Sellafield and the Irish Sea
A model for coastal radioactive contamination

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Summary of argument

- Childhood cancer caused by human internal exposure to novel man-made radioactive isotopes e.g. Sr-90, Pu-239
- Error in ICRP risk model due to averaging of doses over large tissue masses
- Nuclear site (e.g.Sellafield, La Hague, Dounreay) leukemia clusters require error in ICRP model of 300-1000 fold.
- Increases in infant leukemia after Chernobyl demonstrate error of 100-1000 in ICRP risk models.
- Serious consequences for children and adults living near Irish Sea, or other radioactive contamination.
- Confirmed by research in England, Wales and Scotland

•The existing radiation risk model is that of the International Commission on Radiological Protection, ICRP. It is the basis for all legislation in the area of radiation risk. For internal radioactive exposures it seriously flawed.

This is because:

The units, absorbed dose, energy per unit mass are unable to adequately represent the key risk which is ionisation density at the cell level. Thus absorbed dose does not distinguish between warming oneself in front of a fire and eating a hot coal.

The risk of cancer and genetic illness following exposure is based on the yield of cancer in the Japanese population exposed to gamma radiation from the Atomic Bomb in 1945. The doses were very large acute and external (delivered from outside the body) They were therefore the same in every cell. For the lowest exposures quantifiable, the doses were about 100mSv, or 100 times external annual natural background in the UK.

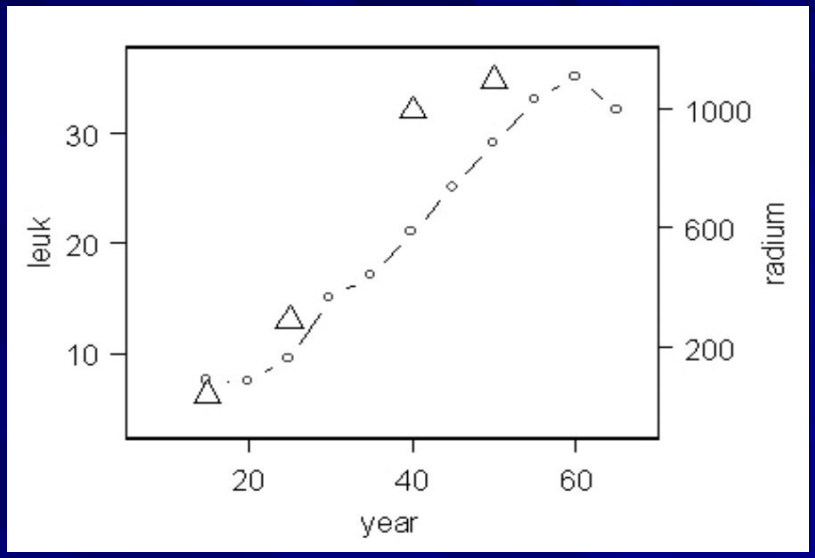
In contrast, internal doses to the cell from the decay of a single respirable Plutonium Oxide particle of 1 micron diameter, translocated from the lung to the lymphatic system is enormously high, many cells being killed and many cells receiving doses of many hundreds of milliSievert. The dose from such a decay, as assessed by the ICRP model, is vanishingly small, since the tissue mass into which it is averaged, is very large. This is also true for the other common environmental particle, Uranium Oxide. Both Pu and U bind preferentially to DNA

Local doses from Plutonium Particles

Table 2 Doses to sphere of tissue 30 micron radius by one particle of PuO_2 of various diameters

Particle diameter μ	Particle vol. cm^3	Mass PuO_2 (g)	Mass Pu239 (g)	Activity of particle	Hits /day (dose/day) Sv	Hits/year (dose/year) Sv
0.05	6.5×10^{-17}	7.5×10^{-16}	6.5×10^{-16}	1.5×10^{-6} Bq	0.129 (0.02)	47 (7.3)
0.1μ	5.2×10^{-16}	6.0×10^{-15}	5.2×10^{-15}	1.2×10^{-5} Bq	1.03 (0.15)	375 (54)
0.2μ	4.2×10^{-15}	4.8×10^{-14}	4.2×10^{-14}	9.6×10^{-5} Bq	8.3 (1.2)	3029 (438)
1.0μ	5.2×10^{-13}	5.9×10^{-12}	5.1×10^{-12}	1.16×10^{-2} Bq	1002 (146)	365800 (53290)
2.0 μ	4.2×10^{-12}	4.8×10^{-11}	4.2×10^{-11}	0.096 Bq	8294 (1220)	3027310 (445300)

Assumptions: Plutonium Oxide (Pu239) is in the PuO2 form (density = 11.6); Alpha decay energy = 5.2 MeV; Alpha range = 30 microns. Relative Biological Effectiveness factor for Alphas = 20 (from ICRP) has been used to convert dose in Grays to effective dose in Sieverts.



Childhood leukemia particularly in the 0-4 age group has been increasing since 1910. The only known cause is exposure to ionizing radiation. This has been well established, both by A-Bomb studies and by obstetric X-ray studies (Alice Stewart). Stewart *et al.* established a 40% increase in children exposed *in utero* to 10mSv of external X-rays. The graph above shows death rate per million population 0-14 (line) and world production of Radium (grams). It is my hypothesis that the major cause of childhood cancer and the increase in adult cancer in the last 50 years is internal exposure to man-made or augmented radioactive substances; high local cell doses from particles or DNA-seeking multiple decay isotopes mainly inhaled and initially translocated to lymphatics.

Unequivocal proof of the existence of an error of upwards of 300-fold in the ICRP model for internal exposures was afforded by the increase reported in infant leukemia in five countries in the exposed in utero cohort.

Increases in leukemia in infants in Wales and Scotland following Chernobyl: Evidence for errors in statutory risk estimates and dose-response assumptions.

Paper presented at the 3rd International Conference
HEALTH EFFECTS OF THE CHERNOBYL ACCIDENT:
RESULTS OF 15-YEAR FOLLOW-UP STUDIES
Organised by Physicians of Chernobyl/ World Health Organisation
Kiev, Ukraine June 4-8

Chris Busby, PhD
Molly Scott Cato, MA, MSc, PhD

- Infant leukemia in the Chernobyl in utero cohort was reported increased in Greece, Germany, Scotland, Wales, Belarus, and the USA.
- Comparison of the doses, which were accurately estimated, and the observed yield compared with the expected yield based on the ICRP model showed a mis-match of between 100 and 1000-fold.
- This would suggest the Sellafield and other nuclear site leukemia clusters are causally related

Gibson BES, Eden OB, Barrett A *et al.* (1988) 'Leukemia in young children in Scotland.' *Lancet* 630

Petridou e, Trichopoulos N, Dessypris N, *et al.* (1996) 'Infant leukemia after *in utero* exposure to radiation from Chernobyl' *Nature* 382: 352-53

Mangano J (1997) 'Childhood leukemia in US may have risen due to fallout from Chernobyl' *British Medical Journal* 314:1200

Michaelis J M, Kalesch U, Burkart W and Grosche B, (1997) 'Infant leukemia after the Chernobyl Accident' *Nature* 387: 246

Busby C, Scott Cato M, (2000) 'Increases in leukemia in infants in Wales and scotland following Chernobyl: Evidence for Errors in Statutory Risk Estimates (UK).'
Energy and Environment 11(2) 127-140

= 100-fold error in present risk model

(1) $p < 10^{-9}$ for total effect

i.e. Not chance

(2) must be radiation from Chernobyl – no other explanation.

(3) Therefore error ∩ 100-fold.

Whole body Caesium trends in England and Wales

Figure 2
Whole body content of Caesium-137 + Caesium-134 measured in the two years following Chernobyl. (source: Etherington and Dorrian (5))

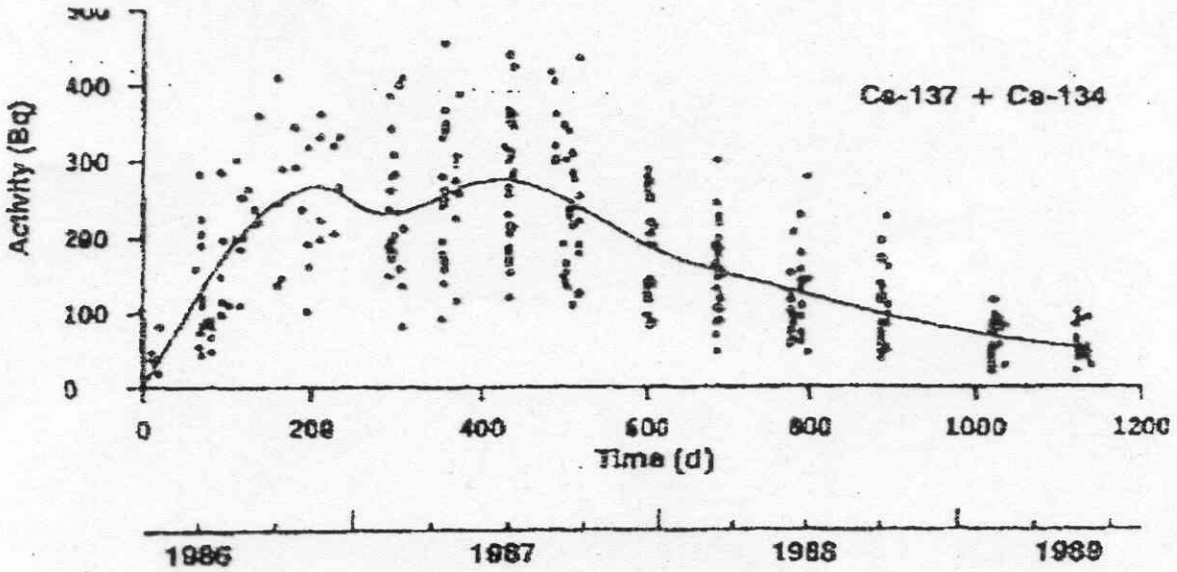


Table 2

Infant leukemia (ages 0-1) in Scotland and Wales and both countries combined (Source: Wales Cancer Intelligence Unit, Scottish Health Services)

