

Follow-up Report on alarming of the air monitor for  $\alpha$ -ray at the Plutonium Fuel Fabrication Facility.

1. Date and Time: At around 14:24 on Wednesday, January 30, 2019
2. Location: Powder Conditioning Room (A-103) (Controlled Area) at the Plutonium Fuel Fabrication Facility

(Figure 1: Facility layout)

(Figure 2: Facility layout of 1st floor)

### 3. Brief description of events

At around 14:24 on January 30, 2019 at the Plutonium Fuel Fabrication Facility, while workers were performing Bag-Out Work as a course of regular periodic replacement of encapsulating vinyl bags at Powder Adjusting Room (A-103), the alarm of the air monitor for  $\alpha$ -ray went off.

(Bag-Out Work: By welding encapsulating vinyl bags, contaminants can be brought out from a glove box with sealed status maintained.)

Seeing the indicated value of the air monitor for  $\alpha$ -ray, the room (A-103) was designated as restriction area. Nine workers in the room, who wore half-face masks during the Work, evacuated the room and took body survey and nasal smear tests (nasal cavity tests). The results showed they were free of skin contamination or internal exposure.

### Chronology

See the attachment

### 4. Initial response

(1) At Room A-103 where the incident happened.

Bag-Out of aluminum cans from a glove box (D-8), followed by Bag-Out of SUS cans were performed. The SUS cans were doubly capsuled and sealed in vinyl bags and then put back in the storage. Then the same procedures were taken for the aluminum cans. (See figure 3: Staffing plan when  $\alpha$  alarm goes off.)

Smear tests for doubly capsuled SUS cans detected contamination.

Soon after the detection, the alarm ( $\alpha$ -8) went off at A-103 at 14:24.

Workers wore half-face masks when the monitor was alarming.

The workers stored the Bagged-Out items in a large vinyl bag and promptly took shelter at a windward location. (See figure 4: Staffing plan after  $\alpha$  alarm goes off.)

- The workers conducted Mutual Survey and initial Contaminated Body Part Identification. When getting high dose results, they reported the results to radiation control staff at around 14:45.

- The radiation control staff decided to cure the room A-102 next to A-103 and make the workers take shelter in the room (A-102) as a measures for the prevention of the spread of contamination. (Curing started at around 15:00 and completed at around 15:22) (Figure 5 Evacuation Route)

- When curing was completed, the workers took shelter in A-102. (Started at around 15:20, completed at around 15:22)

- Setting up of a greenhouse at the corridor was ordered. At the same time, assistants were told to be equipped with protective clothing and to be prepared for the workers' evacuation. (Order was issued at 15:29. The preparation for accepting was ready at 16:31)

(2) At Room A-102, the room next to A-103

The workers who took shelter in Room A-102 conducted Mutual Survey and Contaminated Body Part Identification. Considering the high dose results, the radiation control staff entered the room wearing doubled Tyvek coverall and whole face masks, then conducted body survey. (Chart 1 Body Contamination Results of the Workers)

- The radiation control staff tried to secure the contamination using adhesive tapes. However, for workers with wide ranged contamination, they had to give up securing using adhesive tapes. Depending on the level of contamination, the workers put on additional layer of a coverall to prevent the spread of contamination as well as to prevent skin contamination when taking off the original coverall they wore at the work.

The workers who finished decontamination proceeded to Room A-101 successively. (Started at 16:22)

(3) At Room A-101, the room next to A-102

- After the completion of setting up the greenhouse, the workers took off coveralls. Then they were led to the greenhouse or the corridors in their underwear. Radiation control staff in double Tyvek coverall and whole surface masks conducted body survey and confirmed the presence or absence of skin contamination. (Started at around 17:50, completed at around 19:08)

- The workers then underwent nose smear tests. (Started at 18:01, completed at 19:18)

5. The present status of the incident location.

- Figure 6 Location for applying the second outer vinyl bag welding

- Chart 2 The history of items which experienced vinyl bag exchange

- Figure 7 Surface density measurement record

- Figure 8 Measurement record of radioactive substance concentration in the air (A-103)

- Figure 9 Measurement record of radioactive substance concentration in the air (A-102)

- Figure 10 Trend of air monitor for  $\alpha$  ray

Work Plans from now on

- Move Bagged-Out items (presumably the source of contamination) placed outside at present into a glove box.

- Conduct contamination survey and decontamination of the room. Implement investigation of causes by close observation of the vinyl bags in the glove box.

1. Brief description of events (Brief Overview of the Event)

During periodic replacement of vinyl bags enclosing containers holding nuclear materials by workers with half-face masks at the Powder Conditioning Room (A-103), the atmosphere monitors for  $\alpha$ -particles were alarming. The moment when monitors alarmed, nine workers existed in the room in total and all of them were wearing half-face masks. They evacuated to the next room (A-102) from the room (A-103).

They took body surface contamination check in the evacuated room. In accordance with the safety regulations for PFFF, the room (A-103) was designated as access control area.

## 2. Major Events List

At around 14:24 During periodic replacement of vinyl bags enclosing containers holding nuclear materials by workers with half-face masks at the Powder Conditioning Room (A-103), the atmosphere monitors for  $\alpha$ -particles in the air were alarming. The moment when monitors alarmed, mine workers existed in the A-103 in total and all of them were wearing half-face masks. They evacuated to the next room (A-102) where any elevations of concentration of radioactive particles in the air were not detected from the room (A-103).

