



AGEING MANAGEMENT of RUSSIAN NPP's with VVER TYPE REACTORS

G.Arkadov, A.Usanov
(JSC «VNIIAES», Moscow, Russia)

N.Davidenko, A.Berezanin
(JSC «Concern Energoatom», Moscow, Russia)

Speaker: A.Usanov

- Since 1996 an operating organization of Russian NPPs in cooperation with providing enterprises has realized the program of its NPPs life extension, which have been discussing currently in frame of the wider task, namely plants life management
- The main directions of the activity are as follows:
 - confirmation and sustenance of the safety operation of irreplaceable elements mitigating, if necessary, its operating load conditions;
 - timely replacement of elements, which had exhausted its performance characteristics;
 - sustenance of the rest elements safe operation by the maintenance system, including modernization.

Normative Base

Related to the ageing management activities are regulated by the Russian normative-technical documentation, including the following:

1. Federal norms and regulations НП-017-2000 «Basic requirements to life extension of nuclear power plant»

2. The standard of «Energoatom» СТО 0327-2007 «Nuclear power plant operation beyond an established timeframe»;

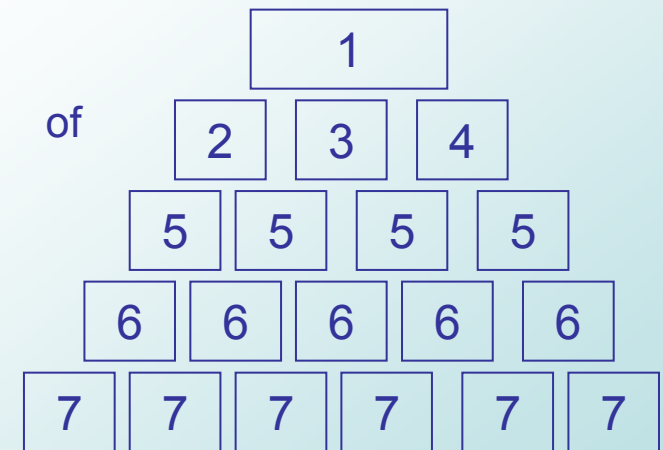
3. The governing document of «Energoatom» РД ЭО 0281-2001 «Provision on management of performance characteristics of power units elements»;

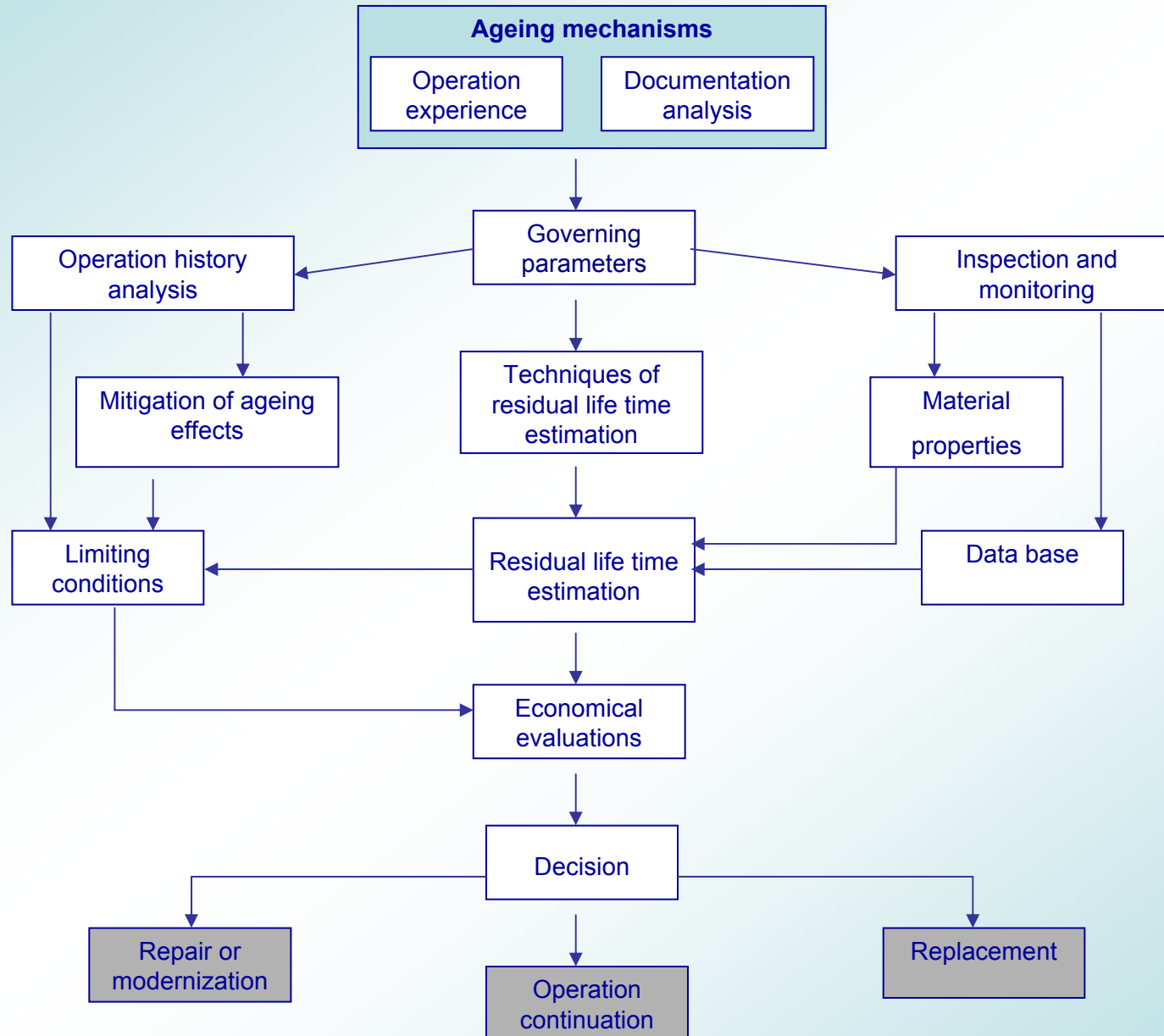
4. The governing document of «Energoatom» РД ЭО 0526-2004 «Typical requirements to the content of the program of preparation of the nuclear power plant to the long term operation».

