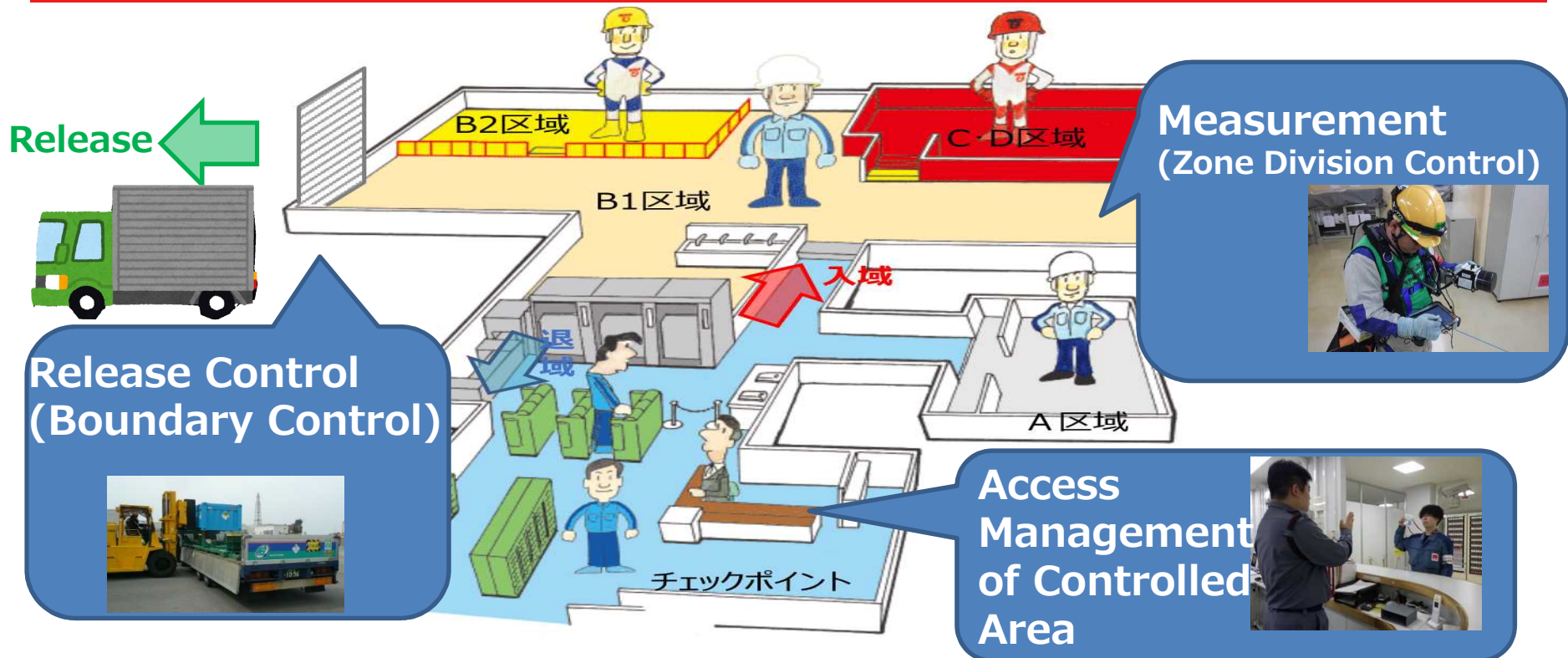# Improvement of radiation control operation

TEPCO

Radiation Control Group
Kashiwazaki Kariwa
Nuclear Power Station

1．Duties of Radiation Control Departmnt

Release

Release Control (Boundary Control)

Measurement (Zone Division Control)

Access Management of Controlled Area

In radiation control operations ,most of the work processes have been carried out manually ,which has resulted in the following types of errors had occurred in the past:

Misread, Transcription error, Misjudgment, Collation error

"Eliminate human intervention as much as possible"

