

Breast Cancer Mortality and Proximity to  
Bradwell Nuclear Power Station in Essex  
1995-1999.  
Correction and Update to 2001  
with a commentary on Official Responses.

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## 1. Background

Green Audit has published two studies on breast cancer mortality in census wards in the vicinity of Bradwell nuclear power station in Essex. The first was *Cancer Mortality and Proximity to Bradwell Nuclear Power Station in Essex, 1995-99; Preliminary results* published in March 2001 [Busby *et al.*, 2001a]. The work was commissioned by a group of residents in West Mersea who were concerned about a proposal to site an incinerator for nuclear waste at the power station. This preliminary study covered mortality risks from all malignancy, breast and prostate cancer. It made no adjustment for social class. It found that there were substantial excess mortality risks, particularly from breast cancer in women who had lived in wards adjacent to the river Blackwater. This finding was similar to the findings of earlier studies on coastal populations near the Irish Sea and near the Hinkley Point nuclear site in Somerset.

Around the same time as the Busby *et al.*, 2001a study was published the now superseded North Essex Health Authority (NEHA) commissioned a study of cancer near Bradwell from the government's Small Area Health Statistics Unit (SAHSU). This is a body set up following the Black Report on the Sellafield leukaemia cluster. SAHSU's remit is to ensure that cancer risk from point sources of pollution may be evaluated by small area analysis. Unlike the public, SAHSU has access to both incidence and mortality data at the small area level. The commissioned report [SAHSU, 2001] claimed that there was no evidence of any statistically significant increases in cancer in any ward in the study area and that the risks of cancer in populations living in annular areas described by circles around the nuclear site of radii 4, 10 and 17km around the plant showed no association with proximity to the plant.

The NEHA Press Release of July 7<sup>th</sup> 2001 quoted Dr Paul Watson, Director of Public Health, 'These (SAHSU) studies show that cancer rates, both in incidence and mortality in the Bradwell area are at normal levels. We hope that these results will reassure the residents of the area and the general public'. The SAHSU study specifically addressed the Green Audit study, and stated:

- That it could not replicate the results and further that it found no excess risk from cancer deaths in any ward in the Green Audit study area.
- That the number of overall deaths from all malignancy claimed by Green Audit was incorrect, being too high by about 200 deaths in a total of 1000 over the five year period (1220 vs.1015)

At the same time as the release of the SAHSU 2001 study, Green Audit released a second report, *Environmental Risk Methodology and Breast Cancer Mortality near Bradwell Nuclear Power Station in Essex 1995-1999* [Busby *et al.*, 2001b]. This study addressed the established methodology for analysing risk near a putative point source. It used the problem of the epidemiology of breast cancer mortality near Bradwell as an example. The authors extended the 26 ward study area of Busby *et al.* 2001a to an area defined by a 17km ring around the nuclear plant and proceeded to examine the results of the annular rings approach used by SAHSU (and earlier studies of nuclear sites) and compare these with results of a comparison between estuarial and inland populations. Busby *et al.* also made a comparison of two estuarial populations, those living on the Blackwater (contaminated by Bradwell) and those living on the Crouch (uncontaminated by a nuclear site). This study also adjusted the expected numbers of cases for Social Class. The conclusions were:

- That the concentric rings approach used by SAHSU showed no effect. (0-4km vs.4-17km, RR=1.01)
- The Blackwater estuarial vs. inland comparison showed a clear excess for breast cancer in women. ( Estuary vs. inland, RR=1.34, p = .003)

- The Blackwater vs. Crouch comparisons showed a clear excess of breast cancer deaths in the Blackwater wards. (RR = 1.93, p = .04)

Busby *et al.* concluded that the concentric rings approach was epidemiologically worthless because radial distance from the nuclear site could not be used as a surrogate for exposure. The excess risk near the estuary was ascribed to exposure following inhalation of radioactive material in the mud which was resuspended and driven ashore by sea-to-land transfer.