Year	Scotland	Wales	Both	2-year groups
1975	1	0	1	
1976	3	0	3	4
1977	1	2	3	
1978	2	0	2	5
1979	0	0	0	
1980	2	0	2	2
1981	4	0	4	
1982	0	1	1	5
1983	1	0	1	
1984	3	0	3	4
1985	1	1	2	
1986	0	1	1	3
1987	6	0	6	
1988	4	4	8	14
1989	2	1	3	
1990	2	1	3	6
1991	0	1	1	
1992	3	2	5	6
1993	3	1	4	
1994	1	0	1	5

Note: In the period 1st Jan 1987 to 30th June 1988 there were 3 cases in Wales and 9 in Scotland

Sellafield

The Sellafield Controversy

- Sellafield, formerly Windscale, and the site of a serious nuclear accident in 1957, is the largest nuclear reprocessing plant in the world and has emitted over 120PBq of b and 1.5PBq of a isotopes to the Irish Sea between 1952 and 1995. On an specific area basis this is ten times more than the total weapons fallout contribution of b- and 350 times more a- to the Irish Sea.
- A ten-fold excess of childhood leukemia and non-Hodgkin lymphoma was identified by Yorkshire TV in 1982 in children 0-4 living nearby (Seascale and coastal villages) and confirmed by independent epidemiological analysis.
- An independent enquiry chaired by Sir Douglas Black in 1983 concluded that on the basis of the current (ICRP) radiation risk model, based on the leukemia yield of the Hiroshima bomb, the doses to the children were too small by a factor of 300 times to explain the cluster.
- Soon after this, similar clusters were discovered near all the major reprocessing sites in Europe i.e. also at Dounreay and La Hague. Both release radioisotopes to the sea. All required error factors of >300.
- Nevertheless, the authorities continue to refuse to accept that there is causality. This would require that the ICRP risk model is be faulty for internal exposure by such factors (in excess of 300-fold). However, no other plausible explanation is available.

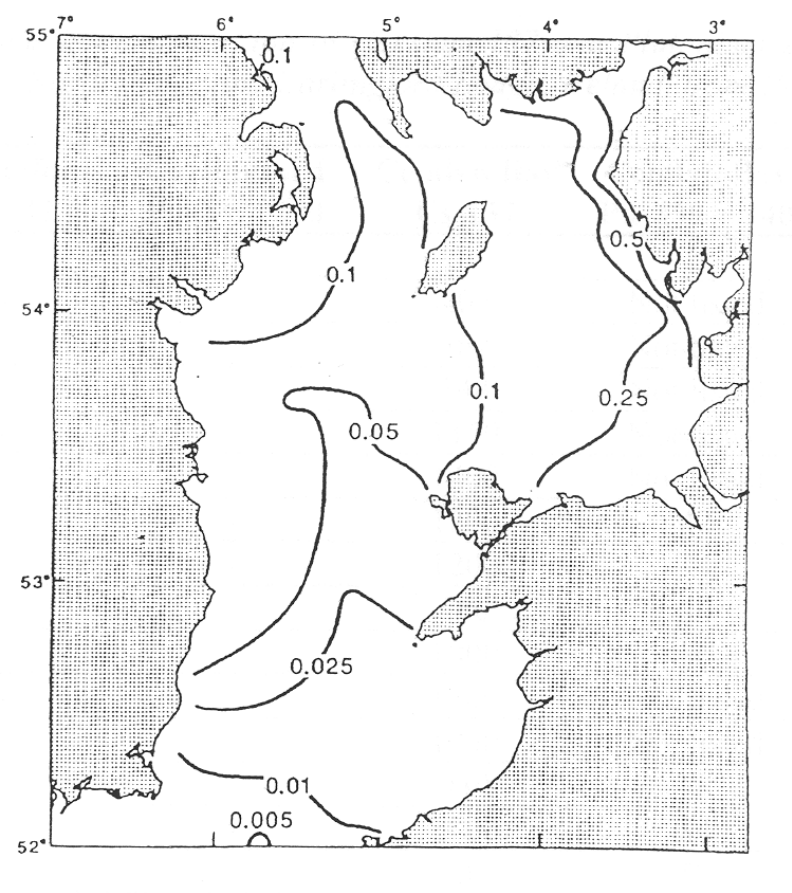
Necessary errors in ICRP model for explanation of nuclear site clusters of childhood leukemia (from ECRR 2003)

Nuclear Site	Year established	Defined ICRP Risk Multiplier	Notes
[a]Sellafield/ Windscale	1983	100-300	Well studied by COMARE: high level of discharge to atmosphere and sea
[a]Dounreay	1986	100-1000	Well studied by COMARE: particle discharges to atmosphere and sea.
[a]La Hague	1993	100-1000	Particle discharges to atmosphere and sea: ecological and case control studies
[c]Aldermaston/ Burghfield	1987	200-1000	Well studied by COMARE: particle discharges to atmosphere and rivers
[b]Hinkley Point	1988	200-1000	Discharges to offshore mud bank
[d]Harwell	1997	200-1000	Discharges to atmosphere and river
[b]Kruemmel, Germany	1992	200-1000	Discharges to atmosphere and river
[d]Julich, Germany	1996	200-1000	Discharges to atmosphere and river
[b]Barsebaeck, Sweden	1998	200-1000	Discharges to atmosphere and sea

[a]Reprocessing plants discharging to sea; [b]Nuclear power station discharging to sea or river; [c]Atomic weapon and nuclear material fabrication plants; [d]Atomic research with discharges to local rivers

Table 11.1 Studies establishing excess leukaemia and cancer risk in children living near nuclear sites.

Sellafield and the Irish Sea



The Irish Sea has restricted and local circulation and is effectively closed at the north entrance. Insoluble material discharged from the Sellafield pipeline becomes attached to sediment and then is redistributed by tidal currents and concentrates in coastal areas where the tidal energy is low. This results in three areas of concentration:

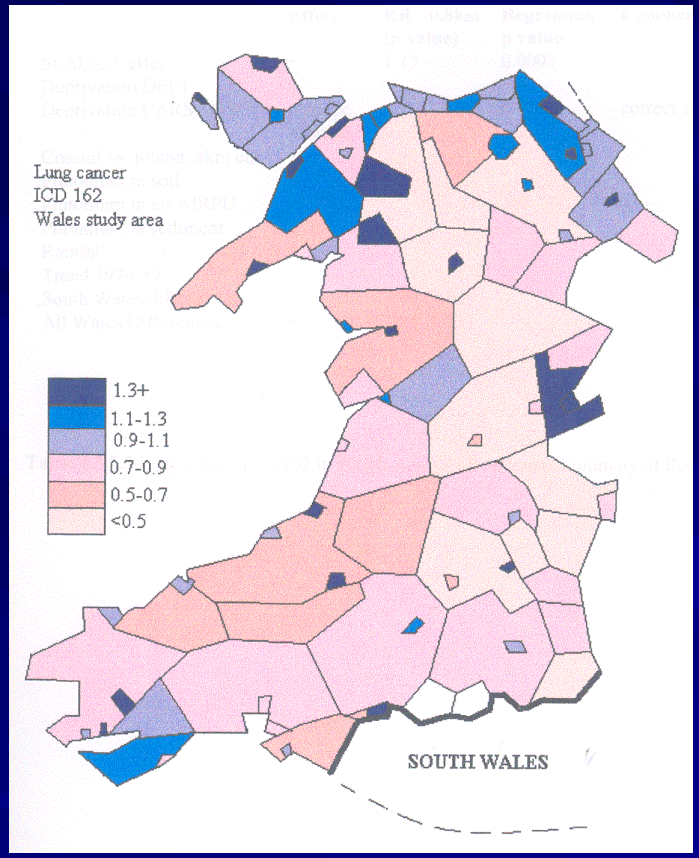
- The coastal areas of Cumbria (e.g. Seascale and coastal villages
- The North Wales Coast (e.g. the Menai Strait, Carnarfon and Bangor)
- North East Ireland (e.g. Dundalk and Carlingford Bay

Plutonium and Caesium and other isotopes attach to fine mud in bays and estuaries. This is Carlingford, in County Louth photographed at half-tide. Sellafield isotopes are found here by the Irish Radiological Protection Institute (IRPI). Data from local GP Andy MacDonald analysed by Green Audit in 1998 showed a 4.6-fold excess of child leukemia in the period 1965-85. Ireland had no national cancer registry until 1994.

