| NRC FORM 241 (7-1999) REPORT OF PROPOSED ACTIVITIES IN NON-AGREEMENT STATES, AREAS OF EXCLUSIVE FEDERAL JURISDICTION, OR OFFSHORE WATERS (Please read the Instructions before completing this form) 1. NAME OF LICENSEE (Prevent or firm proposing to conduct the ectivities described below) Western Kentucky University | | | | APPROVED BY OMB: NO. 3150-0013 EXPIRES: 07/31/2002 Estimated burden per response to comply with this mandatory collection request: 15 minutes. This notification is required so that NRC may echedule inspection of the activities to ensure that they are conducted in accordance with requirements for protection of the public health and sofety. Send comments regarding burden estimate to the Records Management Branch (T-6 EG). U.S. Nuclear Regulatory Commission, Washington, DC 20550-0001, or by Internet e-mail to 6/s1 Anno.gov, and to the Deak Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0013), Office of Management and Budget, Washington, DC 20502. If a means used to impose an information collection dees not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection. 2. TYPE OF REPORT INITIAL IPI REVISION CLARIFICATION | | | |
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| Dept. Environmental Health & Sa | fety | | | Compu | iter Engineer | | |
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| 8. CLIENT NAME, ADDRESS, CITY/COUNTY, STATE, ZIP CODE | 9. AC | TUAL PHYSK | CAL ADDRESS OF | WORK LOCATION | le en address of directions as noss | eihia i | |
| US Army SBCCOM | | | | | | | |
| Stan Gater | | | BLDG E35 | 56, Aberdeen | Proving Ground | i | |
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| APG-EA Maryland 21010 | 10. | CLIENT TELE (Include Ares ((401) | PHONE NUMBER 11. WORK LOCATION TELEPHONE NUMBER (Include Area Code) Code) 436-2321 (401) 436-2321 | | | ER | |
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CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

PAGE 1

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D. 100 MILLICURIES

1. LICENSEE AND 2. ADDRESS

WESTERN KENTUCKY UNIVERSITY DEPARTMENT OF ENV. HLTH & SFTY 1 BIG RED WAY BOWLING GREEN, KY 42101

MARY J. REYNOLDS ATTENTION: TELEPHONE : 270-745-7095

PURSUANT TO KRS 211.842 ET SEQ., THE KENTUCKY CABINET FOR HUMAN RESOURCES REGULATIONS, 902 KAR 100, AND IN RELIANCE ON STATEMENTS AND REPRESENTATIONS HERETOFORE MADE BY THE LICENSEE, A LICENSE IS HEREBY ISSUED TO RECEIVE, ACQUIRE, OWN, POSSESS AND TRANSFER RADIOACTIVE MATERIAL LISTED BELOW; AND TO USE SUCH RADIOACTIVE MATERIAL FOR THE PURPOSE(S) AND AT THE PLACE(S) DESIGNATED BELOW. THIS LICENSE IS SUBJECT TO ALL APPLICABLE RULES, REGULATIONS, AND ORDERS OF THE CABINET FOR HEALTH SERVICES, NOW OR HEREINAFTER IN BFFECT AND TO ANY CONDITIONS SPECIFIED BELOW.

| 3. | LICENSE NUMBER: Amendment NO. | .203-01 7-83 69 |
|----|----------------------------------|---------------------------|
| | | |

4. EXPIRATION DATE: JULY 31, 2002

PHOSPHORUS 33 D. ANY FORM

5. **REVIEWER:** 41

D.

LICENSED MATERIAL 7. FORM 8. POSSESSION LIMIT 6. A. 300 MILLICURIES Α. HYDROGEN 3 A. ANY FORM B. 100 MILLICURIES Β. CARBON 14 B. ANY FORM C. 100 MILLICURIES C. PHOSPHORUS 32 C. ANY FORM

WKU ENV HLTH & SFTY 2707455037

05/02 '02 09:37 NO.315 04/30

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CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

| LICE | NSE NUMBER: 203-01 | 7-8 | 3 AMENDMENT | 69 | PAGE 2 |
|------------|--------------------|------------|--|--------|---|
| E. | SULFUR 35 | z. | ANY FORM | B. | 150 MILLICURIES |
| F. | IODINE 125 | ₽. | ANY FORM | F. | 500 MICROCURIES |
| G. | IODINE 131 | G. | any form | G. | 500 MICROCURIES |
| н. | CESIUM 137 | н. | SEALED SOURCE | H. | 260 MILLICURIES |
| I. | BARIUM 133 | I. | SEALED SOURCE | I. | 10 MILLICURIES |
| J. | COBALT 57 | J. | SEALED SOURCE | J. | 25 MILLICURIES |
| ĸ. | COBALT 60 | ĸ. | SEALED SOURCE | ĸ. | 15 MILLICURIES |
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| P . | CADMIUM 109 | ₽. | SEALED SOURCE | ₽. | 60 MILLICURIES |
| Q. | HYDROGEN 3 | Q. | SEALED SOURCE | Q. | 50 CURIES |
| R. | DEPLETED URANIUM | R. | Metal. | R. | 95 KILOGRAMS |
| S. | CESIUM 137 | s . | SEALED SOURCE (TROXLER DRAWING NO. A-102112) | S. | NO SINGLE SOURCE TO EXCEED 9 MILLI- CURIES |
| Т. | AMERICIUM 241 | т. | SEALED SOURCE (TROXLER DRAWING NO. A-102451) | Τ. | NO SINGLE SOURCE TO EXCEED 44 MILLI- CURIES |
| σ. | NICKEL 63 | υ. | FOIL | υ. | NO SINGLE SOURCE TO EXCEED 15 MILLI- CURIES |

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CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 203-017-83 AMENDMENT 69 PAGE 3 ********* V. TECHNETIUM 99 V. SEALED SOURCE V. NO SINGLE SOURCE TO EXCEED 170 MILLI-CURIES W. IRON 55 W. 60 MILLICURIES W. SEALED SOURCE X. CALIFORNIUM 252 X. SEALED SOURCE X. NO SINGLE SOURCE TO EXCEED 25 MILLI-CURIES Y. CADMIUM 109 Y. SEALED SOURCE Y. NO SINGLE SOURCE TO (AMERSHAM MODEL EXCEED 50 MILLI-CUC.D1; ISOTOPE CURIES PRODUCTS MODEL XFB SERIES-3204 AND 3205; NEW ENGLAND NUCLEAR MODEL NER-465 AND NER-467, CAPSULE LE-66; NORTH AMERICAN SCIENTIFIC MODEL IND 1602) Z. SEALED SOURCE (ISOTOPE PRODUCTS MODEL AN-55) Z. NO SINGLE SOURCE TO EXCEED 100 MILLI-CURIES Z. IRON 55

AUTHORIZED USE 9.

