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PRESENTATIONS

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NUCLEAR FUEL CYCLE INFORMATION WORKSHOP

Oak Ridge National Laboratory+
Oak Ridge, Tennessee 37830

February 15-17, 1983

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Nuclear Fuel Cycle Information Workshop

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Presentation	Author
An Introduction to the Nuclear Fuel Cycle (Overview)	Rex E. Leuze, Chemical Technology Division
Nuclear Fuel Reprocessing	E. D. North, Fuel Recycle Division
Quick & Dirty Facility	Edward L. Nicholson, Fuel Recycle Division
Review of Foreign Reprocessing	W. D. Burch, Fuel Recycle Division
Safeguards for the Nuclear Fuel Cycle - The Needs, Concepts, and Status	H. T. Kerr, Engineering Technology Division
Transportation of Radioactive Materials	L. B. Shappert, Chemical Technology Division
Uranium Enrichment - An Overview	J. R. Merriman, Enrichment Technology Division
Uranium from Phosphate Ores	Fred J. Hurst, Chemistry Division
Transuranium Processing Plant (TRU)	L. J. King, Chemical Technology Division
Waste Disposal	J. O. Blomeke, Fuel Recycle Division
Fuel Fabrication	Roy E. Norman, Fuel Recycle Division
Reactors and Fuel Production	Paul R. Kasten, Central Management Division

LESTER J. KING

Mr. King has been a member of the Chemical Technology Division since 1954. He received his bachelor's and master's degrees in chemical engineering from the University of Rhode Island in 1948 and 1951.

He has been associated with the Transuranium Processing Plant since 1965 and has been the Manager of that facility since 1972.

Lester J. King
Manager, Transuranium Processing Plant
Chemical Technology Division
Oak Ridge National Laboratory
P. O. Box X
Oak Ridge, TN 37830
Telephone 615/574-7071

JOHN E. BIGELOW

Dr. Bigelow initially joined the Chemical Technology Division staff as a summer employee in 1952. He received his bachelor's degree in Chemical Engineering from Purdue University in 1950. His master's and doctor's degrees were received from Massachusetts Institute of Technology in 1952 and 1956.

He has been associated with the DOE's Transplutonium Element Production Program since 1961, and currently holds the position of Transuranium Materials Coordinator.

Dr. John E. Bigelow
Chemical Technology Division
Oak Ridge National Laboratory
P. O. Box X
Oak Ridge, TN 37830
Telephone 615/574-7071

TRANSURANIUM PROCESSING PLANT

The Transuranium Processing Plant (TRU) is a remotely-operated, hot-cell, chemical processing facility of advanced design. The heart of TRU is a battery of nine heavily shielded process cells housed in a two-story building. Each cell, with its 54-inch-thick walls of a special high-density concrete, has enough shielding to stop the neutrons and gamma radiation from 1 gram of californium-252 and associated fission products. Four cells contain chemical processing equipment, three contain equipment for the preparation and inspection of HFIR targets, and two cells are used for analytical chemistry operations. In addition, there are eight laboratories used for process development, for part of the process-control analyses, and for product finishing operations.

The building was designed for absolute containment of the highly radioactive materials handled in the cells and laboratory glove boxes. The vessels that carry the materials, the cubicles within the cells, and the cells themselves constitute three successive containment envelopes, each separately ventilated; ventilation exhausts are doubly filtered before the air is discharged to the stack. To further ensure that all materials are contained within the building, all operating areas and laboratories are maintained slightly below atmospheric pressure by the building ventilation system.

