Poisoned workers & poisoned places

Toxic exposure kept secret

The U.S. government secretly hired hundreds of private companies during the 1940s and '50s to process huge volumes of nuclear weapons material, leaving a legacy of poisoned workers and contaminated communities that lingers to this day.

Poisoned workers & poisoned places

By Peter Eisler, USA TODAY

From mom-and-pop machine shops to big-name chemical firms, private manufacturing facilities across the nation were quietly converted to the risky business of handling tons of uranium, thorium, polonium, beryllium and other radioactive and toxic substances. Few of the contractors were prepared for the hazards of their government-sponsored missions.

Thousands of workers were exposed to dangerous levels of radiation, often hundreds of times stronger than the limits of the time. Dozens of communities were contaminated, their air, ground and water fouled by toxic and radioactive waste.

The risks were kept hidden. In some cases, they have remained so.

A USA TODAY investigation found that the government's reliance on a vast network of private plants, mills and shops to build America's early nuclear arsenal had grave health and environmental consequences. Federal officials knew of severe hazards to the companies' employees and surrounding neighborhoods, but reports detailing the problems were classified and locked away.

The full story of the secret contracting effort has never been told. Many of the companies that were involved have been forgotten, the impact of their operations unexamined for half a century. Yet their history carries profound implications for the thousands of people they employed, as well as for the thousands who lived – and still live – near the factories.

At a time when the nation is reassessing the worker ills and ecological damage wrought by large, government-owned nuclear weapons plants, the record of the private companies that did the work before those facilities were built has had little scrutiny.

Most of the contracting sites were in the industrial belt: through New England, New York, New Jersey and Pennsylvania, around the Great Lakes and down the Ohio and Mississippi river valleys. They were in big cities such as Detroit, Cleveland, Chicago and St. Louis. And they were in smaller communities, such as Lockport, N.Y., Carnegie, Pa., and Joliet, Ill. Some did only minor work for the weapons program, but dozens of private facilities handled large quantities of radioactive and toxic material.

"These places just fell off the map," says Dan Guttman, former director of the President's Advisory Committee on Human Radiation Experiments, set up in 1994 to investigate revelations that government-funded scientists exposed unknowing subjects to dangerous isotopes in secret Cold War studies.

"People were put at considerable risk. It appears (the government) knew full well that (safety) standards were being violated, but there's been no effort to maintain contact with these people (and) look at the effects," says Guttman, a lawyer and weapons program watchdog who returned to private practice after the committee finished its work in 1995. "There's no legitimate reason for this neglect."

USA TODAY reviewed 100,000 pages of government records, many recently declassified and never before subject to public review, to assess the scope and impact of nuclear weapons work done at private facilities in the 1940s and '50s. Reporters visited archives and former contracting sites in 10 states, interviewing scores of former employees, neighbors and government officials.

Key findings:

▶ Beginning with the development of the first atomic bombs during World War II, the government secretly hired about 300 private companies to process and produce material used in nuclear weapons production. At least a third of them handled hundreds, thousands or even millions of pounds of radioactive and toxic material, often without the equipment or knowledge to protect the health and safety of workers or nearby communities.

The contracting wound down in the mid-1950s as government facilities were built to take over most weapons-building operations – a move spurred partly by hazards at contracting sites.

▶ The government regularly documented worker health risks at many of the private facilities doing weapons work, producing highly classified reports that detailed radiation exposure rates hundreds of times above its safety standards.

The Institute for Energy and Environmental Research, hired by USA TODAY to provide an expert review of old radiation data on three contracting operations, estimates that workers in the riskiest jobs had a 40% chance of dying from cancer – an increase of 200% over the general population – as well as higher odds for respiratory and kidney ills. But there's no telling how many, if any, workers have gotten sick or died from their exposures; they've gotten virtually no medical study.

Thousands of workers were put at a 'considerable risk'

1959 photo, American Medical Association archives

Metal dust: A metal-rolling mill similar to those used at Simonds. The ventilator hood atop the machine removed dust; for years at Simonds, work was done on radioactive materials using unventilated mills.

▶ Dozens of companies doing weapons work contaminated the air, soil and water with toxic and radioactive waste. Studies done at the time documented some operations pumping hundreds of pounds of uranium dust into the sky each month and others dumping thousands of pounds of solid and liquid wastes on the ground or into creeks, rivers and sewers.

Federal officials sometimes endorsed such practices as cheap, easy ways to get rid of hazardous byproducts that in many cases left contamination that persists today. As with the workers' health, there's been no effort to assess whether the hazards made anyone ill.

▶ Both the government and executives at the companies it hired for weapons work hid the health and environmental problems.

Federal officials misled workers, insisting their jobs were safe despite having evidence to the contrary. Surviving employees still have not been told of their risks, though screening and early treatment could boost their odds for surviving some illnesses they might face as a result of their work.

Likewise, communities were left unaware of toxic and radioactive waste spilling from behind the innocuous facades of local businesses. The secrecy that shrouded the weapons program's contracting still masks residual contamination at some sites.

"It was a different time, the Cold War was on," says Arthur Piccot, 81, a health and safety monitor with the weapons program in the late '40s and '50s.

Producing weapons "was the priority, period," he says. "A lot of these places were modified (for weapons work) in a hurry. There might be a hole in the roof for ventilation. ... We did what we could to protect (workers). The radioactive waste, we didn't think much about it. People didn't (fully) understand the risks."

'We'll continue to be aggressive'

Energy secretary says U.S. is committed to cleanup

Energy Secretary Bill Richardson, who took office in August 1998, was briefed on USA TODAY's investigation of the health and environmental record of private companies hired in the 1940s and '50s to produce and process radioactive and toxic material for the government's nuclear weapons program.

Here are some of his responses during a telephone interview Tuesday with USA TODAY reporter Peter Eisler:

Q: It seems that a lot of these old contracting sites have been forgotten over the decades since they wrapped up their work. Is that so?

A: Some of these private sites have fallen off the map. And it's important that in the not-too-distant future the government look at their potential hazards and find ways to be responsible to the communities and the workers.

Q: What sort of steps do you think are necessary to address the health and environmental legacies of these places?

A: Over the years, both the government and the contractors were not candid with workers and the public about potential contamination as well as cleanup. We need to find ways to reconstruct and preserve the history of some of these sites. If we find historic sites that need to be cleaned up, I believe the government is obligated to do just that. (And) it is time we pay (workers) if they are sick because of their work.

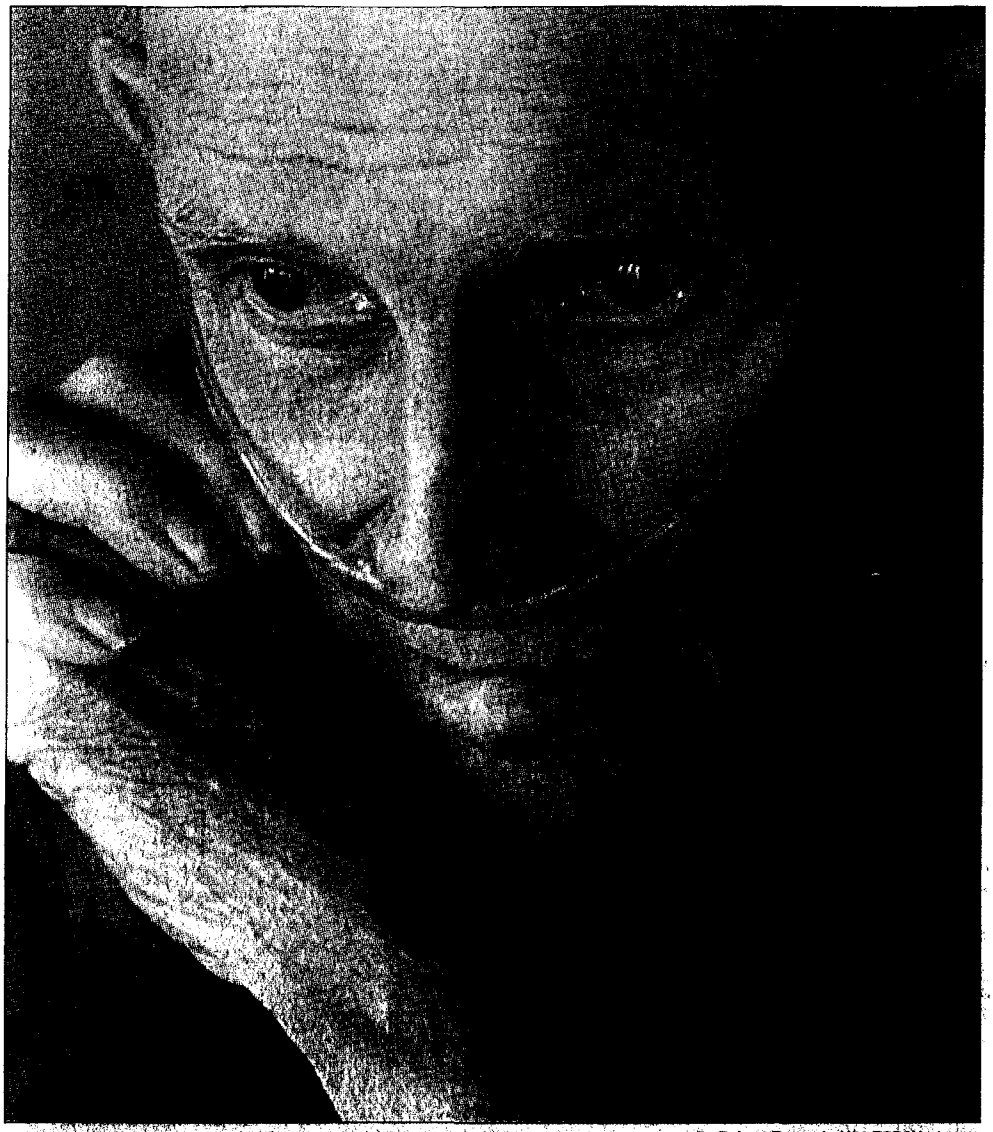
Q: This administration has been the first to acknowledge that the nuclear weapons program caused a lot of illnesses among workers. Now there's legislation to provide compensation to some of those people. Do you think employees at the private sites should be included?

A: We'll continue to be aggressive, whether at federal or private sites.

Q: What about the environmental damage at some of these places?

A: Cleaning up the environmental legacy of the Cold War is a massive task. We have the largest cleanup program in the world, with a budget of over $6 billion a year, to focus on some truly urgent problems. But that doesn't mean we should forget about the past. It will take some time (to address problems at private sites), but we have a responsibility to clean them up.

Toxic con't...



