HEALTH CONSULTATION

DIAMOND ALKALI COMPANY

Newark, Essex County, New Jersey

CERCLIS No.: NJD980528996

August 21, 1996

Prepared by:

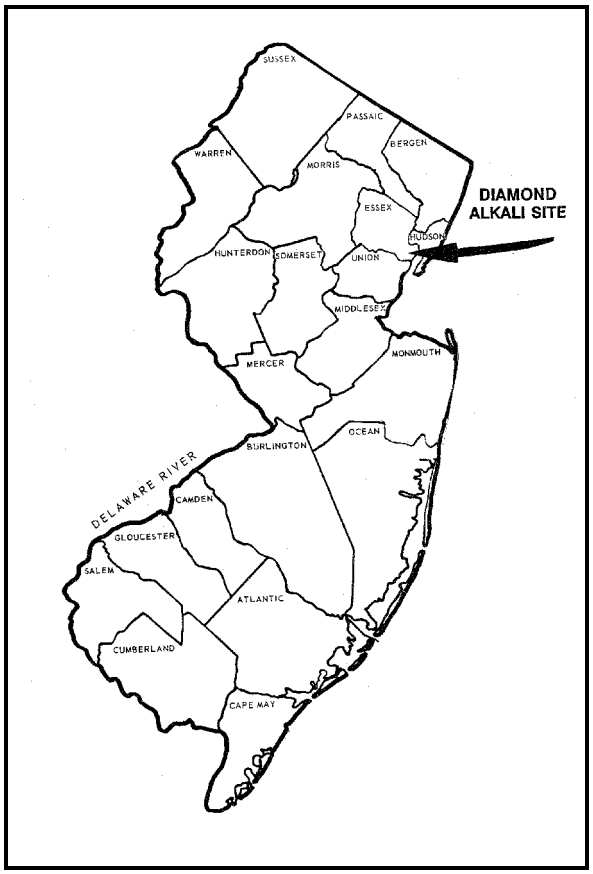
New Jersey Department of Health
Environmental Health Service

Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

The Diamond Alkali (DA) site occupies 5.6 acres located in the "Ironbound" section of Newark, New Jersey, consisting of a 3.4 acre area at 80 Lister Avenue and 2.2 acres at 120 Lister Avenue. The site is bounded on the north by the Passaic River, and on the east, south, and west by various heavy industries and manufacturing facilities (inset).

Between 1951 to 1969, the Diamond Alkali Company operated a chemical plant at this site and manufactured the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D), and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). The compound 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), commonly referred to as dioxin, was produced as a by-product of the herbicide production process.



Dioxin contamination was first discovered in the early 1980's. The soils at the site were found to be heavily contaminated with dioxin at a wide range of concentrations (eg., 60 parts per billion (ppb) at the south gate to 51,000 ppb under a storage tank). The site was added to the National Priorities List (NPL, a.k.a. Superfund) in September 1984.

As part of the Remedial Investigation of this site, extensive on-site and off-site sampling has been performed by the US Environmental Protection Agency (USEPA) to characterize the extent of the contamination[(1)]. On-site contamination was evaluated by the USEPA in May 1983. Off-site samples were taken by the USEPA along transportation routes leading from the site, on streets surrounding the plant, in the "Farmers Market" area, from nearby homes, from air cleaners of nearby industrial buildings, from the Passaic River and the area across the river from the site. A total of 532 dioxin samples and 122 priority pollutant samples were analyzed. The results of this USEPA off-site sampling revealed dioxin contamination which ranged from non detect (ND) to 15 ppb.

The off-site areas impacted by the Diamond Alkali site were remediated in June through September 1985, after the completion of the Remedial Investigation/Feasibility Study (RI/FS). Contaminated soil and other materials (approximately 79,000 cubic yards) collected during this off-site remediation are stored in bulk shipping containers on the DA site (120 Lister Avenue). In addition to surface soil removal, off-site streets were vacuumed to remove dioxin. Certain off-site areas (e.g., the dioxin-

contaminated Passaic River sediments) have yet to be remediated. Final New Jersey Department of Environmental Protection (NJDEP) acceptance of the off-site remediation was not obtained until November 1992.

