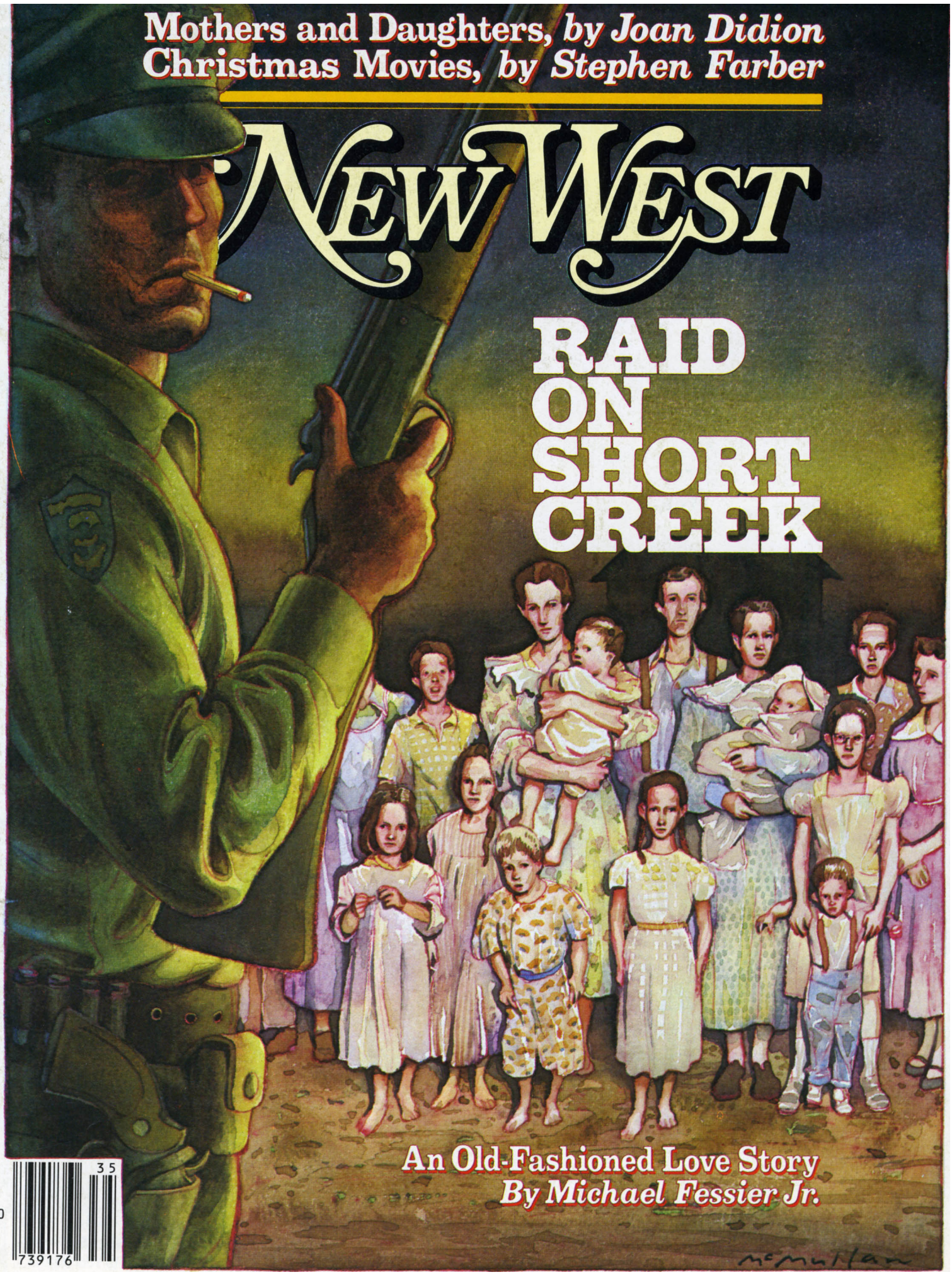
Mothers and Daughters, *by Joan Didion*
Christmas Movies, *by Stephen Farber*

NEW WEST

RAID ON SHORT CREEK



An Old-Fashioned Love Story
By Michael Fessier Jr.