By Robert Deutsch, USA TODAY

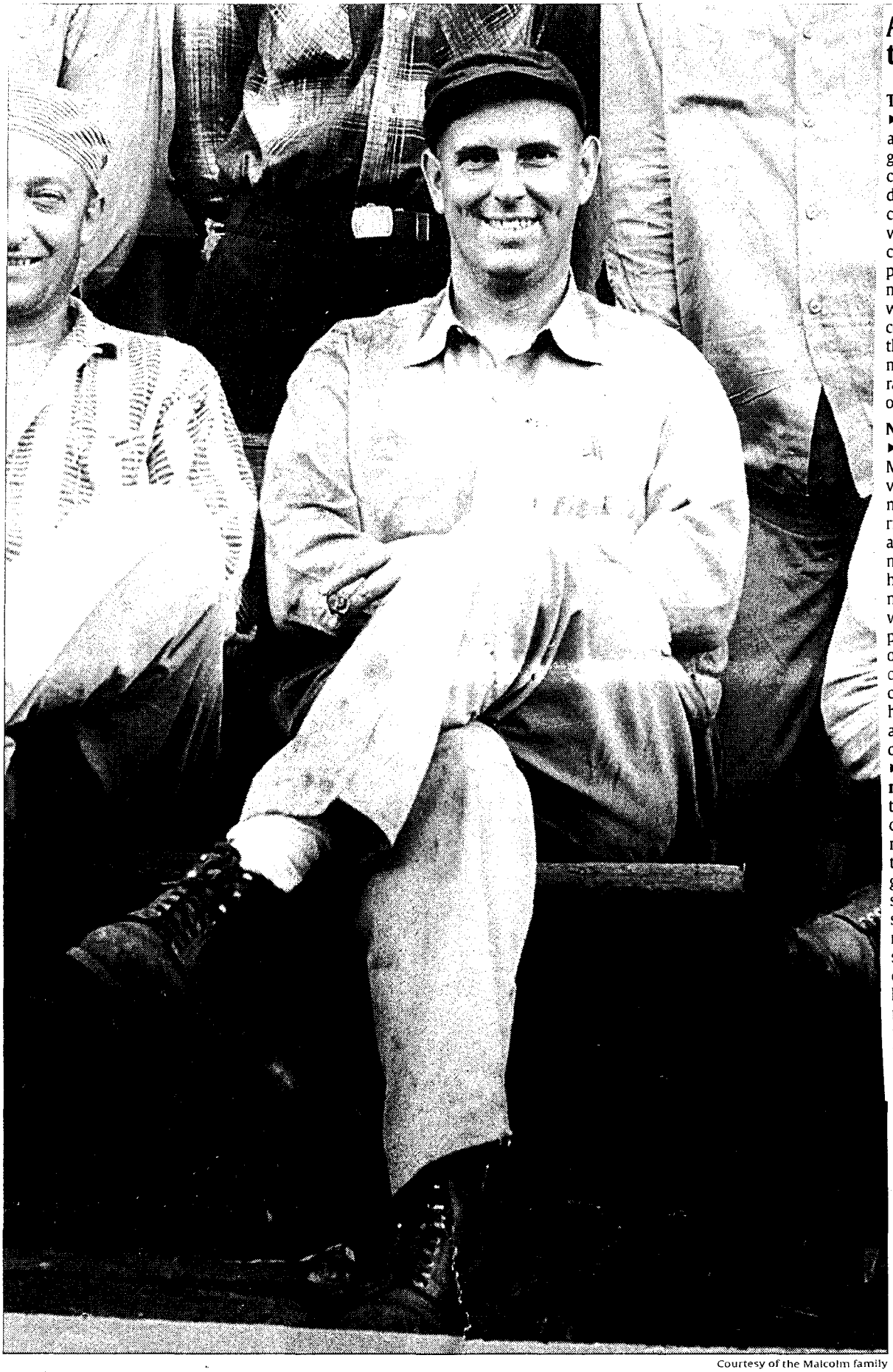
"They always assured us there was no danger": Lewis Malcolm was exposed to hazardous uranium and thorium dust on the job at a Lockport, N.Y., plant that did contracting work for the nuclear weapons program. He died of kidney failure in June. His story, **15A**

▶ For more on this report, including a video and photo gallery, go to USATODAY.com

▶ A nationwide list of where work was done by private companies, 17-18A

Q: The government never has released any sort of comprehensive list of all the private sites. Would you consider compiling a public registry?

A: I would be receptive to such an idea. We've already started to develop databases that can be shared with the public. I believe it's important that we be open with the public and our workers, and we should do a full accounting.



Courtesy of the Malcolm family

Early 1950s: Lewis Malcolm poses for a photo with fellow Simonds Saw and Steel employees. The Lockport, N.Y., company performed work for the government's nuclear weapons program from the late 1940s to the mid-1950s.

About this report

Today

▸ In the 1940s and '50s, the government secretly hired hundreds of private companies to work on the nuclear weapons program – and never told the workers or their communities of the dangers they might face from radiation and other hazards.

Next

▸ **The workers:** Many of the surviving workers now have higher risks for cancer and other ailments, but there has been almost no effort to learn whether such problems have occurred. That oversight might cost those who have gotten sick a chance for compensation.

▸ **The environment:** Radioactive and toxic contamination at many of the contracting sites lingered for years, sometimes with serious health risks. Some sites still are not cleaned up. They have been ignored by federal programs meant to address pollution from nuclear arms productior

The risks were known, but not relayed to workers

By Robert Deutsch, USA TO

This summer: Malcolm before his death. He said he wondered whether his exposure to uranium and thorium dust had caused his health problems. 'I asked my doctor ... and he said, 'Could be; you just can't know for sure.'

In March 1948, when the first rail cars of uranium and thorium began arriving at the Simonds Saw and Steel Co. in Lockport, N.Y., Lewis Malcolm felt lucky to have a job on the plant's big steel rolling mills. In the weeks before he died of kidney failure this June, Malcolm wasn't so sure.

At 79, his once-strapping frame was so withered that his wife had to help him to the car and then drive him 30 miles to a Niagara Falls hospital for the weekly dialysis treatments that kept him alive these past few years.

He wasn't bitter about his illness — one of several linked to the kind of uranium dust exposures he incurred during his years at Simonds. Just curious.

"I've wondered whether something like that could be a cause of this," he said in an interview before he died. "There was a lot of dust. We thought there might be problems. They took urine samples. Sometimes they sent us to the doctor (for exams). They always assured us there was no danger."

On the job at age 18

Malcolm started at the steel mill in the late 1930s, at age 18. He left to serve in the Army during World War II, returned in 1945 and stayed 30 years until he retired.

In 1948, workers were told they would be rolling a new metal, a government job they would work part time each month. The shipments arrived with armed guards who stayed until the metal billets all had been heated and milled into long rods of a precise diameter, often 1.45 inches.

"I told (a guard) one time that I stole a piece, and I really got chewed out, almost got fired," recalls Ed Cook, 84, another Simonds retiree. "I was just kidding. The billets weighed 200 pounds. What was I going to do, carry one out in my lunch bucket?"

The workers learned that this was serious — and secret — business. Many recall federal agents visiting their homes to do background checks and warn them not to discuss the plant's activities. This was standard fare at private facilities hired for weapons work.

By the time the contracting wrapped up at Simonds in the mid-1950s, the company had heated and milled 25 million to 30 million pounds of uranium and 30,000 to 40,000 pounds of thorium. Much of it was rolled into fuel rods for the government's plutonium-producing nuclear reactors in Hanford, Wash.

Federal officials suspected soon after the operation began that it was putting workers in danger.

In October 1948, the medical section of the Atomic Energy Commission (AEC) found "hazardous concentrations" of airborne uranium dust in a site study. The most highly exposed workers were, on average, breathing the dust at levels up to 190 times the "maximum allowable concentration" of the time.

"This operation results in profuse atmospheric contamination," AEC medical experts warned in another report in 1949. "To satisfy Hanford's urgent need for rolled metal, it was necessary to begin (the work) before suitable (safety) controls could be installed."

Over the next few years, the AEC medical section urged Simonds repeatedly to boost safety. The company implemented some orders, building new ventilation systems and issuing coveralls that were laundered each day. Others, such as demands that the plant install a vacuum system to clean radioactive dust, never were implemented.

Still, the changes had an impact. Site studies into the early '50s found uranium dust levels had declined markedly, though in some spots they still hov ered at several times the AEC limit.

But thorium, which continued to b rolled on mills without ventilators, re mained a problem. In 1954, an AE survey at Simonds found that levels c thorium dust, which poses far greate radiation hazards than uranium reached 40 times the federal limit - "too high, even for intermittent opera tions."

AEC staff pointed out to Simond management in a follow-up letter tha recommendations for safety upgrade including mandatory respirator use "were not followed." A later memo re ported that the mill superintenden resisted such ideas and "intimated tha if it became necessary to install elabo rate dust eliminating equipment, fur ther work of this nature would have t be abandoned."

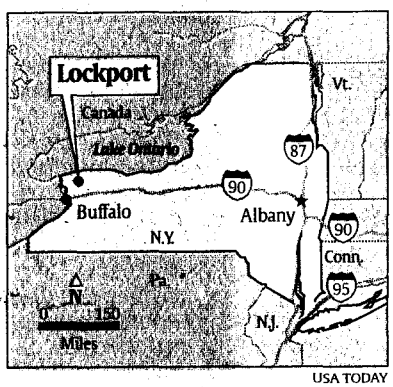
As was often the case, the AE backed off, too dependent on Simond work to risk having the company call i quits.

'Horrible' exposures

Based on the worker exposures doc umented in the old AEC reports, dur ing Simonds' peak years of operatior workers in the most dangerous job suffered annual lung doses of radiatio well over 130 rem (a unit of radiatio measurement), according to estimate

by the Institute for Energy and Environmental Research, a non-profit think tank that specializes in assessing radiological risks. The doses ranged up to 10 times the federal safety standards of the day.

"These exposures are horrible. They were unconscionably high. They violated legal and ethical norms," says Arjun Makhijani, the institute's director, who has written several books on radiation risks and provided expert testimony on the subject for Congress and various court procedings. "At the high end of the (estimated) doses, workers' risk of dying from cancer was increased by more than 20%. Many of



USA TODAY

the workers would also be expected to have kidney damage."

Most of the surviving workers have no idea of the risks they faced: Neither the government nor Simonds' management ever informed them of the plant's radioactive dust problems.

"They never told us any more than they had to," says Charles Leavitt, 71, a Simonds retiree with kidney trouble. "I think there were respirators around, but I don't ever remember seeing anyone wear one. They never gave us a reason, never said there was a health risk."