- A. G. FOR USE IN RESEARCH AND TEACHING APPLICATIONS IN THE LIFE SCIENCES. SPECIFIC APPLICATION FOR EACH INDIVIDUAL USER TO BE APPROVED BY THE UNIVERSITY RADIATION SAFETY COMMITTEE.
- H. R. SEALED SOURCES FOR USE IN RESEARCH AND TEACHING APPLICATIONS IN THE PHYSICS DEPARTMENT. SPECIFIC APPLICATION FOR EACH INDIVIDUAL USER TO BE APPROVED BY THE UNIVERSITY RADIATION SAFETY COMMITTEE.
- Q. FOR USE IN KRUPP POLYSIUS CONTINUOUS NEUTRON ANALYZER MODEL POLAB CNA, EMR PHOTOELECTRONIC NEUTRON GENERATOR MODELS 758 AND 761, AND ME PHYSICS CORPORATION MODEL A-3062 FOR RESEARCH AND DEVELOPMENT.

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CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 203-017-83 AMENDMENT 69 PAGE 4

- S. AND T. FOR USE IN TROXLER MODEL 3400 SERIES MOISTURE/DENSITY GAUGE TO MEASURE THE PROPERTIES OF CONSTRUCTION MATERIALS.
- U. FOR USE IN GAS CHROMATOGRAPHS UNITS WITH ELECTRON CAPTURE DETECTORS.
- V. THRU X. FOR RESEARCH.
- Y. FOR USE IN NITON MODEL 700 SERIES FIELD PORTABLE X-RAY FLUORESCENCE ANALYZER FOR CLASSROOM TRAINING AND ELEMENTAL ANALYSIS AT CONTAMINATED FIELD SITES.
- Z. FOR USE AS AN X-RAY FLUORESCENCE SOURCE IN RESEARCH TO DETECT CHLORINE IN COAL SAMPLES.

CONDITIONS :

- 10. THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE KENTUCKY CABINET FOR HEALTH SERVICES ADMINISTRATIVE RADIATION REGULATIONS, 902 KAR 100.
- 11. RADIOACTIVE MATERIAL SHALL BE USED AT THE FOLLOWING LOCATIONS AS SPECIFIED IN THE APPLICATION ON THE WESTERN KENTUCKY UNIVERSITY CAMPUS:
 - A. THOMPSON COMPLEX
 - B. SCIENCE & TECHNOLOGY HALL
 - C. APPLIED PHYSICS INSTITUTE
 - D. APPLIED PHYSICS ANNEX
 - E. UNIVERSITY FARM SITE
 - F. DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY.

RADIOACTIVE MATERIAL CONTAINED IN THE PORTABLE X-RAY FLUORES-CENCE ANALYZERS, PORTABLE MOISTURE DENSITY GAUGES, AND IN THE FORM OF TRITIUM AS CONTAINED IN THE NEUTRON GENERATORS FOR RESEARCH AND DEVELOPMENT, MAY BE USED AND STORED AT. AND TRANSPORTED TO AND FROM TEMPORARY JOB SITES, IN AREAS NOT UNDER EXCLUSIVE FEDERAL JURISDICTION, ANYWHERE IN THE COMMONWEALTH OF KENTUCKY WHERE THE CABINET MAINTAINS JURISDICTION FOR REGULATING THE USE OF RADIOACTIVE MATERIAL. THE USE OF NEUTRON GENERATORS AT TEMPORARY JOB SITES SHALL BE CONDITIONAL UPON A WRITTEN REQUEST TO AND SUBSEQUENT APPROVAL BY THE CABINET. (THIS CONDITION DOES NOT PROHIBIT USE IN OTHER STATES UNDER RECIPROCITY PRIVILEGES WHICH MAY BE GRANTED BY THE REGULATORY AGENCY HAVING JURISDICTION.)" WKU ENV HLTH & SFTY 2707455037

CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 203-017-83 AMENDMENT 69 PAGE 5

- 12. RADIOACTIVE MATERIAL LISTED IN ITEM 6 ABOVE IS AUTHORIZED FOR USE BY THE FOLLOWING INDIVIDUAL(S) FOR THE MATERIALS AND USES INDICATED:
 - A. ALEXANDER BARZILOV, PH.D. A. SUBITEMS 6.H. THRU 6.R., MICHAEL BELBOT, PH.D. 6.V. THRU 6.X., AND 6.Z. IVAN NOVIKOV, PH.D. JONATHAN C. PASCHAL GARY SPICHIGER PHILLIF WOMBLE, PH.D.
 - B. CLAIRE RINEHART, PH.D. B. H-3 AS LISTED IN SUBITEM 6.A.; P-32, S-35
 - C. KEN J. BALAK, PH.D. C. H-3 AS LISTED IN SUBITEM 6.A.; P-32

E. H-3 AS LISTED IN SUBITEM 6.A.; C-14, P-32, S-35

D. NI-63

- D. WEI-PING PAN, PH.D.
- B. RICK FOWLER
- F. KINCHEL DOERNER, PH.D. F. C-14; P-32
- G. CHERYL DAVIS, PH.D. G. P-32 SIGRID JACOBSHAGEN, PH.D.
- 13. A. RADIOACTIVE MATERIAL LISTED IN SUBITEMS 6.S. AND 6.T. SHALL BE USED BY, OR UNDER THE DIRECT SUPERVISION AND IN THE PHYSICAL PRESENCE OF MATT DETTMAN.
 - B. RADIOACTIVE MATERIAL LISTED IN SUBITEM 6.Y. SHALL BE USED BY, OR UNDER THE DIRECT SUPERVISION AND IN THE PHYSICAL PRESENCE OF ROD HANDY OR CHARLOTTE REEDER.
- 14. THE RADIATION SAFETY OFFICER FOR THE ACTIVITIES AUTHORIZED BY THIS LICENSE IS MARY J. REYNOLDS .
- 15. SEALED SOURCES CONTAINING RADIOACTIVE MATERIAL SHALL NOT BE OPENED.
- 16. RADIOACTIVE MATERIALS SHALL NOT BE USED IN OR ON HUMAN BEINGS OR IN PRODUCTS DISTRIBUTED TO THE PUBLIC.

