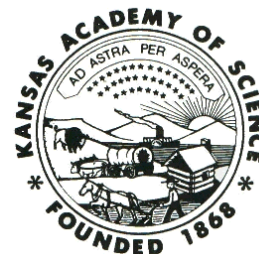


KAS BULLETIN



NEWSLETTER OF THE KANSAS ACADEMY OF SCIENCE

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159th ANNUAL MEETING OF THE KANSAS ACADEMY OF SCIENCE

The 159th annual meeting of the Kansas Academy of Science will be held at Kansas State University campus in Salina, April 9th -10th of 2027. Check the KAS website for updates.



2026 Annual Meeting of the Kansas Academy of Science a Great Success

by Hank Guarisco, editor



The 158th annual meeting of the Kansas Academy of Science was held in conjunction with the Central States Entomological Society at Baker University's Baker Wetlands and the University of Kansas in Lawrence, Kansas on April 10-11, 2026. Late Friday afternoon, approximately 170 meeting participants gathered at the Baker Wetlands Discovery Center for a birding tour through nearby natural areas, followed by a social hour. It was great to visit with old friends and new student members.

Dr. Michael Sitarz of Baker University was the keynote speaker at the banquet dinner. He explored the recently recognized existence of interstellar objects that occasionally enter our solar system, often coming close to earth. They can be recognized by their eccentric elliptical or hyperbolic orbits. Additionally, the earth is being bombarded by tiny meteors, called micrometeorites, which are usually metallic and can be found by passing a strong magnet over roof surfaces. These tiny objects have been examined to gain a better understanding of the origin of our solar system.

The next morning, we convened in the ballroom of the Kansas Union on the University of Kansas campus, and renewed friendships with colleagues over coffee and bagels before attending oral presentations that were divided into four concurrent sessions. There were extensive poster presentations as well.

To elucidate the influence of global warming, there were several studies investigating the foraging behavior of ants and activities of butterflies across warming temperature gradients. Isaac Fox, a Fort Hays State student, conducted a three-year study of the insects on Fort Leavenworth that revealed the presence of 10 new state records as well as five other species in Kansas that have been rarely encountered. KU graduate student, Anaha Quezada presented data on the distribution of butterflies in Kansas based on museum records.

Patrick Geyer of Fort Hays State University presented data indicating that bats were more prevalent above prairie dog towns in western Kansas than adjacent areas, and that they were flying across them to get to the riparian corridor of the nearby Smoky Hill River.

The redspot chub (*Nocomis asper*) is a threatened species in Kansas that occurs in the Spring River in Cherokee County, Kansas and limited, adjacent areas in both Missouri and Oklahoma. Kai Baucom discovered that this species is closely linked with the presence of the ringed crayfish (*Faxonius neglectus*), which is its primary food item. The crayfish is more abundant in smaller sections of the river.

Former KU PhD graduate, Clare Wuellner, who lives in Austin, Texas gave a dynamic presentation on using art as a means of raising the public's acceptance of science. Claire, who is a consummate artist as well as a scientist, does extensive workshops where participants from ages 3 to 94 learn to draw a scientifically accurate monarch butterfly by following the steps outlined in her illustrated guide, "How to Draw a Monarch Butterfly."

After lunch Don Huggins, who is a former senior scientist of the Kansas Biological Survey, gave a Clint Eastward-like presentation entitled: "Lo bueno, lo malo y lo personal." We must save our planet. The time for talk and debate is over. He referred to a historic paper by William Hornaday that listed species of birds and mammals in each state that had become extinct one hundred years ago. These include: the Carolina parakeet, deer, wild turkey, and many others. Turning toward invertebrates, the advent of industrial agriculture has hastened the glaring depletion of insects in more recent years. By the 1970s, new pesticides were being invented at such a fast pace that their effects could not be adequately tested. Only in the 1990s, were studies done that involved the effects of pesticides on entire ecosystems. However, the political climate has led to a decrease in such studies that are sorely needed to curb the rapid elimination of our invertebrate biota. Don then proceeded to recount his own career as a biologist. He and his wife now live on a mountainside in Costa Rica. It was a great joy to see him again.

