Submission by International Campaign on Justice for Bhopal and Bhopal Medical Appeal to the UN Special Rapporteur on Toxics and Human Rights

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About International Campaign on Justice for Bhopal (ICJB)

The International Campaign for Justice in Bhopal (ICJB) is a coalition that is comprised of survivors of the disaster, international volunteers, and environmental, social justice and human rights groups. Using education, grassroots organizing, and non-violent direct action, ICJB works to hold Dow Chemical and the Indian Government accountable for the ongoing chemical disaster in Bhopal, India. Through empowering and advising campaigners in this worldwide movement, ICJB strives to further the Bhopalis' demands for justice. ICJB is led by half a dozen Bhopal survivor organizations working in close alliance with coalition members in India, Canada, the United States of America, and the United Kingdom. For more information about ICJB, access www.bhopal.net

About The Bhopal Medical Appeal (BMA)

The **Bhopal Medical Appeal** (BMA) is a grassroots charity that arose out of the survivors' quest for health, justice and a life of dignity. BMA furthers the efforts of the survivors to provide first class medical care and other forms of support for those damaged by gas and poisoned water, and seeks to share what has been learned with other chemically-afflicted communities. For more information about the BMA, access https://www.bhopal.org/

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Background

On the night of 2 December 1984, a Union Carbide chemical facility at Bhopal, India leaked 27 tonnes of the highly toxic methyl isocyanate (MIC), poisoning tens of thousands of people in the middle of the night, most of whom were sleeping in their homes nearby. It is estimated that 10,000 people died instantly. Total deaths until 2011 were estimated by survivor organisations – conservatively - to be 23,000, with an unknown amount of deaths occurring in the 13 years since. More than 150,000 people are still suffering from the problems caused by the disaster and subsequent contamination; respiratory diseases, liver and kidney disorders, cancers and not least, -particularly relevant for this submission-, reproductive health problems. Research and official documents have shown that women and children suffered disproportionately

A 1997 study, commissioned by Union Carbide from Arthur D. Little, warned that pollution of the underground aquifer (which feeds local drinking water wells) could be happening at a rate far faster than imagined. Still Union Carbide kept silent and did not warn people. It was not until 1999 – a full ten years after Carbide's initial investigation – that a Greenpeace report revealed the full extent of the poisoning, discovering severe contamination of the factory site, surrounding land and groundwater. Levels of mercury in some places were 6,000,000 times higher than background levels. Drinking water wells near the factory used by local people were heavily polluted with chemicals known to produce cancers and genetic birth defects.[1] 42 communities (population of 1,00,000) adjacent to the abandoned Union Carbide factory in Bhopal are already known to have their groundwater contaminated and now this contamination has spread to 29 additional communities with a total population of 1,00,000 have been found to contain Organochlorines. [2] Contaminants reported in the groundwater include 9 of the 28 chemicals known as Persistent Organic Pollutants or more commonly, Forever Chemicals

The Bhopal Gas Tragedy is not an unknown topic to the UN Special Rapporteurship on Toxics and Human Rights. Your esteemed predecessor, Dr. Baskut Tuncat, emphasized the need for the chemical industry to respect human rights, emphasizing on the 35th anniversary of the Bhopal Gas Tragedy that the impacts were ongoing.[3]

This year, 2024, marks the 40th anniversary of the Union Carbide Gas Disaster, where survivors continue to live with the devastation caused four decades ago.

Through this submission the International Campaign on Justice for Bhopal (ICJB) and Bhopal Medical Appeal (BMA), two organizations working with gas tragedy survivors and those affected by ground water contamination on a daily basis through medical, legal and other types of support, and continuing to fight for justice, would like to draw attention to the ongoing impacts on the women exposed who were exposed to the toxic MIC gas on the night of 2nd of December 1984, their children and their children, and in the aftermath till today, communities continue to be poisoned through toxic groundwater. The impacts women face include reproductive health impacts, the right to healthcare, the right to information and the right to remedy, among others.

