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# AN ANALYSIS OF THE EFFECTIVENESS OF REGULATORY AGENCY RESPONSES TO A SITUATION INVOLVING PERCEIVED HEALTH EFFECTS FROM MICROWAVE RADIATION

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## ABSTRACT

The issue of whether exposure to electromagnetic radiation can have deliterious effects on human health has received widespread attention in both the popular and scientific press. Recent studies have shown that such effects can be derived even from fields of very small strengths. Given this concern, it might prove useful to examine the capacity of federal and state agencies concerned with the maintenance of public health to cope with this problem. Using the case of the Vernon Township, New Jersey as a primary example, we find that their effectiveness is apparently compromised by a variety of factors, raising questions concerning their capacity to deal with this particular case, and with their past and future performance on this issue as a whole.

## BACKGROUND

Vernon Township lies in the Northwestern corner of New Jersey, and has no major industry except recreation. Due to its unique topography (situated in a valley between two ranges of the Waywayanda mountains), it is effectively free from electromagnetic interference. This, combined with its proximity to the metropolitan New York area (40 miles distant), made it an ideal location for the domestic telecommunications satellite industry.



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In January, 1974, Western Union established the Westar Earth Station (1), which was followed in June of that same year by American Satellite Corporation's Vernon Earth Station. In 1975, RCA established the Vernon Valley Earth Station, which is the largest domestic communications satellite facility in the United States. At the present time, Vernon Township has the highest civilian concentration of microwave sources in the world, with 3 earth stations, each with 3 or more uplink antennas, and 29 additional point-to-point terrestrial links within 5 miles of the center of town. If the range is extended to 10 miles (to thereby include a greater portion of Sussex County), the number increases to 219 (2).

Residents in Vernon began to notice what they considered to be an abnormally high incidence of health problems in some areas of the Township. This observation caused the creation, in 1982, of a citizens' group called Citizens Against the Towers (CAT) to protest a proposed expansion of the RCA facility that would have effectively doubled its size. In the fall of that year CAT initiated a self-reporting epidemiological survey on the nature, extent and distribution of health problems in the township. This paper reports the results of that study, and the responses of the various state and federal agencies that subsequently became involved.

## SUMMARY OF FINDINGS AND RELATED EVENTS

### The CAT Study

The most significant aspect of the survey was the discovery that incidences of birth defects, malignancies and chromosomal anomalies were not randomly distributed throughout the town, but occurred in clusters. It was estimated that 55% of the reported cases resided in an area where only 27% of the homes were located (Figure 1). Additionally, these clusters occurred on ridge lines, and appeared to be associated with the projected beam paths from the satellite uplinks and/or point-to-point sources. The citizens' group petitioned the town Board of Health and the Sussex County Health department to "make a comprehensive study of the area to determine the extent and cause of the problem." As a result of this, RCA withdrew its initial request (it was resubmitted at a later date).

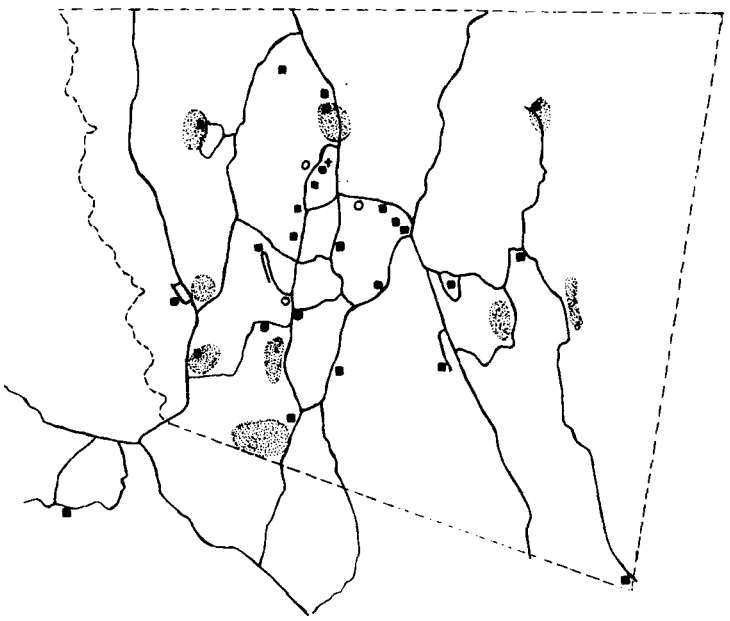

FIGURE 1

Map of Vernon Township. The political boundary of the township is designated by the dashed line, roads are solid lines, satellite earth stations are open circles, EPA measurement sites are solid squares (the solid square with the superscript "+" is the site of the highest field measurement, Rolling Hills Primary School), and the approximate cluster areas are stippled. The majority of cluster areas are either on hillsides facing microwave installations or on geographical crests.

