

Health Consultation

Imperial Oil Company Site

**Monmouth County, Marlboro Township, New Jersey
Cerclis No.: NJD980654009**

April 5, 1995

Prepared By:

**New Jersey Department of Health
Environmental Health Service**

**Under a Cooperative Agreement With
The Agency For Toxic Substances and Disease Registry**

Background and Statement of Issues

The Imperial Oil Company site (IOC) is located in the Morganville section of Marlboro Township, Monmouth County, New Jersey (Figures 1 & 2). The IOC site is a triangular shaped property of approximately 15 acres. It is bounded to the north by Birch Swamp Brook, to the east /southeast by private residences, and to the west and south by Central Railroad right of way. Presently the facility consists of storage and maintenance buildings and 56 above ground storage tanks.

Since 1912, the site has been used by a variety of commercial operations. During the period from 1912-1917, it was occupied by a tomato paste and ketchup manufacturer. The site was occupied by the Stratford Chemical Company (later Brocker Chemical Co.) from 1917 to 1944, which manufactured calcium arsenate, and this operation is considered to be the source of arsenic present in on-site and off-site soils. From 1944-1949, S.B. Pennick & Co. produced flavors and fragrances at the location of the IOC site. The site was acquired by the Champion Chemicals Company in 1950, which commenced oil reclamation operations. In 1969, the property was leased by the Imperial Oil Company which conducted an oil blending operation on the site. The activities of both companies produced the following waste products: wash water, waste oils, sludges, and oily filter clay. As a result, on-site soils were contaminated with petroleum hydrocarbons, lead, barium, arsenic, and polychlorinated biphenyls (PCBs). Off-site soil and sediment samples from the adjacent wetlands area exhibit significant concentrations of petroleum hydrocarbons, PCBs, lead and arsenic (Figure 3).

The RI/FS for the IOC site was initiated in the summer of 1986, with Phase I field work conducted in winter of 1987, and Phase II field work conducted in 1989-1990. The Record of Decision (ROD) defining the selected remedy for off-site soils was signed in September 1990.⁽¹⁾ The selected remedy included the installation of fencing along the perimeter of the site to restrict access, excavation and off-site disposal of approximately 3,700 cubic yards of contaminated soils and restoration of affected wetlands. The ROD for groundwater remediation was signed in September 1992, and removal of floating product is ongoing. Delineation of off-site contamination occurred in the 3rd and 4th quarters of 1994. Five rounds of sampling indicated that contaminants, particularly arsenic, are more widespread than originally anticipated; approximately 4 acres were addressed by the 1990 ROD, but the study area now encompasses approximately 25 acres, and additional characterization activities appear likely. Preliminary data indicate site related contaminants may have migrated along a surface water feature (Birch Swamp Brook) as far as Lake Lefferts which is located in Matawan Borough, approximately 1.5 miles downstream from the IOC site (Figure 4).

The latest round of sampling conducted by the New Jersey Department of Environmental Protection (December 1994) included residential properties, and indicated arsenic levels above NJDEP cleanup criteria (20 mg/kg residential), with one residential property exhibiting one sample at 9,460 mg/kg at 1-2 feet below grade (fbg). Figure 4 indicates the relationship of this property to the IOC site. The NJDEP has made application with the United States Environmental Protection Agency (USEPA) for a removal action at this residence.

At this juncture, the NJDEP has requested the NJDOH perform a health consultation which addresses the following issues:

- 1) Evaluates the nature and magnitude of health effects which may be posed to potentially exposed residents of the area, with specific regard to the aforementioned residential property exhibiting a maximum concentration of 9,460 mg/kg.
- 2) Discusses the plausibility of performing an exposure investigation of potentially affected area residents.
- 3) Evaluates the context of the removal action request to USEPA.

Past ATSDR/NJDOH Activity

The NJDOH prepared a Health Assessment for the IOC site in July, 1990. ⁽²⁾ At the time, the site was evaluated to present a public health hazard on the basis of unrestricted access to, and the need for further characterization of, contaminated off-site areas (Figure 3), and data gaps with regard to potable wells in the area. Subsequent to the health assessment, activity by the NJDEP has addressed these issues in a manner consistent with protection of the public health.

The NJDOH prepared a site review and update (SRU) for the IOC site in April 1993 which identified remedial progress at the site. ⁽³⁾ The SRU concluded that the site influenced area water resources (groundwater, surface water, wetlands), and that the site should be monitored in that context.

Both of these evaluations were based upon the Operable Unit 1 Remedial Investigation and Record of Decision, prior to the 1994 off-site characterization activities.

