TMI Unit-2 Technical Information & Examination Program

UPDATE

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Entry Teams Take First Look at Reactor Head, Polar Crane

The first close look at the Unit-2 reactor vessel head and the polar crane revealed expected rust but no visible damage, according to members of the fifth containment entry team.

The fifth entry into the Unit-2 containment, conducted on December 11 by a team of 14 persons, was devoted to visual inspection of the reactor head and polar crane, additional radiation surveys, and tests of decontamination procedures. All tasks further photographic surveys of the containment interior. Results from the radiation surveys and decontamination tests are expected to be reported in a later issue of the TI&EP Update.

Gregory R. Eidam, a TIO project engineer who participated in the entry, reported that the crane, cables, and hook were rusty but appeared to be structurally sound. One section of copper conductor from the crane was found to have fallen to the 347-foot floor level. A more detailed examination of the polar crane, including motors and auxiliary equipment, is tentatively planned for the seventh containment entry to be conducted in early March.

Other team members reported that the area around the top of the reactor vessel appeared to be rusty. Water was found in the north neutron shield tanks; the south tanks were dry.

Four persons from GPU companies were occupied for more than an hour taking additional radiation surveys on the 305-foot floor level, examing floor penetrations for future sump sampling, and checking locations for television cameras scheduled for installation during the sixth containment entry (see article in this issue).

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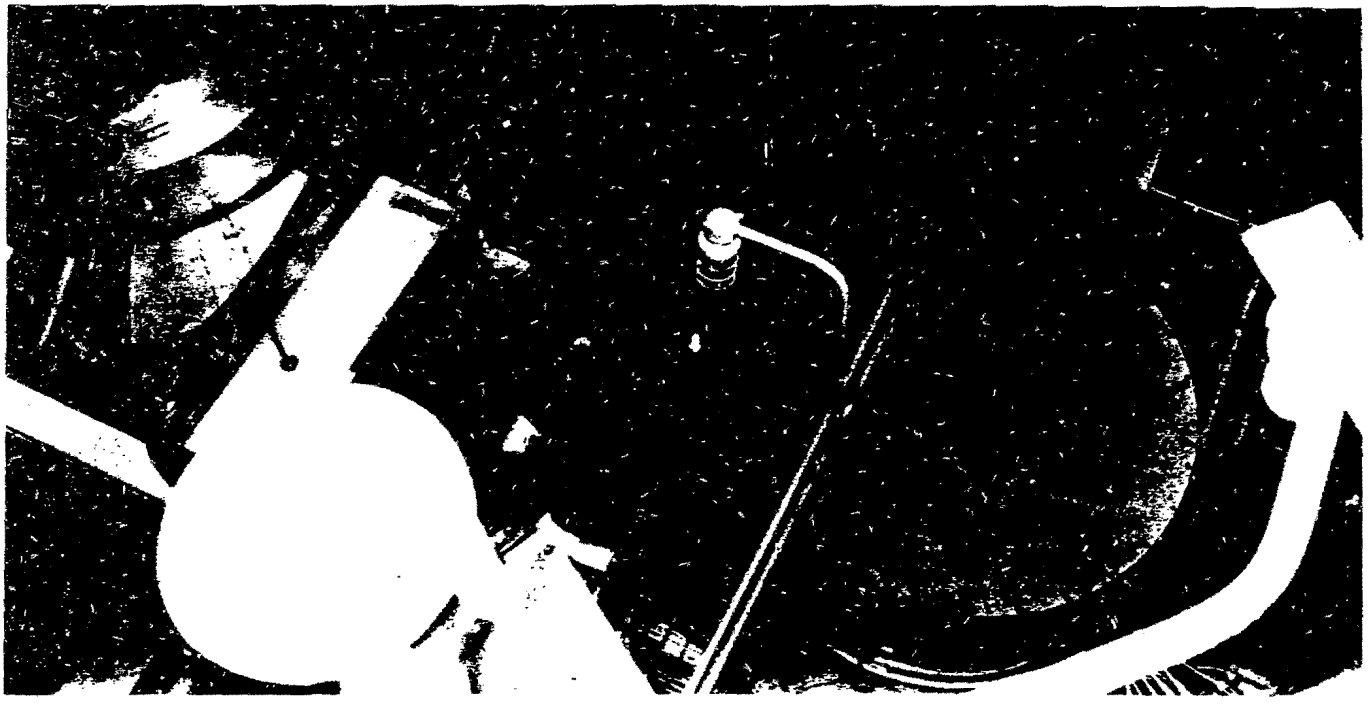


