EFFECT OF EXTENDED EXPOSURE TO SIMULATED LMFBR FUEL REPROCESSING OFF-GAS ON
RADIOIODINE TRAPPING PERFORMANCE OF SORBENTS*

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Conf- 720823--9

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Abstract

For LMFBR fuel reprocessing plants, a required radioiodine retention factor of $\sim 10^8$ is projected. Also projected is a cumulative retention factor of $\sim 10^6$ for iodine fixation achieved upstream of the filter-adsorber assembly used for final off-gas treatment. Thus, this assembly will need to provide a decontamination factor (DF) of $\sim 10^2$, but considerable reserve capability is desired. Certain silver-containing sorbents in a 2-in. depth at 100°C and/or 200°C have, in short-term laboratory tests, exhibited DF's of $> 10^3$ for iodine as methyl iodide or elemental iodine under conditions including 3 vol % water vapor and iodine loadings estimated equivalent to that for at least one year of operation. Present objectives are to obtain information on the effective service life of such sorbents and to ascertain the desirability of locating a catalytic oxidation bed upstream of the sorbents to minimize poisoning by organics and to convert organic iodides to I_2 . Accordingly, a laboratory facility for exposing sorbents to simulated fuel reprocessing off-gas is being operated. The main air stream is humidified to around 85% saturation (referred to room temperature). Elemental iodine (60-day ^{125}I -labeled), dodecane, and nitric oxide are continuously injected at their anticipated concentrations. One group of sorbents is exposed to untreated off-gas while another group is exposed to off-gas which has traversed a Hopcalite bed at 350°C. Methyl iodide (12.3-hr ^{130}I -labeled) is injected periodically to furnish short-term results, whereas long-term cumulative results are obtained with the I_2 .

Sorbents investigated include three varieties of silver zeolite (designated AgX with the percent Ag^+ for Na^+ exchange denoted), GX135 (silver salt-treated alumina-silica), and a type of iodized charcoal. Sorbent depths are 2 in. Excellent performance (indicated I_2 and CH_3I DF's $\geq 10^3$) has been observed thus far for the following test situations: 26% AgX, 1/16-in. pellets, at 200°C, both with and without Hopcalite upstream, 196 days exposure; 99% AgX, 1/16-in. pellets, 100°C, both with and without Hopcalite, 105 days; GX135 (8 x 16 mesh, U.S.), 200°C, with Hopcalite, 196 days; and GX135, 100°C, without Hopcalite, 119 days. (Data are not yet available for GX135, 100°C, with Hopcalite.) Performances observed for other test situations ranged from poor to good. The importance of sorbent particle size was demonstrated by the less favorable performance of 88% AgX, 1/8-in. pellets, 100 and 200°C, relative to that for the 26% AgX, 1/16-in. pellets (200°C). The use of Hopcalite was observed highly beneficial in trapping iodine injected as CH_3I ; in trapping iodine injected as I_2 , its use was beneficial for 26% AgX, 99% AgX, and GX135 and deleterious for 88% AgX (1/8-in. pellets) and iodized charcoal (the latter at 66°C). This investigation is being continued.

*Research sponsored by the U.S. Atomic Energy Commission under contract with the Union Carbide Corporation.

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I. Introduction

In LMFBR fuel reprocessing plants, radioiodine control will be a major problem since rather large amounts of short-cooled fuel are to be involved. For an appropriately-sized plant, a required radioiodine retention factor of $\sim 10^8$ (overall) is projected. Also projected is a cumulative retention factor of $\sim 10^6$ corresponding to iodine removal achieved upstream of the final off-gas trapping system. The latter value is based on consideration of iodine fixation resulting from mechanisms inherent in the fuel reprocessing operations and on evaluation of the expected performance of iodine removal equipment (exclusive of the final trapping system) incorporated in the reprocessing facility. Accordingly, the filter-adsorber assembly employed for final treatment of the off-gas will need to provide a radioiodine decontamination factor (DF) of $\sim 10^2$, but considerable reserve capability would, of course, be desirable. The overall problem of iodine retention in LMFBR fuel reprocessing plants, as outlined above, has been discussed in considerably greater detail by Yarbrow, Crouse, and Cathers. (1) The Chemical Technology Division at ORNL is conducting a rather extensive investigative program on this iodine retention problem as a part of their larger program on LMFBR fuel reprocessing. (2) The work described herein represents a part of the program relating to iodine retention and, more specifically, is concerned with determining the applicability of various sorbents for trapping iodine in the off-gas assembly employed for final treatment.

