testified. Several of them were asked for their views about doing research by contract rather than by grant. In addition, the committee apparently considered the issue repeatedly as it evaluated the VCP through various routes during the course of its investigation. Most of the members of the committee do research by grant, rather than by contract, and their feeling that this is the right way to conduct research is apparent. One gets the impression that the committee is sympathetic to the use of contracts to procure specific services or materials. It makes sense, for instance, to contract with someone to produce viruses, run certain standardized tests, obtain human biopsy material, and so forth. But scientists supported by VCP contracts are also doing a large amount of what can only be called basic research in the strictest sense.

The Zinder committee seems to have two objections to this. One is simply that such studies *should* be done by grant. The other is that because the review of contracts is, in its view, not as rigorous as the review of grant applications by NIH study sections, a lot of mediocre contract work is being supported at what may be the expense of grant research.

There really are two issues. Should all basic research be done exclusively by grants? It is a question the biomedical community has been fixated on for quite a while. Some people say yes. Others, emphatically no. It is not apparent why there has to be an either-or answer, but there are very few people who really *believe* that there is room for both. Most of those who do are scientists who used to work on grants and now have contract support.

Should mediocre work, work that would be turned down as a grant application, be supported, sometimes virtually indefinitely, by contract? Obviously not, and here some of the recommendations of the Zinder committee surely have a place. Scientists should not, for example, sit in the room when their own contracts come up for approval. Nor, for that matter, should members of one review group have control over the contracts of another member. (VCP scientists say this procedure will be avoided under *newly* instituted regulations.) The clincher, which may be legally impossible for the NCI to implement, even were it to want to, is a recommendation to clean house and start all over again. "All contractors should be notified that their contracts will be terminated over the next 3 years."

According to Rauscher, who was responsible for closing the portion of the board meeting at which the Zinder report was discussed, the board gave it mixed reviews. (Among the members of the board, it should be noted, are persons funded by the VCP, persons known to be antipathetic toward it, and persons in between.) There was some feeling, he says, that the report focused too much on the contract versus grant issue. Others felt it failed to recognize some of the very real achievements of VCP scientists, achievement which they believe can be attributed to the fact that the resources of the program and the collaboration it fosters among groups offer something grant research does not. Others felt the report was fine.

Zinder prefers not to comment in detail because he feels obligated to maintain the confidentiality of the board and the NCI, although he says he would have been willing to present the report in open session. He will say, however, that he and the committee stand behind the report and that it was issued without a single minority opinion.

Technically, the cancer board has not yet officially received the report and may not do so until its next meeting in March. Meanwhile, discussion of details of the report will continue through a committee of the board, a committee of the Zinder committee, and a committee of the VCP staff.

Whatever finally happens to the VCP, there are members of the board who say that the Zinder committee report must not simply be accepted and then shelved. Their intention is to see that it is not, which is particularly important at a time when the Administration is putting pressure on the scientific community to do more research by contract, not less.—BARBARA J. CULLITON

Nuclear Safeguards: Holes in the Fence

Stealing a warm silvery lump of plutonium and fashioning it into a makeshift weapon is a scenario of high-technology terrorism that has fired the imagination lately of nuclear critics and Hollywood scriptwriters alike. The Atomic Energy Commission (AEC) acknowledges that skilled technicians could assemble a crude weapon from stolen plutonium or highly enriched uranium. But is it really plausible to suggest that a thief could penetrate the security imposed by the AEC on "special nuclear materials," as it calls the fissionable metals, and could he make off with a critical mass or two?

If a new investigative report by the General Accounting Office (GAO) is any indication, the short answer is Yes. The AEC readily agrees that incentives exist for stealing fissionable material, and that losses have occurred (*Science*, 9 April 1971), but it steadfastly maintains that it is unaware of any actual theft. If the AEC's record really is unblemished though, the GAO's report suggests it may be more by virtue of luck than vigilance.

The GAO's investigation began in the summer of 1972 and centered on 3 of nearly 100 organizations that possess nuclear materials of "high strategic importance" under contracts or licenses granted by the AEC. None of the three companies is identified in the report, although it was learned that at least one processes highly enriched uranium near Oak Ridge, Tennessee.

At each of the three plants, investigators found fissionable material stored in portable containers about the size of small coffee cans. The containers were kept in sheet-steel or cinder-block storage sheds surrounded by fences, wired with alarms, watched by guards, and protected by locks.

Nevertheless, the GAO found that at two of the plants—described only as "Licensee A" and "Licensee B"—one man equipped with an adjustable pocket wrench and a strong arm could breach these barriers and lay his hands, undetected, on the portable containers in a matter of minutes. Locks were found unlocked, seals were broken, alarms

failed to work or were easily foiled, and guards neglected to patrol or simply could not see large areas of the two facilities, the GAO said. As a source familiar with the investigation put it, "We found some pretty bad situations."

