

2003

Classified in the chronological order events and facts are presented in this edition, which over a period of 16 years define the Shelter vital activity. These data help the readers to comprehend the problems and the basic lines of current research and conversion activity at the Shelter object both at national and international levels.

Years that have passed since the beginning of Shelter object operation demonstrated that the construction of this unique facility over the destroyed ChNPP Unit 4 was the only one correct solution under that extreme conditions.

Due to enthusiasm, high qualification skills and really heroic efforts of thousands and thousands experts, scientists, builders, military men the "Sarcophagus" keeps under control the potential risks, which are deep inside it. And though Shelter did not cause people and environment special concern at post - chernobyl time, its state is not considered completely safe now. Practically all the time it is possible to face problems from deteriorating and unsafe constructions, from radioactive dust, which generates more intensively due to fuel containing materials cracking. The self-sustained chain reaction initiation in nuclear fuel remains keeps probable and development of other emergency situations is not completely excluded.

Right after the accident the scientific, research and engineering activity was developed gradually at the Shelter object by the best scientific and technological community of the former Soviet Union in cooperation with Ukrainian institutes. Step by stem their achievements equipped specialists and scientists with new experience and knowledge regarding the object.

Thus the basis for large-scale international cooperation was established. The development of Shelter Implementation Plan (SIP), which was accepted by the governments of Ukraine and G-7 countries in 1997, became the culmination of this cooperation. The basic task for today remains to speed up current Shelter state stabilization and to use funds more effectively, which are allocated by the international community. Also in the nearest years it is necessary to stabilize the general state of the deteriorating facility, to construct a new safety confinement over it (Ukrytiye-2), to demolish the most unsafe constructions and to initiate long-term activity on "sarcophagus" conversion into ecologically safe system, to remove radioactive waste and fuel containing materials out of the Shelter.



1986



Shelter object



Shelter object, view from turbine hall



Buttress wall



Cascade wall



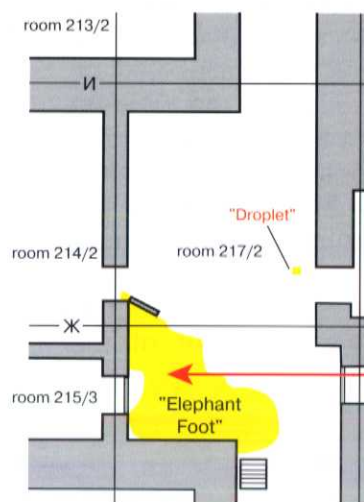
Shelter object roof

▲ November 30 the State Acceptance Commission accepted the Shelter –covered Chernobyl NPP Unit 4 for technical maintenance. Reactor Department-4 (RD-4) was established within the body of Industrial Association Chernobyl NPP for Shelter –covered Unit technological equipment and monitoring systems operation.

▲ As a result of numerous analyses of radioactive fallout the amount of fuel accumulated inside Unit 4 was (more than 95% of estimated irradiated fuel of initial loading). Also new formations were revealed, which relate only to the Shelter object - lava-like fuel containing materials (LFCM), which mainly represent fusion of silicon dioxide, zirconium and fuel.

▲ October 28 the State Commission took a decision according to which the AS UkrSSR Nuclear Research Institute was responsible for authorized monitoring systems and diagnostics development for damaged ChNPP Unit 4 reactor.

▲ In November-December to ensure the nuclear safety the system of potassium metaborate solution feeding (SPMSF) into the damaged reactor was installed.



▲ The Information-Diagnostic Complex "Shater" was put into operation for temperature, gamma-radiation, thermal and neutron flux and building constructions vibration measuring.

▲ In September the logical extension of works on damaged Unit state analysis became the development of Terms of Reference on stationary system for data collection and processing obtained from the sensors, which were installed and were being installed in Unit 4 premises as far as they were developed. First the system was called "Subcrit" then it was given a new name – information and measuring system "Finish".

▲ The first map of Plutonium contamination in 30-km zone was drawn.

▲ For the first time the self-propelled device with a complex of diagnostic equipment was utilized for research works inside "Sarcophagus".

▲ October 13 at the State Commission meeting the report of Kurchatov Atomic Energy Institute was listened to, in which the plan of research work inside the damaged Unit was proposed and the determination of nuclear and radiation risk level of fuel containing materials (FCM) accumulations. As the main technique to penetrate in to fuel accumulations was proposed to use special wells, which were drilled in non-contaminated premises. The issue of a number of object constructions reinforcement was also reviewed. The State Commission supported the given proposals.

