REPLACEMENT TECHNIQUE FOR FRONT ACRYLIC PANELS OF A LARGE SIZE GLOVE BOX USING BAG-IN / BAG-OUT METHOD

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Contents

- Overview of WASTEF
- Developed replacement technique
  - Background
  - Developed replacement technique
  - Developed devices
  - summary

Overview of WASTEF(1/2)

WASTEF : Waste Safety Testing Facility

WASTEF was established in 1982 for examining safety storage and disposal of high-level waste from reprocessing of spent fuel.

The R&D program of high-level waste was finished in 1998.

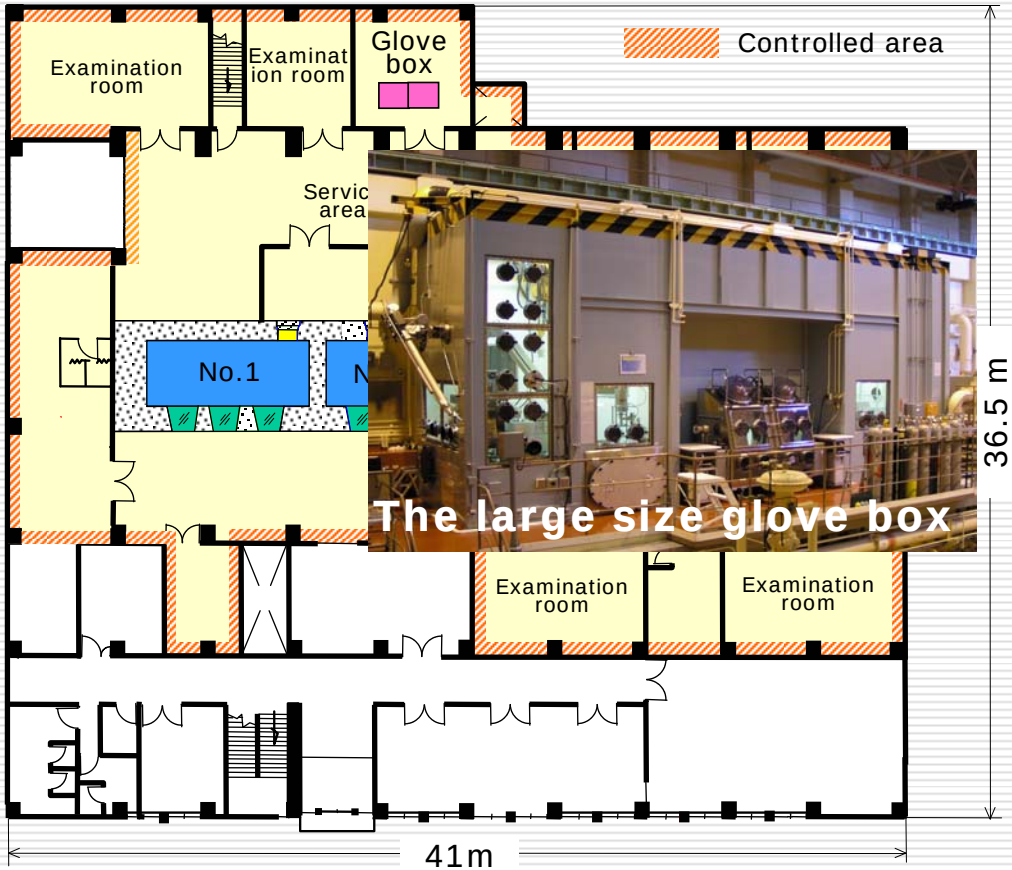
Current Main activities

✓**Experiment on Irradiation Assisted Stress Corrosion Cracking (IASCC)**
to study on the mechanical property of structural materials in the reactor using the SSRT (Slow Strain Rate Tensile) test apparatus.

✓**Experiment on Corrosion test for reprocessing plant materials**
to study on the corrosion test of the materials that are used for spent fuel reprocessing plant.

✓**Experiment on TRU (transuranium elements) Nitride fuel**
to study on the thermal property of TRU nitride fuels for transmutation.

Overview of WASTEF(2/2)



First Floor Plan of WASTEF

- 5 concrete cells
  - **No1~No3: β γ cells**
  - **No4~No5: α γ cells**
- 1 lead cell
- 6 glove boxes
- 6 examination rooms
  - TEM & FIB
  - Auger Microprobe
  - Radioactive analysis
  - DSC etc.
- The large size glove box is set on the roof of the concrete cell.