Evidently spurred by the GAO's findings, the AEC published stringent new security regulations for fissionable materials on 6 November, the day before the GAO released its report. The AEC's regulatory branch is also "restructuring" inspection units that failed utterly, in repeated visits, to detect the security flaws uncovered by the GAO.

Plant A, for example, was surrounded by an 8-foot chain-link fence topped by strands of barbed wire. Along the 4000-foot length of the perimeter fence, however, investigators found 13 weak points that "could allow a potential diverter to easily breach the fence." Ten of these weaknesses—such as easily removable gates, eroded gaps under the fence, weak welds, and a tall concrete post handy as a stepping stone—could not be seen from any guard station. Indeed, from his position at the corner of a building, a guard could not see 80 percent of the plant; and even if he did detect something amiss, the guard was vulnerable in the extreme. Severing of a single telephone cable, the GAO said, would have isolated the entire facility. Although guards were armed with revolvers, they were unqualified to use them, according to AEC standards.

Once through the fence of plant A, a thief's main problem would seem to have been one of choosing from a wealth of possible ways of entering the three storage vaults.

Up on the roof of one vault were 40 thin plastic skylight panels. In just one minute, a GAO investigator unscrewed a panel far enough to gain entry. Alternatively, it was found that ordinary tin snips could cut through the sheet-steel wall of the shed at a rate of 3 feet a minute. But the simplest way to get inside was through one of four doors. Two had no alarms, and one that did had a broken lock, allowing it to be opened "with little effort." The alarm on this door, moreover, could be deactivated by pushing a pencil through a gap between the door jamb and the wall and depressing the alarm's trigger lever.

Another storage vault, made of cinder blocks, lay only 16 feet from the vulnerable fence. Here, the GAO said, entry could be gained simply by ripping flimsy metal louvers off one of two vent holes in the wall. Inside, said the GAO:

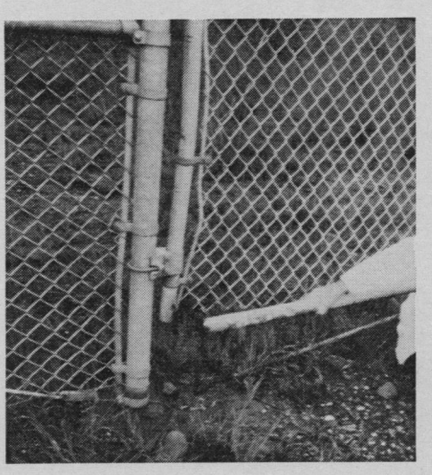
> Portable SNM [special nuclear material] was readily accessible. . . . Additional portable SNM was stored in a cage built of metal fencing material. A portion of the caging was secured only by wedging between two cinder block walls; and one man, in about 5 seconds and without tools, was able to remove the caging and gain entry to the area.

A similar air of casualness prevailed at the plant of "Licensee B," described by the GAO as a two-story brick and cinder-block structure processing "significant quantities" of such things as highly enriched uranium. The building contained four storage vaults, three of which held material of "high strategic value" in half-gallon containers and plastic bottles weighing about 30 pounds.

There were guards, to be sure. But they were unqualified to fire revolvers, they never varied the pattern of their patrols, and they did not ordinarily check the packages and lunch buckets of employees as a means of preventing thefts. Moreover, guards were posted only at the front of the building and were unable to see the rear. No fence shielded the back of the building, where GAO investigators found an unlocked door propped open with a brick. The door led into a boiler room, then into nuclear storage areas.

In the wall of one ground-level vault, investigators found a large hole which had been covered with thin plasterboard and screen. (It took only 15 seconds to remove; about an hour later, plant crews sealed the hole with cement.) It also turned out that none of the storage vaults had intrusion alarms, although the GAO did find one on the door of a trash room containing nonradioactive waste. They tripped the alarm, waited about half an hour, and gave up, reporting that "No one responded."

Plant C was a different story. Although guards never checked incoming and outgoing packages (it was bad for morale, officials said) they seemed alert and qualified. Vaults were rigged with sophisticated ultrasonic intrusion alarms. Like the other facilities, this one had no planned response to attempts at nuclear theft. But it did telephone local police every hour to assure them that all was well. A test of this arrangement produced a prompt, if slightly errant, reaction from the police. When the hourly call failed to come in,



Flaws in security of nuclear processing plants: Fence weld (right) broke when pulled; plaster patch in storage vault wall (below) is easily pushed aside.

local police dispatched a squad car that ended up at the wrong facility, 14 miles away.