At around 14:27 The atmosphere monitor for  $\alpha$ -particles at A-103 (Monitor Number:  $\alpha$ -10) was alarming.

At around 14:50 Converted  $\alpha$ -particles concentration in the air from the value indicated by the  $\alpha$ -monitor ( $\alpha$ -8) in A-103 was  $9.1 \times 10^{-7}$  Bq/cm<sup>3</sup>. Because this value was greater than the value of  $7.0 \times 10^{-7}$  Bq/cm<sup>3</sup> established by the safety regulations for PFFF to control the access.

At around 15:29 Installation of a greenhouse for contamination control at the corridor neighboring the A-101 (next room to A-102) was directed.

16:00 Surface contamination tests for nine workers have been underway.

## 3. Cause

Under investigation

## 4. Impact on the involved workers

Surface contamination tests for nine workers have been underway.

## 5. Environmental impact

As no change has been detected on the results of monitors in monitoring posts and stations on the boundary of laboratories, we consider that there is no impact on environment.

## Attachment

### Chronology of alarm sounding of the air monitor for $\alpha$ ray at Plutonium Fuel Fabrication Facility

At around

- 14:10 Four workers started Bag-Out Work at Glove box D-8.  
Five other workers were in the same room for other work.
- 14:20 When double encapsulating bagged-out items, contamination was detected on the surface of the outer vinyl bag.
- 14:24 The air monitor for  $\alpha$  ray ( $\alpha$ -8) was alarming.  
The workers put bagged-out items in a large vinyl bag and took shelter in a safer place (on the windward position) in the room and conducted mutual survey and the identification of the contaminated body part.
- 14:27 The air monitor for  $\alpha$  ray ( $\alpha$ -10) was alarming.
- 14:45 Command station was set up at Plutonium Fuel Development Center
- 14:50 Powder conditioning room (A-103) was designated as the restriction area, considering that the radioactive concentration in the air might exceed the previously set standard value for the restriction area.
- 14:57 It was confirmed that no dose value change at the monitoring posts or stations was detected at alarming or at the trend after the alarm.
- 14:58 A local response headquarter was set up at the Nuclear Fuel Cycle Engineering Laboratories.
- 15:00 Curing of Room A-102 in which the workers would take shelter started.
- 15:12 No abnormality in the value of monitoring ventilation of the Plutonium Fuel Fabrication Facility was confirmed.
- 15:20 After the completion of the Room A-102 curing, nine workers started to evacuate to Room A-102. (At around 15:22, evacuation of nine workers was completed.)
- 15:22 JAEA judged this incident corresponded to the one that required a report to the relevant safety authorities since setting up of restriction area was required.
- 15:29 Instructions to set up a greenhouse for evacuation at the corridor was issued.
- 16:22 Following decontamination at Room A-102, the workers started evacuation to Room A-101.
- 16:31 Greenhouse at the corridor was ready.
- 17:33 One of the nine worker started to leave Room A-101.
- 18:14 No abnormality detection on the results of the body survey and nasal smear was confirmed for two workers.
- 18:30 No abnormality detection on the results of the body survey and nasal smear was confirmed for another two workers.
- 18:57 No abnormality detection on the results of the body survey and nasal smear was confirmed for other three workers.
- 19:08 No abnormality detection on the results of the body survey was confirmed for the last two workers.  
All the workers involved left Room A-101.
- 19:18 No abnormality detection on the results of the nasal smear was confirmed for the last two workers.  
No abnormality detection on the results of the body survey and nasal smear was confirmed for all nine workers involved.