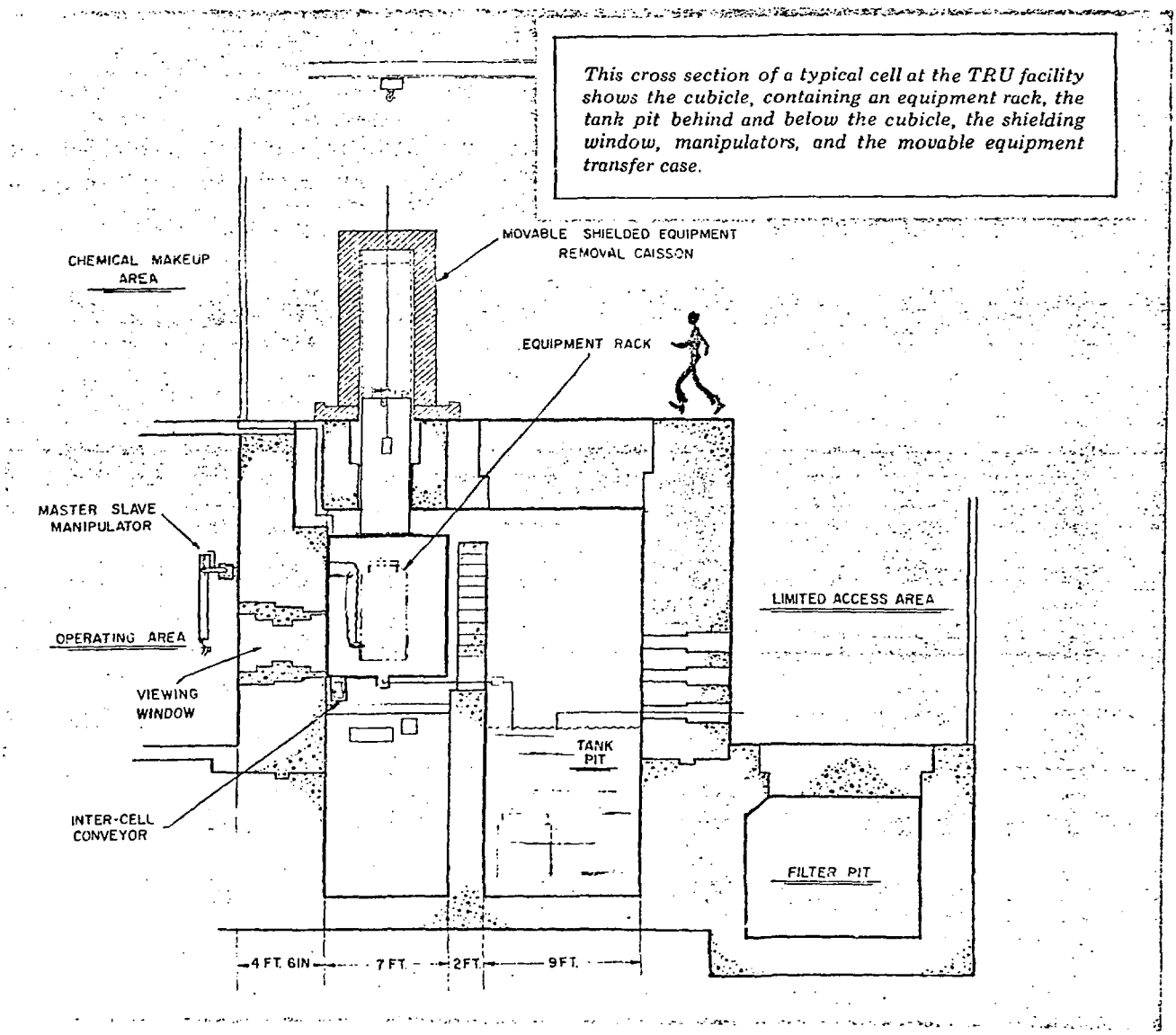
All operations and maintenance are performed remotely with master-slave manipulators and viewed through specially designed windows. Each window consists of several thick panes of lead glass alternating with compartments filled with mineral oil. The oil helps shield against neutrons, while the glass controls the gamma radiation.

Smaller items of chemical processing equipment, such as valves, pumps, and ion exchange columns, are mounted on racks in the cells. This equipment can be installed or removed remotely by using manipulators and air-operated impact wrenches to open or close the disconnect clamps on the many process lines. Process vessels in pits behind the cubicles are serviced and maintained with a combination of remote and underwater maintenance techniques.