2000 Green Audit Wales Cancer Registry Data Study

- From 1997-2000 Green Audit was funded by the Irish State to carry out research on cancer incidence in the small areas of Wales using data for 1974-1989 obtained from Wales Cancer Registry, an organisation of the UK government Welsh Office. The purpose of the study was to examine the possibility that there was an effect on cancer relating to living near contaminated areas of the Irish Sea Coast.
- The results of this study showed a significant and alarming sea coast effect on cancer and leukemia in adults and children, increasing over the period.
- Wales Cancer Registry had already drawn attention to the existence of high levels of cancer and leukemia in children in Wales in a 1994 publication. However, immediately following the release to Green Audit of the datafiles, in 1996, Wales Cancer Registry was dissolved and its personnel dispersed. The files were removed from the mainframe computer. A new organisation, The Wales Cancer Intelligence and Surveillance Unit (WCISU), took over cancer registration 18 months after the closure of WCR and immediately published data which differed from the WCR data by the removal of 18% of the children with cancer from the files.
- Despite refusing to account for this, WCISU maintain that there are no problems with child leukemia in Wales, and in this are backed up by the Committee on Medical Aspects of Radiation in the Environment, Chair Bryn Bridges. COMARE was set up following the Black enquiry into the Sellafield child leukemias and has consistently denied the causal link of childhood leukemia with nuclear pollution.
- Perception that COMARE were too close to the nuclear industry was the reason that the UK Environment Minister Micheal Meacher set up the new Committee examining Radiation Risk from Internal Emitters (CERRIE) in July 2001. The remit of CERRIE was specifically to examine the health effects of internal radiation exposure. This body, of which I was a member, reported in 2004 in two separate reports.

Methods Employed

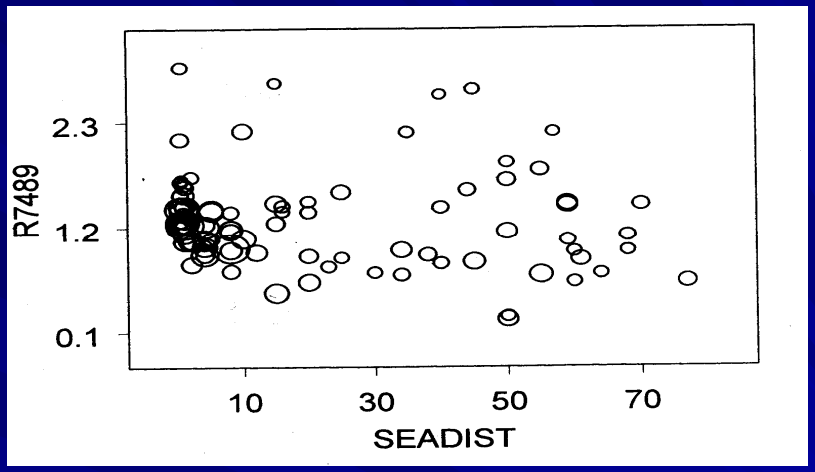


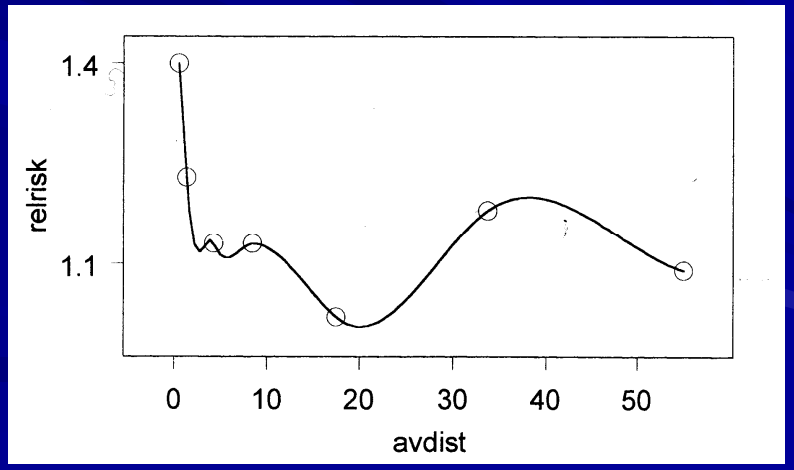
The numbers of cancer cases for all types of cancer and leukemia separately by sex and age and year diagnosed in each of the small areas of residence (AORs) were compared with expected numbers based on census populations for 1981. AORs were grouped into bands by distance from the Irish Sea. Risk was expressed as RR= Obs/Exp for each band and trends were examined over time and by distance. In addition multiple logarithmic regression was used to examine other covariates including, rainfall, plutonium in soil, plutonium/ salt in air, disadvantagement (both Carstairs and Welsh Office Indices) and Social Class. Coastal Towns were compared with inland towns, north with south, and both with South and all Wales

Results for Adults: Wales 1974-89

Seadist range Km	Average (SD)	N AORs	Oberved 74-89	Expected 74-89	Relative Risk	P value
<0.8	0.56 (0.17)	17	14445	10419	1.4	0.0000
0.9<x<2	1.38 (0.51)	13	11714	9559	1.23	0.0000
2.1<x<5	4.27 (0.47)	10	8283	7290	1.13	
5.1<x<11	8.44 (0.88)	10	8358	7388	1.13	
11.1<x<20	17.5 (2.32)	12	4294	4231	1.02	
21<x<40	33.67 (6.5)	12	2995	2524	1.18	
>41	55 (9.5)	23	7153	6579	1.09	
S Wales E=2		65	125054	105201	1.13	
Wales		193	207272	174675	1.12	

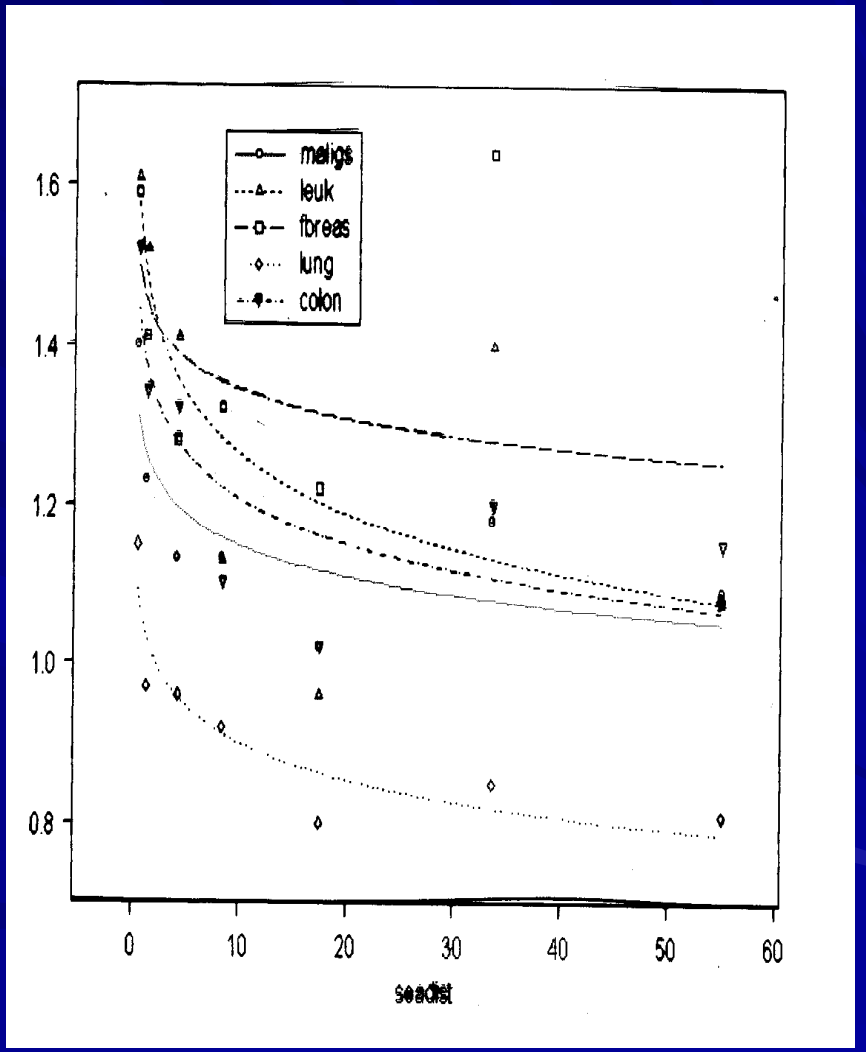
This shows results for all malignancy all adults 1974-89. The details for the AOR bands are given in the table above. Top right is a bubble plot of the individual RRs, radius weighted for expectation by distance from the sea. Bottom right shows a LOESS plot of the risks in the AOR bands. Note the sharp increase in risk in the 1km strip. This is a common feature of the results for adults and children.





The sea coast effect was seen in most of the main cancer sites in adults and was much greater in children

- The graph shows an exponential fit to data points for RR in the AOR bands for all malignancy, leukemia, female breast cancer, lung and colon cancer in adults. For all of these the regression of SEADIST (distance from the sea) on log(RR) was statistically significant at $p<0.05$ level.
- The effect was driven by high risks in towns on the North Wales coast near known areas of radioactive pollution in the intertidal sediment.



