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**The Effect of Public Perception on Residential Property Values in Close  
Proximity to Electricity Distribution Equipment:**

A case study in the UK currently in progress.

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**Abstract**

The continuing scientific debate over the potential health risks from living in close proximity to high voltage power lines (HVOTL's) has been of interest to both the property industry and the utilities for several years (The Royal Institution of Chartered Surveyors, 1996; National Grid, 1997). Despite the fact that there is no conclusive proof that electromagnetic fields (EMF's) produced by power lines causes cancer or other adverse health effects, public perception of these risks appears to have a negative effect on the value and desirability of this type of property. With the growth of risk analysis and stigma damage compensation, property professionals are now beginning to realise the importance that public perception can play in the assessment of property worth.

This paper is part of a larger body of work currently in progress to determine the effects of public and professional perceptions on the value of residential property in proximity to electricity distribution equipment. Empirical research is underway, however there is insufficient data to present a meaningful analysis at this time. Therefore this paper presents a literature review of previous studies carried out to determine the effects on property values and public health, and the methodology behind this investigation.

**Keywords**

Public perception, stigma, EMF's, HVOTL's, health, value.

**1. Introduction**

There is a need to accurately evaluate the impact of electricity distribution equipment on residential property values and marketability, due to a growing trend within the UK residential property industry of building homes either directly beneath or in close proximity to high voltage overhead power lines (HVOTLs) and pylons.

It may be that, due to a demand for new property, value effects are not obvious until

these homes come up for resale (Gell),<sup>1</sup> however the type of property often built closest to the lines, *social housing, flats, (shared accommodation) and small low cost housing*, would suggest that developers have already assumed a negative market impact.

Since the 1950's researchers have been studying the value effects of siting residential property in close proximity to electricity distribution equipment. Most studies between the 1950 and the early 1970s found no association between proximity to HVOTLs and value diminution. These negative results may have been due to the nature of the market or the fact that there had not yet been a publicised association between HVOTLs and potential health risks. It may also be due to the relatively unsophisticated methodology used in assessing such impacts. However since the late 70s and the publication of the first study to link living in proximity to HVOTLS and childhood cancer (Wertheimer and Leeper 1979) studies have generally found that the proximity of lines does have an impact on value. Whilst most studies have found that any negative effect was due to visual or to a lesser extent aural pollution, the perception of potential health effects may also influence the market.

Bell states that “... *all the factors that have an influence on a property's desirability and therefore it's value are traced back to the market's perceptions,*” and therefore property desirability and worth will reflect both buyers and sellers “... *needs, tastes, fears, sensitivities, desires and anticipations...*” (Bell 1999). This is particularly apparent when dealing with the valuation and remediation of contaminated land and there is a growing body of literature on risk analysis, stigma damage and loss of value compensation. Research carried out in the past by Kinnard (1967), Slovic (1987), Syms 1996) Gallimore & Jayne (1997-99) has found that public perception of non-physical contamination such as visual, noise and odour pollution can be strong enough to influence value and marketability, especially when there is an association with a potential health risk. Public perception is now recognised as an important factor in the assessment of property worth.

Professionals have found, when dealing with a known contaminant, that a period of remediation will usually mitigate most negative value effects, and any lasting value diminution as a result of stigma damage tends to disappear with time, However the value effects from the perception of potential health risks from living in proximity to unknown contaminants, such as HVOTLs are more difficult to determine and therefore deal with. Media coverage of the reported health effects, most notably childhood leukaemia, associated with exposure to electromagnetic fields (EMF) like those produced by electricity distribution equipment, has helped create the perception that living in proximity to HVOTLs may be a potential health risk. This association, however remote, is worthy of consideration in determining whether or not this type of property suffers from stigma damage.

The literature review will fall into three categories; property based research to explore the value effects; health studies to establish the possible association between living in proximity to electricity distribution equipment and adverse health effects, and ; studies of risk analysis and stigma damage ‘*since stigma is caused by risk perception*’ (Chan 2001).

The main body of research carried out to determine the effects on the property

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<sup>1</sup> Colin Gell is a Chartered Surveyor, based in Nottingham, England, specialising in the negotiation of easements and compensation claims for the loss of utility on property affected by Electricity distribution equipment.

market has come from the US where power lines are generally situated on a 'right of way' ROW, a corridor of land where construction is prohibited. This means that property adjacent to a 'ROW' has the benefit and enjoyment of this extra land. In the UK there is no recommended ROW and property can and is being built directly beneath HVOTLs making comparisons between the US and the UK markets unreliable. Other more recent studies conducted in New Zealand, (Bond, Callanan, Hargreaves) where HVOTLs cross over residential property, are more relevant to the UK market. These studies have had the benefit of a national house price database (New Zealand Val Pac) and have been able to analyse actual transaction prices over a time frame.

