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**TECHNICAL WORKSHOP ON PUBLIC HEALTH IMPACTS AND RISKS
RESULTING FROM HYDROCARBONS EXPLORATION AND
PRODUCTION**

8th November 2016, Brussels

- GENUK e.V., Non-profit Network on Environmental Illnesses, Germany
- Member of EUROPAEM, the non-profit « European Academy for Environmental Medicine » and HEAL, „Health and Environment Alliance
- Member of the „TEAM GESUNDHEIT“ in the nationwide network of 74 civil groups against fracking
- Cooperating with Lower Saxony Health Authorities since December 2013 in several working groups

Communalities of unconventional and conventional hydrocarbon extraction referring to probable health impacts

Apart from

- the additional health threats by frac fluid additives (e.g. up to 37 % EDCs),
- the dangers of molecular cracking and uncontrolled building of new chemical substances under conditions of high pressure and heat
- the high quantity and density of unconventional drilling sites elevating the risk level of health impacts in unconventional O&NG production...

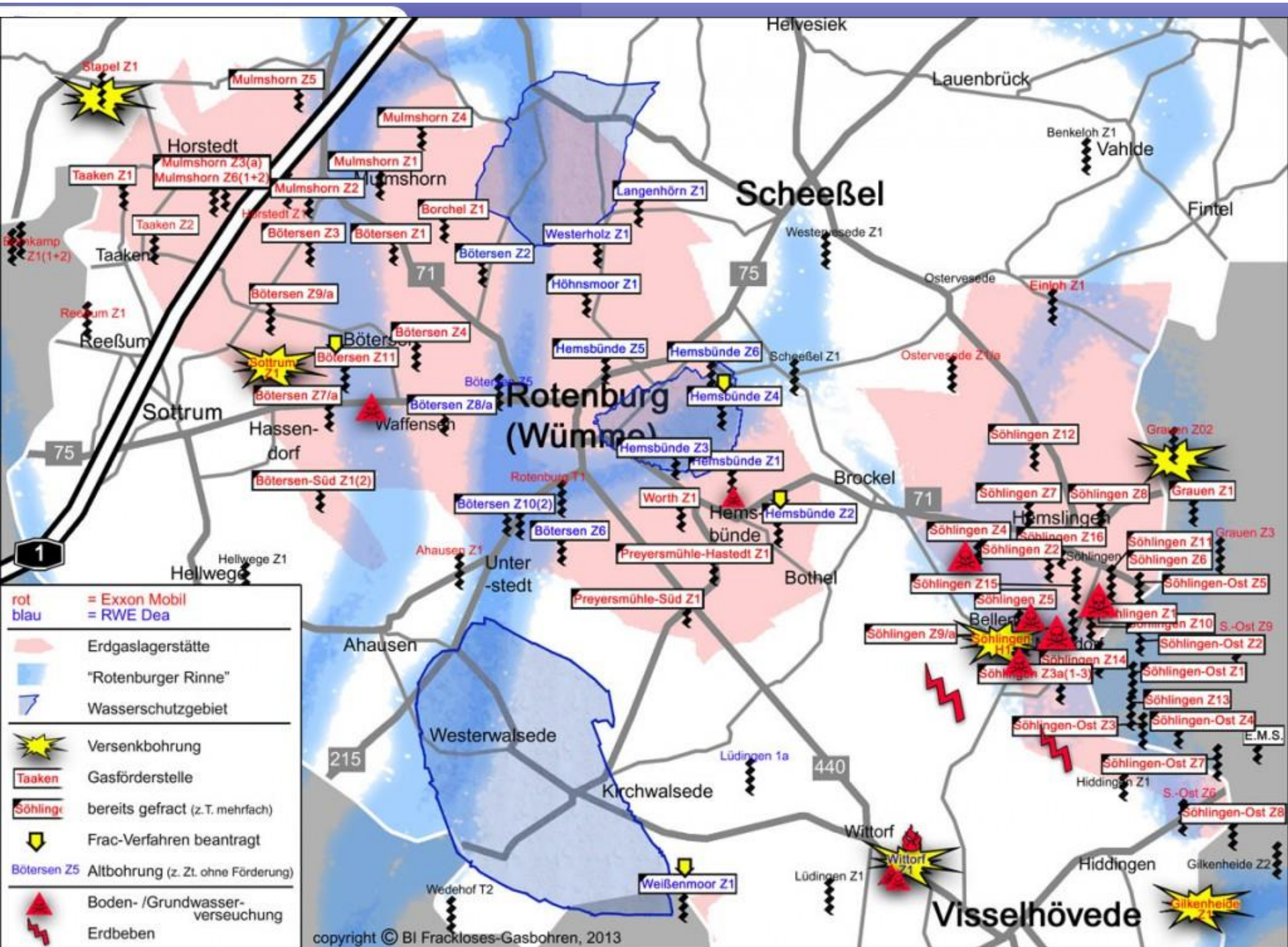
...the main communalities are to be found in the hazardous health effect of the inherent mixture of substances rising up from the depth to air transmission pathways.

