

FEATURES

Sixty Million Car Bombs: Inside Takata's Air Bag Crisis

How the company's failures led to lethal products and the biggest auto recall in history.

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Reprints

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Carlos Solis was driving a familiar route, the few miles from his home to his brother's apartment outside Houston, on a Sunday in January last year. His cousin sat beside him, and a dog was in the back seat. Just as they turned into the complex, their car, a 2002 Honda Accord, was hit. It was a low-speed collision with modest damage. Both front air bags deployed. Solis's cousin got out of the car uninjured. The dog was fine, too. But Solis didn't move. He'd been hurt, though at first it wasn't obvious how. His cousin called Solis's brother, Scott, who ran to the car. Scott tried to stanch the flow of blood from a deep wound in Solis's neck; so did the paramedics. Solis died at the crash scene.

An autopsy, now part of court records, showed that a round piece of metal the size of a hockey puck had shot out of the Accord's air bag, sliced into Solis's neck, and lodged in his cervical spine and shoulder. It severed his carotid artery and jugular vein and fractured his windpipe. Solis was 35 and the father of two teenagers. He was also the sixth person in the U.S. killed by an exploding air bag made by the Japanese company Takata.



A Takata air bag inflator that deployed in 2014. The driver was killed by metal shards.
Source: Didier Law Firm P.A.

Two weeks after Solis's death, his wife received a recall notice for the air bag. The first Takata recall had come seven years earlier, in 2008, limited to air bags in about 4,000 Hondas. The effort has been expanded 20 times, **most recently in May**, and is **the largest and most complex** in U.S. history. It covers more than 60 million air bags in vehicles from BMW, Ford, Honda, Tesla, Toyota, and 12 others, or one of every five cars on the road in the U.S. The recall could affect more than 100 million vehicles around the world. Shrapnel from the devices has killed 13 people, including 10 in the U.S., and injured more than 100.

A Senate investigation and personal injury litigation have turned up company documents suggesting that Takata executives discounted concerns from their own employees and hid the potential danger from Honda, their biggest customer, as well as from U.S. regulators. A Takata spokesman says via e-mail that the "data integrity problems reflected in some of the documents cited by the Senate Committee and produced in litigation are entirely inexcusable and will not be tolerated or repeated," but are not related to the root cause of the air bag ruptures. The company declined to comment further.

It will take at least three years for Takata and other manufacturers to make enough air bags to replace the company's defective ones. Because of their chemistry, Takata's devices become less stable over time. That leaves millions of drivers with cars that could contain an air bag that's like a ticking time bomb.



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Takata, founded by the Takada family in the 1930s as a textile maker, produced parachutes for the Imperial Japanese Army during World War II. In 1960, Takata began manufacturing seat belts for Japan's carmakers, which were leading the country's industrial expansion. It was the only company whose seat belts passed the U.S. National Highway Traffic Safety Administration (NHTSA) crash test standards in 1973.

A few years later, Honda asked Takata to look into manufacturing air bags. The automaker had a small stake in its supplier, and they worked closely together. When Honda opened a plant in England, Takata opened one in Ireland. When Honda went to China, so did Takata. "They were in lockstep to conquer the world," says Scott Upham, the head of Takata's marketing division in Auburn Hills, Mich., from 1994 to 1996 and now the chief executive officer of Valient Market Research. Despite Honda's enthusiasm about air bags, Juichiro Takada, who had taken over from his father as CEO in 1974, hesitated. Air bags deploy in controlled explosions. Their designs are drawn from rockets and munitions. A former Honda engineer, Saburo Kobayashi, described Takada's reservations in a 2012 memoir. "If anything happens to the air bags, Takata will go bankrupt," Takada said, according to the book. "We can't cross a bridge as dangerous as this." Eventually, he relented.

Air bags aren't filled with air. They're filled with gas created by a burning propellant. Propellants are used in jet aircraft to produce thrust; in the interiors of gun chambers; and in mining and demolition. In air bags, the propellant is compressed into aspirin-size tablets and placed in a metal tube called an inflator. After a crash, the tablets are ignited and convert from solid to gas, which erupts out of the inflator and into the bag in milliseconds. Air bags have been mandatory in every U.S. car since 1989, and regulators say they save about 2,500 lives every year. Unlike drugs, there's no approval process for air bags.