There has been little research undertaken in the UK in this area, possibly due to the lack of reliable valuation data. Studies that have been conducted have tended to focus on opinion based surveys (Gallimore & Jayne (1997), Syms (1996), Dent & Sims(1998) and hypothetical valuations (Dent & Sims (1999). These have supported, in theory, the general findings from other countries, namely that the presence of power lines and in particular the pylon, (tower) does have a negative effect on residential property values, although some results have suggested that any value diminution may be the result of over cautious professionals, (valuers and surveyors), rather than a market led response. (Gallimore & Jayne)

**1.1** Therefore due to the lack of published data on the effects of electricity distribution equipment, on the value and marketability of residential property in the UK, this investigation seeks to determine:

- a) Whether this type of residential land and property suffers from value diminution. Valuation evidence will be collected using a case study approach and then analysed to establish whether or not there is a value effect and if so, whether there is a measurable correlation between distance (from the line or pylon) and value, and visual proximity and value. There are some problems with this approach as the UK does not have a national database of actual transaction prices and although this information is often kept by Estate Agents, it is not freely available to the public due to confidentiality laws. Measures to overcome these problems are discussed later on.
- b) Whether any value effect can be attributed to stigma damage caused by the perception of adverse health effects associated with living in proximity to HVOTLs. Opinion based surveys will be used to examine the factors that influence property professionals when making planning, developing and valuation decisions and the factors that influence buyers purchasing decisions. It should be noted that these studies are currently underway and no analysis of data has currently been undertaken.

## **2. Literature Review**

### **2.1 Property studies**

Property studies have been carried out over the last fifty years to assess the impact of overhead power-lines on the value of proximate residential property. Most studies conducted before the early 1970s found no association between proximity to HVOTLs and value diminution, some even suggested that living next to a power line corridor increased property value. These negative results may have been due to the nature of the market or the relatively unsophisticated methodology used in assessing such impacts. It may also have been due to the fact that there had not yet been a publicised association between HVOTLs and potential health risks. However, since

the late 70s property value studies have tended to show that HVOTLs and pylons do have a negative impact on residential property values.

Colwell and Foley (1979) surveyed 164 single-family homes in Decatur, Illinois over an 11-year period up to 1978. Sales analysis showed that substantial differences in value were evident for properties located between 50 and 200 feet from an electric transmission line. In a later study Colwell (1990) found that any negative impact from proximity to HVOTLs diminished both with distance and time, however negative value effects on property in proximity to pylons were less transient. The results Colwell concluded, inferred that time can produce a natural screen to lines more readily than pylons which are, by their nature, more intrusive. This suggests that the cause for value diminution is the visual impact, and perhaps to a lesser extent, aural.

A later study in Canada (Rosiers, 1998) supported this conclusion following a survey of 507 single family house sales. Part of the transmission line corridor passed through a wood and was screened from the property adjacent to it. This property although physically more proximate to the line and pylons, did not suffer from value diminution in the same way as property further away that had a direct view.

Delaney and Timmons (1992) used a combination of matched paired sales analysis and public and professional opinion surveys to assess the effect on value for residential properties. If, as suggested by this study, the value of property is adversely affected then presumably this will also apply to the value of residential land. From the results of the appraisers survey they found that the market value of residential property was, on average, 10.03% lower than comparable properties in the area (the actual range of opinion was from 7.8%-15.5%). The most common reasons cited as the cause of such decline were: visual unattractiveness, health problems, disturbing sound and the perception that they were generally unsafe. They concluded that HVOTLs can have a negative impact on value as demonstrated but, from their survey work, 'appraisers indicated that HVOTLs may affect some residential properties and not others; the effect being a function of the relative price of the property being appraised'. These findings are supported by other studies (Hamilton and Schwann, (1995), Gregory and von Winterfeldt, (1996), differing only in the level of diminution of value or distance from the lines.

In the UK, Electricity Distribution Companies normally site HVOTLs and pylons at least 50m away from residential developments. However, to fulfil the demand for residential property, developers are expanding existing housing estates and new property is being built close to, and in many cases, directly beneath HVOTLs. As stated earlier, the main body of research has come from the US and Canada where lines are sited on a ROW, making comparison with the UK property market unreliable. However comparison can be made with New Zealand studies, where lines can be found crossing directly over residential property, and pylons sit on private land.

Two New Zealand studies arose from a consultation in November 1993 between Transpower New Zealand and the Massey University Real Estate Analysis Unit (MUREAU). Transpower were interested in the effect of high voltage power lines on property values because of the possible compensation that may have to be paid to property owners. The only previously published study had been carried out in Christchurch and Auckland, in 1968, by Valuation New Zealand (VNZ) and concluded that overhead power-lines did not appear to have any effect on the value of property in the 'average locality' but did have a negative effect in the 'superior locality'<sup>2</sup>. The

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<sup>2</sup> Study into the effects of HVOTL's on Property Values in Christchurch and Auckland, New Zealand 1968 by Valuation New Zealand.

results of the 1995 study by Callanan and Hargreaves (June 1995), indicated a negative effect on the value of property which diminishes to almost nothing at around 100m from both the line and the pylons. This had the effect of reducing the value of the property by around 27% at a distance of 10m from the pylon, 13.6% at 20m, 5.4% at 50m diminishing to 2.7% at 100m. For properties directly under the line the effect on value was less than 1%, concluding that the presence of a pylon has a greater impact on the value of property than the power-line itself. One factor that may have affected the results of the survey came to light later on. This related to the strong rumour that either one or both of the transmission lines was shortly to be removed. Shortly after the completion of this study the section of line that runs through the largest area of the Newlands area was, in fact, removed.

