10-95-37

RADIATION PROTECTION COMMITTEE

CAMBRIDGE, MASSACHUSETTS 02139

MINUTES OF THE 117TH MEETING OF THE RADIATION PROTECTION COMMITTEE ON SEPTEMBER 12, 1995

MEMBERS PRESENT: Hemond, Davison, Fiore, Galanek, King, Massé, Matsudaira, Pratt, Wenzel, Yanch.

MEMBERS ABSENT: Dedon, Haldeman, Housman, McCunney, Powell.

EX OFFICIO MEMBERS PRESENT: Fuller, Haes, Irwin, Reilly.

The meeting was called to order at 1:35 PM.

I. The minutes of the 116th meeting were reviewed and accepted as presented.

II. Ratification of Administratively Approved Authorizations: The following administratively approved authorizations were ratified as presented:

II. 1. T-G-2 Amendment
II. 2. W-Z-1 Amendment
II. 3. PFC-B-5 Amendment
II. 4. 7-BK-2 Amendment
II. 5. CSR-A-7 Amendment
II. 6. W-AB-1 New Auth.
II. 7. DCM-A-7 Amendment

III. Ratification of administratively-approved renewal of authorizations. The following administratively-approved renewal applications were ratified as presented:

III. 1. CCR-E-6
III. 2. NRL-C-2
III. 3. CCR-W-2
III. 4. 5-B-4
III. 5. 7-E-4
III. 6. CCR-D-8
III. 7. LNS-Y-2
III. 8. W-Q-4
III. 9. 10-0-2
III. 10. 1-A-3
III. 11. 7-AC-12
III. 12. 7-AA-13
III. 13. 7-D-5
III. 14. 7-C-10
III. 15. 12-M-3
III. 16. NRL-H-2
III. 17. W-O-3
III. 18. W-E-4
III. 19. 7-AH-15

IV. Review of application that exceed administrative-approval guidelines:

IV. 1. None at this time.

V. Quarterly ALARA Report

V.1. Mitch Galanek reported the following ALARA program data for projects monitored for external and internal exposures:

External:

Whole Body: No exposure results in excess of Level 1 reporting requirements.

Skin of Whole Body: No exposure results in excess of Level 1 reporting requirements.

Extremity: No exposure results in excess of Level 1 reporting requirements.

Internal: RPO is currently investigating an internal exposure in excess of the Level 2 reporting requirements. A complete description of this incident will be discussed under new business. At this time, RPO assesses an estimated dose of 4000 mrem to the worker. The worker has been restricted from using radioactive materials until the investigation is complete.

VI. SNM - 986 Activities

VI.1. Don Haes gave quarterly report to the Committee. No changes during the past quarter. See attached quarterly reports.

VII. Analytical XRay/Accelerator Program:

VII.1. The RPC ratified the authorization for Professor Steve Lippard's new analytical x-ray machine. Alan Davison informed Tom Fuller that 2 new machines were purchased by the chemistry department. Tom Fuller to contact Bill Davis in building 2 as to status of second machine and will register as necessary.

VII.2. Tom Fuller distributed an update report on the operating status of the Lanza accelerator in NW13. Please see attached report.

Professor Lanza requests to increase the operating power levels for the accelerator. To date, the machine has been restricted to 20% power. The Committee agreed to allow the project to operate at 50% power ($\approx$ 60 μA) and after an evaluation and appropriate finding of environmental radiation levels, increase the power levels to 100% ($\approx$ 120 μA).

VIII. Laser Safety Program

VIII.1. No report.

IX. New Business

IX.1. Center for Cancer Research Personnel Internal Contamination Incident.

Frank Massé informed the Committee of a recent contamination incident involving the ingestion of ^{32}P by a radiation worker in the Cancer Center.

The worker reported his suspicion that the intake was result of a deliberate act by others to MIT police on Thursday 8/24/95. Investigation assigned to Lieutenant David McCoy.

RPO currently estimates the intake to be approximately 500 μCi of ^{32}P which results in a committed dose of 4200 mrem. RPO will continue to monitor the worker and further refine the dose estimates as appropriate.

A meeting was held on 8/31/95 with the entire research group to discuss the developments to date. Frank Massé and Professor Susumu Tonegawa ran the meeting. The following conditions were established for the renewed use of radioisotopes by the research group.

Tonegawa Lab Isotope Inventory/Distribution Plan
9/1/95

Inventory/Distribution Officers: Dr. Dennis King - Lab Manager
Shu Ying Huang - Senior Technician
Dr. Toshikumi Sascoha - Post Doc

Officers will be responsible for inventory management according to the following procedures:

1) Items received will be logged into an inventory log sheet and stored in a locked box in -20° freezer in room 347 of building E17. Only the above mentioned officers will have keys.

   Inventory log sheet: (kept by Dennis King in room 342)

   Date Rcd | Vendor | Item Description | Lot# | Sp.Ac. | Total

2) Items will be dispensed to authorized users using the following request log (kept by Dennis King in 342).

Date	Name	Item Requested	Quantity μl	μCi	Approx. Purpose	Approx. Date of Use	Date of Disposal

The RPC instructed Mitch Galanek to contact Campus Police to get further information on the extent of the initial investigation. Chairman Harry Hemmond and RPO Frank Massé will draft letters to the Campus Police and the affected radiation worker expressing the committee's concerns about the seriousness of this incident. Copies of the letters will be filed with these minutes.

The RPC wants Campus Police to actively investigate the incident. If proven to be a deliberate act, by a human offender, the perpetrator should be punished to the full extent of the law and appropriate action take to prevent future access to radioactive material.