Site Visit

A site visit of the sample locations discussed in this consultation was performed by NJDOH (James Pasqualo; Project Manager) and ATSDR (Steve Jones; Regional Representative) personnel on February 28, 1995. Representatives of the NJDEP and the USEPA also participated in the site visit. The sample location for the maximum detected concentration of arsenic is located on the banks of Birch Swamp Brook which is situated at the base of a ravine. The area is not restricted and is potentially accessible.

Discussion

Data generated during the 1994 off-site characterization provided by the NJDEP show widespread low level arsenic contamination along the Birch Swamp Brook and associated wetlands. Surface (< 1 fbg) arsenic concentration ranged from background to approximately 60

mg/kg, with most concentrations below 30 mg/kg. Subsurface (> 1 fbg) concentrations ranged from background to 104 mg/kg with most levels below 50 mg/kg. (ATSDR and the NJDOH consider surface soils as 0-3 inches in depth.) One residential property exhibited arsenic concentrations at 125 mg/kg surface and 9,460 mg/kg subsurface. This sample location (stream bank), while accessible to residents, was not proximal to the residence. An additional surface sample proximal to the residence indicated a surface arsenic concentration of 60 mg/kg.

To evaluate the public health significance of these data, exposure doses for inorganic arsenic and subsequent lifetime excess cancer risk estimates (LECRs) were calculated based upon concentrations of 9460 mg/kg, 125 mg/kg, and 60 mg/kg. The human exposure pathway is assumed to be the ingestion of arsenic contaminated soils/dusts. Toxicological estimates were calculated for adults assuming a 70 kg body weight, 50 mg/day ingestion rate ⁽⁴⁾, and an exposure duration of 40 years. Estimates for children assumed a 20 kg body weight, 200 mg/day ingestion rate, and an exposure duration of 10 years.⁽⁵⁾ Table 1 presents estimated exposure doses and associated LECRs.

Similarly, acute exposure dose estimates for a pica child were calculated for the above concentrations based upon ingestion rates of 1,000 mg/day and 2,000 mg/day. These estimates assumed a body weight of 11.5 kg ⁽⁵⁾, and a one time ingestion of the indicated dose. Table 2 presents acute exposure dose estimates for a pica child.

ATSDR has established a minimal risk level (MRL) for chronic oral exposure (duration > 1 year) of 0.0003 mg/kg/day which is equivalent to the USEPA chronic oral reference dose. A MRL is defined as an estimate of daily human exposure to a chemical that is likely to be without an appreciable risk of adverse non-carcinogenic health effects over a specified duration of exposure.

The toxicological effects of the contaminants detected in the environmental media have been considered singly. The cumulative or synergistic effects of mixtures of contaminants may serve to enhance their public health significance. Additionally, individual or mixtures of contaminants may have the ability to produce greater adverse health effects in children as compared to adults. This situation depends upon the specific chemical being ingested or inhaled, its pharmacokinetics in children and adults, and its toxicity in children and adults. This toxicological evaluation may underestimate the potential for adverse health effects in hypersensitive individuals.

9,460 MG/KG

At the maximum concentration of inorganic arsenic detected (9,460 mg/kg), exposure doses exceeded the chronic oral MRL for adults and children. Estimated exposure doses for adults exceed the no observed adverse effect level (NOAEL) for humans with regard to gastrointestinal, dermal/ocular, and hematological effects cited in the ATSDR Toxicological Profile for Arsenic. ⁽⁶⁾ Estimated exposure doses for children equal or exceed the lowest observed adverse effect level (LOAEL) for humans with regard to neurological, hepatic,

dermal/ocular, and cardiovascular effects cited in the ATSDR Toxicological Profile for Arsenic. Carcinogenic risk based upon calculated exposure doses is estimated to range from moderate increased risk (adults) to high increased risk (children). Acute exposure dose estimates for a pica child at this concentration approach and exceed the LOAEL for serious systemic health effects cited in the ATSDR Toxicological Profile for Arsenic, at both the 1,000 and 2,000 mg ingestion rates.

125 MG/KG

At the concentration of 125 mg/kg, estimated exposure doses for adults were below the chronic oral MRL for arsenic. At such concentrations non-carcinogenic health effects among adults are not generally expected. However for children, the chronic oral MRL would be exceeded. Estimated exposure doses for children would approach the NOAEL for dermal/ocular, neurological, and gastrointestinal effects cited in the ATSDR Toxicological Profile for Arsenic. Carcinogenic risk based upon calculated exposure doses is estimated to range from no apparent increased risk (adults) to low increased risk (children). Acute exposure dose estimates for a pica child at this concentration are below the NOAEL for systemic health effects cited in the ATSDR Toxicological Profile for Arsenic. At such concentrations, non-carcinogenic adverse health effects are not generally expected as a result of an exposure of acute duration.

