

UPDATE

October 29, 1980

Published by EG&G Idaho, Inc. for the U.S. Department of Energy

Third Successful Containment Entry Completed

Five men completed the third successful entry into the Unit-2 containment building on October 16, 1980. They were able to stay longer than planned because radiation levels inside the building were lower than anticipated. The team completed all tasks planned for the entry.

The team members were Sam Griffith, 28, a health physics technician with Nuclear Support Services Inc.; Larry E. Eberly, 44, an instrument and control technician with Metropolitan Edison Company (Met-Ed); Guy E. Wise, 45, a Met-Ed machinist; Richard Croll, 28, a radiation-chemical technician with Met-Ed; and Peter Keegan, 27, a Met-Ed senior health physics technician. Griffith was also a member of the team that performed the second containment entry (see article on inside pages).

During the entry, Wise and Croll repaired the locking mechanism of a personnel airlock that is part of the equipment hatch (refer to location maps on the inside pages). The doors to this airlock have been shut since the incident on March 28, 1979. Other team members completed a radiological survey of core flood tanks, performed maintenance on two monitors that keep operators apprised of certain plant systems, and conducted a visual survey of the polar crane, the device used to lift the reactor head during refueling.

Also completed were five tasks supported by the Technical Integration Office (TIO). These were removal of a source range neutron detector preamplifier; removal of a spare parts monitor preamplifier; photographing areas of interest identified during

previous entries; surveying radiation levels in the area around HP-RT-211, the radiation detector removed during the second entry; and removal of a

Continued on page 2

This *TI&EP Update* highlights the venting of the containment and the first three containment entries at TMI Unit-2. This information, although not entirely a part of the technical information and examination program, is considered of general interest to the scientific community.



An entry team member takes beta radiation surveys just south of the enclosed stairway. Behind him are the ventilation ducts. Story on containment entry on inside pages.

Containment Entry

Completed

Continued from page 1

section of cable that was connected to HP-RT-211.

The team recorded radiation readings of between 200 and 500 millirem (mrem) per hour on the 305-foot elevation, or entry level, and in average of 150 mrem per hour on the 347-foot elevation, or operating floor.

Wise and Eberly left the building after the first hour, staying twice as long as was planned. Keegan left with them when a camera malfunctioned. He was scheduled to join Croll and Griffith, who were inside for 90 minutes (30 minutes longer than scheduled).

Actual radiation doses to the team

members were well below the 625 mrem limit set for the entry; they ranged from 200 to just over 450 mrem. By comparison, the company quarterly limit is 1250 mrem and the federal quarterly limit is 3000 mrem.

During the entry, the team wore cotton overalls instead of the heavier fireman's coats worn during the first two entries. They also wore battery-powered air filtration devices with positive-flow air masks, rather than the oxygen tanks worn during the first entry.

The entry preparations and control center activities were videotaped by the TIO. These tapes will be narrated by the entry team manager and will be available for training critiques and management briefing.

Operating Floor Radiation Measurements Taken During Second Entry



The entry team discovered extensive rusting on all of the metal around the power track.

On August 15, 1980, a four-man team made the second entry into the TMI Unit-2 containment and visited the 347-foot level, or operating floor, for the first time since the March 28, 1979 incident. While there, they obtained radiation readings of 100 to 300 millirem per hour (mrem/hr). (See accompanying location maps.) The team members were Martin Cooper, William H. Behrle III, Sam Griffith, and Michael Benson. Benson and

Behrle made the first containment entry on July 23, 1980.

The major priority tasks to be conducted were lighting both the 305-foot and 347-foot levels, surveying for radiation and surface contamination, and photographing the containment interior. Other tasks to be performed included protective covering, directional dose, and surface decontamination experiments and retrieval of selected items from within



The *TI&EP Update* is issued by the EG&G Idaho, Inc., Technical Integration Office, Configuration Document Control Section, under contract DE-AM07-76ID01570 to the Department of Energy, PO Box 88, Middletown, PA 17057. Telephones (717)948-1020 or FTS 590-1020.

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 which, though not part of the TI&EP, would be of general interest to the scientific community.