## 2. Errors in both reports

### *Busby et al. 2001a*

Following investigation by the Committee on Medical Aspects of Radiation in the Environment (COMARE) it has become clear that both Busby *et al.* 2001a and SAHSU 2001 made errors in their calculations. The Busby *et al.* 2001a study had 9 per cent (100 in 1120) too many cancer deaths owing to two computer errors. The first error arose from the accidental dislocation of the column of cancer deaths for the single year 1997, which resulted in deaths for each ward being added to the ward immediately below. For breast cancer this resulted in additions or subtractions of 1 death to about half of the 26 wards in the restricted study area in Busby *et al.*, 2001a. In addition, a typing error resulted in the miscalculation of overall deaths in men in five wards - Birch, Messing and Copford, Pyefleet, Tiptree, West Mersea and Winstree. It was this latter error which increased the number of overall deaths by 100. This error did not affect the breast cancer calculations but may have resulted in incorrect risks being mapped in the six wards. None of these errors had any effect on the second study, Busby *et al.* 2001b as this was an entirely separate study which used a much larger area involving a 17km radius and was carried out in a separate file.

The authors apologise for the errors in Busby *et al.*, 2001a. However, although COMARE made much of the Busby *et al.* error, there is no difference in the overall result, as we shall show.

### *SAHSU 2001*

Although the Busby *et al.* errors make no difference to their result, the same is not true for SAHSU who supplied the health authority with a correction paper, admitting its error, in March 2002. Local organisations were not informed of the error, nor the existence of a new paper. When Green Audit eventually heard about it there was considerable difficulty in obtaining a copy. It turns out that the SAHSU 2001 study had 10 per cent too few cancer deaths (105 in 1120) owing to errors in assigning deaths to post-coded wards in Maldon. The intention of the authors of the SAHSU study becomes clear since the new 2002 paper is not a re-run of the earlier study using the correct figures. This is because repairing the errors involved assigning more deaths in the town and wards of Maldon, close to the muddy estuary, a town where Busby *et al.* had shown a significant sharp excess of breast cancer mortality. In the new SAHSU study there is a change in method. The authors, having originally stated that there were no wards where there was significantly high cancer, now found that the extra cases in Maldon changed this situation. They therefore had to lose this result by using the dubious technique of 'Empirical Bayes Smoothing'. This is a new epidemiological method developed largely by researchers at SAHSU and others in the early 1990s to deal with uncomfortable excess risk indicators near environmental pollution sources. The Bayes statistical method is essentially a way of refining guesses following new information although no one in epidemiology uses it to refine the guess that low level radiation is dangerous to health following the endless list of studies showing this to be the case. Instead, SAHSU epidemiologists set out to remove the significance of disease clusters

by making the *a priori* assumption that a sharp increase in cancer in one ward or small area is intuitively unlikely. Following this, their method sets out to reduce the apparent risk in a target ward by diluting this risk into adjacent wards where risk is lower. The result is that the relative risk in the target ward is reduced below the significance horizon. The philosophy behind this approach has been well stated by Smans and Esteve [1992]:

*For mapping of rare cancers it is important that risks are standardised and smoothed in an appropriate manner in order to avoid conveying the [sic] false information. Without such methodology, spuriously elevated risks will be produced, resulting in unjustified concern in the corresponding population.*

Whilst this may be relevant to rare conditions such as childhood leukaemia (and even here it is questionable) it does not seem appropriate for high incidence diseases and it is certainly not appropriate to use the method to get out of a fix resulting from having made a mistake in your analysis.

### **3. Is there excess breast cancer near the Blackwater Estuary?**

#### *Results of updated study*

In this paper we repeat the 26 ward study of Busby 2001a which examined risk between 1995 and 1999 for breast cancer mortality using the corrected file. In addition, we analyse the 26 ward study for statistical significance by comparing wards which are proximal to the estuary with wards which are not. We extend this study by period using more recent data for 2000 and 2001. The method we use was given in the earlier papers. Table 1 gives Standardised Mortality Ratios (SMRs) for the 26 wards for breast cancer between 1995 and 1999 and is comparable with Table 1 in Busby 2001a. Table 2 shows the same for the extended period 1995-2001.