Those inherent hazardous substances in hydrocarbon extraction, production and waste disposal have common properties in its entirety: they are

- **cancerogenous**
- **teratogenic**
- **mutagenic**
- **toxic**
- **impairing hormone-, nervous-, immune-systems**



**THIS IS NOT AMERICA.....WORKOVER, acidization, gas flaring
Söhlingen, Rotenburg, April 2014**



rot	= Exxon Mobil
blau	= RWE Dea
	Erdgaslagerstätte
	"Rotenburger Rinne"
	Wasserschutzgebiet
	Versenkbohrung
	Gasförderstelle
	bereits gefract (z.T. mehrfach)
	Frac-Verfahren beantragt
	Altbohrung (z. Zt. ohne Förderung)
	Boden- /Grundwasser- verseuchung
	Erdbeben

Reported Health problems in a main area of gas drilling in Lower Saxony

Muscle pain/Fibromyalgia
Joint pain/Rheumatism
Asthma/Respiratory problems
Headache, Migraine, Dizziness
Nausea caused by odour nuisance
Burning sensation of skin and mucosa
Suspected cases of higher premature birth rates
Cancer



**WORKOVER, Acidization
Söhlingen April 2014**

AIR TRANSMISSION ROUTE

VENTING OF GAS

COMPLEX GAS-MIXTURE

PAH, VOC, BTEX, heavy/alkaly metals,
organic Gases, NORM, formaldehyde,
nitrogen oxide, sulfur dioxide, methane...



GAS FLARING

COMBUSTION RESIDUES

PAH, VOC, radionuclide, Heavy metals,
dioxins. Furans, particulate matters...



RELEASES FROM WELLS

+ BOREHOLES, VERTICAL
CRACKS, MUD DEPOSITS...

methane, ethane, propane,
BTEX, VOC, PAK, mercury, hydrogen
sulfide...

Is there a cancer risk due to different oil and gas production methods, including fracking?

Part I

The Lower Saxony Epidemiological Cancer Registry, EKN, elaborated these data:

- 2014, September: There is doubling the rate of non-Hodgkin's lymphoma and tripling the multiple myeloma rate in elder men (aged 60-75 years) in the integrated community of Bothel municipality with approximately 20 drilling sites and drilling activities elder than 30 years - **cause unknown**
- 2015, June: 2.5-fold increase in the disease rate of multiple myeloma and 31% increase in the overall hematologic cancer rate also only in elder men (aged 60 -75 years) in the municipality of Rotenburg with 20 drilling sites and drilling activities elder than 30 years - **cause unknown**

12 different cancer types tested:

Die folgende Tabelle gibt die Ergebnisse für die 15 Untersuchungsgruppen an:

Krebslokalisation bzw. -diagnose	Geschlecht	Beobachtete Neuerkrankungen	Erwartete Neuerkrankungen	p-Wert	Signifikanz für diese Untersuchung
Mund + Rachen	m + w	6	12,1	0,9813	n.s.
Verdauungsorgane außer Leber	m	66	61,0	0,2783	n.s.
	w	52	49,7	0,3916	n.s.
Leber	m + w	2	5,2	0,9667	n.s.
Kehlkopf, Lunge	m	43	39,3	0,2957	n.s.
	w	10	16,0	0,9561	n.s.
Knochen, Haut, Weichteilgewebe u.ä.	m + w	32	27,5	0,2183	n.s.
Brustdrüse	w	85	75,2	0,1411	n.s.
Weibliche Genitalorgane	w	28	28,8	0,5863	n.s.
Prostata, Hoden	m	95	82,9	0,1036	n.s.
Niere, Harnorgane	m + w	29	31,5	0,6948	n.s.
Hirntumoren	m + w	7	6,9	0,5345	n.s.
Endokrine Drüsen	m + w	9	4,5	0,0385	n.s.
Leukämien + Lymphome	m	41	21,3	0,0001	signifikant
	w	15	16,8	0,7010	n.s.

n.s. = nicht signifikant

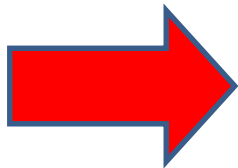
1. mouth/throat,
2. digestive organs (without liver),
3. liver,
4. larynx/lung,
5. bones/skin/soft tissue,
6. mammary gland,
7. female genital organs,
8. prostate/testicle,
9. kidneys/urinary tract organs,
10. brain tumor,
11. endocrine glands,
12. leukemia+ lymphoma

Epidemiological Cancer Registry of Lower Saxony, 2015

In **Tabelle 5** sind die Ergebnisse der gemäß dem Auswertungskonzept rein deskriptiven Betrachtung der Einzelgemeinden aufgeführt. In den Gemeinden Sottrum, Kirchlinteln, Rotenburg, Scheeßel und Visselhövede wurden mehr Neuerkrankungen beobachtet als erwartet ($SIR > 1$), in den Gemeinden Langwedel und Neuenkirchen weniger Fälle als erwartet ($SIR < 1$).