A complete report of the incident including all bioassay results is on file in the Radiation Protection Office.

IX.2. Don Haes reported on a potential microwave exposure to Lincoln Lab employees in Hawaii. Attached is a copy of Don's assessment of exposure. Additional information has been requested from the Navy, the violator of the radar in question. To date, this request has not been honored. Don will continue to work with Lincoln Lab administrators and personal contacts in the Navy to get this issue resolved.

IX.3. No additional new business presented by any committee members.

RPO was notified via the EMS on-call system on 8/19/95 at 6:00 PM of a potential radiation contamination incident. The worker had called the MIT Campus Police and had been transported to the Medical Department decontamination facility. Mitch Galanek and Don Haes arrived at medical at 7:00 PM. The worker had ingested ^{32}P and the bremstrahlung x-rays could be measured from all surfaces of his body. The worker had discovered this while attempting to perform a closeout survey of his activities on that day.

The worker was given a whole body measurement and urinalysis to begin an assessment of his potential intake. Instructed worker to collect all urine voids and report to RPO on Monday for additional whole body measurement.

Don Haes and Mitch Galanek surveyed the entire laboratory where the worker is assigned, all adjacent laboratories, and non laboratory areas to determine the source of contamination. No areas of contamination were detected.

Mitch Galanek went to the worker's apartment and surveyed laundry, floor surfaces, kitchen, bathroom, toilet, tooth brush, etc. No areas of contamination were detected. Worker's wife was also determined to be free of measurable contamination.

Campus Police, Medical, and Mitch Galanek were in contact with Frank Massé during the initial investigation stages.

On Monday, an additional survey was performed in the Tonegawa lab as well as the other labs at the Cancer Center. No unusual contamination levels were detected. The worker brought in his previous week's laundry on Monday for monitoring. He had his underwear and shirts cataloged by day and date for the past 9 days. A careful survey of this clothing revealed small amounts of contamination on his undershorts where droplets of urine might collect. The contamination began on Monday, 8/14/95. We have used this date as the date of intake. Because the contamination level on Monday's underwear was detectable, and because the worker performed ^{32}P work on Monday without having difficulty with the closeout survey it is presumed the intake occurred late on Monday.

The authorized use of radioactive materials by the laboratory was suspended on Tuesday morning. All stock radioactive material was confiscated. On Tuesday afternoon, Mitch Galanek and Don Haes met with the entire laboratory staff to explain what had occurred and why we were suspending their authorization. Lab workers were asked to submit urine samples to RPO for analysis and to work with the lab manager, Dr. Dennis King, to reconcile the laboratories entire use of ^{32}P during the past two weeks. Urine analysis results were no detectable ^{32}P activity in all workers tested. The conclusion of the inventory assessment indicated that 7 vials of ^{32}P were received in that period, containing 700 μl of ^{32}P. RPO records verify that amount.

All ^{32}P was accounted for with the exception of approximately 51.7 μl. Of this volume, 37 μl of missing activity can be traced to the vial received 8/14/95. This vial contained 1.00 mCi of ^{32}P with a calibration date of 8/19/95. This uncounted volume of activity then represents 473 μCi of ^{32}P on 8/14/95.

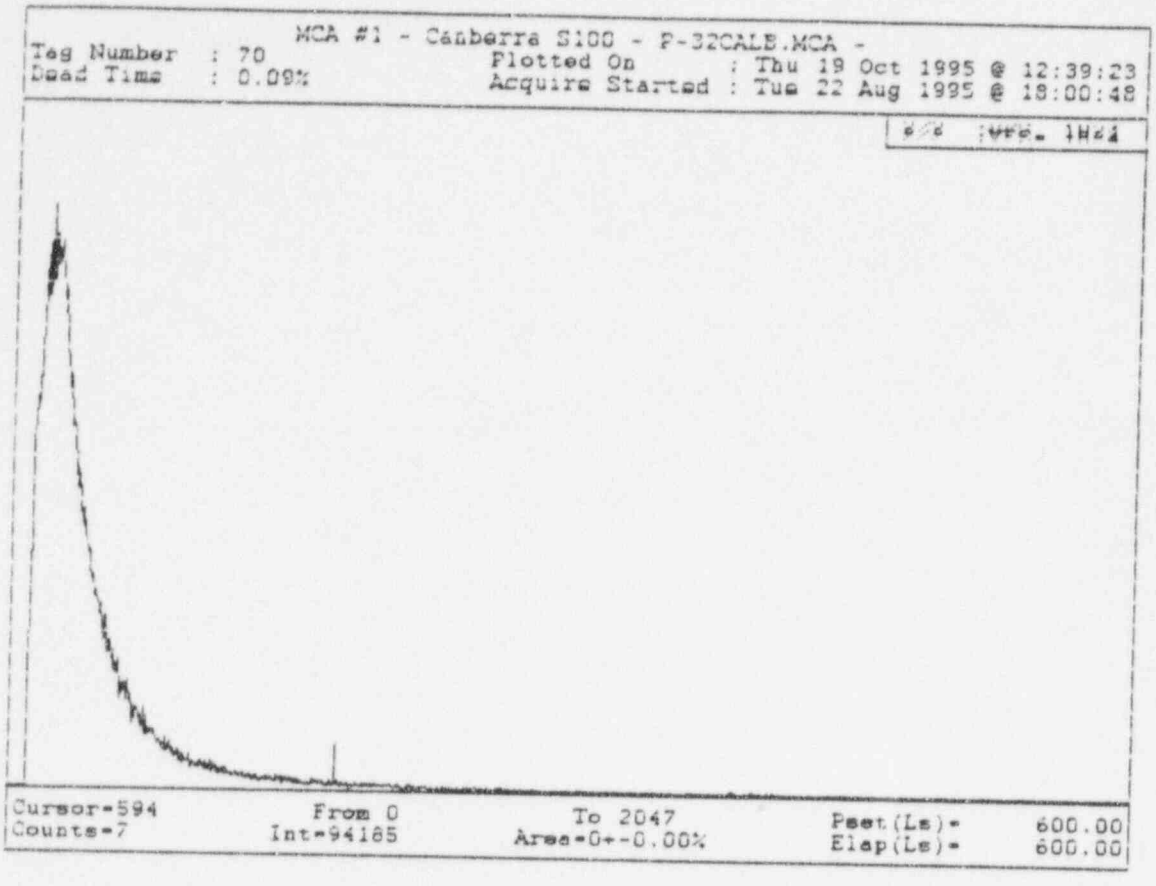
RPO continues to assess the worker intake values by urine analysis and whole body counting. The intake may have occurred due to one of the following:

1) Accidental ingestion of the material.
2) Deliberate ingestion of the material by worker.
3) Specific ingestion by worker due to deliberate action of second party.
4) Random ingestion by worker due to deliberate action of second party.

Meeting adjourned at 3:50 PM.

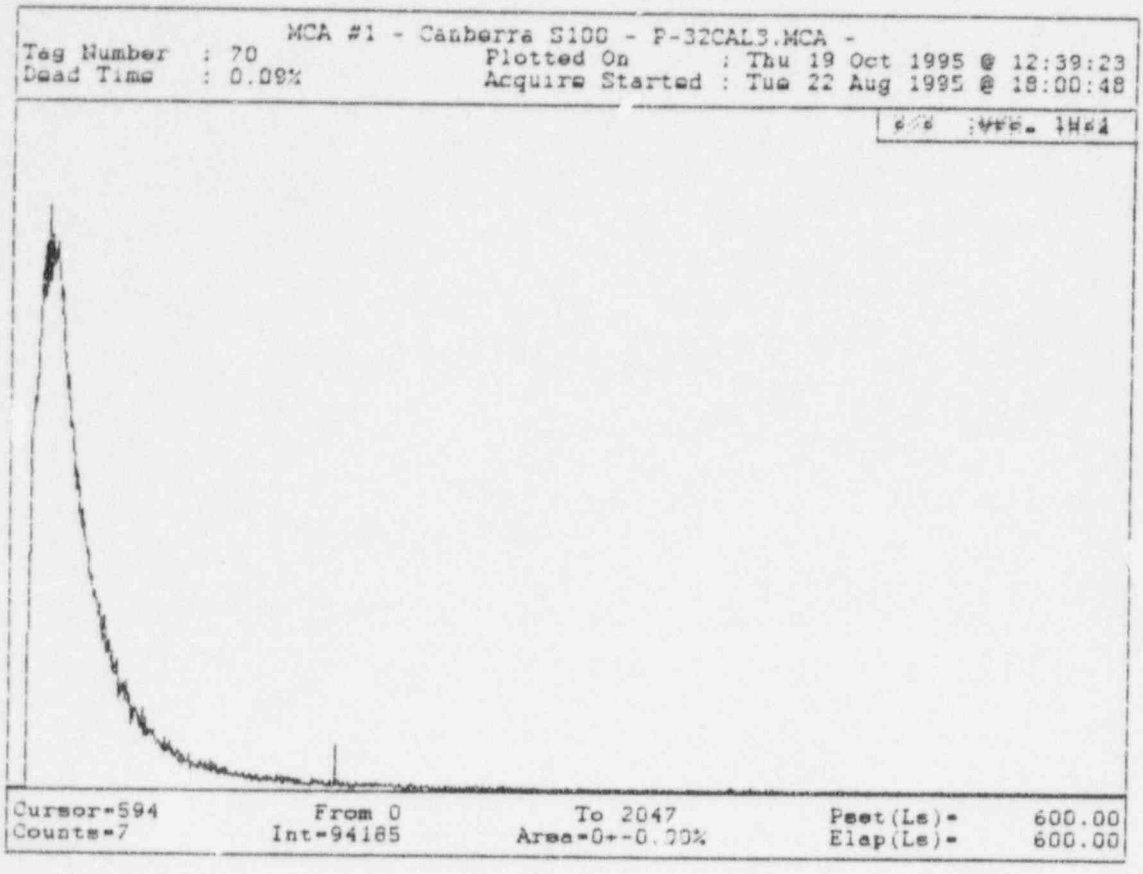
Note: The next scheduled meeting of the RPC is Tuesday, November 21, 1995.