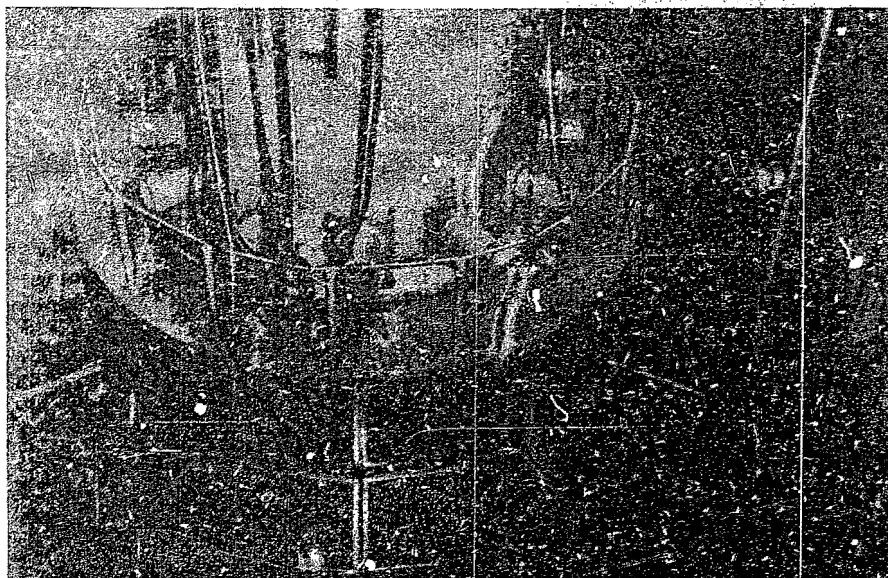
W.W. Bixby is manager of the DOE-TMI Site Office. H.M. Burton is manager of the Technical Integration Office. D.M. Grigg is managing editor of the *TI&EP Update*.

the containment for subsequent analysis.

After turning on the 305-foot and 347-foot level lights, the team obtained radiation readings and surface contamination samples in areas of the 305-foot level not surveyed during the first entry. Radiation readings on the 305-foot level included: north of the open stairwell, 2 rem/hr (location A); five to seven feet from the sump water (using a teletector), 40 to 45 rem/hr (location B); and at contact with the floor drain near the "A" core flood tank, 10 rad/hr and 3 rem/hr gamma (location C).

Floor swipes taken from the 305-foot level showed cesium-134 and cesium-137 concentrations of 6.6×10^{-2} and 4.07×10^{-1} microcuries per square centimeter ($\mu\text{Ci}/\text{cm}^2$) respectively under radiation monitor HP-RT-211 (location D) and of 3.8×10^{-4} and $2.3 \times 10^{-3} \mu\text{Ci}/\text{cm}^2$ respectively under the air coolers (location E). Scrape samples taken from the 305-foot level showed cesium-134 and cesium-137 sample activities of 8.8×10^{-1} and $5.25 \mu\text{Ci}$ respectively near the open stairwell (location F) and of 2.6 and 16.1 μCi respectively near the air coolers (location G).

Radiation surveys taken as the teams moved up the enclosed stairwell (location H) showed an approximately



The walls of the transfer canal are clean. The shield tanks around the reactor vessel head are dry. On the reactor head, the cooling fans and associated electrical leads appear to be clean.

linear decrease from 3 to 5 rem/hr on the 305-foot level to 180 mrem/hr on the 347-foot level.

Radiation surveys on the 347-foot level revealed 600 mrem/hr at the decking outside the enclosed stairwell (location I) and 100 mrem/hr along the south containment wall (location J). Southeast of the head storage stand (location K), the readings increased to 400 mrem/hr. Other radiation levels measured on the 347-foot level included: fuel handling bridge (location L), 100 to 400 mrem/hr; 15 feet from the reactor head and stud bolts (location M), 125 mrem/hr; pressurizer spray line (location N), 2.5 rem/hr; over core flood tanks (locations O and P), 250 to 300 mrem/hr; and behind the enclosed stairwell (location Q), 50 mrem/hr.

Swipes taken on the 347-foot level yielded average cesium-134 and cesium-137 concentrations of 9.0×10^{-3} and $5.6 \times 10^{-2} \mu\text{Ci}/\text{cm}^2$ respectively on the floor and of 2.5×10^{-5} and $1.5 \times 10^{-4} \mu\text{Ci}/\text{cm}^2$ respectively on the walls. Strontium-90 concentrations were found to be $3.1 \times 10^{-5} \mu\text{Ci}/\text{cm}^2$ or less on the floor.

