

Leukaemia Cluster in Children near Kruemmel NPP and GKSS Nuclear Research Center in Germany

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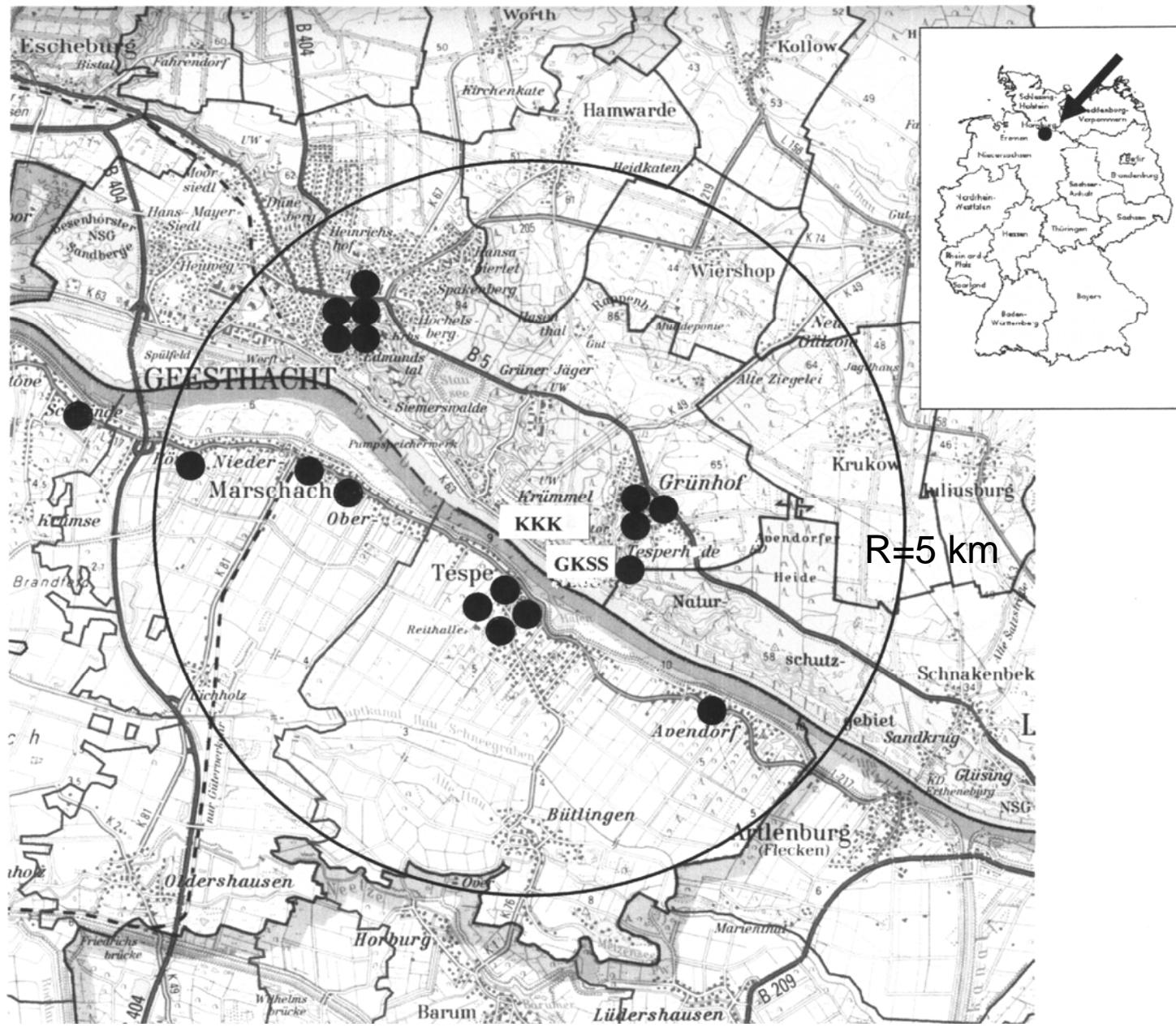
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Studies establishing excess leukaemia and cancer risk in children living near nuclear sites.

