

SUMMARY OF BIOLOGICAL OBSERVATIONS AT OPERATION HURRICANE.PRELIMINARY REPORT TO THE TECHNICAL DIRECTOR.GENERAL REMARKS.

The work planned before the Event included:

- (a) The collection of Fall-Out for botanical experiments in England.
- (b) The catching of animals and fish, to search for radioiodine in their thyroids and radiostrontium in their bones.
- (c) The exposure of vegetables to Fall-out, to examine the form of contamination of their leaves.

Unfortunately, the weather conditions prevailing at the time of the Event resulted in such heavy contamination of one display of plants that they could not be recovered, while the other was not sufficiently contaminated for study. The other projects proceeded successfully.

Besides the planned experiments, it has been possible to make other crude qualitative observations. These were undertaken rather than lose the opportunity to collect information. Indeed, through them it has been possible to compensate for the failure of the vegetable tests.

There follows a brief summary of the various experiments performed.

1. COLLECTION OF FALL-OUT.

4 sq. yards of Fall-out were retrieved from T.2, on D + 3 from a 2.5 r/hr field. They were packed and sent to Harwell on the D + 7 plane. A signal has acknowledged their safe arrival. Further information should follow the growth of plants in this material.

2. VEGETABLE GARDENS.

After careful maturing, randomized layouts of vegetables were taken ashore on D - 2. Despite careful siting and anti-rat measures, one layout was never recovered from Beaver Hill, and the other was hardly contaminated. Although watered and healthy on D + 4 and D + 6 these latter plants had been destroyed by rats by D + 8. Radio-autographs will be made of the few leaf-fragments and the germinating bean retrieved, though it is doubtful if the contamination was sufficient to provide any useful data.

3. ANIMALS.

9 contaminated fish and 3 contaminated rats were caught between D day and D + 7. None of these fish were of a species with discrete visible thyroid glands, but tissue from the region of the thyroid was dissected out.

Thus, skin, muscle, thyroid gland, or tissue, and bone were dissected from these animals, mounted on aluminium trays and forwarded on D + 7 to [REDACTED] H.M.S. ZEEBRUGGE for counting. Preliminary counting on H.M.S. TRACER showed that the tissues from several animals were sufficiently active to obtain decay curves. 5 μ gms of thyroid tissue frequently gave a count comparable to several hundred milligrams of muscle.

Subsequently, 1 fish, 2 rats and 1 bird, all showing mild surface contamination, were caught and dissected. Liquid counts on solutions of thyroid glands and bone did not reveal radioactivity.

Finally, in response to a request from Harwell, received on D + 18, tissues from a bird caught on D + 19 were forwarded to the U.K. on D + 20.

OTHER OBSERVATIONS. (Botanical)

4. SEA WEED EXPERIMENT.

In order to examine the question of the availability and uptake of radio-iodine, by biological systems, the following experiment was performed.

Sea weed, of contamination ten times that of the sea at the time and place of its collection, was washed for 10 minutes in very hot water, dried and ashed at 400° C., using an oxy-acetylene flame. Sodium Chloride was added to the ash in a clean beer bottle. Sulphuric acid was introduced and the gasses liberated were caught in a condom, which was hastily brought over the neck of the bottle. The test of the condom contained a solution of silver nitrate, made from a piece of "wart stick" and the gasses liberated into the condom were milked down to the silver nitrate. A precipitate, presumed to be of Silver Halogen, formed. This was dried on an aluminium tray and its radioactive decay was followed. The results are compatible with a mixture of I/131 and I/132, for no other halogen except Iodine would fit them. However, this conclusion must be accepted with caution pending further decay measurements.

5. OBSERVATIONS ON PLANTS.

A bean from a pod, collected from a radioactive area of Primrose Island on D + 14, showed no contamination.

6. DECONTAMINATION OF VEGETABLE LEAVES.

It seemed worthwhile to determine the extent of decontamination of leaves which might be achieved by cooking methods.

In a pilot experiment a piece of leaf gave a count of 15230 per min per sq. cm when fresh, falling to a count of 7631 per min after washing for 2 mins under a hot fresh water tap, and to 4393 after an additional soaking in Teepol, 5% for 5 minutes.

7. In other experiments it was found that:-

(a) Washing fresh leaves for 10 minutes under a hot (fresh) water tap reduced contamination by 40%.

(b) Soaking fresh leaves in 5% Teepol for 15 minutes reduced contamination by 80 - 90%.

(c) Boiling unwashed leaves for 10 minutes in water with a pinch of salt reduced contamination by about 50%, the removed radioactivity passing into the water.

(d) Washing fresh leaves for 10 minutes in hot water, soaking for ½ hour and boiling for 10 minutes in water, with salt added, reduced contamination by 70 - 80%.

8. Radio autographs of leaves, fresh, washed, boiled or cleaned with Teepol, showed contamination to be particulate (up to D + 8).

OBSERVATIONS ON HUMAN URINE.

9. On several occasions persons moved about contaminated areas of Trinouille Island without respirators, and it was possible to conduct certain crude observations by examining for radioactive urine they passed

subsequent to these exposures to a dust hazard. It was shown that the radioactivity detected in such urine samples probably resulted from inhalation by the following experiment.