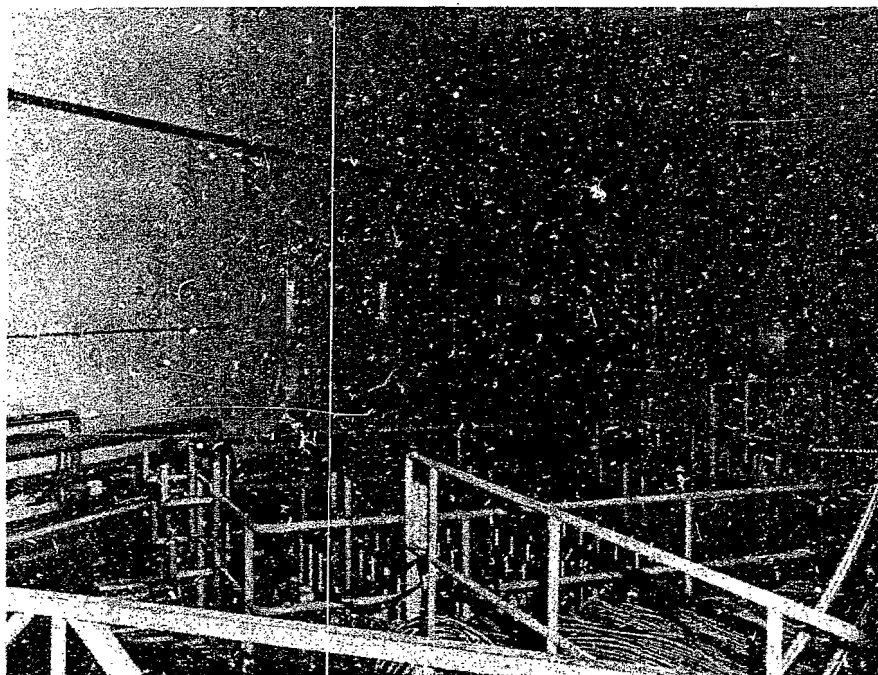
The teams took 67 photographs during the entry. The photographic survey on the 305-foot level showed more details of items identified from the first containment entry on July 23, 1980, and on the 347-foot level, it showed the general areas and structures of the operating deck, fuel handling bridges, D-rings, seal table, and reactor vessel head.

The team members reported rust

and water stains on equipment and floors of the 347-foot level, describing the conditions as similar to those found on the 305-foot level during the first entry. Officials said no significant structural damage was seen; however, elevated temperatures had partially melted a telephone housing, plastic rope, and some yellow plastic sheeting. Behrle reported seeing pieces of what appeared to be wood floating in the dark sump water that filled the containment below the ground level. An estimated 700,000 gallons of contaminated water are believed to be in the sump.

Experiments conducted by the teams included placing two trees of thermoluminescent dosimeters in the containment for protective covering and directional dose tests and wiping a portion of the 305-foot level floor

Continued on page 4



A view of the grill plate on top of the control rod drive mechanisms. The entry team reported it was dry and clean with no debris on it.

Gamma Exposures to Second Entry Team		
Team member	Whole body dose (mrem)	Maximum extremity dose (mrem)
Cooper	140	210
Behrle	260	320
Benson	300	420
Griffith	165	270

