

New Electronic Dosimetry System operating in OKG NPP

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Introduction

A new work dosimetry system was introduced at OKG NPP as a replacement of the old system

OKG plant,

- Oskarshamn 1 464 MWe / 1375 MWth**
- Oskarshamn 2 650 MWe / 1800 (2300) MWth**
- Oskarshamn 3 1450 MWe / 3900 MWth**



Material and method

- EDOS (Electronic Dose information System), a system developed from the last twenty five years of experience from the former DRD/ARBDOS (Direct Reading Dosimeter and Work Dose information System)
- Makes a complete system to meet the required demands and compilations derived from the dose limits given by the authority and constraints set up by OKG,
 - ACS (Access Control System)
 - ODU (OKG Operation and Maintenance system)
 - CDIS ((Swedish) Central Dose Information System)
 - LDIS (Local Dose Information System)
 - WBC (Whole Body Counting system)
 - ALLADIN (OKG archive & search engine)
 - PSCCM (Personal Surface Contamination Control Monitor)



Material and method

ACS, Access control system. From this system EDOS (Electronic Dose Information System) receive a database replica of all personal that are registered as an approved worker (category A or B) at the OKG site.

ACC, Access Card. Is used at initialisation of the EPD (Electronic Personal Dosimeter) to pick up the reference in the database replica to the person in matter.

ODU, Operational and Maintenance system. That is the OKG general planning tool for all setup of Work Orders (WO), Work Order Permit (WOP) and Radiation Work Permit (RWP). RWP is in Swedish named SKYD, and beside the Radiation Protection (RP) it includes Industrial Safety (IS) and Fire Protection (FP).



Material and method

The RWP include all planning concern collective work dose (budget), dose rate at workplace, number of workers, man hours, dose and dose rate limits to be set in the EPD. In case those figures are too high compared to personal available space with respect to OKG constraint or the legal limit, the alarm levels set in the EPD are modified with respect to fit this fact.

The alarm levels for a RWP can also manually be modified in EDOS by the RP staff. That's possible after a discussion with the head of RP/HP and in case decided to be modified also documented with reason for change and reference in ALLADIN (OKG Archive system).

All changes made to any data in EDOS are stored in a “change log” with reason for the change and in special cases also a reference of the documentation in ALLADIN.



Material and method

LDIS, Local Dosimetry Information System. LDIS keeps all information about personal TL-Dosimetry (TLD) and status of approved education and medical availability. It also is the receiver of complementary dose from the other Swedish NPPs (Forsmark, Ringhals and Barsebäck that's in decommission status).

The complementary dose, which is the “cover-up” dose for TLD (dose of records) during its measure and waiting for analysis time that in fact can be up to 45 days and some times more, is directly transferred to EDOS.

Since the complementary dose is measured by active dosimetry (EPD) it means that it requires the same quality assurance as TLD!



Material and method

CDIS, Swedish Central Dose Information System. Contains all employees in the Swedish NPP industry as well as external workers (including foreigners). This system is the reference for the workers dose of records and personal data it secures the dose information in LDIS as well as in EDOS.

From CDIS data is transferred to the National Dose Information system (NDIS).

Material and method

WBC, Whole Body Counting system. Determine committed effective dose $E(t)$ (and committed equivalent dose) from workers in case of intake of radioactive material by inhalation or oral intake.

It's a nuclide specific activity measuring system using three detectors covering Lungs, Gi-tract and Thyroid. It includes the IMBA (Internal Monitoring Bio Assay model). This program is based on the ICRP 66 compartment model to compute the committed effective dose.

Measured activity, the calculated intake activity and the related $E(t)$, as well as the equivalent organ doses are exported to EDOS where it is used to compute personal effective dose (E).



Material and method

ALLADIN, OKG Archive for all document handling. It contains a search engine and is accessed by EDOS through hyperlinks. Its use from EDOS point of view is to get easy access to documentation about EDOS application i.e. help files, instructions related to RP work, RP event documentation and RP reports about constraint exceed both planned and unplanned.

Material and method

PSCCM, Personal Surface Contamination Control Monitor.