Tabelle 5: Häufigkeit von hämatologischen Krebsneuerkrankungsfällen bei Männern in den einzelnen Gemeinden in den Diagnosejahren 2003 – 2012 (Vergleichsregion Bezirk Lüneburg, EKN-Stand 31.03.2015); inkl. DCO-Fällen

Gemeinde	Neuerkrankungen beobachtet	Neuerkrankungen erwartet	SIR (beobachtet/ erwartet)	95% Konfidenzintervall des SIR (zweiseitig)	Altersstandardisierte Neuerkrankungsrate je 100.000 (Stdbev Europa)
Sottrum	42	33,8	1,24	0,90 - 1,68	49,9
Langwedel	34	35,1	0,97	0,67 - 1,35	40,2
Kirchlinteln	28	25,4	1,10	0,73 - 1,59	43,3
Rotenburg, Stadt	72	54,8	1,31	1,03 - 1,66	52,2
Scheeßel	34	31,8	1,07	0,74 - 1,49	41,8
Visselhövede, Stadt	28	27,0	1,04	0,69 - 1,50	44,6
Neuenkirchen	12	16,1	0,74	0,38 - 1,30	29,2



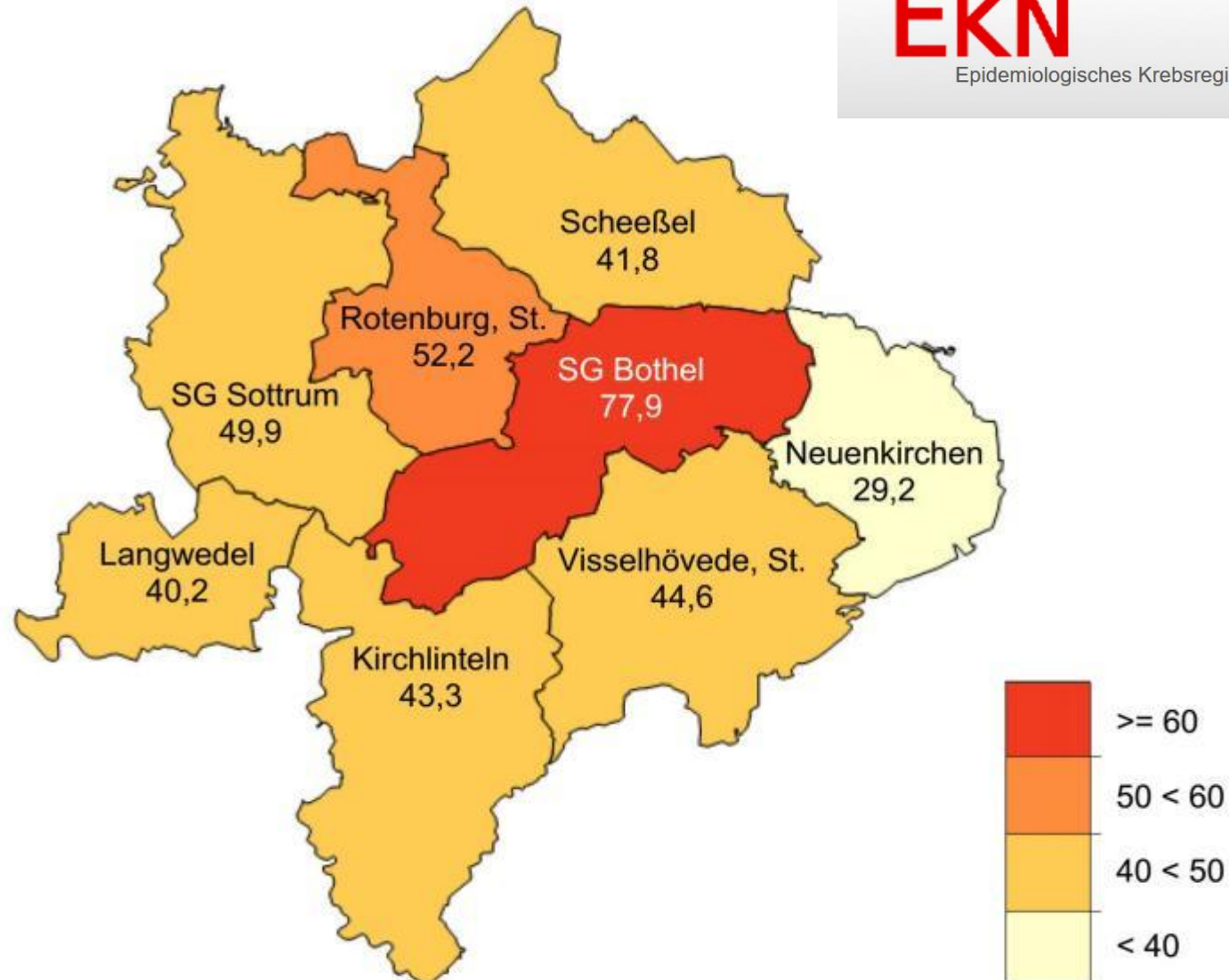


Abbildung 3: Altersstandardisierte Neuerkrankungsraten bei Männern für hämatologische Krebserkrankungen 2003 - 2012 in den untersuchten Gemeinden und der SG Bothel (je 100.000 Einwohner, Standardbevölkerung Europa)