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Radioactivity and

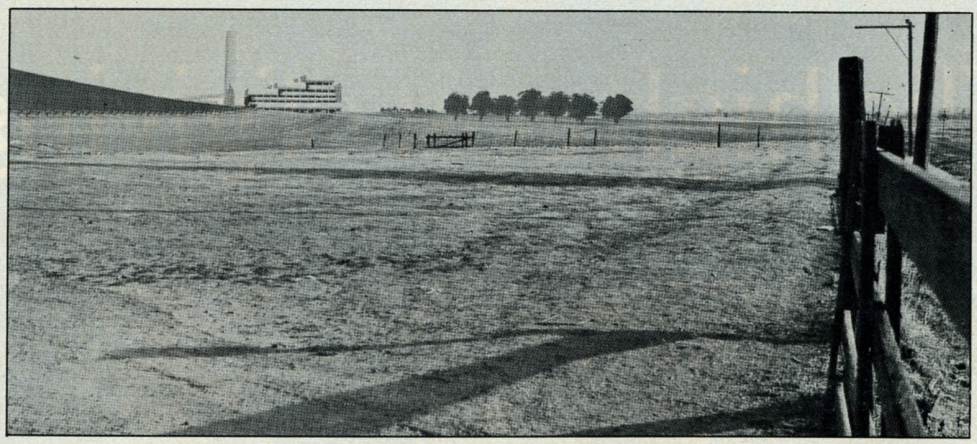
BLACK POWER

COAL. THE MERE WORD evokes pictures of dirty West Virginia towns and grimy Pittsburgh steel mills, skies washed in gritty black tones. Coal means asthma, respiratory problems and black lung disease. But few people think it means radioactivity. Yet there is no disagreement among scientists and government experts that a coal-fired power plant emits radioactivity as a by-product of electricity production. There is only disagreement over how much radioactivity is produced and just how harmful that radioactivity is.

The debate over the degree of radioactivity emitted from coal plants is in many ways indistinguish-

By Lew Perdue

The radiation emitted from a coal plant each year could be four times as great as that produced during Three Mile Island.



Artist's conception of PG&E coal plant to be built in Solano County, 40 miles northeast of San Francisco. Completion date for the 1,600-megawatt plant is set for 1987.

able from the debate currently raging over the safety of nuclear power plants. But there is one important difference: The questions surrounding radiation from coal have not yet made their way out of laboratories, closed-door meetings and studies published in scientific journals. Which means that the public is generally unaware of the problem.

Coal is found in seams in the ground, wedged in layers of rock much the way icing is in a layer cake. It is in these seams that the radiation problem begins. Uranium, thorium, radium and other radioactive elements exist in varying degrees within the seams, and when the coal is mined and then burned, the elements are released into the atmosphere.

Some geological experts say that millions of years ago these radioactive elements were dissolved in groundwater that seeped through layers of coal. As they passed through the coal, they changed in chemical composition and were deposited throughout the seams. Geologists claim the elements are so dispersed throughout the coal that there is no economically feasible way to remove them.

There is a great deal of controversy about the actual uranium content of coal. Even "official" government estimates vary widely. One study made by the U.S. Geological Survey states that the uranium content is somewhere between .005 percent and .02 percent, whereas an Environmental Protection Agency (EPA) study puts it at .001 percent to .1 percent.

But the figures are crucial because they form the basis for calculating the amount of radiation that escapes from a coal-fired power plant. Since no full-scale study has yet been conducted to measure the radiation dosages, researchers use a variety of methods for estimating them. And because these methods use many different uranium concentrations, they result in a variety of opinions about whether coal plants present a health hazard to the public. (Some experts even assert that coal from the western states is higher in uranium than coal from the eastern states, while others say there is no difference.) The conclusions range from "no hazard" to "acute hazard."

The coal usually arrives at the plant by train and is then stored in huge mounds. From the stockpiles, it is fed by conveyor belt into a crusher that grinds it to pebbles. The pebbles are then fed into a pulverizer that reduces them to a black material with the consistency of talcum powder. This black dust is blown by powerful gusts of air into huge furnace-like combustion chambers, where it is burned. The combustion heats water-filled coils, producing the steam that drives the electrical turbines.