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  - Background
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  - Developed devices
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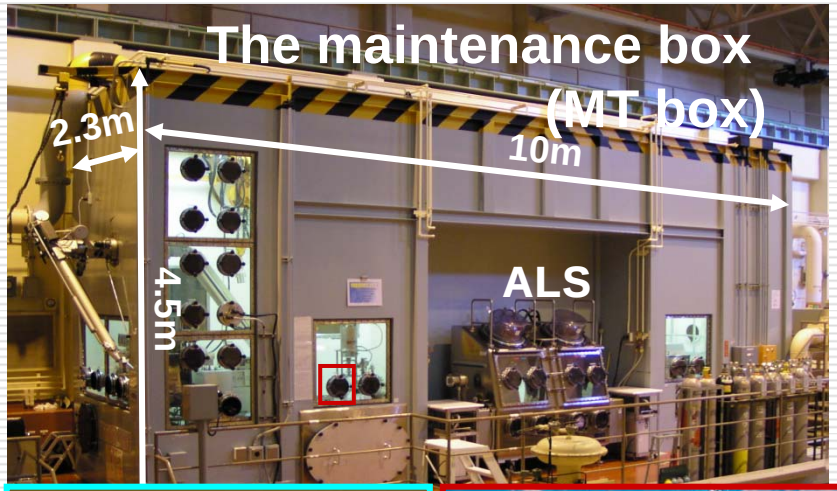
Background

The large size glove box has been used for about 25 years



Objective	Maintenance of $\alpha\gamma$ cell Study of TRU nitride fuel
Size	10m width, 2.3m depth 4.5m height
Apparatus	Air Line Suit (ALS)
Contamination level	30 Bq / cm^2 (α)

Normal panel

Degraded panel

Micro cracks were found in the acrylic panels caused by degradation.

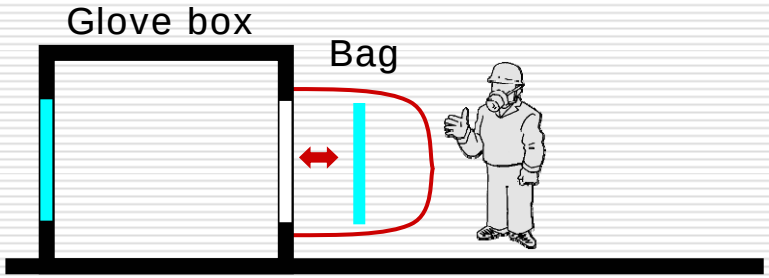
For safety operation

Degraded panels must be replaced by new panels.

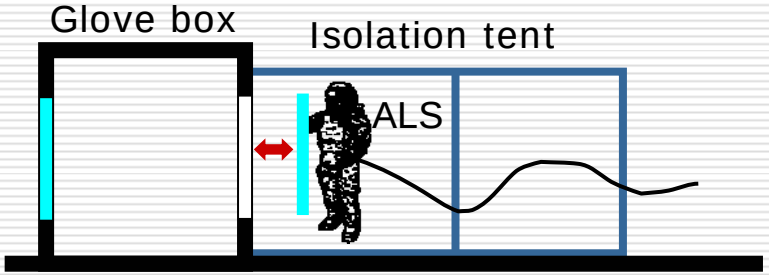
Developed replacement technique

For Saving time and safety operation

Developed technique



Conventional technique



Comparison of replacement technique

	Developed	Conventional
Airtight condition	**Hold**	Break
Decontamination	**Degraded panel only**	The whole of the glove box
ALS work in the isolation tent	**not necessary**	Required

