ISIS REPORT

June 1993

Institute for Science and International Security

To improve the technical basis for sound policies to prevent the spread of nuclear weapons

Building A Corporate Non-Proliferation Ethic

by David Albright and Peter Gray

Increasing numbers and varieties of companies need to be aware of their legal and ethical responsibilities to prevent the spread of nuclear weapons-usable equipment, materials, and technology. Just as the Cold War drew to an end, the world discovered Iraq's unexpected progress toward building its own nuclear weapons. This progress was largely the result of Iraq's ready access to Western technology and commodities.

Although Iraqi efforts are now blocked–at least temporarily–nuclear ambitions across the developing world have replaced superpower rivalry as the most serious threat to international peace and security. As long as weapons of mass destruction are perceived as the ultimate symbols of status and power, additional countries and subnational groups are likely to try to obtain them.

One lesson of the Iraq experience is that even the world's most sophisticated intelligence systems cannot always detect a clandestine nuclear weapons program in its early or intermediate stages. This lack of clear information could lead the United States or other countries to rely increasingly on economic embargoes and military strikes as their main non-proliferation tools. However, such blunt weapons can rarely be used effectively.

In this Report . . .

Although there is no certain way to prevent proliferation, important roadblocks can be created. A key part of this strategy has always been to control the spread of key commodities and technologies. In spite of many technological advances since the Manhattan Project, making nuclear weapons is still a very costly, hazardous, and difficult venture. Export controls have often worked, but the Iraq experience demonstrates the need for sharper regulations and for increased vigilance on the part of corporate suppliers.

The Iraq experience demonstrates the need for increased vigilance on the part of corporate suppliers

INCREASED DEMAND

The growing worldwide civilian demand for advanced technology has made control of weapons-usable commodities and methods both more difficult and more essential. Non-proliferation goals would be relatively simple to sustain if it were only a matter of not exporting any goods that could possibly contribute to a weapons program. But many of the same items, particularly "dual use" items, have legitimate benign uses in a number of industries including agriculture and manufacturing. *Continued on page 3*

The Lessons Of Leybold

by David Albright

The German firm Leybold AG, a leading manufacturer of vacuum pumps and furnaces and other vacuum-related equipment, has joined the forefront of efforts to detect, track, monitor, and stop attempts by nuclear threshold countries to acquire "dual-use" items for their weapons programs. During a March 1993 visit to the firm's corporate headquarters in Hanau, Germany and in follow-up interviews, we learned how Leybold has implemented an exemplary set of export control policies that sharply control its exports to threshold countries.

In 1990, Leybold decided that drastic steps were needed to improve its export practices, and it installed a new management team headed by Leybold's Chairman of the Board and Chief Executive Officer Dr. Horst Heidsieck. A major priority of this new team has been to dramatically change Leybold's export practices, which in the past resulted in considerable negative publicity and business losses, particularly in Japan and the United States. These new policies exceed the requirements of the new, stringent German export laws, which were implemented during the last few years following numerous export scandals.

Leybold's past export practices had cost it considerable business

During the late 1980s and early 1990s, Leybold was criticized in media reports for its exports of sensitive nuclear dual-use items to Iraq, Pakistan, and North Korea. Because a Leybold subsidiary in the United States exported an electron beam welder to the Iraqi military program in 1988, a U.S. Attorney in Connecticut where the subsidiary is located, launched a criminal investigation after the Gulf War. This investigation, conducted with the U.S. Commerce and Customs Departments, has tried to determine whether Leybold violated the conditions of its U.S. export license for this welder.

LEYBOLD AND IRAQ BEFORE THE GULF WAR

A number of European firms, including Leybold, have been mentioned as suppliers to Iraq's military program. Much of the negative publicity about Leybold has focused on exports of three electron beam welders to Iraq in the 1980s, including the welder originating at Leybold's U.S. subsidiary and two others produced in Germany.

The **Institute for Science and International Security*** works to inform the public about science and policy issues affecting national and international security, including the problems of arms races and war, the spread of weapons of mass destruction, and the environmental, safety, and health hazards of nuclear weapons production.