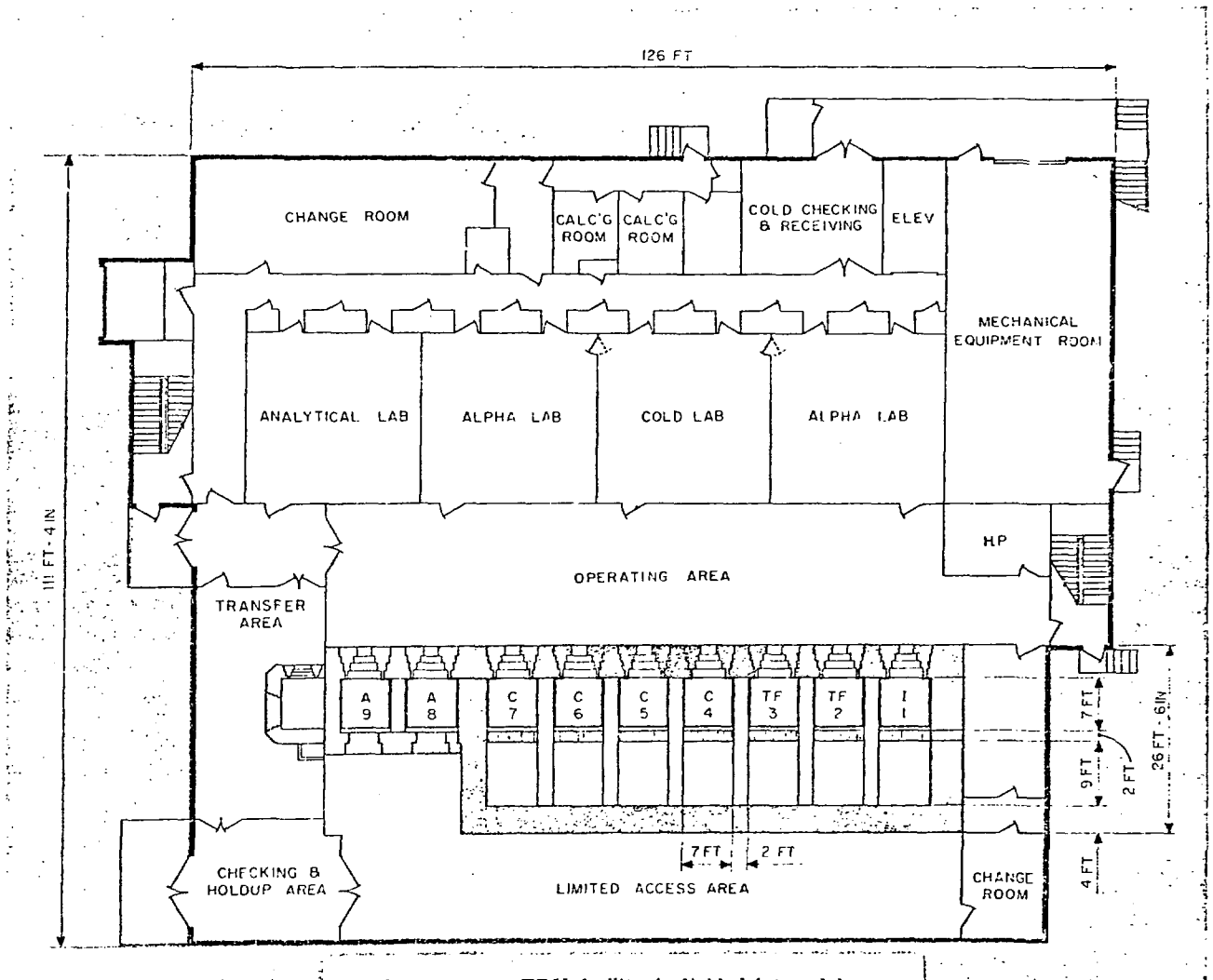
Contaminated equipment can be removed from the cell bank either through an inter-cell conveyor to a shielded carrier at a loading station at one end

of the cell bank or through the top of the cell to a shielded caisson designed to maintain shielding and contamination control during the transfer.