▲ The Integrated Expedition (IE) under Kurchatov Atomic Energy Institute supervision was established by the Ministry of Mid-Level Machine Building Industry Resolution for work implementation at the Shelter object. It comprised relatively not big scientific department (30-50 employees), installation and auxiliary departments. IE number run up to 3000 under necessity of large scope of work implementation. Although Shelter object proceeded to be a part of ChNPP structure, the main works related to its safety improvement were implemented by IE up till 1991.



Inside the destroyed Unit



Fragments of fuel containing masses (FCM)



Measuring-diagnostic system "Shetyor"



Shelter object premises survey



1988



Investigation well drilling in room 515



1 2 3 New routs and premises survey

▲ The Shelter investigation started with utilization of drilled wells. A large data volume was obtained as a result of these investigations. It was managed to determine the nature of inner reactor damages, the state of Shelter constructions, it became possible to penetrate to fuel accumulations and take FCM samples, to carry out direct measurement of neutron multiplication factor in FCM accumulations, which demonstrated that FCM inside the Shelter are in subcritical state. It was determined that fuel inside the Shelter is accumulated in the state of damaged reactor core fragments, solidified glassy mass (lava) and fuel dust.

▲ The results of drilling works allowed to determine new routs for investigation groups entering into Shelter premises and initiated the development of specific diagnostic equipment for works inside sarcophagus.

▲ Since autumn information-measuring system "Finish" (IMS) started functioning. The system was established in the following way: after FCM accumulation was detected, "watch" detectors were mounted near it (mostly through wells). They measured gamma radiation dose rate, neutron flux density, temperature and flux. Detectors' parameters were thermal displayed at the central station and were being reviewed for a long time. Having assured that the channel was efficient and informative, it was converted into stationary measurement mode and it was officially included into system. Since that year data base classified on all IMS measuring channels became available and was permanently updated.



Measuring – diagnostic system "Finish"

▲ FCM accumulations were determined and the first their quantity assessments were carried out. These data were ascertained for a long period of time.

▲ Large-scale works on Shelter constructions reinforcement started in 1987 were completed. Three zones were determined which required urgent emergency actions: deaerator stack, main circulation pumps (MCP) premise and 805/3 premise. In the course of work on wall reinforcement between deaerator stack and turbine hall it was necessary to demolish damaged constructions and decontaminate a part of the turbine hall. Thousands of military men, civil constructors, installers, MinSredMash special enterprises participated in these works. Works were carried out under scientific supervision of IE.

▲ In spite of additional works on object constructions reinforcement, it was obvious for IE experts that Shelter in its existing state couldn't be considered the object the safety of which was ensured for decades. For the first time "Concept on Shelter conversion into ecologically safe system by "Ukrytiye-2" construction was proposed: a sealed facility erection over the existing Shelter, capable to stand many decades. In the long run it is planned to develop new technologies, which allow, under "Ukrytiye-2" protection, to demolish the destroyed Unit, to remove and storage fuel. Since that time long-term activities on Shelter conversion into ecologically safe system have been launched.

▲ With the goal of aerosol radioactivity reduction, which is one of the most significant issues on personnel radiation safety assurance, a remote controlled unit with dust suppression system was manufactured. According to experts estimation the above device allowed to save more than 600 man/rem of collective exposure dose.

▲ Stationary dust suppression system is installed in the Central Hall, that caused the Shelter releases reduction up till 0,3 (and less) Ci/year that constitutes a small part of percent of releases allowed at NPPs in operation.



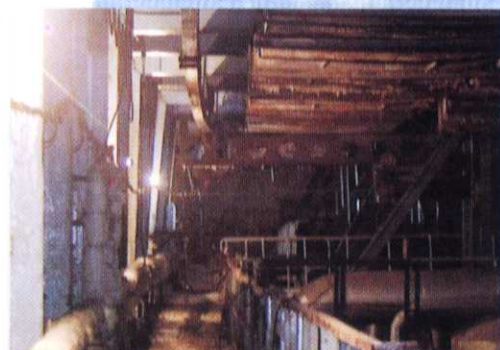
Dust suppression over the destroyed reactor