Two results are immediate. First the corrected files make the estuary effect more apparent, since the Maldon wards now have more breast cancer deaths after the correction, and second, the effect is reinforced after the inclusion of the two extra years 2000 and 2001. The wards most affected by 2001 are the Maldon wards, Tollesbury, Maylandsea and West Mersea, all places with concentrations of people living near contaminated intertidal sediment. Table 3 lists the wards and their 1991 female populations according to whether they are close to the Blackwater estuary or not, using the dummy variable 'mudsand'. Table 4 then shows the result of a comparison of breast cancer between the Blackwater estuary and non-estuary groups for the period of Busby *et al.* 2001a, 1995-99. Table 5 is the same analysis but includes data from 2000 and 2001. Table 6 uses the 1999-2001 data and compares Blackwater estuary wards with Crouch estuary wards. In order to examine the effect of towns, two towns are directly compared. Since Maldon and Burnham on Crouch are both yachting-centre towns on muddy estuaries they should be comparable, except for the radioactivity from Bradwell nuclear power station which contaminates mud near Maldon but not Burnham. Table 7 gives the comparison between all Maldon wards and all Burnham on Crouch wards for the full period.

**Table 1.** Corrected breast cancer SMRs for 26 ward area near Bradwell Nuclear Power Station for period 1995-1999.

<b>Ward</b>	<b>Expect 5 years</b> □	<b>Obs. 95-99</b> □	<b>Rel. Risk</b> □	<b>Poisson</b>
Althorne	2.335	1	0.428	
Burnham-on-Crouch N	2.874	2	0.695	
Burnham-on-Crouch S	5.335	6	1.124	
Goldhanger	1.761	2	1.135	
Great Totham	2.853	3	1.051	
Heybridge East	1.987	2	1.006	
Heybridge West	2.797	3	1.072	
Lt. Baddow, Danbury, S'don	8.337	9	1.079	
Maldon East	4.092	5	1.221	
Maldon NW	5.836	13	2.227	0.007
Maldon South	3.660	5	1.366	
Purleigh	1.418	1	0.705	
St Lawrence	1.525	2	1.311	
Southminster	3.188	3	0.941	
The Maylands	2.355	5	2.122	0.08
Tillingham	1.790	2	1.117	
Tollesbury	2.629	3	1.141	
Tolleshunt D'Arcy	2.000	4	1.999	
Wickham Bishops	2.147	3	1.396	
Woodham	1.480	3	2.026	
Woodham Ferrers & Bickn.	2.017	0	0	
Birch M'ing & Copford	3.790	2	0.527	
Pyefleet	2.747	3	1.092	
Tiptree	7.151	7	0.978	
West Mersea	9.186	14	1.524	0.08
Winstree	1.903	1	0.525	

**Table 2** Corrected breast cancer SMRs for 26 ward area near Bradwell Nuclear Power Station for period 1995-2001.

<b>Ward</b>	<b>Expect 7 years</b>	<b>Obs. 95-01</b>	<b>Rel. Risk</b>	<b>Poisson</b>
Althorne	3.27	1	0.31	
Burnham-on-Crouch N	4.02	2	0.50	
Burnham-on-Crouch S	7.47	8	1.07	
Goldhanger	2.47	4	1.62	
Great Totham	3.99	5	1.25	
Heybridge East	2.78	3	1.08	
Heybridge West	3.92	6	1.53	
Lt. Baddow, Danbury, S'don	11.67	9	0.77	
Maldon East	5.73	7	1.22	
Maldon NW	8.17	16	1.96	0.008
Maldon South	5.12	11	2.15	0.008
Purleigh	1.99	2	1.01	
St Lawrence	2.14	3	1.41	
Southminster	4.46	5	1.12	
The Maylands	3.30	5	1.52	0.08
Tillingham	2.51	3	1.20	
Tollesbury	3.68	7	1.90	0.07
Tolleshunt D'Arcy	2.80	5	1.79	
Wickham Bishops	3.01	4	1.33	
Woodham	2.07	3	1.45	
Woodham Ferrers & Bickn.	3.05	0	0	
Birch M'ing & Copford	5.31	4	0.75	
Pyefleet	3.85	4	1.04	
Tiptree	10.01	8	0.80	
West Mersea	12.87	18	1.40	0.08
Winstree	2.66	1	0.38	