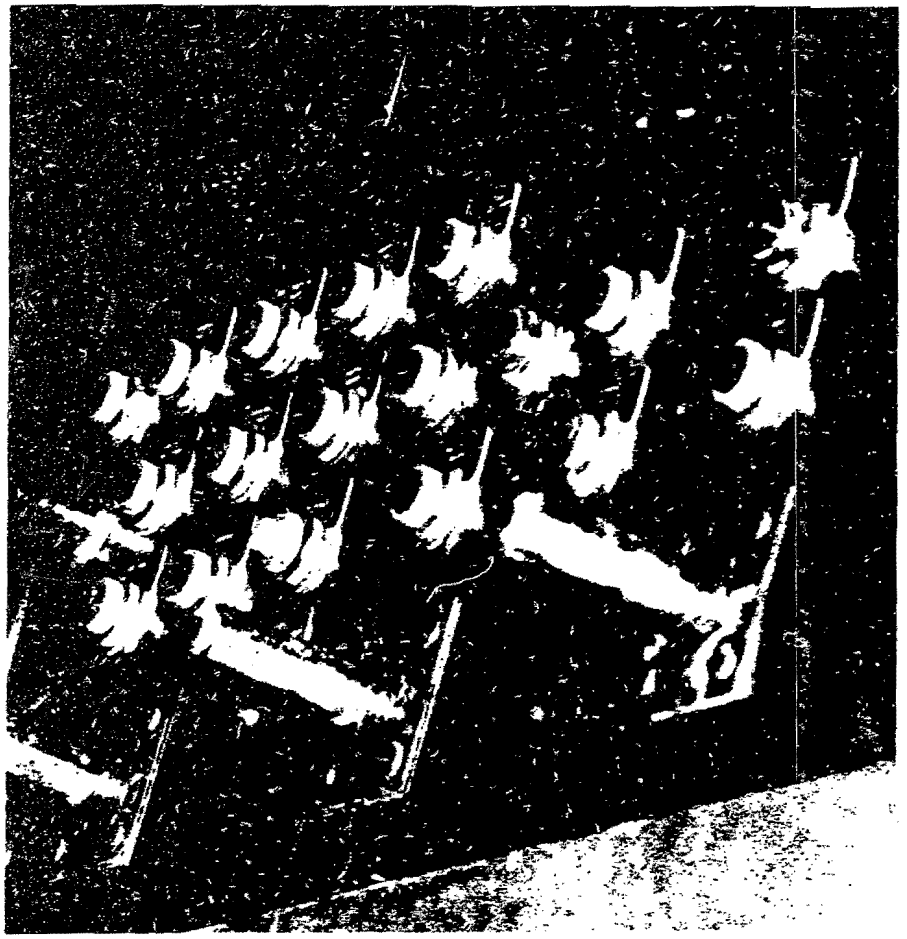
View from the top of the D-ring looking down at the steam generator (left) and the reactor coolant pump (right). Most of the exposed metal surfaces show little sign of corrosion.

Entry Team

Continued from page 1

On the 347-foot floor level, other team members tested gross decontamination methods to determine the most effective techniques. The tests included water flushing at low pressure, water flushing at high pressure, decontamination solution with abrasive scrubbing and a low-pressure flush, strong decontamination solution with low-pressure flush, and a strippable coating. The temperature of all decontamination fluids was 150°F.

Among the entry team members was John Collins, deputy program director of the Nuclear Regulatory Commission's (NRC) TMI Site Office. Collins left TMI recently to take another NRC post with the Office of Inspection and Enforcement, Region 4, in Texas.



Exposed metal parts on the control panel for the auxiliary fuel handling bridge are extensively corroded. Plastic buttons and control handles are partially melted.