Childhood cancer 0-4 in Wales 1974-89 (circles and line) and 1984-88 (red) by distance from Irish Sea

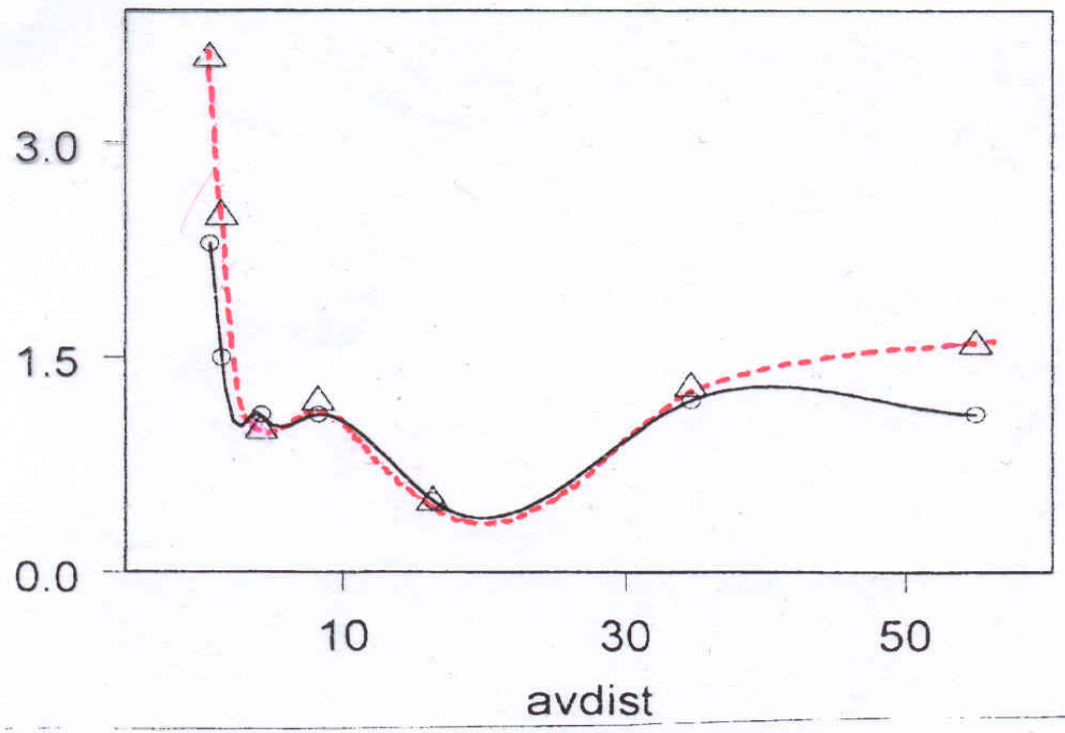


Fig 7. Childhood cancer in Wales 1974-89. Relative Risk trends 0-4 age group (177 cases) aggregated into AORs by distance from Irish sea . (Circles and line 1974-89, triangles 1984-88).

Childhood cancer in Wales 1974-89: some results

Range of distance from sea,<sd> (km)	Mean distance (std. dev)	Observed cases	Expected cases	Relative Risk	P-value Significance (Poisson)	Number of areas aggregated
<0.8	0.56(0.16)	17	4.8	3.6	0.0000	18
0.9<sd<2	1.4 (0.5)	17	6.8	2.5	0.0007	17
2.1<sd<5	4.2 (0.4)	6	6.5	1	-	15
5.1<sd<11	8.24 (0.66)	12	10.4	1.2	-	17
11.1<sd<20	16.4 (2.8)	2	4	0.5	-	14
21.1<sd<40	34.7 (5.8)	8	6.3	1.3	0.28	17
Sd>41	55 (9.3)	9	5.6	1.6	-	27
All South Wales		106	61	1.7	-	61

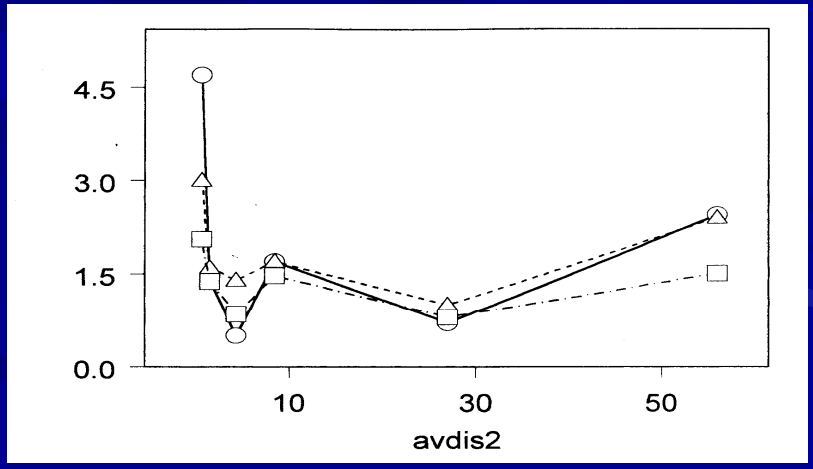
Top left: RR childhood cancer 0-4 1984-88 in distance bands.

Top right: RR brain tumours in coastal vs. inland towns

Bottom right: RR brain tumours in 0-4, 0-9 and 0-14

AOR	Observed cases			Relative Risk		
Northern Coastal	0-4	0-9	0-14	0-4	0-9	0-14
Entire Group of 11 AORs	9	13	15	3.9	2.7	1.9
*71JA Prestatyn	2	4	4	9.5	8.9	5.1
*74AE Llandudno	3	3	4	13.7	6.5	5.0
*74CA Bangor	2	2	2	11	5.1	3.0

AOR	Observed cases			Relative Risk		
Inland	0-4	0-9	0-14	0-4	0-9	0-14
Entire Group of 11 AORs	1	3	3	0.85	1.22	0.53



These results for children were disputed by the Welsh Office and COMARE in 1998 on the basis that the files received by Green Audit from Wales Cancer Registry were inaccurate. The data had been removed from the mainframe system and the new WCISU reported that there were no increases in child cancer in North Wales. By 2003 WCISU claimed that the child leukemia SRR in North Wales was 1.00. However, even in the data supplied by WCISU to COMARE in 2000 there were clusters of cases in the coastal towns close to the contaminated north coast. WCISU refused to release data backing up their claim that there was no problem. The situation changed dramatically in 2004 when the Welsh TV Channel S4C carried out research on the ground and located the children with leukemia and brain tumours near the contaminated Menai Strait near the towns of Bangor, Carnarfon where the earlier data had also suggested a problem (see below)

Table 4.4.3.7. AORs with more than one case and also high (>3) Relative Risk of leukemia age 0-4 in North Wales area between 1982-1990: 1998 revalidated data

AOR[a]	Number observed cases	Relative Risk
71CC Colwyn Bay	3	5.64
74CA Bangor	3	11.2
74CE Caernarfon	2	8.12

[a] refers to a coastal Area of Residence.

HTV: Y Byd ar Bedwar, Feb 10, 2004

Cansyrs Plant (*childhood cancer)*

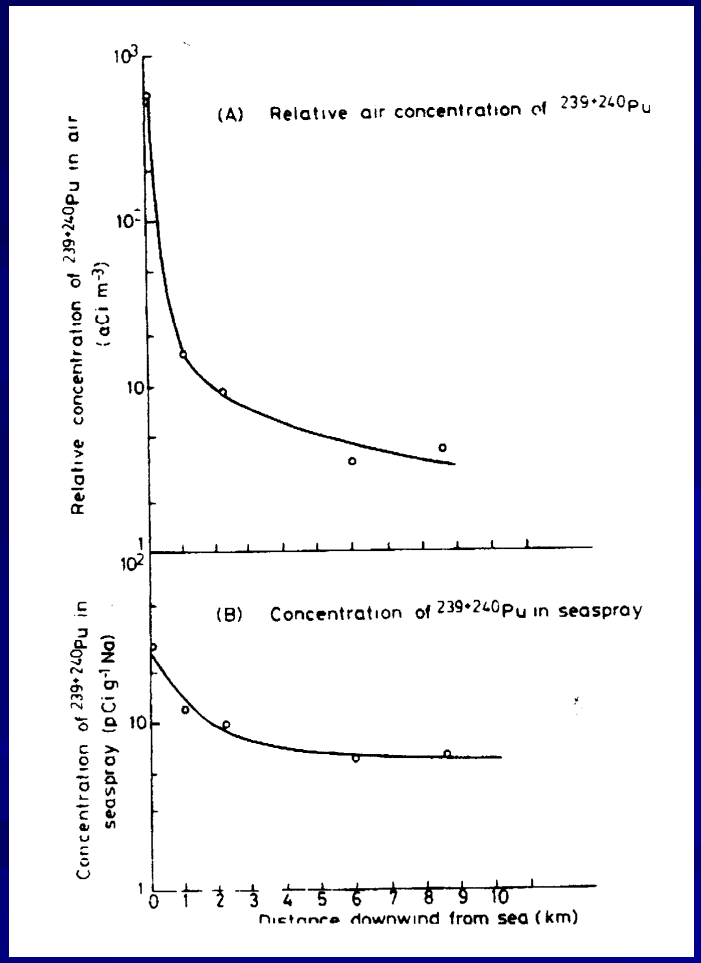
Tweli Griffiths, Linda Parry, Chris Busby