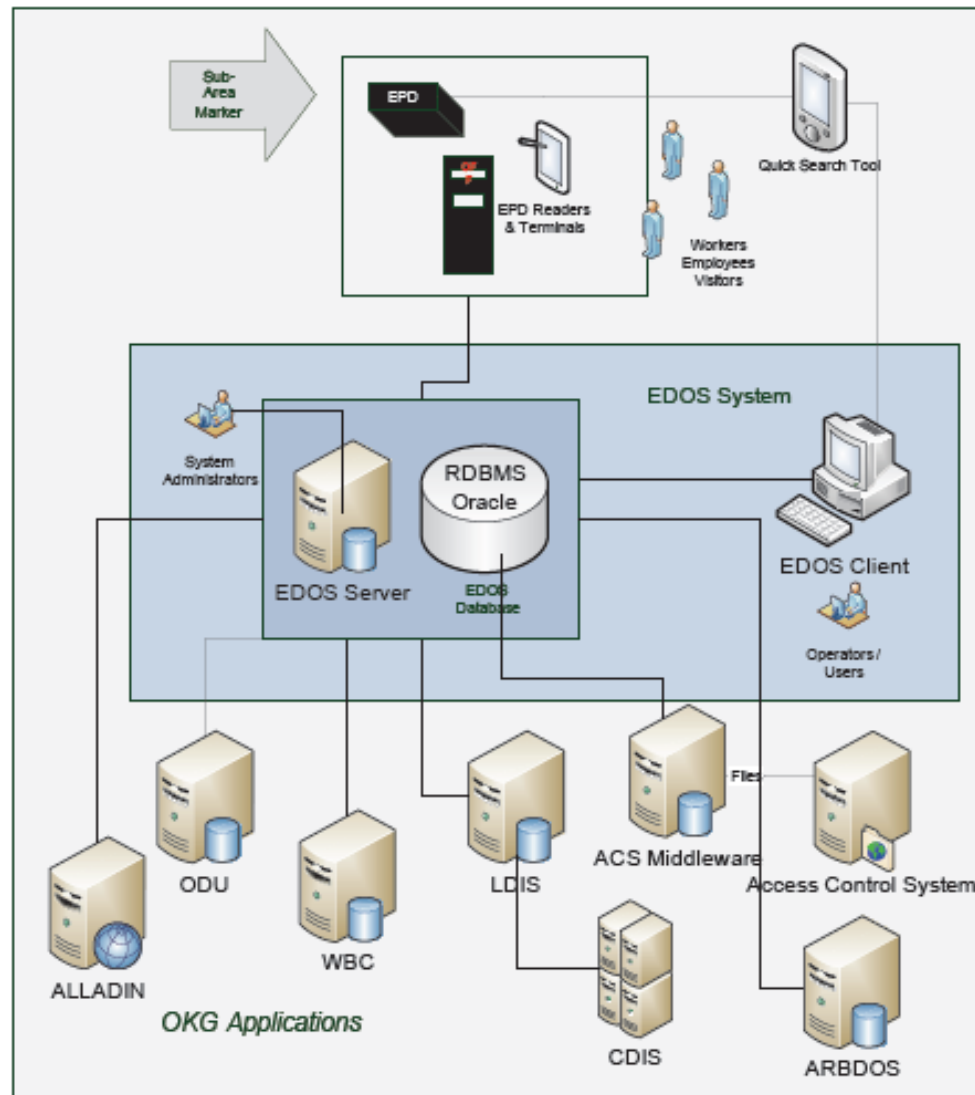
All PSCCM are connected to EDOS via the EPD readers (LMF3). Thereby we are able to pick up all detected contamination alarms and the related person. This can now be related to the RWP this person has been working on.

Since all PSCCM are connected to EDOS and all actions in the LMF3 is recorded it's possible to check whether the contamination has been detected at all passages through the PSCCM and the status. Handy at reason for Whole Body Counting investigations.

Material and method

The summary of this so far is that EDOS covers the most complete dosimetry system we have. It keeps track of all personal dose of record (passive dosimetry), complementary dose (active dosimetry) internal dose (WBC) as well as it keeps track of the legal dose limits, OKG constraints to dose with respect to person level as well as per RWP.

The EDOS / EPD system over view

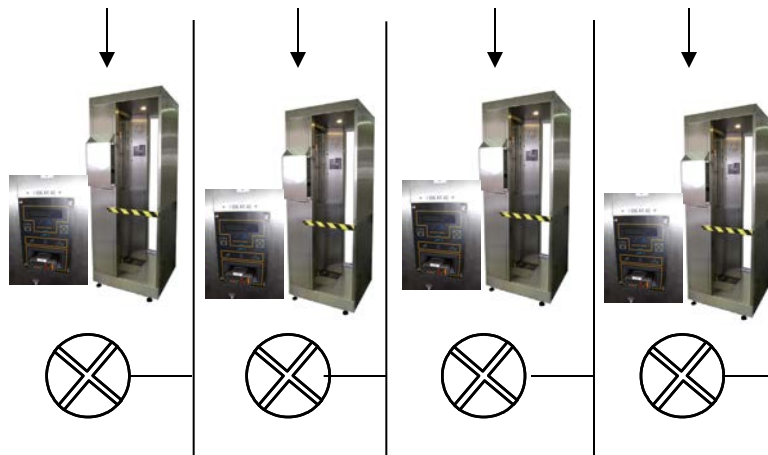


Inner exit from CA

Controlled area (CA)

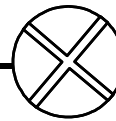


RVC
RHF
RBU
AUX
TRB
WBU



ACC & EPD

Inner Entrance



Cafeteria

Shobench border

« CA »

Outer Entrance



Dressing Room



okg
- a company in the E.ON-group

EPD Reader (LMF3) in different functions

Initialisation



Turnstile



PSCCM





2008/05/22 09:25

Material and method

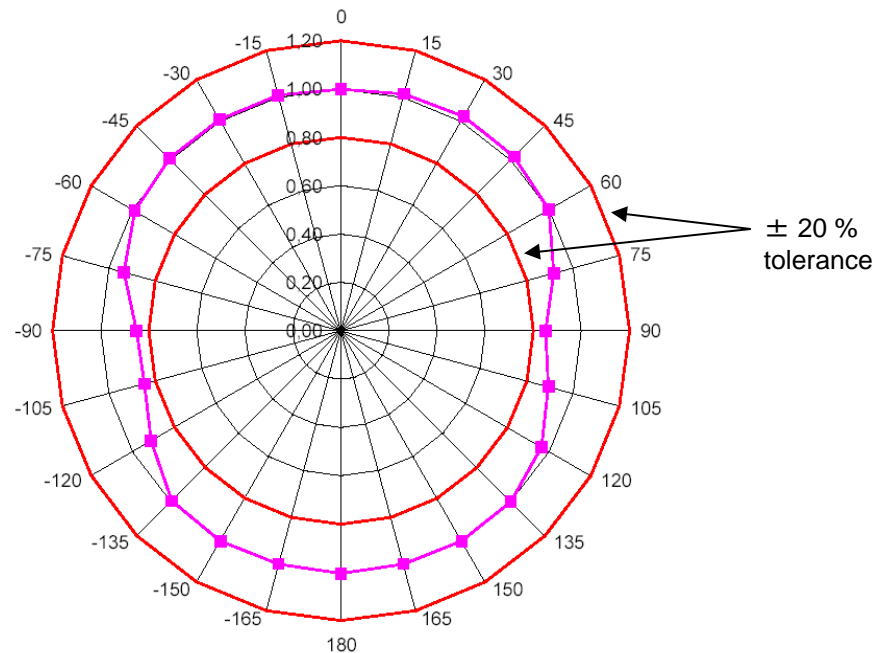
-The EPD (Electronic Personal Dosimeter) is especially designed to meet the requirements regarding,

