

SCIENCE

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Author: Michael Tennesen
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INTO THE TOXIC CLOUD

(All that held back the deadly gas was a pipe worn as thin as a soda can)

As darkness spreads across eastern Washington state, powerful floodlights bathe the steel towers of the chemical refinery in an orange glow. spurts of steam hiss in the warm October air, dancing along metal pipes that weave through the structure like blood vessels.

Amid the maze, a non-descript carbon-steel pipe winds through the open-air silane tower, twisting this way and that before disappearing into a condenser tank. Inside the pipe, superheated gases are slowly refined into liquid silicon, used by the computer industry to make microchips. But the pressurized gases have found a weak spot in the pipe. Silently they gnaw through the metal, millimeter by millimeter. Only the thinnest layer now holds back the toxic gases. Any minute now, they will find a way out. Any minute ...

The sound of laughter echoes off the thick concrete walls of the Silane Control Room, where the night crew is preparing for duty. Some of the men sip sodas while others lace up boots or pull on thick coveralls. Most of the workers at Advanced Silicon Materials, Inc., in Moses Lake have clocked out, leaving these eight technicians to monitor the flow of chemicals and respond to emergencies in the Silane Unit overnight.

But work isn't the only thing on their minds. Tonight marks the end of their four-day week. Tomorrow, the men plan to go hunting together. "So, Deme, you goin' with us?" asks Kevin Gary, the 34-year-old shift supervisor. Demetrio Garibay, 26, looks sheepishly at the floor. He's the only one who hasn't committed to the trip.

Before he can answer, Roy Long chimes in. "He's going," says Long, at 52 the old man of the bunch. "Only he and I are going to stay by the fire and drink beer." Deme tries explains his hesitation. "My wife told me if I shoot some animal and try to bring it home, she won't let me in the door." The men roar. "That's all right," says Kevin. "We'll do the hunting. After dinner, you two can scrub dishes while Jeremy and I serenade you with country tunes." He flashes a quick grin at Jeremy Lohr, 26, a soft-spoken man with short dark hair and a broad, friendly face.

All broad-shouldered and sturdily built, the men are more than co-workers. They're good friends, often getting together in their off hours for meals or special events.

"All right, let's get down to business," says Kevin, turning the conversation from hunting to tonight's assignments. He breaks the team into smaller groups and sends them off to various parts of the complex. Jeremy, Deme, Roy and Rick

Rios will work together on the six-story silane tower, replacing valves and hanging identification tags on pipes.

"See you back here in a few hours," Kevin says, then heads off to a meeting in another section of the plant.

Just below the third elbow joint, the seething chemicals continue to eat away at the inside of the main pipe. After months, perhaps years, of steady pressure, the steel tube has been chewed to the thickness of a soda can. The fragile layer now begins to bulge and buckle as the gasses creep closer to the surface.

Jeremy steps out into the warm night air. He pauses to listen to the geese honking in the distance and to double-check his equipment: splash goggles, helmet, flame-retardant coveralls, tool belt. An expanding cord attaches a microphone, clipped to his lapel, to his radio. Tucked in his belly pack is a half-mask respirator, a lightweight device that gives limited protection from harmful fumes.

His safety equipment is a daily reminder of the hazards of the job. Surging through pipes all around him is a cocktail of deadly gases--silicon tetra chloride, tetra chlorisaline and hydrogen--pressurized and superheated to 1000 degrees. If released into the air, the gases react with moisture to form extremely corrosive hydrochloric acid. Water in large amounts will eventually subdue the chemical, but small amounts of moisture, such as that on the eyes and skin, will only excite it.

Jeremy knows just how wicked the stuff can be. Sometimes when he's changing filters or cleaning pipes, loose gases scorch his nose and bring torrents of tears to his eyes. Once, he and a co-worker tried to wash away a teaspoon of the solidified material that fell out of a pipe filter. As soon as the first drops of water touched it, the tiny chunk burst into a 20-foot toxic cloud, sending both men scrambling for air.

The geese are honking noisily as Jeremy makes his way to the silane tower and clatters up the staircase, his steel-toed boots ringing on the gray metal steps. He stops on the fourth floor and gets to work, paying no attention to the plain brown pipe snaking by him only a few yards away.

The gases inside the pipe are in a frenzy. They hammer at the weak spot until, at last, the defeated steel begins to give way. With one final thrust, they tear through the last layer of resistance, find a pinprick of daylight and, in one violent instant, break free.