5. Branch programs on upgrading of operation reliability of “problem” elements

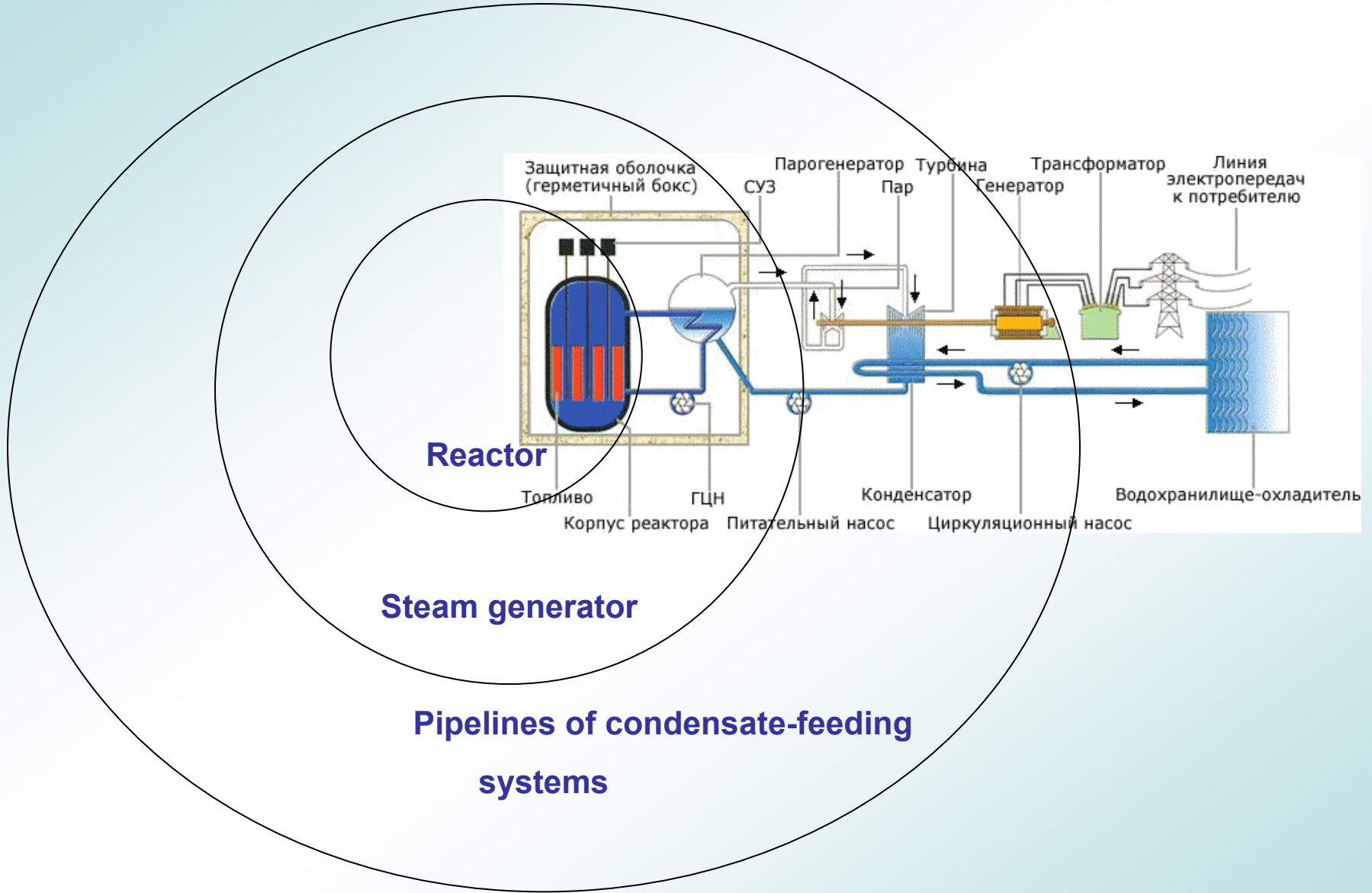
6. NPPs programs on management of performance characteristics of power units elements