In this Report and other publications, ISIS aims to counter misinformation of all kinds with technical, scientific, and economic analyses, and to encourage the free exchange of ideas concerning the uses of science and technology.

*A project of the Tides Foundation

David Albright	President
Tom Zamora Collina	Director of Policy &Research
Peter Gray	Editor & Director of Communications
Todd Perry	Special Assistant to the President

For further information, contact:
Institute for Science and International Security
236 Massachusetts Ave. NE, Suite 500
Washington, DC 20002-4980
202-547-3633 - 202-547-3634 (fax)

The International Atomic Energy Agency's (IAEA's) Action Team, which is responsible for post-Gulf War inspections in Iraq, has linked the two welders produced in Germany to Iraq's clandestine centrifuge uranium enrichment program. The smaller welder was used in Iraq's centrifuge research and development program at the Tuwaitha Nuclear Research Center near Baghdad, and perhaps at other centrifuge research facilities. The larger one was intended for use in a centrifuge production plant at Al Furat, south of Baghdad, that was under construction at the beginning of the Gulf War. This welder remained unpacked at the time of the war because missing components were embargoed after Iraq's invasion of Kuwait. The third welder, from Leybold's U.S. subsidiary, has not been linked to the centrifuge program of Iraq's nuclear project, but to its general military infrastructure or missile program.

The Action Team stated originally that the two welders found in the centrifuge program had "application-specific attachments" to hold centrifuge rotors in place while other components are welded onto them. IAEA officials suspected that Leybold officials must have known the true end use of these welders.

During a day-long visit to their Hanau headquarters, Leybold officials denied that the welders had application-specific fixtures. Dr. Bernhard Herkert, Export Control

Continued on page 6

"Corporate Ethics," continued from page 1

Overly strict export bans could forceclose business opportunities for corporations and hinder progress in countries that desperately need modernization. One observer has noted: "You can't put a fence around the 21st century."

This sort of backlash might occur if another country gets away with what Iraq attempted. The Bush Administration's decision last winter to block a planned BP Chemical plant in Iran illustrates the ambiguities that can attend something as innocuous as synthetic fiber production. Concerned about secret Iranian efforts to acquire weapons of mass destruction and sensitized by the aftermath of overly generous export policies toward Iraq, the U.S. government was not satisfied that BP could prevent diversion of a relatively primitive potential weapon – hydrogen cyanide gas. BP Chemical had an agreement with Iran that the corporation believed contained enough verification requirements to prevent diversion. In this case, the U.S. government was not satisfied with BP's internal constraints because the United States has imposed almost a total trade embargo on Iran.

Some corporations have made contracts with potential proliferators that they later regretted

CORPORATE DILEMMAS

Although a few nations and corporations have ignored the dangerous potential of their exports, or have collaborated with the nuclear procurement efforts of countries such as Pakistan or Iraq, most are willing to do their part to prevent proliferation. Some firms have even tipped off their governments about suspicious exports and cooperated in sting operations against illicit procurement efforts.

In some cases, however, even with the best of intentions and in full cooperation with regulatory agencies, corporations have made contracts that they later regretted. This can lead to large financial losses or embarrassment to the firm and to the country where it is based. The New Jersey based Consarc Industries ran into problems with special furnaces it had contracted to build for Iraq, even after the company alerted the Commerce Department of the possibility that the furnaces might be diverted to weapons uses.

