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**DIRECTORATE-GENERAL JRC**  
**JOINT RESEARCH CENTRE**  
 Institute for Energy  
 Technical and Scientific Support to  
 TACIS and PHARE

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**TACIS NUCLEAR SAFETY**

TACIS PROJECT R8.01/98  
**TRANSLATION, EDITING AND DIFFUSION OF DOCUMENTS**  
**(Results Dissemination)**

**TACIS R2.06/93**  
**Confinement Cable Penetrations**  
**EXECUTIVE SUMMARY**

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## 1 PROJECT SYNOPSIS

Project title                    TACIS 93 Nuclear Safety  
    VVER-213/1000 Confinement Cable Penetrations

Project number                R2.06/93

Country                         Russian Federation

### PROJECT OBJECTIVES

The specific objective of this project is to transfer the AUXITROL know-how to the Russian Beneficiary ELOX for the manufacturing and testing of complete sets of electrical cable penetrations including the different types of penetrations.

### PLANNED OUTPUT

Once this objective has been reached ELOX will be in a position to replace the existing low quality penetrations of VVER-440/V213 and VVER-1000/V320 nuclear power plants by high quality penetrations, qualified for 40 years of operation and entirely manufactured in the CIS. In addition these high quality penetrations could be used in the construction of new power plants.

### PROJECT ACTIVITIES

The project comprised mainly the following work:

- License agreement between ELOX and AUXITROL
- Equipment acquisition needed to manufacture the penetrations
- Know-how transfer (including the knowledge of the standards codes and Quality Assurance Program) and ELOX personnel training in penetrations manufacturing technology and the appropriate methods to carry out electrical connections and installations
- Penetrations manufacture and testing of a set of prototypes of electrical penetrations manufactured by ELOX at the factory in KOMSOMOLSKY (Ukraine) with the technology and under the supervision of AUXITROL
- Product qualification by GOSATOMNADZOR in order to use it in VVER440/V213 and VVER 1000/V312 NPP

**PROJECT STARTING DATE:**    June 1995

**PROJECT DURATION:**            20 months

## **2 OVERAL REPORT ON THE TOTAL PROJECT**

### **2.1 GENERAL POINTS**

The main purposes of the project 'TACIS 93-NUCLEAR SAFETY VVER-213/1000 Confinement Cable Penetrations' are:

- To assist ELOX in:
  - ❖ the purchase of necessary machines and tools for production and for the electric penetrations control,
  - ❖ the installation and starting up of the machines at the KOMSOMOLSKY plant with training on machines maintenance;
- To train engineers and technicians to study technology of the electric penetrations as well as codes and standards applicable to the electric penetrations;
- To train staff to manufacture and to control different types of electric penetrations;
- To train staff in the different connecting methods between penetrations and cables;
- To train on site staff in installation, assembling, connection and control penetrations;
- To train staff in Quality according to the code of the IAEA - 50 CQA for the penetrations manufacturing and the on site installation.

The work took place from June 1995 until the end of May 1997. On AUXITROL request, the program has been extended for 6 months with the agreement of the EC (side letter n\*1 to contract ww-93~06/01~Q2/B006/94-1336). This prolongation has been made without any increase of the original budget.

### **2.2 PROGRESS OF THE WORK PROGRAM**

The work program is divided into 4 phases;

- Phase 1: Preliminary technical and support activities
- Phase 2: Design technology transfer
- Phase 3: Manufacturing know-how transfer
- Phase 4: Connection and installation training,

#### **2.2.1 Phase 1:**

During this period the following works have been done:

1. Definition of working group between AUXITROL and ELOX.
2. Working methods definition.
3. Planning definition.

4. Definition of the Quality Assurance program.
5. Study of the existing installations at ELOX in order to specify the machines and tools to be bought by ELOX for manufacturing and control of the electric penetrations
6. Assistance for ELOX in order to specify the machines and tools to be bought.
7. Assistance for ELOX in the installation and starting up of the machines.
8. Assistance for ELOX in order to obtain from the GOSATGMNADZQR qualification and agreement to manufacture the penetrations in the ELOX plant at KOMSOMOLSKY.

