РОСЭНЕРГОАТОМ
ЭЛЕКТРОЭНЕРГЕТИЧЕСКИЙ ДИВИЗИОН РОСАТОМА

The way to optimize radiation exposure index at the Russian nuclear power plants

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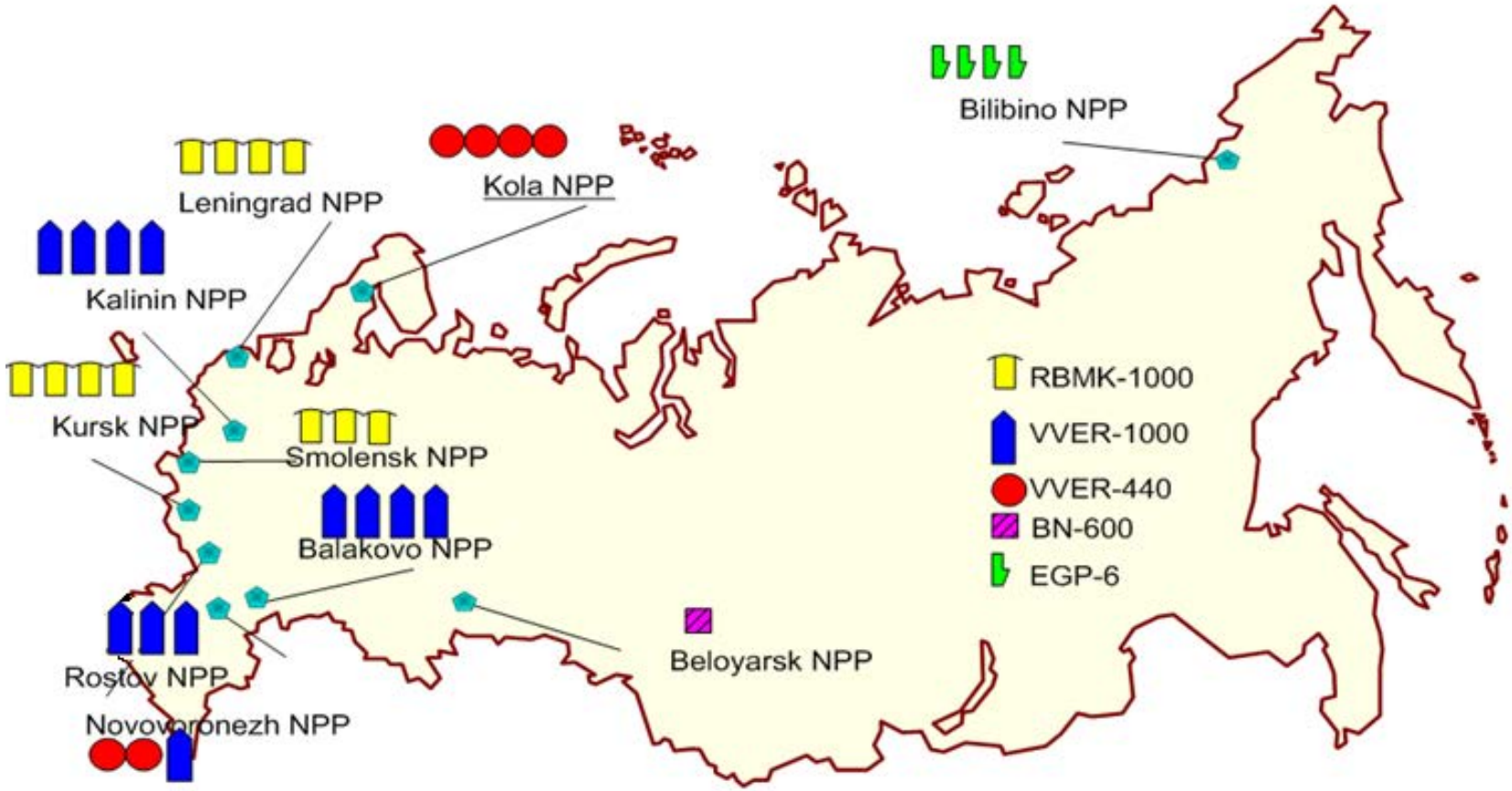
Brusseil, 1-3.06.2016

Russian operating reactors



Main stages of the occupational exposure reduction

Federal law 3 - 1996.
«Radiation safety for Population»

From the 1 January 2000:
20 mSv per year in average for any 5 consequential years,
But not more than 50 mSv per year