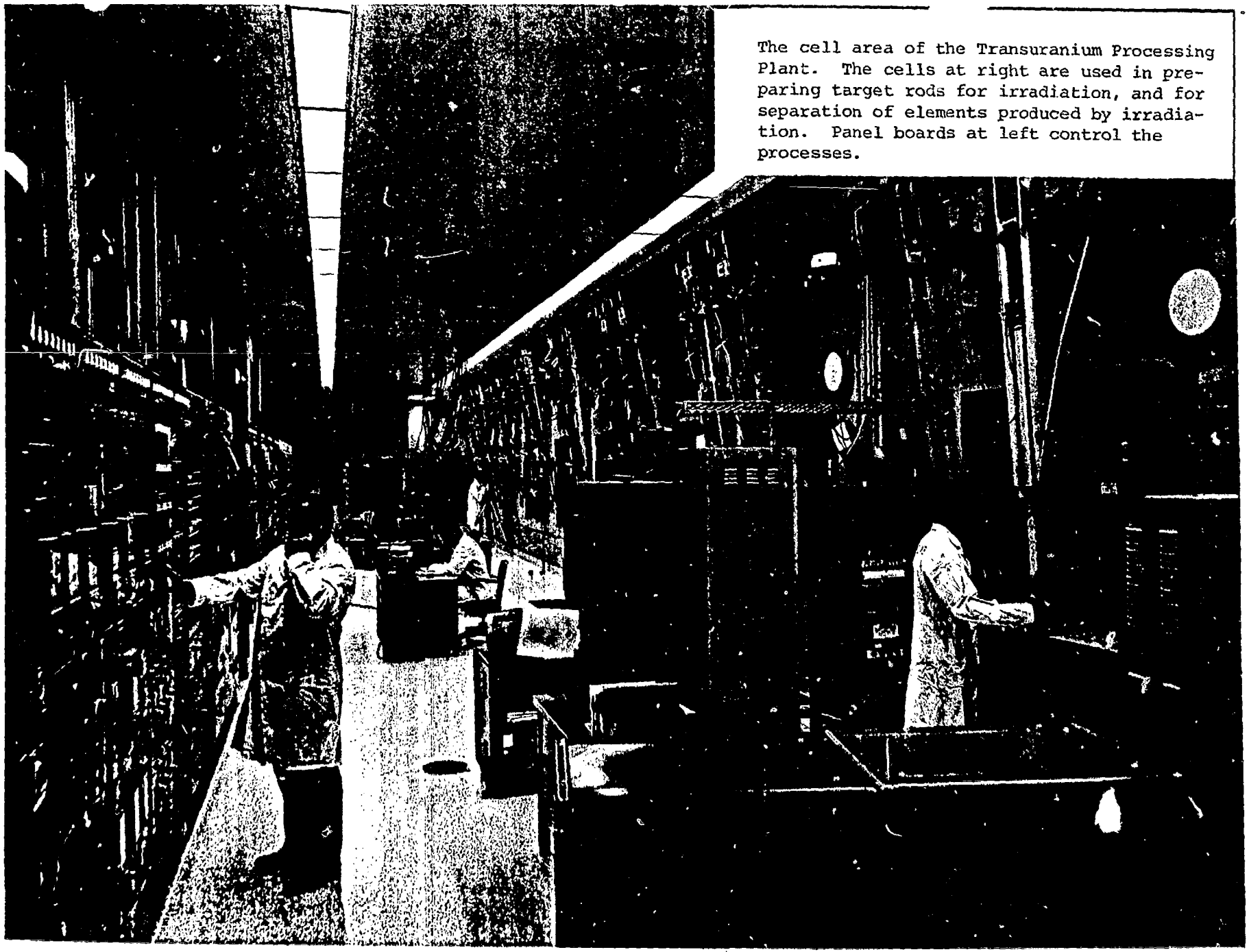
Although the Transuranium Processing Plant was built for the purpose of recovering transuranium elements from targets irradiated in the High Flux Isotope Reactor (HFIR), it is also a highly versatile facility which has extensive provisions for changing and modifying equipment. Thus, it was a relatively simple matter to install a Solvent Extraction Test Facility (SETF) in one of the TRU chemical processing cells for use in the evaluation and demonstration of solvent extraction flowsheets for the recovery of fissile and fertile materials from irradiated reactor fuels. The equipment in the SETF has been designed for process development and demonstrations and the particular type of mixer-settler contactors was chosen because it is easy to observe and sample.