## New Jersey Department of Health Study (3)

Because of continuing controversy, even after RCA's withdrawal, the Sussex County health officer requested that the New Jersey Department of Health (DOH) study the incidence of birth defects in the Township. The resulting study by DOH surveyed the years 1975-1981, inclusive, consisting of a review of hospital records, on birth defects only, gathered from 10 area hospitals (some in New York state) used by the citizens of

Vernon. DOH compared the incidence of specific defects with similar data for the remainder of Sussex County; statistical analyses were prepared on the total number of births in Vernon compared with the total number of births in Sussex.

Begun early in 1983, the results were to be released by June of that year. Though all data had been collected on schedule, it was not released until September of 1984, immediately prior to a vote by the Town Zoning Board on RCA's second application to expand their facility. DOH concluded that "[n]o specific type of [birth] defect was found to occur more often in Vernon Township than would have been expected based on the experience of the rest of Sussex County [the control group]" (4). RCA's application was unanimously approved.

The number of chromosomal anomalies (Trisomy 21 Down's Syndrome) detected by the study "approached statistical significance ($p = .059$)" (5). The incidence throughout Sussex county was found to be low, with only three cases detected exclusive of Vernon; twelve cases could be expected, two in the township itself. In fact, the number DOH found in Vernon was three, a finding which DOH dismissed because two of the three "occurred to women of advanced maternal age." In addition, DOH located one case of another, very rare chromosomal anomaly within the Township during the period covered by the study, Trisomy 18 Edward's Syndrome. DOH made no specific comment on this finding. Additionally, the study specifically disclaimed any attempt to relate its findings with exposure to microwave radiation.

The DOH study was immediately challenged by CAT on the basis that the citizens' group had at that time 8 confirmed cases of Down's Syndrome, and two confirmed cases of Edward's Syndrome. Furthermore, CAT noted that the most significant aspect of its own study, namely the non-random distribution of cases, had been completely ignored by the DOH study. CAT also challenged the use of the remainder of Sussex County as a control, because they believed the concentration of microwave sources in Sussex approached that within Vernon, and was in no was representative of a national average. CAT then went to the Office of Citizen Complaints (OCC), a division of the New Jersey Public Advocate, with a request that OCC review the DOH study.

## The Office of Citizen Complaints (6)

OCC confirmed the existence of the 8 Down's Syndrome cases discovered by the citizens' group, all of which occurred within the period of 1975-1981 and met all criteria used by DOH for inclusion in their study. This led them to the conclusion that

> the difference in the number of Trisomy 21 Down's Syndrome cases which DOH has stated occurred in Vernon Township and our number of verifiable cases alone clearly demonstrates that the study's methodology was flawed, its findings incomplete and its conclusions possibly inaccurate. Our finding points to the possibility that there may be even more Trisomy 21 Down's Syndrome cases in Vernon Township than have been identified as well as additional cases in the rest of Sussex County. There may also be additional incidences of other birth defects in Vernon Township and Sussex County that were not identified by DOH and therefore not included in this [the DOH] study. (7)

Given that the expected incidence of Down's Syndrome within Vernon is two cases, the number confirmed by OCC represents a four-fold increase. Even excluding the cases involving advanced maternal age, the level is still three times that which could be expected.

OCC also discovered that the study's "methodology, findings and conclusions were independently reviewed by two experts outside DOH: Dr. Herbert Pollack, M.D. and Dr. Don R. Justesen, Ph.D." (8). Neither of these men were qualified epidemiologists with the expertise necessary to accurately assess the study's design or results. What is more, both individuals "are consultants for the [satellite communications] industry," Dr. Justesen having routinely testified, at that time on behalf of RCA, with the claim that exposure to microwave radiation did not constitute a health hazard (9).

## National Centers for Disease Control Report (10)

Due to the discrepancy between the findings of the DOH and those confirmed by OCC, as well as "a perceived lack of interest from the DOH" (11), a request was made to the Centers for Disease Control (CDC), Atlanta, to investigate the Vernon

Township. Representatives of CDC visited Vernon on July 17-18, 1985 and met with the various groups involved.

A specific request by CAT was that CDC "conduct a house-by-house survey in the Vernon Township to assess the health status of the community" (12). This was not done; instead, CDC chose to use existing DOH data, already shown to be flawed, combined with pre-existing statistical information. In addition, prior to their visit, CDC requested CAT to supply it with a list of cases it had compiled, including address, date and place of birth. CAT declined to do this on the grounds that it would violate the confidentiality of the survey they had conducted, delivering instead a list of case histories and a survey map with each individual case marked anonymously by place of residence, thereby showing the location of the clusters without compromising the respondents' identities (13).