Stage 1 1996 – 2004

- **Following dose limits**

Stage 2 2005 - 2014

- **Implementation of the targets**

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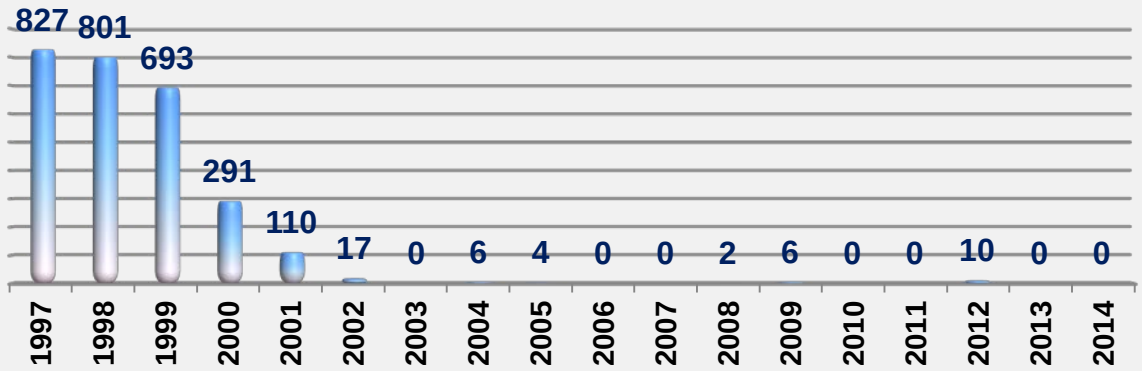
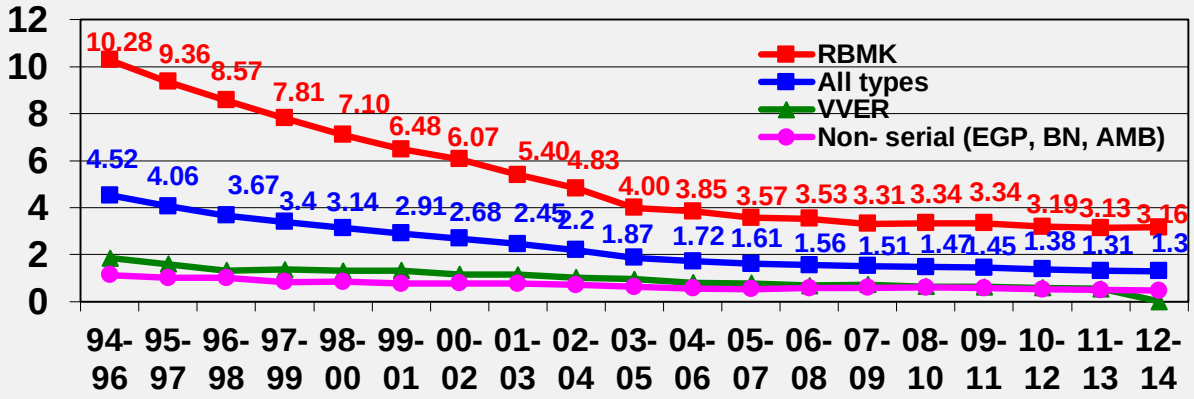
Results of the radiation exposure reduction for the NPP staff

Amount of workers with individual dose exceeded 20 mSv, man



➢Amount of workers with personal dose more than 20 mSv has minimized.

Collective dose, man. Sv/unit



➢ in 1995 -2014 3 times decreasing of Collective dose

➢The most decrease (2,3 times) on stage 1

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Measures of the radiation exposure decrease on NPPs in 2010 – 2015

Optimization of personnel radiation protection program	
✓ *Target*	➢ Optimization of the radiation exposure in conditions of increased amount of radiation-dangerous works due to the modernization measures and decommissioning
✓ *Directions*	➢ Improving of the work organization; ➢ Radiation conditions improving; ➢ Reduction of the exposure time.

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The main measures of the dose exposure reduction in 2010 – 2015

1. Organizational	*Setting of the control level -18, mSv, optimization of the outage time; developing of the Dose Risk Management software ARMIR, programs of dose exposure optimisation, Dose Budget; Development of the automational dose control system…*
2. Radiation conditions improving	*Usage of the protective screens, sorptive mates, sample containers; decreasing amount of the dead zones; high pressure decontamination; modernization of the equipment…*
3. Reduction of the exposure time	*Remote supervision systems,videoendoscopes, manipulators, simulation stands, quick-detachable mates, heat insulation…*





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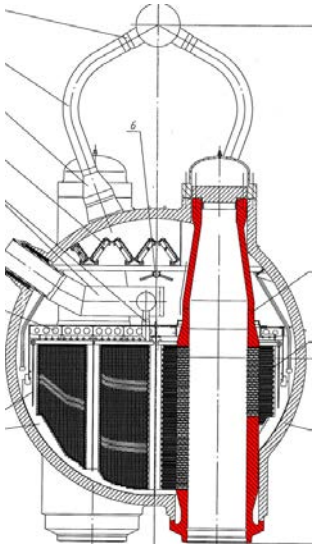
Examples of dose rate reduction measures

