

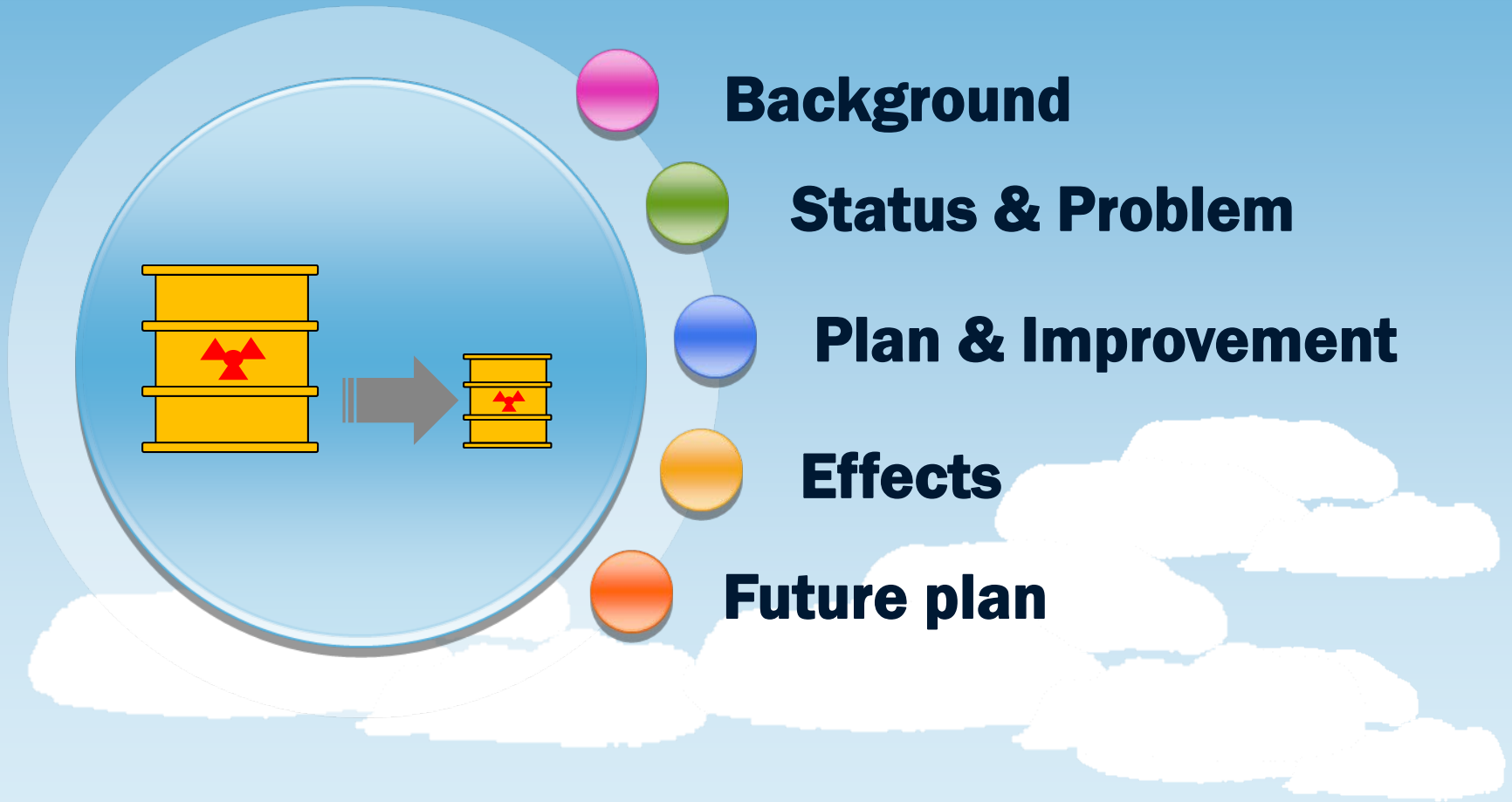


Evolution of radioactive waste management

Yonggwang NPP Unit 5&6



Contents



Background

Status & Problem

Plan & Improvement

Effects

Future plan



Background

● In case of radiation exposure management

- ▶ Disposal Cost : about \$8,000 / drum
- ▶ 5,000 drum /yr, company (2009)