7. NPPs technical decision and decisions of “Energoatom” weekly video-conferences





NPP elements being discussed

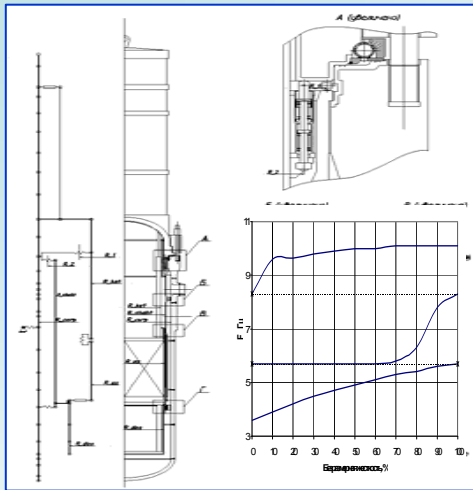


The resistance to radiation embrittlement of VVER

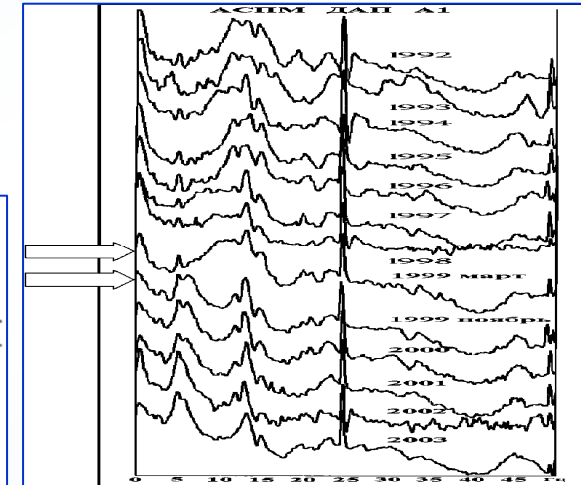
- **Increasing of the resistance to radiation embrittlement of VVER-440 RPV**
 - annealing of 12 VVER-440 reactors pressure vessels to restore mechanical properties of the vessels material;
 - installation of dummy assemblies at the core periphery;
 - updating of modes of vessels loading;
 - heating of water in emergency stock tanks and others.
- **Justification of VVER-440 internals brittle strength before PLEX**
- **Justification of VVER-1000 brittle strength in the frame of contract EDF with concern “Rosenergoatom” (no used RPV of Kalinin-4 NPP was applied)**
 - full RPV NDE using French and Russian technologies;
 - NDE of cutting from RPV;
 - specimens manufacturing from cuttings;
 - testing of irradiated specimens.
- **Developing of technology of the restoring annealing VVER-1000 pressure vessels to assure its operation up to 60 years.**

