

WASHINGTON STATE UNIVERSITY

PULLMAN, WASHINGTON 99164-1500

NUCLEAR RADIATION CENTER

March 16, 1984

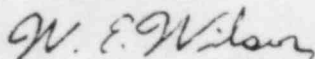
Mr. Ross A. Scarano, Director
Division of Radiological Safety
and Safeguards Programs
U.S. Nuclear Regulatory Commission
Region 5
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Dear Mr. Scarano:

In accordance with the requirements of 10 CFR 21, notification is herewith submitted relating to the failure of Siemens Health Physics Services solid state neutron dosimeters to measure fast neutrons. Washington State University has contracted with Siemens to provide the university with personnel dosimetry service for the measurement of beta-gamma radiation and neutrons. Siemens shifted from NTA film to track etch-type detectors for neutron dosimetry about 8 to 10 months ago. In order to insure that the numbers reported by Siemens were accurate, the university instituted a test program about 8 months ago. A description of the neutron exposure tests and the results obtained are described on the attached memorandum.

The results of our tests on Siemens neutron badges indicated that either our test procedure was invalid or Siemens neutron dosimeters did not function at all. Tests using two other vendors' dosimeters resulted in reasonable results that substantiated the validity of our test procedure. The final conclusion is that Siemens' new solid state neutron dosimeters and the associated processing are defective and simply do not detect fast neutron exposure.

Sincerely,



W. E. Wilson
Associate Director

WEW:efm
enclosures

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M E M O R A N D U M

TO: Bill Wilson, Associate Director
FROM: Jerry Neidiger, Reactor Supervisor *J.N.*
DATE: March 20, 1984
SUBJECT: Evaluation of Siemens Gamma and Neutron Dosimetry Badges

Attached is the evaluation of Siemens film badges worn by personnel at WSU, including personnel at the Nuclear Radiation Center. All badges were placed at the same distance from the source and various dose levels were a function of time only. The gamma film badges were exposed to an NBS calibrated 94 millicurie Cs¹³⁷ source. The neutron badges were exposed to a 1 curie PuBe source, No. M-134, which has a neutron emission rate of 1.58×10^6 n/sec. As of this date, the Siemens neutron badges have failed to record any dose level of neutrons.

Table I gives the test results of neutron exposure for the last six months. These badges were given calibrated neutron doses, then returned to the vendor as part of the building badging account each month. The vendor was unaware these were test badges. When the monthly test badges failed to record any dose, I requested ten additional test badges. I informed Siemens these would be given calibrated doses of radiation and returned to them for evaluation. Table II gives the results of these additional 10 test badges, which was performed in February. Again the neutron badges failed to record any dose of neutrons. As a check of my exposure methods, I requested 10 test dosimetry badges each from two other vendors. As it turned out, one vendor supplied me with two different types of neutron dosimeters for a total of 20

badges, while the other vendor supplied me with three different types of neutron dosimeters for a total of 15 badges. These badges were given identical doses in the identical manner as the Siemens badges and all 35 badges recorded neutron doses within 50% of the expected values.

I believe the Siemens neutron badges to be defective and I have turned my test results over to the Radiation Safety Supervisor for further action with Siemens.

JAN:efm

Table 1

Evaluation of Siemens Neutron Badges for the
Period of July 1, 1983 through December 31, 1983
(all doses in millirem)

<u>Month</u>	<u>Badge No.</u>	<u>Dose Given</u>	<u>Dose Reported</u>	<u>% Error</u>
July	84	30	not read	-
	85	635	not read	-
August	84	40	0	-100%
	85	409	0	-100%
September	84	50	0	-100%
	85	200	0	-100%
October	84	124	0	-100%
	85	396	0	-100%
November	84	180	0	-100%
	85	1323	0	-100%
December	84	200	0	-100%
	85	400	0	-100%

Table II

Results of Special Test Evaluation
on Siemens Neutron Badges Performed on
February 15, 1984

<u>Badge No.</u>	<u>Dose Given</u>	<u>Dose Reported</u>	<u>% Error</u>
091	10	-	Note #1
092	10	-	Note #1
093	25	-	Note #1
094	25	-	Note #1
095	100	Ø	-100%
096	100	Ø	-100%
097	250	Ø	-100%
098	250	Ø	-100%
099	500	Ø	-100%
100	500	Ø	-100%

NOTE #1: Dose given below minimum detectable dose of 30 mrem

SIEMENS

Dear Customer:

Your new solid state neutron dosimeters are in the enclosed box. These dosimeters replace the neutron (green striped) film packets you have received in the past and provide several important advantages, including a lower minimum detectable neutron energy and almost no fading from heat and humidity.