All coal contains a certain amount of ash (mineral residue that remains after combustion); some contains as much as 15 percent. A large proportion of the ash falls to the bottom of the combustion chamber and is hauled away after cleanings. But the finer ash particles are carried toward the stacks. On the way, they are filtered out by electrostatic precipitators, which use electrical charges to comb the particles from the hot combustion gases; then "scrubbers" use water and chemicals to further clean the gases and remove the sulfur dioxide. This cleansing process produces a sludge that is sometimes used to make wallboard.

The ash that is collected in the combustion chambers of coal-fired plants is called "bottom ash." That which escapes is called "fly ash." There is no disagreement among scientists that the sludge, the bottom ash and the fly ash are radioactive. Though a plant is required by federal law to remove at least 99 percent of the "particulate" matter from its effluents, enough radioactive material still escapes into the atmosphere to alarm some scientists and government experts. One recent EPA study states that the typical coal-fired electrical plant could produce nearly four times the amount of radiation every year that was released during the Three Mile Island accident.

The United States contains more than 30 percent of all the world's known re-

serves—more than any other country or region. Some experts say the 1.7 trillion tons of American coal could be mined over the next 2,000 years. Today about 45 percent of the electrical power in the United States is derived from coal, and the National Coal Association expects coal use by utilities to increase from 447-million tons in 1976 to about 880 million tons by 1988.

At first glance, the hazards posed by coal-fired power plants seem irrelevant to the state of California. California is one of only five states in the country that does not have a coal-fired power plant. California's strict air pollution laws have been a significant factor in slowing the development of coal power generation. But California is in an extremely vulnerable energy position, depending on oil and natural gas to supply nearly 80 percent of the state's electricity. In fact, Southern California Edison (SCE), according to one of the company's executives, uses more imported oil than any other utility in the United States.

Though California has none of its own coal-fired power plants, it gets about 12 percent of its electricity from coal plants located outside the state, some from as far away as New Mexico. The single largest source is the Mojave Generating Station, located in the southern tip of Nevada about 21 miles from Needles. The 1,580-megawatt power station is owned by several utilities, with SCE own-

Lew Perdue is a free-lance writer with a special interest in biophysics. In 1977, he wrote a newspaper series on the safety of Pennsylvania's nuclear plants, including Three Mile Island.

ing the largest single share at 56 percent.

Now California utilities, caught in the bind between federal policies against new oil-fired plants, restrictions on nuclear plant licenses and the reluctance of other western states to continue to have their environment fouled so that California can have electricity, are turning to coal as a source of electricity. Several recent developments point to this trend:

→ Pacific Gas and Electric (PG&E) plans to build a 1,600-megawatt, coal-fired plant in Solano County, about 40 miles northeast of San Francisco; Southern California Edison wants to build a 1,500-megawatt plant but has not yet received approval for a site; the Department of Water Resources (DWR) has plans for a 1,000-megawatt coal plant to power its waterworks; and San Diego Gas and Electric officials say that coal is "definitely in our future."

→ The utility companies' plans are supported by state government officials, from Governor Jerry Brown on down to energy commission chairman Richard Maullin, Tom Austin of the Air Resources Board, and DWR director Ron Robie.

→ A study by the California Energy Commission called "Looking Ahead" predicted that by 1991 California could be receiving 29 percent of all its energy supplies from coal.

→ In May, 1978, more than 350 people from universities, utility and coal companies, California state government and governments of half a dozen western states attended the Conference on Coal Use for California, sponsored by the Jet Propulsion Laboratory, the U.S. Department of Energy and the state Energy Commission.

Although a few dissident conferees criticized the meeting for failing to address the question of whether coal was the best answer for the state's energy needs, the conference proceeded and ended with an almost giddy optimism. Coal, most participants agreed, was the answer, and the primary problem was that the plants couldn't be built fast enough.

Only one of twelve major sessions held at the Pasadena conference was de-voted to the environmental effects of coal-fired power plants. The question of radioactivity was raised only briefly by the participants at the conference. The attitude is symptomatic of the power utility industry's lack of knowledge or concern about the possible radiation hazards of coal-fired plants.