From ECRR-Report 2003

Nuclear Site	Year	Notes
^a Sellafield/Windscale, UK	1983	Well studied by ^f COMARE: high level of discharge to atmosphere and sea
^a Dounreay, UK	1986	Well studied by ^f COMARE: high level of discharge to atmosphere and sea
^a La Hague, France	1993	Particle discharge to atmosphere and sea: ecological & case control studies
^c Aldermaston/Burghfield, UK	1987	Well studied by ^f COMARE: particle discharge to atmosphere and rivers
^b Hinkley Point, UK	1988	Discharges to offshore and bank
^d Harwell, UK	1997	Discharges to atmosphere and river
^e Birkenfeld, Germany	1990	Discharges to atmosphere and drinking water
^{b,d} Krümmel, Germany	1992	Discharges to atmosphere and Elbe river
^d Jülich, Germany	1996	Discharges to atmosphere and river
^b Barsebaeck, Sweden	1998	Discharges to atmosphere and sea

^aReprocessing plants discharging to sea; ^bNuclear power station discharge to sea or river; ^cAtomic weapon and nuclear material fabrication plants; ^dAtomic research with discharges to local rivers, ^eUranium waste, ^fCommittee on Medical Aspects of Radiation in the Environment, U.K.



Epidemiologic phenomena about the cluster

- More boys than girls
- Ages at diagnosis ≤ 10 years

Cluster Analysis of the German Registry of Childhood Cancer 1984-1993 for Federal State Lower Saxony (8 million inhabitants)

Location	Mean number of children	Expected Cases ¹	Observed Cases	SIR ²	p-value ³
Kruemmel	1.341	0,6	5 ⁴	7,7	0,0003
Sittensen	1.588	0,7	5	7,4	0,0007
Neu Wulmstorf	2.327	1,0	5	5,0	0,004
Dassel	1.748	0,7	4	5,5	0,007
Bad Pyrmont	2.468	1,0	4	3,9	0,021
Stelle	1.433	0,6	3	4,8	0,025
Braunlage	702	0,3	2	6,7	0,036
Northeim	4.369	1,8	5	2,7	0,038
Wietmarschen	1.854	0,8	3	3,8	0,045
Langenhagen	6.077	2,6	6	2,3	0,048
Duingen	829	0,4	2	5,7	0,048

