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RESPONSIBILITY FOR AGES



IGNALINA
NUCLEAR
POWER PLANT

Radiological information for Steam Drum Separators Dismantling

Ignalina NPP, 2022



ACCREDITED
MSCB-113



ISO 9001:2015
GKLT-0199-QC



Ignalina NPP decommissioning
activities are co-financed by
the European Union

Radiation Protection at INPP

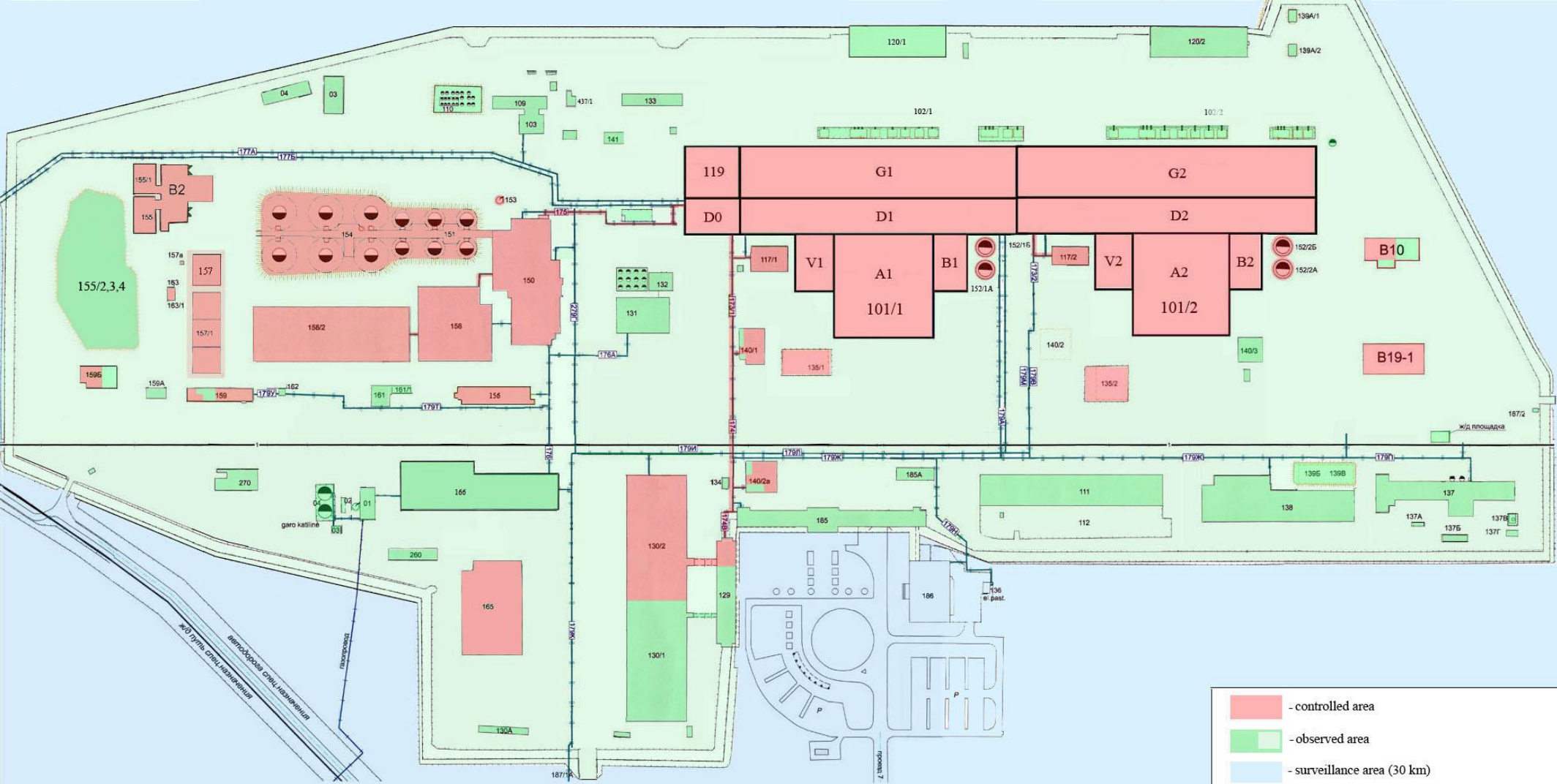
Content:

- I. Requirements for work at INPP controlled area
- II. Radiation Protection procedures for controlled area
- III. Work organization procedure (order) at INPP control area
- IV. Radiation Protection procedures during RAW treatment
- V. RS requirements at Steam Drum Separator Dismantling Project:
 - Radiological survey results
 - Radiological conditions at SDS premises
 - Alarm levels, daily limits
- VI. RAW treatment

I. Ignalina NPP – general view



I. Ignalina NPP – controlled area



I. Ignalina NPP – controlled area (2)

REQUIREMENTS BEFORE START:

- Contract with Ignalina NPP
- State Nuclear Power Safety Inspectorate (VATESI) license or temporary permit (<http://www.vatesi.lt/index.php?id=513&L=1>):
 - Radiation safety assurance agreement between Ignalina NPP and the Contractor (<https://www.iae.lt/administracine-informacija/viesieji-pirkimai/98>)
 - up to 30 days after submission of documents
- Training course at Ignalina NPP training centre (up to 2/3 time on your own):
 - Responsible for Radiation Safety (managers) – up to 60 hours
 - Work under radiation conditions (workers) – up to 20 hours
- Initial on-the-job training – before starting work

I. Ignalina NPP – controlled area (3)

REQUIREMENTS BEFORE START:

- SDS dismantling should be done by A category employees:
 - Over 18 years old
 - Possible annual exposure for whole body up to 18 mSv (15 mSv)
 - Possible annual exposure for lens of the eye up to 18 mSv (15 mSv)
- Exposure control at controlled area is performed by Ignalina NPP. For employee registration at Ignalina NPP data base Contractor must bring for every employee:
 - health check with permission to perform work in a controlled area
 - dose passports (exposure for last 5 years)

I. Ignalina NPP – controlled area (4)

INTERNAL CONTAMINATION CONTROL:

A person's own radiation measurement is performed:

- Before starting work
- Annually
- Right after finishing work at Ignalina NPP
- In case of incidents

EXTERNAL EXPOSURE CONTROL:

- TLD dosimeters – monthly base
- RAD dosimeters – shift base



I. Entering Ignalina NPP controlled area

The passage to controlled area and exit from it is organized through the buildings of sanitary check-points. The sanitary inspection rooms are divided into two sections – „non-contaminated“ („clear“) and „contaminated“ („dirty“)

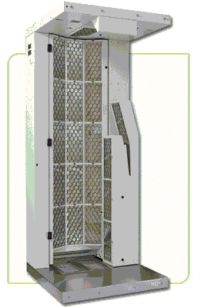
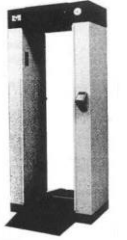
- “clear area”
 - Fully undress (except underwear) and left personal belongings in the locker
- „dirty area”
 - get from Ignalina NPP basic set of personal protective means (PPM)
 - get dressed and enter controlled area



Usually it could take up to 10-20 minutes at entrance

I. Exit from Ignalina NPP controlled area

- „dirty area“
 - Check PPM set for contamination
 - Take off PPM set, enter wash stand
 - Check hands and personal belongings for contamination, carry out decontamination
 - Check hole body for contamination, carry out decontamination
 - Inform the RSD operational staff and then follow the instructions, if needed
- clear area”
 - get dressed and leave the buildings of sanitary check-points




Usually, it could take up to 15-30 minutes

I. At Ignalina NPP controlled area

- Forbidden** to enter controlled area in personal clothes and bring in any personal belongings: handbags, man's handbags, brief cases, *except for keys, glasses, wrist watch, working pass, stationary materials, unpacked documents or documents in the transparent packing (folder, package)*
- Forbidden** to carry out any objects, tools and materials without the dosimetry dosimetrist permission, received in RSD , excluding documents and personal belongings listed above which must be checked for contamination in sanitary check-point when leaving controlled area at radiation control units
- Any equipment, used in contaminated area, and materials from contaminated area should **pass Free Release procedure** in order to take away from controlled area
- If contaminated equipment or material could not be decontaminated to Free Release level, **should be treated as radioactive waste**

II. Radiation Protection procedures

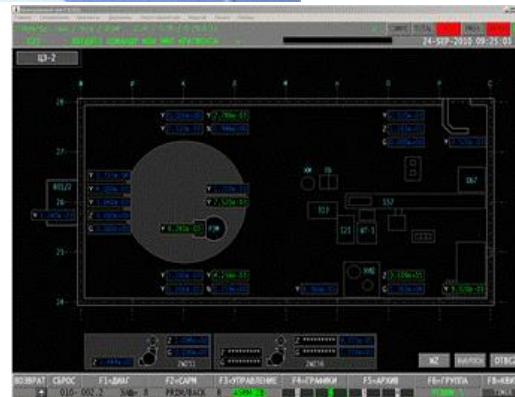
- Work at controlled area is organized according work-orders procedure
- Controlled area is divided in sub-areas according three main criteria:
 - Gamma dose rate, $\mu\text{Sv/h}$
 - Surface contamination, Bq/cm^2
 - Airborne activity concentration, Bq/cm^3
- **Entrance to the I and II without permission is Forbidden**

|  KATEGORIJA | | |
|---|------------------------|--------------------------------|
| IŠORINIS SPINDULIAVIMAS | PAVIRŠIAUS UŽTERŠTUMAS | RADIONUKLIDŲ KONCENTRACIJA ORE |
| | | |

| | Category criteria (Nuclear Safety Requirements BSR-1.9.3-2016 “Radiation protection at nuclear facilities”) | | | |
|-------------|---|---|--|---|
| Category | Dozės galia, $\mu\text{Sv/h}$ | α activity, $\text{Bq}\cdot\text{cm}^{-2}$ | β activity, $\text{Bq}\cdot\text{cm}^{-2}$ | Airborne, $\text{Bq}\cdot\text{m}^{-3}$ |
| I (red) | >56 | >20 | >266 | >1110 |
| II (yellow) | 12–56 | 4–20 | 40–266 | 185–1110 |
| III (green) | <12 | <4 | <40 | <185 |