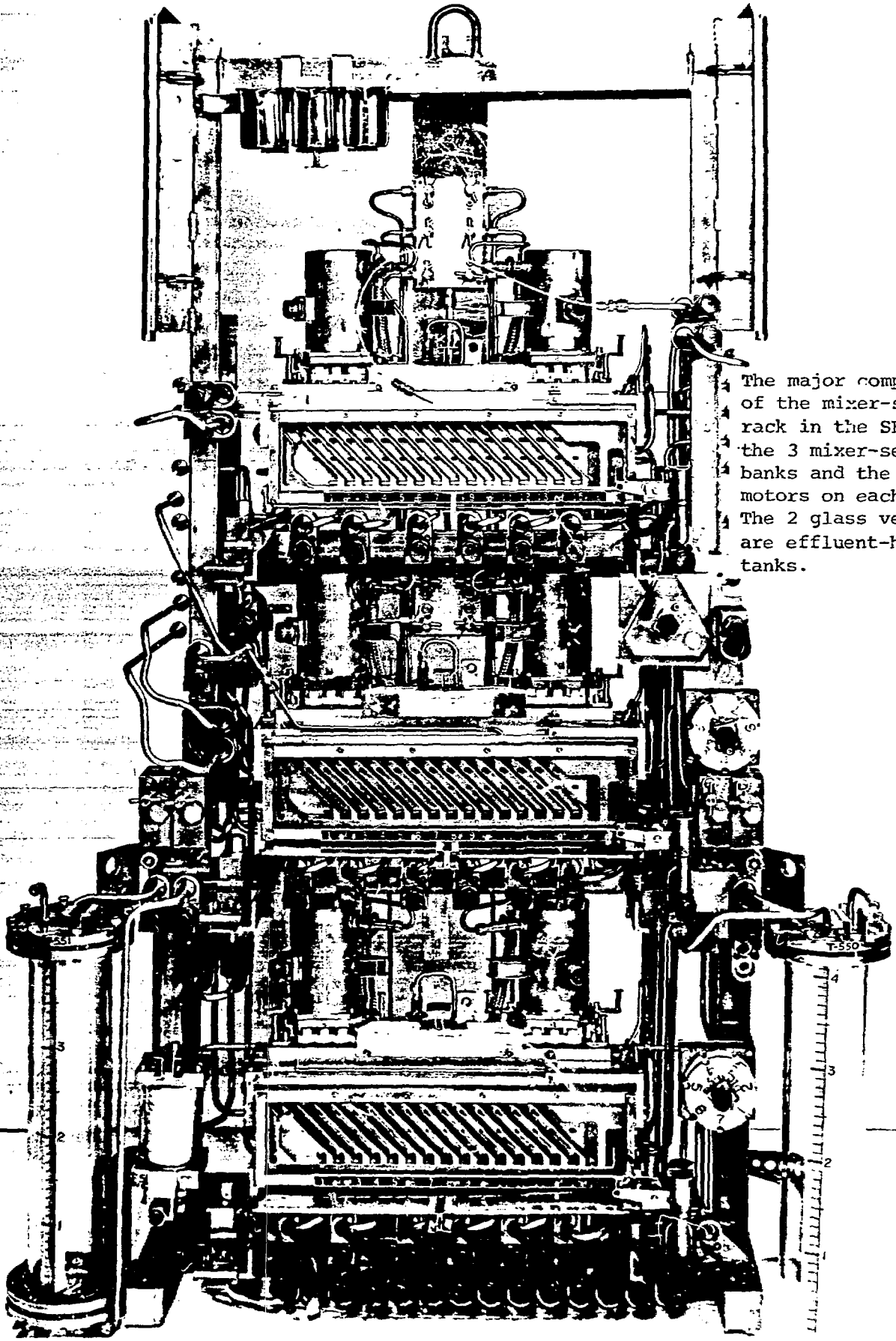
This cross section of a typical cell at the TRU facility shows the cubicle, containing an equipment rack, the tank pit behind and below the cubicle, the shielding window, manipulators, and the movable equipment transfer case.