A second study by Sandy Bond (1995) was a parallel study of the attitudes and reactions of property owners and professionals. This was conducted in the same residential location and ran concurrently to the Callanan and Hargreaves study. She concluded that "both valuers and real estate agent groups are particularly negative in their reactions towards the saleability of properties situated close to the tower and/or HVOTLs." This will influence their advice to potential customers and the value they place on such properties in the market place. A recent study in the UK (Gallimore & Jayne, 1997) attempted to test how far the perceptions of the valuers were influencing the attitudes of the purchasers. In other words, was the diminution of value due to professional valuation advice borne out of valuer caution to avoid professional negligence claims or was it due to genuine market perceptions? In their conclusion they state that *if valuers' perceptions of this risk exceed the public's, there is the danger that valuers may amplify the fear in formulating their advice*.

The study by Millar and Hargreaves (1994) reported that the transaction price for residential property appeared to depend more on the location with the Newlands area than on proximity to either power lines or pylons.<sup>3</sup> In a similar study in Vancouver, Hamilton and Schwann (1995) examined the effects of proximity to transmission lines on the sale prices of 12,907 single, detached dwellings in four neighbourhoods over a 6 year period. The results showed that moving from a house next to the line, to one 100m away would increase the value by an average of 5.8%. It also noted that removal of the visual unsightliness created by the pylons was found to increase the property value by about the same 5.7% and that completely removing the line increased the value by 6.3%.

Some studies have found no value effects (Kung & Seagle 1992), Kroll and Priestley (1992) found that around half the studies they reviewed and analysed had not found any negative value effects. They were also critical of the poor methodology generally used in valuer type studies and the fact that many case studies used too few properties to produce a meaningful result. Studies that have reported a negative market reaction have generally found that it was not the health and safety issues that influenced the market but other factors such as unsightliness, visual and aural pollution. It was these elements, which proved to be more successful in court action, especially in the US for claims of diminution of market price, increase in marketing time and decrease in sales volume. (see Kinnard and Dickey, 1995).

Surveyors and Estate Agents have found that although property adjacent to HVOTLs sells, the presence of lines removes some buyers from the market, and reduces demand, which reduces price. The sale process can also be lengthened by many months and so the true effect on value can be difficult to assess. Calculating the

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<sup>3</sup> Newlands is of a hilly terrain and has panoramic views of the Hutt valley, downtown Wellington and the harbour.

value of this type of property can also provide a challenge to surveyors who are expected to take into consideration the effects of public perception of health risks on the future value and marketability of such property. (RICS practice statement)

## 2.2 Perceptual Studies

There have been a number of perceptual studies seeking to determine the opinions and attitudes of investors, valuers and the public towards a number of contaminants. In a recent study carried out by Paul Syms, (1996) professionals in the property market were subjected to psychometric testing to assess their perceptions regarding 'contaminated land'. He found that overhead power cables were perceived to be 'low risk', unlike an earlier study by Paul Slovic (1992) that indicated a greater perception of risk in respect of this issue. Shortly after the survey was conducted the issue of overhead power lines, "received considerable exposure in the press," Syms stated that in view of the recent press coverage the same study might "produce a different result" if conducted now.

One of the more recent studies into the, 'Attitudes and Policies of Institutional Investors and Lenders Towards On-Site and Nearby Property Contamination.' by Kinnard and Worzala (1996), showed that institutional investors and lenders were more likely to lend on land, or property, with known contaminants than with alleged contaminants, possibly because the risks were quantifiable. They were also more likely to consider investing in, or lending on properties where the contaminant is 'off-site' although at a premium.

Kung and Seagle's (1992) study of homeowner's opinions found that most people who responded to their attitude survey were not aware of any link between HVOTLs and adverse health effects. When asked whether knowledge of potential health risks would have made any difference to their purchase decision, predictably most said they would either have negotiated a lower price or would have purchased in another location. However this was a very small survey of only 80 households in 2 adjacent neighbourhoods (one proximate to HVOTLs). In a similar attitude survey by Dent and Sims (1999), 360 members of Residents Associations in the West Midlands area of the UK were asked their opinions towards a number of potential contaminants. The questionnaire listed eleven possible contaminants to avoid focussing specifically on power lines as the issue under investigation. There was a 30% response rate. The response to the power line/substation category was as follows:

Classed as a Contaminant	Yes	No	Visual	Noise	Health
High Voltage Overhead Power-lines	87%	13%	48%	8%	72%
High Voltage Under-ground Power-lines	38%	62%	2%	3%	70%
Sub-Stations	73%	27%	38%	8%	73%

Predictably, when asked whether or not they would buy a house in close proximity to HVOTLs, under-ground lines and sub-stations, the majority said no. (88%, 57% and 77% respectively) Removing the HVOTLs from sight, reduced the negative response by around 10%. A similar questionnaire was sent to 200 property Surveyors in the same area with a 24% response rate. Replies indicated that whilst both buyers and surveyors view Electricity distribution equipment as a contaminant, buyers are more concerned about the visual and health aspects. Although the results of this study generally supports those found in other recent studies (Bond 1995, Jayne 2000), both the response rate and the type of methodology used are not rigorous enough to support any meaningful conclusions.