WKU ENV HLTH & SFTY 2707455037 05/02 02 09:38 NO.315 08/30

CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

LICENSE NUMBER: 203-017-83 AMENDMENT 69 PAGE 6

- EXPERIMENTAL ANIMALS ADMINISTERED RADIOACTIVE MATERIALS, OR 17. THEIR PRODUCTS, SHALL NOT BE USED FOR HUMAN CONSUMPTION.
- 18. THE LICENSEE SHALL NOT USE RADIOACTIVE MATERIAL IN OR ON HUMAN BEINGS EXCEPT AS PROVIDED OTHERWISE BY SPECIFIC CONDITION OF THIS LICENSE.
- 19. DETECTOR CELLS CONTAINING RADIOACTIVE MATERIAL SHALL NOT BE OPENED OR THE FOIL SOURCES REMOVED FROM THE DETECTOR CELL BY THE LICENSEE.
- 20. MAINTENANCE, REPAIR, CLEANING, REPLACEMENT AND DISPOSAL OF FOILS CONTAINED IN DETECTOR CELLS SHALL BE PERFORMED BY THE DEVICE MANUFACTURER OR OTHER PERSONS SPECIFICALLY AUTHORIZED BY THE CABINET. THE U.S. NUCLEAR REGULATORY COMMISSION, OR AN AGREEMENT STATE.
- ANY CLEANING, MAINTENANCE OR REPAIR OF THE GAUGE(S) INVOLVING 21. REMOVAL OF THE SOURCE ROD FROM THE DEVICES OR REMOVAL OR DISMANTLING OF SHIELDING SHALL BE PERFORMED ONLY BY THE MANUFACTURER OR BY OTHER PERSONS SPECIFICALLY AUTHORIZED BY THE CABINET, THE U.S. NUCLEAR REGULATORY COMMISSION OR AN AGREEMENT STATE TO PERFORM SUCH SERVICES.
- EACH PORTABLE GAUGE SHALL HAVE A LOCK OR OUTER LOCKED CONTAINER 22. DESIGNED TO PREVENT UNAUTHORIZED OR ACCIDENTAL REMOVAL OF THE SEALED SOURCE FROM ITS SHIELDED POSITION. THE GAUGE OR ITS CONTAINER MUST BE LOCKED WHEN IN TRANSPORT, STORAGE OR WHEN NOT UNDER THE DIRECT SURVEILLANCE OF AN AUTHORIZED USER.
- THE LICENSEE SHALL CONDUCT A QUARTERLY PHYSICAL INVENTORY TO 23. ACCOUNT FOR ALL SEALED SOURCES RECEIVED AND POSSESSED UNDER THE LICENSE. THE RECORDS OF THE INVENTORIES SHALL BE MAINTAINED FOR FIVE (5) YEARS FROM THE DATE OF THE INVENTORY FOR INSPECTION BY THE CABINET, AND SHALL INCLUDE THE RADIONUCLIDES, QUANTITIES, MANUFACTURER'S NAME AND MODEL NUMBERS, LOCATION OF SEALED SOURCES, THE DATES OF THE INVENTORY, AND THE NAME OF THE INDIVIDUAL CONDUCTING THE INVENTORY.
- THE LICENSEE IS AUTHORIZED TO HOLD RADIOACTIVE MATERIAL WITH A 24. PHYSICAL HALF-LIFE OF LESS THAN 65 DAYS FOR DECAY-IN-STORAGE BEFORE DISPOSAL IN ORDINARY TRASH PROVIDED:

 - A. RADIOACTIVE WASTE TO BE DISPOSED OF IN THIS MANNER SHALL BE HELD FOR DECAY A MINIMUM OF TEN (10) HALF-LIVES.
 B. PRIOR TO DISPOSAL AS NORMAL WASTE, RADIOACTIVE WASTE SHALL BE MONITORED TO DETERMINE THAT ITS RADIOACTIVITY CANNOT BE DISTINGUISHES FROM BACKGROUND WITH TYPICAL LOW-LEVEL LABORATORY SURVEY INSTRUMENTS. ALL RADIATION LABELS WILL BE OR OBLITERATED.

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CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

PAGE 7 LICENSE NUMBER: 203-017-83 AMENDMENT 69

- A RECORD OF BACH DISPOSAL PERMITTED UNDER THIS LICENSE 25. C. CONDITION SHALL BE RETAINED FOR THREE YEARS. THE RECORD MUST INCLUDE THE DATE OF DISPOSAL, THE DATE ON WHICH THE RADIOACTIVE MATERIAL WAS PLACED IN STORAGE, THE RADIONUCLIDES DISPOSED, THE SURVEY INSTRUMENT USED, THE BACKGROUND DOSE RATE, THE DOSE RATE MEASURED AT THE SURFACE OF EACH WASTE CONTAINER, AND THE NAME OF THE INDIVIDUAL WHO PERFORMED THE DISPOSAL.
- 26. THE LICENSEE MAY ALSO RECEIVE, POSSESS, USE, TRANSFER, OWN OR ACQUIRE RADIOACTIVE MATERIAL NOT IN EXCESS OF FIVE (5) TIMES THE QUANTITIES LISTED IN 902 KAR 100:080, SECTION 2.
- 27. EXCEPT AS SPECIFICALLY PROVIDED OTHERWISE IN THIS LICENSE, THE LICENSEE SHALL CONDUCT ITS PROGRAM IN ACCORDANCE WITH THE STATEMENTS, REPRESENTATIONS, AND PROCEDURES CONTAINED IN THE DOCUMENTS, INCLUDING ANY ENCLOSURES, LISTED BELOW. THE CABINET FOR HEALTH SERVICES REGULATIONS, 902 KAR 100, SHALL GOVERN UNLESS STATEMENTS, REPRESENTATIONS, AND PROCEDURES IN THE LICENSEE'S APPLICATION AND CORRESPONDENCE ARE MORE RESTRICTIVE THAN THE REGULATION.
 - APPLICATION DATED MARCH 6, 2001, SIGNED BY MARY J. Α. REYNOLDS, RSO AND GERALD E. TICE, VICE-PRESIDENT.
 - WESTERN KENTUCKY UNIVERSITY RADIATION SAFETY MANUAL В. RECEIVED JUNE 7, 2001, SIGNED BY GARY RENSDELL, PRESIDENT.
 - C. LETTERS DATED:
 - JUNE 5, 2001, SIGNED BY GERALD E. TICE, VICE-PRESIDENT 1. AND MARY J. REYNOLDS, RSO.
 - JULY 16, 2001, SIGNED BY MARY J. REYNOLDS, RSO. 2.
 - SEPTEMBER 24, 2001, SIGNED BY GERALD E. TICE, VICE-3. PRESIDENT.
 - DECEMBER 7, 2001, SIGNED BY DR. GERALD E. TICE, VICE-4. PRESIDENT.
 - JANUARY 4, 2002, SIGNED BY DR. GERALD B. TICE, CHAIR, 5. RSC AND MARY J. REYNOLDS, RSO.
 - FEBRUARY 19, 2002, SIGNED BY GERALD E. TICE, CHAIR, б. RADIATION SAFETY COMMITTEE AND MARY J. REYNOLDS, RSO.
 - MARCH 19, 2002, SIGNED BY GERALD E. TICE, CHAIR, 7. RADIATION SAFETY COMMITTEE AND MARY J. REYNOLDS, RSO.