Using of quick-detachable heat insulation for primary circuit equipment



Measures on the steam generators:

- Control of the steam generator infill level on the different stages of work.
- Usage of the manipulators for tube killing.
- Improved decontamination of the primary circuit collectors

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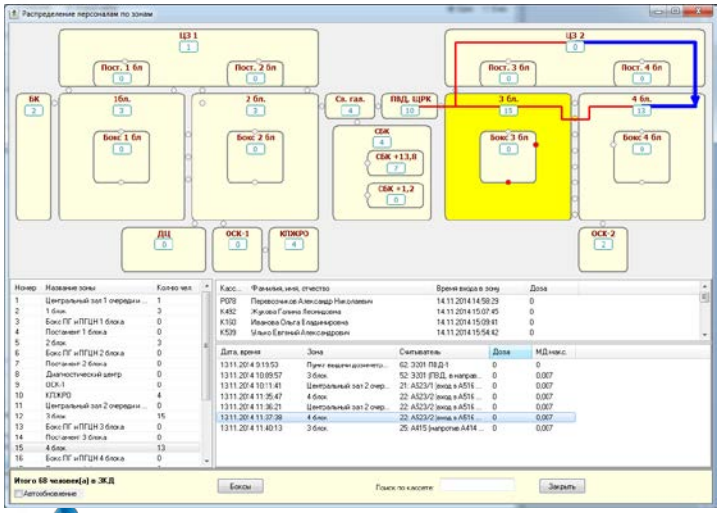
Examples of dose rate reduction measures

Informing about radiation conditions in the area of the work execution



Evolution of the operative dose control system:

- EPD threshold assignment on the minimally sufficient level for the work execution
- Remote exposure monitoring system during RCA movement.
- Usage of the “as low as possible” administrative levels by dose for all sorts of workers and periods of time.

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Results of the second stage of occupational exposure reduction on NPP

Average collective dose from 2010 to 2014 man.Sv/unit		
NPP	Target	Fact
Balakovo	0,6	0,53
Beloyarskaya	0,5	0,32
Bilibino	0,7	0,64
Kalinin	0,6	0,47
Kola	0,8	0,63
Kursk	4,0	3,98
Leningrad	3,0	2,30
Novovoronezh	0,8	0,72
Rostov	0,2	0,11
Smolensk	3,5	3,49

Amount of workers with occupational exposure <1 mSv, %		
64	→	↑ 71

Amount of workers with occupational exposure > 18 mSv, man.		
109	→	↓ 27*

* - after REA approval

Amount of workers with occupational exposure > 80 mSv over 5 years, man.		
57	→	↓ 11

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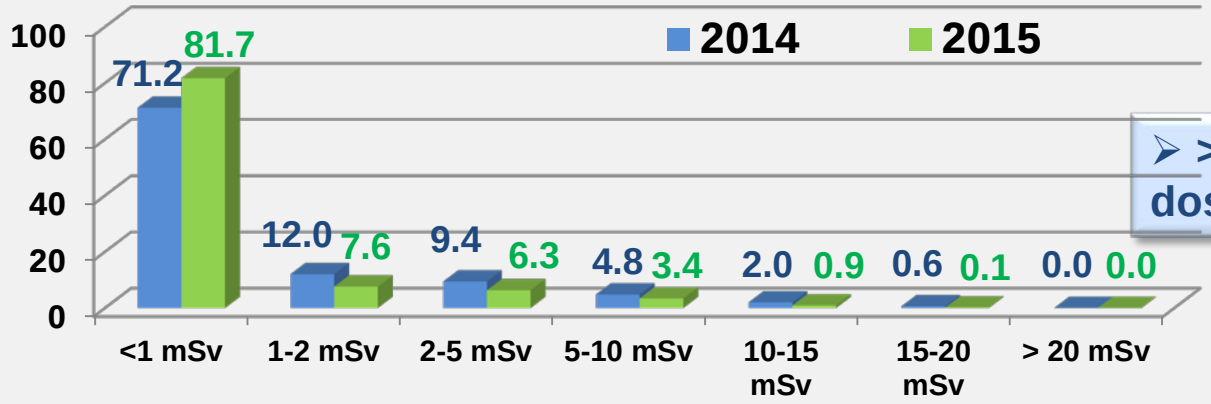
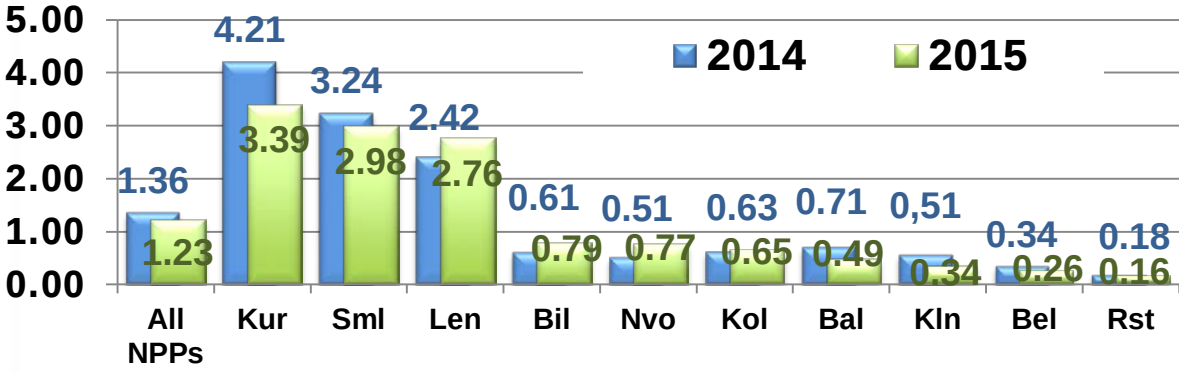
Present occupational exposure