Figure 1: Facility Layout



Figure 2: Facility Layout of 1st Floor

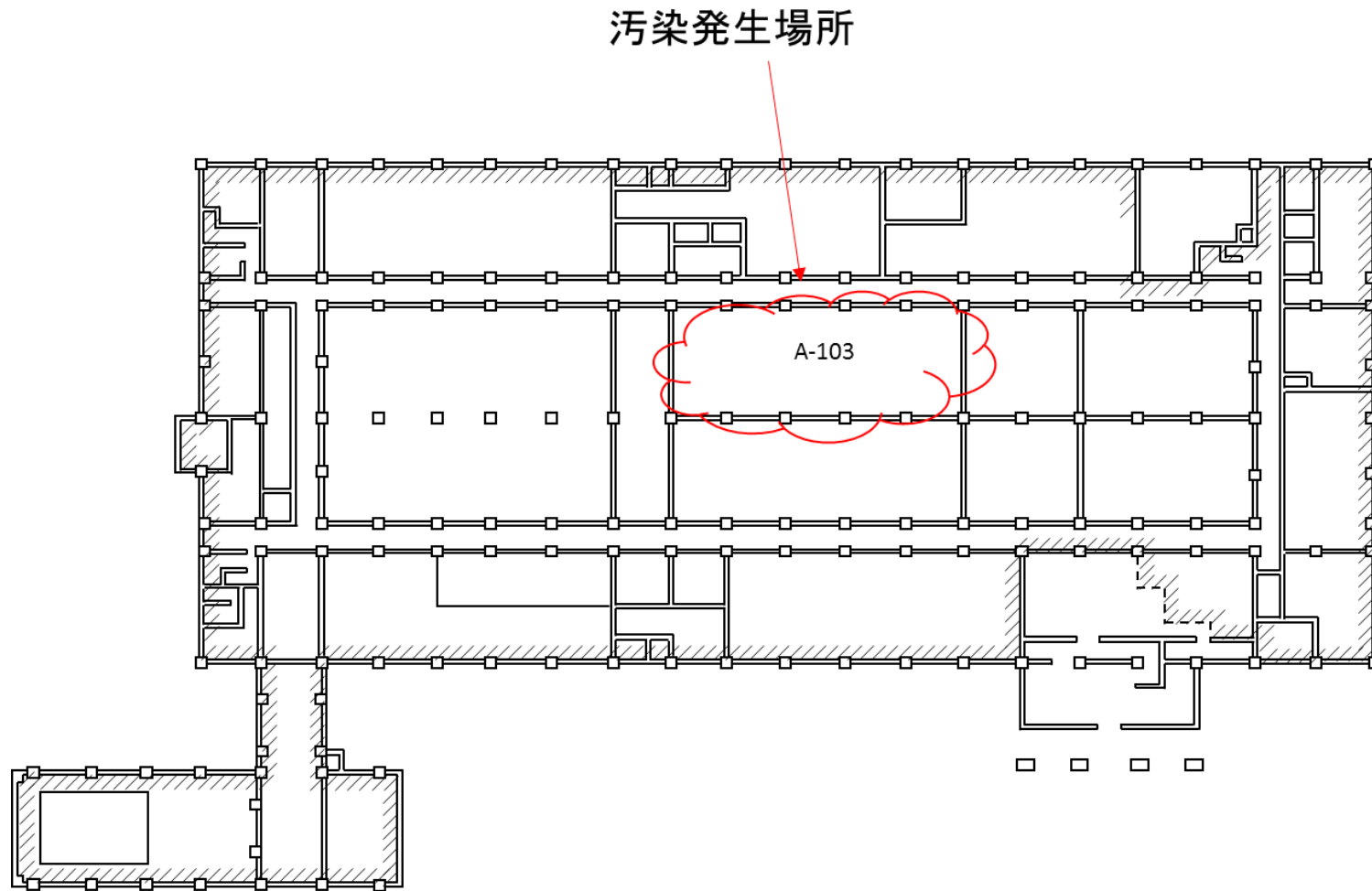


図2 プルトニウム燃料第二開発室(1階平面図)

Figure 3: Staffing plan when  $\alpha$  alarm goes off.