The scope of CDC's analysis was broader than that of the DOH. It included a statistical comparison between the incidence of specific carcinomas in Vernon with that of the remainder of New Jersey. It determined that "no evidence exists of an increased rate of possibly microwave-related cancers [those types which have been shown in the literature to be associated with microwave irradiation] in Vernon Township" (14). No other type of cancer exhibited statistically significant increases. In terms of Downs Syndrome, CDC determined that Vernon evinced an elevation of incidence when compared with the remainder of Sussex County that "approached statistical significance" (3.9% of the births, compared with approximately 3.0% for the rest of the county) (15).

Specific recommendations by CDC included the following (16): (a) "describe the incidence of Downs Syndrome from 1982 to the present", (b) conduct a case-control study of cytogenetically confirmed infants with Downs Syndrome (1975-1985), (c) survey the microwave/radiofrequency radiation in Vernon, (d) "[r]egularly review cancer and birth defect data from ongoing surveillance programs", and (e) "establish an advisory panel to review the planned studies."

CAT noted that this study again failed to consider the aspect of clustering. Its conclusion that health data for Vernon did not represent a significant departure from the

remainder of the state in terms of malignant transformation is based on the random distribution of cases over a given area. When, as CAT contends, 55% of the cases reside in 27% of the total region, a considerably different picture emerges.

In terms of Down's Syndrome, CAT recognized that not only did CDC fail to recognize clustering of cases, but the data on which it based its findings was that garnered by DOH, which used Sussex County as a control. For the reasons described above, this can be regarded as an invalid comparison. Nevertheless, despite the failure to consider the non-randomicity of distribution, and despite the fact that the control population compromised the comparison, an elevated incidence of genetic abnormalities was still discovered.

## The D.O.H. Response

In response to CDC recommendations, the New Jersey Department of Health began to establish the scientific/advisory panel, whose members were to include representatives of the Public Advocate, the Vernon Township Mayor's Blue Ribbon Panel, the Department of Environmental Protection and CAT, the chairperson of the panel serving as the representative of DOH (the Commissioner of Health to select the chairperson, who will then confirm all other appointments).

## Measurement Surveys: DEP and EPA (17)

Prior to the CDC study (18), the Department of Environmental Protection (DEP) went to Vernon and measured microwave radiation levels at "13 sites that had been identified as possible problem areas; no microwave radiation was detected within the limits of their instruments" (19). Recognizing the limitations of their equipment, they suggested that the Environmental Protection Agency (EPA) also make a survey of the township; the results of that study were released in 1985.

EPA measured microwave field densities in the frequency ranges of terrestrial and uplink microwave sources associated with the earth stations at 25 sites within Vernon Township. At selected sites, broadcast bands were also sampled. EPA

determined that typical power densities in the Vernon area were "well below 0.001 $\mu W/cm^2$," which is "far below the 0.005 $\mu W/cm^2$ median power density to which most of the U.S. urban population is exposed." The highest power density discovered in a publicly accessible area was 60 $\mu W/cm^2$, which EPA noted was below the "most restrictive power density limit in the New Jersey regulations" of 1000 $\mu W/cm^2$. The authors have concluded that each of the above assertions are highly suspect and do not accurately characterize the Vernon environment for reasons described below.

## DISCUSSION

A number of criticisms independent of those found by the citizens' group and the OCC may be leveled against each of the above reports. Let us consider them in chronological order, beginning with the DOH study.

One must first question the choice of using the remainder of Sussex County (which contains Vernon) as the control group for the study. This choice was already compromised in at least one instance by factors that appear to make it non-representative of an average sample. At the outset of their report, DOH included data which showed that in 1979 Sussex County had an abnormally high incidence of birth defects (45.9 per 1000 births, as opposed to 34.7 per 1000 state-wide) (20). They dismissed this on the basis that the data was intended for another purpose, but it suggests that the control group already possessed a significantly elevated incidence which would have necessarily biased the outcome.

Moreover, DOH noted in conjunction with the above observation that, in the same year (1979), Vernon itself experienced a 70.0 per 1000 incidence of birth defects, compared with the state-wide average of 34.7 per 1000. The present study, however, reported a rate of 46.0 per 1000 in Vernon for the year (1979); the Sussex rate for the same year is listed as 35.2 per 1000 (19). There is no discussion of the disparity between these two reports, leading one to question whether different criteria were used for reporting birth defects in the Vernon study, and which criteria were more appropriate.

Furthermore, the Vernon rate of 46.0 per 1000 DOH reported is significantly higher than the state-wide average previously cited. This would seem a difference of sufficient magnitude to warrant an investigation to determine the cause of this anomaly. No such investigation is mentioned. Even in light of this discrepancy, DOH averaged the data from 1975-1981, and determimed that the difference between the average annual rate for Vernon, 33.9 per 1000, and that for the remainder of Sussex County, 31.9 per 1000, was "not statistically significant" (22). One would question the propriety of basing the conclusion that Vernon suffered no elevated incidence of birth defects on such simple averaging of annual rates, expecially when these ranged from 21.2 to 46.0 per 1000.