Second Entry

Continued from page 3

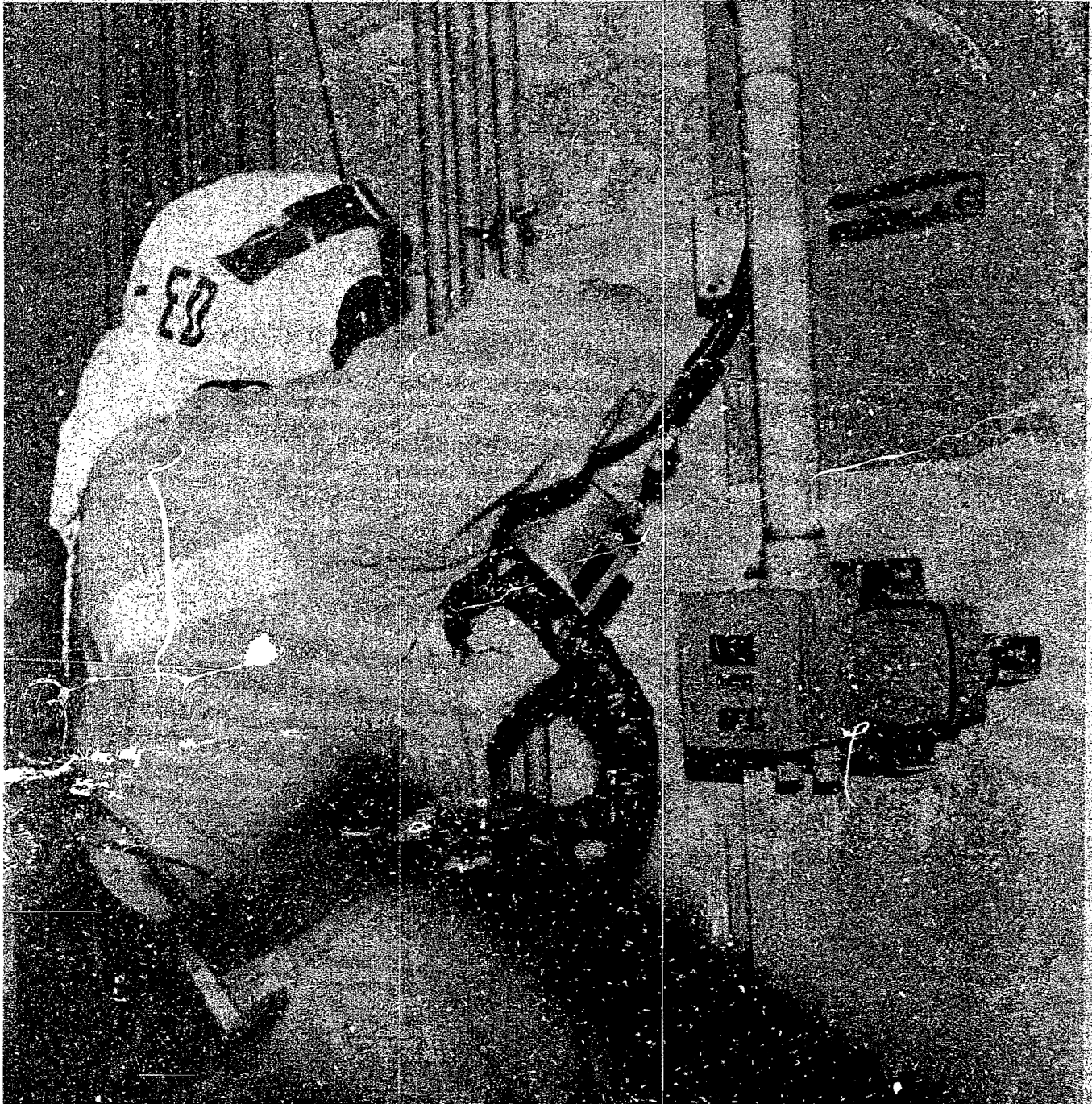
with a Masilin wipe for decontamination testing (location R). Swipes taken before and after the decontamination test showed the wipe removed approximately 90 percent of the loose surface contamination.

