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LOS ALAMOS SCIENTIFIC LABORATORY
of the
University of California
LOS ALAMOS • NEW MEXICO

PLUTONIUM URINALYSIS SAMPLING

DO NOT CIRCULATE

PERMANENT RETENTION

REQUIRED BY CONTRACT

LOS ALAMOS NATIONAL LABORATORY
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UNITED STATES
ATOMIC ENERGY COMMISSION
CONTRACT W-7405-ENG. 36

LA-3836-SOP

STANDARD OPERATING PROCEDURE
FOR
PLUTONIUM URINALYSIS SAMPLING

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INTRODUCTION

This paper is the Standard Operating Procedure to be followed for Plutonium Urinalysis Sampling. It is divided into three primary sections. The first deals with routine sampling and the second deals with sampling procedures for known accidental exposures. Each section will attempt to give the reasoning behind the procedures established therein. The third section deals with the responsibilities of administration of the first two sections. The necessity of establishing this SOP arose because the number of routine plutonium urinalyses performed by Group H-5 had become so excessive that proper treatment of true accidental exposures was impossible. Using the "routine sampling" criteria which follows a large number of unnecessary urinalyses were eliminated.

I. ROUTINE SAMPLING

For purposes of calculating plutonium body burdens from urine assay results and meeting the AEC reporting requirements, it was determined that four samples a year was sufficient.

NOTE: A plutonium urine "sample" (referred to hereafter as "sample" or "urine sample") consists of four voidings usually taken on two consecutive days, before going to bed at night and on arising in the morning. This is assumed to be equivalent to a 24 hour excretion of plutonium.

Therefore, the maximum number of routine samples has been reduced from one every six weeks to one every three months. For personnel with more casual encounters with plutonium, routine sampling at the rate of twice or once per year is sufficient. Guides for determining the routine sampling frequencies are as follows:

A. Quarterly Sampling Category

1) Persons working routinely with 10 gm or more of plutonium (239) in chemical or metallurgical operations, both inside and outside of dry boxes (this should not include supervisors who frequently enter the working areas but do not actually perform the operations).

2) Persons who have 50% or more body burden (according to PUQFUA calculations) whether now in plutonium work or not. (It is desirable to sample at this rate for those persons so that any apparent increase in body burden, due possibly to translocation within the body, will be faithfully followed and reported accordingly to the AEC.)

B. Biannual Sampling Category

1) Persons routinely working with less than 10 gm of plutonium (239) in chemical or metallurgical operations.

2) Some supervisors of the quarterly Sampled Category personnel.

3) Persons with 25% body burden (according to PUQFUA calculations) whether now in plutonium work or not. (Since the body burden of these personnel is less serious than those from the Quarterly Sampling Category, it is felt that a reduced sampling rate is adequate.)

C. Annual Sampling Category

- 1) Other supervisory personnel for either of the above categories.
- 2) Persons working with sealed containers of plutonium, including plutonium-beryllium sources.
- 3) Other persons with casual encounters with plutonium who regularly work in areas where plutonium is handled.

For personnel who routinely work with plutonium enriched in isotopes 238, 240, 242, or others (other than in routine compositions with 239), special individual considerations must be given. Contact H-1 Group Leader, or appropriate Health Physicist, when such occasions arise.

II. SPECIAL ACCIDENTAL EXPOSURE SAMPLING

Because accidental exposures vary in severity, three classes are defined. The two most serious classes apply to all personnel, while the third class applies only to those persons not routinely sampled.

A. Class PA (Prompt Action)

This class contains the most serious accidents and can be any of the following:

- 1) Injection of plutonium into the body (or part thereof) which is detectable by the plutonium wound monitor ($\sim 1/100 \mu\text{g}$).
- 2) Chemical burns (acidic or alkaline) from plutonium bearing solutions.
- 3) Facial contamination in excess of 20,000 c/m on a Pee Wee probe (per 60 sq. cm).
- 4) Nose swipes (either side) in excess of 500 d/m.
- 5) Others (to be added when they arise).

These conditions frequently result from failure of containment or from physical accidents.

For Class PA accidents the special urine sampling procedure to be followed is:

- a) Removal from routine sampling schedule by notifying H-5 Lab section who will initiate the next five steps, by issuing the urine sample collection kits at the appropriate time.
- b) Start collection of the first urine sample on the evening of the day following the accident.
- c) Start collection of the second urine sample approximately ten days after the accident.
- d) Start collection of the third urine sample about one month after the accident.

- e) Continue monthly urine sample collections through twelve months following the accident (this means a total of 14 special urine samples following the accident).
- f) Return to the routine sampling schedule.

NOTE: The person who posts the urine assay results for PUQFUA calculations should determine the number of days from the accident to the first sample of this set and record on the PUQFUA urine assay data card in the appropriate space.

B. Class DA (Delayed Action)

This class contains the remainder of accidents for routinely sampled personnel, for which special action is to be taken. It includes any of the following:

- 1) Occasions when there is no known equipment failure, but when personnel are exposed without benefit of respiratory protection in atmospheres which average 10 times the MPC for a full week or 50 times the MPC for a day.
- 2) Skin contamination which after attempts to decontaminate is still in excess of the limits recommended in the Monitors Handbook.

3) Superficially contaminated (with plutonium) cuts or abrasions which do show a positive count by surface monitoring but give no indication on the wound monitor.

4) When an unanticipated equipment failure results in personnel being exposed to air concentration in excess of the MPC (without benefit of respiratory protection) for an indeterminate period of time.

5) Others (to be added when they arise).