Civil groups of the county Rotenburg/Wümme show the overlapping of the elevated hematologic cancer rates in elder men (yellow areas) and frequency of drilling sites (red points)

Gasindustrie und Krebs-Cluster im Landkreis Rotenburg (Wümme)

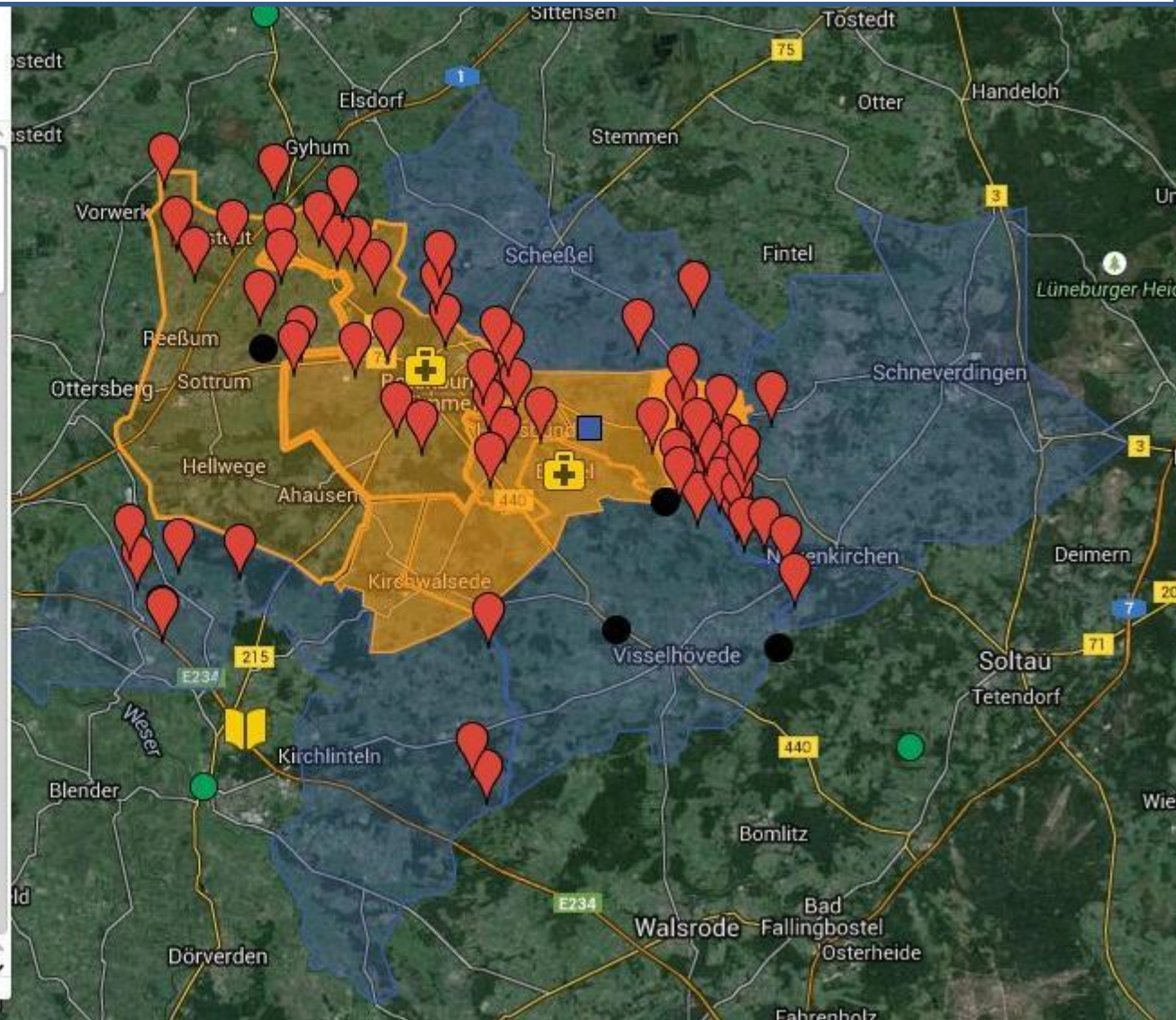
<http://www.krebsregister-niedersachsen.de/index.php/>



Mit Google My Maps erstellt

Unbenannte Ebene

- Kreisstadt Rotenburg (Wümme)
- Scheeßel - Landkreis Rotenburg (W...)
- Visselhövede - Landkreis Rotenbur...
- Neuenkirchen / Schneverdingen (H...)
- Samtgemeinde Sottrum - Landkrei...
- Kirchlinteln (Landkreis Verden)
- Langwedel (Landkreis Verden)
- Söhlingen Z1
- Söhlingen Z2
- Söhlingen Z3
- Söhlingen Z4
- Söhlingen Z5
- Söhlingen Z6 und Z11
- Söhlingen Z7
- Söhlingen Z8
- Söhlingen Z9
- Söhlingen Z10
- Söhlingen Z12



