

**INVESTIGATION OF CANCER INCIDENCE**  
**in the vicinity of**  
**CRANLOME TELECOMMUNICATIONS MAST**

**by**

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**Report Prepared for Dungannon  
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# **CONFIDENTIAL**

## ***Investigation of Cancer Incidence in the vicinity of Cranlome Telecommunications Mast***

This is a report from the Northern Ireland Cancer Registry (NICR), in response to a request from Dungannon & South Tyrone Borough Council, to investigate an alleged cancer cluster in the Cranlome area of Ballygawley, County Tyrone.

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## 1. Background to Request

In 1989, a 150 foot-high telecommunications mast was erected in the Upper Cranlome Road area of Ballygawley, County Tyrone, as part of a radiocommunications network for Northern Ireland Electricity engineers. Since then, the mast has hosted some thirty-five transmitters for operators including the Water Service and the Northern Ireland Ambulance Service, as well as several mobile phone companies. In December 2002, the structure was felled. The story was covered extensively by Northern Ireland media, making the front page of the Belfast Telegraph in late December, with reports appearing in many newspapers including the Daily Telegraph and the Newsletter, as well as in several local television broadcasts. People living near the telecommunications mast were reported (Belfast Telegraph 17/12/02, See Appendix 1) to believe it to be responsible for an alleged cluster of cancer cases in the area.



Cranlome Telecommunications Mast: felled in December 2002

The felling of this mast came after two similar incidents in England in the preceding months, the first of which took place in Wilshaw, West Midlands on 5<sup>th</sup> November and the second which occurred one month later, in nearby Worcestershire. In Northern Ireland, a second mast was felled on Saturday 18<sup>th</sup> January, on the Ballyrea Road, Ballygawley, not far from Cranlome (See Appendix 1).

On Tuesday 11<sup>th</sup> February 2003, in a letter to the NICR, Dungannon and South Tyrone Borough Council requested that “the possibility of a study in respect of Cranlome” be considered (see Appendix 2). The issue was discussed at length, at a statutory meeting of Dungannon & South Tyrone Borough council, on Tuesday 18<sup>th</sup> March, 2003. At that meeting (attended by Dr Telford, Director of Public Health for SHSSB and Dr Gavin, Director of the NICR), the NICR agreed to conduct a full investigation into cancer incidence in the vicinity of the Cranlome telecommunications mast.

## 2. Defining Clusters of a disease

A cluster is the occurrence of a greater than expected number of cases of a particular disease within a group of people, a geographic area, or a period of time. Clusters frequently occur by chance.

A suspected cancer cluster is more likely to be a true cluster if it involves:

- i. a specific geographical area
- ii. a large number of cases of one type of cancer, rather than several different types
- iii. a rare type of cancer, rather than common types
- iv. a number of a certain type of cancer cases in age-groups not usually affected by that type of cancer

NOTE: The occurrence of several types of cancer in a group of people or a geographic area generally does not constitute a cancer cluster.

The next step in establishing whether there is likely to be a true cluster of clinical importance is to compare observed cases with what would be expected and then apply statistical significance tests. However, even if the observed number of cases is found to be statistically significantly greater than the expected number, this does not necessarily mean that there is either a true cluster or that it is of clinical significance. For example, if a statistical level of significance of  $p < 0.05$  is used, then, by chance, one in every twenty tests will give a significant result.

It should also be established that the suspected exposure has the potential to cause the reported cancer, based on what is known about the likely causes of the cancer and what is known about the carcinogenic potential of the exposure.

### **3. Reasons why clusters may be suspected**

Vigilant individuals will often be concerned that a population has a higher rate of cancer than they would expect. Part of this suspicion may reflect the increasing frequency with which cancer is diagnosed in our population. This increase has several causes.

- Firstly, as we live longer, we are more likely to develop diseases of old age, including cancer.
- Secondly, some competing causes of deaths such as infection have been controlled.
- Thirdly, technological advances have improved the accuracy of diagnosis and so we are better at diagnosing cancer when it occurs.
- Also, there is more openness regarding cancer in society today – people are more likely to discuss their cancer and so there is an increased awareness of cancer cases in the community.
- Lastly, lifestyle changes including the use of tobacco, increased exposure to ultraviolet radiation in sunshine, and a high fat, low fruit/vegetable diet, combined with increased alcohol consumption and reduced levels of exercise have all increased our risk of developing cancer.