THE NEED FOR VIGILANCE

Increased corporate responsibility will be necessary in a growing array of industries. Although the difficulties Iraq faced in its efforts to obtain nuclear weapons show that non-military means of controlling nuclear proliferation have been fairly effective, the surprising extent of Iraq's covert program also suggests that government export regulations and good intentions are not sufficient. To do their part, firms that trade in potentially weapons-usable goods need to take the following steps:

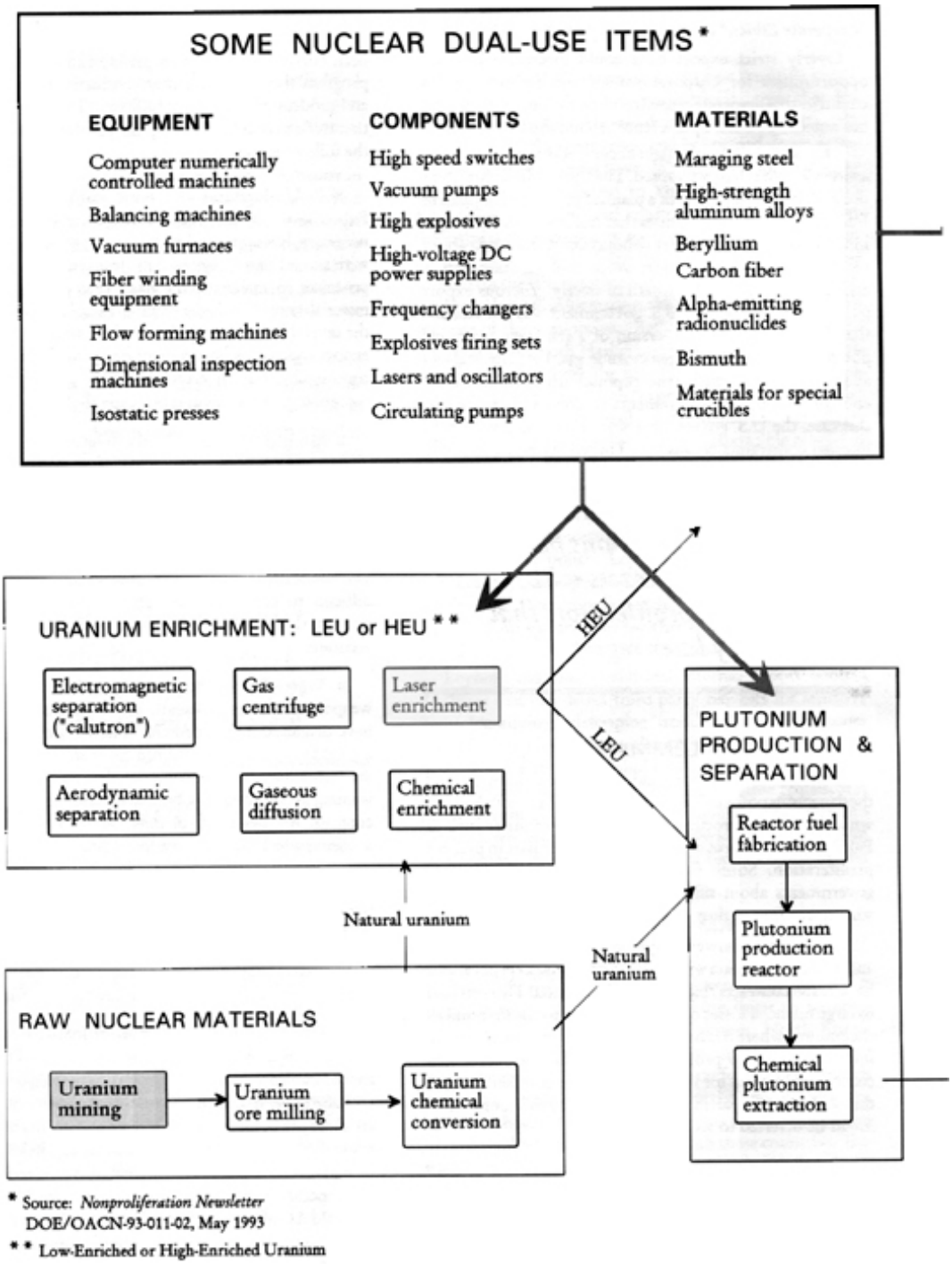
» **Understand the basic routes to the Bomb.** Expertise in nuclear weapon design and production is not necessary, but upper and middle managers should be familiar with several known types of nuclear weapons, and with the processes to make the materials that go into them. The materials and technologies required to make a bomb constitute the several known "paths" to nuclear weapons. The idea of export controls is not to deny every single weapon-usable commodity, but to create obstacles and bottlenecks by recognizing key items and blocking their transfer.