Activity on reducing of vibration loading of Kola NPP (unit 2) internals and fuel assemblies

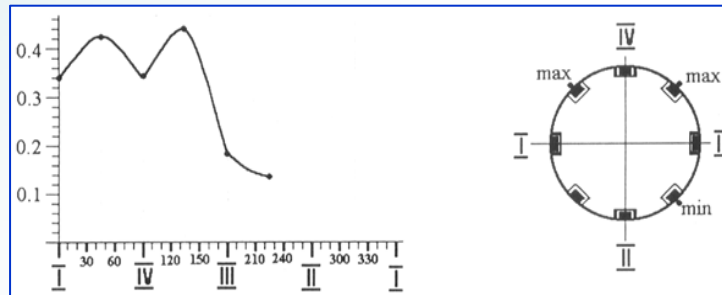
Eigenfrequencies calculations



Vibration measurement archives analysis



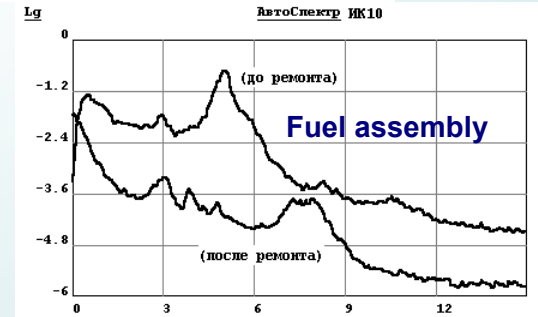
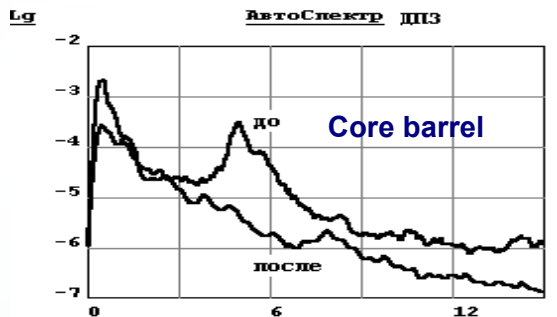
Internals inspection & measurements during outage 2003