- isotropy**
- broad energy interval**
- detection level**
- ability to secure the use of bearer of the dosimeter inside CA (Controlled Area)**

Electronic Personal Dosimeter (EPD)

Isotropy of Saphydose γ i

Isotropy : relative response to ^{60}Co in the horizontal plane containing the reference point and the reference orientation. Responses normalized to 0° response



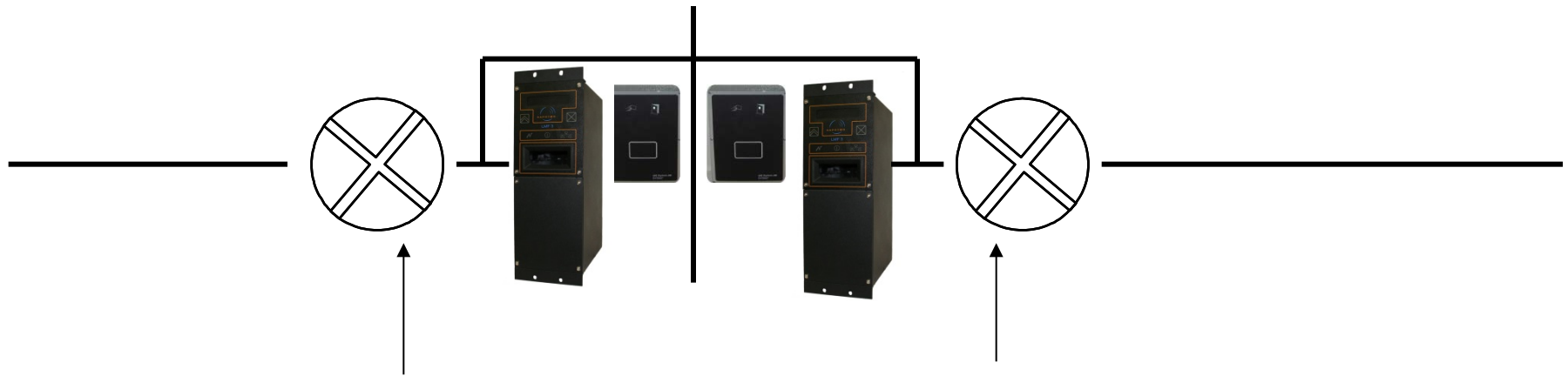
Electronic Personal Dosimeter (EPD)

Energy interval Saphydose γ i

- ♦ Meets IEC61526 standard (class 1)
- ♦ **Energy range from 60keV up to 7MeV for gamma rays**
- ♦ **Dose equivalent measurement from 1 μ Sv to 10Sv (Hp10)**
- ♦ Dose equivalent rate measurement from 0.5 μ Sv/h to 5Sv/h
- ♦ Pre-alarm and alarm thresholds for dose equivalent
- ♦ Pre-alarm and alarm thresholds for dose equivalent rate
- ♦ **Overload of dose equivalent and dose equivalent rate capacity**
- ♦ **Worker's name display**
- ♦ **Multiple auto tests function (detector, memory, battery)**
- ♦ High level of the acoustic alarm (> 85dBA at 30cm)
- ♦ **Movement detector included**
- ♦ Removable EEPROM memory with storage of dose (updated every 15s), dose history and worker name
- ♦ **Insensitive to radio frequencies (cell phone)**
- ♦ **Extremely long battery life time (8000h in use with 2 batteries)**
- ♦ Periodic control management



Secure the use of bearer of the dosimeter inside CA



Entrance at physical border to CA requires booth *ACC & EPD*

Discussion

- The security has been increased for example all persons now wear the electronic dosimeter inside CA
- In general the interest of the environmental dose rate and dose levels has increased due to the actions taken by EDOS when constraints are exceeded
- It has been possible to supervise the actions of the workers
- It has been possible to analyse the work in “close up”

The security has been increased for example all persons now wear the electronic dosimeter inside CA

- At outer entrance on the way in to the dressing room the EPD requires to allow entrance**
- At physical border to CA, passage control requires booth EPD & ACC**

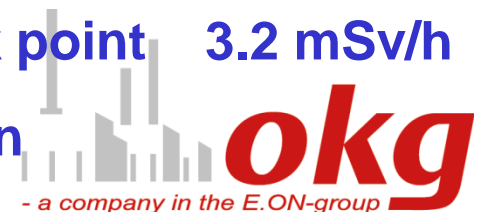
Increased interest of the environmental dose rate and dose levels due to actions taken by EDOS when constraints have been exceeded

Authority dose limits

- Five year effective dose 100 mSv
- Yearly effective dose 50 mSv

Constraints set by OKG

- Yearly effective dose 20 mSv Check point 16 mSv
- Monthly effective dose 10 mSv Check point 8 mSv
- Daily equivalent dose 3 mSv Check point 2.4 mSv
- Dose rate 4 mSv/h Check point 3.2 mSv/h
- ODU individually job related dose / dose rate plan