10-95-38



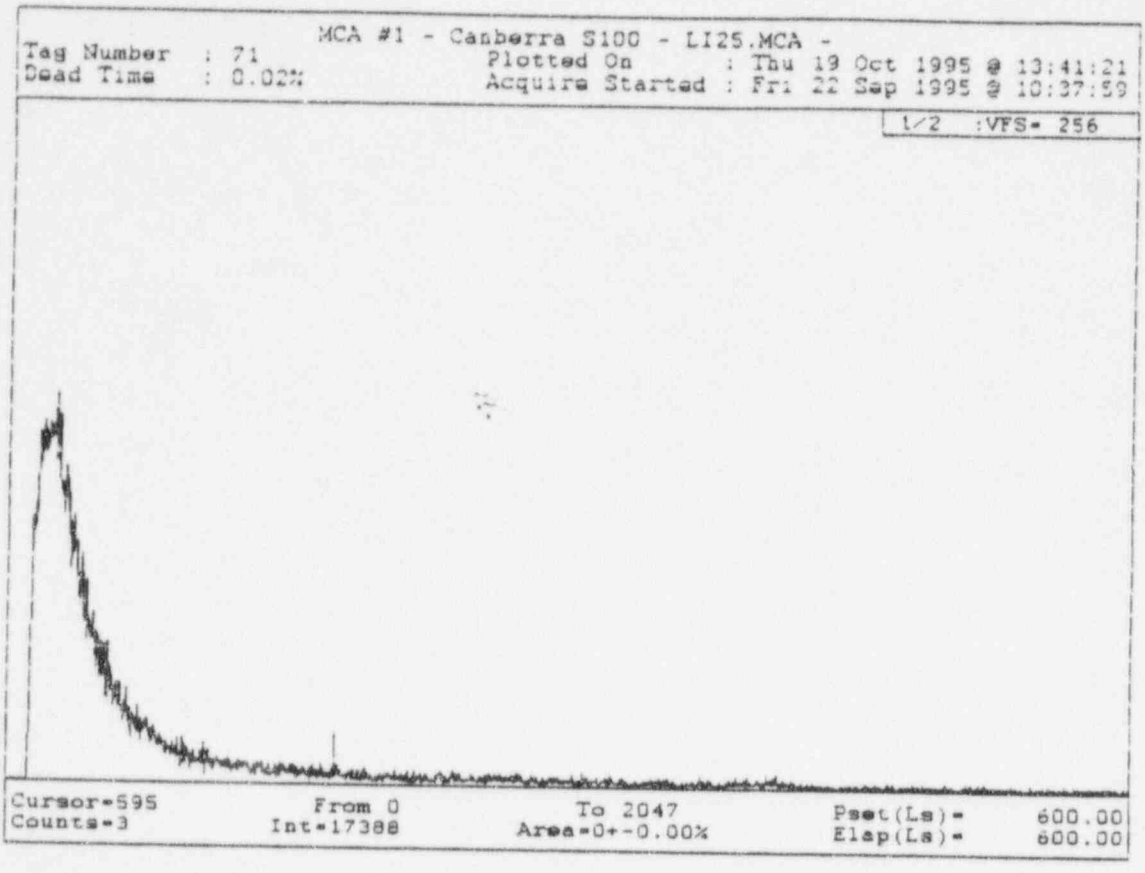
~~Wbod~~ Whole body counter spectrum of calibration sources in phantom. Aug. 22, 1995

10-95-38



~~Wbct~~ Whole body counter spectrum of calibration sources in phantom. Aug. 22, 1995

