

Why Is This Cargo Container Emitting So Much Radiation?

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On July 13, 2010, this cargo container arrived in Genoa, Italy. It was emitting torrents of radiation. No one knew what was inside. And no one knew what to do next.

Photo: Georgio Barrera

Enzo Montagna pulled his Fiat station wagon into Voltri Terminal Europa, a sprawling port on the western edge of Genoa, on Italy's Ligurian coast, and flashed his ID at the guard at the terminal's gate. As he did every time he came to the port, Montagna hooked a left and parked in a small lot near the low-slung customs office.

In Italy, all cargo containers carrying scrap metal get checked for radiation, by hand, before they're allowed off the docks. At Voltri, this job falls to Montagna, a 49-year-old independent consultant certified as an expert in radiation detection by the Italian government. By the time he arrived that morning, longshoremen had gathered eleven 20-foot-long, 8-foot-wide containers from across the terminal, relying on manifests to determine which ones needed to be scanned. The boxes were lined up in two neat rows near the terminal's entrance.

Montagna, dressed in a polo shirt, jeans, and an orange safety vest, grabbed his radiation monitor — a tan Ludlum Model 3 about the size of a toaster. He plugged in a heavy sensor wand and set the device on the ground 20 yards away from the containers. The Model 3 emits a high-pitched beep every time it detects a radioactive particle; Montagna turned it on, and the meter's needle swung hard to the right, burying itself past the maximum reading of 500,000 counts per minute. Instead of its usual staccato chirps, the machine was whining continuously and frantically.

That didn't worry Montagna. The port's humid air sometimes corroded his monitor's connections. He turned the detector off, swapped out the cable between the sensor wand and the box using a spare he kept in his pocket, and turned the device back on. It started wailing again. Montagna was being bathed in radiation.

As he stood in the morning sun listening to that sound, Montagna realized that one of the containers in front of him held a lethal secret. But was that secret merely a slow-motion radioactive industrial accident — or a bomb, one that could decimate the Italian city's entire 15-mile waterfront? Montagna ran back to his car to get a less sensitive detector. He didn't give much thought to protection; at those radiation levels, he would have needed lead armor 5 inches thick to stand within a couple of feet of the source for very long.

Montagna took the new meter and walked up to the sealed boxes, circling each one in turn. Halfway down the second row, a crimson 20-footer with "TGHU 307703 0 22G1" emblazoned in white on its side jerked the dials. As he passed a few feet from the box's left side, Montagna was absorbing radiation equivalent to six chest x-rays per minute.

He looked around the bustling port. Montagna could hear traffic from the highway several hundred yards away and could see the nearby hills of the city. He summoned the safety officer on duty and asked for a stacker, a sort of crane on wheels with an overhead arm that can clean-and-jerk a 50-ton box like a child's toy. Jumping in the cab next to the driver, he pointed to box TGHU 307703 0 22G1.

"Move it," he said.

There are millions of containers just like TGHU 307703 0 22G1. The only thing that distinguished it from the steel boxes stacked in your local port or hitched to a truck one lane over during your morning commute — besides radiation a million times above normal background levels — was the painted-on identification number.

That mix of ubiquity and interchangeability makes the shipping container one of the most radical developments in global commerce since World War II. The first dedicated container ship was built in 1956, and virtually overnight the new logistical approach transformed the cargo business. "In the old days, a whole bunch of guys would stand on the dock, waiting to load cargo onto wooden pallets," says Jim Rice, a supply-chain expert at MIT. "Containers standardized everything. It's like putting Lego blocks together, as opposed to molding things from clay every time."

Unloading a pre-container "breakbulk" cargo ship could take a week. Today, a crew of six Genoese longshoremen can move almost two dozen containers per hour using a crane to unload the ship, a stacker to move the boxes, and a few semi trucks; a ship with 3,000 boxes aboard can be turned around in 48 hours. The efficiency has proven to be an irresistible economic force. In 2010, the world's container ports processed the equivalent of 560 million 20-foot containers. If you set aside bulk commodities like crude oil and grain, that's more than 90 percent of the planet's maritime cargo. By driving the cost of shipping way down and the speed of international commerce way up, containers helped make manufacturing global.

