By Richard C. Paddock

KEBASEN, Indonesia –Smoke billows from the chimney of the small battery smelter, carrying particles of lead, plastic, and sulfuric acid into the air. More dense smoke pours from the open furnace into the smelter’s main room, threatening to engulf two workers as they shovel the lead cells of car batteries into the glowing fire.

The gray cloud drifts over the countryside in Central Java, landing on rice fields and villages. Nearby residents complain that the haze burns their eyes, makes them dizzy and gives them headaches.

“We are upset about the smoke,” says Samsuri, 40, who lives in the farming village of Tegal Wangi about half a mile from the Lut Putra Solder recycling compound. “It makes it difficult to breathe and sometimes makes us sick.”

The Garuda Jaya plant is one of three battery smelters operating at the compound on the outskirts of the Central Java city of Tegal. None has scrubbers on the chimneys to trap the lead dust or other hazardous materials. Nor do they have permits to operate, authorities say.

Smelters like this are notorious for emitting high concentrations of lead and other toxic substances into the air. Lead, a major component of vehicle batteries, has long been known to damage brains, particularly in children. The unlicensed operations show how difficult it is in Indonesia to clean up even well-known hazards.

Government officials relocated the lead recyclers here in 2011 to end an even more hazardous practice: backyard battery smelting in the nearby village of Pesarean. For 44 years, villagers in Pesarean smelted lead acid batteries in their yards and homes, turning their historic metalworking village into a toxic waste site.

The contamination remains, surrounding Tegal’s most significant historic site, the tomb of Sunan Amangkurat 1, the ruthless Sultan of Mataram who ruled the Islamic kingdom of Java for more than two decades in the mid-1600s.

During the sultan’s time, Pesarean was famous for the manufacture of Javanese daggers known as *kris*.

Its long tradition of metalworking continues with dozens of household smelters that still operate in the village. Shops in the surrounding villages are filled with pots, knives and other metal goods made in the historic village.

**High Risk for Children**

Recycling of lead acid batteries is one of the major toxic problems plaguing Indonesia, along with much of the developing world, says Richard Fuller, founder and president of Pure Earth (formerly Blacksmith), a New York-based non-profit that is helping clean up the village. Tens of thousands of battery smelters are operating without environmental safeguards worldwide, he says.

The World Health Organization estimates that lead exposure contributes to 600,000 new cases a year of intellectual disabilities in children. Health experts say there is no safe exposure level for lead and that even relatively low levels can cause serious, sometimes irreversible, brain damage.

Childhood lead exposure also is a risk factor for attention deficit hyperactivity disorder and antisocial and criminal behavior, says Bruce Lanphear a professor at Simon Fraser University in Canada who is a leading expert on lead exposure.

There are scores of illegal battery recycling facilities in Indonesia, including 34 in the greater Jakarta area alone, according to Pure Earth. All 10 of the country’s worst toxic sites are battery recyclers, the group says.

Tuti Hendrawati Mintarsih, director general of hazardous waste in Indonesia’s Ministry of Environment and Forestry, acknowledges the problem but says authorities can’t close illegal smelters because too many people would lose jobs and the operators would move to new, hidden locations.

“This is the social problem,” she says. “When we remind them not to operate the illegal smelter, we should help them find an alternative job.”

**Toxic Village**

Today in Pesarean, which is home to about 1,000 people, gray soil is everywhere. The dusty footpaths where children run barefoot are a dark gray. Fire pits where batteries were burned dot the village. Gray piles of ash and dirt sit where they were dumped years ago. The water in the small village creek runs gray, spilling its waste into a larger stream that flows into the rice fields.

There are about 200 houses in the village, many of them built on contaminated soil. Even now, residents are building new houses on top of the lead waste.

“It’s poisoning the soil, it's poisoning the water, it's poisoning the air,” says Pesarean village head Agus Sustono, 38, who pushed for an end to the battery smelting. “We can see it with the naked eye.”

Sustono warned residents not to drink the groundwater because of the high lead content. But children say no one has told them not to play in the dirt.

Lead exposure of this magnitude is a “huge and pervasive problem,” says Lanphear. “The gray dust undoubtedly contains high concentrations of lead that contaminate the foods people eat, (and) the air they breathe.”

Although battery smelting has been banned in Pesarean since 2011, lead levels in the soil remain high.

Pure Earth, which has helped clean up contaminated sites in Indonesia and other countries, recently tested 500 locations in the village and found that lead exceeded 100 parts per million in every spot. Soil near the village high school measured 5,000 parts per million. A former smelter site 50 yards from the school entrance measured 150,000 parts per million. By contrast, the U.S. Environmental Protection Agency's standard is 400 parts per million for lead in play areas and 1,200 parts per million for non-play areas.

Blood tests of 46 villagers conducted by Pure Earth last year showed even higher lead levels than in 2011 when the smelting stopped. The average lead level in the blood of people in Pesarean last year was 39.3 micrograms per deciliter, far higher than the 5 micrograms per deciliter used by the US Centers for Disease Control as a guideline for action to prevent health effects.