The fact is that the state of California—like the rest of the nation—is stumbling headlong into a crash program to build electrical-generating capacity based on coal, without knowing even the basics about the potentially harmful effects of the pollution from such plants. An Atomic Energy Commission study done in 1976 by James E. Martin—frequently cited by those who dismiss the notion that the radiation is significant—concludes that there is no danger. But that conclusion is based on coal-uranium concentrations of .00004 percent—far below most official estimates.

The AEC–Martin method of guessing concludes that a person might be exposed to .1 millirem (mrem) of radiation per year. But the EPA, which claimed that there is a concentration of .001 percent to .1 percent of uranium in coal, states that the dosage emitted from a 1,000-megawatt coal-fired station could be as high as 380 mrem. At 380 mrem, a coal plant would be giving off nearly four times the radiation released during the Three Mile Island accident. (A joint Nuclear Regulatory Commission; EPA; and Department of Health, Education and Welfare committee estimated that the Three Mile Island accident exposed people to 100 mrem or less.) Three hundred eighty mrem is about 76 times the maximum allowable limit for a nuclear power plant, which, according to regulations just put into effect, can emit a maximum of five mrem (of airborne effluents) per year to people off the site. On the low side—based on .001 percent uranium—the EPA study estimates that the radiation dosage would be 38 mrem per year, about 7.6 times greater than the limit established for nuclear plants. (The average chest x-ray exposes a person to about fifteen mrem.)

Such comparisons are, however, frequently misleading. Most radiation biologists agree that there is no "threshold" below which radiation is not harmful. They agree that radiation doses are cumulative. It doesn't matter whether a person receives 5,000 mrem of radiation all at once, or in multiple small doses of 50 or 100 mrem. It all adds up.

There are no state or federal regulations governing radioactive emissions from coal-fired power plants, though California has enacted strict limitations on nitrogen and sulfur oxides and on particulates.

"No one has looked at the problem carefully enough," says Gerald Fisher, a researcher at the Laboratory for Energy-Related Health Research at the University of California's Davis campus. "We don't know what dosages people are being exposed to."

"All the work that has been done so far in trying to get a handle on the dosages from coal-fired power plants is just an elaborate guess," said an EPA researcher who asked that his name not be used. "The research has not been funded. My guess is that people [in the industry] just really don't want to know. It's like 'maybe if we don't find out, the problem will go away.' "

And one of the reasons for the wide variations among all of the "elaborate guesses" is that the guessers are guessing in different ways. Researchers will base their studies on different estimates of uranium concentrations, or cite various methods of pollution control. Some studies—most notably those that find the radiation levels insignificant—tend to overlook certain radioactive elements actually present in the coal-burning process.

The result is a full spectrum of conclusions, the Martin–AEC study on one end and the EPA study on the other. In the middle are estimates made by researchers at the Department of Energy, and another made by a group at the Oak Ridge National Laboratory in Tennessee. The only two studies that even come close to agreeing are those done by the EPA and Oak Ridge. And those two agree only if the initial concentrations of radioactive materials in coal are figured at the same level.

The Oak Ridge study used a lower uranium concentration than did the EPA study, but if the concentration is made uniform, the Oak Ridge study indicates that an estimated 315 mrem per year is emitted from the coal plant, compared to

Most radiation biologists agree that there is no threshold below which radiation is not harmful. The dosages are all cumulative.

380 mrem in the EPA study. But comparing one study to another is like dividing plums by kumquats: It can't be done with any degree of reliability, say scientists. One man's guess is as good as another's.

If that is indeed the state of the research, the question becomes "Why?" Why are there no valid scientific data on a potential radioactive hazard from coal-fired electrical generating plants?

Well, it's political," says Richard Ragaini, a Lawrence Livermore scientist, well known and respected in the coal research field. "There's not enough money to fund everything that needs to be studied, so it's easier to fund bits and pieces of research here and there. When it comes right down to it, it is often the people with the best political connections who are going to get the research money."

"It *is* a political problem," said a university-based coal researcher, "both in allocating research money and in establishing acceptable levels of pollutants. The standards that are set are set not according to what amounts will do biological damage, but according to what levels can be detected."

Some researchers in the coal combustion field went so far as to charge the Department of Energy (DOE) with applying political pressure to its researchers and denying funding to those who had proposed that measurements of radiation could be taken at coal plants.