Beams displacement under the ceiling in MCP premise



Tie laying for beams supporting under the ceiling in room 805/3



Frames shift on row B at deaerator stack in G-635 room

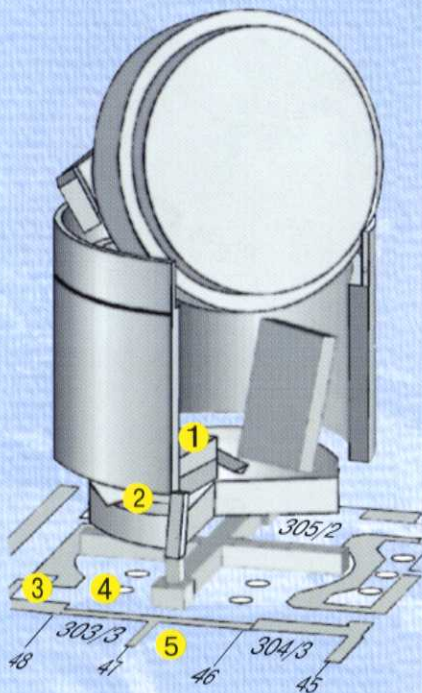


System for dust suppression solution making



Slaggy FCM accumulation in bubbler pool premise

Scheme of "Finish" system neutron channels allocation



1 Channel 48, well 3.21. E

2 Channel 46, well 3.15. J

3 Well 3.11. A

4 Channel 45 in steam distribution corridor

5 Channel 50, well 3.10. G

▲ For the first time the structural modification of FCM were fixed: brittleness of lava-like FCM, fuel dust generation on their surface, soluble Uranium compounds generation and the possibility of their migration with water.

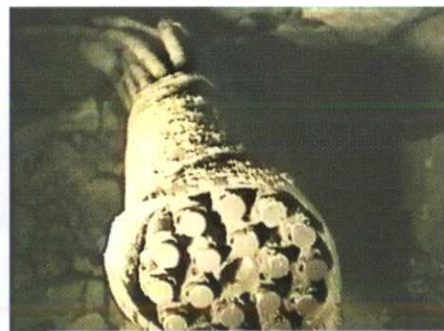
▲ By heat measuring it was stated that 135 ± 30 tons of fuel are accumulated in lava-like FCM at the lower Shelter levels.

▲ The Technical Feasibility of Shelter Nuclear Safety (TFNS) was issued. Its main conclusion is: "In accordance with the proposed status and nuclear safety definition stated in NSR RF PP-89, Shelter Object can be considered at present as nuclear safety" (Later on this conclusion was reconsidered)

▲ In June "Finish" system detector registered persistent velocity counting increase of neutron flux in 304/3 premise. As a result the velocity counting increased 60 times more. Appropriate actions were undertaken – the premise was coated with gadolinium solution, which absorbs neutrons effectively. After that the velocity counting reduced up till normal. Further analyses couldn't definitely determine the reason of that event, though the possibility of self-sustain chain reaction (SCR) initiation was not completely excluded.

▲ By USSR MinAtomEnergProm Order dated August 24 "Shelter "Object" enterprise was established, which was made responsible for:

- Equipment and facilities safety operation;
- Scientific research carrying out and building and installation works implementation;
- Decontamination and accident consequences elimination.



Central hall- a part of fuel assembly



Close to "Mammoth" beam support foundation

▲ Wells have been drilled at the Shelter site, which allowed to perform the first post-accident site engineering-geodesic research works and estimate experimentally the amount of fuel allocated inside.

▲ It was succeed to obtain the FCM samples out of under-reactor premises by using the remote-controlled equipment.

▲ Information –diagnostic complex "Shatyor" was updated.

▲ Shelter guard fencing was reconstructed.

▲ Detailed radiation survey at accessible Shelter premises was carried out.

▲ **Since August Exclusion zone, ChNPP and Shelter object were turned under the jurisdiction of Ukraine.**



Wells study at Shelter site



Investigation wells at Shelter site



Repaired guard fencing



Detailed dosimetry survey in Shelter premises





Southern "hockey-stick"-shaped plates



Turbine hall roof



Preparing for air sampling



MCP premise



Turbine top view

▲ Integrated Expedition was abolished and the Interdisciplinary Scientific and Technical Center "Ukrytiye" (ISTC) under National Academy of Science of Ukraine was established to proceed Shelter Object research, it started its activity since May 1.

▲ Turbine Hall roof sealing was implemented and the places of "hockey-stick plates" joining to its roof were reinforced.

▲ Turbine oil (160 tons) was removed out of turbine hall level and equipment and out of deaerator stack to prevent the emergency fire-fighting situation,

▲ 20 investigation channels of IIS "Finish" were metrologically certified and put into operation, that significantly increased the reliability of FCM state monitoring.

▲ Works on decontamination and suppressed agents spraying were proceeded to reduce the amount of dust in Unit 4 premises.

▲ Radionuclide and chemical test of more than 100 FCM samples was carried out, that enabled to determine the neutron-absorbing elements (boron, gadolinium) availability in them. It has changed for the better the Shelter nuclear safety forecast.