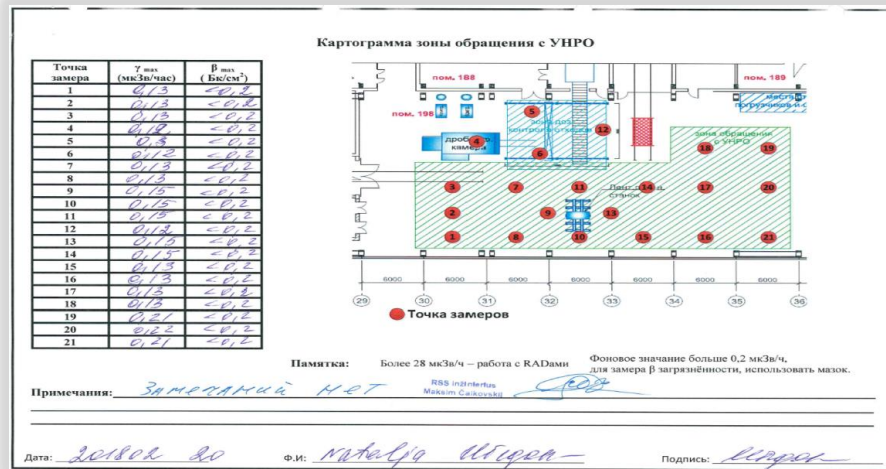
II. Radiation Protection procedures (2)

Radiation condition is monitored and controlled by RSD using mobile and stationary equipment



III. Work organization procedure

- ☐ Before starting work in controlled area, work-order should be prepared and approved by RSD:
 - ✓ Checked radiation condition
 - ✓ Prepare workplace mapping for difficult conditions
 - ✓ Assign additional PPM – **Contractor responsible for ensuring additional PPM**
 - ✓ Additional instruction about existing radiation hazards



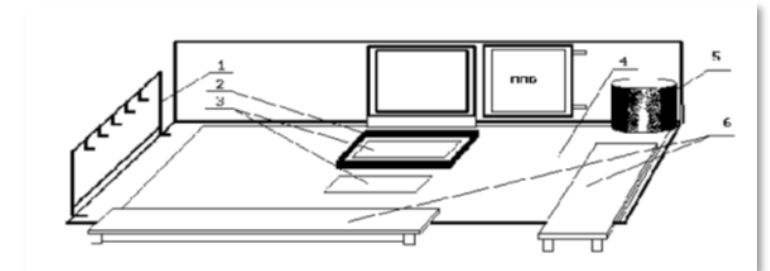
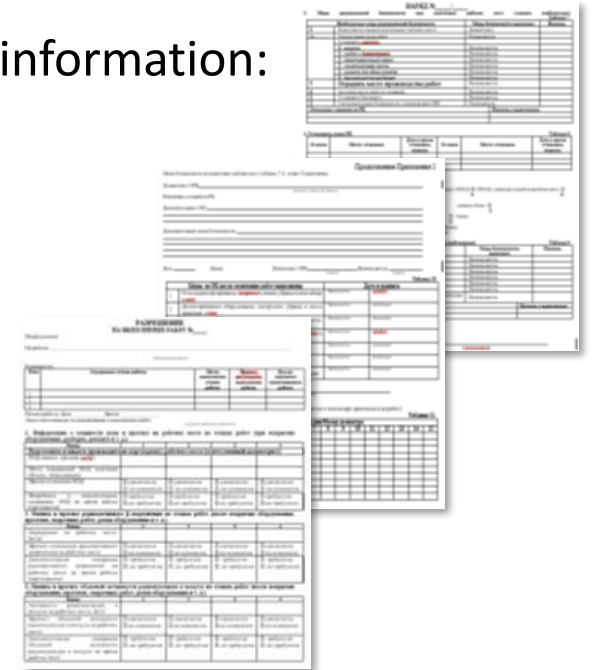
III. Work organization procedure (2)

□ Work-order issued not more than 15 days and should contain all necessary information:

- ✓ The scope and content of work, consistent with the ALARA principle
- ✓ working team composition
- ✓ security measures, etc.
- ✓ Special permission for work, when dose rate is $> 56 \mu\text{Sv/h}$, agreed by RSD

□ Contractor should :

- Prepare work order and reopen it every shift
- Sanitary-check point at entrance/exit from I and II sub-area and get approved by RSD
- Sort out RAW
- Clean working area and decontaminate if needed (control levels)
- Close work order at the end of shift



III. Work organization procedure (3)

RSD health physicists' participation in Contractor work:

- ✓ Determination of radiological condition before work starts
- ✓ Approval of work orders (mapping, PPM, working time and so on)
- ✓ Workplaces and tools contamination monitoring
- ✓ Control over compliance with radiation safety requirements (Contractor is responsible for compliance)
- ✓ Direct participation in work with difficult radiological conditions
- ✓ RAW measurement for pre-sorting purpose
- ✓ Measurement during RAW package formation
- ✓ RAW package and container before transportation
- ✓ Equipment and material measurement before leaving I and II sub-area
- ✓ Tools and personal belongs measurement before leaving controlled area



III. Work organization procedure (4)

□ The scope of measurements and the requirements for measurement depends on its purpose:

- Free Release or RAW pre-sorting
- For free Release very precise measurement of 100% surface
- Measurement prior sending for size reduction and decontamination (5-10%)
- Assessment measurement during decontamination (10-20%)
- Precise RAW measurement during RAW package formation with mapping

□ At each stage, relevant documents are drawn up:

IV. Steam Drum Separator Dismantling Project

Radiological survey of SDS was finished in 2013 and will be available. Main contaminant is Co-60, so current contamination activity is approximately 4 time lower

| | | |
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| <p>СЕРТИФИКАЦИЯ СИСТЕМЫ УПРАВЛЕНИЯ РАДИОЛОГИЧЕСКИМИ РИСКАМИ В ЦЕПИ ПИВ И ПОМЕЩЕНИИ ВС ВЛОА А1</p> <p>№ 07.1.-A1</p> | <p>Исполнитель: ООО "ИГНАЛИНА АЭС"</p> <p>Место: ВЛОА А1</p> | <p>Лист 1 из 10</p> |
|---|--|---------------------|

