

Nuclear Explosives: Technology for On-site Inspection

The scene is the flat landscape around Moscow Airport, where two U.S. Air Force C-130 transport planes have just landed. Airport workers are scurrying, clearing red passenger buses out of the way to make room for a procession of flag-bedecked official limousines onto the runway, bearing officials of the United States and the Soviet Union. The bays of both planes open, revealing two identical wooden crates, each the size of a small house, which contain a large seismic monitoring van (see photo). The Soviet officials inspect the crates very closely, confer among themselves, then point to one, which is hauled from its plane. The other is allowed to go, escorted, on its way to a remote site along the Pechara River in the Urals, where a salvo of peaceful nuclear explosions will soon be detonated underground.

This could be the opening scene in an unusual attempt by the two superpowers to police each other's adherence to the Peaceful Nuclear Explosions Treaty (PNET)* by means of on-site inspection. The PNET was concluded in Moscow in May and is now before the Senate for ratification. Under its terms, certain kinds of explosions will be verified by on-site inspection—a goal which American officials have tried to achieve for years. (The problems of remote verification of nuclear blasts have just been raised by two July Soviet detonations which may have violated the treaty's yield limits. See page 745).

In the event of a preannounced explosion requiring on-site inspection (blasts would be carried out only by the Soviet Union; the United States no longer has a PNE program), duplicate sets of recording equipment would be sent in the van to the site and used during the firing. Each side will get duplicate copies of the printouts. Afterward, "by an agreed process of chance," says the protocol, the inspecting side will choose which set of recording equipment to take home, while the host government takes away the other set for "familiarization." The theory behind this procedure and that regarding

the vans at the airport is that, if the inspectors wanted to cheat by concealing spy equipment in their instruments, they would run a 50:50 chance of being found out.

Fear of spies and spying is deeply ingrained in Soviet life (cameras, for example, are heavily restricted. It is ingrained, as well, in the PNET, which perhaps is why some American officials are calling the treaty and protocol texts cultural documents. For example, inspectors can supply the calibration equipment to measure the hydrostatic shock waves from the salvo of explosions, but the side carrying out the explosion will lower it into the holes. There is even a formula for how close to the explosive device the calibration equipment may be—if it gets too close it might pick up other "unnecessary" information.

Radios are another bugaboo. Local seismic stations may be erected around blast sites, to verify that a salvo contains the announced number of individual explosions. But there are formal procedures for determining what frequencies should be used for radio transmission among the stations.

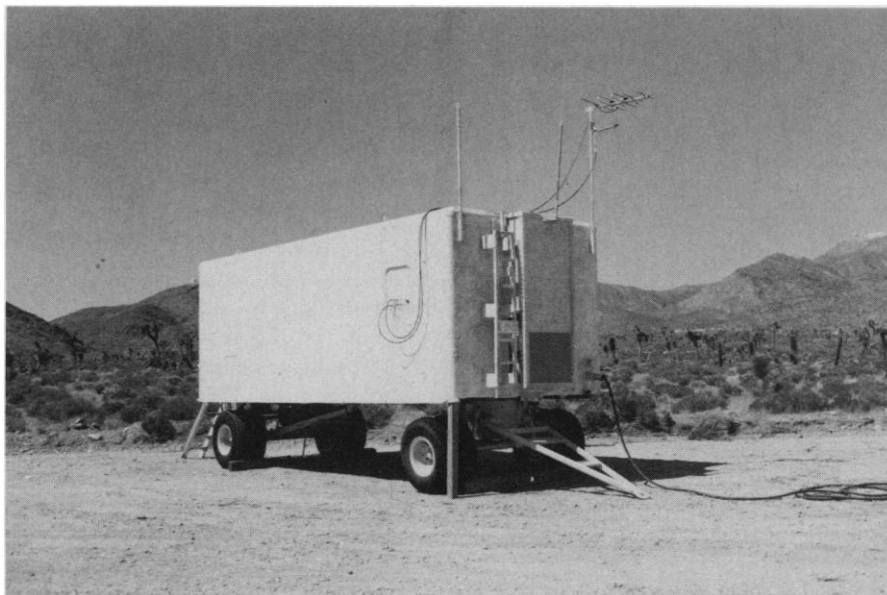
Ordinary items, such as "portable short range communications equipment, field glasses, optical equipment for sur-

veying" shall be supplied by the side carrying out the explosion. But the inspectors bring the cameras, which are to be of the Polaroid type ("having built-in, rapid development capability") so that immediately after a picture is taken, both sides can check that it does not include unauthorized subjects. The text even includes a list of acceptable subjects for photographs.

The treaty is no ordinary, diplomatic text. American officials say that rarely have two nations dotted so many i's and crossed so many t's on the technical details of an arms control agreement. Only after all the specifics were worked out between the two sides was it clear that the Soviet government would indeed accept the on-site inspection principle. Not only are the details the most interesting features of the treaty, but it was through these details that the treaty's general principles were arrived at.

The PNET is a necessary companion to the threshold test ban treaty limiting nuclear weapons tests negotiated between the two countries in May 1974. Both treaties set a limit of 150 kilotons on any single explosion. The threshold test ban, however, is to be verified by only remote means, and two calibration shots are to be fired by each side at their designated weapons tests sites (the Soviets have two—on Novaya Zemlya in the north and in the south at Semipalatinsk) to aid the other side's verification capabilities. Information on the geology of the test sites is also to be supplied.

