

# Reproductive & Generational Health Outcomes Associated with Gulf War Exposures

*by Category of Association, including animal studies*

EXPOSURE:	MALE Gulf War Veterans	FEMALE Gulf War Veterans	CHILDREN of Gulf War Veterans: Prenatal exposure
<b>Benzene</b> (an oil well fire byproduct)	Reproductive effects (L/S)		Childhood leukemia (S)
<b>Carbamate pesticides</b>	Reproductive effects (S)		
<b>Depleted Uranium (DU)</b>	Reproductive effects (a)		
<b>Dioxin</b> (contained in herbicides)	Reproductive effects (a)	Reproductive effects (a)	
<b>Glycols and Glycol Ethers</b> (solvents)	Reproductive effects (L/S)		Birth defects (L/S)
<b>Hexavalent Chromium (Cr6)</b>	Reproductive effects (S)	Adverse pregnancy outcomes (L/S)	Developmental effects: structural defects, delayed sexual maturation (S)
<b>Leishmaniasis infection</b> , during pregnancy		Adverse pregnancy outcomes (S)	
<b>Lindane</b> (an organochlorine pesticide and anti-parasite agent)	Reproductive effects (a)	Reproductive effects (L/S)	Developmental effects (a)
<b>Organophosphate (OP) pesticides</b>	Reproductive effects (L/S)		Neurodevelopmental effects (S)
<b>Particulate matter (PM)</b> (an oil well fire and combustion byproduct)		Adverse pregnancy outcomes (S). Pregnancy-induced hypertensive disorders (L/S)	Low birth weight and preterm birth (S). Respiratory effects; Neuro-developmental effects (L/S)
<b>Perchloroethylene/ Tetrachloroethylene (PERC)</b> (a VOC and degreasing solvent)			Developmental effects (L/S)
<b>Polycyclic Aromatic Hydrocarbons (PAHs)</b> (combustion byproducts)	Reproductive effects (L/S)		Adverse birth outcomes: low birth weight, preterm birth. (L/S) Developmental effects: birth defects, childhood cancer, neurodevelopmental effects, respiratory outcomes in childhood. (L/S)

<b>Pyrethroid pesticides</b>	Reproductive effects (L/S)		Developmental effects (L/S)
<b>Sulfur Mustard (HD)</b>	Reproductive effects (L/S)		
<b>Toluene</b> (a PAH and solvent)			Developmental effects (a)
<b>Trichloroethylene (TCE)</b> (a VOC and solvent)	Reproductive effects (L/S)	Adverse pregnancy outcomes (L/S). Reproductive effects (a).	Developmental effects (L/S)
<b>Xylenes</b> (PAHs and solvents)			Developmental effects (a)

NOTES:

\*All exposures except hexavalent chromium were enumerated as specified agents (or classes of agents) in Title XVI, Sec. 1603(d) of P.L. 105-277 (enacted Oct. 21, 1998), and Title I, Sec. 101(d) of P.L. 105-368 (enacted Nov. 11, 1998).

\*Male reproductive effects: particularly altered semen parameters

\*Female reproductive effects of Lindane exposure were specifically changes in endometrial tissue

**\*(S) = Sufficient Evidence of an Association:** Evidence suggests an association, in that a positive association has been observed between an exposure and a reproductive or developmental effect in humans; however, there is some doubt as to the influence of chance, bias, and confounding.

**\*(L/S) = Limited/Suggestive Evidence of an Association:** Some evidence of an association between exposure and a reproductive or developmental effect in humans exists, but this is limited by the presence of substantial doubt regarding chance, bias, and confounding.

**\*(a) = Animal Studies** of toxic exposures, where animal data were robust but a lack of human data precluded the committee from assigning a stronger category of association. "On one hand, the use of animal models permits greater control with defined exposures. On the other hand, these models may lack temporal resolution since only specific points in time are considered. Often, they do not model the cumulative effect of exposures to mixtures that are observed in humans. In addition, adsorption, distribution, metabolism, and excretion processes can vary widely between humans and other species, and effects seen in one species might not be seen in another." (GW&H v. 11, p. 401)

\*SOURCE OF DATA: National Academies of Sciences, Engineering, and Medicine. 2018. Gulf War and health, Volume 11: Generational health effects of serving in the Gulf War. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25162> , and, "Summary Table: Summary of Conclusions Regarding Categories of Association Between Gulf War Deployment Exposures and Reproductive Effects in Men or Women, Adverse Pregnancy Outcomes, or Developmental Effects": <http://www.nationalacademies.org/hmd/Reports/2018/gulf-war-and-health-volume-11.aspx>