Bond (1995) looked at attitudes towards HVOTLs and found that valuers, estate agents and residents living near the line, "all think of the HVOTLs in negative terms."

Chalmers and Roehr (1993) concluded that value ultimately depends on a number of factors including perception. Arens (1997) found that in the case of residential properties, stigma is a function of uncertainty and that electricity equipment in proximity to residential property can stigmatise property in the same way as a known contaminant would.

### **2.3 Risk Perception and Stigma**

The notion of stigma damage is a relatively new concept within the UK property industry and is usually associated with contaminated land. There are several definitions of stigma, for instance Chalmers & Roehr (1993) define it as *“the reduction in value caused by contamination resulting from the increased risk associated with the contaminated property”*. According to Chan (2001), *“stigma is a loss to property value due to the presence of a risk perception-driven market resistance,”* which not only affects contaminated property, but can also affect the value of properties in close proximity to sources of contamination. Mundy (1992) says that, *“environmental features viewed as repellent, upsetting, or disruptive are stigmatised as undesirable. One such source is technologies such as petroleum processing, nuclear power plants and high voltage power lines.”* Chalmers & Roehr (1993) also identified EMFs from power lines, as one type of stigma that can influence the value of property negatively.

The risks that create stigma can either be real or perceived. Real risk effects can be quantified fairly accurately unlike perceived risk, which is based on many things for instance choice, knowledge, whether it is a personal risk or one which could affect many people, in other words how catastrophic it is. (Mundy, 1992) The level of risk placed on an environmental hazard or contaminant is largely a function of uncertainty, Mundy found that the more information people have about the risks to health, property and their immediate environment, the less of a risk an environmental hazard or contaminant is perceived to be. Control over a hazard or contaminant was found by Slovic (1992) to be one of the more important factors influencing a person's acceptable risk level. Some risks were found to be more acceptable than others because of the potential benefits. (e.g. x-rays).

Stigma often reflects negative news and images and, according to Fischhoff (1985) *‘people tend to ignore evidence that contradicts their current beliefs, and to base their perceptions of relative risk on what they see in the news media’*

Levels of risk also vary according to the different people in the prospective markets, for instance, the business sector might not be as concerned about some contaminants as home buyers and for some individuals a price reduction may be all that is needed to secure a sale, although this may not persuade a lending institution to finance the purchase. (Mundy, 1992) In the UK recently, some lending institutions have been reluctant to lend on property either under, or in close proximity to HVOTLs. This according to some attitude studies (Kinnard & Worzala 1996) may be because unlike most other contaminants where health risks can be quantified and safe public exposure levels set, the potential health risks from exposure to residential EMFs are still unknown. Most research has shown no association between living in close proximity to HVOTLs and adverse health effects, except for a possible increase in the incidence of childhood leukaemia, however some scientists believe that there is cause for concern.

### **2.4 Health Effects**

Since the 1940's research has been carried out to determine the biological effects from exposure to EMFs. Some of these scientific<sup>4</sup> and epidemiological<sup>5</sup> studies have suggested a number of adverse health effects including, headaches, epilepsy, severe depression, suicide, (Baris *et al.*, 1996) Alzheimer disease (Sobel, 1995) and childhood leukaemia (Feytching and Ahlbom, 1993; Linet, 1997). Other research has found no causal relationship between exposure to EMFs and adverse health effects. Gurney *et al.* 1996; Preston *et al.* 1996). Serious concerns about the possible adverse health effects from living in close proximity to high voltage power transmission lines began in 1979 following the Wertheimer and Leeper epidemiological study which reported, "a two to three fold increase in cancer death amongst children living near high current power lines."<sup>6</sup> This report sparked off thousands of scientific studies that 20 years on are still no nearer a conclusion.

Some of the latest research has indicated that EMFs do cause specific changes to humans and animals. Scientists have noticed that exposure promotes memory loss and affects the central nervous system. Magnetic fields may also affect the storage and retrieval of learned information. However these effects tend to be small, transient and reversible once away from the source of exposure.<sup>7</sup> In a Swiss study, children's performance rather than health was found to be impaired significantly even at what was considered to be very low environmental levels of exposure. These findings were backed up by similar studies in Latvia and China.