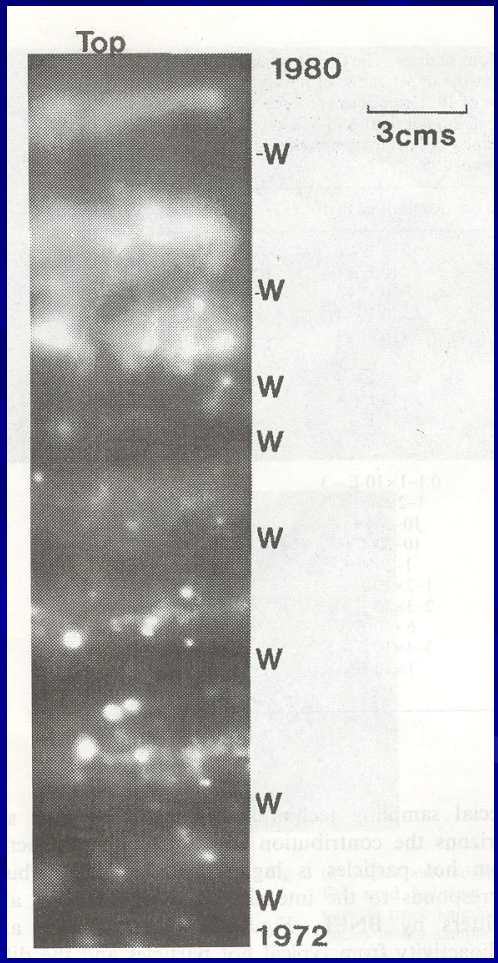
- The discoveries by HTV define the existence of a childhood leukemia and brain tumour cluster in the Menai Strait coastal area of north Wales, more serious and more statistically significant than the Seascale (Sellafield) cluster discovered by Yorkshire TV in 1983.
- From 2000-2003, 21-fold excess child leukaemia in Caernarfon ages 0-4; (3 cases, 0.1 expected, p = 0.0000) and 6 leukaemia cases in the 34 wards adjacent the contaminated Menai Strait, RR = 7.8 (p = 0.0005)
- From 1996-2003, 18-fold excess brain and spinal tumour rate in ages 0-14 in Caernarfon (5 cases; p = 0.0000) and 9 cases in the 34 Menai wards (RR=5.4, p = 0.0004)

Name	sex	Born	Diagnosed	Age at diag	Area A = Anglesey	Cancer
Kiara	f	00	03	2	LlanfairPG (A)	ALL
Mark	m	86	02	15	Boddffordd (A)	Hodgkins Lym.
Terry	m	99	00	1	Beaumaris (A)	ALL
Yazie	f	90	93	3	Bermo (Tywyn)	Brain
Alex	m	90	03	13	Amlwch (A)	NHL
Robert	m	99	02	3	Caernarfon, Waunfawr	ALL
Chloe	f	87	03	15	Menai Br (A)	Brain
Katie	f	99	03	3	Caernarfon	Retinoblastoma
Lee	m	88	02	14	Valley (A)	Brain
Lowri	f	98	00	2	Caernarfon	ALL
Sarah	f	87	01	14	Llandegfan (A)	Hodgkins Lym.
Rheinal	f	87	99	12	Criccieth	ALL
Luke	m	95	99	4	Amlwch (A)	AML
Daniel	m	85	01	14	Gaerwen (A)	Brain
Cantrey	f	98	99	1	Beaumaris (A)	Brain
Aled	m	99	03	4	Caernarfon	ALL
Gareth	m	90	98	8	Criccieth	ALL
Llinos	f	87	99	12	Llangefni (A)	Ovary
Max	m	90	02	11	Treaddur (A)	ALL
Rhys	m	98	02	4	Deiniolen	ALL
Cemlyn	m	89	02	13	Llanllechid	ALL
Chelsea	f	00	03	3	Aberdaron	Brain
Ryan	m	89	91	2	Criccieth	Brain
Ruth	f	84	01	6	Caernarfon	Brain
Lee tomos	m	88	96	8	Caernarfon	Brain
Amy	f	98	02	4	Caernarfon	Brain neuroblastoma

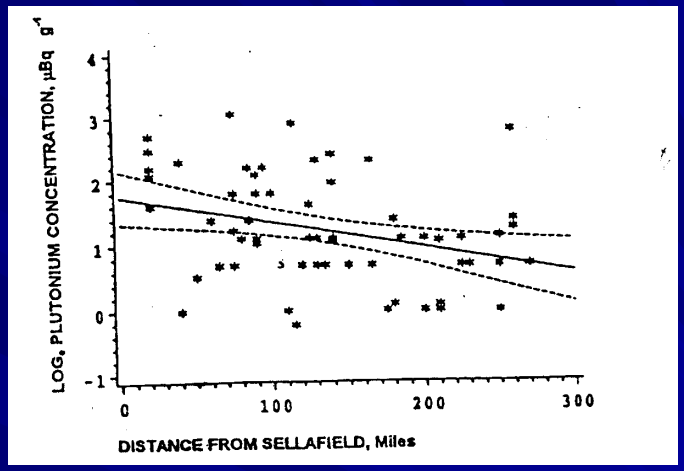
Explanation

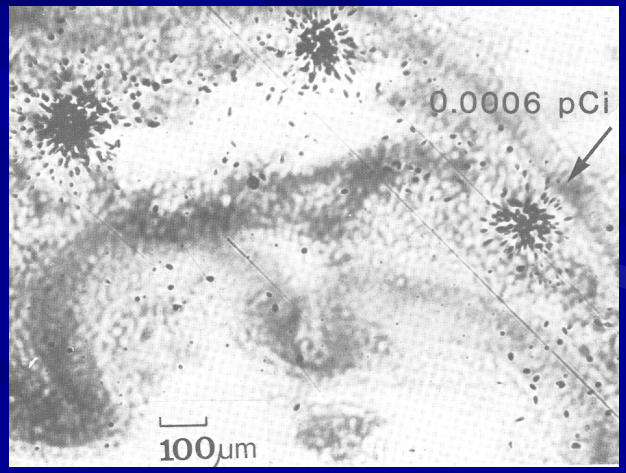
Sea to land transfer of plutonium etc and inhalation of particulates is enhanced near areas of contaminated intertidal sediment.





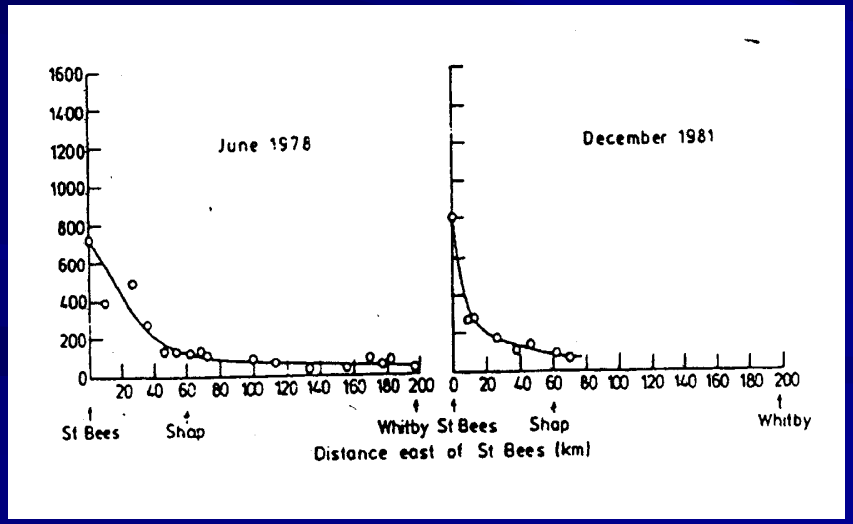
The painting by a Welsh artist, Steven Jones, and is of two little girls in the sea on the Menai. Top right: Plutonium in childrens' teeth by distance from Sellafield (log scale). Bottom: hot particle in edible mussel, CR39 tracks.

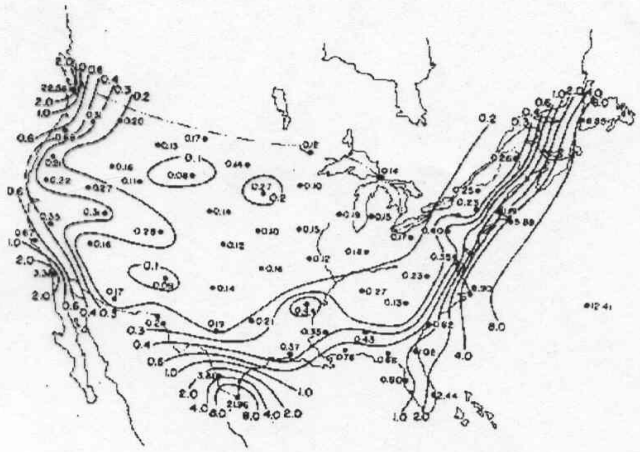




Penetration of Plutonium inland follows penetration of sea derived particles, mainly sodium chloride.

In USA the map opposite shows this (Junge 1963). Below, concentration of Pu-239 in sheep faeces across UK on West East transect from Sellafield. Bottom right, the formation of the ejected particle from seaspray.





