

COST EFFECTIVE SAFETY ENHANCEMENTS FOR RESEARCH REACTORS IN UZBEKISTAN AND KAZAKHSTAN – RESULTS OF A JOINT PROGRAM WITH *USDOE*

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INTRODUCTION

The US Department of Energy’s Office of International Nuclear Safety and Cooperation established the Integrated Research Reactor Safety Enhancement Program (IRRSEP) in February 2002 to support U.S. nonproliferation goals by (1) implementing safety upgrades, or (2) assisting with the safe shutdown and decommissioning of foreign test and research reactors which present security concerns.

IRRSEP’s key objective is to resolve the highest-priority nuclear safety issues at the most vulnerable foreign research reactors as quickly as possible. The prioritization methodology employed identified which research reactors fell into this category. The corrective measures mutually developed with the host facility are based on the premise of developing a sustainable infrastructure within each country to deal with its own nuclear material safety, security, and response issues in the future. IRRSEP also assists in creating an international framework of cooperation and openness between research and test reactor operators, and national and international regulators.

STRUCTURE OF THE PROGRAM

IRRSEP’s key program components are:

Phase I: Self-evaluation by facility using provided checklists followed by prioritization to identify the 20 highest risk facilities

Phase II: Site visits with technical evaluation to finalize a list of projects that will enhance safety consistent with IAEA observations

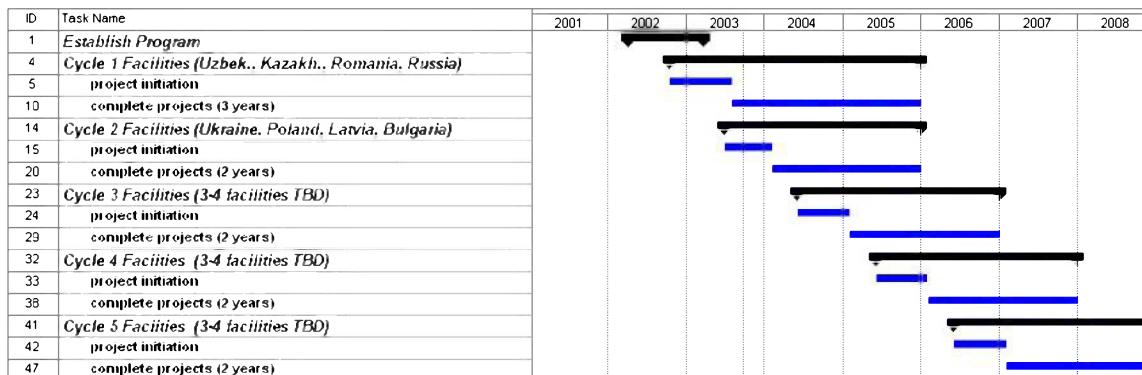
Phase III: Corrective measures to implement the projects

Phase I, II and III are accomplished on a rolling basis, such that work is ongoing at three or four reactors per year. The way this is accomplished is as follows:

- Year 1
 - Information questionnaires/checklists are sent out to facilities to help identify in advance the potential safety issues
 - Based on a facility prioritization scheme and responses from the questionnaire/checklists, technical visits at 2-4 facilities are conducted to identify possible projects at the facilities
 - Prioritize the projects using nuclear safety based grading criteria

- Select projects to be completed the next fiscal year based on the prioritization and the funding available
- Year 2 and beyond
 - Complete the projects (most projects are 1 year projects, some may be multi-year)

Graphically, the program appears like this:



The initial projects under IRRSEP were ‘pilot’ projects and are underway at research reactors in Kazakhstan, Uzbekistan, and Romania. This paper focuses on the projects undertaken at the WWR-K research reactor at the Institute of Nuclear Physics in Alatau, Kazakhstan and the WWR-SM research reactor at the Institute of Nuclear Physics in Ulugbek, Uzbekistan. These projects demonstrate the success and cost effectiveness of the IRRSEP program.