"Look, don't quote me by name because I've got a DOE grant," one university scientist said, "but I think the excuse of insufficient funds to do research on the radiation hazard is just their way of sticking their heads in the sand. They just don't want to know, and they're not going to fund research to answer a question they think is better left unsaid."

Another university scientist added: "I try to stay away from DOE grants. All my funding comes from the National Science Foundation, and *they* don't try to pressure me. But don't quote me—I might have to go to them one day."

Charges that the DOE has used political pressure to influence research were called "bullshit" by Harold Beck, a scientist at the DOE's environmental measurements laboratory in New York City.

"That's ridiculous," Beck said. "It's silly. There is just too little money and too many projects to fund everything. We have to look at the problems and decide in good faith which problems are the worst. My opinion is that the DOE has no vested interest."

Beck is the coauthor of the DOE's showcase paper dealing with the question of radiation from coal-fired power plants. His study concluded that "the radiological hazards are only a small and probably relatively insignificant fraction of the total environmental, health and safety problems associated with the utilization of coal as an energy source."

However, his paper received harsh criticism from three university researchers whose work in coal combustion is well known. None of the three professors would speak for attribution. They all acknowledged that they feared losing present or future DOE funding for their research projects. One scientist was visibly agitated when he was questioned about the Beck paper.

"His work is incomplete and largely speculative," the man said. "He fails to measure all of the radionucleides present—this is just a guess."

"This is the worst sort of intellectual prostitution . . . He's distorting figures," another expert said. "Look at these figures; he's assuming that uranium is enriched by a factor of two. Hell, he's got the same report I have [the Ragaini report from the Lawrence Livermore Labs] that shows the figure is closer to three. No wonder he's not using footnotes. No wonder he uses terms like 'modest enrichment' or 'no significant enrichment' instead of citing the actual figures. It looks like he's being imprecise."

The Ragaini study the scientist referred to reported on a little-understood phenomenon in which some elements in coal are discharged from the coal plant's stacks in a higher concentration in the fly ash particles than is found in unburned coal. Ragaini's study is generally acknowledged as the most accurate piece of research on this subject.

When Beck did his DOE report, he rounded Ragaini's numbers down in every case, and he often used descriptive phrases in place of figures.

"These figures are important—they're very important because they show him in the act of trying to bias a conclusion," the scientist concluded. "No wonder DOE won't fund the right type of research. They're afraid of what they might find. So they use this piece of pseudoscientific stuff to decide this isn't an issue that should be examined."

"If they don't agree with my facts and papers then they can write their own," Beck responded. "This [a bias to support DOE policy] wasn't the paper's purpose at all. The data I came up with was the largest body of information I could get at that time. My paper is a scientific paper and it is the opinion of scientists."

Ragaini, contacted at the Lawrence Livermore Labs, said he had not heard of Beck or his paper, and he declined to comment on the possible distortion of the data in Beck's paper. But a Caltech researcher was more direct:

"If you look back into the history of this whole radioactivity in coal phenomenon, you find that the first work was done by the Atomic Energy Commission. These people were trying to prove that coal was bad and nuclear energy was good. But now here's the same thing on the other side," the Caltech scientist continued. "The DOE has decided that we must go coal in a big way, so they've pulled out the stops to prove that coal is good. The truth probably lies somewhere in between."

Scientists are sure of one thing: During the combustion process, fly ash changes in chemical and physical composition. It is transformed from small, irregular motes of dust to grotesque glassy spheres of varying sizes. Richard Ragaini at Lawrence Livermore, Gerald Fisher at UC Davis, and Rick Flagan at Caltech probably know more about the particles emitted from coal power plants than any other people in the world. What they've discovered is startling.