Finally, the study excluded all induced abortions. Because amniocentesis procedures could have led to the discovery of genetic anomalies in unborn fetuses whom parents may have decided to abort on this basis, such an exclusion might have led to artificially lower incidences of such anomalies than were actually present.

Maximum emphasis should, however, be placed on the failure of DOH to take the non-random distribution into consideration. Despite the fact that this issue was central to the controversy (whether a health problem of any significance existed would be, to some extent, determined by the existence or nonexistence of such clusters), it sought to neither refute nor prove CAT allegations of the same.

Communications between DOH, EPA and OCC indicate, however, that DOH at least began such an analysis. "[T]he determination of some gradient for exposure [requested by DOH from EPA] is necessary for us to test the clustering of birth defects near the microwave stations..." (23). It is unclear whether this indicates that a cluster had been confirmed by DOH, which was now attempting to ascertain its cause, or whether they merely intended to determine whether such clustering existed. A subsequent communication from the Department of the Public Advocate to CAT seems to confirm the former. The Public Advocate contacted the Chief of the Office of Environmental Health at the DOH, who stated that the mapping of documented birth defects in the area had been completed. "She pointed out

that the Department [of Health] had definitely determined that there is an excess of birth defects in Vernon Township, and the next step is to determine the cause of the cluster" (24).

Similar criticisms can be leveled against the report by the CDC, which offered no improvement over the DOH report. The CDC report used either available statistical information or data gathered during the course of the DOH study. This was procedurally incorrect because it was largely in response to flaws in the DOH survey that CDC began its analysis.

The only way to competently address the issue would have been to conduct, as CAT had requested, an on-site (house-to-house) survey of health problems in the township. This would have lent the only acceptable confirmation or denial of the existence of clusters, allowing one to make a determination as to whether there was any relationship between incidence of disease and microwave exposure in Vernon. The CDC report, as designed, could not have been intended to provide such definitive evidence. The CDC recommendations contain no provisions for such a survey.

Their actions seem at variance with accepted procedures even within their own organization. CDC notes that the standard approach to the evaluation of situations like that encountered in Vernon is to review existing data or to "conduct a preliminary study to identify or confirm an unusual pattern of events." The data it chose to review was in large part that which CCC had already shown to be incomplete. Even though CDC was presented with evidence of non-randomicity by the only epidemiological study of the Township that had not been discredited, they failed to consider it.

Correspondence between the various agencies involved reveals that during the study official agencies were incensed by what was felt to be an uncooperative attitude on the part of the citizens' group. In particular, CAT's request for a letter "guaranteeing a comprehensive health study" from CDC, and "allowing CAT's epidemiologist to review all raw data generated in the study," were found particularly abrasive (25,26).

The most recent event in this chronology was the release of the EPA report on its survey in Vernon. The results of the study were completely inadequate to either survey the

environment, or permit a determination as to whether microwave exposure could be related to the observed health problems.

Throughout the report, EPA cited what it termed relevant or otherwise acceptable standards for exposure, primarily the standard of 5000 $\mu W/cm^2$ which was established by New Jersey. All reported measurements fall below this standard. The implication from this is that the reported densities are completely safe. This is a specious argument. At the present time, there is insufficient scientific data to establish any level as acceptable. There is, however, a considerable body of literature which suggests that levels far below the New Jersey standard are productive of unacceptable hazardous biological effects.

As with DOH and CDC before it, EPA also ignored the aspect of clustering in their choice of measurement sites. Significantly, on two occasions EPA refused to accept the same complete data that CAT had provided the CDC, including maps showing the clustering, which would have allowed EPA to make comparisons between field densities in cluster and equally populated non-cluster areas. Given EPA's reluctance, CAT requested merely a contour map of the electromagnetic field intensities in the area, which EPA claimed it was unable to provide due to "inclement weather and road conditions."

Instead EPA picked what appears to be a virtually random selection of measurement sites, from which no coherent relationship between cluster and non-cluster areas could be extrapolated (Figure 2). Furthermore, EPA failed to provide an adequate sampling time for each site measured. Sampling time for each set of frequencies was two minutes at each site, and the time expended at each site was roughly two hours. Since only 25 sites were measured, the data was insufficient to provide anything more than a superficial sample.