OVERVIEW OF IRRSEP ACCOMPLISHMENTS

At the end of the first year of IRRSEP (2002), the initial visits were made to Kazakhstan, Uzbekistan, and Romania. Upon return to the U.S., the projects were prioritized based on impact to nuclear safety. Based on the budget availability, the initial set of projects to be completed was recommended to the host country and agreed to. Originally, there were 9 projects selected for Uzbekistan, 16 projects for Kazakhstan, and 5 projects for Romania.

At the end of the second year of IRRSEP (2003), all of the initial projects for Uzbekistan, Kazakhstan, and Romania were initiated. In addition, initial visits were made and projects identified for facilities in Latvia, Poland, and Ukraine. Unfortunately, DOE also made notification that due to budget shortfalls and new priorities that the IRRSEP was going to have to be terminated. Consequently, multi-year projects in Uzbekistan and Kazakhstan were eliminated, resulting in the number of projects being 7 for Uzbekistan, 9 for Kazakhstan, and 3 for Romania. Further efforts for Latvia, Poland, and Ukraine were terminated.

By the end of the third year (2004), almost all the projects that remain have been completed. The rest of this paper will discuss the details of these projects for Uzbekistan and Kazakhstan.

The fact that IRRSEP was terminated due to other U.S. budget priorities doesn’t mean that the program wasn’t successful. The work that is being completed in Uzbekistan, Kazakhstan, and Romania is making significant enhancements to the nuclear safety posture for those facilities in a very cost effective manner. IRRSEP provides a template on how cost effective projects may be completed and should be initiated again if budget funds become available.

IRRSEP DETAILED RESULTS FOR UZBEKISTAN

The research reactor in Uzbekistan is the WWR-SM reactor located at the Institute of Nuclear Physics (INP) in Ulugbek, Uzbekistan, just northeast of Tashkent. The reactor is a 10 Mwt tank type research reactor built in 1959. The reactor has operated virtually continuously making medical

isotopes and conducting experiments. The key personnel at the INP are Dr. Bekhzod Yuldashev – Director INP and Head of Uzbekistan Academy of Science, Umar Salikbaev – Deputy Director of INP, Dr. Alexander Kist – Director General Councilor of INP, Khusniddin Karabaev – Chief of WWR-SM, Akhror Rakhmanov – Deputy Chief Engineer WWR-SM, and Ramses Bekbulatov – Head, I&C Group WWR-SM.



WWR-SM Reactor



Drs. Yuldashev, Salikbaev, and the US team

Seven projects were ultimately undertaken:

- Project 1 – fire suppression. Fire is one of the greatest real risks at research reactors, especially older reactors. Based on a joint assessment, the actions agreed to be taken included:
 - Provide immediate fire protection equipment (fire extinguishers, etc.). As a result, new fire extinguishers, fire hoses, and new fire system valves were procured and installed.
 - Perform joint fire hazard evaluation to identify improvements for next year implementation. As a result, a ‘no cost’ review was performed jointly with US and INP fire protection specialists. The key items identified included the need for fire protection coating for wood walls, attic, and key electrical conduits; new fire doors; additional fire detectors; and to replace/improve fire hose standpipe system.
 - Project 1B was recently initiated as a separate project to implement the above recommendations.
- Project 3 – Provide new 2 way radios and batteries. Emergency communications is extremely important for response to any type of event. The radios at the facility were out of date and new batteries could not be procured. Consequently, the action for this project was to provide new radios, base station, chargers. The project is now in its final stage.
- Project 4 – important spare parts. The parts of concern were important, including spare ion chambers, signal cabling, and radiation resistant gasketing. At the current time, the contracts with Russia for the parts are being finalized.