Following the discovery of dioxin contamination at the DA site, and in response to community concerns about exposures, the New Jersey Department of Health (NJDOH) conducted a health survey of 368 residents and 595 workers in the vicinity[2]. This study was initiated on June 3, 1983. In the study, the NJDOH noted problems with data analysis including the lack of a control group, but felt that certain interpretations and conclusions could be drawn from these data. In its final conclusion relating to health concerns at the DA site, the NJDOH found that there was no relationship between health complaints and exposure to dioxin. For example, while eight cases of cancer were reported by 305 workers, none were identified as the soft tissue sarcomas associated with dioxin. The study was published on June 28, 1984 and made available to the public.

A Record of Decision (ROD) was signed for the DA site in 1987, and a Judicial Consent Decree (JCD) was negotiated by the responsible party, the US Environmental Protection Agency (USEPA), and the NJDEP to implement the ROD[3,4].

A Health Assessment was prepared for the Agency for Toxic Substances and Disease Registry (ATSDR) on November 5, 1987[5]. The Health Assessment noted that the identifiable human exposure pathways were associated with: direct contact with contaminated soil and dust; ingestion of surface water and contaminated soil in surrounding residential areas; inhalation of contaminated dusts and particulates; ingestion of off-site vegetable and produce from the "Farmers Market" area; ingestion of fish and shellfish from the Passaic River; and secondary contact by families of remedial workers.

The Health Assessment also noted several environmental pathways which included transport of contaminants into the Passaic River by: contaminated groundwater runoff; contaminant emissions from surface soils and contaminated buildings; and bioaccumulation by shellfish and other marine organisms in the Passaic River.

In its final conclusion, ATSDR found the Diamond Alkali Site to be of potential public health concern because human exposure to hazardous substances, at concentrations of concern, may occur for employees working in adjacent industries and for area residents.

A Site Review and Update (SRU) for the Diamond Alkali site was prepared by the New Jersey Department of Health (NJDOH) on September 7, 1993 (revised 1/5/94)[6]. This SRU recommended a health consultation be performed to address several specific issues:

1) Analysis of action levels for dioxin contaminated dust that may be generated during the proposed remediation. A consultation should be completed as part of the design phase, before any remedial activities begin, in order to properly address any potential public health concerns; and

2) A Health Consultation is recommended to evaluate past exposures of area residents to dioxin contaminated soil.

This health consultation will deal with the evaluation of past exposures of area residents to dioxin contaminated soil. The remediation plan and proposed action levels for contaminated dust generated during the remediation were not made available to the ATSDR/NJDOH prior to the demolition at the site.

DISCUSSION

This section contains discussion of the health effects in persons exposed to dioxin contaminated soils found near the Diamond Alkali site. The dioxin levels used in this health consultation are from the USEPA's 1983 study of on and off-site contamination at and in the vicinity of the DA site.

Health effects evaluations are accomplished by estimating the amount (or dose) of those contaminants that a person might come in contact with on a daily basis. This estimated exposure dose is then compared to established health guidelines. People who are exposed for some crucial length of time to contaminants of concern at levels above established guidelines are more likely to have associated illnesses or disease.

Health guidelines are developed for contaminants commonly found at hazardous waste sites. Examples of health guidelines are the ATSDR's Minimal Risk Level (**MRL**) and the USEPA's Reference Dose (**RfD**). When exposure (or dose) is below the MRL or RfD, then non-cancer adverse health effects are unlikely to occur.

MRLs are developed for each type of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (365 days and greater). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status.

The toxicological effects of the dioxin detected in the environmental media has 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.