This problem is further complicated by the varied operation of the antennas themselves (27). The number of dishes in use (transmitting) at any one instant in each of the earth stations fluctuates daily. The number of channels being transmitted (and input powers thereof) by any one antenna varies according to commercial demand. Given this fluctuation, it would be impossible, within a short period of measurement, to describe

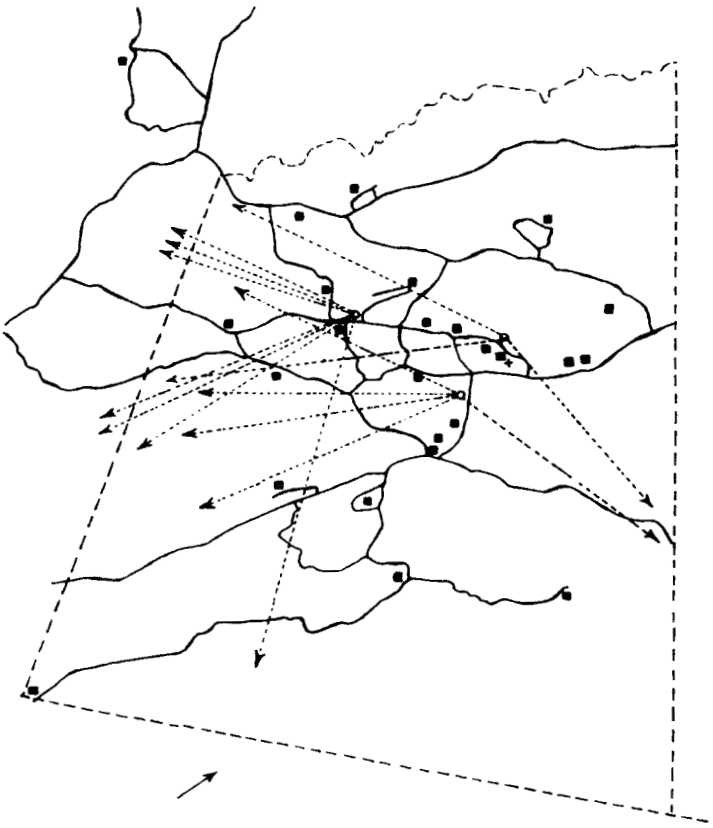

FIGURE 2

Map of Vernon Township demonstrating the average main beam azimuths of uplink transmitter and terrestrial links (dotted lines headed by arrows). The remainder of the designations are identical to those in Figure 1. It should be noted that some uplink azimuths have been indicated to be variable by the operating companies, and that the data on terrestrial sources provided in the EPA report was incomplete.

conditions extant at that site for any other time period than that measured; the result is a sampling totally insufficient to characterize the site even in terms of present day-to-day operation.

This is compounded by an apparently random chronology for measurements at the various sites. Measurements of certain frequencies at some sites are reported as having been taken on one day, while other frequencies at the same site were measured on other days (28). Thus, not only does the report fail to give an accurate picture of the long-term electromagnetic environment in the area, but in most cases it cannot even provide a coherent assessment of the total electromagnetic environment at that site for any period in time. Moreover, while the measurements of some bands are frequently repeated (up to six times at site 12) for no apparent reason, other frequencies were not measured at some sites. Indeed, at site 4, only one microwave frequency band is reported as having been sampled.

An analysis of the field densities recorded by EPA in the Township also bear examination. EPA states that one goal of the study was "to locate points that were topographically elevated, close to earth stations, and along the transmission azimuth angles from the antennas in order to allow measurements as close to the axes of the microwave beams as possible" (29). Additionally, EPA was required to obtain data at "most residential areas" and "at most of the schools in the township."

Using data provided to the EPA by RCA, American Satellite and Western Union, main beam azimuths of all microwave transmitting sources for which there was information (30) were plotted by the authors on a map of the Vernon Township (Figure 2). The measurement sites were then plotted against this background, and arranged into three groups: (1) those with the lowest expected field density (approximately 30° or more from the main beam azimuth of a transmitting microwave source); (2) those with a medium expected field density (approximately less than 30° from a main beam azimuth); and (3) those with the highest expected density (transversed by one or more main beam azimuths).

Only 4 were found to be actually transversed by the main beams of microwave sources, despite the fact that in numerous cases the azimuths transversed highly populated areas that would

seem to have met all criteria and therefore warranted inclusion. Of the 25 sites measured, those with the highest expected densities exhibited nothing approaching the highest levels actually detected in Vernon. In fact, two sites, #10 and #21, exhibited levels that were at or below the average levels exhibited by sites with the lowest expected densities. The highest readings were obtained at those sites falling into the median classification, though these were all below the relevant New Jersey standard for exposure. This discrepancy can be resolved when one considers the spatial variation inherent in microwave transmissions and the side lobe patterns associated with each antenna.

In an associated document, EPA stated that "except for a very narrow path along the ground, it is not possible to projet any measured radiofrequency radiation from these [satellite uplink antenna] sources" (31), an assertion which completely ignores the physics of such transmission. Besides the main beam emitted by the antenna, terrestrial or uplink, a series of sidelobes of radiation are sent into the environment at varying angles from the central azimuth, which are produced by the alternate reinforcement and nullification of the wavefronts as they interact. Nowhere in the report do we have any assurance that EPA compensated for this in their measuring procedure and, as a result, most measurements could have been taken in areas of destructive interference, where levels would be scarcely distinguishable from background noise.