#### 4. Steps in Cluster Investigation

The NICR follows procedures for cluster investigation as outlined by the Ontario Cancer Treatment and Research Foundation (King et al, 1993). The fundamental steps involved in a cluster investigation are as follows;

- i. Validate reported cases.
- ii. Check for additional cases (unreported cases).
- iii. Check literature to identify what is known already on the alleged cancer source.
- iv. Analysis.

At the time of this work the NICR held cancer incidence data for Northern Ireland from 1993-2001 and mortality data for the period up to 2002. Additionally, pathology data, with a reporting delay of only one month, is held at NICR for 80-90% cancers.

#### 5. Study Aim

**The aim of this study is to exploit all available data, to investigate the burden of cancer in the region of the Cranlome Telecommunications Mast, with a view to determining whether or not cancer incidence and mortality in the area are higher than the Northern Ireland average.**

#### 6. Study Method

##### *Ascertainment of Alleged Cases*

One of the primary objectives of this investigation was to concentrate on achieving clear concepts of 'disease', 'area' and 'time'. To enable us to do this, we requested, from those alleging the cluster, accurate information, including personal identifiable data (name, sex, age, date of diagnosis, site of cancer, date of death (where applicable) and postcode) on all alleged cases of cancer reported in the area of interest.

We were subsequently provided with the details of a contact in Ballygawley (Ms X), who was reported to have details of the eleven alleged cancer cases diagnosed in the area of the mast. Ms X was able to provide us with the personal details of two alleged cases (Case(1), diagnosed in 2002 with XXXX cancer and Case(2), diagnosed in 2002 with XXXX cancer). Both cases were substantiated using data from the NICR database. Ms X was, at that time, unable to furnish us with the details of the remaining cases. Instead, Ms X offered us the telephone number of a neighbour, Ms Y, who she thought might have, or be interested in helping to retrieve, further information for this investigation. When we established contact with Ms Y, we were supplied with the details surrounding a third alleged case (Case(3)) who we now know had been reported incorrectly as having been diagnosed with cancer, in an article which appeared in the Newsletter in January 2003. Case(3) had instead been diagnosed with a non-malignant, auto-immune disease, and was undergoing treatment with chemotherapy. Ms Y was unable to shed light on any of the remaining eight cases.

We then contacted Father James Crowley, Parish Priest covering Cranlome area, who had been quoted in the afore-mentioned Newsletter article (January, 2003). Father Crowley was able to supply us with enough information to ascertain three further cases: Case(4), diagnosed

with XXXX cancer in 2002; Case(5), diagnosed with a XXXX tumour in 2001 (checks of NICR data indicated this was non-malignant in nature and therefore not an invasive cancer) and Case(6), diagnosed with a non-malignant condition in 2002. Father Crowley was aware of only three other alleged cancer cases in the area but was unable to supply us with any further information.

At this stage of the investigation, two of the alleged cases had been confirmed as not being cancer and a third as not being an invasive cancer. Despite our best efforts, we were unable to ascertain the existence of the remaining five alleged cases from the community.

*(XXXX Data removed to protect confidentiality)*

### ***Ascertainment of Unreported Cases***

In order to identify any unreported cases occurring in the immediate vicinity of the Mast, we used the NICR database and enlisted the help of experts in Geographical Information Systems (GIS) from Ordnance Survey Northern Ireland (OSNI).

The OSNI Large Scale database consists of 1:1250 and 1:2500 scale vector mappings, a derived 1:10,000 scale Raster product, a COMPAS address database and a vegetation associated database. This database forms the basis on which spatial information in Northern Ireland is held, or is related to, either directly through a coordinated position on the Irish Grid, or indirectly through an address or administration area.

Upon our request, GIS experts at OSNI located the exact co-ordinates of the Cranlome mast on the Irish Grid. Concentric circles, of radius 1km, 2km, 3km, 4km and 5km respectively were drawn around the mast and the COMPAS address database was used to highlight and list all addresses occurring within each of these ranges.