60 MG/KG

At the concentration of 60 mg/kg, estimated exposure doses for adults were below the chronic oral MRL for arsenic. At such concentrations, non-carcinogenic health effects among adults are not generally expected. Exposure doses for children exceeded the chronic oral MRL for arsenic. Estimated exposure doses for children approached the NOAEL for gastrointestinal health effects cited in the ATSDR Toxicological Profile for Arsenic. There is estimated to be no apparent increased cancer risk for adults associated with calculated exposure doses at this concentration. There is estimated to be a low increased cancer risk for children associated with calculated exposure doses at this concentration. Acute exposure dose estimates for a pica child at this concentration are below the NOAEL for systemic health effects cited in the ATSDR Toxicological Profile for Arsenic. At such concentrations, non-carcinogenic adverse health effects are not likely as a result of an acute exposure.

Conclusions

Evaluation of Nature and Magnitude of Health Risks

Exposure doses based upon arsenic levels of 9,460 mg/kg yield a significant risk of carcinogenic and non-carcinogenic health effects to adults and children under a chronic oral exposure scenario, and yield significant risk to children under an acute oral exposure scenario. The public health implications of this evaluation is, however, dependant upon the accessibility and likelihood of human contact with soils exhibiting this or similar concentrations. As this

maximum concentration was detected at > 1 fbg, in an area not proximal to the residence on the property, the probability of human contact is unclear.

The public health significance of exposure doses for surface soils is dependant upon the actual depth at which the sample was taken, and the sample methodology employed. ATSDR and the NJDOH consider surface soils to comprise the first 3 inches of depth, and the conclusions of this consultation are based upon that assumption.

The surface concentration of 125 mg/kg would present a significant health risk to children in terms of carcinogenic and non-carcinogenic outcomes under a chronic oral exposure scenario. This concentration would not be likely to present a significant health risk in terms of carcinogenic and non-carcinogenic outcomes to adults under a chronic oral exposure scenario. This level would not present a significant risk to children under the acute oral exposure scenario.

The surface concentration of 60 mg/kg located proximal to the residence on the property would not be expected to yield significant risk of carcinogenic or non-carcinogenic health effects to adults under the chronic oral exposure scenario. This concentration yields an exposure dose for children which exceeds the MRL for chronic oral exposure, and presents low increased risk of cancer for children under that scenario. However, this concentration would not be expected to yield significant risk to children under the acute oral exposure scenario.

The fact that the sample forming the basis of this consultation was detected in an area of investigation furthest from the IOC site, together with preliminary data indicating a potential impact to surface water features and sediments located further down stream from the IOC site, suggests that further delineation of the extent of off-site arsenic contamination may be indicated.

Exposure Investigation

The decision to conduct a widespread exposure investigation is predicated upon the identification of a completed human exposure pathway to site related contaminants. At this point in the remedial process, further sampling is contemplated by the NJDEP to determine the physical extent of off-site soil (arsenic) contamination. If additional site characterization by NJDEP demonstrates a probable completed human exposure pathway to contaminants at levels of health concern, the NJDOH and the ATSDR will, in conjunction with the NJDEP, consider conducting an exposure investigation and determine what actions may be warranted.

Residents at the property identified in this consultation or other individuals accessing the property may have had opportunity to be exposed to arsenic in soils at levels of public health concern. The degree of exposure is a function largely of the personal habits and activities of the residents (i.e., soil disturbing activities, gardening, and the general likelihood of contact with contaminated areas). If it can be determined that individual activity makes contact with contaminated soils likely, then consideration should be given to determining the degree of exposure through appropriate biological indicators.

Removal Context

Arsenic contaminated soils at the property identified in this consultation can represent a significant health threat under certain conditions. Remediation of this contaminated soil, which presently represents the maximum concentration of off-site arsenic detected by the NJDEP, should be conducted, but the level of expeditiousness is dependent upon conditions at the residence and sample location(s). As noted in the site visit section, the location of the 125 surface/9460 subsurface sample point is on the bank of a brook flowing along the bottom of a ravine. While this location is not likely to be visited on a frequent basis, it is not restricted and thus potentially accessible by children. Similarly, other sample locations (60 mg/kg; surface concentration) appear to be accessible and not restricted.