¹age-standardized

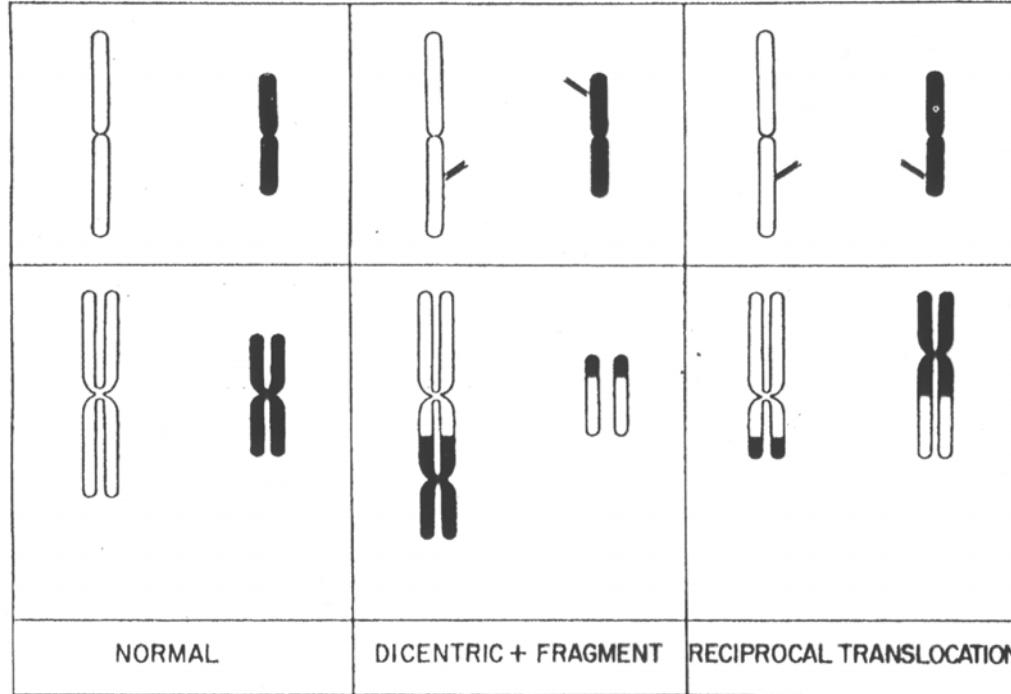
²relation of observed cases to expected

³Poisson distribution assumed

⁴including 1 patient having