Without warning, the pipe ruptures with a powerful, thundering blast that rips through the steel casing and knocks Jeremy off his feet. Through the jagged opening in the pipe shoots a plume of thick, angry gas, spewing out at 60 miles per hour. Jeremy backs away in horror as the pipe disgorges its contents, roaring like a jet on takeoff. In 90 seconds, the pipe has sprayed 30,000 pounds of deadly gas into the air.

Alarms go off all over the plant. For Jeremy, time seems to slow down as he tries to get away from the growing cloud. Glancing at the windsock on the tower, he sees that the breeze is blowing north. He decides his best hope is to make a dash for the maintenance building four stories below and 50 yards to the south. As the air fills with the snow-like flecks of poisonous gas, Jeremy takes a deep breath and races for the staircase, barely aware of the other three men converging on the spot. Within seconds, fingers of gas squeeze past

the rim of his goggles--designed for splashes, not vapors--and begin to etch his eyes with burning acid. His vision blurs instantly.

At the top of the stairs, Jeremy can hold his breath no longer. He reaches for his half-mask respirator, knowing it will do little good in a cloud as dense as this. He sucks in one breath, and another. Then the respirator clogs, and the gas comes pouring in. Suddenly his throat and lungs are on fire. Unable to breathe, he panics. A voice inside him says, Stay in control, don't give up. But it's no good. He needs air now!

He stands at the railing of the staircase and, squinting through the tears and the pain and the burning acid, peers downward at the blurry darkness of the asphalt 40 feet below. He has to escape the choking gas. There's no other choice. He has to jump.

In a building 100 yards away, Kevin Gary gets an emergency call on his portable radio. "We've got a problem here!" screams one of his crew members back in the silane control room.

Kevin rushes outside and looks across the refinery toward the area where he'd just left his men. The entire Silane Unit is engulfed in an enormous cloud, glowing bright orange in the plant's sodium lights. The incandescent fog has already grown more than a block long and over 80 feet high. Even from this distance Kevin can hear the roar of the pipe spitting venom into the atmosphere.

"God almighty," he shouts, "That's a death cloud!" He reaches for his radio and calls to the men in the control room. "Shut the unit down!" Then, breaking into a run, he radios another unit for help. "Call the fire department and put out the alarm to the emergency backup squad. Tell them to get here now!"

His chest thumping, Kevin jumps in his truck and speeds toward the silane tower. He pulls into the parking lot between the maintenance and tech staff buildings. Slipping on his splash goggles, the only protective gear he has with him, he runs into the tech staff building to find a respirator. Though his team receives emergency training every month and is equipped to deal with most gas leaks, nothing in his experience has prepared him for a release of this magnitude. He knows only two things: He has to get water on that cloud. And he has to find his men.

As soon as Kevin enters the tech staff building, he realizes the place is already beginning to fill with gas. It penetrates his goggles, immediately bringing tears to his eyes. Vapors plunge down his throat and into his lungs. To Kevin, it feels as though someone is driving nails into his chest. He straps on a half-mask respirator and, running back outside, takes a quick mental tally of his men. He can account for only two, those in the control room. Where are the other five? Could they have escaped? Are they still alive?

"Jump!" says a voice inside Jeremy, standing on the fourth floor of the tower. And yet somehow through the pain and the thickening fog, reason overcomes panic, and he realizes that jumping would mean almost certain death. Grabbing the guardrail, he hurtles down the stairs, coughing violently and bumping against the other men also running for their lives. Like them, he has lost

control of his limbs and is wobbling like a drunk.

Just below him, Roy Long stops suddenly. His mike cord has become tangled in the pipes. Dazed and hacking violently, he tugs on the wire, then stumbles just as Rick Rios yanks it free and helps him back on his feet. Then, on the last flight of steps, Deme Garibay loses his balance, trips and tumbles most of the way down to the hard floor.

Jeremy rushes to his side. "Get up, Deme!" he says, gasping. Deme doesn't move, so Jeremy reaches down, grabs the man's shirt and drags him along behind him. Pure adrenaline propels Jeremy forward. His body is on full alert. I don't want to die, I don't want to die, he keeps telling himself as he runs. Wobbly and nearly blind, he collides with the wall of the maintenance building and falls. Jeremy struggles to his feet and, pulling Deme with him, stumbles into the building. He props himself against the wall and reaches for the switch on his radio. Each wheezing breath brings stabbing pain to his throat and lungs. He struggles to speak into the radio but can only mouth the words. He tries again. No sound comes out.

Kevin Gary runs out of the tech staff building and quickly finds one of the emergency hydrants located throughout the plant. Aiming the nozzle, he turns the valve and shoots a high-pressure stream of water into the heart of the thick, swirling fog.