But those millions of identical containers are, essentially, mystery boxes. Stevedores used to lay hands on each piece of cargo that went into a ship's hold. Today, a container may be loaded, or "stuffed," thousands of miles from the port. Once the doors are closed and sealed, "no one knows what's inside," says Philip Spayd, a supply-chain security consultant who spent 25 years working for the federal government. "We know what's represented on their documents," but those documents are easily faked, he says. "The only people who really know what's inside are the ones who were there when the container was packed." Containerized cargo is used to smuggle every imaginable form of contraband, from narcotics and small arms to counterfeit purses and illegal immigrants.

Since the terrorist attacks of 9/11, security experts and politicians have zeroed in on containers as a major risk. At the top of their list is the possibility that containers could be used to smuggle a nuclear weapon, in pieces or whole. But nuclear bombs are tremendously complicated, and the key components aren't exactly commonplace. In security circles, nukes are what's known as a "high consequence, low probability" threat.



Radiation inspector Enzo Montagna found the radioactive cargo container on a routine check of scrap metal shipments at a Genoa port. Photo: Georgio Barrera

But that's not true for the next danger on the list: a radiological dispersion device, also known as a dirty bomb. A payload of radioactive material — from inside a hospital's teletherapy machine or instrument sterilizer, for example — sits atop a pile of conventional explosives. When the bomb detonates, it blows a cloud of radioactive dust into the air. The wind does the rest: Under the right conditions, just 20 milligrams of cesium-137 — roughly the amount found in gadgets that hospitals use to calibrate their radiation therapy equipment — could contaminate 40 city blocks.

Compared to a nuclear explosion, a dirty bomb would be a hiccup in terms of destructive force. The real problem would be panic. A light coating of radioactive dust raining down on Manhattan might cause only a minor increase in cancer rates, but it would definitely result in a major national freak-out. Set off at a major port, a dirty bomb would cause a chain reaction of precautionary closures and painstaking inspections that could bring the entire U.S. economy to a crawl within weeks. "The idea that dirty bombs could cause major destruction is complete bullshit. What they could do is cause billions and billions in economic damage," says James Acton, an analyst at the Carnegie Endowment for International Peace. "Dirty bombs are weapons of mass disruption."

In the U.S., officials have significantly beefed up security at the nation's ports since 9/11, and according to the Department of Homeland Security, 99 percent of incoming cargo is now scanned for radiation once it hits U.S. soil. But security hawks want to go even further: In 2007, Congress passed a bill requiring that every container coming into the U.S. — some 66,000 a day — be scanned *before* it enters the country. The Department of Homeland Security was given until 2012 to implement the order, but together with the shipping industry DHS has pushed back. Instead, it promises something called "100 percent screening." Before goods set sail for the U.S., Customs and Border Protection gathers information provided by shippers, including the name and address of the manufacturer, the contents, and the destination. Computer algorithms flag anomalies or containers coming from ports with known security issues, and if that port has a U.S. Customs officer on station, those containers get scanned before they're loaded onto U.S.-bound ships.

So after 10 years and more than \$1 billion spent on scanners, radiation detectors, and beefed-up intelligence, most U.S. ports are still scanning containers onshore, after unloading. Unfortunately, the detectors are easily foiled. Lots of harmless things are slightly radioactive — kitty litter, ceramic tiles, even bananas. So most detectors are set to ignore low radiation levels. Basic shielding would be enough to mask all but the strongest sources. “The radiation portals that were deployed in the aftermath of 9/11 are essentially fine, except for three problems: They won’t find a nuclear bomb, they won’t find highly enriched uranium, and they won’t find a shielded dirty bomb,” says Stephen Flynn, a terrorism expert and president of the Center for National Policy. “Other than that, they’re great pieces of equipment.”