In fact, an AEC information sheet for workers at contracting sites stated that "there will be no danger to anyone's health." The 1947 memo told workers they might "hear the word radiation" mentioned on the job, but it assured them that the level would be "so slight that special instruments must be used to detect it."

Even extreme doses of radiation can't be detected without special instruments.

Studies never done

There's no way to know whether the health problems later suffered by some Simonds workers are the result of the uranium and thorium work. The sort of epidemiological studies that might conclusively link illnesses to their exposures have never been done.

Congress and the Clinton administration are considering legislation to compensate people who did the same sort of work at government-owned weapons plants and later contracted certain cancers and other ailments tied to their jobs. But the bill makes no promises to compensate people who worked at Simonds or most other private facilities. It notes only that workers at commercial sites can be added to the eligibility list in the future.

"It sure would help," Malcolm said of the compensation idea in the interview before his death.

By that time, he was spending about $550 a month on medication and private insurance he'd had to buy since his health benefits from Simonds disappeared with the company's demise 20 years ago. His monthly pension from the steel mill totaled about $580.

A few years back, he and his wife, who also collected Social Security, sold the little farm where they ran a roadside produce stand and moved into a tidy mobile home.

"I asked my doctor whether my (lung and kidney) problems could be related to the work we did, and he said, 'Could be; you just can't know for sure.'" Malcolm said. "You just have to go along with it."

Other sites

There were sites like Simonds all over the country.

After World War II, U.S. officials decided to build on the Manhattan Project, the top-secret military program that yielded the first atomic bombs, and launch a full-blown nuclear weapons production effort.

The Atomic Energy Commission, a civilian agency set up by Congress in 1946 to run the program, recognized that the government lacked the manufacturing facilities and expertise to do the job alone.

Initially, the AEC simply renewed contracts with a small group of companies that had been hired to do work for the Manhattan Project, where the practice of using private firms to do nuclear weapons work was born. But with the Soviet Union's detonation of its first atomic bomb in 1949, the Cold War arms race was on, and the AEC, made up of political appointees of various stripes, moved to a far more aggressive weapons-production schedule. The number of private companies hired to work for the weapons program multiplied.

"Not all contractors are safety-conscious since in every case they are chosen primarily because of (production) capabilities," warned a 1947 memo to AEC officials from Bernard Wolf, medical director in the commission's New York office. "Hazards to public health of AEC operations have been given inadequate consideration."

Wolf, who is now dead, advocated a strong "regulatory" program to see that contractors ensured worker safety; he also noted the need for "studying the waste disposal problem." His recommendations, like those of many health and safety officials in the coming years, were not fully implemented. The commission's main goal was to get a lot of weapons built quickly.

"It was almost like being on a wartime footing," says Richard Hewlett, official historian for the weapons program from 1957 to 1980. Production "was done almost on a crisis basis. The commission approved (operations) that in a normal, peacetime atmosphere would not have been approved."

Most of the AEC's contracting involved uranium, used in various forms as a fissionable explosive for weapons and as raw material to make plutonium, the core of most nuclear weapons. But there were plenty of other toxic and radioactive jobs given to private companies.

Hazardous duty

Some examples of the types of operations — and risks — that defined the contracting effort:

▶ Big uranium-refining and -processing plants in Cleveland; St. Louis; Cannonsburg, Pa.; Deepwater, N.J; and outside Boston and Buffalo handled some of the most dangerous operations. At Harshaw Chemical Co. in Cleveland, for example, classified AEC studies in the late '40s and early '50s found that employees faced "severe exposures" to uranium dust and beta radiation, and workers' kidneys regularly showed signs of uranium poisoning. During that time, records show, the plant also pumped 350 to 500 pounds of uranium dust from its stacks each month, spewing it over nearby areas. The site remains contaminated.

▶ Steel mills and metalworking shops cut and forged uranium, thorium, beryllium and other hazardous material. At Vulcan Crucible Tool and Steel in Aliquippa, Pa., some workers breathed uranium dust at 200 times the AEC's safety limit, records show. At Revere Copper and Brass in Detroit, dust levels of uranium and beryllium, a chemical that causes lung disease, hit 20 times the maximum safe level at that time. Residual pollution was common. A 1980 federal survey of the Carnegie, Pa., site where Superior Steel rolled uranium for the weapons program found radiation in scrap pits and floor areas well above safety standards. Plant owners later had the areas cemented over; federal officials saw no need to check the fix.

▶ Chemical and metallurgical companies produced an array of specialized metals, compounds and solvents with radioactive and toxic properties. Workers making polonium at plants run by Monsanto Chemical in Dayton, Ohio, routinely were found to be ex-

creting high levels of the radioactive element in their urine, records show. At Carborundum Metals in Akron, N.Y., where hafnium and zirconium were refined for weapons use, federal officials endorsed the dumping of hundreds of thousands of gallons of ammonium thiocyanate waste into a sewer that ran into the Niagara River.

At Linde Air Products in Tonawanda, N.Y., weapons program officials endorsed the dumping of millions of gallons of radioactive chemical wastes generated by contracting operations into underground wells.

The contracting network set up by the weapons program "was like a root system spreading into all different sectors of (American) industry. The companies were really diverse," says Timothy Karpin, an industrial historian who has spent the past five years doing research for a "traveler's guide" to nuclear weapons production sites.

"The companies doing the work often weren't aware of the overall goal," adds James Maroncelli, another historian on the book project. "They were told just enough to do the job."

The AEC began to move away from using private facilities to do weapons work in the early '50s, building a network of large, government-owned complexes that gradually took over most operations. The federal plants typically were run by commercial contractors, which still employed some subcontractors to do certain jobs at private facilities. And a number of commercial firms also did radioactive and toxic work for the AEC Naval Reactor Program, which built power plants for nuclear ships and submarines. But most work at private sites ended by 1960.

The AEC "wanted to get things standardized and keep more control over the operations," says Maroncelli. "It was about efficiency and secrecy."

Little time for safety as arms race runs at full speed

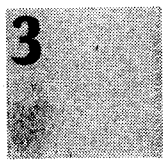
Plans for cutting health and environmental risks at contracting sites, which usually involved slowing or interrupting operations, often got shelved.

Through the 1940s and '50s, classified studies repeatedly found that many of the private firms hired to do weapons work were grossly violating the commission's worker-safety standards. If the problems were corrected, and many were not, it typically took years. Canceling contracts or imposing serious sanctions was never seen as an option for forcing companies to adopt new safeguards.

Health and safety officials generally had little choice but to go along.

"The purpose was production. ... Health and safety was not the chief purpose of these (operations)," says Richard Heatherton, 81, who joined the AEC as an industrial hygienist in the late '40s and stayed as a health and safety expert for the weapons program until 1980.

It's difficult to pinpoint how many people worked at companies hired by the weapons program. A 1949 AEC report noted that at least 3,000 men had been involved in uranium work at just a half-dozen or so of the private sites. Based on records, including workforce figures for some of the contracting outfits, USA TODAY estimates that at least 10,000 people had been employed by the early '50s at commercial facilities that handled radioactive and toxic material for nuclear weapons.



From the earliest days of the nuclear weapons program, health and safety were secondary concerns. Officials at the Atomic Energy Commission recognized that they had to define and minimize the risks of the weapons-making process. But the White House, Congress and the Pentagon demanded that production run at a feverish pace.

Key moments in U.S. nuclear arms history

1941
Dec. 7: Japanese attack Pearl Harbor. United States enters World War II.

1942
Midyear: Scientists gather in Los Alamos, N.M., to work on the "Manhattan Project." Their job is to build the first nuclear weapons before German scientists do.
December: First self-sustaining nuclear reaction is achieved at the University of Chicago.

1945
July 16: "Trinity," code name for the first nuclear test, takes place in Alamogordo, N.M.
Aug. 6: Atomic bomb dropped on Hiroshima, Japan.
Aug. 9: Atomic bomb dropped on Nagasaki, Japan.

1949
First Soviet test of a nuclear bomb.

AP

Nevada site: Marines conduct tactical training exercises during atomic blast in May 1952.

1951
Nevada Test Sit is established. I was originally known as the Nevada Proving Grounds. There have been 928 nuclear tests at the test site sin it opened, inclu ing 100 atmospheric tests.

1962
Cuban Missile Crisis. United States and Sovi Union arguably come their clos est to a nuclear confrontation.

1972
United States ar Soviet Union sig SALT I arms-lim tation treaty.

1991
Soviet Union di solves.

1992
Last U.S. nuclea weapons test.

1993
START II treaty signed by Presi dent Bush and Russian Preside Boris Yeltsin.

"I don't think there was any intent on anyone's part to harm anyone," Heatherton says of the problems at many companies. "If, for example, you recommended ventilation ... yes, they'd intend to put it in, but it wasn't done overnight. You wouldn't stop production to put in new ventilation, so we did a lot with other things, like respirators, which was far from ideal, but you did what you could."

Similarly, efforts to control environmental contamination were pursued only until they threatened to slow down the weapons-making effort.

At a June 1949 meeting of the AEC's Advisory Commission on Biology and Medicine, officials acknowledged that there was little interest in curbing toxic and radioactive waste at uranium-processing operations in Cleveland, St. Louis and elsewhere. "There is a reluctance, naturally, on the part of production people to authorize expenditure of funds to clear these places up," the minutes of the meeting reported.

Yet, while officials running the weapons program weren't always keen on fixing health and environmental problems at contracting sites, they certainly wanted to know all about them.

From the moment the nuclear weapons program began, and especially once the AEC took over, health and environmental conditions at private contracting sites were studied closely. Officials wanted to know how much time workers could spend on particular jobs before suffering ill effects. They wanted to know what sort of risks the contracting operations posed to nearby communities.

The resulting reports were used to determine what safety features should be included in plants the government built to take over many operations that had been done at commercial facilities. And they were used to assess the government's potential liability for health and environmental problems.

The studies were closely held and highly classified, in many cases well into the 1990s, largely because they revealed secrets about weapons work. But other factors that had nothing to do with security also played a big part in the AEC's decision to keep the risky nature of its operations under wraps.

"Papers referring to levels of soil and water contamination surrounding AEC (operations) and papers dealing with potential process hazards to employees are definitely prejudicial to the best interest of the government," said a 1947 AEC memo circulated to top officials. The memo noted that associating such problems with work done by the AEC or its contractors would cause "an increase in insurance claims, increased difficulty in labor relations and adverse public sentiment."

Laid to waste

The brick remains of Simonds Saw and Steel sit empty now, fenced off to the public, marked with signs warning of radiation hazards. Federal programs set up to address pollution from nuclear weapons work have passed it by.