| <p>ОТЧЕТ О ПРОВЕДЕНИИ РАДИОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ ОБОРУДОВАНИЯ КМЩ, СПИР И САОР, НАХОДЯЩЕГОСЯ В ПИВ И ПОМЕЩЕНИИ ВС ВЛОА А1</p> <p>ПРИЛОЖЕНИЕ 1. РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ МЭД ОТ ОБОРУДОВАНИЯ</p> <p>Лист 34 из 150</p> | <p>ОТЧЕТ № 0671.-A1 измерений мощности дозы оборудования</p> <table border="1"> <thead> <tr> <th>Здание/бунк.</th> <th>Помещение</th> <th>Отметка</th> <th>Маркировка</th> <th>Наименование компонента</th> </tr> </thead> <tbody> <tr> <td>1011.1-A1</td> <td>406-2</td> <td>+16.80</td> <td>1УА2801</td> <td>Восстановитель котловар ГДМ (вентри)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Вид измерения</th> <th>Прибор измерения</th> <th>Число мест измерения</th> <th>Среднее значение (мкЗв/ч)</th> <th>Макс. значение (мкЗв/ч)</th> </tr> </thead> <tbody> <tr> <td>Глобо</td> <td>РН-40</td> <td>4</td> <td>3011.3</td> <td>3700.0</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>№ точки измерения</th> <th>Единица измерения</th> <th>Результаты измерения</th> <th>Неопределенность, %</th> <th>Замечание</th> </tr> </thead> <tbody> <tr> <td>0671.1.-A1</td> <td>мкЗв/ч</td> <td>2100.0</td> <td>20</td> <td></td> </tr> <tr> <td>0671.3.-A1</td> <td>мкЗв/ч</td> <td>3045.0</td> <td>20</td> <td></td> </tr> <tr> <td>0671.4.-A1</td> <td>мкЗв/ч</td> <td>3200.0</td> <td>20</td> <td></td> </tr> </tbody> </table> <p>К отчету прилагаются фото в разрезе с указанием точек измерения</p> <table border="1"> <thead> <tr> <th>Дата измерения</th> <th>Исполнитель</th> <th>Ответственный лицо</th> </tr> </thead> <tbody> <tr> <td>2013-04-10</td> <td>Г. Гольман</td> <td>Е. Шенгел</td> </tr> </tbody> </table> | Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | 1011.1-A1 | 406-2 | +16.80 | 1УА2801 | Восстановитель котловар ГДМ (вентри) | Вид измерения | Прибор измерения | Число мест измерения | Среднее значение (мкЗв/ч) | Макс. значение (мкЗв/ч) | Глобо | РН-40 | 4 | 3011.3 | 3700.0 | № точки измерения | Единица измерения | Результаты измерения | Неопределенность, % | Замечание | 0671.1.-A1 | мкЗв/ч | 2100.0 | 20 | | 0671.3.-A1 | мкЗв/ч | 3045.0 | 20 | | 0671.4.-A1 | мкЗв/ч | 3200.0 | 20 | | Дата измерения | Исполнитель | Ответственный лицо | 2013-04-10 | Г. Гольман | Е. Шенгел |
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| Дата измерения | Исполнитель | Ответственное лицо | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2013-03-19 | Г. Гольман | В. Андрикс | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| <p>ОТЧЕТ О ПРОВЕДЕНИИ РАДИОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ ОБОРУДОВАНИЯ КМЩ, СПИР И САОР, НАХОДЯЩЕГОСЯ В ПИВ И ПОМЕЩЕНИИ ВС ВЛОА А1</p> <p>ПРИЛОЖЕНИЕ 3. РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ МЭД ОТ ОБОРУДОВАНИЯ</p> <p>Лист 38 из 150</p> | <p>ОТЧЕТ № G11.2.-A1 измерений мощности дозы оборудования</p> <table border="1"> <thead> <tr> <th>Здание/бунк.</th> <th>Помещение</th> <th>Отметка</th> <th>Маркировка</th> <th>Наименование компонента</th> </tr> </thead> <tbody> <tr> <td>1011.1-A1</td> <td>506-2</td> <td>+21.80</td> <td>1УВ21801</td> <td>Варочный котел пар (вентри)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Вид измерения</th> <th>Прибор измерения</th> <th>Число мест измерения</th> <th>Среднее значение (мкЗв/ч)</th> <th>Макс. значение (мкЗв/ч)</th> </tr> </thead> <tbody> <tr> <td>Глобо</td> <td>РН-40</td> <td>4</td> <td>5522.5</td> <td>7400.0</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>№ точки измерения</th> <th>Единица измерения</th> <th>Результаты измерения</th> <th>Неопределенность, %</th> <th>Замечание</th> </tr> </thead> <tbody> <tr> <td>G11.2.-A1</td> <td>мкЗв/ч</td> <td>3700.0</td> <td>20</td> <td></td> </tr> <tr> <td>G11.3.-A1</td> <td>мкЗв/ч</td> <td>3800.0</td> <td>20</td> <td></td> </tr> <tr> <td>G11.4.-A1</td> <td>мкЗв/ч</td> <td>7400.0</td> <td>20</td> <td></td> </tr> </tbody> </table> <p>К отчету прилагаются фото в разрезе с указанием точек измерения</p> <table border="1"> <thead> <tr> <th>Дата измерения</th> <th>Исполнитель</th> <th>Ответственное лицо</th> </tr> </thead> <tbody> <tr> <td>2013-03-19</td> <td>Г. Гольман</td> <td>В. Андрикс</td> </tr> </tbody> </table> | Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | 1011.1-A1 | 506-2 | +21.80 | 1УВ21801 | Варочный котел пар (вентри) | Вид измерения | Прибор измерения | Число мест измерения | Среднее значение (мкЗв/ч) | Макс. значение (мкЗв/ч) | Глобо | РН-40 | 4 | 5522.5 | 7400.0 | № точки измерения | Единица измерения | Результаты измерения | Неопределенность, % | Замечание | G11.2.-A1 | мкЗв/ч | 3700.0 | 20 | | G11.3.-A1 | мкЗв/ч | 3800.0 | 20 | | G11.4.-A1 | мкЗв/ч | 7400.0 | 20 | | Дата измерения | Исполнитель | Ответственное лицо | 2013-03-19 | Г. Гольман | В. Андрикс |
|---|--|----------------------|---------------------------|-----------------------------|------------|-------------------------|-----------|-------|--------|----------|-----------------------------|---------------|------------------|----------------------|---------------------------|-------------------------|-------|-------|---|--------|--------|-------------------|-------------------|----------------------|---------------------|-----------|-----------|--------|--------|----|--|-----------|--------|--------|----|--|-----------|--------|--------|----|--|----------------|-------------|--------------------|------------|------------|------------|
| Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1011.1-A1 | 506-2 | +21.80 | 1УВ21801 | Варочный котел пар (вентри) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Вид измерения | Прибор измерения | Число мест измерения | Среднее значение (мкЗв/ч) | Макс. значение (мкЗв/ч) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Глобо | РН-40 | 4 | 5522.5 | 7400.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| № точки измерения | Единица измерения | Результаты измерения | Неопределенность, % | Замечание | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G11.2.-A1 | мкЗв/ч | 3700.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G11.3.-A1 | мкЗв/ч | 3800.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G11.4.-A1 | мкЗв/ч | 7400.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Дата измерения | Исполнитель | Ответственное лицо | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2013-03-19 | Г. Гольман | В. Андрикс | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| <p>ОТЧЕТ О ПРОВЕДЕНИИ РАДИОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ ОБОРУДОВАНИЯ КМЩ, СПИР И САОР, НАХОДЯЩЕГОСЯ В ПИВ И ПОМЕЩЕНИИ ВС ВЛОА А1</p> <p>ПРИЛОЖЕНИЕ 4. РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ МЭД ОТ ОБОРУДОВАНИЯ</p> <p>Лист 39 из 150</p> | <p>ОТЧЕТ № PR14.1.-A1 ДО ОТБОРУ И ИМПЕРИОН ПРОБЫ ИЗ ОБЪЕКТА</p> <table border="1"> <thead> <tr> <th>Здание/бунк.</th> <th>Помещение</th> <th>Отметка</th> <th>Маркировка</th> <th>Наименование компонента</th> </tr> </thead> <tbody> <tr> <td>1011.1-A1</td> <td>506-2</td> <td>+21.80</td> <td>1УВ21801</td> <td>Варочный котел пар (вентри)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Вид измерения</th> <th>Прибор измерения</th> <th>Единица измерения</th> <th>Результат измерения</th> <th>Неопределенность, %</th> <th>Дата измерения</th> <th>Исполнитель</th> </tr> </thead> <tbody> <tr> <td>Точка измерения бет</td> <td>РН-111М</td> <td>Вс/с</td> <td>1887.00</td> <td>20</td> <td>2013-03-19</td> <td>Г. Гольман</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Вид измерения</th> <th>Прибор измерения</th> <th>Единица измерения</th> <th>Результат измерения</th> <th>Неопределенность, %</th> <th>Дата измерения</th> <th>Исполнитель</th> </tr> </thead> <tbody> <tr> <td>Секундомер</td> <td>БЭЗ-С</td> <td>БЭЗ-С</td> <td>1114.00</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Номера</th> <th>Единица измерения</th> <th>Указанная активность</th> <th>Полученная активность, %</th> <th>Замечание</th> </tr> </thead> <tbody> <tr> <td>Св-8</td> <td>Вс/с</td> <td>2481.51</td> <td>13.10</td> <td></td> </tr> <tr> <td>Св-10</td> <td>Вс/с</td> <td>1811.11</td> <td>-</td> <td></td> </tr> <tr> <td>Св-14</td> <td>Вс/с</td> <td>16.47</td> <td>27.20</td> <td></td> </tr> <tr> <td>Св-2</td> <td>Вс/с</td> <td>18.08</td> <td>-</td> <td></td> </tr> <tr> <td>Св-04</td> <td>Вс/с</td> <td>23.92</td> <td>18.20</td> <td></td> </tr> <tr> <td>Ав-100в</td> <td>Вс/с</td> <td>18.00</td> <td>-</td> <td></td> </tr> <tr> <td>Ав-110в</td> <td>Вс/с</td> <td>18.33</td> <td>-</td> <td></td> </tr> <tr> <td>Св-13</td> <td>Вс/с</td> <td>9.41</td> <td>-</td> <td></td> </tr> <tr> <td>Св-14</td> <td>Вс/с</td> <td>9.31</td> <td>-</td> <td></td> </tr> <tr> <td>Св-15</td> <td>Вс/с</td> <td>22.07</td> <td>-</td> <td></td> </tr> <tr> <td>Св-16</td> <td>Вс/с</td> <td>22.07</td> <td>-</td> <td></td> </tr> <tr> <td>Св-19</td> <td>Вс/с</td> <td>18.03</td> <td>-</td> <td></td> </tr> <tr> <td>Св-16в</td> <td>Вс/с</td> <td>22.76</td> <td>-</td> <td></td> </tr> </tbody> </table> <p>К отчету прилагаются фото в разрезе с указанием точек отбора пробы</p> <table border="1"> <thead> <tr> <th>Дата измерения</th> <th>Исполнитель</th> <th>Ответственное лицо</th> </tr> </thead> <tbody> <tr> <td>2013-03-20</td> <td>А. Хорина</td> <td>А. Клим</td> </tr> </tbody> </table> | Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | 1011.1-A1 | 506-2 | +21.80 | 1УВ21801 | Варочный котел пар (вентри) | Вид измерения | Прибор измерения | Единица измерения | Результат измерения | Неопределенность, % | Дата измерения | Исполнитель | Точка измерения бет | РН-111М | Вс/с | 1887.00 | 20 | 2013-03-19 | Г. Гольман | Вид измерения | Прибор измерения | Единица измерения | Результат измерения | Неопределенность, % | Дата измерения | Исполнитель | Секундомер | БЭЗ-С | БЭЗ-С | 1114.00 | - | - | - | Номера | Единица измерения | Указанная активность | Полученная активность, % | Замечание | Св-8 | Вс/с | 2481.51 | 13.10 | | Св-10 | Вс/с | 1811.11 | - | | Св-14 | Вс/с | 16.47 | 27.20 | | Св-2 | Вс/с | 18.08 | - | | Св-04 | Вс/с | 23.92 | 18.20 | | Ав-100в | Вс/с | 18.00 | - | | Ав-110в | Вс/с | 18.33 | - | | Св-13 | Вс/с | 9.41 | - | | Св-14 | Вс/с | 9.31 | - | | Св-15 | Вс/с | 22.07 | - | | Св-16 | Вс/с | 22.07 | - | | Св-19 | Вс/с | 18.03 | - | | Св-16в | Вс/с | 22.76 | - | | Дата измерения | Исполнитель | Ответственное лицо | 2013-03-20 | А. Хорина | А. Клим |
|---|---|----------------------|--------------------------|-----------------------------|----------------|-------------------------|-----------|-------|--------|----------|-----------------------------|---------------|------------------|-------------------|---------------------|---------------------|----------------|-------------|---------------------|---------|------|---------|----|------------|------------|---------------|------------------|-------------------|---------------------|---------------------|----------------|-------------|------------|-------|-------|---------|---|---|---|--------|-------------------|----------------------|--------------------------|-----------|------|------|---------|-------|--|-------|------|---------|---|--|-------|------|-------|-------|--|------|------|-------|---|--|-------|------|-------|-------|--|---------|------|-------|---|--|---------|------|-------|---|--|-------|------|------|---|--|-------|------|------|---|--|-------|------|-------|---|--|-------|------|-------|---|--|-------|------|-------|---|--|--------|------|-------|---|--|----------------|-------------|--------------------|------------|-----------|---------|
| Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1011.1-A1 | 506-2 | +21.80 | 1УВ21801 | Варочный котел пар (вентри) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Вид измерения | Прибор измерения | Единица измерения | Результат измерения | Неопределенность, % | Дата измерения | Исполнитель | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Точка измерения бет | РН-111М | Вс/с | 1887.00 | 20 | 2013-03-19 | Г. Гольман | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Вид измерения | Прибор измерения | Единица измерения | Результат измерения | Неопределенность, % | Дата измерения | Исполнитель | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Секундомер | БЭЗ-С | БЭЗ-С | 1114.00 | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Номера | Единица измерения | Указанная активность | Полученная активность, % | Замечание | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-8 | Вс/с | 2481.51 | 13.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-10 | Вс/с | 1811.11 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-14 | Вс/с | 16.47 | 27.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-2 | Вс/с | 18.08 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-04 | Вс/с | 23.92 | 18.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ав-100в | Вс/с | 18.00 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ав-110в | Вс/с | 18.33 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-13 | Вс/с | 9.41 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-14 | Вс/с | 9.31 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-15 | Вс/с | 22.07 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-16 | Вс/с | 22.07 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-19 | Вс/с | 18.03 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Св-16в | Вс/с | 22.76 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Дата измерения | Исполнитель | Ответственное лицо | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2013-03-20 | А. Хорина | А. Клим | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| <p>ОТЧЕТ О ПРОВЕДЕНИИ РАДИОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ ОБОРУДОВАНИЯ КМЩ, СПИР И САОР, НАХОДЯЩЕГОСЯ В ПИВ И ПОМЕЩЕНИИ ВС ВЛОА А1</p> <p>ПРИЛОЖЕНИЕ 5. РЕЗУЛЬТАТЫ ИЗМЕРЕНИЙ МЭД ОТ ОБОРУДОВАНИЯ</p> <p>Лист 148 из 150</p> | <p>ОТЧЕТ № 07.1.-A1 измерений мощности дозы оборудования</p> <table border="1"> <thead> <tr> <th>Здание/бунк.</th> <th>Помещение</th> <th>Отметка</th> <th>Маркировка</th> <th>Наименование компонента</th> </tr> </thead> <tbody> <tr> <td>1011.1-A1</td> <td>406-2</td> <td>+16.80</td> <td>1УА2801</td> <td>Восстановитель котловар ГДМ (вентри)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Вид измерения</th> <th>Прибор измерения</th> <th>Число мест измерения</th> <th>Среднее значение (мкЗв/ч)</th> <th>Макс. значение (мкЗв/ч)</th> </tr> </thead> <tbody> <tr> <td>Глобо</td> <td>РН-40</td> <td>4</td> <td>3011.3</td> <td>3700.0</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>№ точки измерения</th> <th>Единица измерения</th> <th>Результаты измерения</th> <th>Неопределенность, %</th> <th>Замечание</th> </tr> </thead> <tbody> <tr> <td>07.1.-A1</td> <td>мкЗв/ч</td> <td>2100.0</td> <td>20</td> <td></td> </tr> <tr> <td>07.1.3.-A1</td> <td>мкЗв/ч</td> <td>3045.0</td> <td>20</td> <td></td> </tr> <tr> <td>07.1.4.-A1</td> <td>мкЗв/ч</td> <td>3200.0</td> <td>20</td> <td></td> </tr> </tbody> </table> <p>К отчету прилагаются фото в разрезе с указанием точек измерения</p> <table border="1"> <thead> <tr> <th>Дата измерения</th> <th>Исполнитель</th> <th>Ответственное лицо</th> </tr> </thead> <tbody> <tr> <td>2013-04-10</td> <td>Г. Гольман</td> <td>Е. Шенгел</td> </tr> </tbody> </table> | Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | 1011.1-A1 | 406-2 | +16.80 | 1УА2801 | Восстановитель котловар ГДМ (вентри) | Вид измерения | Прибор измерения | Число мест измерения | Среднее значение (мкЗв/ч) | Макс. значение (мкЗв/ч) | Глобо | РН-40 | 4 | 3011.3 | 3700.0 | № точки измерения | Единица измерения | Результаты измерения | Неопределенность, % | Замечание | 07.1.-A1 | мкЗв/ч | 2100.0 | 20 | | 07.1.3.-A1 | мкЗв/ч | 3045.0 | 20 | | 07.1.4.-A1 | мкЗв/ч | 3200.0 | 20 | | Дата измерения | Исполнитель | Ответственное лицо | 2013-04-10 | Г. Гольман | Е. Шенгел |
|--|---|----------------------|---------------------------|--------------------------------------|------------|-------------------------|-----------|-------|--------|---------|--------------------------------------|---------------|------------------|----------------------|---------------------------|-------------------------|-------|-------|---|--------|--------|-------------------|-------------------|----------------------|---------------------|-----------|----------|--------|--------|----|--|------------|--------|--------|----|--|------------|--------|--------|----|--|----------------|-------------|--------------------|------------|------------|-----------|
| Здание/бунк. | Помещение | Отметка | Маркировка | Наименование компонента | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1011.1-A1 | 406-2 | +16.80 | 1УА2801 | Восстановитель котловар ГДМ (вентри) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Вид измерения | Прибор измерения | Число мест измерения | Среднее значение (мкЗв/ч) | Макс. значение (мкЗв/ч) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Глобо | РН-40 | 4 | 3011.3 | 3700.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| № точки измерения | Единица измерения | Результаты измерения | Неопределенность, % | Замечание | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 07.1.-A1 | мкЗв/ч | 2100.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 07.1.3.-A1 | мкЗв/ч | 3045.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 07.1.4.-A1 | мкЗв/ч | 3200.0 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Дата измерения | Исполнитель | Ответственное лицо | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2013-04-10 | Г. Гольман | Е. Шенгел | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