The fact of the matter is that thoroughly scanning every container would slow things down, and that would cut against the very value of containerized shipping. “What’s very important for this agency is to make sure cargo gets in and out as smoothly as possible,” says Dan Baldwin, executive director for Cargo and Conveyance Security at U.S. Customs. “It is important for us to keep the wheels of the American economy rolling.”

The code on the container—TGHU 307703 0 22G1 — is a sort of formal family name. The TGHU prefix tags it as the onetime property of Textainer, a Bermuda-based shipping concern that owns more than 2.4 million boxes just like it. The lone zero is a “check digit” that helps confirm the box’s identity, and the 22G1 designates it as an unventilated, 20-foot-long dry shipping container. The 307703 is the unique part of the ID, the thing that let investigators track its long, winding journey to Genoa.

A Textainer spokesperson says the company last saw container 307703 in April 2010, when its six steel walls were leased to “an established customer.” Italian officials say it was Mediterranean Shipping Company, or MSC, a shipping goliath headquartered in Geneva. Not long after, the box was stuffed at a metal yard in Saudi Arabia under the auspices of Sun Metal Casting, a scrap-metal dealer in the tiny Arab emirate of Ajman. In recent years, scrap metal has become a booming global business, with manufacturers continually searching for cheaper places to get metals like steel and copper — 307703’s load was bound for a foundry called Sigimet in the town of Pozzolo Formigaro, 40 miles north of Genoa.

According to Italian investigators, a grainy picture snapped by the shipper before 307703’s doors were closed and sealed with a thumb-sized lead-and-plastic tag shows radiators and coils of copper wire piled almost to the roof. That’s a 1,360-cubic-foot jumble of metal that could hide almost anything — assuming the photo is actually of the same container and that the container wasn’t tampered with. “When you put a seal on a container, it doesn’t guarantee it hasn’t been broken into. It might have false doors or walls. You could take the doors off the hinges or cut a hole in the box,” MIT’s Rice says.

Investigators scanned the mysterious container to estimate the location and amount of radioactive material inside. They soon zeroed in on an area about 2 feet off the ground on the left wall, where radiation levels reached 500 millisieverts per hour. Triangulating from various readings allowed the crew to guess where to start looking once a robot opened the box.

In June or early July 2010, the box was trucked — Saudi authorities are still investigating by whom — to the docks in Jeddah. There, a crane lifted it into the hold of a ship owned by MSC. On July 9 it passed through Gioia Tauro, a port in Calabria at the toe of Italy’s boot-shaped south. Gioia Tauro is a transshipment center, shuffling more than 3 million containers from ship to ship each year. That no one there checked the container isn’t a surprise. Transshipment ports are the equivalent of the Internet’s packet switchers, more concerned with efficiently shuffling boxes from one ship to another than with what’s inside. “Customs tends not to focus on containers that are being transshipped,” Spayd says. “Their attitude is ‘It’s not my container; it’s just passing through.’”

Comparative radiation doses (total exposure, millisieverts)

- Air Flight, NY to LA 0.003
- Chest X-ray 0.1
- Mammogram 0.7
- One Year of Background 3.1
- One Hour in Fukushima 400

It was hardly the first fishy shipment to pass through Gioia Tauro. Famously, just six weeks after 9/11, workers there heard noises coming from inside a container being transshipped to Nova Scotia via Rotterdam. Inside, police found an Egyptian-born Canadian carrying a Canadian passport, a satellite phone,

a cell phone, a laptop, cameras, maps, and security passes to airports in Canada, Thailand, and Egypt. The container's interior was outfitted with a bed, a water supply, a heater, and a toilet. Nicknamed Container Bob, the man posted bail in Italian court and was never seen again.

According to Italian police, Gioia Tauro is under the influence of the 'Ndrangheta, Calabria's homegrown mafia. In addition to illegal immigrants and weapons, officials say, it's the point of entry for as much as 80 percent of Europe's cocaine. A few months after container 307703 passed through, police at Gioia Tauro working on a tip opened an unassuming box from Brazil filled with tractors and found inside (not listed on the manifest) a ton of pure coke.

