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IRRADIATION TESTING FACILITIES AT THE
HANFORD ATOMIC PRODUCTS OPERATION

by

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A wide range of irradiation testing facilities and services are present at the Hanford Atomic Products Operation. A number of these facilities are described as a means of illustrating the testing equipment and techniques which are currently in use.

INTRODUCTION

The primary purpose and activities associated with the Hanford reactors are, of course, for the production of plutonium. A minor activity is the providing of an irradiation testing service. Although this activity is minor in comparison to the production efforts, the facilities and their operation are of a significant scope. We would like to take this opportunity to describe briefly the types of equipment and service which are available.

GAMMA FACILITIES

Of immediate interest and current application to the 125 A Weapons System Program are the gamma irradiation studies which are being performed under a contract with the Wright-Air Development Center. Figure I is a schematic diagram of the equipment which is being used for this study. The canister, containing the sample of lubricant or fuel, is lowered into the tube and placed in the gamma field. The irradiation assembly is beneath 20 feet of water. Irradiated fuel elements from the Hanford reactors are used as the gamma source. There are manifolds for introducing nitrogen or air to the canisters during the irradiation and exhausting the gases. The average gamma flux is 6.9×10^5 r per hour; there are five such assemblies in operation in the present program.

The data which have been obtained in this series of tests will be presented in another paper at this session. This discussion will be confined to the types of facilities and service which can be provided.

Figure II is a picture of another gamma facility which is in operation at Hanford. The irradiation tubes are six (6) inches internal diameter and have two types of fueling. In the foreground can be seen two tubes which use irradiated slugs for the gamma source, in the background can be seen a tube which has cobalt-60 sources. There

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are two tubes fueled with slugs and three tubes with cobalt-60. The average gamma flux in the former is 2.6×10^5 r/hr and in the latter it is 1.7×10^6 r/hr. We are currently constructing, and will place into operation this fall, another cobalt fueled facility which will also have gamma flux of 1.7×10^6 r/hr.

NEUTRON AND GAMMA TESTING FACILITIES

For tests involving both neutron and gamma irradiations, there are a large number of test facilities. There are eight reactors and each of these has several experimental, or test holes. Figure III is a schematic diagram which shows the locations of the experimental holes at one of the reactors. This is one of the newest reactors and has one of the most complete sets of experimental equipment. There are four facilities 3-1/2 inches in diameter which run from the front to the rear of the reactor stack; there are 12 holes 3-3/4 inches square which run from side to side. The so-called test holes are outfitted with various types of equipment to permit and expedite the conducting of different types of tests. Some of the facilities which are currently in use are shown in the following series of illustrations.

The first and simplest (Figure IV) is a bare channel in the graphite. The sample can be exposed to high neutron and gamma fluxes and long irradiation times are possible. There is no cooling to the sample and the temperature is, of course, high.

Figure V is a diagram of a process tube. The sample is placed in a container and has a water cooling annulus surrounding it. Again, high fluxes can be obtained and, with the water cooling, lower temperatures can be achieved. Some of the tubes are fitted with ball valves which permit the charging and discharging of specimens during reactor operation.

Figure VI is that of a magazine facility. This is used when the simultaneous irradiation of a large number of small samples is desired. The sample containers are 1/2 inch diameter and approximately 8 inches long. A magazine of this type can accommodate approximately 160 samples.

The next diagram (Figure VII) is one of a general purpose facility. This is a side-to-side test hole which has water supplied to both the channel containing the sample and to an outer surrounding annulus. The double coolant annulus provides high flexibility and although the equipment is usually operated with experimental slugs in the manner illustrated, it can be used for other types of tests. One of these facilities is presently being operated as an organic loop. Piping has been placed in the inner tube and organic liquid is circulated during reactor operation. The purpose of this operation is to obtain relatively large volumes of organic coolant which have suffered radiolytic decomposition and then to perform subsequent tests to determine the fouling and heat transfer characteristics of the material.

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The last in this series (Figure VIII) illustrates the Snout facilities. Tubes outfitted in this manner have a water-lock and cask arrangement which permit the charging and discharging during reactor operation.

It should be noted that all these facilities are adaptable to the performing of experiments having a wide range of complexity. This ranges from the mere placing of a sample in a channel, to controlled temperature irradiations, and to highly instrumented tests wherein data are continuously recorded.

Figure IX is a picture of a unique testing facility. This is a side view of a removable section in the shielding of one of the reactors. The section extends entirely through both the biological and thermal shields. Compartments within this assembly can be removed and replaced with materials for testing. To our knowledge, this represents the largest volume testing space at high neutron and gamma flux values in the country. It is admirably suited for the attenuation studies of shielding materials.

We have had preliminary discussions as to the possibility of irradiating in this space instrument assemblies which would be used in the 125 A Weapons System. The instruments could be irradiated under conditions of high fast neutron and gamma fluxes and the instrument performance could be monitored as a function of exposure. The facility appears to be quite appropriate for this type of study.

OTHER, MORE EXTENSIVE FACILITIES

The discussion to this point has been concerned with the use of relatively standard testing facilities. New and rather extensive facilities can be installed and operated where this is in accord with the interests of the Atomic Energy Commission.

Figure X represents a high temperature, high pressure, recirculating water loop which was installed and placed into operation approximately two years ago. The Loop is operated in support of the Naval Reactor Program. This is a picture of a three dimensional model of the equipment and shows the panelboards, pressurizer, canned rotor pumps, heat exchanger and in-pile tube. The equipment operates at 600 F and 2200 psi and is being used for fuel element, corrosion, and water chemistry studies.

We have just completed the design and have started the construction of an even more extensive facility. This is a recirculating gas loop which is being jointly sponsored by the Army Reactor Branch and the Maritime Reactor Branch. The unit will operate at an outlet temperature of approximately 1250 F and will be used for studying fuel element performance, structural materials, and the operating characteristics of gas cooled systems.

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SUMMARY

In summary, a wide range of irradiation testing facilities and services are present at the Hanford Atomic Products Operation. If in the course of this program, or in subsequent studies, such assistance would appear appropriate, we would appreciate your contacting us and discussing the situation.

AF-100 GAMMA FACILITY**FIGURE I**

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2W-

FIGURE II

AEC-GE RICHLAND WASH

122 606 UNCLASSIFIED

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- TEST CHANNEL 3 3/4" SQ.
- OR
- TEST FACILITY 3 1/2" MAX.

TEST CHANNEL ARRANGEMENT

FIGURE III

122 007

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714-51249

CROSS SECTION
(NOT TO SCALE)

TEST HOLE CHANNEL

FIGURE IV

122 008

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FIGURE V

2/10/10

TUBE NUMBERING DIAGRAM

$3\frac{1}{2}$ " O.D. - $\frac{1}{8}$ " WALL
 $3\frac{1}{4}$ " O.D. $\frac{1}{16}$ " WALL

CROSS SECTION
 (NOT TO SCALE)

MAGAZINE FACILITY - "THRU" TYPE

FIGURE VI

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122 010

UNCLASSIFIED

24-51243

GENERAL PURPOSE FACILITY
(SHOWN WITH IN-PILE EXPERIMENT)

FIGURE VII

122 011

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SNOUT II, III FACILITIES

KW PILE
(SHOWING EXPERIMENT IN
PLACE)

FIGURE VIII

122 012

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240-61822

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240-51243

FIGURE IX

AEC-GE RICHLAND, WASH.

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FIGURE X

AEC-GE RICHLAND WASH

120 014

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