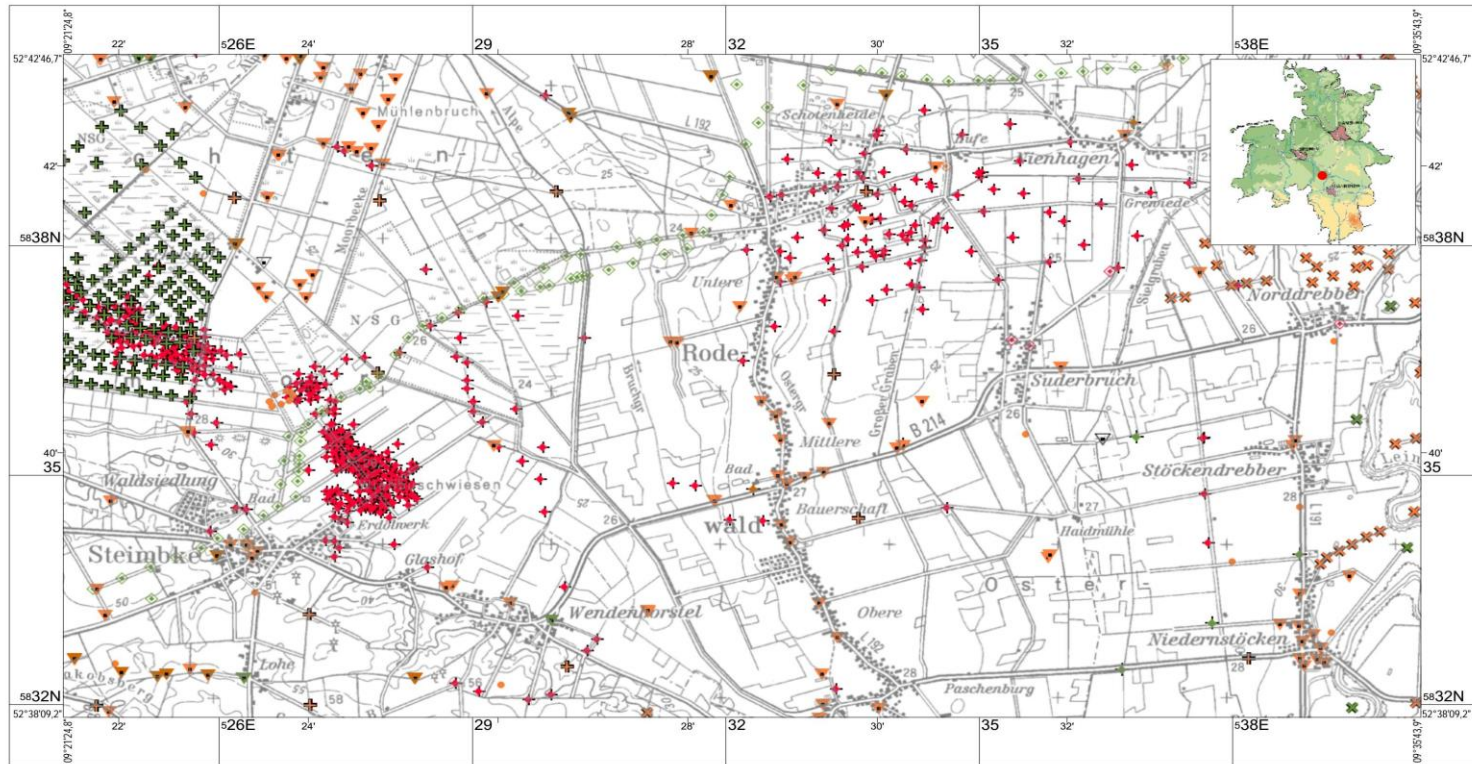
Is there a cancer risk due to different oil and gas production methods, including fracking?

Part II

The Lower Saxony the Epidemiological Cancer Registry, EKN, elaborated these data:

- 2015, December: in the village Rodewald with a history of intense oil production in the county Nienburg: significantly elevated rates of children's leukemia (2004 -2007) – **cause unknown**
- 2016, April: elevated hematologic cancer rates of adults (20 cases while 12 were to be expected) – **cause unknown**

Karteninhalt: Geologische Bohrungen, Hydrogeologische Bohrungen, Ingenieurgeologische Bohrungen, Tiefbohrungen onshore und offshore, Bohrungen der Steine und Erden, Bodenkundliche Kartierung des Küstenraumes, Bodenkundliche Bohrungen



This graphics show one of the central oil drilling areas after world war II (about 40 km in the north of Hannover). The village of Rodewald has had 67 drilling sites. The highest production rate was realized in 1952, but went on till 1994.

Significant rates of leukemia in children at Rodewald/Steimbke :

The result of an examination of the **German children's cancer registry** in the diagnosis period from 1989 - 2014 found 6 cases of hematologic cancer in the area of the integrated community of Steimbke, while 1,7 cases were to be expected. 4 of them lived in the community of Rodewald, where 0,6 cases were to be expected.

