLP test and, therefore, be classified as a characteristically hazardous waste. Preliminarily, these borings will serve as "markers" for approximating "hot spot" areas to be removed on the eastern half of the Citric Block Site during the IRM. These "hot spots" are shown in red in Figure 6. Additional delineation efforts (Task II of this Work Plan), including TCLP testing, will be performed around each of these borings to better define "hot spot" areas prior to implementation of the IRM.

The highest concentrations of contaminants are limited to the 0- to 2-ft interval directly below the existing concrete slab. In almost all cases, soil concentrations decreased significantly at depths deeper than 2 feet below the existing slab. An exception to this is at borings CB-1 and CB-4, where lead (CB-1) and mercury (CB-4) concentrations remain elevated down to 4 feet below the concrete slab. Based upon this information, the IRM soil "hot spot" removal effort in the eastern half of the Citric Block Site will be preliminarily limited to removing the 0- to 2-foot interval immediately underlying the concrete slab in the "hot spot" areas centered on borings shown in Figure 6, with the exception of the areas around borings CB-4 and CB-1, where excavation may proceed down to 4 feet below the slab.

6.0 ADDITIONAL DATA NEEDS

This section identifies additional data needed (data gaps) to complete the characterization of the Citric Block Site and support the implementation of the IRM. The data gaps were identified through an evaluation of the previous investigation results at the Citric Block Site (Roux Associates, 1995a).

Data gaps were identified for the following:

- soil (fill) quality;
- ground-water quality;
- hydrogeology; and
- on-site sewer pathways.

The data generated to eliminate the above-referenced data gaps will be evaluated to fully describe environmental conditions beneath the Citric Block Site and support the implementation of an IRM to excavate and remove soil "hot spots". A description of the data gaps is presented below.

6.1 Soil Quality

Although the soil sampling efforts conducted at the Citric Block Site to date have identified the presence of metals, SVOCs and, to a lesser degree VOCs, in Citric Block Site soil, the available data are not sufficient to completely define the areal and vertical extents of impacted soil, or to support implementation of an IRM. Based upon an evaluation of the available data, the following soil-quality data gaps have been identified.

- The nature and extent (areal and vertical) of soil contamination beneath the western portion of the Citric Block Site (i.e., former Buildings 5, 8, 9 and 11) has not been investigated. Therefore, an investigation of the soil quality beneath this area needs to be performed.

- The extent of soil contamination beneath the eastern portion of the Citric Block Site has not been fully delineated. Only one to two data points were collected within each of the former buildings (i.e., Buildings 1D, 3A, 3B, 4A, 4B, 7A, 7B, and the yard) from the previous investigation which the analytical results indicated detections of VOCs, SVOCs and metals. Some of the detections of SVOCs and metals concentrations exceeded the NYSDEC RSCOs. Therefore, a further investigation is warranted to further delineate the soil impacts in this area.

- The toxicity characteristics of the soil beneath the Citric Block Site need to be determined in order to classify the soil as hazardous or non-hazardous.
- Citric Block Site-specific background concentrations of naturally-occurring metals and PAHs in soil needs to be developed, in order to form a basis for the evaluation of soil metals and PAHs data in potentially-impacted areas of the Citric Block Site. The selected locations for determining the Citric Block Site-specific background concentrations for metals and PAHs will be situated away from known or suspected source areas of contamination.
- Geochemical characteristics of the soil underlying the Citric Block Site need to be determined to form a basis for further evaluating risk, and fate and transport of contaminants in soil. Specifically, metals speciation (i.e., arsenic, chromium and mercury) need to be determined.

6.2 Ground-Water Quality

Ground-water quality data have been developed at the Citric Block Site in both the perched zone and Upper Glacial aquifer. The results of a recent investigation (Roux Associates, 1995a) at the Citric Block Site indicate that metals and, to a lesser degree, VOCs are present in perched ground water. The historical ground-water quality data developed beneath the Citric Block Site in the Upper Glacial aquifer indicate that no impact has occurred from past Citric Block Site operations (Appendix G). Therefore, no further action is warranted in the Upper Glacial aquifer. A description of the data gaps for perched ground-water quality is presented below.

Perched Ground-Water Quality

Although the perched ground-water sampling efforts conducted at the Citric Block Site to date have identified the presence of VOCs and metals in Citric Block Site perched ground water, the available data are insufficient to define the areal and vertical extent of contaminated perched ground water. Based upon an evaluation of the available perched ground-water data, the following data gaps have been identified.

- The nature and extent (areal and vertical) of contamination in perched ground water beneath the western portion of the Citric Block Site (i.e., former Buildings 5, 8, 9 and 11) have not been investigated. Therefore, an investigation of the perched ground-water quality beneath this area needs to be performed.

- Perched ground-water quality conditions beneath the eastern portion of the Citric Block Site (i.e., former Buildings 1D, 3A, 3B, 4A, 4B, 7A, 7B, and the yard) have been preliminarily investigated, with the analytical results indicating detections of VOCs and metals. Therefore, a further investigation is warranted to better define the extent of perched ground-water impacts in this area.

6.3 Hydrogeology

Previous investigations have not sufficiently characterized the hydrogeologic nature of the subsurface materials including the perched ground-water zone (Roux Associates, 1995a). The following data gaps have been identified:

- elevations for perched ground water need to be established beneath the western portion of the Citric Block Site and confirmed beneath the eastern portion of the Citric Block Site;
- ground-water flow directions (if any) in the perched zoned have not been established;
- the permeabilities of the fill material and clay beneath the western portion of the Citric Block Site need to be determined;
- stratigraphy data needs to be determined for the western portion of the Citric Block Site; and
- hydraulic characteristics (i.e., hydraulic conductivity) have not been established for the perched zone.

6.4 On-Site Sewer Pathways

There has been no investigation to date to determine if pathways exist between the on-site soil/perched ground-water contamination and any on-site sewer structures. These structures could act as a potential conduit for off-site migration of contaminants. Therefore, an investigation to determine the locations and accessibility of on-site sewers through a Citric Block Site inspection and review of engineering drawings is warranted. In addition, an evaluation of the sewer invert elevations and the perched ground-water elevations is necessary to determine if there is a potential for leakage of perched ground water into the sewer system.

7.0 CITRIC BLOCK SITE INVESTIGATION AND IRM SCOPE OF WORK

The Citric Block Site Investigation and IRM Scope of Work is designed to quickly develop Citric Block Site-specific data necessary to characterize the nature and extent of contamination, and to support the implementation of the IRM. Specifically, the Citric Block Site Investigation and IRM is designed to:

- further delineate the extent of contamination detected during the previous investigation beneath the eastern portion of the Citric Block Site (i.e., former Buildings 1D, 3A, 3B, 4A, 4B, 7A, 7B, and the yard);
- determine the nature and extent of contamination beneath the western portion of the Citric Block Site (i.e., former Buildings 5, 8, 9 and 11);
- determine the occurrence and continuity of perched ground water, and if migration of contaminants in the perched ground water is occurring onsite;
- develop additional information regarding the permeability of the fill material and clay layer underlying the Citric Block Site;
- investigate the potential for off-site migration of contaminants through on-site sewers;
- perform waste characterization sampling of soil "hot spots" prior to implementation of the IRM; and
- implement an IRM to excavate and remove soil "hot spots".

The Citric Block Site Investigation and IRM Scope of Work is organized into the following tasks.

- Task I: Citric Block Site Reconnaissance;
- Task II: Soil Boring and Sampling - Eastern Portion of Citric Block Site;
- Task III: IRM Implementation - Eastern Portion of Citric Block Site;
- Task IV: Soil Boring and Sampling - Western Portion of Citric Block Site;
- Task V: IRM Implementation - Western Portion of Citric Block Site;
- Task VI: Perched Ground-Water Investigation;
- Task VII: On-Site Sewer Investigation; and
- Task VIII: Data Evaluation and Reporting.

In addition, Project Operation Plans (POPs) have been prepared which outline standard operating procedures to be followed during the performance of all tasks of the Citric Block Site Investigation. The following POPs are included as Appendices to the Work Plan and are summarized below.

Project Operation Plans	Appendix
Sampling and Analysis Plan	A
Quality Assurance Project Plan	B
Health and Safety Plan	C

The SAP is included as Appendix A and describes the types of samples (i.e., soil and perched ground water) to be collected and the procedures to be followed during investigative activities (i.e., drilling, decontamination, and sample collection) conducted at the Citric Block Site. Therefore, the detailed procedures will not be presented separately in each task but will be referred to in Appendix A.

A brief description of the elements of each task is presented below.

7.1 Task I: Citric Block Site Reconnaissance

Citric Block Site reconnaissance will be performed to develop and evaluate available information necessary to characterize Citric Block Site conditions prior to commencement of field activities. The objectives of the Citric Block Site reconnaissance are to:

- survey the Citric Block Site for the purpose of preparing a base map of the Citric Block Site;
- identify underground conduits, pipes and utilities;
- identify the presence of on-site sewers;
- update a well search previously performed (Roux Associates, 1991) of all industrial and potable water supplies within a 4-mile radius of the Citric Block Site;
- establish background sampling locations;
- determine accessibility of the proposed drilling sites; and

- modify soil/ground-water sampling locations and/or other tasks, if necessary, based upon the results of this task.

A brief description of each of the Citric Block Site reconnaissance objectives are presented below.

7.1.1 Citric Block Site Survey

The Citric Block Site will be surveyed to a common datum (e.g., National Geodetic Vertical Datum [NGVD], Brooklyn Datum) for the preparation of a base map by a New York State licensed surveyor. In addition, previous soil boring locations will be reconfirmed as part of this survey.

7.1.2 Identification of Underground Conduits, Pipes and Utilities

The identification of underground conduits (e.g., floor drains), pipes and utilities will be performed, to the degree practicable, through the field inspection and review of engineering drawings prepared for the Citric Block Site. The results of this task will guide the placement of soil borings/monitoring wells. In addition, the results will indicate the approximate locations of these structures and aid in their removal, if necessary.

7.1.3 Identification of On-Site Sewers

On-site sewers will be identified both in the field and through the review of engineering drawings from the local sewer department, if available. By determining the location and elevation of the sewer inverts, the sewers can be assessed as to whether they are considered a migration pathway for contaminants on- and off-site.

7.1.4 Well Search

A well search, which was previously conducted (Roux Associates, 1991), will be updated to identify all industrial and potable water suppliers within a 4-mile radius of the Citric Block Site. The purpose of the well search is to determine if there are any potential receptors near the Citric Block Site.

7.1.5 Accessibility/Modification of Proposed Drilling Sites

Each proposed soil boring and monitoring well location will be examined to determine whether it is accessible by drilling equipment. Utility markouts at each drilling location will be requested from the appropriate local authorities, if necessary. Soil boring and monitoring well locations will be modified to avoid inaccessible areas and underground utilities based upon the Citric Block Site reconnaissance results.

7.1.6 Identification of Background Sampling Locations

Locations for background soil sampling will be chosen to avoid areas which may have been contaminated or otherwise affected by Citric Block Site activities. These areas will be selected based upon historical records review, Citric Block Site investigation and review of aerial photographs.

7.2 Task II: Soil Boring and Sampling - Eastern Portion of Citric Block Site

To fill the identified data gaps discussed in Section 6.0, additional soil samples will be collected on the eastern portion of the Citric Block Site to provide supplemental information with regard to soil quality and hydrogeologic data. The soil boring and sampling objectives are to:

- further delineate the extent of constituents detected during the previous investigation beneath the eastern portion of the Citric Block Site (i.e., former Buildings 1D, 3A, 3B, 4A, 4B, 7A, 7B, and the yard);
- develop Citric Block Site-specific background concentrations for metals and PAHs; and
- determine geochemical characteristics of the soil (e.g., metals speciation).

A total of 16 soil borings will be drilled and sampled using the Geoprobe™ method at the Citric Block Site. The locations of the 11 soil borings within the former buildings on the eastern half of the Citric Block Site are shown in Figure 7 (i.e., CB-14 through CB-24). The locations were selected to achieve the above-referenced objectives and may be modified based upon the results of the Citric Block Site reconnaissance (Task I).

At each soil boring, soil samples will be collected continuously at 2-ft intervals down to the perched ground water or clay layer, whichever is first encountered. Each soil sample will be inspected by the field geologist to characterize lithology and any evidence of contamination (e.g., staining, odors). A portion of each sample will be placed in a plastic Ziploc™ bag or glass jar and screened in the field for VOCs using a photoionization detector (PID). Detailed soil boring and sampling procedures are further discussed in the SAP (Appendix A).

The soil sample collected from the 0 to 2 ft interval (i.e., immediately below the concrete slab) and the soil sample that exhibits the highest degree of contamination (e.g., staining and odors) will be selected for laboratory analysis to assess the nature and extent of any impacts. However, if no impacts are discernible, the samples collected from the 0 to 2 ft interval and the 2 ft interval immediately above the perched ground water (if present) or clay layer will be submitted for analysis.

Each soil sample submitted for laboratory analysis will be analyzed for VOCs using NYSDEC ASP Method 91-1, SVOCs using NYSDEC ASP Method 91-2, metals using Superfund Contract Laboratory Program (CLP) Inorganics Method, TOC using USEPA Method 9060, pH using USEPA Method 9045 and Eh using American Standards & Testing Method (ASTM) Method 4646. Quality assurance samples (e.g., field blanks, matrix spike) will be collected for the above analyses as described in Appendix B.

Each soil boring will be surveyed for horizontal and vertical coordinates relative to the NGVD by a New York State licensed surveyor.

Background Sampling

The need for Citric Block Site-specific background soil quality is based upon the natural occurrence of certain constituents (i.e., metals) at the Citric Block Site, the nature of the media (non-native fill) in which these constituents are found, and the urban setting on which the Pfizer plant resides. In these areas, naturally occurring elements such as metals, and other pervasive compounds such as PAHs are commonly present in urban fill materials at levels above regional background concentrations and even above NYSDEC RSCOs. For example, ash cinders and asphalt are common components of fill that contain high concentrations of metals (e.g., mercury, lead, etc.) and PAHs.

Therefore, to determine the significance of these constituent concentrations at a given urban site, Citric Block Site-specific background soil quality data need to be developed. These data are collected from areas of the Citric Block Site where operations were not performed and are therefore not suspected as being potentially impacted from Citric Block Site operations. These background data will be used to develop Citric Block Site-specific ranges of concentrations for naturally occurring metals and PAHs. These background data will, in turn, be compared to soil metals and base neutral compounds (i.e., PAHs) data in the known areas of concern to identify environmental impacts from these constituents. To accomplish this, five soil samples will be collected from selected locations that will be situated away from known or suspected source areas of contamination. These locations will be established during the Citric Block Site reconnaissance (Task I). Each soil sample will be collected and analyzed from the 0 to 2 ft interval.

The background soil samples will be analyzed for base neutral compounds (i.e., PAHs) using the NYSDEC ASP Method 91-2 and metals using the Superfund CLP Inorganics Method. A further discussion of background sampling can be found in the SAP (Appendix A).

Metals Speciation

To assist in the evaluation of risk, fate and transport and the development of remedial alternatives, metals speciation will be performed for certain metals on all soil samples collected from soil borings at the Citric Block Site including the background samples (but excluding monitoring well pilot boreholes). Speciation will be performed for arsenic, chromium and mercury. A brief discussion of the metals to be speciated is provided below and in Appendix A.

Arsenic speciation (i.e., As^{+3} and As^{+5}) will be performed to determine if the predominant form present in the soil is As^{+3} (carcinogenic) or As^{+5} (non-carcinogenic). It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block

Site), the risk imposed by the As^{+3} (i.e., 0.37 parts per million [ppm] for ingestion) is several orders of magnitude greater than the risk imposed by the As^{+5} (i.e., 23 ppm for ingestion) due to its known behavior as a carcinogen.

Determination of Cr^{+3} and Cr^{+6} will be performed to identify the form of chromium in the soil samples. It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), the risk imposed by Cr^{+6} (i.e., 390 ppm for ingestion) is several orders of magnitude greater than the risk imposed by Cr^{+3} (i.e., 78,000 ppm for ingestion).

Determination of metallic and non-metallic mercury including organic mercury will be performed to identify the form of mercury present in the soil samples. It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), the risk for organic forms of mercury (i.e., methyl mercury) and metallic mercury are greater than the risk for inorganic/non-metallic mercury. In addition, in order to evaluate the form of mercury present in the soil, a mercury vapor meter will be employed to screen the vapor emanating from the boreholes created during soil sampling. The observation of mercury in the vapor phase, will be used to indicate the presence of metallic mercury in the soils. In addition, using the concentrations for mercury in the vapor phase, as measured during screening, coupled with temperature and barometric data, estimates of soil concentrations of metallic mercury may be calculated. The significance of the presence of metallic mercury, as compared to its non-metallic forms, is that provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), it imposes a considerably higher health risk due to its inherent toxicity, high volatilization (i.e., inhalation risk), and high trans-dermal absorption.

Data Evaluation

Soil delineation work proposed in Task II is expected to require five to six weeks to complete (i.e., including laboratory analysis). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas across the eastern portion of the Citric Block Site. Specifically, soil borings yielding soil concentrations above the TCLP limits, as discussed in Section 5.0, will be shown in a map (similar to

Figure 6) and will serve as "markers" for approximating "hot spot" areas to be removed during implementation of the IRM. The results of this work will be provided in a technical memorandum to the NYSDEC.

7.3 Task III: IRM Implementation - Eastern Portion of the Citric Block Site

The IRM for the Citric Block Site will consist of the following tasks:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for waste characterization through TCLP analysis;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab (except near CB-1 and CB-4), based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

7.3.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings (known "hot spot" marker borings are shown in Figure 6) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling; and
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 5-foot or 10-foot) intervals radiating outward from each "hot spot" marker boring. For example, based upon existing Citric Block Site data, additional borings would be performed around existing soil borings CB-1, CB-3, CB-4, CB-6, and CB-8 through CB-12. Soil sampling will continue radially outward from each existing soil boring until the area containing constituents of concern at concentrations exceeding their respective TCLP limits has been completely delineated. For example, as shown in Figure 8, four initial soil borings will be drilled in a "ring" around each existing soil boring. These initial borings are shown in green in Figure 8. For each initial soil boring that contains constituents of concern at concentrations above their respective TCLP limit, sampling will continue outward incrementally (e.g., in 5- and/or 10-foot intervals) from that location until concentrations of all constituents of concern are below their respective TCLP limit. The outermost, or "perimeter", borings will define the limits of the "hot spot" area. In the vicinity of borings CB-1 and CB-4, soil borings will extend downward to a depth of 4 feet below land surface, since the 2- to 4-foot horizon at these locations were also shown to be contaminated during the recent subsurface investigation.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristics of metals using the TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils targeted for excavation will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine full waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for RCRA characteristics using TCLP, reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

7.3.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of "perimeter" borings where concentrations of all constituents of concern are below their respective TCLP limits. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk). Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

7.4 Task IV: Soil Boring and Sampling - Western Portion of Citric Block Site

Soil samples will be collected on the western portion of the Citric Block Site to delineate soil quality and hydrogeologic conditions. The soil boring and sampling objectives are to:

- determine the nature and extent of contamination beneath the western portion of the Citric Block Site (i.e., former Buildings 5, 8, 9 and 11);
- determine additional subsurface hydrogeologic conditions (e.g., vertical permeability [hydraulic conductivity]); and
- determine geochemical characteristics of the soil (e.g., metals speciation).

A total of 27 soil borings will be drilled and sampled using the Geoprobe™ method at the western portion of the Citric Block Site. The locations of the 22 soil borings within the former buildings on the eastern half of the Citric Block Site are shown in Figure 7 (i.e., CB-25 through CB-46). The locations were selected to achieve the above-referenced objectives and may be modified based upon the results of the Citric Block Site reconnaissance (Task I).

At each soil boring, soil samples will be collected continuously at 2-ft intervals down to the perched ground water or clay layer, whichever is first encountered. Two of the 27 soil borings will be drilled to the base of the clay layer beneath the western portion of the Citric Block Site. The locations of the deeper soil borings will be selected in the field, and will be spaced throughout the western portion of the Citric Block Site.

Each soil sample will be inspected by the field geologist to characterize lithology and any evidence of contamination (e.g., staining, odors). A portion of each sample will be placed in a plastic Ziploc™ bag or glass jar and screened in the field for VOCs using a photoionization detector (PID). Detailed soil boring and sampling procedures are further discussed in the SAP (Appendix A).

The soil sample collected from the 0 to 2 ft interval (i.e., immediately below the concrete slab) and the soil sample that exhibits the highest degree of contamination (e.g., staining and odors) will be selected for laboratory analysis to assess the nature and extent of any impacts.

However, if no impacts are discernible, the samples collected from the 0 to 2 ft interval and the 2 ft interval immediately above the perched ground water (if present) or clay layer will be submitted for analysis.

Each soil sample submitted for laboratory analysis will be analyzed for VOCs using NYSDEC ASP Method 91-1, SVOCs using NYSDEC ASP Method 91-2, metals using Superfund Contract Laboratory Program (CLP) Inorganics Method, TOC using USEPA Method 9060, pH using USEPA Method 9045 and Eh using American Standards & Testing Method (ASTM) Method 4646. Quality assurance samples (e.g., field blanks, matrix spike) will be collected for the above analyses as described in Appendix B.

Grain size distribution and vertical permeability (i.e., hydraulic conductivity) will also be established for the samples of fill material and the underlying clay at two locations (i.e., a total of four samples). Determination of these parameters will supplement existing data and assist during the evaluation, if necessary, of fate and transport of potential migration of contaminants vertically through the clay. These four samples will be collected using Shelby™ tubes driven by a truck-mounted drill rig. The locations for these samples will be selected immediately after the completion of samples collected for chemical analyses.

Each soil boring will be surveyed for horizontal and vertical coordinates relative to the NGVD by a New York State licensed surveyor.

Metals Speciation

As discussed in Section 7.2, metals speciation will be performed for certain metals on all soil samples collected from soil borings at the Citric Block Site. Speciation will be performed for arsenic, chromium and mercury. A brief discussion of the metals to be speciated is provided below and in Appendix A.

Data Evaluation

Soil delineation work proposed in Task IV is expected to require five to six weeks to complete (i.e., including laboratory analysis). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas across the western portion of the Citric Block Site. Specifically, soil borings representing "markers" for approximating "hot spot" areas to be removed during implementation of the IRM, as discussed in Section 5.0, will be shown in a map (similar to Figure 6). The results of this work will be provided in a technical memorandum to the NYSDEC.

7.5 Task V: IRM Implementation - Western Portion of the Citric Block Site

The IRM for the western portion of the Citric Block Site will consist of the following tasks:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for waste characterization through TCLP analysis;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab, based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

The scope of IRM efforts for the western half of the Citric Block Site may be modified based upon results of IRM efforts on the eastern portion of the Citric Block Site.

7.5.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling; and
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 10-foot) intervals radiating outward from each "hot spot" marker boring. Soil sampling will continue radially outward from each existing soil boring until "hot spot" areas have been completely delineated.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristic metals using TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for RCRA characteristics using TCLP, reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

7.5.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of "perimeter" borings. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk). Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

7.6 Task VI: Perched Ground-Water Investigation

The objective of the perched ground-water investigation is to determine the occurrence, nature and continuity of perched ground water, and if migration of contaminants in the perched ground water is occurring onsite. This will be accomplished through the installation and sampling of perched zone monitoring wells and water-level monitoring. A description of each component of the perched ground-water investigation is provided below.

7.6.1 Monitoring Well Installation

Nine monitoring wells will be installed in the perched zone throughout the Citric Block Site as shown in Figure 7 (i.e., MW-1 through MW-9). The monitoring wells will be installed to the top of the clay layer (i.e., approximately 8 to 10 ft bls). Detailed procedures of the monitoring well installation are presented in the SAP (Appendix A).

At each monitoring well pilot borehole, soil samples will be collected as discussed in Section 7.2. Soil samples will only be collected for geologic logging and field inspection purposes. No soil samples will be collected for chemical analyses. Detailed soil boring procedures are further discussed in the SAP (Appendix A).

Each monitoring well will also be surveyed for horizontal and vertical coordinates relative to the NGVD to determine the approximate elevation of the perched ground water at the locations where it is present, and to determine, if possible, the direction of the perched ground-water flow beneath the Citric Block Site.

7.6.2 Water-Level Measurements and Ground-Water Sampling

Prior to perched ground-water sampling, two synoptic rounds of water-level measurements will be conducted. The water-level data will be used to verify the presence/absence of perched ground water and construct, if possible, a perched ground-water flow map. The water levels will be measured using a steel tape and chalk or an electronic interface probe. Water-level measurement procedures are provided in Appendix A.

Perched ground-water samples will be collected and analyzed for VOCs using NYSDEC ASP Method 91-4, SVOCs using NYSDEC ASP Method 91-2, metals using Superfund CLP Inorganics Method (i.e., total and dissolved metals), and TOC using USEPA Method 9060. Temperature, pH, specific conductance and Eh will be measured in the field.

Quality assurance samples (e.g., field blanks, matrix spike) will be collected for the above analyses as described in Appendix B. Perched ground-water sampling procedures are presented in Appendix A.

7.7 Task VII: On-Site Sewer Investigation

The objective of the on-site sewer investigation is to determine if potential pathways exist between on-site soil/perched ground-water contamination and the sewer structures that may be acting as a conduit for off-site migration of contaminants. The locations and accessibility of on-site sewers will be determined during the Citric Block Site reconnaissance (Task I). In addition, available engineering drawings of on-site sewers will be obtained from the local sewer department and reviewed.

A survey will be performed to determine the elevations of the sewer inverts and the perched ground water. Leakage of perched ground water into the on-site sewers could be occurring if the elevations of both are either approximately the same or if the sewer invert elevation is lower than the perched ground water and resides in it. If the elevations indicate that leakage into the on-site sewers from the perched ground water could be occurring, a video camera survey will be conducted, if possible. This survey will show whether there is leakage into the sewers from the perched ground water and if the on-site sewers are a conduit for off-site migration.

Each manhole cover rim and inverts for the on-site sewers (if present) will also be surveyed for horizontal and vertical coordinates relative to NGVD by a New York State licensed surveyor.

7.8 Task VIII: Data Evaluation and Reporting

Following completion of each of the additional soil delineation efforts (Task II and Task IV), a technical memorandum will be submitted to the NYSDEC identifying "hot spot" marker borings where focused soil sampling will be performed as the first step of the IRM. Following the IRM focused soil sampling efforts, an additional technical memorandum for each portion of the Citric Block Site will be submitted to the NYSDEC identifying defined "hot spot" areas which will be excavated during the IRM. Following completion of the IRM, the perched ground-water investigation, and on-site sewer investigation activities, a summary report will be prepared. This report will include a summary of the methods performed and the data collected during the investigation and IRM, our findings, conclusions and any recommendations that may be appropriate. This evaluation will include a comparison with the data generated during previous investigations. Report appendices will include soil boring and well logs, analytical data documentation, Quality Assurance/Quality Control (QA/QC) reports, and other data, as appropriate.

8.0 SCHEDULE

The investigation and IRM is designed to proceed in a phased fashion. Specifically, delineation and soil excavation will be implemented and completed for the eastern half of the Citric Block Site, where significant environmental data are already available. This work is anticipated to require 3 to 4 months to complete, following NYSDEC approval to proceed. The implementation schedule for the eastern half of the Citric Block Site provides tentative start and completion dates for each of the scope of work tasks previously described (Figure 9), and will commence within two weeks of the NYSDEC approval. The proposed schedule may require revisions if the field tasks are delayed by inclement weather or availability of subcontractors. However, every effort will be made to adhere to the proposed schedule and the NYSDEC will be notified immediately if any changes are necessary. Wherever possible, tasks have been scheduled concurrently to reduce the overall duration of Citric Block Site investigation efforts. In addition, if a task is completed prior to schedule, the subsequent tasks will be initiated ahead of schedule.

The investigation and IRM for the western half of the Citric Block Site (Tasks IV and V), the perched ground-water investigation (Task VI) and the on-site sewer investigation (Task VII) will commence after the completion of the IRM for the eastern half of the Citric Block Site. Following the completion of IRM efforts for the eastern half of the Citric Block Site, a schedule will be provided to the NYSDEC for the implementation of Tasks IV through VIII.

Sincerely,

ROUX ASSOCIATES, INC.

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TABLES

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-1	CB-1	CB-2	CB-2	CB-3
	Sample Depth (ft bls):	0-2	2-4	0-2	2-4	0-2
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	6,260	7,280	4,530	7,090	2,980
Antimony	--	11.7	7.1 B	3.4 B	6.4 B	9.2 B
Arsenic	7.5	**10.9**	**30.2**	**72.0**	**20.9**	4.3
Barium	300	157	56.6	60.7	97.9	38.5 B
Beryllium	0.16	0.10 B	0.10 B	0.11 B	**0.18 B**	0.04 U
Cadmium	1	**1.5**	**2.9**	0.80 B	**3.9**	0.75 B
Calcium	35,000[1]	10,100	24,000	13,900	4,410	16,200
Chromium	10	**11.9**	**14.0**	7.9	**22.1**	**26.8**
Cobalt	30	3.1 B	5.2 B	22.1	6.9 B	12.6
Copper	25	**255**	**220**	**222**	**654**	**118**
Iron	2,000	**6,880**	**10,900**	**12,500**	**7,590**	**6,090**
Lead	400	**4,220**	**1,660**	360	**484**	**734**
Magnesium	5,000[1]	968	1,480	1,670	976 B	958 B
Manganese	5,000[1]	330	146	197	54.3	102
Mercury	0.1	**484**	**95.5**	**64.1**	**49.4**	**69.2**
Nickel	13	8.5	**29.0**	**15.5**	**42.1**	8.0
Potassium	43,000[1]	377 B	791 B	454 B	530 B	557 B
Selenium	2	1.7	1.4	1.5	0.84 B	0.75 B
Silver	--	14.8	1.5 B	0.12 U	0.13 U	4.5
Sodium	8,000[1]	147 B	744 B	295 B	163 B	215 B
Thallium	--	1.8 B	1.4 B	1.8 B	0.78 B	0.79 B
Vanadium	150	15.4	34.1	16.4	17.1	8.8 B
Zinc	20	**435**	**1,110**	**831**	**532**	**269**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-3	CB-4	CB-4	CB-5	CB-5
Sample Depth (ft bls):		4-6	0-2	2-4	0-2	2-4
Sample Date:		7/13/95	7/13/95	7/13/95	7/12/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	604	4,430	7,430	3,830	4,100
Antimony	--	2.1 B	2.3 B	1.4 B	4.4 B	2.5 B
Arsenic	7.5	**8.2**	**31.2**	**26.4**	5.6	3.6
Barium	300	9.6 B	183	119	55.7	59.4
Beryllium	0.16	0.04 U	0.05 U	**0.19 B**	0.04 U	**0.19 B**
Cadmium	1	0.08 B	0.47 B	0.53 B	0.38 B	0.07 U
Calcium	35,000[1]	303 B	27,100	57,600	32,300	7,930
Chromium	10	0.41 B	8.7	**14.3**	9.7	7.1
Cobalt	30	4.0 B	3.9 B	4.8 B	8.8 B	4.1 B
Copper	25	12.7	**93.8**	**107**	**31.6**	**29.9**
Iron	2,000	**2,090**	**10,300**	**18,000**	**7,830**	**8,750**
Lead	400	66.3	273	158	316	190
Magnesium	5,000[1]	124 B	1,790	7,940	4,070	1,310
Manganese	5,000[1]	8.1	493	858	241	88.1
Mercury	0.1	**2.7**	**2640**	**499**	**68.8**	**85.5**
Nickel	13	**24.1**	7.9 B	12.1	11.5	11.3
Potassium	43,000[1]	209 B	1820	1610	604 B	668 B
Selenium	2	0.43 U	**11.5**	**4.4**	1.2	**5.9**
Silver	--	0.12 U	0.15 U	0.14 U	0.13 U	0.13 U
Sodium	8,000[1]	188 B	368 B	501 B	182 B	250 B
Thallium	--	0.69 U	2.9	3.3	0.71 U	1.6 B
Vanadium	150	1.3 B	20.7	30.0	11.5	13.8
Zinc	20	**714**	**150**	**307**	**93.1**	**53.1**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation: Sample Depth (ft bls): Sample Date:		CB-6 0-2 7/12/95	CB-6* 0-2 7/12/95	CB-6 2-4 7/12/95	CB-7 0-2 7/12/95	CB-7 2-4 7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	4,020	6,510	5,330	3,350	6,000
Antimony	--	70.0	43.1	2.0 B	5.2 B	0.78 U
Arsenic	7.5	**22.6**	**20.5**	**10.7**	**9.8**	1.3 B
Barium	300	130	164	63.0	91.7	18.1 B
Beryllium	0.16	0.04 U	0.05 U	0.12 B	**0.22 B**	0.04 U
Cadmium	1	0.23 B	0.29 B	**1.5**	0.34 B	0.07 U
Calcium	35,000[1]	3,430	12,000	52,000	4,880	650 B
Chromium	10	**19.0**	**20.6**	**12.0**	8.5	9.7
Cobalt	30	3.1 B	4.6 B	5.0 B	6.1 B	2.7 B
Copper	25	**179**	**212**	**78.0**	**54.4**	8.8
Iron	2,000	**20,300**	**23,300**	**10,900**	**13,300**	**5,330**
Lead	400	**2,050**	**1,240**	**541**	145	5.8
Magnesium	5,000[1]	1,160	2,180	3,640	561 B	1,390
Manganese	5,000[1]	83.0	123	277	169	48.8
Mercury	0.1	**28.3**	**57.8**	**30.1**	**7.9**	**2.5**
Nickel	13	**16.4**	**29.7**	**61.7**	**16.6**	9.6
Potassium	43,000[1]	685 B	872 B	679 B	664 B	308 B
Selenium	2	**3.2**	**4.2**	2.0 U	**2.5**	0.79 B
Silver	--	0.12 U	0.14 U	0.11 U	0.14 U	0.13 U
Sodium	8,000[1]	102 U	118 U	150 B	381 B	114 U
Thallium	--	2.0	3.7	1.5 B	2.0 B	0.74 U
Vanadium	150	26.4	26.0	18.4	24.8	9.2 B
Zinc	20	**123**	**142**	**194**	**107**	**22.0**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-8	CB-8	CB-9	CB-9*	CB-9
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/14/95	7/14/95	7/14/95	7/14/95	7/14/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	4,490	3,890	2,890	5,030	10,900
Antimony	--	6,550	7.7 B	58.7	66.7	12.5
Arsenic	7.5	7.2	5.7	**10.0**	**11.1**	**57.0**
Barium	300	55.2	37.2 B	65.0	118	39.7 B
Beryllium	0.16	**0.20 B**	0.04 U	0.04 U	0.11 B	0.04 U
Cadmium	1	0.63 B	0.06 U	0.21 B	**4.1**	0.06 U
Calcium	35,000[1]	14,000	1,070	16,500	25,200	2,900
Chromium	10	7.3	4.3	7.8	8.7	**18.4**
Cobalt	30	3.4 B	4.2 B	**57.4**	**46.8**	5.9 B
Copper	25	**151**	9.9	**42.0**	**53.3**	11.4
Iron	2,000	**5,960**	**7,300**	**6,440**	**7,880**	**5,820**
Lead	400	**4,630**	28.1	362	**919**	34.7
Magnesium	5,000[1]	816 B	771 B	1,470	1,790	1,280
Manganese	5,000[1]	83.9	24.4	108	157	54.6
Mercury	0.1	**17.9**	**0.43**	**52.9**	**56.8**	**0.78**
Nickel	13	10.5	**13.2**	10.1	10.3	**25.4**
Potassium	43,000[1]	651 B	461 B	718 B	994 B	879 B
Selenium	2	0.70 B	1.2	1.4	1.7	1.2
Silver	--	0.13 U	0.12 U	3.9	2.6	0.12 U
Sodium	8,000[1]	448 B	106 U	117 U	352 B	141 B
Thallium	--	0.81 B	0.81 B	1.3 B	1.3 B	0.70 U
Vanadium	150	11.7	4.2 B	14.2	15.6	19.0
Zinc	20	**192**	**78.2**	**87.4**	**131**	**534**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-10	CB-10	CB-11	CB-11	CB-12
	Sample Depth (ft bls):	0-2	2-4	0-2	2-4	0-2
	Sample Date:	7/13/95	7/13/95	7/14/95	7/14/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	6,040	4,150	7,910	10,200	6,240
Antimony	--	2.6 B	0.74 U	3.1 B	0.79 U	4.2 B
Arsenic	7.5	**20.3**	4.6	**33.4**	**12.1**	5.4
Barium	300	**599**	15.0 B	152.0	58.6	**411**
Beryllium	0.16	0.06 B	0.04 U	0.16 B	**0.20 B**	0.08 B
Cadmium	1	**1.9**	0.06 U	0.39 B	0.12 B	**2.7**
Calcium	35,000[1]	60,200	4,510	43,400	8,820	46,300
Chromium	10	**28.4**	7.5	**23.7**	**31.9**	**23.2**
Cobalt	30	5.5 B	2.5 B	5.2 B	6.2 B	5.6 B
Copper	25	**124**	11.2	**72.2**	**35.5**	**123**
Iron	2,000	**18,000**	**6,840**	**19,700**	**17,600**	**19,700**
Lead	400	**665**	77.9	**536**	54.4	**427**
Magnesium	5,000[1]	7,730	1,290	3,830	2,560	5,150
Manganese	5,000[1]	534	52.0	453	303	375
Mercury	0.1	**30.3**	**18.9**	**108**	**15.2**	**32.4**
Nickel	13	**24.0**	8.7	**22.1**	**20.5**	**24.1**
Potassium	43,000[1]	1430	300 B	1640	840 B	957 B
Selenium	2	**2.2**	0.43 U	**2.2**	**2.1**	**2.5**
Silver	--	0.11 U	0.12 U	0.60 B	0.13 U	0.13 U
Sodium	8,000[1]	1,050	593 B	308 B	242 B	471 B
Thallium	--	1.6 B	0.70 U	2.6	2.0 B	2.2 B
Vanadium	150	24.1	8.5 B	22.1	28.9	17.3
Zinc	20	**1,510**	**35.8**	**317**	**117**	**931**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-12	CB-13	CB-13
	Sample Depth (ft bls):	4-6	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)			
Aluminum	33,000[1]	4,580	6,410	6,410
Antimony	--	0.75 U	10.8 B	1.4 B
Arsenic	7.5	1.9 B	**24.0**	**17.9**
Barium	300	46.4	186	83.3
Beryllium	0.16	**0.21 B**	0.09 B	0.06 B
Cadmium	1	0.06 U	**1.1**	0.74 B
Calcium	35,000[1]	1,110	53,600	29,900
Chromium	10	7.8	**20.7**	**11.9**
Cobalt	30	1.8 B	7.3 B	4.8 B
Copper	25	8.9	**405**	**62.6**
Iron	2,000	**3,980**	**34,700**	**8,870**
Lead	400	8.9	**557**	219
Magnesium	5,000[1]	571 B	5,220	3,590
Manganese	5,000[1]	13.1	410	208
Mercury	0.1	**4.3**	**24.0**	**24.0**
Nickel	13	5.0 B	**32.2**	**14.1**
Potassium	43,000[1]	538 B	1,350	981 B
Selenium	2	0.99 B	**6.2**	**2.4**
Silver	--	0.12 U	0.12 U	0.12 U
Sodium	8,000[1]	192 B	567 B	522 B
Thallium	--	1.0 B	3.6	1.9 B
Vanadium	150	15.5	25.3	27.9
Zinc	20	16.1	**517**	**119**

mg/kg - Milligrams per kilogram
ft bls - Feet below land surface
NYSDEC - New York State Department of Environmental Conservation
RSCOs - Recommended Soil Cleanup Objectives
U - Indicates compound not detected
B - Estimated value
[1] - Eastern U.S.A. background
* - Field duplicate
Boldface - Data highlighted in bold represent results detected above the NYSDEC RSCOs.

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-1	CB-1DL	CB-1	CB-2	CB-2
	Sample Depth (ft bls):	0-2	0-2	2-4	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Phenol	30	400 U	2000 U	430 U	410 U	370 U
bis(2-Chloroethyl)ether	--	400 U	2000 U	430 U	410 U	370 U
2-Chlorophenol	800	400 U	2000 U	430 U	410 U	370 U
1,3-Dichlorobenzene	1,600	400 U	2000 U	430 U	410 U	370 U
1,4-Dichlorobenzene	8,500	400 U	2000 U	430 U	410 U	370 U
1,2-Dichlorobenzene	7,900	400 U	2000 U	430 U	410 U	370 U
2-Methylphenol	100	400 U	2000 U	430 U	410 U	370 U
2,2'-oxybis(1-Chloropropane)	--	400 U	2000 U	430 U	410 U	370 U
4-Methylphenol	900	400 U	2000 U	430 U	410 U	370 U
N-Nitroso-di-n-propylamine	--	400 U	2000 U	430 U	410 U	370 U
Hexachloroethane	--	400 U	2000 U	430 U	410 U	370 U
Nitrobenzene	200	400 U	2000 U	430 U	410 U	370 U
Isophorone	--	400 U	2000 U	430 U	410 U	370 U
2-Nitrophenol	330	400 U	2000 U	430 U	410 U	370 U
2,4-Dimethylphenol	--	400 U	2000 U	430 U	410 U	370 U
2,4-Dichlorophenol	400	400 U	2000 U	430 U	410 U	370 U
1,2,4-Trichlorobenzene	3,400	400 U	2000 U	430 U	410 U	370 U
Naphthalene	13,000	400 U	2000 U	430 U	410 U	370 U
4-Chloroaniline	220	400 U	2000 U	430 U	410 U	370 U
Hexachlorobutadiene	--	400 U	2000 U	430 U	410 U	370 U
bis(2-Chloroethoxy)methane	--	400 U	2000 U	430 U	410 U	370 U
4-Chloro-3-Methylphenol	240	400 U	2000 U	430 U	410 U	370 U
2-Methylnaphthalene	36,400	400 U	2000 U	430 U	410 U	370 U
Hexachlorocyclopentadiene	--	400 U	2000 U	430 U	410 U	370 U
2,4,6-Trichlorophenol	--	400 U	2000 U	430 U	410 U	370 U
2,4,5-Trichlorophenol	100	960 U	4800 U	1000 U	980 U	890 U
2-Chloronaphthalene	--	400 U	2000 U	430 U	410 U	370 U
2-Nitroaniline	430	960 U	4800 U	1000 U	980 U	890 U
Dimethylphthalate	2,000	400 U	2000 U	430 U	410 U	370 U
Acenaphthylene	41,000	400 U	2000 U	430 U	410 U	370 U
2,6-Dinitrotoluene	1,000	400 U	2000 U	430 U	410 U	370 U
3-Nitroaniline	500	960 U	4800 U	1000 U	980 U	890 U
Acenaphthene	50,000	120 J	2000 U	430 U	410 U	370 U
2,4-Dinitrophenol	200	960 U	4800 U	1000 U	980 U	890 U
4-Nitrophenol	100	960 U	4800 U	1000 U	980 U	890 U
Dibenzofuran	6,200	71 J	2000 U	430 U	410 U	370 U
2,4-Dinitrotoluene	--	400 U	2000 U	430 U	410 U	370 U
Diethylphthalate	7,100	400 U	2000 U	430 U	410 U	370 U
4-Chlorophenyl-phenylether	--	400 U	2000 U	430 U	410 U	370 U
Fluorene	50,000	240 J	2000 U	430 U	410 U	370 U
4-Nitroaniline	--	960 U	4800 U	1000 U	980 U	890 U
4,6-Dinitro-2-methylphenol	--	960 U	4800 U	1000 U	980 U	890 U
N-Nitrosodiphenylamine (1)	--	400 U	2000 U	430 U	410 U	370 U
4-Bromophenyl-phenylether	--	400 U	2000 U	430 U	410 U	370 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-1	CB-1DL	CB-1	CB-2	CB-2
	Sample Depth (ft bls):	0-2	0-2	2-4	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	400 U	2000 U	430 U	410 U	370 U
Pentachlorophenol	1,000	960 U	4800 U	1000 U	980 U	890 U
Phenanthrene	50,000	8900 E	9000 D	430 U	200 J	180 J
Anthracene	50,000	1600	1600 JD	430 U	44 J	58 J
Carbazole	--	1200	1400 JD	430 U	410 U	370 U
Di-n-butylphthalate	8,100	400 U	2000 U	430 U	410 U	370 U
Fluoranthene	50,000	8200 E	9600 D	500	280 J	330 J
Pyrene	50,000	9800 E	9500 D	460	280 J	310 J
Butylbenzylphthalate	50,000	400 U	2000 U	430 U	410 U	370 U
3,3'-Dichlorobenzidine	--	400 U	2000 U	430 U	410 U	370 U
Benzo (a) anthracene	220	**5100 E**	**4900 D**	180 J	160 J	220 J
Chrysene	400	**6100 E**	**5500 D**	180 J	160 J	210 J
bis(2-Ethylhexyl)phthalate	50,000	400 U	2000 U	430 U	410 U	370 U
Di-n-octylphthalate	50,000	400 U	2000 U	430 U	410 U	370 U
Benzo(b)fluoranthene	1,100	**4900 E**	**3500 D**	110 J	140 J	240 J
Benzo(k)fluoranthene	1,100	**1800**	**3100 D**	100 J	120 J	82 J
Benzo(a)pyrene	61	**4300 E**	**4200 D**	430 U	**130 J**	**170 J**
Indeno(1,2,3-cd)pyrene	3,200	1700	1700 JD	430 U	72 J	88 J
Dibenzo(a,h)anthracene	14	**160 J**	**530 JD**	430 U	410 U	370 U
Benzo(g,h,i)perylene	50,000	1900	2100 D	430 U	89 J	91 J

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-3	CB-3DL	CB-3	CB-4	CB-4
	Sample Depth (ft bls):	0-2	0-2	4-6	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Phenol	30	380 U	1900 U	390 U	440 U	410 U
bis(2-Chloroethyl)ether	--	380 U	1900 U	390 U	440 U	410 U
2-Chlorophenol	800	380 U	1900 U	390 U	440 U	410 U
1,3-Dichlorobenzene	1,600	380 U	1900 U	390 U	440 U	410 U
1,4-Dichlorobenzene	8,500	380 U	1900 U	390 U	440 U	410 U
1,2-Dichlorobenzene	7,900	380 U	1900 U	390 U	440 U	410 U
2-Methylphenol	100	380 U	1900 U	390 U	440 U	410 U
2,2'-oxybis(1-Chloropropane)	--	380 U	1900 U	390 U	440 U	410 U
4-Methylphenol	900	380 U	1900 U	390 U	440 U	410 U
N-Nitroso-di-n-propylamine	--	380 U	1900 U	390 U	440 U	410 U
Hexachloroethane	--	380 U	1900 U	390 U	440 U	410 U
Nitrobenzene	200	380 U	1900 U	390 U	440 U	410 U
Isophorone	--	380 U	1900 U	390 U	440 U	410 U
2-Nitrophenol	330	380 U	1900 U	390 U	440 U	410 U
2,4-Dimethylphenol	--	380 U	1900 U	390 U	440 U	410 U
2,4-Dichlorophenol	400	380 U	1900 U	390 U	440 U	410 U
1,2,4-Trichlorobenzene	3,400	380 U	1900 U	390 U	440 U	410 U
Naphthalene	13,000	380 U	1900 U	390 U	440 U	410 U
4-Chloroaniline	220	380 U	1900 U	390 U	440 U	410 U
Hexachlorobutadiene	--	380 U	1900 U	390 U	440 U	410 U
bis(2-Chloroethoxy)methane	--	380 U	1900 U	390 U	440 U	410 U
4-Chloro-3-Methylphenol	240	380 U	1900 U	390 U	440 U	410 U
2-Methylnaphthalene	36,400	380 U	1900 U	390 U	440 U	410 U
Hexachlorocyclopentadiene	--	380 U	1900 U	390 U	440 U	410 U
2,4,6-Trichlorophenol	--	380 U	1900 U	390 U	440 U	410 U
2,4,5-Trichlorophenol	100	910 U	4500 U	930 U	1000 U	980 U
2-Chloronaphthalene	--	380 U	1900 U	390 U	440 U	410 U
2-Nitroaniline	430	910 U	4500 U	930 U	1000 U	980 U
Dimethylphthalate	2,000	380 U	1900 U	390 U	440 U	410 U
Acenaphthylene	41,000	380 U	1900 U	390 U	440 U	410 U
2,6-Dinitrotoluene	1,000	380 U	1900 U	390 U	440 U	410 U
3-Nitroaniline	500	910 U	4500 U	930 U	1000 U	980 U
Acenaphthene	50,000	100 J	1900 U	390 U	440 U	410 U
2,4-Dinitrophenol	200	910 U	4500 U	930 U	1000 U	980 U
4-Nitrophenol	100	910 U	4500 U	930 U	1000 U	980 U
Dibenzofuran	6,200	53 J	1900 U	390 U	440 U	410 U
2,4-Dinitrotoluene	--	380 U	1900 U	390 U	440 U	410 U
Diethylphthalate	7,100	380 U	1900 U	390 U	440 U	410 U
4-Chlorophenyl-phenylether	--	380 U	1900 U	390 U	440 U	410 U
Fluorene	50,000	210 J	1900 U	390 U	440 U	410 U
4-Nitroaniline	--	910 U	4500 U	930 U	1000 U	980 U
4,6-Dinitro-2-methylphenol	--	910 U	4500 U	930 U	1000 U	980 U
N-Nitrosodiphenylamine (1)	--	380 U	1900 U	390 U	440 U	410 U
4-Bromophenyl-phenylether	--	380 U	1900 U	390 U	440 U	410 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-3	CB-3DL	CB-3	CB-4	CB-4
	Sample Depth (ft bls):	0-2	0-2	4-6	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	380 U	1900 U	390 U	440 U	410 U
Pentachlorophenol	1,000	910 U	4500 U	930 U	1000 U	980 U
Phenanthrene	50,000	7200 E	7100 D	390 U	160 J	130 J
Anthracene	50,000	1300	1500 JD	390 U	59 J	52 J
Carbazole	--	1200	1200 JD	390 U	440 U	410 U
Di-n-butylphthalate	8,100	380 U	1900 U	390 U	440 U	410 U
Fluoranthene	50,000	7200 E	6600 D	75 J	290 J	210 J
Pyrene	50,000	6300 E	7300 D	67 J	240 J	140 J
Butylbenzylphthalate	50,000	240 J	1900 U	390 U	440 U	410 U
3,3'-Dichlorobenzidine	--	380 U	1900 U	390 U	440 U	410 U
Benzo (a) anthracene	220	**3800 E**	**3400 D**	390 U	160 J	410 U
Chrysene	400	**4500 E**	**4000 D**	390 U	160 J	410 U
bis(2-Ethylhexyl)phthalate	50,000	160 J	1900 U	390 U	440 U	410 U
Di-n-octylphthalate	50,000	45 J	1900 U	390 U	440 U	410 U
Benzo(b)fluoranthene	1,100	**2500**	**3000 D**	390 U	220 J	94 J
Benzo(k)fluoranthene	1,100	**2400**	1100 JD	390 U	190 J	100 J
Benzo(a)pyrene	61	**3100 E**	**2900 D**	390 U	**150 J**	**82 J**
Indeno(1,2,3-cd)pyrene	3,200	870	1100 JD	390 U	170 J	89 J
Dibenzo(a,h)anthracene	14	**81 J**	**450 JD**	390 U	440 U	410 U
Benzo(g,h,i)perylene	50,000	1100	1400 JD	390 U	180 J	95 J

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-5	CB-5	CB-6	CB-6*	CB-6
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Phenol	30	380 U	430 U	390 U	410 U	400 U
bis(2-Chloroethyl)ether	--	380 U	430 U	390 U	410 U	400 U
2-Chlorophenol	800	380 U	430 U	390 U	410 U	400 U
1,3-Dichlorobenzene	1,600	380 U	430 U	390 U	410 U	400 U
1,4-Dichlorobenzene	8,500	380 U	430 U	390 U	410 U	400 U
1,2-Dichlorobenzene	7,900	380 U	430 U	390 U	410 U	400 U
2-Methylphenol	100	380 U	430 U	390 U	410 U	400 U
2,2'-oxybis(1-Chloropropane)	--	380 U	430 U	390 U	410 U	400 U
4-Methylphenol	900	380 U	430 U	390 U	410 U	400 U
N-Nitroso-di-n-propylamine	--	380 U	430 U	390 U	410 U	400 U
Hexachloroethane	--	380 U	430 U	390 U	410 U	400 U
Nitrobenzene	200	380 U	430 U	390 U	410 U	400 U
Isophorone	--	380 U	430 U	390 U	410 U	400 U
2-Nitrophenol	330	380 U	430 U	390 U	410 U	400 U
2,4-Dimethylphenol	--	380 U	430 U	390 U	410 U	400 U
2,4-Dichlorophenol	400	380 U	430 U	390 U	410 U	400 U
1,2,4-Trichlorobenzene	3,400	380 U	430 U	390 U	410 U	400 U
Naphthalene	13,000	380 U	430 U	390 U	410 U	400 U
4-Chloroaniline	220	380 U	430 U	390 U	410 U	400 U
Hexachlorobutadiene	--	380 U	430 U	390 U	410 U	400 U
bis(2-Chloroethoxy)methane	--	380 U	430 U	390 U	410 U	400 U
4-Chloro-3-Methylphenol	240	380 U	430 U	390 U	410 U	400 U
2-Methylnaphthalene	36,400	380 U	430 U	390 U	410 U	400 U
Hexachlorocyclopentadiene	--	380 U	430 U	390 U	410 U	400 U
2,4,6-Trichlorophenol	--	380 U	430 U	390 U	410 U	400 U
2,4,5-Trichlorophenol	100	920 U	1000 U	940 U	980 U	950 U
2-Chloronaphthalene	--	380 U	430 U	390 U	410 U	400 U
2-Nitroaniline	430	920 U	1000 U	940 U	980 U	950 U
Dimethylphthalate	2,000	380 U	430 U	390 U	410 U	400 U
Acenaphthylene	41,000	380 U	430 U	58 J	60 J	400 U
2,6-Dinitrotoluene	1,000	380 U	430 U	390 U	410 U	400 U
3-Nitroaniline	500	920 U	1000 U	940 U	980 U	950 U
Acenaphthene	50,000	380 U	430 U	150 J	140 J	400 U
2,4-Dinitrophenol	200	920 U	1000 U	940 U	980 U	950 U
4-Nitrophenol	100	920 U	1000 U	940 U	980 U	950 U
Dibenzofuran	6,200	380 U	430 U	73 J	410 U	400 U
2,4-Dinitrotoluene	--	380 U	430 U	390 U	410 U	400 U
Diethylphthalate	7,100	380 U	430 U	390 U	410 U	400 U
4-Chlorophenyl-phenylether	--	380 U	430 U	390 U	410 U	400 U
Fluorene	50,000	380 U	430 U	140 J	120 J	400 U
4-Nitroaniline	--	920 U	1000 U	940 U	980 U	950 U
4,6-Dinitro-2-methylphenol	--	920 U	1000 U	940 U	980 U	950 U
N-Nitrosodiphenylamine (1)	--	380 U	430 U	390 U	410 U	400 U
4-Bromophenyl-phenylether	--	380 U	430 U	390 U	410 U	400 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-5	CB-5	CB-6	CB-6*	CB-6
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	380 U	430 U	390 U	410 U	400 U
Pentachlorophenol	1,000	920 U	1000 U	940 U	980 U	950 U
Phenanthrene	50,000	650	150 J	1400	1500	590
Anthracene	50,000	180 J	430 U	440	380 J	190 J
Carbazole	--	73 J	430 U	120 J	94 J	400 U
Di-n-butylphthalate	8,100	380 U	430 U	390 U	2100	650
Fluoranthene	50,000	1000	180 J	3000	3200	1100
Pyrene	50,000	550	110 J	1400	1700	550
Butylbenzylphthalate	50,000	380 U	430 U	390 U	410 U	400 U
3,3'-Dichlorobenzidine	--	380 U	430 U	390 U	410 U	400 U
Benzo (a) anthracene	220	**440**	75 J	**1100**	**1200**	**430**
Chrysene	400	**490**	120 J	**1200**	**1200**	**430**
bis(2-Ethylhexyl)phthalate	50,000	380 U	430 U	65 J	150 J	310 J
Di-n-octylphthalate	50,000	78 J	44 J	70 J	120 J	280 J
Benzo(b)fluoranthene	1,100	290 J	60 J	770	940	320 J
Benzo(k)fluoranthene	1,100	310 J	52 J	1100	1100	370 J
Benzo(a)pyrene	61	**380 J**	60 J	**1000**	**1100**	**380 J**
Indeno(1,2,3-cd)pyrene	3,200	120 J	430 U	240 J	240 J	91 J
Dibenzo(a,h)anthracene	14	380 U	430 U	390 U	410 U	400 U
Benzo(g,h,i)perylene	50,000	110 J	430 U	210 J	200 J	78 J

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)	CB-7	CB-7	CB-8	CB-8	CB-9
Sample Depth (ft bls):		0-2	2-4	0-2	2-4	0-2
Sample Date:		7/12/95	7/12/95	7/14/95	7/14/95	7/14/95
Phenol	30	400 U	390 U	390 U	410 U	4000 U
bis(2-Chloroethyl)ether	--	400 U	390 U	390 U	410 U	4000 U
2-Chlorophenol	800	400 U	390 U	390 U	410 U	4000 U
1,3-Dichlorobenzene	1,600	400 U	390 U	390 U	410 U	4000 U
1,4-Dichlorobenzene	8,500	400 U	390 U	390 U	410 U	4000 U
1,2-Dichlorobenzene	7,900	400 U	390 U	390 U	410 U	4000 U
2-Methylphenol	100	400 U	390 U	390 U	410 U	4000 U
2,2'-oxybis(1-Chloropropane)	--	400 U	390 U	390 U	410 U	4000 U
4-Methylphenol	900	400 U	390 U	390 U	410 U	4000 U
N-Nitroso-di-n-propylamine	--	400 U	390 U	390 U	410 U	4000 U
Hexachloroethane	--	400 U	390 U	390 U	410 U	4000 U
Nitrobenzene	200	400 U	390 U	390 U	410 U	4000 U
Isophorone	--	400 U	390 U	390 U	410 U	4000 U
2-Nitrophenol	330	400 U	390 U	390 U	410 U	4000 U
2,4-Dimethylphenol	--	400 U	390 U	390 U	410 U	4000 U
2,4-Dichlorophenol	400	400 U	390 U	390 U	410 U	4000 U
1,2,4-Trichlorobenzene	3,400	400 U	390 U	390 U	410 U	4000 U
Naphthalene	13,000	400 U	390 U	390 U	410 U	4000 U
4-Chloroaniline	220	400 U	390 U	390 U	410 U	4000 U
Hexachlorobutadiene	--	400 U	390 U	390 U	410 U	4000 U
bis(2-Chloroethoxy)methane	--	400 U	390 U	390 U	410 U	4000 U
4-Chloro-3-Methylphenol	240	400 U	390 U	390 U	410 U	4000 U
2-Methylnaphthalene	36,400	400 U	390 U	390 U	410 U	4000 U
Hexachlorocyclopentadiene	--	400 U	390 U	390 U	410 U	4000 U
2,4,6-Trichlorophenol	--	400 U	390 U	390 U	410 U	4000 U
2,4,5-Trichlorophenol	100	960 U	930 U	940 U	980 U	9500 U
2-Chloronaphthalene	--	400 U	390 U	390 U	410 U	4000 U
2-Nitroaniline	430	960 U	930 U	940 U	980 U	9500 U
Dimethylphthalate	2,000	400 U	390 U	390 U	410 U	4000 U
Acenaphthylene	41,000	400 U	390 U	390 U	410 U	4000 U
2,6-Dinitrotoluene	1,000	400 U	390 U	390 U	410 U	4000 U
3-Nitroaniline	500	960 U	930 U	940 U	980 U	9500 U
Acenaphthene	50,000	400 U	390 U	390 U	410 U	4000 U
2,4-Dinitrophenol	200	960 U	930 U	940 U	980 U	9500 U
4-Nitrophenol	100	960 U	930 U	940 U	980 U	9500 U
Dibenzofuran	6,200	400 U	390 U	390 U	410 U	4000 U
2,4-Dinitrotoluene	--	400 U	390 U	390 U	410 U	4000 U
Diethylphthalate	7,100	400 U	390 U	390 U	410 U	4000 U
4-Chlorophenyl-phenylether	--	400 U	390 U	390 U	410 U	4000 U
Fluorene	50,000	400 U	390 U	390 U	410 U	4000 U
4-Nitroaniline	--	960 U	930 U	940 U	980 U	9500 U
4,6-Dinitro-2-methylphenol	--	960 U	930 U	940 U	980 U	9500 U
N-Nitrosodiphenylamine (1)	--	400 U	390 U	390 U	410 U	4000 U
4-Bromophenyl-phenylether	--	400 U	390 U	390 U	410 U	4000 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-7	CB-7	CB-8	CB-8	CB-9
Sample Depth (ft bls):		0-2	2-4	0-2	2-4	0-2
Sample Date:		7/12/95	7/12/95	7/14/95	7/14/95	7/14/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	400 U	390 U	390 U	410 U	4000 U
Pentachlorophenol	1,000	960 U	930 U	940 U	980 U	9500 U
Phenanthrene	50,000	570	390 U	580	410 U	13000
Anthracene	50,000	180 J	390 U	150 J	410 U	2900 J
Carbazole	--	400 U	390 U	390 U	410 U	4000 U
Di-n-butylphthalate	8,100	400 U	390 U	390 U	410 U	4000 U
Fluoranthene	50,000	1500	390 U	1400	410 U	16000
Pyrene	50,000	840	390 U	1100	410 U	9600
Butylbenzylphthalate	50,000	400 U	390 U	390 U	410 U	4000 U
3,3'-Dichlorobenzidine	--	400 U	390 U	390 U	410 U	4000 U
Benzo (a) anthracene	220	**720**	390 U	**820**	410 U	**6500**
Chrysene	400	**760**	390 U	**920**	410 U	**7300**
bis(2-Ethylhexyl)phthalate	50,000	400 U	390 U	390 U	410 U	1400 J
Di-n-octylphthalate	50,000	44 J	390 U	390 U	410 U	4000 U
Benzo(b)fluoranthene	1,100	570	390 U	760	410 U	**5700**
Benzo(k)fluoranthene	1,100	490	390 U	250 J	410 U	**1900 J**
Benzo(a)pyrene	61	**610**	**75 J**	**680**	410 U	**4600**
Indeno(1,2,3-cd)pyrene	3,200	170 J	390 U	440	410 U	1300 J
Dibenzo(a,h)anthracene	14	400 U	390 U	**48 J**	410 U	4000 U
Benzo(g,h,i)perylene	50,000	120 J	390 U	540	410 U	1300 J