Conditions at the property identified in this consultation suggest that access to contaminated areas are unrestricted, and contact with the maximum detected concentrations of arsenic or other as yet unidentified concentrations is possible. Estimated exposure doses for known concentrations indicate there is risk of adverse health effects associated with contact by children, and remediation should therefore occur as soon as is practical.

Cleanup Criteria

The NJDEP residential soil cleanup objective of 20 mg/kg is generally consistent with the ATSDR Environmental Media Evaluation Guide (EMEG) for chronic exposure to arsenic in soils (10 mg/kg child, 200 mg/kg adult). EMEGs are derived from MRLs and represent a media specific, health based contaminant concentration which would yield a MRL dose using standard exposure assumptions. In deriving soil EMEGs, ATSDR assumes a child body weight to be 10 kg and an ingestion rate of 200 mg/day, and assumes for adults a body weight of 70 kg and a soil ingestion rate of 100 mg/day. EMEGs are not direct predictors of adverse health effects, and are not considered to be a cleanup value, but rather are indicators of concentrations above which ATSDR would consider a specific contaminant for further toxicologic evaluation. The ATSDR chronic soil EMEG for arsenic includes a margin of safety, and is generally considered protective of all but hypersensitive individuals.

A cleanup objective of 20 mg/kg would yield an exposure dose within the same order of magnitude as the value of the ATSDR child chronic EMEG for arsenic in soils (allowing for slight variance in body weight and ingestion rates), and thus would be considered protective of the public health.

Recommendations

Site Characterization

Characterization of the extent of off-site soil contamination should continue to determine the plausibility of completed human exposure pathways to arsenic in off-site soils and sediments.

When full delineation has been completed, the NJDOH and the ATSDR should determine the public health significance of the data, and what follow-up activities are appropriate.

Removal

A determination of the conditions at the property and sample locations identified in this consultation indicated that contact by adults or children with soils containing the maximum level of arsenic (9,460 mg/kg at > 1 fbg) could occur under reasonable circumstances. Toxicological evaluation of resultant estimated exposure doses imply the soil should be removed or rendered isolated as soon as is practical. Similarly, it was determined that contact by children with surface soils containing arsenic at 125 mg/kg and 60 mg/kg could occur under reasonable circumstances. Toxicological evaluation of the resultant estimated exposure doses imply the soil should be removed or rendered isolated as soon as is practical.

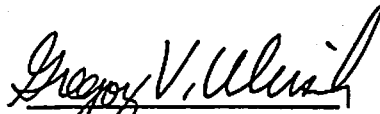
Characterization of off-site potentially contaminated properties should determine whether children are present in residences, or are likely to contact contaminated soils. The lower body weight and possibility of pica behavior among smaller children may translate into toxicologically significant exposure doses. Resources of the NJDOH and/or the ATSDR should be made available to the NJDEP to assist in evaluation of the public health significance of future off-site characterization data.

Exposure Investigation

With regard to the property identified in this consultation, should it be determined that a completed exposure pathway for adults or children exists at levels of toxicologic significance with respect to arsenic in soils as determined above, an exposure investigation based upon biological monitoring should be conducted by the NJDOH and/or the ATSDR. The nature of this investigation should be determined by, and be appropriate for, the exposure scenario of the individuals in question.

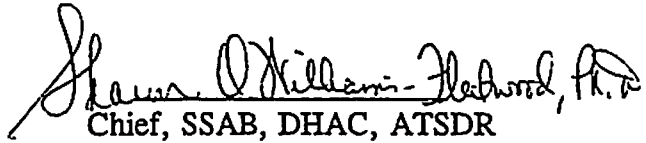
CERTIFICATION

The Health Consultation for the Imperial Oil Company site was prepared by the New Jersey Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.



Technical Project Officer, SPS, SSAB, DHAC

The Superfund Site Assessment Branch (SSAB), Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Chief, SSAB, DHAC, ATSDR

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References

- 1) New Jersey Department of Environmental Protection. Record of Decision: Imperial Oil Company/Champion Chemicals Site (operable Unit One). September 1990.
- 2) Agency for Toxic Substances and Disease Registry. Health Assessment: Imperial Oil Co. Inc./Champion Chemicals; July 1990.
- 3) Agency For Toxic Substances and Disease Registry. Site Review and Update: Imperial Oil Co. Inc./Champion Chemicals; April 1993.
- 4) Agency For Toxic Substances and Disease Registry. Health Assessment Guidance Manual. Chelsea, Michigan: Lewis Publishers, 1992.
- 5) U.S. Environmental Protection Agency. Exposure Factors Handbook. Washington, D.C.: Office of Health and Environmental Assessment. March 1989.
- 6) Agency For Toxic Substances and Disease Registry. Toxicological Profile For Arsenic. Atlanta: ATSDR April 1993.
- 7) New Jersey Department of Environmental Protection. Site Status Report. November 1992.