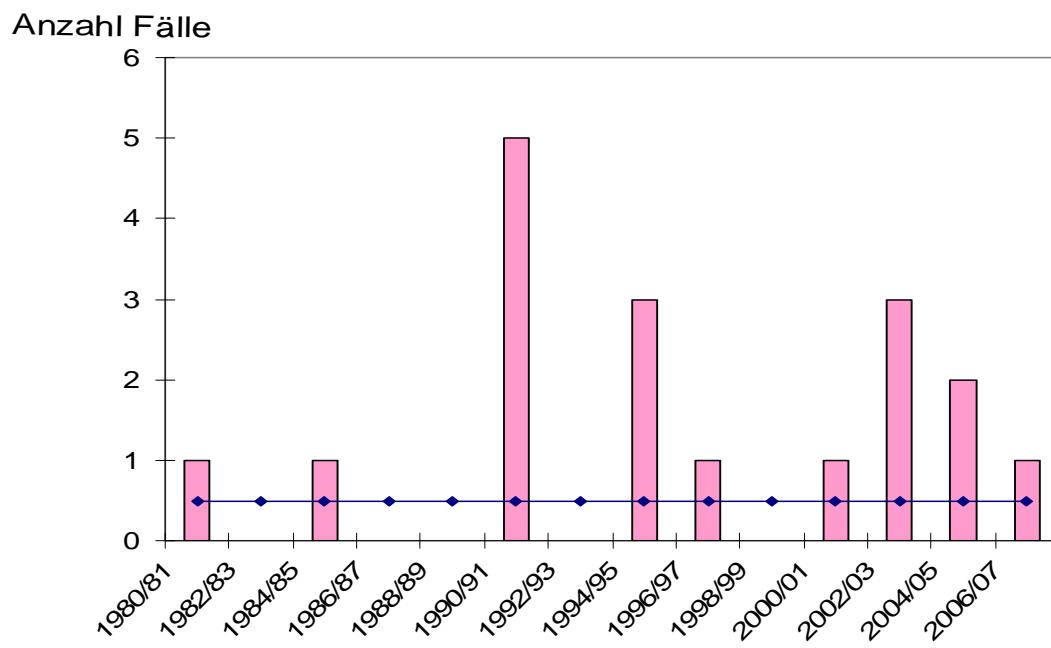
Investigations

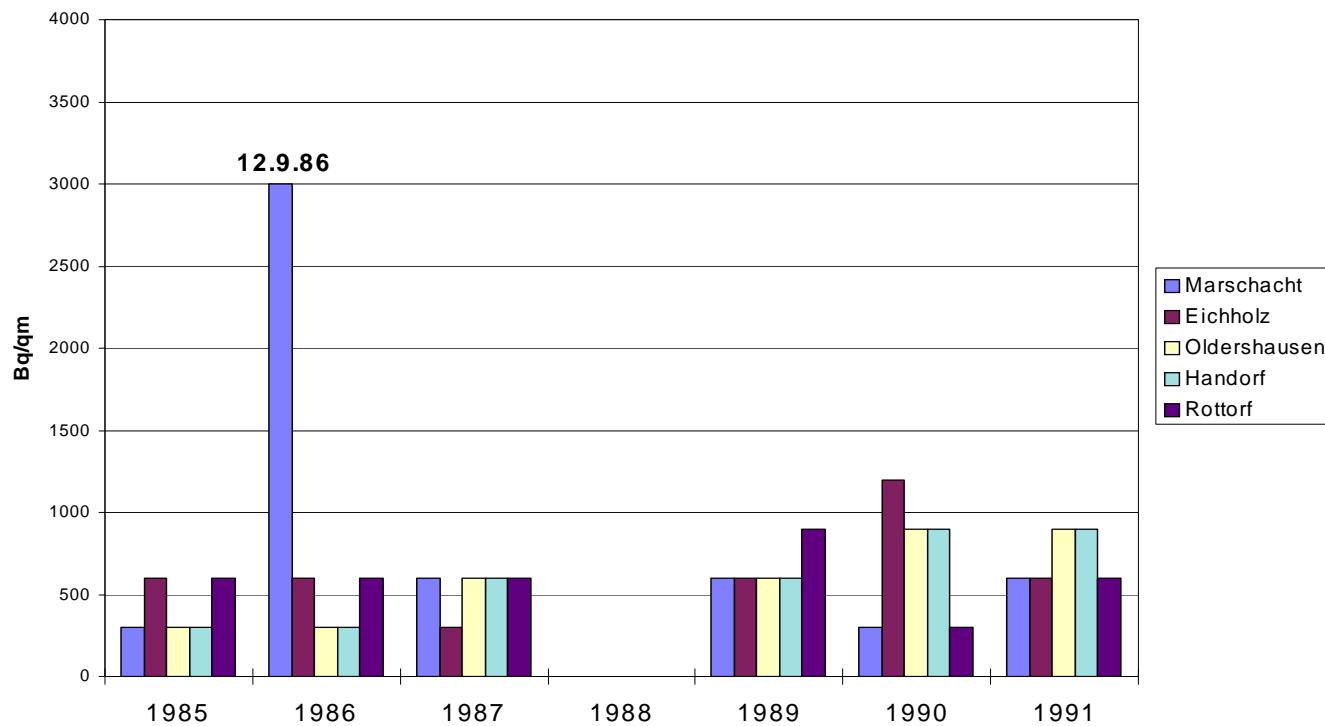
- Chromosome studies
- Environmental radioactivity
- Analysis of an accident