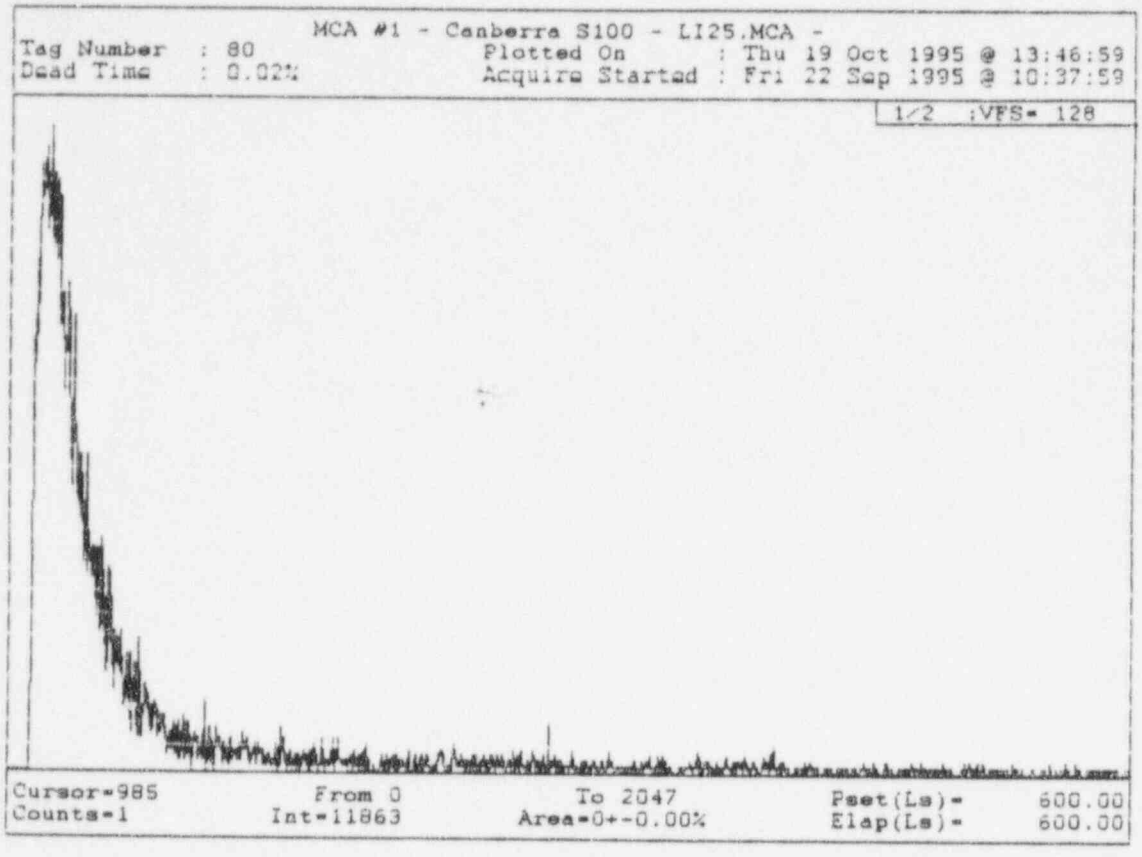
10-95-39



Subject whole body count

Sept. 22, 1995

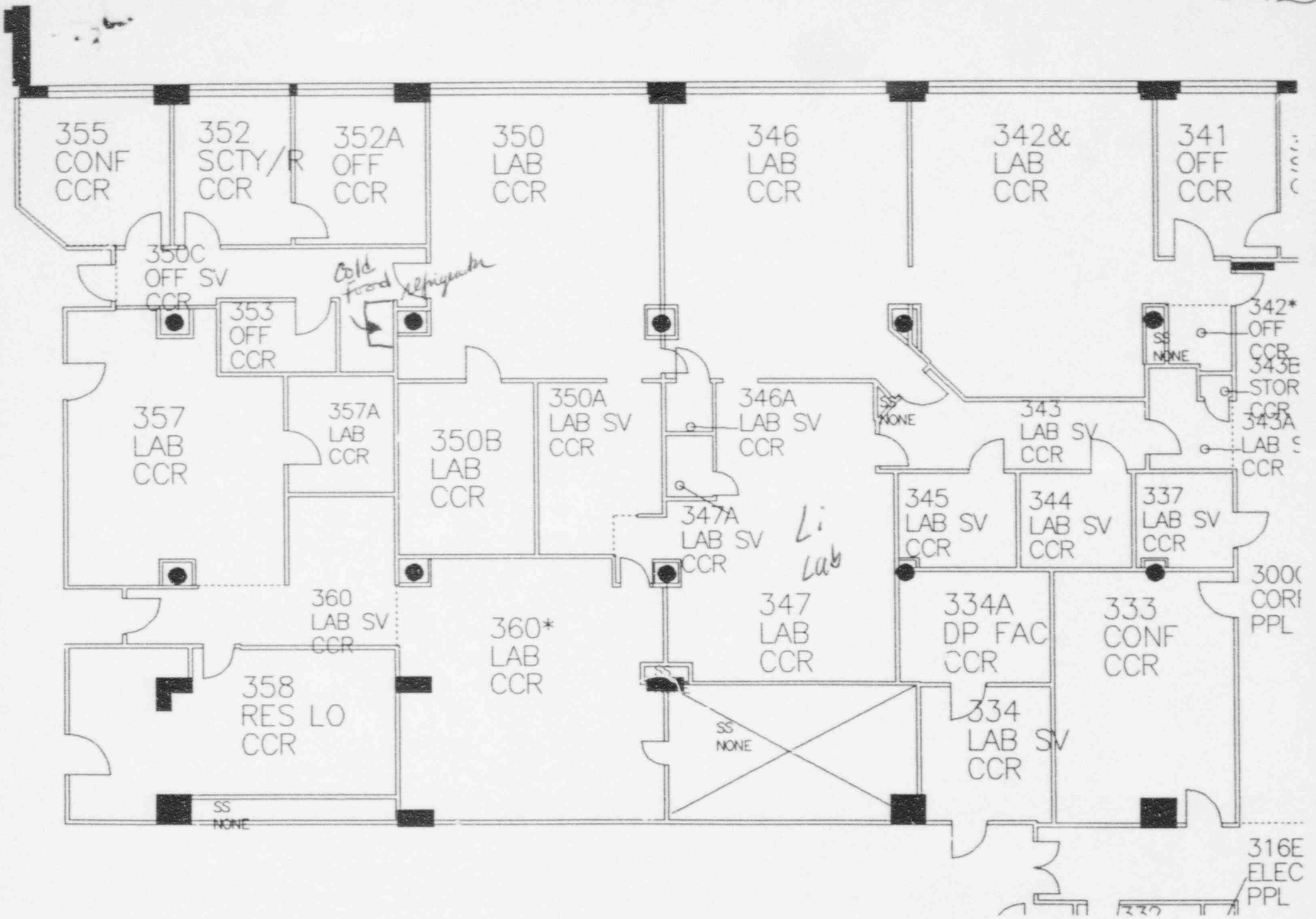
10-95-40



Subject whole
Body Count
with background
subtracted
Sept. 22, 1995

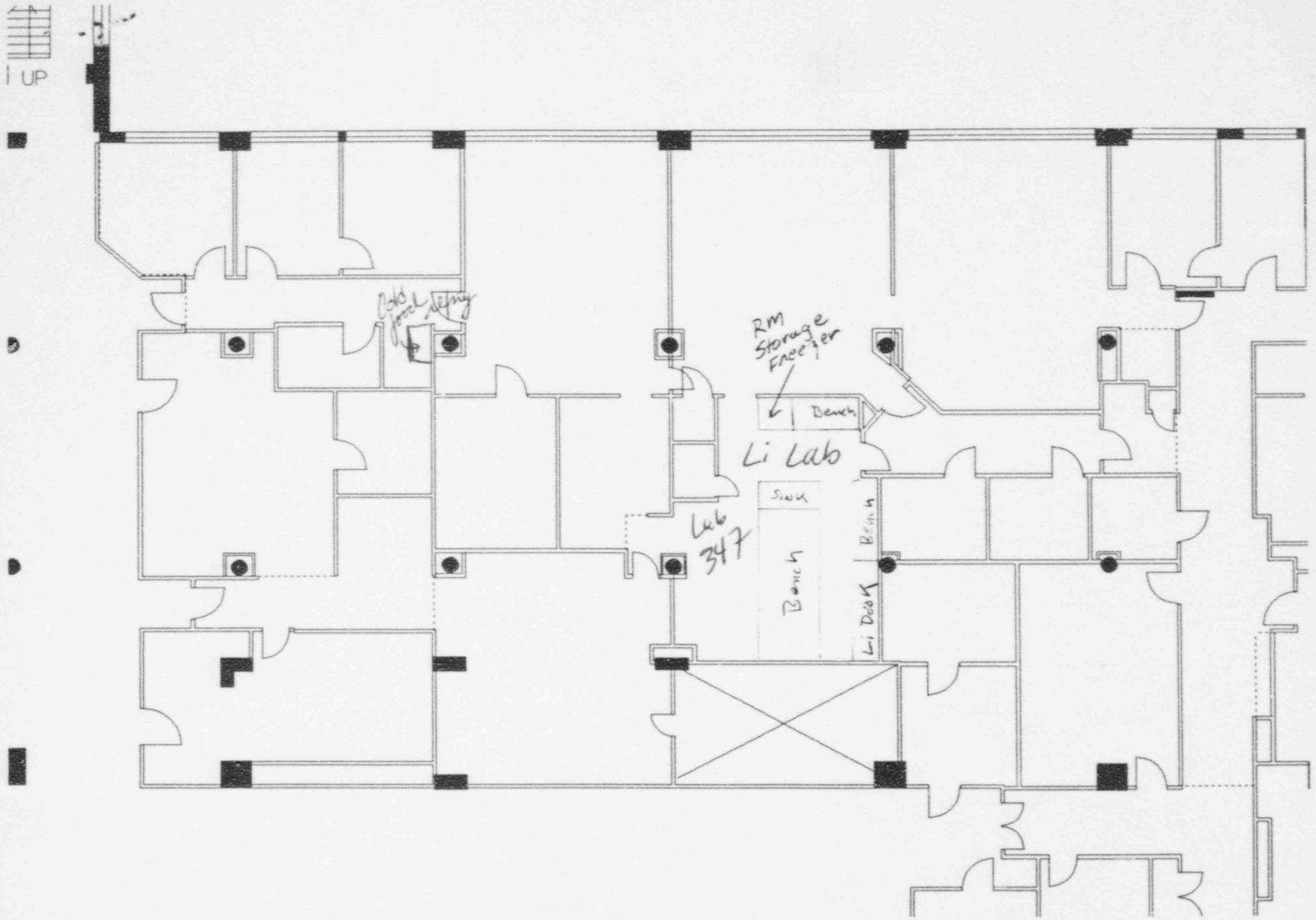
INSITE-C DVIEW(tm) 1.5

10-95-42



DATE: Wed Oct 18 1995 21:55 DRAWING: E17.3 SCALE: 1" = 10.40'

INSITE-CADVIEW(tm) 1.5



DATE: Wed Oct 18 1995 23:58 DRAWING: E17.3 SCALE: 1" = 11.72'

Howard Hughes Medical Institute

PROCUREMENT REQUEST 10-95-43

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672048

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PAGE 1 OF 1

DATE REQUIRED 9/1/94

ATTACHMENTS

P.O. TYPE 7

PR STATUS

STATUS	INITIALS
PLACED	GT
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HOLD TO POST	

QUOTE ____ % $ ____

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			Blanket Order: Supercedes HHMI Doff 030E60022		
			To Be Shipped Weekly 9/1/94 - 8/31/95		
C095	~~52~~ 51	EA	# BLU013H (dCTP α^{32}P) 1 mCi/EA	$84	~~4368~~ 4576
				~~84.00~~ 88.00	
			COMPLETED		
			OK Rad Safety		
			JOAN		

GRAND TOTAL ~~4368~~ 4576

SUGGESTED VENDOR

NEN

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PHONE # 800-557-2121

CONTACT NAME

ADDITIONAL INFORMATION

Tonegawa/E17-360 c

ITEMS	ACCOUNT	CENTER	PROJECT
1	50225	03052 0	

REQUESTOR'S SIGNATURE Dennis Kang DATE 8/19/94

APPROVER'S SIGNATURE Judith A. Cimmer DATE 9-1-94

DATE ORDERED 9/1/94

COMMITTED DATE 8/31/95

FAX NO. 6172888942 P.02/02

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OCT-18-95 WED 13:31

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09/08/95	10/16/95	10/16/95	4450750	37193	00	09	00