Table 1 - Chronic oral soil ingestion exposure dose estimates and associated Lifetime Excess Cancer Risk estimates; Imperial Oil site, Marlboro, N.J.

Inorganic Arsenic Concentration (ppm)	Exposure Dose mg/kg/day	LECR***
9460	Adult .0067 Child .094	Adult 6.7×10^{-3} Child 2.3×10^{-2}
125	Adult .000089 Child .0012	Adult 8.9×10^{-5} Child 3.1×10^{-4}
60	Adult .000043 Child .0006	Adult 4.3×10^{-5} Child 1.5×10^{-4}

Exposure doses exceeding ATSDR/USEPA chronic oral MRL (0.0003 mg/kg/day) listed in bold type.

Assumptions:

Adult: 70 kg body weight
50 mg/day ingestion**
40 year duration

Child: 20 kg body weight
200 mg/day ingestion*
10 year duration

* = USEPA Exposure Factors Handbook

** = ATSDR Health Assessment Guidance Manual

***= Life Time Excess Cancer Risk based upon a oral cancer slope factor of $1.75 \text{ mg/kg/day}^{-1}$

Table 2 - Acute oral exposure dose estimates for soil ingestion, pica child scenario, Imperial Oil site, Marlboro N.J.

Inorganic Arsenic Concentration (ppm)	Exposure Dose 1000 mg ingestion	Exposure Dose 2000 mg ingestion
9460	.82 mg/kg/day	1.6 mg/kg/day
125	.01 mg/kg/day	0.02 mg/kg/day
60	.0053 mg/kg/day	.011 mg/kg/day