» **Monitor countries likely to have nuclear weapons ambitions.** Regardless of advances made during the past half-century, developing or manufacturing nuclear weapons is a large-scale, costly, and hazardous undertaking. That fact, along with the increasingly effective monitoring protocols established under the Non-Proliferation Treaty and other international agreements, makes a nuclear weapons program difficult to conceal. Although the details might not be known, the list of current "threshold" states is reasonably accurate.

» **Watch for third country "pipelines."** Because their weapons ambitions are usually known, countries such as Iraq have disguised their procurement networks. Dual-use items are hidden by using civilian-use cover stories and by routing the technology through countries that are not suspected of wanting nuclear weapons, but that are less careful about export controls. An awareness of these tactics is as important as knowing which countries are likely final destinations.

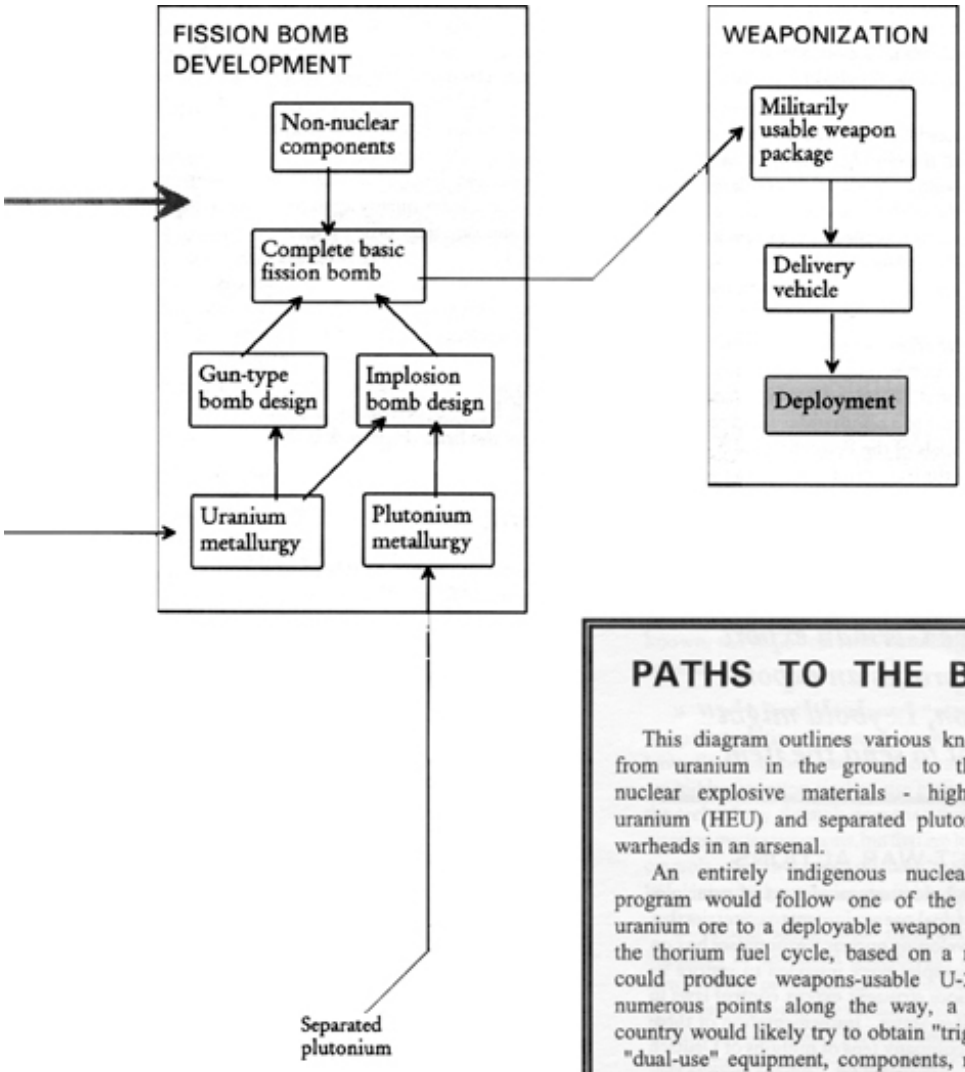
» **Build safeguards into commercial contracts.** Suppliers of advanced technology, especially under long term supply or maintenance contracts, might often have opportunities to impose verifiable performance requirements. Contracts could specify periodic inspections, material balance requirements, tamper-proof seals, or video monitors.