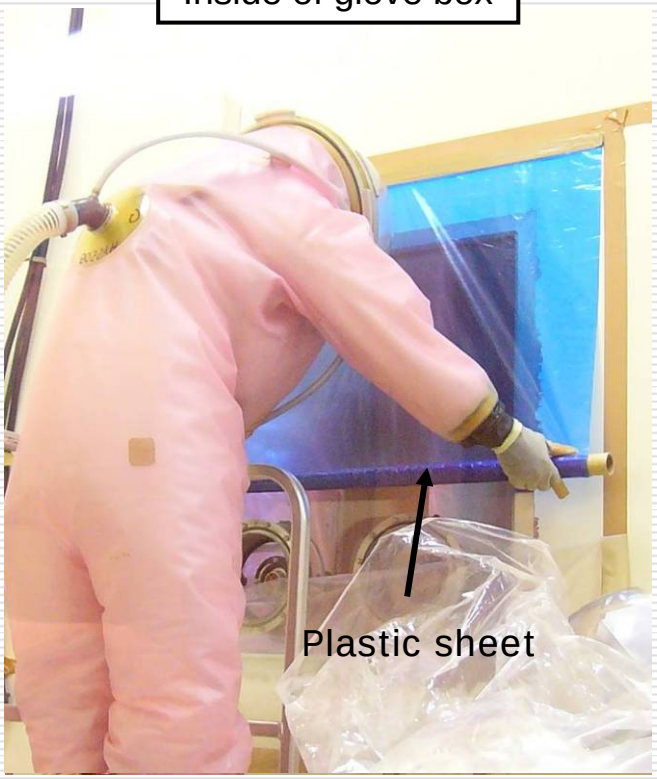
Developed replacement technique

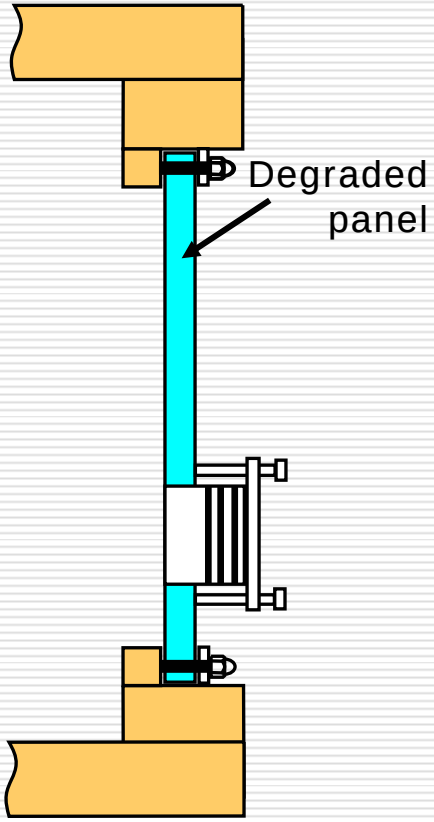
Developed replacement process

1. Decontamination of the degraded panel
2. Attachment of the airtight panel and airtightness test
3. Replacement of the acrylic panels using bag-in /bag-out method
4. Airtightness test using the checking panel

Developed replacement technique

1.Decontamination of degraded panel





Degraded panel:
1.0 X 1.0 m

Contamination level

before
$\beta\ \gamma$: 1.2 Bq /cm^2
$\alpha\ \gamma$: 33.6 Bq /cm^2

after
$\beta\ \gamma$: Back ground
$\alpha\ \gamma$: Back ground

Developed replacement technique

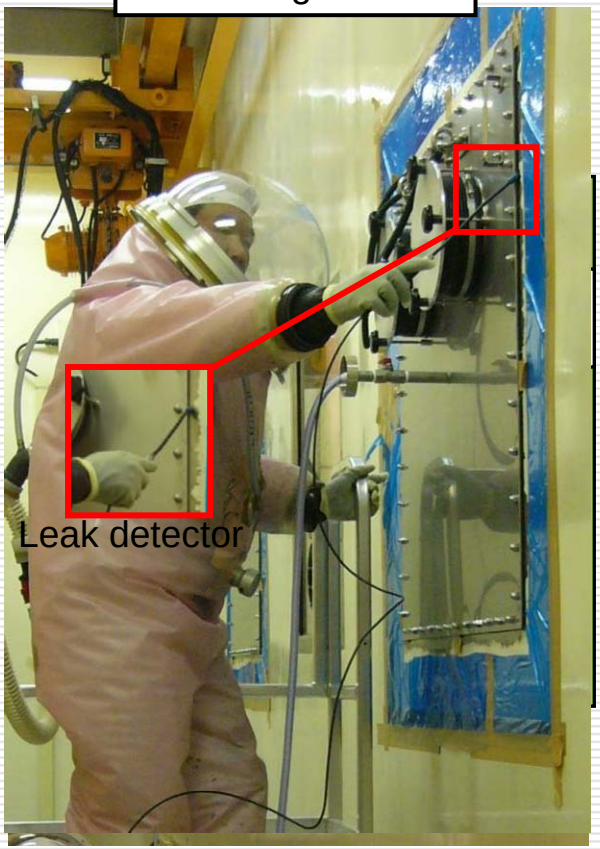
Developed replacement process

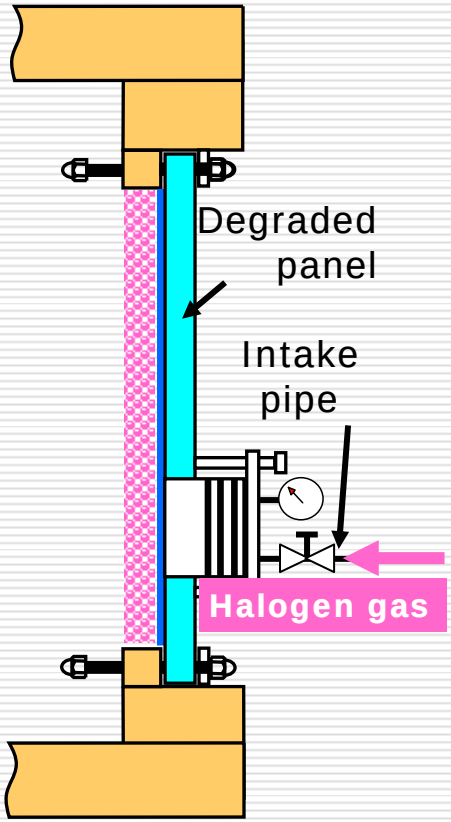
1. Decontamination of the degraded panel
2. Attachment of the airtight panel and airtightness test
3. Replacement of the acrylic panels using bag-in /bag-out method
4. Airtightness test using the checking panel