CABINET FOR HEALTH SERVICES COMMONWEALTH OF KENTUCKY RADIOACTIVE MATERIAL LICENSE

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PAGE LICENSE NUMBER: 203-017-93 AMENDMENT 69 8

D. EXEMPTION DATED MARCH 26, 2002, SIGNED BY JOHN A. VOLPE, PH.D., MANAGER, RADIATION HEALTH & TOXIC AGENTS BRANCH.

per, PX. >

SUPERVISOR RADIATION HEALTH & TOXIC AGENTS BRANCH

DATE ISSUED MAY 2, 2002

MARC SECRETARY CABINET FOR HEALTH SERVICES



Radiation Work Permit

Permit Reference Number: API-0005

This form is to be completed and approved prior to any work performed with radioactive materials. If this work is routine work (same procedures performed on a continual basis), only one form needs to be submitted for the duration of the work. If the work changes significantly, a resubmission of the form may be required.

PRIMARY RESPONSIBLE INVESTIGATOR: Dr. Phil Womble

| TITLE/POSITION: | Assistant Profe | ssor | | | |
|-----------------|-----------------|------|----------|--------|----------|
| DEPT: API | BUILDING: | API | ROOM:N/A | PHONE: | 780-2518 |

List the all the isotopes and physical forms for which the permit is being sought:

| Isotope* | Maximum (in millicuries) that you are requesting to | Physical Form | Source Shall Be | | | |
|----------|--|--|-----------------|------|-------------------|--|
| | be in your possession at any one time, including waste and stores. | | Scaled | Open | Part of Device | |
| 'H | No more than 6000 mCi | Solid deposited on filament and target | X | | х | |

*Also complete and submit the Radioactive Materials Information Form.

 \Box A request for an increase/change regarding the radioactive material X Other <u>Off site use of radioactive material</u>

All Building(s) and Room(s) where isotope will be stored and/or used:

West Jefferson Facility, Battelle, Columbus, OH

Aberdeen Proving Ground, Edgewood Facility, Aberdeen, MD (Federal facility)

Are all of these locations currently listed on the radioactive materials license and posted for

usage/storage of radioactive material? Yes No X Other

Valid Authorization Numbers you currently hold, if any:

| Number | Isotope | Amount |
|--------|---------|--------|
| N/A | N/A | N/A |

Please answer the following questions (use another sheet of paper, if additional space is required).

1. Explain briefly the intended use of the radioactive materials/equipment.

Elemental characterization, non-destructive analysis of improvised explosive devices (IED), and chemical warfare (CW) agents.

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

Page 1 of 4

2. Name and describe the experiment in general terms. Indicate typical amounts (mCi) of radioactive materials to be used, and duration/frequency of use. Describe physical/chemical manipulations or activations intended, if applicable. If this procedure is intended for only a short term, state projected dates. If reciprocity is required, attach all documentation. Also, complete a hazard analysis, if necessary.

PELAN, containing a sealed tube neutron generator of no more than 3 Ci tritium, will be evaluated as a non-intrusive IED and CW agents identification device. The testing will take place between April 13, 2002 and May 10, 2002 at Columbus, OH and Aberdeen, MD.

Testing at Columbus OH will take place under a reciprocity agreement with the State of Ohio.

For the tests at Aberdeen Proving Ground, NRC Form 241 is required for approval of proposed activities in non-agreement states, areas of exclusive federal jurisdiction, or offshore waters.

3. Will this material be used by persons other that you? ∨ Yes □ No If yes, provide information to identify these persons, their qualifications, and indicate how you intend to ensure that they receive adequate supervision.

Jon Paschal will also be using PELAN. He is listed as a responsible investigator on the license for use of all sources at API facilities.

4. Are you familiar with the provisions and regulations of the following:

| Standards for Protection Against Radiation, 902 KAR 100:019? WKU Radioactive Materials License? | X□Yes □□No X□ Yes |
|--|----------------------|
| WKU Radiation Safety Manual (with signed signature page back to RSO)? | □ □No X□ Yes |
| | |

- 5. If there is (or shall be) possession of survey and monitoring equipment, complete the Survey and Monitoring Equipment Form. Itemize specific items owned and/or those which you plan to obtain if this application is approved. A monitoring device is generally required if millicurie amounts are requested.
 - X There is (or shall be) survey/monitoring equipment; a completed Survey and Monitoring Equipment Form is attached. Include any additional information that is important regarding survey/monitoring equipment.
 - Survey/monitoring equipment is not required.

One of the neutron monitors routinely used at API will be taken to Battelle, Columbus OH, and Aberdeen Proving Ground, MD for neutron radiation monitoring.

6. Outline the specific plans for the transportation, receipt, use, and storage of radioactive material(s). Specify the records that will be kept.

<u>Transportation:</u> See <u>TRANSPORTATION OF NEUTRON GENERATOR HEAD</u> section in attached PELAN RADIATION ISSUES

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

Page 2 of 4

<u>Receipt</u>: Source will be wipe-tested by personnel of Battelle and Aberdeen Proving Ground; a copy of the results of the wipe-tests will be recorded <u>Use:</u> See <u>PELAN OPERATION</u> section in attached PELAN RADIATION ISSUES <u>Storage</u>: See OVERNIGHT STORAGE section in attached PELAN RADIATION ISSUES

7. Outline the specific plans for storage and disposal of radioactive waste. Specify the records that will be kept.

No radioactive waste shall be generated.

- 8. Describe arrangements have that have been made with the Radiation Safety Officer with respect to personnel monitoring requirements.
 - X There is (or shall be) personnel monitoring; a completed Survey and Monitoring Equipment Form is attached. Include any additional information that is important regarding personnel monitoring.
 - Personnel monitoring is not needed (state why).

API personnel will wear their WKU-issued dosimeters.

9. Outline the plans for the orientation of assistants, staff, students, or visitors in relation to Items 5 and 7 above, and with respect to radiological safety in general.

RI's have been trained by WKU RSO. RSO's of Battelle and Aberdeen Proving Ground are responsible for personnel there. They have received a copy of the PELAN RADIATION ISSUES.

10. Describe any storage facility(ies) for the radioactive material(s) and outline plans to secure isotope(s) and contaminated waste to prevent use or possession by unauthorized personnel, or to prevent accidental loss.

See <u>OVERNIGHT STORAGE</u> section in attached PELAN RADIATION ISSUES For transportation issues, see <u>TRANSPORTATION OF NEUTRON GENERATOR HEAD</u> in attached PELAN RADIATION ISSUES

11. What facilities and protective equipment are available? (Hoods, absorbent paper, labels, tags, shielding, etc.)

See <u>OPERATIONAL RADIATION SAFETY</u>, <u>EMERGENCY SHUTDOWN</u>, and <u>RADIATION DOSE MEASUREMENT</u> sections in attached PELAN RADIATION ISSUES

12. Describe the precautions that will be taken to test for leakage and/or contamination upon receipt of these materials.