Items retrieved from the containment for subsequent analysis

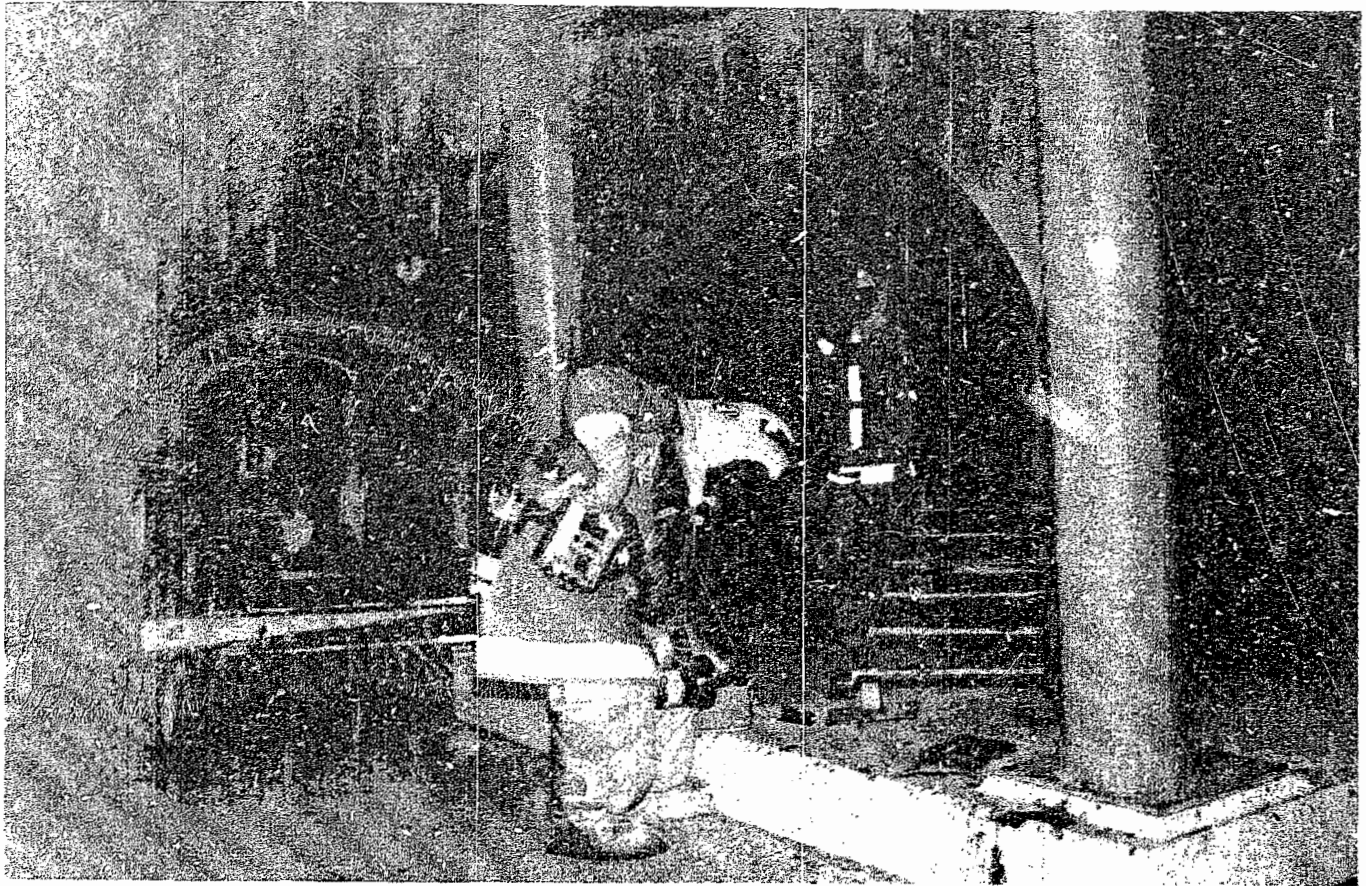
included a radiation detector (location D), a piece of glass (location S), a steel plate (location T), two metal covers, a funnel (location U), and four plastic pipe wrap ties.

Samples gathered during the second entry have been sent to the Department of Energy's Idaho National Engineering Laboratory for comprehensive analysis.

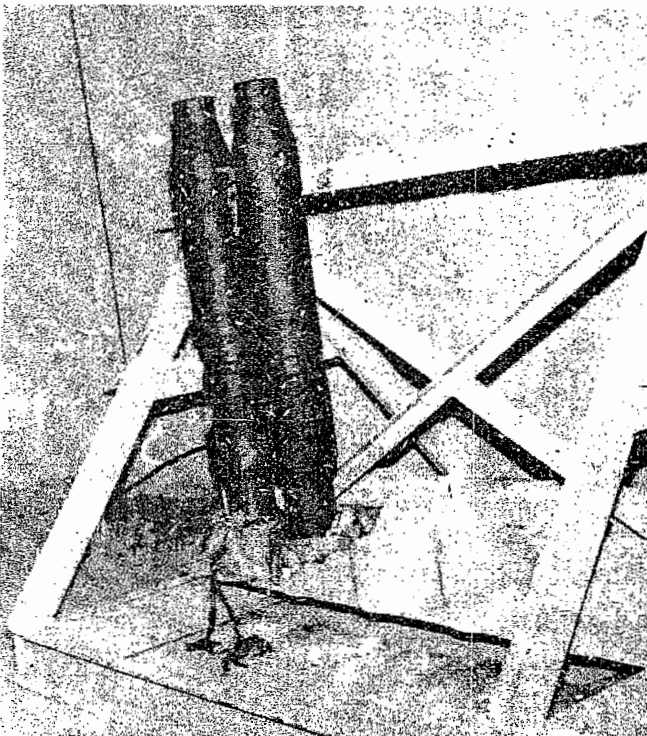
Gamma radiation exposures to the team members varied because of the tasks they performed and the amount of time they were inside the containment. Cooper and Behrle were in the containment just over 20 minutes; Griffith and Benson were in the containment about 40 minutes. The doses measured are presented in the accompanying table.