Certain silver-containing sorbents in a 2-in. depth at 100°C and/or 200°C have, in short-term laboratory tests, exhibited DF's of $> 10^3$ for iodine either as methyl iodide or as elemental iodine under conditions including 3 vol % water vapor and iodine loadings at least equivalent to that estimated for one year of operation (~ 5 mg iodine per cm^3 sorbent in 2-in. depth). (3) Two of these effective sorbents were laboratory-prepared and are referred to as silver zeolites (or, alternately, silver-sodium zeolites) with the degrees of Ag^+ for Na^+ exchange having been approximately 27% and 90%. The selection of these sorbents for investigation in connection with treating LMFBR fuel reprocessing off-gas was, of course, prompted by the development reported by Maeck, Pence, and Keller (4), viz., that silver zeolite is highly effective for trapping iodine in the forms of methyl iodide and elemental iodine. (They mentioned the possible potential of silver zeolite for removing iodine from fuel reprocessing off-gas.) Another effective material was a silver-containing inorganic sorbent obtained from a commercial source (GX-135).

While silver-containing sorbents are expensive, the quantity of off-gas to be treated is estimated to be relatively small (~ 500 cfm for a typical plant); therefore, extremely large quantities of a highly effective sorbent would not be required.

Present objectives are to obtain information on the effective service life of these promising sorbents and to ascertain the desirability of locating a catalytic oxidation bed upstream of the sorbents. The oxidation bed has two functions: (1) to minimize poisoning by destroying organics which might be adsorbed and (2) to convert organic iodides to elemental iodine and thus improve trapping efficiency.

II. Experimental

In this continuing investigation, selected sorbents are exposed to simulated LMFBR fuel reprocessing off-gas for extended periods of time which have varied, for different sorbent-condition combinations, from 77 days to beyond 196 days. One group of sorbents is exposed to untreated off-gas, while another group is exposed

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to off-gas which has traversed a catalytic oxidation bed. Periodically, trapping data for iodine injected as elemental iodine and as methyl iodide are obtained. The experimental modes are such that the results for elemental iodine are basically long-term, while those for methyl iodide are short-term.

Apparatus and Operating Conditions

A schematic diagram of the laboratory facility that is employed is shown in Fig. 1. In its construction, stainless steel type 316 was employed almost exclusively where corrosion might present a problem. Not shown are the various flow meters which are utilized, including the ten exit flowmeters. Dimensions of the sorbent beds and the catalytic oxidation bed (Hopcalite) are given in Table 1 together with certain of the operating conditions such as off-gas velocities and target concentrations for the additives. The reported temperatures are based on readings exhibited by thermocouples with junctions located, in each case, on the centerline immediately downstream of the sorbent or catalyst and, considering the gradients present, are regarded as being representative of the mean values.

During operation of the facility, the main air stream is humidified to the extent of around 85% saturation referred to room temperature (near 26°C). Dodecane* and nitric oxide** are introduced continually into the main air stream to provide concentrations which, on the basis of long term usage, do not differ from the target concentrations by more than about 30%. Elemental iodine, labeled with ^{125}I (60-day half-life), is also continuously injected except for relatively brief periods when the supply is exhausted or some similar reason pertains. (On occasion, operation of the facility is suspended, e.g., to change out the Hopcalite.) While different batches of I_2 were injected during the 196 days of operation covered herein, they were all prepared so as to have nearly the same specific activity at any particular time. As indicated in Table 1, the iodine concentrations of principal interest are those pertaining to the off-gas as it enters the sorbent beds; the concentrations quoted were evaluated using the amounts of ^{125}I found on removed sorbent beds and their associated collection beds. This approach was employed as a consequence of the uncertain amount of iodine deposition in the injection line, connecting lines, etc.

While elemental iodine is injected on a generally continuous basis, methyl iodide, ^{130}I -labeled (12.3-hr half-life), is injected only periodically (roughly bimonthly) and then essentially as a pulse. The injection is probably complete in about 3 min.