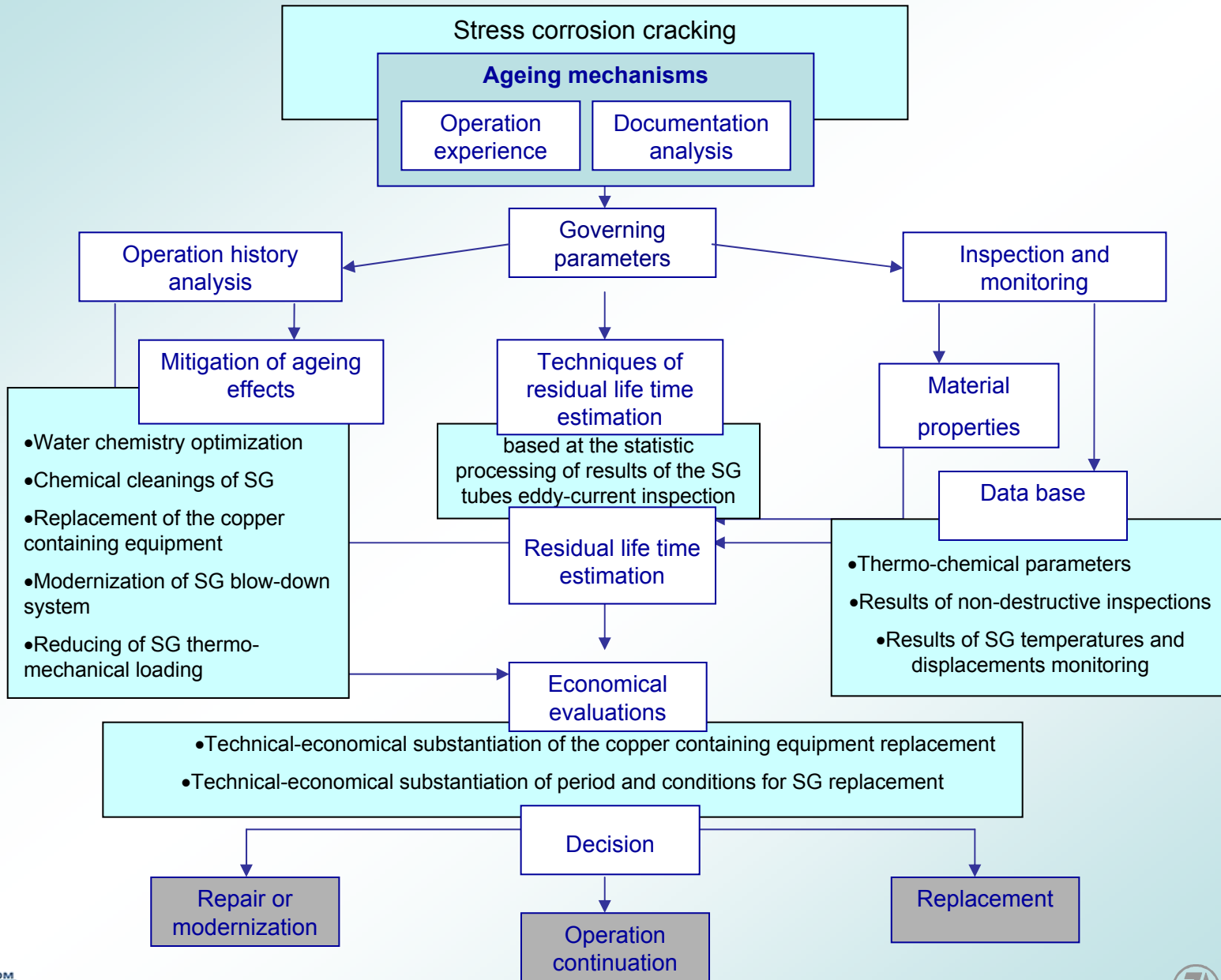
Decision and its realization on core barrel fastening and decreasing flow rate through the reactor