For Class DA accidents the special urine sampling procedure to be followed is:

- a) Removal from routine sampling schedule by notifying H-5 Lab section who will initiate the next three steps, by issuing the urine sample collection kits at the appropriate times.
- b) Start collection of the first urine sample about one month after the accident.
- c) Collect eleven more samples at monthly intervals (this means a total of 12 special urine samples following the accident).
- d) Return to routine sampling schedule.

NOTE: This type of accident is not sufficiently localized to allow any entry in the "No. Days Accident Prior to Sample" column on the PUQFUA input information. Make NO entry for type DA accident.

C. Class NRS (Nonroutinely Sampled)

The incidents in this class of accidents are generally insignificant and are considered routine occurrences for personnel who routinely work with plutonium and who are routinely sampled. As a class of accidents, Class NRS applies only to those persons not routinely sampled, and is used mainly for "public relations" purposes. It also serves to establish a "background" urine level for persons who normally are not exposed to plutonium. Incidents which enter Class NRS are:

- 1) Small wounds occurring in the major plutonium areas (e.g., DP-West, Ten Site, CMR Bldg.) when no activity can be detected (even on the surrounding surface).
- 2) Exposures without respiratory protection to atmospheres containing 10 times the MPC for the period of exposure (if more than a week exposure is involved, it would be a Class DA accident).
- 3) Average nose counts in excess of 50 d/m.
- 4) Skin contamination in excess of 500 c/m per 60 cm² (per Pee Wee probe area) before attempting to decontaminate.
- 5) Others (to be added when they arise).

For Class NRS accidents, a single urine sample (usual type of two morning and two evening voidings) is collected about one month after the accident.

To determine whether a person is routinely sampled, call Group H-5 for information about LASL and Zia personnel. Consider that only the Protective Force of the AEC is routinely sampled, and request a sample for all other AEC employees, who might have a Class NRS accidental exposure. Be sure to emphasize to H-5 (when requesting the sample) that the person concerned is AEC and not LASL or Zia.

Automatic Rescheduling

A policy of requesting (by Group H-5) an additional urine sample whenever the previous sample was 1.0 d/m per sample or greater has been used for several years, and is to continue in use at their discretion. The results of the "automatic rescheduling" sample is not used to initiate another "automatic rescheduling".

Personnel who routinely excrete plutonium at ≥ 1.0 d/m per sample are routinely sampled, but are exempted from the automatic rescheduling. /

The purpose of this policy is twofold: (1) to detect an unexpected high exposure and verify its existence, or (2) to detect a contaminated urine sample and to show that it does not correspond to a true exposure.

The level of 1.0 d/m per sample was selected because it was a convenient level (i.e., about 20 times the 95% confidence level of the lower detection limit of the analytical procedure) for detecting abnormal results. Using Langham's plutonium excretion data, it can be shown that a urine level of 1.4 d/m 24-hour sample obtained on a once-a-year sampling program

would indicate about $\frac{1}{2}$ a permissible body burden of plutonium. This lends further weight to the desire of verification or repudiation of a high urine assay result.

III. RESPONSIBILITIES

The primary responsibility for assigning LASL and Zia personnel to the three routine sampling categories and for requesting the special accidental exposure sampling procedures has been delegated to the Group H-1 section leaders. They should review twice a year the routine sampling schedule for all LASL and Zia personnel under their jurisdiction, and then notify Group H-5 of any changes. They should also be aware of AEC employees who are also employed as LASL "casuals" and classify these personnel for urine sampling. In the case of AEC employees they should notify the Health Physicist in charge of the PUQFUA calculations, who will then request the appropriate scheduling by the AEC. (This procedure is specified because the AEC, not Group H-5, schedules AEC employees for urine sampling.)

In the event of any accidental exposure in the classes given above, the Group H-1 section leaders should classify the accident appropriately. Written notification should be sent to Group H-5, informing them of the necessity of issuing sampling kits. (Phone notification to Group H-5 is allowed to initiate collection of the first sample of a Class PA accident, but written notification must follow.) The notice to Group H-5 should include (1) the name of the person to be sampled, his Z-number, his employer, and his group; (2) the accident classification; and (3) the date on which the first

special sample is requested. A copy of this notice should be sent to the H-1 Group Office and should not include any additional information. (The more detailed accident report required by the H-1 Group Office may include the above information, but that report may not be substituted for the written "notice".

The Group H-1 section leaders should examine the plutonium urine assay results each month to ascertain that the specially scheduled samples were collected. If the urine sample results increase each month, this fact should be brought to the attention of the H-1 Group Office.

While this primary responsibility has been delegated to the Group H-1 section leaders, they should request help or advice from the H-1 Group Office as it is needed.

The Group H-1 secretary shall prepare data cards of urine assay results for IBM card punching. For class PA accidents only, appropriate entries should be made in the "No. Days Accident Prior to Sample" column. The Group H-1 secretary will also maintain a file of the special scheduling for all PA and DA accidents.

Group H-5 will maintain a list of personnel who are routinely sampled, and who are requested to submit special samples. H-5 will do the actual scheduling for LASL and Zia. At the conclusion of a special sampling series, H-5 will return the personnel involved to the routine scheduling in effect prior to the accident.

The H-1 Health Physicist in charge of the PUQFUA program will keep abreast of the current calculations of body burdens, and the analytical changes, and when necessary modify the routine

sampling category, as submitted by the Group H-1 section leaders, notifying them and H-5 in writing of any changes made. After approximately two years operation under this SOP, a review was made of the results obtained from Class PA and Class DA accidents. Data was too meager to warrant changing any of the outlined procedures. A similar review should be conducted after another year's operation.

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