Automate processes to improve safety, quality, and operational efficiency

TEPCO

2．Improvements to radiation control operation

Improvement Project		Improvement measures
Measurement (Zone Division Control) ⇒**Regular dose rate measurment**	On-site measurements are **recorded by hand**	**Increased efficiency through automatic measurement capture** **"PC software development"**
Release Control (Boundary Control) ⇒**Release of Articles**	**Measurement, recording, and judgment are all done by humans**	**Improving quality through automatic measurement capture and automatic judgment** **"Development and production of measuring jigs"**
	Measuring a large amount of scaffolding material **requires manpower and time**	**Increased efficiency through the use of scaffolding material measuring jigs** **"Development and production of measuring jigs"**
Access Management of Controlled Area ⇒**Verification** ⇒**Monitoring** ⇒**Key lending Management**	Due to the large number of identity checks, **incorrect ID cards and absensing personal dosimeters are overlooked** during verification	**Improving quality and efficiency of identity verification** **"Introducing face recognition devices"**
		Improving quality of passive personal dosimeter possession confirmation **"Introducing AI"**
	There are few people accessing the controlled area	**Labor saving for monitoring operations** **"Reconstruction of the monitoring system "** **"Iintroduction of a centralized monitoring system"**
	The procedures are complicated and there is **a risk of lending out the wrong** key.Also, there ae many things to check, which **takes time.**	**Improving the quality and efficiency of key lending operations(under improvement)** **"Introduction of unmanned key lending equipment"**

TEPCO

3．Measurement(Zone Division Control)
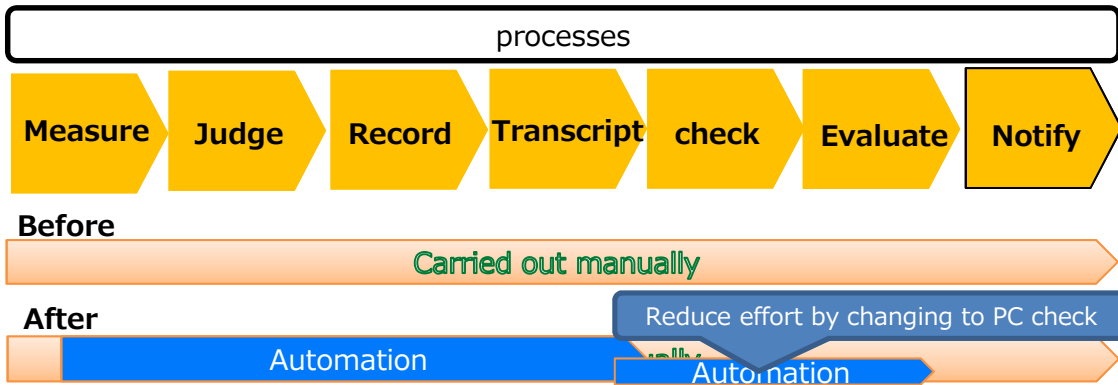
Improvement of regular dose rate mesurment

processes

Measure → Judge → Record → Transcript → check → Evaluate → Notify

Before
Carried out manually

After
Automation

Reduce effort by changing to PC check

Automation

Image of tablet

× ③<0.001
②<0.001 × ④<0.001 ×
⑧<0.001 × ①<0.001 × ⑨<0.001 ×
⑦<0.0 ⑤<0.001

AD_Dosemeter 1.0 測定用Window
設定値
レンジ 0.003
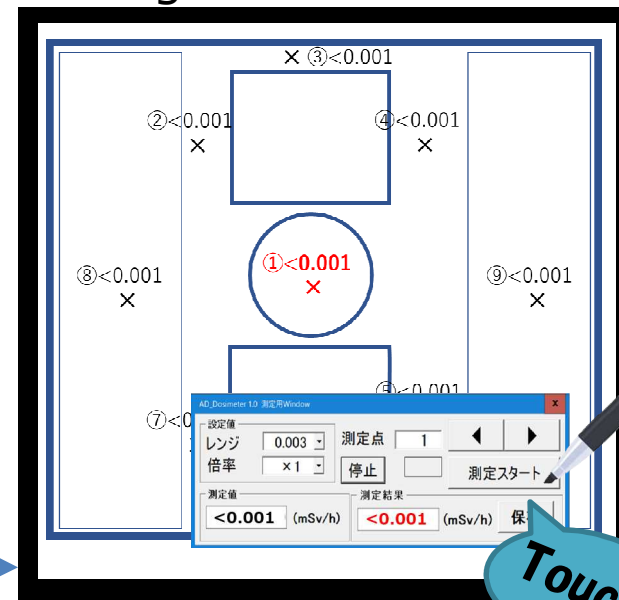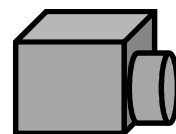倍率 ×1
測定点 1
停止
測定スタート
測定値 <0.001 (mSv/h)
測定結果 <0.001 (mSv/h) 保