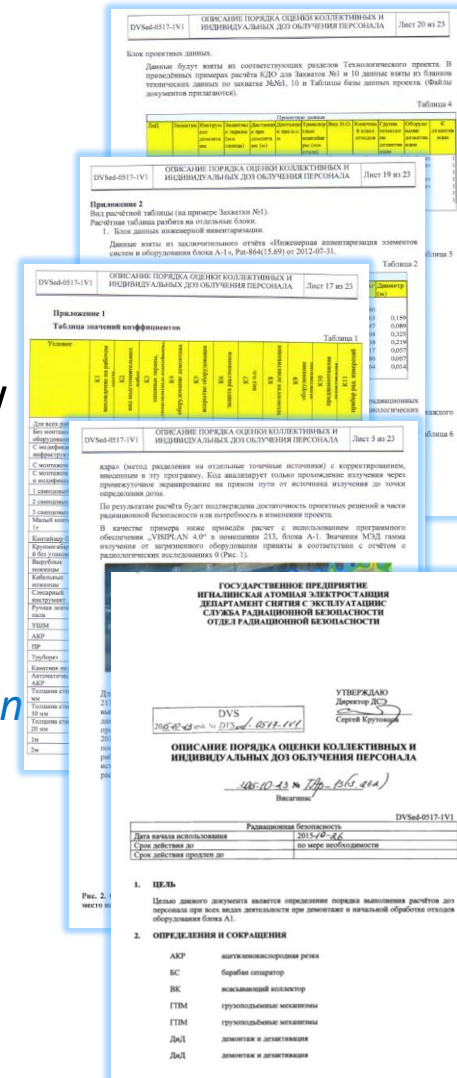
IV. SDS Dismantling Project (2)

- TD and SAR for Unit A1 D&D were approved by VATESI and TSO experts in **May 2021**
- Dismantling of drum separators and auxiliary equipment is a part of the agreed documents
- SAR and TD includes updated information on radiation conditions as it was in 2018 year***
- In order to reduce radiation exposure of personnel, the scope of supply ***includes the development of a new, more advanced technology for dismantling***
- The Supplier shall provide:
 - ✓ ***Technological Project for Dismantling of the equipment, Safety Analysis Report and associated technical documentation (justifications, calculations, etc.)***
 - ✓ ***Licensing support to INPP, to obtain regulatory approval (VATESI) of licensing documents (TP and SAR) for drum separators dismantling and fragmentation***



IV. SDS Dismantling Project (3)

- Current TD and SAR for Unit A1 D&D contains information on collective exposure doses, which was assessed using special, approved by regulator VATESI conservative “Dose assessment methodology”
- Methodology is based on general description of dismantling sequence and using dose rate decreasing coefficients
- Contractor should demonstrate ALARA principal implementation in preparation of new TP for Dismantling of the equipment and SAR for justification



The image shows several overlapping screenshots of Russian regulatory documents. The top document is titled 'Описание порядка оценки коллективных и индивидуальных доз облучения персонала' (Description of the procedure for assessing collective and individual radiation doses of personnel) and includes a table of coefficients. Below it is another similar document with a table of coefficients. The bottom document is a permit form from the State Enterprise 'Ignalina Atomic Power Station' (Государственное предприятие 'Игналинская атомная электростанция') and includes a signature and date.