Developed replacement technique

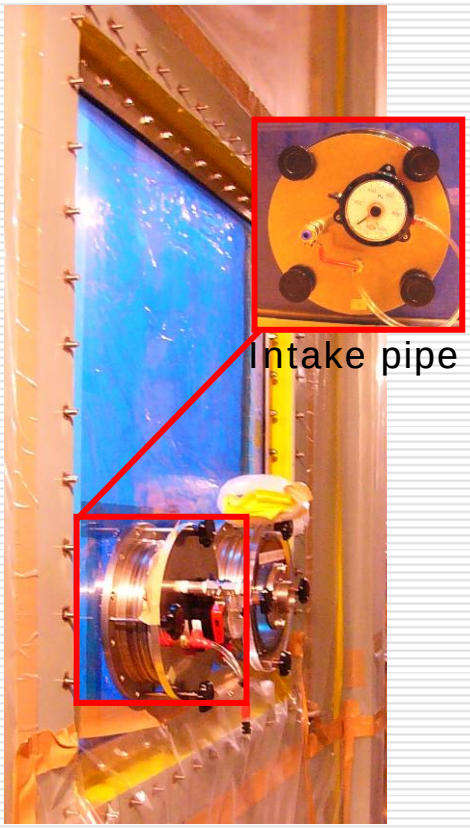
2.Attachment of the airtight panel and airtightness test

Inside of glove box





Outside of glove box



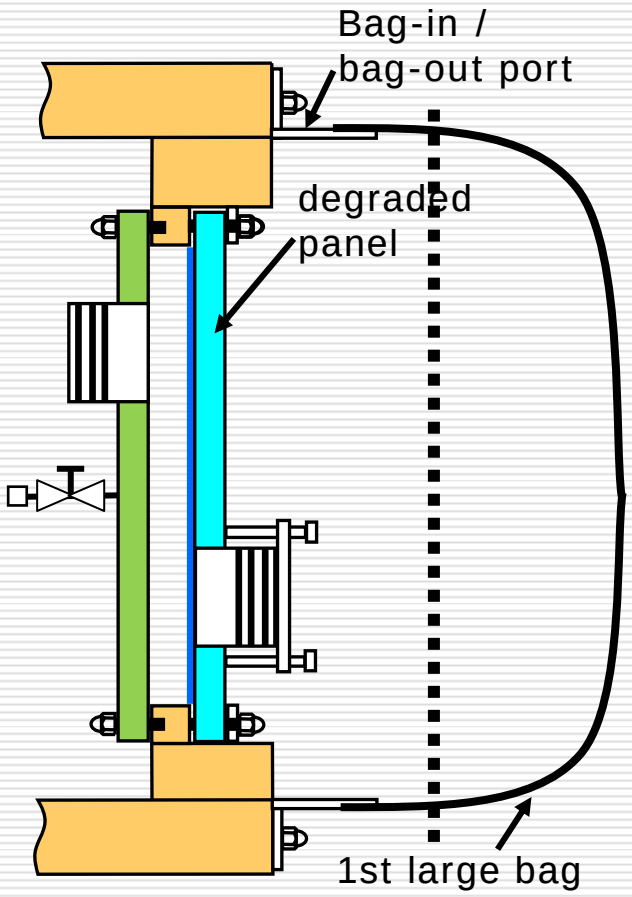
Developed replacement technique

Developed replacement process

1. Decontamination of the degraded panel
2. Attachment of the airtight panel and airtightness test
3. Replacement of the acrylic panels using bag-in /bag-out method
4. Airtightness test using the checking panel

Developed replacement technique

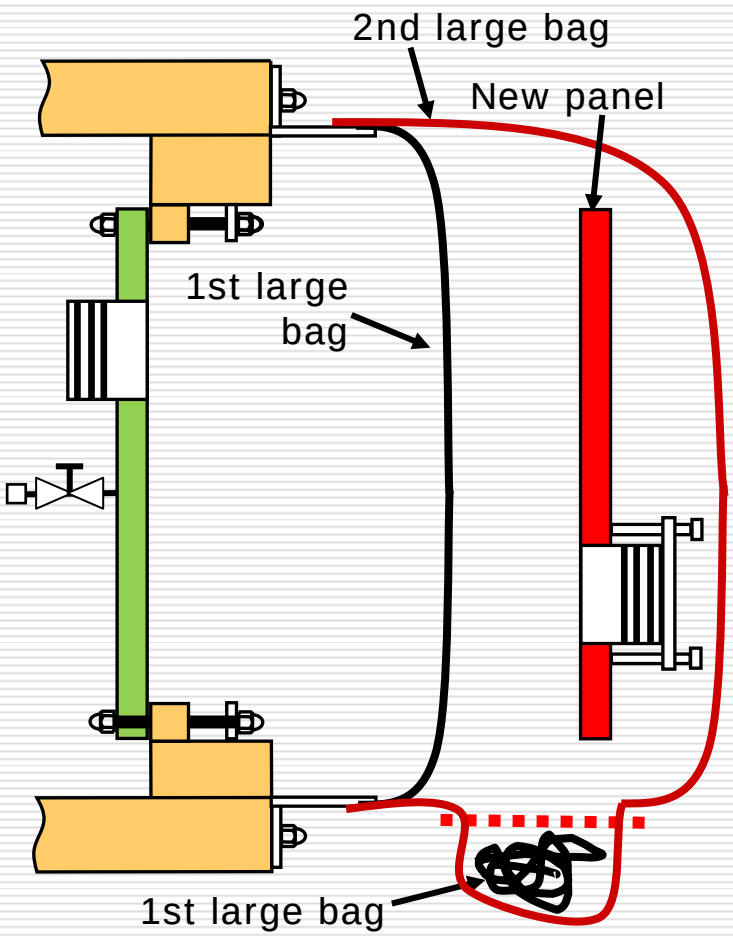
3.Replacement of the acrylic panels(1/2)



1. Bag-in / bag-out port was screwed on the outside of the glove box.
2. The degraded panel was covered with the 1st bag.
3. The degraded panel was removed from the glove box.
4. The 1st large bag containing the degraded panel was sealed and separated from the glove box.