Touch

Measuring instrument

Wired connection
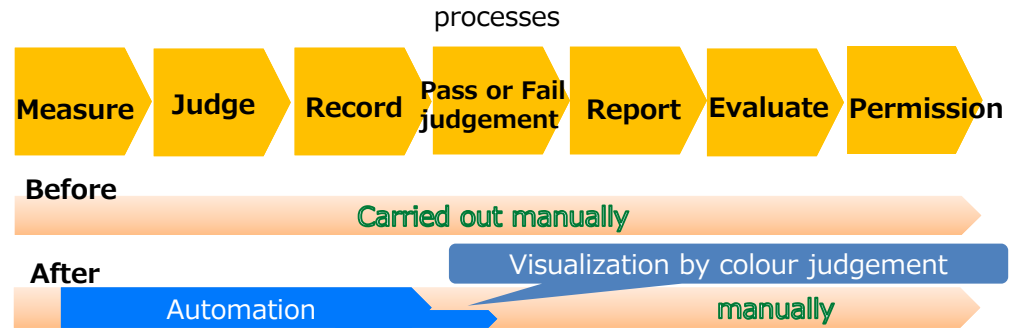
Measured value is automatically recorded

「**Misread**」、「**Misjudgement**」
「**Transcription error**」
Succceeded in eliminating errors!!
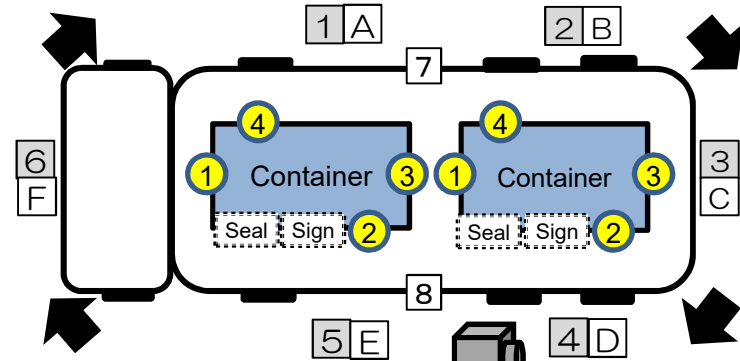
TEPCO

4-1．Release Control(Boundary Control)

Improving the efficiency of drum carry-out measurement

・Simultaneous measurement
・Appearance inspection and unsealing are carried out during measurement
・Wirelessly link the measuring instrument and the computer
・**Automatic creation of records and automatic judgement of values**

processes

| Measure | Judge | Record | Pass or Fail judgement | Report | Evaluate | Permission |

Before — Carried out manually

After — Automation / Visualization by colour judgement / manually

Self-made jig

Vehicle measurement points（14points）

☐ Wireless measuring instrumentⒶ:at 1m,lower part
☐ Wireless measuring instrumentⒷ:Surface