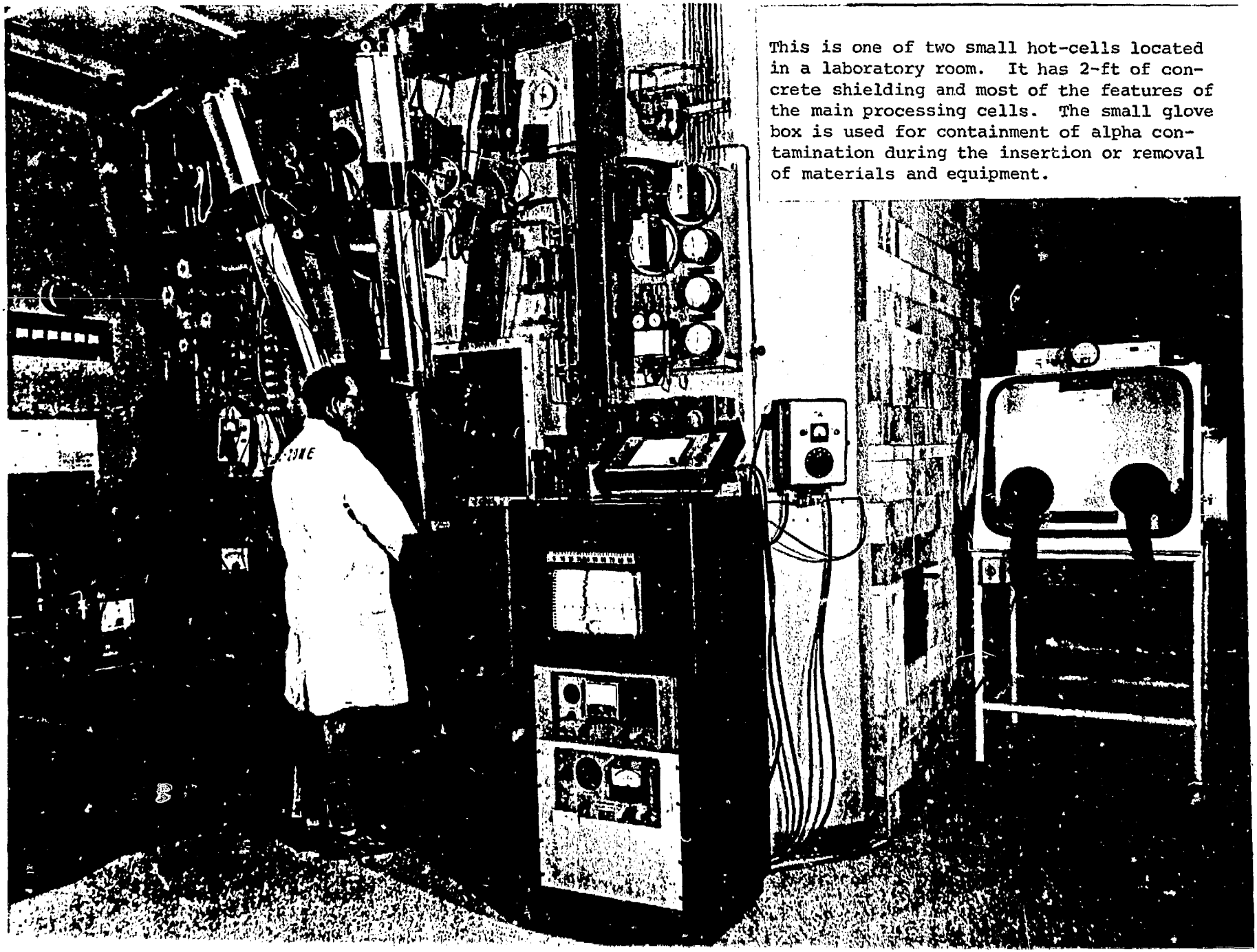
The two-story TRU facility is divided into a laboratory wing and a process area, which includes the shielded cell bank. Remote target fabrication is performed in cells 1, 2, and 3. Chemical separations processes are done in cells 4—7, while 8 and 9 are for analytical chemistry work.