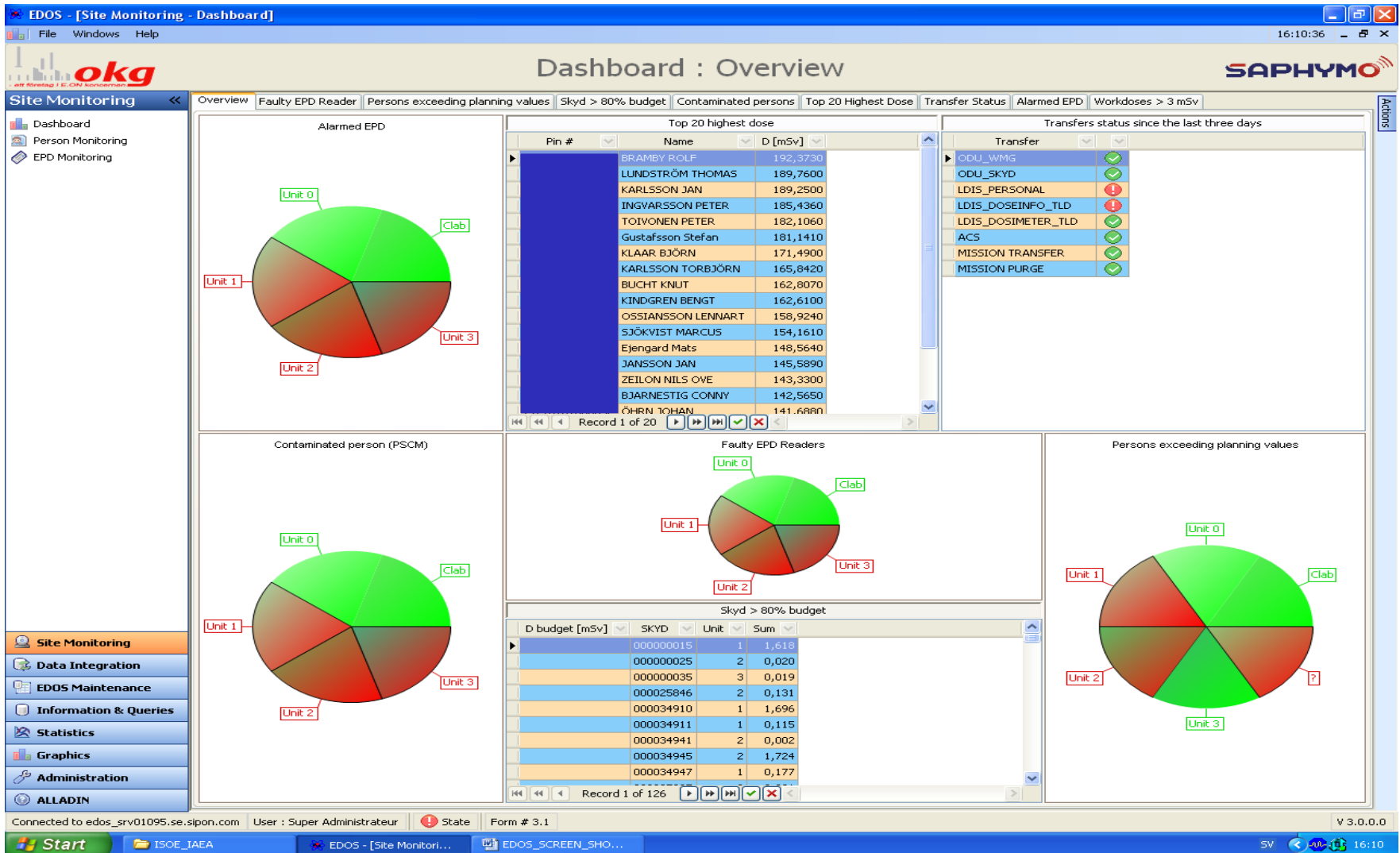


It has been possible to supervise the actions of the workers

- dose develop faster than expected, individually or collective**
- Individuals exceed maximum dose rate limit**
- several workers have exceeded the dose limits**
- number of contaminated persons increase above the measures taken**

This is standard information on EDOS dashboard and can easily be followed up by deeper analysis and quick response action by the RP at the workplace, partially stop the work, changing the measures, set up “job briefing” and supervise workers further to get back on track

It has been possible to supervise the actions of the workers



It has now been possible to analyse the work in “close up”

- By using the “Sub Area Marker” (SAM) in RWP mode we now in an easy way can isolate the main course of dose development
- By the function “Steps per Work dose” or from the RWP event report we then can isolate the dose from different works carried out for further studies/analysis
- SAM can also be used in geographic mode. That’s more to find the first general areas like (RVC, RHF, RBU, TRB, AUX and WBU to concentrate dose reduction actions in



It has now been possible to analyse the work in “close up”

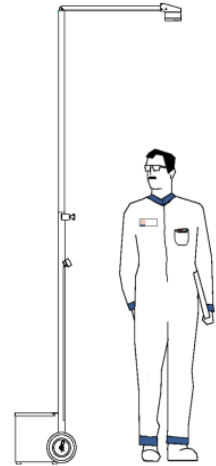
Dosimetry system EDOS «Sub Area Marker» (SAM)

Geographic mode, to pin point general areas like RVC, RHF, RBU, AUX, TRB and WBU

No specific action of the worker

Automatic recording by the dosimeter of data sent by the sub area marker when the worker passes under the sub area marker