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-9*	CB-9	CB-10	CB-10DL	CB-10
Sample Depth (ft bls):		0-2	2-4	0-2	0-2	2-4
Sample Date:		7/14/95	7/14/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Phenol	30	7600 U	400 U	380 U	7600 U	370 U
bis(2-Chloroethyl)ether	--	7600 U	400 U	380 U	7600 U	370 U
2-Chlorophenol	800	7600 U	400 U	380 U	7600 U	370 U
1,3-Dichlorobenzene	1,600	7600 U	400 U	380 U	7600 U	370 U
1,4-Dichlorobenzene	8,500	7600 U	400 U	380 U	7600 U	370 U
1,2-Dichlorobenzene	7,900	7600 U	400 U	380 U	7600 U	370 U
2-Methylphenol	100	7600 U	400 U	380 U	7600 U	370 U
2,2'-oxybis(1-Chloropropane)	--	7600 U	400 U	380 U	7600 U	370 U
4-Methylphenol	900	7600 U	400 U	380 U	7600 U	370 U
N-Nitroso-di-n-propylamine	--	7600 U	400 U	380 U	7600 U	370 U
Hexachloroethane	--	7600 U	400 U	380 U	7600 U	370 U
Nitrobenzene	200	7600 U	400 U	380 U	7600 U	370 U
Isophorone	--	7600 U	400 U	380 U	7600 U	370 U
2-Nitrophenol	330	7600 U	400 U	380 U	7600 U	370 U
2,4-Dimethylphenol	--	7600 U	400 U	380 U	7600 U	370 U
2,4-Dichlorophenol	400	7600 U	400 U	380 U	7600 U	370 U
1,2,4-Trichlorobenzene	3,400	7600 U	400 U	380 U	7600 U	370 U
Naphthalene	13,000	7600 U	400 U	1400	7600 U	370 U
4-Chloroaniline	220	7600 U	400 U	380 U	7600 U	370 U
Hexachlorobutadiene	--	7600 U	400 U	380 U	7600 U	370 U
bis(2-Chloroethoxy)methane	--	7600 U	400 U	380 U	7600 U	370 U
4-Chloro-3-Methylphenol	240	7600 U	400 U	380 U	7600 U	370 U
2-Methylnaphthalene	36,400	7600 U	400 U	770	7600 U	370 U
Hexachlorocyclopentadiene	--	7600 U	400 U	380 U	7600 U	370 U
2,4,6-Trichlorophenol	--	7600 U	400 U	380 U	7600 U	370 U
2,4,5-Trichlorophenol	100	18000 U	970 U	910 U	18000 U	900 U
2-Chloronaphthalene	--	7600 U	400 U	380 U	7600 U	370 U
2-Nitroaniline	430	18000 U	970 U	910 U	18000 U	900 U
Dimethylphthalate	2,000	7600 U	400 U	380 U	7600 U	370 U
Acenaphthylene	41,000	7600 U	400 U	840	1700 JD	370 U
2,6-Dinitrotoluene	1,000	7600 U	400 U	380 U	7600 U	370 U
3-Nitroaniline	500	18000 U	970 U	910 U	18000 U	900 U
Acenaphthene	50,000	7600 U	400 U	1600	7600 U	370 U
2,4-Dinitrophenol	200	18000 U	970 U	910 U	18000 U	900 U
4-Nitrophenol	100	18000 U	970 U	910 U	18000 U	900 U
Dibenzofuran	6,200	2800 J	400 U	1700	1800 JD	370 U
2,4-Dinitrotoluene	--	7600 U	400 U	380 U	7600 U	370 U
Diethylphthalate	7,100	7600 U	400 U	380 U	7600 U	370 U
4-Chlorophenyl-phenylether	--	7600 U	400 U	380 U	7600 U	370 U
Fluorene	50,000	7600 U	400 U	2300	2600 JD	370 U
4-Nitroaniline	--	18000 U	970 U	910 U	18000 U	900 U
4,6-Dinitro-2-methylphenol	--	18000 U	970 U	910 U	18000 U	900 U
N-Nitrosodiphenylamine (1)	--	7600 U	400 U	380 U	7600 U	370 U
4-Bromophenyl-phenylether	--	7600 U	400 U	380 U	7600 U	370 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-9*	CB-9	CB-10	CB-10DL	CB-10
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/14/95	7/14/95	7/13/95	7/13/95	7/13/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	7600 U	400 U	380 U	7600 U	370 U
Pentachlorophenol	1,000	18000 U	970 U	910 U	18000 U	900 U
Phenanthrene	50,000	42000	470	21000 E	26000 D	370 U
Anthracene	50,000	9900	100 J	5000 E	6200 JD	370 U
Carbazole	--	7600 U	400 U	2700	3100 JD	370 U
Di-n-butylphthalate	8,100	7600 U	400 U	320 J	7600 U	370 U
Fluoranthene	50,000	45000	690	27000 E	34000 D	220 J
Pyrene	50,000	26000	450	17000 E	16000 D	220 J
Butylbenzylphthalate	50,000	5000 J	400 U	380 U	7600 U	370 U
3,3'-Dichlorobenzidine	--	7600 U	400 U	380 U	7600 U	370 U
Benzo (a) anthracene	220	**17000**	**280 J**	**12000 E**	**15000 D**	140 J
Chrysene	400	**18000**	290 J	**13000 E**	**15000 D**	160 J
bis(2-Ethylhexyl)phthalate	50,000	5500 J	400 U	620	7600 U	370 U
Di-n-octylphthalate	50,000	7600 U	400 U	380 U	7600 U	370 U
Benzo(b)fluoranthene	1,100	**15000**	190 J	**13000 E**	**10000 D**	110 J
Benzo(k)fluoranthene	1,100	**4400 J**	160 J	**8600 E**	**11000 D**	45 J
Benzo(a)pyrene	61	**11000**	**210 J**	**11000 E**	**11000 D**	370 U
Indeno(1,2,3-cd)pyrene	3,200	3200 J	86 J	**4200 E**	**3500 JD**	370 U
Dibenzo(a,h)anthracene	14	7600 U	400 U	380 U	7600 U	370 U
Benzo(g,h,i)perylene	50,000	2700 J	80 J	4100 E	3000 JD	370 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-11	CB-11	CB-12	CB-12DL	CB-12
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	4-6
	Sample Date:	7/14/95	7/14/95	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Phenol	30	6800 U	400 U	400 U	2000 U	400 U
bis(2-Chloroethyl)ether	--	6800 U	400 U	400 U	2000 U	400 U
2-Chlorophenol	800	6800 U	400 U	400 U	2000 U	400 U
1,3-Dichlorobenzene	1,600	6800 U	400 U	400 U	2000 U	400 U
1,4-Dichlorobenzene	8,500	6800 U	400 U	400 U	2000 U	400 U
1,2-Dichlorobenzene	7,900	6800 U	400 U	400 U	2000 U	400 U
2-Methylphenol	100	6800 U	400 U	400 U	2000 U	400 U
2,2'-oxybis(1-Chloropropane)	--	6800 U	400 U	400 U	2000 U	400 U
4-Methylphenol	900	6800 U	400 U	400 U	2000 U	400 U
N-Nitroso-di-n-propylamine	--	6800 U	400 U	400 U	2000 U	400 U
Hexachloroethane	--	6800 U	400 U	400 U	2000 U	400 U
Nitrobenzene	200	6800 U	400 U	400 U	2000 U	400 U
Isophorone	--	6800 U	400 U	400 U	2000 U	400 U
2-Nitrophenol	330	6800 U	400 U	400 U	2000 U	400 U
2,4-Dimethylphenol	--	6800 U	400 U	400 U	2000 U	400 U
2,4-Dichlorophenol	400	6800 U	400 U	400 U	2000 U	400 U
1,2,4-Trichlorobenzene	3,400	6800 U	400 U	400 U	2000 U	400 U
Naphthalene	13,000	6800 U	400 U	200 J	1200 JD	400 U
4-Chloroaniline	220	6800 U	400 U	400 U	2000 U	400 U
Hexachlorobutadiene	--	6800 U	400 U	400 U	2000 U	400 U
bis(2-Chloroethoxy)methane	--	6800 U	400 U	400 U	2000 U	400 U
4-Chloro-3-Methylphenol	240	6800 U	400 U	400 U	2000 U	400 U
2-Methylnaphthalene	36,400	6800 U	400 U	110 J	2000 U	400 U
Hexachlorocyclopentadiene	--	6800 U	400 U	400 U	2000 U	400 U
2,4,6-Trichlorophenol	--	6800 U	400 U	400 U	2000 U	400 U
2,4,5-Trichlorophenol	100	16000 U	950 U	950 U	4800 U	960 U
2-Chloronaphthalene	--	6800 U	400 U	400 U	2000 U	400 U
2-Nitroaniline	430	16000 U	950 U	950 U	4800 U	960 U
Dimethylphthalate	2,000	6800 U	400 U	100 J	2000 U	400 U
Acenaphthylene	41,000	6800 U	400 U	160 J	2000 U	400 U
2,6-Dinitrotoluene	1,000	6800 U	400 U	400 U	2000 U	400 U
3-Nitroaniline	500	16000 U	950 U	950 U	4800 U	960 U
Acenaphthene	50,000	6800 U	400 U	390 J	2000 U	400 U
2,4-Dinitrophenol	200	16000 U	950 U	950 U	4800 U	960 U
4-Nitrophenol	100	16000 U	950 U	950 U	4800 U	960 U
Dibenzofuran	6,200	6800 U	400 U	210 J	2000 U	400 U
2,4-Dinitrotoluene	--	6800 U	400 U	400 U	2000 U	400 U
Diethylphthalate	7,100	6800 U	400 U	400 U	2000 U	400 U
4-Chlorophenyl-phenylether	--	6800 U	400 U	400 U	2000 U	400 U
Fluorene	50,000	6800 U	400 U	310 J	2000 U	400 U
4-Nitroaniline	--	16000 U	950 U	950 U	4800 U	960 U
4,6-Dinitro-2-methylphenol	--	16000 U	950 U	950 U	4800 U	960 U
N-Nitrosodiphenylamine (1)	--	6800 U	400 U	400 U	2000 U	400 U
4-Bromophenyl-phenylether	--	6800 U	400 U	400 U	2000 U	400 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-11	CB-11	CB-12	CB-12DL	CB-12
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	4-6
	Sample Date:	7/14/95	7/14/95	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Hexachlorobenzene	410	6800 U	400 U	400 U	2000 U	400 U
Pentachlorophenol	1,000	16000 U	950 U	950 U	4800 U	960 U
Phenanthrene	50,000	39000	780	5800 E	3600 D	400 U
Anthracene	50,000	7600	140 J	900	800 JD	400 U
Carbazole	--	3500 JB	400 U	380 J	2000 U	400 U
Di-n-butylphthalate	8,100	6800 U	400 U	420	2000 U	400 U
Fluoranthene	50,000	35000	1000	5600 E	3400 D	400 U
Pyrene	50,000	24000	660	4400 E	2500 D	400 U
Butylbenzylphthalate	50,000	6800 U	400 U	400 U	2000 U	400 U
3,3'-Dichlorobenzidine	--	6800 U	400 U	400 U	2000 U	400 U
Benzo (a) anthracene	220	**14000**	**450**	**2900**	**1600 JD**	400 U
Chrysene	400	**17000**	**510**	**3200 E**	**1800 JD**	400 U
bis(2-Ethylhexyl)phthalate	50,000	5100 J	400 U	220 J	2000 U	400 U
Di-n-octylphthalate	50,000	6800 U	400 U	160 J	2000 U	400 U
Benzo(b)fluoranthene	1,100	**8500**	310 J	**1800**	1100 JD	400 U
Benzo(k)fluoranthene	1,100	**7000**	280 J	**1200**	530 JD	400 U
Benzo(a)pyrene	61	**10000**	**320 J**	**2200**	**1000 JD**	400 U
Indeno(1,2,3-cd)pyrene	3,200	**4400 J**	190 J	1100	400 JD	400 U
Dibenzo(a,h)anthracene	14	**1400 J**	400 U	**87 J**	2000 U	400 U
Benzo(g,h,i)perylene	50,000	4900 J	180 J	1200	410 JD	400 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-13	CB-13DL	CB-13
	Sample Depth (ft bls):	0-2	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)			
Phenol	30	400 U	810 U	390 U
bis(2-Chloroethyl)ether	--	400 U	810 U	390 U
2-Chlorophenol	800	400 U	810 U	390 U
1,3-Dichlorobenzene	1,600	400 U	810 U	390 U
1,4-Dichlorobenzene	8,500	400 U	810 U	390 U
1,2-Dichlorobenzene	7,900	400 U	810 U	390 U
2-Methylphenol	100	400 U	810 U	390 U
2,2'-oxybis(1-Chloropropane)	--	400 U	810 U	390 U
4-Methylphenol	900	400 U	810 U	390 U
N-Nitroso-di-n-propylamine	--	400 U	810 U	390 U
Hexachloroethane	--	400 U	810 U	390 U
Nitrobenzene	200	400 U	810 U	390 U
Isophorone	--	400 U	810 U	390 U
2-Nitrophenol	330	400 U	810 U	390 U
2,4-Dimethylphenol	--	400 U	810 U	390 U
2,4-Dichlorophenol	400	400 U	810 U	390 U
1,2,4-Trichlorobenzene	3,400	400 U	810 U	390 U
Naphthalene	13,000	110 J	810 U	390 U
4-Chloroaniline	220	400 U	810 U	390 U
Hexachlorobutadiene	--	400 U	810 U	390 U
bis(2-Chloroethoxy)methane	--	400 U	810 U	390 U
4-Chloro-3-Methylphenol	240	400 U	810 U	390 U
2-Methylnaphthalene	36,400	400 U	810 U	390 U
Hexachlorocyclopentadiene	--	400 U	810 U	390 U
2,4,6-Trichlorophenol	--	400 U	810 U	390 U
2,4,5-Trichlorophenol	100	970 U	1900 U	930 U
2-Chloronaphthalene	--	400 U	810 U	390 U
2-Nitroaniline	430	970 U	1900 U	930 U
Dimethylphthalate	2,000	400 U	810 U	390 U
Acenaphthylene	41,000	82 J	810 U	390 U
2,6-Dinitrotoluene	1,000	400 U	810 U	390 U
3-Nitroaniline	500	970 U	1900 U	930 U
Acenaphthene	50,000	140 J	810 U	390 U
2,4-Dinitrophenol	200	970 U	1900 U	930 U
4-Nitrophenol	100	970 U	1900 U	930 U
Dibenzofuran	6,200	110 J	810 U	390 U
2,4-Dinitrotoluene	--	400 U	810 U	390 U
Diethylphthalate	7,100	400 U	810 U	390 U
4-Chlorophenyl-phenylether	--	400 U	810 U	390 U
Fluorene	50,000	120 J	810 U	390 U
4-Nitroaniline	--	970 U	1900 U	930 U
4,6-Dinitro-2-methylphenol	--	970 U	1900 U	930 U
N-Nitrosodiphenylamine (1)	--	400 U	810 U	390 U
4-Bromophenyl-phenylether	--	400 U	810 U	390 U

Table 2. Summary of Semivolatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-13	CB-13DL	CB-13
	Sample Depth (ft bls):	0-2	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95
Semivolatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)			
Hexachlorobenzene	410	400 U	810 U	390 U
Pentachlorophenol	1,000	970 U	1900 U	930 U
Phenanthrene	50,000	2000	2300 D	440
Anthracene	50,000	460	600 JD	83 J
Carbazole	--	230 J	260 JD	390 U
Di-n-butylphthalate	8,100	1000	1400 D	390 U
Fluoranthene	50,000	3400 E	3900 D	480
Pyrene	50,000	1200	1400 D	260 J
Butylbenzylphthalate	50,000	400 U	810 U	390 U
3,3'-Dichlorobenzidine	--	400 U	810 U	390 U
Benzo (a) anthracene	220	**1200**	**1400 D**	200 J
Chrysene	400	**1400**	**1700 D**	220 J
bis(2-Ethylhexyl)phthalate	50,000	210 J	290 JD	49 J
Di-n-octylphthalate	50,000	44 J	810 U	43 J
Benzo(b)fluoranthene	1,100	900	**1500 D**	150 J
Benzo(k)fluoranthene	1,100	740	990 D	99 J
Benzo(a)pyrene	61	**920**	**1100 D**	**150 J**
Indeno(1,2,3-cd)pyrene	3,200	270 J	310 JD	62 J
Dibenzo(a,h)anthracene	14	400 U	810 U	390 U
Benzo(g,h,i)perylene	50,000	240 J	270 JD	63 J

µg/kg - Micrograms per kilogram
ft bls - Feet below land surface
NYSDEC - New York State Department of Environmental Conservation
RSCOs - Recommended Soil Cleanup Objectives
U - Indicates compound not detected
J - Estimated value
B - Analyte detected in associated blank sample
E - Exceeds calibration range
D, DL - Sample diluted
* - Field duplicate
Boldface - Data highlighted in bold represent results detected above the NYSDEC RSCOs.

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-1	CB-1	CB-2	CB-2	CB-3
	Sample Depth (ft bls):	0-2	2-4	0-2	2-4	0-2
	Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Chloromethane	--	12 U	13 U	12 U	11 U	11 U
Bromomethane	--	12 U	13 U	12 U	11 U	11 U
Vinyl Chloride	200	12 U	13 U	12 U	11 U	11 U
Chloroethane	1,900	12 U	13 U	12 U	11 U	11 U
Methylene Chloride	100	12 JB	5 JB	6 JB	6 JB	5 JB
Acetone	200	7 J	17	5 J	29	28
Carbon Disulfide	2,700	12 U	13 U	12 U	3 J	11 U
1,1-Dichloroethene	400	12 U	13 U	12 U	11 U	11 U
1,1-Dichloroethane	200	12 U	13 U	12 U	11 U	11 U
1,2-Dichloroethene (total)	300	12 U	13 U	12 U	11 U	11 U
Chloroform	300	12 U	13 U	12 U	11 U	11 U
1,2-Dichloroethane	100	12 U	13 U	12 U	11 U	11 U
2-Butanone	300	12 U	13 U	12 U	5 J	11 U
1,1,1-Trichloroethane	800	12 U	13 U	12 U	11 U	11 U
Carbon Tetrachloride	600	12 U	13 U	12 U	11 U	11 U
Bromodichloromethane	--	12 U	13 U	12 U	11 U	11 U
1,2-Dichloropropane	--	12 U	13 U	12 U	11 U	11 U
cis-1,3-Dichloropropene	--	12 U	13 U	12 U	11 U	11 U
Trichloroethene	700	12 U	13 U	12 U	11 U	11 U
Dibromochloromethane	--	12 U	13 U	12 U	11 U	11 U
1,1,2-Trichloroethane	--	12 U	13 U	12 U	11 U	11 U
Benzene	60	12 U	13 U	12 U	11 U	11 U
trans-1,3-Dichloropropene	--	12 U	13 U	12 U	11 U	11 U
Bromoform	--	12 U	13 U	12 U	11 U	11 U
4-Methyl-2-pentanone	1,000	12 U	13 U	12 U	11 U	11 U
2-Hexanone	--	12 U	13 U	12 U	11 U	11 U
Tetrachloroethene	1,400	12 U	13 U	12 U	11 U	11 U
1,1,2,2-Tetrachloroethane	60	12 U	13 U	12 U	11 U	11 U
Toluene	1,500	12 U	13 U	12 U	11 U	11 U
Chlorobenzene	1,700	12 U	13 U	12 U	11 U	11 U
Ethylbenzene	5,500	12 U	13 U	12 U	11 U	11 U
Styrene	--	12 U	13 U	12 U	11 U	11 U
Xylene (total)	1,200	12 U	13 U	12 U	11 U	11 U

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-3	CB-4	CB-4	CB-5	CB-5
	Sample Depth (ft bls):	4-6	0-2	2-4	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/12/95	7/12/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Chloromethane	--	12 U	13 U	12 U	11 U	13 U
Bromomethane	--	12 U	13 U	12 U	11 U	13 U
Vinyl Chloride	200	12 U	13 U	12 U	11 U	13 U
Chloroethane	1,900	12 U	13 U	12 U	11 U	13 U
Methylene Chloride	100	6 JB	5 JB	3 JB	2 JB	7 JB
Acetone	200	28	13 U	12 U	19	36
Carbon Disulfide	2,700	7 J	13 U	12 U	11 U	13 U
1,1-Dichloroethene	400	12 U	13 U	12 U	11 U	13 U
1,1-Dichloroethane	200	12 U	13 U	12 U	11 U	2 J
1,2-Dichloroethene (total)	300	12 U	13 U	12 U	3 J	7 J
Chloroform	300	12 U	13 U	12 U	3 J	2 J
1,2-Dichloroethane	100	12 U	13 U	12 U	11 U	13 U
2-Butanone	300	19	13 U	12 U	11 U	13 U
1,1,1-Trichloroethane	800	12 U	13 U	12 U	11 U	13 U
Carbon Tetrachloride	600	12 U	13 U	12 U	11 U	13 U
Bromodichloromethane	--	12 U	13 U	12 U	11 U	13 U
1,2-Dichloropropane	--	12 U	13 U	12 U	11 U	13 U
cis-1,3-Dichloropropene	--	12 U	13 U	12 U	11 U	13 U
Trichloroethene	700	12 U	13 U	12 U	11 U	13 U
Dibromochloromethane	--	12 U	13 U	12 U	11 U	13 U
1,1,2-Trichloroethane	--	12 U	13 U	12 U	11 U	13 U
Benzene	60	12 U	13 U	12 U	11 U	13 U
trans-1,3-Dichloropropene	--	12 U	13 U	12 U	11 U	13 U
Bromoform	--	12 U	13 U	12 U	11 U	13 U
4-Methyl-2-pentanone	1,000	12 U	13 U	12 U	11 U	13 U
2-Hexanone	--	12 U	13 U	12 U	11 U	13 U
Tetrachloroethene	1,400	12 U	13 U	12 U	11 U	6 J
1,1,2,2-Tetrachloroethane	60	12 U	13 U	12 U	11 U	13 U
Toluene	1,500	12 U	13 U	12 U	11 U	13 U
Chlorobenzene	1,700	12 U	13 U	12 U	11 U	13 U
Ethylbenzene	5,500	12 U	13 U	12 U	11 U	13 U
Styrene	--	12 U	13 U	12 U	11 U	13 U
Xylene (total)	1,200	12 U	13 U	12 U	11 U	13 U

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-6	CB-6*	CB-6	CB-7	CB-7
Sample Depth (ft bls):		0-2	0-2	2-4	0-2	2-4
Sample Date:		7/12/95	7/12/95	7/12/95	7/12/95	7/12/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Chloromethane	--	12 U	180	12 U	12 U	50
Bromomethane	--	12 U	12 U	12 U	12 U	12 U
Vinyl Chloride	200	12 U	12 U	12 U	12 U	12 U
Chloroethane	1,900	12 U	12 U	12 U	12 U	12 U
Methylene Chloride	100	6 JB	8 JB	6 JB	5 JB	4 JB
Acetone	200	4 J	6 J	28	3 J	15
Carbon Disulfide	2,700	12 U	12 U	12 U	12 U	12 U
1,1-Dichloroethene	400	12 U	12 U	12 U	12 U	12 U
1,1-Dichloroethane	200	12 U	26	12 U	12 U	12 U
1,2-Dichloroethene (total)	300	12 U	12 U	6 J	12 U	12 U
Chloroform	300	5 J	37	2 J	12 U	12 U
1,2-Dichloroethane	100	12 U	12 U	12 U	12 U	12 U
2-Butanone	300	12 U	12 U	6 J	12 U	12 U
1,1,1-Trichloroethane	800	12 U	36	12 U	12 U	12 U
Carbon Tetrachloride	600	12 U	12 U	12 U	12 U	12 U
Bromodichloromethane	--	12 U	12 U	12 U	12 U	12 U
1,2-Dichloropropane	--	12 U	12 U	12 U	12 U	12 U
cis-1,3-Dichloropropene	--	12 U	12 U	12 U	12 U	12 U
Trichloroethene	700	12 U	12 U	12 U	12 U	12 U
Dibromochloromethane	--	12 U	12 U	12 U	12 U	12 U
1,1,2-Trichloroethane	--	12 U	12 U	12 U	12 U	12 U
Benzene	60	12 U	12 U	12 U	12 U	12 U
trans-1,3-Dichloropropene	--	12 U	12 U	12 U	12 U	12 U
Bromoform	--	12 U	12 U	12 U	12 U	12 U
4-Methyl-2-pentanone	1,000	12 U	12 U	12 U	12 U	12 U
2-Hexanone	--	12 U	12 U	12 U	12 U	12 U
Tetrachloroethene	1,400	1 J	12 U	4 J	12 U	12 U
1,1,2,2-Tetrachloroethane	60	12 U	12 U	12 U	12 U	12 U
Toluene	1,500	12 U	12 U	2 J	12 U	12 U
Chlorobenzene	1,700	12 U	12 U	12 U	12 U	12 U
Ethylbenzene	5,500	12 U	12 U	12 U	12 U	12 U
Styrene	--	12 U	12 U	12 U	12 U	12 U
Xylene (total)	1,200	12 U	12 U	12 U	12 U	12 U

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-8	CB-8	CB-9	CB-9*	CB-9
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/14/95	7/14/95	7/14/95	7/14/95	7/14/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Chloromethane	--	12 U	12 U	12 U	11 U	12 U
Bromomethane	--	12 U	12 U	12 U	11 U	12 U
Vinyl Chloride	200	12 U	12 U	12 U	11 U	12 U
Chloroethane	1,900	12 U	12 U	12 U	11 U	12 U
Methylene Chloride	100	5 JB	5 JB	12 B	6 JB	10 JB
Acetone	200	12 U	12 J	9 J	11 U	19
Carbon Disulfide	2,700	12 U	4 J	12 U	11 U	12 U
1,1-Dichloroethene	400	12 U	12 U	12 U	11 U	12 U
1,1-Dichloroethane	200	12 U	12 U	12 U	11 U	12 U
1,2-Dichloroethene (total)	300	12 U	12 U	12 U	11 U	12 U
Chloroform	300	2 J	12 U	3 J	11 U	12 U
1,2-Dichloroethane	100	12 U	12 U	12 U	11 U	12 U
2-Butanone	300	12 U	5 J	12 U	11 U	4 J
1,1,1-Trichloroethane	800	12 U	12 U	12 U	11 U	12 U
Carbon Tetrachloride	600	12 U	12 U	12 U	11 U	12 U
Bromodichloromethane	--	12 U	12 U	12 U	11 U	12 U
1,2-Dichloropropane	--	12 U	12 U	12 U	11 U	12 U
cis-1,3-Dichloropropene	--	12 U	12 U	12 U	11 U	12 U
Trichloroethene	700	12 U	12 U	3 J	11 U	12 U
Dibromochloromethane	--	12 U	12 U	12 U	11 U	12 U
1,1,2-Trichloroethane	--	12 U	12 U	12 U	11 U	12 U
Benzene	60	12 U	12 U	12 U	2 JB	12 U
trans-1,3-Dichloropropene	--	12 U	12 U	12 U	11 U	12 U
Bromoform	--	12 U	12 U	12 U	11 U	12 U
4-Methyl-2-pentanone	1,000	12 U	12 U	12 U	11 U	12 U
2-Hexanone	--	12 U	12 U	12 U	11 U	12 U
Tetrachloroethene	1,400	12 U	12 U	12 U	11 U	12 U
1,1,2,2-Tetrachloroethane	60	12 U	12 U	12 U	11 U	12 U
Toluene	1,500	12 U	12 U	12 U	1 JB	12 U
Chlorobenzene	1,700	7 J	12 U	12 U	11 U	12 U
Ethylbenzene	5,500	12 U	12 U	12 U	11 U	12 U
Styrene	--	12 U	12 U	12 U	11 U	12 U
Xylene (total)	1,200	12 U	12 U	12 U	2 J	12 U

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-10	CB-10	CB-11	CB-11	CB-12
Sample Depth (ft bls):		0-2	2-4	0-2	2-4	0-2
Sample Date:		7/13/95	7/13/95	7/14/95	7/14/95	7/12/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)					
Chloromethane	--	11 U	11 U	10 U	12 U	11 U
Bromomethane	--	11 U	11 U	10 U	12 U	11 U
Vinyl Chloride	200	11 U	11 U	10 U	12 U	11 U
Chloroethane	1,900	11 U	11 U	10 U	12 U	11 U
Methylene Chloride	100	5 JB	10 JB	5 JB	4 JB	3 JB
Acetone	200	11 U	6 J	12	8 J	11 U
Carbon Disulfide	2,700	11 U	11 U	10 U	8 U	11 U
1,1-Dichloroethene	400	11 U	11 U	10 U	12 U	11 U
1,1-Dichloroethane	200	11 U	11 U	10 U	12 U	11 U
1,2-Dichloroethene (total)	300	11 U	11 U	10 U	12 U	11 U
Chloroform	300	11 U	11 U	10 U	12 U	11 U
1,2-Dichloroethane	100	11 U	11 U	10 U	12 U	11 U
2-Butanone	300	11 U	11 U	5 J	12 U	11 U
1,1,1-Trichloroethane	800	11 U	11 U	10 U	12 U	11 U
Carbon Tetrachloride	600	11 U	11 U	10 U	12 U	11 U
Bromodichloromethane	--	11 U	11 U	10 U	12 U	11 U
1,2-Dichloropropane	--	11 U	11 U	10 U	12 U	11 U
cis-1,3-Dichloropropene	--	11 U	11 U	10 U	12 U	11 U
Trichloroethene	700	11 U	11 U	10 U	12 U	11 U
Dibromochloromethane	--	11 U	11 U	10 U	12 U	11 U
1,1,2-Trichloroethane	--	11 U	11 U	10 U	12 U	11 U
Benzene	60	11 U	11 U	10 U	12 U	11 U
trans-1,3-Dichloropropene	--	11 U	11 U	10 U	12 U	11 U
Bromoform	--	11 U	11 U	10 U	12 U	11 U
4-Methyl-2-pentanone	1,000	11 U	11 U	11	12 U	11 U
2-Hexanone	--	11 U	11 U	10 U	12 U	11 U
Tetrachloroethene	1,400	11 U	11 U	2 J	12 U	11 U
1,1,2,2-Tetrachloroethane	60	11 U	11 U	10 U	12 U	11 U
Toluene	1,500	11 U	11 U	1 J	12 U	11 U
Chlorobenzene	1,700	11 U	11 U	10 U	12 U	11 U
Ethylbenzene	5,500	11 U	11 U	10 U	12 U	11 U
Styrene	--	11 U	11 U	10 U	12 U	11 U
Xylene (total)	1,200	11 U	11 U	10 U	12 U	11 U

Table 3. Summary of Volatile Organic Compounds Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-12	CB-13	CB-13
Sample Depth (ft bls):		2-4	0-2	2-4
Sample Date:		7/12/95	7/12/95	7/12/95
Volatile Organic Compounds (Concentrations in µg/kg)	NYSDEC RSCOs (µg/kg)			
Chloromethane	--	12 U	11 U	12 U
Bromomethane	--	12 U	11 U	12 U
Vinyl Chloride	200	12 U	11 U	12 U
Chloroethane	1,900	12 U	11 U	12 U
Methylene Chloride	100	4 JB	6 JB	4 JB
Acetone	200	5 J	9 J	15
Carbon Disulfide	2,700	12 U	11 U	12 U
1,1-Dichloroethene	400	12 U	11 U	12 U
1,1-Dichloroethane	200	12 U	11 U	12 U
1,2-Dichloroethene (total)	300	12 U	8 J	12 U
Chloroform	300	12 U	11 U	12 U
1,2-Dichloroethane	100	12 U	11 U	12 U
2-Butanone	300	12 U	11 U	12 U
1,1,1-Trichloroethane	800	12 U	11 U	12 U
Carbon Tetrachloride	600	12 U	11 U	12 U
Bromodichloromethane	--	12 U	11 U	12 U
1,2-Dichloropropane	--	12 U	11 U	12 U
cis-1,3-Dichloropropene	--	12 U	11 U	12 U
Trichloroethene	700	12 U	2 J	12 U
Dibromochloromethane	--	12 U	11 U	12 U
1,1,2-Trichloroethane	--	12 U	11 U	12 U
Benzene	60	12 U	11 U	12 U
trans-1,3-Dichloropropene	--	12 U	11 U	12 U
Bromoform	--	12 U	11 U	12 U
4-Methyl-2-pentanone	1,000	12 U	11 U	12 U
2-Hexanone	--	12 U	11 U	12 U
Tetrachloroethene	1,400	12 U	7 J	12 U
1,1,2,2-Tetrachloroethane	60	12 U	11 U	12 U
Toluene	1,500	12 U	11 U	12 U
Chlorobenzene	1,700	12 U	11 U	12 U
Ethylbenzene	5,500	12 U	11 U	12 U
Styrene	--	12 U	11 U	12 U
Xylene (total)	1,200	12 U	11 U	12 U

µg/kg - Micrograms per kilogram
ft bls - Feet below land surface
NYSDEC - New York State Department of Environmental Conservation
RSCOs - Recommended Soil Cleanup Objectives
U - Indicates compound not detected
J - Estimated value
B - Analyte detected in associated blank sample
* - Field duplicate

Table 4. Summary of pH and Total Organic Carbon Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:	CB-1	CB-1	CB-2	CB-2	CB-3	CB-3	CB-4	CB-4
Sample Depth (ft bls):	0-2	2-4	0-2	2-4	0-2	4-6	0-2	2-4
Sample Date:	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Parameter								
pH (standard units)	5.73	5.91	6.17	6.31	6.22	6.12	5.67	6.21
Total Organic Carbon (mg/kg)	26,300	9,090	4,130	5,710	25,190	710	21,220	28,800

Sample Designation:	CB-5	CB-5	CB-6	CB-6*	CB-6	CB-7	CB-7	CB-8
Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4	0-2	2-4	0-2
Sample Date:	7/12/95	7/12/95	7/12/95	7/12/95	7/12/95	7/12/95	7/12/95	7/14/95
Parameter								
pH (standard units)	8.50	7.52	8.50	8.00	7.49	7.51	7.03	6.72
Total Organic Carbon (mg/kg)	33,850	207,000	33,000	11,500	61,450	183,000	780	35,800

Sample Designation:	CB-8	CB-9	CB-9*	CB-9	CB-10	CB-10	CB-11	CB-11
Sample Depth (ft bls):	2-4	0-2	0-2	2-4	0-2	2-4	0-2	2-4
Sample Date:	7/14/95	7/14/95	7/14/95	7/14/95	7/13/95	7/13/95	7/14/95	7/14/95
Parameter								
pH (standard units)	6.53	6.17	6.23	6.21	5.98	6.30	6.41	7.03
Total Organic Carbon (mg/kg)	19,800	22,200	6,700	10,100	28,800	1,700	58,800	9,830

Sample Designation:	CB-12	CB-12	CB-13	CB-13
Sample Depth (ft bls):	0-2	4-6	0-2	2-4
Sample Date:	7/12/95	7/12/95	7/12/95	7/12/95
Parameter				
pH (standard units)	7.00	6.51	8.02	8.01
Total Organic Carbon (mg/kg)	35,500	2,040	36,500	32,900

ft bls - Feet below land surface
mg/kg - Milligrams per kilogram
* - Field duplicate

Table 5. Summary of Semivolatile Organic Compounds Previously Detected in Perched Ground Water During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation: Sample Date:	CB-2 7/13/95	CB-10 7/14/95
Semivolatile Organic Compounds (Concentrations in µg/L)		
Phenol	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
2-Methylphenol	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 U	10 U
4-Methylphenol	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitrophenol	10 U	10 U
2,4-Dimethylphenol	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 U	10 U
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U
2-Chloronaphthalene	10 U	10 U
2-Nitroaniline	25 U	25 U
Dimethylphthalate	10 U	10 U
Acenaphthylene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	25 U	25 U
Acenaphthene	10 U	10 U
2,4-Dinitrophenol	25 U	25 U
4-Nitrophenol	25 U	25 U
Dibenzofuran	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethylphthalate	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U
Fluorene	10 U	10 U
4-Nitroaniline	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U

Table 5. Summary of Semivolatile Organic Compounds Previously Detected in Perched Ground Water During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation: Sample Date:	CB-2 7/13/95	CB-10 7/14/95
Semivolatile Organic Compounds (Concentrations in µg/L)		
N-Nitrosodiphenylamine (1)	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U
Hexachlorobenzene	10 U	10 U
Pentachlorophenol	25 U	25 U
Phenanthrene	10 U	10 U
Anthracene	10 U	10 U
Carbazole	10 U	10 U
Di-n-butylphthalate	10 U	10 U
Fluoranthene	10 U	10 U
Pyrene	10 U	10 U
Butylbenzylphthalate	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U
Benzo (a) anthracene	10 U	10 U
Chrysene	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U
Di-n-octylphthalate	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Dibenzo(a,h)anthracene	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U

µg/L - Micrograms per liter
U - Indicates compound not detected

Table 6. Summary of Metals Previously Detected in Perched Ground Water During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation: Sample Date:	CB-2 7/13/95	CB-10 7/14/95
Metals (Concentrations in µg/L)		
Aluminum	55,300	183,000
Antimony	166	119
Arsenic	226	909
Barium	1,470	2,170
Beryllium	2.3 B	8.8
Cadmium	31.4	23.4
Calcium	635,000	2,230,000
Chromium	236	1,670
Cobalt	171	413
Copper	5,190	2,970
Iron	65,400	338,000
Lead	17,900	25,100
Magnesium	46,600	105,000
Manganese	2,670	8,180
Mercury	3,560	5,900
Nickel	470	482
Potassium	72,300	156,000
Selenium	17.9	43.4
Silver	10.6	327
Sodium	176,000	473,000
Thallium	14.2	33.5
Vanadium	153	475
Zinc	8,450	22,800

µg/L - Micrograms per liter
B - Estimated value

Table 7. Summary of Volatile Organic Compounds Previously Detected in Perched Ground Water During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:	CB-2	CB-10	CB-12
Sample Date:	7/13/95	7/14/95	7/12/95
Volatile Organic Compounds (Concentrations in µg/L)			
Chloromethane	1.0 U	1.0 U	1.0 U
Bromomethane	1.0 U	1.0 U	1.0 U
Vinyl Chloride	1.0 U	1.0 U	1.0 U
Chloroethane	1.0 U	1.0 U	**1.0 J**
Methylene Chloride	**1.1 JB**	**1.1 JB**	**0.3 J**
Acetone	**4.2 JB**	**5.6 B**	**17.0**
Carbon Disulfide	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	1.0 U	1.0 U	**0.2 J**
1,1-Dichloroethane	1.0 U	1.0 U	**4.0**
cis-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U
Chloroform	**0.8 J**	**0.6 J**	**0.6 J**
1,2-Dichloroethane	1.0 U	1.0 U	**1.0**
2-Butanone	5.0 U	5.0 U	5.0 U
Bromochloromethane	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	1.0 U	1.0 U	1.0 U
Bromodichloromethane	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U
Trichloroethene	1.0 U	1.0 U	1.0 U
Dibromochloromethane	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	1.0 U	1.0 U	1.0 U
Benzene	1.0 U	**0.3 J**	**0.3 J**
trans-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U
Bromoform	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5.0 U	5.0 U
Tetrachloroethene	1.0 U	**0.6 J**	1.0 U
1,1,2,2-Tetrachloroethane	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	1.0 U	1.0 U	1.0 U
Toluene	**0.2 J**	**0.4 J**	1.0 U
Chlorobenzene	1.0 U	1.0 U	1.0 U
Ethylbenzene	1.0 U	1.0 U	1.0 U
Styrene	1.0 U	1.0 U	1.0 U
Xylene (total)	**0.3 J**	**0.6 J**	1.0 U
1,3-Dichlorobenzene	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	1.0 U	1.0 U	1.0 U

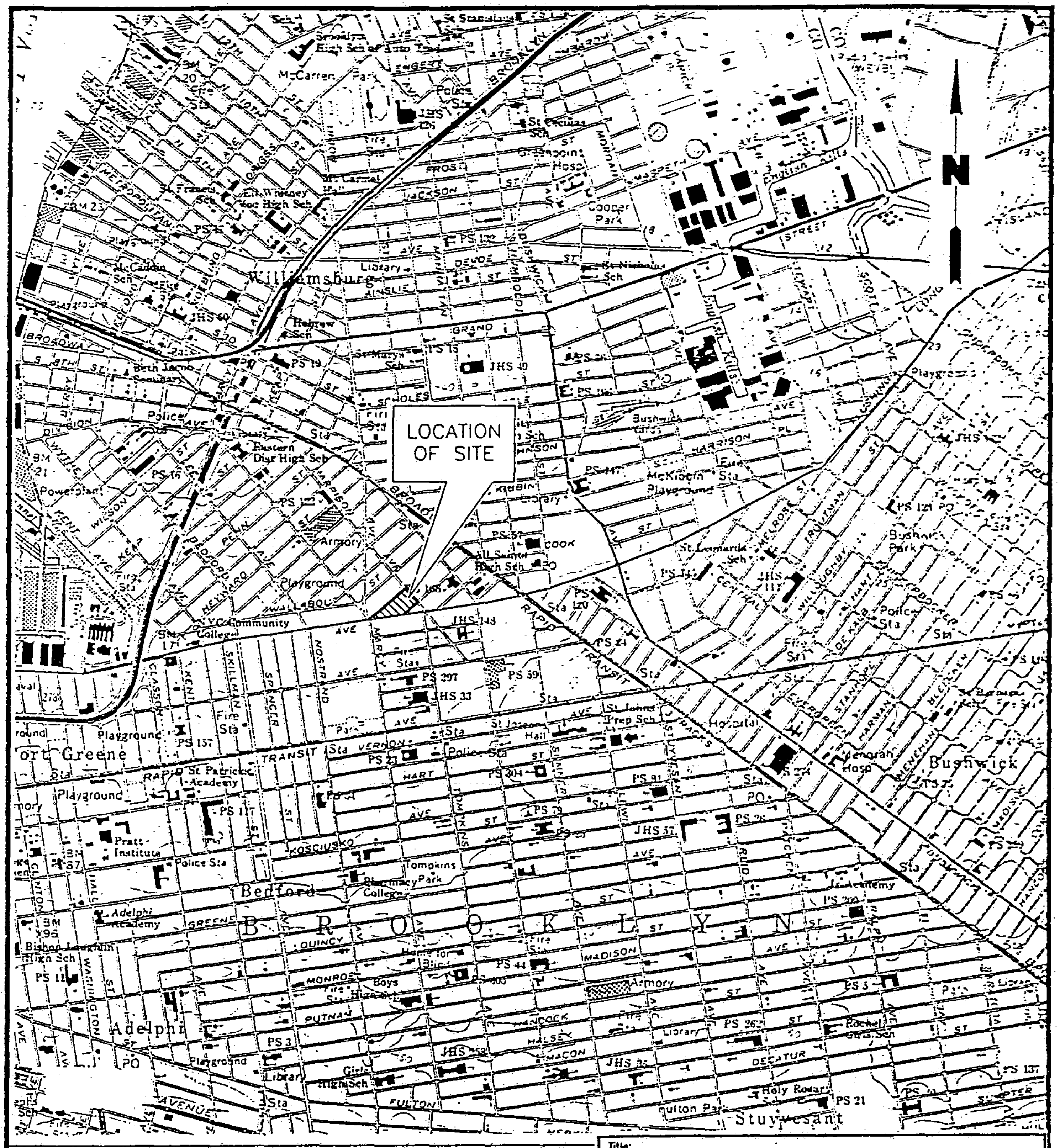
µg/L - Micrograms per liter
U - Indicates compound not detected
J - Estimated value
B - Analyte detected in associated blank sample

Table 8. Summary of pH and Total Organic Carbon Previously Detected in Perched Ground Water During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:	CB-2	CB-10
Sample Date:	7/13/95	7/14/95
Parameter		
pH (standard units)	7.89	8.16
Total Organic Carbon (mg/L)	16.1	80.8

mg/L - Milligrams per liter

FIGURES



SOURCE: USGS BROOKLYN, NY QUADRANGLE, 1979
7.5 MINUTE SERIES TOPOGRAPHIC

Title:

SITE LOCATION MAP

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:

PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: L.M.	Date: 11/95	FIGURE
Prepared by: R.K.	Scale: 1" =2000'	1
Project Mgr: S.J.G.	Revision:	
Project: 04744Y05		

EXPLANATION

PW-1 ■ LOCATION AND DESIGNATION OF FORMER PFIZER PRODUCTION WELL

DW-10 □ LOCATION AND DESIGNATION OF FORMER PFIZER DIFFUSION WELL

— — — OUTLINE OF FORMER BUILDING

▨ AREA OF CITRIC BLOCK

Title:

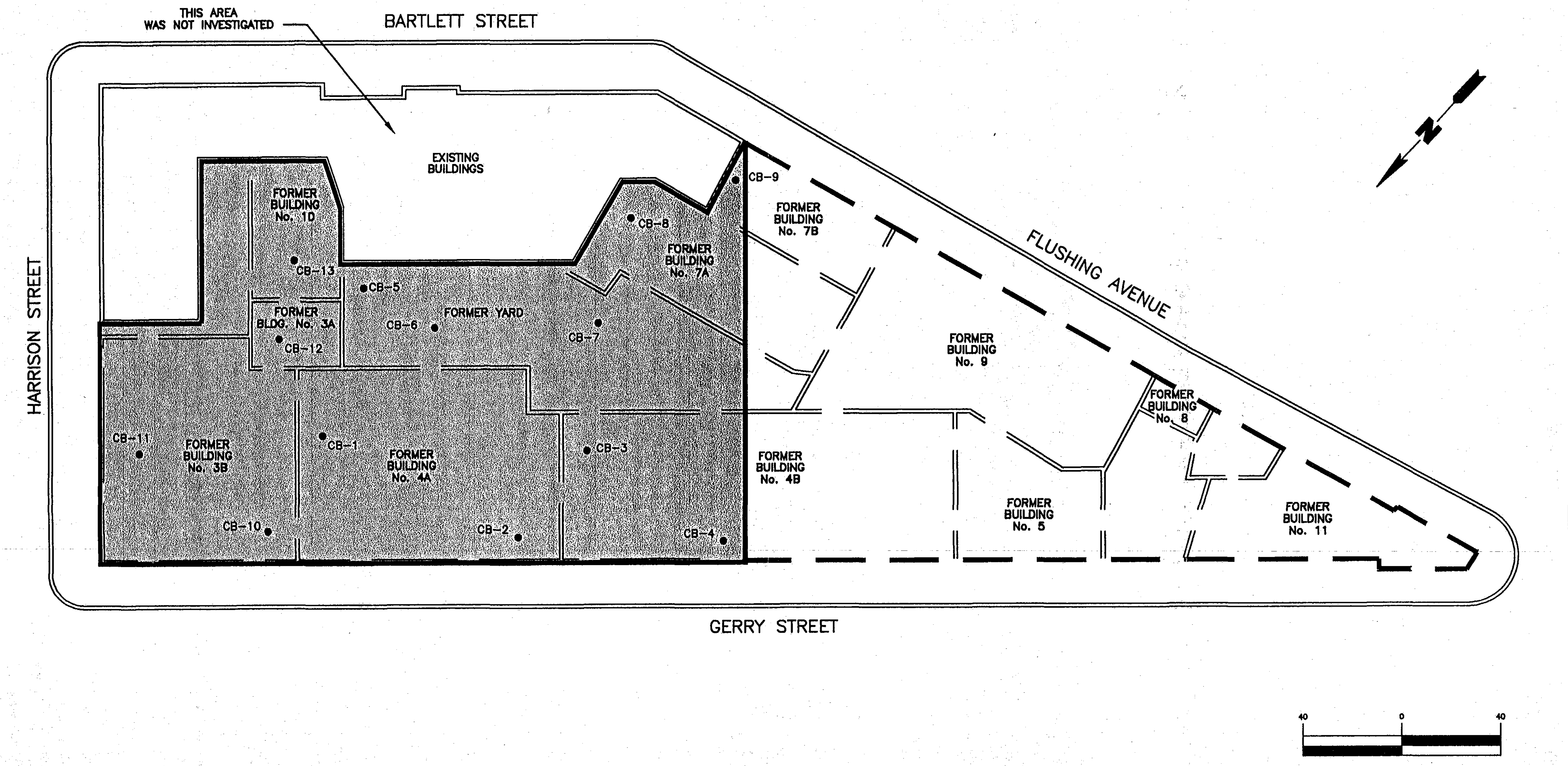
LOCATION OF CITRIC BLOCK

CITRIC BLOCK RI WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Consulting Ground-Water Geologists & Engineers

Compiled by: L.M.	Date: 11/95	FIGURE
Prepared by: R.K.	Scale: SHOWN	2
Project Mgr: S.J.G.	Revision:	
File No: 04744054	Project: 04744Y03	



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORINGS

▨ AREA OF PREVIOUS INVESTIGATION

NOTE: BUILDING DEMOLITION WAS
COMPLETED BY AUGUST, 1995.

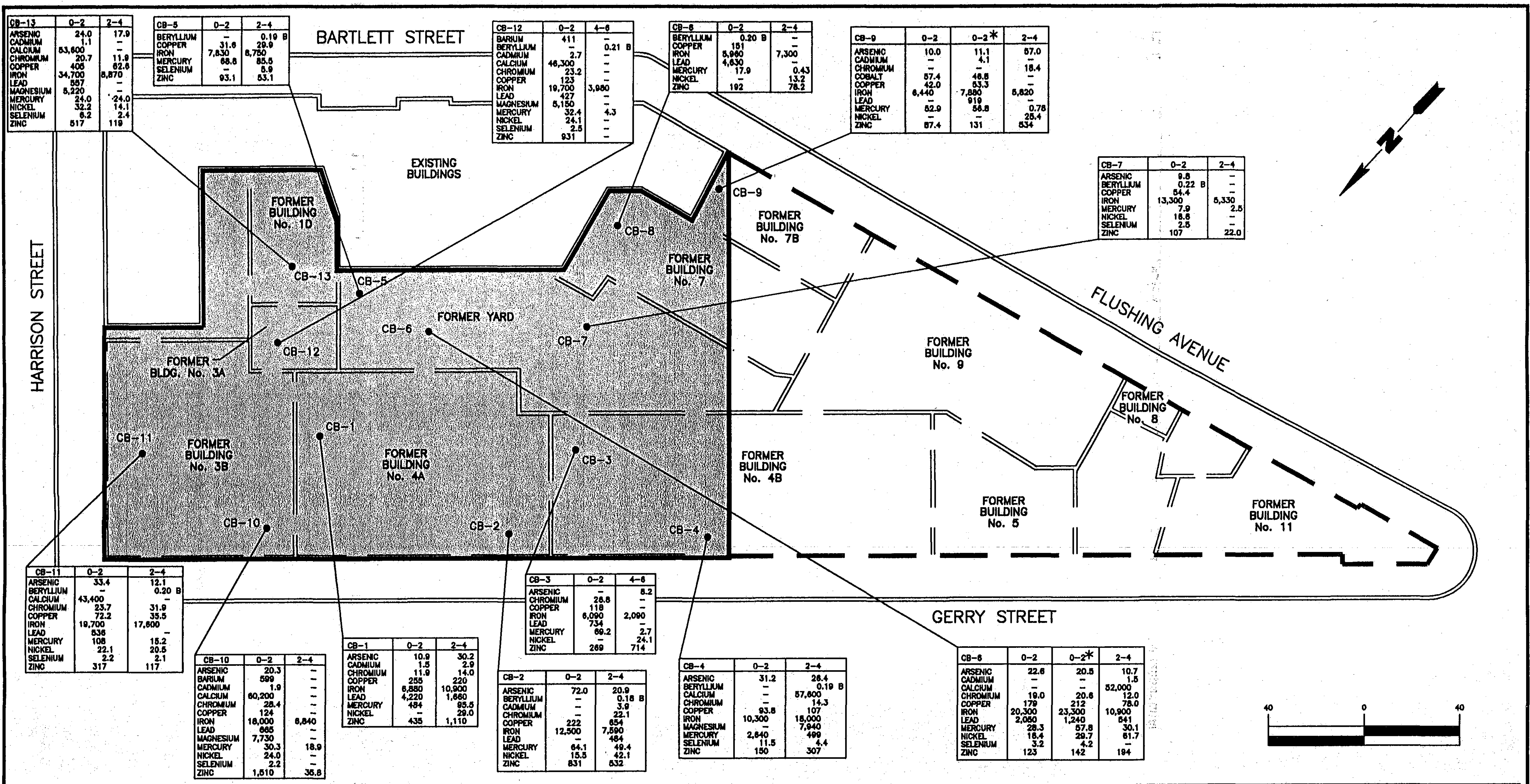
Title:

SITE PLAN

CITRIC BLOCK RI WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC *Environmental Consulting & Management*	Compiled by: S.J.G.	Date: 11/95	FIGURE
	Prepared by: R.K.	Scale: SHOWN	3
	Project Mgr: S.J.G.	Revision:	
	Project No.: 04744Y	File No: 04744053	



CB-13	0-2	2-4
ARSENIC	24.0	17.9
CADMIUM	1.1	–
CALCIUM	53,600	–
CHROMIUM	20.7	11.9
COPPER	405	62.6
IRON	34,700	8,870
LEAD	557	–
MAGNESIUM	5,220	–
MERCURY	24.0	24.0
NICKEL	32.2	14.1
SELENIUM	6.2	2.4
ZINC	517	119

CB-5	0-2	2-4
BERYLLIUM	–	0.19 B
COPPER	31.6	29.9
IRON	7,830	8,750
MERCURY	68.8	85.5
SELENIUM	–	5.9
ZINC	93.1	53.1

CB-12	0-2	4-6
BARIUM	411	–
BERYLLIUM	–	0.21 B
CADMIUM	2.7	–
CALCIUM	46,300	–
CHROMIUM	23.2	–
COPPER	123	–
IRON	19,700	3,980
LEAD	427	–
MAGNESIUM	5,150	–
MERCURY	32.4	4.3
NICKEL	24.1	–
SELENIUM	2.5	–
ZINC	931	–

CB-8	0-2	2-4
BERYLLIUM	0.20 B	–
COPPER	151	–
IRON	5,960	7,300
LEAD	4,630	–
MERCURY	17.9	0.43
NICKEL	–	13.2
ZINC	192	78.2

CB-9	0-2	0-2*	2-4
ARSENIC	10.0	11.1	57.0
CADMIUM	–	4.1	–
CHROMIUM	–	–	16.4
COBALT	57.4	46.6	–
COPPER	42.0	53.3	–
IRON	6,440	7,880	5,820
LEAD	–	919	–
MERCURY	52.9	56.8	0.78
NICKEL	–	–	25.4
ZINC	87.4	131	534

CB-7	0-2	2-4
ARSENIC	9.8	–
BERYLLIUM	0.22 B	–
COPPER	54.4	–
IRON	13,300	5,330
MERCURY	7.9	2.5
NICKEL	16.6	–
SELENIUM	2.5	–
ZINC	107	22.0

CB-11	0-2	2-4
ARSENIC	33.4	12.1
BERYLLIUM	–	0.20 B
CALCIUM	43,400	–
CHROMIUM	23.7	31.9
COPPER	72.2	35.5
IRON	19,700	17,600
LEAD	536	–
MERCURY	108	15.2
NICKEL	22.1	20.5
SELENIUM	2.2	2.1
ZINC	317	117

CB-10	0-2	2-4
ARSENIC	20.3	–
BARIUM	599	–
CADMIUM	1.9	–
CALCIUM	60,200	–
CHROMIUM	28.4	–
COPPER	124	–
IRON	18,000	8,840
LEAD	665	–
MAGNESIUM	7,730	–
MERCURY	30.3	18.9
NICKEL	24.0	–
SELENIUM	2.2	–
ZINC	1,510	35.8

CB-1	0-2	2-4
ARSENIC	10.9	30.2
CADMIUM	1.5	2.9
CHROMIUM	11.9	14.0
COPPER	255	220
IRON	6,880	10,900
LEAD	4,220	1,660
MERCURY	484	95.5
NICKEL	–	29.0
ZINC	435	1,110

CB-3	0-2	4-6
ARSENIC	–	8.2
CHROMIUM	26.8	–
COPPER	118	–
IRON	6,090	2,090
LEAD	734	–
MERCURY	69.2	2.7
NICKEL	–	24.1
ZINC	269	714

CB-2	0-2	2-4
ARSENIC	72.0	20.9
BERYLLIUM	–	0.18 B
CADMIUM	–	3.9
CHROMIUM	–	22.1
COPPER	222	654
IRON	12,500	7,590
LEAD	–	484
MERCURY	64.1	49.4
NICKEL	15.5	42.1
ZINC	831	532

CB-4	0-2	2-4
ARSENIC	31.2	26.4
BERYLLIUM	–	0.19 B
CALCIUM	–	57,600
CHROMIUM	–	14.3
COPPER	93.8	107
IRON	10,300	18,000
MAGNESIUM	–	7,940
MERCURY	2,640	499
SELENIUM	11.5	4.4
ZINC	150	307

CB-6	0-2	0-2*	2-4
ARSENIC	22.6	20.5	10.7
CADMIUM	–	–	1.5
CALCIUM	–	–	52,000
CHROMIUM	19.0	20.6	12.0
COPPER	179	212	78.0
IRON	20,300	23,300	10,900
LEAD	2,050	1,240	641
MERCURY	28.3	57.8	30.1
NICKEL	16.4	29.7	61.7
SELENIUM	3.2	4.2	–
ZINC	123	142	194

EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF SOIL BORING

NYSDEC RSCOs NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION RECOMMENDED SOIL CLEANUP OBJECTIVES

* FIELD DUPLICATE

– DENOTES CONCENTRATION NOT DETECTED OR DETECTED BELOW THE NYSDEC RSCOs

B ESTIMATED VALUE

\+ EASTERN USA BACKGROUND CONCENTRATIONS

mg/Kg MILLIGRAMS PER KILOGRAM

▨ AREA OF INVESTIGATION

NYSDEC RSCOs (mg/Kg)

ARSENIC	7.5
BARIUM	300
BERYLLIUM	0.16
CADMIUM	1
CALCIUM	35,000+
CHROMIUM	10
COBALT	30
COPPER	25
IRON	2,000
LEAD	400
MAGNESIUM	5,000+
MERCURY	0.1
NICKEL	13
SELENIUM	2
ZINC	20

SAMPLE DESIGNATION

SAMPLE DEPTH (FEET BELOW LAND SURFACE)

CB-4	0-2	2-4
ARSENIC	31.2	26.4
BERYLLIUM	–	0.19 B
CALCIUM	–	57,600
CHROMIUM	–	14.3
COPPER	93.8	107
IRON	10,300	18,000
MAGNESIUM	–	7,940
MERCURY	2,640	499
SELENIUM	11.5	4.4
ZINC	180	307

ALL CONCENTRATIONS ARE IN mg/Kg

NOTE: BUILDING DEMOLITION WAS COMPLETED BY AUGUST, 1995.