Survey and wipe tests by Battelle and Aberdeen Proving Ground RSO's.

13. What measures will be taken to prevent, detect, and handle a "spill"?

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

Page 3 of 4

See <u>TRITIUM LEAKS</u> and <u>EMERGENCY PROCEDURES IN CASE OF MAJOR FIRE</u> sections in attached PELAN RADIATION ISSUES

14. Please provide any other information which might be helpful to the Radiation Safety Officer and the Radiation Safety Committee.

Activation information is covered in <u>INDUCED IRRADIATION</u> section in attached PELAN RADIATION ISSUES

DOCUMENTATION REQUIRED IN ADDITION TO THIS FORM

Please complete and submit the Radioactive Materials Information Form (available from the RSO). If there are any hazards that are anticipated during the course of work, please complete and submit a Hazard Analysis Form, available from the Dept. of Environmental Health and Safety. If survey or monitoring equipment is involved, please complete and submit a Survey and Monitoring Equipment Form (available from the RSO).

CERTIFICATION: I certify that the work performed with the materials requested in this application will be done in accordance with the rules and regulations contained in the 902 KAR 100, Western Kentucky University's license, and the WKU Radiation Safety Manual.

Primary Responsible Investigator Signature Date Approved by Date fety Officer) Date Radiation Safety Committee Chair)

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

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Survey and Monitoring Form

Permit Reference Number: API-0005

| Radiation Detectors | | | | | | | | | |
|---------------------|------------------------|-----------|--------------------------|--------------------|---------------|--|--|--|--|
| Manufacturer | Model | Scrial # | Radiation(s) Detected | Last Calibrated | Calibrated By | | | | |
| Victoreen | 190 N, RP- N | 161-probe | ۹. | 2/20/2002 | Inovision | | | | |
| Victoreen | 190N, RP- N | 149-probe | a | 12/12/2001 | Inovision | | | | |

| Occupational Monitoring | | | | | | | | |
|-------------------------|----------------|------------|--------------------------|-----------------|--|--|--|--|
| # Badges | Badge Supplier | Badge Type | Radiation(s) Detected | Rotation Period | | | | |
| 2 | ICN Dosimetry | Whole Body | ∀, ₫, ù ♠ | Monthly | | | | |
| 1 | ICN Dosimetry | Control | ∀, ₿. €Q | Monthly | | | | |

| Visitor/Observer Monitoring | | | | | | | | |
|-----------------------------|---------------|-------------|--------------------------|--------------------|---------------|--|--|--|
| Manufacturer | Model | Serial # | Radiation(s) Detected | Last Calibrated | Calibrated By | | | |
| Monitoring to b | e supplied by | Radiation S | afety Program of | visited facility. | | | | |

Primary RI's Signature:

Approved by:

Officer)

18/02 18/2002 Date

18/02 Date

Date

(Radiation Safety Committee Chair)

EHS RS Form 603 (12/2001) Submit copies for RSO and each member of RSC.

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RADIOACTIVE MATERIALS INFORMATION FORM

| | | | | | | rc | man Reference | NUCLOET: API-0005 |
|--|--|-------------------------|------------|--------------|--------------|----------------------------|------------------|-------------------|
| Isotope* | Original Activity/Date | Identifying Information | | Half-Life | Radiations/% | On License? | Exempt Quantity? | |
| | | Manufacturer | Model | S/N | | | | (0100 00000 105.) |
| H-3 | 1.98 Ci /12/18/98 | MF Physics, A- | 325PH, 199 | 834-8125-102 | 12.33 a | Beta /100% | Yes | No |
| Some isotopes activated on tube | 3 mrem/hr on contact after two hours of neutron production | N/A | | | ~9 m | Gamma and xray/ unknown | N/A | N/A |
| H-3 | 2 Ci/ 2001 | MF Physics, A- | 325PH, 200 | 103-0150-404 | 12.33 a | Beta /100% | Yes | No |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | <u> </u> | | | |
| | | | | | <u> </u> | | | |
| | | | | | | | | |

*If any radioisotopes are produced as a result of the procedure (e.g., activation products), please give all relevant information.

How do you ensure that radioactive materials are secured from ALL Non-Authorized Users?

The radioactive material involved will be handled by Responsible Investigators under the WKU Radioactive Materials License #203-017-83, and stored in a secure location at the sites designated on the accompanying RWP.

8/07 Approved by: Primary RI's Date: Date: Signature: Rad Date:

(Radiation Safety Committee Chair)

2707455037

05/02

'02 09:41 NO.315

16/30

RADIOACTIVE WORK PERMIT AMENDMENT

Permit Reference Number: <u>API-0005</u>

The Western Kentucky University Radiation Safety Committee has approved the amendment to the Radiation Work Permit Number API-0005. This amendment modifies item 2 of the permit to send the neutron generators to Battelle through a license transfer of material, as opposed to under reciprocity agreement.

This decision was made based on the conversation between the RSO for Battelle, Craig Jensen, and the WKU RSO, Mary Reynolds.

Approved by:

4/12/2002 4/12/02 Date Officer) Date

(Radiation Safety Committee Chair)

RADIOACTIVE WORK PERMIT 2nd AMENDMENT

Permit Reference Number: API-0005

The Western Kentucky University Radiation Safety Committee has approved the second amendment to the Radiation Work Permit Number API-0005. This amendment allows the replacement of one neutron generator for another. The same manufacturer, model, source activity, and procedures apply.

This decision was made based on the discovery that the current PELAN II is not working at Battelle, and there is need to continue the tests. Also, as Battelle is only licensed to possess two neutron generators, the non-working generator shall be shipped to WKU (not necessarily received by WKU) prior to their receipt of the replacement generator.

Approved by:

4/16/2002 4/16/02 Date Officer)

(Radiation Safety Committee Chair)

Date

Western Kentucky University

Radiation Work Permit

Permit Reference Number: API-0006

This form is to be completed and approved prior to any work performed with radioactive materials. If this work is routine work (same procedures performed on a continual basis), only one form needs to be submitted for the duration of the work. If the work changes significantly, a resubmission of the form may be required.

PRIMARY RESPONSIBLE INVESTIGATOR: Dr. Phil Womble

| TITLE/POSITION: | <u>Assistant Profe</u> | SSOT | | | |
|-----------------|------------------------|------|------------------|--------|----------|
| DEPT: API | BUILDING: | API | ROOM: <u>N/A</u> | PHONE: | 780-2518 |

List the all the isotopes and physical forms for which the permit is being sought:

| Isotope* | Maximum (in millicuries) that you are requesting to | Physical Form | Sou | rcc Shall Be | |
|----------|--|--|---------------------|--------------|---------------------|
| | be in your possession at any one time, including waste and stores. | | Sealed | Open | Part of Device |
| Ъ | No more than 6000 mCi (3,000 mCi each) | Solid deposited on filament and target | X (2 sources) | | X (2 devices) |

*Also complete and submit the Radioactive Materials Information Form.