1983 Dioxin Study[1]

In 1983, the USEPA initiated a round of extensive environmental sampling at the Diamond Alkali Site and numerous off-site areas. To facilitate the study of off-site dioxin contamination in the vicinity of the site, a portion of the "Ironbound" section of Newark was selected as the study area. The study area was defined to be the part of Newark bordered on the north and northwest by the Passaic River, on the east by the New Jersey Turnpike, and on the south by the Pulaski Skyway. It includes the site of the former Diamond Shamrock/Alkali facility on Lister Avenue, the Brady Iron and Metals facility on Lockwood Street, and the heavily industrialized areas surrounding these two facilities. There were also a number of residences and a major food distribution center, the Farmers Market, located within this area.

The study area was divided into the two relevant Centers for Disease Control (CDC) zoning classifications; *residential* and *commercial*. Any area that contained residences, even if mixed with industrial and/or commercial type buildings, was considered a residential zone. The remaining parts of the study area contained both industrial and commercial structures, and were considered commercial for the purpose of the study. Figure 2 shows a map of the dioxin study area divided into the residential and commercial zones. There were four (4) residential zones, R1 - R4, and four (4) commercial zones, C1 - C4.

In areas R1 - R4, an action level for dioxin of 1.0 part per billion (ppb), previously recommended by CDC for use in residential areas, was used for identifying areas in need of remediation. Due to dioxin analysis limitations in the early-mid 1980's, the USEPA determined that, as a safety factor, results of 0.78 ppb or greater would be considered a level of concern.

In the residential block between Joseph and Esther Streets (Residential Zone 1, Figure 3), a total of 79 surface soil samples (0-2") were taken from around homes and they were tested for dioxin. The levels detected in these soils ranged from non-detected (ND) to 5.3 ppb. Eight (8) of these samples were above the ATSDR comparison value for dioxin in soil. The ATSDR comparison value (environmental media evaluation guide or EMEG) has been set at 1.0 ppb.

As indicated above, an action level for dioxin of 1.0 ppb (0.78 ppb or greater as a margin of safety) was used for identifying remediation sites. ATSDR maintains a policy that residential surface soil concentrations of 1.0 ppb (or less) dioxin are protective of public health.

Dioxin Exposure

Residents living near the Diamond Alkali site have likely been exposed to dioxin contaminated surface soils. Past public health concerns about human exposure to surface soils remains a valid concern.

In evaluating the toxicological significance of past exposure of residents to dioxin in soil taken from around homes, the following assumptions were made: 1) the site was used by children (body weight

= 20 kg) and adults (body weight = 70 kg), 7 time per week, for a period of nine months per year, and that they would ingest 200 milligrams (mg) of soil (children) and 100 mg soil (adults) per day. Two scenarios were evaluated. In the first, past exposures were evaluated up to the time of remediation (pre-remediation). A dioxin concentration of 0.44 ppb was selected as the contaminant concentration for this evaluation. This value is an average of the 79 concentrations found in the surface soil (0-2"). The range of concentrations was ND to 5.3 ppb. The duration of this exposure was assumed to be from 1951 until remediation in 1985, a total of 34 years for adults and an exposure duration of 10 years was employed for children.

Public Health Significance Of Dioxin[8]

Dioxins and related compounds are found nearly everywhere in the developed world. These compounds are potent animal toxicants, producing a range of effects including cancer, developmental and reproductive effects, hepatotoxic reactions, enzyme induction, and death. Some of these effects may be occurring in humans, although we lack the scientific tools and data to directly measure some of these outcomes. However, there is sufficient data to support the inference that humans are likely to respond to dioxins and dioxin-like compounds with a range of effects, if exposures are high enough. Various animal species range from insensitive to very sensitive to dioxin's effects, and humans are believed to fit somewhere in the middle of this sensitivity range. We do know that, on a cellular level, subtle changes can occur in humans at levels within one order of magnitude of the average background body burden.

Once absorbed into the blood, dioxin is distributed to most organs. It is found at the highest levels in adipose tissue and liver. It has a biological half-life of approximately seven years.

Dioxin is known to cause chloracne in some exposed individuals, although absence of chloracne does not indicate lack of exposure.