Eliminate mistakes, Reduce working time,
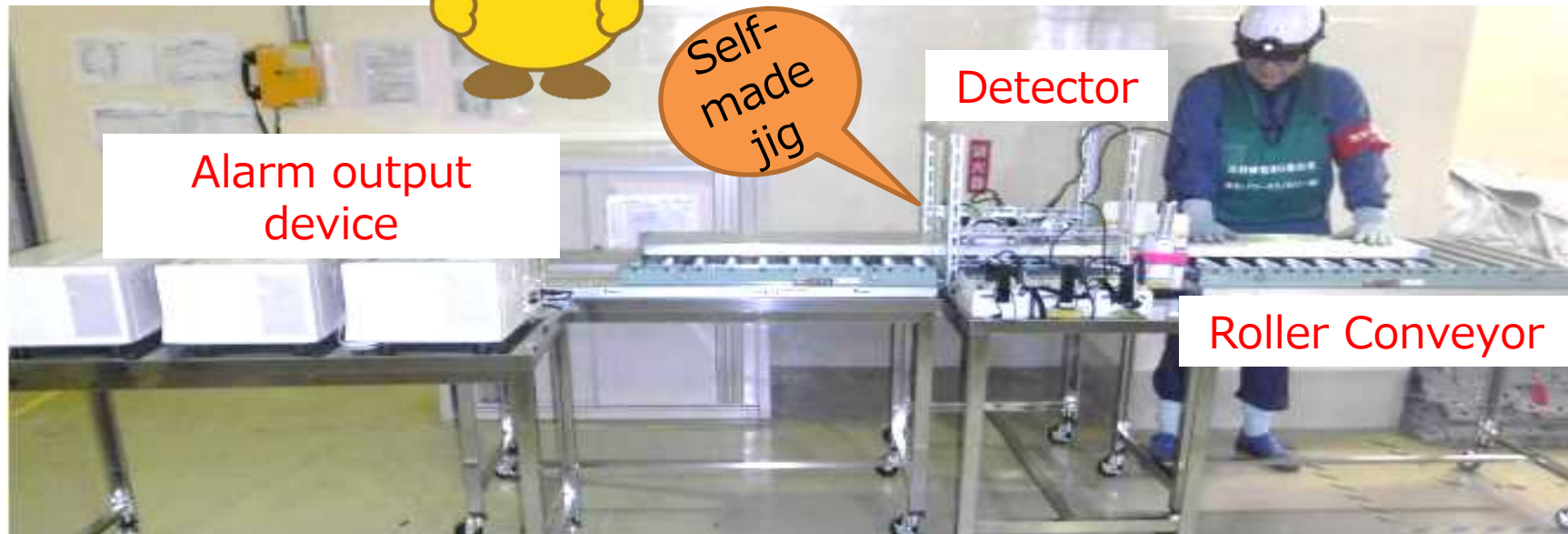Realization of single-person work!

Wireless link
Automatic creation
Record

TEPCO

4-2. Release Control(Boundary Control)

Increase the efficiency of scaffolding material measurement

Before

After

We succeeded in reducing the "personnel" and "time" related to the measurement of scaffolding materials!
○Metre: It's now possible to **work alone**
○Time: Reduce to **1/4**