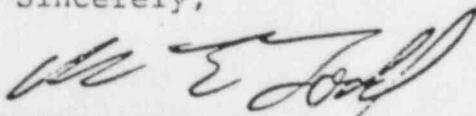
Best of all, we are happy to bring you this new technology at no increase in price.

The neutron dosimeter section of the enclosed instruction book shows how to position the dosimeter and plastic insert in your badge holder.

An option to detect thermal neutron exposure is being developed. We will let you know as soon as it is available.

If you have any questions, please call us.

Sincerely,



William E. Todd
Manager
Health Physics Services

WET/k
enc.

SIEMENS

dosimetry service instructions

NUCLIBADGE® II



only photo on your
should be directed
Physics Services, P.O.
ines, Illinois 60011
15 Toll Free (in Illinois,
ect)

customer and badge
correspondence

ABILITIES

ability to review prompt
the data in your expo
to take, for yourself and
any protective or cor
may be indicated. Fur
necessarily depends
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YOUR FIRST SHIPMENT

Your first shipment contains film packets, plastic badge holders, and a packing list. Each film packet is identified with your account number, wearer number and a type code indicating the type of exposure to be monitored.

Exposure types are:

- 0 Left Ankle
- 1 Whole Body
- 4 Right Wrist
- 5 Left Wrist
- 8 Right Ankle
- 9 Special Whole Body
- = Special Purpose

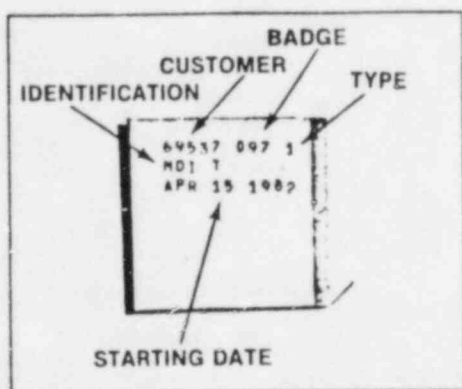


FIGURE 1—FILM IDENTIFICATION

The following paragraphs will explain the purpose and use of the packets and holders.

STANDARD MONITOR PACKET

The standard monitor packets, including the control packet, contain two different types of film having an approximate overall range of 10 millirem to 400 rem for gamma exposures. All packets are color coded to help you tell at a glance if your personnel are wearing a current film packet or an old one.

OPTIONAL EXTENDED RANGE PACKET

If you ordered the optional extended range service, an extended range (red striped) film packet is provided in the first shipment for use with each standard monitor packet except the control, and those with neutron service. This special packet is used to monitor gamma exposures above 500 rem which are beyond the range of the standard monitor packet. Should a high reading be detected during evaluation of your standard monitor packet, you will be notified by telephone to return your extended range packet for evaluation. Normally, a replacement extended range packet is sent every year, at which time the old packet should be discarded. The extended range packet is always identified by a red stripe.

NEUTRON DOSIMETER

The optional track-etch, fast neutron dosimeter should be placed in the depression in the upper-left corner of the inside back of the film badge holder. The plastic insert should be placed between the neutron dosimeter and the regular film packet. Each neutron dosimeter should be returned with the corresponding standard monitor packet for evaluation. Do not return the plastic insert.

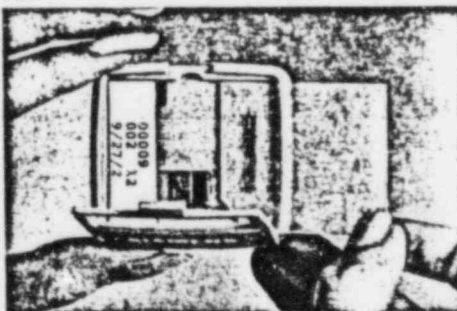


FIGURE 2—NEUTRON DOSIMETER

CONTROL FILM PACKET

The control film (number 0001) is provided in every company all shipments to monitor radiation exposure during the storage. It should not be used for any other purpose. The control should be kept in a holder in an area free of radiation exposure, high temperature, high humidity, and **must be returned with the standard monitor packet on the same date for evaluation.**

SEPARATING PACKETS

Film packets are shipped in stacks. To separate them straight apart to separate individual packets. Do not twist or bend them. This may break the seals and expose the film to light which will destroy it. Separate packets by their edges and apply a necessary pressure in the center.

INSERTING FILM IN HOLDER

To open the badge holder, pull the catch at the top. *Do not try to force the holder more than 90°.*

When using neutron dosimeter, place the neutron dosimeter in the holder first. The standard film packet with the same wearer number and type should be placed on top of the neutron dosimeter. Close the holder and it snaps shut.