Once again, the annual meeting of the KAS was thoroughly enjoyable and was a great success.

Summer Rains Bring Bounty of Edible Mushrooms

by Hank Guarisco, editor



The rainy summer weather in Douglas County encouraged mushrooms to fill the woods. Here is an image of a Chanterelle mushroom found in Douglas County. I hope other KAS members had similar luck.

New Proposals for Nuclear Power in Kansas: Understanding and Assessing Costs and Benefits

Hank Guarisco, editor

Introduction

At a recent meeting of the local Sierra Club, Amir Bahadori, a professor of nuclear engineering, gave us an informative presentation concerning recent advances in nuclear power generation and the possibility of bringing this new technology to Kansas. Recent federal legislation encouraged its expansion, and two companies have expressed interest in Kansas as a destination for new nuclear power generation.

Despite the recent disasters of Chernoble and Fukushima Diaichi, the political climate of the United States has allowed the embrace of nuclear power as one viable way to reduce carbon emissions. Former president Joe Biden instituted The Advance Act in 2024, which proposed to update the Nuclear Regulatory Commission's mission, streamline nuclear regulations to increase the speed and predictability of nuclear plant approval, and accommodate advanced reactors that employ new technology which is intended to improve safety by reducing human error. The Act also provides funding for "first of a kind build," and works toward establishing a domestic nuclear fuel supply chain and uranium enrichment. In May 2025, president Donald Trump issued executive orders to advance nuclear reactor technology, reform the Nuclear regulatory Commission, and reconstuct the nuclear industrial base.

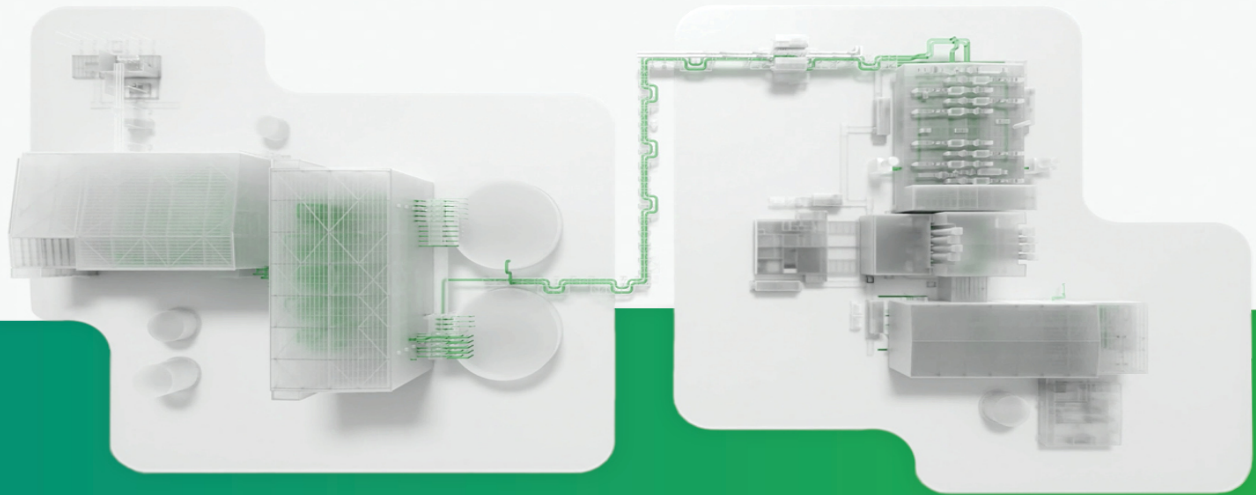
As Kansas citizens and scientists, we should become thoroughly informed about these new proposals, and have enough information to make informed decisions for the future of energy generation within our state. Hopefully, this essay will generate interest in this timely topic so our members can seek out more information.