"There are about 10,000 components in a car," Upham says, "and air bags are probably the most highly engineered among them, even more than the electronics." They have to be small and light enough to fit into the steering wheel and other tight spaces, and they have to deploy with just the right force. Propellant experts keep patent offices busy. They're always trying to come up with formulas that are more efficient, cheaper, and proprietary. Each of the world's five main air bag manufacturers has developed its own chemical compound.

It's best to make explosives in a place with low humidity. Takata started making air bag inflators in the U.S. in 1991, at a facility in Moses Lake, Wash. It's near an old U.S. Air Force base, east of the Cascade Range, where the high-plains air is dry. Takata set up a joint venture with a company called Rocket Research, and when it looked like the business would succeed, it bought the other 50 percent, says Mark Lillie, who was hired as a propellant engineer in 1994 and has spoken out about his experiences at the company. "They spent hundreds of millions of dollars on the facility," he says. "Takata was working hard to catch up and grab market share by being technologically sophisticated. We were moving so fast. It was terrifying, but exciting."

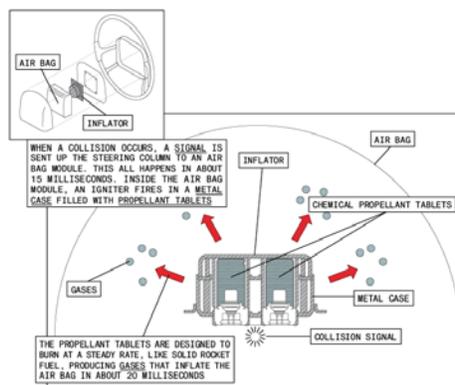
Takata's original propellant was based on a common chemical, sodium azide, derived from a formula the military had developed for launching torpedoes and missiles. Sodium azide was difficult to handle in the factory, though—prone to exploding when exposed to air, light, or jostling. When inhaled, it was toxic, and after the air bags deployed, they left a residue inside cars. Most companies that used it were looking for an alternative.

Takata's second-generation propellant, introduced in 1996, was based on a chemical called tetrazole, which was safer than sodium azide and just as effective. Researchers code-named the formula 3110, and the company marketed it as EnviroSure. Takata was the first to use tetrazole, and the chemical helped the company bring in Ford and General Motors, expanding its share of the North American market to 10 percent. But the supply of high-quality tetrazole was limited and costly. "Takata made promises to customers for volumes that could not be supported by the existing pipeline for the raw materials," Lillie says. "The culture was: We will make a commitment to the customer, and then we will work like the dickens to make it happen somehow."

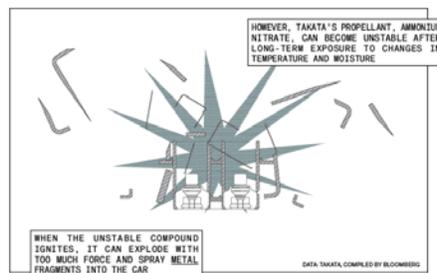
When Takada visited Moses Lake in 1997, he took the managers to dinner to thank them for keeping up with production quotas in tough circumstances. Lillie says Takada told a story: Japanese scientists once cultivated wasabi in labs and test farms, and while it looked beautiful, it had no flavor. Natural wasabi grows on the side of rugged mountains. The scientists realized that the stress on the wasabi produced its distinct flavor. Lillie says, "Then Juichiro turned to the group, paused, and said: 'You

are the wasabi! You've been through these extreme things, and it's going to make you stronger!' ”

Takata also had a skunk works near Detroit, Automotive Systems Labs, and gave it an assignment: develop a propellant formula that would be easier and cheaper to produce than EnviroSure and would allow the air bags themselves to be smaller and lighter. “ASL looked at every chemical compound known to man,” Upham says. Among them was ammonium nitrate, the most widely used commercial chemical explosive in the world, almost as powerful as dynamite. In 1995, Timothy McVeigh used 2,000 pounds of the chemical to blow up the Alfred P. Murrah Federal Building in Oklahoma.



