

# Argonne National Laboratory-East



## Summary Site Environmental Report for Calendar Year 2000



ANL-01/2 (Summary)

Argonne National Laboratory is operated by The University of Chicago for the U.S. Department of Energy under Contract W-31-109-Eng-38.

# Dear reader,

We, the Biology II: Research Questions in Biology class at Downers Grove South High School, summarized the Argonne National Laboratory-East Site Environmental Report for the year 2000, hoping to give the public a better understanding of how carefully Argonne monitors and protects the site's environment.

When approached with this project, the class was very excited. "I thought it was cool when I found out we'd be publishing a book," said Dave Gajewski, junior at South. "When we started to put the book together, it wasn't as easy as we had planned."

"We didn't think the project would be so complicated when we first started," said Cheryl Cramer and Megan Lesiak, juniors at South. "It's a lot more work than we thought."

When Mrs. Luczynski told us we'd be writing a book, the news came as a big surprise! The idea first came about when Dr. Norbert Golchert, a scientist at Argonne, asked the Community High School District 99 to write a summary booklet for Argonne National Laboratory-East. His children attended school in the district and they were impressed with our science program. Biology II was chosen because the class's approach to problem-solving is to answer questions after careful research and analysis. At the time, we were studying dynamics of ecosystems and food webs within those ecosystems. So the opportunity to study Argonne National Laboratory's methods for monitoring its own site's environment fell right into place. The foundation for the project is Illinois State Educational Goal 13B: Know and apply concepts that describe the interaction between science, technology and society.

We started the Argonne project by applying a research format that we use in class. First, we discussed what we knew about Argonne. "Not much," was the answer. Next, we developed foundation questions to be researched about Argonne. Later we met with Argonne scientists and took a tour of the facility. Then we read and reread the Argonne Site Environmental Report. We e-mailed the Argonne scientists for revision and editing ideas, and ultimately, we made this booklet for you.

What you will read comes from our research as we struggled to answer the question: "Describe the effect of a local building project on the surrounding community based upon data drawn from environmen-



George Joch

From left to right, front row: Laura Wentink, Mrs. Kathleen Luczynski, Susan Olson. Second row: Sheena Spikes, Crystal Lanski, Katie Alberts, Kimberly Molzahn. Third row: Megan Lesiak, Cheryl Cramer, Raymond Supangan, David Hale, Lauren Donner, Robert Keefe. Back row: Emmanuel Walker, Matthew Detjen, David Gajewski. Not pictured: Laura Gawel.

tal impact studies." This question is the Illinois Standard Benchmark 13B5b. Since we had a few difficulties understanding the technical material in the source report, one of our goals was to develop a book to help the public understand what Argonne is, what it does, and how it affects its surroundings.

The fact that we were given the opportunity to write this book is so flattering. "This project was fun because we were thinking like scientists. We wrote this for everyone's benefit. This doesn't just pertain to our class, but to everyone," says Susan Olson, senior.

Overall, we'd like to thank Argonne and the scientists who helped give us perhaps a once in a lifetime chance to write a book.

Laura Gawel

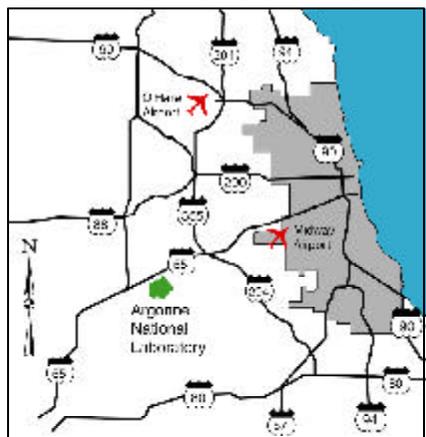
For more information about Argonne's Site Environmental Report, please contact Norbert Golchert at 630-252-3912 or [ngolchert@anl.gov](mailto:ngolchert@anl.gov). For more information about Argonne and its programs, please contact Argonne's Office of Public Affairs at 630-252-5575 or see the World Wide Web site at [www.anl.gov](http://www.anl.gov).

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## What Is Argonne?

**A**rgonne National Laboratory is one of the U.S. Department of Energy's largest multi-program science laboratories. Its annual operating budget is more than \$475 million. More than 200 basic and applied science programs emphasize materials



research, computer science, bio-science, environmental research, physics, chemistry, nuclear reactor technology, and energy-efficient technologies for transportation and industrial

sectors. Argonne operates two sites: Argonne-West, a 900-acre site near Idaho Falls, Idaho, and Argonne-East, a 1500-acre main facility located about 25 miles southwest of downtown Chicago. Argonne-East has occupied its current DuPage County location since 1948. This report deals only with the Argonne-East site.

### Argonne's origins

Enrico Fermi started the "Argonne Laboratory" of the University of Chicago. He received the Nobel Prize in Physics for "his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons." In 1942, he joined the University of Chicago's Metallurgical Laboratory and led the scientific team that produced history's first controlled self-sustaining nuclear chain reaction.

Within three months, the nuclear reactor called "Chicago Pile-1" was moved to the Argonne Forest outside of Chicago. The reactor was then called



*Argonne-East from the air.*

"Chicago Pile-2." Fermi was Argonne's first director. In 1946, the laboratory was designated the nation's first national laboratory, responsible for investigating and developing peaceful uses of nuclear energy. Since then, Argonne-East has evolved from a small, single-mission laboratory into one of the nation's largest multidisciplinary research centers.