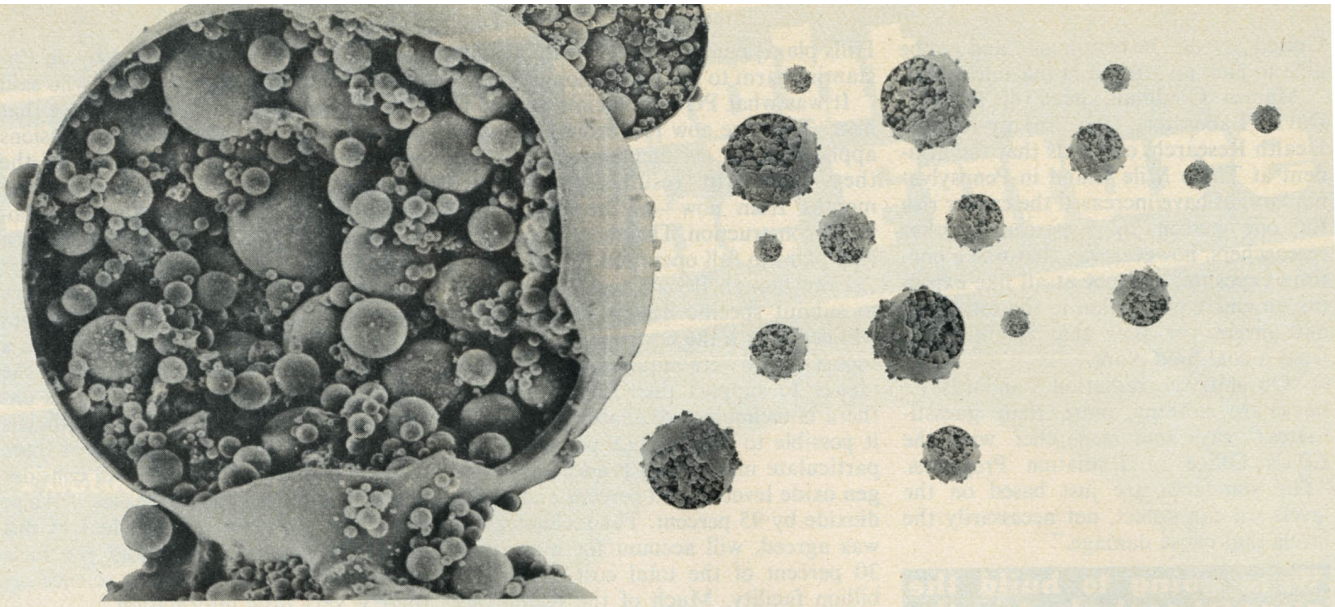
→ As the Ragaini paper showed, some of the most harmful trace elements are "enriched" during the combustion process. Particles that are the most enriched tend to be in the size range of one-tenth to one micron. (A micron is one-millionth of a meter.)

→ Particles in this size range seem to slip through the scrubbers and precipitators in greater numbers than particles of other sizes. They are also the most likely to be deposited in a person's lungs if breathed in, and are the most likely to be carried great distances from the plant.

Scientists know that there is 5 times more lead in fly ash than in coal, 2.8 times more uranium, 1.9 times more radium and 1.2 times more thorium. But they don't know what effect fly ash will have on people. Many of the "head in the sand" proponents of coal power assert that the pollution control devices currently installed on coal plants will take care of the radioactive pollution.

"There is no danger as long as the plants are constructed in accordance with federal regulations," says DOE's Beck.

His words were echoed by officials at Southern California Edison and Pacific Gas and Electric, at the California Energy Commission and the Air Resources Board and the Department of Water Resources. But few of the studies upon which these officials base their conclusions take into account particles that can pass through the antipollution devices, and none of them takes the question of toxic gases into consideration. Beck's study, for example, did not consider the quantities of radioactive radon gas (an odorless, colorless gas formed by the disintegration of radium, one of the elements in coal) that will be virtually unaffected by any of the pollution control devices. None of the studies considered toxic metals with low boiling points that would



Electron-microscope photograph of fly ash particles emitted from coal-fired power plants. Like snowflakes, their shapes and patterns vary.

escape as gases before condensing on fly ash particles once they were discharged into the atmosphere. And none of the studies acknowledged a Federal Power Commission survey that showed that the national average for particulate emission at coal plants was closer to 8 percent—rather than the 1 percent allowed under federal regulations—due to faulty or inefficient pollution control devices.

The potential health hazards from coal-fired power plants don't stop at the smokestack. As much as 78 million metric tons of bottom and fly ash were produced by coal plants from 1970 to 1972, and some 2.5 million tons of scrubber sludge were produced in 1977 alone. This material is primarily disposed of in landfills, although about 11 percent of the bottom ash is sold for use in cinderblocks, concrete manufacturing and roadbed materials. The scrubber sludge, which is relatively high-grade gypsum, is sometimes used in the manufacture of wallboard.