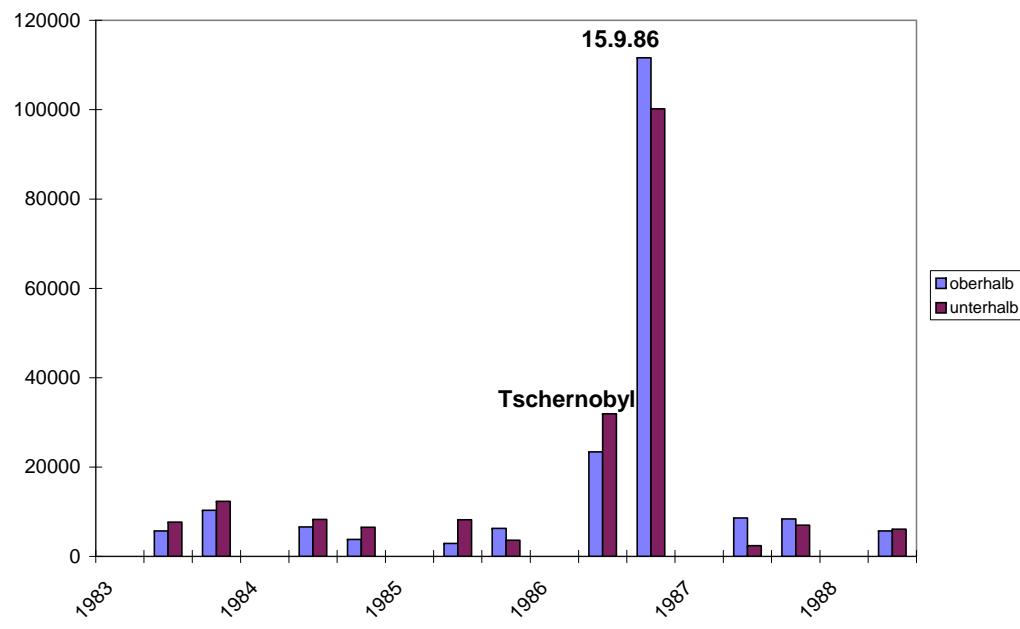
Interchromosomal aberrations







Gemessene Betaflächenaktivität durch GKSS an verschiedenen Stationen



Spaltprodukt Cs 137 im Elbsediment bei GKSS in **mB/kg**, oberhalb
GKSS-Einleitstelle und unterhalb GKSS-Einleitsstelle, Messung LUFA Kiel

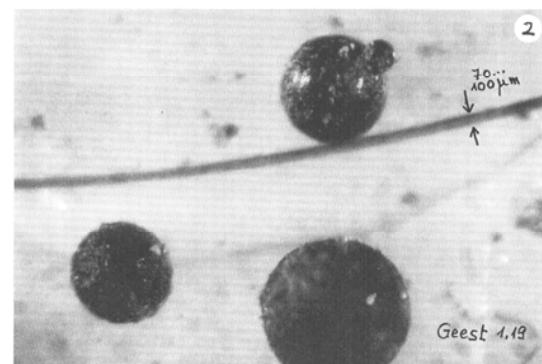
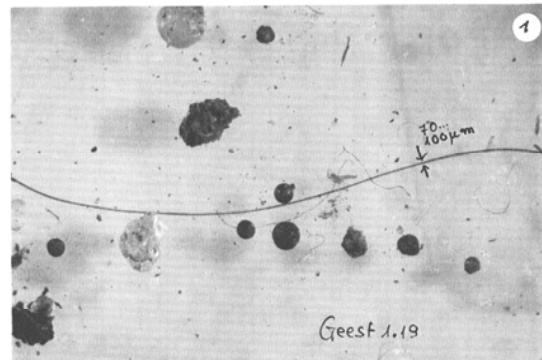
**Dachstaubuntersuchung der Aufsichtsbehörde, ausgeführt
durch Massenspektrometrie in Universität Mainz**

Massenverhältnis der Plutoniumisotope in den Proben Tespe 2 (Elbmarsch)
und Bergenhusen 1 (Kontrollort)

	Verhältnis Isotop/gesamt Pu in %			
	Pu 239	Pu 240	Pu 241	gesamt Pu
„ELBMARSCH“	85,06	14,11	0,83	100
„KONTROLLE“	85,12	14,05	0,85	100

Massenverhältnis der Plutoniumisotope in den Proben Tesperhude 2 (bei Geesthacht),
Kropp 3 (Kontrollort A) und Grabensee (Kontrollort B)

	Verhältnis Isotop/gesamt Pu in %			
	Pu 239	Pu 240	Pu 241	gesamt Pu
„GEESTHACHT“	86,30	13,18	0,53±0,12	100
„KONTROLLE A“	86,06	13,33	0,66±0,18	100
„KONTROLLE B“	86,00	13,28	0,72±0,12	100