Container 307703 was back on the water in a day at most, sailing north past Naples and Rome and finally to Genoa's Voltri Terminal. Though it's one of the largest full-service ports in Italy, Voltri is modest by global standards. In 2010, it flirted with the million-container mark. Just under 500 longshoremen work there in six-hour shifts, around the clock, 363 days a year.

On the night of July 13, the MSC-owned ship eased under one of Voltri's 10 dark-green cranes. Stackers and trucks expertly scattered cargo containers across the terminal's 27 acres of blacktop. As far as Voltri's computers could tell, container 307703 was just another box of innocuous scrap metal. No one was in any hurry to take a closer look. By the time the sun came up, the box had become a single dark-red pixel in a shifting mosaic of commerce, buried among identical containers bearing logos like Yang Ming, Hamburg SVOxFCd, Maersk Sealand, MSC, Cosco, OCL, Sinochem, Hapag-Lloyd, "K" Line, and Hyundai.

Marco Calimero and Luca Garbarino have worked for the Agenzia Regionale per la Protezione dell'Ambiente Ligure (ARPAL), the Ligurian regional environmental agency, since 1990. Partners for more than 20 years, they make an odd pair: Calimero is a former military policeman with a graying crew cut; Garbarino has shaggy hair and a beard. Their side-by-side desks in a cramped, neon-lit office at the environmental agency's headquarters are strewn with papers and chunks of scrap metal converted for use as pencil holders. A small yellow sticker on Calimero's desk reads irradiazione.

On the day Montagna scanned container 307703 — July 20, a week after it was offloaded — the two men were driving back from a meeting in the nearby town of Varazze. Calimero wasn't surprised to see Montagna's name on his cell phone — he sometimes called about bureaucratic stuff. But this was no routine matter.

Montagna quickly told them about his readings, and Calimero and Garbarino headed for the port, stopping at their office to pick up their own gear, well-used radiation detectors packed in padded aluminum cases. They arrived at Voltri less than an hour after Montagna's phone call and found him and an official standing about 250 yards from container 307703, now moved to an unused area on the eastern edge of the port.

The first thing on everyone's mind: Was there a nuclear bomb inside? Instruments in hand, Calimero and Garbarino walked toward the container, confirming Montagna's readings. At 25 yards away, Montagna had measured radiation levels of 0.1 millisieverts per hour. (The maximum allowable exposure for radiation workers in the U.S. is 50 millisieverts per year.) Calimero and Garbarino didn't want to get anywhere near the thing. The high readings were actually good news. The active ingredients of a nuclear device, plutonium or uranium, can be surprisingly difficult to detect. "Bombs don't have such high levels," Montagna says. "If it were a nuclear bomb, there would be much less radiation than was coming out of this thing."

Reassured that they weren't dealing with a full-blown nuke, the men felt secure enough to call local government officials, who mobilized the fire department for a radiological incident. The question was, should they close the port? Evacuate? Reroute the highways? There was still the possibility that this was a dirty bomb. "Shutting the port and the motorways for a false alarm? It would have been total chaos. Chaos," Montagna says.

After arriving and conducting their own analysis, fire department specialists decided to use a line of containers to create a quarantine zone. It wasn't a great solution, but it bought some time. Over the next few

days, Calimero and Garbarino managed to figure out exactly what they were dealing with. The hottest spot was about 2 feet off the ground, in the center of the container's long left side. The team then brought in one of the most sensitive portable detectors on the market, an \$80,000 Ortec HPGe Detective DX-100T. Inside the unit, a 1.65-pound chunk of germanium cooled to -260 degrees Fahrenheit releases electrons when hit with gamma radiation. As they decay, many radioisotopes emit gamma rays, and those occur at specific energy levels. Whatever was in the box was giving off gamma rays at 1,173 and 1,332 kiloelectron volts. It could be only one thing: cobalt-60 slowly alchemizing itself into nickel.