» **Create an anti-proliferation institutional norm.** Guarding against malevolent uses of advanced technology should be an everyday habit, not just a passing concern with each scare over Iraq, Iran, or some other country. Responsible attitudes can be encouraged through statements of corporate principles, cooperation with government agencies, employee incentives and training, and internal reporting requirements. The operating principles drawn up by the German firm Leybold AG after it was investigated for supplying sensitive equipment to Iraq and other threshold countries, might serve as a model for other corporations. □



* Source: *Nonproliferation Newsletter* DOE/OACN-93-011-02, May 1993

* * Low-Enriched or High-Enriched Uranium



PATHS TO THE BOMB

This diagram outlines various known routes from uranium in the ground to the primary nuclear explosive materials - highly-enriched uranium (HEU) and separated plutonium - to warheads in an arsenal.

An entirely indigenous nuclear weapons program would follow one of the lines from uranium ore to a deployable weapon (omitted is the thorium fuel cycle, based on a reactor that could produce weapons-usable U-233). At numerous points along the way, a developing country would likely try to obtain "trigger list" or "dual-use" equipment, components, material, or technology from countries that have nuclear or other advanced industrial capabilities. Trigger list items are generally much more difficult to procure than dual-use items; therefore this chart focuses on dual-use items.

Grey arrows indicate where in the process dual-use imports might particularly ease the costly and complex task of building a nuclear weapon.

"Leybold," continued from page 2

Manager, said the welders had standard fixtures for cylindrical tubes. After reviewing Leybold's evidence, IAEA Action Team officials now say that Leybold's explanation is "plausible."

Leybold officials concede, however, that weaknesses in German export laws and the climate among its employees discouraged aggressive follow-up aimed at confirming the end-use of orders. They also said that the specific company personnel involved in these transactions were unaware of the role of these welders in centrifuge manufacturing, and thus they did not know enough to be suspicious about their true use in Iraq.

Such suspicion and awareness would have been necessary to discover Iraq's true purposes. Iraq routinely disguised the end-use of items it wanted to procure. For example, in November 1982, according to a captured Iraqi trip report to Iraqi superiors, two officials of the Petrochemical-3 Project (PC-3), the codename of the Iraqi nuclear weapons program, visited Leybold to gather information about electron beam welders. These officials did not disclose their true interests to Leybold.

Even if the German export office approves an export application, Leybold might decide not to send the item

LEYBOLD'S POST-WAR ACTIONS

In March 1992, Leybold announced a set of principles controlling its export of dual-use equipment to countries that might be engaged in developing nuclear weapons (see box on back page). These principles were intended to restore its credibility and meet more stringent export control laws in Germany and the United States. Implementation of these principles has cost the company tens of millions of Deutsch marks in lost business. Nevertheless, Leybold expects that these losses will be more than offset by earnings in other areas of the world.

Leybold officials now recognize that corporations must share in the responsibility to stop the proliferation of weapons of mass destruction. Heidsieck said that industry "must cooperate in preventing the further proliferation of weapons of all types." He added that a corporation has the duty to "check, on its own initiative, whether exports to certain countries can be responsibly justified or not."