Oxidizing Catalyst and Sorbents

Such materials as were initially installed and indicated by letters in Fig. 1 follow:

- H Hopcalite, MSA Part No. 21215, 8 x 16 mesh (U.S.), from Mine Safety Appliances Company. Its use as related to the iodine trapping problem has been investigated.(5, 6, 7, 8)
- A Activated carbon, iodized, Grade 42, 8 x 16 mesh (U.S.), from Witco Chemical Corporation.

* Practical, MP - 10.5 to - 9°C, from Matheson Coleman and Bell.

** Technical grade, from the Matheson Company, Inc.

ORNL-DWG 71-1236R

Figure 1. Flow Diagram of Apparatus for Investigating Effects of Long-Term Exposure to Simulated Off-Gas on Trapping Performance of Sorbents.

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- B Silver zeolite, 88% Ag^+ for Na^+ exchange (per analysis at ORNL), 1/8-in. pellets, from Materials Systems Division of Union Carbide Corporation.
- C Same material as B.
- D Silver zeolite, 26% Ag^+ for Na^+ exchange, 1/16-in. pellets, laboratory-prepared by treating Linde Molecular Sieve Type 13X with AgNO_3 solution. (Target degree of exchange was 25%).
- E GX135, 8 x 16 mesh (U.S.), silver salt-treated alumina-silica, from North American Carbon Inc.
- F Activated carbon, iodized, MSA 85851, 8-14 mesh (Tyler), from Mine Safety Appliances Company.

Table 1. Experimental Details for Long-Term Facility

Each test bed section: two 1-in. deep beds in series, 1.05-in. bed diam.

Test bed temperatures (mean): 66, 100, or 200°C

Superficial off-gas velocities in test beds: 46, 50, or 63 fpm (respectively, for preceding temperatures)

Each collection bed section: three 1-in. deep beds in series, 1-in. bed diam.

Hopcalite bed: 2.6-in. depth, 2.1-in. diam., 350°C, superficial off-gas velocity of 108 fpm

Main air stream: 68 lpm, 1 atm, ~ 85% R.H. (at 26°C)

Target concentrations for continuously injected additives:

NO	1×10^{-5} g/l
Dodecane	2×10^{-6} g/l
I_2	4×10^{-8} g/l (at test bed entrance; equivalent to 5 mg I_2/cm^3 sorbent/yr)

Estimated actual I_2 concentrations (from counting data):

First 77 days exposure	9×10^{-8} g/l
Next 119 days exposure	4×10^{-8} g/l

Periodic CH_3I injection: equivalent to 0.1 mg I/cm^3 sorbent/injection;
~ 2×10^{-4} g $\text{CH}_3\text{I}/1$ (over ~ 3 min period)

Radioactive labeling:

I_2 with ^{125}I ($t_{1/2} = 60$ days)	CH_3I with ^{130}I ($t_{1/2} = 12.3$ hr)
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After 77 days of operation, the iodized charcoal without Hopcalite upstream was replaced by GX135, at 100°C, and the 88% silver zeolite (1/8-in. pellets) at 100°C (both positions at 100°C having been involved) was replaced by 99% silver zeolite, 1/16-in. pellets, at 100°C. The latter sorbent is from Union Carbide Corporation.

Then, after 196 days of operation, the iodized charcoal with Hopcalite upstream was replaced by GX135, at 100°C, and the 88% silver zeolite (1/8-in. pellets) at 200°C (both positions) was replaced by 88% silver zeolite, 10 x 20 mesh (U.S.) beads, at 200°C. The latter sorbent is from Davison Chemical Division of W. R. Grace and Company. (Results corresponding to sorbent beds installed after 196 days are not yet available.)

Procedure

Initially, the catalyst (Hopcalite) and sorbents were preequilibrated at their operating temperatures to the flowing humid air for 27 hr without the introduction of additives other than water vapor. (Each time fresh Hopcalite was employed, it was degassed at 350°C prior to connecting its holder with the line leading to the downstream sorbents; whether or not this step served a useful purpose is unknown.) Next, the first methyl iodide injection was performed. Around 17 hr later, the collection beds were removed (and replaced) and assayed for ^{130}I . Then, a few hours after removal of the collection beds, introduction of dodecane, I_2 , and NO was initiated. In obtaining subsequent methyl iodide trapping results, a similar procedure was employed except, in addition, the collection beds were assayed for ^{125}I after allowing sufficient time for essentially complete decay of ^{130}I . (The introduction of additives continued undisturbed during this subsequent methyl iodide testing.) While methyl iodide results were obtained for the sorbents initially installed prior to the introduction of dodecane, NO, and I_2 , analogous results (i.e., for zero exposure time) were not obtained for the replacement sorbent beds.