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[1] See: https://www.bhopal.org/continuing-disaster/second-poisoning/union-carbides-chemical-trail/ and Greenpeace, 1999: https://www.bhopal.org/wp-content/uploads/2018/09/1999-The-Bhopal-Legacy.pdf

[2] See: https://www.thehindu.com/news/national/39-years-after-the-bhopal-gas-tragedy-water-contamination-worries-survivors/article67598837.ece

[3] See: https://www.ohchr.org/en/statements/2019/11/bhopal-chemical-industry-must-respect-human-rights

US based research has demonstrated that women of colour and poorer communities are at greater risk of impacts by toxics. The majority of poor communities often reside in areas where factories are located that report toxic emissions. As a result, poor people suffer higher-than-average rates of asthma, lead poisoning, and exposure to contaminated water, pesticides, and mercury.[4] The same is applicable to the case for Bhopal and the gas tragedy, those living nearest to the factory were the poorest of the poor.

In this submission we describe some of the ongoing impacts women exposed to gas and toxic waste from the Union Carbide factory in Bhopal continue to face.

1. Gynaecological impacts on women exposed to MIC and contaminated ground water

Concerns regarding reproductive health effects due to the Gas Tragedy were raised back in 1985 when research indicated amongst others menstrual cycle disruption. Of a sample of 865 women who lived within a radius of 1 km of the factory and were pregnant at the time of the tragedy, 43 percent of the pregnancies did not result in a live birth and 14 percent of the babies that lived died in the first month.[5] In the years after and to date, many women who were exposed to methyl isocyanate gas suffer from gynaecological problems, including next generations. Some of the most common problems are described below, which have far-reaching impacts on not only the women in question but their entire families.

1.1. Poly Cystic Ovary Syndrome (PCOS)

Sambhavna Trust Clinic, a clinic established in the aftermath of the gas tragedy which provides free and holistic healthcare to Bhopal gas tragedy patients who cannot access government health care, has expressed serious concern about the high prevalence of PCOS among women exposed to Union Carbide's poisonous chemicals in Bhopal. PCOS is a hormonal disorder that is one of the most common causes of infertility. Exposure to chemicals that cause disruptions in the endocrine system is known to cause PCOS. "Data on 12 thousand women patients from Sambhavna clinic shows that women survivors of the Union Carbide gas disaster and those who drank water contaminated with Union Carbide's hazardous factory waste, have four times more PCOS compared to unexposed women. About 30 percent of PCOS patients are daughters of gas exposed parents." "Women with PCOS have irregular menstrual periods, excess body and facial hair and their sonography shows cysts in their ovaries. Apart from infertility, PCOS can cause miscarriage or premature birth, diabetes, hypertension, sleep apnoea, depression, anxiety and endometrial cancer."[6]

[4] See: https://womensvoices.org/about/why-a-womens-organization/
[5] See: https://scialert.net/fulltext/fulltextpdf.php?pdf=academicjournals/rjes/2011/150-156.pdf (p. 152)
[6] See annex 1 and 2 attached to this submission

1.2. Infertility and premature menopause

Sultana is just 41. But the mother of an 11-year-old boy reached her menopause a year ago, far ahead of the normal age.

Shahbano went through a range of painful gynecological symptoms before getting hysterectomy done about five years ago at a relatively young age of 38.[7]

These are not an unheard case among women exposed to MIC during the gas tragedy.

Research showed that gas-exposed women were often unable to marry due to concerns over difficulties to bear children.[8]

1.3. Miscarriages and stillbirths

Studies have documented a fourfold increase in the rate of miscarriage following the Bhopal Gas leak, as well as increased risk of stillbirth and neonatal mortality. Rashida Bee, winner of the Goldman Environmental Prize and who is involved in improving lives of the families of victims, said that a women of her family had miscarriages four times. And such cases are not uncommon. A study carried out by Sambhavna Trust Clinic in 2010 noted that the exposure of pregnant women to the toxic gases had resulted in high levels of pregnancy loss, as well as a high mortality rate in the first five years of life.

