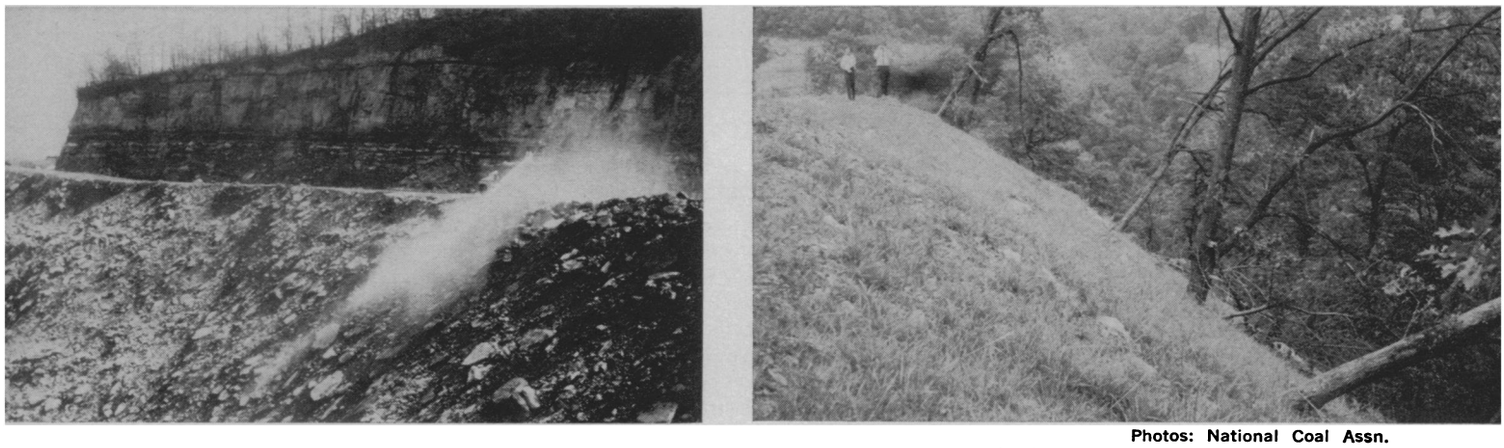

Photos: National Coal Assn.

An unreclaimed strip mine and a reclaimed one: Disagreement exists on whether the reclamation is real.

Sharp conflict on strip-mine reclamation

Some say the question now is whether strip mines should be closed down

Strip mining without reclamation may be one of the most grossly destructive practices of modern technology. Forested hillsides are torn away. More level lands are furrowed with great gullies and accompanying mounds of denuded and sterile soil. Masses of silt from the eroded mines enter waterways. Wildlife habitats are destroyed, fish are killed by acid-mine drainage and county tax bases are depleted after the strip miners pack up and go on to the next site.

But as with so many other environmental problems, the story is not all one-sided. Mining companies say they are making every effort to restore lands to other kinds of productivity after strip mining, and there is evidence of increasing sincerity, despite environmentalists' claim that company rhetoric is rarely backed up by more than cosmetic efforts. But whether company efforts are being made in good faith is really no longer the question, because there seems little doubt the new environmental consciousness will force them to devote resources to reclamation. The question now is: Can it be done?

There is disagreement among scientists on this score, and politicians are also taking sides. Rep. Ken Hechler (D-W.Va.) this year introduced a bill that would ban all strip mining of coal (which accounts for 41 percent of all surface mining) forever. "There is no economic, effective method to restore strip-mined lands," Hechler says. Some 80 House members are co-sponsoring his bill, and Sens. Gaylord Nelson (D-Wis.) and George McGovern (D-S.D.) have introduced the same bill in the Senate. Hechler has no illusions the bill will pass quickly against the concerted opposition that exists. But he also makes it clear the bill is not intended as a gesture aimed at securing a more moderate measure. "I want it to pass in this form," he emphasized in an interview this week. Hechler's aim: To move all coal mining back underground.

The coal industry has been booming in recent months because of the shortage of other kinds of fuels, notably residual fuel oil and natural gas (SN: 11/14/70, p. 379), and an increasing amount of the coal comes from strip mining. In 1969, strip-mined coal accounted for 35.2 percent of the total coal production and in 1970, an estimated 40 percent. This increase represents a peak caused by the fuel crisis and the relative speed of starting up a new strip mine (as opposed to a new underground mine) but there is little doubt there will be increased coal mining for a number of years, mainly to meet power plant needs. If the coal companies have a choice about how they get the coal, they will frequently choose the cheaper strip mining over underground mining.