▼ Projects and technical solutions international tender was announced on Shelter conversion into ecologically safe system, that was the first step to international cooperation.

▲ By ChNPP Order dated 05 March Shelter Object enterprise was reorganized into structural ChNPP department.

▲ In accordance with the program of "Areal" engineer-geodesic research wells were drilled in site technogenic layer.

▲ The first phase of roof air openings sealing was completed – 590 m² of junctions under the total scope of work more than 4660m².

▲ 280 tons of metal constructions were installed to protect 2500 m² of cascade wall against precipitation penetration.

▲ The analyses of samples taken at the Shelter testified that FCM allocated in '305/2 premise contain not melted fragments of fuel pellets, therefore under FCM critical parameters analysis the necessity arose to review the composition fuel + "lava" + water as the most hazardous in comparison with the composition "lava" + water, which had been reviewed earlier. This fact in conjunction with FCM cooling and cracking, which enabled water to penetrate inside them, caused the necessity of making additions to the basic conclusions of Nuclear Safety Technical Feasibility- 1990.

▲ Field measurements of exposure dose rate (EDR) space distribution were carried out next to the Shelter up to 70 m high (program "Lights"). They demonstrated that gamma field around the Shelter is sufficiently heterogeneous, and at the whole site the strong trend of EDR increasing was observed along with height growth above the site surface.

▼ International cooperation

According to the results of the international tender the Concept of stepwise Shelter conversion into ecologically safe condition was accepted by jury resolution dated June 17. Seven stages were assumed as the basis of the Concept:

1. Shelter state research and environment monitoring.
2. Community information about the Shelter state and its site.
3. Shelter state stabilization.
4. Construction of a new safety enclosure over the Shelter ("Ukrytiye-2").
5. Pre-surface radioactive waste (RAW) storage facilities construction.
6. Establishment of RAW classification and processing technological site.
7. Removal, conditioning and storage of radioactive materials, which are accumulated inside "Ukrytiye-2".



New premises survey



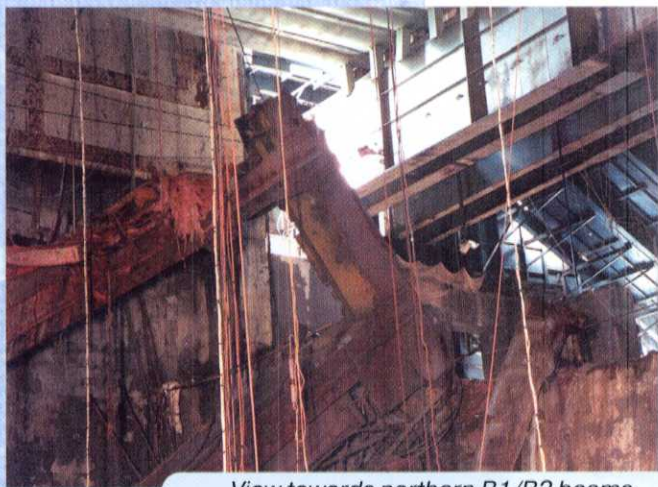
Water sampling in Shelter rooms



Mud sampling in Shelter premises



Cascade wall



View towards northern B1/B2 beams



1 2 Streams of solidified lava-like FCM

▲ By supports installation and their foundation concreting, support junctions of B1/B2 beams, which support "Sarcophagus" roof, were stabilized.

▲ Second and third stages of work on Turbine Hall roof sealing were implemented at 1270m² area and also its cleanout and painting to protect against corrosion was carried out.

▲ Directions of lava-like FCM spread were finely determined, they were identified as 3 basic flows: a large vertical flow, horizontal and small vertical flow.

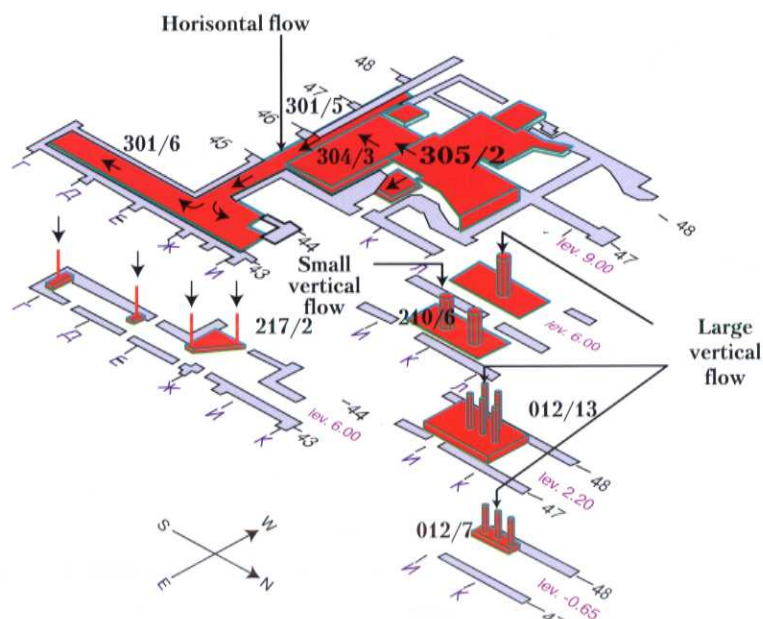
▲ A complete LFCM classification was carried out: brown and black ceramics, slag-like granulated FCM, pumice, melted and frozen metal.