Developed replacement technique

3.Replacement of the acrylic panels(2/2)



Outside of glove box

1. The 2nd large bag containing the new panel was set over the rest of the 1st bag.
2. The rest of the 1st bag was removed, the 1st bag was sealed in the 2nd bag.
3. The new panel was screwed on the glove box.
4. The 2nd large bag and airtight panel were removed from the bag-in /bag-out port.

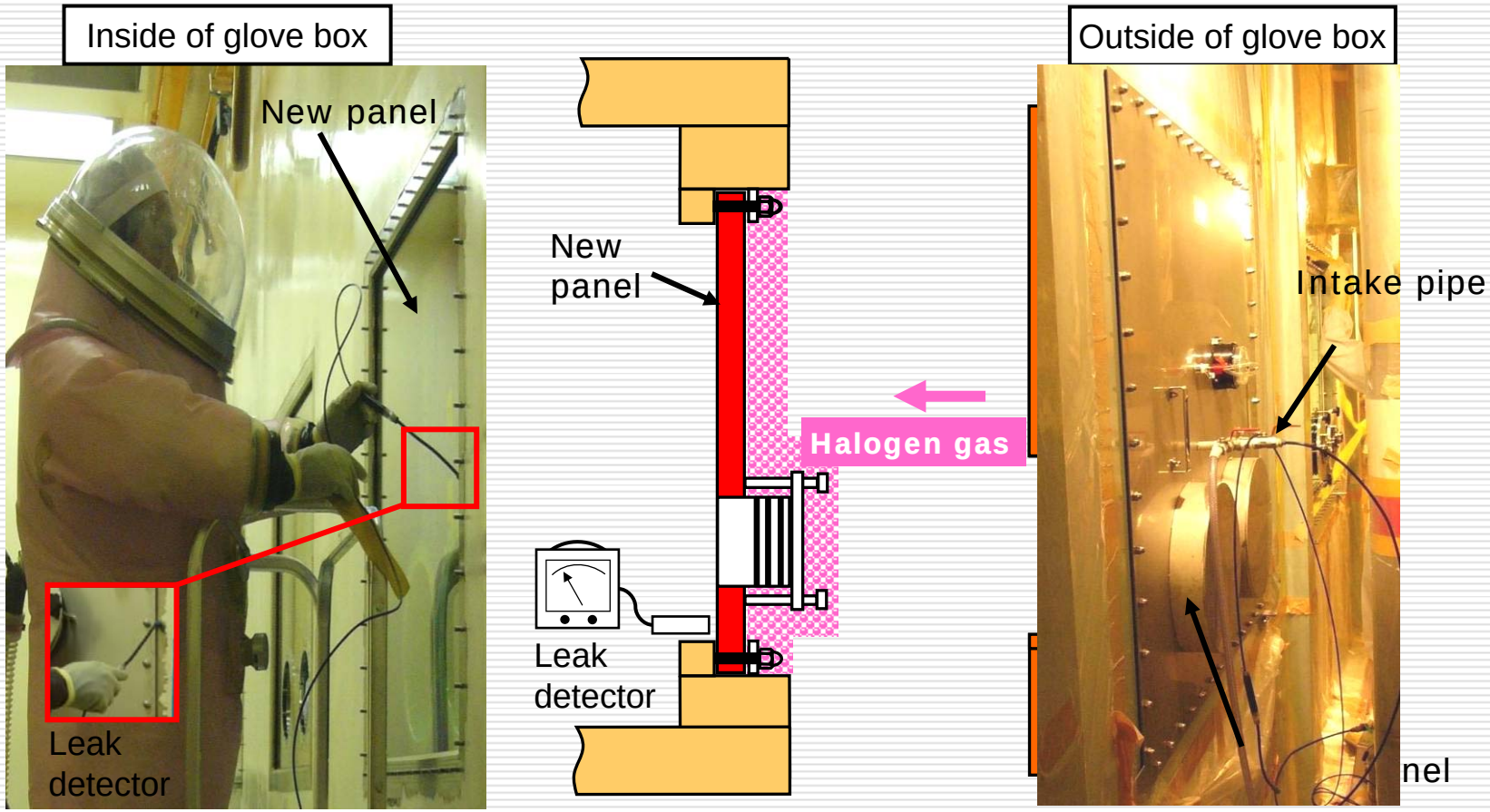
Developed replacement technique

Developed replacement process

1. Decontamination of the degraded panel
2. Attached on the airtight panel and airtightness test
3. Replacement of the acrylic panels using bag-in /bag-out method
4. Airtightness test using the checking panel