Upon receipt of the OSNI data, various NICR matching routines were employed to match addresses in the area of the mast with addresses of cancer registrations on the NICR database. This exercise highlighted seventeen further cases with addresses within 5km of the Cranlome telecommunications mast and diagnosed in 2001/2002. As we had no information on the five remaining alleged cases, we were unable to confirm whether or not these were included within the seventeen, but we presumed they were. The seventeen additional cases were diagnosed as follows: 2 rectum, 2 breast, 2 colon, 1 bladder, 1 ovary, 1 lymphoma, 2 leukaemia and 6 non-melanoma skin cancers.

### ***Geographical areas studied***

Cranlome is located in Ballygawley electoral ward, (population 2296, Northern Ireland Census 2001) which in turn is located in Dungannon District Council (Population 47,849, Northern Ireland Census 2001)

Census Output Areas (OA) for Northern Ireland have been created by the Census Office, based on the results of the 2001 census. The OA is the smallest geographical area for which age- and sex-specific population counts are available. There are 5022 of these OAs, with an average of 125 households in each.

Ballygawley electoral ward is made up of six OAs. OSNI co-ordinate geometry was used to decide which of these six output areas best incorporated the land immediately surrounding the Cranlome telecommunications mast. Output areas 4 and 5 (with a combined population of

684), encompass the Townlands of Cranlome and Ballynahaye and, for the purposes of this investigation, will be referred to as Cranlome.

*Definition of smaller, non-administrative areas*

Population estimates at smaller area level than OA are not available from the Census Office. However, we felt it would be useful to investigate cancer incidence in the non-administrative area adjacent to the mast, using OSNI to locate and define this area. Population numbers and therefore denominators for these areas (falling within concentric circles of radius 1, 2, 3, 4 and 5km from the mast) were obtained from Central Services Agency (CSA), who matched a composite of address variables extracted from the OSNI database with their own system. It should be noted, however, that due to missing values in one particular field supplied by OSNI, CSA were not able to uniquely match all addresses, so population estimates were not made available for approximately 12.8% of addresses falling within a 5km radius of the mast.

Therefore the areas studied for analysis were:-

1. Dungannon District Council Area
2. Ballygawley Electoral Ward
3. Cranlome (including Townlands of Cranlome and Ballnahaye)
4. Areas representing concentric circles of radius 1, 2, 3, 4 and 5km from the mast site.

***Phone Masts and Health – What is Known***

The most comprehensive review of the health effects associated with mobile phone communications is the Stewart Report, which is summarized in Appendix 3. This review did not demonstrate any clear health effects caused by the use of mobile phones or being in proximity to base stations. More recently (January 2004), similar findings were also reported by an independent advisory group on non-ionizing radiation, who reviewed all the evidence to date and published the report ‘Health Effects from Radiofrequency Electromagnetic Fields’. (summary in Appendix 4, full report available at [www.nrpb.org](http://www.nrpb.org))

***Analysis***

In general, the statistical approach to cluster investigation is primarily to use data from basic geographical areas to ascertain whether a local excess has occurred.

In order to determine whether cancer incidence rates in Cranlome/Ballygawley/ Dungannon are unusually high, we started by comparing numbers of cancers diagnosed in each of these pre-defined areas with those diagnosed in the wider Northern Ireland population. Additionally, because of the rural nature of the Cranlome area, we felt it was appropriate to compare cancer incidence rates in Cranlome/Ballygawley with those occurring in the population of Dungannon district council.

Comparison of simple crude rates can frequently give a false picture because of differences in the age structure of the populations to be compared. Since cancer is more common in older age groups, if one population is on average older than the other, then more cases of cancer would occur in the older population than in the younger. So we must have some way of taking account of differences in age structure of the region of interest relative to that of the comparison area (Northern Ireland/Dungannon). This is achieved using the Standardized Incidence Ratio (SIR). In this case, the SIR looks at the observed number of cases in a given

area of interest and compares these with what would be expected in the wider Northern Ireland/Dungannon population.

Similarly, the Standardized Mortality Ratio (SMR) looks at the number of deaths in a given area of interest and compares these with what would be expected in the reference population (in this case, Northern Ireland/Dungannon).

An SIR (SMR) of 100 indicates that observed = expected. A ratio of greater than 100 indicates that the observed number is higher than expected. In general, values of the SIR (SMR) above or below 100 indicate respectively an excess or deficit over what would be expected if the area of interest experienced the same level of incidence (mortality) as the comparison area. The confidence intervals presented here with each SIR (SMR) provide measures of whether the incidence (mortality) ratio is statistically significant. The 95% confidence interval gives the range within which it is 95% certain that the value of each SIR (SMR) lies. If this interval includes the value 100, then the result is not significant. N.B. Small numbers of cases or deaths produce wide confidence intervals.