▲ Shelter Regulations on radiation-technological monitoring was developed.

▲ A system of observation wells, which was established at the Shelter site, allowed for the first time to reveal the dynamics of radionuclide contamination and the level of ground water.

The following was specified:

- Temperature, humidity and velocity of air stream distribution inside the Shelter
- Basic routs of water distribution inside the facility and the places of its allocation
- Dynamics of radionuclides and nuclear materials accumulation in Shelter water



▲ FCM state review for the recent 4 years demonstrated:

- The existed earlier barriers on the way of self-sustained chain reaction (SCR) possible initiation practically stopped functioning. If earlier, water (the necessary moderator) couldn't penetrate inside FCM accumulations due to their high temperature and their surface glassy structure, then now the temperature has become lower and the surface has deeply cracked;

- New, potentially more hazardous FCM modifications were revealed.

▲ These and a number of other circumstances made to come to a conclusion on **necessity to recognize the Shelter Object as nuclear hazardous.**

▲ The categories of storied RAW and the basic types of radioactive contamination were determined. RAW types and amount, including high –active RAW, were estimated both inside the Shelter, and at the Shelter adjoining area.

▲ It was stated that Shelter Object could be neither high –active RAW storage facility, nor depository site for them.

▼ European Community Commission announced a tender on Technical-Economical Feasibility (TEF) development for the first milestones on Shelter conversion into ecologically safe system Concept – existing Shelter state stabilization and "Ukrytie-2" construction. "Alliance" Consortium at the head of French company "Campenon Bernard SGE" won the tender.



Brown ceramics (bubbler pool)



Black ceramics (room 304/3)



Slaggy FCM



Metal (steam distribution corridor)



Shelter object before anticorrosion coating



Shelter object after anticorrosion coating

▲ "The Shelter Technological Regulations for the Fourth ChNPP Reactor" was enforced by ChNPP Order dated 17 January to ensure technical, radiation and nuclear safety under operation.

▲ The first 4 channels of self-sustained chain reaction alarm subsystem (SCR AS) were installed and put into pilot operation.

▲ Turbine Hall roof and cascade wall metal surface slushing was carried out (total area $\approx 33\,000\text{m}^2$) with preliminary cleaning out of corrosion and concrete.

▲ Buttress wall, cascade wall and stairs– elevator block metal construction junctions were reconstructed, stairs–elevator block wall panels at axis 54 were reinforced.

▲ "The Basic Activity Directions on Shelter Safety Assurance for 1995-2000" were approved in August.

▼ Technical-economical feasibility development on Shelter conversion was completed and June 12 "Alliance" Consortium in Kiev submitted the report, which is actual even nowadays. Its basic conclusions are as follows:

1. The existing Shelter is not stable and seismically reliable. Urgent actions are necessary to be undertaken, as the variant "undertake no actions, that is to say, to do nothing" –is not acceptable.

2. Due to a high level of radiation and the actual state of existing constructions, the Shelter long-term stabilization is not considered to be implemented. The existing Shelter construction does not ensure the possibility of radioactive waste removal, the life-time of which totaling tens of thousands years.

3. A construction of new safety enclosure is actual, which will enable Unit 4 to be dismantled.

4. The task of new safety enclosure design and construction is extremely complex and multilateral, which covers as the initial site preparation as the generated RAW removal. Production of radioactive waste processing and storage is necessary to establish before "Ukrytiye-2" construction.

5. Ukraine is not able to finance such project. This issue should be considered critical. International community should demonstrate its intention to support Ukraine to solve issues, associated with Chernobyl accident. The actual option for today is to establish and support political will and financial assurance for the whole term of project implementation.

▼ September 11 in Brussels there was a meeting of European Commission with participation of Ukrainian delegation for determination and coordination of further common actions after research results submitted by "Alliance" Consortium.