Title:

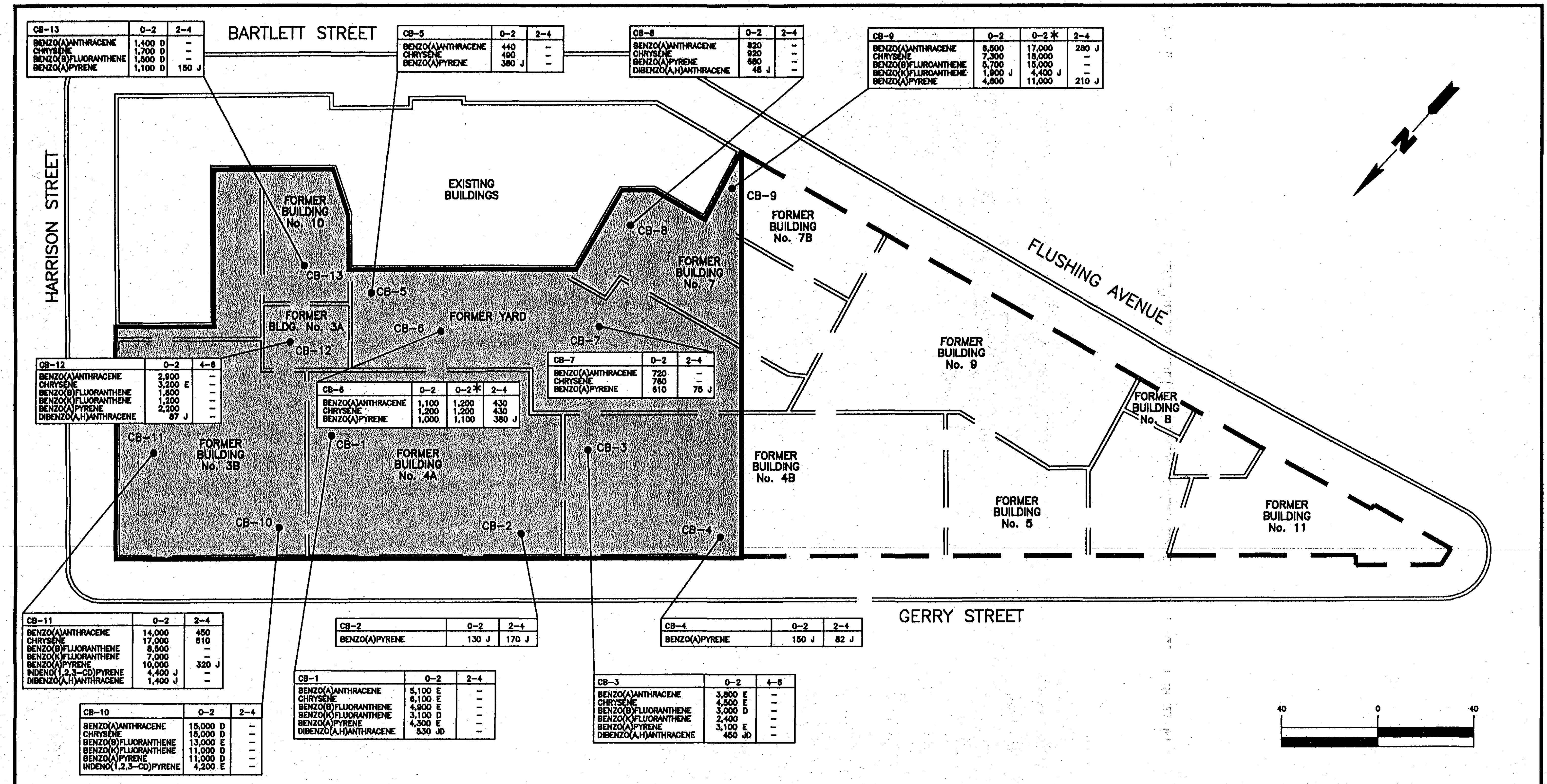
METALS DETECTED IN SOIL THAT EXCEED THE NYSDEC RSCOs

CITRIC BLOCK RI WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: S.J.G.	Date: 11/95	FIGURE
Prepared by: R.K.	Scale: SHOWN	4
Project Mgr: S.J.G.	Revision:	
Project No.: 04744Y	File No: 04744055	



CB-13	0-2	2-4
BENZO(A)ANTHRACENE	1,400 D	–
CHRYSENE	1,700 D	–
BENZO(B)FLUORANTHENE	1,800 D	–
BENZO(A)PYRENE	1,100 D	150 J

CB-5	0-2	2-4
BENZO(A)ANTHRACENE	440	–
CHRYSENE	490	–
BENZO(A)PYRENE	380 J	–

CB-8	0-2	2-4
BENZO(A)ANTHRACENE	820	–
CHRYSENE	920	–
BENZO(A)PYRENE	680	–
DIBENZO(A,H)ANTHRACENE	48 J	–

CB-9	0-2	0-2 *	2-4
BENZO(A)ANTHRACENE	6,500	17,000	280 J
CHRYSENE	7,300	18,000	–
BENZO(B)FLUROANTHENE	5,700	15,000	–
BENZO(K)FLUROANTHENE	1,900 J	4,400 J	–
BENZO(A)PYRENE	4,600	11,000	210 J

CB-12	0-2	4-6
BENZO(A)ANTHRACENE	2,900	–
CHRYSENE	3,200 E	–
BENZO(B)FLUORANTHENE	1,800	–
BENZO(K)FLUORANTHENE	1,200	–
BENZO(A)PYRENE	2,200	–
DIBENZO(A,H)ANTHRACENE	87 J	–

CB-6	0-2	0-2 *	2-4
BENZO(A)ANTHRACENE	1,100	1,200	430
CHRYSENE	1,200	1,200	430
BENZO(A)PYRENE	1,000	1,100	380 J

CB-7	0-2	2-4
BENZO(A)ANTHRACENE	720	–
CHRYSENE	780	–
BENZO(A)PYRENE	610	75 J

CB-11	0-2	2-4
BENZO(A)ANTHRACENE	14,000	450
CHRYSENE	17,000	510
BENZO(B)FLUORANTHENE	8,500	–
BENZO(K)FLUORANTHENE	7,000	–
BENZO(A)PYRENE	10,000	320 J
INDENO(1,2,3-CD)PYRENE	4,400 J	–
DIBENZO(A,H)ANTHRACENE	1,400 J	–

CB-10	0-2	2-4
BENZO(A)ANTHRACENE	15,000 D	–
CHRYSENE	18,000 D	–
BENZO(B)FLUORANTHENE	13,000 E	–
BENZO(K)FLUORANTHENE	11,000 D	–
BENZO(A)PYRENE	11,000 D	–
INDENO(1,2,3-CD)PYRENE	4,200 E	–

CB-2	0-2	2-4
BENZO(A)PYRENE	130 J	170 J

CB-1	0-2	2-4
BENZO(A)ANTHRACENE	5,100 E	–
CHRYSENE	6,100 E	–
BENZO(B)FLUORANTHENE	4,900 E	–
BENZO(K)FLUORANTHENE	3,100 D	–
BENZO(A)PYRENE	4,300 E	–
DIBENZO(A,H)ANTHRACENE	530 JD	–

CB-4	0-2	2-4
BENZO(A)PYRENE	150 J	82 J

CB-3	0-2	4-6
BENZO(A)ANTHRACENE	3,800 E	–
CHRYSENE	4,500 E	–
BENZO(B)FLUORANTHENE	3,000 D	–
BENZO(K)FLUORANTHENE	2,400	–
BENZO(A)PYRENE	3,100 E	–
DIBENZO(A,H)ANTHRACENE	450 JD	–

EXPLANATION

CB-3 ●	LOCATION AND DESIGNATION OF SOIL BORING
NYSDEC RSCOs	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION RECOMMENDED SOIL CLEANUP OBJECTIVES
*	FIELD DUPLICATE
–	DENOTES CONCENTRATION NOT DETECTED OR DETECTED BELOW THE NYSDEC RSCOs
D	SAMPLE DILUTED
E	EXCEEDED CALIBRATION RANGE, ESTIMATED VALUE
J	ESTIMATED VALUE
ug/Kg	MICROGRAMS PER KILOGRAM
▨	AREA OF INVESTIGATION

NYSDEC RSCOs (ug/Kg)	
BENZO(A)ANTHRACENE	220
BENZO(B)FLUORANTHENE	1,100
BENZO(K)FLUORANTHENE	1,100
BENZO(A)PYRENE	61
CHRYSENE	400
DIBENZO(A,H)ANTHRACENE	14
INDENO(1,2,3-CD)PYRENE	3,200

SAMPLE DESIGNATION
SAMPLE DEPTH (FEET BELOW LAND SURFACE)

CB-11	0-2	2-4
BENZO(A)ANTHRACENE	14,000	450
CHRYSENE	17,000	510
BENZO(B)FLUORANTHENE	8,500	–
BENZO(K)FLUORANTHENE	7,000	–
BENZO(A)PYRENE	10,000	320 J
INDENO(1,2,3-CD)PYRENE	4,400 J	–
DIBENZO(A,H)ANTHRACENE	1,400 J	–

ALL CONCENTRATIONS ARE IN ug/Kg

NOTE: BUILDING DEMOLITION WAS COMPLETED BY AUGUST, 1995.

Title:

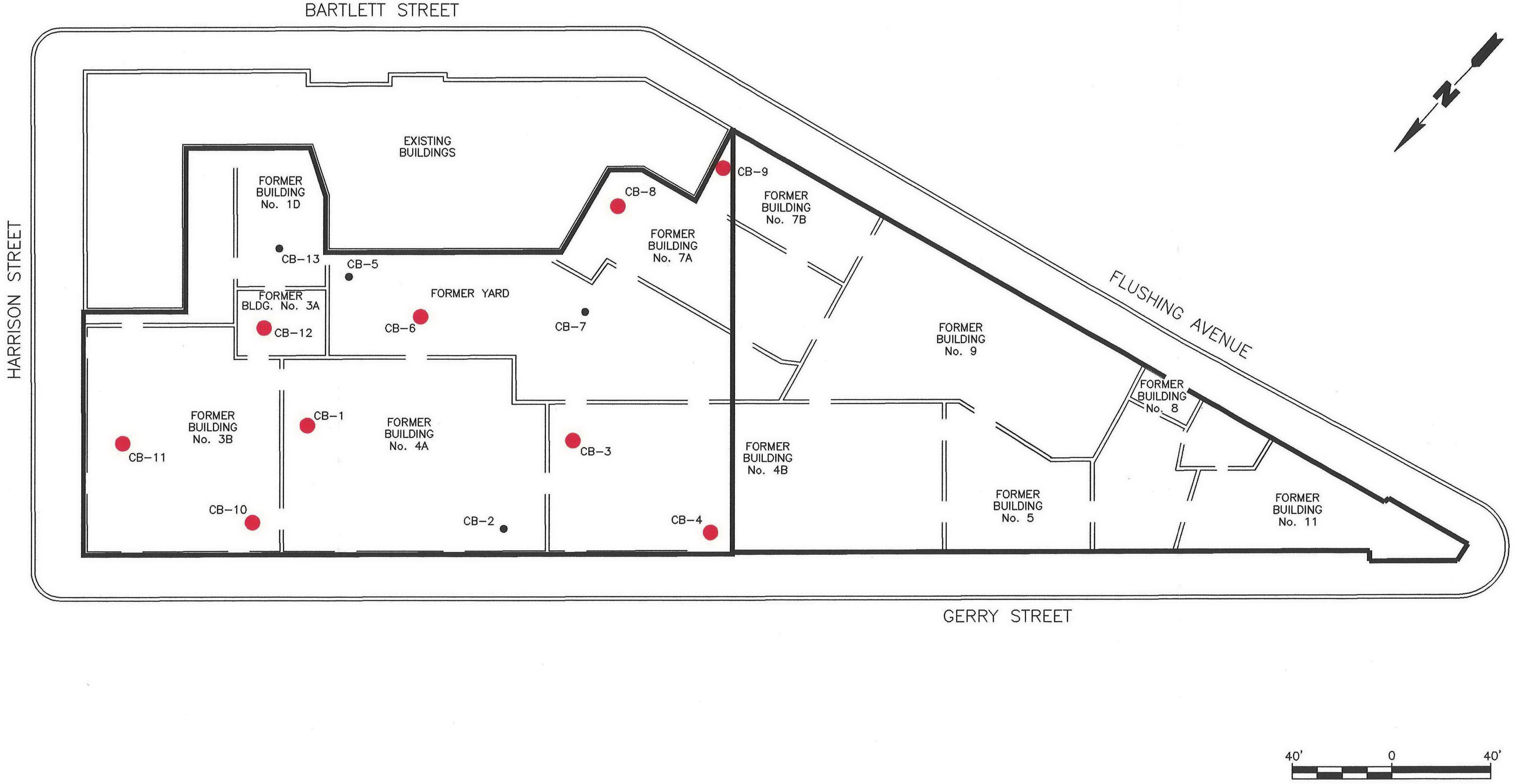
SEMIVOLATILE ORGANIC COMPOUNDS DETECTED IN SOIL THAT EXCEED THE NYSDEC RSCOs

CITRIC BLOCK RI WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: S.J.G.	Date: 11/95	FIGURE
Prepared by: R.K.	Scale: SHOWN	5
Project Mgr: S.J.G.	Revision:	
Project No.: 04744Y	File No: 04744056	



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

IN RED ● LOCATION OF HOT SPOT MARKER SOIL BORINGS

Title:

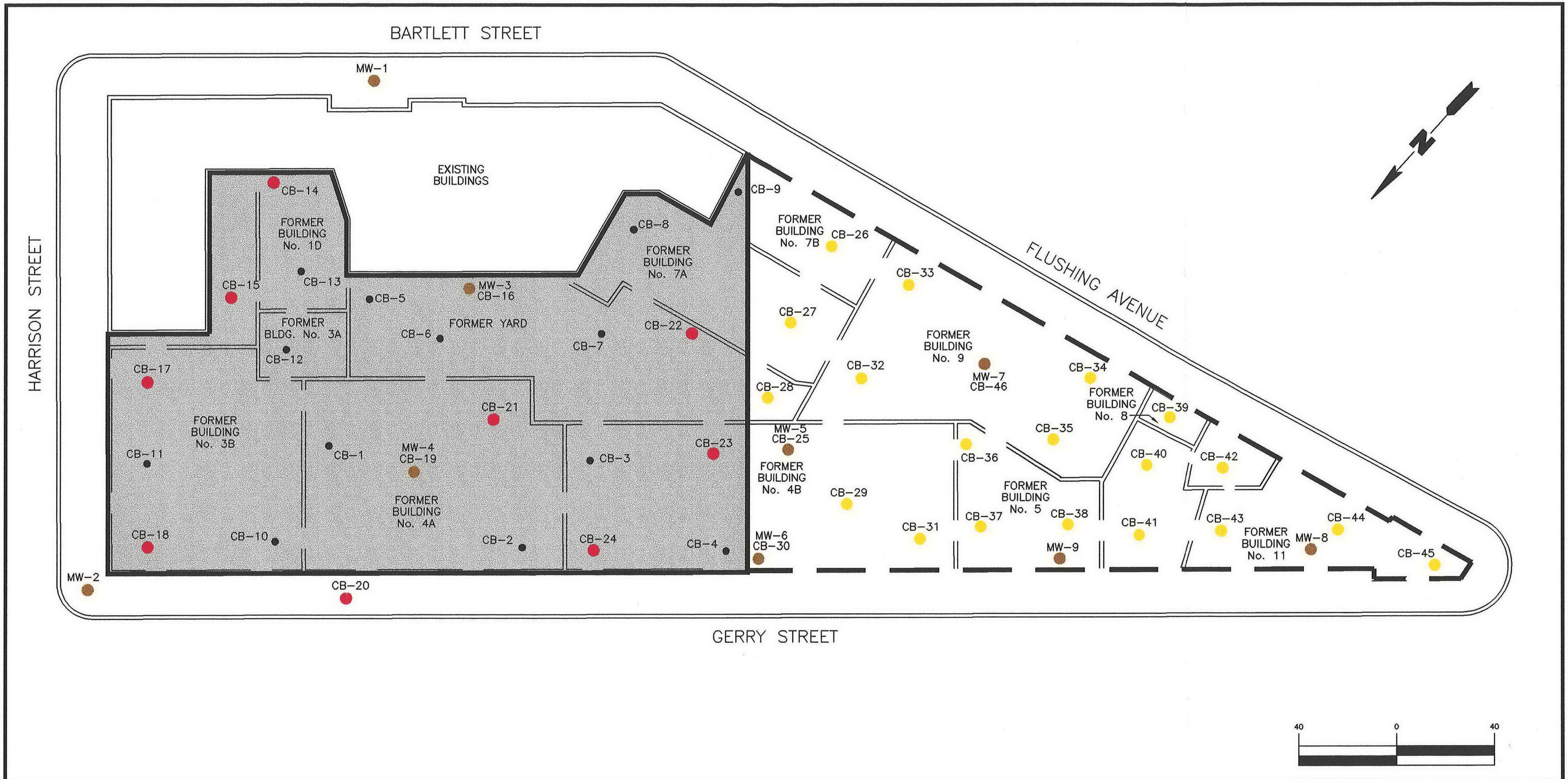
LOCATION OF MARKER
SOIL BORINGS
EASTERN PORTION OF THE
CITRIC BLOCK SITE

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

		FIGURE
Compiled by: S.J.G.	Date: 12/95	6
Prepared by: R.K.	Scale: SHOWN	
Project Mgr: S.J.G.	Revision:	
Project No.: 04744Y	File No: 04744089	



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

▨ AREA OF PREVIOUS INVESTIGATION

CB-14 🔴 LOCATION AND DESIGNATION OF PROPOSED SOIL BORING LOCATION FOR FURTHER DELINEATION AT FORMER BUILDINGS 1D, 3A, 3B, 4A, 4B, 7A AND 7B AND THE FORMER YARD IN THE CENTER OF THE BLOCK (EASTERN PORTION)

CB-35 🟡 LOCATION AND DESIGNATION OF PROPOSED SOIL BORING LOCATION AT FORMER BUILDINGS 4B, 7A, 7B AND THE FORMER YARD IN THE CENTER OF THE BLOCK (WESTERN PORTION) AND FORMER BUILDINGS 5, 8, 9 AND 11.

MW-1 🟤 LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL.

NOTE: BUILDING DEMOLITION WAS COMPLETED BY AUGUST 1995.

BACKGROUND SOIL SAMPLE LOCATIONS ARE NOT SHOWN IN THIS FIGURE SINCE THEY WILL BE DETERMINED DURING THE SITE RECONNAISSANCE (TASK I).

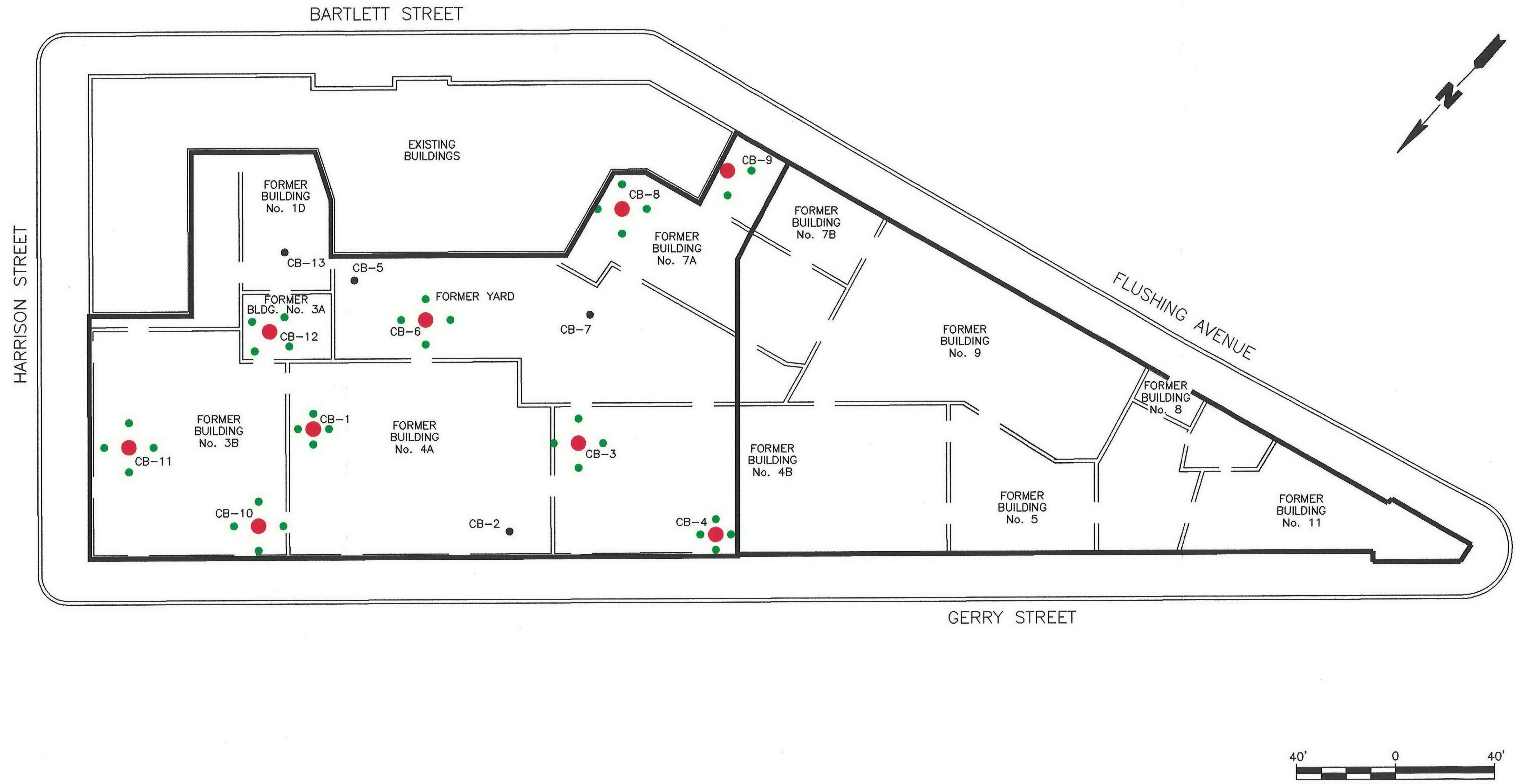
Title:

PROPOSED TASK II AND TASK IV SOIL SAMPLING LOCATIONS AND TASK VI MONITORING WELL LOCATIONS

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC *Environmental Consulting & Management*	Compiled by: S.J.G.	Date: 12/95	FIGURE
	Prepared by: R.K.	Scale: SHOWN	7
	Project Mgr: S.J.G.	Revision:	
	Project No.:04744Y05	File No: 04744087	



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

IN GREEN ● PROPOSED LOCATION OF FOCUSED IRM DELINEATION SOIL BORING

IN RED ● LOCATION OF HOT SPOT MARKER SOIL BORINGS

Title:

PRELIMINARY LOCATIONS OF IRM FOCUSED SOIL BORINGS EASTERN PORTION OF CITRIC BLOCK SITE

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: S.J.G.	Date: 12/95	FIGURE
Prepared by: R.K.	Scale: SHOWN	8
Project Mgr: S.J.G.	Revision:	
Project No.: 04744Y	File No: 04744088	

Figure 9. Estimated Project Schedule To Implement Citric Block Site Investigation and IRM Work Plan, Pfizer Inc, Brooklyn New York.

Task Name	0w	1w	2w	3w	4w	5w	6w	7w	8w	9w	10w	11w	12w	13w	14w	15w	16w	17w
Receipt of Notice to Proceed		■																
TASK I - Site Reconnaissance			■															
TASK II - Soil Boring and Sampling (Eastern Portion)																		
• *Additional Delineation Soil Boring and Sampling*				■	■													
• *Awaiting Analytical Results*[1]				■	■	■	■	■	■									
• *Technical Memorandum Preparation*										■								
TASK III - IRM Implementation (Eastern Portion)																		
• *Focused Soil Boring and Sampling*											■	■	■					
• *Technical Memorandum Preparation*														■				
• *Contractor Selection (conducted by Pfizer)*											■	■	■					
• *Soil Excavation and Disposal*															■	■	■	
TASK IV - Soil Boring and Sampling (Western Portion)	(UNSCHEDULED)																	
• *Delineation Soil Boring and Sampling*																		
• *Awaiting Analytical Results*[1]																		
• *Technical Memorandum Preparation*																		
TASK V - IRM Implementation (Western Portion)	(UNSCHEDULED)																	
• *Focused Soil Boring and Sampling*																		
• *Technical Memorandum Preparation*																		
• *Contractor Selection (conducted by Pfizer)*																		
• *Soil Excavation and Disposal*																		
TASK VI - Perched Ground-Water Investigation	(UNSCHEDULED)																	
• *Monitoring Well Installation*																		
• *Water-level Measurements*																		
• *Ground-Water Sampling*																		
• *Awaiting Analytical Results*[1]																		
TASK VII - On-Site Sewer Investigation	(UNSCHEDULED)																	
TASK VIII - Data Evaluation and Report Preparation	(UNSCHEDULED)																	
• *Draft Report Preparation*																		
• *Pfizer's Review*																		
• *Final Report Preparation*																		

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[1] - Laboratory turnaround time will take approximately four weeks from the receipt of the last sampling batch.

PF04744Y05.3.69/F9.

APPENDICES

APPENDIX A

APPENDIX A

Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN

Pfizer Inc
Brooklyn, New York

Appendix A

December 12, 1995

Approvals:

Roux Associates, Inc.
Project Manager

Scott J Glash
Scott J. Glash

12/12/95
Date

Roux Associates, Inc.
Project Quality Assurance
Coordinator

Linda M. Wilson SJG
Linda M. Wilson

12/12/95
Date

Roux Associates, Inc.
Site Manager

Date

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

The Citric Block Site is part of the Pfizer Williamsburg facility located at 630 Flushing Avenue in Brooklyn, New York (Figure A-1). The general area surrounding the Citric Block Site is a mixture of industrial, commercial and urban residential properties.

Roux Associates, Inc. (Roux Associates) developed a Work Plan to complete delineation efforts and remove soil "hot spots" present on the eastern and western portions of the Citric Block Site. The Work Plan and this Sampling and Analysis Plan (SAP) were developed in accordance with the United States Environmental Protection Agency (USEPA) guidelines (USEPA, 1988).

Roux Associates reviewed available information, including previous investigations conducted at the Citric Block Site, available correspondence, and Citric Block Site plans and drawings to develop this SAP. Descriptions of the Citric Block Site background and environmental conditions are provided in Sections 2.0 and 3.0 of the Work Plan, respectively.

After reviewing the available information, Roux Associates has developed this SAP to confirm the results of previous investigations, and identify and characterize other potential areas of concern. In addition, the SAP describes the types of samples (i.e., soil and perched ground water) to be collected and the procedures to be followed during activities (i.e., drilling, decontamination and sample collection) conducted at the Citric Block Site.

2.0 SAMPLING OBJECTIVES

This SAP describes in detail the sampling and data-gathering methods to be used during implementation of the scope of work. Guidance for the SAP methodology was acquired from the USEPA Compendium of Superfund Field Operations Methods (USEPA, 1987a). The SAP was developed based upon a detailed review of available information developed during previous investigations performed at the Citric Block Site, and is designed to obtain the data necessary to achieve the following objectives:

- a soil-quality investigation will be conducted to determine the nature (e.g., constituents of concern, concentrations, potential for migration) and extent of soil contamination and to identify source area(s) beneath the Citric Block Site;
- an IRM will be performed on the Citric Block Site to remove "hot spots" by excavation defined during the focused soil quality investigation;
- a hydrogeologic and ground-water quality investigation in the perched zone will be conducted to assess the occurrence, continuity, extent and quality of perched ground-water beneath the Citric Block Site;
- further assessment of the continuity, thickness and permeability of the thick clay layer separating the shallow, perched ground water and fill from the deeper Upper Glacial aquifer will be performed to confirm existing data that indicate the clay layer beneath the Citric Block Site prevents hydraulic connection between the fill and the deeper water bearing zones (e.g., Upper Glacial aquifer); and
- an on-site sewer investigation will be performed to determine if pathways exist between the on-site soil/perched ground-water contamination and any adjoining sewer structures.

2.1 Scope of Work

The scope of work discussed in this SAP includes the seven field tasks described in the Work Plan. Specifically, the field tasks include the following:

- Task I: Citric Block Site Reconnaissance;
- Task II: Soil Boring and Sampling - Eastern Portion of the Citric Block Site;
- Task III: IRM Implementation - Eastern Portion of the Citric Block Site;
- Task IV: Soil Boring and Sampling - Western Portion of the Citric Block Site;
- Task V: IRM Implementation - Western Portion of the Citric Block Site;
- Task VI: Perched Ground-Water Investigation; and
- Task VII: On-Site Sewer Investigation.

In order to execute the scope of work in a cost effective manner, these tasks have been phased to develop from a general to a more detailed field sampling program. This approach will be accomplished using the existing data, field screening, and intrusive studies. The field screening will be used to determine which sampling locations should be further investigated using more rigorous analytical methods.

These above-listed tasks are discussed in detail in Section 6.0 of this SAP.

2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. A DQO Planning Process has been developed by the Quality Assurance Management Staff, to assist in determining the amount and type of information required, including acceptable levels of error.

The DQO Planning Process helps the user determine the amount and quality of data, conserves resources by making data collection operations more efficient, and helps focus the objectives and narrows questions to essential issues.

Total study error will be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline conditions) is that the parameters of interest exceed the action level (e.g., waste is hazardous). This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing samples using precise laboratory methods, namely New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP), USEPA Contract Laboratory Program (CLP), and the Test Methods for Evaluating Solid Waste (SW-846).

3.0 SAMPLE TYPES, LOCATION AND FREQUENCY

Soil boring (soils) and monitoring well (ground water) sampling locations will be finalized based upon factors including information collected during the earlier Citric Block Site reconnaissance program (e.g., ground-water elevation data, utility locations, Citric Block Site accessibility, etc.), but are expected to be located near the approximate locations shown in Figure A-1.

3.1 Sample Matrix Types

The two sample matrices anticipated to be collected during implementation of the Work Plan are soil and ground-water samples. Sample types and analytical parameters are summarized by the assigned task in Table A-1.

Ground-water and soil samples collected during the course of the field investigation at the Citric Block Site will be analyzed in accordance with the specified ASP for organic parameters and CLP for inorganic parameters. The analytical suite for these samples may include volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) listed on the Target Compound List (TCL), and inorganic constituents listed on the Target Analyte List (TAL). The analytical parameters for the projected field samples are presented in Table A-2 and further described in the Quality Assurance Project Plan (QAPP), Appendix B of the Work Plan.

Selected soil samples collected will be analyzed by a geotechnical laboratory for grain-size analysis (sieve with hydrometer, if applicable) and vertical permeability. The methods to be used by the geotechnical laboratory are given in Attachment A-1.

Although the majority of the analyses will be performed in a laboratory using the above-mentioned methods, field measurements of physical parameters (pH, specific conductance, temperature and Eh in ground water) will also be used. The DQOs for the specific methods are listed in Table A-3. Sections 3.0 and 7.0 of the QAPP discuss the field and laboratory analytical method choice rationale.

3.2 Sample Location and Frequency

Sample locations and the number of samples collected vary by task and are summarized in Table A-2. Specifics regarding the collection of samples at each location and for each task are provided in Section 6.0. Quality control (QC) samples for the field and laboratory are summarized in Tables A-4 and A-5, respectively.

3.2.1 Task II: Soil Boring and Sampling - Eastern Portion of the Citric Block Site

Soil borings will be sampled to delineate the nature and extent of contamination and to determine hydrogeologic conditions. A total of 16 soil borings (including background samples) will be drilled on the eastern portion of the Citric Block Site to determine hydrogeologic conditions (Figure A-1). Soil samples will be collected from two intervals in each of the 11 soil borings shown in Figure A-1 to evaluate soil quality. Soil samples will be collected from one interval (0 to 2 ft) in the five background soil borings. Analytical parameters for the 22 samples collected onsite will include TCL VOCs, TCL SVOCs, TAL metals plus hexavalent chromium and arsenate/arsenite, total organic carbon (TOC), pH and Eh, as specified in Section 6.2. Analytical parameters for the five background samples will include PAHs and TAL metals.

3.2.2 Task III: IRM Implementation - Eastern Portion of the Citric Block Site

The IRM for the Citric Block Site will consist of the following:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for hazard characterization;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab (except near CB-1 and CB-4), based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

A focused soil boring program will be implemented around the "hot spot" marker borings (known "hot spot" marker borings are shown in Figure A-2) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling;
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The approximate locations of the IRM focused soil borings are shown in Figure A-3.

3.2.3 Task IV: Soil Boring and Sampling - Western Portion of the Citric Block Site

Soil borings will be sampled to delineate the nature and extent of contamination and to determine hydrogeologic conditions. A total of 27 soil borings (including background samples) will be drilled on the western portion of the Citric Block Site to determine hydrogeologic conditions (Figure A-1). Soil samples will be collected from two intervals in each of the 22 soil borings shown in Figure A-1 to evaluate soil quality. Soil samples will be collected from one interval (0 to 2 ft) in the five background soil borings. Analytical parameters for the 44 samples collected onsite will include TCL VOCs, TCL SVOCs, TAL metals plus hexavalent chromium and arsenate/arsenite, total organic carbon (TOC), pH and Eh, as specified in Section 6.4. Analytical parameters for the five background samples will include PAHs and TAL metals. Geotechnical parameters (permeability, grain size) will be analyzed in four samples.

3.2.4 Task V: IRM Implementation - Western Portion of the Citric Block Site

The IRM for the Citric Block Site will consist of the following:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for hazard characterization;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab, based upon soil quality conditions encountered on the western half of the Citric Block Site;

- disposal of excavated soil; and
- backfill and regrading of excavated areas.

A focused soil boring program will be implemented around the "hot spot" marker borings (similar to Figure A-2) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling;
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The scope of the IRM efforts for the western half of the Citric Block Site may be modified based upon results of IRM efforts on the eastern half of the Citric Block Site.

3.2.5 Task VI: Perched Ground-Water Investigation

Monitoring wells will be installed onsite to characterize hydrogeologic and ground-water quality conditions in the perched zone. In addition, one monitoring well will be installed offsite as an upgradient well. Locations of the proposed wells (MW-1 through MW-9) are shown in Figure A-1.

Ground-water samples will be collected from all on-site and off-site monitoring wells. These samples will be analyzed for TCL VOCs, TCL SVOCs, TAL metals (i.e., filtered and unfiltered), and TOC. Field analyses will be conducted for pH, temperature, specific conductance and Eh.

4.0 SAMPLE DESIGNATION

Sample bottles (preserved, if necessary), labels, shipping containers, trip blanks, and field blank water will be provided by the laboratory. During collection and containment of soil samples, the sample container will be labeled with the following information:

- Citric Block Site identifier;
- Roux Associates' project number;
- sample type (media) identification code;
- sample location identifier and field QC identifier (if applicable);
- sample depth and analysis identifier;
- date and time of collection; and
- type of preservative added (if applicable).

During collection and containment of water samples, the sample containers will be labeled with the following information:

- Citric Block Site identifier;
- Roux Associates' project number;
- sample type (media) identification code;
- sample location identifier and field QC identifier (if applicable);
- sequential sample number;
- date and time of collection;
- field handling (e.g., filtration); and
- type of preservative added (if applicable).

The sample identification code and number provided on each sample label will follow the sample number and coding system as described below.

1. Sample type (media) abbreviations will be as presented below.

   ground-water sample = GW
   soil sample = SB

2. Sample location abbreviations will be as presented below.

   soil boring = CB followed by the designated number of the boring.
   monitoring well = MW followed by the designated number of the well. If the sample is field filtered, the number of the well will be followed by "F".

3. Depth intervals will be designated in feet or tenths of a foot (e.g., 0.1, 1.0, etc.).

4. Analytical Method Designations will be as presented below.

   Volatile Organic Compound Analysis = VOC
   Total Organic Carbon Analysis = TOC
   Semivolatile Organic Compound Analysis = SVOC
   Pesticide/Polychlorinated Biphenyls = PCB
   Metals Analysis = MET
   Geotechnical Analysis = GA

5. QC identifiers will be as follows:

   Field replicate = R
   Trip blank = TB
   Field blank = FB
   Matrix Spike and Matrix Spike Duplicate = MS/MSD

For example, the designation "CB-14/0-2/VOC" would indicate that the sample was a soil sample collected at Soil Boring CB-14, that it was collected at a depth interval of 0 to 2 ft below land surface, and was selected for VOC analysis. A record of sequentially numbered ground-water samples for each well location (MW) with corresponding sample designations will be kept in the field book.

5.0 FIELD ACTIVITIES

The following sections describe the standard protocols to be used by field personnel during the course of the sampling activities. Roux Associates' Standard Operating Procedures (SOPs) included in Attachment A-2 will be referenced where applicable. Additional information regarding Quality Assurance/Quality Control (QA/QC) protocols and methods may be found in the QAPP (Appendix B of this Work Plan).

5.1 Field Management

The overall management structure for field activities is presented in Figure A-4. A general discussion of the responsibilities of the technical staff is provided below.

Project Manager. The Project Manager bears the primary responsibility for the successful completion of the work assignment within budget and schedule. The Project Manager provides overall management for the execution of the work and directs the activities of the Field Manager and technical staff. The Project Manager will perform technical review of all field activities, data review and interpretation and the preparation of the report. The Project Manager works closely with the analytical laboratory, data validation contractors, drillers, and surveyors during the execution of the field program. Activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Field Manager. The Field Manager bears the primary responsibility for the successful execution of the field program. The Field Manager directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and in report preparation. The Field Manager will be responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, the Field Manager will work closely with the Citric Block Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff. Field technical staff consists of hydrogeologists and technicians who will perform activities such as water-level measurements, soil and ground-water sampling and preparation of any necessary field documentation.

Citric Block Site Health and Safety Officer. The Citric Block Site Health and Safety Officer (SHSO) will be responsible for the implementation of the HASP. The SHSO will revise the HASP, if required, based upon the results of the Citric Block Site investigation. Any necessary revision to the HASP will be submitted to the Health and Safety Manager for approval.

Project Quality Assurance Coordinator (PQAC). The PQAC provides technical quality assurance assistance, prepares, reviews and approves the Quality Assurance Project Plan (QAPP), oversees any contractor quality assurance activities to ensure compliance with contract specifications, monitors field investigations and prepares QAPP reports, if necessary. The PQAC will work closely with senior management and technical reviewers.

5.2 Citric Block Site Control

Citric Block Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the Citric Block Site. In order to accomplish this objective, the following three considerations have been addressed:

- the establishment of discrete work zones in the investigative area;
- the decontamination of field equipment; and
- the security and access procedures for the Citric Block Site.

All personnel who come onto the Citric Block Site, including plant employees, contractors, and observers, will be required to adhere strictly to the conditions imposed herein, and within the provisions of the HASP (Appendix C).

5.2.1 Field Work Zones

Field work zones will be established in areas where soil and ground-water sampling are conducted. Access will be limited in accordance with the HASP (Appendix C). Control of work zone access will be the responsibility of the Field Manager.

5.2.2 Decontamination

The location of the decontamination area will be determined prior to the start of operations. The decontamination area will be constructed so that wash water generated during decontamination will be collected and containerized for proper disposal.

5.2.3 Citric Block Site Security and Access

The Citric Block Site is currently inactive. Citric Block Site security and access control protocols used by the facility will be followed during implementation of the scope of work. At the completion of each working day, all loose equipment (e.g., sampling equipment, water-level measuring devices, coolers, etc.) will be secured. Heavy equipment, such as the drill rig, will remain onsite, within the current work zone.

5.3 Field Equipment

All measurement systems utilized in the field will be operated in accordance with the manufacturer's instructions and the applicable SOPs in Attachment A-2. Methods of calibrating and maintaining the equipment are provided below.

5.3.1 Equipment Calibration

All measurement equipment will be calibrated according to the manufacturer's recommendations, where applicable. Frequency of instrument calibration will be dictated by the type of measurement device. Table A-6 lists the field measurement equipment to be used and the calibration frequency for the instrument. Records of all calibrations (both frequency and results) will be kept in the field or instrument logbook.

5.3.2 Equipment Maintenance

All field equipment will be stored in a clean, controlled environment (as necessary) to prevent damage due to heat, cold, moisture, etc. prior to use. Reusable equipment will be decontaminated as soon as reasonably possible after use and stored as described above. Decontamination procedures are provided in Section 5.7 and in the SOPs in Attachment A-2. Maintenance for measurement and health and safety equipment will be in accordance with the schedule found in Table A-6.

Equipment failing to meet manufacturer's minimum specifications will be removed from service immediately and kept out of service until the problem is identified and/or resolved. Records of all routine maintenance and repair will be kept in the instrument or field logbook.

5.4 Field Documentation

The following sections provide guidance to field personnel in the areas of documentation and record keeping. The goal of field documentation is to provide a clear and complete record which can be used for reference and information retrieval at a later date. All field documentation will be recorded in bound logbooks or pre-generated activity specific forms using indelible (waterproof) ink. Details of recordkeeping requirements are described in the SOPs in Attachment A-2, and in Section 5.1.2 of the QAPP. Samples of field forms are provided in Attachment A-3.

5.4.1 Field Logbooks

Field logbooks will be used for all record keeping to provide a permanent, bound record of all field-related activities. Additional records may be kept on pre-generated forms for sample tracking and other purposes. The types of information and level of detail required for logbook recording are described in the Field Record Keeping and Quality Assurance/Quality Control SOP in Attachment A-2 and in Section 5.1.2 of the QAPP.

5.4.2 Field Documentation for Drilling and Well Installation

Daily field activities will be summarized in a field notebook to ensure that an accurate record of all field investigation tasks are maintained. Geologic logs will be prepared during the drilling of soil borings and the installation of monitoring wells. An example of a geologic log form is provided in Attachment A-3. Well construction details for the monitoring wells will be recorded in the field notebook. In addition, well construction logs (as-built diagrams) will be prepared for each well installed. Examples of well construction logs are provided in Attachment A-3.

5.4.3 Sampling Documentation

A complete record of how each sample was selected, aliquoted, packaged, and preserved for analysis will be maintained in field logbooks. Specific procedures regarding the level and type of sampling documentation can be found in the activity-specific Roux Associates' SOPs in Attachment A-2. Sample designation and labeling are discussed in Section 4.0 of this SAP. Questions regarding sampling methods and QA will be addressed by the Project Manager or the Roux Associates PQAC.

5.5 Custody Procedures and Documentation

The following sections describe the procedures necessary to document sample custody. The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable). Specific procedures regarding sample tracking from the field to the laboratory are described in the SOP (Attachment A-2) and in Section 5.0 of the QAPP. Examples of a chain of custody form and a custody seal can be found in Attachment A-3.

5.5.1 Field Custody

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. Field technical staff will review all field activities with the Field Manager to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

Samples must be accompanied by a properly completed chain of custody form (Attachment A-3). The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

If split samples are requested, a separate chain of custody form is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency will request the representative's signature on the chain of custody form, acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted in the "Received By" space.

If samples are to be collected and delivered directly to the Field Manager, the Field Manager will complete the chain of custody for laboratory shipment and have the field sampler sign in the "sampler" box. If samples are transferred from the field sampler to an intermediary person before being transferred to the Field Manager, a separate chain of custody form from that used to ship samples to the laboratory must be completed for the field transfers. Any questions regarding custody procedures or QA will be addressed by the Field Manager and/or the PQAC.

5.5.2 Laboratory Custody

The sample custodian at each laboratory will ensure that chain of custody records are completed upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory QA officer will also ensure that sample tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements. Section 5.0 of the QAPP describes the specific laboratory custody and sample handling procedures required for this project.

5.6 Sample Handling and Analysis

To assure quality data acquisition, and the collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples as well as sample packaging and shipping procedures. These procedures are summarized below and are also discussed in Section 5.0 of the QAPP.

5.6.1 Field Sample Handling and Shipment

All samples will be collected and handled according to the appropriate protocols for each matrix described in the SOPs (Attachment A-2). The types of containers, volumes needed and preservation techniques for the aforementioned testing parameters are presented in Table A-7.

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix, and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in the SOPs (Attachment A-2) and in Section 5.0 of the QAPP.

All samples will be shipped within 48 hours of collection and will be preserved appropriately at the time of sample collection. A description of the sample packing and shipping procedures is presented below.

1. Prepare cooler(s) for shipment.
    - Tape drains(s) of cooler shut;
    - Affix "This Side Up" arrow labels and "Fragile" labels on each cooler; and
    - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.

4. Seal sample containers within plastic zip-lock bags to prevent vermiculite from contacting samples, where possible.

5. Place approximately 2 inches of vermiculite or other packaging material at the bottom of the cooler to act as a cushion for the sample containers.

6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.

7. Fill remaining spaces with vermiculite or other packaging material.

8. Ensure all containers are firmly packed in vermiculite or other packaging material.

9. If ice is required to preserve the samples, ice cubes should be repackaged in double zip-lock bags, and placed on top of the vermiculite or other packaging material.

10. Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or other carrier, as appropriate.

11. Separate copies of chain of custody forms. Seal proper copies within a large zip-lock bag and tape to cooler. Retain copies of all forms.

12. Close lid and latch.

13. Secure each cooler using custody seals.

14. Tape cooler shut on both ends.

15. Relinquish to Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT DAY" delivery).

16. Telephone laboratory contact and provide him/her with the following shipment information:

    - sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

5.6.2 Field Analysis

Field analysis for specific conductance, temperature, pH and Eh in aqueous media will be conducted in accordance with the Roux Associates' SOPs included in Attachment A-2. Applicable QA/QC is described in these procedures and/or in Table A-4. Details regarding DQOs are described in the QAPP (Appendix B).

5.6.3 Laboratory Analysis

Analytical methods for the chemical and geochemical analysis of constituents of concern have been chosen based upon DQOs to provide the highest level of data quality for purposes of the evaluation of remedial alternatives. Laboratory analyses will be conducted using standard methodologies as summarized in Table A-3. Applicable QA/QC is described in Table A-4 and Table A-5 for field QC and laboratory QC, respectively. Rationale for the choice of specific analytical methods is provided in Section 7.5 of the QAPP.

5.7 Decontamination Procedures

The procedures for the decontamination of field equipment, personnel and sampling equipment are outlined in the following sections. Detailed procedures for the decontamination of field and sampling equipment are included in the SOPs provided in Attachment A-2.

In an attempt to avoid the spread of contamination, all equipment (i.e., drill rigs, drilling tools, sampling equipment, etc.) must be decontaminated at a reasonable frequency in the decontamination area. The location of the decontamination area will be determined prior to the start of operations. All wash water generated during cleaning will be collected and removed for proper disposal.

5.7.1 Drilling Equipment

The rig and all associated equipment will be cleaned by the contractor before arriving at and exiting the Citric Block Site. The augers, drilling casings, rods, samplers, tools, and any piece of equipment that may come in contact (directly or indirectly) with the soil, will be steam cleaned prior to set up for drilling to ensure proper decontamination. The same steam cleaning procedures will be followed for augers and sampling tools used for each borehole. All steam cleaning (decontamination) activities will be monitored and documented by Roux Associates. Specific procedures for decontaminating drilling equipment are provided in the Roux Associates' SOP in Attachment A-2.

5.7.2 Personnel Protection

The field work will be performed in level D protection with continuous air monitoring provided to demonstrate the adequacy of this protection. Any decontamination of personnel required will be performed at a designated area of the facility and appropriate decontamination materials (e.g. eye wash) will be maintained for use in this area. The required photoionization detector (PID) readings for changing protection levels and other specifics regarding personnel protection and decontamination are discussed in the HASP (Appendix C of this Work Plan).

5.7.3 Sampling Equipment

All soil and water sampling equipment will be decontaminated prior to sampling and between sampling locations according to the procedures outlined in the SOPs included in Attachment A-2. Soil sampling equipment will be decontaminated using steam cleaning equipment, non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket. Water sampling equipment will be decontaminated prior to sampling and between sampling locations in a similar manner. If feasible and practical, bailers used for sampling monitoring wells will be dedicated or disposable and as a result, decontamination (other than before use) will not be required.

5.8 Waste Handling and Disposal

Wastes generated during performance of field tasks (e.g., drill cuttings) will be minimized due to the use of the Geoprobe™. However, cuttings generated from monitoring well installation will be containerized in labeled 55-gallon drums and stored within a designated area of the Citric Block Site. Each drum will be labeled with the Citric Block Site name, drum number, date and nature of contents. All development water and decontamination water produced will also be containerized. Drill cuttings and excess soil materials, liquid wastes and disposable personnel protective equipment will be stored separately.

The handling of all wastes will conform to the health and safety requirements of the HASP. Composite samples will be collected to characterize the wastes prior to transport and disposal. Sample types, analytical parameters, and number of samples analyzed will be dependent upon state and federal transportation, landfill and/or site disposal requirements, and the requirements of the contracted waste hauler and waste-processing facility for wastes determined to be hazardous.

In addition, all vehicles leaving the facility must be properly logged. The log will contain the vehicle identification, the driver's name, time of departure, and approximate volume of material carried. Copies of truck weight tickets, waste manifests, and other receipts as provided by the disposal facility, will be maintained as evidence of the arrival and disposal of the material at the disposal site.

6.0 FIELD INVESTIGATION PROCEDURES

This section describes the methods to be utilized during implementation of each field task described in the Scope of Work section of the Work Plan. The five field tasks identified in the Work Plan are:

- Task I: Citric Block Site Reconnaissance;
- Task II: Soil Boring and Sampling - Eastern Portion of the Citric Block Site;
- Task III: IRM Implementation - Eastern Portion of the Citric Block Site;
- Task IV: Soil Boring and Sampling - Western Portion of the Citric Block Site;
- Task V: IRM Implementation - Western Portion of the Citric Block Site;
- Task VI: Perched Ground-Water Investigation; and
- Task VII: On-Site Sewer Investigation.

The balance of this section is organized by task and provides descriptions of the methods to be utilized in the performance of each task.

6.1 Task I: Citric Block Site Reconnaissance

A Citric Block Site reconnaissance will be performed to develop and evaluate preliminary information necessary to characterize Citric Block Site conditions prior to the implementation of investigative field activities (e.g., monitoring well installation, drilling of soil borings, etc.). Information developed during the Citric Block Site reconnaissance will be used to assist in the determination of the actual location and number of field samples collected. The specific elements of the Citric Block Site reconnaissance are described below.

6.1.1 Citric Block Site Survey

The Citric Block Site will be surveyed to a common datum (e.g., National Geodetic Vertical Datum [NGVD], Brooklyn Datum) for the preparation of a base map by a New York State licensed surveyor. Horizontal control will be measured to the nearest 0.1 foot. Vertical control of land surface and measuring point elevations will be measured to the nearest 0.01 foot, relative to the NGVD, Brooklyn datum. The surveyor will also field-check the soil boring locations from previous investigations.

6.1.2 Accessibility and Utility Markouts

Each proposed well and soil boring location will be inspected by the hydrogeologist to determine whether the location is accessible by drilling equipment. In addition, utility markouts will be requested from the local authorities and facility personnel in an attempt to determine if any subsurface utility is present beneath each proposed drilling location. Moreover, a magnetic locator will be used by the hydrogeologist or designee to survey each proposed drilling location in a further attempt to verify that there are no metallic underground utilities present. The procedures for operating the magnetic locator are provided in the SOPs (Attachment A-2). If necessary, well and soil boring locations will be modified to avoid inaccessible areas or underground utilities.

6.1.3 Identification of On-Site Sewers

On-site sewers will be identified both in the field and through the review of engineering drawings from the local sewer department, if available. Based on the available information, the location and elevation of the sewer inverts will be used to assess whether sewers are considered a migration pathway for contaminants on and offsite.

6.1.4 Identification of Background Sampling Locations

Locations for background soil sampling will be chosen to avoid areas which may have been contaminated or otherwise affected by Citric Block Site activities. These areas will be selected based upon historical records review, Citric Block Site investigation, and review of aerial photographs.

6.2 Task II: Soil Boring and Sampling - Eastern Portion of the Citric Block Site

As part of the Work Plan, 16 soil borings (including five background soil borings) will be drilled on the eastern portion of the Citric Block Site at the approximate locations shown in Figure A-1. Analytical parameters for the soil samples are summarized in Table A-2. Actual drilling locations will be finalized based upon the findings of Tasks I and II. A general discussion concerning the drilling of soil borings within each area to be investigated is provided below.

At each sampling location, borings will be drilled using the Geoprobe™ method, with soil samples being collected at 0 to 2 feet intervals from beneath the concrete slab to perched ground water or clay layer (whichever is encountered first). The lithology of each core sample will be described and recorded. Soil samples will be screened for VOCs using a PID.

A soil sample will be collected for laboratory analyses from the 0 to 2 ft interval (immediately below the concrete slab) in each soil boring. A second sample will be collected from immediately above the perched water (if present) or clay layer, unless there is an odor, visual staining, or PID reading which indicates that an alternate sample be collected.

All soil samples will be analyzed by a NYSDEC certified ASP laboratory, and data will be validated by Data Validation Services of Riparius, New York. The following analytical methods will be used for this Citric Block Site:

- TCL VOCs - ASP 91-1;
- TCL SVOCs - ASP 91-2;
- TAL Metals - CLP SOW ILMO;
- Hexavalent Chromium - USEPA Method 7196;
- Arsenate/arsenite;
- TOC - USEPA Method 9060;
- pH - USEPA Method 9045; and
- Eh - ASTM Method 4646.

Samples will be analyzed for specified chemical parameters as listed in Sections 6.2.1 through 6.2.3. These soil-quality data will be integrated with the previous sampling results to evaluate the nature and extent of contamination in soils above the perched water or clay layer and underlying the Citric Block Site.

A description of the soil boring and analytical program for each area of concern is provided below. This program is based in part upon the results of previous investigations.

6.2.1 Eastern Portion

The eastern portion consists of former Buildings 1D, 3A, 3B, 4A, 4B, 7A, 7B and the former yard. Limited previous investigation results indicated the presence of metals, VOCs, and SVOCs. To further delineate the nature and extent of chemicals present in this area, 11 soil borings (CB-14 through CB-24) are proposed at the locations presented in Figure A-1. All soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL metals, hexavalent chromium and arsenate/arsenite, TOC, Eh, and pH.

6.2.2 Background Samples

The tentative locations for the collection of background soil samples will be determined during the Citric Block Site reconnaissance (Task I). All background samples will be collected using the Roux Associates' Stratified-Random Sampling Protocol (Attachment A-2) which is based upon USEPA guidance documents "Preparation of Soil Sampling Protocol: Techniques and Strategies" (USEPA, 1983), and "Data Quality Objectives for Remedial Response Activities" (USEPA, 1987b).

Five samples will be collected for the background soil sample study. Each boring will be drilled to a total depth of two feet. Split-spoon samples will be collected from the 0 to 2-foot interval in each boring. All samples from the 0 to 2-foot intervals at each background location will be composited.

Soils from each interval will be mixed together in the field using large plastic mixing bowls. Large soil aggregates will be manually broken up using hand pressure, plastic trowels or stainless steel trowels. Soil aggregates which cannot be reduced to less than one centimeter in diameter using these methods will be excluded from the composite. Once the soils have been reduced in size, they will be co-mingled for approximately five minutes, or for a sufficient time to make the composite mixture as homogeneous as feasible. Samples for analysis will then be collected from the composite for packaging and shipment to the off-site laboratories.

Background soil samples will be analyzed for TAL metals and SVOCs (i.e., PAHs) using the CLP Inorganics SOW, and ASP Method 91-2, respectively. These samples will also be analyzed for hexavalent chromium and arsenate/arsenite.

6.3 Task III: IRM Implementation - Eastern Portion of the Citric Block Site

Soil delineation work proposed in Task II is expected to require five to six weeks to complete (i.e., to receive analytical results). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas within the eastern portion of the Citric Block Site. Specifically, soil borings yielding soil concentrations exceeding TCLP limits, as discussed in Section 5.0 of the Work Plan, will be shown in a map (similar to Figure A-2) and will serve as "markers" for approximating "hot spot" areas to be removed during implementation of the IRM. The results of this work will be provided in a technical memorandum to the NYSDEC.

The IRM for the Citric Block Site will consist of the following:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for hazard characterization;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab (except near CB-1 and CB-4), based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

6.3.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings (known "hot spot" marker borings are shown in Figure A-2) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling;
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 10-foot) intervals radiating outward from each "hot spot" marker boring. For example, based upon existing Citric Block Site data, additional borings would be performed around existing soil borings CB-1, CB-3, CB-4, CB-6, and CB-8 through CB-12. Soil sampling will continue radially outward from each existing soil boring until the area containing constituents of concern at concentrations exceeding their respective TCLP limits has been completely delineated. For example, as shown in Figure A-3, four initial soil borings will be drilled in a "ring" around each existing soil boring. These initial borings are shown in green in Figure A-3. For each initial soil boring that contains constituents of concern at concentrations above their respective TCLP limits, sampling will continue outward incrementally (e.g., in 10-foot intervals) from that location until concentrations of all constituents of concern are below their respective TCLP limits. The outermost, or "perimeter", borings will define the limits of the "hot spot" area. In the vicinity of borings CB-1 and CB-4, soil borings will extend downward to a depth of 4 feet below land surface, since the 2- to 4-foot horizon at these locations were also shown to be contaminated during the recent subsurface investigation.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristics of metals using the TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils targeted for excavation will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine full waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for TC metals and/or PAHs (using the Toxicity Characteristic Leaching Procedure), reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

6.3.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Excavation may proceed, if warranted (e.g., contaminated soil in the vicinity of soil borings CB-1 and CB-4 may be excavated to a depth of four feet, depending upon the results of the focused soil boring program.) Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of borings where concentrations of all constituents of concern are below their respective TCLP limits. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk). Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

6.4 Task IV: Soil Boring and Sampling - Western Portion of the Citric Block Site

As part of the Work Plan, 27 soil borings (including five background soil borings) will be drilled on the western portion of the Citric Block Site at the approximate locations shown in Figure A-1. Analytical parameters for the soil samples are summarized in Table A-2. Actual drilling locations will be finalized based upon the findings of Tasks I and IV. A general discussion concerning the drilling of soil borings within each area to be investigated is provided below.

At each sampling location, borings will be drilled using the Geoprobe™ method, with soil samples being collected at 0 to 2 feet intervals from beneath the concrete slab to perched ground water or clay layer (whichever is encountered first). Two of the 27 soil borings will be drilled to the base of the clay layer (approximately 40 ft bls) to assess the continuity and thickness of the clay layer beneath the Citric Block Site. The lithology of each core sample will be described and recorded. Soil samples will be screened for VOCs using a PID.

A soil sample will be collected for laboratory analyses from the 0 to 2 ft interval (immediately below the concrete slab) in each soil boring. A second sample will be collected from immediately above the perched water (if present) or clay layer, unless there is an odor, visual staining, or PID reading which indicates that an alternate sample be collected.

All soil samples will be analyzed by a NYSDEC certified ASP laboratory, and data will be validated by Data Validation Services of Riparius, New York. The following analytical methods will be used for this Citric Block Site:

- TCL VOCs - ASP 91-1;
- TCL SVOCs - ASP 91-2;
- TAL Metals - CLP SOW ILMO;
- Hexavalent Chromium - USEPA Method 7196;
- Arsenate/arsenite;
- TOC - USEPA Method 9060;
- pH - USEPA Method 9045; and
- Eh - ASTM Method 4646.

Four of the soil samples collected from the fill material and underlying clay (two borings) will also be analyzed for grain size distribution and vertical permeability.

Samples will be analyzed for specified chemical parameters as listed in Sections 6.4.1 through 6.4.3. These soil-quality data will be integrated with the previous sampling results to evaluate the nature and extent of contamination in soils above the perched water or clay layer and underlying the Citric Block Site.

A description of the soil boring and analytical program for each area of concern is provided below. This program is based in part upon the results of previous investigations.

6.4.1 Western Portion

The western portion comprises former Buildings 4B and 7B (western portion) and 5, 8, 9, and 11. No previous investigations have been performed in this area, therefore to define the nature and extent of contamination, 22 soil borings (CB-25 through CB-46) are proposed at the locations presented in Figure A-1. All soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL metals, hexavalent chromium and arsenate/arsenite, TOC, Eh, and pH.