The 9.1-acre site lies in a section of Lockport devoted to industrial development. But the Simonds property, now owned by a bankruptcy trustee in Philadelphia, is unfit for human use. Its total assessed value, buildings included, is $150. "We actually have a shortage of good industrial land, and the (Simonds) site has good potential for light industrial use," says Edmund Sullivan of the Niagara County Planning Department. "We'd like to see that site cleaned up and back on the tax rolls. We think it's a federal responsibility."

The U.S. government has spent decades arguing quite the opposite.

When the AEC hired Simonds to roll uranium and thorium metal, it included a "hold harmless" clause in the contract. It essentially freed the government from liability for damage done to Simonds' site or its workforce as a result of the weapons work. The AEC included such clauses in virtually all its contracts. They have been used by U.S. officials over the past 20 years to rule out federal cleanups at a number of former contracting sites that remain contaminated from their weapons work. This summer, New York state filed notice of its intention to sue the Department of Energy, the modern-day steward of the nuclear weapons program, to force a federal cleanup at the old mill. It might be the first serious test of the "hold harmless" clauses.

"The U.S. government's failure to clean up the site, despite its clear legal duty to do so, is inexcusable," New York Attorney General Eliot Spitzer says. "The citizens of New York continue to live with a serious radiological threat because of federal foot-dragging. It's a disgrace." The Energy Department recently offered to recommend that Simonds' pollution finally be considered for federal action. The state wants a firmer — and more immediate — commitment.

Like many of the contaminated sites left over from the government's nuclear weapons contracting operation, Simonds poses little imminent public health risk. Most of the radioactivity is "fixed" in the plant's walls and soil, unlikely to move off the site or affect anyone who doesn't regularly spend time on the abandoned property.

But if the land is disturbed, or if buildings are torn down, there's a risk that the radioactivity could be released into the air or migrate into water supplies. State estimates for cleanup: $18 million to $50 million.

Early knowledge

The AEC knew early on that waste from its work at Simonds was polluting both the plant and the surrounding area. In a 1949 report circulated to top commission staff, health and safety officials noted that contaminated water, used to cool heated uranium and thorium rods, was dumped directly into the local sewer system. They proposed a study to determine the amount of radioactivity in the water, but it appears that was never done.

In 1950, an inspection of the plant found radioactive dust on many rafters and ledges. AEC officials surveying the site also noted a "substantial increase" in uranium dust exiting the plant from ventilation exhaust stacks.

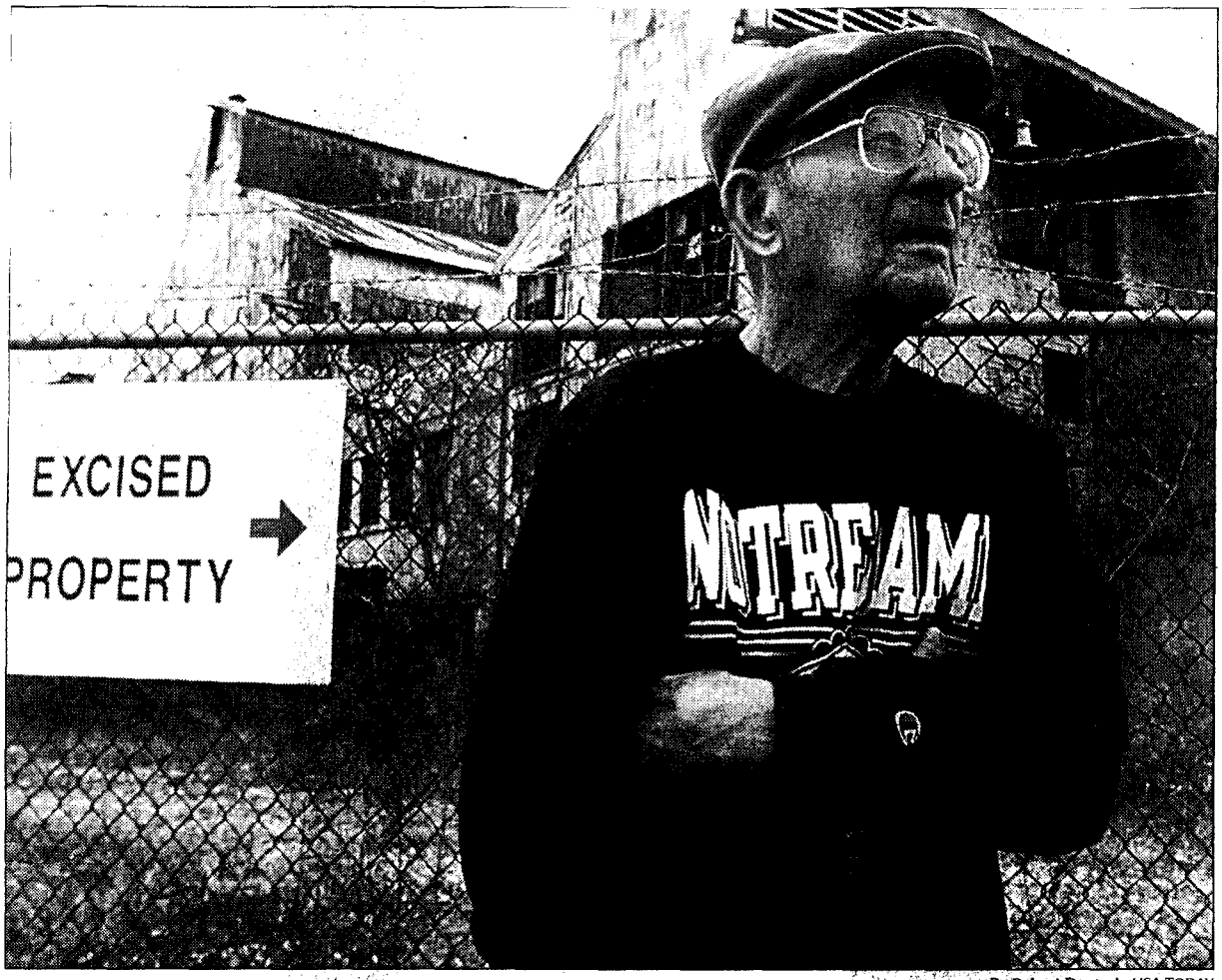
Simonds' management resisted some requests to clean up the steel mill, records show. After AEC work at the site was finished in the mid-'50s — the rolling and milling was shifted to the new, government-owned Fernald uranium processing plant in Cincinnati — the commission hired a private firm to decontaminate Simonds.

That effort, mostly wiping dust off exposed surfaces in the plant, was enough for the AEC to deem the site clean enough for "unrestricted use."

In 1977, the government came back for another look. A federal survey found radioactivity in the plant and nearby soil at levels far above modern-day safety limits.

But based on the "hold harmless" clause in Simonds' old government contracts, the site was deemed ineligible for government cleanup. Officials notified state and local environmental agencies and walked away. The plant has been shuttered for nearly 20 years, but the fight over who should clean it up has continued. A few years ago, a homeless man was found living in the building. Local officials worried about his health, but he declined medical attention and moved on.

Toxic con't...



By Robert Deutsch, USA TODAY

Lasting effect on community: Ed Cook, 84, stands in front of the former Simonds Saw and Steel plant in Lockport, N.Y. The mill where Cook used to work is now fenced off, considered unfit for human use because of the radioactivity.

Official sites got attention; private sites stayed private

There's no telling how much health or environmental damage may or may not have been done at the scores of sites where companies secretly worked for the nuclear weapons program.

The big federal studies that have identified increased rates of cancer and other illnesses among workers and neighbors at government-owned weapons plants never looked for problems at privately owned facilities that did similar work, often with far fewer safety precautions. And some contracting sites still have never been checked thoroughly for contamination.

Yet federal officials recognized 50 years ago that such follow-up would be necessary.

In a 1949 report on risks to workers at private facilities processing uranium for the AEC, medical officials in the commission's New York office warned that "this large reservoir of potential damage should, if at all possible, be followed carefully in the future. ...

"Unless this is done," the report added, "there could be a considerable lag between the appearance of disease conditions and the recognition of their etiology," or cause.

Many in the AEC expressed the same sort of concerns about environmental contamination.

"It is unthinkable that AEC would permit the discharge of long-life radioactive or toxic wastes into the ground or waterways without ascertaining, within reasonable limits, what effect these actions will have," said a classified 1948 memo by one of the commission's sanitary engineers. "Similarly, disposal of wastes from plant stacks or (exhaust) hoods into the atmosphere carries with it a responsibility to all who may be affected."

The memo, sent to top AEC officials, noted, "At each of our producing plants and laboratories, the disposal of toxic and radioactive wastes presents an actual or potential serious problem (and) their discharge to the atmosphere (and) soil, to sewers or to waterways involves hazards of various degrees."

The AEC did monitor workplace haz ards and ecological problems at mar of the private company sites that did i weapons work, but only while thos operations were ongoing. Despite th protests of some health and safety off cials, those studies were almost neve as a matter of policy, shared with worl ers or neighbors who might be affecte And once the government closed i contracts, it did not go back to revie long-term effects.

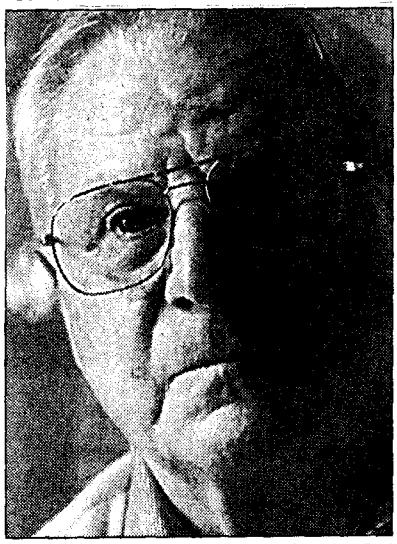
It wasn't until the late 1970s that th government launched an effort to a dress contamination from nucle weapons production at private co tracting sites. But the Formerly Utilize Sites Remedial Action Program (FU RAP) has been politicized and unde funded. It has not checked for contan nation at some properties where cor panies did hazardous work and th investigations it did often proved inad quate. Moreover, some sites whe FUSRAP did find radiological probler (its surveyors generally did not look f chemical toxins) were deemed "ineli ble" for cleanup because of old "hc harmless" releases.

On the worker health front, ther

been even less effort to account for the impact of the weapons program's contracting efforts.

Twice, the government has sponsored limited studies.