TIO Engineer Participates in Fifth Entry

Gregory R. Eidam, a Technical Integration Office Project engineer, helped inspect the Unit-2 polar crane during the fifth containment entry, conducted on December 11.

Eidam was the project engineer for the original installation and refurbishment efforts for the polar crane at the Loss-of-Fluid-Test (LOFT) Facility at the Department of Energy's Idaho National Engineering Laboratory.

"We took the stairs up (from the 347-foot floor level) and climbed the crane access ladder between the two crane box beams," Eidam said. "We took radiation readings and did a visual inspection. The crane looked rusty, as were the couplings and the rails. It appeared to be in structurally good condition."

Eidam remarked that one section of copper conductor (bus bar) from the crane had fallen to the 347-foot level floor.

Before climbing to the polar crane, Eidam helped photograph conditions inside the containment. He watched, as part of the buddy-system plan, when two other team members climbed down to inspect the top of the reactor vessel.

According to Harold Burton, Manager of the TIO, refurbishment of the Unit-2 polar crane is an extremely important activity of the TI&EP. "It represents a critical path activity to early examination of the reactor core and removal of the reactor vessel head, both key recovery program milestones," stated Burton.

Eidam is scheduled to join the seventh containment entry team in late February for more extensive mechanical and electrical inspections of the crane and its components.

TMI Unit-2 Technical Information & Examination Program

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The *TI&EP Update* is specifically designed to highlight data and information obtained as part of the TMI-2 Technical Information and Examination Program (TI&EP). As space permits, the *TI&EP Update* may feature certain TMI-related information that, though not part of the TI&EP, would be of general interest to the scientific community.

W.W. Bixby is manager of the DOE-TMI Site Office. H.M. Burton is manager of the Technical Integration Office. D.M. Grigg is managing editor of the *TI&EP Update;* G.R. Brown is associate editor.

Fourth Entry on Videotape

Twelve engineers and technicians, working in three shifts over a three-hour-and-forty-minute period, filmed an hour of videotape footage inside Unit-2 as part of the reactor building damage asessment during the fourth containment entry. They supplemented the videotape by taking 71 still photographs.

The November 13 videotape included 20 minutes of filming at the 305-foot floor level and 40 minutes at the 347-foot floor level. The tape was later edited to 20 minutes and narration was added.

The other activities by team members on the 347-foot floor level included moving the auxiliary fuel handling bridge for easier access to a ladder leading to the reactor vessel head area, testing decontamination methods, and conducting radiological surveys.

On the 305-foot level, gamma readings ranged from 200 millirem per hour (mrem/hr) in the northeast section of the containment to 3800 mrem/hr at the B core flood tank piping. Gamma readings on the 347-foot level ranged from 100 mrem/hr at the top of the east D ring to 1000 mrem/hr at a floor drain and 1500 mrem/hr at about one meter into the west D ring.

Smear samples taken on the 305-foot level as part of testing decontamination methods yielded the preliminary results shown in Table 1.

A scrape sample taken outside the decontamination methods test area yielded preliminary readings of 3.4×10^{-1} microcuries (μCi) of cesium-134 and 2.4×10^{1} μCi of cesium-137. A scrape sample from the test area following decontamination testing showed 5.0×10^{-2} μCi of cesium-134 and 3.6×10^{-1} μCi of cesium-137.

A paint chip found on the floor at the 347-foot level had results of 1.6×10^{-2} μCi of cesium-134, 1.1×10^{-1} μCi of cesium-137, and 4.8×10^{-3} μCi of strontium-90. The chip is believed to be from the containment building dome.