Ammonium nitrate was about one-tenth the price of tetrazole, according to Upham, who also reviewed industry patents. But ammonium nitrate had a critical flaw that he says led other air bag makers to give up on it: Ammonium nitrate has five phases of varying density that make it hard to keep stable over time. A propellant made with ammonium nitrate would swell and shrink with temperature changes, and eventually the tablet would break down into powder. Water and humidity would speed the process. Powder burns more quickly than a tablet, so an air bag whose propellant had crumbled would be likely to deploy too aggressively. The controlled explosion would be just an explosion. “Everybody went down a certain road, and only Takata went down another road,” says Jochen Siebert, who’s followed the air bag industry since the 1990s and is now managing director of JSC Automotive Consulting. “If you read the conference papers from back then, you can actually see that people said, ‘No, you shouldn’t. It’s dangerous.’ ”



When Lillie and other Moses Lake engineers met with their ASL colleagues in December 1998 to review a new design using ammonium nitrate, Lillie says they were told the phase stability problem had been solved. He rejected the design nonetheless. ASL wasn't able to provide documented evidence of the safety of its product, he said in a January 2016 deposition, taken as part of a personal injury suit against Takata and Honda. "Never any evidence, never any test results, never any test reports, nothing to substantiate they had overcome the phase stability problem," Lillie testified.

"At the meeting, I literally said that if we go forward with this, somebody will be killed," he adds in an interview, echoing his testimony. After the design review, Lillie says he met separately with the engineer who served as the liaison with Takata headquarters in Tokyo. "What I gathered from the conversation was, 'Yes, I'll pass on your concerns, but don't expect it to do any good, because the decision has already been made.'" The head of ASL was Paresh Khandhadia, who had a master's in chemical engineering and "was a very smooth operator," Lillie says. "Tokyo put a tremendous amount of stock in his credentials." Neither Khandhadia, who left Takata in 2015, nor his lawyer responded to requests for comment. During a deposition last year, Khandhadia was nearly silent, citing his Fifth Amendment right not to testify against himself.

Lillie says he left Takata in 1999, partly because the company ignored his warnings about ammonium nitrate. He says Takata's executives and workforce were unprepared to take on such a difficult design and manufacturing process. "Takata engineers claimed they had this magic," he says. "No one else could figure it out, and they had."

As the Moses Lake facility prepared to manufacture inflators with the ammonium nitrate propellant, some of Lillie's former employees became anxious. "It was always push, push, push the envelope," says Michael Britton, a propellant engineer who left in 2000. Lillie testified that a Takata engineer wasn't allowed to investigate an inflator that ruptured during testing, and that when he protested, he was reassigned. A quality manager told Lillie that he was pressured by an executive at Moses Lake to manipulate test data. "Torture the data until it confesses" is the way the engineers described it, Lillie said in his deposition. A Takata spokesman says ASL conducted testing that "went beyond industry standards at the time" and found no significant changes in the propellant's performance or physical properties, and that a German research institute has since tested the propellant and found no evidence of a loss of phase stability. He also says there's no evidence that Lillie raised any concerns about using ammonium nitrate or that Takata executives weren't interested in hearing them.

In November 2000, Tom Sheridan, then a Takata product engineer, wrote a memo to his bosses about test data for Honda. "The objective of this cover letter is to point out that the Honda test report has incorrect data, data that cannot be validated, data that was incorrectly labeled, or data that does not

exist," it said. The memo was turned over to plaintiffs' lawyers suing the two companies. Sheridan, who left Takata in 2002, testified that after he submitted the report, none of his bosses spoke to him about the issues he raised. A company spokesperson says: "Takata deeply regrets that this validation test data was incorrectly reported," but that the test results aren't related to the cause of the ruptures.



Pieces of metal shrapnel from a defective Takata air bag are displayed at a 2015 news conference in Washington, D.C.
Photographer: Chip Somodevilla/Getty Images

By 2001, Takata was confident it had engineered a safe way to make air bags with ammonium nitrate and was selling them to automakers including Honda and Nissan. It began moving production to a new plant in Monclova, Mexico, where workers were paid less and had less experience with explosives. Takata hired local managers and gave them a great deal of autonomy, Upham says. From late 2001 to late 2002, workers there left some of the compressed propellant exposed to uncontrolled moisture, which can over time lead to "over-aggressive combustion," according to regulatory filings. Takata later told NHTSA it had improved manufacturing conditions.