### Argonne today

Much of Argonne's research today involves close collaboration with other U.S. Department of Energy laboratories. Argonne also forms joint research partnerships with many industries and universities to strengthen research programs and help transfer useful technology to industry. Argonne's research is centered on science serving society. Most of the research done at Argonne will directly or indirectly affect the public in the future.

Today, the laboratory employs 4,000 employees, including about 1,400 scientists and engineers, at its two sites. The University of Chicago operates Argonne as part of the U.S. Department of Energy's national laboratory system.

### Argonne-East's environs

Argonne-East is surrounded by the 2,200 acre Waterfall Glen Forest Preserve, which is open to the public. Waterfall Glen is used as a public recreational area and nature preserve. More than eight million people live in communities within 50 miles of Argonne.

*Crystal Lanski, Susan Olson*

# Summary

This booklet explains major portions of the ongoing environmental monitoring program conducted by Argonne National Laboratory-East in the calendar year 2000. The full Site Environmental Report, written by N.W. Golchert, R.G. Kolzow and L.P. Moos, can be obtained by contacting Argonne National Laboratory in Argonne, Illinois, 60439, or by going to the Web site ([www.anl.gov](http://www.anl.gov)).

Our booklet includes descriptions of the Argonne-East site, missions and programs; the status of compliance with environmental regulations; environmental protection and restoration activities; current projects; past, present and potential problems and the monitoring program for air, water and radioactivity in the area. "The policy of Argonne National Laboratory is that its activities are to be conducted in such a manner that worker and public health and safety and protection of the environment are given the highest priority." The environmental surveillance program conducts regular monitoring for radiation, radioactive materials and nonradiological materials on the Argonne-East site and in the surrounding region. The detection of such releases to the environment is of great importance. If a release occurs, the monitoring program clearly identifies the substance, its magnitude and its origin. Programs and controls are set up to eliminate, contain or remove the substance from the environment.

## Inception

During the years 1947-1948, the environmental monitoring program began. The samples collected then provided a baseline of materials in the media to be monitored — air, water, groundwater and radiation emissions. Many hazardous or radioactive substances occur naturally in these media, and the baseline data collected in 1947 provide a comparison with natural conditions as the years of research proceed. The first 30 years of the monitoring program focused on radiological activity. Monitoring of nonradiological materials began in 1980. Current monitoring involves approximately 50 percent radiological and 50 percent nonradiological materials.

Argonne National Laboratory wants to determine and monitor its impact on the public, its employees and

the environment. Some of the environmental monitoring is required by law, as a result of permits and commitments. Through the data collected and analyzed, Argonne is able to determine the effectiveness of its own pollution control and remedial activities.

## What is Monitored

The Clean Air Act requires that certain types of air emissions be sampled and analyzed. Surface water, including treated sewage and storm water, is released into Sawmill Creek. From there, it flows to the DesPlaines River, to the Kankakee River, to the Illinois River, then to the Mississippi River, and finally into the Gulf of Mexico. The dissolved mineral content ("total dissolved solids"), sediment ("total suspended solids") and radiation in Argonne's surface water are closely monitored under the Clean Water Act. Groundwater is monitored under other regulations. Environmental samples are analyzed and compared with applicable guidelines and standards.

There are three major components to Argonne's site environmental management. The environmental monitoring program collects and presents data. The environmental restoration program evaluates suspected areas of environmental concern and manages any needed cleanup activities. The environmental compliance program keeps Argonne's operations within the guidelines determined by the state and federal government. The monitoring program supports current activities dealing with wastewater treatment, solid waste disposal, air emissions, hazardous waste management, radioactive waste management and mixed waste management.

The monitoring program is continually reviewed and revised. The annual Site Environmental Report keeps Argonne's neighbors informed that Argonne is a safe place to have in our community and provides many scientists with important data upon which they continually devise better ways to solve our environmental problems.

## Stewardship

Argonne is committed to long-term stewardship with regards to the environment. The monitoring shows that Argonne-East is in compliance with appropriate standards and permit limits. The Site Environmental Report identifies trends, provides information for public viewing and interpretation, and shows what substances are emitted from Argonne-East and where they come from.

Argonne operates the Argonne Information Center, which is located at Argonne-East's main entrance and is open to the public Tuesday through Friday. For more information visit the center and become familiar with this interesting facility and its research.

*Mrs. Kathleen Luczynski*

### SAMPLES AND ANALYSES IN FY 2000

Samples scheduled	1,962
Sample bottles collected	3,437
Analyses performed	9,638
Analytical results reported	22,489

# Glossary

**alpha radiation:** Free-flying helium nuclei, composed of two protons and two neutrons. Alpha radiation of a given energy is less penetrating than beta or gamma radiation of the same energy, but can do more damage to cells because it is heavier. On the other hand, it is also the easiest type of radiation to shield against because it is larger. Tissue paper will stop it.

**beta radiation:** Composed of free-flying electrons, beta radiation of a given energy penetrates more than alpha radiation, but less than gamma radiation of the same energy. As a result, beta radiation of a given energy does less damage than alpha radiation, but more than gamma radiation of the same energy.

**compliance:** In agreement with; according to.

**constituent:** Serving as a part of a whole; component.

**Department of Energy (DOE):** A U.S. government department that monitors the nation's energy resources and supply, conducts basic and applied research, and manages the nation's nuclear weapons program.

