

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 30-28902/85-01  
Docket No. 30-28902  
License No. 20-00320-21 Priority 1 Category B  
Licensee: E. I. DuPont  
NEN Products  
575 Albany Street  
Boston, Massachusetts 02118

Facility Name: E. I. DuPont NEN Products

Inspection At: Boston, Massachusetts

Inspection Conducted: November 22 and December 24, 1985

Inspector: *F. Costello* 1/24/86  
F. Costello, Senior Health Physicist date

Approved by: *J. Kinneman* 1/22/86  
J. Kinneman, Chief date  
Nuclear Materials Safety Section A

Inspection Summary: Special announced inspection on November 22, 1985, to review the circumstances of a reported exposure to the skin of the left thumb of a worker on November 18, 1985 (Report No. 30-28902/85-01)

Areas Inspected: Notification of incident, interviews with personnel, and dose calculations.

Results: One violation was identified: exposure to the extremity of an individual in excess of the limit contained in 10 CFR 20.101(a).

## DETAILS

### 1. Persons Contacted

\*Ray Sheppard, Manager, Safety and Employee Relations  
\*Dennis Dumas, Area Supervisor, Site Safety; Corporate  
Radiation Safety Officer  
\*Len Smith, Section Supervisor, Radiation Protection  
Christopher Wright, Trainer of Chem-Technologist  
Linda Murphy, Associate Technical Specialist  
Thomas LaBone, Development Health Physicist  
\*Jeanne Krieger, Manager, Research Products  
Crist Filer, Supervisor, Custom Synthesis  
\*Harry Burrell, Superintendent  
William Abbott, Production Supervisor, Carbon-14 Precursor  
Laboratory  
Exposed Individual

The inspector also interviewed several chem-technologists and other individuals during the inspection.

\*Denotes those present during exit interview.

### 2. Notification of Incident

On November 21, 1985, at approximately 3:00 p.m., a licensee representative contacted the NRC Region I office to report a radiation dose to the skin of the finger of an individual which was potentially in excess of regulatory limits. The licensee reported that a chem-technologist who was working with carbon-14 in the form of acetic anhydride had been contaminated and that preliminary dose calculations indicated that a dose as high as 75,000 rads may have been received by a three square centimeter portion of her left thumb. The licensee representative stated that approximately 40 microcuries of carbon-14 appeared to have been incorporated into this area of the skin. At 4:00 p.m. on November 21, 1985, a written report of this incident was sent by the licensee to NRC Region I by facsimile machine. A copy of this report, with the name and social security number of the chem-technologist deleted, is included as Attachment 1 to this report.

### 3. Interviews with Personnel

On November 22, 1985, an inspection was conducted at the licensee's facility to review the incident reported by the licensee on November 21, 1985. During the course of the inspection, the following licensee personnel were interviewed about their knowledge of this incident: the chem-technologist, the trainer of the chem-technologist, the supervisor - custom synthesis, the development health physicist, the section supervisor - radiation protection, and the corporate radiation safety officer. The details of these interviews are summarized below.

a. Chem-Technologist

The chem-technologist involved in the incident stated that she began working for the licensee on June 17, 1985. Previously, she had studied chemical technology at the Community College of Rhode Island and had no previous experience working with radioactive materials. She stated that she had been provided three days of radiation protection training that included a test to determine her comprehension of the material. She stated that she passed the test. She said that, prior to the incident, she had received training in laboratory procedures from Christopher Wright (trainer of the chem-technologist) and had worked with tritium and carbon-14.

She told the inspector that the contamination incident had occurred on Monday, November 18, 1985, at approximately 1:00 p.m. She said that she was synthesizing a compound using one milliliter of acetic anhydride labelled with 211 millicuries of carbon-14. She stated that she wore one pair of PVC gloves at the time. She said that Dr. Wright was working in the laboratory at the time, but was not directly observing each step of the operation. The procedure involved injecting the carbon-14 labelled acetic anhydride through a rubber septum into a flask. The flask had a nitrogen-filled balloon attached to the other of its two openings to maintain the atmosphere required in the flask during the synthesis. She stated that, using a syringe, she withdrew the one milliliter of labelled acetic anhydride from the ampule in which it was received and injected it through the rubber septum into the flask. She then pipetted unlabelled acetic anhydride, put it into the ampule, withdrew this using the syringe, and injected it into the flask. The purpose of this step was to rinse the ampule and syringe to ensure the transfer of all of the labelled acetic anhydride. When she repeated this rinsing procedure, a small drop appeared at the end of the syringe when she withdrew the acetic anhydride from the ampule. She pulled back on the plunger of the syringe to draw the drop into the needle but, when she attempted to inject the material into the flask, the drop reappeared at the end of the needle. She stated that she believes that this drop may have contaminated the rubber septum. She said that she subsequently was unable to withdraw the syringe from the septum because the needle had been inadvertently stuck through a thick part of the rubber septum. She said that she grasped the septum with her left hand and tried to pull out the syringe with her right hand but was still unable to free the syringe. Her trainer, Dr. Wright, observed that she was having difficulties and successfully removed the syringe from the rubber septum.