New Nuclear Technologies

Two types of smaller nuclear reactors have been proposed to meet future energy needs in Kansas: "TerraPower's Natrium" (345MWe) sodium-cooled fast reactor and A Deep Fission Gravity Reactor (15MWe). The latter is an experimental reactor being constructed by a Berkeley startup company at the Army Ammunition Plant in Parsons, Kansas; while DeSoto, Jackson County, and Coffee County have all expressed interest in the Natrium reactor. There currently is a "memorandum of understanding" among the Kansas Economic Development Agency, Evergy, and TerraPower to bring this technology to Kansas. TerraPower is constructing its first natrium reactor, which should be completed in 2028 in Kemmerer, Wyoming. The Deep Fission Gravity reactor in Parsons is the first of its kind anywhere.

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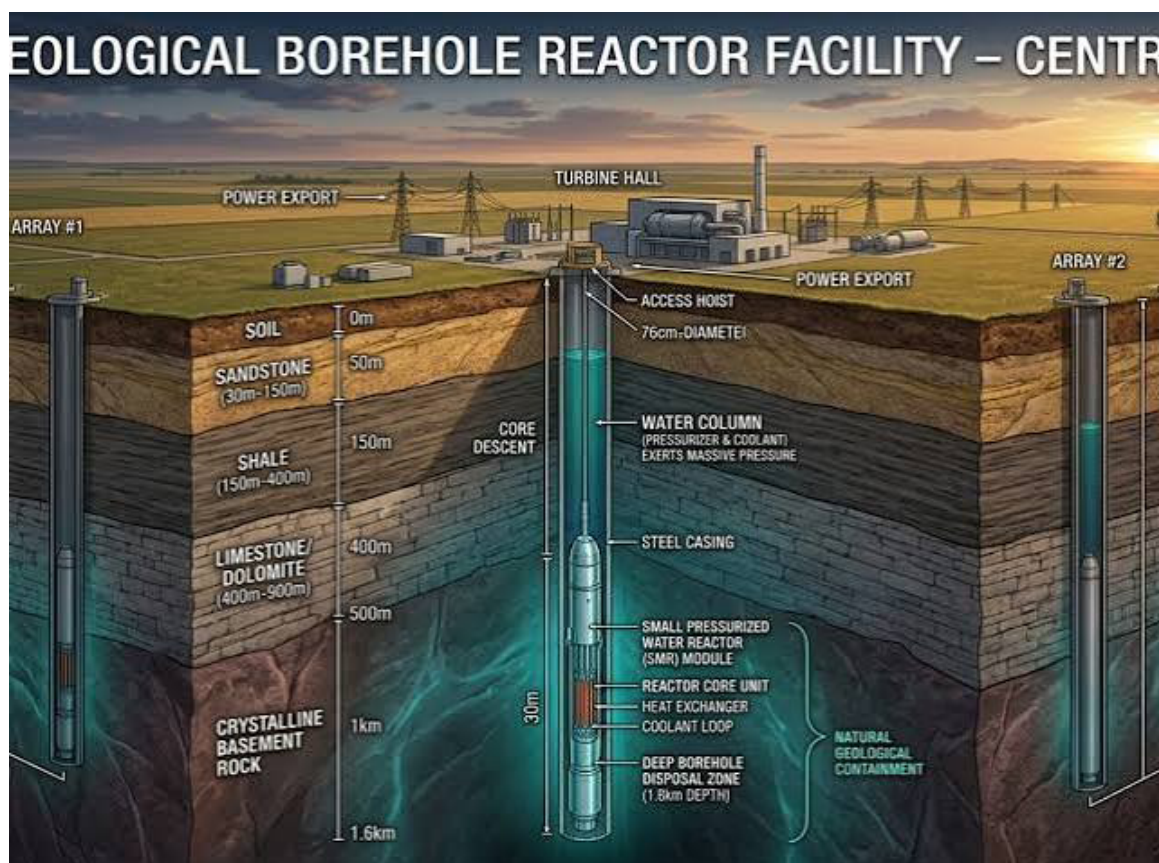
Unlike a conventional nuclear reactor that uses pressurized water to achieve the extreme temperatures needed, molten sodium stores more heat and it does not need to be pressurized. Instead of using water as a heat exchanger, this reactor uses a beryllium salt that can also function as a thermal battery. When excess heat is not needed, it is stored in the vat of Beryllium salt.