Cobalt-60 is usually sold as a solid piece of metal to be used in medical devices like teletherapy machines and blood irradiators. Other isotopes are better suited for dirty bombs. There's cesium-137, which has a pesky propensity to bind with concrete and, combined with chlorine, forms a powder as fine as talcum. Or there's americium-241, minute amounts of which are used in smoke detectors. But cobalt is hard to blow up. And Calimero and Garbarino estimated there to be less than half a pound of cobalt in the box. When I met with him in April, Stefano Maggiolo, director of ARPAL's local office, explained the problem's magnitude via a visual aid. In a conference room not far from Genoa's old city, he picked up a piece of red-wrapped candy from a basket on the table and handed it to me with an earnest smile. "The cobalt-60 is this big," he said. "It's a little *caramella* of cobalt."

Nobody had any good explanations of why cobalt-60 would be in this container. And even if it *wasn't* a bomb, what could they do with the box? It couldn't stay in the port, but no one in the port would move it. The threat had been downgraded to a serious environmental hazard, but officials still couldn't entirely rule out some kind of terrorist plot. "The radiation is so high it's not possible for humans to go inside. We need to use robots," Garbarino said last spring. "The final answer will come when they extract the source."

From the air, Genoa's cityscape carves a dramatic, thin line of apartment buildings and factories more than 15 miles long pressed between blue sea and steep green hills. Most of the city's 600,000 citizens live within a mile of the water, in crowded hillside neighborhoods where public transportation options include elevators and funiculars.

An artificial strip of land 500 yards wide and nearly a mile long, the Voltri terminal sits on the city's western edge, just beyond its small airport. A 100-yard-wide lane of water separates it from Pra', a working-class suburb. Anyone in Genoa will tell you that the hundreds of greenhouses dotting the hillsides of Pra' grow the best basil in Italy, the key ingredient in true pesto Genovese.

But the real business in Genoa is the port. Genoa's history goes back more than 2,000 years, and the town has been dependent on the sea since the very beginning. In the 14th and 15th centuries, Genoese sailors and navigators were in high demand all over Europe. Genoa native Christopher Columbus learned his navigation skills along its 15th-century docks.

Today, Voltri is the gateway to northern Italy's industrial heartland. In addition to containers, 50,000 cars a year come through the port on their way to dealers across southern Europe. "Historically, Genoa has always based its life on the port," says Ivan Drogo, head of Multicon, a local business association. "Shutting down the port would shut down Genoa."

A dirty bomb attack at a major port would paralyze shipping, bringing the economy to a crawl within weeks.

For six months after the container was discovered, officials made no public announcement about it, and the port's business continued as usual. But rumor spread through the city. For a while, the only reaction was from port workers. Giacomo Santoro, whose FILT union represents most of the port's longshoremen, claims Voltri management had his members move the container before adequately explaining the risks involved. And because the box spent a week on the dock between the time it was offloaded and when Montagna scanned it, dozens of people may have been unknowingly exposed to dangerous radiation. In protest, port workers staged a 24-hour strike in August 2010, three weeks after the container landed on the dock. For the next five days, the terminal's union workers struck for two hours each shift.

Locals took up the cause. For neighborhood activist Nicola Montese, a burly young screenwriter and TV host who grew up in the shadow of the terminal's cranes, the container was just another example of Genoa's disdain for the working-class neighborhood across from the port. "Everyone always dumps their trash in Pra'," Montese says. "We don't need another problem." Montese spent months trying to drum up outrage in the local community, hanging hand-painted banners on fences near the port and organizing meetings and protests.

Behind closed doors, officials from various agencies, foreign governments, and businesses struggled to come up with a plan. This was the worst radiologic incident in Italian history, and nobody knew whom to blame or what to do about it. "I've seen cesium from Egypt and americium from Russia," says the environmental agency's Maggiolo, who has a doctorate in physics. "But I've never seen something like this."