Those recycling schemes may sound good until you realize that the stuff is radioactive. Even Harold Beck, with his cautious estimates, says that the hazards from piles of bottom ash could be as great as those from the uranium mill tailings that caused so much concern in Grand Junction, Colorado, a few years ago.

The culprit, for the most part, is radon gas. Beck's paper estimates that some cement used in the United States may contain as much as 30 percent fly ash. He says there is "the possibility of increased radiation exposures to people occupying structures built with ash containing [radioactive] materials. . . ."

The problem of radioactive wastes from coal-fired plants continues, though, beyond its use in building materials. Most bottom ash is simply buried in landfill. Scientists speculate that radioactive elements, and other harmful materials, may be leached out of the landfill and may then contaminate water supplies.

There are two types of health problems caused by exposure to radiation: acute radiation sickness and long-term problems like cancer and birth defects. Acute radiation sickness is caused by exposure to high levels of radiation. The sickness—characterized by nausea, loss of hair and bleeding—is the type suffered by victims of nuclear blasts or accidents. Long-term effects may be experienced by people who survive acute radiation sickness, or by people who receive small doses of low-level radiation. And low-level radiation is all around us: in dental and medical x rays, in radioisotopes used in medical treatments, in certain types of building materials, and in the effluents of nuclear and coal-fired electrical power plants. Low-level radiation is suspected of damaging the genetic structure of cells, which might result in cancer or in mutations and birth defects.

Many proponents of coal power assert that "the [low-level] radiation is safe—it's like a week in Denver," or that "it's nothing compared with background radiation." Background radiation—that which is received from normal exposure to cosmic rays and to radiation from rocks and other natural materials—amounts to about 125 mrem per year. Because of the city's altitude, the background radiation in Denver is about 40 percent higher than average. But what these coal-power proponents conveniently fail to consider is the additive effect of radiation. An additional twenty mrem from chest x rays is not "safe" just because it is lower than the background radiation. An additional 38 mrem from a coal plant is not "safe" because it is below background levels.

A person who is exposed to a background radiation of 125 mrem, and who has two dental x rays, a chest x ray and lives near a coal plant emitting 100 mrem per year, may receive 285 mrem of radiation per year from those sources. And that yearly sum is cumulative over a lifetime.

"There is no doubt that any increase in radiation will mean an increase in [bad] health effects," says Dr. Amos Norman of the UCLA department of radiation oncology. "But sometimes the increase may be so small that it's impossible to detect statistically." Norman maintains that the number of cancer cases and mutations varies so widely each year that increases might be hidden within the statistical variation. "We could have increases in the tens of thousands in the

The average level for particulate emission at coal plants is 8 percent, rather than the 1 percent allowed under federal law.

Photograph courtesy of Science Magazine

United States," he continues, "and not be able to pick up a trend in the statistics."

Marvin Goldman, head of the UC Davis Laboratory for Energy-Related Health Research, contends that the accident at Three Mile Island in Pennsylvania "might have increased the cancer risk for one person by 1 percent." Other researchers, however, say that was a one-time exposure, and not at all like exposing an entire population to the estimated 380 mrem per year that might result from a coal-fired plant.

"Oh shit, the radiation standards we have are nothing more than guesstimates," says one researcher with the EPA's Office of Radiation Programs. "The standards are just based on the levels we can detect, not necessarily the levels that cause damage."

We're going to build the cleanest coal plant in the world," says John F. Mc-

Kenzie, supervising civil engineer at PG&E. He and other PG&E officials are gathered around the standard corporate conference table, nodding in agreement. Charles Thissell—who herded the PG&E proposal through the regulatory process—is quiet and reserved, dressed in the dark pinstripes of the legal profession, but he too displays uncharacteristic enthusiasm. Barry Cossette, PG&E's mustachioed PR man, grins from ear to ear; Bob Hosemann, one of the engineers responsible for designing the plant, animatedly approves the statement; and Ted White ("he's our government and public affairs man," Cossette explains) leans back in his chair, surveys the scene, pronounces it good and flashes his lobbyist's smile. It is Friday, September 21, and just two weeks earlier, PG&E announced its site for a $2 billion, 1,600-megawatt coal-fired power plant to be located near Solano County, across the Sacramento River from the town of Pittsburg. The plant, named Montezuma Hills, has received approval from the state Energy Commission.