When an air bag exploded in a Honda Accord in 2004, shooting out metal fragments and injuring the driver, Takata called it an anomaly. The accident, in Alabama, turned out to be the first of more than 100. Honda says it settled with the driver; the terms are confidential.

Around the same time, a former Takata senior executive based in Europe says he challenged Khandhadia about the use of ammonium nitrate, but Khandhadia had Tokyo's support. The executive, who remained at the company for a decade, didn't want to be named because he still works in the industry. He wasn't the only one in Europe who considered ammonium nitrate too risky. Renault refused to buy air bags with it. The former executive went around Khandhadia rather than fight him. He says he hired a propellant specialist to help develop a more stable formula using guanidine nitrate, and since about 2008, Takata in Europe has sold air bags using that. He says Takata's China team also adopted the formula.

Bob Schubert, a Takata propellant engineer in the U.S., also worried about ammonium nitrate, according to the former executive. In January 2005, Schubert wrote to his boss that the company was “prettying up” air bag data sent to Honda. At one point, the devices were said to have passed tests that never occurred. “It has come to my attention that the practice has gone beyond all reasonable bounds and likely constitutes fraud,” he wrote in an e-mail produced in a lawsuit. Schubert, now a member of Takata’s new-product safety group, wasn’t made available for an interview. Takata says it apologizes for these lapses, but they’re unrelated to the current air bag inflator recalls.



A 2006 explosion at Takata's factory in Mexico.
Photographer: Gustavo Adolfo Rodriguez/Reuters

Three explosions shook the Monclova factory in March 2006. Fireballs spewed out, windows on nearby houses were shattered, and local papers reported that authorities had to evacuate thousands of residents. Takata says only that employees weren’t handling “propellant scrap” properly and that afterward the factory improved its safety procedures. The plant resumed operations within a month, and Takata’s customers didn’t suffer any production disruptions. *Automotive News* called Takata’s quick recovery “**remarkable.**”

Takata engineers were filing patents for processes to improve the stability of ammonium nitrate. One described coating the chemical particles with paraffin to create a shield against heat and humidity, says Lillie, who’s reviewed the documents. Another said that phase-stabilized ammonium nitrate propellants “exhibit significant aggressive behavior with regard to ballistic properties” and that air bag inflators are subject to environmental conditions that can cause problems, including “over-pressurization of the inflator leading to rupture.” Takata previously has said that it’s “always understood the effects that moisture may have on the combustion characteristics of ammonium nitrate, but phase-stabilized ammonium nitrate propellant is safe and effective for use in air bag inflators when properly engineered and manufactured.”

In 2006 a Takata engineering manager sent an e-mail to a colleague that suggests data about potential problems with product tests were being hidden or ignored: "It is yet another mess-o-shit we will be handed with no real fix possible. The plant should have been screaming bloody murder long ago." A Takata spokesman reiterates that such data integrity problems are inexcusable and won't be tolerated, but that they have nothing to do with the root cause of the air bag ruptures.

Takata went public in November of that year, listing shares on the Tokyo Stock Exchange. The Takada family and trust retained a stake of more than 80 percent (it's now about 60 percent). A succession plan was put in place the following year. Juichiro Takada became chairman, while remaining CEO until the time came to hand over leadership to his son Shigehisa, then 41, who was promoted to president. Akiko Takada, Shigehisa's mother, resigned as a director and became an adviser. The differences between father and son were striking: Juichiro, known as Jim to his American employees, would get down on his knees to inspect factory equipment. Lillie describes Shigehisa as awkward, quiet, and entitled. When he visited Moses Lake in the late 1990s, he wouldn't put on safety glasses, and Lillie didn't let him onto the factory floor.

Honda announced the first recall of 3,940 cars in November 2008, citing excessive moisture that had affected the ammonium nitrate propellant at Takata's plant in Mexico. Takata assured Honda and federal regulators that the manufacturing problems were limited and had been addressed. In fact, Takata changed the composition of the propellant mix itself, adding a desiccant, a substance that absorbs water. The engineers believed this would prevent the ammonium nitrate from degrading and exploding.