● Enhanced management of Radioactive wastes

- ▶ Investigation factor and patterns from workplace generation of radwaste to drumming

Before | **improve**

collection
wastes
and drumming



Every step intervention

Waste **classification** (work
place)
Segregation and Collection
(contaminated/clean)

Need for
analysis
system



Background

- **Radioactive Waste Management has been 2'nd priority**
 - ▶ Radiation exposure management in NPPs
 - ALARA committee & peer group
 - Advanced Equipments and techniques (CCTV, Real-time systems, zinc injection, Ultra sonic cleaning, etc)
 - Extensive Data Bases and servers for exposure reduction
 - Collective dose at Yonggwang : 0.29man-Sv/ unit (2009)
 - world average in light water nuclear reactors : 0.85man-Sv/unit-yr
 - ▶ **Just to begin to enhance the radioactive waste management**
 - no systematic data base



Status & Problem

- After works, Wastes was mixed and discarded regardless of contamination

- Waste without cross contamination
- Increased radwastes volume

- Unregistered wastes

- No guard to monitor and classify
 - radwastes increase , without Feedback

Before : Workers freely discarded waste into bin installed registered area



< Contaminated / clean >

~ 2007 2008 ~



<Radwastes type : paper, vinyl, iron etc>



Status & Problem

- All Drums even though partial contaminated
 - Pay no efforts and interests in reduction
 - Recycle possibility, partial decontamination or removal
- Without Characterization and volume reduction
 - Poor system on Classification and characterization
 - Without Adequate action to reduce (wash, decontamination, delay & decay, others)
- Poor management of Liquid radwastes
 - Uncontaminated Clean water(2ry) in RCA usually entered in Liquid radwaste disposal System (Closed Cooling Water, Chilled Water)
 - LRS ion Exchange resin was saturated with high chemical concentration and treated with radwaste
 - Temporary drain water(Boric Acid water) mixed with foreign materials accelerated resin saturation
 - Finally, generating radwastes by replacing Charcoal, Resin, MF/RO in LRDPS



Plan for Improvement

Wastes collection station (PAB 77')

- Take wastes collection bag
- Register Name in charge of wastes

Reducing action before work

- Estimate the quantity of waste
- Review the activity of workers
- Restrict carrying unnecessary materials in RCA at entrance

Real time Measuring & Recording (PAB 77')

- Measuring, Classifying, Collecting & Recording
 - ⇒ by waste types
 - ⇒ by related works
 - ⇒ contaminated or clean
 - ⇒ daily & cumulative

monitoring shift for wastes

- regular check for work place
- classify & help to treat wastes (contaminated / clean)





Improvement

- Development & operation of Real-time management program for Radwastes

Field Data

Program

collection Station

- Location : PAB 77'
- Real time classifying & Summarizing



Data Base

- Radwaste types D/B
- Related works D/B
- contaminated/clean D/B
- daily / cumulative D/B

(Daily General Status Report)

- daily general status**
Works / radwaste types / contaminated or clean
- cumulative Trend**
Main Works / Radwaste types
Daily / cumulative
- analysis**
investigating & recording
⇒ Main generation source
⇒ excessive/unnecessary

Radwastes reduction

Feedback (analysis & action)



Improvement

Real-time management program (DATA BASE)

■ The 6th Outage for Unit 6 — Status of radwastes followe

schedule	date
division	works group
Rx decomposition & Re-assembly	Auxiliary Decomposition
	Rx Decomposition
	Rx head Pulling up / settle down
	UGS Pulling up / settle down
	CSB Pulling up / settle down
	stud hole Inspection / repair
	stud bolt repair
	HJTC Decomposition / Re-assembly
	Rx Re-assembly
	Auxiliary Re-assembly
	Flange Inspection
	prevention of debris & particle

by works (kg)					
18th	19th	20th	21th	22th	23th
D+1	D+2	D+3	D+4	D+5	D+6
	6.1	1.14	4.7	4.7	4.62
		3.1	13.12	7.84	5.4
		6.98	5.74		
		2.46			
		3.58			
		5.32			

