

Genetically Engineered Mosquitoes

— *Coming Soon to Florida and Texas?* —



**Friends of
the Earth**

Oxitec, a biotech company, is currently lobbying for state and local approvals in Florida and Texas for the release of at least half a billion of its patented genetically engineered (GE) mosquitoes into communities. In May 2020, the Environmental Protection Agency (EPA) approved experimental trials for Oxitec Corporation's new GE mosquito for release in Monroe County, FL, and Harris County, TX. Scientific research has found that genetically engineered mosquitoes pose significant risks to human health and ecosystems. Despite a lack of independent safety assessment, regulatory oversight, proof of effectiveness, transparency, and most importantly prior informed consent from the communities, both Oxitec and the U.S. government seemed determined to push ahead with the release. A final approval on the release of the mosquitoes in Florida is pending.

This briefing summarizes what is known about Oxitec's genetically engineered mosquitoes, risks to human health and the environment and safer alternatives for addressing mosquito-borne diseases. It discusses the major concerns that GE mosquitoes could create hybrid wild mosquitoes and could worsen the spread of mosquito-borne diseases. It also reveals the negative impacts GE mosquitoes may have on animals, including endangered or threatened species, as well as broader ecosystems.

About Friends of the Earth:

Friends of the Earth fights to protect our environment and create a healthy and just world. We are more than one million members and activists across all 50 states working to make this vision a reality. We are part of the Friends of the Earth International Federation, a network in 74 countries working for social and environmental justice.

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What is Oxitec and what are genetically engineered mosquitoes?


Oxitec is a UK-based commercial company, which produces genetically engineered mosquitoes and other genetically engineered insects. In early 2020, Oxitec was purchased by U.S.-based venture capital firm, Third Security. Oxitec first proposed GE mosquito experimental trials in Key Haven, Florida, but Oxitec withdrew its application from the Food and Drug Administration (FDA) in 2016 following strong opposition from local community members and a local vote against the trials.

Oxitec has genetically engineered the *Aedes aegypti* mosquito, known to transmit tropical diseases like dengue fever, Zika, and chikungunya. The GE mosquitoes, once released, are intended to mate with wild *Aedes aegypti* mosquitoes and are supposed to pass on a lethal gene to offspring. The GE mosquito's female offspring are engineered to die at the larval stage in the absence of the antibiotic tetracycline, which acts as a chemical switch to allow for successful reproduction in the laboratory. After millions of GE males are released across a region, the intent is to reduce the wild *Aedes aegypti* mosquito population. The population reduction, however, is dependent on ongoing repeated releases of GE mosquitoes, which Mosquito Control Districts would continuously need to purchase.¹ The proposed

trials are for a new version of the GE mosquitoes in which only the female offspring are supposed to die and the GE male mosquitoes continue to live and breed for multiple generations.

Are genetically engineered mosquitoes regulated and assessed for safety?

At present, oversight and safety assessment for genetically engineered mosquitoes is completely inadequate. The EPA considers GE mosquitoes to be biopesticides, but regulations for biopesticides are not specific to genetically engineered insects and their potential impacts on human health or the environment.² Full company data related to these patented organisms is not publicly available. Ahead of any consideration of the release of genetically engineered mosquitoes, mandatory, independent, and transparent safety assessments, as well as oversight specific to genetically engineered insects, must be in place. In addition, government agencies must not allow for company self-assessment of risks and must require third-party peer-reviewed public health and environmental assessments.



Do Oxitec's genetically engineered mosquitoes "work" and what are their risks to our health and environment?

To date, genetically engineered mosquitoes have been an expensive failure. Studies have shown that they are not 100% sterile, there is no evidence of their effectiveness at disease reduction, and their release may result in the spread of more mosquito borne diseases. To date, none of the field trials in the Cayman Islands, Malaysia, or Panama effectively reduced the *Aedes aegypti* mosquito population or disease rates.³

In addition, GE mosquito production is costly. In 2014, the release of 300,000 GE mosquitoes in Panama was reported to have cost \$620,000 (more than \$2 per mosquito).⁴

GE mosquitoes don't die off and are not sterile:

- According to Oxitec's reports, at least 3% of the offspring of Oxitec's GE mosquitoes survive to adulthood, even in the absence of the antibiotic tetracycline.⁵ In the presence of tetracycline, commonly found in septic tanks, animal manure, and pet food, the survival rate increased to 15–18%.⁶ The use of tetracycline to breed the GE mosquitoes in the laboratory also risks spreading

- antibiotic resistance, which could pose a major risk to human and animal health.⁷ With Oxitec's new version of its GE mosquitoes, most of the male offspring of the GE mosquitoes will survive and mate to produce more GE mosquitoes.

