

Radioactive Contamination of Recycled Metal

Background by Gordon Edwards, November 10, 2014

http://ccnr.org/radioactive_metal_2014.pdf

In a recent post ["Too Heavy A Price To Pay?", http://ccnr.org/CCNR_BAPE_2014.pdf] mention is made of contaminated steel from a Mexican scrapyards ending up in radioactive table legs in a restaurant in Winnipeg Manitoba. Some readers have asked for more details.

The following article from the New York Times (May 1, 1984) discusses the episode more fully. Gamma-emitting steel was trucked all over North America, causing contamination problems in Mexico, the USA and Canada. The source of the contamination was cobalt-60 from a discarded cancer therapy unit.

Cobalt-60 is a very powerful gamma ray emitter that does not exist in nature. It is created inside all nuclear reactors, as non-radioactive cobalt-59 atoms absorb neutrons to become radioactive cobalt-60 atoms.

Atomic radiation from the disintegration of radioactive atoms is very harmful to living cells -- particularly those that are rapidly dividing, like cancer cells for example. By focussing the gamma rays from cobalt-60 on cancerous tumours, the growth of the tumour can be arrested and even reversed. Healthy cells that are irradiated in the process are a kind of "collateral damage". Some of those damaged cells may even develop into cancer cells later on, but not for many years to come.

So the patient has the benefit of damaging or destroying the cancerous growth that might kill him or her in a matter of months, by accepting the risk that a new radiation-caused cancer may (or may not) develop many years later.

The thousands of cobalt-60 pellets that ended up in the Mexican scrapyards probably came from Canada. The world's first "cobalt bombs" (as these cancer therapy units were then called) were built in 1951 in Saskatoon, Saskatchewan, and London, Ontario. Since then thousands of cobalt-60 cancer therapy units have been sold worldwide. Canada was the country that began marketing cobalt-60 and has always been the main North American supplier of cobalt-60.

Since radiation cannot be seen, felt, smelled or tasted, no one in Mexico knew that the scrap metal had become extremely dangerous. The contamination went undetected for eight and a half months. It was only by a lucky accident that anybody found out about it. The driver of one of the many trucks carrying radioactively contaminated metal from Mexico got confused and mistakenly turned into the Los Alamos Nuclear Laboratories, setting off radiation alarms.

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Had this not happened, the radioactive steel may have gone undetected – and the contamination uncorrected -- for years.

This dramatic incident highlights the dangers if allowing radioactive wastes from the nuclear industry from being "recycled" by blending it into otherwise uncontaminated scrap metal, as is currently allowed by regulations that have been surreptitiously approved in Russia, Europe, and Canada.

Many believe that there should be zero tolerance for this practice of contaminating recycled metal with low-level radioactive waste, a practice euphemistically called "free release" by the nuclear industry and its overly compliant regulatory bodies.

Gordon Edwards.

Nuclear Spill at Juarez Looms as One of Worst

*By Sandra Blakeslee, NY Times, May 1, 1984
<http://tinyurl.com/5s8zszo>*

Five months ago, a Mexican electrician forced open an unmarked capsule filled with 6,010 tiny, silvery pellets that looked like cake decorations. He paid little attention as they spilled into the bed of his pickup truck, onto the road and later throughout a junkyard in his hometown of Juarez, just across the Rio Grande from El Paso.

But at that moment the electrician unwittingly caused what is now being recognized as potentially the worst spill of radioactive material in North American history. Since then, more than 200 people have been exposed to radiation from the tiny pellets of cobalt 60 that had once been the core of a cancer-treatment device.

The full dimensions of the spill, which officials in the United States said has released radiation 100 times more intense than the nuclear accident at Three Mile Island in Pennsylvania, are still unknown because the incident was so unusual. Unlike most nuclear accidents, in which one or two people are exposed to a brief burst of high radiation, this one involved scores of people exposed to low but significant levels of radiation intermittently over a long period of time.

Mexican officials say it is too soon to know if the people exposed to the radiation suffered any long-term health effects. But 10 people exposed in Juarez have undergone chromosome tests, and all showed damage, the authorities said.

"In terms of how many people were potentially exposed and the duration of their exposure, it could be the most serious radiation accident" in North America, said Karl

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Hubner, a leading radiation accident expert at the Oak Ridge Associated Universities in Tennessee.