8.93	0.54	23.72	14.06	9.6	9.76
5.36	12.84	5.6			
42.67	57.01	70.62	107.56	109.67	226.12
Raw Data(person&work)			Raw Data(Deposit)		

daily cumulative	0	8.5	13.24	0	4.8	2.4	13.52	6.28	0.7	7.6	10.91	8.84	7.88	11.26	13.6
Refueling Machine's Improvement work			11.34	6.54								7.66			11.91
total SUM	12.22	25.57	63.9	61.5	25.98	35.5	36.84	45.91	11.48	44.41	33.92	53.81	40.36	42.47	

General Status / Graph Daily&Cumulative / Cumulative(Works) / Daily(works) / Cumulative Graph(Types) / Cumulative Graph(works)



Real-time management program (DATA BASE)

Waste collection station RAW DATA

Waste collection station RAW DATA (Person & Works)

[illegible]



Improvement

- Real-time management program (Daily general report – *1page*)

► Daily work status

D+24

No.	Work	Radwastes		Note
		Type	weight(kg)	
1	V/V Warehouse Arrangement(PAB 77')	Paper, Vinyl, Iron, Rubber, Plastic	50.48	Paper(0.56), Vinyl(0.58), Iron(47.3), Rubber(1.68), Plastic(0.36)
2	In-Service Inspection (ISI)	Paper, Vinyl, Iron, Rubber, Plastic, Cloth, etc.	10.66	Paper(2.98), Vinyl(0.94), Iron(0.46), Rubber(0.52), Plastic(1.56), Cloth(2.74), Wood(1.46)
3	Plugging tool' s Removal & Decontamination	Paper, Vinyl, Rubber,	9.64	Paper(5.68), Vinyl(1.8), Rubber(2.16)
4	SG Drain Nozzle Equip. Decontamination	Paper, Iron, Rubber, Plastic, Cloth	9.5	Paper(7.06), Iron(1.42), Cloth(0.14), Rubber(0.84), Plastic(0.04),
5	Grapple processing	Paper, Vinyl, Rubber, Cloth	5.8	Paper(0.8), Vinyl(2.94), Rubber(0.98), Cloth(1.08)
6	RCB wastes Monitoring	Paper, Vinyl, Iron, Rubber, Plastic, Cloth,	3.66	Paper(3.0), Vinyl(0.08), Iron(0.06), Rubber(0.1), Plastic(0.28), Cloth(0.24)
7	essential chiller decomposition	Iron	3.46	Iron(3.46)