6.4.2 Background Samples

The tentative locations for the collection of background soil samples will be determined during the Citric Block Site reconnaissance (Task I). All background samples will be collected using the Roux Associates' Stratified-Random Sampling Protocol (Attachment A-2) which is based upon USEPA guidance documents "Preparation of Soil Sampling Protocol: Techniques and Strategies" (USEPA, 1983), and "Data Quality Objectives for Remedial Response Activities" (USEPA, 1987b).

Five samples will be collected for the background soil sample study. Each boring will be drilled to a total depth of two feet. Split-spoon samples will be collected from the 0 to 2-foot interval in each boring. All samples from the 0 to 2-foot intervals at each background location will be composited.

Soils from each interval will be mixed together in the field using large plastic mixing bowls. Large soil aggregates will be manually broken up using hand pressure, plastic trowels or stainless steel trowels. Soil aggregates which cannot be reduced to less than one centimeter in diameter using these methods will be excluded from the composite. Once the soils have been reduced in size, they will be co-mingled for approximately five minutes, or for a sufficient time to make the composite mixture as homogeneous as feasible. Samples for analysis will then be collected from the composite for packaging and shipment to the off-site laboratories.

Background soil samples will be analyzed for TAL metals and SVOCs (i.e., PAHs) using the CLP Inorganics SOW, and ASP Method 91-2, respectively. These samples will also be analyzed for hexavalent chromium and arsenate/arsenite.

6.4.3 Sampling for Permeability Testing

Undisturbed (Shelby™ tube) soil samples will be collected from the fill material and clay layer at two selected locations. To the extent possible, logs from pre-existing wells will be consulted to determine the depth to the interface so that a representative sample can be collected.

The Shelby™ tube samples will be recovered using the pushed-tube method. The tubes will be advanced into the formation in one continuous push using the drill rig hydraulics. Once the tube is pushed down to the desired sampling interval, the tube will be gently twisted to break the bottom of the sample. The tube will then be recovered by the drilling crew.

Following recovery of the tube, the length of the sample will be measured and recorded by the on-site Roux Associates' hydrogeologist. Each end of the tube will be squared off and any cuttings or slough will be removed. The ends of the sample will then be tightly sealed using melted wax. After sealing, any remaining void space will be filled using packaging material. The ends of the tube will then be closed with a tight-fitting plastic cap, and wrapped with duct tape. These soil samples will be delivered by hand to the geotechnical laboratory to minimize disturbance.

The samples will be analyzed by the geotechnical laboratory for the parameters summarized in Table A-1. If Shelby™ tube samples cannot be obtained, split-spoon samples will be collected for grain-size analysis.

6.5 Task V: IRM Implementation - Western Portion of the Citric Block Site

Soil delineation work proposed in Task IV is expected to require five to six weeks to complete (i.e., to receive analytical results). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas within the western portion of the Citric Block Site. Specifically, soil borings yielding soil concentrations exceeding TCLP limits, as discussed in Section 5.0 of the Work Plan, will be shown in a map (similar to Figure A-2) and will serve as "markers" for approximating "hot spot" areas to be removed during implementation of the IRM. The results of this work will be provided in a technical memorandum to the NYSDEC.

The IRM for the Citric Block Site will consist of the following:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for hazard characterization;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab, based upon soil quality conditions encountered on the western half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

6.5.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings (similar to Figure A-2) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling;
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 10-foot) intervals radiating outward from each "hot spot" marker boring. For example, based upon existing Citric Block Site data for the eastern portion, additional borings would be performed around existing soil borings CB-1, CB-3, CB-4, CB-6, and CB-8 through CB-12. Soil sampling will continue radially outward from each existing soil boring until the area containing constituents of concern at concentrations exceeding their respective TCLP limits has been completely delineated. For example, as shown in Figure A-3, four initial soil borings will be drilled in a "ring" around each existing soil boring. These initial borings are shown in green in Figure A-3. For each initial soil boring that contains constituents of concern at concentrations above their respective TCLP limits, sampling will continue outward incrementally (e.g., in 10-foot intervals) from that location until concentrations of all constituents of concern are below their respective TCLP limits. The outermost, or "perimeter", borings will define the limits of the "hot spot" area.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristics metals using TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for TC metals and/or PAHs (using the Toxicity Characteristic Leaching Procedure), reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

6.5.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of "perimeter" borings. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk).

Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

6.6 Task VI: Perched Ground-Water Investigation

To assess hydrogeologic and ground-water quality conditions, nine monitoring wells (MW-1 through MW-9) will be installed. The overall objective of this task is to comprehensively characterize hydrogeologic and ground-water quality conditions in the perched water zone underlying the Citric Block Site. Locations of the proposed monitoring wells are shown in Figure A-1.

6.6.1 Monitoring Well Installation

Monitoring wells will be installed using a hollow-stem auger, truck-mounted drill rig. Once the boring is drilled to total depth (approximately 8 to 10 ft below land surface [bls]), a 10-foot length of 2-inch diameter 10 slot (0.010 inch) PVC riser casing will be installed through the augers and the top of the well screen will be set at 5 feet above the clay layer. The borehole annulus will then be gravel packed (No. 1 Morie sand or equivalent) in place to 1 to 2 feet above the top of the screen while the augers are simultaneously lifted to expose the screened interval. A 1-foot thick bentonite seal will be installed above the gravel pack, and the remainder of the annular space will be filled to land surface with bentonite grout. A water-tight locking cap (with lock) will be installed inside a protective flush mount curb box.

During drilling of the well borehole, split-spoon core barrel samples will be collected every two feet from land surface to approximately 10 ft bls. The lithology of the core samples will be described and recorded, and samples will be screened in the field for VOCs using a PID.

The monitoring wells will be developed using one or more of the following methods:

- pumping and backwashing; and
- surging (with a surge block) and pumping.

Development will continue until each monitoring well produces sediment-clear water to the extent possible, and a proper hydraulic connection is established between the well screen and the perched water zone. The well development will be conducted in accordance with SOPs provided in Attachment A-2.

Roux Associates will provide oversight of all well drilling, installation, and development activities in accordance with Roux Associates' SOPs which are presented in Attachment A-2.

Following installation of all monitoring wells, each will be surveyed for horizontal and vertical coordinates. Both surface elevations and measuring point elevations will be measured at each well. Horizontal coordinates will be accurate to ± 0.1 foot, while vertical coordinates will be accurate to ± 0.01 foot.

6.6.2 Water-Level Measurements and Ground-Water Sampling

Two complete rounds of water-level measurements will be performed for all monitoring wells. Water levels will be measured to the nearest 0.01 foot using a steel measuring tape and chalk. An electronic interface probe will be used to assess the potential presence of non-aqueous phase liquids (NAPLs) in monitoring wells. Detections of dense non-aqueous phase liquid (DNAPL) or light non-aqueous phase liquid (LNAPL) by the electronic interface probe will be verified by using a clear acrylic bailer. The SOPs which will be followed during the measurement of water levels are provided in Attachment A-2.

Following the installation and development of the proposed monitoring wells, a comprehensive round of ground-water samples will be collected. Specifically, ground-water samples will be collected from the nine newly installed monitoring wells.

SOPs for measuring water levels, sounding monitoring wells, purging monitoring wells, sampling monitoring wells, decontamination of nondisposable measuring, sampling, and field analytical equipment, and implementing QA/QC procedures are provided in Attachment A-2. All disposable sampling equipment (e.g., ropes, disposable bailers) will be discarded in an appropriate manner. A synopsis of these procedures is provided below.

Water-level measurements and sounding the monitoring well will provide data to determine the amount of standing water in each well. Three to five times the volume of standing water in each monitoring well will be purged (evacuated) prior to sample collection (if possible). Removing all stagnant water from the well will ensure the collection of a representative sample from the aquifers. Purging will be implemented using a submersible pump or bailer, depending upon the well size, depth to water, and yield.

Ground-water samples for VOCs will be collected using precleaned (decontaminated), bottom-filling bailers and new nonabsorbent cord. Bailers will either be discarded (if disposable type) or decontaminated after sampling each monitoring well, and new rope will be used for each sampling event.

Ground-water samples will be poured into appropriate laboratory-supplied containers (Table A-7) and covered with septa and caps or Teflon™ lined lids. The sample will be decanted with minimum agitation and the vials for VOC analysis will be filled to exclude headspace. Samples collected for dissolved TAL metals analyses will be field filtered using a 0.45 micron membrane to remove particulates prior to submitting the sample to the laboratory. In addition, an unfiltered ground-water sample from each well will be submitted to the laboratory for total TAL metals analyses.

All ground-water samples will be analyzed for TCL VOCs, TCL SVOCs, TAL metals (filtered, unfiltered), and TOC. Eh, pH, temperature and specific conductance will be measured in the field. The respective SOPs providing detailed methodologies for each are included in Attachment A-2.

6.7 Task VII: On-Site Sewer Investigation

Based on the results of the locations and accessibility of on-site sewers investigated during the Citric Block Site reconnaissance, an evaluation will be performed to determine the elevations of the sewer inverts and the perched ground water. If the elevations indicate that leakage into the sewers from the perched ground water is possible, a video camera survey will be conducted.

Each manhole cover rim and invert for the sewer will be surveyed for horizontal and vertical coordinates relative to NGVD by a New York State licensed surveyor.

7.0 REFERENCES

United States Environmental Protection Agency. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. Environmental Monitoring Systems Laboratory, EPA-600/4-83-020.

United States Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste, SW-846. U.S. Environmental Protection Agency, Washington, DC.

United States Environmental Protection Agency. 1987a. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response, EPA/540/P-87/001.

United States Environmental Protection Agency. 1987b. Data Quality Objectives for Remedial Response Activities.

United States Environmental Protection Agency. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. Office of Emergency and Remedial Response, EPA/540/G-89/004.

Table A-1. Sample Types/Analyses by Task, Citric Block, Pfizer Inc, Brooklyn, New York

Task	Media	Field Analyses	Laboratory Analyses
Task II: Soil Borings - Eastern Portion	Soil	PID(1) screening	TCL(2) VOCs(3), TCL SVOCs(4), TAL(5) metals, TOC(6), hexavalent chromium, arsenate/arsenite, pH, Eh
Task III: IRM Implementation - Eastern Portion	Soil	PID Screening	TC metals and total mercury
Task IV: Soil Borings - Western Portion	Soil	PID screening	TCL VOCs, TCL SVOCs, TAL metals, TOC, hexavalent chromium, arsenate/arsenite, pH, Eh, geotechnical parameters(7)
Task V: IRM Implementation - Western Portion	Soil	PID Screening	TC metals and total mercury
Task VI: Ground-Water Sampling	Ground Water	pH, specific conductance, temperature, Eh	TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), TOC

(1) Photoionization Detector - screens for volatile organic compounds (vapor phase)
(2) Target Compound List
(3) Volatile Organic Compounds
(4) Semivolatile Organic Compounds
(5) Target Analyte List
(6) Total Organic Carbon
(7) Includes vertical permeability and grain-size analysis.

Table A-2. Projected Number of Field Samples, Citric Block, Pfizer Inc, Brooklyn, New York

Task	Parameter	Field Samples	Field Duplicates	Field Blanks(a)	Trip Blanks(b)	MS/MSD(c) (Extra Volume)	Total Laboratory Samples
II Soil Borings - Eastern Portion							
Soil	TCL VOCs	22	3	10	10	3x2	51
	TCL SVOCs	22	3	10	N/A(d)	3x2	41
	TAL Metals	22	3	10	N/A	3x2	41
	Hexavalent Chromium	22	3	10	N/A	3x2	41
	Arsenate/Arsenite	22	3	10	N/A	3x2	41
	TOC/pH/Eh	22	3	10	N/A	N/A	35
Background	PAHs	5	1	1	N/A	1x2	9
	TAL Metals	5	1	1	N/A	1x2	9
	Hexavalent Chromium	5	1	1	N/A	1x2	9
	Arsenate/Arsenite	5	1	1	N/A	1x2	9
III IRM Implementation - Eastern Portion							
Soil	TC Metals Total Mercury	(f)	(f)	(f)	(f)	(f)	(f)
IV Soil Borings - Western Portion							
Soil	TCL VOCs	44	5	15	15	5x2	89
	TCL SVOCs	44	5	15	N/A	5x2	74
	TAL Metals	44	5	15	N/A	5x2	74
	Hexavalent Chromium	44	5	15	N/A	5x2	74
	Arsenate/Arsenite	44	5	15	N/A	5x2	74
	TOC/pH/Eh	44	5	15	N/A	N/A	64
	Geotechnical(e)	4	N/A	N/A	N/A	N/A	4
Background	PAHs	5	1	1	N/A	1x2	9
	TAL Metals	5	1	1	N/A	1x2	9
	Hexavalent Chromium	5	1	1	N/A	1x2	9
	Arsenate/Arsenite	5	1	1	N/A	1x2	9

Table A-2. Projected Number of Field Samples, Citric Block, Pfizer Inc, Brooklyn, New York

Task	Parameter	Field Samples	Field Duplicates	Field Blanks(a)	Trip Blanks(b)	MS/MSD(c) (Extra Volume)	Total Laboratory Samples
V IRM Implementation - Western Portion							
Soil	TC Metals Total Mercury	(f)	(f)	(f)	(f)	(f)	(f)
VI Perched Ground-Water Sampling							
Groundwater	TCL VOCs	9	1	1	1	1x2	14
	TCL SVOCs	9	1	1	N/A	1x2	13
	TAL Metals	18	1	1	N/A	N/A	20
	TOC	9	1	1	N/A	N/A	11

(a) Field blank frequency estimates based on one per twenty, or one per day minimum, whichever is more frequent.
(b) The number of trip blanks is estimated due to requirement of one trip blank per cooler.
(c) Matrix Spike/Matrix Spike Duplicate.
(d) Not Applicable.
(e) Includes vertical permeability and grain size.
(f) To be determined after the completion of Task II.

Table A-3. Project Quality Control Summary, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
TCL VOCs	Water	10 µg/L	58-137%[d]	24 RPD[e]	95%	ASP 91-4
TCL SVOCs	Water	10 to 50 µg/L	10-111%[d]	50 RPD[e]	95%	ASP 91-2
TAL Metals	Water	0.2 to 5000 µg/L	75-125%	20 RPD	95%	CLP SOW
TCL VOCs	Soil	5 to 10 µg/kg[c]	59-172%[d]	24 RPD[e]	95%	ASP 91-1
TCL SVOCs	Soil	330 to 1600 µg/kg[c]	11-142%[d]	50 RPD[e]	95%	ASP 91-2
Hexavalent Chromium	Soil	0.6 to 6 mg/kg	75-125%	30 RPD[e]	90%	7196[g]
TAL Metals (includes Total Mercury)	Soil	0.2 to 1000 mg/kg[c]	75-125%	35 RPD	95%	CLP SOW
TOC	Soil	1,000 mg/kg	90-110%	9060[f]	90%	9060[g]
TOC	Water	TBD	TBD	TBD	TBD	TBD
Arsenate/Arsenite	Soil	[l]	[l]	[l]	[l]	[l]
TCLP Metals	Soil	N/A	75-125%	N/A	90%	1311/CLP SOW
pH (Off-Site)	Soil	0.01 units	0.1 units	[f]	90%	9045[g]
Eh (Off-Site)	Soil	N/A	N/A	N/A	90%	[h]
Grain Size	Soil	N/A	N/A	N/A	90%	[i]
Permeability	Soil	N/A	N/A	N/A	90%	[j]

Table A-3. Project Quality Control Summary, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
Field pH/Temperature/ Specific Conductance/Eh	Water	per SOP	per SOP	per SOP	90%	[k]

[a] Quantitation limits are based on CLP SOW 3/90 requirements (where applicable) or on method references.
[b] Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory.
[c] Limits are based on nominal wet weight of sample. Dry Weight limits will be higher.
[d] Actual limits for matrix spikes, surrogates and laboratory control samples are provided in the CLP SOW.
[e] Actual limits for relative percent difference (RPD) of Matrix spike duplicates are provided in the CLP SOW.
[f] Per method requirements, if applicable.
[g] EPA 1986, Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.
[h] ASTM D4646.
[i] ASTM D422-63.
[j] ASTM D5084-90.
[k] EPA 1983, Methods for Chemical Analysis of Water and Wastes (Methods 120.1, 150.1 and 170.1).
[l] Non-routine Methods.
µg/L micrograms per liter.
µg/kg micrograms per kilogram.
mg/kg milligrams per kilogram.
N/A Not applicable.
TBD To Be Determined.

Table A-4. Field Quality Control Sample Frequency, Citric Block, Pfizer Inc, Brooklyn, New York

Parameters	Media	Trip Blank[(a)]	Field Blank[(b)]	Field Duplicates[(c)]
VOC, SVOC	Soil	1/20	1/20	1/20
TAL Metals	Soil	N/A	1/20	1/20
VOC, SVOC	Ground Water	1/20	1/20	1/20
TAL Metals (including Total Mercury)	Ground Water	N/A	1/20	1/20
pH/Temperature/Eh/ Specific Conductance[(d)]	Ground Water	N/A	N/A	1/20
TOC	Ground Water	N/A	1/20	1/20
Geotechnical[(e)]	Soil	N/A	N/A	N/A
TOC, pH, Eh	Soil	N/A	1/20	1/20
Arsenate/Arsenite	Soil	N/A	N/A	N/A
Hexavalent Chromium	Soil	N/A	N/A	N/A
TCLP Metals	Soil	N/A	N/A	N/A

(a) Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only).
(b) Where applicable, one per twenty or fewer field samples, or one per day, whichever is most frequent.
(c) Where applicable, one per twenty or fewer field samples.
(d) Field Parameters.
(e) Off-site analysis for permeability and grain size.

Table A-5. Laboratory Quality Control Sample Frequency, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Matrix	Method Blank(a)	Matrix Spikes or MS/MSD(a)	Laboratory Replicates(a)	Analysis Methods(b)
VOCs	Soil	1/20	1/20	N/A	ASP 91-1
SVOCs	Soil	1/20	1/20	N/A	ASP 91-2
Hexavalent Chromium	Soil	1/20	1/20	1/20	7196(c)
TAL Metals (including Total Mercury)	Soil	1/20	1/20	1/20	CLP SOW
VOCs	Water	1/20	1/20	N/A	ASP 91-4
SVOCs	Water	1/20	1/20	N/A	ASP 91-2
TAL Metals	Water	1/20	1/20	1/20	CLP SOW
TOC	Soil	1/20	1/20	1/20	9060(c)
TOC	Water	1/20	1/20	1/20	9060(c)
Arsenate/Arsenite	Soil	N/A	N/A	N/A	(d)
Hexavalent Chromium	Soil	N/A	N/A	N/A	(c)
TCLP Metals	Soil	N/A	N/A	N/A	(c)
Permeability	Soil	N/A	N/A	N/A	ASTM D5084-90
Grain Size	Soil	N/A	N/A	N/A	ASTM D422-63
Eh	Soil	N/A	N/A	1/20	ASTM D4646
pH	Soil	N/A	N/A	1/20	9045(c)

(a) Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent.
(b) Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory.
(c) Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.
(d) Non-Routine Methods.

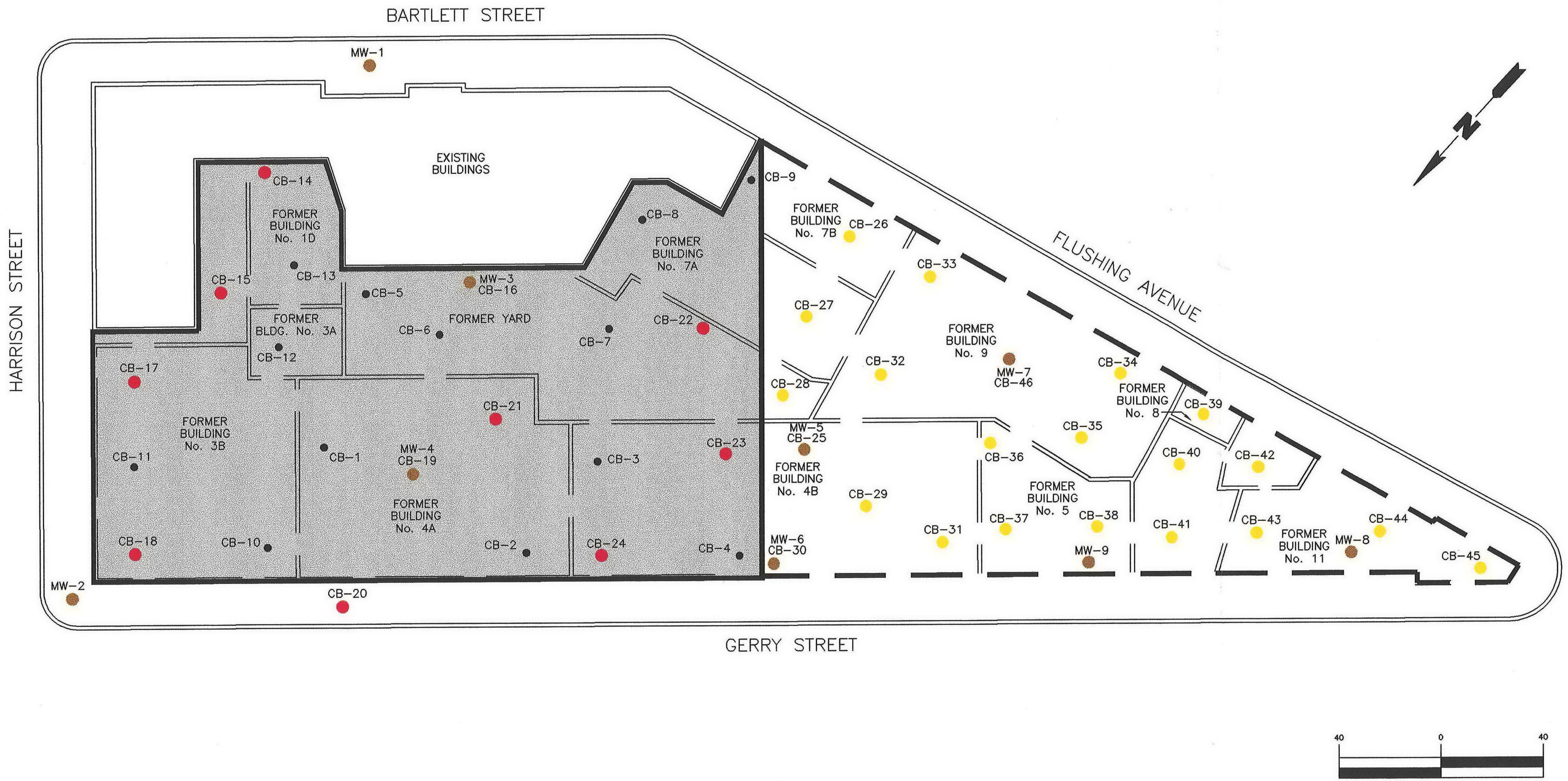
Table A-6. Field Equipment Calibration Requirements and Maintenance Schedule, Citric Block, Pfizer Inc, Brooklyn, New York

Equipment Type	Calibration Requirements	Maintenance Schedule
PID	Attachment A-2	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
pH Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Eh Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Specific Conductance Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Thermometer	Attachment A-2	Regularly check for breakage.
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.
Magnetometer	Attachment A-2	Replace batteries as necessary.
Surveying Instruments	Attachment A-2	Regularly clean instrument lenses.
Interface Probe	Attachment A-2	Replace batteries as necessary.
Stream Flow Gauge	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Data Logger and Pressure Transducers	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.

Table A-7. Preservation, Holding Times and Sample Containers, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Preservation	Holding Time[a]	Containers
Aqueous VOCs	HCl to pH<2 4°C store in dark	14 days	2 x 40 ml vials w/teflon septum
Aqueous SVOCs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous Total Organic Carbon	4° until analysis HCl to pH<2	28 days	1 liter plastic bottle
Aqueous Metals (Mercury)	HNO_3 to pH<2	180 days (26 days)	1 liter plastic bottle (included above)
Soil VOCs	4°C until extraction and analysis	14 days[b]	4 oz jar w/teflon lined lid
Soil SVOCs	4°C until extraction and analysis	14 days until extraction[c] 40 days until analysis	4 oz jar w/teflon lined lid
Soil Metals (Mercury)	4°C until analysis	180 days[d] (26 days)[e]	8 oz jar w/teflon lined lid (included above)
Soil Arsenate/Arsenite	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil pH	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil Eh	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil TOC	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil Hexavalent Chromium	4°C until analysis	24 hours	4 oz jar w/teflon lined lid

[a] From collection until analysis unless otherwise specified.
[b] 14 days from field to TCLP extraction/14 days from extraction to analysis
[c] 14 days from field to TCLP extraction/7 days from TCLP extraction to preparative extraction/40 days to analysis
[d] 180 days from field to TCLP extraction/180 days from extraction to analysis
[e] 26 days from field to TCLP extraction/26 days from extraction to analysis



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

▨ AREA OF PREVIOUS INVESTIGATION

CB-14 🔴 LOCATION AND DESIGNATION OF PROPOSED SOIL BORING LOCATION FOR FURTHER DELINEATION AT FORMER BUILDINGS 1D, 3A, 3B, 4A, 4B, 7A AND 7B AND THE FORMER YARD IN THE CENTER OF THE BLOCK (EASTERN PORTION)

CB-35 🟡 LOCATION AND DESIGNATION OF PROPOSED SOIL BORING LOCATION AT FORMER BUILDINGS 4B, 7A, 7B AND THE FORMER YARD IN THE CENTER OF THE BLOCK (WESTERN PORTION) AND FORMER BUILDINGS 5, 8, 9 AND 11.

MW-1 🟤 LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL.

NOTE: BUILDING DEMOLITION WAS COMPLETED BY AUGUST 1995.

BACKGROUND SOIL SAMPLE LOCATIONS ARE NOT SHOWN IN THIS FIGURE SINCE THEY WILL BE DETERMINED DURING THE SITE RECONNAISSANCE (TASK I).

Title:

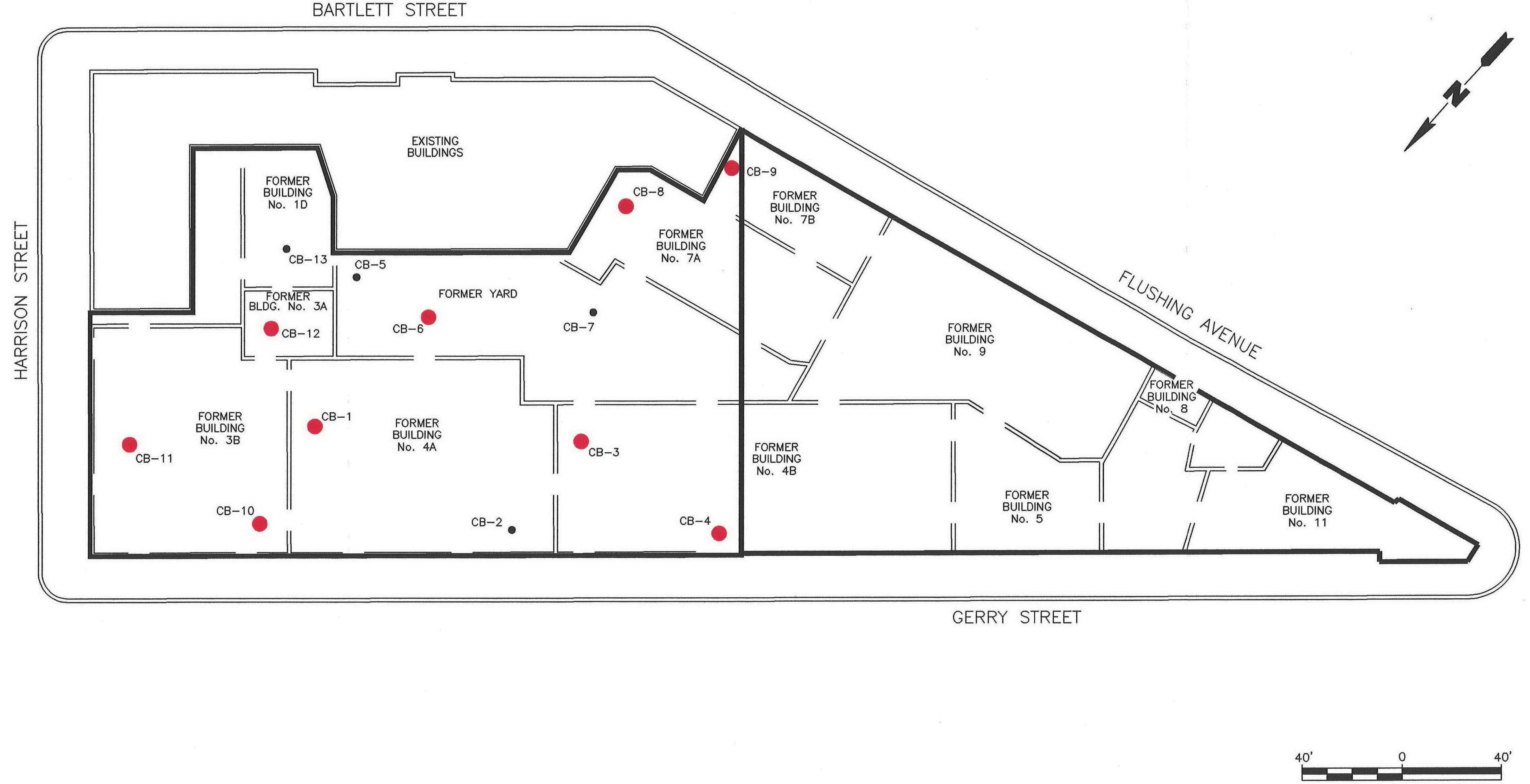
PROPOSED TASK II AND TASK IV SOIL SAMPLING LOCATIONS AND TASK VI MONITORING WELL LOCATIONS

CITRIC BLOCK SITE INVESTIGATION AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: S.J.G.	Date: 12/95	FIGURE
Prepared by: R.K.	Scale: SHOWN	A-1
Project Mgr: S.J.G.	Revision:	
Project No.:04744Y05	File No: 04744092	



EXPLANATION

CB-3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

IN RED ● LOCATION OF HOT SPOT MARKER SOIL BORINGS

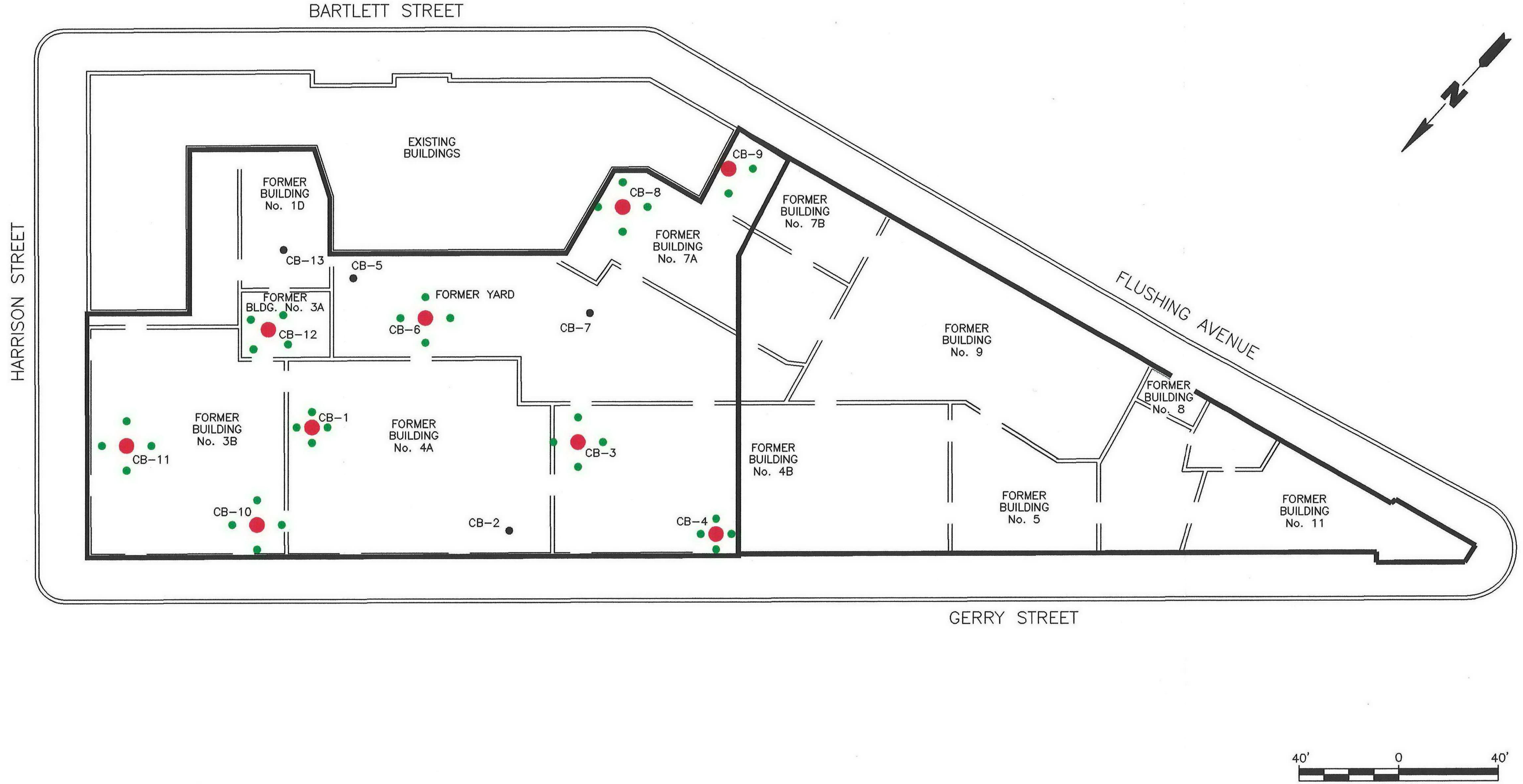
Title:

LOCATION OF MARKER SOIL BORINGS EASTERN PORTION OF THE CITRIC BLOCK SITE

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC Environmental Consulting & Management	Compiled by: S.J.G.	Date: 12/95	FIGURE
	Prepared by: R.K.	Scale: SHOWN	A-2
	Project Mgr: S.J.G.	Revision:	
	Project No.: 04744Y	File No: 04744089	



EXPLANATION

CB–3 ● LOCATION AND DESIGNATION OF PREVIOUS SOIL BORING

IN GREEN ● PROPOSED LOCATION OF FOCUSED IRM DELINEATION SOIL BORING

IN RED ● LOCATION OF HOT SPOT MARKER SOIL BORINGS

Title:

PRELIMINARY LOCATIONS OF IRM FOCUSED SOIL BORINGS EASTERN PORTION OF CITRIC BLOCK SIT

CITRIC BLOCK SITE INVESTIGATION
AND IRM WORK PLAN

Prepared For:
PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC *Environmental Consulting & Management*	Compiled by: S.J.G.	Date: 12/95	FIGURE
	Prepared by: R.R.	Scale: SHOWN	A–3
	Project Mgr: S.J.G.	Revision:	
	Project No.: 04744Y	File No: 04744093	

FIELD ORGANIZATION CHART

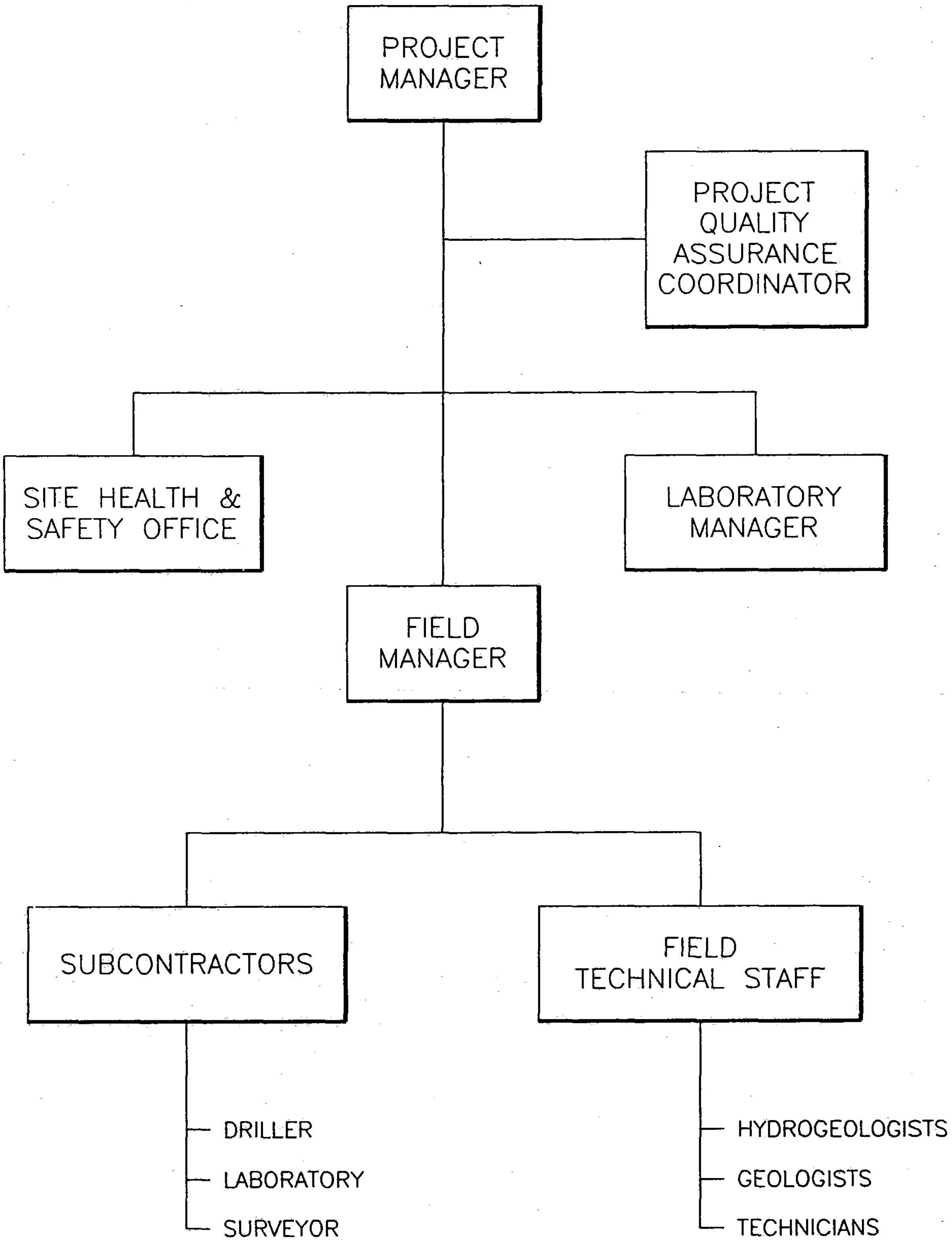


FIGURE A-4

ATTACHMENT A-1

Geotechnical Laboratory Methods (Upon Request)

ATTACHMENT A-2

Roux Associates, Inc.
Standard Operating Procedures (SOPs)

ATTACHMENT A-2

Table of Contents for Standard Operating Procedures

STANDARD OPERATING PROCEDURE
FOR MEASURING THE pH OF WATER SAMPLES

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (GDM)

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the pH of water in the field. The pH is measured in the field using a pH meter which should have the ability to compensate for temperature (automatically or manually). The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The manufacturer's instrument manual for each particular pH meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when pH readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of the pH meter is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific instructions. Usual procedures are given below.

2.2 Recalibration must occur if: 1) the pH of the samples being measured is outside the previous calibration range; 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.3 Two buffer calibrations bracketing the expected pH range of samples are to be performed prior to its use in a study. Three pH buffers (4.0, 7.0, and 10.0) are read after standardization at pH of 7.0 to evaluate the linearity and electrodes.

2.4 The measurements of sample and buffers are made while stirring. The samples and buffers are measured at the same temperature; therefore, the pH meter must be temperature compensated. If not, then record the temperature.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date:

b. pH meter identification.

c. Calibration results using pH standards.

d. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 The pH electrodes must be kept in good working order as follows:

a. Proper levels of electrolyte solution are maintained. The electrolyte solution level should be at least 1 inch above the solution being measured.

b. The electrodes must be carefully rinsed with distilled or deionized water before each measurement.

3.3 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature and pH are measured immediately.

3.4 The temperature of the sample is measured and the pH meter is compensated for the water temperature. If compensation is not possible, then record the temperature.

3.5 The electrodes are immersed in a water sample and stirred continuously until the pH reading equilibrates. The pH will be measured and recorded in increments of 0.1 or 0.1 SU.

3.6 Pertinent data are documented in the field notebook or appropriate field form, and initialed and dated.

3.7 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

Standard Operating Procedures
Measuring of Conductivity of Water Samples

STANDARD OPERATING PROCEDURE
FOR MEASURING THE CONDUCTIVITY
OF WATER SAMPLES

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the electrical conductance (conductivity) of water in the field. The conductivity is measured in the field using a conductivity meter which compensates for temperature (automatically or manually). Some conductivity meters measure directly in micromhos/centimeter (μmhos/cm) while others have to be converted to this unit. Conductivity will be recorded in μmhos/cm. The manufacturer's instrument manual of each particular conductivity meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the ground water or surface water. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when conductivity readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration is in accordance with the manufacturer's specific directions.

2.2 Calibration of the conductivity meter is to be performed at the beginning and end of each day's use.

2.3 Recalibration must occur if: 1) the specific conductivity of samples being measured is outside the calibration standard solution range; or 2) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.4 Choose a conductivity calibration solution that is near the conductivity of the water samples to be measured.

2.5 Select the appropriate conductivity calibration solution and adjust the span on the instrument to the conductivity calibration solution value.

2.6 Rinse the probe in distilled or deionized water and store the probe according to the manufacturer's specifications (e.g., distilled or deionized water, or a buffer solution).

2.7 The following information is documented in the calibration logbook:

a. Date.

b. Conductivity meter identification.

c. Initials of individual performing calibration.

d. Calibration results.

3.0 PROCEDURE

3.1 The conductivity electrodes must be kept in good working order as specified by the manufacturer.

3.2 The water sample is placed in a clean, appropriate container(s) and the temperature and conductivity are measured immediately.

3.3 The temperature of the sample is taken and the conductivity meter is compensated for the water temperature.

3.4 The probe is immersed in a water sample until the meter equilibrates.

3.5 In reading the conductivity meter scale, one or more of the following may have to be considered:

a. The reading may have to be multiplied appropriately (e.g., the reading is expressed in micromhos/centimeter).

b. If the conductivity meter is not capable of compensating for temperature differences, then note that the conductance measurements are not temperature compensated and document the temperatures.

c. If the conductivity meter can be compensated for temperature, then adjust the temperature control before reading the conductance measurement. (Some meters automatically compensate for temperature, and this should be documented.)

3.6 Conductivity measurements are recorded in the field notebook and on the appropriate field form, and initialed and dated. Units of μmhos/cm are used to represent conductivity.

3.7 The probe will be cleaned with distilled or deionized water after each use and will be stored according to the manufacturer's specifications (e.g., conductivity cells may have to be stored in distilled or deionized water, or a buffer solution).

Standard Operating Procedures
Measuring of Water Temperature

STANDARD OPERATING PROCEDURE
FOR MEASURING WATER TEMPERATURE

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water temperature in the field. Temperature measuring devices may include thermometers, and pH and/or conductivity meters equipped with a temperature probe. The temperature measuring device must be rapidly equilibrating, precision-grade, and meet or exceed National Bureau of Standards (NBS) specifications for accuracy. Temperature will be measured and recorded in degrees Celsius/Centigrade (° C). If the temperature measuring device is a meter, then the manufacturer's instrument manual, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

Temperature data is collected in the field to determine the temperature of the water sample under ambient (in situ) conditions. Temperature data can be used to evaluate the mobility of compounds in ground water and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when temperature readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of thermometers and temperature measuring meters will be performed before entering the field and checked upon return to the office.

2.2 Temperature measuring devices will be calibrated against a NBS-traceable thermometer.

2.3 If a thermometer is used to measure temperature, then the thermometer must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the thermometer does not read within this range and the thermometer cannot be calibrated, then it will not be used for temperature measurements and will be disposed of in an appropriate manner. If the thermometer does not read within this range and the thermometer can be calibrated, then the thermometer will be calibrated to the NBS-traceable thermometer.

2.4 If a temperature measuring meter is used to measure temperature, then the meter must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the meter does not read within this range and the meter cannot be calibrated, then it will not be used for temperature measurements and will be sent to the manufacturer for service and repair. If the meter does not read within this range and the meter can be calibrated, then the meter will be calibrated to the NBS-traceable thermometer.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.

b. Thermometer and/or Meter identification.

c. Calibration results relative to NBS-traceable thermometer.

d. Initials of individual performing calibration.

3.0 PROCEDURE

3.1 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature is measured immediately.

3.2 If a thermometer is used, then the thermometer is first rinsed with distilled or deionized water and is then immersed in water until the temperature equilibrates. The temperature is read in °C. The thermometer is rinsed again after measuring the temperature.

3.3 If a temperature measuring meter is used, then the probe is first carefully rinsed with distilled or deionized water. The probe is then immersed in water according to the manufacturer's specifications (e.g., specified submergence, stirred) until the temperature equilibrates. The temperature is read in °C. The probe is rinsed again after measuring the temperature.

3.4 Temperature data are recorded in the field notebook or appropriate field form, and initialed and dated.

STANDARD OPERATING PROCEDURE FOR MEASURING WATER-LEVELS AND SOUNDING A WELL WITH A STEEL TAPE

Date: December 21, 1989 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (CDD)

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using steel measuring tapes. A steel tape is used to measure the depth to ground water below an established (surveyed) measuring point (MP) and/or to sound a well (i.e., to measure the depth of well). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow. A well is sounded to determine the total depth of the well (i.e., to provide information regarding potential siltation problems [filling-in with sediment]). This can be used to eliminate possible confusion concerning identification of the well in cases where there are several similar, adjacent, unlabeled wells. Depth to water and sounding data can also be used to calculate the volume of standing water in the well (which is a prerequisite for purging a well before well sampling, and will be addressed in respective SOPs).

A steel tape is the preferred water-level measuring device because it is the most accurate, especially when measurements are taken under static conditions. However, this technique may be inappropriate under nonstatic (changing) conditions such as aquifer tests when water levels may be changing rapidly or when water is cascading into a well. These conditions would require the use of an electronic sounding device (refer to SOP for Measuring Water Levels using an Electronic Sounding Device (M-Scope).

2.0 DECONTAMINATION

The steel tape must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 PROCEDURE

3.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

3.2 The tape will be equipped with a weight to ensure the tape is held vertically and is kept taut when lowered into the well. Measure and record the distance from the bottom of the tape to the bottom of the weight to ensure the proper depth is measured when sounding a well.

3.3 If a water-level measurement is to be taken, then apply chalk (e.g., carpenter's chalk) to the bottom few feet of the tape and lower it into the water.

3.4 The top of the tape is held at an even-foot increment at the MP. This is the "held" value, and is recorded as such.

3.5 The tape is rolled up, and the cut (i.e., the mark between the dry and wet chalk) is noted. This "wet" value is measured accurately to the nearest 0.01 foot, and is recorded as such. The difference between the "held" value and the "wet" value is the DTW.

3.6 Always remeasure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.).

3.7 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

3.8 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

3.9 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

3.10 If the well is being sounded (depth measured), then lower the tape to the bottom of the well and measure its length accurately from the MP to the nearest 0.01 foot. Compare the sounded depth to the as-built well construction log (diagram). This will determine if siltation has occurred and redevelopment is necessary to establish a good hydraulic connection between the well screen and the aquifer.

3.11 All pertinent data will be recorded in the field notebook and on appropriate field forms, and initialed and dated.

STANDARD OPERATING PROCEDURE
FOR CONDUCTING A SLUG TEST

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to describe the methods to be used for conducting slug tests. A slug test is a method for determining aquifer coefficients (hydraulic conductivity) in areas characterized by low-permeability materials where pumping tests are not practical. This method involves measuring the response of a well to either the injection or withdrawal of a small amount of water of known volume from the well. (For the purpose of this SOP, well and piezometer can be used interchangeably.)

During testing, water-level changes with time (data) are measured and recorded. A pressure transducer and a data logger are to be used to collect slug test data as they provide a means for collecting substantial, meaningful data (in a short period of time) needed for analysis.

2.0 EQUIPMENT AND MATERIALS

2.1 The following items may be needed for conducting a slug test:

a. Electronic sounding device (m-scope).

b. Steel tape (in 0.01-foot increments) and chalk (e.g., blue carpenter's).

c. Data loggers and pressure transducers.

d. Field forms (i.e., Daily Log, Pumping Test, and Well Inspection Checklist) and study notebook.

e. Stop watch or watch with second display/hand.

f. Bailer or slug.

g. Non-absorbent cord (e.g., polypropylene).

h. Portable personal computer (PC), appropriate cables, software, and floppy disks.

i. Five-gallon bucket.

j. Clean cloth or paper towel.

k. Non-phosphate, laboratory-grade detergent solution.

l. Distilled or deionized water and potable water.

m. Flashlights/illumination.

n. Extra batteries (flashlight, meters).

3.0 DECONTAMINATION

3.1 Make sure all equipment that enters the well is decontaminated and cleaned before use. Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, initial and date the decontamination procedures on the appropriate field form (e.g., Daily Log) or in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a slug by: 1) wearing disposable gloves, 2) scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

c. Decontaminate a transducer and cable by: 1) wearing disposable gloves, 2) wiping transducer-related equipment (e.g., probe, cables) with a clean cloth and non-phosphate, laboratory-grade detergent solution, and 3) rinsing or wiping equipment with a clean cloth and distilled/deionized water or potable water.

d. Decontaminate a steel measuring tape or electronic sounding device (m-scope) by: 1) wearing disposable gloves, 2) wiping water-level measurement equipment with a clean cloth and non-phosphate, laboratory-grade detergent solution, and 3) rinsing or wiping equipment with a clean cloth and distilled/deionized water or potable water.

4.0 PROCEDURE

4.1 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s). Complete the Well Inspection Checklist, and initial and date upon completion.

4.2 Enter all pertinent data concerning the well to be tested on the Pumping Test form and Daily Log form, and in the study notebook.

4.3 Measure water levels (the depth to water below the predetermined measuring point [MP]) in the test well to an accuracy of 0.01 foot several times prior to the slug test. Document the water-level measurements, and initial and date data entries.

4.4 Sound (measure the total depth) the test well to an accuracy of 0.01 foot. Compare the sounded depth to the as-built total depth of the well to ensure no appreciable sanding or silting (clogging) has occurred. Document the sounded depth and, initial and date data entry. If appreciable clogging has taken place, then the well must be redeveloped to re-establish good hydraulic connection between the well and the aquifer. Wells must respond quickly to changes in water levels.

4.5 Install the precleaned transducer (which is to be used instead of manual measurement devices, e.g., steel tape and chalk or m-scope) to a predetermined depth, connect it to the data logger, and verify that the equipment is working. Program the data logger accordingly, using the PC and appropriate software.

4.6 Run a rising-head slug test by inserting the precleaned slug or the precleaned bailer (to displace or remove, respectively, a known volume of water) and allow the water level to equilibrate (i.e., return to the static condition). Remove the slug or the bailer and begin recording the data immediately. Collect the water-level data according to a predetermined schedule while water levels rise and the aquifer returns to static or near-static conditions;

or

Run a falling-head slug test by 1) adding a known volume of clean (e.g., distilled, deionized, potable) water to the well, 2) inserting the precleaned slug (to displace ["add"] a known volume of water) and immediately collecting the water-level data according to a predetermined schedule while the water levels fall and the aquifer returns to static or near-static conditions. Do not disturb the slug following its introduction into the well because this will adversely affect test results.

4.7 Review the data to determine if a meaningful test has been conducted and perform a duplicate test if deemed necessary.

4.8 Transfer the data from the transducer and data logger to the PC.

4.9 Secure the test well prior to leaving (i.e., replace cap and/or cover, and lock).

4.10 Clean (decontaminate) all test equipment that came in contact with the ground water according to the appropriate protocols listed in Section 3.0 (above).

STANDARD OPERATING PROCEDURE FOR COLLECTION OF SOIL SAMPLES FOR LABORATORY ANALYSIS

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

STANDARD OPERATING PROCEDURE FOR SOIL BORING AND/OR MONITORING OR OBSERVATION WELL DRILLING, FORMATION SAMPLING AND BOREHOLE ABANDONMENT IN UNCONSOLIDATED FORMATIONS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, and air rotary. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in. The diameter of a well that can be constructed inside the hollow stem is limited, however, to about 4 in.

3.2 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.3 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.4 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which "pulls" the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide "shoe" to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) "sand heave" when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.5 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.2 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.3 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.4 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.5 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.6 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.7 Record geologic information in the geologic log form and in the field notebook.

5.8 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.2 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.3 The soil cores from the wells drilled at the site are used for lithologic identification. The first 18 inches of soil for each borehole will be collected intact using a split-spoon sample, Shelby-tube sampler, or Denison-core sampler. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.4 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.5 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the SOP for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Upon the completion of the investigation, a determination will be made as whether to maintain the borehole (for a well or piezometer) or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the borehole, then the state will be notified and a request will be presented for borehole abandonment. Upon state approval to seal the borehole, appropriate state borehole abandonment forms will be completed, if required. Following state approval, the abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

7.2 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

STANDARD OPERATING PROCEDURE
FOR DECONTAMINATION OF FIELD EQUIPMENT

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis CAM

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinsate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

STANDARD OPERATING PROCEDURE
FOR SAMPLE HANDLING

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCotiis (GAT)

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., Teflon™) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., Teflon™). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an indivudual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

STANDARD OPERATING PROCEDURE
FOR FIELD RECORD KEEPING AND
QUALITY ASSURANCE/QUALITY CONTROL

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel onsite.

b. Name, date, and time of arrival onsite by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival onsite by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel onsite.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

STANDARD OPERATING PROCEDURE
FOR COLLECTION OF QUALITY CONTROL SAMPLES
FOR WATER-QUALITY DATA

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

STANDARD OPERATING PROCEDURE FOR FILTRATION OF GROUND-WATER AND SURFACE-WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (EDM)

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of ground-water samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Ground-water samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that filtration of ground water for metals analysis has been a standard practice with the United States Geological Survey (USGS) for many years. However, it should also be noted that certain regulatory agencies insist that ground-water samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, in order to quantify the concentrations of dissolved metals in ground water, filtration will be employed.

Within this framework, filtration refers to the filtering of water either directly or at the end of a filtration series through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltering of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter and using an exorbitant amount of time to filter the sample.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below is also used.

2.0 MATERIALS AND EQUIPMENT

To field filter ground-water samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

a. Non-phosphate, laboratory-grade detergent.

b. Distilled/Deionized water.

c. Potable water.

d. Field forms (e.g., daily log, sampling, etc.) and field notebook.

e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.

f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

g. Teflon™ tape.

h. Vacuum pump (e.g., hand-operated or electric).

i. Appropriate tubing and fittings.

j. Disposable gloves.

k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If reusable filtering equipment is being used, the following is the minimum decontamination procedure:

  a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.

  b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.

  c. Remove vacuum tubing from flask.

  d. Remove filter membrane from funnel.

e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.

f. Rinse with potable water.

g. Rinse with copious amounts of distilled or deionized water.

h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc.

4.0 PROCEDURE

4.1 Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.

4.2 Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.

4.3 Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).

4.4 Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).

4.5 Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.

4.6 Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.

4.7 Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).

4.8 Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

STANDARD OPERATING PROCEDURE
FOR SAMPLING GROUND-WATER MONITORING
WELLS FOR DISSOLVED CONSTITUENTS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. De Cillis GDM

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g, m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lick bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

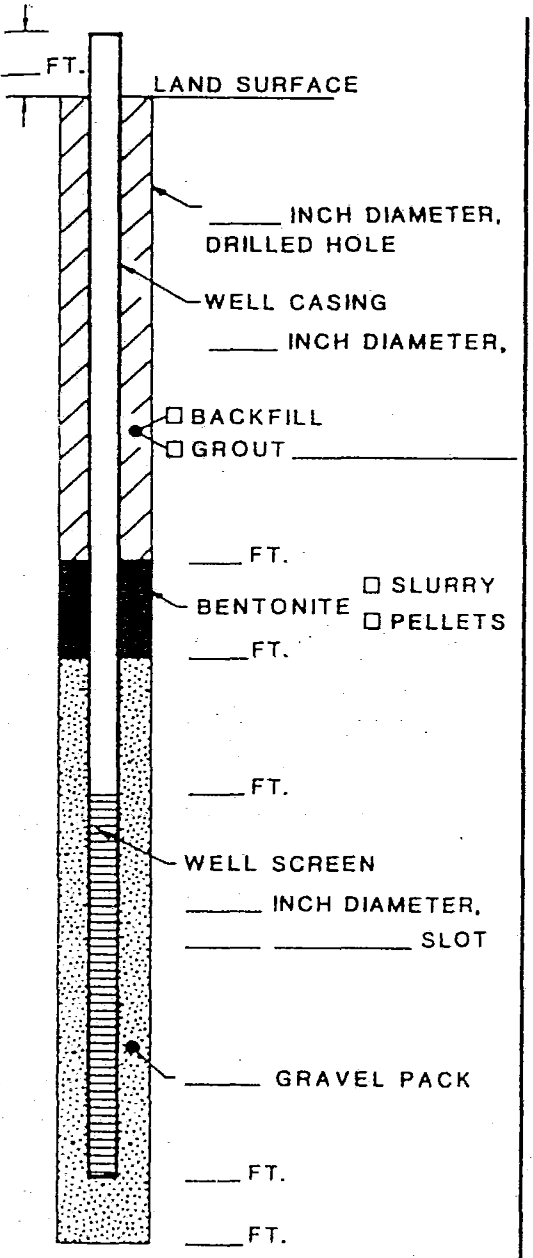
5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

ATTACHMENT A-3

Field Forms

ROUX
Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

MONITORING WELL
CONSTRUCTION LOG



NOTE:
ALL DEPTHS IN FEET
BELOW LAND SURFACE

PROJECT NAME ___ NUMBER ___

WELL NO. ___ PERMIT NO. ___

TOWN/CITY ___

COUNTY ___ STATE ___

LAND-SURFACE ELEVATION

AND DATUM ___ FEET ☐ SURVEYED

___ ☐ ESTIMATED

INSTALLATION DATE(S) ___

DRILLING METHOD ___

DRILLING CONTRACTOR ___

DRILLING FLUID ___

___

DEVELOPMENT TECHNIQUE(S) AND DATE(S)

___

___

___

FLUID LOSS DURING DRILLING ___ GALLONS

WATER REMOVED DURING DEVELOPMENT ___ GALLONS

STATIC DEPTH TO WATER ___ FEET BELOW M.P.

PUMPING DEPTH TO WATER ___ FEET BELOW M.P.

PUMPING DURATION ___ HOURS

YIELD ___ GPM ___ DATE ___

SPECIFIC CAPACITY ___ GPM/FT.

WELL PURPOSE ___

___

___

REMARKS ___

___

___

___

___

___

HYDROGEOLOGIST ___

CONSULTING GROUND WATER GEOLOGISTS
ROUX ASSOCIATES

GEOLOGIC LOG

Study No. ____________ Date ____________
Project ____________
Client ____________
Page ____________ Of ____________
Logged By ____________
Well No. ____________
Loc. ____________
M.P. Elevation ____________
Drilling Started ____________ Ended ____________
Driller ____________
Type Of Rig ____________

WELL DATA

Hole Diam. (in.) ____________
Final Depth (ft.) ____________
Casing Diam. (in.) ____________
Casing Length (ft.) ____________
Screen Setting (ft.) ____________
Screen Slot & Type ____________
Well Status ____________

G W READINGS(1)

Date	DTW MP(2)	Elev.W.T.

SAMPLER

Type ____________
Hammer ____________ lb.
Fall ____________ in.

DEVELOPMENT

Elev. (1)	SAMPLE				Strata Change & Gen. Desc.	Depth (ft.)	SAMPLE DESCRIPTION
	No.	Rec.	Depth (ft.)	Blows/6"			

REMARKS: (1) in feet relative to a common datum
(2) from top of PVC casing

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

WELL SAMPLING DATA FORM

CLIENT ____________________
PROJECT NO. ____________________
LOCATION ____________________

WELL NUMBER		TYPE OF WELL	
DATE		STORAGE TANK	
WEATHER		TIME OF START	
SAMPLED BY		TIME OF FINISH	

DEPTH TO BOTTOM OF WELL ____________________ FT.
DEPTH TO WATER ____________________ FT.
WATER COLUMN ____________________ FT.
VOLUME OF WATER IN WELL ____________________ GAL.
VOLUME OF WATER TO REMOVE ____________________ GAL.
VOLUME REMOVED ____________________ GAL.