BSR-1.9.3-2016 “Radiation protection at nuclear facilities”:

6.2. Dangerous works from the radiation protection point of view – the works in the course of which the collective dose of workers may exceed 50 man·mSv and / or the dose rate of ionising radiation in a workplace may exceed 1 mSv/h, or where more stringent radiological criteria determined by the licence or permit holder.

92. In order to optimise radiation protection when performing the works dangerous from the radiation protection point of view, the licence or permit holder shall carry out the radiation protection optimisation analysis (hereinafter – the ALARA analysis) and ensure the implementation of the radiation protection optimisation measures identified during thereof analysis.

IV. SDS Dismantling Project (4)

Dose rate calculation was made taking in account foreseen cutting technology (gas or plasma), and limits from internal operational manuals

Operational manual for ensuring radiation safety during work in the controlled area (DVSed-0512-7):

- It is allowed to move equipment depending on the dose rate of gamma radiation from it at a distance of 0.1 m:
 - Up to 0.1 mSv/h - in „hands“
 - 0.1 – 1.0 mSv/h – in a distance more then 0.5 m from the body
 - 1.0 – 5.0 mSv/h – in a distance more then 1.0 m from the body
 - 5.0 – 10.0 mSv/h – in a distance more then 2.0 m from the body
 - Over 10.0 mSv/h – only remotely, or in a container with biological shielding

IV. SDS Dismantling Project (5)

Operational manual for ensuring radiation safety during work in the controlled area DVSed-0512-7:

PPM used at various concentrations of airborne activity in the air of the working area:

| airborne activity concentration (Bq/m ³) | Personal respiratory protection |
|---|---|
| Gama-/beta-emitting nuclides (Co-60, Sr-90, Nb-94, Cs-137) | |
| 60-1200 | Respirator FFP-3, half mask with aerosol filter (20 maximum allowable concentration - MAC) |
| 1200-2400 | Mask with aerosol filter (40 MAC) |
| 2400-30000 | Air-supplied helmet with filter pack, air-supplied containment suit (500 MACK) |
| >30000 | Helmet with clean air supply, insulating suit with clean air supply (Spiromatic or similar) |
| Alfa-emitting nuclides (uranium, plutonium, americium) | |
| 0,2-4 | Respirator FFP-3, half mask with aerosol filter (20 MAC) |
| 4-8 | Mask with aerosol filter (40 MAC) |
| 8-100 | Air-supplied helmet with filter pack, air-supplied containment suit (500 MAC) |
| >100 | Helmet with clean air supply, insulating suit with clean air supply (Spiromatic or similar) |

IV. SDS Dismantling Project (6)

□ Current TD and SAR for Unit A1 D&D contains information on contamination:
“hot spot”

➤ steam-water reserve branches:

dose rate up to 52.0 mSv/h

| № БС | Маркировка резервных патрубков ПВК БС | | | | | | | | | | | |
|---------|---------------------------------------|------|------|------|------|------|------|-----|-----|-----|-----|-----|
| | МЭД γ-излучения, мЗв/ч | | | | | | | | | | | |
| 11 | B4 | B2 | B3 | A4 | B5 | B1 | A5 | A1 | A3 | A2 | | |
| | 18,0 | 16,0 | 14,0 | 13,0 | 11,0 | 11,0 | 10,0 | 9,7 | 9,2 | 9,2 | 8,0 | 5,8 |
| 12 | V4 | G7 | V5 | V2 | V3 | G3 | V1 | G2 | G5 | G1 | G4 | G6 |
| | 20,0 | 13,0 | 12,0 | 10,0 | 8,4 | 8,0 | 7,6 | 5,0 | 2,5 | 1,5 | | |
| 21 | E1 | I3 | E4 | E3 | E2 | I2 | I1 | E5 | | | | |
| | 52,0 | 30,0 | 27,0 | 24,0 | 24,0 | 14,0 | 11,0 | 8,0 | | | | |
| 22 | L2 | K3 | L1 | K2 | K1 | | | | | | | |
| | 40,0 | 20,0 | 20,0 | 15,0 | 11,0 | | | | | | | |

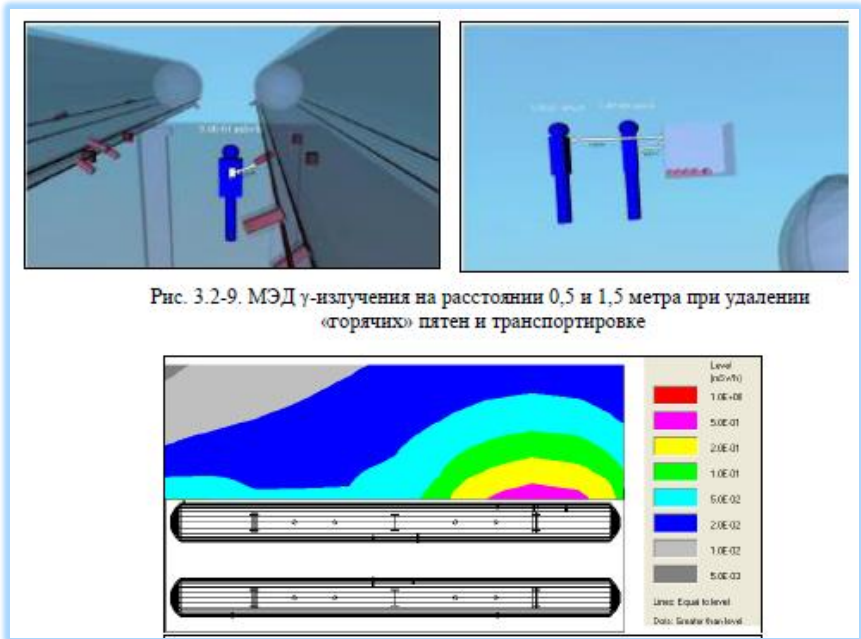
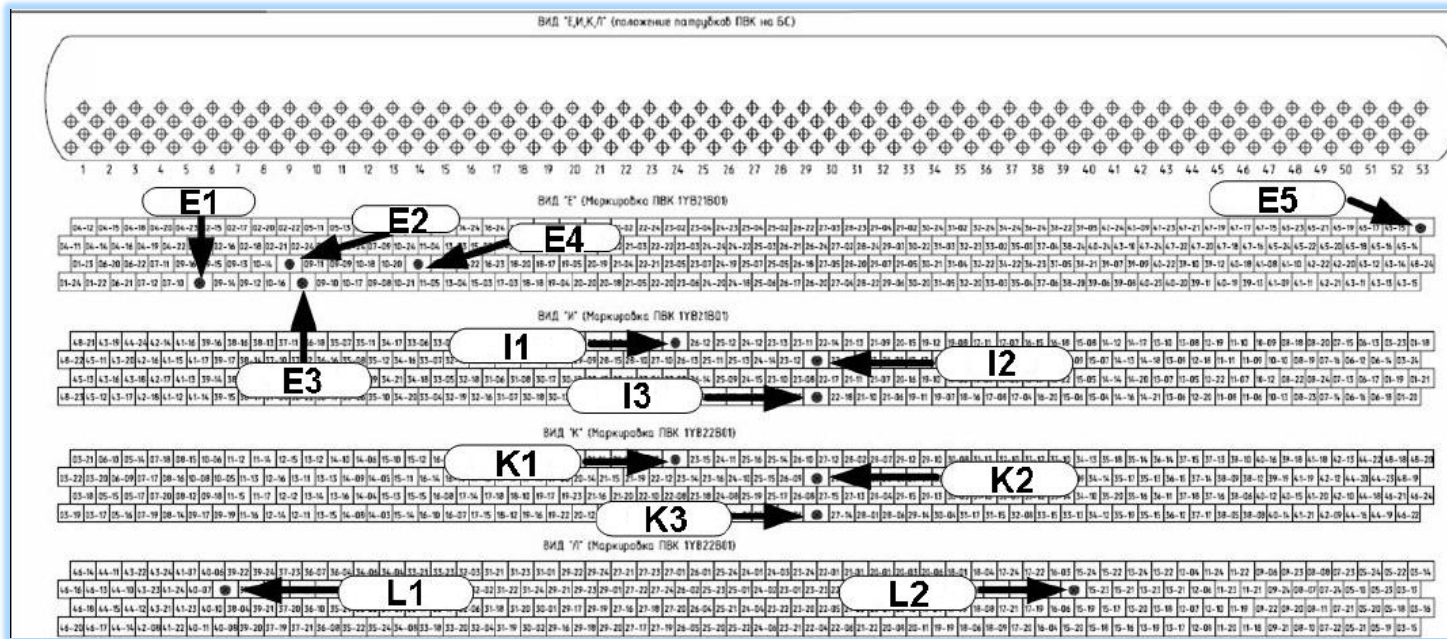
➤ plugs of dismantled water cross junctions:

dose rate up to 45.0 mSv/h

| № БС | Маркировка заглушек ВУТ БС | | | |
|---------|----------------------------|------|------|------|
| | МЭД γ-излучения, мЗв/ч | | | |
| 11 | ВУТ1 | ВУТ2 | ВУТ3 | ВУТ4 |
| | 2,5 | 3,0 | 7,0 | 6,8 |
| 12 | ВУТ5 | ВУТ6 | ВУТ7 | ВУТ8 |
| | 8,5 | 4,6 | 6,7 | 6,5 |
| 21 | ВУТ1 | ВУТ2 | ВУТ3 | ВУТ4 |
| | 5,0 | 2,1 | 6,5 | 2,4 |
| 22 | ВУТ5 | ВУТ6 | ВУТ7 | ВУТ8 |
| | 10,0 | 45,0 | 7,0 | 5,9 |