In every case except for one, it appears that this was so. "[T]he highest peak power density seen during the study in any band was approximately 3000 $pW/cm^2$ in the 11-GHz band at site 13" (32). At site 13, the Polling Hills Primary School, the highest detected levels were reported, 2810 $pW/cm^2$ in the 10.6-11.8 GHz range. "The second highest level was about 980 $pW/cm^2$ in the same band at site 12." This refers to the Lounsberry Middle School, both schools being within a radius of approximately 1000 feet of the AMSAT facility. EPA goes on to note that "it is probable that at sites 12 and 13, EPA chose measurement locations that are near the axes of one or more of the 11-GHz band terrestrial relays in the area." Furthermore, "these sources use high gain antennas to concentrate very low transmitter powers into narrow microwave beams."

The nearest terrestrial microwave link operating in this frequency band is located at the American Satellite facility, and has a main beam azimuth of 81° True North, directed some 40° away from site 13, and more than 90° away from site 12. Western Union has two terrestrial links operating in the same band, directed along an azimuth of 73° TN, approximately 85° from site 13, and 100° from site 12.

Neither school is located near the main beam of either terrestrial source. What is being measured must be the power inherent in a side lobe from the main beam, most likely from the AMSAT facility. This side lobe, then, is delivering to these schools what are, in comparison with the other measurements listed by the report, phenomenal power densities. It should also be noted that terrestrial links operate at much lower power levels than uplinks; this particular AMSAT antenna has an input power of 15 Watts. The average satellite uplink is commonly operating at between 1000 and 2000 Watts.

Side lobes from the earth terminals should contain correspondingly higher field densities. From this we can only conclude that EPA did in fact not measure in any of the side lobes from these sources. Perhaps one explanation for the anomalies at sites 12 and 13 is that, as schools, EPA was required to include them in the survey, offering EPA less discretionary latitide in site selection (33).

As for measurements ostensibly made along main beam azimuths, microwave transmissions display a "dramatic spatial variability" (34). Power levels can change radically even across the path of the main beam. Thus, a single measurement especially when one considers its duration of only two minutes, along what is ostensibly the central azimuth of an uplink, could well result in such low readings. This does not reflect total power output. It only means that at that point, and at that time, power densities are measurably lower. Hence, the exact location where a measurement is made, and the time at which it is made can have an extremely significant impact on the result.

This is reiterated by EPA's findings within the confines of the RCA facility. Because of the terrain, they were forced to use portable measuring equipment, calibrating it using one of the antennas at the site. Two meters were used, each placed "at the same location directly before the 11-meter Scientific

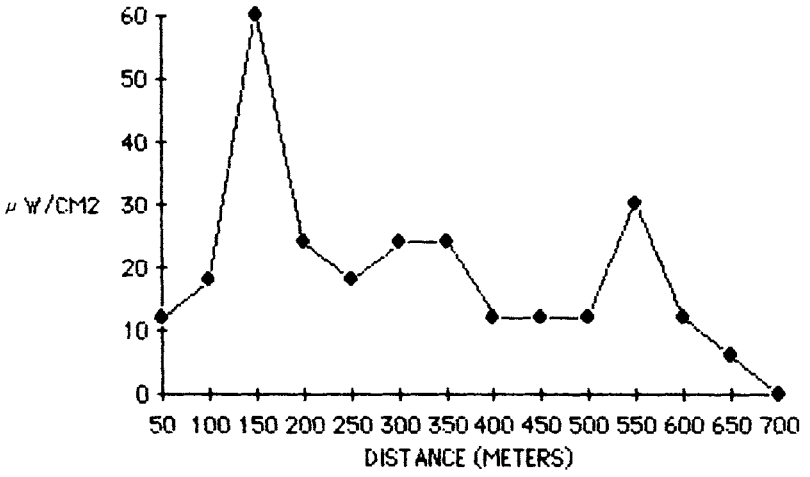


FIGURE 3

EPA measurements in front of the 11-m Scientific Atlanta antenna at the RCA installation. Measurements were taken at 50' intervals in a line that approximated the main beam azimuth. Its elevation angle was compensated for by the existence of a hill whose grade apparently paralleled that angle, thus (it is implied by the EPA report) allowing for the measurements to reflect field densities within the main beam.

Atlanta dish." The dish was an uplink, with an azimuth of 252° and an elevation of 10°, operating in the 6 GHz band. The meters recorded 102 $\mu W/cm^2$ and 120 $\mu W/cm^2$. Measurements were then made up a hill along the azimuth of the main beam, at 50' intervals out to a distance of 700 feet (Figure 3). The highest reading, 60 $\mu W/cm^2$, was still well below the accepted standard for exposure of 5000 $\mu W/cm^2$.