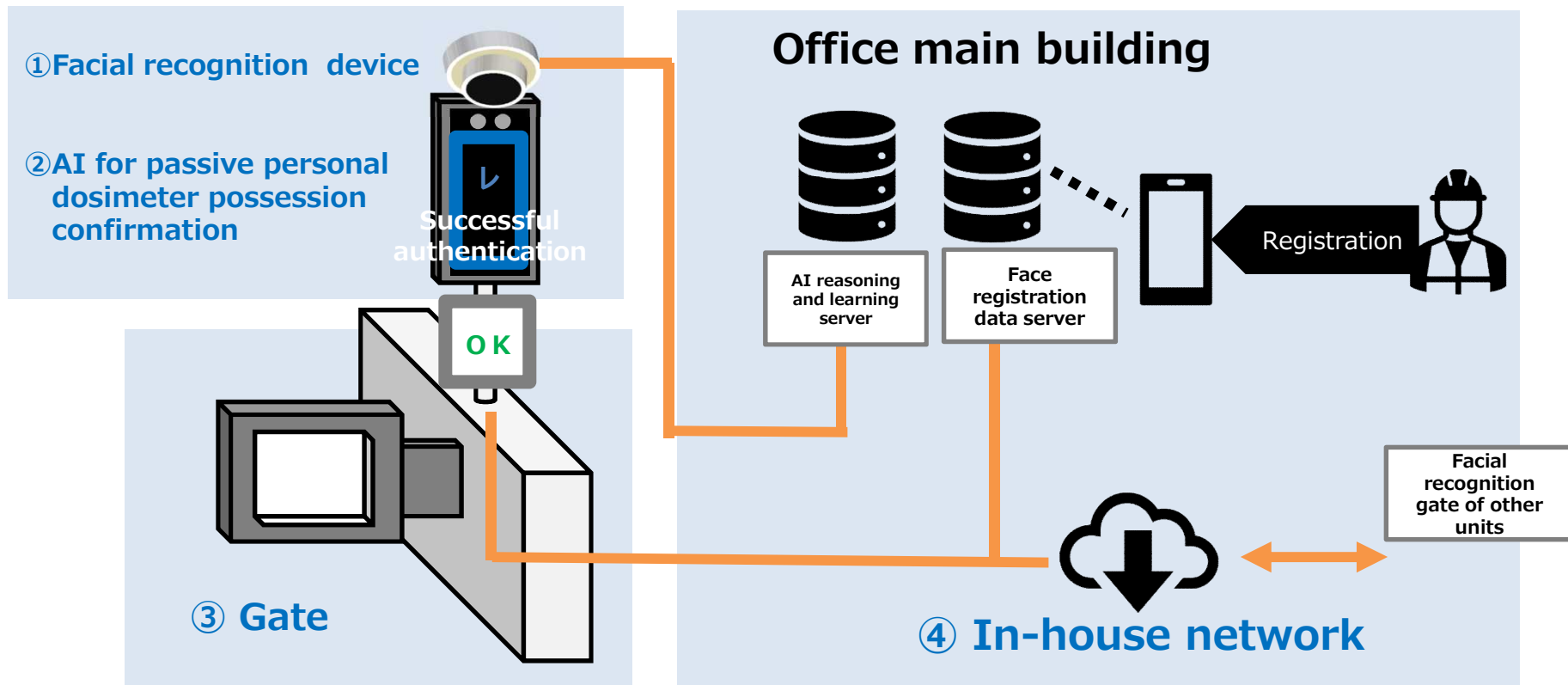Measuring scaffolding materials has become easier.

Self-made jig

Detector

Alarm output device

Roller Conveyor

TEPCO

5-1-1.Access Management of Controlled Area

We have developed a new "face recognition gate" by integrating four systems:
① Facial recognition device ② AI for passive personal dosimeter possession ③Gate ④ In-house network

①Facial recognition device

②AI for passive personal dosimeter possession confirmation

Successful authentication

OK

③ Gate

Office main building

AI reasoning and learning server

Face registration data server

Registration

Facial recognition gate of other units

④ In-house network

"Human error" and "human burden" were eliminated and the quality was improved.

TEPCO

5-1-2. Access Management of Controlled Area

Improvement of "Confirmation of personal identity of people entering the control area" and "Confirmation of possession of a personal dosimeter"
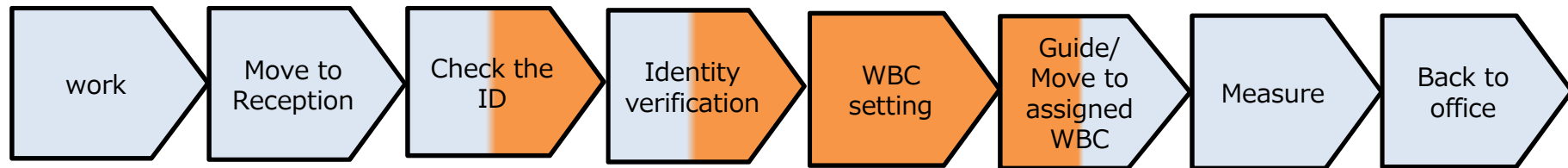
Before