IV. SDS Dismantling Project (7)

- ❑ Current TD and SAR for Unit A1 D&D contains information on collective exposure doses:
 - “hot spot” removal
 - steam-water reserve branches: **CD = 16.5 man*mSv**
 - plugs of dismantled water cross junctions: **CD = 37.0 man*mSv**



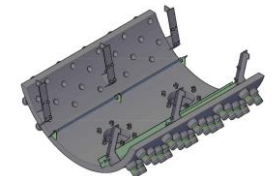
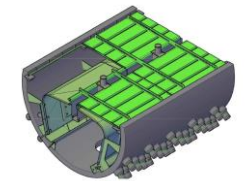
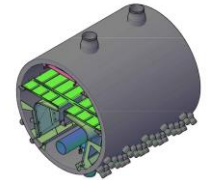
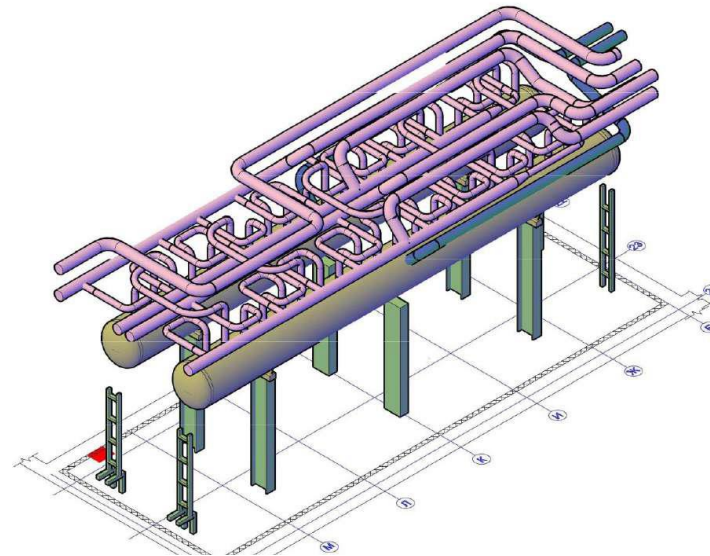
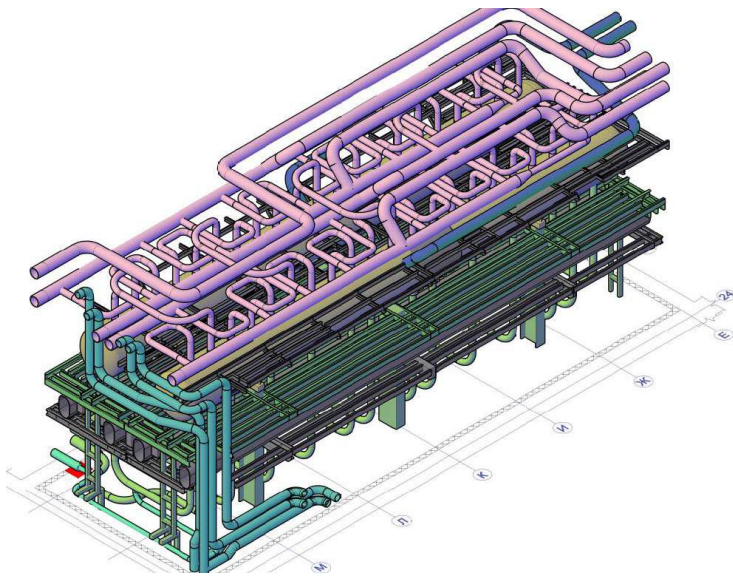
- ❑ More advanced technology for dismantling should reduced collective exposure doses

IV. SDS Dismantling Project (8)

- Current TD and SAR for Unit A1 D&D contains information on collective exposure doses:

Dismantling of drum separators and auxiliary equipment

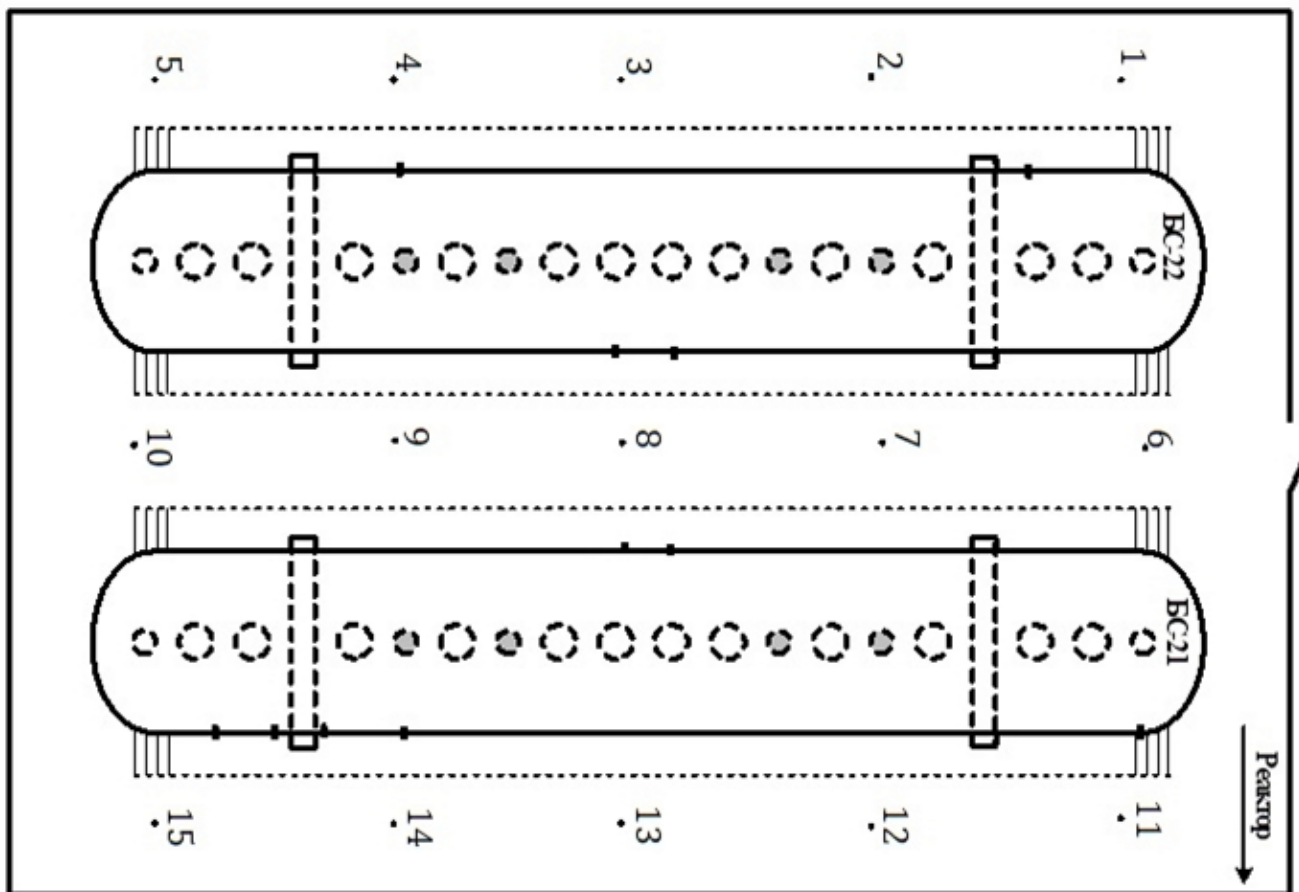
- work package Nr.17: **CD = 1643.0 man*mSv**
- work package Nr.18 : **CD = 1630.0 man*mSv**



- More advanced technology for dismantling should reduced collective exposure doses