**Table 3** Ward populations in 1991 and mudsand dichotomy.

<b>Ward</b>	<b>Female Population 1991</b>	<b>Mudsand (1 = B'water estuary)</b>
Althorne	1143	0
Burnham-on-Crouch N	1324	0
Burnham-on-Crouch S	2281	0
Goldhanger	792	0
Great Totham	1527	0
Heybridge East	1854	1
Heybridge West	1405	0
Lt. Baddow, Danbury, S'don	4145	0
Maldon East	1352	1
Maldon NW	2019	1
Maldon South	2200	1
Purleigh	783	0
St Lawrence	708	1
Southminster	1701	0
The Maylands	1659	1
Tillingham	873	1
Tollesbury	1300	1
Tolleshunt D'Arcy	933	0
Wickham Bishops	1054	0
Woodham	792	0
Woodham Ferrers & Bickn.	1546	0
Birch M'ing & Copford	1533	0
Pyefleet	1130	0
Tiptree	3918	0
West Mersea	3451	1
Winstree	1159	0

**Table 4** Comparing estuary (mudsand = 1) with non-estuary (mudsand = 0) for breast cancer mortality 1995-1999

	<b>Breast cancer deaths</b>	<b>Female Population</b>	<b>Relative Risk* (95% confidence interval)</b>
Blackwater estuary	51	15413	1.58 (1.08<RR<2.32); p = .019
Non Blackwater	53	27166	1

\*standardised to study group demography

**Table 5** Comparing estuary (mudsand = 1) with non-estuary (mudsand = 0) for breast cancer mortality 1995-2001

	<b>Breast cancer deaths</b>	<b>Female Population</b>	<b>Relative Risk* (95% confidence interval)</b>
Blackwater estuary	73	15413	1.7 (1.22<RR<2.34); p = .0015
Non Blackwater	71	27166	1

\* standardised to study group demography

**Table 6** Comparing Blackwater wards with Crouch wards for breast cancer mortality 1995-2001

	<b>Breast cancer deaths</b>	<b>Female Population</b>	<b>Relative Risk* (95% confidence interval)</b>
Blackwater estuary	73	15413	2.1 (1.12<RR<3.98); p = .018
Crouch estuary	11	4748	1

\* standardised to study group demography

**Table 7** Comparing Maldon wards with Burnham on Crouch wards for breast cancer mortality 1995-2001

	<b>Breast cancer deaths</b>	<b>Female Population</b>	<b>Relative Risk* (95% confidence interval)</b>
Maldon (3) wards	34	5571	2.1 (1.02<RR<4.15); p = .04
Burnham (2) wards	10	3364	1

\* standardised to study group demography

#### **4. Discussion**

##### *Of results*

Analysis of the corrected file for 1995-99 for the 26 ward area confirms the existence of significantly raised breast cancer mortality in wards which border the mud flats and creeks of the river Blackwater compared with wards which do not. This finding is reinforced slightly by the correction. Thus we see that the Blackwater estuary wards have (Table 4) 58% more breast cancer deaths than the non-Blackwater wards. Further, there is a significant excess of deaths in Maldon Northwest. Addition of deaths in two more recent years, 2000 and 2001 increase this to 70% excess deaths in the Blackwater; both findings are statistically

significant at the 5% level. The increased level of breast cancer in Maldon Northwest remains. Comparison of the Blackwater with the Crouch shows that there were more than twice as many breast cancer deaths in the Blackwater wards (Table 6) and the same is true for a comparison of Maldon with Burnham on Crouch, which is an appropriate control. Both results are statistically significant. This effect has also been found in the town of Burnham on Sea in Somerset, close to sediment contaminated by the nearby Hinkley Point nuclear power station. The latter mortality cluster, reported in 2000 [Busby *et al.*, 2000] has been confirmed by a recent questionnaire study [Busby *et al.*, 2002a]. The most recent 2001 ONS mortality figures show that the breast cancer cluster in Burnham on Sea North continues (2.07 expected 4 observed in 2001). The sediment near both towns and near the estuary wards of the Blackwater is contaminated by radioactive material from nuclear power stations and also weapons fallout. The hypothesis that exposure via sea to land transfer and inhalation is the cause of the cancer risk increases has been outlined in earlier studies and will not be further examined here. What is of further interest here is the official responses to these discoveries, and we will devote some space to this.