The men are all very happy. It has taken them more than a year's worth of hearings involving more than 80 witnesses and 16,000 pages of testimony, all speaking to the question of whether a coal plant could meet California's strict clean air laws.

"We conclude," the Energy Commission report states, "that Fossil 1 & 2 [the former designation of the Montezuma Hills plant] can be built . . . without substantial harm to the population at large."

It was what PG&E officials wanted to hear. They are now proceeding on to the application for certification stage, which they hope will result—some twenty months from now—in the approval to begin construction. They hope to have the coal plant in full operation by 1987.

Even though PG&E was not required to submit specific design details—those will come with the environmental impact report—they were required to present evidence to support their contention that there is technology available that makes it possible to control 99.8 percent of the particulate matter and reduce the nitrogen oxide levels by 90 percent and sulfur dioxide by 95 percent. The technology, it was agreed, will account for more than 30 percent of the total cost of the $2-billion facility. Much of the technology has never before been used in power production in the United States.

Though the Energy Commission report says that "the emission levels of the stipulation require that PG&E utilize technology which has not yet been widely tested on the commercial market," PG&E expresses confidence that the new methods would work.

PG&E is planning to use something called a "low Nox" burner to eliminate nitrogen oxides. Experimental work is still being done on the burner. PG&E is also planning to use a "baghouse" with thousands of tightly woven fiber-glass bags (more efficient than an electrostatic precipitator) to filter out particulate matter. Baghouses, according to papers presented at the Pasadena coal conference, have never been used on an electrical plant this size. The largest currently in use has some 600 huge bags shaped like vacuum cleaner bags. The Montezuma Hills plant may need as many as 30,000 bags. PG&E is also planning to use a "spray vessel scrubber" that will utilize limestone mixed with water sprays to cleanse the sulfur dioxides.

The height of the smokestack mitigates local impact and spreads the pollution over a wider area. According to documents filed by PG&E in the hearings that explain wind patterns, the winds are generally out of the west to northwest and would result in "elevated annual concentration of pollutants to the east through southeast," which is roughly toward Stockton.

The question of radioactivity was addressed briefly in the hearings by an Energy Commission staff member who said that "there is no conclusive evidence that indicates that the radionucleide emissions estimated to occur as the result of the proposed facility will produce adverse health effects," and that "most radionucleides . . . will be controlled by best available control technology."

None of the PG&E officials were aware of the Oak Ridge or EPA studies on emission levels. But they did express a concern about learning more about the problem rather than dismissing it as unworthy of consideration. PG&E officials say they are taking another look at trace element content in coal and will consider it when making coal purchases. "We've never really had any need to look at this before," McKenzie says, "and you have to remember it's an emerging science . . . there is very little information."

PG&E seems proud to be a pioneer in antipollution technology, but the old technocratic paranoia is running rampant at Southern California Edison. "Why is there any interest in this?" asks Alexander Weir, manager, chemical systems research and development, for SCE. "Why don't you write something about ozone or L.A.'s terrible smog? There are coal plants all over the world; it's just another fuel to burn to make electricity. I don't think there is any problem."

"There seems to be an attempt by those people who oppose all new coal plants to blow out of proportion those things like trace elements and carcinogens into a major problem, which it is not," says Tom Reed, who is the project manager for SCE's proposed plant.

Reed says that SCE does not consider the uranium and other trace element content in purchasing their coal. When asked if it might become a factor, Reed replies, "No. But if it becomes a big factor in the licensing process, it will have more emphasis placed on it."

Southern California Edison and the Department of Water Resources are still looking for potential sites for their plants, both of which they hope to have completed by 1990. DWR officials say they "don't know anything about radiation."

The problems of radiation are "rather a sleeper," comments Floyd Galpin, head of the EPA's division of environmental analysis. "People in the industry are not generally aware." Harold Beck of the DOE puts it more succinctly: "They just aren't worrying about it." ■

PG&E is planning on building a baghouse made up of at least 30,000 fiber-glass bags to filter out the hazardous pollutants.