16 urine samples were collected 24 hours after a series of sorties into T. Island.

4 were from subjects exposed without wearing respirators to radioactive areas and who lived on the Base Ship.

4 were from subjects exposed to radioactive areas, but who wore respirators, and who lived on the Base Ship.

4 were from subjects who had been aboard H.M.S. TRACKER continuously after the event, and

4 were from persons who had been confined to H.M.S. CAMPANIA following the event.

The table below shows the counts, per 10 mins., per 8 ml urine, compared to the background counts, using a liquid counter:

MEN ON T ISLAND. NO RESPIRATOR.	MEN ON T ISLAND. WITH RESPIRATOR.	MEN ONLY ON HEALTH SHIP	MEN ONLY ON BASE SHIP.
336	6	44	+ 14
377	62	46	- 16
300	31	28	- 9
206	- 4	42	- 12

It will be seen that, in all groups where the increased dust inhalation risk existed, the counts were higher than in comparable control groups.

10. These observations have been confirmed in several other experiments. Urine was collected for the 48 hours after exposure from 2 men, who wore respirators while exposed to 2.6 r. No activity was detected in their urine. On the other hand, on the same day another man walked along Main Beach three times, and although his total dose was only 0.15 r., his urine, collected for 48 hours afterwards, showed 5.1 c.p.m. per 8 ml. (20 min count). The total urine volume was 1400 ml. and the efficiency of the counter for mixed fission products at this time was 0.5 - 1.0 %. Thus, in 48 hours, this man had eliminated approximately 1/30 microcuries.

11. Another study was made of a man who was exposed to 3.0 r. without wearing a respirator. The first 13 consecutive urine samples passed after exposure were examined for radioactivity, using a liquid counter. (Subject lived on Base Ship).

Counts made within 1 hour of samples being passed ranged up to 81 c.p.m. per 8 ml. urine. In 30 hours he had eliminated at least 1 microcuries.

These, and other, urine samples showed a radioactive element or elements of half life less than 1 day, mixed with others of mean half-life 5 - 20 days. Similar results have been found in urine samples prepared for dry counting, and in air samples taken on T. Island at D + 18.

12. In a crude qualitative study, urine samples from another man taken various days after exposure to a dust hazard showed the following counts.

1 Day.	28 C.p.m.
4 Days.	11.7 C.p.m.
5 days.	7.3 C.p.m.

Radioactive dust-covered records etc on Fo¹ castle.

From this it is concluded that radioactivity can be traced in the urine for up to 5 days after exposure to dust in a contaminated area. It would therefore appear that the fractions of microcuries referred to above which were excreted in 30 - 45 hrs, were not the total excretions after inhaling radioactive dust.

VARIOUS OTHER MEASUREMENTS.

Various other measurements have been made in the hope that they may be of some use to Civilian Defence Planners.

13. Sweat losses while wearing protective clothing.

Crude measurements of sweating were made by recording losses of weight.

On one day, Dry Bulb Shade Temperature 86 ° F. Wet Bulb 75 ° F. with only moderate winds, men working in protective clothing, gloves and respirators, in sand, lost between 3 and 16 lbs in 2 - 3 hours:- the mean weight loss for 11 men was 8½ lbs each. In the same period, controls on H.M.S. TRACKER lost an average of 1 lb.

Many measurements made on other days support the contention that the thermal stress of the present protective equipment, when worn in full, might be too great for civilians indulging in Rescue Operations, especially civilians over 40 years of age.

14. Time and Motion Studies.

One day was devoted to measuring the times needed to accomplish various decontamination procedures, to assist the design of decontamination units of the future, and to indicate the economies of sending survey parties into radioactively contaminated areas.

(a) It was found that 12 men, working a better than 8 hour day in several cases, could keep abreast of the work needed to support 65 - 75 men going ashore, and/or operating boats, each day. (This does not, of course, include the economies of manufacturing equipment and clothing, not laundry and water supplies).

(b) The times for the various decontamination procedures were as follows:-

Undressing down to underwear and socks.	61	secs.
Preliminary Beta/Gamma Monitoring. (Using 1021)	169	"
Showering.	390	"
Drying.	126	"
Second Monitoring.	164	"
In the case of persons still contaminated:		
Application of decontamination chemicals.	60	"
2nd shower.	235	"
2nd drying.	120	"

Note: Some subjects needed 3, 4 or even 5 showers before they were "clean".

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It would not have been possible to accomplish the foregoing without the assistance of very many persons, ranging from the Administrative Staffs of the Navy, Army and Ministry of Supply down to the Seaman who brought buckets of fresh water to the dissecting area on the Upper Deck of H. M. S. TRACKER. However, at this time I would like to acknowledge especially the assistance of the following:-

- W. J. [redacted] in sea-weed, urine, and plant experiments.
- [redacted] and [redacted] in collecting botanical samples.
- [redacted] and the Boat's Crews in collecting zoological samples.
- [redacted] and [redacted] in counting some urine samples.
- [redacted] in undertaking to count zoological tissues.