Data recorded by the dosimeter (sub area marker number, date and time, dose value)



Radiation Work Permit mode, pin point the higher dose rate area of a work task

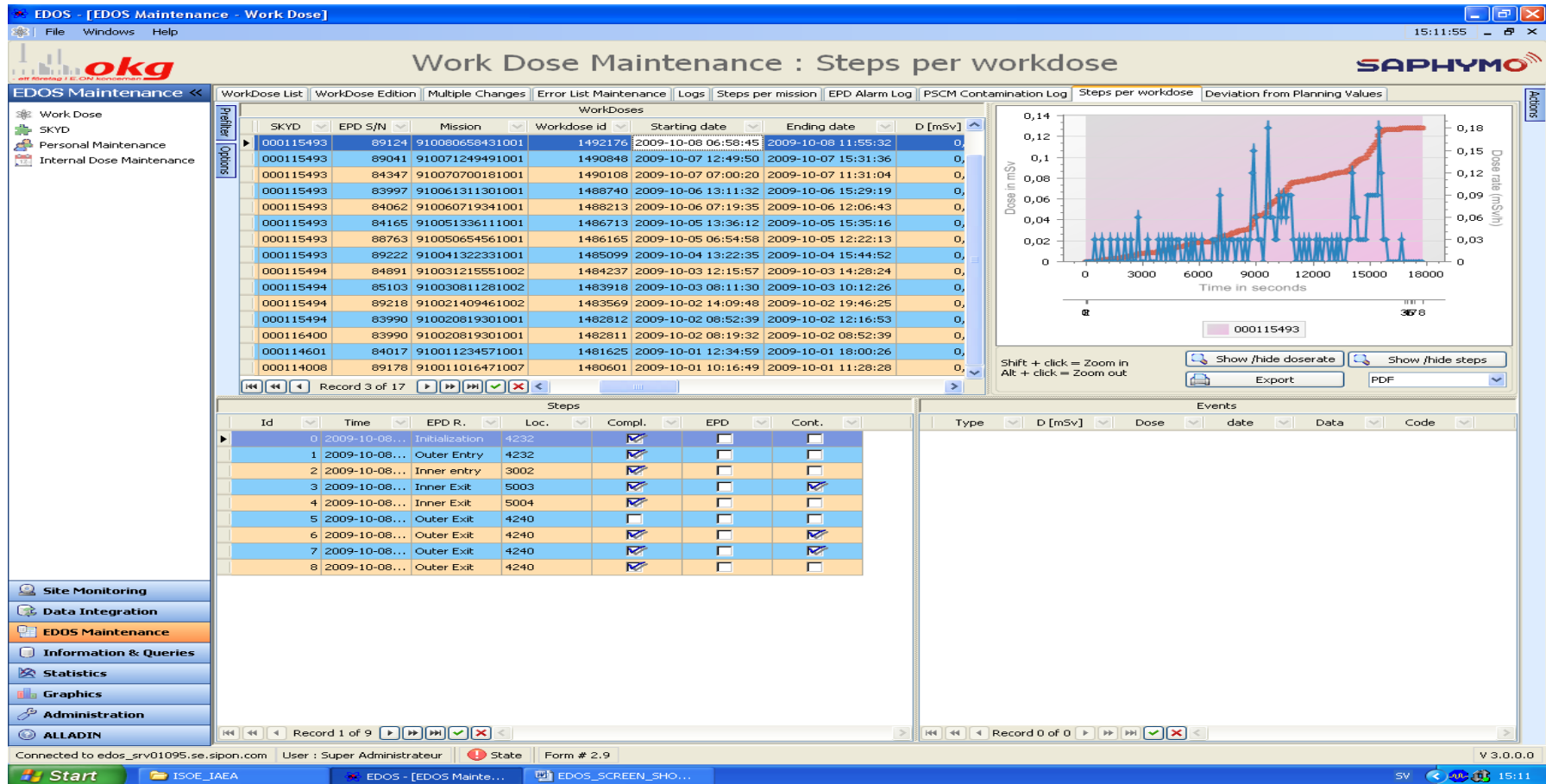
Reading of the RWP indexing (event) detached to the sub area marker number setup in EDOS

Automatic recording by the dosimeter of data sent by the sub area marker when the worker passes under the sub area marker