▼ The results of this meeting were presented in minutes and they concern as follows:

- Determine safety goals and stabilization project criteria for the existing Shelter and new safety enclosure;
- Develop terms of reference for the existing Shelter and new safety enclosure;
- These actions will be implemented as TACIS projects.

▼ According to this minutes European Commission awarded a contract with "Alliance" Consortium and "Trischler und Partner GmbH" firm on short and long-term measures development. In accordance with Ukraine's Cabinet Resolution (#696-p of 14.11.95) the functions of Client on Shelter conversion into ecologically safe system were delegated to Goskatom and ChNPP

▼ In December the Memorandum of Understanding between the Government of Ukraine, G-7 countries and European Commission on Chernobyl NPP shutdown was accepted.

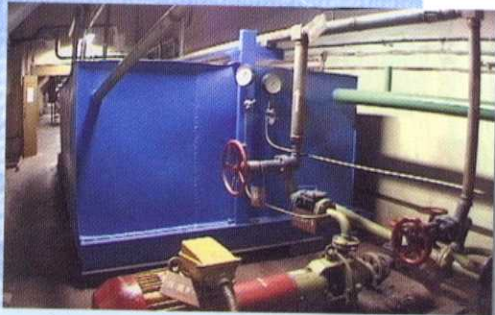


Plates allocation at upper levels of stairs-elevator block

▲ International experts assessments confirmed "Alliance" Consortium conclusion on impossibility of Shelter transformation into the site of fuel containing materials final burial.

▲ The Legislative and Normative Basis of Ukraine state on the issues of RAW management in 30 km zone was reviewed, which would meet the actual radiation and nuclear safety requirements and would take into account Shelter specific conditions.





System of liquid radioactive waste collection and removal out of turbine hall and deaerator stack



Neutron absorber feed system



Maintenance site decontamination at Ventstack.



Metal constructions eventual collapse zone

▲ The works on Shelter investigation as the source of radiation aerosols in overground atmosphere layer were initiated.

▲ In January **the system of liquid radwaste collection and removal** was put into operation. Approximately 4500m³ of liquid RAW were pumped out of turbine hall and deaerator stack during a year period (activity ranged from 3,2x10⁻⁷ up to 1,6x10⁻⁶ Ci/l of Cs¹³⁷).

▲ **A system of neutron absorbing solution supply into voluminous FCM accumulations** was put into pilot operation.

▲ **Potassium metaborate feed system**, designed for FCM subcriticality increasing, was updated and converted to gadolinium nitrate as the more effective neutron absorber.

▲ The fourth stage of roof sealing covering the area of 2022m² was completed.

▲ To reduce the level of radiation 120m³ of concrete was put over the buttress wall. After concrete pouring the level of exposure dose rate of gamma radiation was reduced from 2,5 R/h up to 70 mR/h.

▲ Preparation for Ventilation Stack (VS) repair started: the working project was developed, the site was decontaminated.

▲ "Shelter Fire Protection Concept" was approved.

▲ September 12 and 16 neutron incidents were held (control levels were exceeded). Simultaneous increase and decrease of readings on two independent monitoring systems was recorded: IMS "Finish" and SCR alarm system. It was revealed that these anomalous events, associated with neutron flux density increase, could be explained by as modification of FCM multiplying characteristics caused by rain water penetration, as equipment error caused by the same reason.

▲ Shelter current safety analysis and situation development forecasts" was issued. In the "Analysis..." for the first time risks of potential accidents were determined, initial situation was specified, a number of accidents development scenarios were reviewed and their consequences were estimated. It was stated that under all emergency situations the most hazardous is radioactive dust release, which could be caused by the Shelter upper constructions collapse. The "Analysis....." demonstrated that Shelter couldn't be considered a nuclear safety facility at the current stage. Also definite actions were reviewed, which were planned to ensure long-term Shelter object safety (stabilization) and to prepare for complete Shelter conversion into ecologically safe system.

▲ Ukraine's Cabinet of Ministers Resolution "Measures on Shelter conversion into ecologically safe system" was accepted December 28. The Resolution determined the basic goal of the fastest nuclear fuel remains removal, their isolation and burial in accordance with actual Ukrainian and international standards.

▲ Nuclear fuel quantitative assessment inside the Shelter was actually ascertained. A can be seen comparing the data in columns 3 and 4 of the table ahead, where the information from "The Shelter Current Safety Analysis and Situation Development Forecasts" dated 28.08.96 and ISTC "Ukrytiye" expert conclusions on 01.06.00 is introduced.



Under reactor premises.