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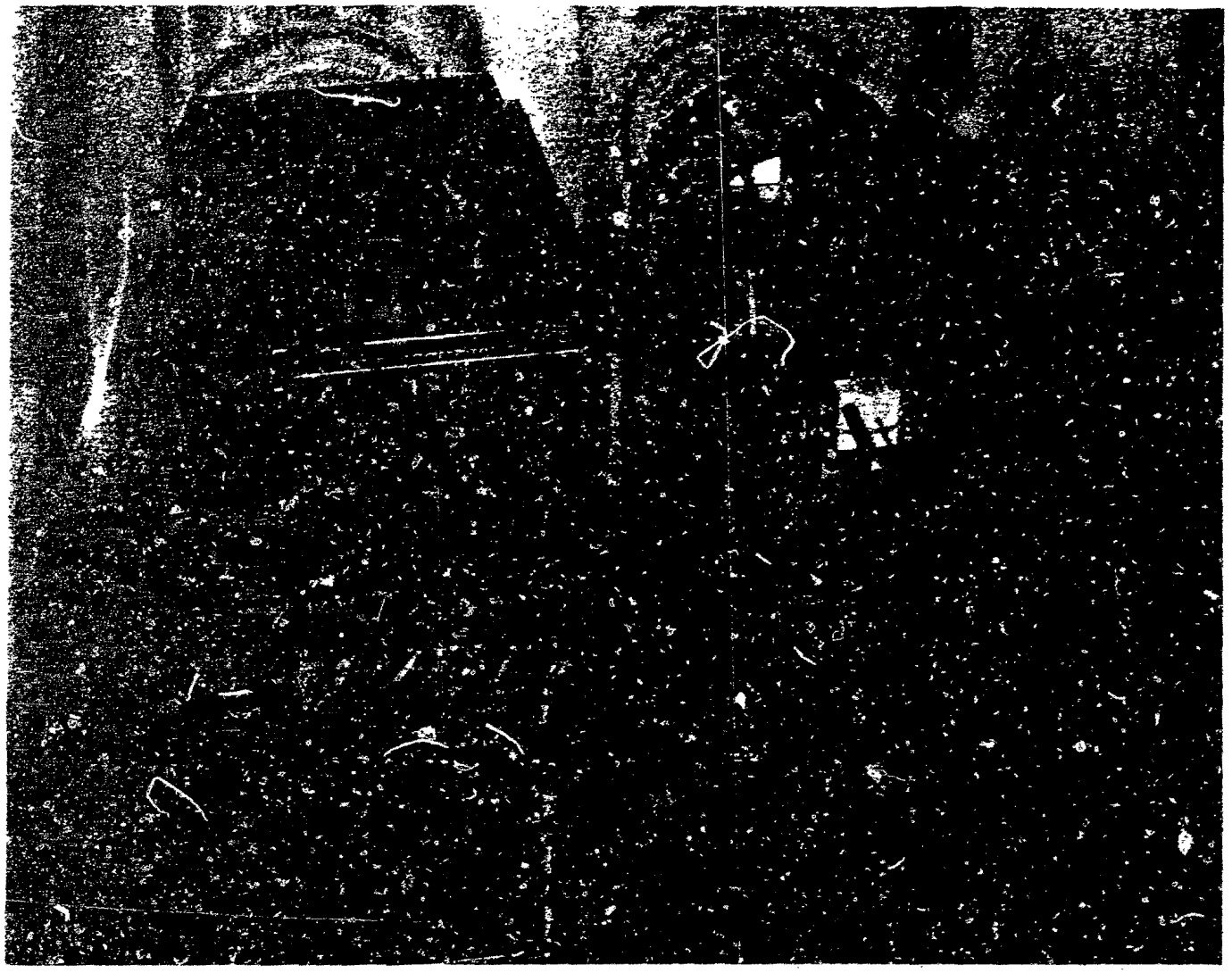
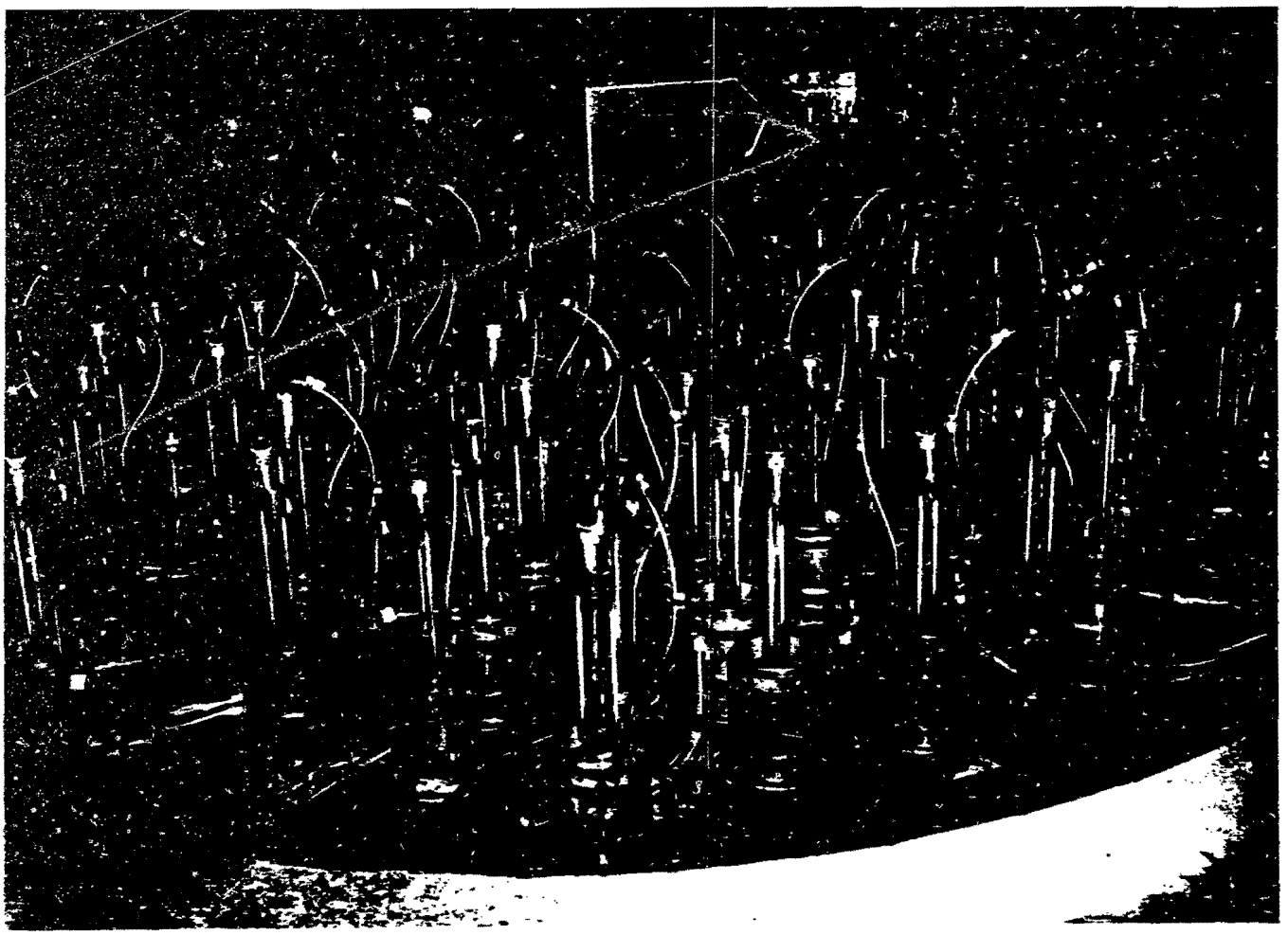