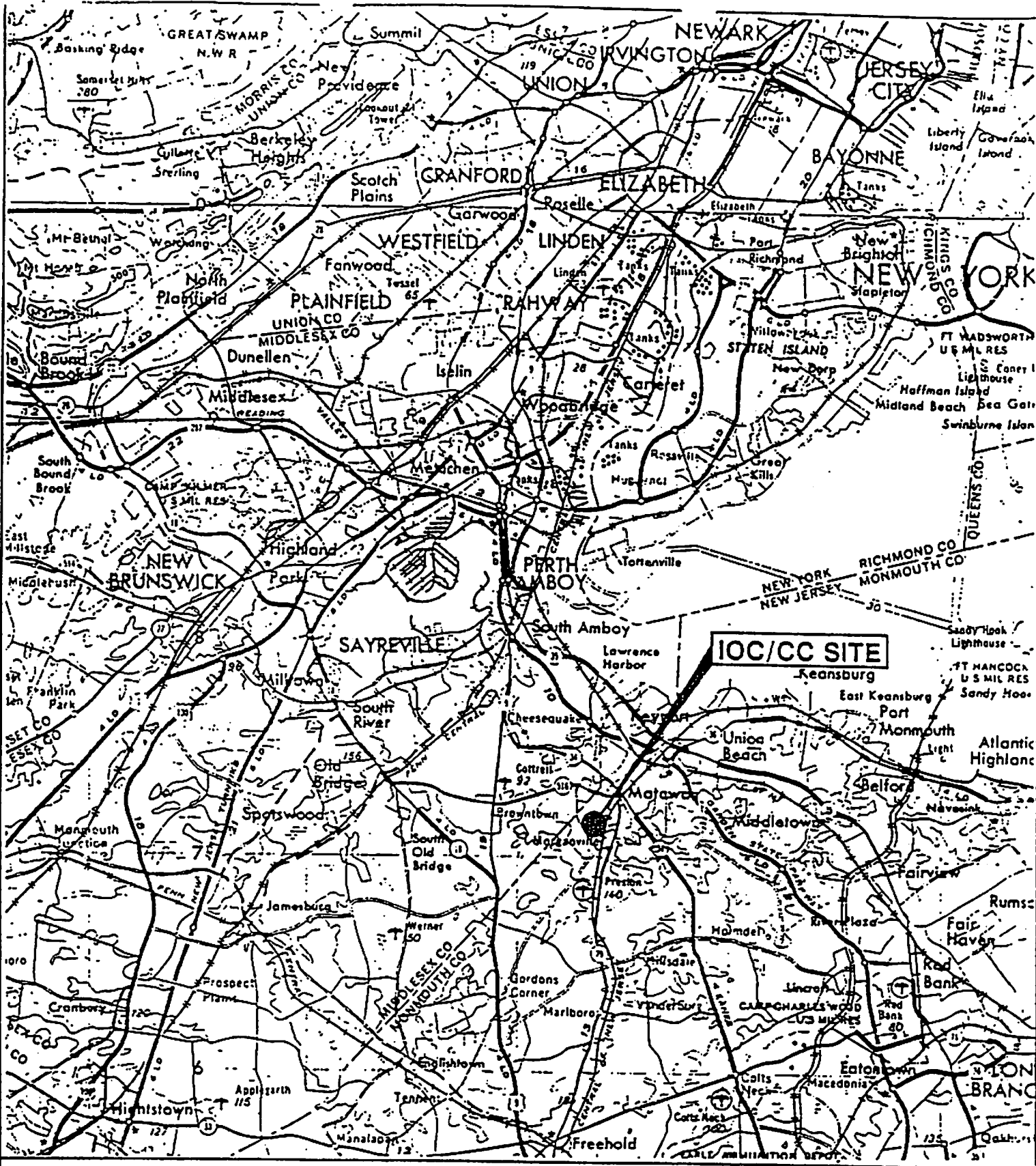
Assumptions

11.5 kg body weight (average boy/girl; age up to 3 years)*
Ingestion of indicated dose one time only.

