Working with Beryllium in Efremov Institute

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Workshop on Beryllium Applications and Health & Safety
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Outline

- Types of work with beryllium
- Legislative base
- Medical formalities
- Contamination monitoring
- Information for visitors
- Lessons learned
Types of work with Beryllium

- Assembling fingers with Be tiles
- Brazing of Be tiles onto heat sink structure
- HHF tests by e-beam
- Vacuum and hydraulic tests
- Final assembling of FW panels
- Final cleaning of FW panels
- 3-D measuring
- Packaging
- Storing
**Legislative base**

- Sanitary rules «СП 46-83 - Design and operation of enterprises for the production and processing of beryllium and its compounds»
- Sanitary rules «№993-72 - Medical regulations for working with beryllium and its compounds»
- Methodological instructions «МУ 2.2.1.25 – 06 Hygienic requirements for design and operation of enterprises for the production and processing of beryllium and its compounds»

Some key points from documents

- Fitter’s works with Be parts (without mechanical processing, finishing, attrition etc.) can be done in regular assembly shop
- Measurement of Be physical and mechanical properties (thermal conductivity, thermal expansion coefficient, ultimate strength etc.) at temperatures less than 700 °C can be done in regular facilities in regular lab
- Storage of metallic Be can be realized in common storage facilities

Based on mentioned requirements development and implementation of local safety works instructions has been started
Medical formalities

• All Efremov’s staff working with Be has to pass periodical general medical inspection with additional special tests (blood, urine) emphasized on Be detection

• Beryllium lymphocyte proliferation test (BeLPT) not required

• All areas of Be activities (mock-ups assembling, testing, cleaning, storage) have to be periodically checked on Be contamination level

According to Russian requirements (СП 993-72 and МУ 2.2.1.25-06) the maximum permissible concentrations of Be are:

for non-processing Be organizations (Efremov)

• Air (environment) 0,01 µg/m³
• Surface 30 µg/m²
Contamination monitoring

Test protocol

Atmospheric concentration

Regular measurements once a month
Extra measurements based on the situation

Example of report

Concentration, µg/m³

Location: mock-up assembling, testing, cleaning areas
Air flow 20 l/min
Exposure 40 min, therefore 800 liters

Results never exceeded 0,01 µg/m³
Contamination monitoring

Test protocol

Location:
Mock-ups/fingers assembling table,
table in front of US bath
Sampling Dry smear (CCFE-like)

Non-Beryllium surfaces in Be control zones

Regular measurements
once a month

Extra measurements
based on the situation

Example of report

Results: always less 10 µg/m²
Contamination monitoring

Be surfaces of mock-ups brazed and/or HHF tested

Measurements after brazing and HHF test

Test protocol

Example of report

Current results: In some mock-ups a value exceeding 30 µg/m² was observed
Current conclusion: RPE (FFP3 masks), gloves, lab coats (in some cases) are mandatory for any handling of brazed mock-up or finger
## Contamination monitoring

### Zoning of areas in relation to possible Be contamination

<table>
<thead>
<tr>
<th>Be non-controlled zones</th>
<th>Surface contamination levels ($\mu$g/m$^2$)</th>
<th>Airborne contamination levels ($\mu$g/m$^3$)</th>
<th>Precaution prior to entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>(offices area)</td>
<td>$\leq 30$</td>
<td>$\leq 0.01$</td>
<td>No precaution</td>
</tr>
</tbody>
</table>

**Be controlled zones**

| (mock-ups assembling, testing, cleaning, areas) | $\leq 30$ | $\leq 0.2$ | No precaution |

| Working with brazed (mock-up/finger) components | $>30^*$ | $\leq 0.2$ | RPE (FFP3 masks), gloves, lab coats (in some cases) are mandatory for any handling of brazed mock-up/finger |

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*In some mock-ups a value exceeding 30 was observed*
Information for visitors

Completed Beryllium safety questionnaire forms describe the current status of objects of interest

- Efremov provides disposable RPE (FFP3 masks), gloves, lab coats, disposal container
- Any additional protection (PAS, Tornado hood, ?) – on your own base
**First lessons learned**

- In general, the organization of work with beryllium in Efremov meets the requirements of Russian health and safety services.
- It seems no problems on the organization of visits of representatives of IO-CT.
- The obvious necessity of finding a reliable and replicable method of sampling and analysis of surface contamination. The current results have a very large spread.
- Up to now, there is no evidence of a dependency between the amount of surface contamination and atmospheric air.
- Control of atmospheric air seems to be more effective in relation to H&S.
- Using PAS seems to be very attractive.