IV. Radiological conditions in SDS premises

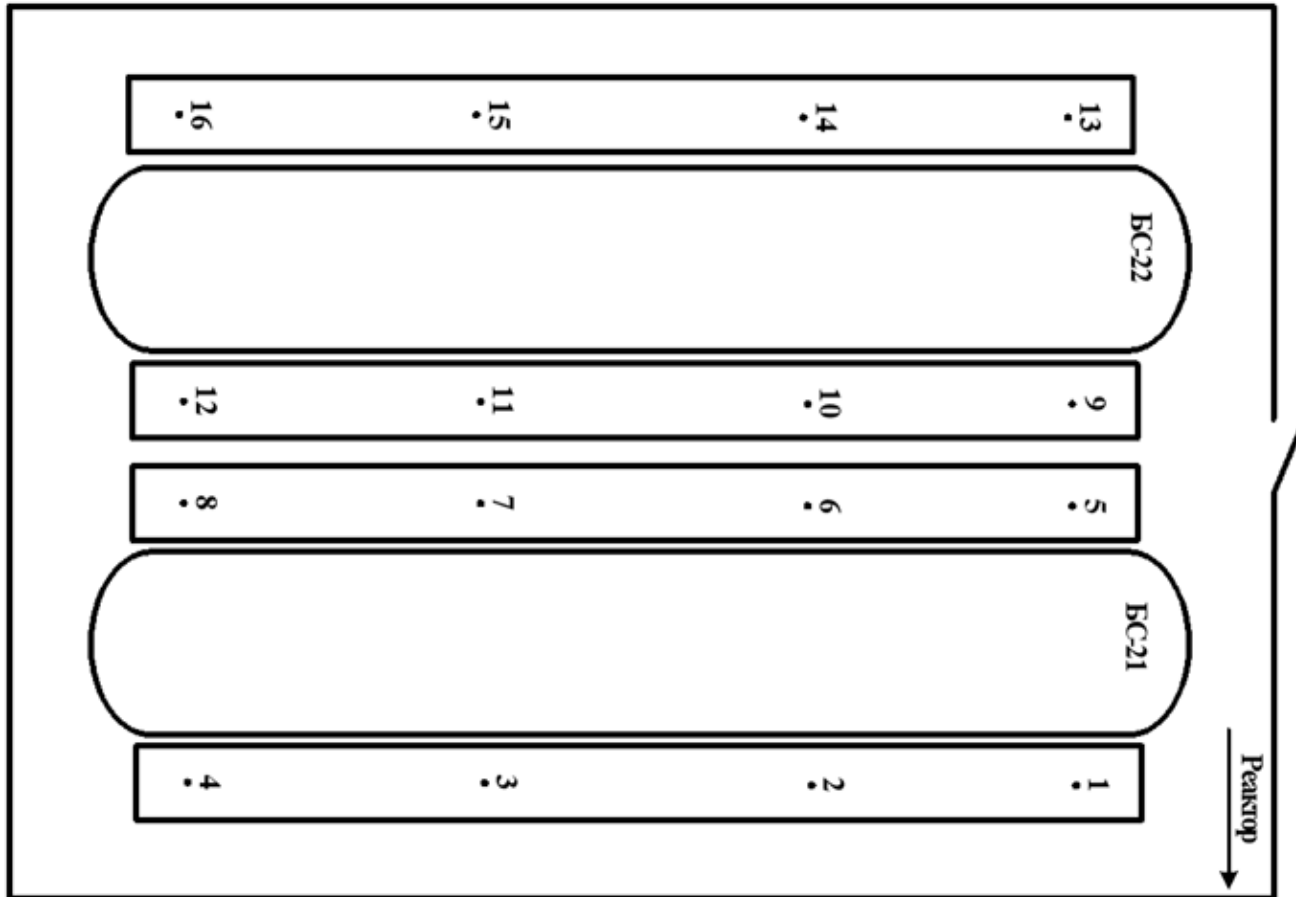
□ Radiological conditions in SDS premises on 2022-02-25 (Unit A1, 506/2, +28 m), surface contamination is about 20 Bq/cm²:



| Nr. | Dose rate mSv/h |
|-----|-----------------|
| 1. | 0,12 |
| 2. | 0,12 |
| 3. | 0,13 |
| 4. | 0,21 |
| 5. | 0,20 |
| 6. | 0,07 |
| 7. | 0,19 |
| 8. | 0,30 |
| 9. | 0,19 |
| 10. | 0,10 |
| 11. | 0,12 |
| 12. | 0,12 |
| 13. | 0,13 |
| 14. | 0,21 |
| 15. | 0,21 |

IV. Radiological conditions in SDS premises (2)

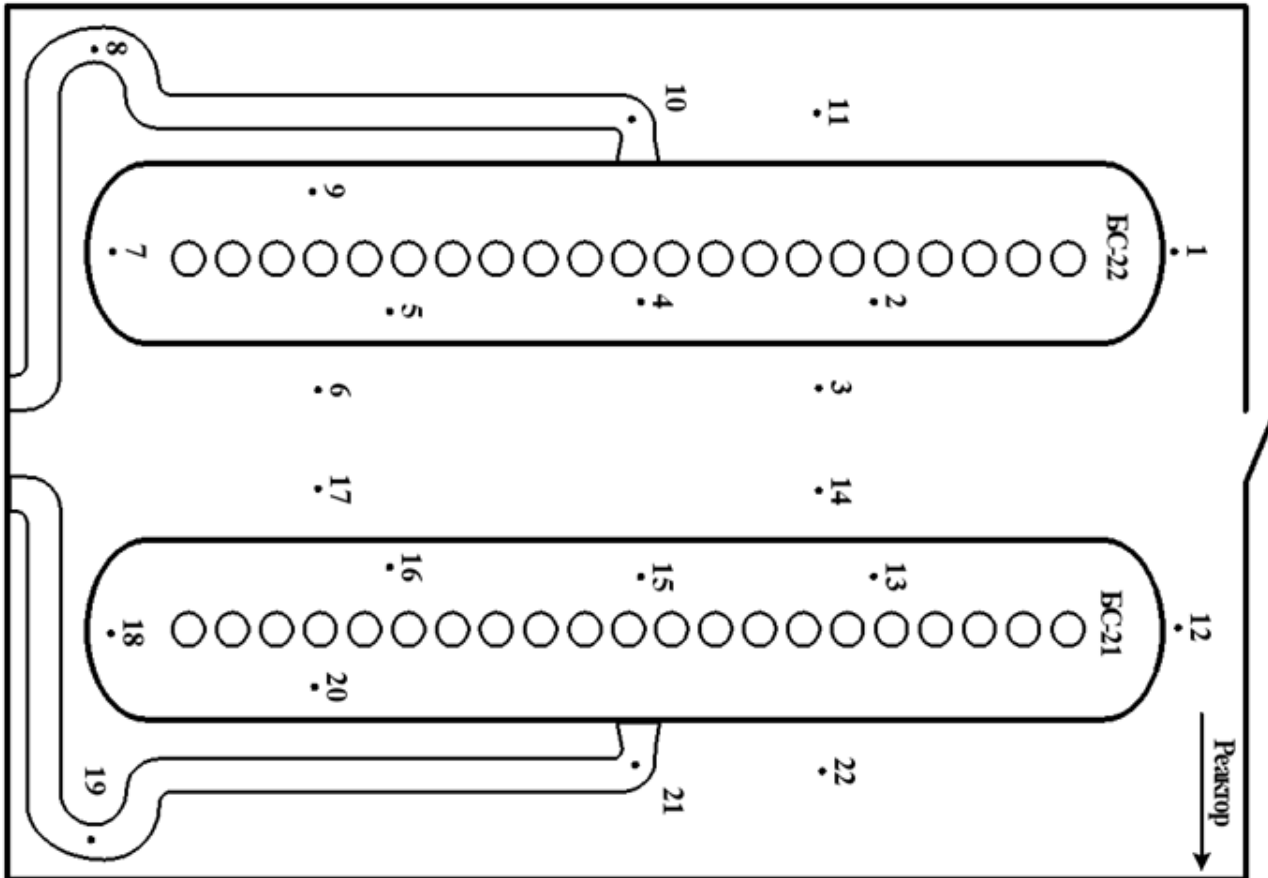
□ Radiological conditions in SDS premises on 2022-02-25 (Unit A1, 506/2, +30 m), surface contamination is about 20 Bq/cm²:



| Nr. | Dose rate mSv/h |
|-----|-----------------|
| 1. | 0,10 |
| 2. | 0,13 |
| 3. | 0,22 |
| 4. | 0,06 |
| 5. | 0,11 |
| 6. | 0,14 |
| 7. | 0,25 |
| 8. | 0,06 |
| 9. | 0,12 |
| 10. | 0,14 |
| 11. | 0,21 |
| 12. | 0,08 |
| 13. | 0,11 |
| 14. | 0,12 |
| 15. | 0,19 |
| 16. | 0,07 |

IV. Radiological conditions in SDS premises (3)

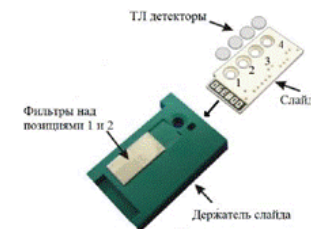
☐ Radiological conditions in SDS premises on 2022-02-25 (Unit A1, 506/2, +32 m) , surface contamination is about 20 Bq/cm²:



| Nr. | Dose rate mSv/h | Nr. | Dose rate mSv/h |
|-----|-----------------|-----|-----------------|
| 1. | 0,017 | 12. | 0,019 |
| 2. | 0,019 | 13. | 0,019 |
| 3. | 0,020 | 14. | 0,020 |
| 4. | 0,020 | 15. | 0,020 |
| 5. | 0,020 | 16. | 0,020 |
| 6. | 0,020 | 17. | 0,019 |
| 7. | 0,020 | 18. | 0,017 |
| 8. | 0,020 | 19. | 0,018 |
| 9. | 0,018 | 20. | 0,019 |
| 10. | 0,017 | 21. | 0,020 |
| 11. | 0,018 | 22. | 0,020 |