In one, researchers found in the early 1990s that workers who did uranium



By Robert Deutsch, USA TODAY

Cappola: Simonds retiree says he would have kept his good-paying job even if he had known the risks.

refining at Mallinckrodt Chemical Co. in St. Louis showed increases in lymphatic, esophageal and rectal cancers, as well as kidney diseases. A study in the early 1980s of workers who processed uranium at Linde Air Products in Tonawanda, N.Y., also found higher rates of cancer and respiratory ills.

It's past time to "fill out the story," says Robert Alvarez, former special adviser to Energy Secretary Bill Richardson on health and safety issues.

"The nuclear weapons program was far more widespread, and contamination and worker health problems were far more ubiquitous on a national scale" than the government has acknowledged, adds Alvarez, who now works as a private consultant and was briefed on USA TODAY's investigation. "The systemic failure to provide a safe working environment and to protect and warn people (at risk) played out at these sites every day. The companies should be held responsible, but ultimately, they worked for the government, which also had a responsibility to ensure that these places were safe."

The Clinton administration has made a more aggressive effort than ever before to boost federal accountability for the health and environmental legacy of nuclear weapons production. But the private contracting sites that worked on the weapons program still have gotten relatively little attention.

In the past year, Energy Secretary Bill Richardson has offered the first government admissions that the nuclear weapons program caused widespread health problems, but his statements have focused on the problems at big, government-owned production plants and labs. And the legislation now being considered to offer compensation to sick workers promises only to cover those who worked at federal facilities, leaving future administrations the option of deciding whether employees at private contracting sites should be covered.

The bill "is written broadly enough so it would clearly include people at these other facilities," says Assistant Energy Secretary David Michaels, who argues that Congress, with its regional constituencies, would not allow workers from private sites to be cut out of the deal. "We didn't want to write specific sites into the bill because we knew we would (miss) some of them."

As for environmental contamination, Energy Department reports in recent years have occasionally noted problems associated with work done on the property of private companies. But relatively few of those operations were named specifically, and there's been no compilation of a comprehensive public registry of all the places where that sort of work took place.

After years of federal inaction, many workers and communities that are aware of risks they may face because of nuclear weapons contracting operations have learned to live with them.

"If I'd have known (about the hazards), I would have asked more questions, taken more precautions," says Nick Cappola, 80, a Simonds retiree who milled much of the thorium that came through the plant and remains in good health. "I guess I'm lucky. But if I'd have known everything, all of it, I still would have stayed there."

Why? Cappola shrugs his shoulders as if the answer is obvious: "Five kids."

Toxic con't...

More than 100,000 pages of documents surveyed

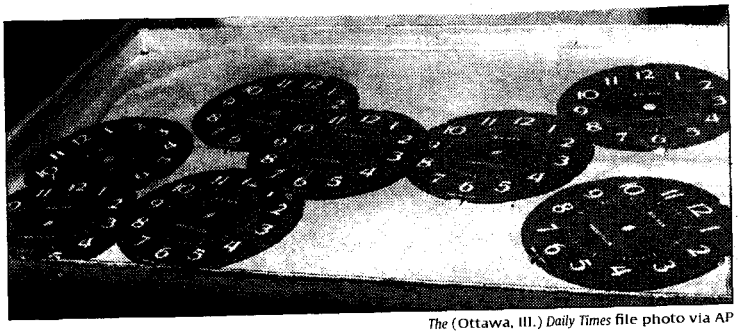
USA TODAY investigative reporter Peter Eisler spent 10 months on this "Poisoned workers & poisoned places" project. Eisler:

- Examined more than 100,000 pages of declassified documents detailing the work private companies did for the nuclear weapons program and the information that researchers gathered on the workers. The reporting took him to archives in Washington, D.C.; Atlanta; Albany, N.Y.; and College Park, Md. The records are mostly from the files of the Atomic Energy Commission and the Manhattan Project.
- Visited sites where the work was done, or directed other reporters to them, in 10 states. Eisler and the other reporters interviewed more than three dozen people who had worked at such plants or are relatives of such workers.
- Conducted scores of additional interviews with medical and scientific experts, current or former government officials, congressional staff, union officials and activists.
- Created an extensive computer database that catalogs information he uncovered about the sites where work was done.
- Filed a half-dozen Freedom of Information Act requests for documents not available at the archives.

In addition to that work, USA TODAY contracted with the Institute for Energy and Environmental Studies, a nonpartisan public interest research group, to perform "dose reconstruction" studies. Those studies, based on the records uncovered by Eisler, provide estimates of how much radiation workers absorbed when doing the weapons work. The institute did similar research for workers and neighbors at the government-owned Fernald weapons production facility in Cincinnati. The federal government later settled lawsuits by the workers and neighbors, who alleged they were exposed to dangerous levels of radiation.

toxic con't...

Type of radiation doesn't matter: 'The devil is in the dose'



The (Ottawa, Ill.) *Daily Times* file photo via AP

A hazardous art: Workers at U.S. Radium who hand-painted glow-in-the-dark dials similar to these suffered effects of radiation exposure.

By Steve Sternberg
USA TODAY

For three years, Grace Fryer of Orange, N.J., worked for the U.S. Radium Co. Each day, she mixed glue, water and radium powder and applied the glimmering, glow-in-the-dark paint to the numbers on watch faces. When the narrow tips of the horsehair brushes became misshapen, she reshaped them with her lips, as her supervisors had advised.

"I think I pointed mine with my lips about six times to every watch dial," she told the Orange *Daily Courier* in 1928..

In 1922, two years after Fryer left the factory to take a job as a bank teller, her teeth began falling out and she developed a painful abscess in her jaw. She and four other women filed a much-publicized lawsuit against their employer. Eventually, the women won a settlement of $10,000 each, plus a $600-a-year annuity and medical expenses. Soon after, they died.

At that time, little was known about how nuclear radiation affects human health. The case, perhaps the first involving occupational exposure to lethal doses of radiation, marked the birth of a new science, the study of the health effects of radioactive isotopes.

The field would grow along with the nation's nuclear weapons industry — abetted, authorities say, by scientists determined to deepen their understanding of radiation and its risks by exposing thousands of people to radioactive substances. Cancer patients, pregnant women, orphans and military personnel were exposed. So were thousands of workers in government laboratories and weapons-production plants, and thousands more in the private manufacturing facilities detailed in this USA TODAY series.

The best information on the risks of these exposures has emerged from intensive research involving survivors of the atomic bombings of Hiroshima and Nagasaki in 1945. As many as 200,000 people were killed immediately or died in the aftermath of the explosions. Scientists also have linked 428 of 4,863 cancer cases in atomic bomb survivors from 1950 to 1990 to genetic damage from the bomb blasts.

Cancer occurs because radiation disables genetic controls on cell growth and replication, says Owen Hoffman of the environmental consulting firm SENES Oak Ridge in Tennessee. Whether the radiation comes from uranium, polonium, thorium or radium doesn't matter; what matters is the amount of radioactive energy deposited in tissue, Hoffman says. "The devil is in the dose," he says.

Researchers think of radiation dosages as the amount of energy absorbed per unit of body mass, usually expressed in scientific units as joules per kilogram, says Keith Eckerman, a dosimetry expert at Oak Ridge National Laboratory in Tennessee. Some isotopes are more likely than others to affect human health following exposure because they emit more radiation.

Scientists measure the amount of radioactive energy deposited in tissue using a unit called a "gray." One gray is enough to cause radiation sickness, which is marked by nausea, vomiting, diarrhea, fever and the sloughing off of damaged tissue in the gut. Radiation sickness can kill in hours, days or weeks; death is brought on by infection or uncontrolled bleeding. However, people do become ill at much lower doses. "The consensus is that there is no dose at which there is absolutely no risk," Hoffman says.

A single dose of about 0.15 gray to the genitals can cause temporary sterility in men, and 0.25 gray delivered to a fetus at day 28 of gestation can cause birth defects and other developmental problems. Experts say studies of the survivors of Hiroshima and Nagasaki have shown that a dose greater than 0.2 gray is enough to significantly increase the number of cancers that emerge in a population.

Researchers have found that:

▸ **Uranium** and various uranium compounds, used as fuel for plutonium-production reactors or as the explosive in atomic bombs, can affect the body in different ways, depending on how they are processed. If a uranium compound isn't soluble, it is likely to be inhaled as dust and collect in the lungs, where it eventually causes cancer. If the uranium compound is soluble, it is deposited in bone, where it can cause leukemia by damaging the blood-forming marrow. Uranium, and such compounds as uranium hexafluoride and uranium tetrafluoride, also can act as a chemical toxin, killing off cells in the liver and kidney.

Although about 80% of uranium is excreted from the body in the first day, the remainder can stay in the body for years.

▸ **Polonium**, a radioactive decay product of radon that is used to trigger chain reactions in nuclear weapons, behaves differently than uranium. Although polonium exposure is likely to occur by inhaling dust particles in the air, polonium doesn't settle in the lungs, as uranium does. It filters into the blood and is carried throughout the body.

"Polonium's hazards may well be higher than uranium because a larger dose of energy would be retained in the body longer," Eckerman says. Because it travels throughout the body, polonium has been linked to more soft-tissue cancers than bone cancers. Typical sites: the liver, spleen and kidney.

▸ **Thorium**, used in nuclear reactors that produce enriched uranium and plutonium, concentrates in the lungs and in focal points in bone. "It can localize in the skeleton, irradiating critical blood-forming tissues," Eckerman says. The short-term danger is radiation sickness; the long-term dangers are lung cancer, leukemia, lymphoma and bone cancer.

▸ **Radium**, a common byproduct of uranium refining, gives off radon gas. Radon gas is highly carcinogenic: Most radioactive substances will increase the risk of cancer in a population by one ca per 1,000 people, but radon i creases the lifetime risk of lur cancer to one in 100. Experts no that 30% of lung cancers amon non-smokers in the general pop ulation are thought to result fror radon exposure.

If there is good news, it is tha radium is readily distribute throughout bone, diluting th amount of energy absorbe through the entire skeleton. But ra dium can cause bone cancer, as i did in many of Grace Fryer's co workers in the watch-face factory.

▸ **Beryllium** is non-radioactiv but extremely hazardous. Stronge than steel and lighter than alumi nium, Beryllium is useful in bomb making and aerospace. ("There' even a bicycle made of beryllium alloy," says Babette Marrone, an expert on chronic beryllium disease at Oak Ridge National Laboratory. Beryllium disease most commonly strikes machinists who work with the metal. It collects in the lungs.

In some people, beryllium deposition is harmless; others have a genetic susceptibility that makes beryllium exposure life-threatening. In those cases, immune cells in the lungs encase beryllium particles in nodules of scar tissue, which impair breathing.