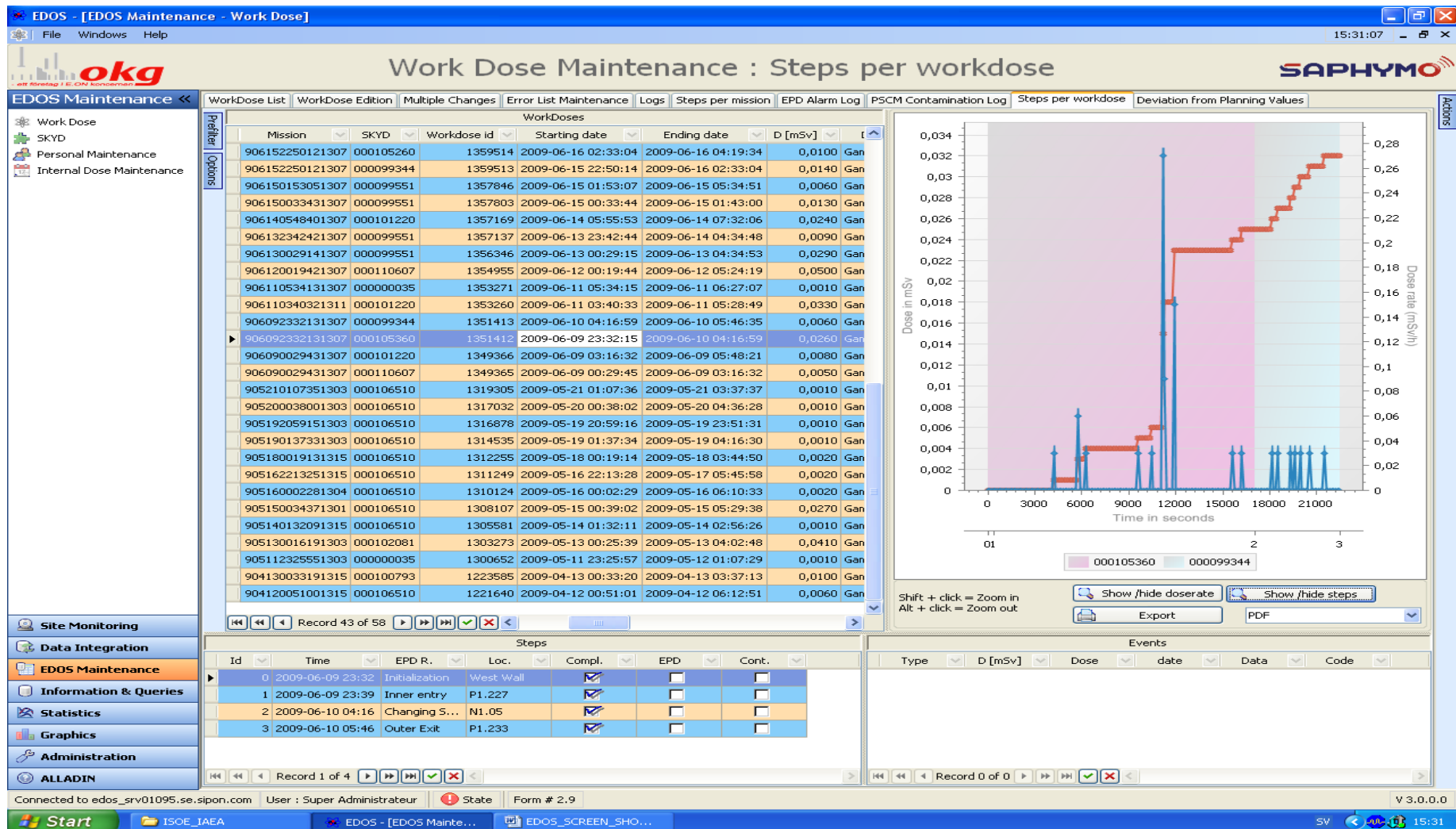
Data recorded by the dosimeter (RWP, sub area marker number (the index), date and time, dose value)



It has now been possible to analyse the work in “close up”



It has now been possible to analyse the work in “close up”



It has now been possible to analyse the work in “close up”

EDOS - [Data Integration - ODU]