The aid group and the environmental agency are drafting a cleanup plan for Pesarean, with work expected to start next year.

Today, lead smelting has ended in Pesarean but other metalwork continues. Women sort through piles of junk to separate aluminum, iron and other usable materials. Men melt the metal over open fires to make ingots, sending acrid smoke into the air. Craftsmen work over small metal forges in the back rooms of their houses, making tools, cookware, machine parts and anything else that might sell.

Fathoni, 51, who like many Indonesians uses only one name, has lived in Pesarean for 30 years. A former metalworker, he’s now the village gravedigger and has a side job performing massages to relieve hernias. When the battery fires were blazing, he says, the air burned his lungs and made breathing difficult. He remains concerned about how the lead may affect his three grandchildren.

“I’m very worried,” he says. “I know the land is contaminated and we can’t drink the groundwater. The government should do the cleanup immediately.”

But his neighbor, Sudiono, 75, a longtime smelter operator in Pesarean, says concern over lead is unwarranted. Villagers have been building homes on the gray soil for years, he says, and he doesn’t know anyone who has been harmed.

“I started this kind of business when I was 18 and nothing has happened to me,” he says. “People today are looking for problems.”

**Three New Smelters**

Down the road in Kebasen, the three new battery smelters can process thousands of batteries a day. The environmental agency chose the 16-acre site to replace Pesarean’s home-style smelting, although two of the smelters were established by newcomers.

All three operate within a compound run by Lut Putra Solder, or LPS, which also manages its own recycling ventures, often in primitive fashion. In one section, men wielding long sticks melt aluminum cans and bottle caps over open fires, the harsh smoke rising in clouds around them. In another, men make paving stones with slag from the lead smelters.

The largest of the battery smelters is run by a company that does not officially exist, at least on paper: It has no name or permit to operate. Nevertheless, Bukitun, the facility’s manager, welcomed unexpected visitors and was happy to explain his operation.

The smelter is a cavernous room with two furnaces and stacks of discarded battery casings. The workers each sit on a battery casing on the floor and swing small axes to split open the batteries and remove the lead cells. The acid is dumped beforehand into a cement pond outside, Bukitun says.

Other workers shovel the cells into the furnaces. After the lead melts, they pour it into trays to make ingots. The lead is bought by a company that makes fishing weights and air gun pellets.

He says his 10 workers earn the equivalent of $4 a day, more than most laborers make in the business.

Bukitun says the smelter, which opened in early 2015, recovers about 50 percent of the batteries’ weight in lead and another 40 percent is slag. The rest of the material goes up in smoke, he says. The 27-meter chimney has no scrubber but a nozzle mounted near the top squirts water on the smoke as it exits.

“It sprays the smoke so the lead dust falls down,” he says.

Experts say such a system does little to capture lead particles. Bukitun says he is open to suggestions on how to reduce the contamination. He wouldn’t mind financial assistance either.

“We need guidance if there is something better we can do,” he says.

Bukitun says the company operates under LPS’s permit. But Riyanto, the LPS operations manager, says that is not correct. His company’s permit does not cover any of the battery smelters, he says, and each smelter must apply for its own. "If they were under the LPS permit,” he says, “they would need to add safeguards.”

Residents in nearby Tegal Wangi began complaining to LPS about smoke from the facility’s operations before the battery smelters opened. Now they say the air quality is even worse with the three smelters.

“When I am in the field, the smoke is very thick,” says Suharti, 65, who grows rice near the recycling center. “It’s hard to breathe and my eyes sting. It smells like plastic is burning.”

Riyanto says LPS periodically distributes milk and rice to the residents of nine nearby villages as compensation for the pollution.

Agus Subagyo, head of the environmental agency, say he has made no move to shut the smelters for operating without permits because he doesn’t want to see a return to backyard battery smelting. The permit process is costly and time-consuming for the companies, he says, but he will push them to comply.

“In the old location, people were smelting batteries inside their houses and it was very bad for their health,” he says. “Moving them to a special industrial zone is the best way to make it healthier and cleaner, although we still need some improvement.”

**No Rules**

On the northern edge of the LPS compound, the floor of the Garuda Jaya smelter is slippery with battery acid. The workers try to avoid the smoke as it surges into the room.

Daniel Rizal, 26, the manager, says his company came here in 2013 because it could operate without government interference. “In Tegal, there are no rules about smelting lead,” he says.

He says the lead hazard doesn't trouble him. “I’m more worried the government might shut us down,” he says. “I have a family to feed.”

Outside, half-hidden in weeds, a sign erected by the health agency reads: “Warning…!!! Pollution and environmental contamination are damaging our future generations.”

Behind it, lead-laced smoke pours from the Garuda Jaya chimney.

This story was produced in collaboration with the Pulitzer Center on Crisis Reporting.