Staff dose interval distribution



➢ > 90 % of staff with dose < 5 mSv

Collective doses on NPP in 2014 – 2015 (man.Sv/unit)



➢ Maximal doses on the RBMK NPP;
➢ Among RBMK maximal doses on the Kursk NPP

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Reduction of the radiation exposure on the RBMK NPP

The Program of the radiation exposure reduction on the RBMK NPP

✓ ***Period of realization***	**2014 – 2017**
✓ ***Specifics***	➢ **It is supposed to involve contractors into radiation exposure reduction work;** ➢ **Measures include radiation dangerous works preparation, process and follow-up actions.**

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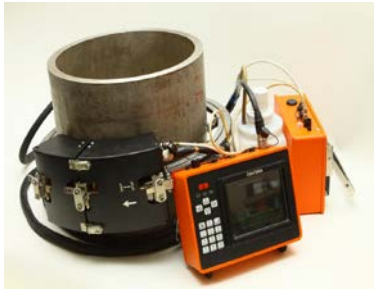
Reduction of the radiation exposure on the Kursk NPP

The Program of the improving radiation conditions and radiation exposure reduction on the Kursk NPP	
✓ *Period of realization*	**2014 – 2017 гг.**
✓ *Specifics*	➢ **The program based on the program of the radiation exposure reduction on RBMK NPP;** ➢ **The specific measures of the radiation conditions on the Kursk NPP are included.**



Program indicators	*2014*	*2015*
Maximal individual dose for 6 month, mSv	15,16	7,89
Staff with doses > 15 mSv/year	204	86

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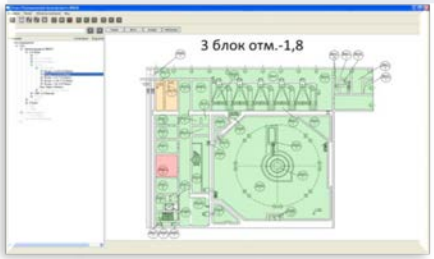
Main measures of the occupational exposure reduction in 2015 – 2019

The Program of optimization of the staff radiation protection

✓ *Directions*	➢ Improving of the work organization; ➢ radiation conditions improvement; ➢ reducing of the exposure time; ➢ improving of the radiation control systems.



Target indicators for specific NPP
➢ Individual dose for an year
➢Individual dose for 5 years
➢ Collective dose per unit
➢ Amount of workers with dose between 1 and 5 mSv (%)
➢ Amount of workers with individual radiation risk > 0,001

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Main tasks of the operation exposure reduction on the NPP

➢ Reducing of quantity of the critical group on the Kursk NPP	Special project of the radiation safety of the maintenance staff on the Kursk NPP
➢ Radiation conditioin improving and reduction of the operation exposure on the Kursk NPP	The Program of the radiation conditions improving and radiation exposure reduction on the Kursk NPP
➢ Reduction of the operating exposure on the RBMK NPP's	The Program of the radiation exposure reduction on the RBMK NPP
➢ Optimization of the operating exposure on the VVER, BN and EGP power plants	The Program of optimization of the staff radiation protection

Main ways of the dose reduction on the NPP

➢ Optimization of the radiation protection on the NPP level	▪ Optimization of the amount of works and operational control scope ▪ Implementation of the maintanance concept «according to technical state» ▪ Increasing of the quantity of the high qualified staff in the critical group
➢ Optimization of the radiation protection on the worker level	▪ Developing of the radiation risk management system

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Summary

- Main dose limits are complied on all Russian NPP
- The dose reduction process Is going on during the long time period
- The temp of dose reduction process is slowing down during last 10 years
- The occupational exposure on the RBMK NPP's still on the high level
- The biggest doses are forming on the Kursk NPP
- Rosenergoatom's and NPP's programs provide and realize measures for reducing doses of the own and subcontractors staff

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