**dosimeter:** A device that monitors how much radiation a person has been exposed to.

**ecosystems:** A community of animals and plants, together with its environment.

**gamma radiation:** Highly energetic light waves or photons, just above X-rays on the electromagnetic spectrum. Gamma radiation of a given energy penetrates more than alpha or beta radiation of the same energy. But because photons are so small, gamma radiation is also the least damaging of the three kinds of radiation.

**greenhouse gases:** Gases, such as carbon dioxide, that trap solar radiation and thereby contribute to the "greenhouse effect," the warming of the Earth and its lower atmosphere.

**herbicide:** Chemicals that kill off unwanted plants.



George Joch

**ionizing radiation:** Alpha particles, beta particles, gamma-rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions by removing electrons from atoms and molecules.

**NESHAP:** National Emission Standards for Hazardous Air Pollutants; a set of federal regulation that sets limits on airborne emissions of hazardous chemicals and radioactive materials.

**nonradiological material:** Material that does not contain any radioactivity.

**nuclide:** A type of atom specified by its atomic number, atomic mass, and energy state, such as carbon-14.

**phytoremediation:** The process of using green plants to clean up contaminated soil, groundwater and wastewater.

**population:** A group of the same species living in a particular area.

**radiation:** A nuclear reaction that releases energy in the form of alpha, beta or gamma rays.

**radioactive:** Exhibiting spontaneous emission of nuclear radiation.

**radioactivity:** Radiation, including alpha, beta and gamma rays, emitted by a radioactive substance.

**radiochemistry:** The branch of chemistry that deals with radioactive substances.

**radiological:** Related to nuclear radiation; applies to devices that produce radiation but do not induce radioactivity.

**radionuclide:** An atom, as specified by its atomic number, atomic mass, and energy state, that exhibits radioactivity.

**species:** Organisms that resemble one another in appearance, behavior, chemistry and genes. They can interbreed in nature and produce fertile offspring.

**topography:** The lay of the land: rolling hills, flat, etc.

**Vehicle Emissions Control Program:** The federal program that controls toxic air emissions from motor vehicles through technological controls, such as catalytic converters, on motor vehicles.

**volatile:** Capable of becoming a gas easily.

**volatile organic compounds:** Carbon-based chemicals that easily become gases. Examples include cleaning fluids, industrial solvents and petroleum products.

Laura Gawel

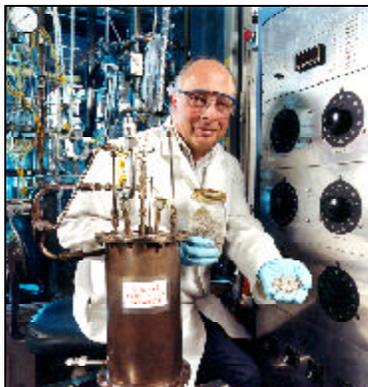
# Current projects

Argonne National Laboratory is currently working on more than 200 basic and applied research projects. Important areas of research are helping develop cleaner, more efficient cars and trucks, better ways to clean up the environment, advanced nuclear reactors that are safer and produce less waste, more efficient wires to transmit electricity, and new ways to diagnose and treat diseases like cancer.

Argonne also designs, builds and operates one-of-a-kind research “user facilities,” such as the Advanced Photon Source. These user facilities, which are available to qualified scientists from public and private laboratories all over the nation, are too expensive for a single company or university to build and operate.

## Car of the future

Argonne is currently helping industry develop the car of the future. Some of the cars that are now being studied are new hybrid-electric vehicles, such as the Honda Insight and the Toyota Prius. These vehicles switch between battery power and engine power,



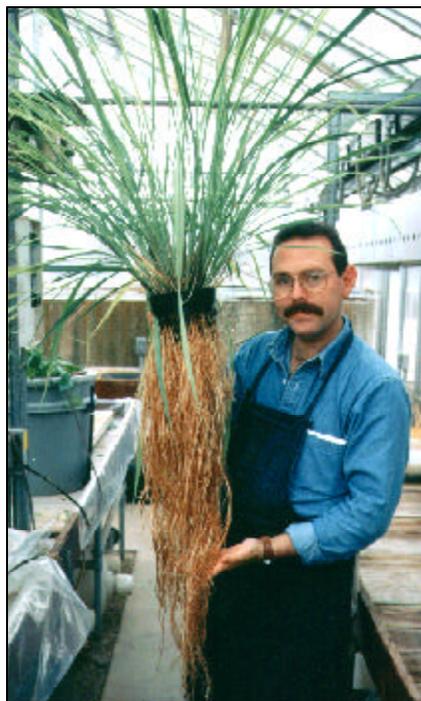
*Fuel reformer*

depending on traffic conditions. Argonne is also helping develop fuel cells — sort of batteries with fuel tanks — to power electric cars and trucks. The fuel cell automobile will run on hydrogen, which would be released from gasoline using a small “reformer” that

Argonne is developing. These new cars and trucks will save fuel and reduce pollution.

## Environmental Science

Some of Argonne’s environmental research is helping clean up problem areas on the Argonne-East site. The leading example is phytoremediation, which is using plants to clean up volatile organic compounds, metals and tritium in the soil. About 800 trees



*Phytoremediation*

were planted to take in the waste in the ground. The main pollutants Argonne is trying to get rid of are volatile organics: compounds such as cleaning fluids, industrial solvents and petroleum products. The trees being used are poplar, willow and cottonwood. Along with working hard to remove pollutants,

Argonne is also restoring the prairie and other natural ecosystems on the Argonne site.