No serious difficulties have been encountered during this phase. Machines and tools are operational. The official agreement from the GOSATOMNADZOR for manufacturing the penetrations in the ELOX plant have been received.

#### **2.2.2 Phase 2:**

During this period the following works have been carried out:

1. Training of the ELOX staff in the control and maintenance of machines and tools,
2. Training and transfer the electric penetrations knowledge, particular training in codes and standards which govern the electric penetrations (IEEE 317 and 323, code ASME, 10 CFR50, RCC-E, CEI 772, ISO 9001, guides and codes of the IAEA, Russian codes and standards),
3. Training to Quality Assurance and to control techniques of the electric penetrations,
4. Training to Quality Assurance for packaging and transport,
5. Training to Quality Assurance for the on site activities.

The realization of this phase did not face any serious problem. The ELOX staff becomes familiar with the electric penetrations production techniques. Moreover the implementation of only Quality Assurance System at ELOX shall guarantee a good quality of manufactured equipment.

#### **2.2.3 Phase 3:**

During this period the following work have been carried out:

Training and transfer of the know-how for manufacturing and testing the electric penetrations.

This phase, the longest one, has been the more important, because the whole penetrations manufacturing operations were manual. The whole trained staff became familiar with the penetrations manufacturing,

#### **2.2.4 Phase 4:**

During this period the following works have been done:

1. Training in wiring and to the different connecting methods of the electric penetrations,
2. Training in tie implementation of the more tractable sleeves,
3. Training in the on site installation and assembly (penetrations handling, assembly, welding, control, connecting),
4. Quality Assurance training on site.

This phase took place without any particular problem and allowed the ELOX staff to visit a French nuclear power station. This visit has been very positive because it allowed the ELOX staff to have another point of view about the electric penetrations installation.

### 3 SUMMARY

During all the above-mentioned phases the whole EIOX staff followed a minimum training to Quality Assurance. Moreover, some engineers and technicians have been trained in the production management used at AUXITROL.

### 4 TRAINING AND NUMBER OF TRAINED PERSONS

The following training took place:

Task	Subject	Number of Staff
6	Training in equipment operation and maintenance	4
7	Transfer of electric penetration design technology	17
8	Training on management and quality assurance	12
9	Transfer of penetration manufacturing know-how	30
10	Training on electrical wiring and connection methods	14
11	Training in on site installation activities	19

### 5 PLANNING

On its whole, the program planning has been respected. The prolongation as specified in the chapter 3.1.2. was requested in order to improve training in the connecting, assembly and on site installation methods and to increase the number of persons to be trained,

This program prolongation allowed also the ELOX staff to visit a French nuclear power station under construction.

### 6 DELIVERABLES

Although some delays (particularly for the qualification and the agreement from the GOSATOMNAD2OR to manufacture the penetrations in the ELOX plant), all deliverables forecast in the contract have been supplied.

## 7 LESSONS LEARNT AND RECOMMENDATIONS

The whole program was performed without any significant difficulties. The following conclusions were made:

- ELOX has the technical means (premises, machines, tools) to manufacture and control entirely assembled electric penetrations,
- The staff acquired sufficient technical knowledge to manufacture and control complete electric penetrations as well as to do their installation, welding and on site testing
- The training of the staff and the implementation of one Quality Assurance program according to the 50 CQA and to the ISO norm must guarantee that the equipment manufactured and tested by ELOX has an acceptable quality for nuclear industry

The only task not solved in the framework of the project duration, was the supply of components (tubes, conductors and insulators of penetrations as well as thermo retractable sleeves). No supplier was found in the CIS who was able to deliver these parts in an acceptable quality according to the requirements.

Recommendation was: To continue searching (outside of the present project) in order to find suppliers for the penetrations components in the CIS.

## 8 ATTACHMENT 1

### LOW AND MEDIUM VOLTAGE ELECTRICAL PENETRATIONS ASSEMBLED BY ELOX