This application is:

• An initial application for this radioactive material

 \Box A request for an increase/change regarding the radioactive material X Other <u>Off site use</u> of <u>radioactive material</u>

All Building(s) and Room(s) where isotope will be stored and/or used:

NAVY EOD TECHNOLOGY DIVISION (NEODTD), INDIAN HEAD, MD (Federal facility)

Are all of these locations currently listed on the radioactive materials license and posted for

usage/storage of radioactive material? Yes No X Other

Valid Authorization Numbers you currently hold, if any:

| Number | Isotope | Amount |
|--------|---------|--------|
| N/A | N/A | N/A |

Please answer the following questions (use another sheet of paper, if additional space is required).

1. Explain briefly the intended use of the radioactive materials/equipment.

Elemental characterization, non-destructive analysis of unexploded ordnance

2. Name and describe the experiment in general terms. Indicate typical amounts (mCi) of radioactive materials to be used, and duration/frequency of use. Describe physical/chemical manipulations or activations intended, if applicable. If this procedure

EHS RS Form 901 (12/2001)

Submit copies for RSO and each member of RSC.

Page 1 of 4

is intended for only a short term, state projected dates. If reciprocity is required, attach all documentation. Also, complete a bazard analysis, if necessary.

PELAN, containing a sealed tube neutron generator of no more than 3 Ci tritium, will be evaluated as a non-intrusive unexploded ordnance identification device. The testing will take place between May 10, 2002 and May 25, 2002 at Indian Head, MD. Although testing will be performed using only one PELAN unit, because of the continuous use of PELAN over 15 days, a second PELAN unit will be needed as a back up, in case of malfunction of the first PELAN unit.

For the tests at NEODTD, an NRC Form 241 is required for approval of proposed activities in non-agreement states, areas of exclusive federal jurisdiction, or offshore waters.

3. Will this material be used by persons other that you? ∨ Yes □ No If yes, provide information to identify these persons, their qualifications, and indicate how you intend to ensure that they receive adequate supervision,

Jon Paschal and Ivan Novikov will also be using PELAN. They are listed as responsible investigators on the license for use of all sources at API facilities.

4. Are you familiar with the provisions and regulations of the following:

| Standards for Protection Against Radiation, 902 KAR 100:0197 | X Yes | No |
|---|-------|------------|
| WKU Radioactive Materials License? | X Yes | No |
| WKU Radiation Safety Manual (with signed signature page back to PSO)? | Y Vac | 1 40 No |
| (Whit office office of the bage offer to NOC) | ~ 105 | 110 |

5. If there is (or shall be) possession of survey and monitoring equipment, complete the Survey and Monitoring Equipment Form. Itemize specific items owned and/or those which you plan to obtain if this application is approved. A monitoring device is generally required if millicurie amounts are requested.

X There is (or shall be) survey/monitoring equipment; a completed Survey and Monitoring Equipment Form is attached. Include any additional information that is important regarding survey/monitoring equipment.

□ Survey/monitoring equipment is not required.

One of the neutron monitors routinely used at API will be taken to Indian Head, MD for neutron radiation monitoring.

6. Outline the specific plans for the transportation, receipt, use, and storage of radioactive material(s). Specify the records that will be kept.

<u>Transportation:</u> See <u>TRANSPORTATION OF NEUTRON GENERATOR HEAD</u> section in attached PELAN RADIATION ISSUES

<u>Receipt</u>: Source will be wipe-tested by personnel NAVEODTD; a copy of the results of the wipe-tests will be recorded

<u>Use:</u> See <u>PELAN OPERATION</u> section in attached PELAN RADIATION ISSUES <u>Storage:</u> See OVERNIGHT STORAGE section in attached PELAN RADIATION ISSUES

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

Page 2 of 4

7. Outline the specific plans for storage and disposal of radioactive waste. Specify the records that will be kept.

No radioactive waste shall be generated.

- 8. Describe arrangements have that have been made with the Radiation Safety Officer with respect to personnel monitoring requirements.
 - X There is (or shall be) personnel monitoring; a completed Survey and Monitoring Equipment Form is attached. Include any additional information that is important regarding personnel monitoring.
 - Personnel monitoring is not needed (state why).

API personnel will wear their WKU-issued dosimeters.

9. Outline the plans for the orientation of assistants, staff, students, or visitors in relation to Items 5 and 7 above, and with respect to radiological safety in general.

RI's have been trained by WKURSO. RSO of NAVEODTD, Indian Head, MD is responsible for personnel there. He has received a copy of the PELAN RADIATION ISSUES.

10. Describe any storage facility(ies) for the radioactive material(s) and outline plans to secure isotopc(s) and contaminated waste to prevent use or possession by unauthorized personnel, or to prevent accidental loss.

See <u>OVERNIGHT STORAGE</u> section in attached PELAN RADIATION ISSUES For transportation issues, see <u>TRANSPORTATION OF NEUTRON GENERATOR HEAD</u> in attached PELAN RADIATION ISSUES

11. What facilities and protective equipment are available? (Hoods, absorbent paper, labels, tags, shielding, etc.)

See <u>OPERATIONAL RADIATION SAFETY</u>, <u>EMERGENCY SHUTDOWN</u>, and <u>RADIATION DOSE MEASUREMENT</u> sections in attached PELAN RADIATION ISSUES

12. Describe the precautions that will be taken to test for leakage and/or contamination upon receipt of these materials.

Survey and wipe tests by NAVEODTD, Indian Head, MD RSO.

13. What measures will be taken to prevent, detect, and handle a "spill"?

See <u>TRITIUM LEAKS</u> and <u>EMERGENCY PROCEDURES IN CASE OF MAJOR FIRE</u> sections in attached PELAN RADIATION ISSUES

14. Please provide any other information which might be helpful to the Radiation Safety Officer and the Radiation Safety Committee.

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC. Activation information is covered in <u>INDUCED JRRADIATION</u> section in attached PELAN RADIATION ISSUES

DOCUMENTATION REQUIRED IN ADDITION TO THIS FORM

Please complete and submit the Radioactive Materials Information Form (available from the RSO). If there are any hazards that are anticipated during the course of work, please complete and submit a Hazard Analysis Form, available from the Dept. of Environmental Health and Safety. If survey or monitoring equipment is involved, please complete and submit a Survey and Monitoring Equipment Form (available from the RSO).