Geest: 1.19; NO von KKK
Kugelhäufigkeit (KH): 2

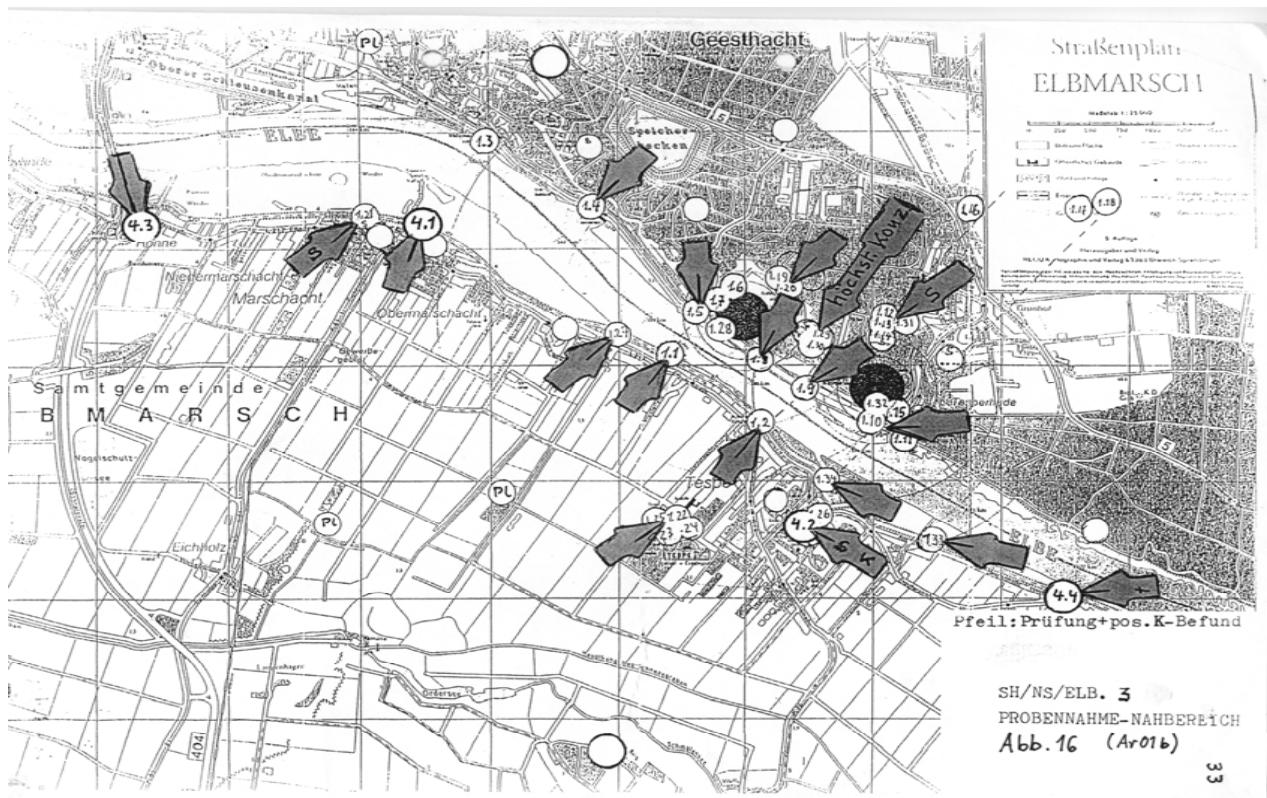
1 (>60/30g Boden)

2 (10-60/30g)

3 (<10/30g)

4 (quasi 0)

Abb.22



Which hypotheses are offered to explain the effect other than radiation?

Chance

Viruses, general clustering caused by microepidemias

Greaves

Kinlen

Genetical susceptibility

Unknown factors which are to detect by studying the molecular mechanisms in leukaemia development (German Commission on radiological Protection)

Unknown risk factors to be found by further research efforts

Leukaemia in childhood is caused by ionizing radiation via 4 induction chains:

- Somatic – exposure as a child
- Prenatal – by exposure of the embryo or fetus in utero
- Genetic/preconceptional – by gonadal exposure of mother or father

