Title

AIR CLEANING EXPERIENCES WITH I131 IN THE GAS PHASE I. I131 FROM ANIMAL EXPERIMENTATION

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Publication Date

1957-06-01

UCRL 8014

UNIVERSITY OF CALIFORNIA

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for 5th AEC Air Cleaning Seminar June 1957

UCRL-8014

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

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Printed for the U. S. Atomic Energy Commission

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I. I^{131} From Animal Experimentation

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ABSTRACT

The environment of rats injected intravenously with massive doses of I^{131} in isotonic saline becomes quickly contaminated with I^{131} exhaled and/or excreted by the animals. The chemical form(s) is unknown. A portion of the airborne fraction passes thru high efficiency (CWS 6 and millipore) filters and is thus assumed to be gaseous. Employment of activated charcoal to decontaminate the gas, and attempts to measure the success thereof, are described.

The following summary report refers to radioactive gaseous I^{131} compounds in very dilute concentrations in air and not necessarily to chemical processing off-gases.

Routine air sampling employing HV-70 filter media revealed the presence of I^{131} contaminated dusts in animal rooms housing rats injected with this element at the millicurie level. Since many iodine compounds have appreciable vapor pressures at room temperature and the specific activity is high for this isotope it was felt a quantity could be detected as filter-passing, presumably gaseous, activity. This hypothesis was readily confirmed by drawing animal

room air via tubing outdoors to a millipore filter followed by a section of activated charcoal. The ratio of I^{131} in the charcoal was slightly more than 100 fold that in the dust sample. Extending the room air samples data thereby suggested air concentrations exceeding the recommended MPC values of Handbook 52.

Despite the fact that such rat injection experiments are intermittent and that results of contamination of thyroid gamma activity in the handlers remain negative, radioisotope containment policies at UCRL do not permit continuation of known dispersal to the environment. As a consequence, a four phase "semi-crash" program was instituted: (1) construct and install a cabinet to house all I^{131} injected rats all exhaust from which went thru CWS 6 filters, (2) provide facilities for enhanced protective ventilation across workers during periods of animal handling, (3) install a "pilot plant" stack gas decontamination unit beyond the filters based on engineering and literature data, and (4) study the effluent gas for quantitative information.

Item (2) dictated several hundred CFM. This factor plus those of time and expense ruled out a silver nitrate scrubber for the pilot plant unit. It was decided to employ a deep bed of activated charcoal; accordingly 216 lbs. was loaded into a 55 gallon locking-lid drum modified to handle the entire off-gas. Incorporated was a central well into which could be lowered a shielded scintillation detector with a collimating slit in the shield. Paralleling the drum circuit we set up a sampling complex comprising several elements: (a) a caustic scrubber, (b) glass tubes into which weighed amounts of charcoal were held and could be replaced, (c) 20 liter ion chambers, (d) gas flow rate

measuring apparatus, (e) methods for varying flow rate, (f) temperature measuring equipment, and (g) relative humidity determining instruments.

We hoped to be able to investigate the adsorption characteristics of the active material as well as to evaluate the efficiency of the pilot plant as a decontaminator.

As a health protection set up it worked well for the animal room; dust and charcoal samples from the room dropped markedly. Active waste-handling was much easier. Exposures were acceptable but still techniques need improvement to approach the goal of zero.

Regarding the stack gas decontamination we're still not quite sure where we landed. Probably due to mechanical difficulties, we never saw any activity in the ion chambers. The caustic scrubber did not reveal any countable I^{131}. This does not say there was no iodine trapped in the caustic scrubber but that it was less than the detector could pick up and record. Specifically, charcoal iodine was readily detectable representing concentrations of but 27 d/p/m per liter in the gas thruput; the limit of resolution on counting scrubber liquor was such that had 0.7 dpm per liter gas thruput been adsorbed it would have been detected. This value was not seen.

Activity in enclosure air was measured in the charcoal of both the drum and the glass tubes. Based on the corrected readings, the calculated adsorbable maximum concentration in the off-gas was about 8×10^6 dpm/m^3. The total represented but 0.36% of the 300 millicuries injected. We have no knowledge how much escaped the system but have theoretical grounds for judging this to be small in proportion. The basis of this was (1) the ob-

servation that more than 90% of the adsorbed activity resided in the first one-third centimeter of bed depth in a total of 63 centimeters; (2) no activity detectable at 25 centimeters depth; and (3) published data on iodine adsorption indicating a very sharp wave front is found in activated charcoal. Nevertheless, this factor needs experimental confirmation before actual efficiency numbers can be assigned to the decontamination process.

Parenthetically, it is pertinent to note that inquiry of several other sites, concerning their I^{131} decontamination equipment efficiencies, revealed without exception their numbers were dependent upon assumptions of efficiency within their sampling train. In no case was a material balance demonstrated.

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