The fourth entry was videotaped using a camera installed in containment penetration 626. This penetration was also used for visual examination of the containment interior and drawing reactor building air samples prior to the first entry (see *TI&EP Update* of April 15, 1980).

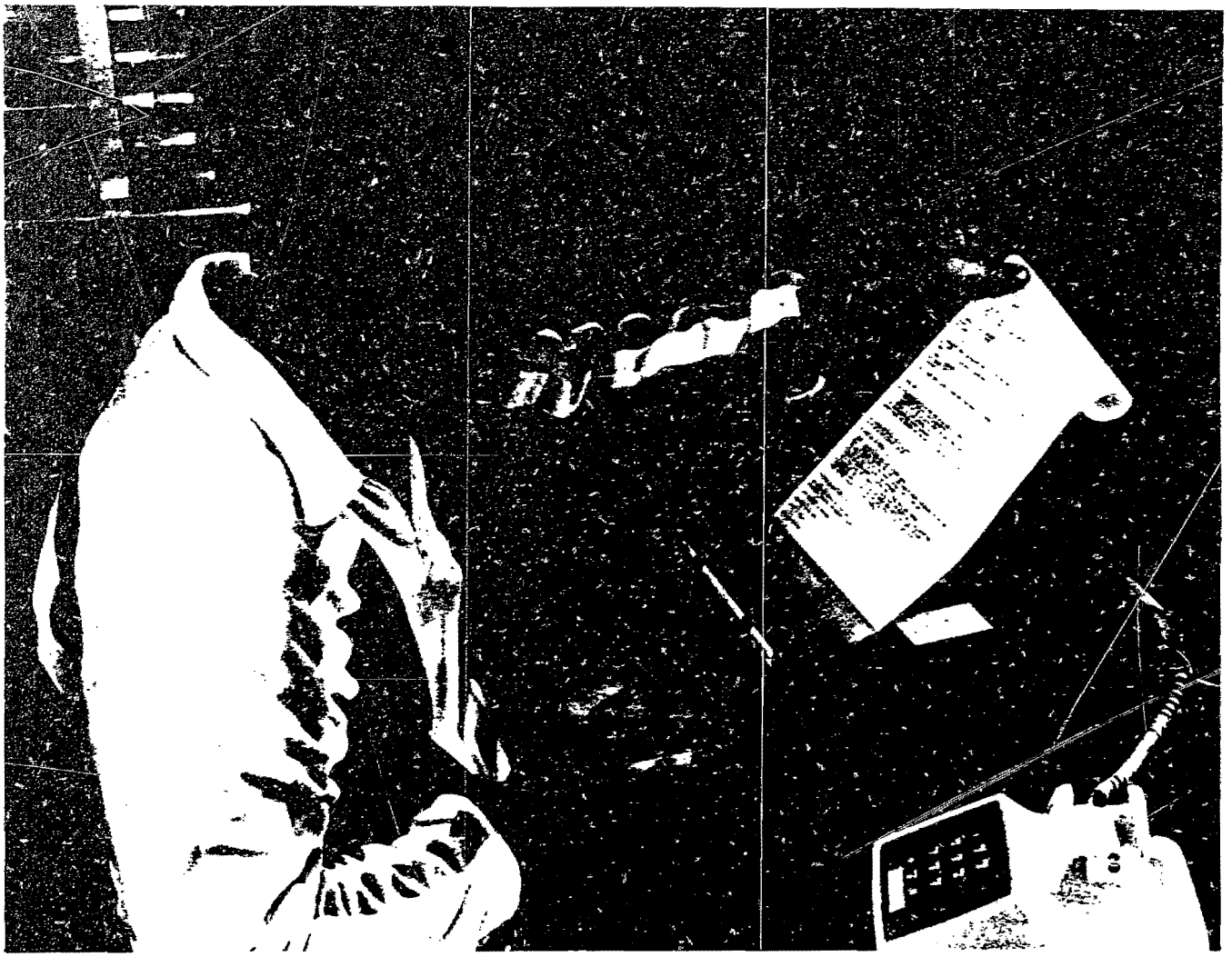
Fourth Entry *Continued from page 3*

Table 1. Preliminary Analyses of Smears Taken on the 305-Foot Level (in microcuries)

Treatment	Sample No.	Cesium-134	Cesium-137	Strontium-90
Before decontamination	1	1.7E0 ± 7.6E-3	1.2E1 ± 1.9E-2	2.3E-1 ± 5%
	2	1.3E0 + 6.6E-3	8.9E0 + 1.6E-2	5.7E-1 + 5%
After demineralized water wash	3	1.8E-2 ± 3.1E-4	1.4E-1 ± 7.6E-4	5.2E-3 ± 5%
	4	2.6E-2 + 3.7E-4	1.9E-1 + 8.9E-4	1.4E-2 + 5%
After Radiac wash	5	7.8E-3 ± 2E-4	5.8E-2 ± 4.9E-4	5.6E-3 ± 5%
	6	3.8E-3 + 1.4E-4	2.8E-2 + 3.4E-4	7.7E-4 + 5%
After Radiac scrub	7	8.5E-3 ± 2.1E-4	6.3E-2 ± 5.1E-4	3.3E-3 ± 5%
	8	5.1E-3 + 1.6E-4	3.6E-2 + 3.9E-4	1.2E-3 + 5%



Accumulation of boron crystals is evident around the base of the incore instrumentation seal table. Corrosion is visible on the exposed metal surfaces.