Analyses were conducted initially at district council level and then at electoral ward level, with further analysis focusing on the so-called “Output Areas” encompassing the Cranlome Mast. Further investigations were then carried out on the smaller, non-administrative areas representing concentric circles of radius 1, 2, 3, 4 and 5km from the mast. For this final part of the analysis, the calculation of expected cancers was based on known cancer rates in the Dungannon district council area, whilst its statistical evaluation was based on the calculated probability of there being at least as many cases observed in each small area of interest.

### ***Cancers Monitored***

The cancers picked for analysis were;

- (1) all cancers
- (2) all cancers excluding NMS\*
- (3) the top 3 cancers for males; lung, prostate, and colorectal cancer
- (4) the top 3 cancers for females; breast, lung and colorectal cancer, and
- (5) cancers allegedly linked with electromagnetic radiation (brain (Hardell et al, 2001), leukaemia (Lagorio et al, 1997), lymphoma and haematopoietic cancer (Szmigielski et al, 2001)).

\*Non-melanoma skins (NMS) account for around a quarter of all cancers diagnosed here each year. These cancers are readily treatable and rarely cause death (average deaths: 12 per year). Many cancer registries do not collect data on NMS and it reasonable therefore, for purposes of analysis, to consider all cases excluding NMS. This permits the burden of more serious cancers to be assessed more meaningfully.



## 7. Results

### 1. CASE IDENTIFICATION

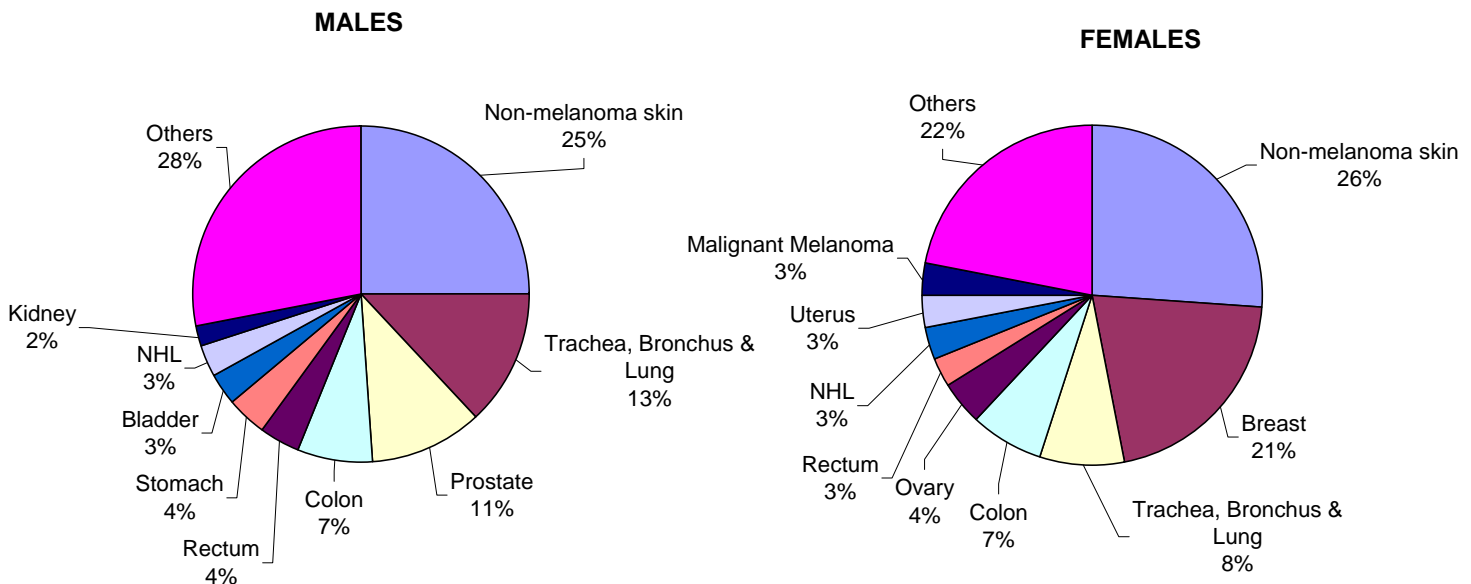
Of the eleven alleged cases, two out of six which could be verified, were not cancer and one was a non-malignant tumour. In addition to the three confirmed cancer cases, details of an additional seventeen cancer patients living within 5km of the Cranlome mast were held by the NICR. The types of cancer were as follows:

- 6 non melanoma skin cancers,
- 3 breast cancers,
- 3 colon,
- 2 rectum,
- 2 leukaemia's (in older people),
- 1 lymphoma,
- 1 bladder,
- 1 ovary,
- 1 lung

#### **Comment**

This pattern of cancers represents that which would be expected in the general population and not that of a cluster. On average, 8,500 people are diagnosed annually with cancer in Northern Ireland. Approximately one quarter of these cases are non-melanoma skin cancers which, if detected early, can be successfully treated and rarely cause death. Excluding these skin cancer cases, this means that over 6,000 serious cancers are diagnosed here each year, including over 850 lung cancers, around 900 breast cancers, over 200 bladder cancers and approximately 900 colorectal cancers.

#### **Most Commonly Diagnosed Cancers (%) in Northern Ireland by Site and Sex (1993-2001) for All Ages**



In many cluster investigations, initial conclusions such as these are sufficient to halt the study, as they do not warrant further investigation. Nevertheless we proceeded to a comparison of rates between various geographical areas which included the Cranlome area.

## 2. INCIDENCE

### **Comparison of Cancer Incidence Rates in Dungannon District Council with N. Ireland; Ballygawley compared with (a) N. Ireland and (b) Dungannon District Council Area and Cranlome compared with Dungannon District Council Area.**

The NICR's most recent data for 2001 incident cases has been used, where appropriate, to update previous analyses carried out earlier this year and presented to Dungannon & South Tyrone Borough Council.

#### *A. Analyses at administrative area level (1993-2001)*

The following analyses compare observed versus expected incidence rates, giving a Standardized Incidence Ratio (SIR), with associated 95% confidence limits. Significant results are indicated in the tables and text. In the table 'lower' indicates that levels are lower than expected, 'no difference' indicates that levels are within the expected range and 'higher' indicates that levels are higher than expected. 'N/A' indicates that the SIR is not available, as numbers were too small.

N.B. Incident cases for males and females have been combined and analysed together where numbers are small, i.e. for analysis at Ballygawley electoral ward level and in the Cranlome area.

Table 1: All Age Standardised Incidence Ratios (SIRs), by site (1993-2001)

	Dungannon compared to NI		Ballygawley compared to N. Ireland <sup>1</sup>	Ballygawley compared to Dungannon <sup>1</sup>	Cranlome compared to N. Ireland <sup>1</sup>	Cranlome compared to Dungannon <sup>1</sup>
	Column A	Column B	Column C	Column D	Column E	Column F
	males	females	persons	persons	persons	persons
All cancers	lower 94 (88-99)	no difference 100 (94-106)	lower 77 (60-93)	lower 80 (62-97)	no difference 93 (61-126)	no difference 96 (63-130)
All cancers exc. NMS <sup>2</sup>	lower 90 (83-97)	no difference 99 (92-106)	lower 76 (57-96)	no difference 81 (61-102)	no difference 94 (57-132)	no difference 101 (60-141)
Lung	lower 84 (69-99)	lower 54 (38-70)	N/A	N/A	N/A	N/A
Breast	n/a	no difference 104 (90-118)	N/A	N/A	N/A	N/A
Colorectal	lower 78 (62-94)	no difference 120 (99-141)	N/A	N/A	N/A	N/A
Prostate	no difference 88 (71-105)	n/a	N/A	N/A	N/A	N/A
Brain, lymphomas & leukaemias	no difference 101 (79-124)	no difference 99 (74-124)	N/A	N/A	N/A	N/A

<sup>1</sup> Due to restrictions placed upon the analysis by small numbers of cases, these investigations were carried out on both sexes combined, for all cancer sites and for all cancer sites excluding non-melanoma skin cancers.