## Advanced Photon Source

The Advanced Photon Source (APS) at Argonne produces the nation’s most brilliant X-ray beams for materials science, biology and geology. It has a circumference of 1,104 meters, which is large enough to encircle an entire baseball park. It produces its X-rays by using synchrotron radiation. This complex machine accelerates and stores a beam of subatomic particles that, when vibrated by powerful arrays of magnets, emit X-ray beams. Scientists and engineers from all over the world use the APS to study the properties and structures of materials in far more detail and less time than ever before. Some examples of this are snapshots or movies of chemical and biological reactions that are too fast to have been observed before the APS was built.

Examples of recent research done at the APS include:

- Identifying the human genes that contribute to juvenile diabetes.
- Showing that lead poisoning was the most likely cause of Beethoven’s years of chronic illness.
- Showing how microorganisms play a key role in forming natural deposits of zinc and other minerals.
- Studying the working wing muscles of living fruit flies to learn how muscles function and coordinate.



*Advanced Photon Source*

## Energy

Argonne is one of the nation's leading centers for studying superconductivity, which is the flow of electricity with no resistance. Argonne is trying to understand why some materials make better superconductors than others. This knowledge could help industry make inexpensive superconductive wires that would save energy.

Argonne's energy research program is developing safer nuclear reactors that produce less radioactive waste. Nuclear energy is the only proven technology that can generate large amounts of electricity without producing greenhouse gases that are believed to contribute to global climate change.

## Biochip Research

Argonne researchers are developing biological microchips — or biochips — and related technologies to make biological analysis faster and more efficient. Biochips are essentially biochemistry laboratories in



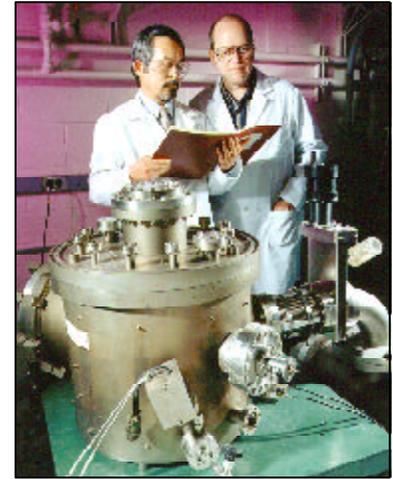
*Biochips*

miniature. Each biochip consists of thousands of three-dimensional gels mounted on ordinary glass microscope slides. Each gel is like a mini-test tube. By using robots to load the gels with chemicals and using computers to read the resulting reactions, thousands of biological and chemical reactions can be completed and analyzed in minutes.

Biochips are being developed to detect genetic changes in cells and toxic chemicals and organisms in the environment.

## Nanoscience

Today scientists envision the day when nanomaterials will let us create new products and technologies. Nanomaterials are clusters of atoms or molecules that measure a few billionths of a meter across. Materials made from these tiny clusters can be stronger, tougher and more reactive than normal-sized materials. They may display new electronic properties, may be more chemically reactive and more resistant to friction and wear. This technology



*Nanoscience*

could let us produce a number of things that can change the way the world works today, such as microscopic bullets that can be injected into patients to seek and destroy viruses, or even supercomputers small enough to wear as a ring on your finger.

## Advanced computing

Argonne's "Chiba City" is the new destination for scientists developing high-performance computer software. Chiba City is a cluster of 256 Linux nodes at Argonne-East. Linux computers offer advanced computing at far lower cost than traditional supercomputers. Large numbers of relatively cheap desktop-type or server

computers can be connected to form a powerful supercomputer. But the big unknown about these cluster computers is scalability: When hundreds or thousands of computer processors are linked together, how well will they work? Chiba City is a system where computer scientists from all over the country can log on and test their ideas about new algorithms, communication libraries and parallel file systems.



*Chiba City*

*Dave Hale and Katie Alberts*

# Radiation at Argonne

Are the white deer that roam the Argonne-East site white because they're suffering from radiation? Of course not! This is just one of many mis-

guided notions some Argonne visitors have upon seeing the deer, which are naturally white. They are native to southern Europe, northern Africa and parts of Asia. They were the exotic pets of a family whose

country retreat once occupied land that is now part of Argonne's DuPage County site.

Radiation comes from radionuclides that decay. When they decay, radionuclides release alpha, beta or gamma radiation. Alpha radiation is more harmful than beta or gamma radiation of the same energy, but it cannot penetrate far through solid objects. Tissue paper will block it. Gamma radiation is less harmful than alpha or beta radiation of the same energy, but it is more penetrating and harder to block.

At Argonne-East, radiation is used in many research programs. Argonne monitors radiation in the water and in the air to make sure that it is a safe for Argonne employees and neighboring communities. The fact that Argonne has never exceeded the radiological dose limit says a lot for the facility: They are very safety oriented in making sure that radiation emissions are closely monitored and controlled.

## What is radiation?

Radiation is all around us in everyday life and can not be avoided, but too much radiation can be harmful and even deadly. Radiation is energy in the form of waves or particles moving through space. The common light, heat and radio waves are actually forms of radiation; that is, electromagnetic waves. Gamma radiation is high-energy electromagnetic waves. There is also particulate radiation, which is radiation in the form of particles; examples include alpha and beta radiation.

