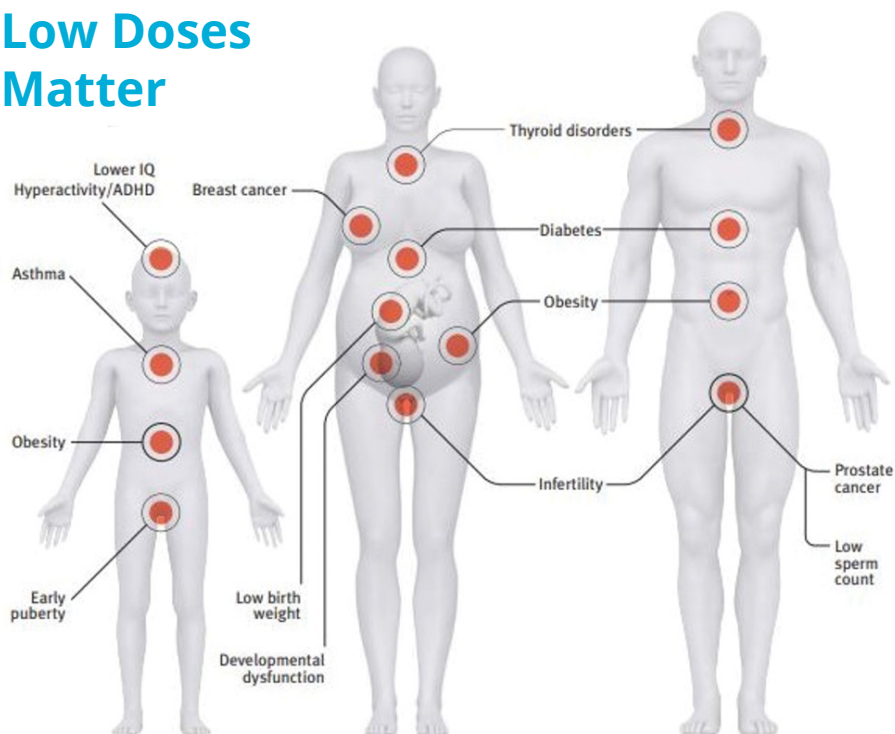


## Endocrine Disrupting Chemicals (EDCs) and Shale Gas Development

A growing body of scientific research suggests that many chemicals, both natural and synthetic, interfere with hormones and the endocrine system and produce unfavorable effects in laboratory animals, wildlife, livestock, pets, and humans (Gore et al., 2015). These chemicals are referred to as endocrine disrupting chemicals (EDCs). Studies indicate that shale gas development uses and produces EDCs, exposure to which can produce negative impacts on health.

### Low Doses Matter



**Everyday exposures to EDCs contribute to modern health epidemics.**

*Graphic courtesy of Health and Environmental Alliance and the Endocrine Disruption Exchange*

Endocrine disrupting chemicals (EDCs) have been identified in fracturing fluid and in the wastewater and air emissions generated during the process of shale gas development. These EDCs may contaminate air, water, soil, and food sources and expose residents through inhalation, ingestion, and skin absorption. Research in recent years has resulted in a greater understanding of the actions of EDCs, but it is not always known how EDCs work, even when EDC exposure has been linked to negative health impacts.

- Nagel et al. (2020) reviewed experimental studies that evaluated the potential endocrine-mediated health impacts of exposure to a mixture of 23 unconventional oil and gas (UOG) chemicals commonly found in wastewater. They found that UOG chemicals and wastewater disrupted hormone receptors. Notably, the UOG mix:
  - Altered sperm counts, ovarian function, and pituitary hormones in adulthood
  - Induced mammary gland changes and precancerous lesions

These findings highlight the diverse body systems impacted by exposure to EDCs in UOG wastewater.

- Bolden et al. (2018) reviewed existing studies that measured air pollutants emitted near UOG activity to generate a list of 106 chemicals that appeared in at least two studies. Twenty-one of the chemicals have been shown to disrupt endocrine activity and may impact the production of hormones. The authors note that EDCs can have negative impacts at low exposure concentrations, resulting in less than optimal developmental, behavioral, reproductive, and metabolic conditions.

## DEFINITIONS AND BACKGROUND INFORMATION

**Endocrine System:** a collection of glands and hormones that regulate growth and development, reproduction, response to stress, sexual development, and brain function, such as emotions, memory, and learning.

**EDC:** a chemical or chemical mixture in the environment that can interfere with hormone action.

**Hormones:** hundreds of chemical messengers—such as insulin, thyroid hormone, estrogen, and testosterone—that the body uses to regulate every aspect of life. Hormones act to set the stage for how the body grows, develops, ages, and responds to environmental factors throughout life.

### How do EDCs impact our health?

Effects may occur at any age but can vary depending on when in life exposures occur. For example, fetal development, early childhood, and puberty are critical periods of exposure because rapid growth and development controlled by hormones is occurring.

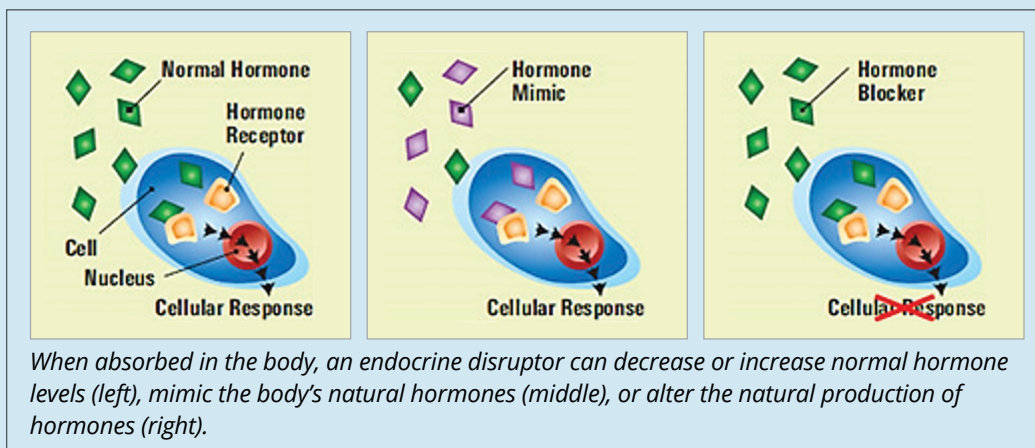
Since hormones work in very tiny amounts, even small exposures to EDCs can affect body function. EDCs may have a very different effect at high versus low levels of exposure, but both disrupt normal hormone function in a harmful way.

### Examples of recognized health effects include:

- Abnormal development of sex organs
- Reduced ability to have children
- Changes to secondary sex characteristics, such as those that develop in puberty (e.g., underarm hair)
- Cancers such as breast, ovarian, prostate, testicular
- Impaired intellectual development
- Altered behavior or response to stress
- Increased buildup of fat and changes in ability to respond to insulin and regulate blood sugar

### EDCs disrupt normal hormone signals in two main ways. They:

- Change the amount of hormone available by altering production, metabolism, or secretion
- Mimic or block the action of hormones and their receptors at target tissues



Graphic courtesy of the National Institute of Environmental Health Sciences

Bolden, A.L., Schultz, K., Pelch, K.E., Kwiatkowski, C.F. (2018). Exploring the endocrine activity of air pollutants associated with unconventional oil and gas extraction. *Environmental Health*, 17, 26. <https://doi.org/10.1186/s12940-018-0368-z>

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