F.J. Kocsis III, TIO Information and Records Manager, uses a computer terminal to relay TMI data to nuclear utilities. The terminal is part of the Nuclear NOTEPAD computer conferencing system.

TIO Relays Data to Nuclear Utilities

A computer conferencing system is helping the TIO disseminate information to nuclear utilities about activities at TMI Unit-2.

Nuclear NOTEPAD, formerly known just as NOTEPAD, offers computer conferencing among 62 nuclear utilities with operating or construction licenses, the Nuclear Safety Analysis Center (NSAC)/ Institute of Nuclear Power Operations (INPO), and the TIO at Three Mile Island via either printout or video display terminals.

"Nuclear NOTEPAD users can receive from TIO the results from containment entries, pertinent news stories about TMI activities, and news releases from the GPU Public Affairs Office," said Frank J. Kocsis III, TIO Information and Records Manager.

"As more reports and data about the TMI-2 recovery become available, we will make announcements on NOTEPAD so that interested nuclear utilities may request it," Kocsis said.

Kocsis and Ronald Simard, Assistant Director for Information and Data Services at NSAC, set up the TMI NOTEPAD operation nine months ago. NSAC and INPO jointly found NOTEPAD. INFOMEDIA Corporation of Palo Alto, California, operates the computer conferencing system.

"NOTEPAD has been used extensively to share expertise among the nuclear utilities and gain information about Nuclear Regulatory Commission orders for design and operating changes in nuclear plants," Kocsis said.

NOTEPAD was organized in August, 1979, after the Kemeny Commission criticized the lack of information being shared among nuclear utilities.

The value of NOTEPAD, officials said, was demonstrated in February, 1980, when Florida Power Corporation's Crystal River Plant experienced problems and information sharing helped rectify the situation.

Cameras Installed in Unit-2

Technicians have installed eight black-and-white television cameras inside Unit-2 to provide continuous visual monitoring of conditions inside the containment building. Videotaping equipment, included as part of the system, will allow making visual records of future events within the containment and will assist the TIO in documenting damage within the reactor building.

The installation, performed as part of the sixth containment entry on February 3rd and 5th, included placement of four cameras each for overlapping coverage on the 305- and 347-foot levels of the building. Technicians transported the cameras into the containment on the first day of the entry, and installed them on the second day.

The night-vision cameras, dubbed "moon landers" because of the white environmental housings atop tripods, are linked to control consoles in the Unit-2 control room and the entry command center.

Each camera has a zoom lens with a one-billion-to-one dynamic range so that they will operate in extremely low light levels, according to James W. Mock, the TIO project engineer who worked with General Public Utilities Corporation on the installation. Auxiliary lights can be attached to the cameras if necessary.

The camera housings include windshield wipers to remove condensation that accumulates in the high humidity of the containment. Each housing also has positions, both inside and outside, for attaching radiation dosimeters.

Mock explained that for camera control from the consoles, each camera unit has redundant receivers for remote operation of lens zooming, panning, and tilting. Cables especially manufactured for the project carry the signals from the containment to the monitor screens on each console. Operators at the console can see transmissions from each camera and select a desired view for recording on videotape.

Krypton-85 Venting Final Results

Final results of effluent monitoring done during the two-week venting of krypton-85 from the Unit-2 containment showed that about 44,132 Curies were released. The venting occurred from June 28 to July 11, 1980 and was described in the *TI&EP Update,* October 29, 1980.

Analyses indicated the reactor building originally contained about 44,600 Curies of krypton. In addition, the project vented an estimated 1.3 Curies of tritium, 5.5×10^{-6} Curies of cesium-137, and 5.72×10^{-9} Curies of strontium-90.