Most of the cobalt 60 pellets were scooped up by a giant junkyard magnet, mixed in with other scrap metal and taken to two Mexican foundries, where they were melted into steel reinforcement rods and restaurant table legs. Thousands of tons of this "hot" metal were then shipped throughout Mexico and the United States.

Meanwhile, hundreds of the pellets remained in the back of the electrician's pickup truck, which sat parked for eight weeks in a busy neighborhood of Juarez. People walked by the truck every day, and neighborhood children played on it.

Mexican public health officials said that about 200 people were exposed, but that most are believed to have absorbed relatively low levels of radiation. **The device involved in the Juarez accident was a Picker 3000 cancer therapy unit.** Manufactured about 20 years ago, it contained small pellets of metallic cobalt, made radioactive in a nuclear reactor, that were placed in a stainless steel container. This capsule was sealed in a tungsten wheel the size of a tricycle tire, which was then placed behind thick lead shielding. Radiation emitted through a pinhole in the lead was used to treat patients with localized cancers. About 1,000 newer cancer-treatment machines using the same principle are in use today throughout the United States, Dr. Hubner said.

In 1977 a Lubbock, Tex., hospital sold the unit to an X-ray equipment company in Fort Worth, which in turn sold it to a medical clinic, Centro Medico, in Juarez. According to the United States Nuclear Regulatory Commission, **the sale was legal even though the clinic in Mexico had no license to receive radioactive materials.**

Once in Juarez, however, the machine sat in a warehouse. Doctors at the clinic said they were never able to hire the specialist required to operate the device.

Device Sold to Junkyard for Nine Dollars

Then, late last November, an electrician, Vicente Sotelo, said he was told to go to the warehouse to pick up some material and to take it to the Jonke Fenix junkyard in Juarez. He and a co-worker heaved the radioactive tungsten wheel, which had been removed from its enormous lead casing, into the back of a pickup truck. Mr. Sotelo later told the authorities he forced the unmarked capsule open on the back of his truck.

Doctors at the clinic say Mr. Sotelo was not authorized to take the wheel containing the capsule, which he sold to the junkyard for \$9. No charges have been filed, and the Mexican authorities said they were still investigating the incident.

When the capsule was breached it held about **400 curies of radioactive cobalt in the 6,010 pellets.** Each pellet, according to Joel Lubenau, a health physicist at the Nuclear Regulatory Agency, produced a **radiation dose of 25 rads per hour two inches from the pellet.** One to 50 rads per hour is considered a significant radiation dose. In comparison,

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the highest exposure a bystander could have received from the nuclear accident at Three Mile Island was 100 millirads, or about one-tenth of a rad.

A rad is a unit of absorbed radiation. An average chest X-ray produces 20 to 30 millirads instantaneously. A lethal dose for half the population is 450 rads received instantaneously over the whole body.

"If you sat next to a pellet over many hours, you might several days later develop a reddening of the skin," Dr. Lubenau said. "If a pellet became embedded in your shoe you could get localized high exposure to the body."

Children Played on 'Hot' Truck

By Dec. 6, Mr. Sotelo had thrown the capsule off his truck into the salvage yard. The date is known because all paperwork from the junkyard dated Dec. 6 or later is radioactive.

About 60 curies of cobalt remained on the truck, which Mr. Sotelo drove home to his neighborhood in another part of the city. It stood parked for eight weeks, most of the time with a flat tire, near a row of back-street houses. Children played on and near the truck. People passed it every day, including Mr. Sotelo's own family.

The truck was dangerously "hot." From one yard away, it emitted 50 rads an hour of radioactivity. "It was a large source that can give whole body exposure," Dr. Lubenau said. "Most people at 100 rads or so will start demonstrating physical signs of radiation injury." These include a decrease in white blood cells, which protect the body from infection, and blood platelets, as well as temporary damage to the body's chromosomes.

Meanwhile, the capsule containing the remaining cobalt pellets – 340 curies worth – was contaminating the junkyard. It was dumped near an enormous magnet used to pick up and load scrap metal onto trucks, the metal to be recycled at Mexican foundries.