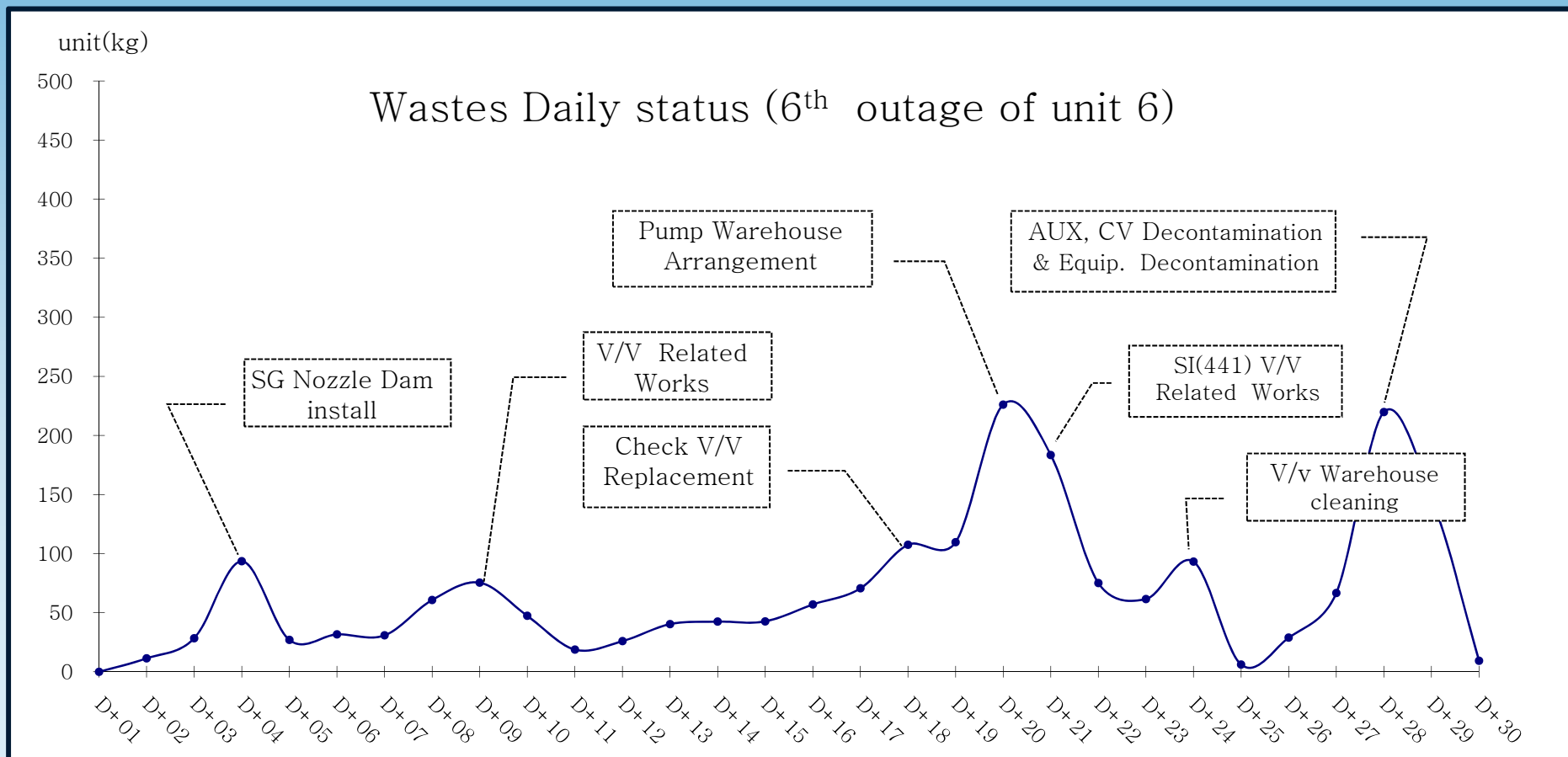


Improvement

Real-time management program (Daily general report – 2page)

► Daily Trend

D+30





Improvement

- Real-time management program (Daily general report – *3page*)

► Cumulative by works

D+24

Work		Daily	Cumulative	Work		Daily	Cumulative
Rx	Decomposition & assembly	0.00	141.30	Primary Pump	3.46	128.06	
	Inspection	0.00	21.60	Primary V/V	0.00	203.77	
	etc	0.00	6.08	ISI	10.66	38.50	
	Auxiliary Equip.	0.00	36.71	Radiation Safety Control	0.00	73.80	
Refueling		5.80	20.62	Decontamination & Wash	0.00	56.64	
S / G	Man-Way	0.00	7.02	Radwastes Treatment	3.66	14.34	
	Nozzle dam instal & removal	0.00	39.10	Instrument Equip. Work	0.00	16.60	
	U-Tube ECT	0.00	41.16	Etc. Works	50.48	262.69	
	Lancing/FOSAR	0.00	25.73	SAB Waste monitoring	0.00	64.14	
	U-Tube Plugging	9.64	9.64	RCB exit	0.00	101.65	
	Drain Nozzle Repair	9.50	55.70	Waste Monitoring	0.00	34.19	
RCP Decomposition & inspection		0.00	100.61	Improvement of Refueling Machine	0.00	61.25	
				SUM	93.20	1,560.90	