How severe the illness is depends on the individual's sensitivity to beryllium. Effects can emerge 10 to 40 years after exposure, with an average latency of about 12 years. People who are highly sensitive to beryllium can deteriorate in a matter of months, suffocating because their lungs no longer function; others might experience mild illness or not get sick at all.

Some private contractors that did nuclear weapons work, by state

This is believed to be the most comprehensive list ever made public of the private sites where companies had contracts or subcontracts to do work for the government's nuclear weapons program.

USA TODAY reviewed more than 100,000 pages of declassified federal records and identified more than 300 private companies and properties that apparently were engaged in weapons work. In many cases, though, the newspaper was unable to confirm the specific nature of the contracting operations. This list includes 150 sites for which basic information could be obtained. In a few cases, the list also shows properties that were not directly employed in weapons work but were contaminated by contracting efforts nearby.

The list does not include military or other government-owned installations, nor does it include the many colleges and universities that had research contracts with the weapons program. It also does not account for the many uranium mines and mills employed by the nuclear weapons program. Wherever possible, the list indicates worker health risks or environmental contamination. But that information, like the list itself, is not comprehensive.

City	Contractor/site	Operation
Alabama		
Birmingham	Southern Research Institute	Research and testing on uranium and other radioactive material, 1950-62. Work involved at least 440 pounds of uranium metal, but total quantity of material handled is unclear.
California		
Downey	North American Aviation	Processed at least 300 uranium slugs slated for use as nuclear reactor fuel in early 1953.
La Jolla	General Atomics	Processed and recycled scrap uranium materials, early 1960s. Duration of work and quantity of material handled unclear.
Pleasanton	General Electric Vallecitos Nuclear Center	Research on nuclear fuel elements, late '50s-'78. About 30 cubic yards of highly contaminated wastes, now stored on site, are slated for federal cleanup.
Richmond	Stauffer Metals	Limited processing and purification of uranium, involving at least 700 pounds of material, early 1960s. Records show some decontamination was done on equipment and facilities. Total quantity of material handled and duration of work unclear.
Riverside	Hunter Douglas/ Bridgeport Brass	Fabrication and extrusion of uranium and zirconium metals, 1959-61. Duration and volume of work unclear, but company handled at least 1,600 pounds of uranium metal.
Simi Valley/ Canoga Park	Atomics Intl/Rockwell	The Santa Susana Field Lab and nearby plants handled various research and uranium processing jobs, mid-50s through mid-60s. Some facilities were contaminated and are slated for federal cleanup.
Walnut Creek	Dow Chemical	Studies on processing of uranium and thorium ores, 1947-57. A 1977 federal survey showed no contamination.
Colorado		
Denver	Shattuck Chemical	Extraction of uranium from scrap material for reuse by the weapons program during the 1960s. The site, used primarily for commercial radium production, is contaminated with an array of toxic and radioactive wastes. Government-supervised cleanup is ongoing.
Connecticut		
Bridgeport	Bridgeport Brass, Havens Plant	Extrusion and machining of uranium metal, 1952-62. Such operations typically generated radioactive dust. A 1980 federal survey found no significant contamination at the site.
Bridgeport	American Chain and Cable	Milled uranium rods in 1944. Records suggest work was quite limited; total quantity of material handled is unclear.
Canaan	Nelco Metals	Production of purified magnesium, late 1940s.
Putnam	Metals Selling	Storage of large quantities of purified magnesium, late 1940s.
Seymour	Bridgeport Brass	Rolling and extrusion of uranium metal from 1962-64. Quantity of material handled is unclear. Government surveys in early '90s showed uranium contamination in floor drains and soil. Federal cleanup completed in 1994.
Stamford	Dorr	At least two series of tests on various processes for refining uranium compounds in 1954. Records indicate the process raised considerable amount of radioactive dust. Volume and duration of work unclear.
Waterbury	American Brass	Limited extrusion, machining and copper-cladding of uranium metal, 1956-59, including at least 50 billets in 1959. Records suggest limited potential for contamination because material was copper-coated. No recent radiation surveys found for this site.
Delaware		
North Claymont	Allied Chemical and Dye	Research on extracting uranium from phosphoric acid, early 1950s. Records suggest only a few pounds of uranium concentrate were produced. In 1977, federal officials ruled that the limited potential for contamination made a radiation survey unnecessary.

Toxic con't...

Florida		
Bartow	Armour Fertilizer Works	Research on extracting uranium from phosphoric acid, 1951-55. Records suggest only gram quantities of uranium concentrate were produced. Partial federal survey in 1977 showed slightly elevated radiation levels attributed to phosphate operations.
Bartow	Int'l Minerals and Chemical	Extensive uranium extraction from phosphate solutions, mid-1950s. Produced 100 tons of uranium oxide, typically at a rate of 2-3 tons per month. Partial federal survey in 1977 showed slightly elevated radiation levels attributed to commercial phosphate operations.
Mulberry	Int'l Minerals and Chemical	Research on uranium recovery from phosphate-rich clay, 1951-55. Records suggest a limited amount of material was produced. Partial federal survey in 1977 found slightly elevated radiation levels attributed to commercial phosphate operations.
Nichols	Virginia-Carolina Chemical	Extracted less than 10 tons of uranium from phosphoric acid, 1954-55. Small amount of radioactive soil removed after 1977 federal survey. Slight contamination remained, attributed partly to commercial phosphate work.
Ridgewood	W.R. Grace	Uranium recovery from phosphoric acid, 1954-55. Operation was short-lived, and quantity of material handled appears low. Federal survey of the site in 1977 showed radiation levels typical of phosphate operations.
Tampa	U.S. Phosphoric Plant Uranium Recovery Unit	Uranium extraction, 1951-54; peak production 60 tons per year.
Illinois		
Blue Island	Vapofier	Company was scheduled to machine 96 uranium metal billets in 1944, but it's unclear whether the work was performed.
Chicago	Quality Hardware and Machine	Canned uranium metal rods in aluminum casings, 1944-45, handling at least 29,000 pieces. Records suggest low potential for contamination. A 1989 survey found no significant levels of radiation.
Chicago	R. Krasberg and Sons Manufacturing	Records suggest the company was hired to machine limited amounts of uranium metal in 1944, but it's unclear whether the work was performed.
Chicago	Museum of Science and Industry	Rooms used by Argonne National Laboratory for research on radioactive material, 1946-53. No signs of contamination in 1977 federal survey.
Chicago	Podbeilniac	Small amount of experimental uranium processing in 1957. Records suggest equipment was decontaminated after work's completion.
East Moline	American Machine and Metals	Tested methods for dehydrating uranium compounds over two-day period in 1960. At least 25 pounds of material involved. Records suggest limited potential for environmental contamination or radiation exposures to workers.
Granite City	Granite City Steel	X-ray testing of uranium ingots, 1958-66. Radiological surveys in 1989 and 1991 identified small amounts of radioactive contamination in the building. Federal cleanup completed in 1993.
Joliet	William E. Pratt Mfg.	Machining and grinding of uranium metal, 1943-46. Records suggest some radioactive dust may have been generated during the intermittent operations. A 1989 federal survey found no significant contamination at the site.
Joliet	Blockson Chemical	Extracted the better part of 2 million pounds of uranium from phosphate, 1965-62. Federal survey in 1977 found elevated radiation in soil and building; waste could not be segregated from that linked to commercial phosphate work.
Madison	Dow Chemical	Uranium foundry work. In 1957, Dow performed research on uranium metal extrusion; In 1959-60, uranium rods were extruded for the government's Weldon Spring, Mo., plant.
Metropolis	Allied Chemical Plant	Beginning in 1962, refining and production of uranium compounds. Federal cleanup planned for on-site contamination.
N. Chicago	Fansteel Metallurgical	Beryllium processing.
W. Chicago	Lindsay Light and Chem/ Lindsay Chemical	Large-scale thorium purification mid-'40s through mid-'50s; provided about 4,600 tons of purified thorium for the weapons program. Extensive radioactive contamination of both buildings and grounds. Federal/state cleanup ongoing.
Indiana		
Fort Wayne	Joslyn Mfg. and Supply	Intermittent extrusion and grinding of substantial quantities of uranium metal, 1944-49. Such operations typically raised radioactive dust. A 1949 federal survey showed some contamination and clean-up was done. In 1976, slightly elevated radiation found in isolated areas.
Shelbyville	General Electric Plant	Processed and compacted at least 500 pounds of thorium metal in 1956. Records show some decontamination was done upon work's completion.
Iowa		
Davenport	Bendix Aviation, Pioneer Division	Unknown – subcontractor to Feed Materials Production Center in Fernald, Ohio; very small amounts of testing of decontamination techniques on 20 uranium storage drums.
Maryland		
Curtis Bay, Baltimore	W.R. Grace	Processed approximately 998 tons of thorium in 1955-58. Federal cleanup planned for 36,000 cubic yards of radioactive waste on property.
Massachusetts		
Allston	Raytheon	Component fabrication; no evidence that radioactive materials were handled.
Ashland	Fenwal	Testing of relatively small amounts of uranium-contaminated magnesium compounds 1966-68; subcontractor to Fernald plant.
Attleboro	Metals and Controls	Fabricated enriched uranium foils for AEC, 1952-59.
Beverly	Metal Hydrides	Uranium refining, 1942-48. Produced uranium metal in form of pyrophoric powder; recast uranium metal scrap; researched methods of extracting uranium from ores; worked with large quantities of uranium.