After

AI

Facial recognition device

TEPCO

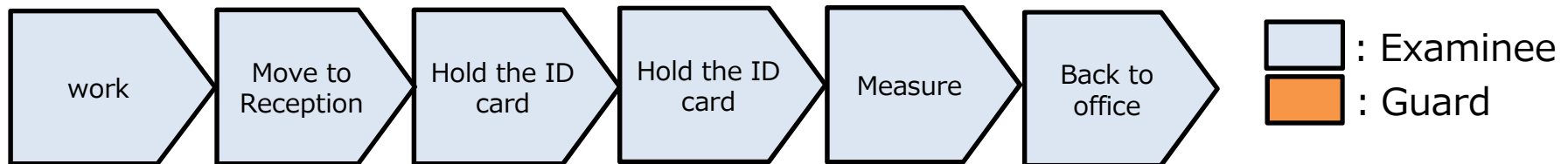# (Reference)Introduction of facial recognition device to the WBC

The facial recognition device is also introduced into the WBC(Whole Body Counter) and used to verify the identity of the person being measured.

Before

| work | Move to Reception | Check the ID | Identity verification | WBC setting | Guide/ Move to assigned WBC | Measure | Back to office |

As a measure to prevent spoofing, the work has increased by adding monitors and checking.

After

| work | Move to Reception | Hold the ID card | Hold the ID card | Measure | Back to office |