Eight months later, Shigehisa Takada had to defend his company in front of Honda executives. At a meeting in Honda's offices outside Los Angeles, which was recounted in an internal e-mail produced in a lawsuit, he was asked if he grasped the gravity of their predicament. The Honda executive said he was "constantly worrying" because Takata didn't appear to have control of the situation. "Tighten the system inside Takata again," the Honda executive said, according to the e-mail. A Honda engineer added that Takata was moving too slowly: "Why does it explode? I want to know the truth."



U.S. regulators began an investigation into Takata in late 2009 and closed it six months later, noting the company had identified the problem—a manufacturing mistake at its other plant at Moses Lake—and Honda had issued a recall for those air bags. “My take is that if NHTSA had done the right thing and really probed Takata, they could have caught it a lot sooner and we wouldn’t have the crisis we have today,” says Clarence Ditlow, the executive director of the nonprofit Center for Auto Safety. “Takata made one of the most colossal blunders in the history of the industry.”



A recalled Takata air bag inflator.
Photographer: Joe Skipper/Reuters

In a widely reported incident on April 2, 2010, Kristy Williams stopped at a red light in Morrow, Ga., and the air bag in her 2001 Honda Civic deployed by mistake. The inflator exploded, and shredded metal hit Williams in the neck, severing her carotid artery. She stuck two fingers in the gaping wound to stop the bleeding as she waited for an ambulance. The blood loss led to several strokes, a seizure, and a speech disorder, according to a lawsuit she filed against Takata and Honda. The companies settled her case confidentially.

Honda expanded recalls of cars with Takata air bags in 2009, 2010, and 2011, eventually to include 2.5 million vehicles. In 2013, Takata filed a **defect report** with U.S. regulators stating that certain passenger-side air bags could rupture as a result of manufacturing errors that were exacerbated when the air bags were exposed to heat and humidity. A year later, NHTSA asked 10 car companies to recall 7.8 million vehicles with Takata air bags in seven Southern states as well as Puerto Rico and the U.S. Virgin Islands. After the announcement, so many people checked the NHTSA website **that it crashed**. Toyota advised passengers not to sit in the front seats of several models until the air bags were replaced.

The situation in Monclova threatened to create other problems for Takata. Guillermo Apud, a supervisor at the plant, had to scold employees in a May 2011 e-mail about their sloppy, and potentially dangerous, work habits. He had noticed that they were “reworking,” trying to fix defective parts on the inflator assembly line rather than removing them to be examined later. “Rework on the line is PROHIBITED!!! We can’t have leaders/materials/people/operators REWORKING material left and right without ANY control, this is why we have defect upon defect. We need to change NOW!” In 2012 workers there put the wrong part into inflators, and more than 350,000 vehicles from three carmakers had to be recalled. Takata says Apud was trying to convey the importance of quality and safety and make sure the inflators were properly manufactured.

In March 2012, Angelina Sujata was driving her 2001 Honda Civic at about 25 miles an hour near Columbia, S.C., when the vehicle ahead of her slammed on the brakes. The 18-year-old hit the car, and the next thing she remembers was feeling a sharp pain in her chest. “My chest was sliced open, down to the bone,” she says in an interview. Sujata was rushed to the hospital, where a doctor pulled out several metal fragments. A year later she received a recall notice about the defective air bag. She sued Honda and Takata and is waiting for a trial date.

It took until 2015 for Takata to acknowledge the problem was more widespread, and NHTSA announced a nationwide recall of some 22 million inflators. “Takata provided inaccurate, incomplete, and misleading information to regulators for nearly a decade,” says NHTSA spokesman Bryan Thomas. “Had they told the truth, Takata could have prevented this from becoming a global crisis.” Takata declined to comment.

Shigehisa Takada took over the company after Juichiro died in 2011. He was 45 and had worked at

Takata his entire adult life, mostly in his father's shadow. As recall followed recall, he apologized in written statements and newspaper ads. When the company was called to testify before Congress, he sent deputies on all four occasions. Takada didn't make his first public apology until June 25, 2015, after the annual shareholder meeting. He bowed and whispered: "The company that should be offering the safety to the users ended up hurting them. It grieves me most deeply." He also insisted that Takata's air bags were safe. He didn't mention that Takata had tried to fix the problem by changing the propellant formula in 2008. He made it seem as if the source of the trouble was a mystery.