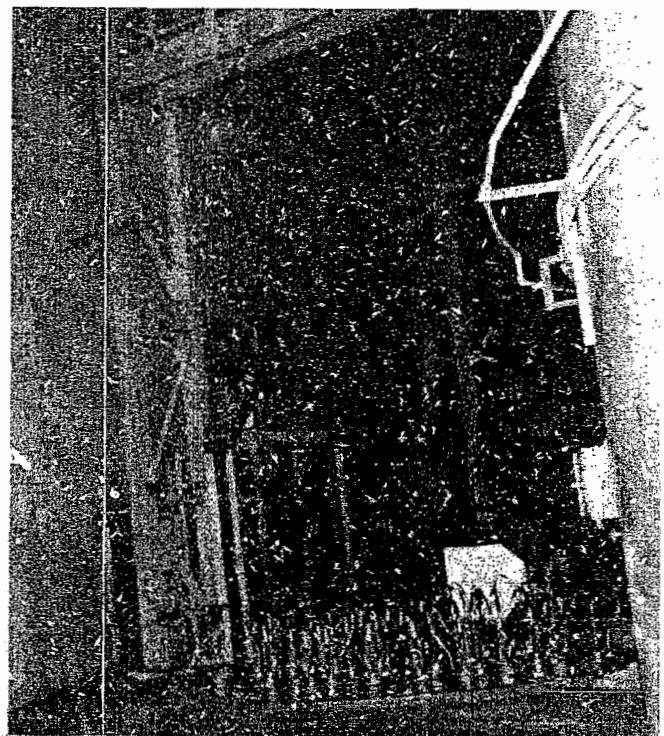
Martin Cooper works on removing radiation monitor HP-RT-211 from the cable. The detector was easily removed from the mounting bracket. The detector has been shipped to Sandia Laboratories for analysis.



A team member takes beta radiation survey at the bottom of the reactor cooler pump stand.



Two guide studs rest on the storage stands for reactor vessel studs. After the initial fueling efforts, the guide studs were wrapped in plastic. Melted plastic is at the bottom of the stand. In addition, a section of magenta and yellow plastic rope has melted to the stand base.



In the foreground, the core instrumentation electrical connections are visible and appear undamaged. In the background, the steel structure for the fuel handling bridge is visible.

Containment Venting Releases 43,000 Curies of Krypton-85

A two-week project to vent krypton-85 from the Unit-2 containment building released an estimated 43,000 Curies of the isotope to the atmosphere between June 28 and July 11 of 1980. Monitoring by General Public Utilities Corporation (GPU) and federal agencies indicated the maximum offsite radiation doses during the venting were 4.34 millirem (mrem) to the skin and 0.044 mrem to the whole body. The maximum doses allowed by the NRC are 15 mrem to skin and 5 mrem to the whole body.

GPU officials attributed the difference between the actual release and the prerelease estimate of 57,000 Curies to deliberately conservative estimates of the containment volume and the amount of krypton trapped in the building. Original plans called for the venting procedure to take from two

to four weeks using the reactor building purge system to effect the operation.

The venting began June 28 after the Nuclear Regulatory Commission (NRC) approved the operation. After four minutes of venting, however, radiation monitors sounded and officials halted the procedure.

Late in the afternoon of June 28, a five-hour test of venting rates began. The test helped engineers conclude that the radiation monitor alarm was erroneous. Venting was resumed at 3 p.m. June 29, using the hydrogen purge system to obtain a smaller air flow rate.

Engineers used the system for the next 10 days, admitting fresh air to the containment as krypton mixed with air was discharged through filtering mechanisms, past radiation monitoring

devices, and up a 160-foot exhaust stack. Air flow rates through the hydrogen purge system reached a maximum of 565 cubic feet per minute (cfm).

On July 8, engineers switched the purging process back to the reactor building purge system at a flow rate of 1000 cfm. By this time, the krypton concentration had diminished sufficiently to allow a gradual increase of the purging rate to 18,500 cfm. About 27 Curies were vented in the final four hours of the process before engineers declared the venting completed.

The venting was stopped periodically during the two-week period for routine filter changes. Other stops occurred when weather conditions made venting undesirable.