The Hopcalite beds were changed out after, referring to successive cases, 77, 63, and 56 days exposure to simulated off-gas.

Evaluation of Decontamination Factors

As already indicated, periodic results are obtained corresponding to the trapping of iodine introduced as CH_3I and its retention for around 17 hr. The results for a particular injection are evaluated without regard to those for a different injection, that is, the methyl iodide results are on a noncumulative basis. Each of the decontamination factors presented herein for methyl iodide and associated with a given 2-in. depth of sorbent corresponds to the following quotient: one tenth the corrected counting rate of the ^{130}I -labeled source, as determined just prior to injection, divided by the sum of the corrected ^{130}I -counting rates found for the parts (beds, screens, and retaining springs) of the collection bed section downstream of that 2-in. depth of sorbent. (The apportionment is one-tenth because there are ten sorbent sections, and the counting rates as used include corrections for decay and background.) The methyl iodide decontamination factors associated with sorbents downstream of Hopcalite are actually manifestations of I_2 trapping capability since the methyl iodide which traversed the Hopcalite bed was converted to elemental iodine. (6) Some fraction of the latter is undoubtedly retained over the time period involved on surfaces upstream of the sorbents. Also, considering the manner in which the methyl iodide decontamination factors are evaluated, any amounts of ^{130}I retained in the connecting lines between the sorbent bed sections and the collection bed

sections are, in effect, included with the quantities trapped further upstream. (The connecting lines are of 1/4-in. O.D., 35-mil wall, stainless steel type 316; lengths are 0.7 ft where sorbent temperatures are 66 or 100°C and 5 ft where sorbent temperatures are 200°C.) Accordingly, each of these methyl iodide decontamination factors corresponds to the overall result of all removal processes occurring between the point of injection and the point of entrance into the applicable collection bed section.

As contrasted with the results for methyl iodide, the decontamination factors for elemental iodine are evaluated on a cumulative basis for the relatively long exposure periods involved and apply, within the limitations to be indicated, to those quantities of ^{125}I -labeled iodine which enter the test bed sections. For each of those cases where the test beds were removed and assayed for ^{125}I , excluding two cases where the associated collection beds were indicative of ineffective trapping, the quantity of iodine entering was taken to be that found on the removed test beds (the two 1-in. depths in series) plus that found on the two or more successive collection bed sections associated with them. (Actually, the calculations were made in terms of corrected counting rates, which included allowance for the different degrees of attenuation by different sorbents, the latter correction being necessitated by the low energy of ^{125}I radiation.(9)) For other cases, the quantities of entering iodine are estimates based on those quantities evaluated as described above, length of exposure time, and the particular time period pertaining (to allow for the variation in effective I_2 concentration). Each I_2 decontamination factor, then, is the quotient of the calculated amount of iodine (injected as I_2) entering the test bed section during the specified exposure time divided by the total amount found on the one or more collection bed sections that was (were) located downstream during that exposure time. Quantities of iodine retained in the lines between the test bed sections and the collection bed sections are not measured and, therefore, the I_2 results are interpreted in a manner somewhat similar to that employed for the CH_3I results, with particular reference being made to the situation where conversion to I_2 by passage through Hopcalite pertained. (For the I_2 results, however, any ^{125}I retention occurring upstream of the sorbents is not directly involved in their interpretation.) Accordingly, each of the I_2 decontamination factors corresponds to the result of removal processes occurring between the point of entrance to the applicable test bed section and the point of entrance to its successive collection bed sections.

The effects of iodine retention on nonsorbent surfaces may not be as important in this work as the above discussion would suggest since available evidence indicates that I_2 is transported through the facility at an appreciable rate. However, at least until more definitive information is obtained, recognition of the possible role of nonsorbent surfaces in achieving the degrees of decontamination as were observed appears necessary.