Until recently no occupational link had been found to suggest that exposure to EMFs caused adverse health effects. However recent studies have shown a correlation between seamstresses and the development of neuro-degenerative diseases such as Alzheimer's, Vascular Dementia and Parkinson's Disease.<sup>8</sup> He suggested that this might be due to a reduction in melatonin production, which is thought to act as a detoxifier. (*EMFs inhibit the body's production of melatonin. Sewing machines produce a high level of EMF close to the body*) Professor Russell Reiter states that the "reduction of melatonin..., by any means, increases a cell's vulnerability to alteration by carcinogenic agents."<sup>9</sup> In addition, the production of calcium, which is now known to play a central role in the development of the immune system, is negatively affected by exposure to EMFs.

A reduction in the level of melatonin is only one of the possible biological explanations for a causal link between EMF exposure and cancer. Evidence is growing to support the theory that EMFs do not necessarily have to cause genetic damage to cause cancer or development abnormalities. "*By influencing signal transduction pathways, which in turn can generate cell proliferation, cell differentiation, and even transformation to a cancer phenotype, EMF can potentially be involved in a host of disease processes without ever penetrating the cell membrane in any significant manner.*"<sup>10</sup>

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<sup>4</sup> Scientific research is done under laboratory conditions and uses either animals or tissue samples to test the biological effects of exposure to EMFs

<sup>5</sup> Epidemiology is the study of the incidence of diseases in the population. For instance the link between smoking and cancer, and exposure to asbestos and lung disease, was discovered and accepted before scientists proved there was biological causal link.

<sup>6</sup> E. Wertheimer and E. Leeper, Electrical Wiring Configurations and Childhood Cancer. Amer. Journal Epidemiol, vol. 109, p273-284. 1979.

<sup>7</sup> Sienkiewicz, Z.J., Haylock, R.G.E. & Saunders, R.D. (1998). Bioelectromagnetics, 19, 79-84.

<sup>8</sup> Professor Eugene Sobel, Southern California Medical School, Los Angeles Neurodegenerative Diseases and EMF Exposure 1998 EMF Meeting Bristol University.

<sup>9</sup> Wilson *et al* (1986) 'The Cherry Report'

<sup>10</sup> Luben R.A. 1993 Effects of Low Energy Electromagnetic Fields Pulsed and DC on Membrane Signal Transduction Processes in Biological Systems. Health Phys ics. 61:15-28

For several years scientists have thought that the development of cancer in humans and animals is a multi-step disease process. In this process, a single cell can develop from an otherwise normal tissue into a malignancy that can eventually destroy the organism. Professor Ross Adey states that many papers give evidence of EMF as a cancer promoter in this multi-step process. Dr Neil Cherry adds that scientific evidence would also suggest that EMF is “both a cancer initiator and a cancer promoter, which also enhances progression of the disease.”

Professor Dennis Henshaw’s (1998) theory would seem to support this. He found that EMFs from power lines attract particles in the air, which could include pesticides, and radon both known carcinogens, which would then be inhaled by anyone in close proximity to lines. Interestingly other research has found that exposure to EMFs limits the effectiveness of Tamoxifen, which is the drug used to inhibit the growth of cancerous cells.<sup>11</sup>

Several epidemiological appraisals of residential / EMF studies have recently been carried out. The 1996 appraisal by Li, Theriault and Lin,<sup>12</sup> conclude that out of 7 epidemiological studies conducted on the risk of cancer among adults, only 3 found a link with leukaemia. In 1997, when Theriault combined children and adults in his analysis, the results show relative risks of 1.3 to 1.8 for residences within 50 metres of high voltage lines and for calculated fields greater than 0.2 micro T.s<sup>13</sup>

Other more recent reviews have produced conflicting results. Coste, Moutet, and Bernard (1996)<sup>14</sup>, for example, reviewed thirteen epidemiological studies and found that eleven showed some association between exposure to residential magnetic fields and childhood cancers. This association seems to relate to the wire code<sup>15</sup> method of estimating exposure levels developed by Wertheimer and Leeper 1979 and improved on by Savitz 1988<sup>16</sup>. Savitz found that this system was surprisingly accurate in determining the magnetic field levels, found in a house, caused by proximate HVOTLs and sub stations. He also suggested that there might be a dose response rate, however epidemiologists are unable to determine why this method consistently shows a correlation between high wire codes and childhood leukaemia and yet actual measurement do not.

At the beginning of 2001 the Government announced the findings from the largest UK childhood leukaemia study conducted to date. The results confirmed those of earlier findings suggesting that living in close proximity to high voltage overhead power lines (HVOTLs) could double the risk of developing childhood leukaemia.<sup>17</sup>

## 2.5 Exposure Guidelines

Many countries have their own national standards or guidelines for exposure to EMFs or have adopted those of the International Commission for Non Ionising Radiological Protection (ICNIRP). Even then some countries still allow some short term public exposures to exceed guidelines. For instance in Germany, people walking under high voltage power lines may be exposed briefly to electric fields in excess of guidelines. The UK’s EMF exposure guidelines have remained the same,

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<sup>11</sup> Harland J.D., Levine G.A., Liburdy R.P. (1998) Electricity and Magnetism in Biology and Medicine

<sup>12</sup> Li, Theriault and Lin Adult Cancers Occupational Environ Med 53(8):505-510,1996

<sup>13</sup> Theriault : Occupational Environ Med 54:625-628,1997

<sup>14</sup> D.Coste, J.P. Moutet, J.L. Bernard Electromagnetic Residential Fields and Childhood Cancer: State of Epidemiological Research Rev Epidemiol Sante Publique 1996 Jan;44(1):80-92

<sup>15</sup> Wire coding is a system of coding electricity distribution wires by their type, configuration and distance from residential property.