Several advantages of this system include: 1) it is “fast” reactor since, unlike water, the liquid sodium doesn’t slow down the fast neutrons produced by the fission process. This translates into more efficient use of nuclear fuel.

2) The speed of the nuclear reaction doesn’t need to be moderated because all of the energy is taken up by the beryllium salt heat exchanger. Therefore, the reactor core can be smaller with this design. 3) Since the molten sodium naturally circulates throughout the core, no valves or pumps are needed. This is important since faulty valves and pumps are the second most likely cause of failure in nuclear power plants. The greatest hazard by two orders of magnitude is human error.

Disadvantages include: 1) liquid sodium is extremely reactive in air and water. It spontaneously ignites in air and explodes in water. Therefore, before installing the sodium, the pipes must be purged of all air and water vapor. This also makes maintenance difficult because the system must be drained, flushed, and operated in an oxygen-free atmosphere. 2) Because of the very high concentration of neutrons in the reactor, this system can be tricky to manage. 3) Unlike conventional pressurized water reactors which use 3%-5% uranium, the sodium reactor requires uranium enriched to 20%. The only commercial source for this fuel has been Russia, but this is no longer an option because of the United States’ support for Ukraine. Therefore, TerraPower is partnering with ASP Isotopes to build a fuel fabrication plant in South Africa that would supply the needed fuel. 4) The more highly enriched uranium fuel also poses a greater terrorism threat. However, the Department of Energy (DOE) has recently awarded four contracts to produce the enriched fuel in the United States.

To bring this technology to Kansas, several conditions are needed: community support, favorable physical characteristics of the site, ability of the site to get Nuclear Regulatory Commission (NRC) licensing, and the ability of access existing infrastructure.



Gravity Reactor

This type of reactor involves drilling a 30-inch bore hole one mile underground into the crystalline basement rock. A small pressurized water reactor module and a heat exchanger sit at the bottom of this hole. The depth provides 160 atmospheres of pressure and the natural geology provides the shielding and containment. Heat exchangers used in geothermal installations transfer the energy from the reactor to the turbine generator at the surface. Since no containment vessel is required, the costs of construction should be reduced by 80%. An array of 100 of these 15 MWe microreactors is planned for the Parson's site. The energy would be used to power a data center.

However, site characteristics, especially geological strata must be ideal for it to work safely. Passive circulation of air and water are touted to be inherently safe, but the Union of Concerned Scientists believe that there should still be a back-up system in case of accidents.

Uranium Mining

Health hazards for uranium miners include lung cancer and a significant increase in death rates. Both have been documented for many years. Although increased ventilation would improve conditions, most mines do not employ enough equipment to make a significant difference. Fine uranium dust as well as high concentrations of radon and radon daughters emit alpha particles that adversely impact the lining of the lungs.

Uranium tailings piles are also sources of unwanted radiation. In the 1970s, one potential solution was to include tailings in making concrete for building construction in Colorado. However, the excess radiation levels inside these buildings made this solution untenable.

Long-term Storage of High-level Radioactive Waste

The spent nuclear waste from power plants operating in the United States is currently stored on-site, because there is no permanent storage area. In the 1980s, initial studies were conducted to assess the feasibility of storing the waste in the Kansas salt mines. However, there was a public outcry against this idea, predominantly because there had been unlogged exploratory oil wells in the 1930s that perforated the rock strata so that waste material could potentially come in contact with the ground water over time.