CERTIFICATION: I certify that the work performed with the materials requested in this application will be done in accordance with the rules and regulations contained in the 902 KAR 100, Western Kentucky University's license, and the WKU Radiation Safety Manual.

Primary Responsible Investigator Signature Date Approved by Date Safety Officer) 5/1/02 Date (Radiation Safety Committee Chair)

EHS RS Form 901 (12/2001) Submit copies for RSO and each member of RSC.

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Survey and Monitoring Form

Permit Reference Number; API-0006

| Radiation Detectors | | | | | | | |
|---------------------|----------------|-----------|--------------------------|--------------------|---------------|--|--|
| Manufacturer | Model | Serial # | Radiation(s) Detected | Last Calibrated | Calibrated By | | |
| Victoreen | 190N, RP- N | 161-probe | η | 2/20/2002 | Inovision | | |
| Victoreen | 190N, RP- N | 149-probe | η | 12/12/2001 | Inovision | | |

One of the two will be used.

| Occupational Monitoring | | | | | | | |
|-------------------------|----------------|------------|--------------------------|-----------------|--|--|--|
| # Badges | Badge Supplier | Badge Type | Radiation(s) Detected | Rotation Period | | | |
| 2 | ICN Dosimetry | Whole Body | α, β, γ, η | Monthly | | | |
| 1 | ICN Dosimetry | Control | α, β, γ, η | Monthly | | | |

| Visitor/Observer Monitoring | | | | | | | |
|--|-------|----------|--------------------------|--------------------|---------------|--|--|
| Manufacturer | Model | Serial # | Radiation(s) Detected | Last Calibrated | Calibrated By | | |
| Monitoring to be supplied by Radiation Safety Program of visited facility. | | | | | | | |

(Radiation Safety Committee Chair)

Primary RI's Signature:

Approved by;

Date

Officer)

02

Date

102 Date

EHS RS Form 603 (12/2001) Submit copies for RSO and each member of RSC.

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RADIOACTIVE MATERIALS INFORMATION FORM

| Failed and the second s | | · · · · · | | | | Pe | rmit Reference] | Number: <u>API-0006</u> |
|---|--|-------------------------|---------------|--------------------|--------------|---------------------------------------|------------------|-------------------------|
| Isotope* | Original Activity/Date | Identifying Information | | Half-Life | Radiations/% | On License? | Exempt Quantity? | |
| | | Manufacturer | Model | S/N | | | | |
| H-3 | 1.98 Ci/ 12-18-1998 | MF Physics, A- | 325PH, 199 | 9834-8125-102 | 12.33 a | Beta /100% | Yes | No |
| H-3 | 2.15 Ci/ 11-18-1998 | MF Physics, A-: | 325PH, 199 | 9827-8104-101 | 12.33 a | Beta /100% | Yes | No |
| H-3 | 1.43 Ci/ 3-15-2002 | MF Physics, A- | 320-4P, 20 | 0103-0150-404 | 12.33 a | Beta /100% | Yes | No |
| Н-3 | 2.2 Ci/ 3-28-2002 | MF Physics, A | 320-4P, 20 | 0066-0150-401 | 12.33 a | Beta /100% | Yes | No |
| Some isotopes activated on tube | 3 mrem/hr on contact after two hours of neutron production | N/A | | | ~9 m | Gamma and xray/ unknown | N/A | N/A |
| Importan | t Note: Only two of the four | listed neutron get | nerators are | e to be used for t | he test. | · · · · · · · · · · · · · · · · · · · | | |
| | | | · · · · · · · | · · · · · · | | 1 | | |
| | | | | | | | | |

*If any radioisotopes are produced as a result of the procedure (e.g., activation products), please give all relevant information.

How do you ensure that radioactive materials are secured from ALL Non-Authorized Users?

The radioactive material involved will be handled by Responsible Investigators under the WKU Radioactive Materials License #203-017-83, and stored in a secure location at the sites designated on the accompanying RWP.

Primary RI's Signature:

Date: 6 U Approved by:

(Radiation/Safety Officer)

Date:

Date:

(Radiation Safety Committee Chair)

WESTERN KENTUCKY UNIVERSITY



PELAN RADIATION ISSUES

Date: January 20, 2002

INTRODUCTION

PELAN is intended to be used for detection of explosive devices, illicit drugs, as well as chemical warfare agents and anti-personnel landmines.

PELAN has been through a series of laboratory and field trials using simulated and real explosives, drugs, chemical warfare agents, etc. These trials have taken place over the last four years at the Applied Physics Institute, at Federal facilities in the USA and various national and international facilities worldwide.

RADIATION SOURCE

PELAN contains a sealed tube neutron generator Model A-325PH manufactured by MF PHYSICS. It produces neutrons by accelerating deuterium ions through a potential difference of up to 100,000 Volts and allowing them to impinge on a tritium target. Neutron characteristics of the generator are:

Neutron fluence : $1-1.5 \times 10^8$ n/s in a 4π geometry Amount of tritium in the sealed tube: approx. 1.1×10^{11} Bq (3 Ci)

The neutron generator head (manufactured by MF Physics) is contained in the upper horizontal cylindrical segment of the PELAN probe (see figure on p. 6). The head consists of a pressure housing, electrical connectors, a high voltage section and a neutron generator tube. The head volume is normally filled with sulfur hexafluoride which is used as an insulating gas. The housing of the accelerator head is sealed, and is designed to contain any tritium that may be present due to breakage of the tube. The neutron generator tube is a sealed tube constructed from stainless steel, vacuum melt iron, copper, glass and ceramic. Laser welds, TIG welds and high temperature braze materials are used in tube fabrication. All braze materials have melting points of 779°C or higher.

Please note that the neutron generator does not produce any neutrons until several switches are turned ON. To start the neutron generator, the main power key in the Power and Control Module of PELAN must be turned ON, the neutron

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generator interlock must be closed, and the START icon on the palm-top computer must be depressed.

RADIATION TRAINING

Personnel that work with PELAN should have been issued neutron dosimeters and have received radiation training in:

- Radiation effects
- ALARA principle
- Posting and chaining of radiation areas
- Storage of neutron generator
- Radiation monitoring devices, and
- Radiation emergency procedures

PELAN OPERATION

PELAN has been built to operate as an automatic instrument with minimum intervention from the operator. The operation of PELAN is done with the palm-top computer, from a distance of up to 30 m from the PELAN probe. The interrogation procedure is as follows:

- 1. The operator places the PELAN probe within a few centimeters from the object to be interrogated. A power source (110/220 V AC or a 12 V battery pack) is connected to the PCM.
- 2. The PCM main power key is turned ON, the neutron generator interlock is closed, and the operator with the palm-top computer removes himself to a safe stand-off distance (see the section on operational radiation safety).
- 3. The operator presses the START icon on the palm-top. An automatic procedure is initiated, whereby a high voltage is placed across the neutron generator tube, and all pulsing electronic circuits and data acquisition modules are powered. When all systems are readied, an automatic data acquisition cycle is initiated and data are acquired for a pre-determined time. At the end of acquisition time, the neutron generator power is automatically turned off, and the accumulated data are de-convoluted. The results of the de-convolution are fed to a decision-making tree, and the computer displays the words THREAT or NO THREAT if no explosive has been detected in the interrogated object. For the cases of chemical warfare agents etc., similar types of display are used.