Some 3.5 million acres of land in the United States have been disturbed by strip mining. Until a few years ago, reclamation efforts were small. But in 1970, says the National Coal Association, 58,000 acres of land strip-mined for coal were reclaimed—as judged by certification under state laws—and the figures were slightly higher for the two preceding years. But, suggests Dr. Ronald D. Hill of the Water Quality Office of the Environmental Protection Agency, state certification is not always meaningful. "State governments could possibly do the job," says Dr. Hill, "but they don't." In Virginia, for example, he says, there are only 14 inspectors for 200 mines. There are exceptions, such as in Kentucky where the state "wants an inspector on every job every two weeks," but Dr. Hill suggests states in general may never devote necessary resources to the job.

Dr. Hill, however, believes much of the strip-mined land can be economically reclaimed, and he described some demonstrated techniques at a meeting of the Association of Southeastern Biologists in Richmond, Va., two weeks ago.

Contour mining of hillsides is by far the most destructive to the environment. Following the contour of a hillside, mining companies make deep shelf-like cuts to the mineral deposit, tossing the overburden on the downhill slope and creating an almost vertical "highwall" on the uphill slope. If the mine is left in this condition, erosion and landsliding are often severe, even when attempts are made to grade the slopes. Erosion of highwalls and spoil banks creates severe silt problems in streams, sometimes clogging them, and acid-mine drainage adds to water problems. There is the obvious destruction of wildlife habitats and esthetic values.

"Preplanning is the first step in reclamation," says Dr. Hill. Analysis of overburden material should first be made, he says, so that the overburden can be stacked and "less toxic, more fertile, and less acid-producing materials" can be placed on top of the pile, and water drainage and treatment plans can be developed for the acid-mine drainage that will nonetheless result. Surface and subsurface water patterns should be studied so mining and water treatment facilities will fit together optimally.

Then during the mining operation, the fertile soil—usually topsoil—should be stockpiled for placing back on top after mining. Creation of long, steep slopes should be avoided, and sometimes overburden should be hauled to a fill area.

The actual reclamation effort should begin as soon as possible after mining because the fresh material is easier to handle. The mines should first be graded

back to their original contour. Then the area can be fertilized and be seeded with grasses and legumes. Given the usual ecological succession, climax species such as hardwood trees will return in 10 to 20 years, says Dr. Hill.

The cost of such a plan would be around $500 to $1,000 per acre if carried out immediately after mining, and nearer $1,600 later, says Dr. Hill. He believes the cost of reclamation per ton of coal would rarely be higher than 25 cents and sometimes as low as 2 or 3 cents. Even the 25-cent figure is well within the means of coal companies, he believes. The ecological problems involved with mining of more level areas are considerably less perplexing than those from contour mining, he says.

Hechler insists, however, that the ecological problems for both are far more complex than Hill's proposal acknowledges. Evidence is, he says, that some West Virginia strip-mined land may take 400 years to get back to its original condition. Dr. Robert R. Curry of the University of Montana scorns the practice of merely applying feritlizers to denuded land, pointing out that a soil complex conducive to full ecological vigor takes thousands of years to develop, through complicated chemical, geological and biological processes (see p. 302). Without this substrate of nature-conditioned soil, he says, fertilizers will simply run off with water. And Dr. Hill concedes water quality is still affected five years after reclamation.

But Dr. William Sopper of Pennsylvania State University reports that in a single growing season he produced lush ground cover and a high survival rate for many trees on previously sterile strip-mine spoil materials by spraying treated sewage effluent on the materials (SN: 4/24/71, p. 286). The purpose of Dr. Sopper's work was to purify the effluents, and the highly successful spoil fertility results were a happy by-product. Dr. Rolf Eliassen of Stanford University this week suggested a coal sewage symbiosis that would have rail cars hauling coal to population centers; the then empty cars would haul sewage sludge back to fertilize spoil banks.