Herkert noted that whereas in the past sensitive export matters rarely reached top management, now that has "drastically changed." He said that so far his office has dealt with about 3,500 export cases, and has turned down many orders that could not meet Leybold's strict policies. Company officials are now required to know government export regulations and laws, and must submit sensitive orders through a detailed company approval process that checks for possible misuse. His office requires company personnel involved in the sale, manufacture, and shipping of equipment to obtain detailed information about the customer and final purpose of this equipment. Before a sensitive item can be shipped off-site, both Herkert and Heidsieck must approve that shipment. Under the new German export laws, each company must nominate an "export responsible executive" who will be held personally accountable for any illegal actions by the firm. Heidsieck is the responsible official at Leybold.

Importantly, even if the German export office approves an export application, Leybold might decide not to send that item if doubts or concerns remain about its possible end-use. As a matter of policy, Leybold will consult with both German and U.S. export officials if questions about an end-use develop. According to Leybold officials, the company will not complete an order if either U.S. or German export agencies continue to raise questions about end-use.

Leybold has also established internal export control databases that can detect third party requests for sensitive items. Identifying and stopping "front" and "shell" companies is a difficult but important endeavor in curbing the misuse of dual-use items in the threshold states. In one case, after a threshold state was denied an export, the same request was received from a Bangkok trading company, which was also turned down. Subsequently, a request was denied from a firm in Moscow. Herkert said that this type of situation has happened "more than once."

VIRTUAL EMBARGO ON MANY THRESHOLD STATES

Leybold's strict export policy has essentially resulted in an embargo on the export of dual-use items to sensitive countries, including Israel, India, Pakistan, North Korea, Iran, Iraq, and Syria. The last four are parties to the Nuclear Non-Proliferation Treaty, and thus have full-scope safeguards in place. Nevertheless, suspicions about their nuclear weapons ambitions have led western governments to warn companies to be careful when doing business with these countries. But it is only because of Leybold's own internal policy of controls that this de facto embargo has developed.

As a result of its policies, Leybold told the Soreq Nuclear Research Center of the Israel Atomic Energy Commission in 1992 that it could not provide spare parts for about 100 vacuum pumps it had supplied Soreq during the last 20 years.

In a September 9 letter, Soreq expressed its astonishment at Leybold's decision. The foreign purchasing manager at Soreq wrote: "Today, we are unable to obtain compatible heating elements from [any] other source but Leybold. We urgently ask for the equipment, or else some of our pumps may come to an abrupt and permanent end."

In an October 10, 1992 follow-up letter explaining the reasons for its refusal, Herkert said: "We have, over the last six months, turned down many requests for quotation [price] for new equipment as well as orders for spare-parts needed for previously supplied equipment of certain customers in countries which have not accepted the full-scope safeguards of the IAEA. Thus, we see no other possibility but also to refrain from accepting your order for the said spare parts." Although all of these exports to Soreq complied with German export regulations and laws, he said that because of its new export policies, Leybold has "assumed responsibility for proactively addressing the issue of the non-proliferation of sensitive technology."

India's failure to sign the NPT was a major reason for not commissioning a furnace.

During the summer of 1992, Leybold notified the Indian government that it would not commission, or start, a vacuum furnace that it had previously sold the Indian Atomic Energy Department for civilian use at the Nuclear Fuel Complex at Hyderabad. In an August 26, 1992 letter to the Indian Department of Atomic Energy, Dr. W. Diemar, of Leybold Durferrit GMBH, a subsidiary of Leybold, informed India that Leybold Durferrit "could see no other possibility but to refrain from commissioning" the vacuum arc melting furnace it had supplied earlier. Diemar wrote: "Though the commissioning of the furnace does not come under US jurisdiction, US authorities have strongly advised against rendering such services to you." Diemar cited India's failure to sign the NPT as a major reason for not commissioning the furnace.

In mid September, Mr. K. Balu of the Indian Department of Atomic Energy responded to Leybold: "I must express our sense of shock with the way a reputed German firm, such as

Continued on page 8

INTERNATIONAL EXPORT CONTROLS

Export controls are an interlocking set of national and international laws, regulations, and agreements. Most of the international controls apply to fuel cycle items, such as plutonium and enriched uranium production. The oldest nuclear controls are the Zangger Committee (Nuclear Exporters' Committee) Trigger List, which implements supplier commitments in the Non-Proliferation Treaty. This list includes only "especially designed or prepared" nuclear items. The participating countries agree not to sell these items to any facilities not under IAEA safeguards. The sale of an item "triggers" safeguards.