2. Birth defects

A study conducted by the Indian Council for Medical Research (ICMR) which was not published found nine percent of newborns of gas victims had birth defects as against 1.3 per cent newborns of non-victims.[9] A 2023 study shows the long-term health consequences and potential intergenerational effects of the Bhopal Gas Tragedy. Researchers gathered data from the National Family Health Survey (NFHS-4) conducted between 2015 and 2016 and the Integrated Public Use Microdata Series from India for the year 1999, including individuals ranging from ages six to 64 years and those in utero at the time of the disaster. Women who were pregnant with male fetuses and resided within 100 km of Bhopal had a one percentage point higher disability rate that affected their employment 15 years later.[10]

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[7] See: https://www.hindustantimes.com/bhopal/women-survivors-struggle-with-reproductive-health/story-INU7AnDVp82WUGivewgEuL.html

[8] Amnesty International, *Clouds of Injustice – Bhopal Disaster 20 years on*, see: https://www.amnesty.ch/fr/themes/economie-et-droits-humains/exemples/justice-pour-bhopal/Clouds_of_injustice_Bericht_2004.pdf

[9] See: https://www.downtoearth.org.in/news/environment/birth-defects-remain-high-in-bhopal-gas-survivors-35-years-after-disaster-67979

[10] Gordon C McCord, [1] Prashant Bharadwaj,[2] Lotus McDougal,[3] Arushi Kaushik,[2] and Anita Raj[3], *Long-term health and human capital effects of in utero exposure to an industrial disaster: a spatial difference-in-differences analysis of the Bhopal gas tragedy.* Published online 2023 May 9. doi: 10.1136/bmjopen-2022-066733. See: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10335451/

3. Contaminated breastmilk

A 2002 study by the Fact-Finding Mission on Bhopal found lead, mercury and organochlorines in the breastmilk of nursing mothers. Many of the chemicals found in the water are hydrophobic. Once they are in the system they can only leave through the placenta or through breast milk.[11] A new study is currently being undertaken where breastmilk of mothers has been sampled to detect toxics.

4. Access to adequate healthcare

Many of the women suffering from reproductive health issues do not have access to any specialised healthcare. Victims have been told that they cannot receive treatment at one of the government hospitals. The government hospitals instituted after the gas tragedy for gas victims do not have a gynaecological wing. According to The Bhopal Memorial Hospital and Research Centre (BMHRC) – super speciality hospital built to provide free medical care to Bhopal gas victims does not have a gynaecology or a Paediatric department. They have to rely on private hospitals which they cannot afford, or charitable clinics such as Sambhavna Trust.[12] Those living in the areas where ground water is contaminated do not have even access to free medical care in gas relief hospitals.

5. Access to information

Numerous studies have been carried out to assess the ongoing health impacts on Bhopal Gas Tragedy survivors. Many studies indicating the huge impact of the gas tragedy and exposure to MIC on the reproductive health of women have been conducted but no effort has been made to date to create any database on these issues, nor conduct research that might help rid the women survivors of their ailments.[13] A 2012 study of women's access to gas-related healthcare facilities highlighted that the lack of long-term medical data meant that survivors continued to receive many of the same symptomatic medical treatments that they received in the first few days after the disaster.[14]

A 2016-2017 study conducted by the Indian Council for Medical Research showing damning facts, such as that mothers exposed to the tragedy are begetting children with defects, was not published, alleging that the methodology was not sound and should therefore not be brought into the public domain. As Rashida Bee, the president of the Bhopal Gas Peedit Mahila Stationery Karmchari Sangh, an organization standing up for the rights of Bhopal gas tragedy survivors said, *"If the study's design was indeed flawed, how was it approved at three successive meetings over two years? If mistakes have been made, why hide them from people?"*[15]

A list of studies carried on acute Reproductive effects, spontaneous miscarriages, perinatal and neonatal mortalities, menstrual irregularities, increased pregnancy loss, decreased placental/fetal

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[11] See: https://www.theguardian.com/global-development/2023/jun/14/bhopal-toxic-gas-leak-chemical-environmental-disaster-waiting-for-justice-union-carbide-dow#:~:text=A%20follow%2Dup%20study%20in,birth%20defects%20and%20reproductive%20disorders.