It is implied here that the peak power emitted by the dish will not exceed this amount. This, however, is paradoxical in that the antenna is being fed at approximately 1000 Watts. What is more, EPA reported that the detected levels drop to zero at 700 meters along the main beam axis, an impossibility when one considers that it is attempting to communicate with a satellite over 22,000 miles distant.

Two possibilities exist. Either they did not, contrary to the report's implication, follow along the direct beam azimuth, or the antenna may not have been fully operational. The former possibility seems more likely. Had the measurements been taken within the main beam or any of its more substantial side lobes, the readings would have necessarily been far greater. Indeed, Figure 3 suggests a side lobe pattern, but since the field densities reported bear no resemblance to the actual power output, one can only conclude that the measurements were made in an area of destructive interference between two wavefronts (a certain field density would, however, be expected because of the proximity to the generating source and the high power levels involved).

The EPA report was also reviewed and commented upon in a preliminary fashion by an independent engineering firm (Raines Engineering, Potomac, MD) (35). The comments contain several additional points: lack of reproduction of previous measurements, failure to reconcile actual with predicted measurements, lack of a good contour plot or similar display of predicted electromagnetic fields and non-comprehensive numbers (or locations) of measurement sites. The preliminary statements by Raines Engineering conclude that "in previous hearings, we were led to believe that the radiation spilling over from the satellite dishes was so slight as to be imperceptible and almost unmeasurable. EPA's own measurements demonstrate that we were grossly misled. The signals spilling over from the dishes are very strong indeed. Some of them are over ten times stronger than the best television signals."

## CONCLUSION

None of the studies done thus far have either addressed, or gathered the data relating to, the primary concerns of CAT.

The data gathered by CAT would appear to indicate that a health problem of some magnitude exists in Vernon Township. The salient points of this data are twofold: that there is a proven excess of genetic defects within the Township, and that the geographic location of these cases coincides with the locations of clusters of other birth defects and malignancies. It is significant that none of the studies either acknowledged or

investigated this apparent non-random distribution. Since the citizens' concern is primarily that exposure to the abundant microwave fields present in the Township is the cause of this non-random distribution, the only valid scientific study would be one that directly determined first whether such clustering actually existed, and whether any such clusters are related to a similarly non-random distribution of the microwave field intensities. It is quite evident that such a study has thus far not been done, and therefore any inference that the present studies indicate no relationship between such disease patterns and microwave radiation is invalid.

It should be noted that a statistically significant relationship between the cluster areas and levels of microwave field intensities would not depend upon any preconceived notion of the values of such field intensities. In that light, Vernon Township presents an excellent real world experiment from which extremely important information relating to this general problem could be obtained. The obvious failure of all of the regulatory agencies thus far involved to adequately deal with the Vernon Township situation would appear to indicate that, at this time, these agencies are unable to effectively resolve this general problem (36).

## ENDNOTES

(1) Also known as the Glenwood Earth Station.

(2) In response from R.F. Cleveland (Federal Communications Commission), to Margaret Conomos, New Jersey DOH, July 27, 1983.

(3) Halprin, George J., Director of Parental and Child Health Services, and Lawson, Charles, Public Health Epidemiologist, "Birth Defects Study Sussex County & Vernon Township 1975-1981," Released by New Jersey DOH.

(4) DOH, p. 5.

(5) *DOH*, pp. 4-5.

(6) A report prepared by the New Jersey Department of the Public Advocate, Office of Citizen Complaints (no date of release).

(7) OCC, p. 16.

(8) OCC, p. 6.

(9) This fact draws into question the disclaimer by DOH that its study did not attempt to assess the possibility that health problems in Vernon could be the result of microwave exposure. By using industry consultants as reviewers, it appears that DOH was operating under the assumption that such exposure was innocuous, or else this choice would have been regarded as seriously compromising its nonpartisan appearance -- Authors.

(10) Edmonds, et al.: Report of Centers for Disease Control Consultation on Vernon Township, New Jersey, Division of Birth Defects and Developmental Disabilities and the Division of Chronic Disease Control, Centers for Disease Control, November 12, 1985.

(11) CDC, p.4.

(12) CDC, p. 6.

(13) It should be noted that CDC's request was not in keeping with the practices of the CDC itself; in a recent study it conducted on Reyes Syndrome, CDC refused to provide even the name of the area where the study was done, much less specific addresses of its participants. See Gina Kolata, Dispute over Access to Reye's Study Data, Science 230, 297-298, 1985.

(14) CDC, p. 11.

(15) CDC, p. 8.

(16) CDC, p. 12.

(17) An Investigation of Microwave and Radiofrequency Radiation in Vernon Township, New Jersey, Electromagnetics Branch, U.S. Environmental Protection Agency, 1986. Undertaken at the request of the New Jersey Department of Environmental Protection under Interagency Agreement #RWNJ931658-01-0, November 10-16, 1985.