RATE OF PURGE ____________________
METHOD OF PURGE ____________________

PHYSICAL APPEARANCE/COMMENTS

FIELD MEASUREMENTS

TIME	pH	COND	TEMP	TURB	Eh	O^2

TYPES OF SAMPLES COLLECTED

LABORATORY NAME AND LOCATION

ROUX

CHAIN OF CUSTODY

№ 00152

Ground-Water Consultants
ROUX ASSOCIATES INC

PROJECT NAME		PROJECT NUMBER	ANALYSES						PAGE OF	
PROJECT LOCATION										
SAMPLER(S)										
SAMPLE DESIGNATION/LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX						TOTAL BOTTLES	PRESERVATION

RELINQUISHED BY: SAMPLER'S (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE) FOR	DATE	TIME	SEAL INTACT Y OR N
DELIVERY METHOD	COMMENTS						
ANALYTICAL LABORATORY							

CUSTODY SEAL

DATE ______________________________

SIGNATURE ________________________

ROUX

FIELD CHANGE DOCUMENTATION

DATE: ____________________ FIELD CHANGE #: ____________________

PERSON REQUESTING CHANGE: ____________________

COMPANY/TITLE: ____________________

FIELD CHANGE: ____________________

____

____

____

REASON FOR FIELD CHANGE: ____________________

____

____

____

____

ACKNOWLEDGEMENT: ____________________

WORK PLAN ADDENDUM REQUIRED (Y/N): ____________________

ADDENDUM SUBMITTED TO: ____________________

ADDENDUM SUBMITTED TO: ____________________

APPENDIX B

APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

Pfizer Inc
Brooklyn, New York

Appendix B

December 12, 1995

Approvals:

Roux Associates, Inc.
Project Manager
Scott J Glash
Scott J. Glash
12/12/95
Date

Roux Associates, Inc.
Project Quality Assurance Coordinator
Joanne Yeary
Joanne Yeary
12/12/95
Date

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CONTENTS (Continued)

TABLES

FIGURE

ATTACHMENTS

1.0 PROJECT DESCRIPTION

The objectives of the Citric Block Investigation and Interim Remedial Measure (IRM) Work Plan are to complete delineation efforts and remove soil "hot spots" present on the eastern and western portions of the Citric Block Site at the Pfizer Inc Williamsburg Facility in Brooklyn, New York (Facility), for all media of concern. Information generated as part of the Work Plan may also be used to evaluate alternatives for remediation, and to provide the technical basis for choosing a preferred remedial alternative, if necessary.

This Quality Assurance Project Plan (QAPP) outlines the measures that will be taken to ensure that the data generated are of quality sufficient to meet the data quality objectives of precision, accuracy and completeness.

1.1 Introduction

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities for the Citric Block Site. This QAPP also describes the specific protocols which will be used to control the following sampling, sample handling and storage, chain of custody, and laboratory and field analysis activities.

All QA/QC procedures have been developed and implemented in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP was prepared by Roux Associates, Inc. (Roux Associates) in accordance with USEPA QAPP guidance documents, with content and format based upon the "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" (EPA QA/R-5), and the "Guidance for the Data Quality Objectives Process" (EPA QA/G-4).

1.2 Citric Block Site History/Background Information

The Work Plan provides more details of the Citric Block Site history, physical features, hydrogeology, and ground-water resources.

1.3 Past Data Collection Activity/Current Status

In July 1995, Roux Associates conducted a subsurface investigation in the eastern portion of the Citric Block Site. The area of investigation included former Buildings 1D, 3A, 3B, 4A, 4B, 7A, and 7B, as well as the yard located in the center of the block. The scope of work for the investigation included drilling 13 soil borings, collecting soil samples from the borings, and collecting perched ground-water samples. Soil and ground-water samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, total organic carbon (TOC), and pH, using the New York State Department of Environmental Conservation (NYSDEC's) Analytical Services Protocol (ASP). Undisturbed soil samples were also collected for geotechnical analyses, including grain-size and permeability. In addition, a preliminary exposure pathways analysis was performed to determine if exposure pathways exist at the Citric Block Site that could lead to risk to public health or to the environment. The results of this investigation were reported in a September 28, 1995 report titled "Subsurface Investigation of the Citric Block, Former Buildings 1D, 3A, 3B, 4A, 4B, 7A, and 7B" (Roux Associates, 1995), and are summarized in Section 3.2 of the Work Plan.

1.4 Project Objectives and Scope

Overall objectives for data generated as part of this investigation (for each task) are described in the Work Plan. Work Plan objectives which require collection of field data include the following:

- supplement previous investigations performed at the Citric Block Site to characterize environmental conditions; and
- support performance of an IRM.

This field investigation will include the following sampling activities:

- subsurface soil sampling; and
- ground-water sampling.

Samples will be analyzed for one or more of the following: Target Compound List (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, pH, Eh, grain size, permeability, TOC, and metal speciation (i.e., arsenic, chromium and mercury) to determine soil geotechnical and geochemical parameters. Some samples may also be analyzed for Resource Conservation and Recovery Act (RCRA) characteristics (i.e., toxicity, ignitability, reactivity, and corrosivity). Toxicity characteristics will be determined using the Toxicity Characteristic Leaching Procedure (TCLP) and will be limited to RCRA metals.

1.5 Sample Network Design and Rationale

The sample network design and rationale for sample locations is described in detail in the Work Plan.

1.6 Parameters to be Tested and Frequency

Projected sample matrices, analytical parameters and frequencies of field sample collection are provided in Tables B-1 and B-2.

1.7 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G-4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;
- determine the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objectives of the sampling at this Citric Block Site are the following:

- determination of the presence of contamination in areas not previously investigated; and
- further characterization of the deeper geologic conditions encountered during previous investigations.

A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for confirmation of previous sampling, and for potential areas of concern. Background samples (for polycyclic aromatic hydrocarbons [PAHs] and inorganics) will be collected based on the stratified random method described in the USEPA guidance document "Preparation of Soil Sampling Protocol: Techniques and Strategies." The locations for this sampling will be chosen to avoid areas which may have been contaminated or otherwise affected by Citric Block Site activities.

Total study error is the combination of sampling and measurement error. Total study error is directly related to decision error. These decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline condition) is that the parameter of interest exceeds the action level (e.g., waste is hazardous). This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using more precise laboratory methods. Analyses will be performed using USEPA and NYSDEC methods.

1.8 Project Schedule

A project schedule which includes the schedule for the sampling tasks, is provided in the Work Plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall management structure for field activities is presented in Figure B-1. A general summary of the responsibilities of the technical staff is provided below.

Project Manager. The Project Manager (PM) bears the primary responsibility for the successful completion of the work assignment within budget and schedule. Provides overall management for the execution of the Work Plan and directs the activities of the Field Manager (FM) and technical staff. Performs technical review of all field activities, data review and interpretation and the preparation of the Work Plan. Works closely with the analytical laboratory, data validation contractors, drillers and surveyors during the execution of the field program. Activities of the PM are supported by senior management, the Project Quality Assurance Coordinators, and support staff.

Field Manager. The Field Manager (FM) bears the primary responsibility for the successful execution of the field program. Directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. Responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, works closely with the Citric Block Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff. Field technical staff consists of hydrogeologists and technicians who will perform activities such as water-level measurements, soil and ground-water sampling, and preparation of any field documentation which may be necessary.

Citric Block Site Health and Safety Officer. The Citric Block Site Health and Safety Officer (SHSO) will be responsible for the implementation of the HASP. The SHSO will revise the HASP, if required, based upon the results of the Citric Block Site investigation. Any necessary revision to the HASP will be submitted to the Health and Safety Manager for approval.

Project Quality Assurance Coordinator (PQAC). Provides technical quality assurance assistance; prepares, reviews, and approves the Quality Assurance Project Plan (QAPP); oversees any contractor quality assurance activities to ensure compliance with contract specifications; monitors field investigations and prepares QAPP reports, if necessary.

Works closely with senior management and technical reviewers, Document Control Manager, and Laboratory/Data Validation Manager.

Laboratory Quality Assurance Officer. Identified at each laboratory contracted for analysis and preparation of the data package. The Laboratory Quality Assurance Officer will evaluate analytical results to ensure that the laboratory maintains a good performance.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting that will provide results which maximize the likelihood that the data are collected, analyzed and documented such that it is defensible. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the project specific objectives for precision, accuracy, representativeness, completeness, and comparability, known as the "PARCC" parameters.

3.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

Accuracy, precision and completeness requirements will be addressed for all the data generated. Accuracy, the ability to obtain a true value, is monitored through the use of field and method blanks, spikes, and standards, and compared to federal and state regulations and guidelines. This will reflect the impact of matrix interferences. Precision, the ability to replicate a value, is monitored through duplicate (replicate) samples. It is assessed for each matrix. Corrective actions and documentation for substandard recoveries, or substandard precision, must be performed by the laboratory. These parameters will be based on ASP/Contract Laboratory Program (CLP) criteria for ASP/CLP analyses, or modified criteria for non-CLP/ASP analyses.

Instrument sensitivity must be monitored to ensure the data quality through constant instrument performance. Method detection limits depend on instrument sensitivity and matrix effects. Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near detection limit standards and response factors.

Quality control criteria for laboratory and field analyses are provided in Table B-3. Standard Operating Procedures (SOPs) for the field equipment to measure pH and conductivity are outlined in the Roux Associates' SOPs included in Attachment A-2 of Appendix A. Accuracy and precision requirements for some field screening analyses are also included in Table B-3. Required field and laboratory QC samples and frequencies are summarized in Tables B-4 and B-5, respectively.

3.2 Completeness, Representativeness and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratory will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested using the ASP/CLP Routine Analytical Services (RAS) methods and 90 percent for other methods. Following completion of the analytical testing, the percent completeness will be calculated by the following equations:

$$\text{completeness (percent)} = \frac{\text{(Valid Data Obtained)}}{\text{(Total Data Planned)}} \times 100$$

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of Citric Block Site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in the Work Plan. Representativeness will be satisfied by ensuring that the Sampling and Analysis Plan (SAP) is followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed in part by the analysis of field duplicate samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

4.0 SAMPLING PROCEDURES

Detailed sampling procedures in the SAP describe the sampling and data gathering methods. For each task, the SAP includes the following:

- description of the source matrix and sampling procedures;
- description of containers, preservation, holding times, etc., used in sample collection, transport, and storage;
- procedures for decontamination of equipment; and
- chain of custody procedures.

Table B-6 presents a summary of sample containers, preservation, and holding times.

5.0 SAMPLE CUSTODY

The possession and proper transfer of samples and sample related information must be traceable from the time the samples are collected until the data have been accepted for analysis. The SAP describes the procedures for sample custody from the point where the sample is collected through the laboratory analysis. The following sections summarize the general aspects of custody and how they will be applied and managed during the course of the project.

A sample or sample related information (sample or evidence file) is under your custody if it:

- is in your possession;
- is in your view, after being in your possession;
- is in your possession and you place them in a secured location; or
- is in a secured, designated place.

5.1 Field Chain of Custody Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering and other sample designation documentation are included in the SAP.

5.1.1 Field Procedures

(a) The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(b) All bottles will be labeled with the appropriate sample numbers and locations (Appendix A, Section 4.0).

(c) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

(d) The Field Manager will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

5.1.2 Field Logbooks/Documentation

Field logbooks will be used to document all data collecting activities performed in the field. As such, entries will be described in sufficient detail such that persons going to the Citric Block Site could reconstruct a particular situation without reliance on memory. A summary of field documentation requirements is presented below.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control area when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered into the field book. The names of visitors to the Citric Block Site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink (if possible) and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed by the person making the correction. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the SAP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, sample volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description (in the field logs but not the chain of custody).

5.1.3 Transfer of Custody and Shipment Procedures

(a) Samples will be accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

(b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate, signed custody record enclosed in or on each sample box or cooler. Shipping containers will be locked and secured with strapping tape and USEPA custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

(c) Whenever samples are split with another source (i.e. a government agency), a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

(d) All shipments will be accompanied by the chain of custody record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office. Photocopies of the original record should be made before shipment, if possible, to ensure that clean copies can be made later.

(e) If the samples are sent by common carrier, a bill of lading (airbill) must be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample cooler and the custody seals remain intact.

5.2 Laboratory Chain of Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the laboratory QA plan in Attachment B-1. All laboratory handling and custody procedures must conform to the ASP/CLP Statement of Work (SOW) requirements. A brief summary of the required laboratory custody and sample handling procedures is presented below.

The laboratory's quality assurance officer will ensure that chain of custody records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory's quality assurance officer will also ensure that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all measurements and measuring equipment which are used for conducting field tests and laboratory analyses. All equipment must be calibrated prior to each use and on a periodic basis.

6.1 Field Instruments/Equipment

Field instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The calibration and use of field instruments are described in the SAP (Appendix A).

Equipment to be used during field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that all maintenance requirements are being observed. Backup instrumentation will be sent into the field where possible. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required. Preventive maintenance will be conducted for equipment and instruments to ensure the accuracy of measurement systems, and to ensure the availability of spare parts and backup systems (see Section 11.0).

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instrumentation may include a pH meter, a conductivity meter and thermometers for water analyses. A portable gas chromatograph, Organic Vapor Analyzer (OVA) or photoionization detector (PID) may be used for air sampling. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved.

6.2 Laboratory Instruments

The ASP/CLP calibration procedures and frequencies are specified in the NYSDEC ASP procedures and CLP organic and inorganic SOWs. In all cases where analyses are conducted according to the NYSDEC-ASP/USEPA-CLP protocols, the calibration procedures and frequencies specified in the applicable ASP/CLP RAS SOW will be followed.

Calibration of laboratory equipment for non-ASP/CLP analyses will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audits. For all instruments, the laboratory will retain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of laboratory calibration will be kept as follows:

- if possible each instrument will have record of calibration permanently affixed with an assigned record number;
- a label will be affixed to each instrument showing description, manufacturer, model numbers, date of last calibration, by whom calibrated (signature), and due date of next calibration. Reports and compensation or correction figures will be maintained with the instrument;
- a written stepwise calibration procedure will be available for each piece of test and measurement equipment; and
- any instrument that is not calibrated with the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

More detailed information on the calibration of laboratory equipment is presented in Section 9 of this QAPP and in the laboratory QA plan included as Attachment B-1.

6.3 Standards/Calibration Solutions Preparation

The standards/calibration solutions preparation will be performed in accordance with the ASP/CLP SOWs, if applicable, and using good laboratory practice (GLP) in all cases. More specific information on standards and reagent preparation is provided in Sections 9.3 and 9.4 of this QAPP.

7.0 ANALYTICAL PROCEDURES

Analytical procedures for this project have been selected to generate data meeting the DQOs required for the scope of work. A summary of the methods chosen and the rationale for each method selected is presented below. These methods are summarized in Table B-3. Sampling methods and procedures applicable to health and safety (e.g. personnel monitoring) are described in the HASP (Appendix C).

7.1 Laboratory Parameters

Methods published by USEPA will be used as the basis for all analyses for which such methods exist. The laboratory will follow methods detailed in the ASP/CLP SOW for organic analyses and the ASP/CLP SOW for inorganic analyses for the analysis of parameters by ASP/CLP protocols. The methods specified in Table B-3 shall be followed for non-CLP analytical parameters. These methods have been chosen based on applicability to the investigation and the level of data quality provided by the method.

7.2 Field Parameters

The procedures for field measurement of pH, Eh, temperature, specific conductivity, and organic vapors (using a PID) are described in the SOPs in Attachment A-2 of the SAP. Method references are included in Table B-3.

Portable probes operated according to the manufacturer's instructions and the Roux Associates' SOPs included in Attachment A-2 of the SAP (Appendix A) will be used for specific conductivity, Eh and pH. For these field measurements, ground water will be collected and transferred into clean containers. The separate specific conductivity, Eh and pH probes will be inserted into the beakers and allowed to equilibrate prior to recording the readings.

7.3 Analytical Quality Control

The analytical measurement QC for field and laboratory analyses will generally address the parameters of precision and accuracy. The required QC sample types, frequency and acceptance criteria for the laboratory and field measurements are summarized in Table B-2. Assessment of data quality based on the QC results is part of the data validation process and is discussed in Sections 8, 9, 10, and 12.

7.4 Proposed Analytical Laboratories

All analytical laboratories used for this work will meet the requirements of the respective laboratory QA plan and any other requirements for performing analyses to meet the required DQOs. The laboratory qualifications statement(s) and/or QA plan are included in Attachment B-1.

7.5 Rationale for Analytical Method Selection

All analytical methods selected for use during this project have been chosen based upon the following criteria:

- ability of the method to meet the established data quality objective for the parameter;
- validity and reproducibility of the method;
- ability to report detection limits below the ASP/CLP RAS Contract Required Quantitation Limit (CRQL) for compounds with action levels below the CRQL;
- conformance of the method to standard USEPA methods and practices; and
- cost comparison between the method alternatives (if applicable).

After reviewing these criteria, the analytical methods summarized in Table B-3 were chosen for this project. The rationale for choosing the specific analysis method is presented below for field and laboratory analyses.

7.5.1 Field Analysis Method Selection Rationale

Physical Analysis of Water Samples

Water samples requiring analyses for pH, Eh, temperature, specific conductance, etc. will be analyzed using Roux Associates' SOPs which are based upon the published USEPA methods for water. These analyses will be performed to provide supplementary and background data for off-site laboratory analyses and to assist in the overall water quality characterization. Data generated through the use of these methods will meet or exceed the established task specific data needs/uses.

7.5.2 Laboratory Analysis Method Selection Rationale

Chemical Analysis of Water Samples

Water samples requiring chemical analyses for TAL metals will be analyzed using CLP protocols, and organics (VOCs and SVOCs) will be analyzed using ASP methods. These analyses will be performed to provide information regarding Citric Block Site characterization, remedial alternatives, and risk assessment. The TOC will be analyzed using the Test Methods for Evaluating Solid Waste (SW-846). Data generated through the use of these methods will meet or exceed the established task specific data needs/uses.

Chemical Analysis of Soil Samples

Soil samples requiring chemical analyses for TAL metals using CLP protocols, and TCL organics (VOCs, SVOCs) will be analyzed using ASP procedures. The ASP/CLP analyses will be performed to provide information regarding Citric Block Site characterization, remedial alternatives, and risk assessment. Data generated through the use of these methods will meet or exceed the established task specific data needs/uses.

Soil sample analysis for TOC, pH, and Eh will be performed using SW-846. These analyses will be performed to provide information regarding Citric Block Site characterization and remedial alternatives. Data generated through the use of these methods will meet or exceed the established task specific data needs/uses.

Geotechnical Analysis of Soil Samples

Soil samples requiring geotechnical analyses (grain size, permeability, etc.) will be analyzed using standard or other established protocols (Table B-3). These analyses will be performed to provide information regarding Citric Block Site characterization and remedial alternatives. Data generated through the use of these methods will meet or exceed the established task specific data needs/uses.

8.0 DATA REDUCTION, VALIDATION AND REPORTING

Applicable methods/procedures will be required for the reduction, validation and reporting of data generated during all phases of this project. Both the field and laboratory data will be subjected to a level of data validation commensurate with the required data quality level. All data will be validated using either the USEPA Region II CLP Organics Data Review and Preliminary Review (SOP No. HW-6, Revision 8), and the Evaluation of Metals Data for the Contract Laboratory Program (SOP No. HW-2, Revision #11) or the same guidelines modified for non-CLP analyses. The level of complete transcription checks (raw data to reporting for calculation checks) shall nominally be 10 percent, but this percentage may be increased or decreased depending on the nature and significance of the individual results.

8.1 Data Reduction

Data reduction involves the generation, interpretation and calculation of results from the field and laboratory analyses performed as part of the data gathering effort. In order to make the appropriate decisions, it is necessary to verify that the reported values are correct, both in the way they have been generated (instrument calibration, etc.) and the way they are calculated and reported. Due to the different quantities of documentation and the different quality levels of data generated in the field and the laboratory, somewhat different levels of effort are required for reduction verification for these different data sources.

8.1.1 Field Data Reduction

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. If the data are to be used in the project reports, they will be documented in the report. All measurement data recorded in field logbooks or field forms will be reviewed by the Project Manager for completeness and clarity. Any discrepancies noted will be resolved by the Project Manager. All calculation equations shall also be verified by the Project Manager and individual calculations will be verified at a minimum frequency of ten percent by the PQAC. Any field information entered into data systems will be subject to the Roux Associates QA/QC procedures (Attachment B-2).

8.1.2 Laboratory Data Reduction

The off-site laboratory will perform in-house analytical data reduction and validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- raw data produced by the analyst is turned over to the respective area supervisor;
- the area supervisor reviews the data for attainment of quality control criteria as outlined in ASP/CLP protocols and/or established EPA methods and for overall reasonableness;
- upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the Laboratory's QA Officer;
- the Laboratory's QA Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency;
- the Laboratory's QA Officer and area supervisors will decide whether any sample reanalysis is required; and
- upon acceptance of the preliminary reports by the Laboratory's QA Officer, final reports will be generated and signed by the Laboratory's Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

Data reduction reporting procedures will be those specified in the ASP/CLP SOW, and SOW for inorganic and organic analyses.

Laboratories will prepare and retain full analytical and QC documentation the same as (ASP/CLP analyses) or similar to that (non-ASP/CLP analyses) required by the Analytical Services Protocols and Contact Laboratory Program.

The laboratory will report the data in chronological order along with all pertinent QC data. Laboratories will provide the following information to the prime Contractor in each analytical data package submitted.

1. Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated results of inorganic and organic compounds identified and quantified.

3. Analytical results for QC samples, spikes, sample duplicates, initial and a continuing calibration verification standards and blanks, standard procedural (method) blanks, laboratory control samples, and ICP interference check samples.
4. Tabulation of instrument detection limits determined in pure water.
5. Raw data system printouts (or legible photocopies) identifying: date of analyses, analyst, parameter(s) determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.
6. Sample preparation/extraction/analysis logs including weights, volumes and dilutions.

For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, surrogate spike recoveries, chromatogram, gas chromatogram/mass spectrometer (GC/MS) spectra, and computer printouts.

8.2 Field Data Validation

Field data assessment will be accomplished by the efforts of the PQAC and/or Project Manager. The data assessment by the Project Manager or his designee will be based on the criteria that the sample was properly collected and handled according to the SAP and Section 5.

8.3 Laboratory Data Validation

Validation of laboratory generated data will be performed by a Roux Associates' subcontractor. The qualifications of this firm are provided as Attachment B-3. The Contractor data reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of data accuracy, precision, representativeness and completeness, based on criteria in Section 3, will be performed and presented in the RI report.

The data reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

Data validation for laboratory data will be performed in accordance with the USEPA functional guidelines for evaluating organic analyses and inorganic analyses for all samples analyzed using ASP/CLP methodology. Non-ASP/CLP analysis data will also be validated using the functional guidelines, but use of the guidelines will be modified according to the applicable method and required QA/QC. It is anticipated that all laboratory data will be validated, with at least ten percent of the data being fully validated (i.e., complete transcription checks, calculation checks, etc.).

8.4 Data Reporting

All data generated for the Citric Block Site will be computerized in a database format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided in accordance with the USEPA Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses and Inorganic Analyses, as well as additional comments of the data reviewer for ASP/CLP analyses. For non-ASP/CLP analysis, the data will include appropriate flags based on the data validation functional guidelines. The data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank. Selected data reviewer comments will also become part of the database in order to indicate whether the data are usable as a quantitative concentration, usable with caution as an estimated concentration, or unusable due to out-of-control QC results.

The Citric Block Site data set(s) will be available for controlled access by the Process Manager, and authorized personnel using a Citric Block Site-specific code. The complete data set(s) will be incorporated into the report.

9.0 QUALITY CONTROL CHECKS

The following sections describe the QC checks that are commonly applied to investigations and their definition and purpose. There are two main areas of the data gathering process which may be checked: the field procedures and the laboratory procedures. A summary of the various field and laboratory QC checks applicable to this project and their required frequencies are provided in Tables B-4 and B-5, respectively.

9.1 Field Generated Quality Control Checks

Field generated QC checks are samples sent to the laboratory from the field by either the field sampling team (internal) or by a third party (USEPA, state agency). These types of samples serve as checks on both the sampling and measurement systems and assist in determining the overall data quality with regard to representativeness, accuracy and precision. The number and type of field QC samples submitted varies with the intended data use and the level of contamination (i.e. sample analyte concentrations) expected.

9.1.1 Internal Field Checks

Trip blank

Trip blanks generally pertain to volatile organic samples only. Trip blanks are prepared by filling a sample container with analyte-free water prior to the sampling event. The trip blanks are then transported to the field and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and sent for analysis. There should be one trip blank included in each sample shipping container. The samples are used to determine if any cross-contamination between sample containers occurs. At no time after their preparation are the trip blank sample containers opened before they reach the laboratory.

Field Blank

Field blanks (also called decontamination rinsate blanks) are defined as samples which are obtained by running analyte-free water through sample collection equipment (bailer, pump, auger, etc.) after decontamination, and placing it in the appropriate sample containers for analysis. These samples are used to determine if decontamination procedures are adequate.

Duplicates

Field duplicates (also called replicates or collocates) are individual portions of the same (replicates) or essentially the same (collocated) field sample. Collocates are independent samples collected in close proximity to one another such that they are essentially an equal representation of the parameter(s) of interest at a given point in space and time. Examples of collocated samples include: samples from two air quality analyzers sampling from a common sample manifold, two water samples collected at essentially the same time and place from the same source, and side-by-side soil core samples.

Collocated samples, when collected, processed, and analyzed by the same organization, provide intralaboratory precision information for the entire measurement system including sample acquisition, homogeneity, handling, shipping, storage, preparation and analysis. Collocated samples, when collected, processed and analyzed by different organizations, provide intralaboratory precision information for the entire measurement system.

Replicate samples are samples from the same sampling point that have been divided into two or more portions at some step in the measurement process after sample collection. An example of a field replicate sample would be a soil core sample that has been collected, split, and placed into two or more individual sample containers.

Duplicate samples can be used to estimate the overall precision of a data collection activity. Sampling error can be estimated by the comparison of collocated and replicated results from the same sample. If a significant difference in precision between the two subsets is found, it may be attributed to sampling design error.

Blinds

Blind samples can be either internal or external field QC samples. Internal blind samples are samples of known (performance evaluation, reference) or unknown (field sample replicates) concentration sent to the laboratory as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. Split samples are usually replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision).

9.1.2 External Field Checks

Blinds

Blind samples can be either internal or external field QC samples. External blind samples are usually samples of known (performance evaluation, reference) concentration sent to the laboratory (usually by a regulatory agency) as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. External split samples are replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision). External split samples may be generated for regulatory agencies, local resident oversight groups, or other interested/responsible parties.

9.2 Laboratory Generated QC Check Samples

Laboratory generated QC check samples are samples generated at the analytical laboratory by the laboratory personnel from the same (internal) or a different (external) laboratory. These types of samples serve as checks on the laboratory sampling and measurement systems and assist in determining the data quality with regard to laboratory accuracy and precision. The number and type of laboratory QC check samples varies with the intended data use and the level of contamination (i.e. sample analyte concentrations) expected.

Laboratory QC check samples may measure either method and/or instrument performance. Method (preparation) performance check samples collectively measure the entire laboratory analytical data generation process, from sample allocating in the laboratory through the analysis and data reduction. Instrument (analysis) check samples measure the laboratory performance from the point where analysis begins, generally excluding any preparation/extraction affects, through the analysis and data reduction.

9.2.1 Internal Laboratory Checks

Method Blank

Method blanks (also called preparation blanks) are usually aliquots of analyte free water which are processed through all procedures, materials, reagents, and labware used for sample preparation and analysis. However, a method blank may be an aliquot of a known low level analyte matrix (such as washed sand) in order to more appropriately match the matrix of interest. Method blanks are used to determine if contaminants are present in the reagents, laboratory preparation, or analysis systems.

Reagent Blank

A reagent blank is prepared in the same manner as a method blank but is not subjected to the preparation procedures (digestion and/or extraction). Reagent blanks are used to determine the purity of the reagents used in the preparation/extraction and to isolate other contamination present in the analysis system.

Duplicates

Laboratory duplicate samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix duplicates) and samples run through only the analysis method (analysis or instrument duplicates). In either case a "duplicate" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Duplicate samples are used to define either method (preparation plus instrument) or instrument precision. In some organic methods, two additional duplicate aliquots of the same sample are prepared and spiked (matrix spike and matrix spike duplicate) in lieu of a normal matrix duplicate.

Spikes

Laboratory spike samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix spikes) and samples run through only the analysis method (analysis or instrument spikes). In either case a "spike" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method which is spiked (fortified) with a known quantity of analyte and carried from that point on through the rest of the method as a routine sample. Spiked samples are used to define either method (preparation plus instrument) or instrument accuracy.

Surrogates

Surrogates are similar to matrix spikes and generally apply only to organic parameters. Surrogate spikes are added to all samples and are used to measure the effect of the sample matrix on specific compound recoveries. Surrogate spikes generally do not effect the routine sample results since the surrogate compounds are isotopically labelled. Surrogates are used to help define accuracy.

Internal Standards

Internal standards are similar to analysis spikes and generally apply only to organic parameters and inorganic analyses by Inductively Coupled Plasma (ICP). Internal standards are added to all samples (after preparation/extraction) and are used to determine the amount of variance in a measurement system due to transport, spectral, and other affects. Since the internal standard is a known quantity of analyte(s) generally not found in the environment, the results of the other analytes may be corrected for measurement system effects based on the percent recovery of the internal standard.

Control Samples

Laboratory control samples fall into two basic categories: samples run through the entire sample allocating, preparation, and analysis method (method or matrix controls) and samples run through only the analysis method (analysis or instrument controls). In either case, control samples are samples of known or certified concentration which are introduced at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Control samples are used to define either method (preparation plus instrument) or instrument accuracy. Examples of laboratory control samples are standard reference materials (SRMs), performance evaluation (PE) samples, laboratory control samples (LCS), and method control samples (MCS).

Analytical Batch

An analytical batch is a group of field and associated quality control samples which are prepared (and preferably analyzed) concurrently using the exact same method, techniques, materials, reagents, labware, etc. Generally, a laboratory analytical batch is defined as twenty or fewer field samples of the same matrix prepared and processed at the same time. All associated quality control samples should be prepared concurrently, and in addition to, the twenty or fewer field samples.

9.2.2 External Laboratory Checks

Round Robin Samples

Round robin samples are samples generated at one laboratory and sent to other laboratories for confirmation analysis. The "true" sample concentration is determined based on the statistical analysis of the various results reported by each laboratory. These samples are usually used to gauge accuracy. Examples of these types of samples include interlaboratory confirmation samples, proficiency analytical testing samples (PATs), and in some cases performance evaluation (PE) samples (in order to assign "true" values for the PE sample).

Performance Evaluation Samples

Performance evaluation (PE) samples are samples of known or assumed (based on round robin analyses) known concentration which are submitted to the laboratories by certifying (e.g. American Industrial Hygiene Association) or contracting agencies (e.g. CLP). PE samples are used to test the laboratory's competence in sample analysis and/or data package documentation and assembly. In terms of data quality, the PE sample is used to measure accuracy.

9.3 Standards Preparation

Calibration standards are prepared in the laboratory by dissolving or mixing a known amount of nominally pure analyte in the appropriate matrix using volumetric containers. Calibration standards must be prepared from a standard source which is traceable to a certified primary reference material (National Bureau of Standards or other certifying agency). All calibration standards must be prepared so that the types and concentration of the reagents used in the standard preparation are equivalent to the types and concentration of the reagents used in preparing the samples to be analyzed. Calibration curves are then generated to quantify the field sample results by comparison of the field sample response against the calibration standard response.

9.4 Reagents Preparation

All reagents used for analysis must be documented to be free of significant analyte concentration (i.e., all analytes to be measured are present below required detection limits) during or prior to the use of the reagents for sample preparation or analysis. Reagent blanks or method blanks (as required by the specific method) and other associated QC samples must be prepared using the same reagent lot(s) used for the actual field sample preparation. All reagent lots used for sample and standard preparation and analysis must be documented so that any resulting contamination problems can be traced to the specific standards and samples which were prepared using the reagent lot(s).

9.5 Calibration Checks

Once the calibration of an analysis system has been established using calibration standards, it is necessary to check the analysis system initially and periodically to verify correct standard preparation and system performance. Important elements to verify before and during the course of sample analysis include the accuracy of the calibration across the range of concentrations to be measured, the sensitivity of the instrument during the specific analysis run, and other transient changes in instrument performance, such as drift and linearity. To accomplish this verification task, analytical protocols require the analysis of calibration quality control samples which serve as instrument checks and as triggers for necessary corrective action.

Initial Calibration Verification Standards

The initial calibration verification standard (ICV) is usually prepared in the concentration range of greatest interest, using an agency supplied standard or an alternate standard source (i.e., a different standard manufacturer) than that used for the calibration standards. The ICV must be prepared utilizing the same reagents and reagent concentration used for both the calibration standards and field samples. The purpose of this standard is to verify the accuracy of the initial calibration before any samples are analyzed.

Continuing Calibration Verification Standards

The continuing calibration verification standard (CCV) is prepared in the same manner as the initial calibration verification standard, except that it generally may be from either the same source, or from an alternate source as the calibration standards. The purpose of the CCV is to provide a periodic check on the accuracy of the calibration curve during sample analysis.

Initial Calibration Blank

An initial calibration blank (ICB) is a reagent blank prepared utilizing the same reagent(s) and reagent concentration used for both the calibration standards and the field samples. The purpose of the ICB is to verify that the sensitivity of the instrument meets the required limit of quantification before any samples are analyzed.

Continuing Calibration Blank

The continuing calibration blank (CCB) is prepared in the same manner as the initial calibration blank. The purpose of the CCB is to verify both the lack of baseline drift and the instrument sensitivity during analysis.

Near Detection Limit Standard

This standard is a calibration standard prepared to be at or near the required limit of quantitation (detection limit) for the measurement system (typically at the required detection limit or two times the required detection limit). The purpose of this standard is to provide a gauge of the accuracy of the instrument/instrument calibration at or near the required limit of quantification.

Linear Range Verification Standard

The linear range verification standard is a calibration standard prepared at a concentration greater than any of the calibration standards. The purpose of this standard is to verify accuracy of the analytical system at analyte concentrations greater than the highest calibration standard. This standard is generally only applicable to analytical systems with wide ranges of linearity (typically three or more orders of magnitude), such as ICP, where calibration across the entire linear range is cumbersome or impractical.

Interference Check Sample

The interference check sample (ICS) is a standard material prepared by spiking (fortifying) a solution of analytes of interest (in the concentration range of interest) with interfering analytes of a much higher concentration. The purpose of this sample is to verify that the analytical system is free from interferences due to the interfering analytes at the concentrations of interfering analytes and analytes of interest present in the ICS.

9.6 Control Charts

Control charts are used to determine if acceptable method performance has been achieved. In general, control charts are developed for methods where a standard level of performance has yet to be established and/or set limits of performance have not been validated through multiple analyses and statistical manipulation.

The basis of a control chart is to determine an accepted mean result and the allowable variance around the accepted mean. Typically, the allowable variance is measured in terms of the "level of confidence" in a particular result. Based on a statistical analysis of the results obtained over a period of time, the mean and standard deviation of the measurements can be determined. Once these values are known, a control chart can be established using the mean as the "true" value and some multiple of the standard deviation (confidence level) as the allowable variance. For most control charts, the allowable variance is set at the 95 percent or 99 percent confidence level, meaning there is a 95 or 99 percent chance that the control sample value will fall within the range of the control window, if the method is performed correctly.

Where established limits of acceptability are not available for this project's analyses, a minimum criteria of ± 25 percent will be required for method accuracy in both soil and water samples; and ± 20 relative percent difference (RPD) for water samples and ± 35 RPD for soil samples will be required for method precision. Completeness will be established at 95 percent for ASP/CLP analyses and 90 percent for non-ASP/CLP analyses, based on the precision and accuracy criteria noted above. Table B-3 summarizes the required precision, accuracy and completeness requirements for the parameters anticipated for this project.

If no reference material with published acceptance limits meeting the criteria established above (for analyses without established limits of acceptability) is available for the specified analytical method, statistically valid control charts for the analytical method must be developed by the laboratory prior to analysis of any field samples. All field sample results reported from this analytical method must be concurrently prepared and analyzed with a laboratory generated control sample having a result within ± two standard deviations (95 percent confidence level) of the mean result established by the laboratory through the use of control charts.

9.7 Database/Electronic Media Quality Control Checks

For data entered into electronic media by laboratories and contractors other than Roux Associates, all electronic media will be verified through the data validation and authentication (if applicable) programs as described in Section 8. Hardcopy data from the laboratories and/or contractors will also be compared against the electronic media generated by these sources at the level and frequency specified in Section 8.

For data input into databases, or electronic media generated by Roux Associates, the quality of the data entry and output will be verified according to the Roux Associates' Project Quality Assurance/Quality Control Procedures included in Attachment B-2.

10.0 QUALITY ASSURANCE AUDITS

This section provides the types, frequencies and content of the various audits and audit functions to be applied to this project. Audits for the work generally consist of four types: management audits, data quality audits, technical systems audits and performance audits. These audits may be internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization). The purpose of these audits is to establish and verify that the sampling and analysis activities are performed in accordance with the QAPP.

Project audits are intended to provide information regarding:

- on-going assessment of the data quality;
- identification of areas with a need for improvement;
- verification of QA program implementation;
- assessment of applied resources to complete the assigned tasks, and;
- address changes and/or variances to procedures necessitated by the actual field or laboratory conditions.

Roux Associates is dedicated to confirmation of the specific and overall QA/QC objectives for this project through the use of management, performance and systems audits. The specific content and frequency of audits anticipated for this project are delineated below.

10.1 Management Audits

Management audits will be performed by Roux Associates personnel to determine whether the management functions and responsibilities related to environmental measurements are performed in accordance with Roux Associates' quality assurance procedures. Management audits will include a review of the QAPP implementation for this project in order to evaluate:

- the level of management support;
- the field and analytical tracking systems;
- the procedures for developing the project DQOs;
- the procedures for developing, approving and reviewing the QAPP;

- the procedures for developing and approving SOPs; and
- the procedures and schedules for conducting audits.

Management audits are an on-going function of the Roux Associates' QA/QC procedures. Project specific management audits for this project are the responsibility of the Project Manager and will be implemented as required for each management function. The Project Manager will review the management program and the other audit functions on a routine basis.

10.2 Data Quality Audits

Data quality audits will be performed by Roux Associates or Roux Associates' contractor personnel to determine whether data derived as part of the work are of known quality. Data quality audits will be supported by the data validation effort to determine whether or not sufficient information exists with the data set to support an assessment of data quality. Through the use of data validation and authentication (if applicable), information provided by Roux Associates and its contractors will be used to audit and evaluate:

- if a data set, or all the data sets of a particular project, met the DQOs;
- if the contractor collecting or reducing the data performed their own data quality assessment; and
- if the contractor identified deficiencies (if they existed) and corrected the cause(s), both technical and managerial.

For data generated by laboratories and contractors other than Roux Associates, all data will be verified through the data validation and authentication (if applicable) programs as described in Section 8. Hardcopy data from the laboratories and/or contractors will be checked for completeness and accuracy of data reduction at the level and frequency specified in this section. If data validation is performed by Roux Associates' subcontractors, key data may be subject to additional Roux Associates validation based on its importance in decision making for the project.

For data generated by Roux Associates, the quality of the data entry and reduction will be verified according to the Roux Associates' Evaluation and Validation of Data SOP in Attachment B-4 and the Roux Associates' Project QA/QC procedures included in Attachment B-2.

All data quality functions will be subject to Roux Associates oversight to assure the accuracy and completeness of the data reduction and validation efforts. Data quality is the responsibility of the PQAC and will be implemented as required for each type of data generating activity. At a minimum, the PQAC will review the data validation effort, perform spot checks on the quality of the data validation effort, and document his/her findings.

10.3 Technical Systems Audits

Technical systems audits will be performed to determine if the field and laboratory sampling and analytical systems specified in the SAP and QAPP are sufficient to generate data which will meet the stated DQOs. These audits will include the on-site examination of field and laboratory activities for quality and conformance to the SAP and QAPP. Both internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization) audits will be performed for both the field and laboratory systems.

10.3.1 Field Audits - Internal

The internal field audits will include examination and review of field sampling records, field instrument operating records, sample collection, handling, packaging and shipping procedures, maintenance of QA procedures, chain of custody, etc. to determine conformity to the SAP and QAPP. Internal audits of field activities (sampling and measurements) will be conducted by the Roux Associates PQAC and/or Project Manager. Should any deficiencies be discovered during the course of the audit, the PQAC will have the authority to take any necessary action, including implementing a "stop work" order, to correct the deficiency.

These internal field audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits to correct deficiencies, and to verify that QA procedures are maintained throughout the investigation, will be conducted on a routine basis. The specific contents of these audits will be based on Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) guidelines.

10.3.2 Field Audits - External

At this time it is not anticipated that external audits of the field activities will be necessary. However, if the internal audits determine that deficiencies exist which require an outside organization or agent to resolve the problem(s), Roux Associates will employ the services of an outside subcontractor to audit the field activities and make/suggest corrections to the problem.

10.3.3 Laboratory Audits - Internal

The internal laboratory system audits will be performed by the Laboratory QA Officer on at least an annual basis (at a minimum) and will include examination laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc. as described in the laboratory QA Plan (if applicable) or according to the guidelines set forth in the ASP/CLP Bid Package documentation regarding laboratory QA requirements.

10.3.4 Laboratory Audits - External

For this project it is anticipated that only laboratories currently meeting the criteria set forth for the ASP/CLP will be used for off-site sample analyses. These laboratories will have already been subject to a laboratory audit by USEPA personnel and it is not anticipated that an additional audit by Roux Associates or Roux Associates' subcontractor personnel will be required. However, should any laboratory be selected which has not been audited by the ASP/CLP, or an equivalent audit (state or other federal agency), in the last 12 months, Roux Associates or its contractor personnel will perform a laboratory audit using the guidelines set forth in the ASP/CLP Bid Package documentation prior to that laboratory performing any field sample analyses.

10.4 Performance Evaluation Audits

The internal performance audits of laboratory(ies) will be conducted by the Laboratory QA Officer. The performance audits will be conducted on at least a quarterly basis. Blind QC samples will be prepared and submitted along with project samples to the laboratory for analysis throughout the project. The Laboratory QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratories maintain a good performance.

External performance audits of the laboratories selected for the project will have already been performed by the ASP/CLP for some or all of the analytes being tested. These performance evaluation audits may be supplemented by the use of field generated blind QC samples (replicates) submitted by Roux Associates.

Internal performance evaluation audits of the field measurements performed by Roux Associates' personnel may be utilized if suitable reference solutions are available for the specific project activities. These types of checks could include analysis of "blind" calibration span gases for PID measurements, or analysis of USEPA Environmental Monitoring Systems Laboratory aqueous check samples for pH and specific conductivity.

For laboratory checks, tolerance limits for the performance evaluation samples will be based on the accepted values supplied with the check sample/standard. For the field checks, the tolerance limits will also be based on the accepted values supplied with the check sample/standard, but may be modified as necessary to take into account the less quantitative (screening) nature of the field analytical measurements.

11.0 PREVENTATIVE MAINTENANCE PROCEDURES

The preventative maintenance procedures described below are designed to prevent injury and loss of time and data due to faulty equipment/instrumentation. The purpose of preventative maintenance is to address potential problems before they occur and to help assure that equipment/measurement systems operate adequately when used for routine project activities.

11.1 Field Equipment/Instruments

The field instruments for this project includes thermometers, pH meters, Eh meters, PIDs, and conductivity meters. Specific preventative maintenance procedures to be followed for this and other field equipment are those recommended by the manufacturer and described in the applicable Roux Associates SOPs (see SAP Attachment A-2).

Table B-7 summarizes the relevant preventive maintenance procedures for specific pieces of field equipment to be used for sampling, monitoring, and documentation for this project.

Field instruments will be checked and calibrated in the office before they are shipped or carried to the field at the start of the project. These instruments will be checked and calibrated in the field on a daily basis before and after use. Calibration checks will be performed and will be documented in the field logbook.

11.2 Laboratory Instruments

As part of their QA/QC Program, the laboratory will conduct a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions.

These procedures will be documented in the laboratory QA Plan (Attachment B-1). Roux Associates will perform oversight of the laboratory maintenance program through the audit functions described in Section 10.

11.3 Documentation

Appropriate documentation of all equipment/instrument maintenance shall be maintained by the field and laboratory personnel and shall include what was done, date, time (if appropriate), next scheduled maintenance, equipment status, anomalies, and person performing maintenance. This documentation shall be entered into field logbooks, or into specific maintenance log forms for off-site maintenance activities.

12.0 SPECIFIC AND ROUTINE PROCEDURES TO ASSESS DATA QUALITY OBJECTIVES

This section will describe the specific methods and equations used to assess the quality of the data with regard to precision, accuracy and completeness. Previous sections in the QAPP have described the methods of data reduction and validation, defined the terms of the PARCC parameters, and described the types and frequencies of the various audit activities (see Sections 3, 8 and 10).

The procedures used to assess the DQOs as outlined in this QAPP were developed to generate data which meets the specific needs of the project. Through the use of a systematic method of data assessment, data of known quality will be produced and applied to the project needs based on the actual data quality.

By subjecting the data to standard calculations and validation guidelines, the usability of the data are enhanced when comparison against past, present or future data is necessary. Actual use of any data for specific project purposes will be determined by the Citric Block Site Manager in coordination with the PQAC, based on the required data quality needs for a particular data set (i.e., matrix type, concentration level, intended data use, quantification accuracy and precision needs, etc.).

12.1 Specific Assessment Parameters

The following sections list the parameters which will be assessed and the calculations applicable to the specific measurement. The acceptable limits for the individual parameters (for both field and laboratory analyses) are discussed in Sections 3 and 9.

Accuracy:

Accuracy of laboratory results will be assessed using the analytical results of method blanks, reagent blanks, matrix spikes, field blanks, bottle blanks, near detection limit and linear range standards, etc. The percent recovery (%R) of analysis and matrix spike samples will be calculated using the following equation:

$$\%R = \frac{A - B}{C} \times 100$$

Where: A = The analyte concentration determined experimentally in the spiked sample;

B = The analyte concentration determined by a separate analysis of the unspiked sample; and

C = The amount of analyte added in the spike.

Precision:

Precision will be assessed by calculating the relative percent difference (RPD) between the field and/or laboratory duplicate samples (e.g. field duplicates and/or splits, laboratory matrix spike/matrix spike duplicate [MS/MSD] for organic analysis, and laboratory duplicate analyses for inorganic analysis). The RPD will be calculated for each pair of duplicates using the following equation:

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where: S = First sample value (original or MS value)

D = Second sample value (duplicate or MSD value)

Completeness:

Completeness measures of the amount of valid data obtained from a measurement system compared to the amount of data expected to be obtained under normal conditions. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

Representativeness:

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, and parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network for this project was designed to provide data representative of Citric Block Site conditions. During development of the sampling network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in Section 7.5.

Representativeness of the data will be assessed by the Project Manager and the PQAC through review and comparison of the applicable data (field and laboratory duplicates, splits, spikes, PE samples, etc.) and by verifying that the SAP/design set forth in the SAP was followed for all data generated during the project activities.

Comparability:

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends in part on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data for these project activities (i.e., intra-project comparison). These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Assessment of statistical comparability will be based primarily on the use of field splits and internal and external PE samples. Specifics regarding the assessment of comparability within sample sets can be found in the Roux Associates' Evaluation and Validation of Data SOP in Attachment B-4.

Required Limit of Quantitation (Detection Limit):

The required limits of quantitation for the various analyses are found in Table B-3. For ASP/CLP analyses, these detection limits shall be arrived at using the methodology set forth in the specific statement of work for that parameter. For non-ASP/CLP analyses, the detection limit(s) shall be arrived at using either the ASP/CLP methodology (as applied to a particular analysis other than the ASP/CLP specified methods) or using a "standard" method based on the general guidelines presented below.

- The limit of quantitation shall be based on the variability of the blank response for the complete analytical procedure, or the variability for the signal-to-background response in a processed sample when there is not a detectable blank response. The detection limit will be established as three times the standard deviation of the blank or background response, adjusted for the amount of sample typically extracted and the final extract volume of the method (i.e., all dilutions and sample weight variables must be included in the calculation).
- Best professional judgment shall be used to adjust the limit of detection upward in cases where the transient occurrence of high instrument precision (i.e., low variability) results in a calculated limit of detection less than the absolute sensitivity of the analytical instrument. When no significant blank response is detectable, the limit of detection shall be estimated based on the standard deviation of low-level standard (concentrations at or near the expected instrument detection limit) responses.

12.2 Management of DQO Assessment

Assessment of the on-going ability to generate data of a known quality will be the primary responsibility of the PQAC and will be overseen by the Project Manager. As discussed previously in Sections 8 and 10, Roux Associates will be responsible for performing audits for technical systems and data quality on an on-going basis.

13.0 CORRECTIVE ACTIONS

Corrective action generally addresses the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. The following paragraphs describe the mechanics of how corrective action will be managed and implemented during the course of this project.

Corrective actions may be required for two classes of problems: analytical and equipment functional problems, and noncompliance problems. Analytical and equipment functional problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review. The need for laboratory analysis corrective actions is based on predetermined limits for acceptability (Section 3). By conducting system and performance audits, the Laboratory QA Officer will determine if the overall data generating systems are acceptable (Sections 9 and 10).

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the PQAC and/or Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the laboratory QA Officer and method specific corrective actions will be implemented.

13.1 Field Corrective Action

Corrective actions will be implemented by field personnel and documented in the field record book. No staff member will initiate corrective action without notification through the proper channels. If corrective actions are insufficient, a stop-work order may be issued by the Project Manager.

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformance, or suspected deficiencies of any activity (or issued document) by reporting the situation to the Project Manager or designee. The Project Manager will be responsible for assessing the suspected problems in consultation with the PQAC and Project Manager, and for making decisions based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance and/or requires corrective action, then a nonconformance report will be initiated by the Citric Block Site personnel and submitted to the Citric Block Site Manager for review.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and
- ensuring nonconformance reports are included in the Citric Block Site documentation project files.

If appropriate, the Project Manager will ensure that no additional work which is dependent on the nonconforming activity be performed until the corrective actions are completed.

Corrective action for field measurements may include the following:

- repeat the measurement to check the error;
- check for all proper adjustments for ambient conditions such as temperature;
- check the batteries;
- recalibration;
- check the calibration;
- replace the instrument or measurement devices; and
- stop work (if necessary).

The Project Manager or his designee is ultimately responsible for all Citric Block Site activities. In this role, the Project Manager at times is required to adjust the Citric Block Site programs to accommodate the Citric Block Site program specific needs. The change in the program will be documented on the Field Change Request form (Attachment B-5) that will be signed by the initiators and the Project Manager or designee. The Field Change Request shall be attached to the file copy of the affected document. The Project Manager and the PQAC must approve the change in writing or verbally prior to the field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and appropriate action will be taken by the Citric Block Site Manager to document the significance of the problem.

The Project Manager is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties.

13.2 Laboratory Corrective Action

Corrective action is required whenever an out-of-control event or potential out-of-control event is noted. The corrective action taken will be somewhat dependent on the analysis and the event. These actions are to be implemented in accordance with the Laboratory QA Plan in Attachment B-1 and the ASP/CLP SOWs, as appropriate and applicable.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality assurance reports serve the purpose of identifying, tracking and summarizing any field and laboratory activities which occur during the project. These reports provide a permanent record which addresses the adequacy of the QAPP, problems or deficiencies noted during audits, and resolution of the identified areas of concern. The following sections provide a summary of the report contents and frequency requirements for the writing and submission of QA reports.

14.1 Specific Quality Assurance Reports

In addition to the audit reports submitted to the Citric Block Site Manager in accordance with Section 10, a QA progress report will be submitted periodically to the Project Manager by the PQAC which addresses the identification or resolution of all QA issues occurring over that time period. If a project lasts less than two months, only a final QA report will be submitted. The final QA report will be incorporated into the final project report and will contain QA progress report sections that summarize data quality information collected during the project.

Each periodic or final QA report will include the following types of information: purpose and scope of report, time frame covered, project status (overall and by task if applicable), results of any data quality or other audits conducted during the time period, problem identification/updates/resolution, QAPP changes, project related training activities, visits by third party organizations, sources of additional information, and who receives the reports.

14.2 QA Report Management

The Citric Block Site Manager will be responsible for assuring that the frequency and content of the report(s) are met. Applicable sections of the report will be sent to the PQAC and the Health and Safety Manager for approval/disapproval. Any deficiencies found in the QA reports will be brought to the attention of the Corporate Quality Assurance Officer and will require correction within 14 days for periodic reports, or within one month for final reports.

The submission of QA reports will be included in the overall project management schedule as critical path points to assist in meeting the QA objectives for this project.

15.0 REFERENCES

Roux Associates, Inc. 1995. Subsurface Investigation of the Citric Block, Former Buildings 1D, 3A, 3B, 4A, 4B, 7A, and 7B.

United States Environmental Protection Agency. 1994. Guidance for the Data Quality Objectives Process, EPA QA/G-4, September 1994.

Table B-1. Sample Types/Analyses by Task, Citric Block, Pfizer Inc, Brooklyn, New York

Task	Media	Field Analyses	Laboratory Analyses
Task II: Soil Borings - Eastern Portion	Soil	PID(1) screening	TCL(2) VOCs(3), TCL SVOCs(4), TAL(5) metals, TOC(6), hexavalent chromium, arsenate/arsenite, pH, Eh
Task III: IRM Implementation - Eastern Portion	Soil	PID Screening	TC metals and total mercury
Task IV: Soil Borings - Western Portion	Soil	PID screening	TCL VOCs, TCL SVOCs, TAL metals, TOC, hexavalent chromium, arsenate/arsenite, pH, Eh, geotechnical parameters(7)
Task V: IRM Implementation - Western Portion	Soil	PID Screening	TC metals and total mercury
Task VI: Ground-Water Sampling	Ground Water	pH, specific conductance, temperature, Eh	TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), TOC

(1) Photoionization Detector - screens for volatile organic compounds (vapor phase)
(2) Target Compound List
(3) Volatile Organic Compounds
(4) Semivolatile Organic Compounds
(5) Target Analyte List
(6) Total Organic Carbon
(7) Includes vertical permeability and grain-size analysis.

Table B-2. Projected Number of Field Samples, Citric Block, Pfizer Inc, Brooklyn, New York

Task	Parameter	Field Samples	Field Duplicates	Field Blanks[a]	Trip Blanks[b]	MS/MSD[c] (Extra Volume)	Total Laboratory Samples
II Soil Borings - Eastern Portion							
Soil	TCL VOCs	22	3	10	10	3x2	51
	TCL SVOCs	22	3	10	N/A[d]	3x2	41
	TAL Metals	22	3	10	N/A	3x2	41
	Hexavalent Chromium	22	3	10	N/A	3x2	41
	Arsenate/Arsenite	22	3	10	N/A	3x2	41
	TOC/pH/Eh	22	3	10	N/A	N/A	35
Background	PAHs	5	1	1	N/A	1x2	9
	TAL Metals	5	1	1	N/A	1x2	9
	Hexavalent Chromium	5	1	1	N/A	1x2	9
	Arsenate/Arsenite	5	1	1	N/A	1x2	9
III IRM Implementation - Eastern Portion							
Soil	TC Metals Total Mercury	(f)	(f)	(f)	(f)	(f)	(f)
IV Soil Borings - Western Portion							
Soil	TCL VOCs	44	5	15	15	5x2	89
	TCL SVOCs	44	5	15	N/A	5x2	74
	TAL Metals	44	5	15	N/A	5x2	74
	Hexavalent Chromium	44	5	15	N/A	5x2	74
	Arsenate/Arsenite	44	5	15	N/A	5x2	74
	TOC/pH/Eh	44	5	15	N/A	N/A	64
	Geotechnical[e]	4	N/A	N/A	N/A	N/A	4
Background	PAHs	5	1	1	N/A	1x2	9
	TAL Metals	5	1	1	N/A	1x2	9
	Hexavalent Chromium	5	1	1	N/A	1x2	9
	Arsenate/Arsenite	5	1	1	N/A	1x2	9

Table B-2. Projected Number of Field Samples, Citric Block, Pfizer Inc, Brooklyn, New York

Task		Parameter	Field Samples	Field Duplicates	Field Blanks(a)	Trip Blanks(b)	MS/MSD(c) (Extra Volume)	Total Laboratory Samples
V	IRM Implementation - Western Portion							
	Soil	TC Metals Total Mercury	(f)	(f)	(f)	(f)	(f)	(f)
VI	Perched Ground-Water Sampling							
	Groundwater	TCL VOCs	9	1	1	1	1x2	14
		TCL SVOCs	9	1	1	N/A	1x2	13
		TAL Metals	18	1	1	N/A	N/A	20
		TOC	9	1	1	N/A	N/A	11

(a) Field blank frequency estimates based on one per twenty, or one per day minimum, whichever is more frequent.
(b) The number of trip blanks is estimated due to requirement of one trip blank per cooler.
(c) Matrix Spike/Matrix Spike Duplicate.
(d) Not Applicable.
(e) Includes vertical permeability and grain size.
(f) To be determined after the completion of Task II.

Table B-3. Project Quality Control Summary, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Matrix	Quantitation Limit(a)	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method(b)
TCL VOCs	Water	10 µg/L	58-137%(d)	24 RPD(e)	95%	ASP 91-4
TCL SVOCs	Water	10 to 50 µg/L	10-111%(d)	50 RPD(e)	95%	ASP 91-2
TAL Metals	Water	0.2 to 5000 µg/L	75-125%	20 RPD	95%	CLP SOW
TCL VOCs	Soil	5 to 10 µg/kg(c)	59-172%(d)	24 RPD(e)	95%	ASP 91-1
TCL SVOCs	Soil	330 to 1600 µg/kg(c)	11-142%(d)	50 RPD(e)	95%	ASP 91-2
Hexavalent Chromium	Soil	0.6 to 6 mg/kg	75-125%	30 RPD(e)	90%	7196(g)
TAL Metals (includes Total Mercury)	Soil	0.2 to 1000 mg/kg(c)	75-125%	35 RPD	95%	CLP SOW
TOC	Soil	1,000 mg/kg	90-110%	9060(f)	90%	9060(g)
TOC	Water	TBD	TBD	TBD	TBD	TBD
Arsenate/Arsenite	Soil	(i)	(i)	(i)	(i)	(i)
TCLP Metals	Soil	N/A	75-125%	N/A	90%	1311/CLP SOW
pH (Off-Site)	Soil	0.01 units	0.1 units	(f)	90%	9045(g)
Eh (Off-Site)	Soil	N/A	N/A	N/A	90%	(h)
Grain Size	Soil	N/A	N/A	N/A	90%	(i)
Permeability	Soil	N/A	N/A	N/A	90%	(j)

Table B-3. Project Quality Control Summary, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
Field pH/Temperature/ Specific Conductance/Eh	Water	per SOP	per SOP	per SOP	90%	[k]

[a] Quantitation limits are based on CLP SOW 3/90 requirements (where applicable) or on method references.
[b] Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory.
[c] Limits are based on nominal wet weight of sample. Dry Weight limits will be higher.
[d] Actual limits for matrix spikes, surrogates and laboratory control samples are provided in the CLP SOW.
[e] Actual limits for relative percent difference (RPD) of Matrix spike duplicates are provided in the CLP SOW.
[f] Per method requirements, if applicable.
[g] EPA 1986, Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.
[h] ASTM D4646.
[i] ASTM D422-63.
[j] ASTM D5084-90.
[k] EPA 1983, Methods for Chemical Analysis of Water and Wastes (Methods 120.1, 150.1 and 170.1).
[l] Non-routine Methods.
µg/L micrograms per liter.
µg/kg micrograms per kilogram.
mg/kg milligrams per kilogram.
N/A Not applicable.
TBD To Be Determined.

Table B-4. Field Quality Control Sample Frequency, Citric Block, Pfizer Inc, Brooklyn, New York

Parameters	Media	Trip Blank[a]	Field Blank[b]	Field Duplicates[c]
VOC, SVOC	Soil	1/20	1/20	1/20
TAL Metals	Soil	N/A	1/20	1/20
VOC, SVOC	Ground Water	1/20	1/20	1/20
TAL Metals (including Total Mercury)	Ground Water	N/A	1/20	1/20
pH/Temperature/Eh/ Specific Conductance[d]	Ground Water	N/A	N/A	1/20
TOC	Ground Water	N/A	1/20	1/20
Geotechnical[e]	Soil	N/A	N/A	N/A
TOC, pH, Eh	Soil	N/A	1/20	1/20
Arsenate/Arsenite	Soil	N/A	N/A	N/A
Hexavalent Chromium	Soil	N/A	N/A	N/A
TCLP Metals	Soil	N/A	N/A	N/A

(a) Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only).
(b) Where applicable, one per twenty or fewer field samples, or one per day, whichever is most frequent.
(c) Where applicable, one per twenty or fewer field samples.
(d) Field Parameters.
(e) Off-site analysis for permeability and grain size.