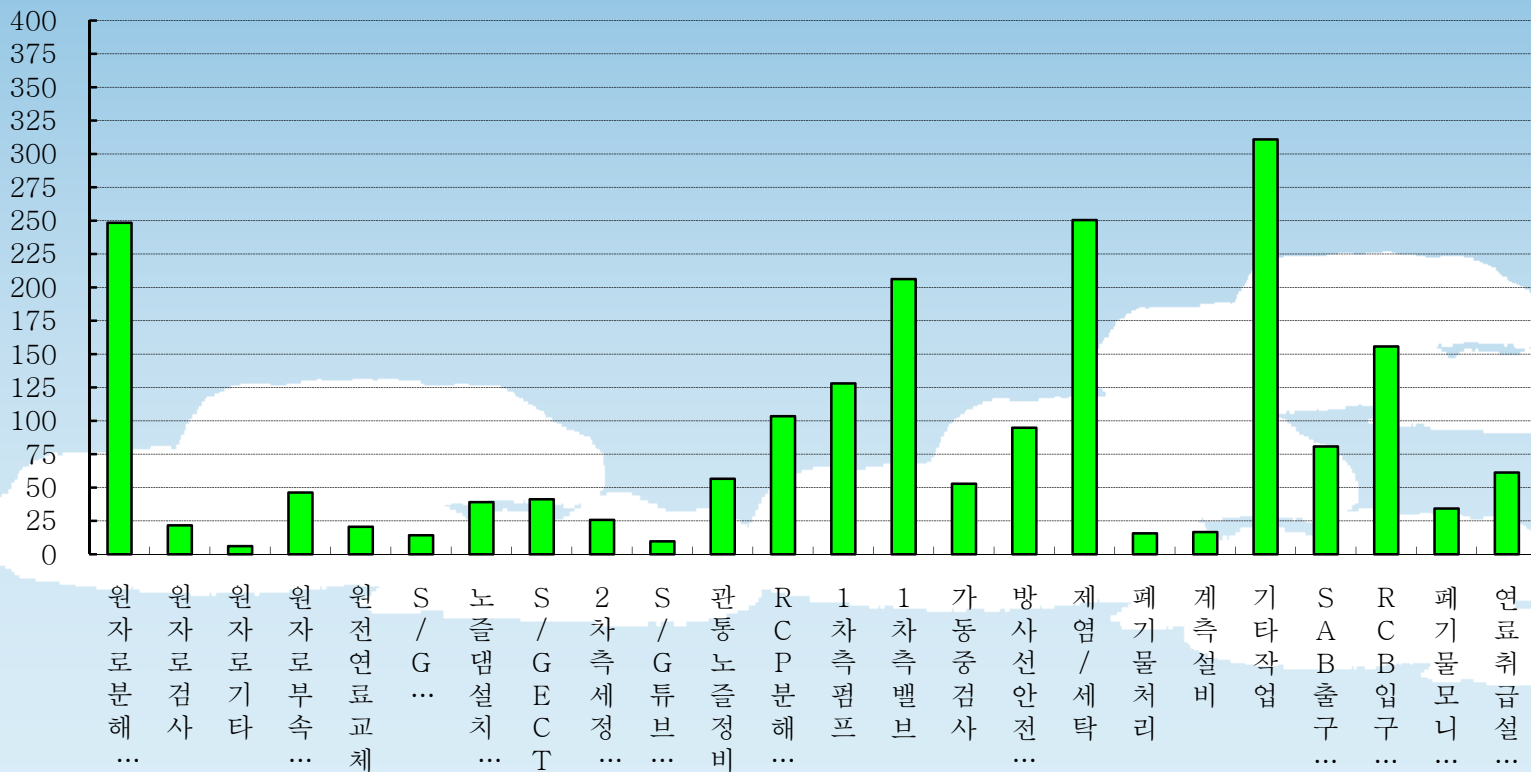
Improvement

Real-time management program (Daily general report – 3page)