<sup>16</sup> Savitz D, Wachtel H, Barnes F, John E, Tvrdik J. 1988 Case Control Study of Childhood Cancer and Exposure to 60Hz Magnetic Fields. American Journal of Epidemiology Vol 128, No, 1 p21-38

<sup>17</sup> UK Childhood Cancer Study Group Headed by Professor Nick Day of the University of Cambridge

(based on the results of the 1996 Finland study by Verkasalo,)<sup>18</sup> following the results of several major epidemiological studies. These recent studies have so far concluded that it is unlikely that residential exposure to EMF from power-lines and other transmission equipment would cause cancer within the recommended exposure guidelines. However over the last few years some existing lines have been upgraded to cope with the increasing demand for electricity. In a draft document intended for circulation to local Planning Departments around the UK the World Health Organisation has stated that exposure levels directly beneath the centre span of a 400kV overhead power line would under certain conditions exceed the ICNIRP 5kV/m public exposure guidelines. Although the electric field would be screened, to some degree by the building, the magnetic field would still be the same.

Many countries are now recommending that new double circuit lines should be arranged in a special configuration to allow some cancelling of the magnetic fields, in order to reduce the overall field strengths in the vicinity of overhead power lines. This was recommended following an EMF Assessment & Site Impact Report for the Orange Rockland Utilities Proposed Distribution Substation in May 1997 carried out by VitaTech Engineering, Inc.<sup>19</sup> The proposed distribution substation was to be located adjacent to two existing 138kV transmission lines and two inactive (disconnected) transmission lines. VitaTech's job was to assess the increase in EMFs from the proposed substation and the effect on the environment including property value. They found that the substation would only produce a slight increase in magnetic field strengths compared to the existing transmission line emissions and recommended that the active transmission lines be 'reverse phased' to significantly reduce the magnetic field emissions to recommended limits. They also recommended that no homes should be built within 100ft of the substation fence line and that an earthen wall of 8-10ft high be erected to both screen and reduce the electric field and noise levels. Following research on the effects on property value of proximity to transmission lines and substations in the Washington DC metropolitan area, VitaTech found that:

Within 100ft property is devalued by 25-30%.

Within 200ft property is devalued by 15-20%

Within 300ft property is devalued by 5-10%.

They concluded that "homeowners near the proposed substation would probably already suffer a 20-30% property devaluation due to the proximity to transmission lines and that the proposed substation would only increase the devaluation by a small amount because the transmission lines are more visible and imposing."

## 2.6 Legal Aspects

Although claims against the electricity industry have increased over the last few years, 'most have no substance as they are based upon the unsubstantiated claim that there is a health risk.' (Ryan, 1994. *Regina v Secretary of State for Trade and Industry, ex parte Duddridge and others* [6<sup>th</sup> October 1995] Leigh Day and Co., 1996. Scottish Power, 1997.) Other more tangible effects on amenity are often ignored, such as visual and aural pollution, birds using the lines as trees and development restrictions. (*Newhall Consortium –v- West Midlands Electricity* [1999])

American courts will compensate property owners for a diminution of value due to

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<sup>18</sup> Pia Verkassalo, Eero Pukkala, Jaakko Kaprio, et. al. Magnetic fields of high power lines and risk of cancer in Finnish adults: nationwide cohort study. British Medical Journal 313 (26-Oct 1996):1047-51

<sup>19</sup> Orange and Rockland Utilities Proposed Distribution Substation-Electromagnetic Field Assessment & Site Impact Report May 6<sup>th</sup> 1997 Written for the Town Clerk of Stony Point, New York by Louis Vitale Jr. VitaTech Engineering Inc

public perception of potential health risks, (*Florida Power & Light Co.-v- Jennings. [1987].*) (*SDG&E Co. -v-Daley. [1988]*) In a later case (*Criscula -v- Power Authority of the State of New York. [1993]*) New York State Court of Appeals confirmed that stigma was powerful enough to reduce property values and limited the responsibility of the property owner, when seeking compensation, to prove that the presence of a power line posed a health risk. However, they did require that the claimant establish 'some prevalent perception' that the power lines were the reason for the reduction in value. This ruling was explained in *Komis v City of Santa Fe* when the court ruled that '*whether danger is a scientifically genuine or verifiable fact should be irrelevant to the central issue of its market value impacts.*' Citing several prior cases the court said that, '*there should be no requirement that the claimant... must establish the reasonableness of a fear or perception of danger.*' Gregory and Winterfeldt suggest that "it is this ruling which opens the door to the social rather than scientific process for establishing compensation awards related to the siting and operation of transmission lines, this includes stigma." Fischhoff, (1985) suggests that this ruling is the cause for an "increase in the level of concern" among the utilities regarding the public perception of possible EMF related health risks.