The cloud rolls menacingly, but Kevin holds his position behind the hydrant, tears streaming from his burning eyes. After a few moments the fog slowly begins to pull back. With the water still flowing, Kevin barks repeatedly into his radio. "Rick! Deme! Jeremy! Roy! Mark! Are you there?" But there's no answer. Kevin then runs from one hydrant to another, chopping down chunks of cloud with cascades of water. At last, a man from another part of the plant shows up to help. Together they build a wall of water, flowing at 2,500 gallons a minute, around the cloud. Slowly, the beast backs off.

Suddenly, Kevin's radio crackles, and over the sound of rushing water he can just make out the words. "I'm hurt," moans Jeremy in a choked whisper. "Help me."

"Where are you?" Kevin yells.

Gasping for breath, Jeremy slowly lifts his head from his chest and fumbles for his microphone switch. With great effort he forces enough air from his lungs to make a sound. "In the maintenance building," he manages to say. Kevin dashes for the maintenance building, dodging the tongues of vapor licking out at him. In the doorway he finds Deme, slumped over, his face bleeding, acid foaming and sizzling in the cuts. "I can't breathe," Deme wheezes. "I can't breathe." In the hallway Kevin hears moaning. He runs around the corner and finds Jeremy in a daze, slumped against a wall.

"Both of you need to get up and into the showers right now!" he yells. Neither man moves. He tries to lift Deme, but the injured man only curls up in a tighter ball.

Just then, an emergency van from another part of the plant appears outside, and Kevin rushes out to meet it. He helps the driver strap an oxygen mask over Deme's face, then turns to Jeremy.

But Jeremy is gone.

Terrified and confused, Kevin leaves Deme with the other man and runs out to look for Jeremy. He finds him right around the corner, on the floor, lying very still. Kevin flips him over and starts to slap his face, only to recoil at the sight. Already, the acid has attacked Jeremy's body. His normally brown hair is bleached a ghostly white, as are his clothing and skin. A bubbling foam covers his eyes. Kevin knows if the acid isn't washed off soon, his friend will go blind. And if he doesn't get to a hospital soon, he may die. "Get moving," Kevin shouts, coaxing Jeremy toward the showers in the employee locker room.

"I can't."

"Yes you can! Now get up!"

He grabs Jeremy's arm, wraps it over his shoulder and pulls him to his feet. Kevin can hear Jeremy hacking with every breath as he drags him to the locker room.

Like a man awakened from a deep sleep, Jeremy struggles to make sense of the events unfolding around him. He feels his body being tugged and pushed. Please, no, just let me sleep. His burning eyes roll crazily in their sockets. Somewhere, off in the distance, he hears a voice, Kevin's voice, echoing strangely. As if in a dream he hears water running, then suddenly he feels the sting of fire as water reacts with the chemical residue on his skin. He thrashes to escape the pain and the stench and the bitter taste of acid on his tongue, but strong arms hold him fast.

By now, the scene is alive with emergency activity. Workers from other parts of the plant take positions behind hydrants and begin blasting at the body of the cloud, now visibly shrinking and breaking apart under the attack. Meanwhile, paramedics and county fire fighters have rounded up all the crew members and rushed them to the hospital. Now Kevin knows where all his men are. But the danger isn't over. Worried that volatile remnants of the toxic fog will drift into the surrounding community, Kevin collars the sheriff, who's just arrived on the scene, and tells him to set up roadblocks and instruct neighbors to stay indoors.

Then Kevin turns his attention to the cause of it all--the pipe. Under his direction, two workers wearing oxygen tanks and full hazardous material outfits slowly climb the stairs of the silane tower to the fourth floor. While others train streams of water on them, the men isolate the leak and shut off the last bit of pressure in the line. Finally, only 30 minutes after it began, the nightmare ends.

Next morning, the rising sun reveals the full impact of the cloud's fury. To Kevin Gary, who did not go home that night, the refinery in the aftermath of the gas leak looks like a war zone. In the light of day it's also clear that, while most of the cloud had been contained at the plant, a portion broke free. Lumbering along in the breeze, the acid fog seared a path 25 yards wide and five miles long northward into the surrounding countryside, burning crops and etching holes in windows, cars and rooftops. Trees were scorched as if by fire from above. Miraculously, no one outside the plant was injured.

Four crew members were treated for chemical burns and chemical pneumonia. Sadly, Deme Garibay and Roy Long died from their injuries. Jeremy Lohr and Rick Rios still suffer health effects.

Since the accident, the friendship among the crew members has only strengthened. Whenever possible, their families get together for barbecues on Kevin Gary's deck.

Michael Tennesen spent a week with the crew in Eastern Washington for this story.

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