Wastes Status by works (6th outage of Unit 6)

D+ 30

Wastes(kg)

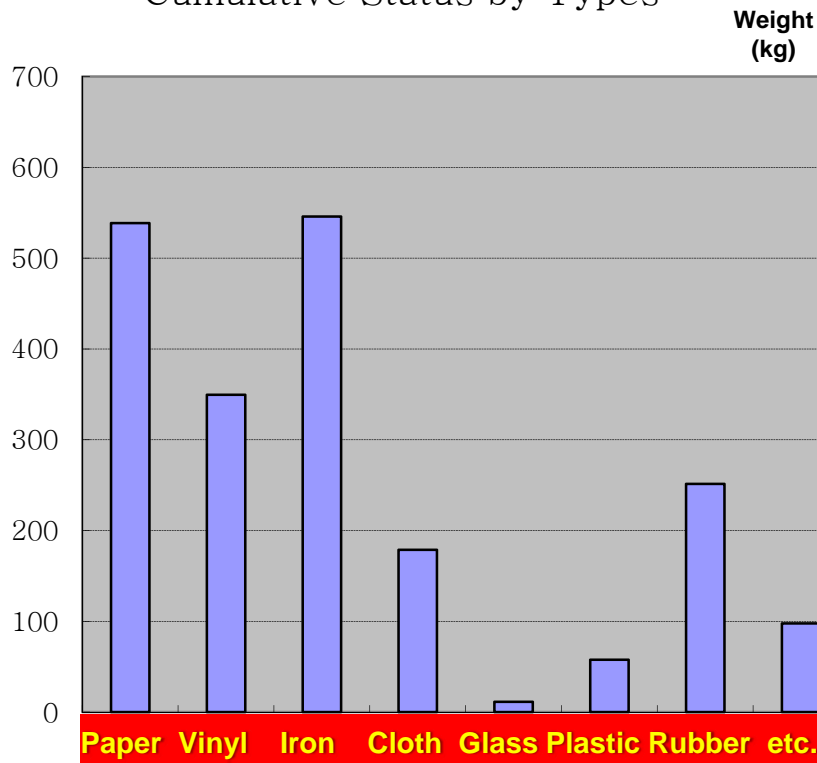




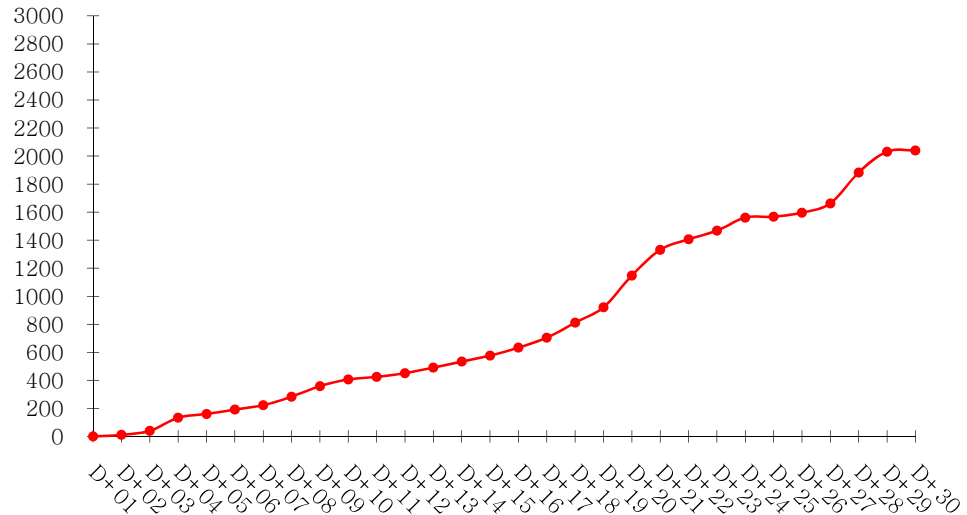
Improvement

- Real-time management program (Daily general report – 2,4page)