Penetration of seaspray inland in the USA
Ocean derived Chloride ion concentration
from Junge 1961

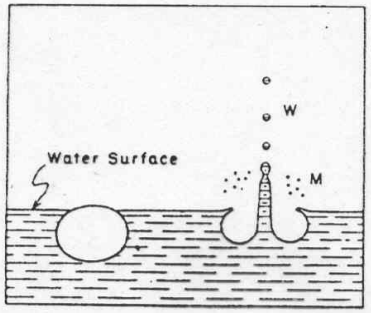
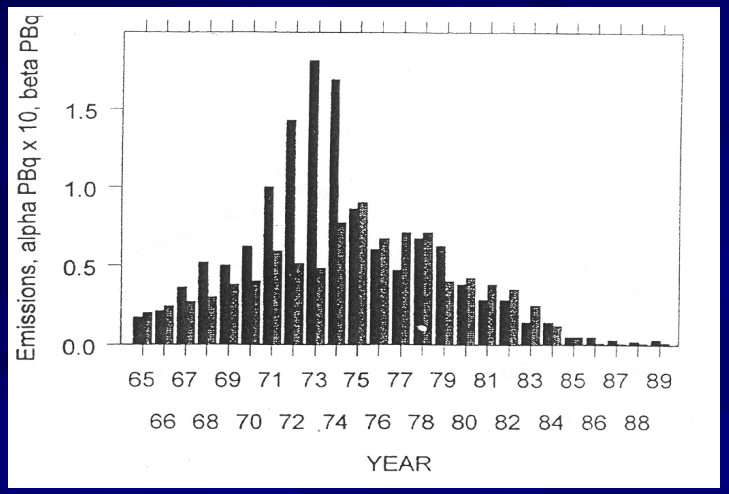
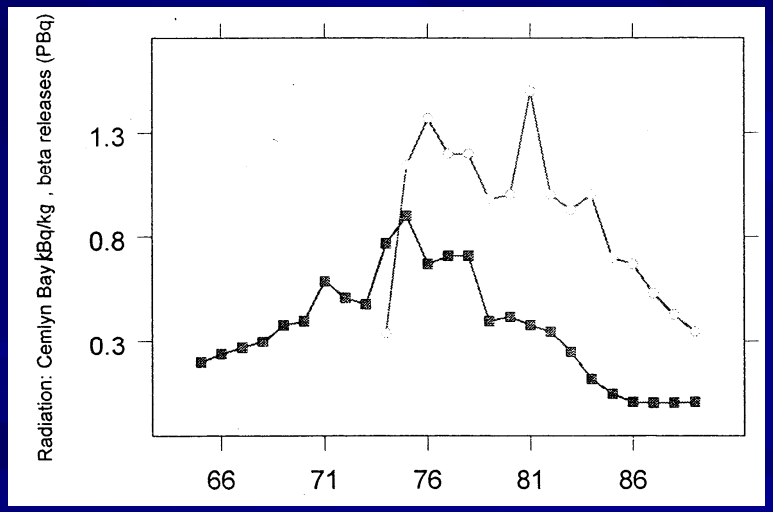
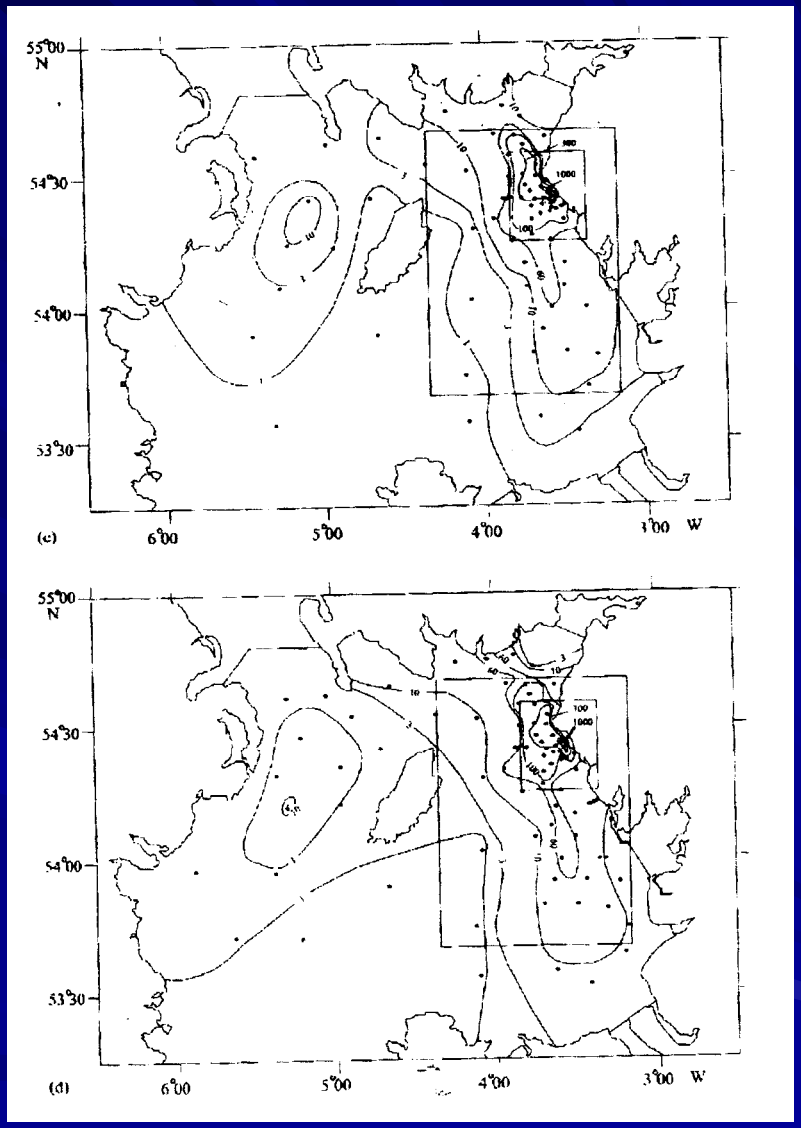


FIG. 34. The formation of sea-salt particles from the bursting of bubbles. The large droplets *W* originate upon disintegration of the jet and have been studied by Woodcock and his associates (Kientzler *et al.* 1954). More numerous and smaller particles *M* can form from the bursting of the bubble film (Mason, 1954).


Emissions, alpha PBq x 10, beta PBq
1.5
1.0
0.5
0.0
65 67 69 71 73 75 77 79 81 83 85 87 89
66 68 70 72 74 76 78 80 82 84 86 88
YEAR


Radiation: Cemlyn Bay kBq/kg , beta releases (PBq)
1.3
0.8
0.3
66
71
76
81
86


55°00 N
54°30
54°00
53°30
(c)
6°00
5°00
4°00
3°00 W
55°00 N
54°30
54°00
53°30
(d)
6°00
5°00
4°00
3°00 W

Supporting evidence

- Green Audit has found the sea coast effect on adult cancer in small area incidence studies in Ireland using National data 1994-96
- Green Audit/STAD questionnaire study in Carlingford and Dundalk showed that the effect on adult cancer shows highest trend in the 100m strip close to the contaminated mud.
- Green Audit has found a sea coast effect near two nuclear sites in the UK discharging to the sea, Hinkley Point in Somerset and Bradwell in Essex.
- A study by the University of Lancaster in 1988 found a sea coast effect on leukemia in Lancashire (Sellafield contamination)
- A study by University College Dublin found a modest sea coast effect on child leukemia in 1983-86 data on the east coast of Ireland.
- A study by Cartwright *et al* showed excess child leukemia in wards near estuaries in England and Wales in 1990.
- The Dounreay enquiry heard from the Scottish ISD that South West Scotland had the highest child leukemia rates.

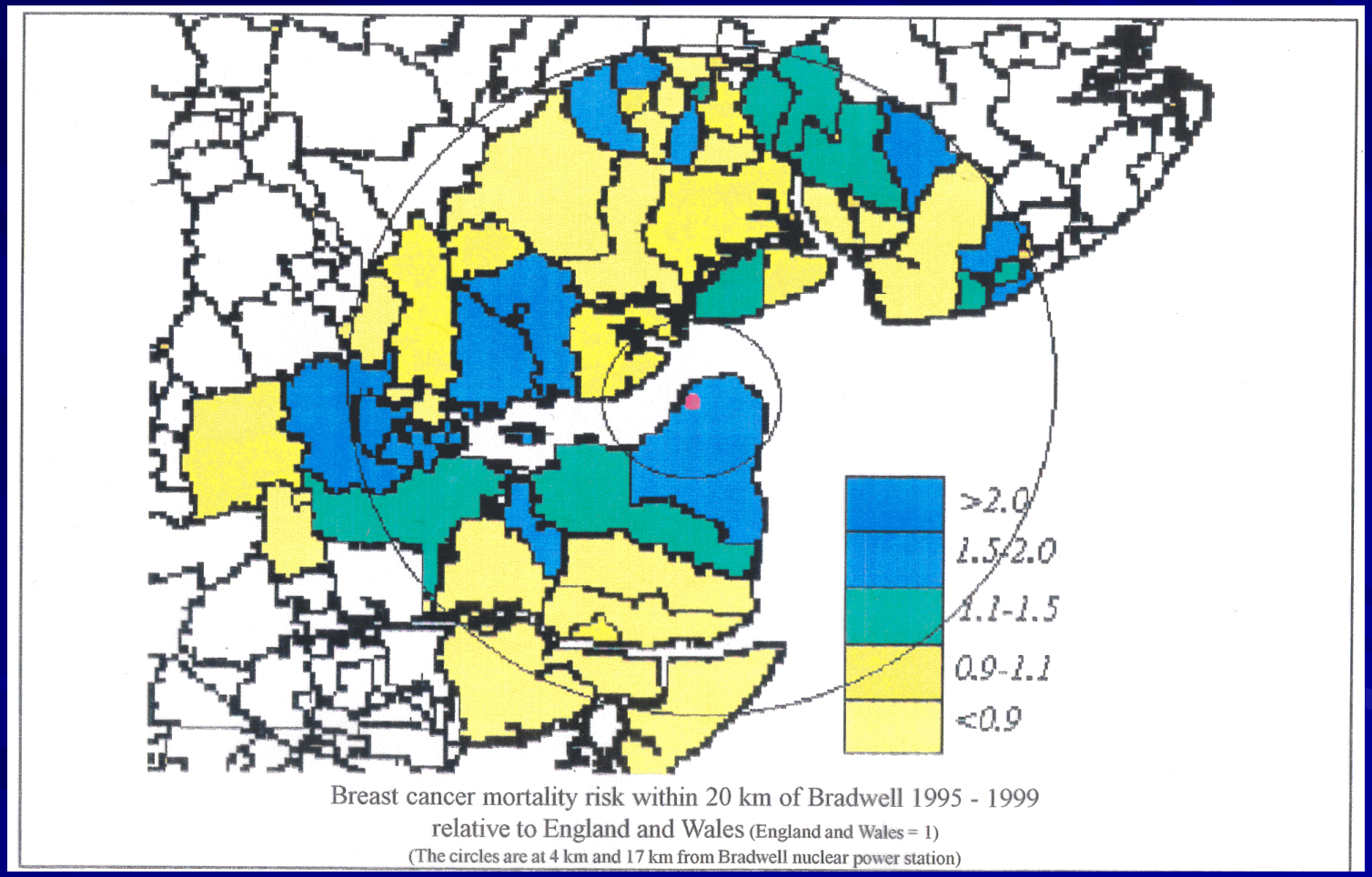
Child leukemia 0-4 in Dumfries and Galloway, Scotland

