GENERAL ELECTRIC

SPACE DIVISION

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In reply refer to: CTR- 3636

22 April 1980

Department of the Air Force
Headquarters, Space Division (AFSC)
Los Angeles Air Force Station
P. O. Box 92960, Worldway Postal Center
Los Angeles, CA 90009

Attention: Mr. R. E. VanTress/PML

Subject: Application for Amendment to NRC Licence #37-02006-05

Reference: 1) Contract F04701-77-C-0036
2) AFR 122-16, SAMSO Supp. No. 1

Gentlemen:

The subject GE/Space Division license is a Type A specific license of broad scope. One of the activities under this license and approved by the NRC Radiation Safety Committee is the use of Krypton-85 for leak testing of spacecraft. The method of use is described in the attachments.

General Electric/Space Division is requesting an amendment to license #37-02006-05 which would permit General Electric personnel to use the Krypton-85 for testing at the USAF Eastern Test Range, Cape Canaveral, Florida. The enclosed attachments contain a description of the testing, facilities and radiation protection controls.

In accordance with AFR 122-16, SAMSO Supp. No. 1, please forward seven (7) copies (two of which are signed originals) to Hq-SD, Attention: SGX.

If you have any questions concerning this request, please contact Mr. Paul Ruggles (A/C 215-962-2563) or the undersigned.

Very truly yours,

G. H. Hoke, Manager
DSCS III Business and
Contract Management

/gmr

cc: Mr. M. Bone/AFPRO - w/attch.
Mr. Bernard Singer, Chief - w/attch.
Radioisotopes Licensing Branch
Division of Fuel Cycles & Material Safety
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

R. Cook, Hq-SD/YKD - w/attch.

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See 03593

Attachment #1

Leak Test Operator Qualifications

The personnel who will perform krypton-85 leak testing at the ETR will be approved by the Ionizing Radiation Advisory Group. Requirements for approval include the following:

- Completion of training in the use of the TRW leak detection apparatus as certified by the Manager, Systems Test
- Experience with at least one leak test at the Valley Forge Space Center
- Education and training in the radiation protection aspects of Kr85 by the Space Division Health Physicist
- Education in license requirements by the Health Physicist
- Approval by the VFSC Medical Services to perform radiation work

The Manager, Systems Test will maintain a roster of all currently approved leak test operators and be responsible for the conduct of all General Electric personnel associated with these tests.

Attachment #2

Description of Leak Test System

Purpose

The reason for leak testing the spacecraft by the method described below is to conform with quality assurance specifications of the U.S. Dept. of Defense. This method provides greater sensitivity to leakage than do other methods.

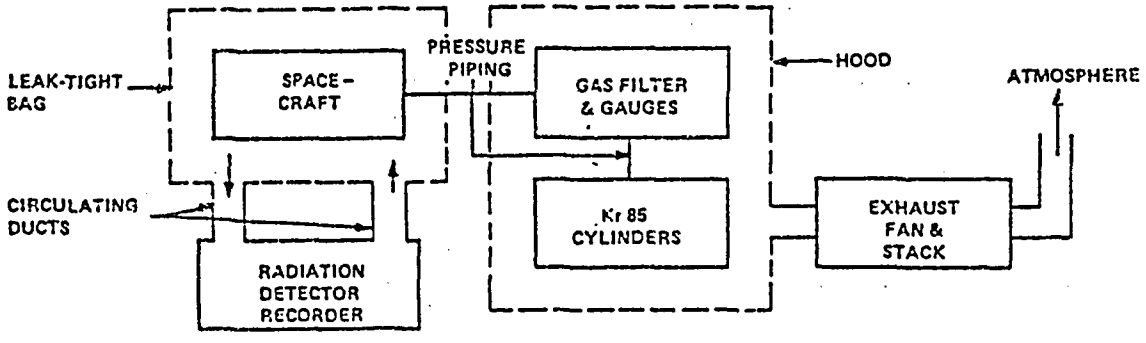
Apparatus

The following items are utilized to perform these tests:

- Kr-85 diluted with helium in standard gas cylinders at a concentration of about 1.5 microcuries per milliter
- gauges, piping, filters and pressurizing pump associated with Kr-85 cylinders
- a hood with powered exhaust ventilation to enclose the Kr85 cylinders and associated equipment during the progress of the test
- the spacecraft to be tested
- a leak-tight bag to enclose the article under test
- a radiation detector and associated circulating fan to measure the concentration of Kr85 in the bag enclosing the test article
- radiation protection monitoring equipment

Description of Leak Test Set-up

The leak test apparatus is set up according to the following block diagram to perform the leak test:

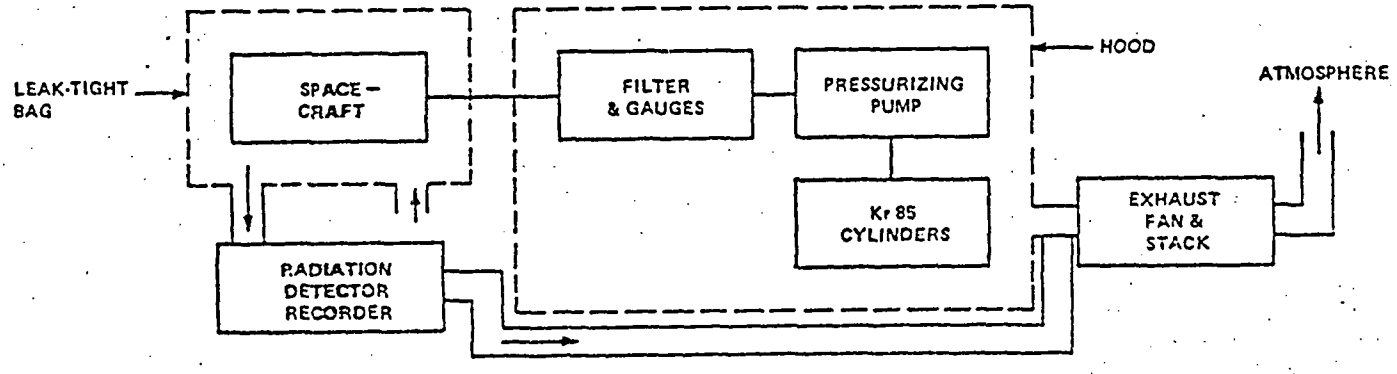


The spacecraft is pressurized with the Kr85/He mix through a filter and gauges. The Kr85 leaks from the test article into the leak-tight bag. The atmosphere in the bag is circulated in a closed loop through the radiation detector/recorder. The pressurization of the test article is controlled so that the expected concentration of Kr85 inside the leak-tight bag is normally less than 10 microcuries per cubic meter.

The piping and connections are checked for leak tightness prior to the introduction of Kr85 by pressurizing with inert gas. Valve manipulations are performed inside the hood.

Gas Recovery and Venting

At the end of the leak test, the set-up is reconfigured as shown in the following diagram:



The pressurizing pump is introduced into the system by means of valving. The gas in the spacecraft is pumped back into the cylinders. The leak-tight bag is vented through the detector/recorder as shown until the count rate in the detector reaches background. The amount of Kr85 vented through this route is somewhat less than 500 microcuries.

After the pump has reached its capability to pump the gas from the test article to the cylinders, a small amount of Kr85 remains in the spacecraft. The quantity is on the order of 1 millicurie. The quantity in the spacecraft is reduced to less than 100 microcuries by repetitive pressurizing and venting with nitrogen. The venting gas is directed into the exhaust system.

At the completion of the entire test cycle the apparatus is surveyed for radiation due to residual radioactivity.

Attachment #3

Description of Facilities

The leak test operations will be conducted in the Satellite Assembly Building at the USAF Eastern Test Range. This building is equipped with an exhaust ventilation system. The flow rate is 500 cubic feet per minute. The stack terminates at 88 feet above grade. The building height is 70 feet above grade. The hood in attachment #2 would be connected to this exhaust system.

The occupancy of the site in a radius of 400 meters is about 75 people. The population within a radius of 800 meters is approximately 1500. All of these people are employees at the ETR.

Attachment #4

Safety Analysis & Radiation Protection

Emergency Actions

The spacecraft piping and associated equipment will have been tested for leakage prior to the final test at the ETR. Extreme care is used to avoid damaging the spacecraft in any manner due to its high value. The gas cylinders are handled with carts and normal industrial good practices to avoid damage.

Emergency situations and actions are as follows:

- Castrophic failure - evacuation of all personnel until Kr85 has dispersed to a concentration of 10 uCi/m^3 or less.
- Major piping break or other leak - one previously identified individual valves off the cylinder, then evacuates. All others evacuate at the start.
- Minor or over-specification leakage - gas supply is valved off, gas is recovered as appropriate or vented so that repairs can be performed.

Experience at the Valley Forge Space Center has shown that the systems described herein are highly reliable against leakage.

Gas Release Analysis

All Kr85 is normally vented through the 27 meter stack on the Satellite Assembly Building. The normal release rates are expected to be less than 2 millicuries over a period of about one hour at the end of a test.

However, in the event of failure of the cylinder pressurizing pump, it may be necessary to vent the spacecraft and release the inventory in the spacecraft of about 0.5 Ci. In this case, the maximum permitted venting rate is determined by the ground level concentration. The limiting concentration is taken to be $3x10^{-7}$ uCi/ml, which is the maximum permitted continous concentration for exposure to the general population. Sutton's equation for the maximum downwind concentration:

$$X_{max} = \frac{2Q\ Cz}{e\pi uh^2 Cy}$$

Values:

X max = $3x10^{-7}$ uCi/ml = maximum downwind concentration
Q = release rate
e = 2.71
π = 3.14
u = wind speed = 1 meter/second
h = stack height = 27 meters
Cz,Cy = diffusion coefficients
Cz = Cy (isotropic diffusion)

This yield maximum permitted leak rate of 1.9 millicuries per second.

Attachment #4
continued

Radiation Protection & Administrative Controls

Radiation protection services will be under the direction of the Valley Forge Space Center Radiation Protection Officer. The available instrumentation of the VF Space Center will be utilized at the Eastern Test Range as needed.

Administrative control will be in accordance with the test procedure #DC3-TP-6103. This procedure will be available at the site.

Attachment #5

Radioactive Materials

Isotope	Form	Quantity	Use
Kr85	any	15 Curies	leak test gas
Ba133	sealed	20 microcuries	calibration source