"They continue to deny that ammonium nitrate is to blame," Upham says. "They say they're still looking for the root cause. That's like O.J. saying he's going to find Nicole's killer."



Shigehisa Takada's public apology at the shareholder meeting, June 2015.
Photographer: Yoshikazu Tsuno/AFP/Getty Images

Five months later, on Nov. 3, 2015, U.S. regulators announced that Takata would **pay a fine of \$70 million**—and as much as \$130 million more if it fails to meet its commitments. It also has to cooperate with an independent monitor. NHTSA says the civil penalty is the largest the agency has ever imposed and the extent of the monitor's oversight is unprecedented. CEO Takada said the company agreed to the penalty "considering the strong demand from NHTSA and also the users' anxiety, even though we are confident of the safety of our product." The same day, Honda said publicly that the air bag maker seemed to have manipulated test data. When Takada was asked about that at a news conference, he said, "We did not do it. I don't think."

In early May, federal safety regulators said three independent investigations had come to the same conclusion about the lethal air bags: Long-term exposure to changes in temperature and **moisture** can make ammonium nitrate propellant dangerously powerful. "The science now clearly shows that these inflators can become unsafe over time, and faster when exposed to high humidity and high temperature fluctuations," said Mark Rosekind, the head of NHTSA. The agency also expanded the recall to more than 60 million air bags—every one that doesn't have the drying agent. The bags must be replaced by 2019. Takata has until the end of 2019 to prove that even the air bags with the drying agent are safe. On June 1, a Senate report noted that four carmakers are still selling new models with faulty air bags that will need replacing.

Japan also recently expanded its own recall to almost 20 million vehicles. A definitive count isn't possible; Takata doesn't disclose the total number of air bags that will have to be replaced.

Bloomberg News contacted affected carmakers and used regulators' announcements to calculate a worldwide figure of roughly 100 million.

Schubert, the engineer who's joined Takata's product safety group, said in a deposition that the ammonium nitrate propellant doesn't cause problems "until the degradation process has proceeded a very long way, and then the results fairly quickly go to rupture." He suggested the process could take 10 years, while lawyers for some of the victims say it can happen in as few as seven. This would explain why most of the deaths have occurred since 2011 in cars with air bags manufactured roughly a decade before.

Only 8.4 million Takata air bags had been replaced in the U.S. as of May. Carmakers and dealers face two problems. Although Takata used the same chemical compound as the base for its propellant, the air bags came in various shapes and sizes, complicating their replacement. Takata says it has "dramatically increased" production of new parts, but its competitors have been only too happy to step in. NHTSA says those companies are making 70 percent of the replacement inflators. Still, there won't be enough.

The second challenge is that it's been difficult in many cases to find the owners of older vehicles, which are more likely to have changed hands at least once. That was the case with Carlos Solis, whose Honda had two previous owners before he bought it from a used-car dealer. Such dealers aren't required to keep track of recalls for the cars on their lots. Since last year, Honda has flashed alerts on stadium scoreboards and placed ads on Facebook and Twitter. It's even hired private detectives to track down owners of older vehicles.

Takata is under a criminal investigation by the U.S. Department of Justice and has been sued by the state of Hawaii for allegedly covering up the defects in its air bags. (Takata says it's cooperating fully with Justice. It declines to comment on the lawsuit.) The company faces potential fines, as well as the cost of litigation and payouts to victims. At some point it also will have to settle up with carmakers that for now are paying for the replacement air bags. The total could be more than \$11 billion, according to an analyst at Jefferies. Takata doesn't have billions. It has only \$520 million on hand and is worth about \$340 million, less than one-tenth what it was worth at its peak in 2007. The company had a 17 percent share of the global air bag market then; Upham estimates that will have shrunk to 5 percent by 2020.

On May 25, Takata said it had hired Lazard to help secure funding and negotiate with its customers. That's a polite way of saying someone else will decide its future. No matter who that someone is, the Takada family's stake will likely be reduced and the **CEO replaced**. "Takata will have to own up to what they've done," says Carlos Solis's brother, Scott. "They brought this on themselves."

—*With Yuki Hagiwara*