### *Of official responses*

The tone of all official responses to the Bradwell studies has been negative, dismissive and in certain cases offensive. NEHA officially stated that there was no cause for concern and implied that the Green Audit studies were flawed and inaccurate, their conclusions invalid, the science bogus and the authors unscientific. SAHSU has produced a study which stated that there was no excess breast cancer risk in any ward in the area. Was this true, or was it an attempt to cover up a problem?

The first observation we make is that both NEHA and SAHSU cannot have been unaware that the idea that a breast cancer excess existed near the Blackwater did not begin with Green Audit but was published in the Essex Sustainability Report for 1999 [Essex County Council, 1999] together with risk maps. Fig 1 shows the map. Local newspapers have also highlighted the issue\*.

It must have been a shock to SAHSU when we published our second report on risk methodology at the same time as their report which used this exact methodology. The argument about methodology clearly forced COMARE into the area. At this point, COMARE looked at the ONS data and discovered that both teams had made errors. But what did they do then? Rather than address the problem of whether there is a significant breast cancer excess near the nuclear site, COMARE focussed on the errors in the first Busby *et al.*, report. In a letter to Busby, the Chair of COMARE, Bryn Bridges wrote: 'The analysis you conducted with these corrupt data were valueless.' COMARE apparently did not look to see what the corrected figures showed. Why not?

COMARE, SAHSU and the Health Authority all failed to let Green Audit know that SAHSU had made errors in its study: this information arose in a conversation with the Chair of COMARE at a meeting of the new Committee Examining Radiation Risk from Internal Emitters (CERRIE). When eventually the new SAHSU paper was obtained, after considerable pressure was put on the Health Authority to release it, it emerged that the paper had changed its method and invoked 'Bayesian Smoothing' to deny the existence of the breast cluster in Maldon Northwest. SAHSU was certainly aware of the estuary/non estuary dichotomy of Busby *et al.*, and had admitted in its first report that its method did not allow for differentials in the transport of radioactive contaminants in the environment there was no attempt to address the clustering, nor to examine whether it were true.

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\* For example, *Council crackdown on breast cancer: Residents urged to take up healthy eating and stop smoking*: Maldon and Burnham Standard June 7 2001

This looks very like an attempt to cover up a significant health problem and its source: there is more interesting information that bears on this and the matter of trust and public confidence. In 2002 Busby applied to Imperial College London under the Data Protection Act to access any emails that contained information on him personally. Imperial College administers the email system for SAHSU. After a considerable period of time, 8 pages of emails were delivered by Chris Ince, Data Protection Officer. In these 8 pages, there were 431 lines of script blacked out with felt tip pen and 28 lines of script. One readable piece states:

*[blacked out] and has Busby on his back to release all correspondence and details concerning our discrepancies. This obviously reinforces Busby's conspiracy theory [blacked out]*

another states:

*[Blacked out] because it will allow Busby an undefended swing at SAHSU. North Essex considered inviting Busby to their Press conference (Blacked out).*

The most interesting aspect of these emails is that great pains have been taken to make sure that the authors and actors are not identified. However, it is possible to identify three of the authors by reading the pieces of the typescript above and below the black felt tip line. Three are:

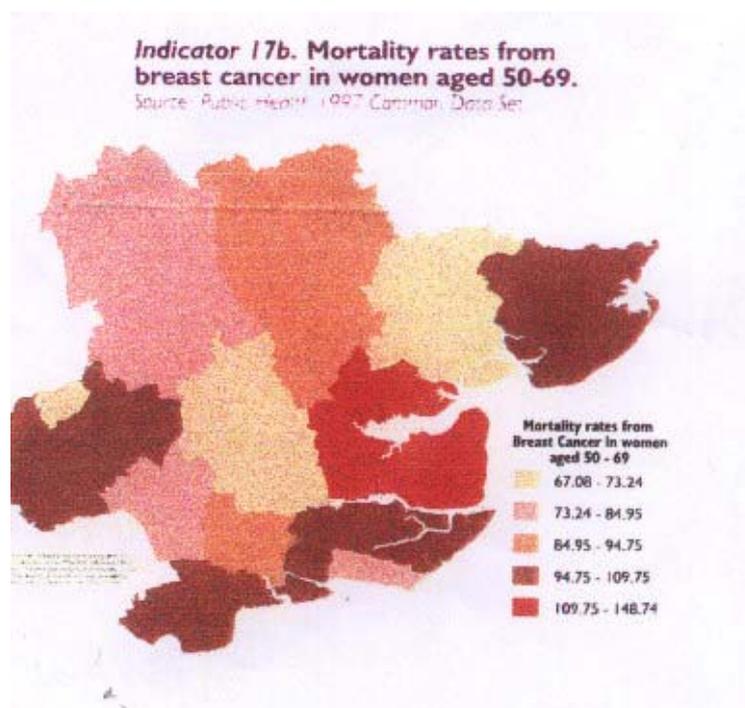
Prof. Paul Elliott, Director of SAHSU

Dr Paul Aylin, SAHSU

Dr Mike Quinn, head of National Cancer Registration Bureau at ONS

Are these three engaged in conspiring to cover up increases in cancer near a nuclear site? The intercepted emails suggest that this is exactly what is happening. The matter has been referred to the Ombudsman to order release of the complete scripts. Is COMARE desperately trying to avoid conceding that people are dying because of man-made nuclear radiation in the environment by attacking the environmental researchers rather than examining the thesis on the basis of the data? It rather looks like it to us.

There is another aspect to this affair. It involves the costs of research and the financial support of the institutions engaged in this research. The environmentalists have no money and no institutional financial support, while government groups like SAHSU and the National Radiological Protection Board have large budgets and their researchers are paid large salaries. This is true also of the Health Authorities and their staff. Green Audit did both their studies for £400, a sum that was raised by subscriptions among a small group of local people who were frightened that radiation from the local nuclear site might be the cause of the excess cancer, which anecdotal evidence suggested existed. The mortality data itself for the seven years costs £490. The Health Authority, on their part, commissioned SAHSU to analyse the data and report. The cost of this SAHSU work has not been admitted, but the cost of a similar SAHSU study in Cardiff in 2001 was reported to be £30,000. Thus NEHA committed about £30,000 of tax-payers' money to a group that not only carried out a poorly designed and inadequate piece of epidemiology, but couldn't even obtain the correct numbers of deaths. When they eventually realised that this was the case, which would not have happened had not Green Audit published their second report, SAHSU then produced a new report in which its authors changed their methodology to sustain their original finding.



**Fig 1.** Breast cancer mortality map published in 1999 in the Essex Sustainability Report showing excess around the Blackwater Estuary.

## 5. Conclusion

Ever since the 1983 discovery of the Sellafield (Seascale) leukaemia cluster it has become increasingly apparent to people living near nuclear sites that the epidemiological examination of radiation risk has been the subject of bias and cover-up at a very high level. It is also clear to these people that the reassurances they are given by the organisations who are paid to protect their health are worthless. If the truth about radiation and health is to be discovered, then accurate mortality and incidence data must be discovered, and statistical and epidemiological analysis should be undertaken by environmental groups funded by government, as well as by establishment groups. However, in recent years regional Cancer Registries have intensified restrictions on releasing incidence data, withholding figures which, according to their own Guidelines, ought to be available on request. The notable exception is that in 1995 the Wales Cancer Registry released its entire small area cancer incidence database to Green Audit – an event which was followed swiftly by closure of the WCR and a complex of data destruction and denial which COMARE signally failed to investigate in an even handed fashion.

There is not a level playing field in this debate. On one side there are small independent environmental research groups working under difficult conditions with inadequate information being attacked by the establishment and funded at a pathetic level by groups of local citizens. On the other side are the weighty government organisations with budgets of millions of pounds and departments full of qualified researchers.

It is to be welcomed that the opposition or ‘dialogical’ approach to examining risk in this area has now been accepted and partly put into practice in the new CERRIE committee. This approach has the capacity to deal with the scientific advice problem. However, the affair of breast cancer near Bradwell shows that there is a large trust deficit remaining in this area, associated with the internal operations of SAHSU, the Cancer Registries and COMARE. This is not an isolated affair: similar attacks, denials, cover-ups and shenanigans have occurred following Green Audit studies of cancer on the Welsh and Irish coasts and near Hinkley Point and Oldbury nuclear power stations. There is also the problem of the funding of citizen

groups who wish to have an independent analysis of the situation, and the release of data to these groups to make such studies possible. The present situation is unacceptable.

## References

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