NE O.	QUANTITY ORDERED	QUANTITY SHIPPED	PART NUMBER	DESCRIPTION	PACKAGE SIZE	LOT/SERIAL NUMBER
04	1	1	BLU013H 0117	****DO NOT INCLUDE RECYCLING** ****INFO OR LABELING ON THIS** ****PACKAGE********** DEOXYCYTIDINE 5'-TRIPHOSPHATE TETRA-(TRIETHYLAMMONIUM) SALT [A-32P]-DRY ICE	1MC 37000KBQ	013H10125

Phy OK ✓
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DUPONT

Under the U.S. Food Drug and Cosmetic Act, a licensed physician may use and a licensed pharmacist may prepare radioactive material for human use. Radiopharmaceutical drug products authorized for commercial sale and distribution are available from another division of Du Pont. Research studies using radioactive materials generally must be conducted under a Notice of Claimed Investigational Exemption for a New Drug (IND) in accordance with 21 CFR 312 or under cognizance of a Radioactive Drug Research Committee (RDRC) in accordance with 21 CFR 361. The Food Drug and Cosmetic Act permits licensed medical practitioners and pharmacists to prepare drugs for use in the course of their specific professional practice. It should be noted, however, that Du Pont makes no warranty, express or implied, with respect to the sterility or pyrogenicity of its research products, including any warranty of merchantability or fitness for any particular purpose. A physician or pharmacist administering or preparing a radioactive substance for human use bears all responsibility for its safety, efficacy and pharmaceutical quality, including its sterility and pyrogenicity. Prior to shipment of a radioactive material for potential human use, Du Pont requires acknowledgement of the circumstances described above. Du Pont will provide a Form #1001 for this acknowledgement.