The capsule was made of nonferrous metal. Every time it was scooped up by the magnet, it eventually fell to the ground, spilling out cobalt pellets like salt from a shaker. The pellets were ferrous. The magnet picked them up and mixed them into the scrap leaving the junkyard. **Some pellets were pulverized and thoroughly spread across the huge junkyard, and others are believed to have become imbedded in truck tires and spread along highways.**

In this manner, **300 curies of radioactive cobalt made its way to two foundries. One in Juarez manufactured metal table legs and sent them to the largest distributor of restaurant tables in the United States. Another in Chihuahua produced about 5,000 tons of rebar, or steel rods used to reinforce concrete** in building projects.

About 600 tons of the contaminated steel was shipped to the United States in December and January.

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Spill Discovered by Accident

When a delivery truck took a wrong turn near the Los Alamos National Laboratory in New Mexico on Jan. 17, a radiation alarm was tripped. Thus, by accident, did the American and Mexican authorities learn of the contamination. It was quickly traced to the junkyard, which was closed Jan. 20. Mr. Sotelo's truck was impounded Jan. 26.

American officials said they tracked down all the table legs and rebar in February and March and have returned the material to Mexico. While there were a few "hot spots" of up to 600 millirads per hour, most of the metal produced very low levels of radiation and never posed a serious health threat to Americans who came in contact with the metal, they said.

But Mexican officials have had a much tougher job. About 40 curies of the cobalt pellets remained spread around the junkyard. It took two months to mop up there.

Pellets could have been dropped anywhere on the roads between Juarez and Chihuahua. Last month a special reconnaissance helicopter provided by the United States Department of Energy flew over the area and found 22 radioactive sites. Eight pellets were dug out of highway pavement.

Such material, along with the radioactive truck, is now in a special holding area near Juarez, waiting to be buried at a safe disposal site, said Roberto Trevino of Mexico's National Commission for Nuclear Safety and Safeguards.

Thousands of tons of contaminated rebar, however, have spread into four or five Mexican states. Hundreds of new homes built with the rods may have to be torn down, he said.

Chromosome Damage Is Found

The accident has been costly to Mexico. But the greatest toll may be levied on the people who were most exposed to the radioactive cobalt.

The problem, Dr. Hubner said, is to figure how to identify the people who were exposed and what doses of radioactivity they encountered.

One standard method of assessing radiation exposure, which costs about \$1,000 per person to conduct, involves looking for chromosome damage. It is controversial because it cannot predict long-term health consequences of radiation exposure.

White blood cells of 10 Juarez residents, four people from the neighborhood and six junkyard workers, were cultured in Dr. Hubner's laboratory. As the cells were allowed to divide 500 times, the number of broken or aberrant chromosomes were counted. This number was then used to estimate the dose of radiation received.

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It appears that **several people were exposed to 150 or 200 rads**, Dr. Hubner said, which is higher than the doses received by Marshall Islanders who encountered radioactive fallout from United States nuclear tests. Those with the highest exposures included two junkyard workers, one of Mr. Sotelo's neighbors and the man who helped Mr. Sotelo load the cancer device off the truck. Mr. Sotelo apparently escaped serious contamination.

But "broken chromosomes only tell us there was damage and nothing about its biological consequences," Dr. Hubner said. "It is not predictive in terms of genetic effects or future cancers."

Meanwhile, the junkyard workers and families are being monitored by Mexican health officials. **One man received a radiation burn on his hand, Mr. Trevino said, and others experienced blackened fingernails and reduced sperm counts.** But blood counts appear to have returned to normal, he said, and no one seems to have suffered serious health complications.

'It's O.K. – We're Still Alive'

Mr. Sotelo, who has three children, said that he has been dismissed from his job and cannot find another, and that his neighbors are worried and upset. But "It's O.K.," he said. "We're still alive. Maybe the doctors exaggerated the danger."

Concern over the implications of the incident continues. American officials, worried that more contaminated rebar might make its way into the United States, have asked the Nuclear Regulatory Commission to place **scores of radiation detectors at all major border crossings.**

The commission is taking a new look at export regulations, according to Richard Cunningham of the agency's division of materials licensing and policy issues. "There is no requirement now that we have to know if a person who receives a radioactive material from this country is authorized by their own country to possess it," he said. **"We sell thousands of radioactive sources to other nations every year."**

Mexican and United States officials are meeting today in El Paso to discuss ways to help one another finish cleaning up the Juarez accident, to monitor the health of people exposed to radiation and how to prevent future accidents.

"There is a growing international trade in nuclear materials used for medicine, research and industrial purposes," Dr. Hubner said. **"Although this type of accident is rare, it could happen again anywhere to anyone."**