(18) The results of the study were presented to CDC at a meeting on July 17, 1985. No record is given of the exact locations where the measurements were taken, nor when the study was done.

(19) CDC, p. 5.

(20) Data for 1979, something which DOH again disregarded on the basis that "its accuracy had not been tested." See p. 1 of the DOH report.

(21) DOH, Table 5.

(22) DOH, p. 4.

(23) Letter from Margaret G. Conomos, DOH, to Paul A. Giardina, Chief, Radiation Branch, U.S. EPA, March 18, 1984.

(24) Letter from Joseph Rodrigues, Department of the Public Advocate, to Mr. and Mrs. Kreindler of CAT, April 27, 1984.

(25) Letter from Gerald P. Nicholl's Acting Chief, Division of Environmental Quality, New Jersey Department of Environmental Protection, to Mr. and Mrs. Stephen Kreindler, CAT, November 10, 1985. Nicholl's is referring to the CDC study; the communication was, however, primarily concerned with the EPA study.

(26) One questions whether the independent verification of conclusions constitutes anything not in keeping with acceptable scientific methodology; it should not matter to CDC whether the data is provided or not unless the conclusions they derived were unsupported by the data.

(27) By way of example, for RCA's facility at the beginning of the study, November 11, 1986, only one dish (13-meter E-systems) was in continuous operation (0001-2400 GMT); two others, an S/A 11-meter and RSI 11-meter, were in semi-continuous use, with one or more channels in use through 0001-2400 GMT. The remaining dish utilized that day was the Harris 13-meter, which had no continuous broadcasts. This is significant because the actual power output at any given moment will vary depending on a number of factors, one of which is the number of channels being transmitted. The 13-meter in continuous use broadcast eight separate frequencies simultaneously, leading to an obvious high output power; the Harris 13-m, however, transmitted only one frequency at a time, its output power being, therefore, significantly lower. Thus, for every antenna except the 13-m F-systems, power output would have varied widely over the course of the day, leading to corresponding variations in the field densities experienced in the surrounding environment.

(28) A case in point; site #12, the Lounsberry Hollow Middle School. On November 13, the 10.6-11.8 GHz region was sampled twice, and the 5.9-6.5 GHz band was sampled once. On November 15, EPA appears to have returned to the site, at which time they measured the 5.9-6.5 GHz region -- for a total of seven times. On the following day, EPA returned yet again, this time to survey the 14.18-14.21 region, which they did only once.

(29) EPA, p. 3.

(30) The number of terrestrial links is certain to be far higher than the report suggests.

(31) Letter from Paul A. Giardina, Chief, Radiation Branch, U.S. EPA, to Margaret G. Conomos, DOH July 26, 1985.

(32) EPA, p. 11.

(33) The antenna pattern plots for the AMSAT 11-GHz terrestrial

link were among those excluded from the report by EPA "in the interest of brevity."

(34) EPA, p. 2.

(35) Letter dated June 18, 1986 from Jeremy K. Raines to John V. McDermott, an attorney in Vernon, NJ.

(36) At this writing, an apparently unrelated event has occurred which could have a direct bearing on any future attempt to properly investigate the situation in Vernon Township. On the 15th of June of this year the DEP announced that "a quarry site in Vernon Township wuld receive excavated soil containing trace amounts of radium". Subsequent investigation by the press and citizens of Vernon revealed that the soil was originally dumped at another site in New Jersey c. 60-70 years ago, transferred to that location from the site of a factory that manufactured luminous dials for watches. Residential housing was subsequently constructed on the original dump site. A few years ago, radon levels in the basements of these homes had been measured as being above the level deemed permissible by EPA.

Excavation of between 5,000 and 10,000 cubic yards had already been done, that soil stored in drums at two sites in New Jersey. The stated intent of the DEP was to move these drums to Vernon, construct a blending plant in which the contaminated soil was to be mixed with local soil to produce a mixture that would then be used to restore the quarry site. If this initial procedure was successful, then an additional 100,000 cubic yards would be similarly disposed of in Vernon Township.

The Township obtained an injunctin against the proposed dumping on June 23rd; however, this was quickly overturned, and a further appeal was made to the New Jersey Supreme Court which ruled against the Township on July 25th. Movement of the present 10,000 cubic yards of radium-contaminated soil is due to begin this year. It is important to consider the consequences of this action apart

from their obvious ecological concern. Property values in the Vernon township have, in light of this recent publicity, fallen drastically. It can be projected that, due to perceived fears on the part of township residents, if the planned disposal occurs many individuals will be induced to leave the township and locate elsewhere. If this comes to pass, the population base required for any competent epidemiological survey would be in all probability irretrievably lost, as would any possibility for effectively resolving the question of whether any connection between microwave exposure and the health problems in Vernon could be established.