Pre-remediation Period (1951-1985)

During this 34 year period residents may have be exposed to dioxin (maximum 5.3 ppb). For the purposes of this consultation, an average concentration of 0.44 ppb was used to analyze its toxicological significance.

The estimated exposure dose for adults is one order of magnitude below the chronic oral Minimal Risk Level (MRL) of 0.000000001 (1×10^{-9}) mg/kg/day. The estimated exposure dose for children, however, slightly exceeds this MRL. Exposure doses do not exceed the no observed adverse effect levels (NOAELs) for chronic exposure in animals (for effects other than cancer) cited in the ATSDR Toxicological Profile for this compound. Therefore, adverse health effects are not likely at the average concentration of 0.44 ppb. If maximum concentrations of dioxin are used (i.e., above 1 ppb), human exposure, particularly among children, may have occurred at levels of public health

significance.

Studies have shown that dioxin is a probable human carcinogen, and is associated with soft tissue sarcomas. There is no current oral carcinogenic slope factor from which to calculate a Lifetime Excess Cancer Risk (LECR) for dioxin exposure at the site. However, calculated exposure doses give an estimated human cancer risk level of 10^{-6}, based on the ATSDR Toxicological Profile for Dioxin[7]. The quantitative risk mentioned above represents an insignificant or no increased risk of cancer in adults and children.

Post-remediation Period (1985-1995)

By 1985, the residential block between Joseph and Esther Streets (Residential Zone 1, Figure 3) had been remediated. As indicated above, an action level for dioxin of 1.0 ppb (0.78 ppb as a margin of safety) was used for identifying specific remediation sites. During the ten (10) year period following off-site remediation, residents may have be exposed to low levels of dioxin. These levels were, however, were below the current ATSDR soil policy level of 1.0 ppb and the 0.78 ppb margin of safety used by the USEPA.

Post-remedial dioxin levels may yield an exposure dose exceeding the MRL depending upon the amount of soil and/or dust ingested. For example, at a dioxin concentration of 0.5 ppb, a child ingesting 40 mg of soil per day would achieve an exposure dose equalling the chronic oral MRL for dioxin. It is, however, ATSDR's policy that residential surface soil concentrations of 1.0 ppb (or less) dioxin are protective of public health.

CONCLUSIONS

There are areas of documented off-site soil contamination in residential areas near the Diamond Alkali Site. Residents living near the site have likely been exposed to dioxin contaminated surface soils. Health risks can be estimated for the potential exposure pathway associated with ingestion of contaminated surface soil. The following conclusions were made regarding dioxin exposure to residents living near the Diamond Alkali Site:

1. The Diamond Alkali Site represented a public health hazard in the past, based on available information and an analysis of exposure dose and duration. Adult residents living near the site were not likely to have been exposed to contamination at concentrations sufficient to constitute a public health hazard. Children, however, may have been exposed, in the past, to levels of dioxin that may pose a public health hazard.

   Past surface soil exposures were evaluated (pre-remediation) based upon an average dioxin concentration of 0.44 ppb. Exposure doses calculated for adult residents were one order of magnitude below the chronic oral Minimal Risk Level (MRL) of 0.000000001 (1.0×10^{-9}) mg/kg/day. The estimated exposure dose for children, however, slightly exceeded this MRL. Calculated exposure doses do not exceed the no observed adverse effect levels (NOAELs) for chronic exposure in animals (for effects other than cancer). Calculated exposure doses give an estimated human cancer risk level of 10^{-6}, based on the ATSDR Toxicological Profile for Dioxin[7]. The quantitative risk mentioned above, which is based on a worst-case scenario, represents an insignificant or no increased risk of cancer in adults and children.

2. Following off-site remediation in 1985, residents may have been exposed to dioxin below 0.78 ppb and it is likely that human exposure to concentrations of dioxin below the current ATSDR soil policy level of 1.0 ppb is occurring. It is possible that human exposures, at post-remedial dioxin levels, may yield an exposure dose exceeding the MRL depending upon the amount of soil and/or dust ingested. The ATSDR, however, maintains a policy that residential surface soil concentrations of 1.0 ppb (or less) dioxin are protective of public health. Therefore, the site is currently evaluated by the ATSDR/NJDOH to represent no apparent health hazard.

