Concern over leaks at radwaste site

An evaluating committee last week recommended major changes in the design and operation of the nation's first underground nuclear waste repository, located near Carlsbad, N.M. The recommendations follow recent reports that water is leaking into the facility, which is scheduled to begin accepting waste in October of this year. But engineers working for the Department of Energy (DOE), which operates the repository, contend that the water will not create significant problems.

The repository, called the Waste Isolation Pilot Program (WIPP), is located in salt deposits 2,150 feet below ground. It will house Defense Department waste that is contaminated with plutonium, an element that remains radioactive for thousands of years. DOE originally selected this site because scientists believed the salt deposits would keep the waste dry. However, tests in the last three years have indicated that the salt contains more moisture than had originally been assumed, and that the moisture is leaking into the repository.

"It is possible that because of the problem, the WIPP site may not meet EPA [Environmental Protection Agency] standards," says Lokesh Chaturvedi, a member of the Environmental Evaluation Group, a committee of scientists that oversees the WIPP project on behalf of the state of New Mexico. The group presented information on the water problem to a state task force last week.

"The problem should be resolved before they put a large quantity of waste in," Chaturvedi told SCIENCE NEWS. "We are not saying that the site should be abandoned. We are saying that some engineering changes can take care of the problem."

But scientists from the federal government's Sandia National Laboratory in Albuquerque, who have studied the hydrology of the WIPP site for the DOE, told the task force that the amount of water entering the repository was insignificant. "We think there's no problem at all. It doesn't require us to change our plans as far as when we proceed or how we proceed," says Wendell Weart, chief of Sandia's waste management technology department.

The repository is designed so that the walls of salt will slowly collapse, enveloping the canisters of waste and sealing them in a watertight salt capsule. But an independent group of University of New Mexico scientists testified last month before a congressional subcommittee that the brine leaking into the repository would corrode the waste canisters and turn the solid waste into a liquid slurry before the rooms have collapsed.

Future generations searching for oil, gas or mineral deposits may unwittingly drill into the repository. And if they hit a slurry, pressurized by the collapsing room, this radioactive waste would gush to the surface.

The current EPA standards require DOE to consider such a possibility. If the waste becomes liquefied, it is likely the repository will violate the standards, says Chaturvedi.

The repository will contain 56 rooms, each measuring 100 meters long, 10 m wide and 4 m high. At the task force meeting, Sandia's Weart presented estimates, based on computer models, that the amount of water entering each room in the next 100 years would be less than 43 cubic meters. According to Weart, these estimates represent the most complete and accurate data on the inflow rate.

"We believe that we could accommodate something like five times as much water as the maximum that we predict and the waste would still be solid," says Weart. "We don't think there's any real concern or potential for a slurry to exist in those rooms."

Chaturvedi and the University of New Mexico scientists question the accuracy of Sandia's numbers. Both groups have calculated that water is leaking into the repository at rates much higher than 43 cubic meters per 100 years. They also believe that calculations of risk should consider time well beyond the 100-year mark.

Legislation now before Congress would allow the DOE to fill 15 percent of the WIPP repository before the department demonstrates that the facility will meet EPA safety standards. DOE is scheduled to complete by 1992 a performance assessment study that will indicate whether the repository can comply with the standards.

Chaturvedi's Environmental Evaluation Group recommends that DOE alter its plans because of the water leakage. If inflow rates are high enough, DOE may have to reprocess the waste before placing it in the repository. Therefore, he says, "they should only put that amount of waste in that is necessary for *genuine* experiments."

But Konrad Krauskopf of Stanford University, who heads a National Academy of Sciences committee that periodically reviews the WIPP site, contends that the water inflow is "nothing new."

"Personally, as an individual," he says, "I think it would be sensible at this point to start putting in waste according to schedule and see what happens. Everybody expects that the waste will be retrievable for the first few years. That has been part of the plan for years and years.

"The expense of putting it in and taking it out isn't prohibitive. I think we'd learn a good deal if we started putting it in. Chances are very good that it will just stay there." — *R. Monastersky*

Body shape: In the eye of the receptor?