The badge number, name and company should appear in the window in the top of the holder.

WEARING YOUR BADGE

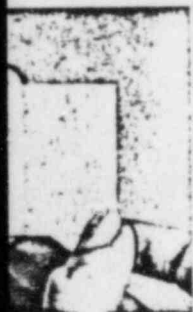
You should wear your badge throughout the working day. Clip-on badges should be worn between waist and neck at an approximate total body radiation level.

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DOSIMETER

CONTROL FILM PACKET

The control film number 0001 will accompany all shipments to monitor any radiation exposure during transit or storage. It should not be used for any other purpose. The control should be kept in a holder in an area free from radiation exposure, high temperature and high humidity, and **must be returned with the standard monitor packets of the same date for evaluation.**

SEPARATING PACKETS

Film packets are shipped in strips. Pull them straight apart to separate into individual packets. Do not twist as this may break the seals and expose the film to light which will destroy it. Handle packets by their edges and avoid unnecessary pressure in the center.

INSERTING FILM IN HOLDER

To open the badge holder, pull gently on the catch at the top. *Do not try to open the holder more than 90°*

When using neutron dosimeters, place the neutron dosimeter in the holder first. The standard monitor packet with the same wearer number and type should be placed on top of the neutron dosimeter. Close the holder until it snaps shut.

The badge number, name and date should appear in the window in the front of the holder.

WEARING YOUR BADGE

You should wear your badge throughout the working day. Clip-on badges should be worn between waist and neck level to approximate total body radiation. If,

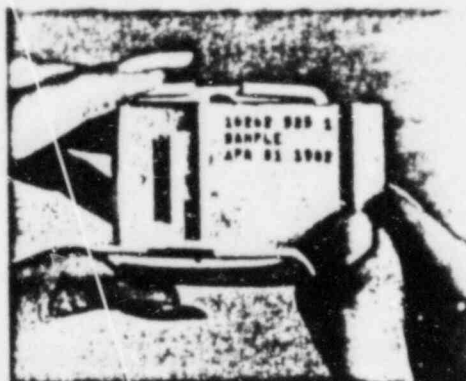


FIGURE 3—OPENING HOLDER

however, one area of the body is more likely to be exposed than the rest, the badge should be worn in that area. The front of the badge should face away from the body. Never allow clothing, buttons, buckles, pens, etc. to shield the front of the badge.

REPLACEMENT FILM PACKETS

Replacement film packets will be sent before the end of your monitoring period. These films should be placed in use on the date printed on the film packets. Return the used packets with their control film promptly in the reusable shipping container using the return address label provided. Film packets which have become contaminated with radioactive solutions must never be returned to Siemens without prior knowledge and consent.

NUCLIBADGE II EXPOSURE REPORT

At the end of each monitoring period when films are returned for evaluation, a radiation exposure report showing the type and amount of exposure to each wearer will be issued. The information in the table on the last page of this booklet will help you interpret your exposure report. Additional data will be found on the back of each report.

CHANGE OF SERVICE

Charges are for the number of film packets shipped to you whether they are used or not. Changes made in your service should be requested using the change form on the back of the packing list received with your most recent film shipment. Cancellations must be received at least 20 days before the date of the shipment to be altered. If service is cancelled for any participant you must return the film badge holder. You will be charged for any holder not returned. Do not reassign badge numbers to persons other than those to whom they were originally assigned since all exposure records are kept by badge number. When reinstating personnel, you must supply us with the badge number and approximate date of the last film worn.

ANY QUESTIONS

Questions about any phase of your Nuclibadge II service should be directed to Siemens Health Physics Services, P.O. Box 1367, Des Plaines, Illinois 60018. Phone: 800/323 6015 Toll Free (in Illinois, 312/635-3387, Collect).

Always refer to customer and badge numbers in any correspondence.

YOUR RESPONSIBILITIES

It is your responsibility to review promptly and with care the data in your exposure reports and to take, for yourself and your employees, any protective or corrective action that may be indicated. Further, reliable data necessarily depends upon proper practices on your part. Accordingly, your utilization of Nuclibadge II dosimetry service must conform with these instructions.

BASIC RADIATION EXPOSURE LIMITS

TYPE OF EXPOSURE	LIMIT	COLUMN # ON REPORT
Whole Body	1,250 Millirem per quarter	14 *
	5,000 Millirem per year	17 *
Skin	7,500 Millirem per quarter	15 *
Lifetime Whole Body	5,000 Millirem X (Age-18)	19 *
Pregnant Women (with respect to fetus)	500 Millirem in gestation period	Readings from Column 12 must be totaled over gestation period **
Hand, Forearms, Feet	18,750 Millirem per quarter	15 *
Ankles	75,000 Millirem per year	18 *

* U.S. Nuclear Regulatory Commission Regulations, Title 10, Part 20, Code of Federal Regulations. Copies available from USNRC, Washington, D.C. 20546.

