

## Science Spotlight

April 2015

### Exposure Assessment Study Encourages Safer Agricultural Work Practices in Egypt

*By Megan Avakian*

Results from a pesticide exposure assessment study are being used to develop and encourage safer work practices in Egypt's agricultural sector, which employs approximately 40 percent of the Egyptian workforce. The study, funded in part by the National Institute of Environmental Health Sciences (NIEHS), was designed to measure exposure to two common [organophosphorus \(OP\) pesticides](#) among Egyptian cotton field workers. These pesticides are some of the most widely used chemical insecticides in the world, and a growing body of evidence links OP exposure to neurotoxic effects in humans. The scientists set out to clarify the OP exposure among these workers in Egypt. Their findings have been translated into ways to protect Egyptian agricultural workers from harmful environmental exposures.

In Egypt, the national Ministry of Agriculture directs insecticide application in cotton fields and employs agricultural workers. Ministry of Agriculture employees are assigned to one of three job categories—applicator, technician, or engineer—each with a specific role in the pesticide application process. Applicators apply pesticides with backpack sprayers, technicians walk each row with the applicator to direct the path of pesticide application, and engineers direct the application process from the edge of the field. The application cycle typically occurs from mid-June to mid-August. During the year this study was conducted, two OP pesticides, chlorpyrifos (CPF) and profenofos (PFF), were sprayed in the fields.

According to Pamela Lein, Ph.D., an NIEHS-grantee and study author, this evaluation is different from past occupational pesticide exposure assessments in Egypt because the workers serially applied CPF and PFF to the fields. This involved an initial application of CPF followed by an application of PFF, and then a second application of CPF. "It is also the first longitudinal study of occupational exposure to profenofos, which was developed for pests with resistance to chlorpyrifos and other organophosphorus pesticides," added Lein, who is a neurotoxicologist and professor at the University of California, Davis.



An Egyptian agricultural worker uses a backpack sprayer to apply pesticides to a cotton field. Note that he is spraying the pesticides into his walking path. Results from the current study have encouraged workers to adopt safer work practices, such as spraying to their side.

(Photo courtesy of W. Kent Anger, Ph.D.)

The research team assessed OP exposure in 37 adult Egyptian workers from the Ministry of Agriculture who were stationed at three field sites in the governorate of Menoufia. They collected urine and blood samples from the workers before, during, and after the insecticide application season. To characterize OP exposure, the researchers analyzed urine samples for specific biomarkers of CPF and PFF exposure. They also analyzed blood samples for cholinesterase enzyme activity, a biomarker for neurotoxicity. The researchers found a wide range of exposures among workers within the same job categories, between job categories, and between field stations. Many past studies of occupational OP exposure have relied on job categories as a surrogate measure of exposure. "The prediction prior to our study was that exposure would vary across job titles such that applicators would experience the highest exposures, engineers the lowest, and technicians would fall somewhere between these two extremes," explained Lein. Although this generally held true, the researchers did find a significant number of individual exposures that would not have been accurately predicted by their job category, such as some engineers and technicians with higher exposures than some applicators. "Our study shows that using individual exposure data, rather than job category, will provide a better understanding of the relationship between OP pesticide exposure and adverse health effects," said Lein.

In keeping with the NIEHS objective of translating scientific data into information that can be used to protect public health, the researchers used results from the study to demonstrate to the Ministry of Agriculture that without safe work practices, workers are at risk for being exposed to pesticides at levels higher than what is considered safe. They also developed posters to help workers understand their OP exposure risk and how to modify their behavior to reduce exposure. "Prior to our study, the workers might wear a dust mask and long pants to protect themselves from pesticide exposure," noted Lein, "Since presenting our findings to focus groups of workers and the Ministry of Agriculture, workers have changed several of their work practices to decrease their exposure to pesticides, such as spraying to their side so that they are not walking through plants wet with pesticides, and wearing chemical-protective chaps to shield their lower body from spray."

### **Citation**

Singleton ST, Lein PJ, Dadson OA, McGarrigle BP, Farahat FM, Farahat T, Bonner MR, Fenske RA, Galvin K, Lasarev MR, Anger WK, Rohlman DS, Olson JR. 2015. Longitudinal assessment of occupational exposures to the organophosphorous insecticides chlorpyrifos and profenofos in Egyptian cotton field workers. *Int J Hyg Environ Health* 218:203-211. [\[Abstract\]](#)