III. Results and Discussion

In the processing of LMFBR fuel which has cooled for the projected time of 30 days, the iodine isotopes of primary concern will be 8.07-day ^{131}I and 1.7 x 10^7 -year ^{129}I , with the ^{131}I being controlling with respect to the degree of retention required. The decay of trapped ^{131}I will mitigate the iodine retention problem since ^{131}I decays to stable ^{131}Xe either directly or via 11.8-day ^{131m}Xe which is in low yield and which is considerably less hazardous than ^{131}I . As indicated earlier, the decontamination factors (DF's) of this investigation do not reflect decontamination resulting from decay. (That is, the extents of decontamination attributable to ^{125}I or ^{130}I decay were, in effect, eliminated by making appropriate corrections.) The DF's as are to be presented for the ^{125}I -

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labeled I_2 are for exposure times of ≥ 35 days. Thus, in the extension of these values so as to apply to ^{131}I , the imposition of allowances for ^{131}I decay would result in the revised values being substantially larger. (Calculation of such values has not as yet been performed.) With regard to the DF's for the ^{130}I -labeled CH_3I , the time periods pertaining are short, viz., around 17 hr, and, consequently, imposition of ^{131}I -decay allowances would result in only trivial increases in these values.

Observed Decontamination Factors for Iodine and Methyl Iodide

The results for the sorbents initially installed are presented in Figs. 2-6 where the decontamination factors, evaluated and qualified as already described, are plotted versus accumulated exposure time. In instances where the calculated DF's are substantially in excess of 1×10^4 , the corresponding data points have arrows pointing upward; where incomplete trapping in the collection beds was indicated, the data points have arrows pointing downward.

The performance observed for the type of iodized charcoal that was investigated (Fig. 2) indicates that its useful service life under the conditions which pertained is rather limited. (The extent to which these results might apply to other types of iodized charcoal is not known.) A striking feature of the data is that trapping (and retention) of iodine introduced as I_2 was affected adversely and to a large extent by the use of Hopcalite. This behavior will be referred to again herein. As may be noted, the DF's for iodine injected as methyl iodide for the case of Hopcalite upstream remained high, due to conversion of methyl iodide to iodine, but this good performance was more than offset by the attendant severe loss in trapping efficiency for the iodine injected as I_2 . Actually, the use of charcoal in off-gas systems containing oxides of nitrogen is to be avoided because of the danger of combustion, at least at higher concentrations. (10) Iodized charcoal was included in this investigation for purposes of comparison with previous experience.

The results for 88% silver zeolite, 1/8-in. pellets (Figs. 3 and 4) are indicative of no better than fair performance, considering that DF's of 1×10^3 or greater are desired. Again, the use of Hopcalite is observed to be detrimental with regard to I_2 trapping, although the results obtained with this sorbent at $100^\circ C$ are not very conclusive on this point. That the performance of this material was not better is ascribed to the large pellet size. This sorbent was included partly to examine the effect of pellet size and partly because it was the only commercial form of silver zeolite readily available when operation of the facility was initiated.

Excellent performance was observed for 26% silver zeolite, 1/16-in. pellets, at $200^\circ C$ (Fig. 5). The methyl iodide decontamination factors are all high and those for I_2 are satisfactorily high. In contrast with the behavior exhibited in Figs. 2, 3, and 4, the use of Hopcalite is indicated to have a beneficial effect on the trapping of I_2 .

Excellent performance was observed for GX135 at $200^\circ C$ (Fig. 6) for the case of Hopcalite upstream. For the case of Hopcalite not upstream, however, the results for methyl iodide at 140 and 196 days exposure indicate significant deterioration in capability for trapping iodine in this form. (In an effort to eliminate ambiguity in the succeeding methyl iodide values, the collection bed sorbent for this particular case has been changed to laboratory-prepared 93% silver zeolite, 1/16-in. pellets.) With respect to I_2 trapping, the use of Hopcalite was observed beneficial.

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Figure 2. Effect of Exposure to Simulated Off-Gas on Radiiodine Trapping Capability of Witco Grade 42 Iodized Charcoal, 8 x 16 Mesh (U.S.), at ~ 66°C.

ORNL-DWG 72-8400R

Figure 3. Effect of Exposure to Simulated Off-Gas on Radioiodine Trapping Capability of Union Carbide 88% Silver Zeolite, 1/8-in. Pellets, at ~ 100°C.

Figure 4. Effect of Exposure to Simulated Off-Gas on Radioiodine Trapping Capability of Union Carbide 88% Silver Zeolite, 1/8-in. Pellets, at ~ 200°C.