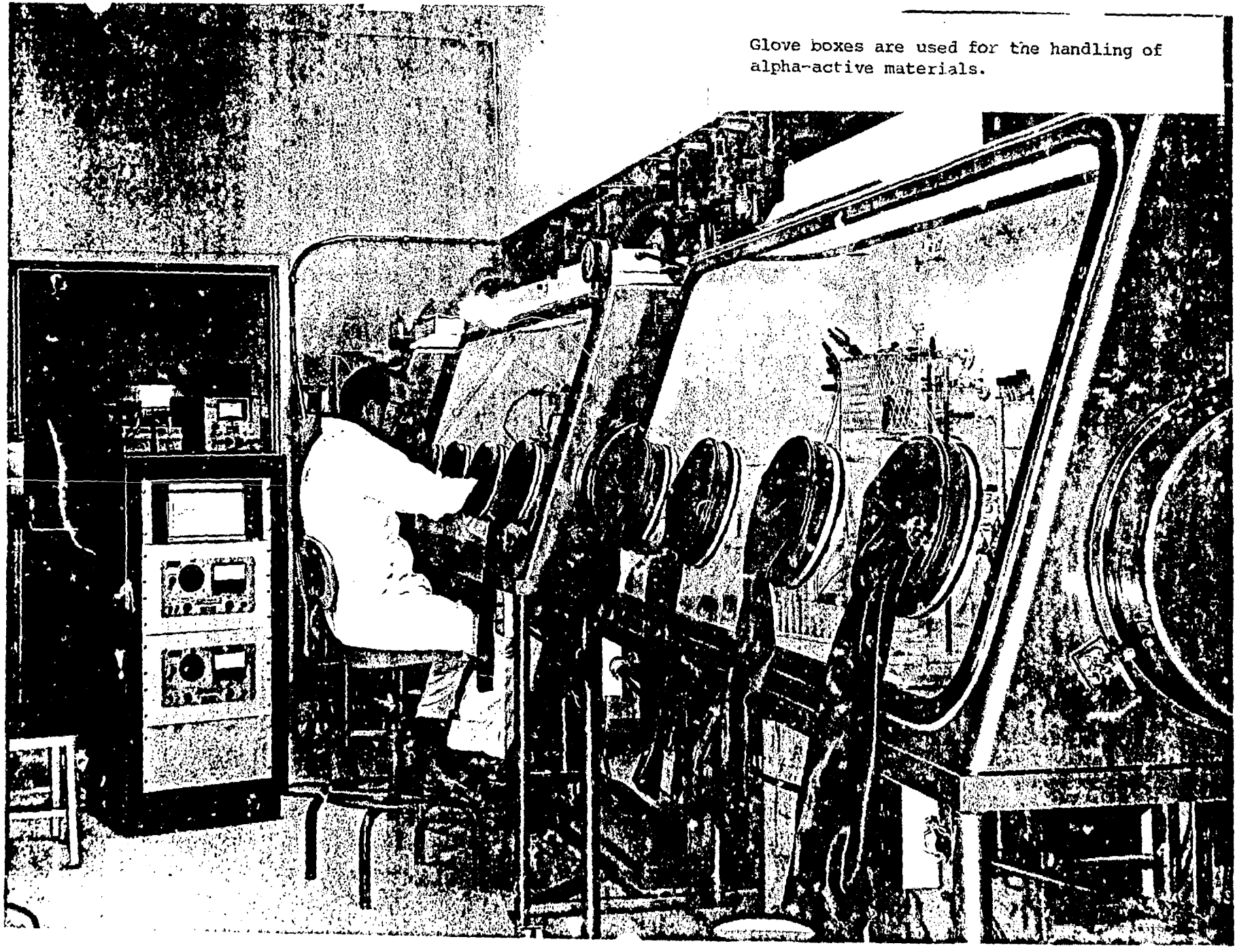
The cell area of the Transuranium Processing Plant. The cells at right are used in preparing target rods for irradiation, and for separation of elements produced by irradiation. Panel boards at left control the processes.