Since completion of the venting, the utility has vented about 100 curies of krypton a month, which is permissible within NRC guidelines. The releases have usually occurred before teams go into the containment

Two Engineers First to Enter Containment Since 1979 Incident

On July 23, 1980, William H. Behrle III and Michael Benson became the first persons to enter the Unit-2 containment building since the March 28, 1979 incident. During the entry, they visited the 305-foot elevation, or entry level, to conduct radiological and photographic surveys of conditions within the containment. (See accompanying location map.) While in the containment, they used two-way radios to communicate with the command center. Behrle and Benson are both engineers employed by Metropolitan Edison Company, a subsidiary of General Public Utilities Corporation (GPU).

While in the containment, the men took 29 photographs, made radiation measurements, and gathered six 100-square-centimeter swipe samples or subsequent contamination measurements. In addition, they retrieved a 5-gallon plastic bucket containing debris from the containment for subsequent analysis.

Preliminary information gathered from the radiation measurements showed gamma radiation levels from 100 to 600 millirems per hour

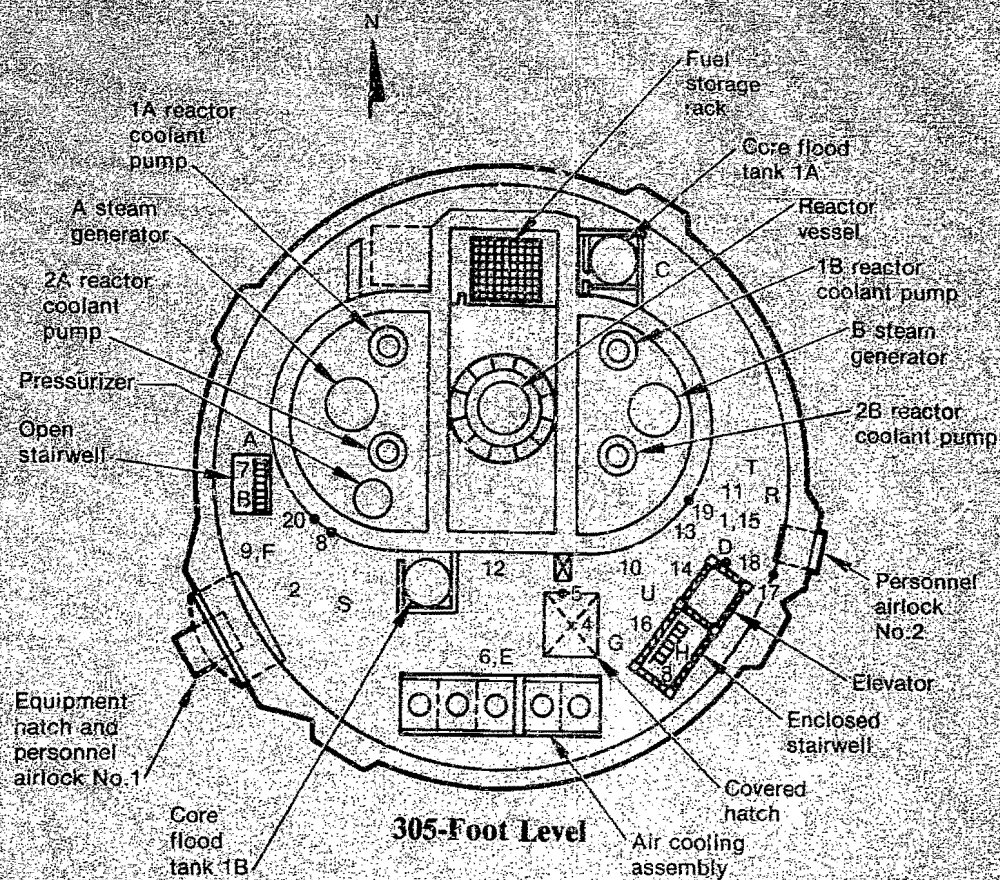
305-Foot Level Gamma Radiation Measurements		
Location	Dose Rate (rem/hr)	Map location
Enclosed stairwell	8	3
Metal deck for covered floor hatch	10	4
Edge of metal-covered floor hatch	4	5
Air coolers	1.4	6
Top of open stairwell	18	7
D-ring and liner	0.4	8
Floor drains (range)	2 to 5	9, 10, 11
Core flood piping	3	12
Seal injection piping	3	13
Elevator door	3	14

(mrem/hr) near the personnel airlock (loc. 1) and 100 mrem/hr at the equipment airlock (location 2). Other radiation measurements are given in the accompanying table. The general beta radiation levels in the area were 1 to 2 Rad per hour.