More stringent controls on nuclear commodities are implemented under the Nuclear Suppliers Group (NSG), consisting of more than 25 member countries. Under these controls, the supply of nuclear items requires full-scope safeguards, or IAEA inspections of all nuclear activities in a country.

The newest international export controls implemented by the NSG are controls on dual-use commodities, which have legitimate civilian uses but that are also key in nuclear materials and weapons production. The Nuclear Dual-Use List comprising 65 items is aimed at preventing both fuel cycle and weaponization activities. Unlike other international controls, approval of an export requires a set of "tests" that are applied to the end users. According to U.S. officials, the NSG is moving to require full-scope safeguards as a condition of supplying any items on the dual-use list. (In the United States these items are controlled by the Bureau of Export Administration in the Department of Commerce.)

Newer supplier nations, such as Brazil, China, and India, are not NSG members, since they are also importers and present special policy dilemmas. South Africa, while a supplier, has not adhered sufficiently to the NSG guidelines to be considered a member.

Source: *Critical Technologies Newsletter* DOE/OACN-92-010-002, August, 1992

"Leybold," continued from page 7

yours," does not "honour their contractual commitments in international trade." He then warned Leybold: "Failure on your part to honour the contractual commitments may require [the] Government of India to review their policy vis-a-vis transaction of any business with your firm in the future."

Leybold's refusal to commission the furnace also exposes it to possible legal action by India. Nevertheless, Heidsieck states, "We remain committed to the strict adherence to our principles and procedures even under these circumstances."

CENTRALIZED END USER INFORMATION STILL LACKING

If corporations are to play a major role in thwarting would-be proliferators, they require reliable, current information about the end use of sensitive items. This type of information is vital in deciding whether to refuse sales or reject contractual commitments, especially in cases where the export is in fact legal, but the end use of the export remains in question.

Companies depend on governments for this type of information. In some cases Leybold has had a difficult time obtaining reliable, timely information from either Germany or the United States about the end user. Leybold officials found that both countries lack centralized information databases about front companies and potential end users. It also found that much of the existing information about end users is classified, and thus unavailable to Leybold and other companies.

If the goal is for companies to do more than just obey the letter of the law, governments must be willing to supply them with better information. □

THE LEYBOLD PRINCIPLES

The Germany-based Leybold AG supplies state-of-the-art vacuum equipment and advanced vacuum technology. Although not explicitly military, these are considered "dual-use" items. Some Leybold equipment and processes could be crucial to uranium enrichment, weaponization, and other military goals. This fact came to light when the firm and a U.S. subsidiary were investigated because of electron-beam welders they supplied to Iraq's nuclear and military programs.

Following that embarrassment, Leybold adopted a set of ethical principles and operating guidelines in 1992 that apply to its divisions and subsidiaries worldwide. These principles are paraphrased below.

1) All relevant employees will learn, and strictly abide by, applicable national, foreign, and international export controls and regulations.

2) Even if a particular export is legal, Leybold will voluntarily restrain itself from supplying items to suspected nuclear weapons programs in nonnuclear weapon states that are not signatories to the Non-Proliferation Treaty or an equivalent international treaty, do not have in place full-scope IAEA safeguards, or are "sensitive" for other reasons.

3) Leybold will exercise the same restraint domestically, if the firm has reason to believe that its products are to be diverted to nuclear weapons projects in sensitive countries.

4) The firm will maintain regular contact and consultation with government agencies connected with export policy in order to track countries and goods of concern. In the event of any doubt about a transaction, Leybold will contact responsible agencies for information and advice. If concerns continue about the end-use of an item, Leybold will not export it.

Institute for Science and International Security
236 Massachusetts Ave NE, Suite 500
Washington, DC 20002-4980