This is a **significant elevation** in children younger than 15 years for the Joint Community of Steimbke as well as the single Community of Rodewald. In the period between 2003-2007 3 children got sick with leukemia just in Rodewald

Elevated rates of hematologic cancer Rates in adults:

- 19 + 1 men and women, amongst them a big group multiple myeloma

Tabelle 3: Häufigkeit von hämatologischen Krebsneuerkrankungsfällen in der SG Steimbke und der Gemeinde Rodewald in den Diagnosejahren 2005 - 2013 (inklusive DCO-Fällen, Vergleichsregion Bezirk Hannover, EKN-Stand Dezember 2015)

Gebiete	Neuerkrankungen beobachtet	Neuerkrankungen erwartet	SIR (beobachtet/ erwartet)	95% Konfidenz- Intervall des SIR (zweiseitig)	p-Wert (einseitig)
SG Steimbke	46	36,2	1,27	0,93 - 1,69	0,0661
Gemeinde Rodewald	20*	12,7	1,57	0,96 - 2,43	0,0358

*Beobachtete Fälle inkl. einem geschätzten Fall

Rodewald – an exemplary case of pollution by industry and omission by statal authorities

Here the results of measurements of emissions of BTEX by the **German Technical Supervisory Association in 1988** were very striking, especially referring to benzene:

instead of max. 5 mg benzene per m³ air, there were **1890 mg benzene per m³ air emitted day and night 365 days a year by those 8 m high exhaust pipes**

Who prompted this important measurement?

No, it was not initiated by the mining supervising authorities - it was the nearby neighbour, disturbed by strong odours, who started a lawsuit against the precursor-company to Exxon Mobile Europe (nowadays owner).

What happened after the court decision to stop the station blowdown or simple gas venting?

The mining authorities ignored fully the hazardous consequences and remained inactive for decades

Unconventional oil and gas development and risk of childhood leukemia: Assessing the evidence

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...“our assessment identified 20 known or suspected carcinogens that could be measured in future studies to advance exposure and risk assessments of cancer-causing agents.”

Group 1, carcinogenic to humans: 1,3-Butadiene / Benzene / Engine haust (diesel) / Ethanol / Formaldehyde / Particulate matter / Radon /

Group 2A, Probably carcinogenic to humans: Dibenz(a,h)antracen / Tetrachloroethylene

Group 2B, Possibly carcinogenic to humans: Acetaldehyde / Acrylonitrile / Carbon tetrachloride / Chrysene / Cumene / Ethylbenzene / Indeno(1,2,3-cd)pyrene / Isoprene / Lead / Naphtalene / Styrene

Table 3Potential air pollutants related to unconventional oil and natural gas development with evidence of carcinogenicity (n = 20).^a

CASRNs	Chemical name	Associated with leukemia/lymphoma ^b	Reference	IARC monograph publication year	IARC monograph volume #
<i>Group 1: Carcinogenic to humans</i>					
106-99-0	1,3-Butadiene	Leukemia, lymphoma	Brown et al. (2015), Macey et al. (2014), McKenzie et al. (2012), Olaguer (2012)	2012	Sup 7, 54, 71, 97, 100F
71-43-2	Benzene	Leukemia, lymphoma	Brown et al. (2015), Bunch et al. (2014), Field et al. (2014), Jackson et al. (2014), Lampe and Stolz (2015), Macey et al. (2014), McCawley (2015), McKenzie et al. (2012), Moore et al. (2014), Pekney et al. (2014), Rich and Crosby (2013), Rutter et al. (2015), Shonkoff et al. (2014), Ternes (2012)	2012	29, sup 7, 100F
	Engine exhaust (diesel)	Leukemia, lymphoma	Adgate et al. (2014), Lampe and Stolz (2015), McCawley (2015), Shonkoff et al. (2014)	2013	46, 105
64-17-5	Ethanol	Leukemia, lymphoma	McCawley (2015)	2012	96, 100E
50-00-0	Formaldehyde	Leukemia, lymphoma	Brown et al. (2015), Field et al. (2014), Jackson et al. (2014), Macey et al. (2014), McCawley (2015), Olaguer (2012), Shonkoff et al. (2014), Ternes (2012)	2012	Sup 7, 62, 88, 100F
	Particulate matter	–	Adgate et al. (2014), Brown et al. (2015), Brown et al. (2014), Evans et al. (2015), Field et al. (2014), Goetz et al. (2015), Jackson et al. (2014), Macey et al. (2014), Moore et al. (2014), Pacsi et al. (2015), Pekney et al. (2014), Roy et al. (2014), Song et al. (2015), Ternes (2012), Vinciguerra et al. (2015), Walters et al. (2015)	2015	109
	Radon	–	Casey et al. (2015), Evans et al. (2015), Shonkoff et al. (2014)	2012	43, 78, 100D
<i>Group 2A: Probably carcinogenic to humans</i>					
53-70-3	Dibenz(a,h)anthracene	Lymphoma	McCawley (2015)	2010	Sup 7, 92
127-18-4	Tetrachloroethylene	Leukemia, lymphoma	Brown et al. (2015)	2014	Sup 7, 63, 106
<i>Group 2B: Possibly carcinogenic to humans</i>					
75-07-0	Acetaldehyde	–	Brown et al. (2015), McCawley (2015), Ternes (2012)	1999	36, sup 7, 71
107-13-1	Acrylonitrile	–	Shonkoff et al. (2014)	1999	71
	Carbon tetrachloride	Lymphoma	Brown et al. (2015)	1999	20, sup 7, 71
	Chrysene	Lymphoma	McCawley (2015)	2010	92
98-82-8	Cumene	–	McCawley (2015), McKenzie et al. (2012)	2013	101
100-41-4	Ethylbenzene	–	Brown et al. (2015), Bunch et al. (2014), Field et al. (2014), Jackson et al. (2014), Lampe and Stolz (2015), Macey et al. (2014), McCawley (2015), McKenzie et al. (2012), Moore et al. (2014), Pekney et al. (2014), Rich and Crosby (2013), Shonkoff et al. (2014), Ternes (2012)	2000	77
193-39-5	Indeno(1,2,3-cd)pyrene	Lymphoma	McCawley (2015)	2010	Sup 7, 92
	Isoprene	–	McCawley (2015), McKenzie et al. (2012), Olaguer (2012), Rutter et al. (2015)	1999	60, 71
7439-92-1	Lead	–	Brown et al. (2015), Ternes (2012)	1987, 2006	23, sup 7, 87
91-20-3	Naphthalene	–	Brown et al. (2015), McCawley (2015)	2002	82
100-42-5	Styrene	Leukemia	McCawley (2015), McKenzie et al. (2012), Pekney et al. (2014), Rutter et al. (2015)	2002	60, 82