Developed replacement technique

4.Airtightness test using airtight panel



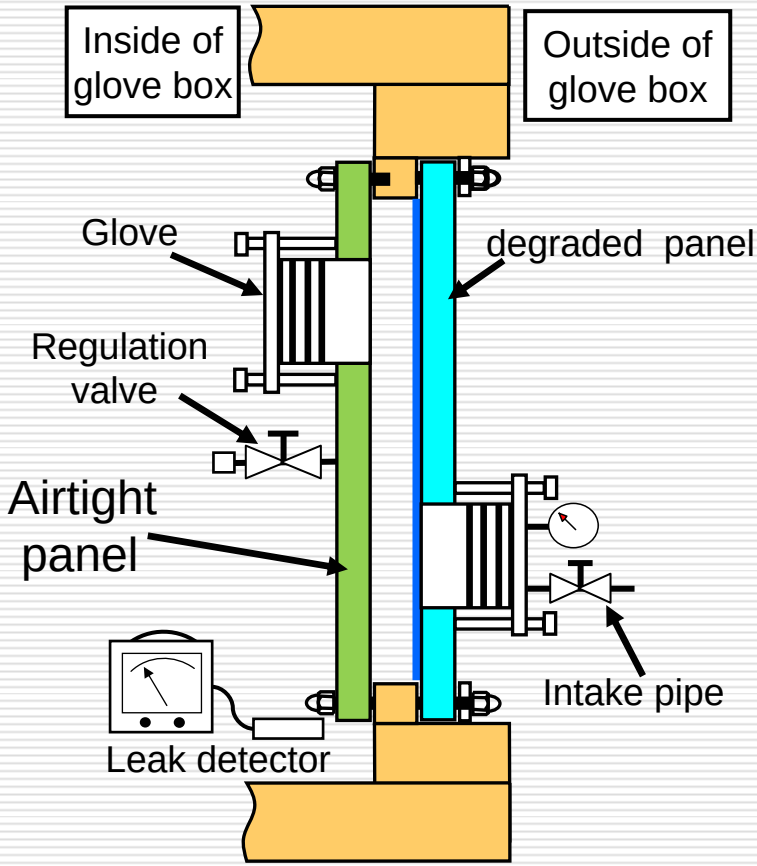
Developed devices(1/3)

Airtight panel

Keeping negative pressure of the inside of glove box

1. Regulation valve of negative pressure
   controls negative pressure for to prevent pressure rise between the aging panel and the airtight panel .

2. Two gloves
   help to remove aging panel by pushing from inside of the glove box.



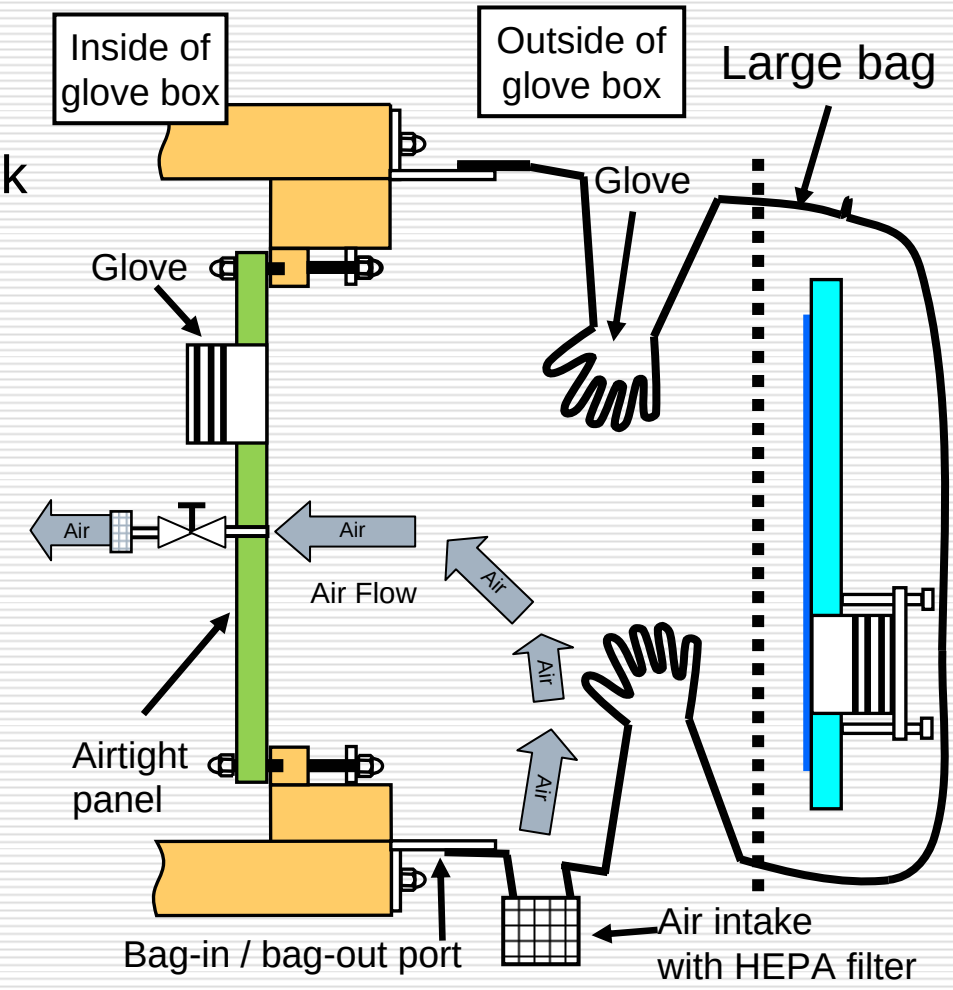
Developed devices(2/3)

The large bag

Covered over the acrylic panel
Avoidance of contamination risk

1. Air intake with HEPA filter
   is used to make air flow.
   Air flow prevents inside of the bag from being contamination.
   and keep the workability.