Initial core barrel eigenfrequencies

Vibration spectrums before and after repair



Ageing management of VVER steam generators



Kinds of SG inspection and monitoring

Leakage monitoring using N16

Inspection of intertube space during outage

Tubes eddy current inspection

SG displacement monitoring

**Interface between water
chemical modes/ SG
chemical cleaning recipes**

and

**SG elements technical
conditions**

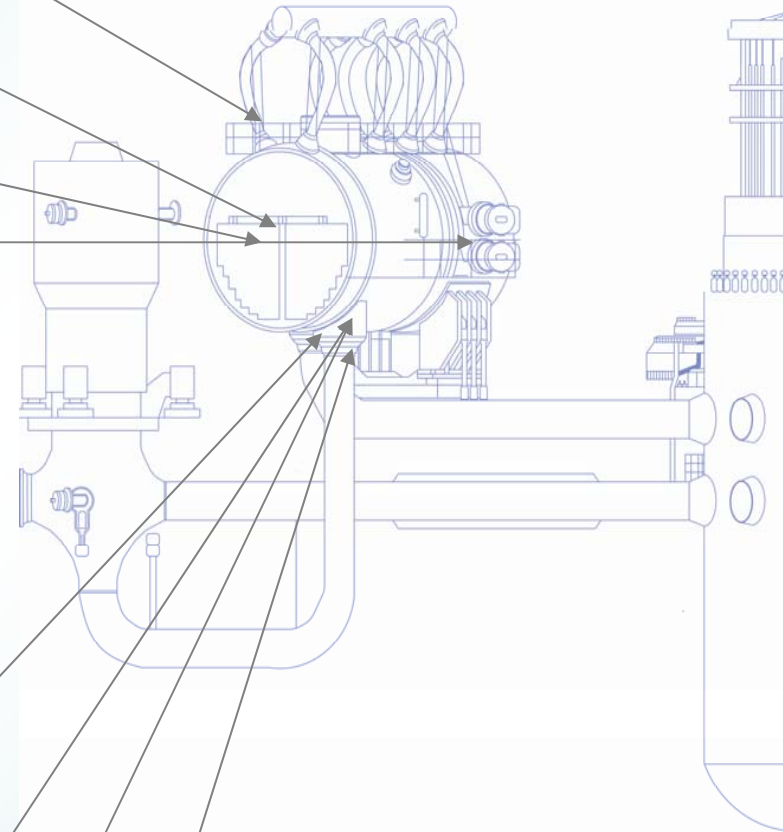
through data bases

Temperatures monitoring

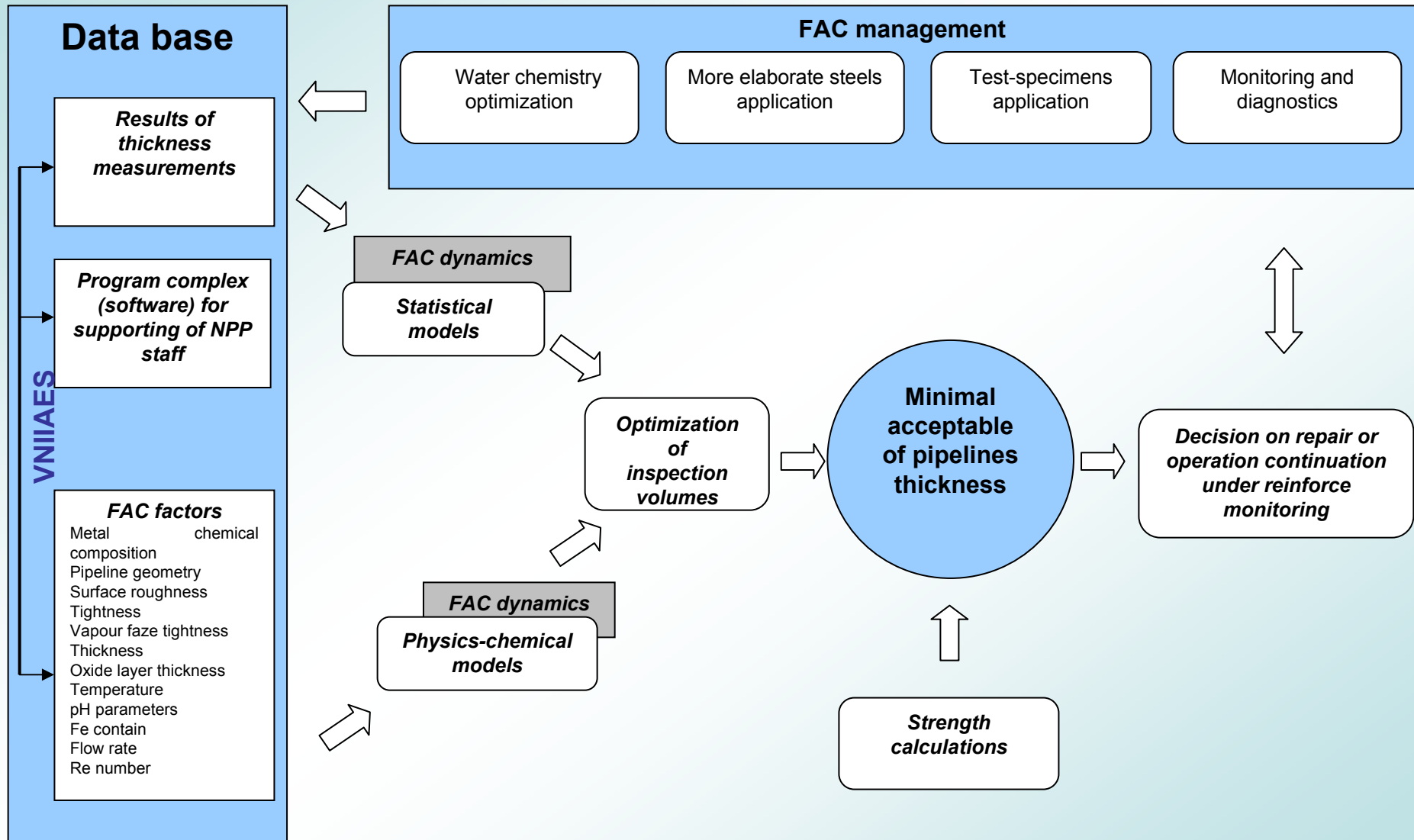
Video-inspection of collector "cradles"

Ultrasonic inspection of weld joints 23

Acoustic monitoring of weld joints 23 (111)