3. The site has been adequately characterized to determine public health implications.

RECOMMENDATIONS

Cease/Reduce Exposure

1. The data and information developed in this Health Consultation have been evaluated to determine whether ATSDR's Health Activities Recommendation Panel (HARP) follow-up actions may be indicated. This Health Consultation was evaluated by HARP.

2. New environmental, toxicological (e.g., revision of the current ATSDR soil policy level below 1.0 ppb), health outcome data, or changes in conditions as a result of implementing the proposed remedial plan, may determine the need for other additional actions at this site.

RECOMMENDATIONS OF THE HEALTH ACTIVITIES RECOMMENDATIONS PANEL (HARP)

The data and information developed in the health consultation for the Diamond Alkali Site, Newark, New Jersey, have been evaluated by ATSDR's Health Activities Recommendation Panel (HARP) for appropriate follow-up with respect to health activities. The panel determined that the community health education and health professional education being conducted by the New Jersey Department of Health are the appropriate follow-up health activities. No other follow-up actions are indicated at this time.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Diamond Alkali Site contains a description of the actions to be taken at or in the vicinity of the site. The purpose of the PHAP is to ensure that this health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included, is a commitment on the part of ATSDR and NJDOH to follow-up on this plan to ensure that it is implemented. ATSDR will provide an annual follow-up to this PHAP, outlining the actions completed and those in progress. This report will be placed in repositories that contain copies of this site review and update, and will be provided to persons who request it. The public health actions taken or to be implemented are as follows:

Actions Undertaken by ATSDR/NJDOH:

1. These data and information developed in the Health Consultation have been evaluated by ATSDR/NJDOH to determine public health concerns, regarding potential human exposure pathways associated with the Diamond Alkali Site.

2. The ATSDR/NJDOH participated in a November 2, 1994, public meeting. The purpose of the meeting was to elicit community concerns regarding the site.

3. The NJDOH is conducting physician education in the form of a newsletter for the Diamond Alkali site.

Actions Planned

1. An assessment of the need for community involvement activities is planned. The NJDOH will contact community leaders and other interested parties to assess community needs. Dependent upon need, site specific educational materials will be disseminated through either a fact sheet or local newsletter.

2. Physician education at the site will be conducted by the NJDOH, if a need is identified. This

need will be based on responses to the physician newsletter and/or requests received from the Medical community.

3. The NJDOH and/or ATSDR will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

CERTIFICATION

The Health Consultation for the Diamond Alkali 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 site review and update was initiated.

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Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Site Review and Update and concurs with its findings.

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Branch Chief, SSAB, DHAC, ATSDR

DOCUMENTS REVIEWED

1. NUS Corporation, Sampling Results, 80 Lister Avenue, Newark New Jersey, June 16, 1986.

2. Health Survey of residents and workers in the Vicinity of 80 Lister Avenue, Newark New Jersey, NJDOH, June 28, 1984.

3. Judicial Consent Decree, Diamond Alkali Site, USEPA, July, 1989.

4. Record of Decision, Diamond Alkali Site, USEPA, September 30, 1987.

5. Agency for Toxic Substances and Disease Registry, Health Assessment for Diamond Alkali Site, Newark, New Jersey, November 5, 1987.

6. Agency for Toxic Substances and Disease Registry, Site Review and Update, Diamond Alkali Site, September 7, 1993 (revises 1/5/94).

7. Agency for Toxic Substances and Disease Registry, Toxicological Profile for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. Atlanta: ATSDR, June 1989.