The amount of radiation absorbed by living tissue is called "dose." Since alpha radiation of a given energy is more damaging than beta, which is more

damaging than gamma, the amount of radiation energy absorbed per gram of tissue (called "absorbed dose") is multiplied by a quality factor to get the dose equivalent. One of the most commonly used units of dose equivalent is millirem (mrem).

Radiation comes from natural and human-made sources. The most common sources of radiation are cosmic radiation, terrestrial radiation, internal radiation, human-made radiation, and other miscellaneous sources. Cosmic radiation comes from space and hits



Dave Jacqué

the earth's surface. Terrestrial radiation is emitted from radioactive materials in soil, rocks and minerals. Human-made radiation comes from sources such as medical and consumer products. Consumer radiation comes from items

that people buy and use, such as smoke detectors and airport X-ray baggage-inspection systems. Medical uses of radiation include X-rays and various forms of radiation diagnostics and therapy. Other forms of radiation include emissions from radioactive facilities and nuclear weapon testing in the atmosphere.

With all this in mind, most people only receive around 300 mrem a year from natural radiation. For comparison, a typical medical X-ray carries a dose of about 10 mrem, and a person flying round trip between Los Angeles and New York City receives about 5 mrem from the increased exposure to natural cosmic rays at the higher altitude. Natural radiation accounts for 78 percent of the radiation that the average person is exposed to. Of natural radiation, 66 percent comes from radon.

## Radiation monitoring

Radiation can be hazardous if not used or handled correctly. Argonne employees, even those who do not work with radiation, know that the laboratory's policies and procedures for managing radiation on site are based on the principle of "ALARA," which means to keep exposures "As Low As Reasonably Achievable." To ensure that Argonne employees who work with radioactive materials are safe, special radiation monitoring badges are worn. Roughly the size of a deck of cards, the badges must be worn at all times to show how much radiation a person receives while the badge is worn. If any person's cumulative exposure builds up faster than expected, even though

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## Summary of the Estimated Dose to the Public, 2000

Component	Dose	Max. allowed	Agency
Air (NESHAP)	0.047 mrem/year	10 mrem/year	EPA
Water	0.019 mrem/year	4 mrem/year	EPA
Direct Radiation	0.010 mrem/year	No standard	None
All sources	0.076 mrem/year	100 mrem/year	DOE

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it may still be within safe limits, Argonne staff members investigate the situation to find out why. Measures that might be taken to reduce exposure include adding more protective shielding, finding a new approach to the job, or getting more people to work on a project so the average worker's exposure is reduced.

Radiation levels measured at Argonne-East are compared with safe levels set by federal regulatory agencies to protect workers and the public. The government sets these standards very low in order to be "conservative" in keeping people safe, and Argonne sets its internal standards even lower. Argonne measures radionuclide concentrations in air, surface water, subsurface water and sediment. Argonne also measures external penetrating radiation doses on and off the site. Since radioactivity is generally transported by air and water, these are the key concentration areas of our focus.

### Radiation in the air

Air filter samples are collected and analyzed to find the radioactive content of particles in the air at Argonne-East and in neighboring communities. The samplers are placed at 14 locations around the Argonne-East perimeter and at 6 off-site locations. The Argonne staff changes on-site filters weekly. Off-site filters are changed by cooperating local agencies.

### Radiation in the water

Liquid wastewater from buildings or facilities that use or process radioactive materials is collected in retention tanks. When these get full, they are sampled and analyzed for alpha and beta radioactivity. If radioactivity is higher than standards, the liquid in the tank is disposed of through evaporation, and the residue is disposed of as solid low-level radioactive waste at licensed disposal facilities. If radioactivity is within safe standards, the wastewater is transported in dedicated pipes to Argonne-East's on-site laboratory wastewater treatment plant for proper treatment.

A related monitoring program involves the radiological analysis of the main wastewater treatment plant discharge into Sawmill Creek. Samples at the point of discharge are collected daily for analysis. Argonne-

East's wastewater flows from Sawmill Creek into the Des Plaines River. To monitor the discharges to the Des Plaines River, the river is sampled two times a month, both upstream and downstream of the site.

In conclusion, although radiation is dangerous when not dealt with properly, Argonne-East is taking measures to control it and keep exposures well within safe levels. The table above shows that Argonne truly puts what it says into practice. In 2000, the people at Argonne kept radiation levels very much below the exposure limits set by the Department of Energy and the Environmental Protection Agency. Argonne management feels it has a responsibility to ensure the safety of both the public and Argonne's employees. In order to do this, samples are collected in the air and water to evaluate radiation releases and exposures. Argonne-East is a productive and safe facility that can only hope to achieve higher success in the future.

*Laura Wentink, Sheena Spikes*



*George Joch*

# Water Monitoring

Look at the picture of the creek. This creek, like many others in the United States, is clean of pollution and clear of hazardous materials. Argonne has a creek of its own, Sawmill Creek, which flows southward through Argonne property and later pours into the Des Plaines River.

This creek has remained clean, clear of hazardous wastes and pollution free because Argonne treats all the water it discharges into the stream — some 750,000 gallons per day — in

accordance with the regulations and requirements of the U.S. Environmental Protection Agency (EPA), and the Illinois Environmental Protection Agency (IEPA).

