John R. Horan, Director
Health and Safety Division

Ralph V. Batie, Assistant Director
Operational Safety

PRELIMINARY INHALATION STUDY

HSHP:CAH

I. Purpose - To develop techniques for in vivo calibration of whole body counters for measurement of radioisotope burdens in the lung.

II. Background - The general concept of the subject rough-and-ready experiments was brought about by contractor requests to Analysis Branch for the measurement of soft gamma emitters, specifically U-235 in the lung of contractor workers. Since the low energy radiations create problems of geometry and self absorption, it was decided that and in vivo calibration tool would be a desirable thing. To this end, then, thinking began on what sorts of systems and animals could be used for spike studies for the specific purpose of calibrating the whole body counter or other in vivo measuring instruments. The two animals considered in this vein were the pig and the bear; these being the two which (excluding chimps) would most closely approximate human thoracic anatomy. The bear presented mechanical as well as emotional problems, therefore it was decided to try the pig. Physical measurements of the lung anatomy of the pig were made on two occasions; once by Mike Tiernan and once by Dr. Spikard and Hawley.

Since it was desired to measure lung dosages specifically, a concept of intratrachial injection of an aerosol was considered. This would involve placing a endrotrachial tube deep into the trachea and through this tube injecting aerosol-size particles of U-235 oxide into the lung proper. This will more than likely present some real problems. Dr. Spickard contacted Hanford Labs and was referred to the University of Washington. The people at University of Washington cautioned against laryngeal spasm and subsequent death. However, if the direct lung injection can be accomplished, pharyngeal and esophageal contribution can be avoided.

A simple but (hopefully) effective dust generator has been built and tested on a preliminary basis. This generates roughly one-micron size particles of U-238. The generator consists of a Waring Blender which agitates the fine dusts. The fines are carried by low air flows

through a system of chambers which separates out the larger particles. The smaller particles which pass through the mechanism will be injected into a large chamber from which the anaesthetized pig will draw the particles into its own lung through natural chest expansion.

After an injection has been accomplished, the machinery will be cleaned and the remaining quantity of uranium will be measured. The pig, while still under anaesthesia, will be counted in the whole body counter or with the portable instrument which the Analysis Branch is considering using to determine in lung burdens of low-level emitters.

As you can see, the major emphasis at this stage of the experiment must be placed on the mechanical, handling, and anaesthesia problems involved, and in the refinement and development of the techniques involved for the spike itself.

III. Progress to date - The barn at the EDF has been modified to contain pigs. This consisted only of the construction of a pig pen inside the barn at an estimated dollar cost of $50. One $20, 120-pound pig was procured on January 25. The $20 was taken from the Branches' petty cash fund. A self-feeder was purchased by requisition at a cost of $28. A transport and holding cage was made by the modification of a large animal trap already on hand. The aerosol generation equipment consists of a Waring Blender, a plastic chamber which had been used for the isolation of growing plants, and an impaction bottle which was used for an experiment aimed at the development of a noble gas sampler. Total expenditures to date, actual cash outlay, should not exceed $200. It is estimated that approximately two-man weeks of effort have been put into the project.

IV. Outline of Future Actions - The following table lists the points in time at which various phases of the experiment should be accomplished.

Experiment Portion	Time Accomplished	Man-weeks needed
1. Development of anaethesia & handling techniques for the pig	Week of Feb 8	2 H.P. Branch 1/2 Medical Br.
2. Development of injection techniques	Week of Feb 23	2 H.P. Branch
3. Actual Spike & Whole Body Counting	Week of March 1	1 H.P. Branch 1 Analytical Br.

V. Future Plans - If injection techniques proves to be successful, then a thorough literature search of the state of the art of inhalation studies, with particular reference to dose and the behavior of particulate matter in the lungs, should be made. The research then could be expanded to incorporate such things as histological and autoradiographical investigations, calculations of lung burden and dose, and, conceivably, behavior of hot particles on the cellular level. Until the technique for spiking for the calibrations of the whole body counter can be accomplished, there can be no real plans set for future activities. We intend to play it by ear through the first or preliminary phases of the inhalation studies.

HSHP	HSHP	HSOS
CAHawley:dc	WPGammill	RVBatie
2-3-65	2- -65	2- -65