File Windows Help 15:49:18

ODU Integration : SKYD SAPHYMO

Data Integration << SKYD Work Managers

SKYD	USOP	Room	Date from	to	Extend	Implement	Occurenc	Type of	Description of work
99344	3.735		28-APR-09	21-MAY-09	25-JUN-09	R_PULS	3.RA	ÅA	Montage av upphängningar och rörledningar
98886	3.663.WB103	3.B3.36	29-APR-09	13-MAY-09	22-MAY-09	R_PULS	3.RA	ÅA	S-314.B Demontage av ställverksgrupper för
99322	3.735		29-APR-09	26-MAY-09	12-JUN-09	R_PULS	3.RA	ÅA	System 735. Tryckprovning enligt WPULS 07-
99323	3.735		31-MAY-09	01-JUL-09		R_PULS	3.RA	ÅA	System 735. Tryckprovning enligt WPULS 07-
112820	3.462.L237	3.D5.23	28-APR-09	30-APR-09		UM3	3.RA.MV	AU	Skapad från Felanmälan
105945	3.754		28-APR-09	18-MAY-09	30-MAY-09	R_PULS	3.RA	ÅA	System 754 (321): Tryckprovning enligt WPULS
105458	3.354		17-SEP-09	18-SEP-09		R_PULS	3.RA	ÅA	Kalla samfunktionsprov i 354
107014	3.354		25-APR-09	07-MAY-09	12-JUN-09	R_PULS	3.RA	ÅA	Driftsättn.instr för verifiering av ändringar i 3
98744	3.505	3.E1.13	29-APR-09	30-MAY-09		R_PULS	3.RA	ÅA	Hålltagning i nytt skåp QNE.142
111073	2.314	2.R3.03	10-AUG-09	21-AUG-09		UE2I	2RA-UEA	FUÅR	PROVNING / TEST
112844	2.263		28-MAY-09	05-JUN-09	15-JUN-09	UR		FUSÅ	Mottagning av nytt bränsle
112846	8		01-JUN-09	10-JUL-09		CTM		FU	INSPEKTION
103218	0ÖVS.113		06-OCT-08	31-JAN-09	30-JUN-09	ENT		ÅA	Nyans rotorförråd utanför FVB1
111078	2.321.V16	2.R5.31	10-AUG-09	21-AUG-09		UE2I	2RA-UEA	FU	PROVNING / TEST
111080	2.354.V1	2.R6.31	17-AUG-09	19-AUG-09		UE2I	2RA-UEA	FUÅR	PROVNING / TEST
111126	2.312.V26.V1	2.D6.31	04-AUG-09	21-AUG-09		UM2	2RA-UMT	FUÅK	Säkerhetsventiler i Turbin
111171	2.311.V93	2.R5.10	03-AUG-09	25-AUG-09		UM2	2RA-UMP	FUÅK	Säkerhetsventiler Reaktor
111459	2.150.A1	2.D6.01	10-AUG-09	26-AUG-09	28-AUG-09	USY	2RA-USE	FUÅK	Blåsvägar Block 2 Turbin
111378	2.332.V10.D1	2.D6.41	05-AUG-09	21-AUG-09		UE2E	2RA	FUSÅ	Service av motordon och växel.
111537	2.723.P3.P1	2.F3.18	10-AUG-09	14-AUG-09		UM2	2RA-UMH	PAU	Komplett översyn av pump
111734	2.138.X2	2.R1.50	03-AUG-09	25-AUG-09		UM2	2RA-UMP	FU	Demontage/montage av servicekupol
111393	2.312.V3.B1	2.R6.18	06-AUG-09	14-AUG-09		UE2E	2RA	FUSÅ	Service av växel.
111544	2.723.V129...	2.F3.18	17-AUG-09	21-AUG-09		UM2	2RA-UMH	FU	Kontroll av backventil. Översyn pump
111556	2	2.D4.22	10-AUG-09	20-AUG-09		USY	2RA	AU	Skapad från Felanmälan
111576	2.140		02-AUG-09	06-SEP-09	13-SEP-09	DB2	2RA-D	FUÅR	Rondering, avgränsning och basläggning R o
111579	2.424.K807		10-AUG-09	19-AUG-09		UE2I	2RA	AU	Kalibrering byte av sensor för 424.K806 och
112167	2.541.V101...	2.R5.41	10-AUG-09	14-AUG-09		UM2	2RA-UMP	FUTBU	Diagnostiktest av ventil.
111730	2.121.A2.B1	2.R5.41	03-AUG-09	01-SEP-09		UM2	2RA-UMP	FUSÅ	Öppning av lucka i
112195	2.150	2.D6.41	03-AUG-09	28-AUG-09		USY	2RA	FUSÅ	Montering lyftutrustning
112084	2.332.V50	2.D4.44	08-AUG-09	09-AUG-09		USM	2RA	FUSÅ	2.332.V50
112892	2.831		28-APR-09	28-APR-09		USM		ÅA	Byte av kabel
112337	2.312.V3.V1	2.R6.18	05-AUG-09	21-AUG-09		UM2	2RA-UMP	FU	Demontage av ventilöverdel
112343	2.352.T2	2.R1.20	04-AUG-09	31-AUG-09	01-SEP-09	UM2	2RA-UMP	FUSÅ	PROVNING / TEST
111728	2.121.A4	2.R1.57	03-AUG-09	01-SEP-09		UM2	2RA-UMP	FUSÅ	Öppning av lucka
112359	2.414.V1.D1	2.D6.11	04-AUG-09	21-AUG-09		UE2I	2RA-UEI	FUEBU	Servobyte
112364	2.414.V12.V1	2.D6.11	04-AUG-09	21-AUG-09		UM2	2RA-UMT	FU	Översyn av HT ventil.
112367	2.432.V13.V1	2.D2.14	05-AUG-09	14-AUG-09	21-AUG-09	UM2	2RA-UMT	FU	Översyn av ventil 432 V13
112368	2.441.V13.V1	2.D3.15	05-AUG-09	21-AUG-09		UM2	2KOMRA	FU	Översyn av ventil.
112903	8.344.TA3.T1	8.H06.08	11-MAY-09	13-MAY-09	15-MAY-09	CTM		FUÅK	BESIKTNING
111331	2.231.Z1	2.R11.30	05-AUG-09	05-AUG-09		UR	2RA-UMR	FUÅR	Logikprov med laddmaskin "bränsle"
111332	2.211	2.R11.30	08-AUG-09	10-AUG-09					Avtätning av drivdonshus vid byte av drivdon
111334	2.222	2.R11.30	13-AUG-09		24-AUG-09	UR	2RA-UMR	FU	Ur- och återladdning av stvrstavar för drivo

Record 4928 of 5375

Connected to edos_srv01095.se.sipon.com User : Super Administrateur State Form # 9.1 V 3.0.0.0

Start ISOE_IAEA EDOS - [Data Integra... EDOS_SCREEN_SHO...

SV 15:49

- a company in the E.ON-group

It has now been possible to analyse the work in “close up”

EDOS - [Site Monitoring - EPD Monitoring]

File Windows Help 16:03:41

okg SAPHYMO

EPD Monitoring : List

Site Monitoring << List

Dashboard
Person Monitoring
EPD Monitoring

Current Missions

Starting date: 2009-09-28 (Count=2)

Id	Unit	Starting	Ending	Pin #	Card #	O. Cat	Site	EPD	Cat.	Departme	Sup
909280...	1	2009-09-28...		198903313...	27542	65	10	89170	3	ÅFK	UTP
909280...	1	2009-09-28...		195102192...	172065	70	10	84220	3	LMTEL	UIE
Starting date: 2009-10-01 (Count=1)											
910011...	1	2009-10-01...		197909022...	300712	70	10	84196	3	NEA	USM
Starting date: 2009-10-02 (Count=2)											
910020...	2	2009-10-02...		197110252...	136663	31	10	88804	4	ISSKKS	MR
910021...	3	2009-10-02...		198102282...	362553	70	10	85244	3	LINPRO	X