Genoese officials were stuck. No shipping line in its right mind would transport container 307703 knowing only that it was radioactive but not what was inside. Neither Saudi Arabia nor the United Arab Emirates were willing to take it back. As a temporary measure, six months after the container was delivered the port built a three-sided "castle" of triple-stacked yellow containers half-filled with concrete around the unwanted box, which still sat at the terminal's unused far end. Signs reading *pericolo — radiazione ionizzante* ("Danger — Ionizing Radiation") were posted at regular intervals, reminding port workers to keep their distance.

After months of wrangling over who was responsible for the removal operation — priced at \$700,000 — the port and the Italian ministry of the interior finally decided to split the bill. On July 18, 2011, just over a year after the box was unloaded in Genoa, 40 firefighters, a police bomb squad, representatives from the port authority, a team of robot operators, and Calimero and Garbarino descended on the Voltri terminal. Five huge green tents were pitched on the port's blacktop to house computers and gear. Ten fire trucks and emergency vehicles were parked 100 yards behind the shield wall.

Using a remotely controlled excavator specially fitted for demolition work, firefighters drilled a foot-wide hole in the corrugated steel roof. Because there was still an outside chance that the container might hold a bomb, the fire department then tested for chemicals that would indicate explosives. When it didn't find any, a waist-high tracked robot with three high-resolution cameras was lowered by crane onto the top of the box. Using the robot's cameras, the bomb squad searched the inside of the container's door for tripwires or detonators. All they could see were the radiators and copper wire that were officially supposed to be in the box — more than 22 tons of it.

Confident that container 307703 wasn't going to explode, firefighters let the excavator go to work. "We ripped it open like a tin can," says Alessandro Segatori, then the Genoese fire department's second-in-command. That part was easy; finding the radioactive bit was not. A piece of metal weighing less than 6 ounces had to be plucked out of nearly 50,000 pounds of scrap. For the next three days, the excavator grabbed clawfuls of copper, no more than a few cubic feet at a time, and tossed it out of the box. Technicians inspected each tangle of metal by hand, scanned it for radiation, and discarded it.

At 11 a.m. on the morning of July 26, the radiation detectors arrayed around the container twitched hard when the excavator's claw eased up out of the container. As the firefighters held their breath, some of the metal slipped and fell back into the box, and the radiation measurements dropped again. On the next pass, the excavator bobbed the source again—this time onto the ground. The camera robot circled the container, searching for the nugget, for the next 10 hours.

Just as the last daylight was fading, the robot's gripper teased from a coil of copper wire a pencil-like cylinder 9 inches long and a third of an inch in diameter. The radiation detectors confirmed a direct hit. "Because of its shape, it was not easy to detect," Segatori says. "Even more strikingly, the source was copper-colored, which camouflaged it almost perfectly."

Shortly after midnight, the robot tried to seal the cylinder inside several nested lead and steel containers. But the innermost bucket, built for a small, round *caramella*, was too small. It took two more days for a new container to be constructed. Finally, on July 29, the object was sealed inside several inches of lead and

placed into a green and yellow steel tank bolted to the flatbed of a truck. A police car escorted the truck across the docks, through the gates, and onto the highway.

Aside from a few scratches, there are no identifying marks on the cylinder to help investigators figure out what it is or where it came from. The encapsulated chunk of cobalt will make its way north to Leipzig, Germany, where a specialized firm will search it for a serial number and eventually melt it down and recycle it. Judging by its size and shape, the object was probably part of a medical device or a machine used to sterilize food. Disposing of such material is expensive; Italian officials won't speculate on how it got conveniently lost in a Saudi scrap yard. No one knows how the cobalt got into the container or how the container got into the system.

Regardless, the mystery of container 307703 is no longer Genoa's concern. The sliver of cobalt that sat on the dock for more than a year is now hundreds of miles away, the container that housed it now scrap metal itself. And more than 1,000 new cargo containers will come in tomorrow.

Additional reporting by Gabriele Ferracci.