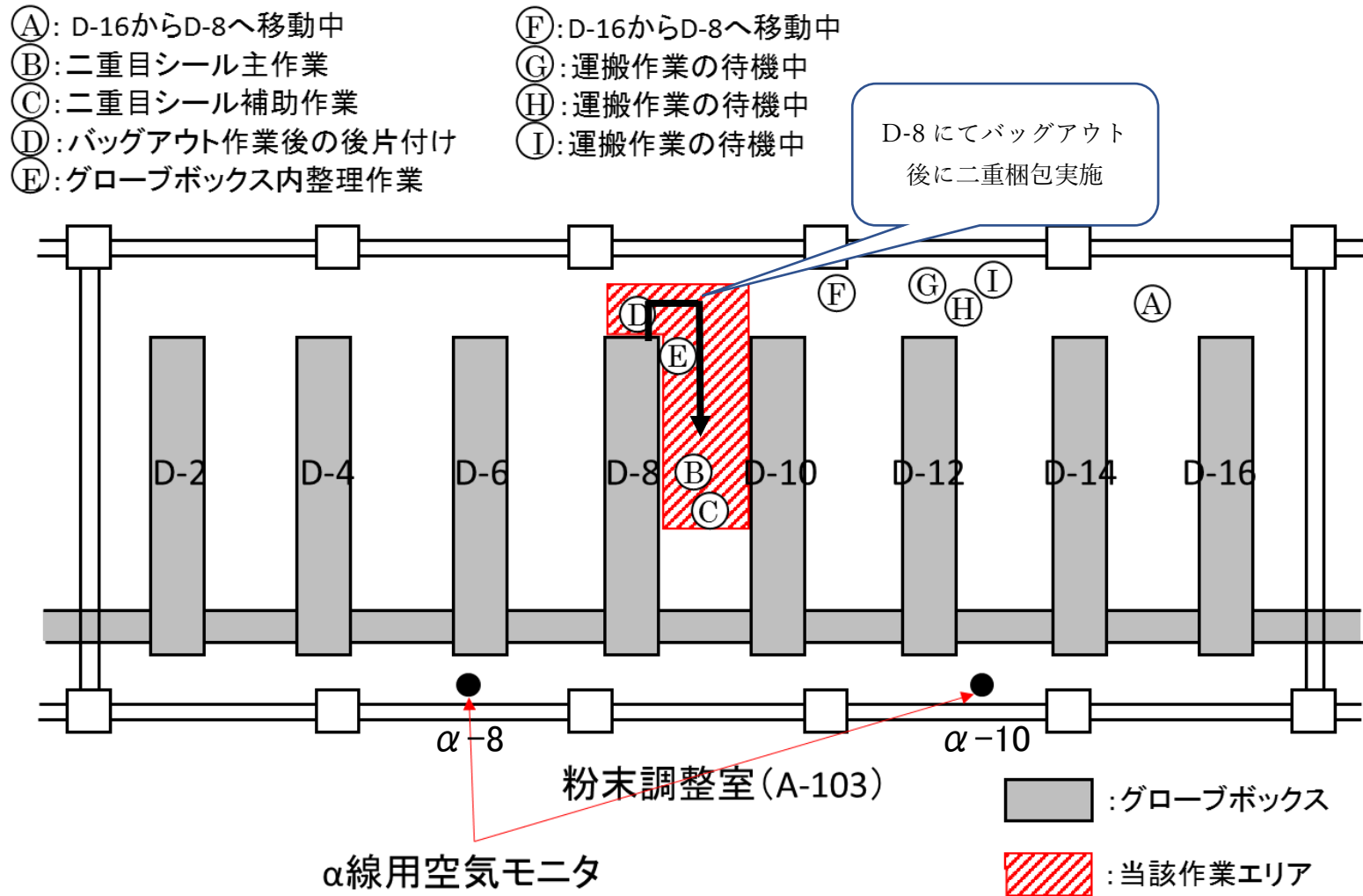


図3 α線用空気モニタ警報吹鳴時の人員配置

Figure 4: Staffing plan after  $\alpha$  alarm goes off.