8. New Jersey Department of Health, Health and Hazardous Waste, Volume Number 1, Issue 1 (Dioxin), September 1995.

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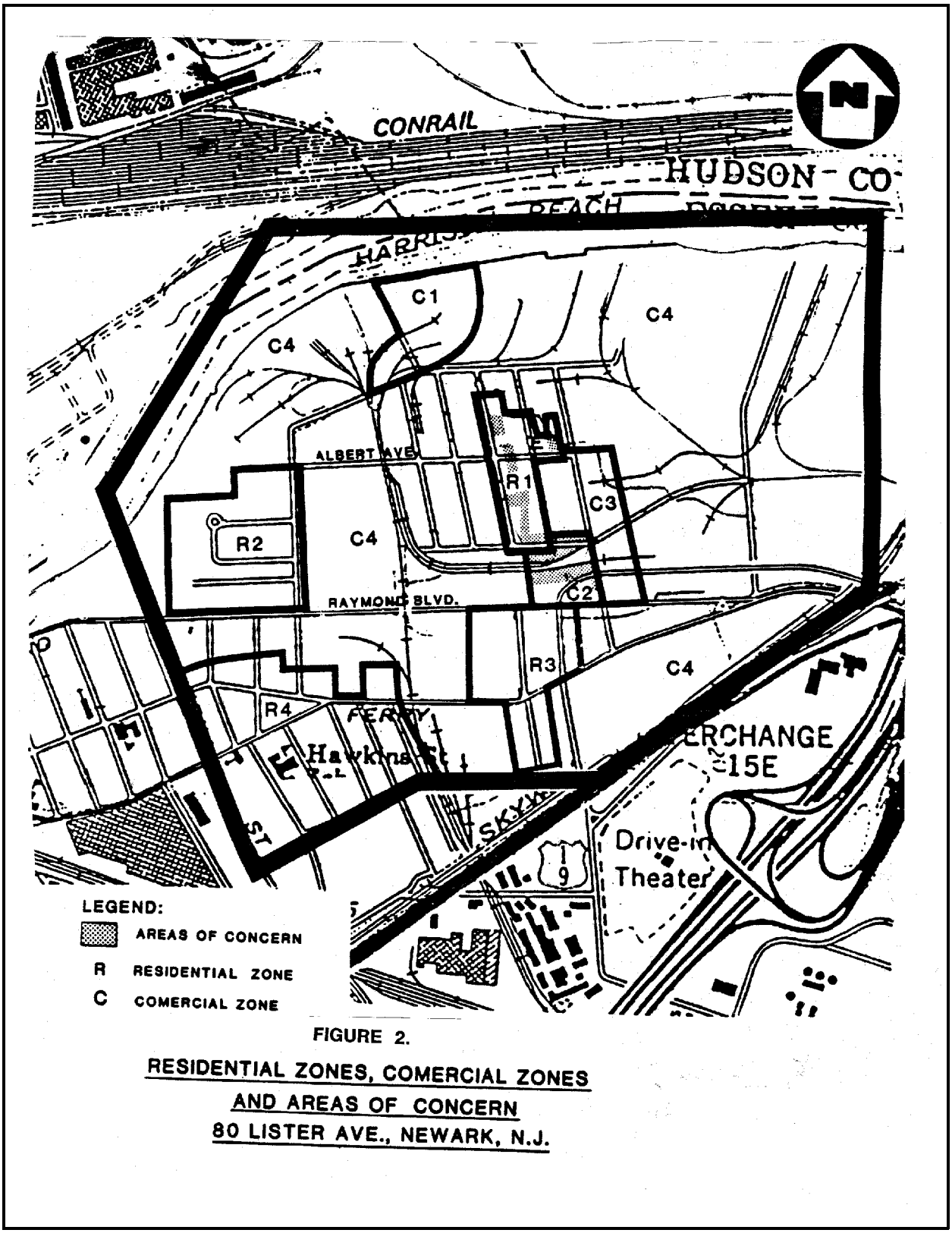

FIGURE 2.

RESIDENTIAL ZONES, COMERCIAL ZONES
AND AREAS OF CONCERN
80 LISTER AVE., NEWARK, N.J.