* = USEPA Exposure Factors Handbook

Appendices

Figures 1 - 4



APPROXIMATE SCALE

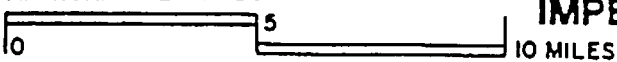


FIGURE 1
 SITE LOCATION MAP
 IMPERIAL OIL/CHAMPION CHEMICALS SITE
 MORGANVILLE, NEW JERSEY

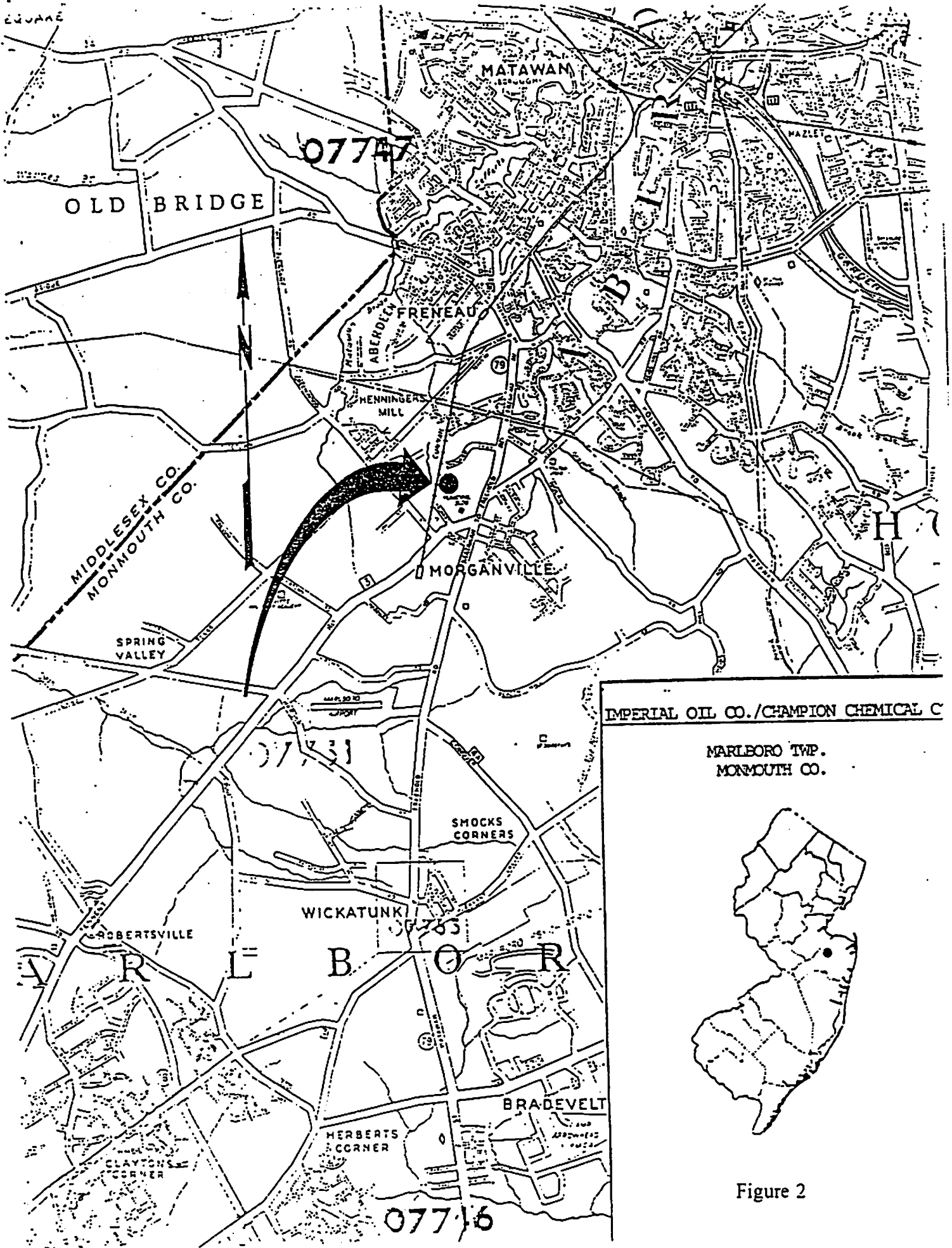