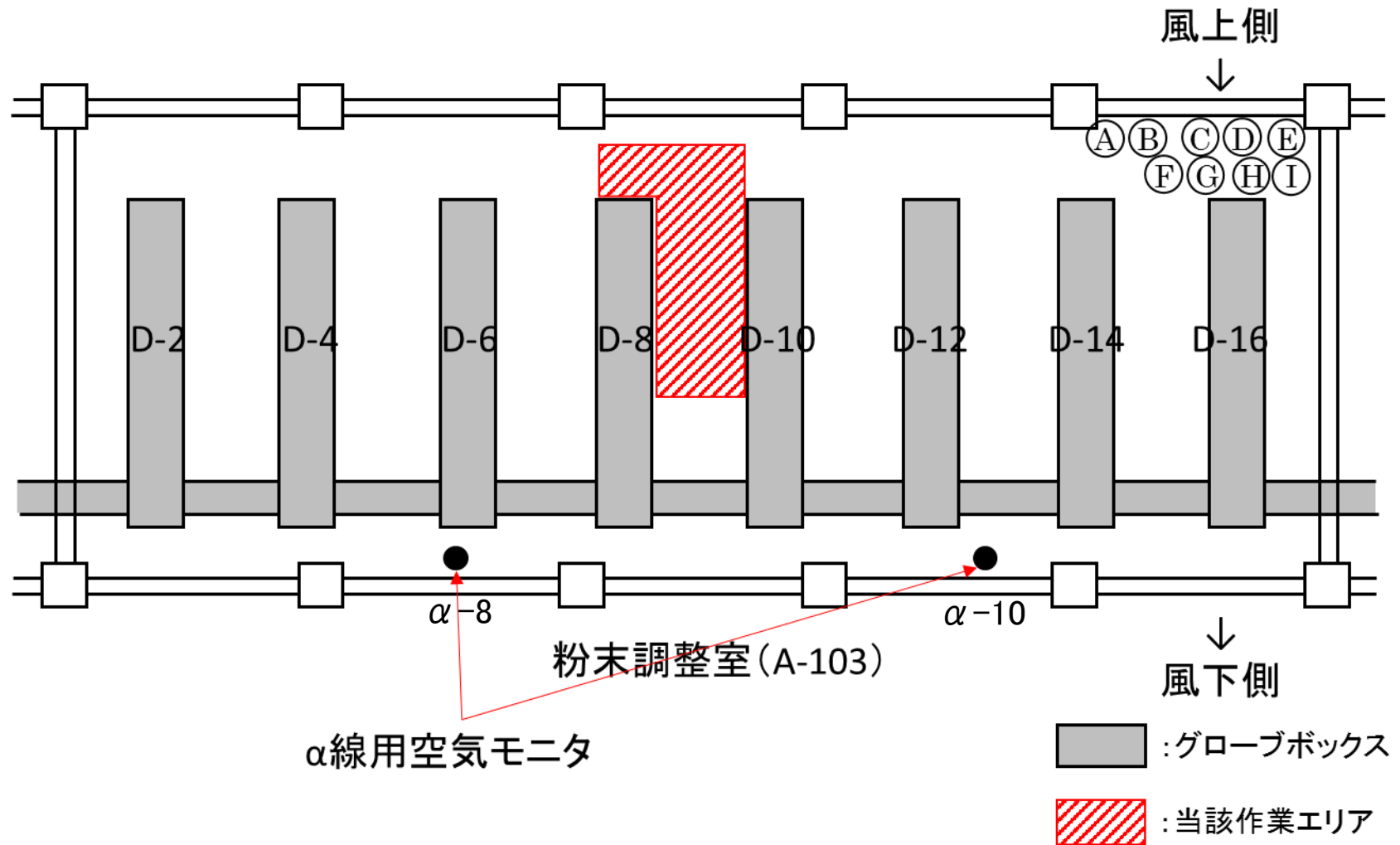


図4  $\alpha$ 線用空気モニタ警報吹鳴後の人員配置



Figure 5: Evacuation Route

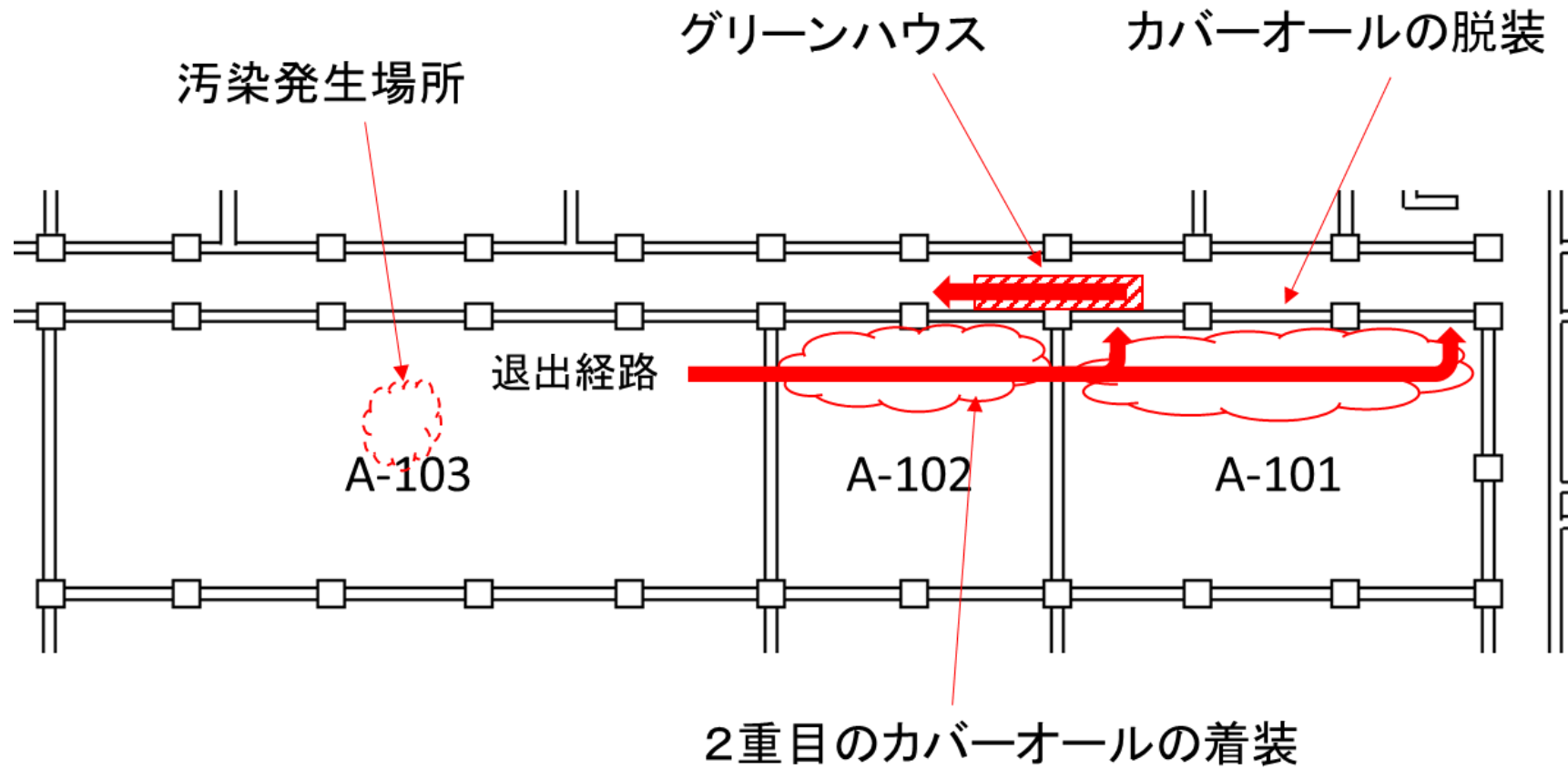


図5 作業者の退出経路

Figure 6: Location for applying the second outer vinyl bag welding