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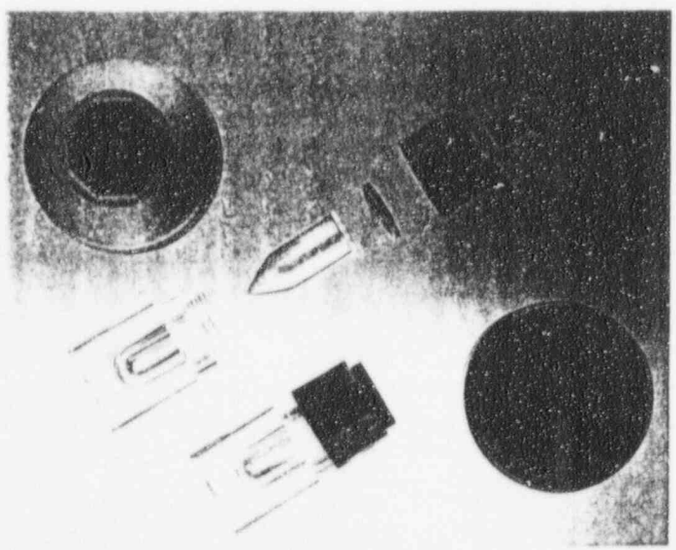
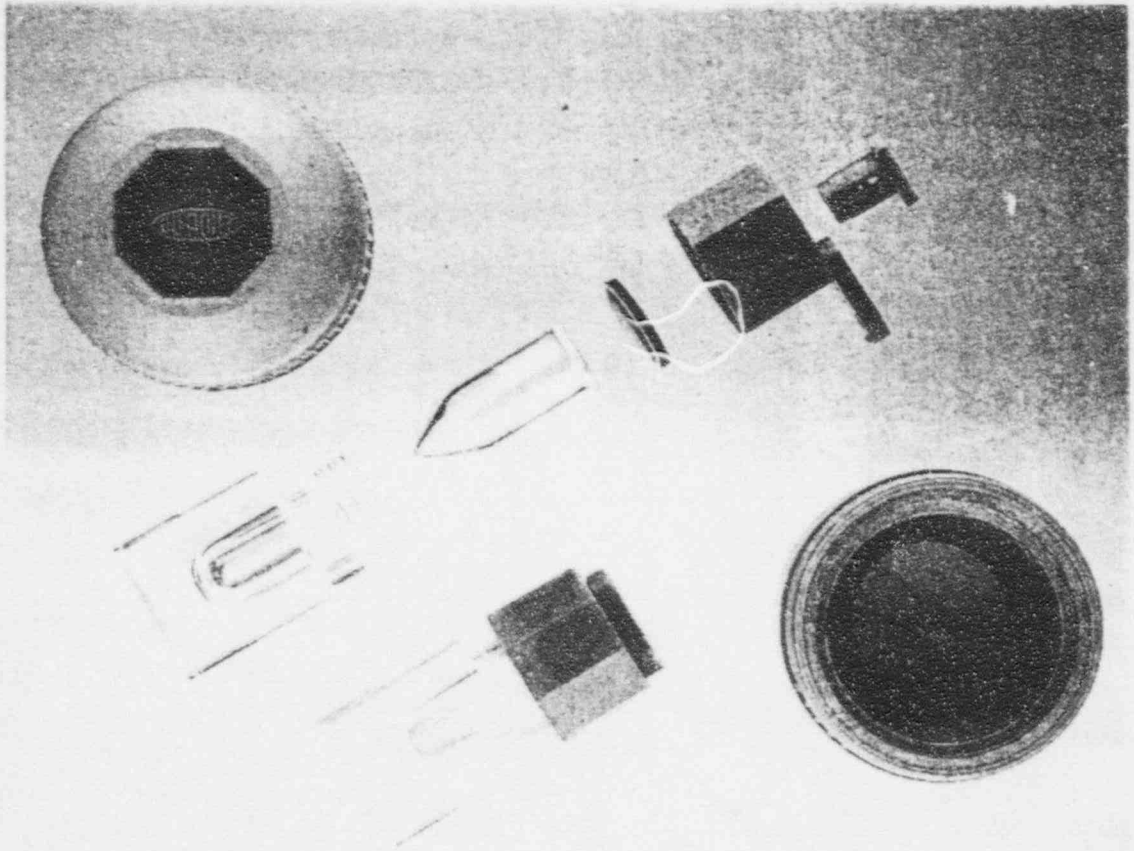


and convenience standards for the shipment of radiochemicals, including [^{32}P]nucleotides; [^{32}P], [^{35}S], and [^{125}I]nuclides; [^{35}S]amino acids; [^{3}H], [^{125}I] and [^{14}C] labeled compounds.

A UV-absorbing version of the NENSURE used for light-sensitive compounds.