- In 2005 the Freedom of Information Act became law in the UK
- I suggested to the Green MSP for this area of South West Scotland, Chris Balance, that he apply for child leukemia data by ward from the Scottish Cancer registry so I could analyse it to see if the effects of the Sellafield contamination and the DU contamination from the Dundrennan range were apparent on the coast.
- When the cancer registry refused the data on confidentiality grounds Balance applied to the FoI commissioner for the data
- The Scottish FoI commission ordered the data to be released.
- The Cancer Registry refused and appealed to the Court of Sessions, the Scottish Appeal Court in Edinburgh. They upheld the FoI commissioner and again ordered the data released.
- The cancer registry again refused and appealed to the House of Lords in London; the British government sent a representative who bullied the Lords into overthrowing the two previous decisions. The data remain secret. The cases cost the taxpayer more than £1M

Meanwhile the Scottish Cancer Registry conducted their own study, published in *Occupational and Environmental Medicine*

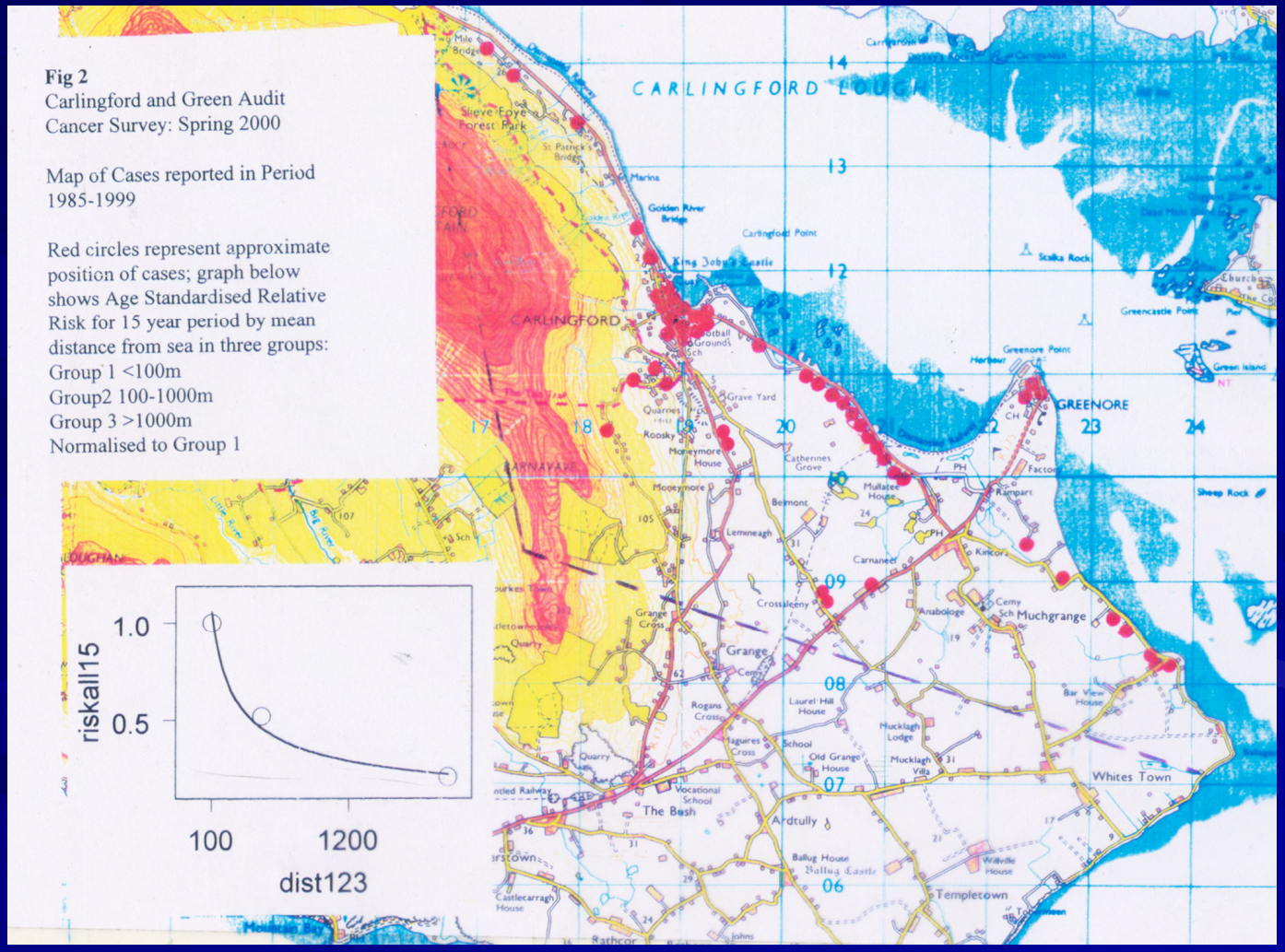
- Their study split the area into three bands, by increasing distance from the sea. Examination of all child leukemias 1974-2003 showed no consistent trend by distance from the sea and the authors concluded that their was no effect of the radioactive contamination
- However the argument was seriously flawed since Chernobyl occurred in the middle of their study period. The Chernobyl radiation fell inland in the hills, the most distant band from the sea and this biased the analysis since the highest levels of child leukemia were in this area following the Chernobyl radiation.
- I obtained the data for the 3 years after Chernobyl from the authors and reanalysed the child leukemias in the area with these 3 yeasr taken out. The sea coast effect immediately became apparent.
- I published the analysis in the same journal *Occ. Env. Med*. earlier this year.
- Without availability of small area data it is difficult to see if contamination has any effect. The cancer registries should be the target of public campaigns for data access.

Breast cancer mortality in wards near contaminated mud near Bradwell NPP, Essex, UK



Breast cancer mortality risk within 20 km of Bradwell 1995 - 1999
relative to England and Wales (England and Wales = 1)
(The circles are at 4 km and 17 km from Bradwell nuclear power station)

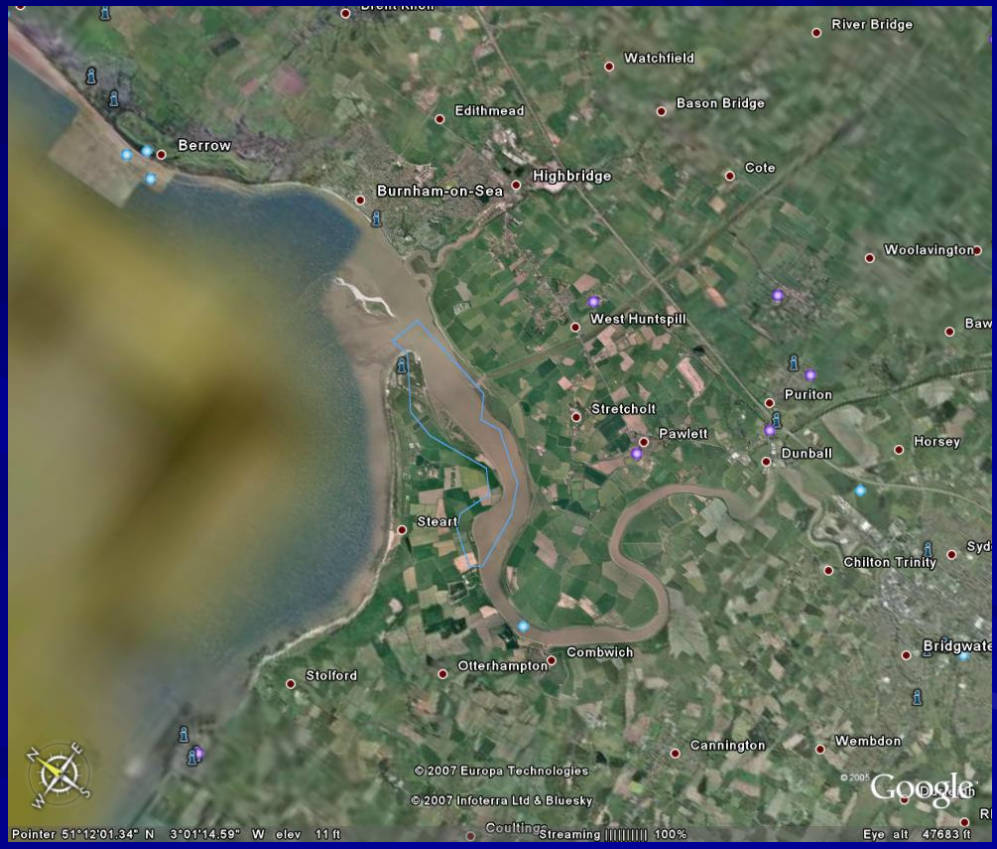
Results of STAD/ Green Audit questionnaire study in Carlingford and Greenore, Ireland, 2000;
red dots are cancer cases; blue region is contaminated mud.