The GAO report does not explain why it picked these three plants for examination, nor does it indicate how representative they may be of the many other private firms authorized to hold large quantities of fissionable materials. One GAO official familiar with the investigation told *Science* that these plants were not chosen as a representative sample. Nonetheless, Theodore Taylor, a nuclear physicist who has emerged in the past few years as one of the AEC's best-informed critics on nuclear safeguards, says that he thinks the security measures described in the GAO report reflected the general level of protection afforded in mid-1972. "It would be wrong to imply that the stuff is just lying around without any physical security, and some facilities are quite sophisticated," says Taylor, a former deputy director of the Pentagon's Defense Atomic Support Agency. "But it is reasonable," he adds, "to say that what the GAO found was fairly typical."

How much longer holes in the fences and broken locks on the doors will remain typical of American safeguards is hard to tell. The AEC says the three plants in question have been improved (although the GAO hasn't been back to check) and, after years of procrastination, the commission is moving quickly now to tighten security both of transportation and storage of nuclear materials. Both the GAO and critics like Taylor attribute lax security in the past to ambiguous and sketchy AEC regulations that gave private firms little idea of what was expected of them. The AEC sensed the inadequacy of these regulations more than 3 years ago when it began an internal study of the protection afforded "special nuclear materials." In September 1971, the internal study group said the regulations needed clarifying and elaboration; that access to SNM needed tightening; and that the inspection system needed strengthening.

Last February, the AEC did finally propose stringent new security measures, and the outcry from the nuclear industry, which has resisted tighter security on the grounds that it would cost too much, was quick and vehement. Among other things, the new rules called for armed guards capable of repelling all but a "significant armed attack," for active intrusion alarms on storage sites, searches of persons and vehicles entering and leaving storage and processing areas, redundant communications with police, and more frequent and meticulous inventories of fissionable materials. All this, said Exxon Nuclear, was "obviously unworkable." A committee of the Atomic Industrial Forum (AIF) a trade group, said the guard requirement threatened to turn nuclear facilities into an "armed camp." The regulations, said Babcock & Wilcox (whose subsidiary the Nuclear Materials and Engineering Corp., of Apollo, Pa., gained notoriety in 1966 for losing 100 kilograms of weapons-grade uranium), were "beyond the bounds of reason."

The AEC has since clarified some parts of its new rules, and mildly softened others, and the level of industry anxiety has abated accordingly. "Nuclear safeguards is still a small, young business," notes a spokesman for the AIF. "The industry is holding its breath right now, waiting to get some experience with the new regulations."

One reason the business is still small is that the civilian power reactor business has not yet begun to deal in large amounts of plutonium or uranium enriched to the point where it could be used in a weapon (about 90 percent uranium-235.) But as fuel reprocessing plants begin to proliferate, and as they begin to recycle the plutonium that appears as a waste product in spent fuel rods, the quantities of weapons-usable material shuffling around the country and stockpiled in vaults is expected to rise rapidly toward a level of 1 million kilograms a year by 1980. "That's why I'm trying to get the message across now," says Taylor. "If we wait until 1978 to impose strict safeguards, we'll have real chaos".

—ROBERT GILLETT

International Conferences: A Package Deal That Came Unwrapped

The international conference held in an attractive European city is so accepted a consolation of academic life that only a killjoy would raise doubts about its value to the taxpayer, who foots most of the bill. But a conference held recently in the fashionable holiday resort of Montreux, on Lake Geneva, was such a disaster that many of the participants wished they had found less arduous ways of combining business with pleasure.

The invitation to the International Congress on Drug Education, held from 15 through 18 October, suggested that no excessive demands would be made on participants' powers of attention. Admittedly, there were 4 hours of lectures scheduled, but the rest of the time was to be passed in the form of the talk sessions known as workshops. Conference activities were to last only 6 hours a day, and participants' energies were to be revitalized in the evening by a program of Swiss soirées, dinner dances, and "folkloric demonstrations." And to recover from the exertions of the conference, participants had offered to them in the package deal the option of post-Congress cruises down the Rhine and tours to Amsterdam or Paris.

Right from the start the academic conférenciers found that their trip was going to be less idyllic than the pictures on the travel brochure. The bus drivers who ferried them from Geneva airport to Montreux did not know which hotels to leave them at. Rooms had been allocated on an apparently random basis, so that some people who had booked for tourist class were lodged in deluxe suites and a conferee who had paid for a $31-a-day room found herself in a room without bath or toilet. When the delegates assembled for their first meeting, they were refused entrance by the hotel management and had to wait 2 hours in the lobby while another room was found.