Cumulative Status by Types



단위(kg) Total cumulative Wastes (6th outage of unit 6)



Division	Paper	Vinyl	Iron	Cloth	Glass	Plastic	Rubber	etc	SUM
Daily	2.76	1.18	1.18	0.38	0.00	0.00	3.84	0.00	9.34
Cumul Ative	541.5	350.8	547	179.2	11.3	57.7	255.2	97.8	2,040



Improvement

Real-time management program (Daily general report – 4page)

► Daily Analysis & Feedback

D+24

No.	Analysis & Feedback	Remark
1	Iron From PAB 77' "A" KPS Valve Team Warehouse Cleaning - After Contamination Inspection, Moving Contaminated Iron to RWB Decay & Storage Area - Amount : Iron 47.3 kg	After Decontamination, Keeping in RWB Decay & Storage Area - long term Decay
2	Request related Worker to reduce Decontaminating Paper - SG Drain Nozzle & Plugging Equip. Decontamination works - Amount : Wet Paper 47.3 kg	Drying Wet Paper and Drumming Separating Reusable Paper
3	Forecasting for Warehouse Cleaning & arranging - KPS Warehouses, RCB Temporary Warehouse	Waste Monitoring
4	etc. - Wood : ISI (1.56 kg)	-



Main Examples - Real time management

CASE	Real time management	Remark
Separating as Clean waste	Separating in Working Area and waste collection station	166.35 kg as clean
Vinyl	Replace Vinyl with Washable Matts (fabric material)	-

Before(vinyl)



Improve (washable fabric matt)







Main Examples - Real time management

CASE	Real time management	Remark	
Iron from refueling Machine's Improvement	<ul style="list-style-type: none"> ALARA Meeting before work Sorting by contamination level Separating Reusable parts Decontamination and cutting 	before 6,016kg	After 616kg
		Clean 5,400kg	





Main Examples - Real time management

CASE	Real time management	Remark
cleaning Paper	Reuse as possible	-
Gloves, socks	Reuse as cleaning & water sucking materials	
Liquid Radwaste	Install Filter on floor drain - protecting foreign material in LRS	
	Separating Anticorrosive chemical water (CCW, Chiller)	-



Main Examples - Real time management

● Separating Anticorrosive chemical water(CCW, Chiller)

- ▶ Unnecessary for change of LRDPS Filling Material(Charcoal, Resin)
- ▶ To past, Usually changed during Outage (design performance : $1.85\text{E-}1\text{Bq/cc}$ above)

Outage	Change	LRDPS Filling Materials				Remark
		Charcoal (ℓ)	Resin (ℓ)	SUM (ℓ)	Drum [EA]	
6-3 th	'06.2 ~ 5	9,400	10,188	19,588	98	
5-4 th	'06.10 ~ '07. 1	4,800	10,300	15,100	76	Installation of MF/RO ('06.11)
6-4 th	'07.6 ~ 9	1,200	5,500	6,700	34	Separating RCS
5-5 th	'08.7	1,200	2,975	4,175	21	
5-6 th	'09.9 ~ 12	2,400	7,200	9,600	48	
6-6 th	-	-	-	-	-	Performance(After Outage) - Activity N/D



Effects

Real time Analysis

Prompt Feedback

Wastes Reduction

Before Improvement	After Improvement
No idea of generation Source & Person	<ul style="list-style-type: none">● Identifying of causes and Feedback● responsible management for generating person
Mixing and all dispose after works	<ul style="list-style-type: none">● Separating contaminated / uncontaminated● Adequate decontamination according to Radioactive characterization
Poor in objective management because of Data less	<ul style="list-style-type: none">● Objective management & ALARA for wastes
Without Pretreatment of Liquid radwastes	<ul style="list-style-type: none">● Separating Liquid radwaste (CCW, Chiller, etc)● Install filter on Floor Drain to prohibit foreign materials