Table B-5. **Laboratory Quality Control Sample Frequency, Citric Block, Pfizer Inc, Brooklyn, New York**

Parameter	Matrix	Method Blank[a]	Matrix Spikes or MS/MSD[a]	Laboratory Replicates[a]	Analysis Methods[b]
VOCs	Soil	1/20	1/20	N/A	ASP 91-1
SVOCs	Soil	1/20	1/20	N/A	ASP 91-2
Hexavalent Chromium	Soil	1/20	1/20	1/20	7196[c]
TAL Metals (including Total Mercury)	Soil	1/20	1/20	1/20	CLP SOW
VOCs	Water	1/20	1/20	N/A	ASP 91-4
SVOCs	Water	1/20	1/20	N/A	ASP 91-2
TAL Metals	Water	1/20	1/20	1/20	CLP SOW
TOC	Soil	1/20	1/20	1/20	9060[c]
TOC	Water	1/20	1/20	1/20	9060[c]
Arsenate/Arsenite	Soil	N/A	N/A	N/A	[d]
Hexavalent Chromium	Soil	N/A	N/A	N/A	[c]
TCLP Metals	Soil	N/A	N/A	N/A	[c]
Permeability	Soil	N/A	N/A	N/A	ASTM D5084-90
Grain Size	Soil	N/A	N/A	N/A	ASTM D422-63
Eh	Soil	N/A	N/A	1/20	ASTM D4646
pH	Soil	N/A	N/A	1/20	9045[c]

(a) Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent.
(b) Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory.
(c) Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.
(d) Non-Routine Methods.

Table B-6. Field Equipment Calibration Requirements and Maintenance Schedule, Citric Block, Pfizer Inc, Brooklyn, New York

Equipment Type	Calibration Requirements	Maintenance Schedule
PID	Attachment A-2	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
pH Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Eh Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Specific Conductance Meter	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Thermometer	Attachment A-2	Regularly check for breakage.
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.
Magnetometer	Attachment A-2	Replace batteries as necessary.
Surveying Instruments	Attachment A-2	Regularly clean instrument lenses.
Interface Probe	Attachment A-2	Replace batteries as necessary.
Stream Flow Gauge	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.
Data Logger and Pressure Transducers	Attachment A-2	Per manufacturer's specifications and as needed based on calibration checks.

Table B-7. Preservation, Holding Times and Sample Containers, Citric Block, Pfizer Inc, Brooklyn, New York

Parameter	Preservation	Holding Time[a]	Containers
Aqueous VOCs	HCl to pH<2 4°C store in dark	14 days	2 x 40 ml vials w/teflon septum
Aqueous SVOCs	4°C until extraction and analysis	7 days until extraction, 40 days until analysis	2 x 80 oz amber bottles w/teflon lined lid
Aqueous Total Organic Carbon	4° until analysis HCl to pH<2	28 days	1 liter plastic bottle
Aqueous Metals (Mercury)	HNO_3 to pH<2	180 days (26 days)	1 liter plastic bottle (included above)
Soil VOCs	4°C until extraction and analysis	14 days[b]	4 oz jar w/teflon lined lid
Soil SVOCs	4°C until extraction and analysis	14 days until extraction[c] 40 days until analysis	4 oz jar w/teflon lined lid
Soil Metals (Mercury)	4°C until analysis	180 days[d] (26 days)[e]	8 oz jar w/teflon lined lid (included above)
Soil Arsenate/Arsenite	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil pH	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil Eh	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil TOC	4°C until analysis	28 days	8 oz jar w/teflon lined lid (included above)
Soil Hexavalent Chromium	4°C until analysis	24 hours	4 oz jar w/teflon lined lid

[a] From collection until analysis unless otherwise specified.

[b] 14 days from field to TCLP extraction/14 days from extraction to analysis

[c] 14 days from field to TCLP extraction/7 days from TCLP extraction to preparative extraction/40 days to analysis

[d] 180 days from field to TCLP extraction/180 days from extraction to analysis

[e] 26 days from field to TCLP extraction/26 days from extraction to analysis

FIELD ORGANIZATION CHART

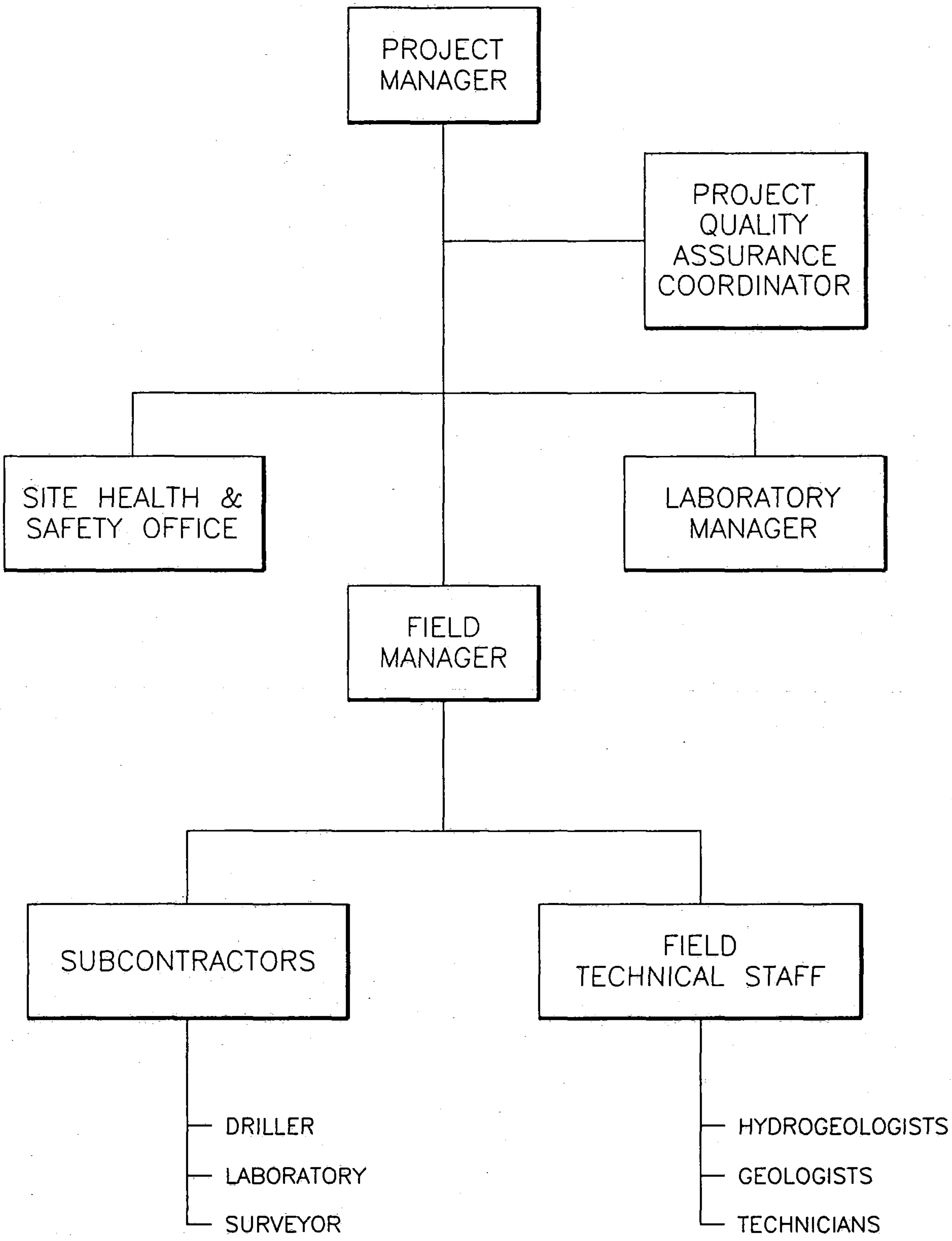

FIGURE B-1

ATTACHMENT B-1

Analytical Laboratory Quality Assurance Plan (Upon Request)

ATTACHMENT B-2

Roux Associates, Inc. Standard Operating Procedure
Quality Assurance/Quality Control Procedures

STANDARD OPERATING PROCEDURE
FOR EVALUATION AND VALIDATION OF DATA

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish the criteria to be followed for the evaluation of data quality and for data validation. Because valid media-quality data are integral to environmental investigations that characterize site conditions, the quality of the data generated by a laboratory is extremely important to the successful completion of a project. The level of data evaluation and validation required is determined by the project data quality objectives and must be outlined in the work plan/scope of work. Data collected to establish qualitative trends, for example, do not require the same level of validation as data generated to support litigation.

The data evaluation procedure described in Section 2.0 of this SOP is designed to provide a measure of comparability regarding quality control (QC) samples, i.e., between duplicate or replicate samples and to detect any contamination or bias in analyses of blanks. They may be used for both intra-laboratory and inter-laboratory comparisons.

The data validation procedure described in Section 3.0 of this SOP is designed to provide a stringent review of analytical chemical data with respect to sample receipt and handling, analytical methods used, and data reporting and deliverables.

Prior to performing any data evaluation or validation, it is crucial that all appropriate regulatory agencies be contacted and their data validation requirements be determined, as these requirements vary from agency to agency and may vary among different Regions of the United States Environmental Protection Agency (USEPA).

2.0 PROCEDURE FOR EVALUATION OF DATA

2.1 Not all analytical data packages will require a full data validation procedure as described in Section 3.0. The procedures described in this section provide an initial screening to help decide if full data validation is warranted. These data evaluation procedures are used as a quality assurance (QA) check for water-quality data, and are not generally applicable to soil-quality data. They are to be used when a full data validation procedure (described in Section 3.0) is not required.

2.2 Primary/Replicate, Primary Split and Primary/Laboratory Duplicate Comparisons

X = primary sample concentration

Y = replicate/split/laboratory duplicate sample concentration

$Z = \{(X-Y)/[(X+Y)/2]\} \times 100$

IDC = initial concentration requiring dilution, if samples have been diluted. If samples did not require dilution, then use the first range (i.e., QL-10[QL]).

QL = Quantitation Limit[1]

<u>Organic Constituents</u>

Range	Quantitative	Qualitative	Unusable
QL - 10(QL)	$Z \le 60\%$	$100\% > Z > 60\%$	$Z \ge 100\%$
10(QL) - IDC	$Z \le 40\%$	$100\% > Z > 40\%$	$Z \ge 100\%$
X or Y > IDC	$Z \le 60\%$	$100\% > Z > 60\%$	$Z \ge 100\%$

<u>Inorganic Constituents</u>

Analytical Method	Quantitative	Qualitative	Unusable
Wet Chemistry testing	$Z \le 60\%$	$100\% > Z > 60\%$	$Z \ge 100\%$
Atomic Absorption (AA)	$Z \le 40\%$	$100\% > Z > 40\%$	$Z \ge 100\%$
Inductively Coupled Plasma (ICP)	$Z \le 40\%$	$100\% > Z > 40\%$	$Z \ge 100\%$

2.3 Comparison of Blanks

X = primary sample concentration[2]

D = highest concentration in associated blank(s)

Y = X/dilution factor

	Quantitative	Qualitative	Unusable
Field Blank	$D \le 0.1X$	$0.5X > D > 0.1X$	$D \ge 0.5X$
Trip Blank	$D \le 0.1X$	$0.5X > D > 0.1X$	$D \ge 0.5X$
Lab Blank	$D \le 0.1Y$	$0.5Y > D > 0.1Y$	$D \ge 0.5Y$

[1] The quantitation limit will be dependent upon the specific methodology and the matrix, and will be either the minimum detection limit (MDL) or the practical quantitation limit (PQL).

[2] Results reported as BDL (below the detection limit) will be considered Quantitative because the primary samples have not been affected by the bias(es) which resulted in concentrations reported in the blank sample(s).

3.0 PROCEDURE FOR DATA VALIDATION

3.1 Determine study-specific data quality needs and pertinent regulatory agency data validation requirements.

3.2 Contact the appropriate regulatory agency(ies) to obtain their data validation procedure manual. This manual will indicate acceptable ranges for QC parameters to be investigated and procedures to follow for data which do not meet these requirements.

3.3 For inorganic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Instrument calibration, including initial and continuing calibration verification.

c. Blank(s).

d. Laboratory control sample(s).

e. Inductively Coupled Plasma (ICP) interference check samples.

f. Duplicate sample(s).

g. Matrix spike sample(s).

h. Furnace atomic absorption QC.

i. ICP serial dilution(s).

j. Sample result verifications.

k. Field duplicates.

l. General data assessment.

3.4 For organic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Gas Chromatograph/Mass Spectrometer (GC/MS) tuning.

c. GC calibration, initial and continuing.

d. Blanks.

e. Surrogate recoveries.

f. Matrix spike/matrix spike duplicates.

g. Internal standards performances.

h. Target Compounds List (TCL) compound identifications.

i. Reported detection limits.

j. Tentatively identified compounds (TICs).

k. Overall system performance.

l. General data assessment.

3.5 The parameters which do not conform to requirements are then listed and the data are qualified according to the guidelines provided in the appropriate regulatory agency's data validation procedure manual. The qualified data package is then reviewed and the project data reviewer, the project geochemist and/or the project manager makes a professional judgement concerning the validity of the data package, and its usability for the project.

ATTACHMENT B-3

Field Change Request Form

FIELD CHANGE REQUEST FORM

DATE: ____________ FIELD CHANGE #: ____________

PERSON REQUESTING CHANGE: ____________

COMPANY/TITLE: ____________

FIELD CHANGE: ____________

REASON FOR FIELD CHANGE: ____________

ACKNOWLEDGEMENT: ____________

WORK PLAN ADDENDUM REQUIRED (Y/N): ____________

ADDENDUM SUBMITTED TO: ____________

ADDENDUM SUBMITTED TO: ____________

APPENDIX C

APPENDIX C

Health and Safety Plan

HEALTH AND SAFETY PLAN

Pfizer Inc
Willliamsburg, New York

Appendix C

December 12, 1995

Approvals:

Roux Associates, Inc. Project Manager	Scott J Glash Scott J. Glash	12/12/95 Date
Roux Associates, Inc. Health and Safety Manager	Linda M Wilson Linda M. Wilson	12/12/95 Date
Roux Associates, Inc. Site Health and Safety Manager		Date

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1.0 GENERAL

This Site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations, and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities to be performed during the investigation at the Citric Block (Site) at the Pfizer Inc Williamsburg Facility, Brooklyn, New York. The HASP will be implemented by the designated Citric Block Site Health and Safety Officer (SHSO) during work at the Citric Block Site.

Compliance with this HASP is required for all Roux Associates employees and third parties who enter this Citric Block Site. Assistance in implementing this HASP can be obtained from Roux Associates' Health and Safety Manager (HSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by Roux Associates' HSM or her designee.

Scope of Work

The Scope of Work for this investigation will include implementation of the following tasks:

- Soil Boring and Sampling;
- Monitoring Well Installation; and
- Water-Level Measurements and Ground-Water Sampling.

Each task is described in detail in Section 7.0 and Appendix A of the Work Plan.

2.0 EMERGENCY INFORMATION

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Police		(718) 963-5311
Fire		(718) 636-1700
Hospital	Woodhull Medical Center	(718) 963-8000
National Response Center		(800) 424-8802
Poison Control Center		(800) 526-8816
Roux Associates' Health and Safety Manager	Linda Wilson	(516) 232-2600

The route to Woodhull Medical Center is shown in Figure C-1.

3.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

Roux Associates has designated health and safety personnel to be responsible for the implementation of this HASP for Roux Associates employees, and to provide assistance to the Contractor for health and safety related issues.

Personnel Designation	Responsibilities
Health and Safety Manager (HSM)	Implementation and modification of the HASP. Will assign health and safety duties. Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Citric Block Site conditions. Schedules adequate personnel and equipment to perform job safely.
Citric Block Site Health and Safety Officer (SHSO)/Citric Block Site Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies HSM of accidents/ incidents. Coordinates health and safety activities. Makes contact with local emergency groups prior to beginning work on-site. Responsible for evacuation, emergency treatment, and emergency transport of Citric Block Site personnel.
Field Crew Personnel	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.

4.0 CITRIC BLOCK SITE HISTORY AND PHYSICAL DESCRIPTION

This section provides a brief summary of the history and physical description of the Citric Block Site, as documented in part by Camp, Dresser and McKee (CDM) in the Corrective Action Prior to Loss of Interim Status Final Report.

4.1 Location

The Williamsburg facility is located at 630 Flushing Avenue, in Brooklyn, New York (Figure 1 of the Work Plan). The Citric Block is situated in the central portion of the facility. It is bounded on the north by Gerry Street, on the east by Harrison Avenue, and on the south by Flushing Avenue and the northern edge of three existing buildings.

4.2 Citric Block Site History

The Citric Block Site was first developed for chemical manufacturing between 1854 and 1888, during which time Pfizer purchased 72 lots of land surrounding the original Pfizer building on Bartlett Street (Miles, 1978; *p 5*). It is unclear whether or not these lots were vacant at the time of purchase, nor are the exact locations of these lots known (i.e., whether or not some of these lots were located on the Citric Block Site). An 1887 Sanborn fire insurance map shows that Pfizer occupied the entire Citric Block Site by that time, as well as parts of adjacent blocks. According to the 1887 Sanborn Map, the following buildings/operations existed on the Citric Block Site:

- a machine shop was located within Buildings 1D and 3A;
- bisulfide of carbon was stored within Building 1A and 1B;
- chloroform stills were located in the southern portion of Building 4B;
- packing and storage was located within the eastern portion of Building 6, while camphor storage was located in the western portion of Building 6;
- the camphor shop was located in Building 7;
- a carpenters shop was located in the vicinity of Building 8;
- the storage of lime, phosphorous and sulphur was located in Building 9;
- kettles (contents unknown) were present in Building 11; and
- the center of the block appears to have been an open yard.

Products produced by Pfizer during this time period include iodine preparations, mercurials, boric acid, camphor, citric acid, tartar derivatives, and chloroform (Miles, 1978; *pp 5, 7, 8 and 9*). According to the 1887 Sanborn map, it appears that the chloroform and camphor were produced at the Citric Block Site in Buildings 4B and 7, respectively. During the same time period, it is unclear to the exact locations (i.e., at the Citric Block Site or at other portions of the Pfizer facility) of the production of the mercurials, iodine preparation, boric acid, citric acid and tartar derivatives.

In the latter part of the nineteenth century and the early part of the twentieth century, Pfizer apparently expanded its operations at the Citric Block Site to include fermentation of citric acid and production of strychnine. However, it is not known of the exact location where the production of citric acid and strychnine occurred. In addition, a 1904 Sanborn fire insurance map shows that Pfizer expanded operations at the Citric Block Site by the addition of many buildings. It is unclear to the exact operation that occurred in each building, however, the following buildings/operations existed or ceased to exist:

- kettles (unknown contents) were now present in the northern portion of Building 1B;
- the chloroform stills located in the southern portion of Building 4B were no longer present;
- the camphor shop located in Building 7 was replaced with a tinsmith and "Japan Manufacturing"; and
- the mercurial building (Building 11) was now present where previously kettles (unknown contents) existed.

As shown in a 1918 Sanborn map, the operations at the Citric Block Site further expanded as follows:

- a nitric acid department was shown to be located between Buildings 1B, 1D and 3A;
- Building 6 was further expanded for storage, shipping and packing. In addition, a laboratory was now present in the northeastern portion of Building 6;
- Building 7 (former tinsmith) was now occupied for tartar emetic manufacturing; and
- the carpenter shop (Building 8) was no longer present.

By the 1930s, chemicals produced at the facility (of which the Citric Block is a part) reportedly included tartar emetic, mercury salts, bismuth medicinal salts, blueprint chemicals, iodides, synthetic phenolphthalein, tartaric acid, tartrate, citrates, gluconic acid, and gluconates (Miles, 1978; *p 48*). Raw materials reportedly used at the facility reportedly included iodine, ingots of bismuth metal, liquid mercury, iron ore, antimony oxide, and crude camphor (Miles, 1978; *p 48*). Exactly which of these chemical-manufacturing operations took place at the Citric Block Site, and where specific chemicals were handled or stored, is unclear. However, it is known that the Citric Block Site was used for the manufacturing of citric acid, chloroform, tartar emetic (Building 7) and mercurials (Building 11), and for administration and research purposes (Building 6).

According to the Sanborn fire insurance maps, no apparent changes to buildings/operations occurred from 1918 until around 1947. There was only one apparent change to the Citric Block Site by 1947. The laboratory that existed in the northeastern portion of Building 6 had expanded to include the entire building, and also housed an office. It is noted that a building construction date of 1941 is present on the 1947 Sanborn map.

The Citric Block Site remained fully occupied by buildings housing various facility operations until the late 1970s, when the former Building 11 (mercurial building) was demolished. Manufacturing activities ceased at the Citric Block Site around 1985. All buildings at the Citric Block Site were demolished during 1994 and 1995, with the exception of Buildings 1A, 1B and 6. Buildings 1A and 1B constitute the original Pfizer buildings and are being retained for historical purposes. Building 6 was renovated for use as an elementary school. The elementary school opened in 1993.

5.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated investigation activities include chemical and physical hazards. There is little potential for encountering biological hazards due to the nature of the work location and the activities to be conducted.

5.1 Chemical Hazards

Previous investigations have shown the presence of various organic compounds and metals at the Citric Block Site. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table C-1. This table includes action levels (permissible exposure levels) which will establish the level of protection. The potential for encountering these contaminants exists during intrusive activities such as drilling.

5.2 Physical Hazards

A variety of physical hazards may be present during Citric Block Site activities. These hazards are similar to those associated with any construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation, the use of power and hand tools, hazardous working surfaces, and handling and storage of fuels. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements will be covered during safety briefings.

5.2.1 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. High noise operations will be evaluated at the discretion of the SHSO. Personnel with 8-hour time-weighted-average exposures exceeding 85 dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95.

5.2.2 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest and electrolyte fluid replacement therapy. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105 °F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of protective equipment (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88 °F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

5.2.3 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40 °F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;

- abnormal behavior;
- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

6.0 TRAINING REQUIREMENTS

The Hazardous Waste Operations and Emergency Response Rule (29 CFR 1910.120) requires that all personnel be trained to recognize on-site hazards, understand the provisions of this HASP, and be made aware of the responsible health and safety personnel. This section discusses the means to meet these requirements.

6.1 Basic Training

All Citric Block Site personnel who will perform work in areas where the potential for toxic exposure exists will be health and safety-trained prior to performing work on-site, per OSHA 29 CFR 1910.120(e). Training records will be submitted to and maintained by the SHSO on-site, as described in Section 6.4.

6.2 Citric Block Site-Specific Training

Health- and safety-related training that will specifically address the activities, procedures, monitoring and equipment for the Citric Block Site operations will be provided to all Citric Block Site personnel and visitors by the SHSO. It will include Citric Block Site and facility layout, hazards, emergency services at the Citric Block Site and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand, and to reinforce their responsibilities regarding safety and operations for their particular activity. Citric Block Site-specific training will be documented and kept as part of the project records.

6.3 Safety Briefings

Project personnel will be given briefings by the SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be held when new operations are to be conducted, whenever changes in work practices must be implemented, before work is begun at each location, and each Monday morning. Records of safety briefings will be kept as part of the project records.

6.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, injury/incident reports, medical examination records and exposure monitoring records will be maintained by Roux Associates and each contractor for a period of at least thirty years after the employment termination date of each employee. Pertinent health and safety training and medical certifications will be kept onsite during the field operations. The SHSO shall maintain a daily written log of all health and safety monitoring activities, and monitoring results shall become part of the project records.

7.0 MONITORING PROCEDURES FOR CITRIC BLOCK SITE OPERATIONS

The SHSO will record wind direction and temperature during monitoring in the logbook. All monitoring equipment will be calibrated per the owner's manual which will be kept onsite, or at least monthly according to Citric Block Site inspection rules.

7.1 Intrusive Operations

Data from previous investigations have identified the presence of organic compounds in soil. Air monitoring will be performed to establish the concentrations of these constituents during intrusive activities (e.g., well installation) using a photoionization detector (PID), and Dräeger tubes (for benzene).

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 parts per million (ppm), which is below the permissible exposure level (PEL) for all constituents of concern (except benzene). If the PID indicates that total vapor exceeds the 5 ppm level, the SHSO will order cessation of the activity until all personnel within the work zone have donned a full face air purifying respirator, or until the nature of the hazard has been more thoroughly evaluated.

Dräeger tubes will be used to provide direct readings to establish the levels of benzene if the PID indicates that total vapor exceeds the 5 ppm level, to determine that personal protection is adequate. The Dräeger tubes will not be chemical specific to benzene, but will be conservatively biased high, and the readings will enable the SHSO to make an immediate decision on the level of protection. If <u>any</u> detections of benzene are noted based upon the Dräeger tube readings, the SHSO will order cessation of the activity until:

- all potentially exposed personnel have donned Level B respiratory protection (supplied air);
- the benzene levels are not detectable by the Dräeger tubes; or
- the nature of the hazard has been more thoroughly evaluated and it has been determined that the measured compound(s) was not benzene.

Metals have also been identified at the Citric Block Site, therefore, particulate monitoring will be performed during intrusive activities. In addition to particulate monitoring, the following techniques may be employed to mitigate the generation and migration of dust during construction activities:

- misting equipment and excavation faces;
- covering excavated areas and material after excavation activity ceases;
- hauling materials in tarped or watertight containers; and
- applying water to haul roads.

Particulate monitoring will be performed downwind of the intrusive activity with a portable particulate monitor that will have the alarm set at 150 micrograms per cubic meter ($\mu g/m^3$). If the downwind particulate levels exceed 120 $\mu g/m^3$ over 15 minutes, the particulate levels upwind of the activity will be measured. If the downwind level is more than 80 $\mu g/m^3$ greater than the upwind particulate level, work will be stopped and corrective action (i.e., misting) will be taken.

7.2 Non-Intrusive Operations

Based on the current understanding of Citric Block Site conditions, monitoring may be performed using Dräeger tubes on the first day of non-intrusive operations and periodically thereafter, if the PID readings indicate a more accurate assessment is warranted.

8.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates, Inc. personnel and contractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- complete medical and work histories;
- EKG;
- urinalysis;
- physical exam;
- eye exam;
- blood chemistry;
- pulmonary function test; and
- audiometry.

The examination will be taken annually, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the HSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, or if other Citric Block Site conditions warrant further medical surveillance.

9.0 ZONES, PROTECTION AND COMMUNICATIONS

Work zones, levels of personal protection, and means of communication are described below.

9.1 Citric Block Site Zones

Roux Associates employs the following three zone approach to Citric Block Site operations.

- the Work Zone;
- the Contamination Reduction Zone; and
- the Support Zone.

9.1.1 Work Zone

The Work Zone is the area where work will be conducted. The Work Zone will be designated by a temporary barrier consisting of red barricade tape. No personnel shall work in the Work Zone without a buddy. All workers within the Work Zone shall wear the proper personal protective equipment (see Section 9.2). No unauthorized persons will be allowed in the Work Zone during Citric Block Site activities.

No personnel are allowed in the Work Zone without:

- a buddy;
- the proper personal protective equipment;
- medical authorization; and
- training certification.

9.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Work Zone and the Support Zone. The CRZ will provide for full personnel and portable equipment decontamination (Section 9.3). The CRZ will also contain safety and emergency equipment such as first aid equipment (bandages, blankets, eye wash) and containment equipment (adsorbent, fire extinguisher).

9.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will provide for team communications and emergency response. Appropriate safety and support equipment will be located in this zone. The Support Zone will be located up-wind of Citric Block Site operations, if possible and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/ decontaminated and labeled samples and drummed wastes.

9.2 Personal Protection

This section describes the levels of protection which will be required by on-site personnel during the remediation activities.

9.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO with approval of the HSM. Where more than one hazard area is indicated, further definition shall be provided by review of Citric Block Site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

During intrusive activities, continuous monitoring will be performed using the PID. Dräeger tubes will also be used for initial and periodic real-time measurements of benzene. The use of Dräeger tubes for benzene will allow the SHSO to make an immediate decision on the adequacy of protection against this compound. Should the PID or Dräeger tubes indicate that the PEL for benzene has been exceeded, work will cease in this area until:

- workers have donned a full face air purifying respirator; or
- the concentration levels for benzene are below the Dräeger tube detection levels.

Protection may be upgraded or downgraded by the SHSO in conjunction with the HSM based upon the PID instrument and Dräeger tube results.

9.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

Level D Protection

1. PPE:
   - Cotton coveralls
   - Cotton gloves
   - Boots/shoes, leather or chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable)
   - Safety glasses or chemical splash goggles
   - Hard hat
   - Escape mask

2. Criteria for selection

   PID readings in the breathing zone are less than 5 ppm, and benzene is not detected using Dräeger tubes. Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

NOTE: Modifications of Level D will be used to increase the level of skin protection during activities which increase the degree of contact with chemical hazards. These modifications include the use of chemical/corrosion resistant coveralls (e.g., tyveks), and chemical resistant gloves.

Level C Protection

1. PPE:
   - Full-face, air-purifying, cartridge-equipped respirator Mine Safety and Health Administration ([MSHA]/National Institute for Occupational Safety and Health [NIOSH] approved)
   - Chemical-resistant clothing (coverall; hooded, two- piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)

- Cotton or synthetic coveralls*
- Gloves (outer), chemical-resistant - nitriles
- Gloves (inner), chemical-resistant - latex
- Boots (inner), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant (disposable)
- Hard hat (face shield)
- Escape mask*
- 2-Way radio communications (intrinsically safe)*

*Optional

2. Criteria for selection
   - Continuous total vapor readings register between 5 ppm and 25 ppm on PID, and benzene is not detected with Dräeger tubes.
   - Measured air concentrations of identified substances (organic vapors) will be reduced by the respirator to at or below the substance's exposure limit, and the concentration is within the service limit of the canister.
   - Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.
   - Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
   - Job functions have been determined not to require self-contained breathing apparatus.

<u>Level B Protection</u>

1. PPE:
   - Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved)
   - Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical- resistant coveralls)
   - Coveralls

- Gloves (outer), chemical-resistant - nitriles
- Gloves (inner), chemical-resistant - latex
- Boots (inner), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant (disposable)
- Hard hat (face shield)
- 2-way radio communications (intrinsically safe)

2. Criteria for Selection

   Meeting any one of these criteria warrants use of Level B protection:

   - PID readings in the breathing zone are greater than 25 ppm and less than 500 ppm, <u>or</u> benzene is detected, but less than 100 ppm utilizing Dräeger tubes.
   - The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
     - -- with IDLH concentrations

       or
     - -- exceeding limits of protection afforded by a full-face, air-purifying mask

       or
     - -- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.
   - The atmosphere contains less than 19.5% oxygen.
   - Operations at the Citric Block Site make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
   - If work is performed in an enclosed space.

9.3 Decontamination Procedures

A steam cleaner will be utilized to decontaminate heavy equipment used in drilling. Personnel should exercise caution when using a steam cleaner. The high pressure steam can cause burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

9.3.1 Contamination Prevention

Adequate contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include the following.

<u>Personnel</u>

- Do not walk through areas of obvious or known contamination;
- Do not handle contaminated materials directly;
- Make sure all PPE has no cuts or tears prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants;
- Do not carry cigarettes, gum, etc., into contaminated areas; and
- Use disposables to cover nondisposable equipment when contact is probable.

<u>Sampling/Monitoring</u>

- When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

<u>Heavy Equipment</u>

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
- Excavated soils should be contained and kept out of the way of workers.

9.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures C-2, C-3 and C-4 illustrate decontamination procedures for Levels D, C and B, respectively. Safety briefings shall explain the decontamination procedures for personnel and portable equipment for the various levels of protection. Heavy equipment will be decontaminated with a steam cleaner.

9.3.3 Disposal Procedures

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left at the Citric Block Site. All potentially contaminated materials (e.g., soil, clothing, gloves, etc.) will be bagged or drummed, as necessary, and segregated for disposal. All contaminated materials shall be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste. All waste disposal operations conducted by Roux Associates will be monitored by the SHSO and carried out under the appropriate level of personal protection.

9.4 Standard Operating Procedures/Safe Work Practices

This section discusses safe work practices to be used during all activities. In addition, non-monitoring safety related procedures are described.

9.4.1 Communications

- Telephones -- A telephone will be available for communication with emergency support services/facilities.
- Hand Signals -- To be employed by personnel required to have Level C protection. They shall be known by the entire field team before operations commence and covered during Citric Block Site-specific training.

The following hand signals will be used, if needed:

Signal	Meaning
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

9.4.2 General Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth contact and ingestion of material is prohibited onsite except in lunch room or designated office areas.
- Hands must be washed thoroughly upon leaving the Work Zone or before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the Citric Block Site until it has been decontaminated and properly packaged and labeled.
- Portable eyewash stations shall be located in the decontamination staging area in the Support Zone.
- No facial hair, which interferes with a satisfactory fit of respiratory equipment, will be allowed on personnel that may be required to wear respiratory protective equipment.
- An emergency first aid kit and fire extinguisher shall be onsite in the Support Zone at all times.
- All respiratory protection selected to be used onsite shall meet NIOSH/MSHA requirements for the existing contaminants.
- Any skin contact with surface and ground water shall be avoided.
- No contact lenses may be worn.

9.4.3 Waste Disposal

All waste disposal operations shall be monitored by the SHSO and performed using the appropriate level of personal protection. Personnel shall wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance shall be practiced at all times.

9.4.4 Heavy Equipment and Drill Rig Safety

Typical machinery to be found at this Site may include pumps, compressors, generators, portable lighting systems, fork lifts, trucks, dozers, backhoes, and drill rigs. From a safety standpoint, it is important for all Site workers to be continually aware of the equipment around them. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by operators.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for housekeeping around the rig because of the rods, auger sections, rope, and hand tools cluttering the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards that must be respected. A clean, dry, sound rope should always be used. Hands should be kept away from the test hammer. Hearing loss, while not an immediate danger, is considerable over time. Hearing protection must be worn.

9.4.5 Confined Space Entry

The scope of work does not require personnel to enter any confined space during the conduct of this project. Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

A permit-required confined space is one that meets the definition of confined space, and has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- contains any other recognized serious safety or health hazards.

10.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA 29 CFR 1910.120 to be available for use and is included below. A copy of this plan shall be posted in the Support Zone at each work site.

10.1 Citric Block Site Emergency Coordinator(s)

The SHSO shall act as the Citric Block Site Emergency Coordinator to make contact with the local fire, police and other emergency units prior to beginning work onsite. In these contacts, the SHSO will inform the emergency units about the nature and duration of work expected at the Citric Block Site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants.

The SHSO or his designee shall implement this emergency plan whenever conditions at the Citric Block Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of Citric Block Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

10.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn or other appropriate device will be sounded by the SHSO for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified in advance by the SHSO. Under no circumstances will incoming personnel or visitors be allowed to proceed into the evacuated area once the emergency signal has been given. The SHSO must see that access for emergency equipment is provided and that all combustible apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. The hospital route will be posted onsite (Figure C-1). Any other excavation routes will be specified by the appropriate emergency personnel.

10.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Work Zone as described above (Section 10.2); and
- notify fire department and security.

10.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person on-site to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups should be contacted. Those groups will alert National or Regional Response Teams as necessary. The personnel listed below shall be notified as necessary.

Type	Name	Telephone #
Fire Department		(718) 636-1700
Hazardous Material Emergency Response		911
Police Department		(718) 963-5311
Ambulance		911
Poison Control Center		(800) 526-8816
Hospital	Woodhull Medical Center	(718) 963-8000
National Response Center (Release or Spill)		(800) 424-8802
Citric Block Site Health and Safety Officer	Nicholas Argentieri	On-Site (718) 218-8428
Health and Safety Manager	Linda Wilson	(516) 232-2600
Citric Block Site Manager	Scott Glash	(516) 232-2600

10.5 Personal Injury

Emergency first aid shall be applied on-site as deemed necessary to stabilize the patient. Notify the emergency units as deemed necessary.

10.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated on-site as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided on-site at the CRZ and/or support zone as appropriate. Eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration	Decontaminate and transport to emergency medical facility. SHSO will provide medical data sheets to medical personnel as requested.

10.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- heavy rainfall;
- potential for heat stress;
- potential for cold stress and cold-related injuries;
- limited visibility;
- potential for electrical storms;
- potential for malfunction of health and safety monitoring equipment or gear; and
- potential for accidents.

11.0 AUTHORIZATIONS

Personnel authorized to enter the Citric Block Site while operations are being conducted must be approved by the SHSO and the Project Manager. This document will be completed when the subcontractors have assigned trained personnel for the Citric Block Site. Authorization will require completion of appropriate training courses, medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates personnel are authorized to perform work onsite:

1. Scott Glash
2. Douglas Swanson
3. Linda Wilson
4. Jeffrey Makowski
5. Nicholas Argentieri
6. Ann Farrell
7. Susan Weber
8. Peter Barczak
9. Peter Gerbasi
10.

Pfizer Inc personnel authorized to enter the Citric Block Site are:

1. Tom Kline
2. John Keith
3. Steve Kemp
4. Anthony Carcich
5. Tom Snee
6. Nathan Edeson
7. Harold Carter
8.
9.
10.

12.0 FIELD TEAM REVIEW

Each person entering the Citric Block Site and each field member shall sign this section after Site-specific training is completed and before being permitted to work on Site.

I have read and understand this Citric Block Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Citric Block Site/Project: ____________________

Name Printed	Signature	Date

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Citric Block, Pfizer Inc, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Ethylbenzene	100-41-4	435 100 ppm	2,000 ppm	435 100 ppm	Dermal; inhalation; ingestion	CNS depressant Sensory irritant Narcosis	eyes resp system	Liquid, aromatic BP = 277°F FP = 59°F
Benzene	71-43-2	30 10 ppm	0	3 1 ppm	Dermal; inhalation ingestion	CNS depressant Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid BP = 80.093°C flammable LEL = 1.4% UEL = 8.0%
Toluene	108-88-3	375 100 ppm	2,000 ppm	375 100 ppm	Dermal; inhalation; ingestion	CNS depressant Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP = 11.04°C flammable LEL = 1.2% UEL = 7.1%
Xylenes	1330-20-7	100 ppm	1,000 ppm	100 ppm	Dermal; inhalation; ingestion;	CNS depressant Sensory irritant Dermatitis Abdominal pain	CNS eyes GI tract blood liver kidney	Liquid, aromatic BP = 281°F -292°F FP = 81-90°F
Petroleum hydrocarbons (Petroleum distilled)	8002-05-9	1,600 400 ppm	10,000	1,600 400 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP = 86-460°F UEL = 5.9% LEL = 1.1% Flammable
Aroclor-1260	11096-82-5	0.001	None	None	Dermal; inhalation; ingestion	Liver damage Nausea Abdominal pain	liver skin	

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Citric Block, Pfizer Inc, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Arsenic	7440-38-2	0.2	None	0.5 organic 0.01 - inorganic	Dermal; inhalation; ingestion	Sensory irritant Lung & skin cancer Aplastic anemia Numbness	skin eyes lungs blood peripheral nervous system	Silver gray - tin white BP = sublimes
Barium (soluble)	7440-39-3	0.5	250 mg/m^3	0.5	Inhalation; ingestion	Sensory irritant Increase muscle contractility Slows heart rate	skin eyes smooth muscle heart	Silver white BP = 1640°C
Barium (insoluble) (as barium sulfate)	7727-43-7	10	None	10 5 resp.	Inhalation; ingestion	Baritosis	lungs	White or yellow odorless
Beryllium	7440-41-7	0.0005	10 mg/m^3	0.002	Inhalation	Resp system Weight loss	lungs skin eyes	Hard, brittle gray solid BP = 4532°F
Cadmium (dust)	7440-43-9	0.05	40 mg/m^3	0.2	Inhalation; ingestion	Sensory irritant Lung injury Kidney disease Cancer	skin eyes kidneys bone	Silver-white/blue tinged BP = 1409°F Noncombustible
Chromium	7440-47-3	0.5	None	1	Dermal; inhalation; ingestion	Decreased pulmonary function Sensory irritant	lung skin eyes	Steel gray metal
Chromium (VI)	7440-47-3	0.05	None	None	Dermal; inhalation; ingestion	Nasal and lung tumors Sensory irritant	lungs eyes skin	Red, rhombic crystals
Cobalt	7440-48-4	0.05	20 mg/m^3	0.05	Dermal; inhalation; ingestion	Cough Decrease pulm function	resp system skin	Odorless silver gray to black BP = 5612°F

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Citric Block, Pfizer Inc, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Copper (dusts and fumes)	7440-50-8	1	None	1	Dermal; inhalation; ingestion	Sensory irritant GI irritation CNS depressant	skin eyes GI tract CNS	Reddish metal BP = 4730°F Powdered form may ignite
Lead	7439-92-1	0.15	700	0.2	Dermal; inhalation; ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP = 3164°F
Mercury vapor	7439-97-6	0.05 (skin)	28 mg/m^3	0.05 (skin)	Dermal; inhalation; ingestion	Tremor Insomnia Chest pain GI disturbance Eye irritant Skin irritant	skin resp system CNS kidneys eyes	Silver, white, odorless liquid BP = 674°F
Nickel	7440-02-0	1.0	None	1.0	Dermal; inhalation; ingestion	Pulmonary fibrosis Lung cancer Sinus cancer Sensory irritant GI irritation	lungs skin eyes GI tract	Silver-white metal BP = 2730°C
Selenium	7782-49-2	0.2	100 mg/m^3	0.2	Dermal; inhalation; ingestion	Sensory irritant Bronchial irritatant GI distress	respiratory system skin eyes liver kidneys blood	Steel grey, non-metallic BP = 690°F
Zinc Oxide (dust)	7440-66-6	10	None	10 5 resp.	Dermal; inhalation; ingestion	Skin irritant Cough	skin lungs	Bluish-white metallic element

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Citric Block, Pfizer Inc, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties

TLV - Threshold Unit Value – must not be exceeded over 8 hour shift
IDLH - Immediately Dangerous to Life and Health – maximum concentration from which one could escape in 30 minutes without a respirator
PEL - Permissible Exposure Limit – must not be exceeded over 8 hour shift
mg/m^3 - milligrams per cubic meter
ppm - Part Per Million
CNS - Central Nervous System
CVS - Cardiovascular System
GI tract - Gastrointestinal tract
BP - Boiling Point
FP - Flash Point
UEL - Upper Explosive Limit
LEL - Lower Explosive Limit
°F - degrees Fahrenheit
°C - degrees Celsius

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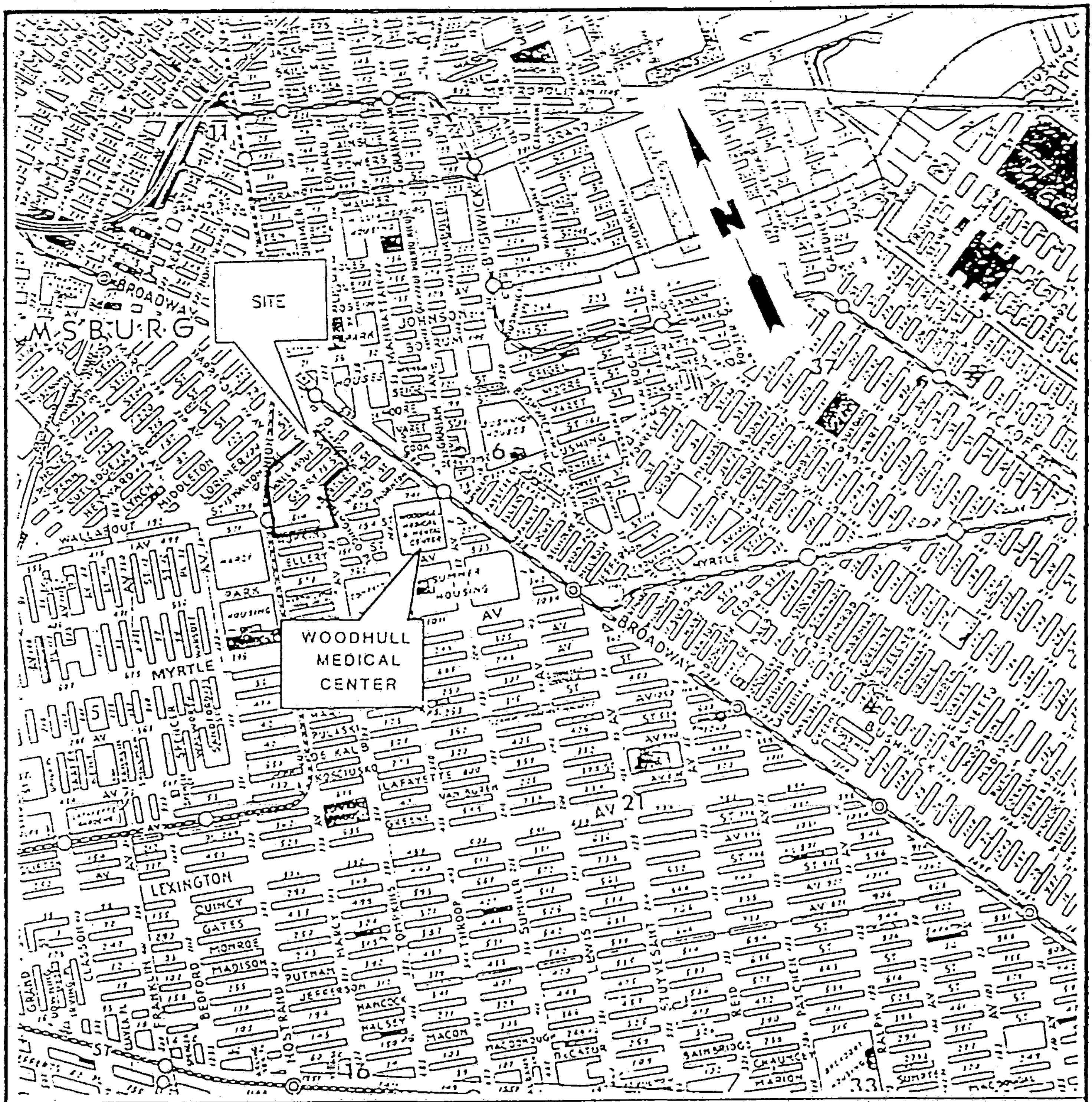


DIRECTIONS TO HOSPITAL:
FROM WALTON STREET TURN RIGHT ON BROADWAY.
TAKE BROADWAY FOR APPROXIMATELY SIX BLOCKS.
WOODHULL MEDICAL CENTER IS ON LEFT.

Title:

ROUTE TO WOODHULL
MEDICAL CENTER

CITRIC BLOCK RI WORK PLAN

Prepared For:

PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC *Environmental Consulting & Management*	Compiled by:	L.M.	Date: 10/95		FIGURE
	Prepared by:	R.K.	Scale: N.T.S.		C-1
	Project Mgr:	S.J.G.	Revision:		
	File No:	04744Y	Project: 04744Y		

TYPICAL DECONTAMINATION LAYOUT
LEVEL D DECONTAMINATION PROCEDURES

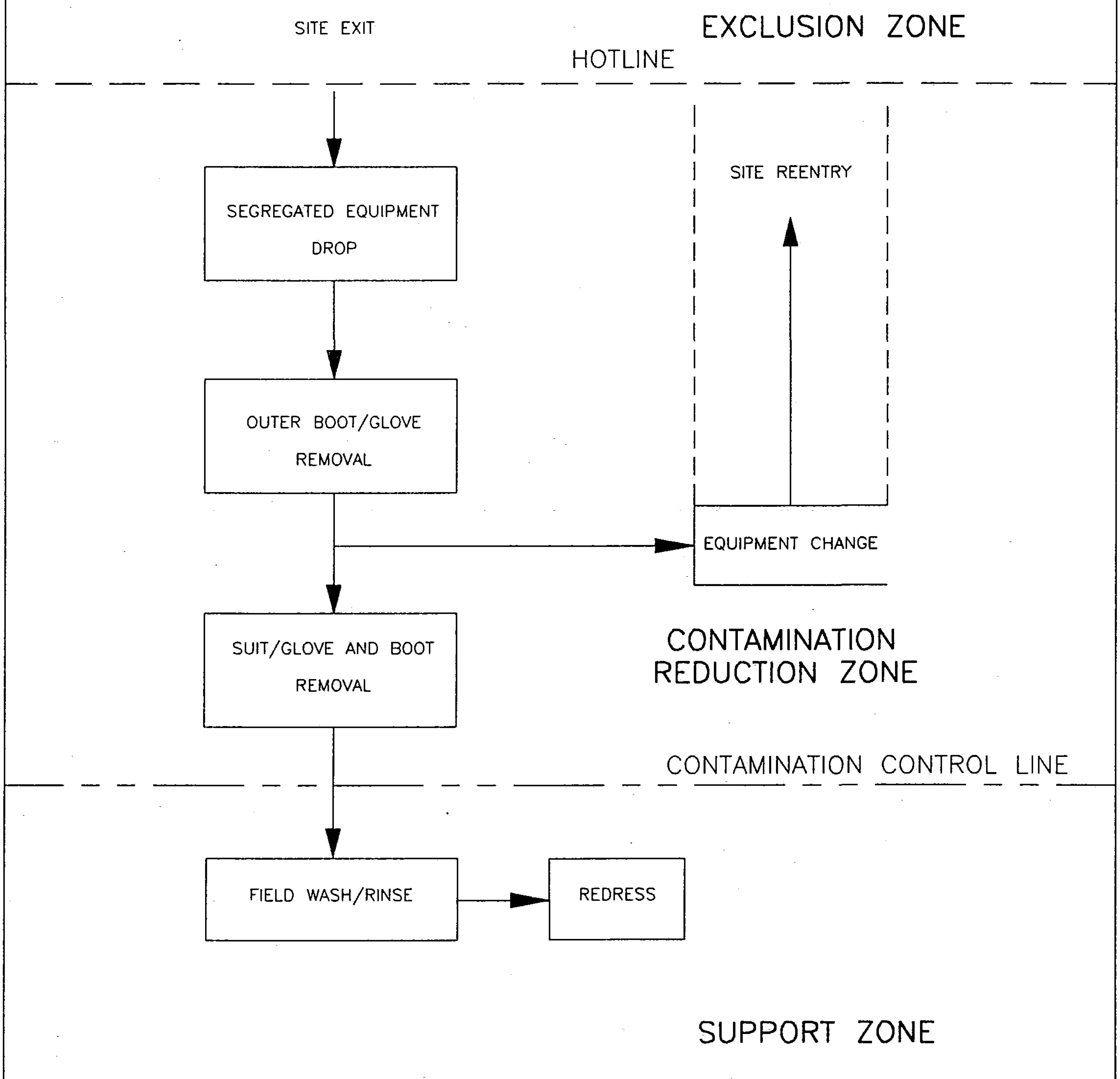


FIGURE C-2

TYPICAL DECONTAMINATION LAYOUT

LEVEL C PROTECTION

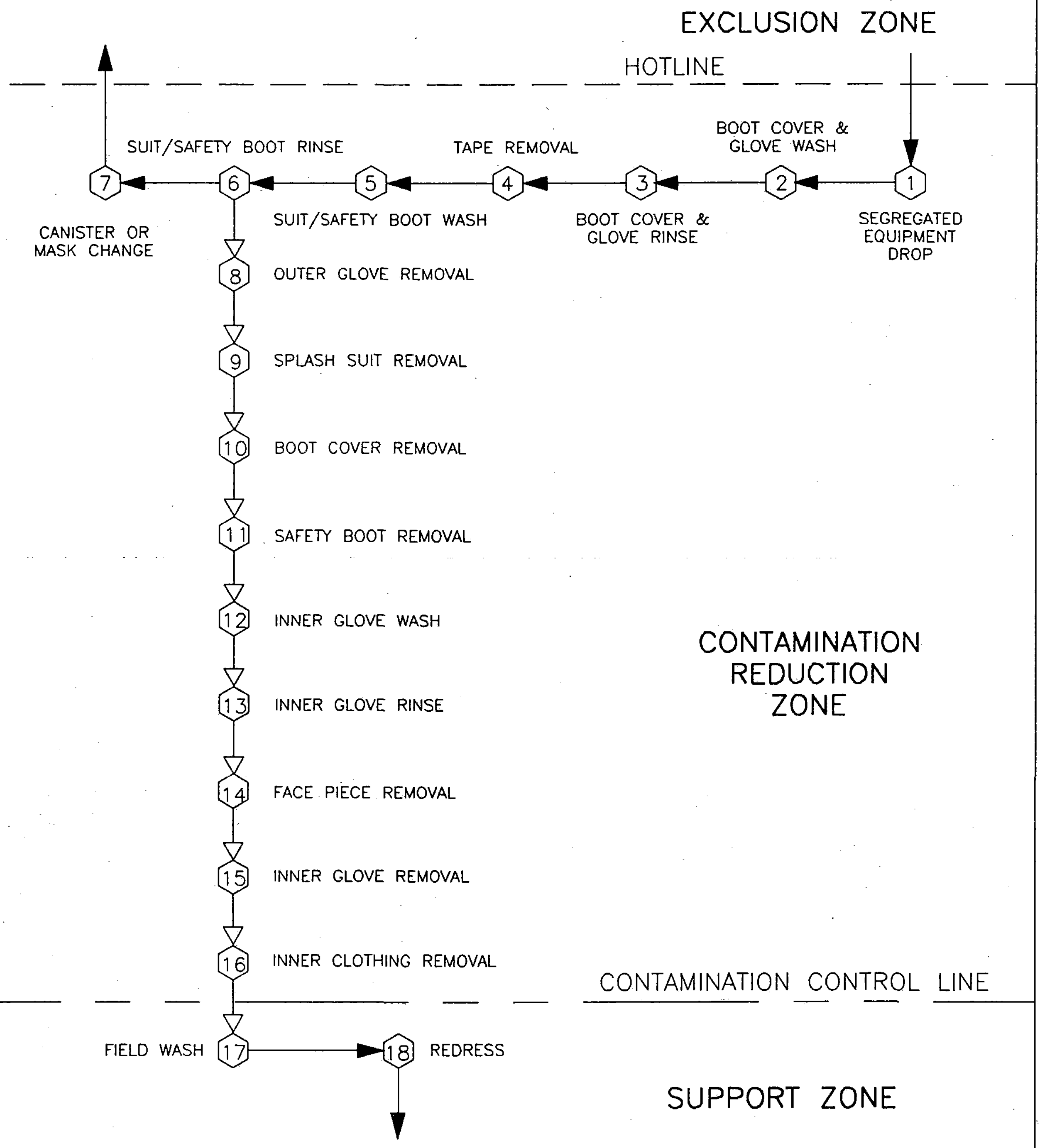


FIGURE C-3

TYPICAL DECONTAMINATION LAYOUT

LEVEL B PROTECTION

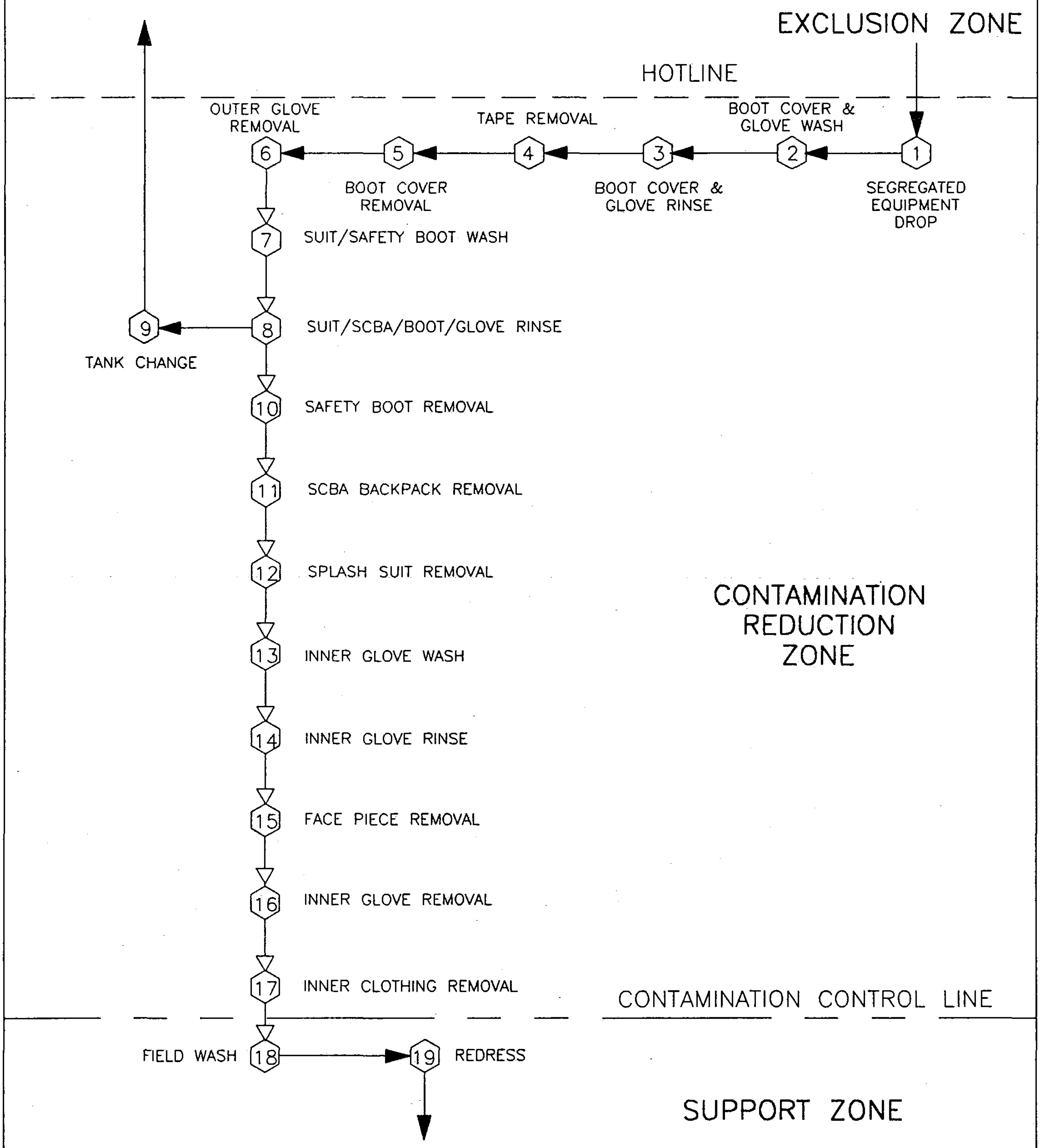


FIGURE C-4

ATTACHMENT C-1

Incident Report

INCIDENT REPORT

Site ______________________________

Site Location ______________________________

Report Prepared By ______________________________
Name Printed Title

Incident Category (Check all that apply)

____ Injury
____ Near Miss
____ Motor Vehicle
____ Mechanical
____ Illness
____ On-Site Equipment
____ Fire
____ Other
____ Property Damage
____ Chemical Exposure
____ Electrical

Date and Time of Incident ______________________________

Names of Persons Injured (see end of report for details)

____

____

____

NARRATIVE REPORT OF INCIDENT

(Provide sufficient detail so that the reader may fully understand the actions leading to or contributing to the incident, the incident occurrence, and actions following the incident. Append additional sheets of paper if necessary.)

____

____

____

____

____

____

Project #
Project Name: ____________________
Location: ____________________
Date: ____________________

WITNESSES TO INCIDENT

1. Name ____________________ Company ____________________
   Address ____
   Telephone No. ____
2. Name ____________________ Company ____________________
   Address ____
   Telephone No. ____

PROPERTY DAMAGE

Brief Description of Property Damage ____

Estimate of Damage ____

INCIDENT LOCATION

INCIDENT ANALYSIS

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions): ____

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

Was weather a factor? ______________________

Unsafe mechanical/physical/environmental condition at time of incident (be specific) ______________________

____

Unsafe act by injured and/or others contributing to the incident (be specific, must be answered) ______________________

____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue) ______________________

____

ON-SITE INCIDENTS

Level of personal protection equipment required in Site Safety Plan ______________________

____

____

____

Modifications ______________________

____

____

Was injured using required equipment? ______________________

____

INCIDENT REPORT

Page 4 of 4

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

INCIDENT FOLLOW-UP

Date of Incident ____________________

Site ____________________

Brief Description of Incident ____________________

____

____

Outcome of Incident ____________________

____

____

Physician's Recommendations ____________________

____

____

Date Injured Returned to Work ____________________

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT C-2

Site Safety Follow-Up Report

Project # ____________________

Project Name: ____________________

Location: ____________________

Date: ____________________

SITE SAFETY FOLLOW-UP REPORT

This section must be filled out and returned to the Site Safety Officer after each site visit or task.