RADIATION DOSE MEASUREMENTS

PELAN is to be used in places where a threat exists, or where there is a suspicion of contraband transportation. Since it is not a stationary device, radiation protection is primarily afforded through distance, and by operating PELAN at the lowest practically possible level of neutron production. Repeated measurements with calibrated neutron monitors (VICTOREEN Model RP-N neutron monitor) have shown that the neutron dose rate is approximately 0.01 mSv/hr (1 mRem/hr) at a distance of 8 m (25 ft) from the PELAN probe, and about 0.005-0.007 mSv/hr (0.5-0.7 mRem/hr) at 13 m (40 ft) from the probe. Please note that at these low radiation levels, neutron dosimeters are not very accurate, although they carry a certified calibration. In many instances, two calibrated VICTOREEN monitors were used simultaneously, and the readings were averaged. Each interrogation of a suspicious object takes place within 5 minutes. The badged personnel will operate PELAN from a distance of 8 m or larger, depending on the available space. All unbadged personnel will be requested to remain at a distance of 13 m or larger. At 13 m, for a five minute interrogation, an unbadged person will receive a dose of 0.0006 mSv (0.06 mRem). This dose is less than 1/10 of the dose that this person will receive per day from natural radiation exposure (which averages 0.008 mSv/day (0.8 mRem/day)). If ten interrogations are witnessed by this person (and this approaches the realistic maximum of interrogations/day) this person will receive from PELAN an approximately equal amount of radiation to the one received/day from natural radiation exposure. If this person flew a distance of 1,900 km in order to witness the field trials, he/she received an approximate dose of 0.03 mSv during the round trip flight (compared to the 0.006 mSv (0.6 mRem) received from PELAN for ten interrogations).

The above comparisons indicate that the radiation exposure with the operation of PELAN is very small. At any rate, the ALARA principle should be utilized during all field use.

OPERATIONAL RADIATION SAFETY

During operation, when setting up a PELAN interrogation, an area of radius 10 m around the PELAN probe is to be cordoned off. Appropriate radiation signs are to be placed along the perimeter, warning personnel not to cross into the cordoned area.

EMERGENCY SHUTDOWN

When PELAN has been energized and neutrons are produced, the neutron production can be instantaneously stopped via the STOP icon on the palmtop.

TRITIUM LEAKS

As previously described in the Radiation Source Section, the neutron generator head is designed to contain any tritium that may be present due to breakage of the neutron generator tube. The generator head is routinely leak tested for tritium on a monthly basis by wiping the generator head and counting the wipe in a liquid scintillation counter. Gloves are worn when handling the tube until leak tests show that tritium has not leaked from the tube. Records of leak tests are maintained. This procedure will also be performed prior to a) shipment of the PELAN probe to any other location, b) prior to operating PELAN after its arrival at the facility, and c) any following transportation. If a tritium leak is detected in the generator head, or when an accident has occurred that may have breached the integrity of the head, the head will be inserted and sealed in a PVC pipe. The sealed pipe will then be returned to the manufacturer, since the head does not have any customer serviceable part. There is no reason to expect personnel to receive exposure to tritium unless an accident ruptures the head's stainless steel housing and the inner sealed housing of the tube. In the event of such catastrophic failure, a survey of body fluids on the exposed individual(s) will be conducted for evidence of tritium uptake.

TRANSPORTATION OF NEUTRON GENERATOR HEAD

The neutron generator head, according to the US CFR 173.424, is an excepted package for radioactive instrument. As such there are no radiation markings or labels required for its shipment. The package is prepared for shipment according to CFR 173.422 by carrying a label stating "This package conforms to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package instruments, or articles, UN2910". It is then shipped via overnight carrier.

Prior to transportation and after the wipe test, the SF_6 gas contained in the neutron generator head is released to the atmosphere, using an appropriate pressure manifold. Upon the receipt of the head at the site where PELAN is going to be used, and after the results of the arrival wipe test, the neutron generator head is pressurized again at the manufacture recommended pressure, using the pressure manifold.

OVERNIGHT STORAGE

For overnight storage, PELAN's key is removed and the unit is placed in a secure area within the boundaries of the facility where PELAN is used. The key of the container is carried by authorized personnel, and a telephone number where they can be reached after hours is posted in the vicinity of the storage space and with the facility's security personnel.

EMERGENCY PROCEDURES IN CASE OF MAJOR FIRE

If a major fire occurs and the possibility exists that the temperature at the location of the probe reached the braze material melting point $[779^{\circ}C]$ all personnel should be kept at a distance of 20m or more from the position of the probe. If the neutron generator head has been breached, the tritium in the titanium tritide target will evaporate and will escape in the atmosphere. Assuming a maximum tritium load in the tube of 2.6×10^{11} Bq that escaped, and that the general public has been kept at the minimum distance of 20 m from the PELAN probe, the 2.6×10^{11} Bq of tritium will be diluted to less than 4600 m³ of air/ 3.7×10^{7} Bq of tritium, the non-ocupational Maximum Permissible Concentration (NCRP Report No. 72).

Individuals who may be called upon to fight a fire in the PELAN site should be made aware that radioactive material will be present (NCRP Report No. 72).

If the neutron generator head does not have any visible breaching marks, a wipe should be taken (from a safe distance) of the PELAN probe for leak testing.

INDUCED IRRADIATION

After each use of PELAN there is radioactivity induced in both the parts of PELAN surrounding the neutron generator tube and the interrogated material.

PELAN induced irradiation

Several experiments were carried out whereby PELAN was continuously operated for 2 hours and the induced radiation was measured on the outside surface of the tube at the position of the tritium target. On contact, gamma and x-ray dose of 0.03 mSv/hr (3 mRem/hr) was measured, with an average half-life of approximately 9 minutes. The dose at a distance of 30 cm from the surface was less than 0.003 mSv/hr (0.3 mRem/hr). To put these numbers into perspective, an operator that spends 5 minutes moving the PELAN probe from one position to another, would expect to receive approximately 10% of the radiation that he/she receives in one day from natural radiation exposure.

Induced irradiation in the interrogated material

Studies and several calculations carried out by the US Dept of Defense have shown that no detectable level of irradiation damage occurs in any of the materials that are irradiated with fast neutrons over a few minutes.