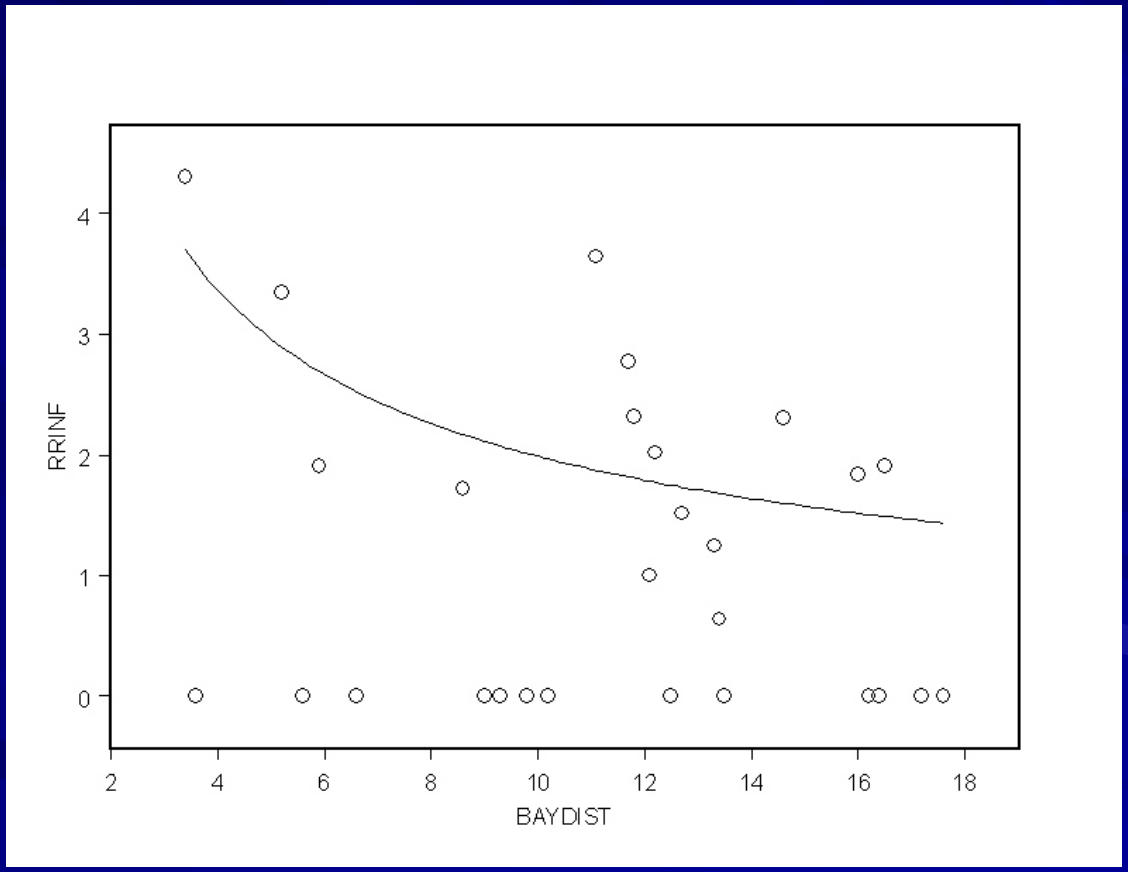
Evidence from Hinkley Point, Somerset, 2008

Hinkley Point Nuclear Power Station Somerset, UK situated on the coast upwind of Burnham on Sea

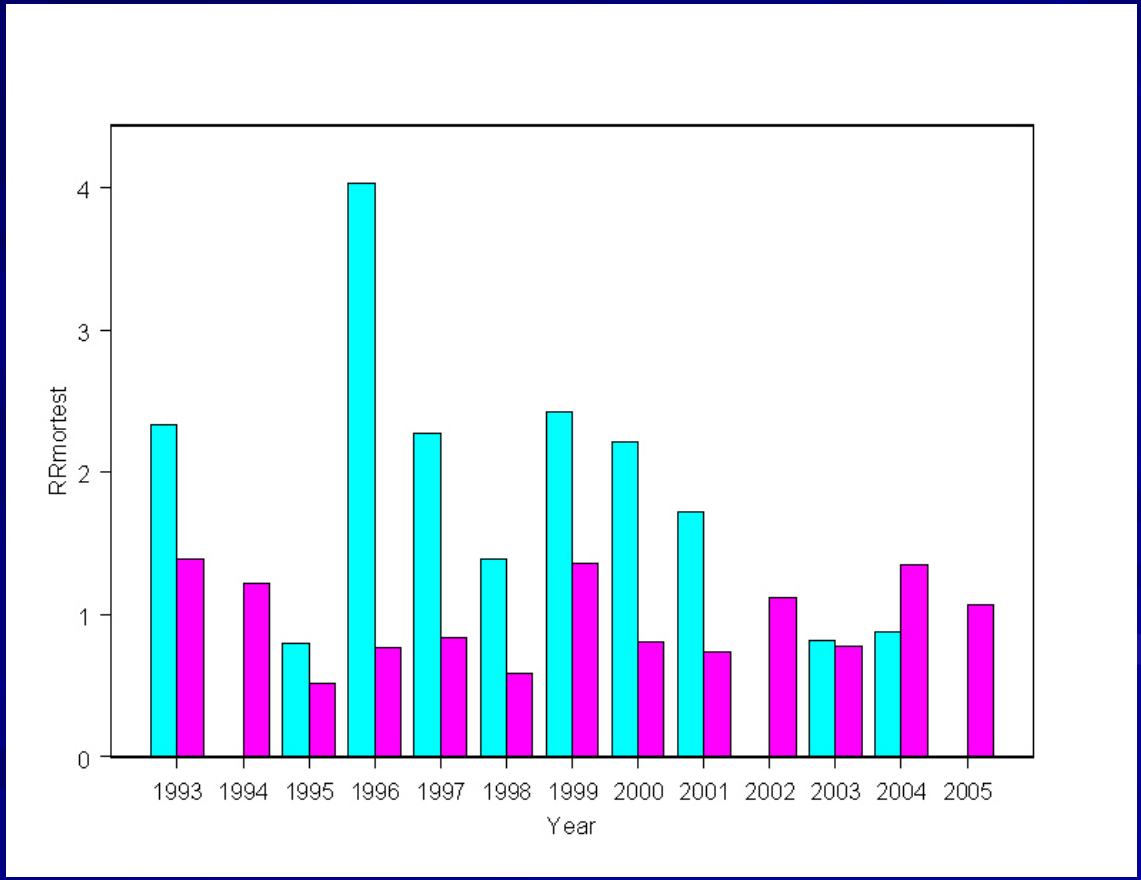
Radioactive material is discharged to the sea and accumulates in the intertidal sediment. In 2001, Green Audit showed a 2-fold excess risk of breast cancer deaths in the town from 1996. This was followed by a Green Audit designed door to door survey in 2002 which confirmed the excess and found a leukemia excess also. In 2007, Green Audit began looking at infant mortality in the area.



Infant mortality relative risk by ward distance from contaminated sediment near Hinkley Point; exponential fit to data



Infant mortality risk trend in estuary wards near Hinkley Point (blue) compared with inland wards (red). 1993-2005 The effects is highly statistically significant and seems to follow a peak in 1996



Conclusions

The increases in childhood leukemia and other childhood cancer are primarily caused be exposure to internal man-made radionuclides.

The ICRP model used to underpin the operation of nuclear plants and discharges of radiation to the environment are flawed by more than two orders of magnitude.

This is arguable in terms of theory (high local dose etc.) and clear in epidemiological studies, specifically the Chernobyl Infants.

The current cancer epidemic in adults has the same principal cause.

Coastal populations near fission-product and uranium contaminated sediment suffer excess risks of cancer and leukemia

What we are doing?

- The CERRIE Minority Report was published by us on 7th September 2004. ISBN 0-9543081-1-5 and is available from www.greenaudit.org or www.llrc.org
- The report of the European Committee on Radiation Risk ISBN 1-897761-24-4 was published on Jan 30th 2003 and is available from www.euradcom.org
- Further details of our research can be found on the websites of the Low Level Radiation Campaign www.llrc.org and Green Audit www.greenaudit.org
- Much of my research and my activities including all the Irish Sea Sellafield research can be found in my new 2007 book *Wolves of Water* available from Green Audit (admin@greenaudit.org) and all booksellers

The nuclear industry is conducting a war against humanity– Dr John Gofman, 1981