



# *Research Reactor Management in Low Budget Environment*

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University Research Reactors are often managed accounting on low institutional budget (**about 100.000 euro for the University of Pavia**). Besides, the utilization of this kind of reactors is usually not particularly profitable because even if they can be used for several nuclear applications (eg. NAA, basic physics research, radiation damage on electronic components, medical applications, etc.) they produce small income.

Often, though, a low institutional budget is balanced by a fair number of human resources dedicated to the reactor maintenance and operation. Thus, in order to be able to assure safety and good operation, a key point for small research reactors is to be able to grow local competences in maintenance activities and to implement a good Quality Assurance Program (or an Integrated Management System – UNI EN ISO 9001/2008 and BS OHSAS 18001/2007).

Both these issues have been supported in the last few years at the University of Pavia. As result a almost complete home-made refurbishment of the reactor instrumentation and control system, a partial upgrading of the reactor cooling system and of the reactor building ventilation system were projected and realized in the last 5 – 6 years with a reasonably low money expense (about 400.000 euro).

➤ *Refurbishment of the Instrumentation & Control System*

In specific:

- Reactor Linear Power Channel and Chart Recorder;
- Reactor Percent Power Safety Channel;
- Ion chambers High Voltage and Low Voltage Power Supply;
- Automatic Reactor Power Control;
- Fuel Elements and Cooling-Water Temperatures Measuring Channels;
- Water Conductivity Measuring Channel.

➤ *Substitution of the tertiary water-cooling circuit and a partial substitution of the components of the secondary water-cooling circuit*

➤ *New Radiation Area Monitoring System*

➤ *Reactor Building Air Filtering and Ventilation System*

➤ *Core re-configuration*

In Pavia, during the last two years all Maintenance Sections and the Health Physics Service were evaluated by QA internal inspections (**UNI EN ISO 9001/2008**) every three months.

The procedures for reactor operation and maintenance were reviewed and updated. And this process is in continuous development.

The Occupational Health and Safety Management Systems (**BS OHSAS 18001/2007**) is under implementation.

Of course a **severe budget planning and maintenance planning** over few years (at least 2 – 3 years) is also necessary in order to be able to manage unexpected minor components failures. The introduction of **fares for the reactor utilization** can represent also a significant contribution to the overall budget (for the University of Pavia this contribution is about 40% of the institutional budget).

As a conclusion, I submit to the attention of the TWGRR the proposal to suggest IAEA to support these two issues:

- to support low power reactor to grow local competences in maintenance activities by circulation of knowledge (and experts)
- to support low power reactor to implement a adequate Integrated Management System (Quality Assurance, Safety and Environment Sustainability)

However, to be realistic, it is important to notice that **unexpected major components failures** (eg. structural), **fresh fuel supply and reactor decommissioning** are activities that **cannot be manage with low budget** no matter how good is the management.

Thanks for your Attention!