The shape of our bodies — whether bottom-heavy or thick-in-the-middle — may be related to hormone-binding structures on the surface of fat cells. As a result, while we may be able to shrink in size, changing our *proportions* through dieting may be nearly impossible, says Rudolph L. Leibel of Rockefeller University in New York City.

At the American Heart Association's 15th Science Writers Forum, held this week in New Orleans, Leibel discussed recent data from his group showing that responses by certain hormone receptors bound on fat cells (adipocytes) are influenced by a person's gender, pregnancy and age. An understanding of how these receptors, called alpha$_2$ and beta$_1$, are stimulated could help explain the relationship between obesity and conditions like heart disease, and thus could offer ways to reduce fat-related health risks, says Leibel.

The notion of who's fat and who's not can be "a nasty business," according to Leibel, who says the fat cell should be regarded "with the same sort of respect as the brain cell or the endothelial cell [lining blood vessels]." Fat, he says, "is not simply something put there to torture us, or to make money for the diet industry." Instead, it serves as an efficient way to store energy. Although our 30 billion fat cells account for only 0.1 percent of the body's total cell population, they contain nearly all the readily available energy, Leibel notes.

But too much fat can be dangerous, causing increased risk of heart disease, diabetes and stroke. Studies have shown that a male-pattern weight gain — concentrated primarily in the abdomen area — is associated with more heart disease than is a female-type weight gain concentrated in the thighs and buttocks (SN: 7/16/83, p.44). The exact reasons for this are unclear, but the observations have focused attention on patterns of fat deposition.

At Rockefeller, scientists are asking how the shape of the body is controlled, with the hope of reducing specific fat deposits someday. Along with genetics and the number of fat cells, adipocyte size is considered important in determining the amount of body fat. The New York group's research suggests that cell size is regulated by receptors, found on all fat cells, for the hormones norepinephrine and epinephrine. But while these so-called alpha$_2$ and beta$_1$ receptors bind both hormones, the relative numbers of each type of receptor activated during binding apparently affect fat distribution, says Leibel.

For example, when the beta$_1$ receptor is the one predominantly stimulated, there

is an increase in intracellular production of lipase, an enzyme that breaks down fat. When the $alpha_2$ receptor is stimulated, however, this fat destruction is inhibited and fat remains inside, making the fat cell even fatter.

Determining how these cell receptors relate to body shape and subsequent health risks is a matter of comparing apples and pears, since most overweight males have apple-like shapes and the majority of overweight females are pear-shaped. In a recently completed study of fat cells taken from various body sites, Leibel and his co-workers found that men and women essentially have equivalent $beta_1$ activity in the buttocks. Also, both sexes have higher $alpha_2$ activity in the buttocks than in the abdominal area – meaning, as Leibel explains, that both sexes are likely "to hang on to fat in their [buttocks]." But he says gender makes a difference when it comes to potbellies: Men tend to have more $alpha_2$ activity, and therefore fat retention, in the abdomen than do women, according to the study.

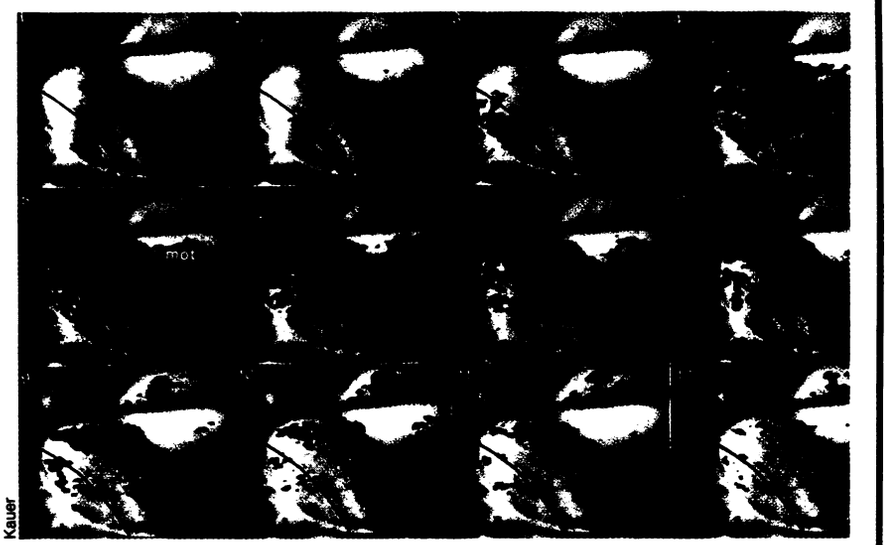
The researchers also observed that fat tissue serves as an energy depot during breast-feeding. A woman's receptor response changes during lactation, with the $alpha_2$ activity in the hips and thighs temporarily dropping in a form of spot reducing, making fat available for use elsewhere in the body. If scientists were able to determine how these localized changes take place, says Leibel, "we would clearly have a very powerful tool for the clinical management of obesity and related problems."