The chem-technologist stated that Dr. Wright suggested that she monitor the fingers on her left hand for contamination with a nearby GM detector. She said that she removed and discarded her gloves, monitored her fingers with the GM survey meter and that the meter indicated that her fingers were contaminated. She did not recall the

actual reading. She then tried to decontaminate her fingers by washing them, but, when she resurveyed them, she determined that she was unable to remove the radioactivity. She said that she went to the Radiation Protection office and notified Linda Murphy of the incident. Linda Murphy is an associate technical specialist in the Radiation Protection Section. She said that Ms. Murphy surveyed her (the chem-technologist's) fingers and attempted unsuccessfully to decontaminate them using a chemical decontamination agent. She said that she provided breath and urine samples to Ms. Murphy, who told her, when these samples were analyzed, that no radioactivity had been detected. She said that she also collected her urine during the night after the incident, provided this to the Radiation Protection Section, and was told that no radioactivity was detected.

b. Trainer of Chem-Technologist

The inspector toured the Custom Synthesis Laboratory and interviewed Christopher Wright, the individual who trained the chem-technologist in laboratory procedures. Dr. Wright stated that he was in the laboratory during the incident on November 18, 1985. He confirmed the description of the incident which had been provided by the chem-technologist. He said that he had instructed her on the method for setting up the synthesis and had checked her progress several times during the setup. He said that the addition of the carbon-14 labelled compound is the last step in the procedure. He said that he surveyed his fingers after he successfully removed the syringe from the rubber septum and that no radioactivity was detected. He demonstrated his method for surveying his fingers and the inspector noted that the method was adequate and that there was no detectable activity on his fingers.

c. Supervisor - Custom Synthesis

Crist Filer, the supervisor of the Custom Synthesis Laboratory, stated that, as a result of the November 18, 1985 incident, the licensee was reviewing its syringe-handling techniques. She also stated that William Abbott, the production supervisor in the carbon-14 precursor lab, had prepared a list which indicated what gloves should be worn when handling each compound to prevent its penetration to the skin. The inspector was shown a copy of this list and noted that it was as described by the supervisor - custom synthesis. This list noted that rubber and vinyl gloves should be worn when handling acetic anhydride.

d. Associate Technical Specialist

Linda Murphy is the licensee's associate technical specialist and was the individual in the Radiation Protection Section who surveyed the chem-technologist immediately after the incident on November 18, 1985. She stated that the chem-technologist came to the Radiation Protection office at approximately 2:00 p.m. When she surveyed the chem-technologist's fingers with a GM detector, the meter went offscale.

She stated that she was unable to obtain a reading with an ionization chamber. She said that she tried to decontaminate the fingers using DYESOL solution but was unsuccessful. She also said that she obtained breath and urine samples from the chem-technologist and that these samples contained no measurable activity. She stated that she notified John LaFerriere, a development health physicist, who made an initial dose estimate of 19 rem to the fingers of the chem-technologist. A copy of this initial evaluation, which was performed on November 18, 1985, is included as Attachment 2 to this report. The dose estimate was made by averaging the dose over 300 square centimeters.

Additional surveys of the contaminated area of the thumb and index finger were performed by Linda Murphy on Tuesday, November 19, 1985. Copies of the survey results are included as Attachments 3 and 4 to this report.

e. Development Health Physicist and Section Supervisor - Radiation Protection

The inspector interviewed Len Smith, the section supervisor - radiation protection, and Thomas LaBone, development health physicist, together on November 22, 1985. They stated that acetic anhydride passes very quickly through the type of PVC glove worn by the chem-technologist at the time of the incident and adheres rapidly to skin tissue. They stated that the information available to them indicates that, within 3-5 seconds, it is too late to decontaminate the affected skin. They told the inspector that the company physician, Dr. Joseph Rapognani, was examining the worker on a regular basis and had observed no clinical symptoms on the contaminated skin. They stated that they became involved in the evaluation of this incident on Wednesday, November 20, 1985, and that, at that time, they calculated the dose which was included in the report submitted to the NRC on November 21, 1985 (Attachment 1 to this report). They stated that an Incident Investigation Committee was formed which reviewed this event on November 20, 1985. A draft of the report of this Committee is included as Attachment 5 to this report. The two individuals said that they notified licensee management (Ray Sheppard, manager - safety and employee relations) of this incident on Wednesday, November 20, 1985.

The methodology used to estimate the skin doses was described by Messrs. Smith and LaBone to the inspector. They stated that their best estimate at that time was that 40-110 microcuries were incorporated into the skin of the chem-technologist's left thumb and forefinger at the time of the incident and that the dose to a one square centimeter area of the basal layer of the skin on the left thumb was between 310 and 2260 rads, depending upon the depth of penetration of the material into the skin. This dose estimate was based on the apparent 20 hour effective half-life of the material

on the skin. They stated that they would continue to revise their calculations and would submit the final dose estimate and corrective actions to the NRC by December 9, 1985.

4. Dose Assessment

On December 16, 1985, the licensee submitted its final evaluation of this incident, including dose estimates and corrective actions. This is included as Attachment 6 to this report.

The inspector reviewed the licensee's dose estimates and concurred with the licensee's determination that the chem-technologist received a dose of approximately 93 rem to a one square centimeter area of the basal layer of the skin of her left thumb.

This finding represents an apparent violation of 10 CFR 20.101(a), which limits the dose to extremities to 18.75 rem per calendar quarter.

5. Exit Interview

The inspector met with the individuals denoted in paragraph 1 of this report at the conclusion of the inspection on November 22, 1985. The scope and findings of the inspection were summarized.