Person Responsible for Follow-up Report ________________________________

Actual Date of Work ____

ACTUAL SITE INVESTIGATION TEAM

Roux Personnel	Responsibility

Other Interested Parties	Affiliation	Purpose of Visit

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

PERSONAL PROTECTIVE EQUIPMENT

Level of Respiratory Protection Used	Activity Performed

Field Dress	Activity

MONITORING EQUIPMENT

HNU/OVA/CGI

- Background reading ____________________
  - Readings above background? ____________________
  - Location of high readings ____________________

____

____

Radiation

- Readings above background? ____ Yes ____ No
- If yes, specify where readings were found and what action was taken

____

____

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

GENERAL SAFETY

Were any safety problems encountered while on site?
Explain ____________________

ACCIDENT REPORT INFORMATION

Did Any Team Member Report	Yes	No
• Chemical exposure	____	____
• Illness, discomfort, or unusual symptoms	____	____
• Environmental problems (heat, cold, etc.)	____	____

Explain ____________________

Was an Employee Exposure/Injury Incident Report Completed? ____ Yes ____ No

INJURIES

Injured Person

Name of Address of Injured ______________________

____

SSN ______________ Age __________ Sex __________

Years of Service ______________ Time on Present Job ______________

Title/Classification ______________________

Severity of Injury or Illness

- ______ Disabling
- ______ Fatality
- ______ Non-Disabling
- ______ Medical Treatment

Estimated Number of Days Away From Job ______________________

Nature of Injury or Illness ______________________

____

____

Classification of Injury

- ______ Fractures
- ______ Dislocations
- ______ Sprains
- ______ Abrasions
- ______ Lacerations
- ______ Punctures
- ______ Faint/Dizziness
- ______ Other
- ______ Heat Burns
- ______ Chemical Burns
- ______ Radiation Burns
- ______ Bruises
- ______ Blisters
- ______ Bites
- ______ Dermal Allergy
- ______ Cold Exposure
- ______ Frostbite
- ______ Heat Stroke
- ______ Heat Exhaustion Concussion
- ______ Toxic
- ______ Toxic Respiratory Exposure
- ______ Ingestion
- ______ Respiratory Allergy

Part of Body Affected ______________________

Degree of Disability ______________________

Date Medical Care was Received ______________________

Where Medical Care was Received ______________________

Address (if off-site) ______________________

If Hospitalized, Name, Address and Telephone of Hospital ______________________

____

____

Name, Address and Telephone Number of Physician ______________________

____

____

ATTACHMENT C-3

Health and Safety
Field Change Request Form

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

FIELD CHANGE REQUEST

SITE SAFETY REVIEW – CHANGES AND OVERALL EVALUATION
(To Be Completed For Each Field Change In Plan)

Was the Safety Plan Followed as presented ____ Yes ____ No

Describe, in detail, all changes to the Safety Plan

____
____
____
____
____

Reason for changes ____
____
____
____
____

Follow-up, Review and Evaluation Prepared by ______________________ Date ____________

Discipline ____

Approved by: Site Manager ______________________ Date ____________

Site Safety Officer ______________________ Date ____________

Approved by: Office Health & Safety Supervisor ______________________ Date ____________

Evaluation of Site Safety Plan

Was the Safety Plan adequate? ____ Yes ____ No

What changes would you recommend? ____
____
____
____
____

APPENDIX D

APPENDIX D

Previous Investigation Soil Boring Logs

Project: **PFIZER INC WILLIAMSBURG, BROOKLYN**	Log of Soil Boring No. **CB-1**

Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/13/95	Date Completed: 7/13/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 8.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 6 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: Not Encountered	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown coarse SAND and red brick, little concrete (fill); dry.	FILL			0	4.5-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
	Dark gray to black SILT and coarse Sand (fill); moist to wet.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
5	Dark gray to black SILT and coarse Sand (fill); wet.				0	Black staining. Sample collected for grain size analysis of fill material. Geotechnical samples collected from 2-4 ft and 6-8 ft for permeability.
	Gray CLAY, little fine Sand; moist.	CL				Black staining. Bottom of borehole 6 feet below land surface.
10						
15						
20						
25						

ROUX

Project: PFIZER INC WILLIAMSBURG, BROOKLYN	Log of Soil Boring No. CB-2

Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/13/95	Date Completed: 7/13/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 16.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 16 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: 3.5 feet	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown coarse SAND and Silt, little Gravel, little concrete and red brick (fill); dry.	FILL			NM	10-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Brown to gray medium SAND and Silt (fill); moist to wet.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Gray medium SAND and Silt (fill); wet.				0	
5	Gray fine SAND, some Silt, little Clay (fill); wet.				NM	No headspace analysis due to insufficient sample volume.
	Gray fine to medium SAND (fill); wet.				0	Water samples collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
10	Gray fine to medium SAND (fill); wet.				0	
	No recovery.		○		NM	No headspace analysis due to no sample recovery.
15	Gray CLAY, some Silt, some fine Sand; moist.	CL			0	
						Bottom of borehole 16 feet below land surface.
20						
25						

ROUX

Project: **PFIZER INC** **WILLIAMSBURG, BROOKLYN**	Log of Soil Boring No. **CB-3**

Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/13/95**	Date Completed: **7/13/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **16.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite**	from **0 ft** to **16 ft**
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **Not Encountered**	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Light brown medium to coarse SAND, trace Gravel (fill); dry.	FILL			NM	5-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Wood.				0	
	Dark gray fine SAND (fill); moist.				6	Sample from 4-6 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. Trace petroleum odor.
5	Dark gray fine SAND (fill); moist.				0	
	Dark gray fine SAND (fill); moist.				0	
10	Dark gray fine SAND (fill); moist.				0	
	Dark gray fine SAND and Silt, some Clay (fill); moist.				0	
15	Dark gray CLAY, some Silt, some fine Sand; moist.	CL			0	
						Bottom of borehole 16 feet below land surface.
20						
25						

Project: PFIZER INC WILLIAMSBURG, BROOKLYN	Log of Soil Boring No. CB-4

Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/13/95	Date Completed: 7/13/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 8.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 8 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: Not Encountered	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Black coarse SAND and Gravel (fill); moist.	FILL			NM	Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume. Black staining.
	Dark gray to black coarse SAND, some Gravel, little red brick (fill); moist.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume. Black staining.
	Black SILT, some Clay (fill); moist.				0	Black staining.
5						Sample collected for grain size analysis of fill material.
	Black SILT, some Clay (fill); moist.				0	Black staining.
	Green-gray CLAY; moist.	CL				Geotechnical samples collected from 2-4 ft and 7-9 ft for permeability.
						Bottom of borehole 8 feet below land surface.
10						
15						
20						
25						

Project: 04744Y03 Roux Associates

Project: **PFIZER INC** **WILLIAMSBURG, BROOKLYN**		Log of Soil Boring No. **CB-5**	
Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/12/95**	Date Completed: **7/12/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **20.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite** from **0 ft** to **20 ft**	
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **Not Encountered**	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown SILT and coarse Sand, some concrete (fill); dry.	FILL			NM	8-inch concrete core not included in geologic logging.
	Brown SILT and coarse Sand, trace concrete (fill); moist.				0	Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Gray CLAY, some Silt; moist.	CL				Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
5	No recovery.	SW	○		NM	No headspace analysis due to no sample recovery.
	Gray fine to medium SAND; moist.				0	
	Gray fine to medium SAND; wet.				0	
10	Gray fine to medium SAND; wet.				0	
	Gray fine to medium SAND; wet.				0	
15	Dark gray CLAY, some Silt, trace fine Sand; moist.	CL			0	
	Dark gray CLAY, some Silt, trace fine Sand; moist.				0	
	Gray CLAY, little Silt; moist.				0	
20						Bottom of borehole 20 feet below land surface.
25						

Project: 04744Y03 **Roux Associates** Page 1 of 1

Project: **PFIZER INC WILLIAMSBURG, BROOKLYN**		Log of Soil Boring No. **CB-6**	
Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/12/95**	Date Completed: **7/12/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **6.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite** from **0 ft** to **6 ft**	
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **Not Encountered**	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown SILT, little coarse Sand, trace concrete (fill); dry.	FILL			NM	8-inch concrete core not included in geologic logging.
	Light brown medium SAND, little concrete (fill); moist.				NM	Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Dark gray medium SAND, little Silt (fill); moist to wet.				0	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume. Sample collected for grain size analysis of fill material. Geotechnical samples collected from 2-4 ft and 6-8 ft for permeability. Bottom of borehole 6 feet below land surface.
5	Dark gray CLAY, some Silt; moist.	CL				
10						
15						
20						
25						

ROUX

Project: PFIZER INC WILLIAMSBURG, BROOKLYN		Log of Soil Boring No. CB-7	
Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/12/95	Date Completed: 7/12/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 20.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite from 0 ft to 20 ft	
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: Not Encountered	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown to black coarse SAND and Gravel, some concrete (fill); dry.	FILL			0	10-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
	Dark gray SILT and fine Sand, trace green-gray Clay, trace concrete (fill); moist.				0	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
5	Dark gray fine to medium SAND (fill); moist to wet.				0	
	Dark gray fine to medium SAND (fill); wet.				0	
	Dark gray fine to medium SAND (fill); wet.				0	
10	No recovery.		○		NM	No headspace analysis due to no sample recovery.
	Dark gray fine to medium SAND (fill); wet.				0	
15	Dark gray fine to medium SAND (fill); wet.				0	
	Dark gray fine to medium SAND (fill); wet.				0	
	Gray CLAY, some Silt; moist.	CL			0	
20						Bottom of borehole 20 feet below land surface.
25						

Project: PFIZER INC WILLIAMSBURG, BROOKLYN		Log of Soil Boring No. CB-8	
Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/14/95	Date Completed: 7/14/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 10.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 10 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: Not Encountered	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown coarse SAND, some red brick and Gravel (fill); dry.	FILL			NM	7.5-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Gray SILT, trace Clay (fill); moist.				NM	Trace petroleum odor. Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Gray SILT, trace Clay (fill); moist.				0	
5	Dark gray fine to medium SAND, trace Gravel (fill); dry.					
	Dark gray medium to coarse SAND (fill); moist.				0	
	Gray fine to medium SAND, little Silt (fill); moist.				0	
	Gray CLAY, some Silt, some fine Sand; moist.	CL				
10						Bottom of borehole 10 feet below land surface.
15						
20						
25						

ROUX

Project: **PFIZER INC WILLIAMSBURG, BROOKLYN**		Log of Soil Boring No. **CB-9**	
Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/14/95**	Date Completed: **7/14/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **6.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite**	from **0 ft** to **6 ft**
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **Not Encountered**	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown to black coarse SAND and Gravel, some red brick (fill); dry.	FILL			NM	5-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Dark gray SILT, little Clay, trace fine Sand (fill); moist.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
5	Green-gray CLAY, some Silt, some fine Sand; dry.	CL			0	Orange, yellow, and red staining of clay. Sample collected for grain size analysis of fill material. Geotechnical samples collected from 1-3 ft and 5-7 ft for permeability. Bottom of borehole 6 feet below land surface.
10						
15						
20						
25						

Project: **PFIZER INC** **WILLIAMSBURG, BROOKLYN**		Log of Soil Boring No. **CB-10**	
Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/13/95**	Date Completed: **7/13/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **6.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite**	from **0 ft** to **6 ft**
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **3.5** feet	

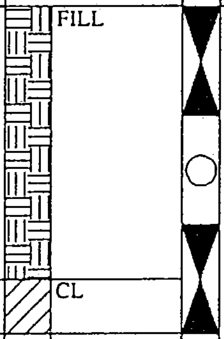
Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown SILT, little red brick and concrete, trace coarse Sand (fill); dry.	FILL			NM	5-inch concrete core not inluded in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Gray fine to medium SAND and Silt, trace red brick (fill); moist to wet.				0	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
	Gray medium SAND (fill); wet.				0	Water samples collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis.
5	Gray to black CLAY, some fine Sand; moist.	CL				Black staining. Bottom of borehole 6 feet below land surface.
10						
15						
20						
25						

Project: PFIZER INC WILLIAMSBURG, BROOKLYN	Log of Soil Boring No. CB-11

Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/14/95	Date Completed: 7/14/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 20.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 20 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: Not Encountered	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Orange-brown coarse SAND and Gravel, some red brick (fill); dry.	FILL			NM	12-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Black coarse SAND, little Silt (fill); moist.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
5	Black coarse SAND, little Silt (fill); moist.				0	Black staining and trace petroleum odor.
	Black SILT, some coarse Sand, trace Gravel (fill); moist.				0	Black staining.
	Black SILT, trace Clay (fill); moist.				0	Black staining.
10	Gray CLAY, some Silt; moist.	CL			0	
	Gray CLAY, some Silt; moist.				0	
	Dark gray CLAY, some Silt; moist.				0	
15	No recovery.				NR	No headspace analysis due to no sample recovery.
	Dark gray CLAY, some Silt, little fine Sand; moist.				0	
20						Bottom of borehole 20 feet below land surface.
25						

Project: PFIZER INC WILLIAMSBURG, BROOKLYN		Log of Soil Boring No. CB-12	
Logged By: Jeff Makowski	Checked By: S. Glash	Date Started: 7/12/95	Date Completed: 7/12/95
Drilling Co: Aquifer Drilling & Test		Drill Bit Diameter: 2-inch	Total Depth: 6.0 ft
Driller: Anthony Hilenski		Backfill Material: Bentonite	from 0 ft to 6 ft
Drilling Method: Geoprobe		Sampler: Acetate Tube	
Drilling Equipment: Geoprobe 5400		Depth to Water at Time of Drilling: 3.0 feet	



Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Dark brown medium to coarse SAND, little red brick, trace concrete (fill); dry.	FILL			NM	12-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	No recovery.				NM	No headspace analysis due to no sample recovery.
	Dark brown SILT, little medium Sand (fill); moist.				NM	Sample from 4-6 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume. Water sample collected for TCL VOC analysis. Slight petroleum odor in water sample. Bottom of borehole 6 feet below land surface.
5	Green-gray CLAY, some Silt; moist.	CL				
10						
15						
20						
25						

ROUX

Project: **PFIZER INC** **WILLIAMSBURG, BROOKLYN**	Log of Soil Boring No. **CB-13**

Logged By: **Jeff Makowski**	Checked By: **S. Glash**	Date Started: **7/12/95**	Date Completed: **7/12/95**
Drilling Co: **Aquifer Drilling & Test**		Drill Bit Diameter: **2-inch**	Total Depth: **8.0 ft**
Driller: **Anthony Hilenski**		Backfill Material: **Bentonite**	from **0 ft** to **8 ft**
Drilling Method: **Geoprobe**		Sampler: **Acetate Tube**	
Drilling Equipment: **Geoprobe 5400**		Depth to Water at Time of Drilling: **Not Encountered**	

Depth (feet)	LITHOLOGIC DESCRIPTION	Lithology	Sampler	Blows per 6"	PID (ppm)	REMARKS
	Brown coarse SAND, some red brick, little concrete (fill); dry.	FILL			NM	8-inch concrete core not included in geologic logging. Sample from 0-2 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Brown coarse SAND, some red brick, little concrete (fill); dry to moist.				NM	Sample from 2-4 ft collected for TCL VOC, TCL SVOC, TAL Metals, TOC and pH analysis. No headspace analysis due to insufficient sample volume.
	Dark brown SILT, little red brick, little medium Sand (fill); moist to wet.				0	Sample collected for grain size analysis of fill material.
5						
	Brown SILT, some medium Sand (fill); wet.				0	Geotechnical samples collected from 1-3 ft and 8-10 ft for permeability.
	Gray CLAY, some Silt; moist.	CL				Bottom of borehole 8 feet below land surface.
10						
15						
20						
25						

APPENDIX E

APPENDIX E

Previous Investigation Geotechnical Report

GEOTECHNICAL LABORATORY TEST RESULTS
FOR PFIZER, INC.
CITRIC BLOCK
WILLIAMSBURG FACILTIY
BROOKLYN, NEW YORK

Performed For:

Roux Associates, Inc.
1377 Motor Parkway
Islandia, NY 11788

Performed By:

J&L Testing Company, Inc.
938 South Central Avenue
Canonsburg, PA 15317

July 27, 1995
Job No.: 95S1845-02

JLT J&L TESTING COMPANY, INC.
GEOTECHNICAL AND GEOSYNTHETICS MATERIALS TESTING AND RESEARCH

July 27, 1995
Job No.: 95S1845-02

Roux Associates, Inc.
1377 Motor Parkway
Islandia, NY 11788

Attn: Mr. Scott J. Glash, C.P.G.

RE: GEOTECHNICAL LABORATORY TESTING FOR PFIZER, INC.
CITRIC BLOCK, WILLIAMSBURG FACILITY
BROOKLYN, NEW YORK

Dear Mr. Glash:

J&L Testing Company, Inc. (JLT) is pleased to present the results of the above referenced geotechnical testing performed on the samples shipped to our laboratory on July 18, 1995. The total number of samples and sample identification are as listed in the sample chain of custody attached (Appendix B).

The tests performed are permeability testing (ASTM D5084) on the Shelby tube samples labeled "clay" and "fill", respectively, and grain size analysis including hydrometer (ASTM D422) performed on the samples shipped in zip lock bags. All test results are labeled and presented in Appendix A. All samples will be retained for a period of 90 days and then disposed unless instructed otherwise.

We sincerely appreciate your confidence in our services and look forward to working with you again. Should you have any questions, comments or require additional information please call. Thank you.

Sincerely,

J & L TESTING COMPANY, INC.

Mahiru Shettima, Ph.D., P.E.
Director

Enclosure
MS/jlt

APPENDIX A

IGINE [illegible] I Ma[illegible]ski
DATE ASSI July 19, 1995
DATE DUE ASAP

JO [illegible] 95[illegible]15-[illegible]
JOB NAME Roux Associates
Pfizer, Williamsburg
Facility

DA[illegible]. [illegible] 19, [illegible]5
DATE CMP. July 26, 1995
REC. BY J.R.
PAGE NO 1 of 1

SUMMARY OF LABORATORY TEST RESULTS

BORING AND SAMPLE NO.	DEPTH feet	CLASSIFICATION	PERM k cm/sec	NATURAL WATER CONTENT (%)	ATTERBERG LIMIT		UNCON. COMPRESS		UNIT DRY WGT (pcf)	RELATIVE DENSITY	GRAIN SIZE		TRIAXAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (pcf)	STRAIN (%)			SIEVE	HYDR	U.U.	CIU	CELL PRESSURE (psi)	BACK PRESSURE (psi)
CB-1	Bulk	Silty Sand (SM)									*	*				
CB-4	Bulk	Silty Sand (SM)									*	*				
CB-6	Bulk	Silty Sand (SM)									*	*				
CB-9	Bulk	Silty Sand (SW-SM)									*	*				
CB-13	Bulk	Silty Sand (SM)									*	*				
CB-1	2-4 ft.	Tube Sample - Fill	5.14×10^{-6}													
CB-1	6-8 ft.	Tube Sample - Clay	1.31×10^{-5}													
CB-4	2-4 ft.	Tube Sample - Fill	1.24×10^{-5}													
CB-4	7-9 ft.	Tube Sample - Clay	8.75×10^{-5}													
CB-6	2-4 ft.	Tube Sample - Fill	2.82×10^{-7}													
CB-6	6-8 ft.	Tube Sample - Clay	8.62×10^{-7}													
CB-9	1-3 ft.	Tube Sample - Fill	9.41×10^{-8}													
CB-9	5-7 ft.	Tube Sample - Clay	6.32×10^{-7}													
CB-13	1-3 ft.	Tube Sample - Fill	1.69×10^{-4}													
CB-13	8-10 ft.	Tube Sample - Clay	1.44×10^{-7}													

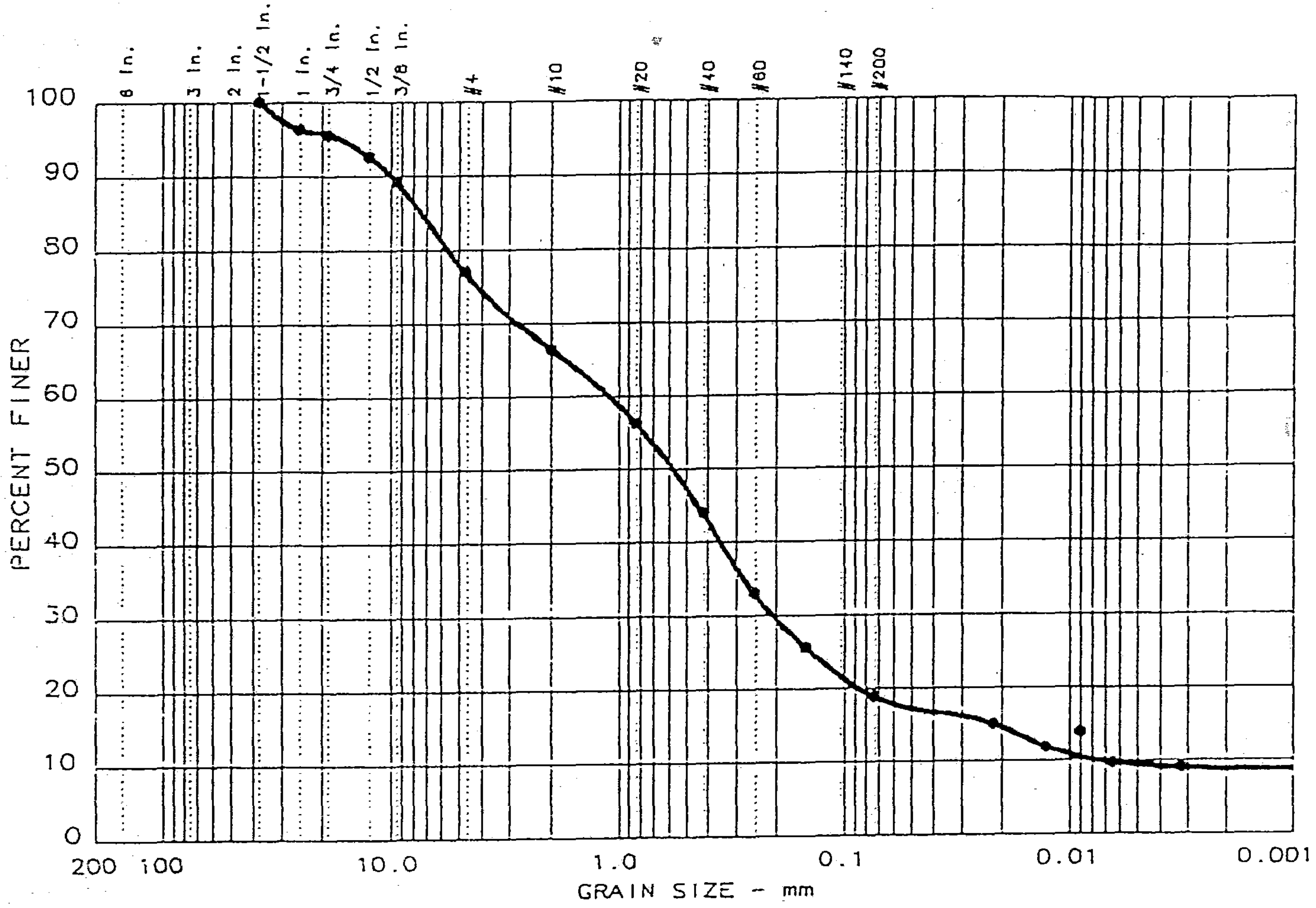
* See Test Curves

Test Comp and Checked

Test In Progress

CB - 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	11	0.0	22.9	58.3	10.0	8.8	SM

SIEVE inches size	PERCENT FINER		
	●		
1.5	100.0		
1	96.2		
0.75	95.5		
0.5	92.5		
0.375	89.2		
	GRAIN SIZE		
D_{60}	1.11		
D_{30}	0.21		
D_{10}	0.00		
	COEFFICIENTS		
C_c	5.31		
C_u	153.1		

SIEVE number size	PERCENT FINER		
	●		
4	77.1		
10	66.4		
20	56.2		
40	43.9		
60	33.0		
100	25.6		
200	18.8		

Sample information:

● CB-1

PFIZER WILLIAMSBURG

Remarks:

J & L TESTING CO., INC.

Project No.: 95S1845-02
Project: ROUX ASSOCIATES

Date: 07-24-95
Data Sheet No. 3

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-1 FILL	Tested By	:	JR
Description	:	(2'-4')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	2.50	Final Height (in)	:	2.48
Initial Diameter (in)	:	2.88	Final Diameter (in)	:	2.88
Initial Wet Weight (g)	:	477.80	Final Wet Weight (g)	:	469.90
Wet Density (pcf)	:	111.67	Wet Density (pcf)	:	111.09
Moisture Content %	:	40.00	Moisture Content %	:	37.60
Dry Density (pcf)	:	79.76	Dry Density (pcf)	:	80.73

Test Parameters

Fluid		:	Deaired Water	Effective Confining Pressure (psi)	:	5
Cell Pressure	(psi)	:	48.00	Gradient	:	22.26
Head Water	(psi)	:	44.00			
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	20.15
Length, L	(in)	:	2.48
Area, A	(sqin)	:	6.49
Head, h	(psi)	:	2.00
Time, t	(min)	:	65.00
Temp. T	(Deg C)	:	23.0

Computed Permeability

PERMEABILITY, K = 5.14E-06 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client : ROUX ASSOCIATES
Project Location : PFIZER WILLIAMS
Sample Number : CB-1 CLAY
Description : (6'-8')

Date : 7-27-95
Job No. : 95S1845-02
Tested By : JR
Checked By: JS

Physical Property Data

Initial Height (in) : 1.67
Initial Diameter (in) : 2.83
Initial Wet Weight (g) : 374.20
Wet Density (pcf) : 136.07
Moisture Content % : 17.10
Dry Density (pcf) : 116.20

Final Height (in) : 1.66
Final Diameter (in) : 2.80
Final Wet Weight (g) : 371.40
Wet Density (pcf) : 138.30
Moisture Content % : 15.80
Dry Density (pcf) : 119.43

Test Parameters

Fluid : Deaired Water
Cell Pressure (psi) : 48.00
Head Water (psi) : 44.00
Tail Water (psi) : 42.00

Effective Confining Pressure (psi) : 5
Gradient : 33.25

Permeability Input Data

Flow, Q (cc) : 17.90
Length, L (in) : 1.66
Area, A (sqin) : 6.16
Head, h (psi) : 2.00
Time, t (min) : 16.00
Temp, T (Deg C) : 23.0

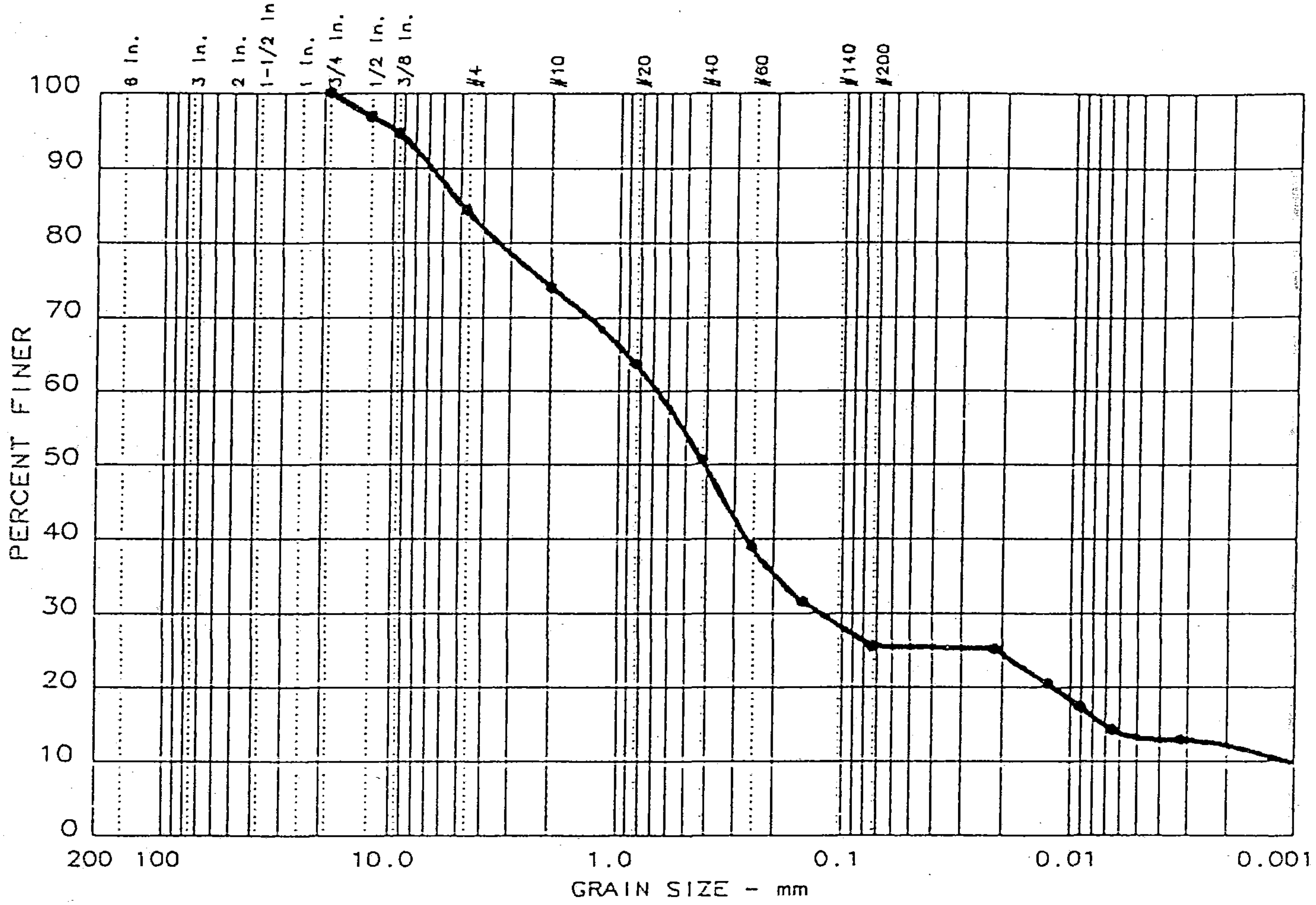
Computed Permeability

PERMEABILITY, K = 1.31E-05 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

CB - 4

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	9	0.0	15.6	58.8	13.5	12.1	SM

SIEVE inches size	PERCENT FINER ●		
0.75	100.0		
0.5	96.8		
0.375	94.6		

	GRAIN SIZE		
D_{60}	0.67		
D_{30}	0.12		
D_{10}	0.00		

	COEFFICIENTS		
C_c	20.89		
C_u	616.6		

SIEVE number size	PERCENT FINER ●		
4	84.4		
10	74.1		
20	63.7		
40	50.7		
60	39.0		
100	31.6		
200	25.6		

Sample information:

● CB-4

PFIZER WILLIAMSBURG

Remarks:

J & L TESTING
CO., INC.

Project No.: 95S1845-02
Project: ROUX ASSOCIATES

Date: 07-24-95 Data Sheet No. 1

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-4 FILL	Tested By	:	JR
Description	:	(2'-4')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	2.74	Final Height (in)	:	2.74
Initial Diameter (in)	:	2.81	Final Diameter (in)	:	2.79
Initial Wet Weight (g)	:	580.40	Final Wet Weight (g)	:	583.20
Wet Density (pcf)	:	130.01	Wet Density (pcf)	:	132.51
Moisture Content %	:	20.10	Moisture Content %	:	20.60
Dry Density (pcf)	:	108.25	Dry Density (pcf)	:	109.88

Test Parameters

Fluid		:	Deaired Water	Effective		
Cell Pressure	(psi)	:	48.00	Confining Pressure (psi)	:	5
Head Water	(psi)	:	44.00	Gradient	:	20.15
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	15.90
Length, L	(in)	:	2.74
Area, A	(sqin)	:	6.11
Head, h	(psi)	:	2.00
Time, t	(min)	:	25.00
Temp. T	(Deg C)	:	23.0

Computed Permeability

PERMEABILITY, K = 1.24E-05 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-4 CLAY	Tested By	:	JR
Description	:	(7'-9')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	1.80	Final Height (in)	:	1.78
Initial Diameter (in)	:	2.80	Final Diameter (in)	:	2.85
Initial Wet Weight (g)	:	385.30	Final Wet Weight (g)	:	386.80
Wet Density (pcf)	:	132.31	Wet Density (pcf)	:	129.65
Moisture Content %	:	22.80	Moisture Content %	:	23.40
Dry Density (pcf)	:	107.75	Dry Density (pcf)	:	105.07

Test Parameters

Fluid		:	Deaired Water	Effective		
Cell Pressure	(psi)	:	48.00	Confining Pressure (psi)	:	5.5
Head Water	(psi)	:	43.00	Gradient	:	15.51
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	30.00
Length, L	(in)	:	1.78
Area, A	(sqin)	:	6.38
Head, h	(psi)	:	1.00
Time, t	(min)	:	8.31
Temp, T	(Deg C)	:	23.0

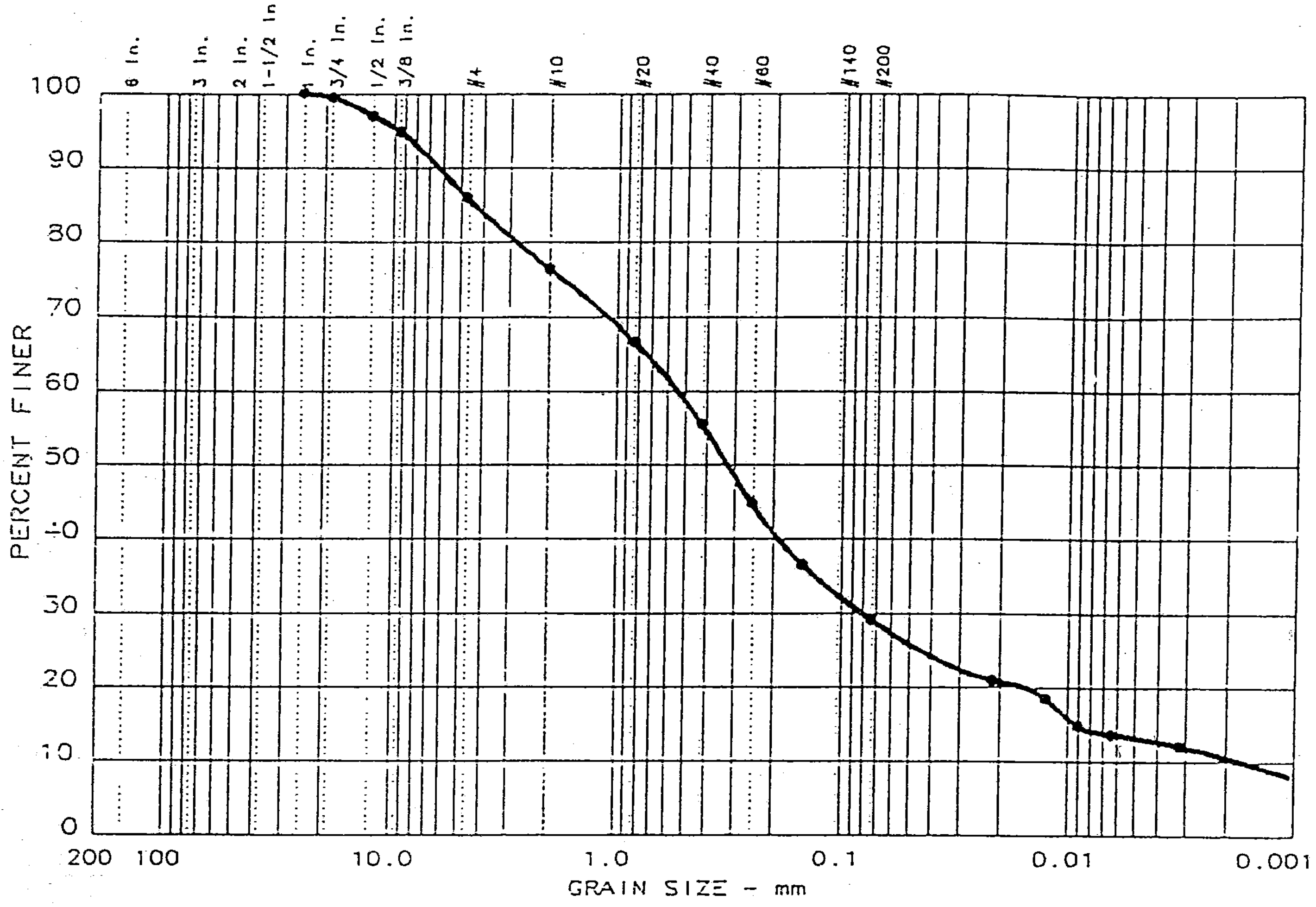
Computed Permeability

PERMEABILITY, K = 8.75E-05 (cm/sec) at 20 Degrees C

J & L TESTING CO, INC.

CB - 6

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	10	0.0	14.0	56.8	18.7	10.5	SM

SIEVE inches size	PERCENT FINER ●		
1	100.0		
0.75	99.4		
0.5	97.0		
0.375	94.8		

	GRAIN SIZE		
D_{60}	0.53		
D_{30}	0.08		
D_{10}	0.00		

	COEFFICIENTS		
C_c	7.00		
C_u	305.5		

SIEVE number size	PERCENT FINER ●		
4	86.0		
10	76.3		
20	66.6		
40	55.5		
60	44.7		
100	36.5		
200	29.2		

Sample information:

● CB-6

PFIZER WILLIAMSBURG

Remarks:

J & L TESTING
CO., INC.

Project No.: 95S1845-02
Project: ROUX ASSOCIATES

Date: 07-24-95 Data Sheet No. 2

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-6 FILL	Tested By	:	JR
Description	:	(2'-4')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	2.80	Final Height (in)	:	2.78
Initial Diameter (in)	:	2.85	Final Diameter (in)	:	2.83
Initial Wet Weight (g)	:	619.30	Final Wet Weight (g)	:	606.90
Wet Density (pcf)	:	131.96	Wet Density (pcf)	:	132.10
Moisture Content %	:	21.20	Moisture Content %	:	18.70
Dry Density (pcf)	:	108.88	Dry Density (pcf)	:	111.29

Test Parameters

Fluid		:	Deaired Water	Effective		
Cell Pressure	(psi)	:	48.00	Confining Pressure (psi)	:	5
Head Water	(psi)	:	44.00	Gradient	:	19.86
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	21.40
Length, L	(in)	:	2.78
Area, A	(sqin)	:	6.29
Head, h	(psi)	:	2.00
Time, t	(min)	:	1455.00
Temp, T	(Deg C)	:	23.0

Computed Permeability

PERMEABILITY, K = 2.82E-07 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-6 CLAY	Tested By	:	JR
Description	:	(6'-8')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	2.27	Final Height (in)	:	2.38
Initial Diameter (in)	:	2.85	Final Diameter (in)	:	2.77
Initial Wet Weight (g)	:	536.00	Final Wet Weight (g)	:	522.10
Wet Density (pcf)	:	140.88	Wet Density (pcf)	:	138.55
Moisture Content %	:	18.40	Moisture Content %	:	16.10
Dry Density (pcf)	:	118.99	Dry Density (pcf)	:	119.34

Test Parameters

Fluid		:	Deaired Water	Effective		
Cell Pressure	(psi)	:	48.00	Confining Pressure (psi)	:	5
Head Water	(psi)	:	44.00	Gradient	:	23.19
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	9.95
Length, L	(in)	:	2.38
Area, A	(sqin)	:	6.03
Head, h	(psi)	:	2.00
Time, t	(min)	:	198.00
Temp, T	(Deg C)	:	23.0

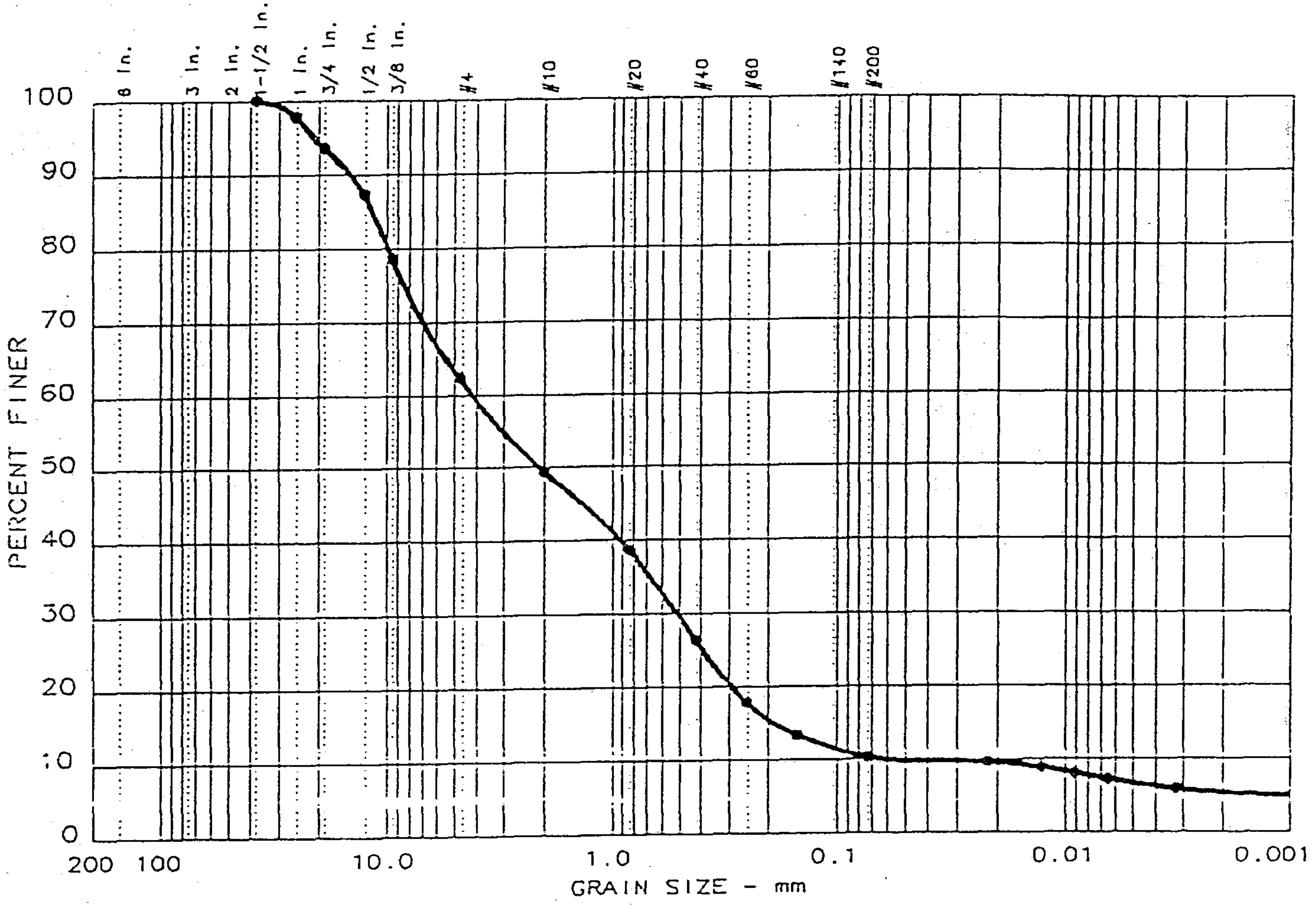
Computed Permeability

PERMEABILITY, K = 8.62E-07 (cm/sec) at 20 Degrees C

J & L TESTING CO, INC.

CB - 9

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	13	0.0	37.6	52.1	5.0	5.3	SW-SM

SIEVE inches size	PERCENT FINER ●		
1.5	100.0		
1	97.8		
0.75	93.5		
0.5	87.3		
0.375	78.6		

	GRAIN SIZE		
D_{60}	4.12		
D_{30}	0.51		
D_{10}	0.05		

	COEFFICIENTS		
C_c	1.07		
C_u	70.8		

SIEVE number size	PERCENT FINER ●		
4	62.4		
10	49.3		
20	38.6		
40	26.4		
60	17.8		
100	13.4		
200	10.3		

Sample information:

● CB-9

PFIZER WILLIAMSBURG

Remarks:

J & L TESTING
CO., INC.

Project No.: 95S1845-02

Project: ROUX ASSOCIATES

Date: 07-24-95

Data Sheet No. 5

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	: ROUX ASSOCIATES	Date	: 7-27-95
Project Location	: PFIZER WILLIAMS	Job No.	: 95S1845-02
Sample Number	: CB-9 FILL	Tested By	: JR
Description	: (1'-3')	Checked By:	JS

Physical Property Data

Initial Height (in)	: 2.00	Final Height (in)	: 2.00
Initial Diameter (in)	: 2.72	Final Diameter (in)	: 2.73
Initial Wet Weight (g)	: 359.90	Final Wet Weight (g)	: 367.20
Wet Density (pcf)	: 117.87	Wet Density (pcf)	: 119.38
Moisture Content %	: 22.40	Moisture Content %	: 23.40
Dry Density (pcf)	: 96.30	Dry Density (pcf)	: 96.75

Test Parameters

Fluid		: Deaired Water	Effective	
Cell Pressure	(psi)	: 48.00	Confining Pressure (psi)	: 5.5
Head Water	(psi)	: 43.00	Gradient	: 13.80
Tail Water	(psi)	: 42.00		

Permeability Input Data

Flow, Q	(cc)	: 23.15
Length, L	(in)	: 2.00
Area, A	(sqin)	: 5.85
Head, h	(psi)	: 1.00
Time, t	(min)	: 73.00
Temp, T	(Deg C)	: 23.0

Computed Permeability

PERMEABILITY, K = 9.41E-06 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	: ROUX ASSOCIATES	Date	: 7-27-95
Project Location	: PFIZER WILLIAMS	Job No.	: 95S1845-02
Sample Number	: CB-9 CLAY	Tested By	: JR
Description	: (5'-7')	Checked By:	JS

Physical Property Data

Initial Height (in)	2.67	Final Height (in)	2.70
Initial Diameter (in)	2.78	Final Diameter (in)	2.73
Initial Wet Weight (g)	529.40	Final Wet Weight (g)	520.20
Wet Density (pcf)	124.33	Wet Density (pcf)	125.28
Moisture Content %	24.30	Moisture Content %	22.10
Dry Density (pcf)	100.03	Dry Density (pcf)	102.60

Test Parameters

Fluid	Deaired Water	Effective	
Cell Pressure (psi)	48.00	Confining Pressure (psi)	5
Head Water (psi)	44.00	Gradient	20.44
Tail Water (psi)	42.00		

Permeability Input Data

Flow, Q	(cc)	16.20
Length, L	(in)	2.70
Area, A	(sqin)	5.85
Head, h	(psi)	2.00
Time, t	(min)	513.00
Temp, T	(Deg C)	23.0

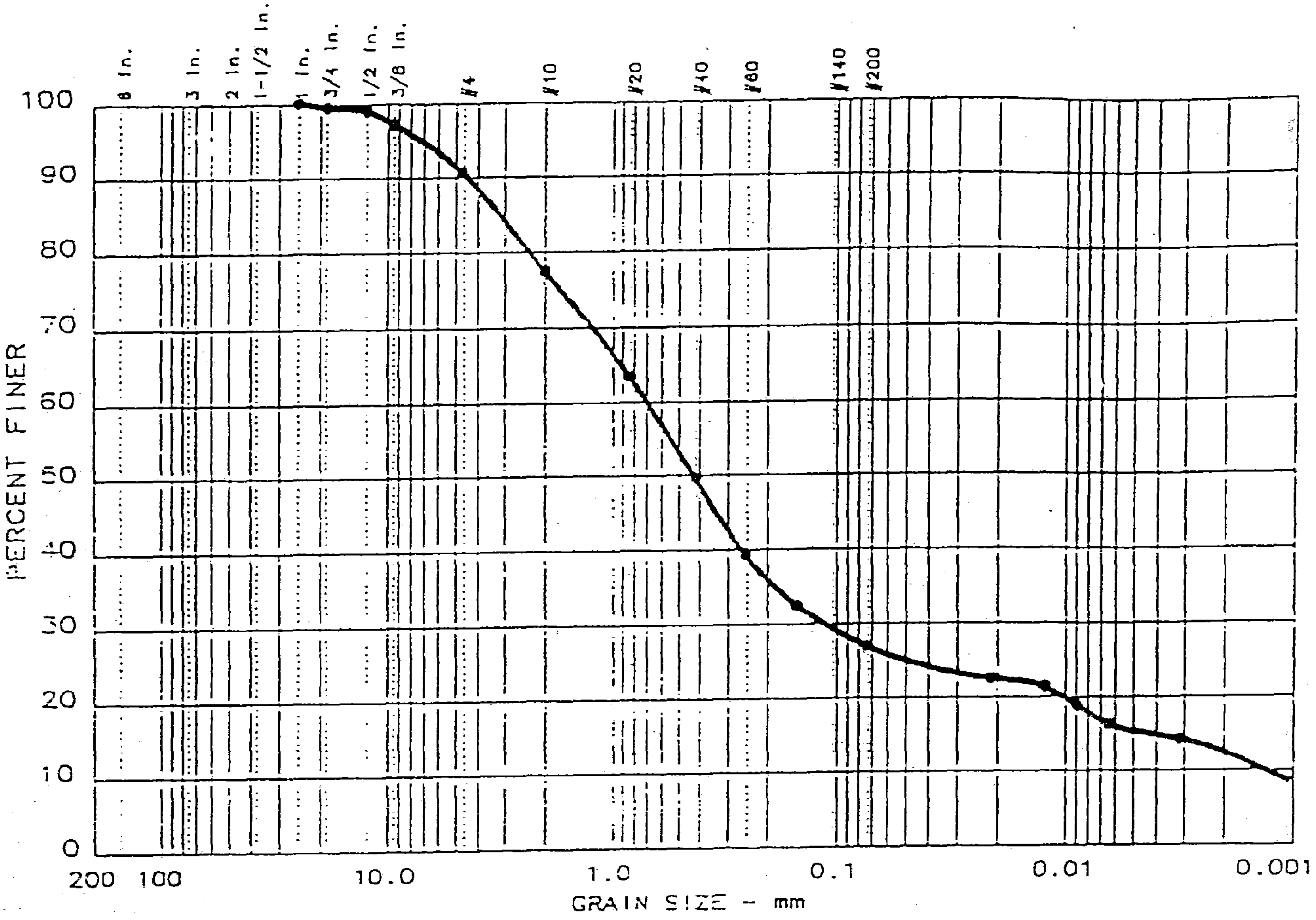
Computed Permeability

PERMEABILITY, K = 6.32E-07 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

CB - 13

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	12	0.0	9.4	63.7	14.6	12.3	SM

SIEVE inches size	PERCENT FINER ●		
1	100.0		
0.75	99.4		
0.5	98.9		
0.375	97.2		

	GRAIN SIZE		
D_{60}	0.69		
D_{30}	0.11		
D_{10}	0.00		

	COEFFICIENTS		
C_c	14.13		
C_u	524.8		

SIEVE number size	PERCENT FINER ●		
4	90.6		
10	77.4		
20	63.5		
40	49.5		
60	39.3		
100	32.5		
200	26.9		

Sample information:

● CB-13

PFIZER WILLIAMSBURG

Remarks:

J & L TESTING CO., INC.

Project No.: 95S1845-02
Project: ROUX ASSOCIATES
Date: 07-24-95
Data Sheet No. 4

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	:	ROUX ASSOCIATES	Date	:	7-27-95
Project Location	:	PFIZER WILLIAMS	Job No.	:	95S1845-02
Sample Number	:	CB-13 FILL	Tested By	:	JR
Description	:	(1'-3')	Checked By:		JS

Physical Property Data

Initial Height (in)	:	1.30	Final Height (in)	:	1.29
Initial Diameter (in)	:	2.80	Final Diameter (in)	:	2.76
Initial Wet Weight (g)	:	212.00	Final Wet Weight (g)	:	219.70
Wet Density (pcf)	:	100.80	Wet Density (pcf)	:	108.35
Moisture Content %	:	16.00	Moisture Content %	:	24.30
Dry Density (pcf)	:	86.90	Dry Density (pcf)	:	87.17

Test Parameters

Fluid		:	Deaired Water	Effective		
Cell Pressure	(psi)	:	48.00	Confining Pressure (psi)	:	5.5
Head Water	(psi)	:	43.00	Gradient	:	21.40
Tail Water	(psi)	:	42.00			

Permeability Input Data

Flow, Q	(cc)	:	30.00
Length, L	(in)	:	1.29
Area, A	(sqin)	:	5.98
Head, h	(psi)	:	1.00
Time, t	(min)	:	3.33
Temp, T	(Deg C)	:	23.0

Computed Permeability

PERMEABILITY, K = 1.69E-04 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

Client	ROUX ASSOCIATES	Date	7-27-95
Project Location	PFIZER WILLIAMS	Job No.	95S1845-02
Sample Number	CB-13 CLAY	Tested By	JR
Description	(8'-10')	Checked By:	JS

Physical Property Data

Initial Height (in)	2.40	Final Height (in)	2.50
Initial Diameter (in)	2.92	Final Diameter (in)	2.86
Initial Wet Weight (g)	566.60	Final Wet Weight (g)	546.00
Wet Density (pcf)	134.18	Wet Density (pcf)	129.40
Moisture Content %	24.90	Moisture Content %	20.10
Dry Density (pcf)	107.43	Dry Density (pcf)	107.74

Test Parameters

Fluid		Deaired Water	Effective	
Cell Pressure	(psi)	48.00	Confining Pressure (psi)	5
Head Water	(psi)	44.00	Gradient	22.08
Tail Water	(psi)	42.00		

Permeability Input Data

Flow, Q	(cc)	4.40
Length, L	(in)	2.50
Area, A	(sqin)	6.42
Head, h	(psi)	2.00
Time, t	(min)	515.00
Temp, T	(Deg C)	23.0

Computed Permeability

PERMEABILITY, K = 1.44E-07 (cm/sec) at 20 Degrees C

J & L TESTING CO. INC.

APPENDIX B

ROUX

CHAIN OF CUSTODY

Nº 02653Y

ROUX ASSOCIATES INC
Environmental Consulting & Management

1377 MOTOR PARKWAY
ISLANDIA, NEW YORK 11788
(516) 232-2600 FAX (516) 232-9898

PROJECT NAME: PFIZER-WILLIAMSBURG
PROJECT NUMBER: 04744Y03
PROJECT LOCATION: WILLIAMSBURG, BROOKLYN
SAMPLER(S): JEFF MAKOWSKI

ANALYSES — PAGE 1 OF 1

SAMPLE DESIGNATION/LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	PERMEABILITY TESTING					TOTAL BOTTLES	NOTES
CB-13/1'-3'	7/17/95	1100	SOIL	X					1	
CB-1/2'-4'	7/18/95	1000							1	
CB-1/6'-8'	7/18/95	1010							1	SHELBY TUBES
CB-9/5'-7'	7/18/95	1140							1	SHIPPED
CB-9/1'-3'	7/18/95	1145							1	SEPARATELY
CB-13/8'-10'	7/18/95	1230							1	FROM COOLER
CB-4/2'-4'	7/18/95	1335							1	
CB-4/7'-9'	7/18/95	1350							1	
CB-6/2'-4'	7/18/95	1540							1	
CB-6/6'-8'	7/18/95	1555	↓	↓					1	

RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT
	ROUX	7/18/95	1600	[✓ Y] OR N					Y OR N
				Y OR N					Y OR N
				Y OR N					Y OR N

DELIVERY METHOD: FED. EX. P1
ANALYTICAL LABORATORY: J&L COMPANY

COMMENTS: PLEASE REPORT TO SCOTT GLASH

ROUX

CHAIN OF CUSTODY

№ 02652Y

ROUX ASSOCIATES INC
Environmental Consulting
& Management

1377 MOTOR PARKWAY
ISLANDIA, NEW YORK 11788
(516) 232-2600 FAX (516) 232-9898

ANALYSES

PAGE 1 OF 1

PROJECT NAME: PFIZER - WILLIAMSBURG

PROJECT NUMBER: 04744Y03

PROJECT LOCATION: WILLIAMSBURG, BROOKLYN

SAMPLER(S): JEFF MAKOWSKI

SAMPLE DESIGNATION/LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	GRAIN SIZE & HYDROMETER TESTING					TOTAL BOTTLES	NOTES
~~CB-11~~ (1m) (1m)	~~7/17/95~~	~~1225~~	~~Soil~~	~~X~~					~~1~~	(1m)
CB-1	7/18/95	1000	SOIL	X					1	
CB-13	7/17/95	1005	SOIL	X					1	
CB-9	7/18/95	1150	SOIL	X					1	
CB-4	7/18/95	1400	SOIL	X					1	
CB-6	7/18/95	1545	SOIL	X					1	

RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
	Roux Assoc	7/18/95	1600	[✓ Y] OR N					Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N

DELIVERY METHOD: FED. EX. P1 #549833059

COMMENTS: PLEASE REPORT TO SCOTT GLASH

ANALYTICAL LABORATORY: J&L TESTING

APPENDIX F

APPENDIX F

Well Completion Reports

LAYNE-NEW YORK CO., INC.

1250 West Elizabeth Ave., Linden, New Jersey

INSTALLER'S REPORT

Contract PFIZER CHEMICAL CO.
Completion Date april 22 1959
Location BROOKLYN, NEW YORK
Customer's Well No. 1
City .... State ....
~~L.-N. Y. Co.~~ Well No. STATE # K1570

PUMP

Deming water Lubricated

Pump No. K1570 Type K.F. Setting 131' 5" Suction 11"
Basket NONE Size Discharge 4" Size of Tubing 4' PIPE Size Shafting 1¼
Size Pump 7" No. of Stages .... Impellers Br. or C.I. ....
Head .... Max. Lgth. Dischg. 125 Weight Pump .... Flanged ~~or Coupled~~ Discharge ....
Changes in Pump, if any ....
How long did you operate Pump? 52 HOURS Length of Air Line 125' 8"
Operating instructions given to .... Title ....
Report by letter any difficulties or extra expense on job ....

MOTOR

ake G.E. Volts 220/440 Phase 3 H. P. 20
Frame 6301 Model 1F75-4 Type 1 K.F. Cycle 60
mperes 50/25 R. P. M. 1755 Form .... Serial 4827404

WELL

apacity (GPM) 323 Pumping Level 83' Static Level 53'9" Pressure ....
Guarantee (GPM) .... Driller .... Depth of Well from Base Plate 155'
staller .... What changes did you make in Well? ....