<sup>2</sup> Non-melanoma skins (NMS) account for around a quarter of all cancers diagnosed here each year. These cancers are readily treatable and rarely cause death (average deaths: 12 per year). Many cancer registries do not collect data on NMS and it reasonable therefore, for purposes of analysis, to consider all cases excluding NMS. This permits the burden of more serious cancers to be assessed more meaningfully.

## Comments

### *Cancer Incidence in Dungannon compared with NI (1993-2001)*

- For men, incidence of lung cancer, colorectal cancers and all cancers combined were significantly lower in the area of Dungannon district council than for Northern Ireland as a whole. The same was true for cancer of all sites excluding non-melanoma skins. No significant difference was found between numbers of prostate cancer cases diagnosed in Dungannon and Northern Ireland as a whole. This was also the case for lymphatic and haematopoietic cancers and brain cancer (See Column A Table 1).
- For women, no significant difference was found between numbers of cases of breast and colorectal cancers diagnosed in Dungannon and Northern Ireland as a whole. The same was true for lymphatic and haematopoietic cancers and brain cancer, all cancers excluding non-melanoma skins and all cancers combined. Incidence of lung cancer in females in Dungannon was significantly lower than expected (See Column B Table 1).
- The types of cancers diagnosed in Dungannon district council area were in accordance with what one might expect to be diagnosed in the general population, e.g. lung, colorectal, breast, prostate, stomach, etc.

### *Trends in Incidence*

Closer inspection of age-standardized incidence rates for the Dungannon district council area (1993-2001) revealed no significant trend (upwards or downwards) in incidence of all cancers excluding non-melanoma skin cancers in men or women.

### *Cancer Incidence in Ballygawley electoral ward compared with NI and Dungannon district council*

Incidence rates for all cancers in Ballygawley electoral ward (1993-2001) were significantly lower than expected when compared with the Northern Ireland (Column C Table 1) and Dungannon district council populations (Column D Table 1). Incidence rates for all cancers excluding NMS in Ballygawley electoral ward (1993-2001) were also significantly lower than expected in the Northern Ireland population as a whole (Column C Table 1) and not significantly different from those expected among the population of Dungannon district council (Column D Table 1).

### *Cancer Incidence in the Cranlome area (OA4+OA5) compared with NI and Dungannon district council*

Incidence rates for all cancers in the Cranlome area (1993-2001) were not significantly different from those in Northern Ireland, (Column E Table 1) nor were they significantly different from those expected among the population of Dungannon district council (Column F Table 1). The same was true for all cancers excluding NMS.

### ***B. Further Investigation of cancer incidence at non-administrative area level***

The purpose of this analysis was to look specifically at cancers diagnosed in close proximity to the mast, within the period of interest (2001-2002). NOTE expected incidence rates for 2002 (in this case using Dungannon district council as the reference population) were calculated using cancer incidence data pertaining to 2001, since 2002 incidence data by small area of NI was not available at the time of this study.

Table 2: Number of cancer cases diagnosed at various distances from the mast (2001 & 2002)

<b>Distance from mast (km)</b>	<b>No. cancer cases (2001)</b>	<b>No. cancer cases (2002)</b>
0-1	0	0
1-2	0	3
2-3	2	1
3-4	0	5
4-5	3	6

Investigation into incidence of all cancers excluding non-melanoma skin cancer (2001-2002) and separately for all cancers including non-melanoma skin cancer, in the areas encompassing up to 3km and 3-5km around Cranlome mast, revealed no significant excess of these cancers in this area (See Appendix 5).

N.B. It should be noted that expected rates (2001) used for this non-administrative area analysis will be underestimates of the true rates, since population estimates required for the calculation of these rates were not available for approximately 12.8% of addresses falling within a 5km radius of the mast. This means that, in this analysis, ratios of observed to expected number of cases (for areas encompassing 0-3km and 3-5km from the mast) will actually appear larger than we would expect (had all population estimates been available) and will subsequently present a worse situation than that which occurred in reality.

### **3. MORTALITY**

The most recent deaths information available (deaths occurring in the year 2002) has been used, where appropriate, to update previous analyses carried out earlier this year.

The analyses compare observed versus expected mortality rates, giving a Standardized Mortality Ratio (SMR), with associated 95% confidence limits. Significant results are indicated in the tables and text.