## Clean Water Act

One of the major codes that Argonne abides by is the Clean Water Act. In 1977, the Clean Water Act was established as a major amendment to the Federal Pollution Control Act. The goal of the Clean Water Act is to provide for the restoration and maintenance of water throughout the country, with the ultimate goal of providing and maintaining water suitable for fishing and swimming. The Water Quality Act of 1987 significantly changed the Clean Water Act by placing greater emphasis on the monitoring and controlling of toxic materials in wastewater. Later amendments placed stricter limits on the quality of water discharged from regulated facilities such as Argonne, and expanded the number of chemical constituents that have to be monitored in waste water.

## Why water is monitored

Water discharged from Argonne into Sawmill Creek is monitored to ensure that any harmful materials — such as radionuclides or hazardous chemicals — are within safe limits. If unsafe levels of

harmful materials were allowed to enter natural streams, creeks and rivers, they could lead to illness and even death of people, animals or plants.

## How water is treated

To maintain safe levels, Argonne's wastewater is treated in either of two different systems, depending on its source. Argonne's sanitary wastewater treatment center handles water that does not contain radioactive or hazardous material. This water comes from restrooms, the cafeteria and office buildings. Treatment at the sanitary wastewater treatment facility

consists mainly of clarifiers, trickling filters and sand filters.

The second treatment facility is the laboratory wastewater treatment center. The water that is treated here has been

used in research activities and sometimes contains hazardous or radioactive material. The water in the laboratory wastewater treatment center consists primarily of aeration, solids-contact clarification and pH adjustment. Other processes can be added depending on the make-up of the wastewater.

## Surface water and groundwater

Argonne monitors surface water, groundwater, liquid wastewater and drinking water for contamination. Surface water is monitored by collecting samples from several points, including Sawmill Creek, at which Argonne discharges water into the environment. Samples are collected and analyzed every week.

Groundwater samples are collected and analyzed quarterly from monitoring wells in areas where there are potential groundwater problems. These problems come from the 1950s and 1960s when Argonne-East followed disposal procedures that were acceptable then, but which science has since learned were not best for the environment. Examples of these areas include material storage yards, old sludge drying beds and closed landfills. Later, this waste was found to have

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George Joch

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hazardous material and pose a threat to the environment. Another important example is the previous use of French drains. These are gravel-lined holes that were used in the 1950s and 1960s to dispose of volatile organic compounds, such as cleaning fluids, organic solvents and petroleum products.

In general, hazardous substances found in Argonne's surface- and groundwater are well within safe regulatory guidelines. The few exceptions are covered under the discussion of liquid effluent discharge exceedances at the end of this section, and in the final section of this booklet.

## Drinking water

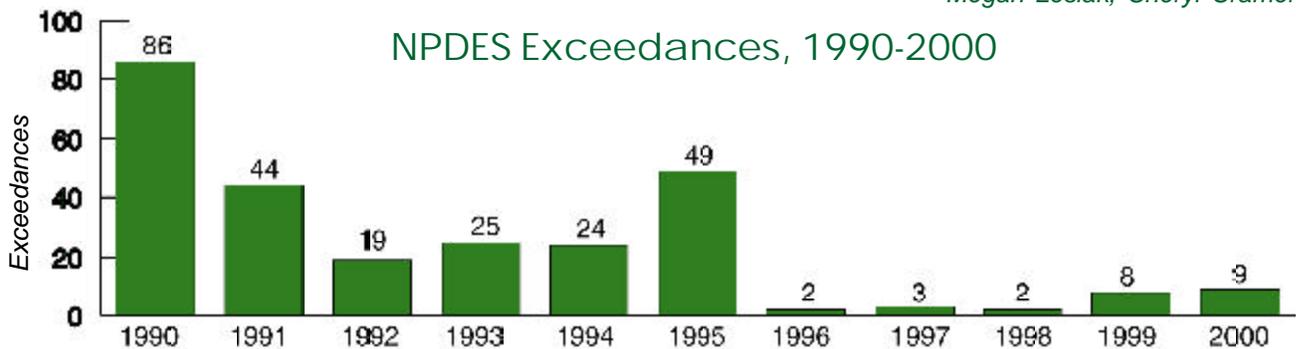
The Safe Drinking Water Act, established in 1974, regulates the concentrations of certain chemicals and substances in drinking water. In January 1997, Argonne began using Lake Michigan as its source of drinking water, replacing the rocky well water formally

used. Argonne continues to monitor the old wells for radionuclides and volatile organic compounds. Analysis of these samples shows that all concentrations are within safe regulatory guidelines. Well water samples were taken quarterly in 2000.

## Liquid effluent exceedances

In past years, Argonne has exceeded a few times a year the National Pollutant Discharge Elimination System (NPDES) limits, which regulate the concentrations of total dissolved solids, total suspended solids and other parameters in waste water discharged from the Argonne site. "Total dissolved solids" refers mainly to salt used to de-ice Argonne roads in winter and which is washed into the wastewater treatment plant when the snow and ice melt. "Total suspended solids," refers mainly to natural silt that washes into Sawmill Creek during heavy rains. As the accompanying graph shows, the number of annual NPDES exceedances has decreased from 1990 to 2000.

*Megan Lesiak, Cheryl Cramer*



# Air Monitoring

Argonne National Laboratory-East uses extensive air-monitoring programs to help protect the air quality on site and in local neighborhoods. Argonne's policy is to comply with all federal and state health, safety and environmental laws and regulations to protect the health and safety of workers and the public and to minimize damage to property.