Concord	Nuclear Metals	Extrusion and processing uranium metal; also worked with beryllium.
Graniteville	C.B. Sargent & Sons	Tests on drying and extrusion of uranium and thorium compounds in 1968. Tests indicated minimal potential for airborne contamination.
Hudson	La Pointe Machine and Tool	Limited testing of machining techniques on small amounts of uranium metal, 1956. Some equipment later had to be decontaminated.
Indian Orchard	Chapman Valve Mfg.	Machined large volumes of uranium metal into rods and bars for nuclear reactor fuel. Burned uranium chips and shavings in incinerator.
Newton	NRC Equipment	Firm was scheduled to do welding and melting of uranium metal components, but it is unclear whether the work was completed. Federal records also show that this site handled beryllium for the nuclear weapons program.
West Hanover	American Potash & Chemical	Production of lithium carbonate in 1955. In early 1960s, worked with limited quantities of various uranium compounds.
Winchester	Winchester Engineering and Analytical Center	Private contractors, including American Cyanamid and National Lead Co., developed processes for refining uranium and thorium in this government-owned building, 1952-59. Radioactive waste from the operation was later found to have been dumped in the Woburn landfill.
Worcester	Heald Machine	Tested specialized drilling equipment on 100 uranium metals rods for four days in May 1960. Records indicate equipment was decontaminated at the end of the test.
Michigan		
Adrian	Bridgeport Brass/ General Motors	Extrusion of thorium and uranium, sometimes enriched, 1950s. Records show operations raised radioactive dust. Contamination found in floors, plumbing, mid-'80s. Federal cleanup removed 175 cubic yards of waste in 1995.
Adrian	Gerity-Michigan	Extrusion of beryllium at a government-leased facility, 1949. Duration of work and quantity of materials handled unclear.
Battle Creek	Oliver	Conversion of uranium compounds to metal briquettes. Records show at least 10,000 pounds of uranium compounds was processed with "considerable potential" for radioactive contamination.
Detroit	Revere Copper and Brass	Extrusion and machining of hundreds of tons uranium, as well as some beryllium, 1943-54. Records of the time suggest substantial worker exposures to radioactive and toxic dust.
Detroit	Wolverine Tube Division	Uranium, beryllium and thorium extrusion and fabrication of uranium slugs, 1943-46.
Detroit	Carboloy	Grinding of uranium slugs, mid-1950s; volume and duration of work unclear.
Farmington	Star Cutter	Drilled uranium metal slugs in June 1956; quantity and duration of operation unknown.
Flint	AC Spark Plug	Fabrication of beryllium components; quantity and duration of operation unknown.
Saginaw	Baker-Perkins	Mixing of uranium compounds in the mid-'50s; duration of work and quantity of material unknown. Documents indicate some potential for contamination.
Saginaw	Mitts & Merrel	Crushing and grinding of thorium compounds, mid-1950s. Operation created high levels of radioactive dust. Duration of work and volume of material handled are unclear.
Missouri		
City	**Contractor/site**	**Operation**
Hazelwood	Commercial Discount of Chicago/Latty Ave.	In the 1960s, stored large quantities of radioactive waste from uranium and thorium processing by Mallinckrodt Co. in St. Louis.
Hematite	United Nuclear	Processed and recycled scrap uranium materials, early 1960s. Duration of work and quantity of material handled unclear.
Joplin	Roger Iron	Hired in 1956 to crush magnesium liners from uranium-contaminated vessels used in uranium processing. Volume and duration of work unclear, though the job apparently posed relatively little contamination risk.
St. Louis	Medart	Testing of machining equipment on unspecified number of uranium metal bars for one week in 1952. Records suggest "considerable" amounts of uranium dust were raised during the tests. Unclear whether decontamination took place.
St. Louis	St. Louis Airport Storage Site	Storage of residues resulting from processing of uranium ore at Mallinckrodt in St. Louis from 1946 to late 1950s.
St. Louis	Mallinckrodt Chemical	Processed thousands of tons of uranium and thorium at several sites in downtown St. Louis, 1942-57. Some areas cleaned up, others remain contaminated and are slated for federal action.
Nevada		
Henderson	Titanium Metals	Limited chemical processing in late-'50s of magnesium fluoride with low uranium content. Extent of work appears to have been limited. Little documentation exists.
New Hampshire		
Concord	R. Brew	Subcontracted to test new furnace designs for heating uranium metal. Records suggest small amounts of material and little potential for contamination.

Toxic con't...

New Jersey		
Bayway	Phelps Dodge Copper	Uranium extrusion and rolling. Possibly involved in uranium enrichment work as well. Duration and quantity of work unknown.
Bloomfield	Westinghouse Electric	Produced up to one ton per month of uranium metal, 1941-43. Records show additional uranium and thorium work through 1946; quantities unclear. Residual contamination cleaned by Westinghouse, late 1970s.
Burlington	U.S. Pipe and Foundry	Beryllium processing. Quantity of material and extent of operation unclear.
Deepwater	DuPont Chambers Works (E.I. duPont de Nemours	Large-scale production and processing of various uranium compounds, 1942-47. Substantial contamination remains; slated for federal cleanup.
Jersey City	Kellex/Pierpont (Vitro)	Substantial amounts of uranium processing, including isotope separation, 1940s-1950s. Purchased by Vitro in 1951, weapons work concluded in 1953. Government cleaned up 273 cubic yards of radioactive waste in 1981.
Maywood	Maywood Chemical Works	Large-scale thorium refining, some lithium production, 1940s and '50s. Extensive contamination with uranium, thorium and radium wastes. Federal cleanup ongoing.
Newark	Baker and Co; Baker and Williams	Reprocessing of substantial amounts of radioactive platinum, early 1950s; duration and quantity of material unclear. Air quality studies during the operation showed no significant contamination.
Wallington	Tube Reducing	Extrusion and cutting of uranium metal, early to mid-1950s; Records suggest the operation raised substantial levels of radioactive dust.
Wayne	Rare Earths/W.R. Grace	Produced large amounts of thorium for both the weapons program and commercial use, 1948-71. Company bought by W.R. Grace in 1957. Federal cleanup of adjacent properties is complete. Main site acquired by U.S. government in 1984 and designated as interim storage site for remaining radioactive wastes, including 109,000 cubic yards of contaminated soil.
West Orange	Vitro	Processed uranium compounds, late 1950s to early '60s, quantities exceeding more than 10,000 pounds per year in early '60s. In late '50s, company also did isotope separation work. 1977 federal survey found minor contamination; cleanup deemed unnecessary.
New York		
Akron	Carborundum Metals	Refining of hafnium and zirconium for AEC's nuclear reactor materials program. Generated thousands of gallons of liquid thiocyanate waste and other chemical byproducts, many disposed of at nearby Lake Ontario Ordnance Works near Niagara Falls.
Bayside	Sylvania Electric; Sylvania Corning Nuclear	Extensive research and some processing of uranium, thorium and possibly beryllium compounds, late 1940s to early 1960s.
Brooklyn	American Machine and Foundry	Machining of uranium, thorium and zirconium metal plates and rods used to produce nuclear weapons fuel, 1951-54. In 1951, the company machined at least 125 tons of uranium metal.
Brooklyn	Wolff-Alport	Thorium processing and/or storage involving about 13,500 pounds of material in 1950. Duration of contract and total quantity of material handled unclear.
Brooklyn	American Machine and Foundry-NY City	Machined uranium, thorium and zirconium metal, 1951-55, including at least 125 tons in contract's first year. Operations carried significant potential for raising radioactive dust. No records found on worker exposures, site contamination.
Buffalo	American Car and Foundry/ Buffalo Works	Production of weapons components, apparently not involving radioactive materials, such as lightweight aluminum bomb casings.
Buffalo	B & L Steel	Straightening, grinding and rolling of uranium metal rods, 1950s. Records suggest operation raised substantial amounts of radioactive dust. About 20 cubic yards of radioactive waste and debris removed in federal cleanup, 1995.
Buffalo	Buflovak	Records suggest limited testing of processing techniques on uranium compounds in 1951. Quantity of materials used and duration of work unclear.
Colonie	National Lead Industries/ Colonie Site	Fabrication of uranium and thorium metal, 1950s. Extensive radioactive waste from stacks. Federal cleanup done on more than 50 nearby properties; remediation ongoing at main site, which holds 52,500 cubic yards of contaminated soil.
Dunkirk	Allegheny-Ludlum Steel	Limited extrusion of uranium metal rods, 1950-52. Such operations typically raised significant amounts of radioactive dust. A federal survey in 1980 found no evidence of residual contamination at the site.
Hicksville	Sylvania Corning Plant/ Sylvania Electric Products	Conversion of powdered uranium compounds into metal nuclear fuel elements, 1952-66. In 1954, the plant produced 5,000 uranium slugs.
Ithaca	Ithaca Gun	At least two series of forging tests on uranium metal tubes, 1961-62. Records show "considerable potential" for radioactive dust from the tests, which involved unspecified amounts of uranium. Some decontamination done after tests.
Lackawanna	Bethlehem Steel	Rolling and extrusion of uranium metal billets, 1949-52. Extremely high levels of radioactive dust reported during some operations in 1951.
Lockport	Simonds Saw and Steel	Large-scale extrusion of uranium and thorium metals, 1948-56. Up to 35 million pounds of uranium and 40,000 pounds of thorium processed on site. Records show high worker exposures to radioactive dust. Site remains contaminated.
New York	Baker and Williams Warehouses	Short-term storage of concentrated uranium compounds in the early 1940s at three adjacent Manhattan warehouses. In the late 1980s, radioactive contamination was found on the floors. Federal cleanup completed in 1992.
New York	Radiation Applications	Company considered for experiments on removing cesium and strontium from radioactive waste, but unclear whether work was done. Company also had several other contracts supporting nuclear reactor operations at federal sites.