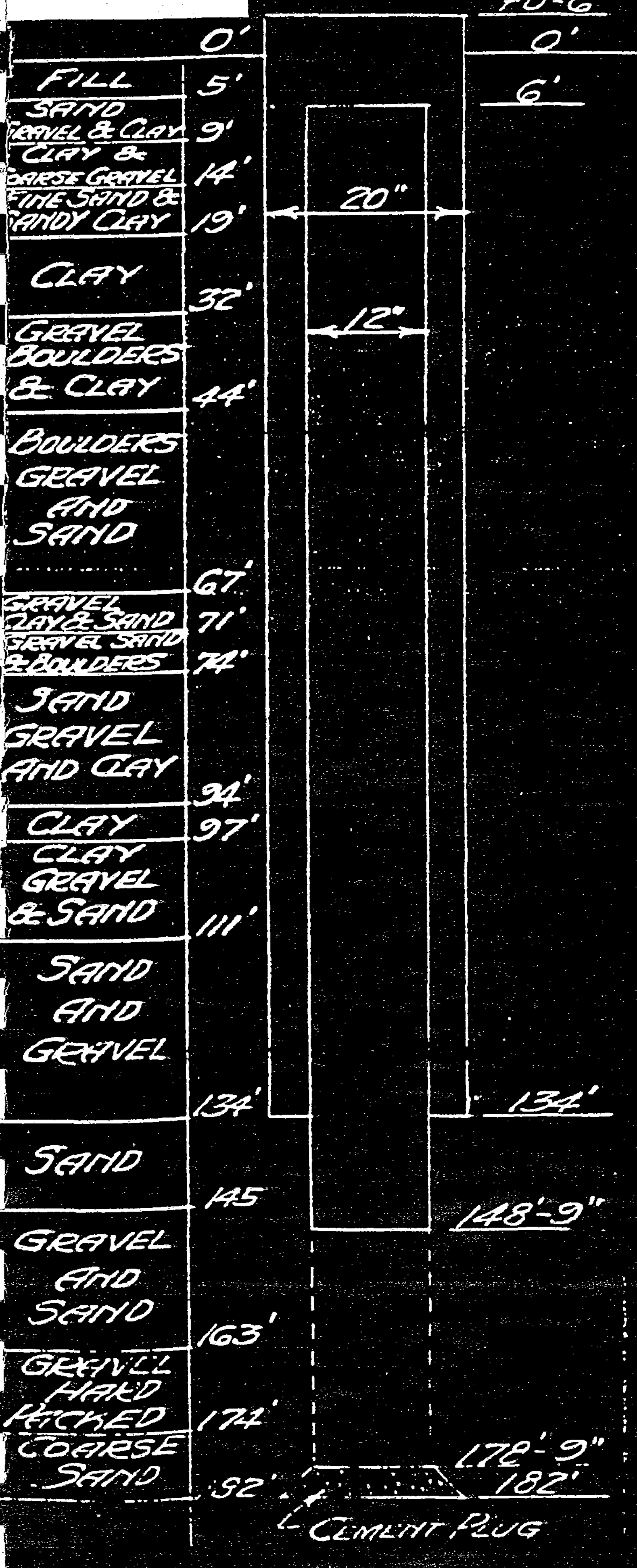
TEST

ME	R. P. M.	PUMPING LEVEL	G. P. M.	PUMP PRESSURE	MAIN PRESSURE	VOLTAGE	AMP.	H. P.
M	1755	88'	317					
M	· ·	91'	317					20
P	·	88'	317					· ·
M	· ·	83'	323					·
PM	· ·	83'	323					· ·
M	· ·	83'	317					· ·

FOR THE PURCHASER

S. Vitiello
FOR LAYNE-NEW YORK CO.

WELL No. 5



Material

Pit: 134'-6" OF 20" STEEL PIPE T.Bo
142'-9" OF 12" " " "

Screen: 30' OF 12" EVERDUR

Cone: 12"x18" CEMENTED

Pump

8-15-61
4-2-54

Type	RKLC M (SPEC)	Shop No.	22668A
Setting	~~125'-2"~~ 135'-3"	Size	12"
Suction	9'-10" OF 8"	Stages	4
Basket	E.K.	Impellers	BRONZE
Discharge	8"	Head	TF 825
Tubing	WATER LUB.	Press B. P.	70 #
Shafting	1½"	Air Line	~~135'~~ B.P. ~~145'~~ 130' ~~144'-8"~~

Motor

Make	U.S.	Type	CODE "G"
Volts	208	Cycle	60
Phase	3	Amp.	202
H.P.	75	R. P. M.	1800
Frame	952	Form	VERT.
Model	CFU	Serial	345583

Well

Started	1-25-51	Static Level	71' 70'
First Test	3-23-51	Production	710 715
Final Test	6-4-51	Pumping Level	91' 80'
Accepted	6-4-51	Guarantee	700
Clear Depth	179'	Press.	70 #

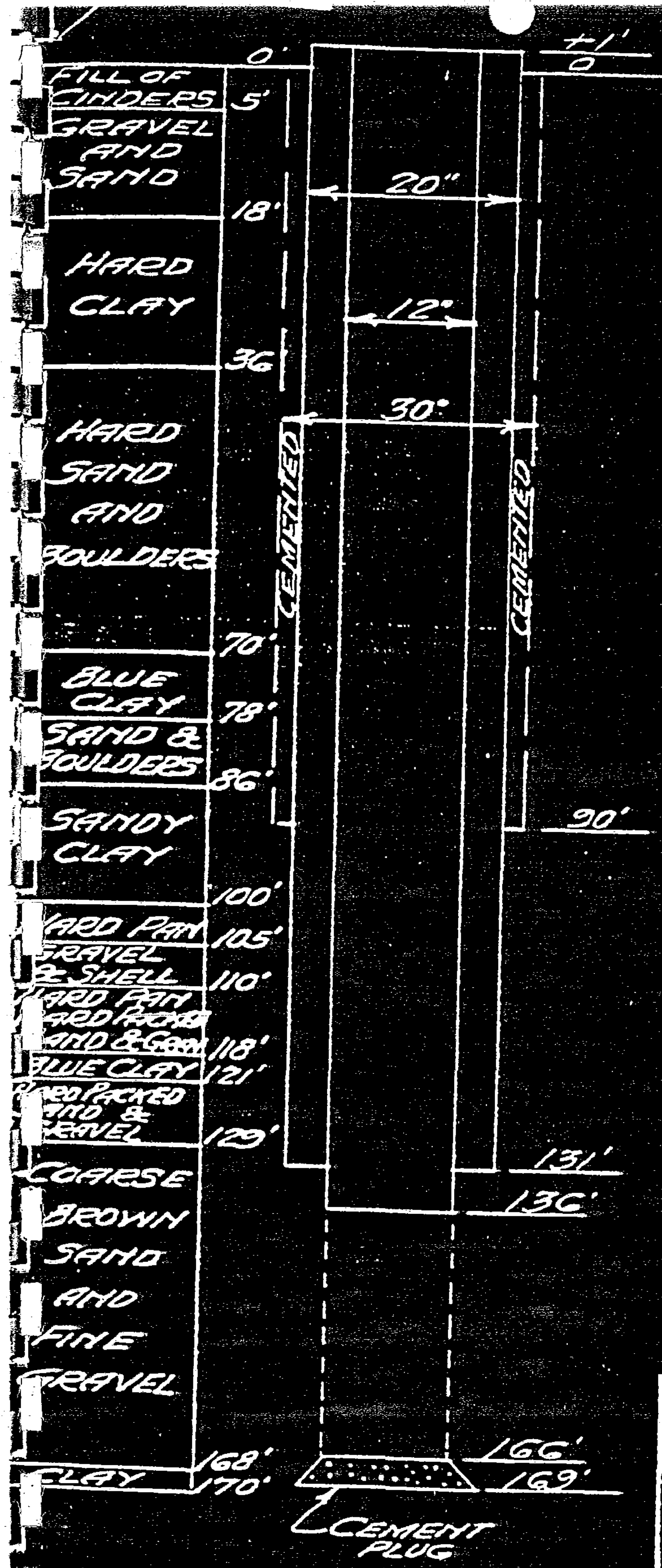
Driller: G.S. DIVINS

Installer: C.A. JOLLEY - T. POWELL

K-2048

CHAS PFIZER & CO INC
BARTLETT ST. PLANT
BROOKLYN, N.Y.

RFO
4/3 (THEIR #5)



Material

Pit: 132' of 20" Steel Pipe, Welded
137' " 12" " " T & C.

Screen: 30' of 12" Everdur

Cone: 1-12"x18"x 3' Long Cone, Cemented

Pump

Type	RKLC	Shop No.	7-16-51 19078
Setting	125'-3"	Size	12"
Suction	10' of 8"	Stages	4
Basket		Impellers	Bronze
Discharge	8"x10' Cplo.	Head	TF 818
Tubing	Water Lub.	Press. B. P.	40#
Shafting	1½"	Air Line	~~133~~ 128' 3" B.P.

Motor

Make	U.S.	Type	Hollow Shaft
Volts	208	Cycle	60
Phase	3	Amp.	123 for 220V
H. P.	50	R. P. M.	1800
Frame	405-4	Form	Vert.
Model	CFU	Serial	653594

Well

Started	9-15-48	Static Level	73'
First Test	11-13-48	Production	800 700 Fin.
Final Test	12-20-48	Pumping Level	85' 87 Fin.
Accepted	12-20-48	Guarantee	700
Clear Depth	166'	Press.	44# B.P. Fin.

Driller: John Petrash

Installer: Q. S. Chandler

LAYNE-NEW YORK CO., INC. NEW YORK, N. Y.
WATER SUPPLY CONTRACTORS

CHAS. PFIZER CO.
BROOKLYN, N.Y.
BARTLETT ST. PLANT

PLAN BY R.F.O.
APPROVED BY

WELL No. ~~2~~ 3 (THEIR #6)
N.Y.W.P. & C.C. # K-1629

U

LAYNE-NEW YORK CO., INC.

1250 West Elizabeth Ave., Linden, New Jersey

INSTALLER'S REPORT

Completion Date 1-17-78

Owner Pfizer Inc

Customer's Well No. 8

Location Flushing Ave

L. N. Y. Co. Well No. Not Layne

City Brooklyn

State N.Y.

Job No. 8-123-01

PUMP

Pump No. None Type T.H.C. Setting to Suction Flange 114'2" Suction 1'6" of 6"

Basket None Size Discharge 5" Size of Tubing Water lube Size of Shafting 1 3/16"

Make Layne Size Pump 8" No. of Stages 5 Impellers Br. or ~~C.I.~~ Br.

Head Drawing Max. Lgth. Disch 109'10" ~~Weight Pump~~ Lateral 1/4" ~~Flgd.~~ or Cpld. Discharge Cpld.

Changes in Pump, if any

How long did you operate Pump? Length of Air Line from Base Plate 109'10"

Operating instructions given to Title

Report by letter any difficulties or extra expense on job

MOTOR

Make G.E. Volts 220-440 Phase 3 H. P. 20

Frame N6301 Model 12F1331 Type KF Cycle 60

Amperes 50-25 R. P. M. 1760 Form Vertical Serial 5446129

Upper Bearing No. Lower Bearing No.

AUXILIARY DRIVE

GEAR DRIVE

Make Type Model H. P. Ratio Serial

ENGINE

Make Type Model Spec. No. R. P. M. Serial

CLUTCH POWER TAKEOFF

Make Model Serial Spec. No.

WELL

Capacity (GPM) Pumping Level Static Level 37' Pressure

Size of Air Release Valve None Depth of Well from Base Plate 151'4"

Installer. William What changes did you make in Well?

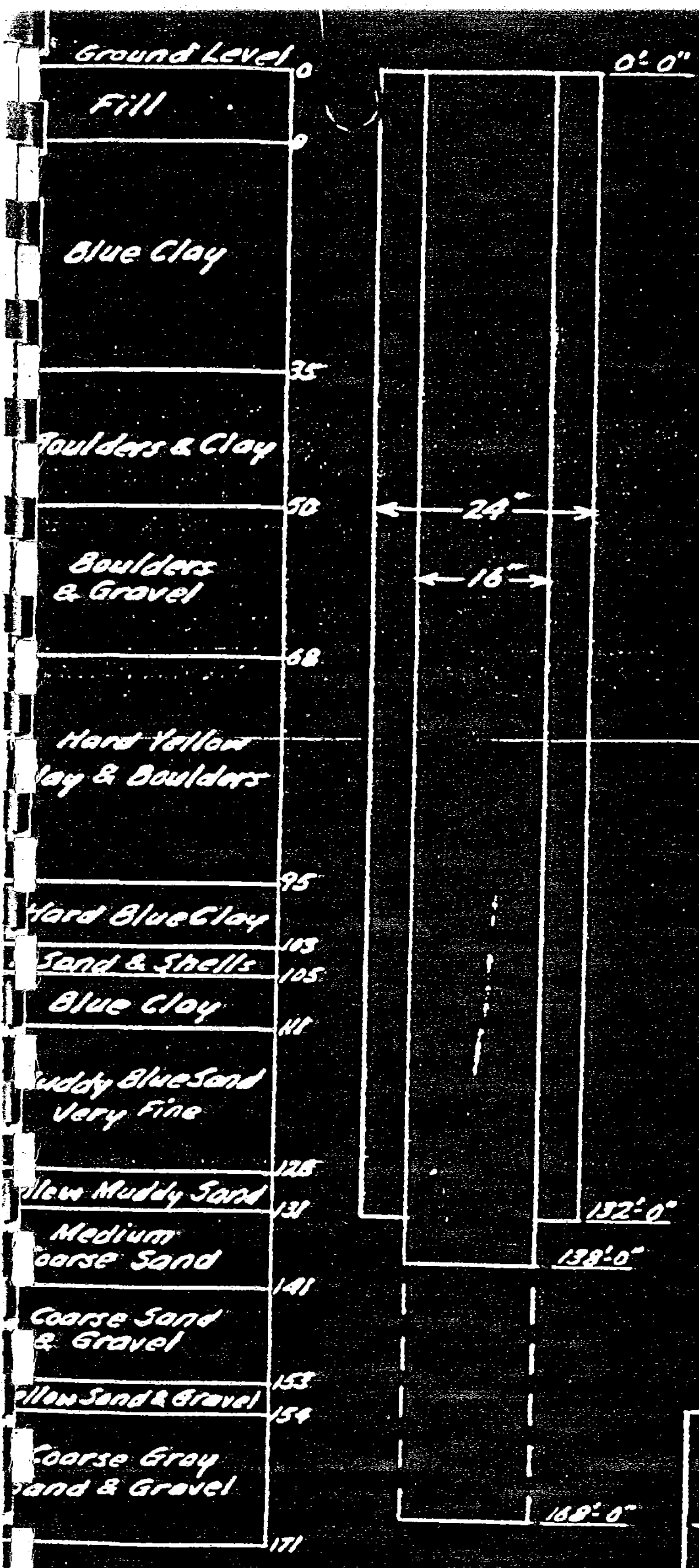
LIST ON REVERSE SIDE, ALL PARTS USED AND ANY OTHER REMARKS.

RECORD RESULTS OF ANY PUMP TEST MADE ON "RECORD OF TEST" FORM AND SEND IN WITH INSTALLER'S REPORT.

Comments or Remarks:

Repaired bowls. New T.S. + M.D. shaft. Replace T.S. Column
Repair stuffing box + replace spider bearings. Column coupling
getting thin around spider. Well pumping sand on start.

FOR LAYNE-NEW YORK CO.



Pit: 132' of 24" O.D. × 3/8" Pipe Welded
138' of 16" O.D. × 3/8" " "

Screen: 30' of 16" Everdur

Cone: Steel Plate

Pump

Type	DRLC	Shop No.	12579
Setting	123'-8" to S.F.	Size	15"
Suction	10' of 8"	Stages	2
Basket	—	Impellers	Bronze
Discharge	8"	Head	TA 1
Tubing	Water Lub.	Press. B. P.	53#
Shafting	1½"	Air Line	120'

12-21-50

Motor

4-25-50

Make	U.S.	Type	Hollowshaft
Volts	208	Cycle	60
Phase	3	Amp.	~~282~~ 256
H. P.	~~75~~ 100	R. P. M.	1800
Frame	~~952~~ 504-5	Form	Vertical
Model	CFU CODE-"F"	Serial	~~845583~~ ~~852628~~ 872147

Well

Started	1-5-43	Static Level	71'-6"
First Test	5-2-43	Production	993
Final "	7-8-43	Pumping Level	81
Accepted	7-8-43	Guarantee	993
Clear Depth	172' B.P.	Press.	53#

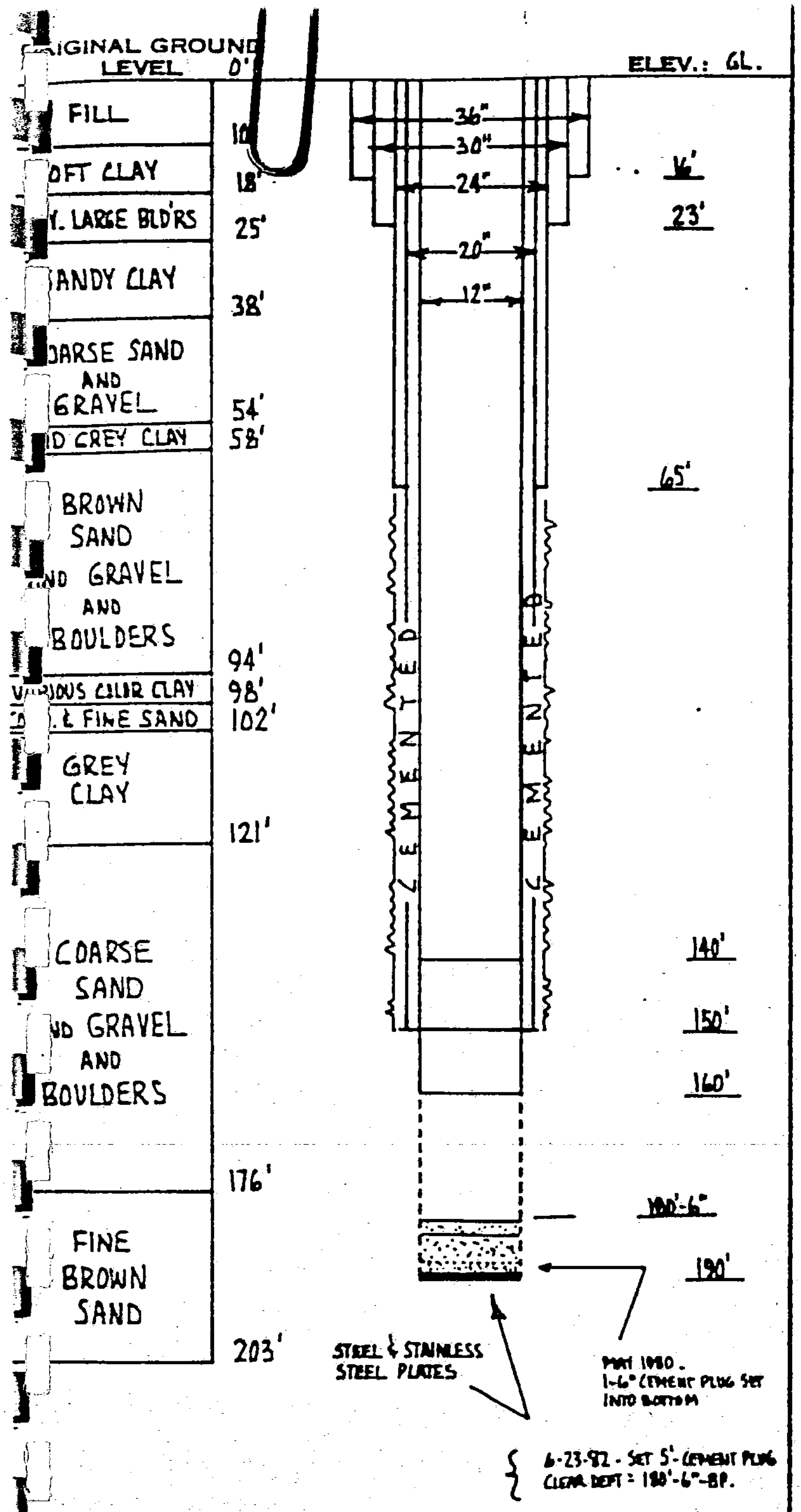
Driller: O.R. Firestone & L.E. Willoughby

Installer: T.A. Murray

LAYNE-NEW YORK CO., INC. NEW YORK N.Y.
K1344 WATER SUPPLY CONTRACTORS

CHAS. PFIZER & CO., INC.
11 BARTLETT STREET
BROOKLYN, N.Y.
DRAWN BY W.A.N. APPROVED W.A.N.
WELL NO. 1 (THEIR #10)

5-10-43



STEEL & STAINLESS STEEL PLATES

MAY 1980.
1-6" CEMENT PLUG SET INTO BOTTOM

6-23-92 - SET 5'-CEMENT PLUG
CLEAR DEPT = 180'-6"-BP.

MATERIAL

PIPE: 16' OF 36" DIAM X ½" WALL BLACK STEEL PIPE WELDED
23' OF 30" DIAM X 3/8" WALL BLACK STEEL PIPE WELDED
65' OF 24" DIAM X 3/8" WALL BLACK STEEL PIPE WELDED
151' OF 20" DIAM X 3/8" WALL BLACK STEEL PIPE WELDED
140' OF 12" DIAM X 3/8" WALL BLACK STEEL PIPE T+C
20' OF 12" DIAM X 7-GA. TYPE-304 STAINLESS STEEL PIPE WELDED.

SCREEN: 30' OF 12" DIAM X 7-GA. LAYNE-TYPE-304 STAINLESS SHUTTER NO: 7

PLUG: 3/4" STEEL AND 7-GA. STAINLESS STEEL PLATES WELDED

GRAVEL: 40 TONS OF #2

SEAL: CEMENT GROUT TO 150'

PUMP 6-23-82

SIZE	12"	NUMBER	62849
STAGES	4	TYPE	~~RKAH~~ RKLC# 19078-A
SETTING	125'-5" TO SP.	COLUMN	8"x 5'+16' CPLD.
TUBING	X.W. LUBE	SHAFTING	1 11/16"
BOWLS	CAST IRON ENAM.	IMPELLERS	BRONZE
IMP. SHAFT	TYPE-303 STAINLESS	SUCTION	10' OF 8"
STRAINER	NONE	PRESS. B.P.	
HEAD	TF-825	AIR LINE	~~120'~~-BP 121'-4"

MOTOR

MAKE	U.S.	TYPE	RU
VOLTS	208	CYCLE	60
PHASE	3	AMP.	250
H. P.	100	RPM	1800
FRAME	404 TPH	NON REV.	YES
MODEL	VHS	SERIAL NO.	PA306482
UPPER BRG.	1-7222M	LOWER BRG.	6212J

GEAR DRIVE

MFG.		MODEL	
RATIO		SERIAL NO.	
HVY. THRUST		NON-REV.	

ENGINE

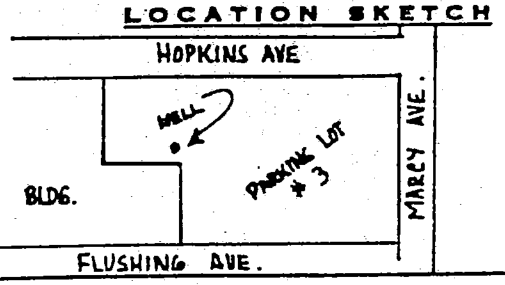
MFG.		MODEL	
RPM		CONTINUOUS H. P.	
FUEL		SERIAL NO.	

WELL

STARTED	6-9-69	CLEAR DEPTH	190'-BP.
FIRST TEST	3-6-70	METHOD	REVERSE ROTARY
FINAL TEST		GUAR. CAP.	
ACCEPTED	3-6-70	GUAR. PRESS.	
B. P. ELEV.		FORMATION	
DIST. TO G.W.	150'	DRILLER	E. SABLOSKY - S. VIEFELD

DATE	3-6-70	7-23-70	5-10-80		
STATIC LEV.	51'	51'	21'-6"		
PRODUCTION	1212	1125			
PUMP. LEVEL	79'	67'			
WATER TEMP.					

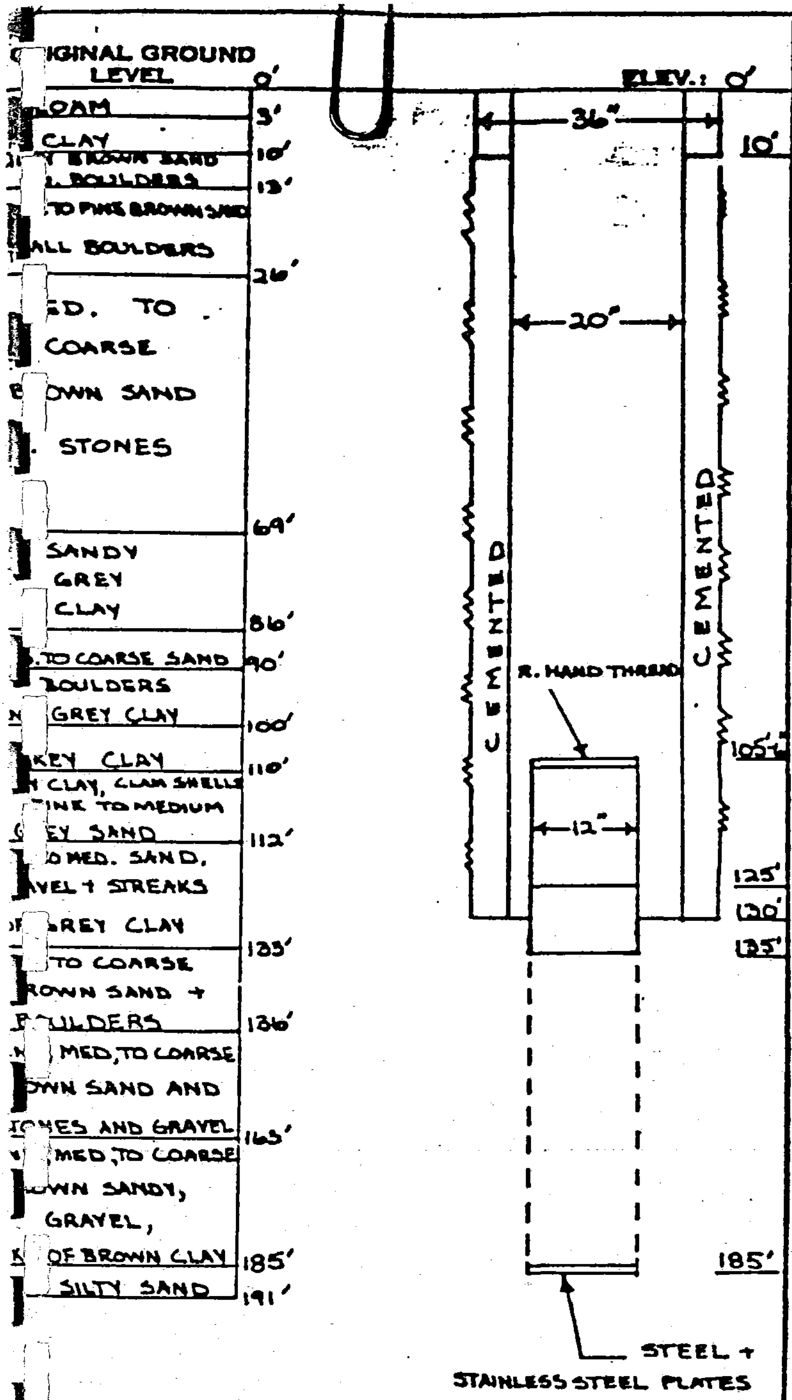
LOCATION SKETCH



LAYNE-NEW YORK CO., INC. - LINDEN, N. J.
WATER SUPPLY CONTRACTORS

CHARLES F. PFIZER COMPANY_ PARKING LOT #3_ BKLYN, N.Y.

DRAWN BY	NM.	STATE #	K-3133
LAYNE WELL #	7	CUSTOMER WELL #	14



MATERIAL

PIPE: 130' OF 20" DIAM. .375 WALL BLACK STEEL PIPE WELDED
19'-6" OF 12" DIAM. .375 WALL BLACK STEEL PIPE WELDED

SCREEN: 50' OF 12" LAYNE 304- STAINLESS STEEL SHUTTER SCREEN- 7 GAUGE NO. 7 SLOT

PLUG: 3/4" STEEL AND STAINLESS STEEL PLATES WELDED IN BOTTOM

GRAVEL: 47,000 # OF #2-#3 MIX

SEAL: 170 BAGS CEMENT GROUT OUTSIDE 20" CASING TO 120'

PUMP

SIZE 12"	NUMBER 38628
STAGES 4	TYPE RKBH
SETTING 95'-2" TO G.F.	COLUMN 8" x 5' + 10' CPLD.
TUBING NONE - W.L.	SHAFTING 1 1/2" CRS.
BOWLS CAST IRON ENAM.	IMPELLERS BRONZE
IMP. SHAFT 410 STAINLESS STEEL	SUCTION 9'-10" OF 8"
STRAINER NONE	PRESS. B.P.
HEAD	AIR LINE 105' B.P.

MOTOR

MAKE U.S.	TYPE RU
VOLTS 208	CYCLE 60
PHASE 3	AMP. 250
H. P. 100	RPM 1800
FRAME 404TPH	NON REV. YES
MODEL HOLLOWSHAFT	SERIAL NO. P4306481
UPPER BRG. 1-7222 M	LOWER BRG. 1-6212 T

GEAR DRIVE

MFG.	MODEL
RATIO	SERIAL NO.
HVY. THRUST	NON-REV.

ENGINE

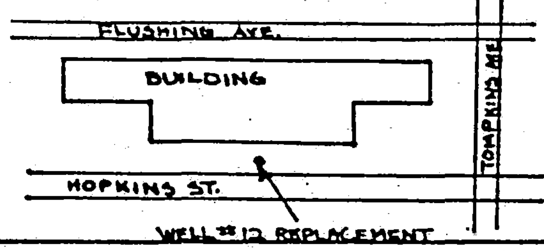
MFG.	MODEL
RPM	CONTINUOUS H. P.
FUEL	SERIAL NO.

WELL

STARTED 9/10/76	CLEAR DEPTH 185' - G.L.
FIRST TEST 10/8/76	METHOD REV. ROTARY
FINAL TEST	GUAR. CAP. 1400 GPM
ACCEPTED 10/8/76	GUAR. PRESS.
B. P. ELEV.	FORMATION
DIST. TO G.W. 110'	DRILLER D. CICOGNA S. DI BARTOLO

DATE	10/8/76				
STATIC LEV.	32'-6"				
PRODUCTION	1400 GPM				
PUMP. LEVEL	58'				
WATER TEMP.	60°				

LOCATION SKETCH

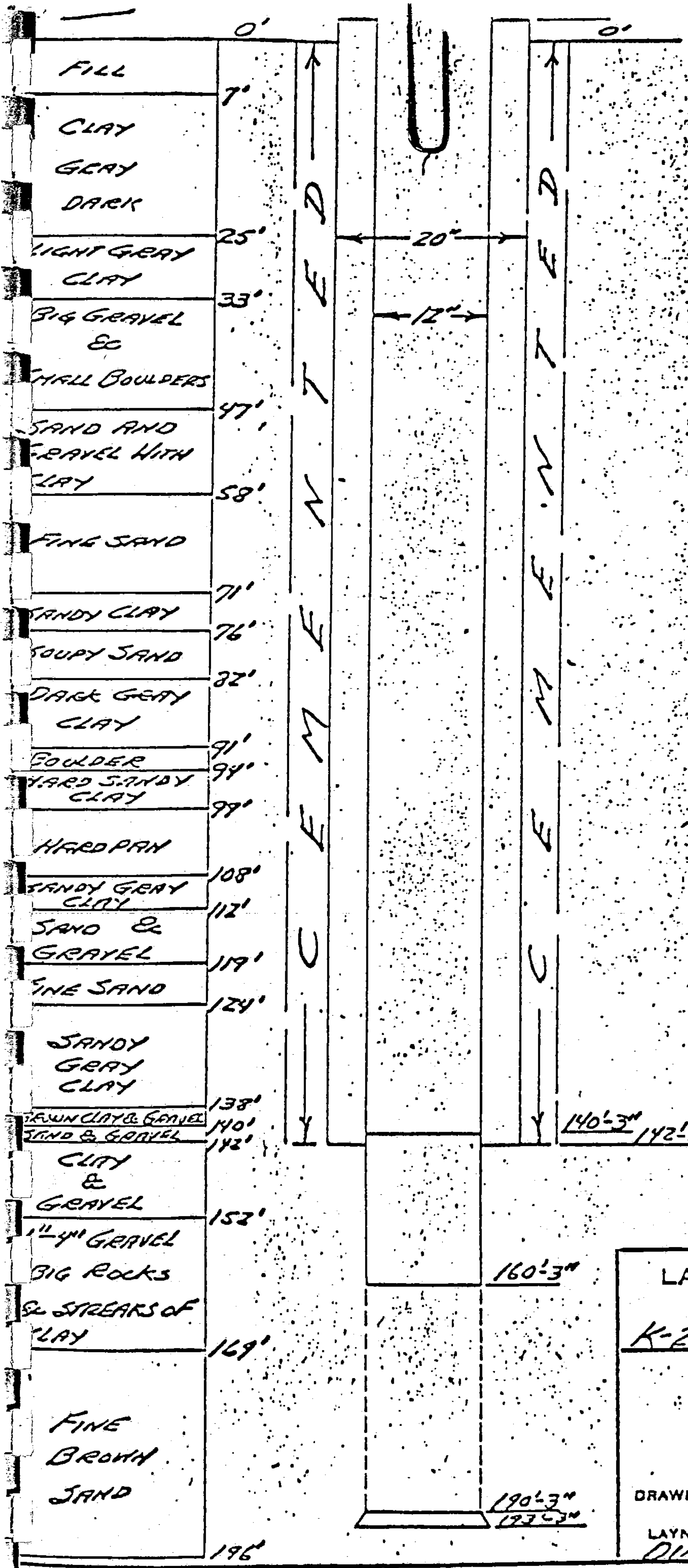


LAYNE-NEW YORK CO., INC. - LINDEN, N. J.
WATER SUPPLY CONTRACTORS

PFIZER INC. 11 BARTLETT ST., BROOKLYN, N.Y.

DRAWN BY K.C.
LAYNE WELL #

STATE # K-3220
CUSTOMER WELL #12-REPLACEMENT
T-#15



[illegible] OF 20" STEEL [illegible]
141'-11" OF 12" STEEL PIPE T.&C.
20' OF 12" MONEL BLANK

Screen: 30' OF 12" MONEL

Cone: 3' CONE

Pump

Type	Shop No.
Setting	Size
Suction	Stages
Basket	Impellers
Discharge	Head
Tubing	Press B. P.
Shafting	Air Line

Motor

Make	Type
Volts	Cycle
Phase	Amp.
H. P.	R. P. M.
Frame	Form
Model	Serial

Well CABLE TOOL

Started 10-18-57	Static Level 55'
First Test 11-26-57	Production
Final Test	Pumping Level
Accepted	Guarantee
Clear Depth	Press.

Driller: FRITZ KRAMER

Installer:

LAYNE-NEW YORK CO., INC. NEW YORK, N. Y.
WATER SUPPLY CONTRACTORS

K-2434D

CHAS. PFIZER & CO.
11 BARTLETT ST.
BROOKLYN, N.Y.

DRAWN BY S&B

APPROVED BY

LAYNE WELL NO. DIFFUSION #1

DRAWING NO.

U

Application No. [illegible]-1445

Well No. K-2236 #12
Diff." " K-2435D #20

STATE OF NEW YORK

DEPARTMENT OF CONSERVATION
DIVISION OF WATER POWER AND CONTROL

APPROVAL OF WELL SYSTEM AND PERMIT TO OPERATE

Owner: Chas. Pfizer & Co., Inc.

Address: 11 Bartlett Street, Brooklyn, New York

Location: 60 ft. N. of Hopkins St., 355 ft. W. of Tompkins Ave., Kings County (Well No. 12)

Depth 142.7 ft. Diameter casings 20-12 in. Diameter screen 12 in.

Pump: Elec. deep well turbine of 1000 gallons per minute capacity

Water to be used for cooling purposes

Special conditions: All well water pumped in excess of 2,940 gallons a minute and in excess of 1,131 million gallons annually must be returned to the same aquifer; the diffused water will be that used in a completely closed system; meters to record the amount of well water pumped and diffused must be maintained and readings reported monthly to this Commission.

Driller: Layne-New York Co., Inc., 150 Denton Ave., Garden City Park, New York.

All construction has been completed in accordance with the provisions of Decision (s) of June 7, 1955, and the system may be operated subject to the terms thereof.

Albany, New York

Date October 6, 1959

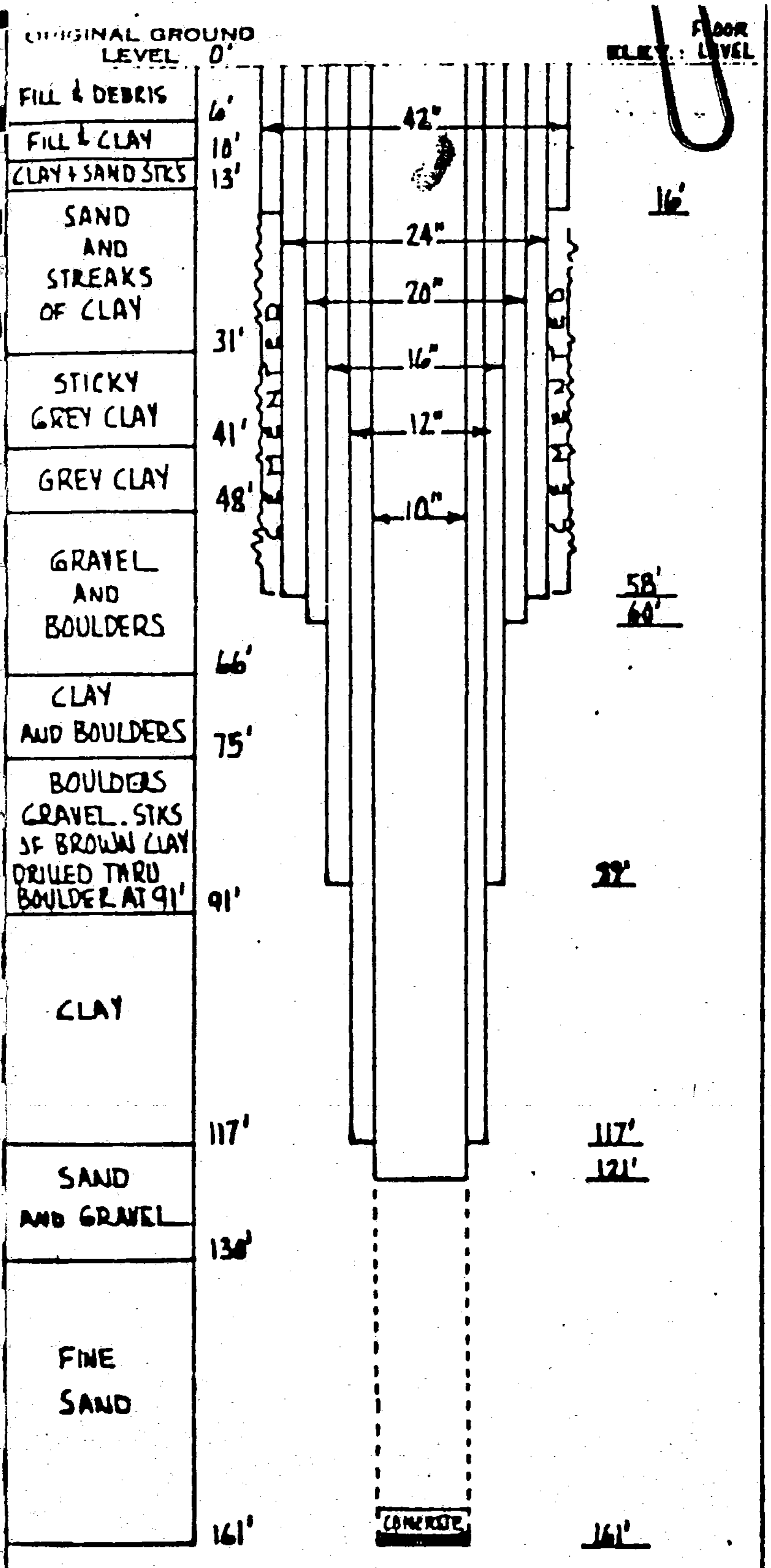
WATER POWER AND CONTROL COMMISSION

By (L.S.) J. C. THOMPSON

Secretary

Post this notice near well

S-10/14/59



MATERIAL

PIPE 16' OF 42" DIAM x 3/8" WALL BLACK STEEL PIPE WELDED
58' OF 24" DIAM x 3/8" WALL BLACK STEEL PIPE WELDED
58' OF 20" DIAM x 3/8" WALL BLACK STEEL PIPE WELDED
89' OF 16" DIAM x 3/8" WALL BLACK STEEL PIPE WELDED
117' OF 12" DIAM x STD. WALL BLACK STEEL PIPE WELDED

SCREEN. 121' OF 10" DIAM x STD. WALL BLACK STEEL PIPE WELDED
40' OF 10" DIAM x 7 GA. LAYNE_304 STAINLESS STEEL SHUTTER NO: 6

PLUG: 10" DIAM x 6 FT. LONG CONCRETE PLUG.

GRAVEL: 50 BAGS OF # 3

SEAL: CEMENT GROUT

PUMP

SIZE		NUMBER	
STAGES		TYPE	
SETTING		COLUMN	
TUBING		SHAFTING	
BOWLS		IMPELLERS	
IMP. SHAFT		SUCTION	
STRAINER		PRESS. B.P.	
HEAD		AIR LINE	

MOTOR

MAKE		TYPE	
VOLTS		CYCLE	
PHASE		AMP.	
H. P.		RPM	
FRAME		NON REV.	
MODEL		SERIAL NO.	
UPPER BRG.		LOWER BRG.	

GEAR DRIVE

MFG.		MODEL	
RATIO		SERIAL NO.	
HVY. THRUST		NON-REV.	

ENGINE

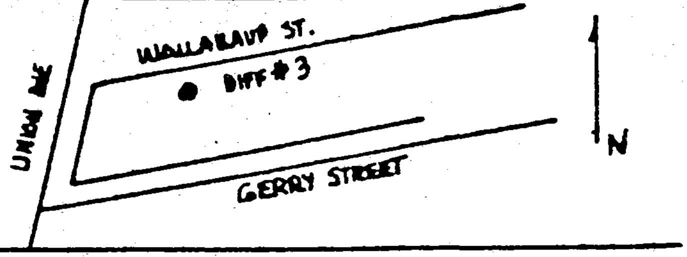
MFG.		MODEL	
RPM		CONTINUOUS H. P.	
FUEL		SERIAL NO.	

WELL

STARTED	9.4.69	CLEAR DEPTH	155' FLOOR LEV.
FIRST TEST	12.7.70	METHOD	CABLE TOOL + REV. ROTARY
FINAL TEST		GUAR. CAP.	
ACCEPTED	12.7.70	GUAR. PRESS.	
B. P. ELEV.		FORMATION	
DIST. TO G.W.		DRILLER	CATONE, DIBARTOLA, TUCKER, BUKOWSKI

DATE	12.7.70				
STATIC LEV.	45'				
PRODUCTION	1040 GPM				
PUMP. LEVEL	104'				
WATER TEMP.	56°				

LOCATION SKETCH



LAYNE-NEW YORK CO., INC. - LINDEN, N. J.
WATER SUPPLY CONTRACTORS

CHAS. PFIZER COMPANY _ FLUSHING AVE. BKLYN, N.Y.

DRAWN BY NM
LAYNE WELL # DIFF #3
STATE # K. 3134 D
CUSTOMER WELL # DIFF # 3

APPENDIX G

APPENDIX G

Historical Ground-Water Quality Data

Pfizer

PFIZER INC., BROOKLYN PLANT: 11 BARTLETT STREET, BROOKLYN, N.Y. 11206

June 23, 1986

New York State Department of Environmnetal Conservation
2 World Trade Center
33rd Floor
New York, New York 10047

Dear Mr. E. Khadaran:

Enclosed is a copy of the analysis that you requested on our Well No. K-3133.

(WELL 14)

C. P. Schwaderer
Sr. Utilities Eng
Brooklyn Plant

cc: Mr. P. Senatore, Brooklyn Plant Environmnetal Control Manger

INDUSTRIAL TESTING LABORATORIES
Analytical and Consulting Chemists

50 MADISON AVENUE, NEW YORK, N.Y. 10010
(212) 685-8788

MEMBERSHIPS
CORPORATE/INDIVIDUAL

American Association of Candy Technologists
American Association of Cereal Chemists
American Association of Clinical Chemists
American Chemical Society
American Council of Independent Laboratories, I
American Institute of Chemists
American Oil Chemists Society
American Petroleum Institute
American Pharmaceutical Association
American Public Health Association
American Society for Testing & Materials
American Society of Microbiology
Association of Consulting Chemists
& Chemical Engineers
International Food Technologists
Society for Applied Spectroscopy
Society of Cosmetic Chemists

CERTIFICATE OF ANALYSIS-

June 18, 1986 SERIAL No.: 86-121-260

Pfizer, Inc. DATE RECEIVED: 5-1-86

Water-sample

The samples of water submitted by Pfizer Inc., 11 Bartlett Street, Brooklyn, N.Y. 11206 taken from Pfizer Well [K-3133] were tested for the parameter listed in Attachment No. 1, N.Y.S. Dept. of Envi0 ronmental Conservation. The results of these analyses are as follows:

GENERAL	RESULTS
Turbidity, NTU	2.2
Color	4 units
pH	6.85
Hydrogen Sulfide	<0.1 ppm
Odor	no odor observed
Total coliform	none
Total dissolved solids	384 ppm
Specific conductance	580 µmho
Hardness, $CaCo_3$	155 ppm
Alkalinity, $CaCo_3$	166 ppm
INORGANICS	
Arsenic	<0.01 ppm
Barium	<0.2 ppm
Cadmium	<0.01 ppm
Calcium	62 ppm
Chloride	44.5 ppm
Chromium	0.05 ppm

INORGANICS - CONT.	RESULTS
Copper	0.01 ppm
Cyanide	<0.01 ppm
Fluoride	0.69 ppm
Iron	0.06 ppm
Lead	<0.01 ppm
Manganese	<0.01 ppm
Mercury	<0.001ppm
Nitrate-Nitrogen	0.21 ppm
Nitrite-Nitrogen	<0.1 ppm
Nitrogen-Amonia	<0.1 ppm
Ptassium	2 ppm
Selenium	<0.01 ppm
Silver	<0.01 ppm
Sodium	22 ppm
Sulfate	15.6 ppm
Zinc	<0.01 ppm

VOLATILE ORGANICS	RESULTS
1. Chloromethane	<1. ppb
2. Bromomethane	<5. ppb
3. Vinyl Chloride	<1. ppb
4. Chloroethane	<1. ppb
5. Methylene Chloride	3. ppb
6. 1,1-dichloroethene	<1. ppb
7. 1,1-dichloroethane	<1. ppb
8. Chloroform	4. ppb
9. 1,2-dichloroethane	<1. ppb

VOLATILE ORGANICS	RESULTS
10. p-1,2-dichloroethene	<1. ppb
11. 1,1, 1, trichloroethane	<1. ppb
12. Carbon tetrachloride	<1. ppb
13. Bromodichloromethane	<1. ppb
14. 1,2 Dichloropropane	<1. ppb
15. trans-1-3-Dichloropropene	<1. ppb
16. Trichloroethene	<1. ppb
17. Benzene	<1. ppb
18. Dibromochloromethane	<1. ppb
19. 1,1,2-Trichloroethane	<1. ppb
20. Cis-1,3, Dichloropropene	<1. ppb
21. 2-Chloroethylvinyl ether	<10.ppb
22. Bromoform	<2. ppb
23. 1,1,2,2 Tetrachloroethane	<2. ppb
24. Tetrachloroethene	<1. ppb
25. Toluene	<1. ppb
26. Chlorobenzene	<1. ppb
27. Ethylbenzene	<1. ppb
28. Xylenes	<1. ppb
Total trihalomethanes	<1. ppb
Methylene Blue Active Subs. MBAS	<1. ppm

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American Oil Chemists Society
American Petroleum Institute
American Pharmaceutical Association
American Public Health Association
American Society for Testing & Materials
American Society of Microbiology
Association of Consulting Chemists
& Chemical Engineers
International Food Technologists
Society for Applied Spectroscopy
Society of Cosmetic Chemists

POLYCHLORINATED BIPHENYLS	RESULTS
PCB 1242	<1. ppb
PCB 1254	<1. ppb
PCB 1221	<1. ppb
PCB 1232	<1. ppb
PCB 1248	<1. ppb
PCB 1260	<1. ppb
PCB 1016	<1. ppb

PESTICIDES	RESULTS
Endrin	<.01 ppb
Lindane	<.01 ppb
Methoxychlor	<.2 ppb
Toxaphene	<1. ppb
2,4-D	<1. ppb
2,4,5 -TP (Silvex)	<1. ppb

METHODS: E P A Methods 601,601,608
A P H A Standards Methods
16th Edition.

Respectfully submitted
INDUSTRIAL TESTING LABORATORIES

Stephen Gould, Ph.D
Analyst

Kenneth J. Kohlhof
President

KJK/ac

NALCO

ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #1

ANALYSIS NO.	P 10957
ANALYSIS NO.	P 10958
ANALYSIS NO.	P 10959
DATE SAMPLED	1/18/80
DATE RECEIVED	1/21/80
DATE PRINTED	1/29/80

CATIONS:	PPM
SODIUM (NA)	370.
ANIONS:	PPM
CHLORIDE (CL)	830.
SULFATE (SO4)	230.
NITRATE (NO3)	3.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	17.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	2100.
TOTAL DISSOLVED SOLIDS AT 105 C	2200.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	500.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	320.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.9
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.64

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 820 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

1927 NOLTE DR • PAULSBORO, NJ 08066

NALCO CHEMICAL COMPANY

REGIONAL ANALYTICAL LABORATORIES

CENTRAL LABORATORY

Box 127
Anaheim, CA 92805

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Sugar Land, TX 77478

6216 W. 66th Place
Chicago, Illinois 60638

NALCO

ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #6

ANALYSIS NO. P 10960
ANALYSIS NO. P 10961
ANALYSIS NO. P 10962
DATE SAMPLED 1/18/80
DATE RECEIVED 1/21/80
DATE PRINTED 1/29/80

CATIONS:	PPM
SODIUM (NA)	480.
ANIONS:	PPM
CHLORIDE (CL)	990.
SULFATE (SO4)	230.
NITRATE (NO3)	13.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	*ND (2.)
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	2400.
TOTAL DISSOLVED SOLIDS AT 105 C	2400.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	470.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	350.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.1
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.28

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 820 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

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ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #8

ANALYSIS NO.	P 10963
ANALYSIS NO.	P 10964
ANALYSIS NO.	P 10965
DATE SAMPLED	1/18/80
DATE RECEIVED	1/21/80
DATE PRINTED	1/29/80

CATIONS:	PPM
SODIUM (NA)	95.
ANIONS:	**PPM**
CHLORIDE (CL)	170.
SULFATE (SO4)	190.
NITRATE (NO3)	13.
OTHERS:	**PPM**
ACIDITY (CACO3) - TOTAL	8.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	840.
TOTAL DISSOLVED SOLIDS AT 105 C	790.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	270.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	190.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.1
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.07

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 460 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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ANALYTICAL SERVICE LABORATORY . REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #10

ANALYSIS NO. P 10966
ANALYSIS NO. P 10967
ANALYSIS NO. P 10968
DATE SAMPLED 1/18/80
DATE RECEIVED 1/21/80
DATE PRINTED 1/29/80

CATIONS:	PPM
SODIUM (NA)	400.
ANIONS:	**PPM**
CHLORIDE (CL)	840.
SULFATE (SO4)	170.
NITRATE (NO3)	*ND (1.)
OTHERS:	**PPM**
ACIDITY (CACO3) - TOTAL	13.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	1900.
TOTAL DISSOLVED SOLIDS AT 105 C	1800.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	350.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	310.
IRON (FE) - SOLUBLE AND INSOLUBLE	1.8
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.46

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 660 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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Chicago, Illinois 60638

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ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #14

ANALYSIS NO.	P 10969
ANALYSIS NO.	P 10970
ANALYSIS NO.	P 10971
DATE SAMPLED	1/18/80
DATE RECEIVED	1/21/80
DATE PRINTED	1/29/80

CATIONS:	PPM
SODIUM (NA)	94.
ANIONS:	PPM
CHLORIDE (CL)	200.
SULFATE (SO4)	100.
NITRATE (NO3)	8.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	5.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	790.
TOTAL DISSOLVED SOLIDS AT 105 C	720.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	240.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	160.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.1
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.36

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 400 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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Sugar Land, TX 77478

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6216 W. 66th Place
Chicago, Illinois 60638

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ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
WELL #15

ANALYSIS NO. P 10972
ANALYSIS NO. P 10973
ANALYSIS NO. P 10974
DATE SAMPLED 1/18/80
DATE RECEIVED 1/21/80
DATE PRINTED 1/29/80

CATIONS:	PPM
SODIUM (NA)	57.
ANIONS:	PPM
CHLORIDE (CL)	110.
SULFATE (SO4)	220.
NITRATE (NO3)	24.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	14.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	920.
TOTAL DISSOLVED SOLIDS AT 105 C	760.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	320.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	200.
IRON (FE) - SOLUBLE AND INSOLUBLE	*ND (0.1)
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.05

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 520 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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Chicago, Illinois 60638

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ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
TANK 4A

ANALYSIS NO.	P 10975
ANALYSIS NO.	P 10976
ANALYSIS NO.	P 10977
DATE SAMPLED	1/18/80
DATE RECEIVED	1/21/80
DATE PRINTED	1/29/80

CATIONS:	PPM
SODIUM (NA)	450.
ANIONS:	PPM
CHLORIDE (CL)	970.
SULFATE (SO4)	240.
NITRATE (NO3)	12.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	14.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	2500.
TOTAL DISSOLVED SOLIDS AT 105 C	2300.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	490.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	350.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.2
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.35

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 840 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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ANALYTICAL SERVICE LABORATORY . REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
TANK 9A #1

ANALYSIS NO.	P 10978
ANALYSIS NO.	P 10979
ANALYSIS NO.	P 10980
DATE SAMPLED	1/18/80
DATE RECEIVED	1/21/80
DATE PRINTED	1/29/80

CATIONS:	PPM
SODIUM (NA)	91.
ANIONS:	**PPM**
CHLORIDE (CL)	200.
SULFATE (SO4)	110.
NITRATE (NO3)	7.
OTHERS:	**PPM**
ACIDITY (CACO3) - TOTAL	8.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	870.
TOTAL DISSOLVED SOLIDS AT 105 C	710.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	230.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	150.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.1
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.36

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 380 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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ANALYTICAL SERVICE LABORATORY REPORT

WATER ANALYSIS

FROM:
PFIZER, INC.
BROOKLYN, NEW YORK

SAMPLE MARKED:
TANK 9A #2

ANALYSIS NO. P 10981
ANALYSIS NO. P 10982
ANALYSIS NO. P 10983
DATE SAMPLED 1/18/80
DATE RECEIVED 1/21/80
DATE PRINTED 1/29/80

CATIONS:	PPM
SODIUM (NA)	91.
ANIONS:	PPM
CHLORIDE (CL)	200.
SULFATE (SO4)	110.
NITRATE (NO3)	7.
OTHERS:	PPM
ACIDITY (CACO3) - TOTAL	7.
ACIDITY (CACO3) - FREE MINERAL	*ND (2.)
TOTAL SOLIDS AT 105 C	870.
TOTAL DISSOLVED SOLIDS AT 105 C	720.
CALCIUM (CACO3) - SOLUBLE AND INSOLUBLE	230.
MAGNESIUM (CACO3) - SOLUBLE AND INSOLUBLE	150.
IRON (FE) - SOLUBLE AND INSOLUBLE	0.1
MANGANESE (MN) - SOLUBLE AND INSOLUBLE	0.38

*NOT DETECTED (BELOW INDICATED LIMIT OF DETECTION)

LAB COMMENTS:

TOTAL HARDNESS EQUALS THE SUM OF CALCIUM PLUS MAGNESIUM, 380 PPM AS CACO3. RESULTS REPRESENT THE AVERAGE OF THREE ANALYSES OF SAMPLE, OBTAINED FROM DUPLICATE SAMPLE BOTTLES.

James J Hickey

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6216 W. 66th Place
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TEST	METHOD	DETECTION LIMIT PPM	REFERENCE: STANDARD METHODS 14th EDITION
Acidity - Total	Titrate with base to phenolphthalein end point. Reported as $CaCO_3$.	2.	402 (Pg. 273)
Acidity - Free Mineral	Titrate with base to methyl orange end point. Reported as $CaCO_3$.	2.	402 (Pg. 273)
Calcium - Total	Atomic Absorption Spectroscopy. Reported as $CaCO_3$	0.2	306A (Pg. 186)
Chloride	Titrate with silver nitrate, chromate indicator. Reported as Cl.	1.	408A (Pg. 303)
Iron - Total	Atomic Absorption Spectroscopy. Reported as Fe.	0.1	310B (Pg. 213)
Magnesium - Total	Atomic Absorption Spectroscopy. Reported as $CaCO_3$.	0.1	313B (Pg. 223)
Manganese - Total	Atomic Absorption Spectroscopy. Reported as Mn.	0.05	314A (Pg. 224)
Nitrate	Cadmium Reduction - colorimetric Reported as NO_3.	1.	419C (Pg. 423)
Sodium - Total	Atomic Absorption Spectroscopy. Reported as Na.	0.1	320A (Pg. 250)
Solids - Total	Gravimetric Determination of unfiltered sample, dried at 105°C. Reported in ppm.	5.	208A (Pg. 91)
Solids - Total Dissolved	Gravimetric Determination of filtered sample, dried at 105°C. Reported in ppm.	5.	208B (Pg. 92)
Sulfate	Turbidimetric. Reported as SO_4.	2	427C (Pg. 496)

NALCO CHEMICAL COMPANY
2901 BUTTERFIELD ROAD ▫ OAK BROOK, ILLINOIS 60521 ▫ AREA 312-887-7500

January 30,1980

Mr. C. Schwaderer
Pfizer Inc.
11 Bartlett St.
Brooklyn, New York

Thank you for inquiring about our analytical services.

The total cost to analyze 108 well waters in triplicate and according to the attached schedule is $36,158.40.

Below is a brief description of out services:

METHODS OF ANALYSES

All methods of analyses will be performed in accordance with procedures specified by the U.S. Environmental Protection Agency, Standard Methods, and/or ASTM Methods.

QUALITY ASSURANCE

Our existing quality assurance program calls for the following:

1) 10 percent of all samples are run in duplicate and/or spiked.

2) Regular and routine comparisons of replicate results with other laboratories, including EPA.

SAMPLING AND PRESERVATION KITS

Nalco will provide Pfizer, Inc. with proper sample bottles, preprinted sample labels, shipping labels, preservatives, and preservation instructions.

Three month's supply of these sampling and preservation kits will be sent to your plant each quarter allowing at least ten (10) calendar days prior to their intended use.

LABORATORY LOCATION

All of the samples will be processed at Nalco's regional laboratory located at Paulsboro, New Jersey, the shipping address is:

Nalco Chemical Company
1927 Nolte Drive
Paulsboro, New Jersey 08060
attn: Analytical Laboratory

LABORATORY REPORTING

Signed laboratory reports will be mailed within twelve (12) calendar days after sample receipt.

DURATION OF CONTRACTS

The duration of the contract will be one (1) year.

INVOICES

Invoices will be sent on a quarterly basis and will reflect only the number of samples analyzed.

We look forward to working with you on your analytical needs. Please call should you have any questions.

Very truly yours,

R. Navarro

R.P.Navarro
Project Specialist

cc:J.J.Hickey
C.R.Hoefs
R.J.Martin - WTC4
R.A.Storrs
J.D.Tinsley - WTC4
A.J. Young

ANALYTICAL PROGRAM

CODE	DESCRIPTION	UNIT PRICE ($)
NA	Sodium	11.70
CL	Chloride	6.30
SO4	Sulfate	8.10
NO3	Nitrate	11.70
AP	Total Acidity	5.40
AM	Free Mineral Acidity	5.40
TS	Total Solids	8.40
TDS	Total Dissolved Solids	8.10
CA	Total Calcium	11.70
MG	Total Magnesium	11.70
FE	Total Iron	11.70
MN	Total Manganese	11.70
		$ 111.60 per sample

Sampling Schedule: 9 well waters in triplicate per month for a period of one year.

[redacted]
BROOKLYN

[redacted] REQUEST FOR PURCHASE

B 66019

[redacted] ORI	[redacted] SE CL	[redacted] E TO ACCT NO.	DELIVER TO:
2/13/80	2631	1164	/

ITEM NO.	QUANTITY	DESCRIPTION (ON MACHINERY PARTS STATE SERIAL NOS.)	FOR USE OF RECEIVING DEPT.
		Nalco Chemical Company	
		2901 Butterfield Road	
		Oak Brook Illinois	
		Refer to Quote Jan 30, 1980	
		To test the following Wells	
		As per the Attached Quotation	
		Two diff Months	
		(10/79) #1, #6, #8, #10, #15	
		Tank 4A, (Tank 9A-#1+#2)	
		(1/80) #1, #6, #8, #10, #14	
		#15, Tank 4A, (Tank 9A, #1+#2)	
		Total of 17 Samples	
		Tested in Triplicate at	
		$111.60/sample	
		(111.60/test)(17) samples (3 Test/sample) =	
		$5691.60	

FOR PURCHASING DEPT USE ONLY

VENDOR, ITEM NOS.:
FILE WORD
TERMS F.O.B.
DEL'Y DATE VIA

VENDOR, ITEM NOS.:
FILE WORD
TERMS F.O.B.
DEL'Y DATE VIA

VENDOR, ITEM NOS.:
FILE WORD
TERMS F.O.B.
DEL'Y DATE VIA

EXEMPT FROM SALES TAX ☐

FOR RECEIVING DEPT USE ONLY

	DATE	BY	CARRIER/PRO	COLL.
A				
B				
C				
D				
E				

PURPOSE USED FOR: Well Water Testing

USE BLACK BALL POINT PEN. PRINT OR WRITE CLEARLY. USE DESCRIPTION AREA FOR ADDITIONAL ACCT. NO. INFORMATION OR REMARKS.

ISSUED BY: L Lustrino

APPROVED BY: Order Appd By Broo