DuPont NEN®

PHOSPHORUS-32

^{32}P
14.29 d
β^- 1.71
no γ
E 1.71

PHOSPHOROUS-32 Decay Table

Physical Half-Life: 14.29 Days [1]

Days	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
0	1.000	0.976	0.953	0.930	0.908	0.886	0.865	0.844	0.824	0.804
5	0.785	0.766	0.748	0.730	0.712	0.695	0.678	0.662	0.646	0.631
10	0.616	0.601	0.587	0.573	0.559	0.545	0.532	0.520	0.507	0.495
15	0.483	0.472	0.460	0.449	0.438	0.428	0.418	0.408	0.398	0.388
20	0.379	0.370	0.361	0.353	0.344	0.336	0.328	0.320	0.312	0.305
25	0.297	0.290	0.283	0.277	0.270	0.264	0.257	0.251	0.245	0.239
30	0.233	0.228	0.222	0.217	0.212	0.207	0.202	0.197	0.192	0.188
35	0.183	0.179	0.174	0.170	0.166	0.162	0.158	0.155	0.151	0.147
40	0.144	0.140	0.137	0.134	0.130	0.127	0.124	0.121	0.118	0.116
45	0.113	0.110	0.107	0.105	0.102	0.100	0.098	0.095	0.093	0.091
50	0.088	0.086	0.084	0.082	0.080	0.078	0.077	0.075	0.073	0.071
55	0.069	0.068	0.066	0.065	0.063	0.062	0.060	0.059	0.057	0.056
60	0.054	0.053	0.052	0.051	0.049	0.048	0.047	0.046	0.045	0.044

Physical Data

Maximum Beta Energy =
1.71 MeV (100%)[1]

Maximum Range of Beta in Air =
6 m (20 ft.)[2]

Maximum Range of Beta in Water =
8 mm (0.3 in.)[2]

Occupational Limits[3]

Annual Limit on Intake = 600 µCi (22 MBq)
for oral intake

and 400 µCi (15 MBq)
for inhalation intake

Derived Air Concentration = 2×10^{-7} µCi/mL
(7.4 kBq/m³)

Dosimetry

Uptakes of phosphorous are assumed to be retained with a half-life of 0.5 days. Of this phosphorous 0.15 is rapidly excreted, 0.15 is retained in intracellular fluids with a half-life of 2 days, 0.4 is retained in soft tissue with a half-life of 19 days and 0.3 retained permanently in mineral bone where ^{32}P is reduced by radioactive decay.[4]

The high-energy beta emissions can present a substantial skin and eye dose hazard. Multi 100-millicurie (multi 3.7 GB1) quantities of 32P can produce significant secondary radiation, presenting a more penetrating external exposure hazard.

DuPont has developed the following suggestions for handling phosphorous-32 after years of experience working with this high energy beta emitter.

General Handling Precautions for Phosphorous-32

1. Designate areas for handling ^{32}P and clearly label all containers.
2. Store ^{32}P behind lead shielding.
3. Wear extremity and whole body dosimeters while handling mCi (37 MBq) quantities.
4. Handle millicurie (37 MBq) quantities of ^{32}P behind 1-cm (0.375-in.)-thick Lucite[5] shielding. Where necessary, increase shielding by attaching 3-mm to 6-mm (0.125-in. to 0.25-in.)-thick lead sheets to the outside of the Lucite[5] to reduce secondary radiation.
5. Do not work over open containers.
6. Practice routine operations to improve dexterity and speed before using ^{32}P.
7. Avoid skin exposure by using tools to indirectly handle unshielded sources and potentially contaminated vessels.
8. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{32}P is handled.
9. Use transfer pipettes, spill trays and absorbent coverings to confine contamination.
10. Handle potentially volatile chemical forms in ventilated enclosures.
11. Sample exhausted effluent and room air by continously drawing a known quantity through membrane filters.
12. Use lab coat, wrist guards and disposable gloves for secondary protection.
13. Regularly monitor and promptly decontaminate gloves and surfaces to maintain contamination and exposure control.
14. Use end-window Geiger-Mueller detectors, NaI(Tl) detector or liquid scintillation counter to detect ^{32}P.
15. Submit urine samples for bioassay from two hours to seven days after handling ^{32}P to indicate uptake by personnel.
16. Isolate waste in clearly labeled shielded container and hold for decay.
17. Establish surface contamination, air concentration and urinalysis action levels below regulatory limits and investigate and correct any causes that may threaten these levels to be exceeded.
18. On completing an operation, secure all ^{32}P; remove protective clothing; dispose of protective coverings; monitor and decontaminate self and surfaces; wash hands and monitor hands again.

The dose rate at the mouth of an open combi-vial containing 1 mCi (37 MBq) of ^{32}P in 1 mL of liquid is roughly 22 rem/hour (260 mSv/hour).[5] Since this dose rate will not be attenuated significantly by air, shielding materials should be placed between the source and personnel to absorb most of the radiation. The best shield for a ^{32}P source is a material like Lucite[5] 1-cm (0.375-in.)-thick, or other plastic that will absorb the beta particles while generating little secondary radiation. For millicurie (37 MBq) amounts of ^{32}P, thin, high-density shielding, such as lead 3-mm to 6-mm (0.375-in. to 0.25-in.)-thick, should be added to the exterior of the Lucite[5] shield to absorb the more penetrating secondary radiation.

A high local dose can be received if the radioactive material is touched and allowed to remain on the skin or gloves. Both the hands and face can receive a considerable dose of radiation near an open container of ^{32}P, paticularly if the radioactivity is in a concentrated form. Therefore, never work over an open container of ^{32}P.

References

1. Kocher, Dav J C., Radioactive Decay Data Tables. Springfield. National Technical Information Service. 1981 DOE/TIC-11026.
2. Kaplan, Irving, Nuclear Physics. New York: Addison-Wesley, 1964.
3. U.S. Nuclear Regulatory Commission 10 CFR 20.1001 to 20.2401—Standards for Protection Against Radiation. 1994.
4. ICRP Publication 30 Part 1, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford. 1979.
5. Measurements made using Landauer TLD 100 chips extremity badges.

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