2. Two gloves
   handle the acrylic.



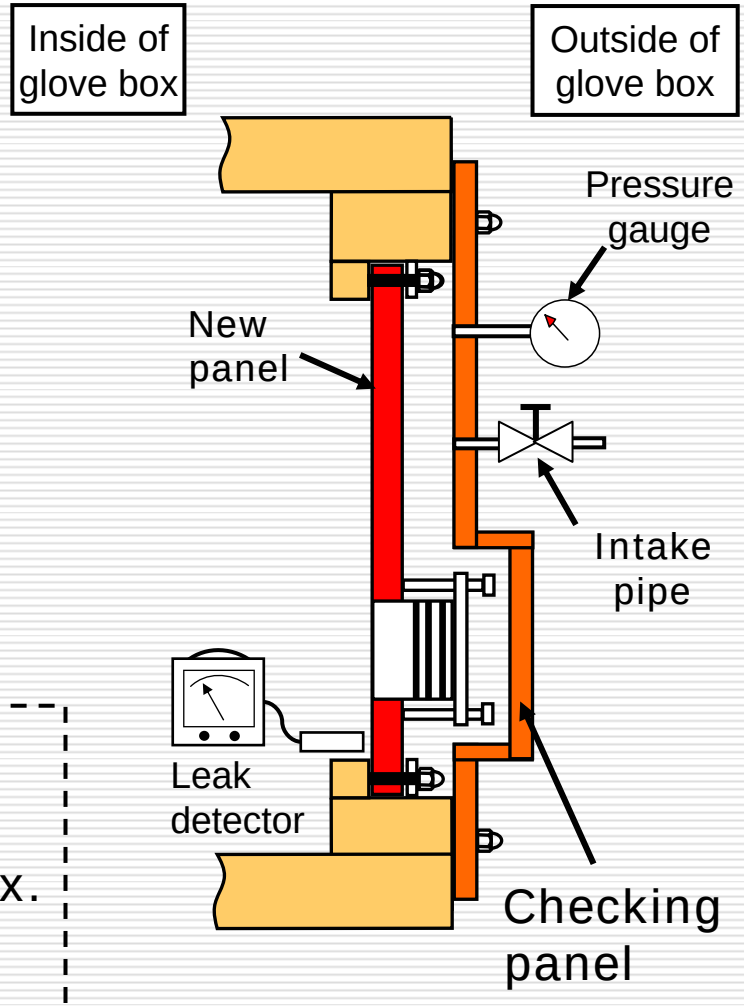
Developed devices(3/3)

Checking panel

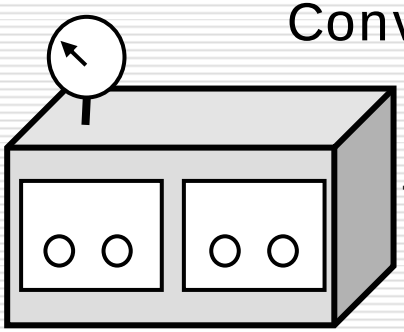
Easy airtightness test

Simply and surefire confirmation test

1. Intake pipe for halogen gas
   is used to inject halogen gas.
2. Pressure gauge
   confirmed halogen gas pressure between new panel and checking panel .



Conventional method



has been performed for the whole of the glove box. This method can not find the leak panel.

Summary

- ✓ New replacement technique was developed and performed.
  - The time of ALS work is reduced by developed devices.
  - Three degraded panels of the MT box were replaced using developed replacement technique.
  - The working time of replacement was about 20days.
  - Contamination of radionuclide around the working area was not occurred.
- ✓ The person-day of replacement is less than 1/5 of a conventional technique.

The developed technique is safer and more economical than the conventional one.