Activity on increasing of erosion-corrosion resistance of Russian NPPs pipelines and equipment



VNIIAES

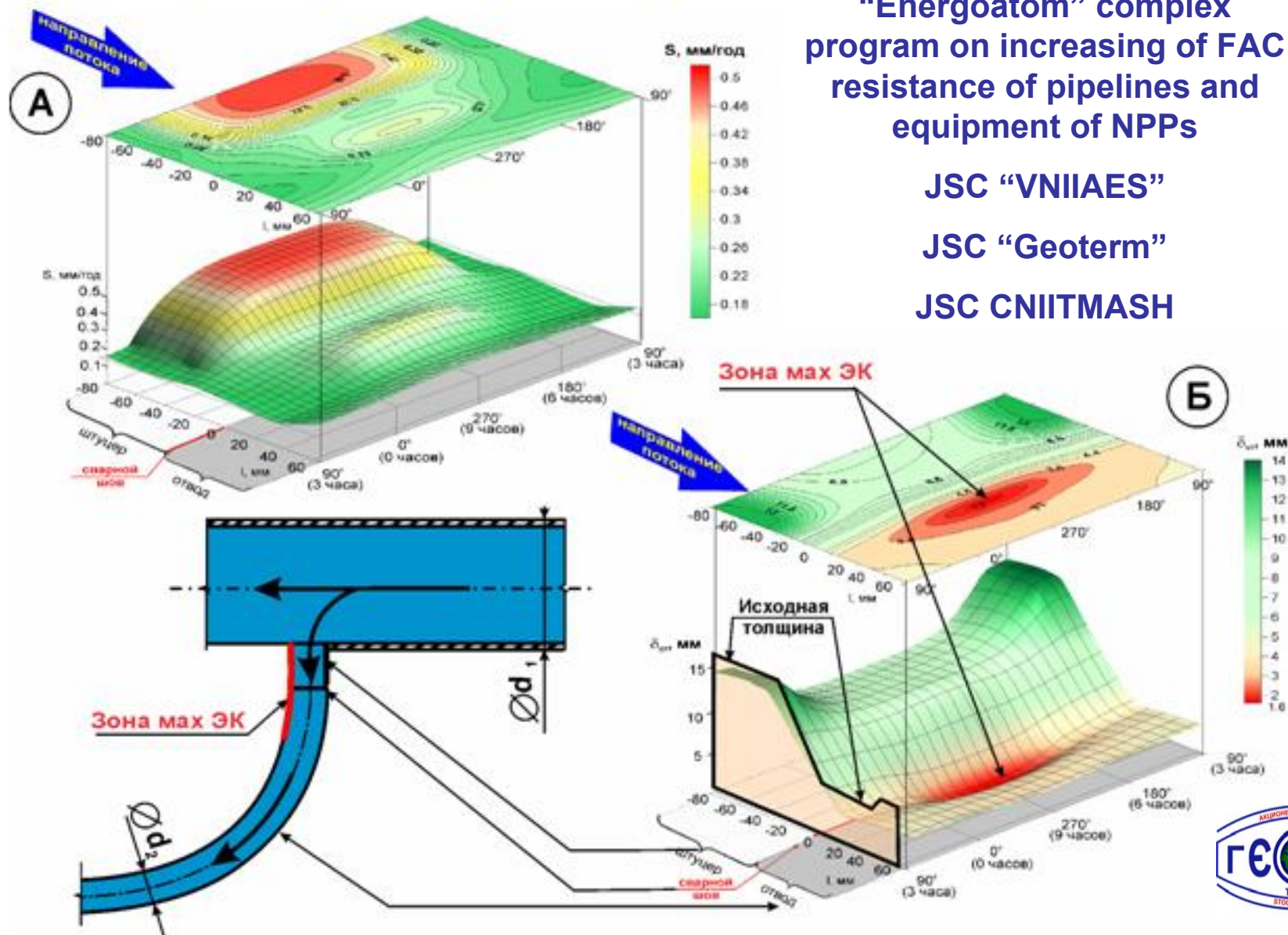
Calculation of FAC intensity using software PAMЭK-1

“Energoatom” complex program on increasing of FAC resistance of pipelines and equipment of NPPs

JSC “VNI AES”

JSC “Geoterm”

JSC CNITMASH



THANK YOU FOR YOUR ATTENTION !