IV. Alarm levels, daily limits

- ❑ All works in controlled area are performed with permitted **daily dose of exposure 200 $\mu\text{Sv}/\text{day}$**
alert level is set to 180 μkSv in order to ensure, that the employee has time to leave the work area
- ❑ For employees, participating in SDS Dismantling Project, dosimeters to measure the exposure for lens of the eye will be given (change on the monthly base)
- ❑ Allowed work time in SDS premises on some platforms (+28m and + 30m) currently **is about 1-2 hours**
- ❑ Annual exposure dose is limited to **18 mSv**
starting from 15 mSv, daily dose of exposure decreases to 50 $\mu\text{Sv}/\text{day}$
- ❑ In the Radiation safety assurance agreement between Ignalina NPP and the Contractor **could be set different, but only lower** annual exposure dose limit

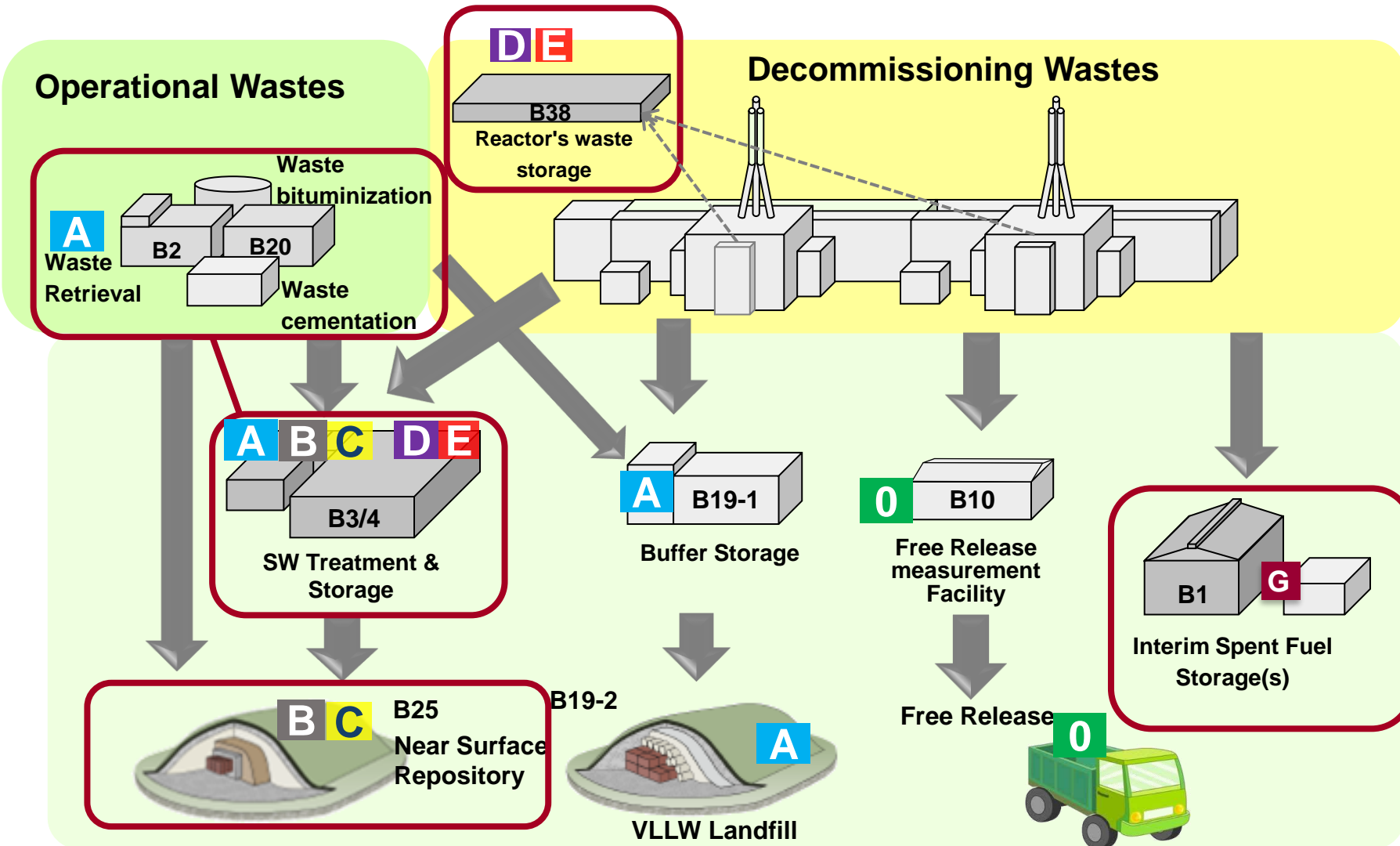


IV. Alarm levels, daily limits (2)

- Airborne radioactivity concentration at working places will be monitored promptly
- Alert level will be set (preliminary to 85 Bq/m³)**
- Internal surface SDS contamination is about 80000 Bq/cm²
- Allowed surface contamination for working premises in that sub-area is up to 40 Bq/cm²



V. RAW treatment



0 Free Release Waste

Short-lived Low Level and Intermediate Level Waste:

A Very Low-Level Waste (<0,2 mSv/h)

B Low Level Waste (0,2-2 mSv/h)

C Intermediate Level Waste (>2 mSv/h)

Long-lived Low Level and Intermediate Level Waste:

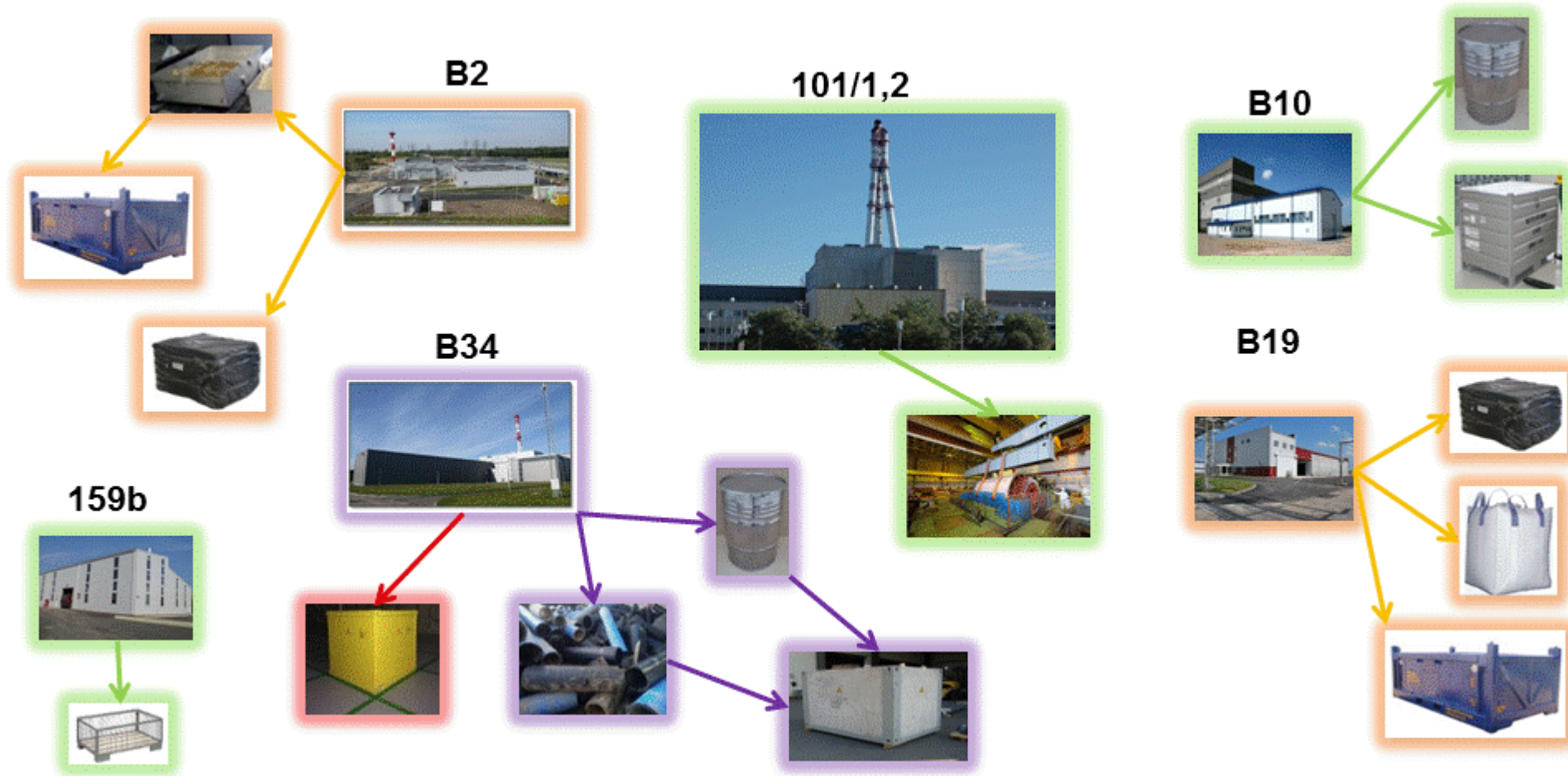
D Low Level Waste (<10 mSv/h)

E Intermediate Level Waste (>10 mSv/h)

G High Level Waste (nuclear fuel)

V. RAW treatment (2)

Types of radioactive waste packages



V. RAW treatment (3)

0 Free Release



A Very Low Level Waste



V. RAW treatment (4)

B Short-Lived Low-Level Waste

C Short-Lived Intermediate Level Waste



D Long-Lived Low-Level Waste

E Long-Lived Intermediate Level Waste



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