The PNET sets the ground rules for tests outside of the designated weapons test grounds. All such explosions are to



U.S. seismic monitoring van used to monitor underground nuclear weapons tests.

*Accepted title; officially, the title is Treaty on Underground Nuclear Explosions for Peaceful Purposes.

be for peaceful purposes, and no one blast shall exceed 150 kilotons. Salvos are allowed if no one explosion exceeds 150 kilotons and if the total yield is no greater than 1500 kilotons, or 1½ megatons. The on-site inspection arrangements apply to salvos, and are optional in the case of 100- to 150-kiloton explosions. Under the treaty, all peaceful explosions are to be preannounced, with information as to time, location, yield, and local geology provided to the other side.

The inspection agreements in PNET however, are the outgrowth of the limits of each side's teleseismic monitoring networks. Officials explain that the American seismic network (run by the Air Force and called the Atomic Energy Detection System) can detect movements of the earth's surface as small as 10 angstroms. But the remote seismic stations have difficulty discriminating explosions that occur within a few seconds of each other—the instruments may just add up the shocks and record them as a

single, larger blast. Thus, the American negotiators convinced their Soviet counterparts that, if salvos were to be allowed, on-site inspection would be necessary as well. The Soviets clearly wanted to keep open the option of very large total yields since their technical literature often mentions huge planned PNE's in the several megaton range for gargantuan projects—such as one to divert the Pechara River southward into the Volga to ultimately raise the sinking waterline of the Caspian Sea.

Advocates of arms control outside the government have been strongly critical of the verification arrangements in the PNET. When the United States, the Soviet Union, and the United Kingdom signed the 1963 limited test ban treaty banning nuclear explosions everywhere except underground, they committed themselves to seek a comprehensive, or absolute, test ban. When American officials talked of on-site inspection to police such a ban, they had in mind grant-

ing inspectors wide-ranging access to the other side's territory, so they could journey somewhere to check up on some announced events that seemed ambiguous to the remote sensing networks. Inspection, they believed, should be a right, rather than the privilege conferred in the PNET for inspectors to travel to prearranged test sites, "along agreed access routes," with their cameras safely packed away in "secure storage" most of the time. Nongovernment arms control advocates have argued that if the Soviets wanted to keep their PNE options open so very badly, the American PNET negotiators could perhaps have driven a better bargain.

These and other criticisms will doubtless be raised when the Senate begins hearings on the two treaties later this year. It remains to be seen whether the critics will carry the day—or whether the spectacle of identical crates arriving at Moscow airport will become a reality after all.—DEBORAH SHAPLEY

Cosmetic Standards: Are Pesticides Overused for Appearances Sake?

The unblemished tomato and the flawless orange are dear to the American consumer, but the methods employed to produce such impeccable fruit and vegetables, particularly the heavy use of pesticides, are being questioned by environmentalists and coming under the scrutiny of federal rulemakers. Currently, a draft report on the relationship between so-called cosmetic food standards* and pesticides has become the center of controversy. The report was prepared for the Environmental Protection Agency by a Berkeley study group; EPA officials say it has generated more paper and more work for the agency than any previous pesticides study.

A major line of argument pursued in the report is that the overuse of pesticides is encouraged because mass buyers, notably supermarket chains, stress cosmetic criteria for produce. Con-

sequently, there is heavy pressure on the grower to achieve the right kind of color and blemish control and he responds almost automatically by applying heavy doses of pesticide. The report argues that the consumer should have the option of buying less perfect fruit at lower prices. "Reduction of cosmetic quality standards," says the report, "would result in saving to both the grower, who would use less pesticide, and the consumer."

Analysis of the extent to which pesticides are used specifically for cosmetic purposes is relatively new, but at least one study done by researchers at Berkeley's agricultural research station near Fresno indicates that pest control tactics planned by well trained advisers could reduce the use of pesticides on tomatoes grown for canning by more than 50 percent.

The main theme of the report is that the use of pesticides for cosmetic purposes works against the strategy called "integrated pest management." This strategy does not exclude the use of pes-

ticides but attempts to take into account "all the factors that impinge on the ecosystem," and, according to the report, "implies that, in addition to the immediate welfare of the grower, the welfare of other groups in society should be considered in pest management decisions."

According to proponents quoted in the report, integrated pest management "represents a change in the philosophy of pest control: it utilizes and builds upon the natural mortality that affects any pest population, it [permits economically tolerable] densities of pests and it augments natural control with a variety of techniques that are tailored to be minimally disruptive."

The report contains heavy criticism both explicit and implicit of the status quo in pest control management and has come under attack not only from the agricultural trade press but from agricultural scientists who charge that, among other things, the report understates the need for chemical control of insects and overstates the present adequacy of integrated pest management techniques available for use with most crops. Some agricultural scientists argue that present cosmetic standards are justified because they prevent the marketing of produce with blemishes associated with pathogens or toxins dangerous to health, but which consumers would not recognize.

These differences of opinion have brought the report an unusual amount of attention. The head of the study team

*Cosmetic damage to produce, according to the report, "refers to superficial damage to the exterior appearance of the commodity, which damage does not significantly affect the taste, nutrition or storage capacity of the produce."