** NCRP Report No. 39, Basic Radiation Protection Criteria. Copies available from NCRP Publications, P.O. Box 4867, Washington, D.C. 20008.

SIEMENS

Health Physics Services
2000 Nuclear Drive
Des Plaines, Illinois 60018
Telephone: 312/635-3387
800/323-6015

Printed in U.S.A.

Rev. 2, 10/82

PART 21 REPORT LOG SHEET

1. Subject of Report - FAILURE OF TRACK ETCH NEUTRON DOSIMETERS TO INDICATE NEUTRON EXPOSURE
2. Date Verbal Notification Received - MARCH 16, 1984 Received By - C. SHERMAN
3. Date Information Placed in Daily Report - MARCH 19, 1984
4. Name and Address of Person Providing Verbal Notification
 - a) Name - W.E. WILSON, ASSOCIATE DIRECTOR
 - b) Company and Address - WASHINGTON STATE UNIVERSITY - NUCLEAR RADIATION CENTER
PULLMAN, WN. 99164-1300
 - c) Telephone No. - (509) 335-8641
5. Description of Problem - WASH. ST. UNIV. FOUND THAT NEUTRON TRACK ETCH DOSIMETERS SUPPLIED BY SIEMENS GAMMA-SONICS INC. FAILED TO INDICATE EXPOSURE TO FAST NEUTRONS
6. Nuclear Facilities Affected - WASH. ST. UNIV. AND ANY FACILITY WITH THE POTENTIAL FOR FAST NEUTRON EXPOSURES WHICH PLACES RELIANCE FOR NEUTRON DOSIMETRY ON SIEMENS DOSIMETRY SERVICE.
7. Date 5-day Written Report Due - MARCH 21, 1984 Date Received - MARCH 22, 1984
8. Div. Secretary Mail Written Report to HQ's and Other Affected Regions
 - a) Date Mailed to HQ's Document Control Desk - _____
 - b) Date Mailed to Other Regions - _____
9. Generic Issue Data Sheet (TI-2500/3) submitted? ☒ Yes ☐ No
10. Additional Comments - _____

Part 21 Report Reviewed by AS/MSHDate 3/23/84Region V Form No. 809
Revised 3/13/84

Attachment 1

CFR 21 Report
IE-19 1/1

Data Sheet No.: _____

POTENTIALLY GENERIC ISSUE DATA SHEET

#46
Appendix A
TI 2500/3
4/1/80

Facility WASHINGTON STATE UNIV.

Docket No. 50-027

Date of Event MARCH 16, 1984

Inspection (or other Report) JOCFRZI REPORT DATED MAR. 20, 1984

1. Brief Description of Issue (Not required if included in supporting data)

LICENSEE REPORTED BY TELEPHONE (3/16/84) AND JOCFRZI REPORT DATED MARCH 16, 1984 THAT TRACK ETCH NEUTRON DOSIMETERS SUPPLIED TO THE FACILITY DURING THE PERIOD JULY 1, 1983 AND DECEMBER 31, 1983 FAILED TO RESPOND TO FAST NEUTRONS. THE FAILURE TO RESPOND WAS DETERMINED BY LICENSEE TESTS OVER THE RANGE OF 30 - 1300 MRAM. ADDITIONAL TESTING IN FEBRUARY 1984 OVER THE RANGE OF 100-500 MRAM ALSO RESULTED IN FAILURE - IN ALL CASES FAILURE WAS 100%. COMPETITOR'S DOSIMETERS SUCCESSFULLY PASSED THE SAME TEST.

2. How Found (If appropriate)

INTERNAL VERIFICATION (WASH. ST. UNIV.) OF VENDOR SUPPLIED SERVICE

3. Why Considered Potentially Generic (i.e. - reference applicable criteria or give reason)

COULD RESULT IN FAILURE TO CORRECTLY MEASURE PERSONNEL EXPOSURE AT ANY FACILITY USING SIEMENS TRACK ETCH DOSIMETERS WITH POTENTIAL FOR FAST NEUTRON EXPOSURE

4. V
Region

H. NORTH
Originator

F.A. WENSLAWSKI
Section Chief/Branch Chief

5. Other Region Reporting That The Problem Has Also Been Identified By Them

Region _____, Chief Reporting _____, Docket No. _____

6. Evaluation by IE:HQ

Bulletin ☒

Circular ☐

Information Notice ☐

Other ☐ _____

No further action required ☐