ORNL-DWG 72-8399R

Figure 5. Effect of Exposure to Simulated Off-Gas on Radioiodine Trapping Capability of Laboratory-Prepared 26% Silver Zeolite, 1/16-in. Pellets, at ~ 200°C.

ORNL-DWG 72-8398R

Figure 6. Effect of Exposure to Simulated Off-Gas on Radioiodine Trapping Capability of North American Carbon GX135 (Silver Salt-Treated Alumina-Silica), 8 x 16 Mesh (U.S.), at ~ 200°C.

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The results which have been obtained for the test beds which replaced certain of those initially installed will be described only briefly at this time. The corresponding test situations are the three following: (1) GX135 (from North American Carbon and which is same kind of sorbent as that of Fig. 6), 100°C, without Hopcalite upstream; (2) 99% silver zeolite (from Union Carbide), 1/16-in. pellets, 100°C, without Hopcalite upstream; and (3) like (2) except with Hopcalite upstream. The DF's evaluated for these test situations correspond to exposure times of around 55 and 110 days. Those for CH_3I were all $> 1 \times 10^4$; those for I_2 were all $\geq 1 \times 10^3$. The resolution pertaining to these I_2 DF's was barely adequate due to the corresponding sorbents having been in the facility only during the later part of the overall exposure time, and the ^{125}I activity of the injected iodine had become relatively low. (Modifications in procedure have subsequently been made in order to maintain the ^{125}I activity at a fairly high level and to provide additional data regarding the amount of ^{125}I penetrating to that region of the facility in which the test beds are located.)

Trapping Behavior of Elemental Iodine and Methyl Iodide

Probably, the most notable feature of the results, although not necessarily the most important, was the observation that, for certain of the sorbents, the trapping performance for iodine injected as I_2 was adversely affected by the use of Hopcalite. In this connection, the distribution of ^{125}I in the collection beds is of interest (referring to situations where the collected quantity of ^{125}I was appreciable). For cases where Hopcalite was not upstream, the ^{125}I was trapped effectively in the first of the three collection beds (i.e., like I_2). For the cases where Hopcalite was upstream, significant amounts of ^{125}I were also found in the second and third collection beds. In some of these cases, the successive amounts corresponding to a given set of collection beds decreased in a regular manner as is typical of methyl iodide trapping by iodized charcoal at a relative humidity of, say, 90%. (The reasonable assumption that the distribution is described by a geometric series is employed in calculating and correcting for the radioactivity which penetrates the final collection bed.) In some other of these cases, denoted on the graphs by solid squares with arrows pointing downward, the ^{125}I distribution on the three beds was roughly uniform.

The behavior observed for the ^{130}I -labeled methyl iodide was just the opposite but in accord with expectation. If Hopcalite was not upstream and an appreciable amount penetrated to the collection beds, the ^{130}I was, in general, distributed throughout the collection beds in the descending contour characteristic of the isotopic exchange decontamination process; in two cases, denoted in Fig. 6 by downward arrows, the distribution was roughly uniform. With Hopcalite upstream, that which penetrated the sorbent under test stopped on the first collection bed as a consequence of the conversion from CH_3I to I_2 .

Accordingly, the available information indicates that formation of one or more organic compounds of iodine is involved in the poorer performance exhibited by certain of the sorbents with respect to trapping iodine injected as I_2 when the simulated off-gas has traversed the Hopcalite bed. This aspect was investigated by passing portions of the two gas streams, not treated and treated (with Hopcalite), through iodine characterization packs of the type developed by Bennett, Hinds, and Adams. (11) These packs differentiate between reactive iodine (I_2), iodine associated with airborne particles, and organic iodides. The sampling ports were located near the inlets to the test bed sections. At least 98% of the ^{125}I -labeled iodine in either stream was indicated to be in the elemental form. These data together with the related observations are consistent with the following suggested possibilities: (1) that organic fragments in the

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Hopcalite-treated stream react with iodine trapped on the test beds to yield organic iodides of which some fraction is evolved and (2) that dodecane in the untreated stream undergoes little reaction with the trapped iodine. These possibilities are not submitted as being on a firm basis, and, perhaps, as the investigation continues, additional evidence, contrary or confirmatory, will be obtained. The feature of the results prompting these comments has not been observed as yet for the more effective sorbents; therefore, from a practical standpoint, the development of a more conclusive interpretation is not regarded as being particularly urgent at the present time.

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