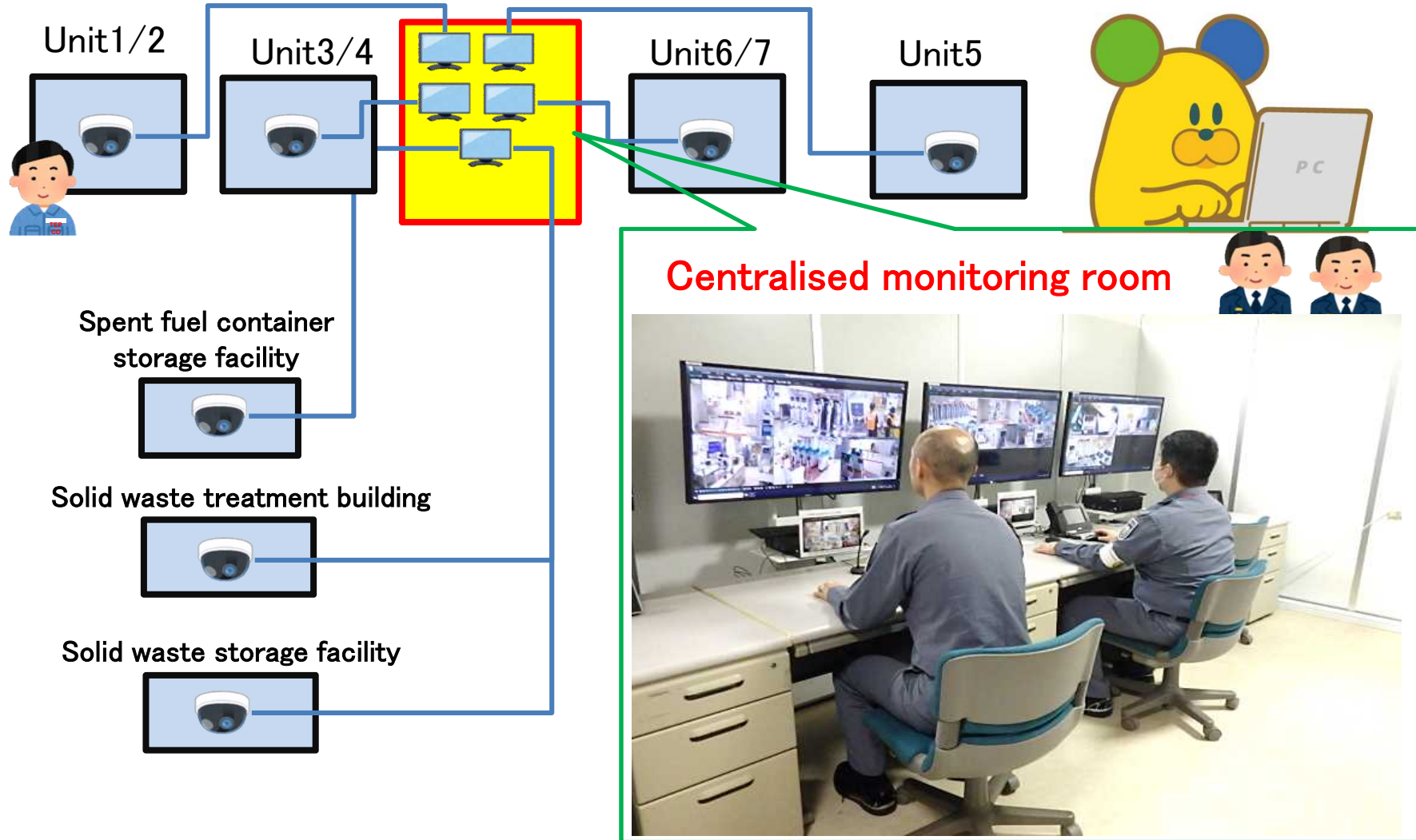☐ : Examinee
☐ : Guard

*Mechanism
The WBC examinee does facial recognition while sitting, and the measurement stops when he stands during the measurement or when someone else tries to enter.

With the installation of a facial recognition device, there is no need for checks by guards, and workers themselves can be inspected.

TEPCO

Improvement of night boundary monitoring work: Centralisation of boundary monitoring

Unit1/2　　Unit3/4　　　　　　　Unit6/7　　Unit5

Spent fuel container storage facility

Solid waste treatment building

Solid waste storage facility
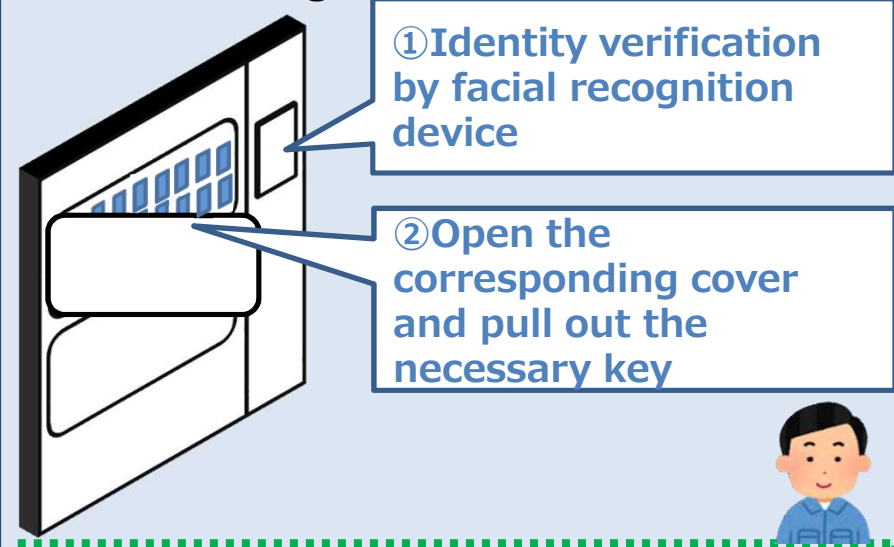
Centralised monitoring room