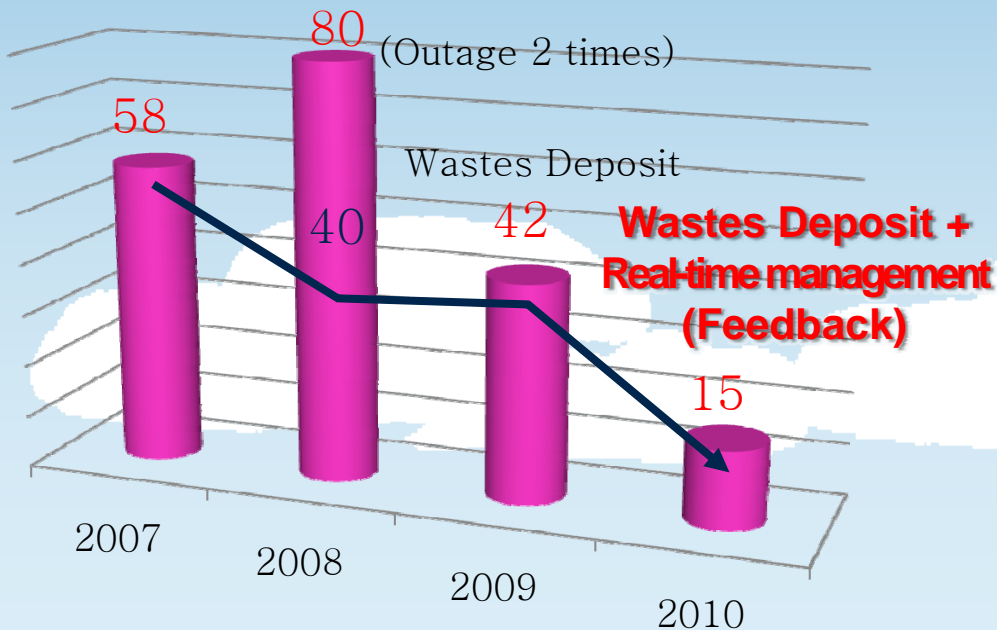
Effects



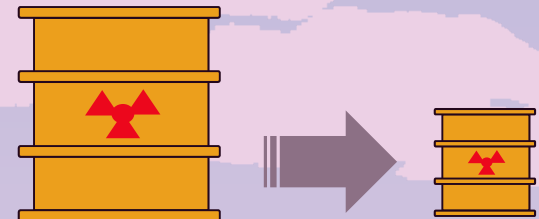
Waste Reduction by Real-time management program

Dry Active Waste (DAW Drum)	plan	Result	Reduction Rate
	38	15	61

Outage Radwaste Drum (Yearly)



- Reduction Rate Compared With Plan : 61%
- Reduction Rate Compared With Previous Year : 64%





Effects



Costs reduction

Division	Details	Cost Reduction
Reduced DAW Drum	Reduced amount × disposal costs = 23Drum × \$8,000 / drum	\$184,000
LRDPS Filling Material (Charcoal + Resin)	2009 Amount × disposal costs = 48Drum × \$8,000 / drum	\$ 384,000
SUM	\$568,000 (without any payment for program development)	



Future Plan

Improvement Of Main Radwastes Source

- ▶ packing Vinyl Wrap (Reuse or water soluble PVA type)
- ▶ Plastic Gloves (Mixed Type With Cotton and Rubber gloves)
- ▶ Decontamination Paper (Reuse plan is Under conderation)

Objective management and ALARA For Radwaste Reduction

Video Production to inform and educate Waste Reduction

- ▶ Period (Taking movie clips & photos) : 6th – unit 6

Program Upgrade for more convenience and practical use

- ▶ More effective Management of Radwaste
 - various and interactive Analysis & Diagnosis
 - Graphical User Interface
 - Management Of Drumming & radwaste Clearance
 - Related Informations (exposure dose, regional radiation Rate, etc)



Thank You