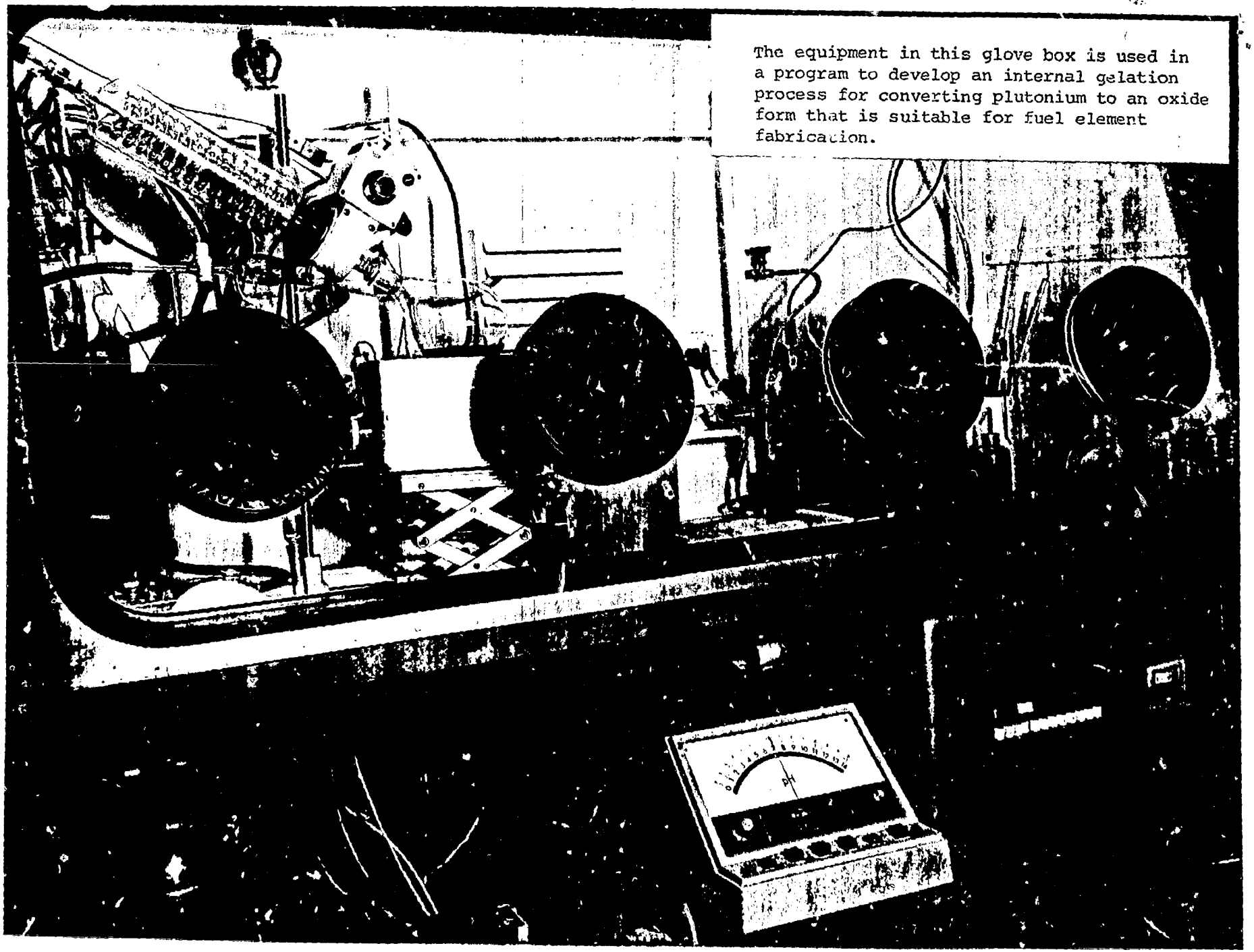
The major components of the mixer-settler rack in the SETF are the 3 mixer-settler banks and the 2 drive motors on each bank. The 2 glass vessels are effluent-handling tanks.



This is one of two small hot-cells located in a laboratory room. It has 2-ft of concrete shielding and most of the features of the main processing cells. The small glove box is used for containment of alpha contamination during the insertion or removal of materials and equipment.



Glove boxes are used for the handling of alpha-active materials.



The equipment in this glove box is used in a program to develop an internal gelation process for converting plutonium to an oxide form that is suitable for fuel element fabrication.