[12] See: https://www.hindustantimes.com/bhopal/women-survivors-struggle-with-reproductive-health/story-INU7AnDVp82WUGivewgEuL.html

[13] See: https://www.hindustantimes.com/bhopal/women-survivors-struggle-with-reproductive-health/story-INU7AnDVp82WUGivewgEuL.html

[14] R. Shadaan, *Women's Access to Healthcare 28 Years After the Bhopal Disaster: A Case Study of Jai Prakash Nagar*, December 2012, www.bhopal.org/wp-content/uploads/2016/06/Womens-Access-to-Healthcare-in-JP-Nagar-R.Shadaan-2014.pdf

[15] See: https://thewire.in/rights/bhopal-gas-tragedy-study-birth-defects and https://www.downtoearth.org.in/news/environment/birth-defects-remain-high-in-bhopal-gas-survivors-35-years-after-disaster-67979

17 https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)62562-3/fulltext

weight, genotoxic effects such as Increased chromosomal abnormalities and impact on next generation are attached as Annexure 1

6. Access to remedy and compensation

To date no further compensation for victims of the gas tragedy than the amount [25,000 Indian Rupees] that was settled on in the late 1980s has been provided. Those victims that continue to be exposed to toxic groundwater have not been recognized at all as gas tragedy victims and are therefore not entitled to compensation nor free healthcare. The lack of data that is independent, reliable and recognized by the authorities makes it even more complicated to get such access to free health care. As ICJB Rachna Dhingra has said in an interview in this regard: *"Data on congenital defects in children could help secure proper compensation for the victims".* The National Institute for Research on Environmental Health, Bhopal under Indian Council of Medical Research came into existence on 11th October 2010 with immediate focus on research on MIC affected population in the areas of Genetic disorders, Congenital disorders, women related medical issues, impact on second generation children have yet to carry out a single study on any of these topics.[16]

7. Widows of Bhopal

Women who lost their husbands during the gas tragedy often faced financial hardship for the rest of their lives. While the state government built an area, known as the widow colony with around 2,500 houses for survivors, inhabited primarily by widows, it did not ensure adequate living conditions. Road access is poor, there are open gutters, sewage is substandard and limited access to drinking water. Even though a widow's pension scheme was instituted, the amount the widows receive is insufficient to cover basic needs.[17] Govt of Madhya Pradesh provides social support of Rs 1000/month to about 4600 widows and arbitrarily denies pension to several hundred widows who fit the same criteria. In the last 13 years, pension of widows have been arbitrarily stopped for as long as 3 years.[19]

8. Bhopal gas tragedy survivors: women human rights and environmental defenders

Women survivors and supporters of the Bhopal Gas Tragedy have been at the forefront of the fight for justice for the victims of the leak. They have founded organizations to support children of victims and self-help groups and community groups, they have marched hundreds of kilometres from Bhopal to Delhi to protest and seek justice, they have gone on hunger strikes and they have travelled the world to tell the story of their struggles and continuing impacts and hardship. These same women who have merely sought justice and remedy through peaceful means, courageous human rights and environmental defenders, have been harassed and threatened, by police, by spies hired by the companies (Union Carbide and Dow Chemical) in question and others opposing Union Carbide, Dow Chemical or the government.

Conclusion and recommendations

In sum, the above clearly shows that the Bhopal Gas Tragedy and leaking of tonnes of MIC has had gendered impacts. To date women continue to suffer and bear the brunt of this tragedy. Women still

do not have adequate access to healthcare for their specific illnesses, and there is no sufficient data publicly available which is recognized in order to address these issues.

ICJB and BMA recommend that:

1. Independent environmental, health and medical impact assessments are carried out periodically by recognized, independent institutions to assess the ongoing impacts of the Bhopal Gas Tragedy on survivors and others continued to be impacted through groundwater contamination.
2. Such studies and assessments should include gender experts so that the gendered impacts of the Bhopal Gas Tragedy can be taken into consideration and assessed adequately
3. The findings of such assessments should be made public and should be disseminated in an accessible manner
4. There should be adequate monitoring of the ongoing impacts and treatment of those affected by the toxic contamination, with specialized, free and accessible healthcare for women suffering from health impacts due to the gas tragedy, then and now, given their specific gendered health impacts due to exposure to the toxics
5. Other impacts on women affected by the gas tragedy, such as widows, should receive an adequate monthly pension as demanded by local groups, and should be provided with adequate living conditions
6. Dow Chemical, the company that took over Union Carbide, should be held accountable for the legacy impacts it inherited by taking over Union Carbide and it should pay due compensation for the ongoing impacts of the Gas Tragedy and ensure clean up of the contaminated soil and groundwater
7. The chemical industry more generally should respect human rights and commit to practice human rights due diligence, including increased transparency on their practices, the risks and mitigation measures in case of a disaster