New Fire Extinguishers



New Emergency Diesel

- Project 6 – emergency power. On loss of offsite power, important reactor and primary system instrumentation and equipment was lost. The action identified to rectify the situation included adding loads to new emergency diesel provided by US MPC&A program (diesel capacity was upgraded for this purpose), adding an uninterruptible power supply for critical reactor protection loads (reactor control instruments, dosimetry system), and adding a new ‘emergency cooling’ pump that could supply a source of recirculation cooling to the reactor primary system in the event of a loss of power.
- Project 7 – Non-destructive Examination (NDE) Training and Equipment. It is very important to have an internal capability to perform NDE examinations on important reactor pressure boundary components. The actions identified to do this included providing training for 3 engineers/technicians, procuring new NDE equipment, and requiring an inspection plan to be written and demonstrated
- Project 8 – Provide for portable underwater lighting for surveillance of reactor tank. The available lights were made at the facility and were not sufficient. A local manufacturer that produces fountain lights was found that could produce high quality lights meeting requirements.

IRRSEP DETAILED RESULTS FOR KAZAKHSTAN

The research reactor in Kazakhstan is the WWR-K reactor located at the Institute of Nuclear Physics (INP) in Alatau, Kazakhstan - east of Almaty. The reactor is also a 10 Mwt tank type research reactor built in 1967. The reactor was shutdown in 1988 due to seismic concerns. It was restarted in 1998 with the power derated to 6 Mwt. Additionally, water makeup tanks were expanded and seismic braces were added and seismic ‘shields’ were added to protect important components in case of building superstructure collapse in a seismic event. The reactor is



WWR-K Reactor



**Dr. Kadyrzhanov, Petr Chakrov
and the US Team**

currently operating making medical isotopes, material testing, conducting experiments and seeking new missions. The key personnel at the INP are Dr. Kairat Kadyrzhanov – Director of INP, Petr Chakrov – Deputy Director of INP, and Vyacheslav Chernyaev – Chief Engineer of WWR-K

Nine projects were ultimately undertaken:

- Project 1 – 48v battery. The old battery and rectifier were not functional and were important to provide a backup power to key instrumentation (power level, etc). The solution decided upon was to provide for an uninterruptible power supply.
- Projects 2 & 10 - provide control rod drive (CRD) and instrumentation improvements. The old CRD cabling was not per specification which required stainless steel cabling. Actions decided upon included providing uninterruptible power supplies to provide for more reliable power and to provide for new cabling that did meet specification requirements.
- Project 3 & 11- provide water intrusion monitors for new fuel and HEU material storage areas, and portable neutron monitors. The water intrusion monitors replaced hand made units. Portable neutron instruments are being provided (which the facility did not have previously) are important for surveillance during fuel transfers
- Project 4 – provide new communications systems. As stated previously, good communications is absolutely necessary for control of actions in an emergency. The actions agreed to included providing for a new public address system, 2-way radios, and digital telephone equipment.



**New Fire Protection
Equipment**

- Projects 5, 6 (combined), 7 – fire detection and suppression. As stated previously, fire is probably the single greatest safety hazard at a research reactor. The WWR-K facility needed both a new fire detection system and high priority fire suppression equipment – fire extinguishers, et. al.

- Project 8 – Non-Destructive examination (NDE) and Welding Training and Equipment. Similar to Uzbekistan, WWR-K needed equipment and training for surveillance and repair of reactor pressure boundary. The actions agreed to were to pay for certified NDE training for 3 NDE and 1 welding engineers (training provided in Russia) and provide for NDE equipment (ultrasonic flaw detector and remote video inspection system). Development of an inspection plan will also be required.

CONCLUSION

The methods IRRSEP employed in the execution if its program provided for cost effective safety enhancements. The primary reasons for this are:

- Close cooperation between US and the Kazakhstan/Uzbekistan technical experts in choosing and scoping projects
- Requiring engineering and procurement to be accomplished locally. This maximizes the use of INP staff and local contractors.

These two simple principles besides being cost effective enhance meeting the IRRSEP objective of developing a sustainable infrastructure within each country to deal with its own nuclear material safety, security, and response issues in the future, and also creating an international framework of cooperation and openness between research and test reactor operators, and national and international regulators.

Though IRRSEP is currently not being continued, IRRSEP provides a template on how cost effective projects may be completed and should be initiated again if budget funds become available.