Figure 2

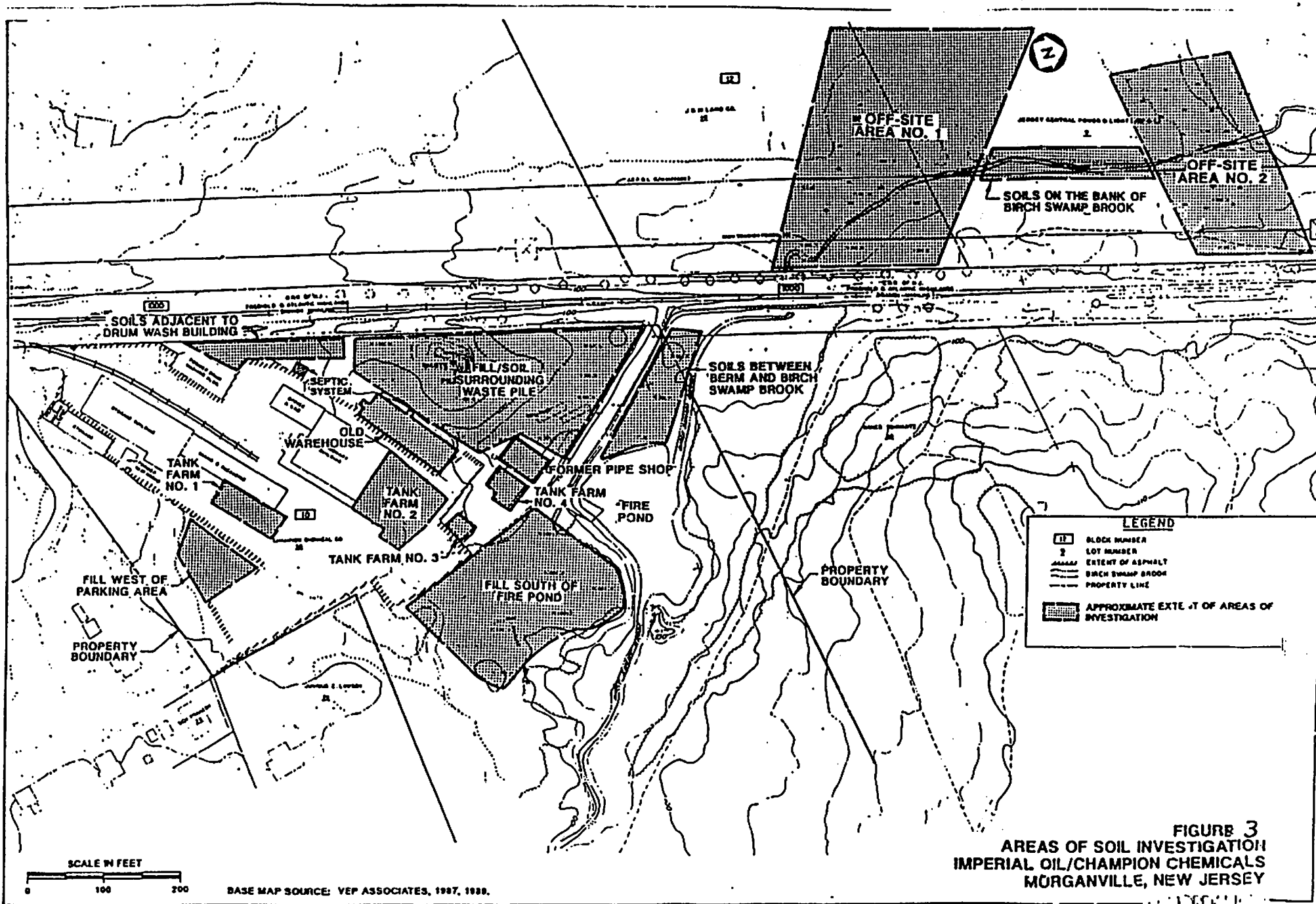


FIGURE 3
AREAS OF SOIL INVESTIGATION
IMPERIAL OIL/CHAMPION CHEMICALS
MORGANVILLE, NEW JERSEY

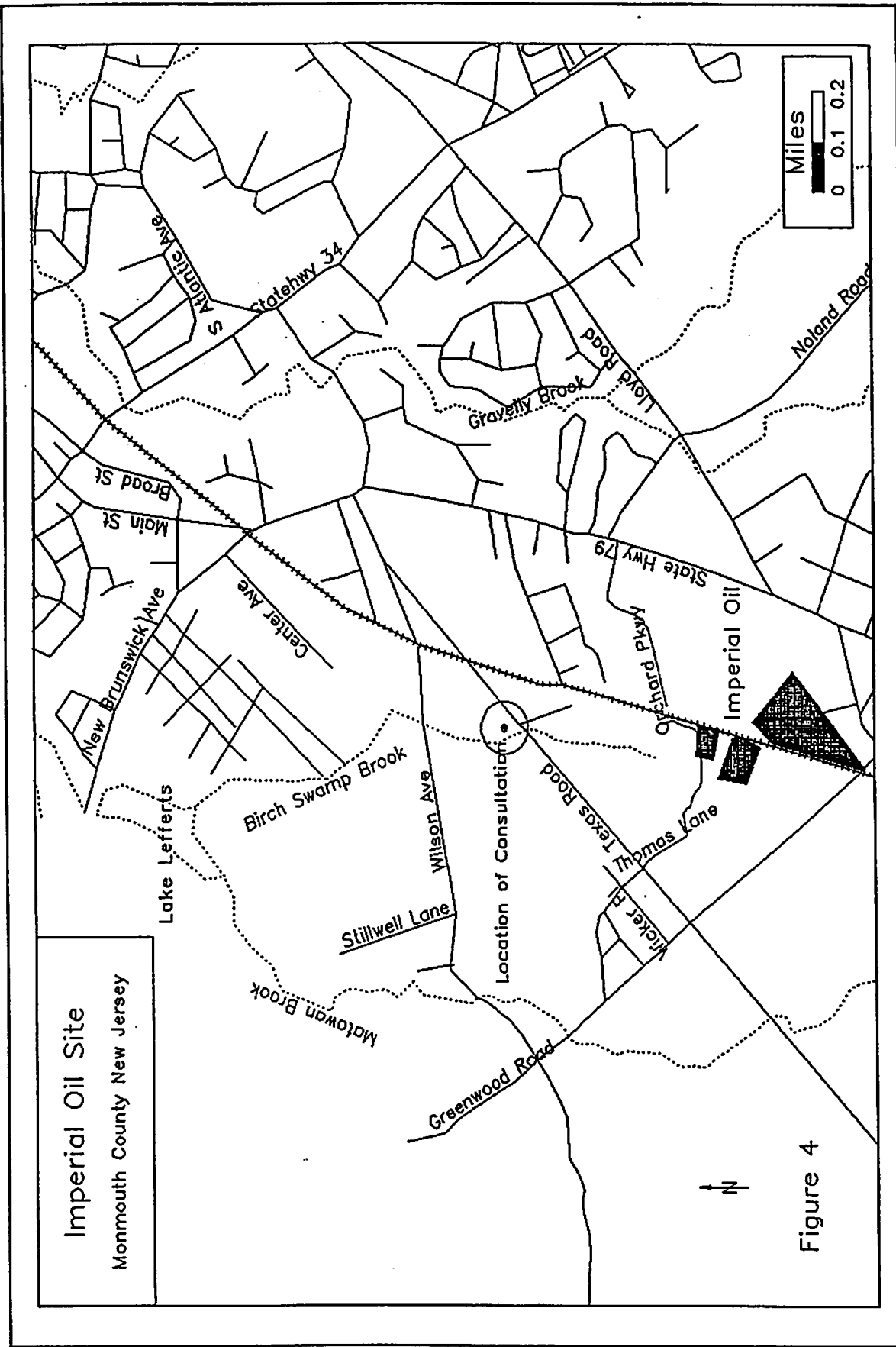


Figure 4 - Imperial Oil; Location of Consultation