Argonne-East monitors the air on its site and emissions from certain specified facilities for chemicals, radioactive materials and asbestos. Results are compared against the requirements of federal regulations. This federal environmental law sets emission limits for air pollutants and determines emissions limit and operating criteria for certain hazardous air

pollutants. In Illinois, the U.S. government delegates implementation and enforcement of the Clean Air Act to the Illinois Environmental Protection Agency.

Airborne radiological emissions from Argonne-East are also subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. NESHAP is a body of federal regulations that applies specifically to radiological emissions from U.S. Department of Energy facilities, such as Argonne.

In 2000, the latest year for which data have been fully analyzed, all measurements of all pollutants — chemical, radiological and asbestos — are well within safe regulatory standards.

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## Conventional air pollution

The major potential source of conventional air pollution at Argonne-East is the Building 108 Central Boiler House, which burns low-sulfur coal from December through March to provide steam heating for many Argonne buildings. This facility is a source of airborne sulfur and nitrogen oxides. The following table shows the amount of coal Argonne-East burned in 2000.

### Coal burned at Central Boiler House in 2000

Month Operated	(hours)	Low-Sulfur Coal Burned (tons)
January	720	2,147
February	336	1,053
March	264	943
April-November	0	0
December	744	2,770
Total	2,064	6,913

Under the Clean Air Act, Argonne-East must also evaluate emissions of carbon monoxide, particulates, volatile organic compounds, hazardous air pollutants and ozone-depleting substances. Various research and support activities at Argonne-East provide potential sources of these pollutants. Examples include the boiler house; transportation facilities that use and dispense gasoline, methanol-gasoline blend and ethanol-gasoline blend; two alkali-metal reaction booths; various bulk chemicals tanks; a dust collection system; the Engine Test Facility; a medical equipment sterilization unit; and fire-department training activities. All these activities and their associated facilities are operated in compliance with the applicable regulations and permits.

## Radionuclide emissions

To monitor for airborne radiological particle emissions, Argonne-East uses air samplers equipped with filters to continuously collect airborne particles for analysis. Particle samplers are placed at 14 locations around the Argonne-East perimeter. Six additional sampling stations are located about five miles from Argonne-East to provide “normal” background concentrations for comparison. Particles are collected with fiberglass filters, which are changed weekly.

Particles collected at 12 of the on-site sampling stations and five of the off-site stations are measured for alpha, beta and gamma radiation. Particles collected at the remaining two on-site and one off-site

stations are chemically analyzed for the presence of plutonium, thorium, uranium and strontium, the radionuclides most likely to be airborne as a result of Argonne operations. In addition, gaseous radiological emissions are also monitored in facility exhausts.

All concentrations of all airborne radiological samples that Argonne collected in 2000 were well within safe standards. During 2000, concentrations of uranium and thorium were within the range expected from their presence in nature. With a single exception, concentrations of strontium-90 were below the limits

that standard laboratory methods and instruments can detect. Federal regulations require Argonne to calculate the highest possible estimated dose to the “maximally

exposed individual” who lives nearest the Argonne-East site. In 2000, that individual — who is assumed to live east of the site and to spend all year outdoors — would have received an estimated total cumulative dose of 0.046 mrem/yr. This is about 1/200th of the 10 mrem annual dose permitted by NESHAP regulations. For comparison, a typical medical chest X-ray delivers a dose of about 10 mrem to the patient.

## Asbestos-containing material

Most of the buildings at Argonne-East were built before 1960, and many contain large amounts of asbestos-containing materials, such as insulation around pipes and tanks, spray-applied surfaces for fireproofing, floor tile, and asbestos-cement panels. This material is removed as necessary during renovations or maintenance. Asbestos removal and disposal are governed by the asbestos NESHAP, the Toxic Substances Control Act (TSCA), and the Occupational Safety and Health Administration’s worker protection standards.

During 2000, about 2,800 cubic feet of asbestos-containing material was removed from Argonne-East buildings. It was disposed of according to federal and state regulations at certified landfills in Streator, Ill., and Richland, Wash. The Illinois EPA was notified during December 2000 that Argonne expected to remove no more than 3,500 cubic feet of asbestos-containing material 2001.

*Raymond Supangan, Emmanuel Walker*

# Habitat Management

## Deer

One distinct characteristic that makes Argonne special is the two different deer species that



George Joch

roam the grounds. Ordinary white-tailed deer live at Argonne. Native to Illinois, they are brown, except for the white undersides of their tails.

A species of deer not seen everyday is the white, or fallow

deer. Currently, about 40 of these deer roam the Argonne site. Unlike their cousins, the white deer are pure white. They are born a creamy tan color with white spots, and it is only after reaching their first year that the deer become fully white. The fallow deer are native to north Africa, southern Europe, and parts of Asia. They were brought to the area in the early 20th century as a gift to Gustav Freund, who owned a country estate on some of the land that Argonne-East now occupies. Early in the mornings, groups of white deer can be seen grazing and playing together. Young bucks are often seen fighting, and once in the 1950s, the fire department had to come out to separate the interlocked antlers of two animals blocking a roadway. It is truly a remarkable experience to see the white deer in a natural habitat.