ANNEXURE 1

Below are the citations for the specific studies on Reproductive, Genetic, and Impact on next generation as a result of toxic exposure

A. Reproductive:

Acute reproductive effects:
Spontaneous miscarriages, perinatal and neonatal mortalities, menstrual irregularities

Chronic reproductive effects:
Increased pregnancy loss, infant mortality, decreased placental/fetal weight

- Daniel, C. S. *et al.* Preliminary report on the spermatogenic function of male subjects exposed to gas at Bhopal. *Indian J. Med. Res.* 86 Suppl, 83–86 (1987).
- Kanhere, S., Darbari, B. S. & Shrivastava, A. K. Morphological study of placentae of expectant mothers exposed to gas leak at Bhopal. *Indian J. Med. Res.* 86 Suppl, 77–82 (1987).
- Bhandari, N. R. *et al.* Pregnancy outcome in women exposed to toxic gas at Bhopal. *Indian J. Med. Res.* 92, 28–33 (1990).
- Shilotri, N. P. Gynaecological and obstetrical survey of Bhopal women following exposure to methyl isocyanate. *J. Postgrad. Med.* 32, 203 (1986).
- Epidemiological and experimental studies on the effects of methyl isocyanate on the course of pregnancy - PubMed.
- Reproductive toxicity of methyl isocyanate in mice - PubMed. https://pubmed.ncbi.nlm.nih.gov/3586061/.
- Methyl isocyanate: reproductive and developmental toxicology studies in Swiss mice - PubMed. https://pubmed.ncbi.nlm.nih.gov/3622429/.
- Kapoor, R. Fetal loss and contraceptive acceptance among the Bhopal gas victims. *Soc. Biol.* 38, 242–248 (1991).
- Bajaj, J. S., Misra, A., Rajalakshmi, M. & Madan, R. Environmental release of chemicals and reproductive ecology. *Environ. Health Perspect.* 101 Suppl 2, 125–130 (1993).

B. <u>Genetics:</u>

Acute genotoxic effects :
Increased chromosomal abnormalities

Chronic genotoxic effects :
Persistent chromosomal abnormalities, marginal increase in oropharynx cancer.

- Goswami, H. K. Cytogenetic effects of methyl isocyanate exposure in Bhopal. *Hum. Genet.* 74, 81–84 (1986).
- Ghosh, B. B. *et al.* Cytogenetic studies in human populations exposed to gas leak at Bhopal, India. *Environ. Health Perspect.* 86, 323–326 (1990).
- Goswami, H. *et al.* Search for chromosomal variations among gas-exposed persons in Bhopal - PubMed. https://pubmed.ncbi.nlm.nih.gov/2298454/ (1994).

- Mohi-Ud-Din Malla, T., Senthilkumar, C., Sharma, N. & Ganesh, N. Chromosome Instability Among Bhopal Gas Tragedy Survivors. *Am.-Eurasian J. Toxicol. Sci.* 245–249 (2011).
- Ganguly, B. B. & Mandal, S. Cytogenetic changes in the Bhopal population exposed to methyl isocyanate (MIC) in 1984: Then and 30 years later. *Mutat. Res. Genet. Toxicol. Environ. Mutagen.* 824, 9–19 (2017).
- Ganguly, B. B., Mandal, S. & Kadam, N. N. Frequency of micronuclei in population of Bhopal exposed to methyl isocyanate in 1984. *The Nucleus* 62, 269–275 (2019).
- Ganguly, B. B., Ganguly, S. & Kadam, N. N. Spectrum of stable and unstable rearrangements in lymphocytic chromosomes investigated in Bhopal population 30 years post MIC disaster amid co-exposure to lifestyle, living, and occupational hazards. *Environ. Sci. Pollut. Res. Int.* (2022) doi:10.1007/s11356-022-22053-5.
- Samarth RM, Gandhi P, Maudar KK (2013) Retrospective review of cytogenetic studies on Methyl Isocyanate with special reference to Bhopal Gas Tragedy: Is the next generation also at risk? Int J Occup Med Environ Health 26(3):324–336
- Bani Bandana Ganguly1*, Shouvik Mandal1 and Nitin N Kadam
- Genotoxic and Carcinogenic Effects of Methyl Isocyanate (MIC) Reviewed on Exposed Bhopal Population and Future Perspectives for Assessment of Long-Term MIC-Effect. Journal of Environmental and Analytical Toxicology, 2017
- Ganguly, B. B., Mandal, S., Banerjee, N., Kadam, N. N. & Abbi, R. Effect of age at exposure on chromosome abnormalities in MIC-exposed Bhopal population detected 30 years post-disaster. *Mutat. Res. Mol. Mech. Mutagen.* 809, 32–50 (2018).