Figure 2

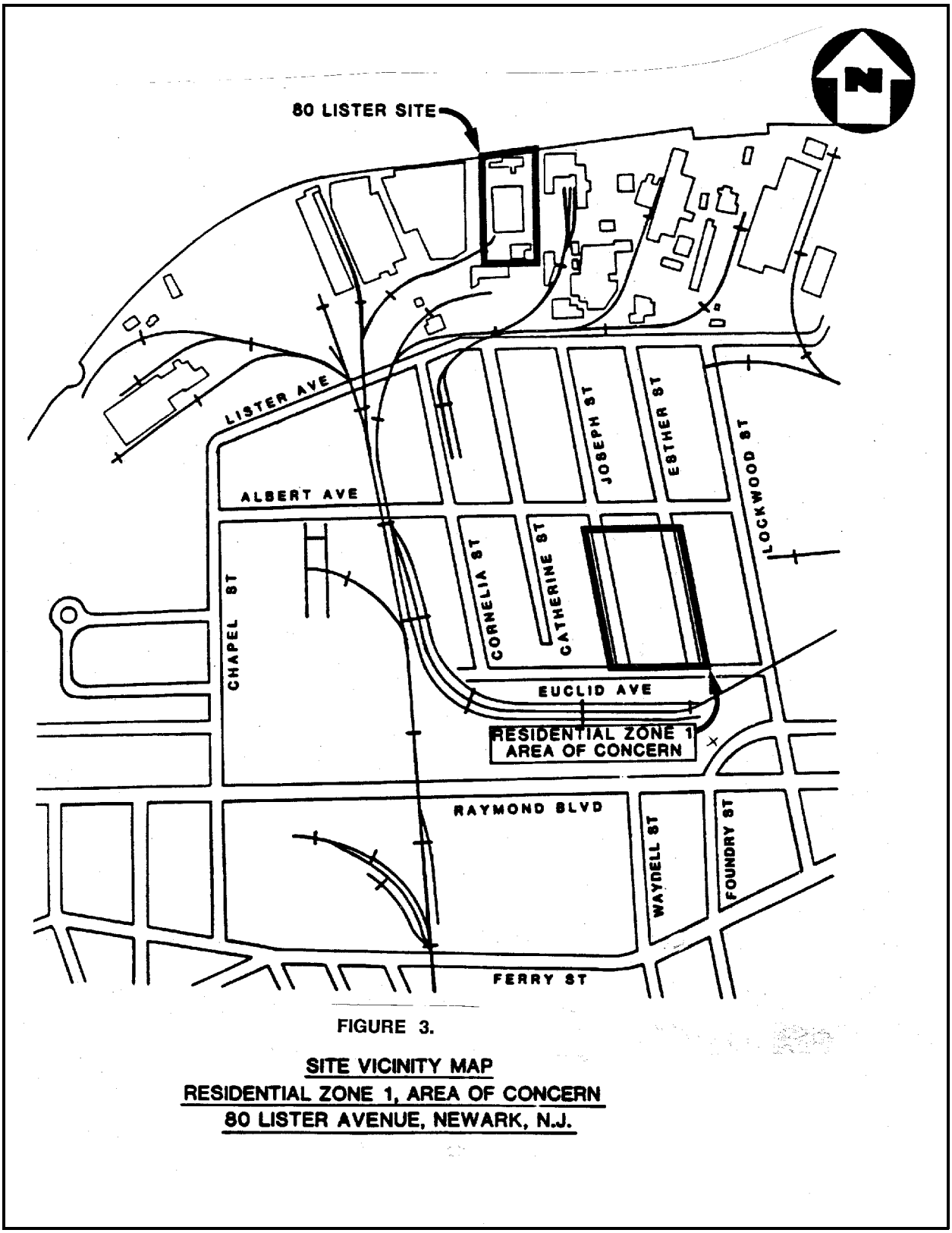

FIGURE 3.

SITE VICINITY MAP
RESIDENTIAL ZONE 1, AREA OF CONCERN
80 LISTER AVENUE, NEWARK, N.J.

Figure 3