However, courts in the UK do not consider, the public perception of potential health risks a valid reason to award any such claim, subsequently compensation for loss of value will only be paid to owners of property touched or crossed by electricity distribution equipment. This is in the form of a wayleave payment (*Electricity Act 1989 Schedule 4*) and makes no provision for the effect of stigma on value.

Recently planning permission has been refused on the grounds of public fears about health risks most notably in *Newport Borough Council -v- Secretary of State for Wales and Browning & Ferris Environmental Services [1998]*. A 1999 planning appeal decision '*confirmed that the public perception of harm can be a material planning consideration*' (Chartered Surveyor Monthly 1999). In January 2001 *two landmark decisions by the Planning Inspectorate have endorsed decisions by planning authorities to refuse phone masts on the grounds of public fears about health hazards.*' (Planning 2001) Despite the lack of any scientific justification for this fear, the recent planning authority decisions would suggest that public fears of potential health risks is a material planning condition.

### **3.0 Background to the Current Study**

The value effect of public perception of health risks is difficult to quantify. According to some studies, the public's 'perception' that Electricity transmission equipment, and other sources of EMF (e.g. *radio/TV transmission masts, mobile phone base stations*) might cause adverse health effects, can reduce property values (*Bond 1995, Kinnard 1995, Colwell 1990*), The effects of natural disasters, such as earthquakes, flood, hurricanes, etc., and man-made risks, such as land contamination, and environmental pollution, have been studied extensively (*MacDonald et al 1987, Talbot 1992, Colwell 1990, Murdock et al 1993, Montz 1992 and others*) and the risks to health, land and property are generally quantifiable. This has given property surveyors factual information to form the basis of a valuation on land or property in proximity to such a location. However, risk analysis becomes considerably more difficult when the market reacts to fears and perceived risks, which are usually fuelled by the media, and supported by enough feasible evidence, although nothing conclusive, to have an effect on the value of residential land and property.

Research carried out by Chalmers and Roehr (1993) suggests that it is not the actual contamination but the perception of the contamination by the market that is important. Kinnard 1967, Slovic 1987, Syms 1996, and Gallimore & Jayne 1997-99

have all found that public perception of non-physical contaminants such as visual, and aural pollution can be strong enough to influence the value and marketability of property, especially when there is an association with a potential health risk. One way to assess the effect of perception of an environmental hazard or contaminant is to conduct an attitude study, although there is no guarantee that buyer will react in the same way to a real situation as a hypothetical one.

Bond (2001) suggests the use of conjoint analysis (a survey-based approach) in the determination of stigma damage. This approach realises that the markets opinions and attitudes towards contamination issues will be reflected in the price they are willing to pay for affected property. Conjoint analysis basically breaks down the various attributes of a good or service, (in this case land and property and can *'if price is included as an attribute'* place a value on it. Chan criticises the use of survey-based approaches due to the time scale involved in collecting and analysing the data. However, it is possible that once data has been collected on the various residential property attributes and the way they contribute to the price a buyer is willing to pay, then value adjustments should become a more logical and accurate process than the current *'intuition and guesstimation'* found by Chan (2001) to be the way that appraisers generally find the stigma adjustment factor when valuing contaminated land or property.

Stigma is one of the problems faced by valuers in the UK who are expected to take into account the effect of the public perception of potential health risks associated with living in proximity to HVOTLs when valuing residential property close to lines and towers.<sup>20</sup> Without a methodology or benchmark for valuing this type of property or awarding loss of value compensation, (other than wayleave compensation), all decisions seem to rely on the judgement and therefore the perceptions and opinions of the individual professionals involved. Therefore, if there is a negative relationship between proximity to electricity distribution equipment and residential property values, it is vital that a simple, but effective methodology be found to measure this effect.

### **3.1 Aims of the Research**

The aim of this research is to;

- determine the factors that influence the value and marketability of property in close proximity to electricity distribution equipment.
- examine the relationship between public and professional perceptions of potential health risks and the desirability and value of residential property.
- determine whether there is a measurable correlation between distance (from distribution equipment) and value, and visual proximity and value.
- to establish a benchmark / methodology to measure the effect on the value of residential property, if it is found to be negatively effected by proximity to electricity distribution equipment.

### **4.0 Methodology**

In the UK very little research has been carried out to determine the actual impact on residential possibly due to the lack of available historical data; however a

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<sup>20</sup> RICS guidelines Red Book practice statement GN3.7: 1996 amended in 1997. A mandatory requirement for values to advise clients on the existence of and implications for future value and marketability of HVOTLs and Sub-stations in close proximity to property.

hypothetical residential property valuation carried out by Dent & Sims<sup>21</sup> (1998 & 1999) found that the presence of an overhead power line generally reduced value by between 5% - 11% and a pylon could reduce value by as much as 50%.