Another possibility for secure, safe storage was the military facility at Yucca Mountain, about 80 miles away from Las Vegas. However, one prominent state senator from Nevada objected, so there was no federal funding to proceed with this option, which has been characterized as a "Zombie Project." There was also considerable public opposition at the local level concerning the transportation of high level radioactive waste through their communities by truck or rail.

The funding for a long-term high level radioactive waste storage site is to come from industry and the federal government. Although the federal government has not made its contribution, utility companies operating nuclear power plants have been charging customers \$.001 per kilowatt-hr since 1982. The money, which amounts to approximately 56 billion dollars, sits in the federal government's Nuclear Waste Fund.

Over 90,000 metric tons of high-level nuclear waste is temporarily housed at 70 reactor sites around the country. Because of the excessive heat produced, this waste is first placed in pools of water for several years until it cools enough to be transferred to stainless steel containers encased in concrete. Due to the long half-life of many of these fission products, the waste must be securely and safely stored for hundreds of years or longer.

Who Will Pay for Nuclear Energy

There would be no nuclear industry without government subsidies. Of course, both the fossil fuel industry and renewable energy projects also receive federal funding.

Besides subsidizing the research, development and construction of nuclear power plants, the federal government is the “insurer of last resort” in case of a catastrophic nuclear accident. The liability of an energy company is capped at 10 billion dollars. Any amount above that would be paid by the federal government, ie. taxpayers.

Although the industry cap seems fairly substantial, the estimated cost of the Fukushima disaster was projected to exceed 250 billion dollars.

Risks to Human Health and the Environment

Both large and small releases of radioactive materials constitute some level of risk to both human health and the environment. In a catastrophic accident, there would be an untold number of immediate deaths, but the long term effects would be of greater consequence. Following acute exposure, there would be at least an order of magnitude increase in the number of cancer deaths and genetic anomalies.

Several fission products that are particularly concerning include: Strontium-90 which accumulates in bone tissue, iodine-131 which is concentrated in the thyroid gland, and Cesium-137, which mimics potassium in the body.

Very high levels of heavy metals are often accumulated in aquatic systems. The average concentration factor of clams and mussels for zinc-65 is 33,000. Therefore, minute quantities of these metals in water are concentrated by these and other aquatic organisms downstream from radioactive releases.

Conclusions

Although these new nuclear technologies have addressed two of the main causes of nuclear accidents: human error and moveable parts such as valves and pumps, they are still unproven technologies with many potential problems. The use of molten sodium requires careful handling so that it is never exposed to air or water, making maintenance particularly challenging. The ultimate disposal of highly toxic radioactive waste has still not been decided. So, can the proposed advanced nuclear technologies be considered a “green” alternative to fossil fuels, or will this movement create a new set of potential health and environmental problems?

Kansans must decide where to invest their resources to power the future. An impartial state energy office is needed to weigh the alternatives of renewables (solar, wind, geothermal), fossil fuels, and nuclear fission. Since we currently don't have such an entity, Kansas citizens should become better informed to be able to make good choices for our energy future.

Note: The sources of information for this article include various text books on radiation biophysics, on-line sources for the new technology, and publications of the Union of Concerned Scientists.

Ode to Sunlight

Perpetually shining, our orb so bright
Each day emerging from the depth of night,
Extends her rosy fingers across the sky at dawn,
Sallies forth, quixotically slaying shadows through the morn,
Then casts her gaze upon noontimes' placid waters.

Delighted by her clear reflection,
She lingers, warming hearts of those below,
Who proceed once again,
from the kirk, through the dells,
Their doubts and fears dispelled.

The warm breeze of her own creation
Beckons her to languidly recline.
She sinks slowly into afternoon's sublime
Whisperings of far away lands and times,
By the river Lethe, and Isles of Langerhans.

Her gaze is long, but the day is fleeting.
Like nimble steps of hooves beating
Across the savannas and steppes below.
Her hair glows in streaks of red and gold and purple
As she kisses the horizon, and melts into the night.

Hank Guarisco December 7, 2025



KANSAS ACADEMY OF SCIENCE

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