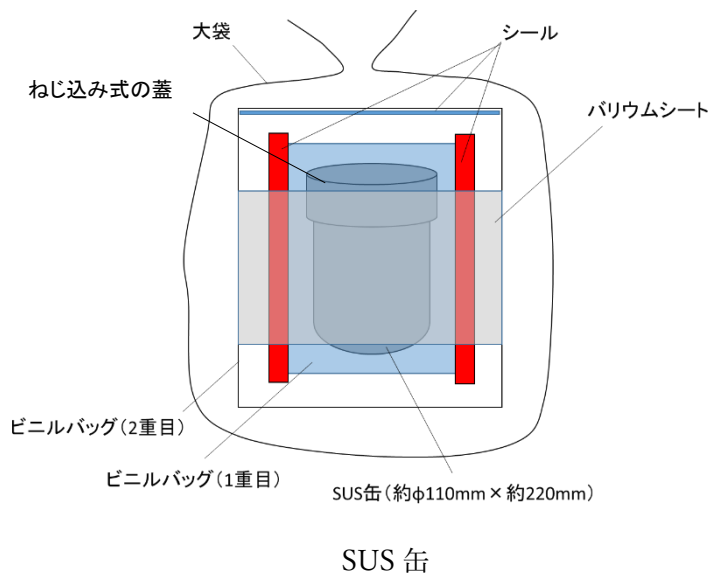
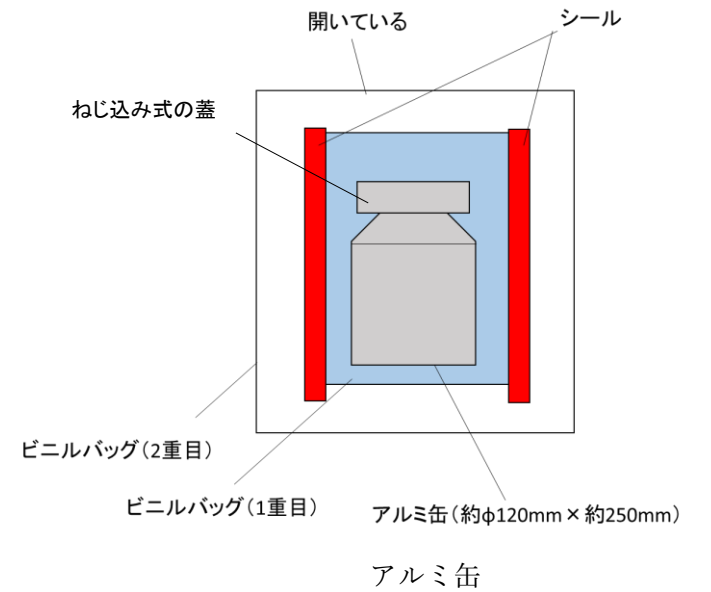


図6 2重目ビニルバッグ梱包作業場所



アルミ缶 (新品)    SUS缶 (新品)

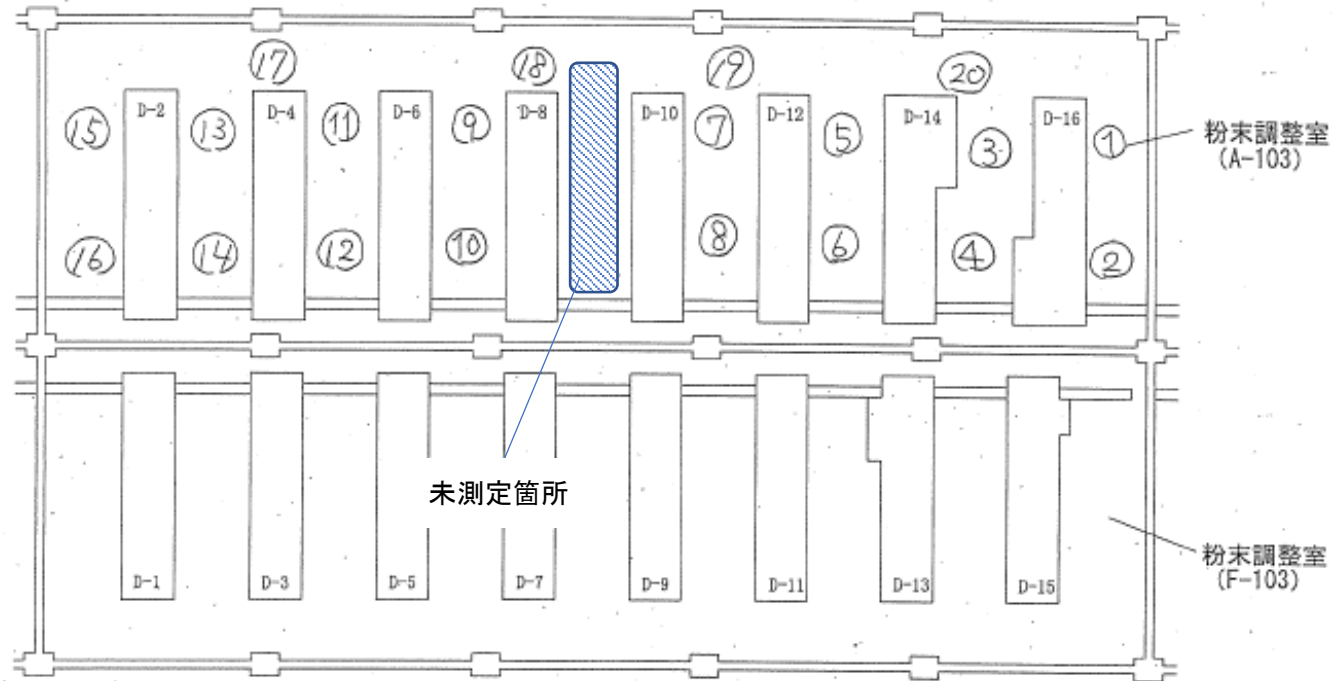


アルミ缶 (新品)    SUS缶 (新品)

Figure 7: Surface density measurement record

単位 (Bq/cm<sup>2</sup>)