Radiological monitoring by the General Public Utilities Corporation and the Environmental Protection Agency confirmed that detectable offsite releases of radioactive material were well within the technical specifications set for venting by the Nuclear Regulatory Commission (NRC).

Since July, the utility has vented about 100 Curies of krypton-85 a month, which is permissible within NRC guidelines. The releases are usually made before entries into the containment building.

GEND Group Hosts First International Seminar

More than 100 persons from 21 countries learned about the progress of the TMI Unit-2 research effort and plans for future work during a two-day seminar in Washington, D.C.

The seminar, hosted by the GEND group -- General Public Utilities Corporation, Electric Power Research Institute, United States Nuclear Regulatory Commission, and United States Department of Energy -- was the first directed to an international audience.

"The emphasis of the presentations was the plans for carrying out research programs and selected results to date in three areas -- instrumentation and electrical survivability, decontamination and dose reduction, and radioactive waste processing," said Willis W. Bixby, DOE Site Manager at TMI.

The GEND group sponsors the Three Mile Island Technical Information and Examination Program to obtain valuable generic information from the Unit-2 accident.

The November 21 and 22 seminar, Bixby said, included presentations on nine major task areas:

- Instrumentation and electrical survivability
- Fission product transport and deposition
- Decontamination and dose reduction
- Radioactive waste handling
- Data bank
- Mechanical component survivability
- Early core damage assessment
- Core deposition studies
- Fuel and core component examination program

Participants also had the opportunity to watch a 20-minute, narrated, color videotape of the fourth entry into the Unit-2 containment.

The GEND group plans to be "quite flexible in working with individual nations or organizations within nations," Herbert Feinroth, DOE director for the System and Safety Evaluation Division, told the seminar. Suggestions for participation included purchase of technical reports and direct involvement in development of nuclear waste disposal programs.

Five countries -- Germany, Italy, Spain, Sweden, and Taiwan -- already have representatives at TMI to work with the utility. Representatives from other countries gave positive responses to the possibility of participating, but none have made committments as yet.

"Each government or organization at the meeting was encouraged to participate in a manner considered suitable to its needs." Bixby said.

HP-RT-211 Analysis Results

Sandia National Laboratories has completed analysis of radiation detector HP-RT-211, which was removed from the containment building during the second entry (see *TI&EP Update* of October 29, 1980). The major preliminary findings are:

- the total radiation dose estimate for the detector is lower than previous estimates,
- equipment having electrical connectors should be oriented so that the connector is shielded from direct spray or the connector shell should be potted to reduce the possibility of water and contaminant intrusion, and
- with slight adjustment or modification, some instruments may still provide correct and usable information despite partial failure.

The cause of the instrument failure was confirmed to be a 163-ohm short circuit between the collector and emitter of a 2N-3906 transistor, which was part of the detector output circuit.

Scanning electron microscope photographs showed a catastrophic punch-through between the collector and emitter. Scientists postulated that the failure occurred when the containment building spray system actuated during the TMI incident, shorting the signal and 600-volt pins in the backshell of the connector joining the detector to its cable. (No other radiation detector failed in this manner.)

Although the failure caused the instrument to indicate low, instrument data recorded on a stripchart appear to be proportional to actual radiation levels in the containment. Efforts to reconstruct the radiation profile time history are continuing.

Six transistors, two pieces of Teflon tubing, and a buna nitrile "O" ring were removed from the detector for use in estimating the total gamma radiation dose. Data collected by exposing like devices to known radiation doses enabled scientists to estimate the total dose at the detector location within the containment to be between 0.7E5 and 3E5 rads.

Gamma spectroscopy and radiochemical analysis of the outside detector surfaces indicated the presence of cesium and strontium contaminants but no transuranics (to the minimum detectable limits of the instruments used). The top horizontal surface had cesium-134 and cesium-137 gamma levels of 0.048 and 0.305 microcuries per square centimeter respectively. The levels on the sides and bottom were lower by a factor of four. Beta-gamma film profiles of the contaminant distributions showed localized hotspots. The "O" ring seal prevented contaminants from entering the inside of the detector.