Record 4 of 6595

Current Steps

Id	Time	EPD R.	Loc.	Co	EPD
0	2009-10-02 07:11	Initialization	5226		
1	2009-10-02 07:15	Inner entry	3002		
2	2009-10-02 07:30	Inner Exit	5004		
3	2009-10-02 08:36	Inner Exit	5001		
4	2009-10-02 08:39	Inner entry	3002		
5	2009-10-02 09:00	Inner Exit	5003		
6	2009-10-02 10:02	Inner entry	3001		
7	2009-10-02 10:10	Inner Exit	5001		
8	2009-10-02 10:11	Inner entry	3002		
9	2009-10-02 10:31	Inner Exit	5003		
10	2009-10-02 10:31	Inner entry	3002		
11	2009-10-02 10:51	Inner Exit	5003		
12	2009-10-02 11:17	Inner entry	3002		
13	2009-10-02 11:34	Inner Exit	5001		
14	2009-10-02 12:34	Inner entry	3002		
15	2009-10-02 12:38	Inner Exit	5003		
16	2009-10-02 12:55	Inner Exit	5002		

Record 2 of 19

Current Events

Id	Type	D [mSv]	D event	Event	Code
----	------	---------	---------	-------	------

Record 0 of 0

Current Workdoses

SKYD	Dose type	D [mSv]	D P-Al.	D Al. Thld	D' p-Al.	D' Al. Thld	D Alarm	D' Alarm	Personal	External	Moving
000094909	Gamma	0,0020	0,4000	0,5000	1,6000	2,0000	0		0		

Record 1 of 1

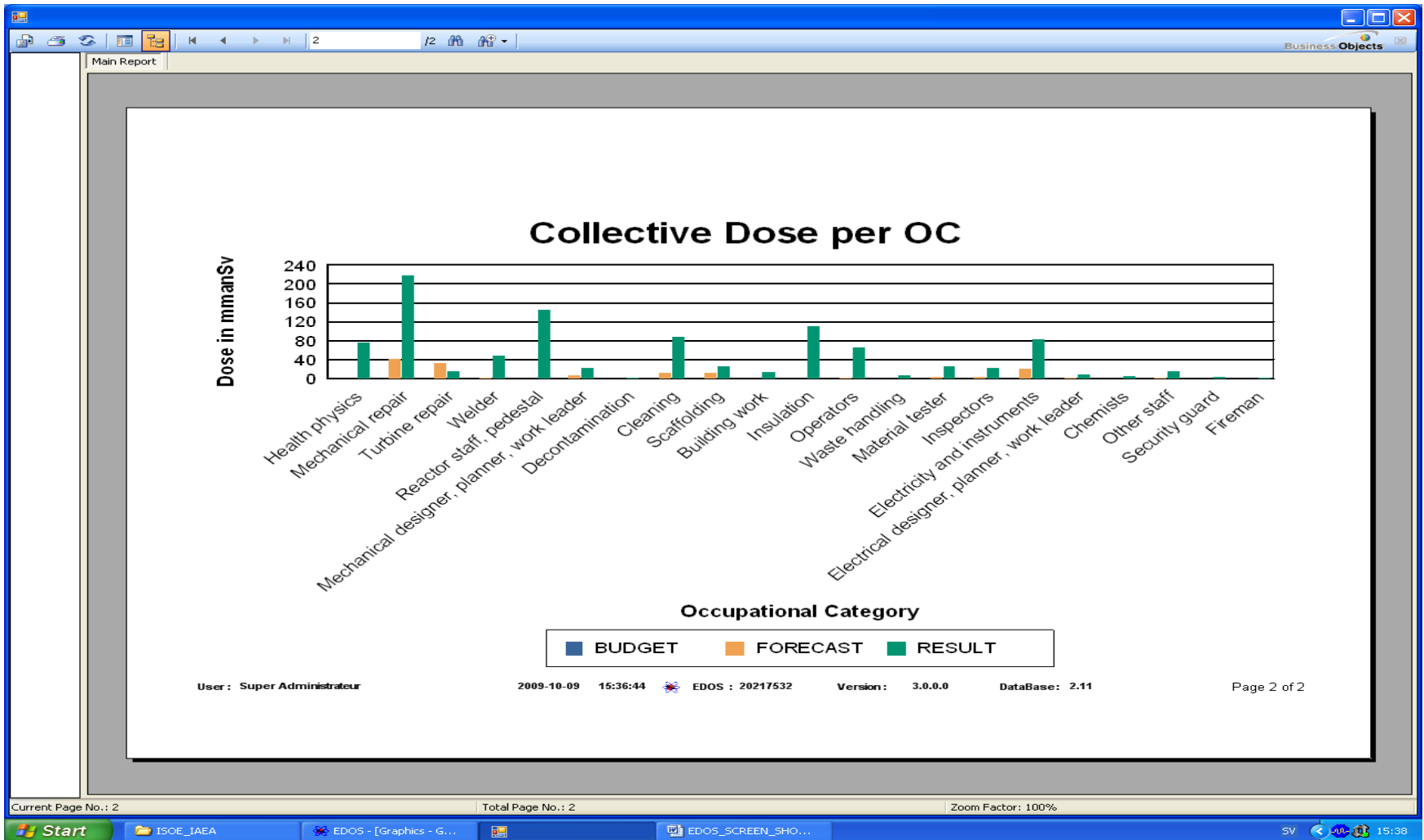
Navigation: Refresh

Site Monitoring
Data Integration
EDOS Maintenance
Information & Queries
Statistics
Graphics
Administration
ALLADIN

Connected to edos_srv01095.se.sipon.com User : Super Administrateur State Form # 16.1 V 3.0.0.0

Start ISOE_IAEA EDOS - [Site Monitori... EDOS_SCREEN_SHO...

Graphic report example



The End

Thank you

for Your attention