No disease reduction:

- There is no data to support Oxitec's claims that open releases of GE mosquitoes will reduce incidence of mosquito borne diseases. The Environmental Protection Agency (EPA) notes that Oxitec's trials are not set up to test for disease reduction.⁸ There have been field trials in the Cayman Islands, Panama, Malaysia, and Brazil. Releases in Panama and Malaysia have stopped, and the Cayman Islands ended its plans for larger releases because of concerns that the GE mosquitos would not be effective in reducing dengue rates.⁹ In addition, even if the experiment were to result in a decrease in the *Aedes aegypti* mosquito, it is likely that other varieties of mosquitoes, such as the *Aedes albopictus* (Asian tiger) mosquitoes, which also transmit dengue and several other viruses (including chikungunya), will increase in numbers to fill the new niche.^{10, 11} In other words, other species of wild mosquitoes in the environment, including in peoples' homes and backyards, will still be able to spread disease.



Biting female mosquitoes, which spread disease, may survive:

- Not only are Oxitec's mosquitoes not sterile but females, which bite and spread disease, have been inadvertently released in Oxitec's experiments, due to difficulties with the process of sorting males and females.^{12, 13} Oxitec says its new version of the GE mosquito solves this problem, but it is still possible some biting female GE mosquitoes will survive. Because of the very large numbers of GE mosquitoes proposed for release, even a small percentage of biting female GE mosquitoes may lead to a larger number of females in the environment.

- Humans and animals may swallow GE mosquitoes in the air or in water supplies, where the female GE mosquito larvae die. There have not been adequate assessments of whether the ingestion of GE mosquitoes is safe for humans or animals. Also, of concern is that biting female GE mosquitoes may inject a novel engineered protein into humans.¹⁴ Oxitec has yet to show that these novel proteins would not harm humans or animals.

GE mosquitoes could make things worse:

- A recent study from Yale University confirmed that Oxitec's claims that the mosquitoes were sterile were not true, and that some of the offspring of Oxitec's genetically engineered

- mosquitoes survived into adulthood. Their genes spread into wild populations of mosquitoes. There is concern that these hybrid GE-wild mosquitoes could spread more viruses, and be more resistant to insecticides than the original wild mosquitoes.^{15,16,17,18,19} The new version of Oxitec's GE mosquitoes will make this problem a lot worse, because only the female offspring die and the GE males continue to mate with wild mosquitoes for many generations. Oxitec has not tested whether its mosquitoes are more likely to spread diseases than the wild mosquitoes already in the area.

- It is also possible that the in response to a large release of GE mosquitoes, wild mosquitoes could move into surrounding areas, increasing the health risks for people there. It could be a "solution" that makes the problem even worse.

Environmental risks:

- GE mosquitoes could pose significant threats to sensitive ecosystems like the flood prone areas in Texas and Everglades in Florida. GE mosquito survival in the environment is likely. However, it is unclear what impacts GE mosquitoes may have on animals, including endangered or threatened species, as well as broader ecosystems. Additionally, the risks of ingesting GE mosquitoes have not been adequately assessed.²⁰



Community right to free and prior informed consent

People should not be unwittingly forced to be part of a risky experiment that benefits private biotech corporations. Ahead of any release of GE mosquitoes, state and local governments should convene extensive public meetings, led by independent scientists, ecologists, public health experts, and community leaders, in sites of release as well as the surrounding areas, to offer unbiased education about the risks and proposals – as well as alternatives. Free and informed consent is central to ethics on human subject trials. Although the EPA has not deemed this to be a human subject trial, there is a risk that female mosquitoes could be released and bite people. Community members should have a right to reject the specific trial areas and have a right to leave the field trial areas or demand the halt of the experiment entirely if they so decide.²¹ But people may be forced into Oxitec's field experiment against their will.

What you can do:

- Friends of the Earth believes that Oxitec's application for the release of GE mosquitoes is inadequate, dangerous, and full of holes. Their analyses do not have the necessary data or appropriate risk assessments to draw complete

safety conclusions, and the assessments do not adequately address potential unintended consequences. Considering the unanswered questions and the gaps in data analysis, it is critical Mosquito Control Districts reject Oxitec's application for genetically engineered mosquitoes.

Instead, they should evaluate alternative methods of addressing mosquito borne disease prevention, particularly methods which may be less risky, more effective, and more sustainable for people and the environment. Community-based programs that educate communities about dengue prevention and low-cost ways to prevent mosquitoes from breeding have been proven to decrease disease rates and have been successful across the world.²²

To take action, contact the Mosquito Control District in Monroe County, Florida, and Harris County, Texas, as well as elected officials at the local and state level, and ask that they not approve the GE mosquito trials.

For more information visit:
<https://foe.org/projects/gmo-animals/>

Endnotes

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