If there were a way to lose weight just from the abdomen, the amount of weight loss needed to gain health benefits would not have to be so great, says Leibel. But how such selective slimming will come about is a mystery. Designing a drug specific enough to properly alter receptor activity will be a difficult task, he says. He also notes that liposuction, a procedure used to remove fat from under the skin surface, cannot reduce the deeper, more important fat deposits.

And results from his current research sound depressing for those fighting a bulge here and there. In a preliminary study of 18 women undergoing weight loss through dieting, he discovered that body proportions stay constant, while the $alpha_2$ and $beta_1$ receptors "go haywire." In measuring the waist- to hip-size ratio, Leibel and his colleagues found no change in body proportion when comparing the pre-diet figure to that after a 10 percent weight loss. What they did see were large changes in the performance of both receptors in the abdominal and buttock region. Leibel emphasizes that this research is preliminary and the scientists are not yet able to explain why these apparent receptor changes do not seem to affect body shape.

– D.D. Edwards

Video reveals brain activity patterns



A new video technique is allowing scientists to visualize working brain circuits with unprecedented detail in living salamanders. The technique is helping to show how the brain "maps" sensations, and may someday reveal the neural basis of learning, memory and thought, researchers say.

As reported in the Jan. 14 NATURE, *John Kauer of the New England Medical Center in Boston applied a voltage-sensitive dye to exposed salamander brains and filmed the dye as it fluoresced in response to electrical activity of individual neurons. In this series of computer-enhanced video frames taken at 30-millisecond intervals, the spread of nerve firing within one plane of the brain can be observed following an initial electrical stimulation of the olfactory nerve. Green represents electrical activity more than 1 standard deviation (SD) above baseline; red represents activity 2 SDs above baseline. Superimposed black lines show divisions between different layers of the brain. By focusing at different depths, scientists can obtain a three-dimensional image of neural activity for various sorts of stimulation.*

"We don't really know how odors are encoded by a neural system," Kauer says. "But many, many cells participate in the response to each odor, and what we presently think is that it's the pattern of activity distributed across these many cells that encodes the odor. You can think of it as an ensemble or a hologram of some kind. What we've developed is a way to record this ensemble activity." He says the new imaging system may help to validate some of the computer models that attempt to simulate neural networks (SN: 1/9/88, p.27).

U.S., Soviets sign scientific accord

The recent thaw in U.S.-Soviet relations has spilled over into science. On Jan. 12 in Moscow, the scientific academies of the two countries signed a five-year cooperative agreement that invigorates and broadens their formal scientific relations, which had begun to erode this decade largely because of the U.S. response to Soviet treatment of dissident scientists.

The U.S. National Academy of Sciences (NAS) and the Academy of Sciences of the USSR have engaged in scientific exchanges and other joint efforts since 1959. Prompted in part by the Soviets' internal exile of physicist Andrei Sakharov, the NAS in 1980 suspended all bilateral workshops. These were not reinstated until 1986, when a formal agreement was signed following the 1985 Geneva summit. The new Agreement on Scientific Cooperation builds on this previous two-year program.

The recent accord expands programs for the exchanges of scientists, resumes the convening of joint workshops and extends various cooperative research projects. According to a statement released by the U.S. delegation to Moscow, some of the scientific workshops planned for the next two years will focus on earthquake prediction, the development of new vaccines (including those for AIDS), biotechnology and its agricultural applications, astrophysics and planetary sciences.

Cooperative research that will be continued or initiated includes studies on condensed matter theory, the evolution of geological processes, abating erosion of the global ecology, energy conservation and nuclear reactor safety.

– S. Weisburd

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