The first and possibly most important part of this study is to establish whether or not there is an effect on residential property value. To determine this, 4 locations were initially selected for a case study, where property prices near and not near HVOTLs and pylons could be compared. Local Estate Agents agreed to send details of property as it came on the market, however this soon proved problematic and after around four months of data collection, some areas produced few sales and in others information became sporadic. Agents were also unwilling to divulge the actual transaction price despite assurances of confidentiality, which meant that the data only gave the surveyors opinion of value and not the markets. Clearly a new approach was needed. Past experience has shown that any location for a valuation case study would need to be closely monitored thus placing a restriction on distance. In addition it was vital to find some way of checking the reliability of the data in the study areas. The proposed methodology will still use a combination of valuation case studies, and attitudinal surveys.

#### **4.1 Valuation case study:**

Data is currently being collected from 3 locations in the Midlands (Central England). The first location is essentially two estates totalling approx 2000 properties, situated on 64 hectares of land separated by a main road, in a suburb known as Sutton Coldfield to the north east of Birmingham. A 132kV double circuit HVOTL runs through the east side of both estates. One side of the road (Site A) is a low to medium cost housing estate with some social housing and sheltered accommodation for old people on the west side, (*built in the 1980s*) with medium cost single family homes to the east (*situated under and closest to the line*) built, in stages, during the last 10 years. The HVOTL passes directly over some property, and pylons are sited as close as 3 metres to the brickwork. On the other side of the road, (Site B) the estate is on a gradual incline and the HVOTL can only be seen from part of the estate. Housing tends to be middle priced single-family dwellings with some social housing built closest to the line and some higher priced homes adjacent to a small wood. Part of the estate has views of a nature reserve and most importantly there is nothing other than the presence of the HVOTL that would obviously detract from the value and marketability of property.

The second location is St Peters a medium cost single family dwelling estate of 179.1 hectares to the south of Worcester town centre. A 132kV line runs through the southern part of the estate crossing over property in the south-east and is only visible from part of the estate. There is also a large sub-station close to the main road although it is fairly well screened, in the S.E. sector. The estate has evolved over the last 20 years, and property under the line has been built since 1996. Once again there are no other obvious factors to detract from property value and marketability other than the HVOTL and the sub-station.

The third location is Monkspath a medium priced single family dwelling suburb close to Solihull, in the West Midlands. A 132kV single circuit line runs through part of the estate and, is rumoured to be removed shortly. The Network Department of the

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<sup>21</sup> To establish the potential effect on value (as there is no national or regional data base of house sales to analyse actual sales figures) surveys were carried out which consisted of a hypothetical valuation sent out to 120 estate agents in the West Midlands area. Surveyors and agents were asked to re-value a 4 bedroom house on an estate valued at £97,000 with the inclusion of a substation, an overhead power line, a pylon and an underground power line. Dent and Sims 1998, 1999.

Electricity Utility has stated that there are no immediate plans to remove the line although they are currently dealing with several complaints from local residents. However the line is old having been installed in the 30's and is likely to be replaced in the foreseeable future. With new technology enabling a 132kV line to be sited underground in much the same way as cable for TV, it is feasible that this line will be under-grounded. For this reason, property closest to the line is being monitored to determine any changes should the line be removed. However this may not happen in time to be included in the final write up of this research. There is also the obvious problem that market changes may already be taking place if Estate Agents are misinforming buyers that the line is due for removal.

Property will be indexed using the same criteria as the Nationwide and Halifax house price index (*number of rooms, bedrooms, bathrooms, garage, etc*) and plotted onto large-scale maps for analysis. As mentioned earlier, due to the problems obtaining actual transaction prices, data from these study areas only represents the valuers opinion of the market price and therefore needs to be compared with actual transaction prices from similar residential estates. The Scottish property register keeps records of transaction prices on all property sold in Scotland and this is available for analysis. Transaction prices from similar estates in Scotland for the last 5 years will be compared with data from the case study locations to determine whether the actual value effects are comparable to those predicted by the valuer. Estate agents from around the UK will be randomly selected and interviewed to test the homogeneity of the data.

#### **4.2 Perception Studies:**

To test public and professional perceptions towards HVOTLs, pylons and other sources of EMFs a perceptual study will be conducted to establish attitudes, opinions and determine whether public and professional views are similar. Buyers, surveyors and valuers will be randomly selected to test general attitudes. Homeowners living in proximity to HVOTLs and sub-stations will be interviewed. Policies and opinions will be sought from lending institutions, development companies, the Electricity Utilities, local planning authorities and action groups. This will be implemented using a standardised questionnaire, which will be developed following the literature review. A telephone survey will be conducted with participants randomly selected from each sample group followed by in depth interviews with willing participants.

Finally it has been suggested that attitude surveys do not necessarily predict actual behaviour in the market place therefore to test the robustness of the response to the attitude surveys a negotiation experiment will be conducted using data from a new estate in Aylesbury Buckinghamshire. The methodology used by Black & Diaz (1996), Gallimore (2001), and Harvard (2001) in their market participant behaviour experiments will be adopted to determine whether the market is likely to react in the same way as attitude studies would suggest.

#### **5.0 Conclusions**

The results of this study should be reached by Oct 2003

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