Niagara Falls	Titanium Alloys Manufacturing	Multiple contracts for producing and processing zirconium, uranium compounds and thorium scrap, 1940s to 1950s. Large volumes of toxic and, in some cases, explosive waste, dumped at government's nearby Lake Ontario Ordnance Works.
Niagara Falls	Electro Metallurgical	Large-scale conversion of uranium compounds to metal; processing of titanium and thorium; recycling of metallic scrap, 1942-53. High levels of radioactive dust. Soil contamination found, late 1970s, but link to weapons work unclear.
Niagara Falls	Hooker Electrochemical	Processing of uranium-bearing slag for recycling, production of boron-10 and xylene hexafluoride, mainly in the 1940s. Heavily contaminated site, also used for commercial chemical work, included in U.S. Superfund cleanup program.
Niagara Falls	Niagara Smelting Division, Stauffer Chemical	Production of boron trichloride, 1943-44. Records note workers' exposure to anhydrous chlorine and boron trichloride vapors. Plant was dismantled in 1945 without any inspection for residual hazards.
Port Richmond	Archer-Daniels-Midland, Staten Island Warehouse	Stored thousands of drums of ore containing high levels of uranium and radium, 1940-42. Buildings later destroyed for a parking lot. Some radioactive contamination found in 1976.
Rochester	Gleason Works	Testing of machining techniques on at least 140 uranium metal slugs (size and weight unknown). Records suggest limited potential for airborne radioactivity. Some decontamination work later done on equipment used in tests.
Tonawanda	Linde Air Products Division	Large-scale uranium separation and processing, 1942-48. Records show high worker exposures to radioactive dust. Buildings, soil and water contaminated; waste also was dumped at nearby properties. Federal cleanup ongoing.
Tonawanda	Haist disposal site/Ashland Oil /Seaway Industrial Park	Property leased in 1943 as a disposal site for radioactive waste from nearby Linde plant. Government bought site a year later and subsequently sold it to Ashland. Widespread contamination identified in the 1970s. Federal cleanup ongoing.
Watervliet	Allegheny-Ludlum Steel	Limited extrusion and rolling of uranium metal rods, mostly on weekends, 1950-52. Such operations typically raised radioactive dust, sometimes in substantial amounts. Surveys showed little potential for environmental contamination.
Ohio		
Ashtabula	Reactive Metals	Extrusion, forging and machining of large quantities of uranium metal, 1962-88. Extensive contamination of air and soil with radioactive and toxic byproducts, though most contained on site. Federal cleanup is ongoing.
Cincinnati	American Steel Foundries	Limited work on converting uranium compounds to metal bars, 1954-56. One test in 1956 involved 2,000 pounds of uranium tetrafluoride. Records suggest the work raised radioactive dust; some decontamination done in late 1950s.
Cincinnati	Cincinnati Milling Machine	Limited testing of electrochemical machining techniques on at least 14 pounds of uranium metal. A 1963 report indicates that the equipment used was decontaminated.
Cincinnati	John Van Range	Limited testing of stamping techniques on uranium metal, 1956. Records suggest minimal potential for radioactive contamination.
Cincinnati	Magnus Brass	Machining of at least 200 uranium metal ingots, 1954-57. Such operations typically generated radioactive dust; some decontamination done, 1950s.
Cincinnati	Process Research	Company was given contract to develop machining methods for weapons material in 1952, but scope and duration of work, while apparently limited, are unclear.
Cincinnati	R. W. Leblond Machine Tool	Approximately 17 tons of natural uranium metal used to test boring equipment. Some decontamination work was done after the tests, slightly contaminated coolant left for company use.
Cleveland	Brush Beryllium	Extensive research and manufacturing involving beryllium, uranium and thorium compounds at two sites, 1942 to 1950s. Records suggest workers faced substantial radioactive and toxic exposures. Properties redeveloped after work ended.
Cleveland	E.I. Du Pont de Nemours & Co., Grasselli Research Laboratory	Testing of methods for fabricating uranium metal cylinders, early 1940s. No waste disposed of on site. 1976 survey found no significant contamination.
Cleveland	Harshaw Chemical	Large-scale production and refining of uranium compounds, 1942-53. Records show extremely high worker exposures to radioactive dust and toxic fumes. Extensive contamination remains in building and grounds. No cleanup scheduled.
Cleveland	Horizons	Refining and conversion of thorium compounds into metal, 1940s-1950s. Records show operation generated substantial radioactive dust. Contamination identified in two buildings, 1977, but site deemed ineligible for federal cleanup.
Cleveland	Clevite	Processing of uranium and thorium compounds, 1956-63, including manufacture of enriched uranium fuel for nuclear reactors. Contamination identified in the building in 1993; private, government-certified cleanup done in 1998.
Cleveland	McKinney Tool and Manufacturing	Machining of uranium metal, at least six months in 1944. Quantity of material handled and precise duration of work unclear.
Cleveland	Tocco Induction Heating Division	Intermittent tests of special furnace systems on uranium metal rods, 1966-68. Records show work was sporadic, involved relatively small amounts of material with "minimal potential for residual contamination."

Columbus	Battelle Memorial Institute, Battelle Columbus Division	Multiple buildings involved in nuclear research, processing of uranium and thorium, 1943-86. Substantial risks of radioactive and toxic exposure for many workers. Widespread contamination remains; federal cleanup ongoing.
Columbus	B & T Metals	Machining and extrusion of uranium metal into rods over seven months in 1943. Records show the operation raised radioactive dust in work and office areas. Contamination in building and soil found in 1990; federal clean-up done in 1996.
Columbus	Battelle Columbus Laboratories	Multiple buildings involved in research on nuclear reactor fuels, fabrication of uranium rods and processing of various isotopic compounds, 1943-86. Widespread contamination in buildings; limited outdoor waste. Federal cleanup ongoing.
Dayton	Monsanto Chemical	The "Dayton Project" was a large-scale polonium production operation run by Monsanto in private buildings leased by government, early 1940s-1949. Federal survey found on-site polonium contamination, 1977; slated for federal cleanup.
Fairfield	Associated Aircraft Tool and Manufacturing	Machining of 95,000 uranium metal slugs, 1956. Radiological surveys in early 1990s found contamination in building, soil. Federal cleanup, including removal of 160 cubic yards of radioactive waste, completed in 1995.
Hamilton	Herring-Hall-Marvin Safe	Limited machining of uranium metal, 1943-51 (at least six tons of material). Such operations typically raised radioactive dust while they were conducted. A 1988 government survey found "negligible" levels of residual contamination.
Norwood	Gruen Watch	Shaved and stamped washers from uranium metal strips, May-June 1956. Some air monitoring done in June 1956 indicated that radioactive dust was raised during the intermittent operation, leaving some potential for contamination.
Oxford	Alba Craft Shop	Machining of large quantities of uranium metal, 1952-57. Operations raised substantial amounts of radioactive dust. Federal cleanup, including removal of 2,800 cubic yards of contaminated soil and building debris, completed in 1995.
Painesville	Clifton Products	Production of beryllium products including beryllium copper ingots, metal alloys and oxides, early 1940s-1950's. Health surveys done during the operation showed high levels of beryllium in plant air, up to 50 times the safety limits of the day.
Painesville	Diamond Magnesium	Site received at least 1,650 tons of radioactive scrap steel for use in magnesium production, 1951-53. Residual soil contamination identified in the 1980s. Site is slated for government cleanup.
Toledo	Baker Bros.	Machining of uranium metal rods, 1943-44. Records suggest the operation raised radioactive dust. Residual contamination identified in several outdoor areas and one small indoor area, 1989. Federal cleanup done in 1996.
Warren	Copperweld Steel	Straightening of uranium metal rods, mostly on weekends, early 1940s. More than 3,000 pieces handled in 1943. Records suggest additional work may have occurred. No obvious evidence of site contamination in federal screening survey, 1988.
Pennsylvania		
Aliquippa	Vulcan Crucible Tool and Steel; Aliquippa Forge	Cutting and extrusion of uranium metal, late 1940s. Records show many workers were exposed to radioactive dust. In 1978, government found contamination in building and soil. Federal clean-up removed 951 cubic yards of waste, 1994.
Birdsboro	Birdsboro Steel & Foundry	Built special equipment for machining uranium metal bars at the government's Fernald nuclear weapons facility near Cincinnati. No evidence that any radioactive material was used at the site.
Cannonsburg	Vitro Manufacturing	Processed large volumes of uranium from waste generated at other weapons plants, 1942-57. Records show high levels of radioactive dust and widespread environmental contamination. Federal cleanup of site and neighbor properties, 1985.
Carnegie	Superior Steel	Intermittent manufacturing of uranium metal plates, 1952-57. Records suggest the operation raised substantial amounts of radioactive dust. Some residual contamination discovered in 1980 and was to be addressed by site's owners.
East Pittsburgh	Westinghouse Atomic Power Development Plant	Pilot-scale processing of uranium compounds and metal, 1940s. Details of the operation are scarce. A 1976 federal survey revealed only trace amounts of residual contamination.
Malvern (Exton)	Foote Mineral	Separation and refining of zirconium compounds, late 1940s. In 1949, company produced about 200 pounds per month of refined zirconium for weapons use. Duration of contract and total quantity of material handled unclear.
McKeesport	U.S. Steel, National Tube Div.	Limited testing of extrusion techniques on uranium metal, 1959-60. At least 24 uranium billets were processed in two, week-long tests. Some equipment decontaminated; the rest put in storage for future use. Unclear whether more jobs done.
Philadelphia	Rohm & Haas	Research on zirconium/hafnium separation, late 1940s; Research on processing methods for uranium ores, early 1950s. Site survey in 1977 found no evidence of contamination.
Pittsburgh	Heppenstall	Forged more than 110,000 pounds of uranium metal into prescribed shapes, 1955. Radioactive dust from the operation cleaned up on completion and site certified as decontaminated in both private and federal reviews, late 1980s.
Reading	Carpenter Steel	Limited extrusion of uranium metal bars, apparently for less than six months in 1944. Federal survey in 1988 identified minor levels of radioactive contamination, but below guidelines for unrestricted public use.

Springdale	C.H. Schnoor	Machining and extrusion of uranium metal, 1940s, including 24,000 uranium metal slugs for nuclear reactor fuel. Contamination found under building, late 1980s. Federal clean-up of 626 cubic yards of radioactive waste done in 1994.
Washington	Jessop Steel	Limited rolling and extrusion of uranium metal in the mid-1950s. Radiological survey in 1989 found no obvious evidence of site contamination.
Waynesboro	Landis Machine Tool	Grinding of uranium metal slugs, 1952. Quantity of uranium and duration of work unclear. Air monitoring records suggest that considerable amounts of radioactive dust were raised during the operation.
West Chester	Aeroprojects	Research and development on methods for producing and processing materials made of beryllium, mercury, thorium, and uranium 1951-73. Work tapered in mid-1960s. Small quantities of radioactive waste were buried on site.
Rhode Island		
Cranston	C.I. Hayes	Conducted limited heat-treating tests using 10 uranium billets in January 1964. Records suggest minimal potential for radioactive releases.
Tennessee		
Erwin	W. R. Grace	Processed and recycled scrap uranium materials, early 1960s. Duration of work and quantity of material handled unclear.
Texas		
Dallas	Sutton, Steele and Steele	Hired in 1951 to test methods for removing uranium from residue left on processing equipment. About 15 pounds of uranium was involved in initial tests; total volume of work unclear. Records suggest little potential for contamination.
Fort Worth	AMCOT	Machined approximately 5 tons of uranium metal from July 1961 to March 1963. Records suggest the process released limited amounts of radiation. Some decontamination work was done at the site in April 1963.
Pasadena	Mathieson Chemical, Pilot Plant	Extracted less than 50 pounds of uranium from byproducts of phosphate work, 1951-52. Federal survey in 1977 found small amounts of radioactive contamination in sink, drain; material was to be sent to approved disposal site.
Texas City	Texas City Chemicals	Recovered uranium compounds from byproducts of commercial phosphate production, 1952-56. Original plant torn down. A 1977 survey revealed above-normal levels of radiation in soils; no conclusive link to weapons work.
Virginia		
Richmond	Virginia-Carolina Chemical	Research for six months on methods of extracting gram quantities of uranium from byproducts of commercial phosphate production, early 1950s. Potential for contamination deemed low in 1985; no survey was done.
Wisconsin		
Milwaukee	Allis-Chalmers	Machining of uranium metal. Duration and quantity of work unclear.