- ① : 0.1
- ② : 0.3
- ③ : 0.1
- ④ : 0.3
- ⑤ : 0.5
- ⑥ : 0.6
- ⑦ : 0.8
- ⑧ : 0.8
- ⑨ : 1.1
- ⑩ : 0.4
- ⑪ : 0.7
- ⑫ : 0.6
- ⑬ : 0.3
- ⑭ : 0.3
- ⑮ : 0.1
- ⑯ : 0.2
- ⑰ : 0.5
- ⑱ : 0.6
- ⑲ : 0.3
- ⑳ : 0.3



未測定箇所

粉末調整室 (A-103)

粉末調整室 (F-103)

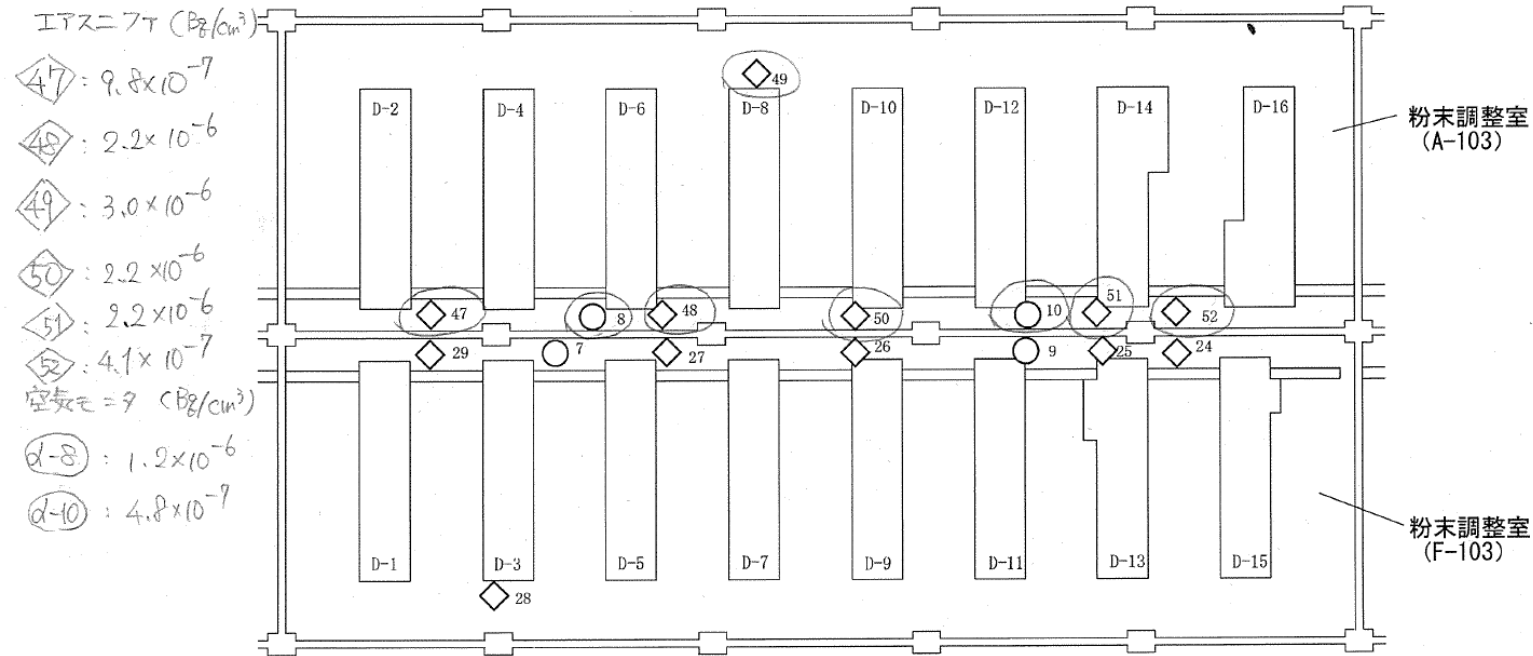
凡例

○ : スミヤの番号を示す

放射線状況

採取日時: 平成31年1月30日21時38分  
 採取場所: 上記図面に示す (20点)  
 測定日時: 平成31年1月30日22時22分  
 測定結果: 最大 1.1 Bq/cm<sup>2</sup>  
 検出下限値: α線 4 × 10<sup>-2</sup> Bq/cm<sup>2</sup>

Figure 8: Measurement record of radioactive substance concentration in the air (A-103)