TEPCO

Improvement of key lending work （On the way to improve）

In conjunction with the facial recognition system introduced in the "Improvement of personal identification", we will tighten identity verification and automate key lending.
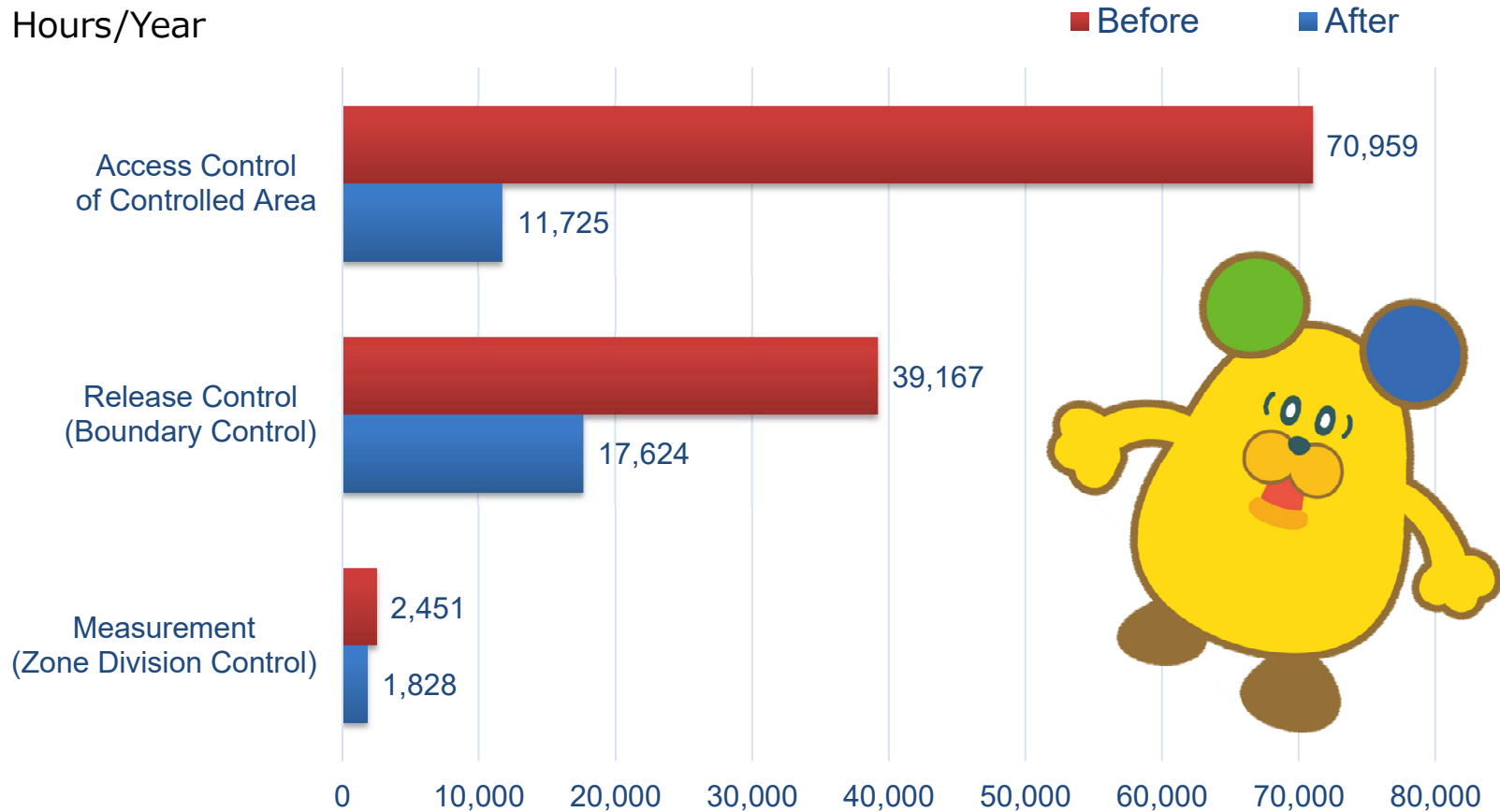
Facial recognition system

PC for management（Biostar2）

Facial recognition device（FacestationF2）

AC100V AC100V

Improving of key lending work

2C

V

AC100V

Security gate

wiegand

Facial recognition device（FacestationF2）

AC100V

The image of key lending

①Identity verification by facial recognition device

②Open the corresponding cover and pull out the necessary key

（Point)
- Since it is based on lending only to the radiation managers of the cooperating company, identity verification is required.
- Because there is a risk of re-lending the ID card, a stricter authentication method with "ID card" + "face recognition" has been adopted.

TEPCO

Hours/Year

Before **After**

Category	Before	After
Access Control of Controlled Area	70,959	11,725
Release Control (Boundary Control)	39,167	17,624
Measurement (Zone Division Control)	2,451	1,828

(x-axis: 0, 10,000, 20,000, 30,000, 40,000, 50,000, 60,000, 70,000, 80,000)

By automating the work process, we improved quality and efficiency, and realized a reduction in working time!!

Thank you for your attention.

TEPCO