**A. Cancer Mortality in Dungannon district council (1993-2002)**

Table 3: All Age Male Standardised Mortality Ratios (SMRs) for Dungannon (1993-2002)

	Brain, lymphomas & leukaemias	Lung	Colorectal	Prostate	All sites exc NMS*	All sites
SMR (95% confidence limits)	110 (80–141) NS	85 (70-101) NS	92 (68-117) NS	89 (64-114) NS	90 (82-98) Significantly lower	90 (81-98) Significantly lower

NS=Not Significant

\*NMS= Non Melanoma Skin

Table 4: All Age Female Standardised Mortality Ratios (SMRs) for Dungannon (1993-2002)

	Brain, lymphomas & leukaemias	Lung	Colorectal	Breast	All sites exc NMS*	All sites
SMR (95% confidence limits)	65 (38-92) Significantly lower	54 (37-70) Significantly lower	122 (92-152) NS	95 (73-117) NS	91 (82-100) NS	92 (83-101) NS

*Comments*

- For men, mortality due to cancers of all sites, both including and excluding non-melanoma skins, was significantly lower in the area of Dungannon district council than Northern Ireland as a whole. No significant difference was found between numbers of deaths due to lung, colorectal and prostate cancer in Dungannon and Northern Ireland. This was also the case for deaths due to lymphatic and haematopoietic cancers and brain cancer.
- For women, no significant difference was found between numbers of deaths due to breast and colorectal cancers diagnosed in Dungannon and Northern Ireland as a whole. The same was true for deaths due to all cancers (both including and excluding non-melanoma skins) in females in Dungannon. Mortality due to lung cancer, lymphatic and haematopoietic cancers and brain cancer was significantly lower in Dungannon females for this period than expected.
- Closer examination of mortality rates (1993-2002) revealed no apparent upward trend in incidence of cancers in males or females in Dungannon district council area.

## **8. Discussion**

Of the eleven alleged cancer cases originally reported to have occurred in the period 2001-2002, in the area surrounding the Cranlome mast, details on six were provided through contact with the community. Two of these six were identified as not being cancer and one further case was identified as a non-malignant tumour. The importance of having a database such as that held by the NICR became evident when we searched for additional cases.

In addition to the three confirmed cancer cases, details of an additional seventeen cancer patients were held by the NICR and were included in the analysis. The types of cancer diagnosed in this group were in keeping with those experienced by the Northern Ireland population.

It is clear from the results that the types of cancers diagnosed over a two-year period (2001-2002), in the vicinity of Cranlome telecommunications mast, were of a variety of sites, each with different risk determinants. Indeed the diversity of the cancers diagnosed in this sample serves as evidence against the existence of a common source or carcinogenesis.

Comprehensive reviews of the literature to date (see Appendix 3 and Appendix 4) have revealed that the overwhelming majority of scientists believe that exposure to radiofrequency radiation below guidelines does not cause adverse health effects to the general population.

In many cluster investigations, initial conclusions such as these are sufficient to halt the study. We decided that, due to intense public anxiety regarding this issue, various geographical area analyses (at district council/electoral ward/output area/non-administrative area level) should be carried out. We also felt that, due to the rural nature of the area encompassing the alleged cluster, it was appropriate to conduct analyses using not only Northern Ireland but also Dungannon district council as the reference or comparison region. The results of each of the investigations are very clear. The level of cancer in the Ballygawley area (1993-2001) was significantly lower than expected when compared with Northern Ireland levels and not significantly different from levels experienced in the area of Dungannon district council. Further to this, cancer incidence rates in the Cranlome area (Output areas 4+5) were not significantly different from rates encountered at Northern Ireland level or Dungannon district council level. Also, there was no evidence of an excess of cancer cases in non-administrative areas adjacent to the mast (less than 3km and 3-5 km from the mast).

## **9. Conclusions**

A thorough examination of cancer incidence rates in the vicinity of Cranlome telecommunications mast has led to the conclusion that this area does not appear to have statistically higher rates than Dungannon or Northern Ireland, nor is there an apparent, significant, increasing trend in the rates. In conclusion, there is no evidence of a cancer cluster in the nearer or wider Cranlome area.

### Acknowledgements

We are very grateful to Stephen Evans of Ordnance Survey Northern Ireland who provided expertise in Geographical Information Systems for this investigation. We would also like to acknowledge Steven McCurdy and Maire Brolly of Central Services Agency, who supplied population statistics for the study at non-administrative area level.

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