A number of bills now in Congress—including an Administration bill—evidence faith in techniques such as those proposed by Drs. Hill, Sopper and Eliassen. The bills rely primarily on Federal inspection and enforcement of reclamation rather than on outright closing down of strip mines. Whether or not reclamation is applicable to significant acreages will depend on the results of large-scale demonstrations of the techniques. In the meantime, in view of state governments' performance to date, environmentalists insist the Federal takeover of enforcement is the least that can be done. □

FIRST SPACE STATION

Soyuz 10 link a mystery

The Soviet Unon made good its official hints last week and launched a three-man Soyuz crew into space April 23 to dock with the orbiting space station Salyut launched four days earlier (SN: 4/24/71, p. 278). They also made good their aim to beat the United States again in space—this time with the first space station. A more unusual achievement of sorts was the duration of the Soyuz 10 flight—less than two days—making it the shortest three-man space flight in history.

All this, coupled with the usual Soviet secrecy, has kept the real mission of Soyuz 10 shrouded in mystery, and Western space watchers leaping from one explanation to another.

Meanwhile, the Soviets seem unruffled. The Soyuz 10 cosmonauts—veterans commander Vladimir Shatalov and flight engineer Alexei Yeliseyev and rookie test engineer Nikolai Rukavishnikov—made a soft landing in the early morning darkness about 44 yards from a lake near Karaganda, Kazakhstan, April 25. After the landing, Shatalov said of his latest venture: "Now it can be said that the Soviet Union's research in the field of opening up space is continuing . . . along the road toward the creation of orbital research stations. . . . The previous five-year period was directed toward a step-by-step solution of this problem. This flight is a routine step on the road to creation of such stations. . . ."

Western observers had thought Salyut was such a station—and therefore the "creation" had already been accomplished.

Information from Tass and other Soviet news sources as well as interviews with the cosmonauts helped to fill in some of the blanks.

The Soyuz 10 spacecraft was a modified space ship—perhaps the first in a new series of what Shatalov calls a "remarkable multipurpose machine." An Izvestia report describes the design of the new craft as aptly combining "elements of a cargo ship and an orbital station. . . ."

The engine and fuel reserves of the craft enable it to perform wide maneuvers in near-earth orbit (about 100 to 130 miles) to altitudes of up to 1,500 kilometers (930 miles).

The flight unfolded slowly. On Saturday Soyuz 10 docked with the space lab Salyut and remained docked for five and a half hours. (There was no mention of the expected transfer of crew from Soyuz through a possible new docking tunnel to Salyut.) The docking itself was a combined automatic and manual task. Soyuz approached within 180 meters of Salyut automatically. The further "approach and berthing," say the cosmonauts, "were then carried out by the crew."

"We first saw Salyut on the screen of an optical instrument at a distance of 15 kilometers," says Yeliseyev. "The station has special light beacons which make its detection easier." A television camera mounted on Soyuz transmitted pictures to ground control. "It was a very impressive picture," says Yeliseyev. "An object with a tremendous amount of instruments and various antennas."

Although the Soviets have not officially mentioned the size or weight of Salyut, several hints, subject to interpretation, were offered. "The docking of this type is a more difficult task as compared with the docking of two Soyuz or Cosmos spaceships—craft of roughly the same mass," explains cosmonaut-scientist Konstantin Feoktistov. Cosmonaut Yeliseyev described the docking haltingly, "I don't even know what to compare it with. It was, you know, it was a little like a train entering a railroad terminal. That's how we felt as our rather big Soyuz eased up to the station."

But the French came up with some exact statistics: Salyut is four times the size of Soyuz—36 cubic meters (about 1,271 cubic feet and probably room for 24 cosmonauts). It has four docking tunnels, adds the French news service Agence France Press (United States space officials had estimated it to be larger than the 17-ton Proton 4 cosmic-ray satellite launched in 1968).

If the docking were accomplished with no problems however, the major question puzzling Western observers is why the crew did not transfer to Salyut and why such an expensive mission with three men was so short.

Commander Shatalov explained: "By duration the flight was a short one, but a very big and tense one by volume of works, aims and tasks. We were instructed to perform comprehensive trials of the modified Soyuz 10 jointly with the research orbital station Salyut. We performed this work, tested the ship, checked the station systems during joint flight and practiced joint maneuvering with it. . . ."

Feoktistov described the main purpose of the brief flight as "undoubtedly . . . the testing of a new technical means for docking in space."

But a Tass article the day of the launch had been more ambitious, outlining three aims for Soyuz 10: to conduct joint experiments with the orbital station and make a comprehensive check of the ship's onboard systems; to test further the manual and automatic control systems, and the orientation and stabilization by the ship in different flight conditions; and to hold medico-biological research to study the influence of space flight factors on the