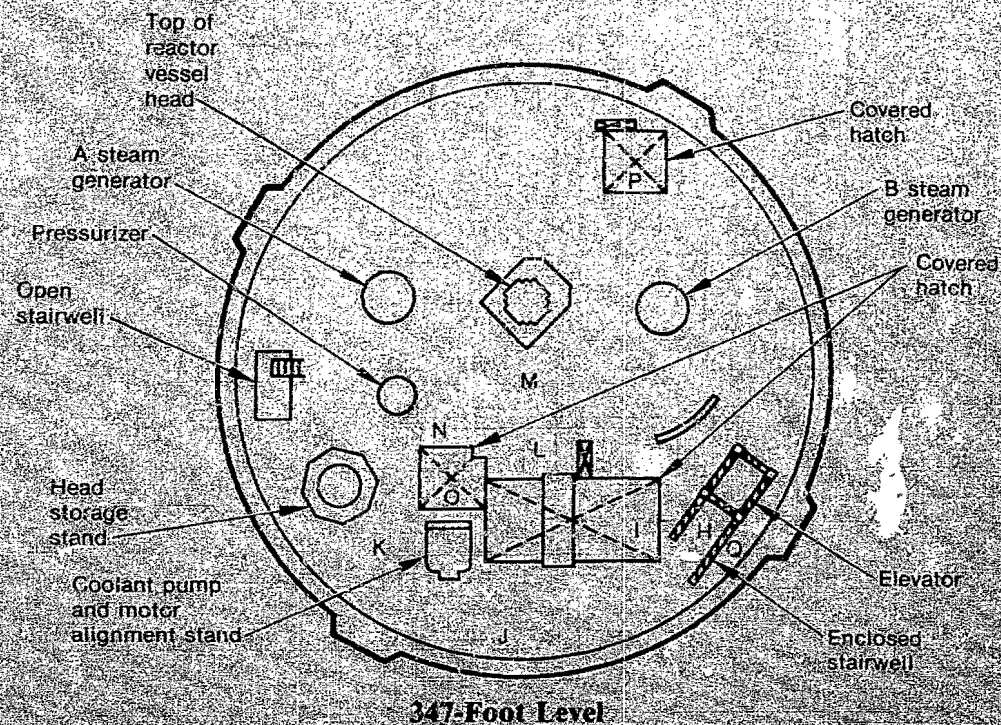
Preliminary results from floor swipes (locations 15 and 16) indicated the presence of cesium-134 and

cesium-137 in concentrations of about 3×10^{-2} and 1×10^{-1} microcuries per square centimeter ($\mu\text{Ci}/\text{cm}^2$) respectively. Wall swipes (locations 17 through 20) indicated concentrations of the same cesium isotopes at about 2×10^{-5} and 4×10^{-4} $\mu\text{Ci}/\text{cm}^2$ respectively. Also detected in the wall swipes were radioactive isotopes of

Continued on page 8



Numbers indicate first entry locations
Letters indicate second entry locations



Continued from page 6

cerium, cobalt, antimony, and niobium in concentrations of 1×10^{-7} to 1×10^{-6} $\mu\text{Ci}/\text{cm}^2$. Technical personnel indicated that these elements were probably also present in the floor swipes but were undetectable because the high cesium levels masked their activity.

The men reported deposits of rust and dirt, colored orange and purple, on the floor. Some areas had

watermarks that indicated apparent operation of the building spray system during or after the incident.

The men received whole body radiation exposures of approximately 190 mrem with a maximum extremity dose of about 220 mrem. No beta-dose measurements were taken. They wore two sets of anticontamination clothing under firefighter-type coats, pants, and boots. Self-contained breathing equipment supplied air for each man.

The first containment entry had been planned for May 20, 1980 but was aborted after the men were unable to turn the airlock door locking wheel. (See TI&EP Update dated July 31, 1980.) GPU officials attributed the failure to a malfunctioning locking mechanism. The door was later opened by drilling through a bulkhead to a locking pin and freeing the pin. The door still can be shut and sealed.

THE UNIT-2 Technical Information & Examination Program



EG&G Idaho, Inc. • P.O. Box 88
Middletown, PA 17057