FCM Distribution inside the Shelter

Premise description and its Number	FCM Modifications	Estimated Fuel Amount in tons (on Uranium basis)		Notes
		"Analysis..." 21.08.1996	Expert Estimation 01.06.2000	
Central Hall (CH) 914/2	Reactor core fragments (RC)	10-36	<21	Subject to 48 fuel assemblies with fresh fuel (5,5 tons). Possible availability of lava-like FCM
South spent fuel pool	Fuel assemblies with spent fuel	~ 20	14,8	129 fuel assemblies with spent fuel. Possible availability of lava-like FCM
Majority of premises (24 m level and above)	Fuel dust hot fuel particles	~10	~5 at the collapse surface in CH, total ~30	Estimation of 30 tons including dust at collapse surface and inside in CH and dust in all other premises
Underreactor 305/2 and 504/2 rooms up to 24m level	RC fragments, lava-like FCM, fuel dust	75 (+25/-35)	85±25	Estimation were carried out on six FCM accumulations. The origin of all lava-like FCM streams.
Steam distribution corridor (210/5, 210/6, 210/7)	Lava-like FCM	25±11	12±6	"Great vertical stream" and "small vertical stream"
Bubbler pool-2 (012/13, 012/14, 012/15)	Lava-like FCM	8±3	Minimum 3 maximum 14	"Great vertical stream" and "small vertical stream"
Bubbler pool-1 (012/5, 012/6, 012/7)	Lava-like FCM	1,5±0,7	1,9(+1,0/-0,5)	"Great vertical stream" and "small vertical stream"
304/3 room	Lava-like FCM	For all five premises 11±5	6±2	"Horizontal lava stream"
301/5, 301/6, 303/2 rooms	Lava-like FCM		4,5±2,5	"Horizontal lava stream"
217/2 room	Lava-like FCM		0,4±0,2	"Elephant foot", "stalactites" - got from "horizontal lava stream"
Water in all premises	Uranium soluble salts, colloids	~ 3kg	~ 4kg	Fuel content in ground mud-more than 50kg of Uranium (room001/3)
Fuel at Shelter site	RC fragments, fuel dust	0,6 (+0,3/-0,2)	0,75±0,25	



Activities at Shelter site



Rooms decontamination



Geodesic measurement



*Ground water measurement
at Shelter local zone*

▲ March 28 for the first time ChNPP obtained license from Gosatominspektsiya on Shelter object operation. April the Government Commission on issues of comprehensive solution of Chernobyl NPP problems approved the "Shelter Stabilization Strategy" and "Shelter Conversion Strategy". The policy of Ukraine regarding Shelter conversion was stated in the second document. It was based on the fact that removal of nuclear fuel out of the Shelter was considered to be the basic condition of its conversion.

New "Radiation Safety Standards of Ukraine" (RSSU-97) was enforced in Ukraine.

▼ Throughout the work implementation on TACIS project "Chernobyl Unit 4, Short and Long Term Measures" a detailed program of work implementation "Shelter Implementation Plan" (SIP) was developed under cooperation with Commission of European Communities, USA, Ukraine and International Advisory Group.

▼ At the beginning of December "The Regulations on Chernobyl Shelter Fund" (CSF) was developed. November 20 Conference of Donor-Countries was held in New York, which allocated their funds into CSF. European Bank for Reconstruction and Development (EBRD) was assigned CSF Administrator. At this conference the agreement between Ukraine and EBRD on Fund activities was signed ("Framework Agreement"). December 11 a Contract on ChNPP Units 3, 4 Ventilation Stack Foundation and Bracing Repair was awarded between ChNPP and Pacific Northwest National Laboratory (PNNL).

▲ Structural characteristics and degradation up to dust generation of Lava-like FCM were studied.

▲ The ways of water penetration inside the Shelter premises and also its radionuclide and chemical composition were analyzed. Quantitative assessment of water amount was carried out, which penetrated inside the Shelter in the process of humidity condensation out of air at cold constructions.

▼ February 4 Verchovna Rada of Ukraine ratified «Framework Agreement» between Ukraine and EBRD.

▼ April 22 a Contract was awarded to the tender winner for SIP Project Management Unit Consultant (SIP PMU).

▼ Since May till November tender procedures were completed and contracts were awarded between "Energoatom" Company and tender winners for SIP Early Biddable Projects. In June ChNPP Units 3, 4 Ventilation Stack foundation and bracing repair was completed, the project total cost ~\$2,25 ml USD, US contribution is totaling \$1 ml USD, contribution of Canada was \$800 000 USD, Ukraine- \$450 000 USD.