## Wetlands

The protection and management of natural wetlands is an important part of Argonne's environmental stewardship efforts. Surveying teams have identified about 35 individual wetland areas on the Argonne site. Argonne is protecting and managing these wetlands by various methods, including controlled burning and herbicide application.

These methods discourage the survival of plants that are not native to the wetland, which ultimately

leaves room for the native plants to flourish. If these measures do not work, Argonne can intervene and purposely plant the desired species.

## Native plants

Along with wetland management, Argonne is working on restoring native plants to open prairie areas and woodlands of the site. Controlled burns and hand clearing of non-native plants are combined with plantings of native species to encourage growth of the prairies and woodlands. The wetland management program supports

and enhances the goals of economically and environmentally beneficial landscaping by using environmentally sensitive landscaping practices and native plants. These practices protect our natural heritage and provide us with wildlife habitat. The practices may also reduce fertilizer, pesticide and irrigation costs, because native plants are best suited to the local environment and climate. The use of hazardous chemicals, such as pesticides and herbicides, can be decreased due to the native plant's natural resistance to pests.



## Endangered species

The Endangered Species Act of 1973 protects plants and animals whose existence or habitat is threatened by human development. No federally threatened or endangered species, or their habitats, are known to exist on the Argonne-East site. However, three federally endangered species — the Hine's emerald dragonfly, the leafy prairie clover, and the lakeside daisy — reside in the Waterfall Glen Forest Preserve that surrounds Argonne-East.

*Kimberly Molzahn, Matthew Detjen, Lauren Donner*

# Current issues

**B**ased on the results of the environmental monitoring program and a review of the operations and activities at Argonne, three issues have been identified that offer Argonne an opportunity to improve its environmental performance. One area is compliance with the conditions of Argonne's National Pollutant Discharge Elimination System (NPDES) permit, which limits the concentration of dissolved and suspended solids in the wastewater that Argonne discharges to the environment. The second deals with high concentrations of certain toxic substances in groundwater near a former landfill on the Argonne-East site. The third is the timely completion of the environmental cleanup projects at a few Argonne-East areas that became contaminated during the 1950s and 1960s as a result of waste-disposal practices that were accepted then, but not today.



## NPDES Compliance

Argonne is required to have a permit from the Illinois Environmental Protection Agency (IEPA) to discharge wastewater to the local streams and rivers. The permit contains a number of conditions and limits on various chemical constituents. Argonne must monitor specific discharge locations ("outfalls") for these chemicals and report results to the IEPA every month. Several of these chemical concentrations have occasionally exceeded the permit limits.

During the winter, for example, surface water flowing from Argonne into the wastewater treatment plant has contained too many dissolved solids. This is attributed to road salt, which is washed into surface

water when the snow melts. Argonne is evaluating its road-salting program to balance driving and walking safety with the need to comply with the permit limits.

Another source of dissolved solids that occasionally causes permit exceedances is the boiler house that provides steam heating for many buildings at Argonne-East. During the heating season, chemicals used to clean the boiler's heating plates sometimes build up and exceed the permit limits in water dis-

charged from Argonne's on-site wastewater treatment plant. To avoid future exceedances, Argonne is working with DuPage County to pump boiler-house wastewater to the county's wastewater treatment facility.

Argonne's NPDES permit also places limits on total suspended solids — essentially silt and dirt — in discharged surface water. Argonne exceeded total suspended solids limits at several outfalls in 2000. This is being addressed by improving erosion-control procedures on site. Discharges from the Argonne cooling towers to surface waters have resulted in problems with meeting the aquatic toxicity limits. Argonne is working to reroute these surface-water discharges to the

Argonne wastewater treatment plant, where the toxicity can be reduced.

## 800 Area Landfill

Argonne-East operated a sanitary landfill in the site's northwest corner from 1966 to 1992. As part of the closure process, Argonne must monitor the groundwater under and around the landfill and report the results to the IEPA. This quarterly report has identified several substances, mostly metals, that exceed the State of Illinois groundwater quality standards. Examples include manganese, iron, chloride, nickel, lead and total dissolved solids. Argonne is presently determining how far these substances have spread and evaluating improved environmental sampling methods.

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## Environmental Remediation

Argonne has identified a number of locations on the site that, as a result of past practices, require some level of environmental cleanup. The original list contained 740 sites, but this has been reduced to 57 sites by voluntary cleanup and other means. The remaining 57 sites are being cleaned up under the Resource Conservation and Recovery Act. So far, 44 of these sites have been cleaned. The remediation work is scheduled for completion by the end of 2003. However, 12 of the cleanup activities, such as at the 800 area landfill, will require leaving some of the waste material in place. These 12 sites will require long-term environmental stewardship, including some level of ongoing monitoring to assure the IEPA that the remaining waste remains in place.

### Summary

Most of the ongoing environmental concerns at Argonne-East involve compliance with state and federal permits, primarily the NPDES permit and the landfill closure permit. The chemical species of interest are nonradioactive ones, such as metals, salt and volatile organic compounds. Although individual exceedances may occur, the intent is to avoid the continuous or frequent violation of the permit limits. Argonne is actively addressing these problems and plans are in place to eliminate them. Argonne will continue to monitor its environment to assure the public that the laboratory is a good neighbor.

*David Gajewski, Robert Keefe*



*George Joch*



*Laurie Culbert*



*George Joch*

*Except for the class picture on page 2, all photos in this publication were taken at the Argonne-East site. The text was edited by David Baurac. Layout and design by Dave Jacqu .*