Thank you for your attention

Comparison of the person-day of replacement

Developed technique: average 7 person / day
Conventional technique: average 13 person / day

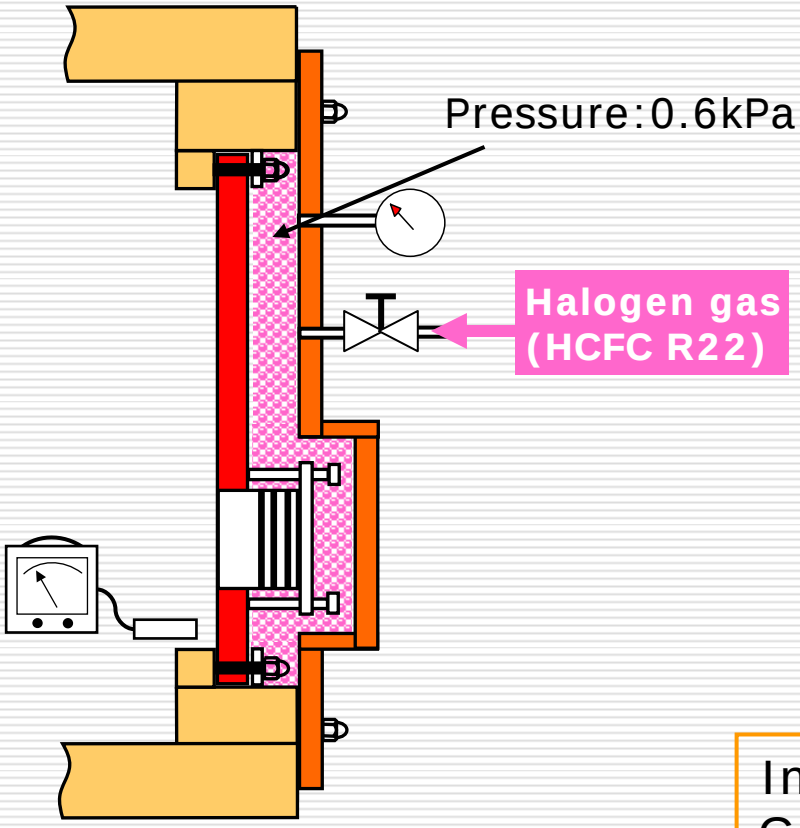
	Conventional technique (person-day)	Development technique (person-day)
Decontamination	390	35
Installation of isolation tent	130	-
Attached airtight panel	-	38.5
Replacement of panels	39	38.5
Airtight test	26	14
Cleanup of working area	65	14
Uninstallation of isolation tent	130	-
Total	760	140

The working time

Developed technique: average 7 person / day
Conventional technique: average 13 person / day

	Conventional technique	Development technique
Decontamination	30	5
Installation of isolation tent	10	-
Attached airtight panel	-	5.5
Replacement of panels	3	5.5
Airtight test	2	2
Cleanup of working area	5	2
Uninstallation of isolation tent	10	-
Total	60	20

Halogen leak test method



Testing process

1.Halogen gas is injected into the test area. And test area is pressurized by halogen gas. Gas pressure is 0.6kPa

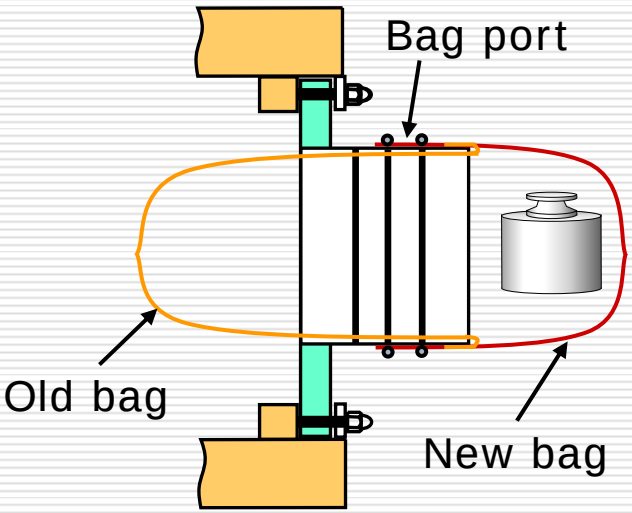
2.Gas pressure is maintained 30 minute.

3.Leak point is searched using halogen leak detector.

Injected gas: HFC R22 (replacing halon)
Gas pressure: 0.6kPa
Criterion of leakage: 1×10^{-6} Pa·m^3/s

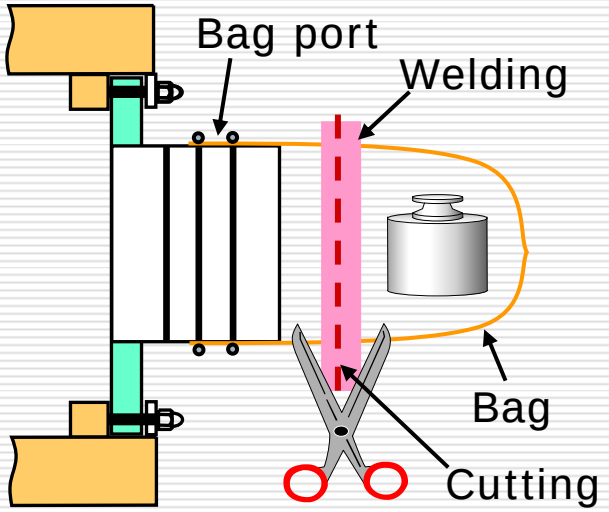
Bag-in / bag-out method

Bag-in



1. New bag containing objects are set over the old bag.
2. Old bag is removed and objects are into the glove box.

Bag-out



1. Objects are set in the bag from the glove box.
2. The bag containing objects is sealed by in-pulse welding machine.
3. The center of welding line is cut using scissors.