



# Frequently Asked Questions about Sterile Insect Technique (SIT)

## Invasive Mosquito Preventative Release Program

### What is Sterile Insect Technique (SIT)?

The Sterile Insect Technique (SIT) is an innovative pest control method used to manage and reduce the populations of certain insect pests that damage crops or transmit diseases. It is an environmentally friendly insect pest control method reducing the use of insecticides, as well as maintaining the ecosystem. It has been successfully used by the [California Department of Food and Agriculture](#) to control the [Mediterranean fruit fly](#), and the United States Department of Agriculture to control [the screwworm](#).

### Is Sterile Insect Technique a new technology?

No, SIT was first developed by the United States Department of Agriculture to control screwworms, a type of fly that can be devastating to cattle. It has been used successfully for more than 60 years to control different kinds of insects and agricultural pests that can damage crops and livestock. [The California Department of Food and Agriculture](#) currently uses SIT to control [Mediterranean fruit fly](#) infestations in citrus and other fruit trees in Southern California.

### Why are new mosquito control techniques needed?

Two invasive urban mosquitoes are spreading in California, the yellow fever mosquito, *Aedes aegypti*, and the Asian tiger mosquito, *Aedes albopictus*. First detected in 2011, these mosquitoes are now found in more than 300 cities and 22 counties throughout the state. Invasive *Aedes* mosquitoes spread viruses that cause Zika, dengue, chikungunya, and yellow fever. There are no human vaccines for many of these mosquito-borne diseases, and these diseases can have long-term health consequences.

Invasive *Aedes* mosquitoes are hard to control because they have become resistant to commonly used insecticides. They lay their eggs in small, hidden water sources in people's front yards, backyards, and patios — areas where mosquito control agencies cannot easily inspect. Due to the difficult nature of controlling invasive *Aedes* mosquitoes as well as the public health risks they pose, mosquito and vector control agencies need additional control methods to effectively address this problem. Many agencies are exploring the use of Sterile Insect Techniques (SIT) and other innovative technologies to help reduce the population of disease-transmitting mosquitoes.

### What are the different related technologies being considered?

There are currently three different technologies that mosquito control experts are evaluating: Incompatible insect technique (IIT), irradiation, and self-limiting mosquitoes. The District is exploring irradiation.

- [Irradiated mosquitoes](#) start as normal mosquitoes raised in a laboratory. Male mosquitoes are then separated from the females. It's important to note that male mosquitoes do not bite. Male mosquitoes are then subject to irradiation, using either X-rays or gamma rays, which sterilizes these male mosquitoes. The sterile adult male mosquitoes are then released in specific areas to mate with the wild females. The resulting eggs are not viable and therefore do not hatch, reducing the number of mosquitoes within the release area. Irradiated *Aedes aegypti* mosquito releases have shown great success as a control method in Florida and other areas around the world.
- [Incompatible Insect Technique \(IIT\)](#) harnesses the power of the bacteria *Wolbachia* to reduce mosquito populations. This naturally occurring bacteria is found in about 60 percent of insects around the world, including butterflies, dragonflies, moths, and beetles. With this technique, male *Aedes* mosquitoes are raised in a lab with a specific type of *Wolbachia* that they do not normally have. These male *Aedes* mosquitoes are released to mate with wild female *Aedes* mosquitoes that have a different type of *Wolbachia* or none at all. During mating, the

mismatched *Wolbachia* bacteria causes the eggs to fail to hatch. This can reduce the overall number of *Aedes* mosquitoes over time. [The Consolidated Mosquito Abatement District](#), in partnership with Verily and [MosquitoMate](#), recently completed a successful three-year pilot project called [DeBug Fresno](#), which used *Wolbachia* male mosquitoes to reduce populations of *Aedes aegypti* mosquitoes by 95% in tested residential communities in Fresno County.

- [Self-limiting mosquitoes](#), pioneered by [Oxitec](#), and in development at various other companies, [utilizes genetically engineered mosquitoes to reduce mosquito populations](#). When Oxitec's Friendly™ *Aedes aegypti* male mosquitoes mate with wild females, their offspring inherit a copy of the self-limiting gene, which prevents female offspring from growing and surviving to adulthood. Oxitec's mosquitoes only target their own species, and their self-limiting gene cannot be established in the ecosystem. Oxitec has received approval from the U.S. Environmental Protection Agency for a pilot project in California that is being planned in partnership with the Delta Mosquito and Vector Control District in Tulare County. The company needs to receive approval from the California Department of Pesticide Regulation before it can begin the project.

### **Why is the District considering irradiation over other control methods?**

The District is exploring and investigating irradiation as a form of SIT. This SIT method exposes male mosquitoes to radiation in a lab. The radiation method can either utilize gamma rays or X-rays and will sterilize the mosquitoes prior to release. The District is currently exploring using an X-ray irradiator, the same technology used in medical practices. Irradiation is cost-effective and less technically demanding than using IIT or self-limiting gene mosquitoes as the District can create a laboratory mosquito colony from local mosquitoes. Irradiated mosquitoes are not genetically engineered.

### **How are mosquitoes irradiated?**

Large numbers of mosquitoes are raised in a lab. Male mosquito pupae are separated from female pupae. Males are irradiated, using ionizing radiation, to make them sterile. Males are then regularly released to mate with wild females. After mating, the resulting eggs will not hatch.

### **Will SIT harm the environment and other insects?**

No. SIT technologies specifically work to control invasive *Aedes* mosquitoes which are not originally found in California and do not have a place in our natural ecosystem. Reducing or controlling these mosquitoes will not harm insect-eating animals that are native to California.

### **Will SIT replace traditional mosquito control efforts?**

No, SIT and other related technologies will not replace traditional mosquito control methods. If used, they will be part of an Integrated Vector Management approach, which is an evidence-based, data-driven decision-making tool used to suppress mosquito-borne diseases. There are many decisions that are made to determine which mosquito control techniques will be most effective for each situation in order to best protect public health. These decisions are made at a local level and any emerging technology that is used to protect the public from mosquito-transmitted diseases would be used in conjunction with traditional control methods.

### **Can modified mosquitoes bite people and alter their DNA?**

No, SIT and other related technologies only involve releasing male mosquitoes, which do not bite people.

### **Are there any significant risks to using SIT?**

No. *Aedes aegypti* mosquitoes are non-native to Southern California and pose serious public health risks because of the diseases they can carry. The threat of exotic disease outbreaks and frequent travel to areas with mosquito-borne disease transmission has increased. If conditions are right, this can expose communities to local outbreaks. Using SIT will significantly reduce the invasive *Aedes aegypti* population and reduce the threat of local disease outbreaks.

### **What can I do as a resident to help the District combat invasive mosquitoes?**

Mosquito control is a shared responsibility. Residents should be proactive and inspect their properties once a week, especially after rain events, to eliminate standing water, store miscellaneous containers, or throw away if unneeded. For solutions and on how to prevent mosquito breeding, residents can visit:

<https://www.glamosquito.org/do-it-yourself-solutions-for-mosquito-problems> and download the [mosquito source checklist](#).