CASRNs, Chemical Abstract Service Registry Numbers; IARC, International Agency for Research on Cancer.

^a All compounds were abstracted from the scientific literature through systematic review of studies (n = 49) including measurement, modeling, or descriptive summary of air pollutants potentially associated with unconventional oil and gas development.^b If an association with leukemia and/or lymphoma was not reported in the IARC monographs due to no/insufficient evidence, or if there was a null association, we determined the chemical not to be associated with leukemia and/or lymphoma (“–”).

Table 3 in review:
„Unconventional
oil and gas
development and
risk of childhood
leukemia:
Assessing the
evidence”

Yale School of
Public Health and
National Cancer
Institute, USA

Published 23rd
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“Science of the
Total
Environment”

Comment on the German Draft Legislation on Hydraulic Fracturing: The Need for an Accurate State of Knowledge and for Independent Scientific Research

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- THE NEED FOR AN ACCURATE STATE OF SCIENTIFIC KNOWLEDGE
- THE NEED TO REGOGNIZE SCIENTIFIC RESEARCH GAPS
- THE NEED FOR FURTHER REGULATIONS TO ENSURE MEANINGFUL AND INDEPENDENT SCIENCE

Differences in legal frameworks for environment & health protection

USA – political intervention

e.g.

➤ **2005 “Energy Policy Act”** also known as “Halliburton Loophole” as an exemption law. Consequently the EPA does not regulate the injection of fracturing fluids under the Safe Drinking Act.

➤ **2013 “Energy Modernizing” Act, North Carolina**, “...shall not apply to rules adopted by the Mining and Energy Commission, the Environmental Management Commission, the Sedimentation Control Commission, and the Commission for Public Health for the management of oil and gas exploration, development, and production activities in the State, including the use of horizontal drilling and hydraulic fracturing for that purpose.”

Germany - omission

e.g.

- The authoritative law for air quality control in the Federal Republic of Germany is the Federal Immission Control Act (Bundes-Immissionsschutzgesetz, BImSchG) at which the “Technical Guidelines on Air Quality Control (TA Luft)” are related
- Most industrial plants and installations are requiring authorization or notification
- **But many facilities in the hydrocarbon production are not considered subject to authorization according to „TA Luft“**
- **Hydrocarbon production waste is also not underlying the “SEVESO III Directive Ordinance on Hazardous Incidents”**



Herzlich willkommen
im Landesamt für Bergbau, Energie und Geologie

“State Authority for Mining, Energy and Geology in Lower Saxony”, LBEG is both: supervisory and licensing authority. It is responsible for 4 federal states

LBEG as supervisory authority has to control 5.000* facilities, including 3.000* drilling sites and production plants, caverns, filtering equipments, borehole integrity etc. and **about 600* kilometers of underground pipelines** with crude gas including wastewater 1 meter beyond the surface in Lower Saxony

The total number of the LBEG field staff personnel is 17*

* source: personal communication

This newspaper accuses LBEG 2014 since years having had notice about the problem with mercury soil intoxication around the drilling sites in Rotenburg/Wümme – in contrast to the district administration who was not informed

Amt kennt Quecksilber-Problem seit Jahren – Lokalnachrichten aus Rotenburg – WESER-KURIER

06/06/14

Bergbau-Behörde hat Erkenntnisse über Belastung durch Erdgas-Förderstellen nicht mit dem Landkreis geteilt - 06.2014