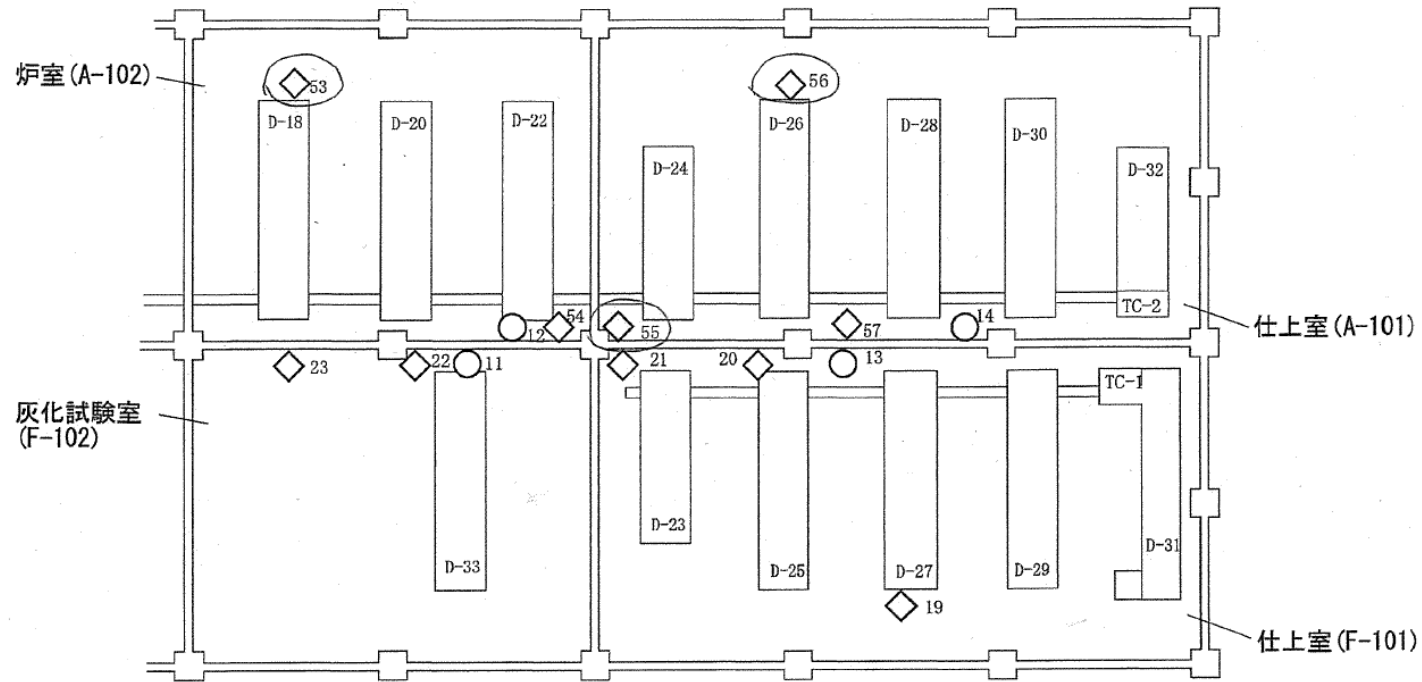


- 凡例
- ◇ : エアスニファの採取場所を示す
  - : α線空気モニタの採取場所を示す

放射線状況

採取日時: 平成31年1月25日10時00分~平成31年1月30日21時45分  
 採取場所: 上記図面に示す (8点)  
 測定日時: 平成31年1月30日23時05分  
 測定結果: 最大  $3.0 \times 10^{-6}$  Bq/cm<sup>3</sup> (A/S-49) (1週間平均濃度)  
 管理目標値:  $7 \times 10^{-8}$  Bq/cm<sup>3</sup> (1週間平均濃度)  
 検出下限値:  $3.7 \times 10^{-10}$  Bq/cm<sup>3</sup> (1週間平均濃度)

Figure 9: Measurement record of radioactive substance concentration in the air (A-102)



- 凡例
- ◇ : エアスニファの採取場所を示す
  - : α線空気モニタの採取場所を示す

放射線状況

採取日時 : 平成31年1月25日10時00分~平成31年1月30日21時45分

採取場所 : 上記図面に示す (3点)

測定日時 : 平成31年1月30日23時05分

測定結果 : 全て管理目標値以下

管理目標値 :  $\alpha$   $7 \times 10^{-8} \text{Bq/cm}^3$  (1週間平均濃度)

検出下限値 :  $\alpha$   $3.7 \times 10^{-10} \text{Bq/cm}^3$  (1週間平均濃度)

Chart 1: Body Contamination Results of the Workers

作業者	最大汚染箇所*	$\alpha$ 線測定値(最大)**
A	カバーオール(大腿部)	$2.9 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
B	カバーオール(大腿部)	$9.6 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
C	RIゴム手袋(両手)	$1.2 [\text{Bq}/\text{cm}^2]$
D	RIシューズ(両足)	$3.6 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
E	RIシューズ(両足)	$2.9 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
F	RIシューズ(両足)	$2.2 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
G	RIシューズ(両足)	$1.5 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
H	RIシューズ(両足)	$1.8 \times 10^{-1} [\text{Bq}/\text{cm}^2]$
I	RIシューズ(両足)	$1.5 \times 10^{-1} [\text{Bq}/\text{cm}^2]$

\*: 全員RIゴム手袋、RIシューズ、カバーオールに汚染あり。うち最大値であった箇所を示す。

\*\* : サーベイ前に汚染拡大防止を施した部位を除く最大値。汚染面積が特定できないため検出器の入射窓面積(70cm<sup>2</sup>)を使用して算出。

(参考)法令に定める表面密度限度: 4Bq/cm<sup>2</sup>( $\alpha$ 線)

Chart 2: The history of items which experienced vinyl bag exchange

容器材質	内容物	MOX重量 (g)	Pu重量 (g)	前回ビニールバッグ交換日
アルミ缶	MOX粉末			H26.11.12
SUS缶	MOX粉末			H30.3.27

Figure 10: Trend of air monitor for  $\alpha$  ray