C. Cancers:

- Dikshit, R. & Kanhere, S. Cancer patterns of lung, oropharynx and oral cavity cancer in relation to gas exposure at Bhopal. *Cancer Causes Control* 10, 627–636 (1999).
- Mishra, P. *et al.* Correlation of aberrant expression of p53, Rad50, and cyclin-E proteins with microsatellite instability in gallbladder adenocarcinomas. *Genet. Mol. Researcg* 8, 1202–1210 (2009).
- Mohi-Ud-Din Malla, T., Senthilkumar, C., Sharma, N. & Ganesh, N. Chromosome Instability Among Bhopal Gas Tragedy Survivors. *Am.-Eurasian J. Toxicol. Sci.* 245–249 (2011).
- Association of microsatellite instability and chronic obstructive pulmonary disorder in isocyanate-Exposed population of Bhopal - PMC.
- Increased micronucleus frequency in peripheral blood lymphocytes contributes to cancer risk in the methyl isocyanate-affected population of Bhopal - PubMed.
- Senthilkumar, Chinnu Sugavanam, Sah, Nand Kishor, Ganesh, Narayanan
- Methyl Isocyanate and Carcinogenesis: Bridgeable Gaps in Scientific Knowledge. Asian Pacific Journal of Cancer Prevention, Volume 13 Issue 6
- Pg: 2429-2435 (2012)
- PK Mishra, Gorantla Venkata Raghuram, Neha Bunkar, Arpit Bhargava, Naveen Kumar Khare. Molecular Bio-Dosimetry for carcinogenic risk assessment in survivors of Bhopal Gas Tragedy. International Journal of Occupational Medicine and Environmental Health 2015;28(6)
- Khan, I. *et al.* In silico docking of methyl isocyanate (MIC) and its hydrolytic product (1, 3-dimethylurea) shows significant interaction with DNA Methyltransferase 1 suggests cancer risk in Bhopal-Gas- Tragedy survivors. *Asian Pac. J. Cancer Prev. APJCP* 16, 7663–7670 (2015).

- Bani Bandana Ganguly1, Shouvik Mandal1 and Nitin N Kadam
- Genotoxic and Carcinogenic Effects of Methyl Isocyanate (MIC) Reviewed on Exposed Bhopal Population and Future Perspectives for Assessment of Long-Term MIC-Effect. Journal of Environmental and Analytical Toxicology, 2017

D. Impact on Next Generation

Growth retardation, Immunological problems

- Sarangi, S. *et al.* Effects of exposure of parents to toxic gases in Bhopal on the offspring. *Am. J. Ind. Med.* 53, 836–841 (2010).
- Daya R Varma, Ritesh Pal, Diana Katgara, Satinath Sarangi, Tasneem Zaidi, Steven Holleran, Rajashekhar Ramakrishnan and Shree Mulay. *Catch-up growth in males affected by the Union Carbide disaster of 1984 in Bhopal, India.* The Journal of the Federation of American Societies for Experimental Biology 22:1137.1, 2008
- Ranjan, N., Sarangi, S., Padmanabhan, V.T., Holleran, S., Ramakrishnan, R., and Varma, D.R. (2003). Methyl isocyanate exposure and growth patterns of adolescents in Bhopal. *JAMA* **290,** 1856-1857
- Mishra, P. K. *et al.* In utero exposure to methyl isocyanate in the Bhopal gas disaster: evidence of persisting hyperactivation of the immune system two decades later. *Occup. Environ. Med.* 66, 279–279 (2009).