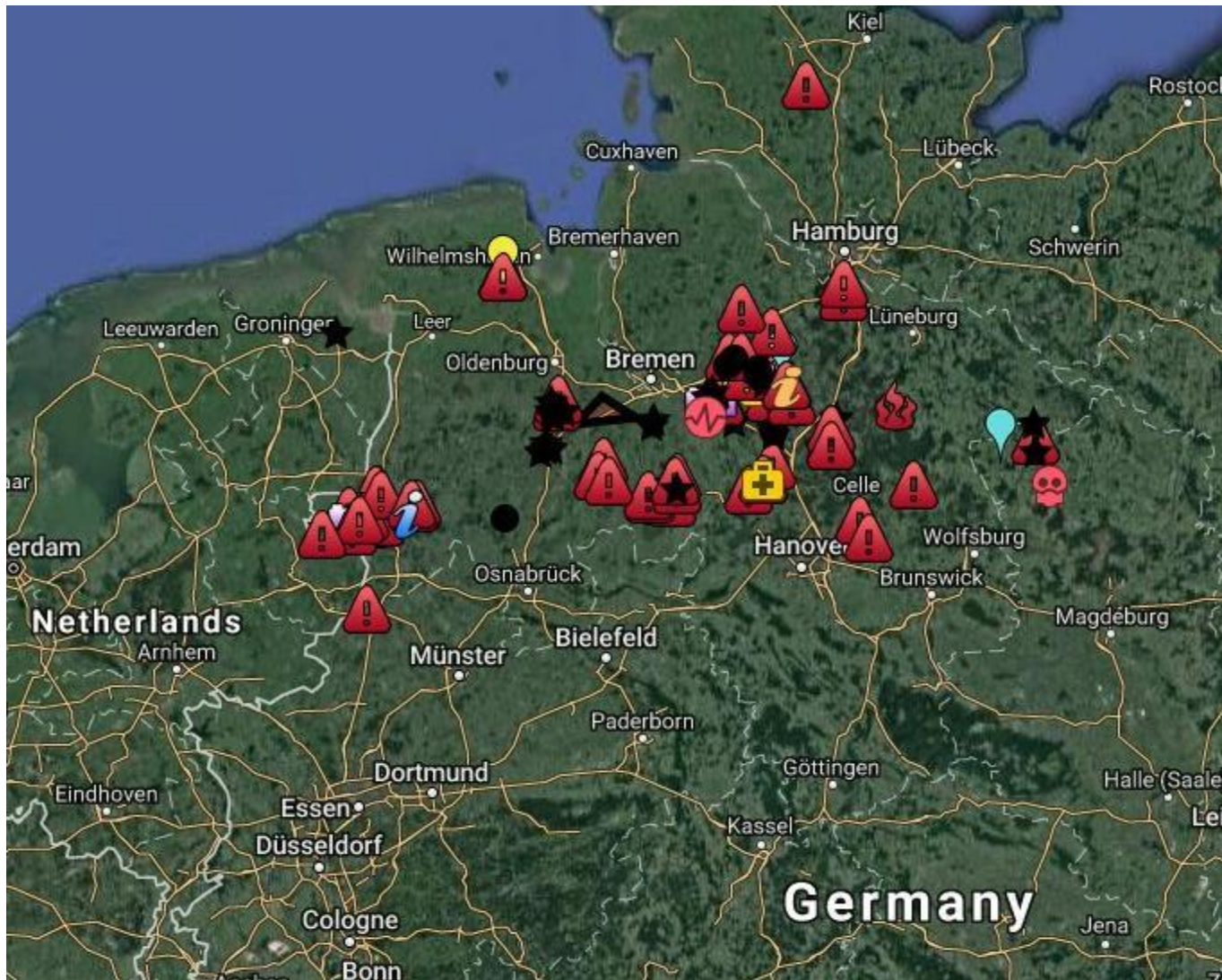
Amt kennt Quecksilber-Problem seit Jahren

Von Johannes Heeg

Landkreis Rotenburg. Dem Landesbergamt ist seit Jahren bekannt, dass Bereiche um Erdgasförderstellen im Kreis Rotenburg mit Quecksilber belastet sind. Der Landkreis Rotenburg wusste das bislang nicht.



Civil groups set up a registry of about hundred accidents, filters burning, leakages of waste water, leakages of underground crude gas (PE-)tubes, unsafe deposition of drilling tubes (Ra-226), earth quakes and others



After 70 years of hydrocarbon extraction in Lower Saxony about 500 undeclared drilling mud waste pits have been found by civil groups. In Lower Saxony does not exist a single landfillclass III waste disposal site. Waste tourism to North-Rhine Westphalia is preprogrammed for the next decades



Main deficiencies – main tasks – next steps

Which consequences are to be drawn by the knowledge of an insufficient...

- **exercise of the mining authorities of their supervisory role** - in order to facilitate effective controls by enforcement authorities
- **awareness of public health authorities about their task of health protection**, instead of mainly health administration – towards a real prevention practise
- **environmental monitoring** – in order to set up emission/immission databases
- **human biomonitoring** – in order to start a **comprehensive health impact assessment** with integration of **Clinical Environmental Medicine**
- **set-up of databases** – in order to set up more health registries, than only cancer
- **scientific study situation and enormous knowledge gaps** – necessitating intense efforts producing prospective epidemiological population studies
- **hazard control measures** – aiming at a **holistic consideration of the protected property human being and acting on the basis of the precautionary principle**

Thank you for your attention