▼ In the frames of International Nuclear Safety Program USA DoE PNNL to improve Shelter nuclear safety monitoring delivered a «pilot» neutron monitoring system to ChNPP.

▲ In December the independent complex of technical equipment, as a part of IMS "Finish", was singled out to ensure the regulation monitoring of FCM subcriticality state. It was called "Finish-R". The complex comprised 21 measuring channels to monitor neutron flux density, exposure dose rate of gamma radiation and temperature.



Air openings in the Shelter roof



Water accumulation inside bubbler pool premises



Water sampling



Ventilation Stack repair



1999



Detector installation



Measuring equipment



Installation

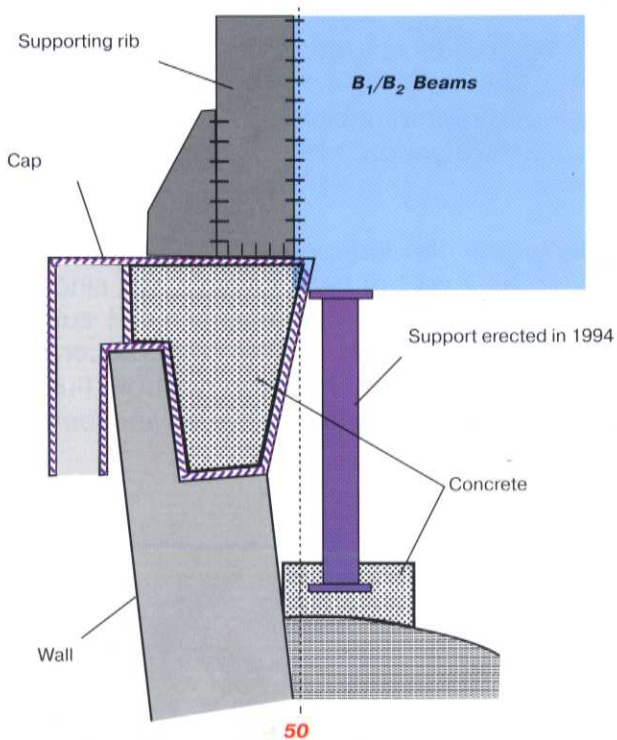


Welding

▲ IMS "Finish" was reconstructed, a "Pilot" nuclear safety monitoring system was installed and tested. The obtained results will be used in the course of prospective FCM monitoring system development.

▲ April 5 the Cabinet of Ministers of Ukraine approved "Comprehensive Program of RAW Management", November 25 "Shelter RAW Management Concept" was accepted.

▼ In December in SIP framework works on B1/B2 western supports stabilization were completed. The project cost totaling \$2,85 ml USD was financed out of Chernobyl Shelter Fund.



▲ A system of fuel containing materials monitoring "Signal" was put into regular operation, which was since 1995 in experimental operation, and was called SCR alarm system.

▲ Remote-control station of neutron absorber feed system "UK SOVG-40" was installed, adjusted and put into operation.

▲ Monitoring system of thermalphysic parameters "Shatyor" was dismantled, it was put out of operation due to its life time completion.

▲ Ventilation Stack-2 (VS-2) light fencing was installed, there was no it since the accident.

▲ Separate roof areas were sealed to prevent precipitation penetration.

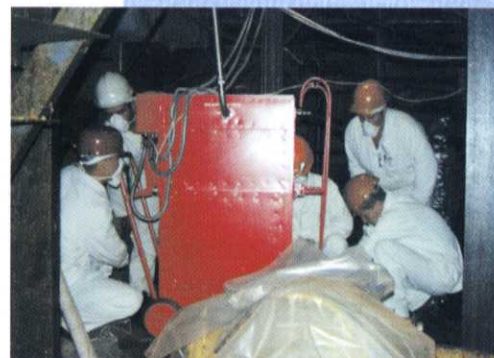
▲ In summer site preparation for "small" construction base was launched, - a site for large-scale stabilization development and preparation for new safety confinement construction in the frames of SIP.

▲ High ways were laid to transport radioactive waste.

▲ Analysis of dust, generated inside the Shelter, was carried out.

▲ Shelter constructions were surveyed and their reliability was estimated.

▲ "State Basic Sanitary Norms on Radiation Protection of Ukraine" were accepted.



Neutron absorber feed system adjustment



Re-equipment of Ventilation stack lightning



Cascade wall sealing



2000



▼ In accordance with SIP in May key program milestone P1 decision "Stabilization and Shielding Strategy" was accepted, which determined the tasks of the current stage- Shelter constructions stabilization. The basic goal of this decision is to reduce the risk of protective constructions collapse by their stabilization at the term before new safety confinement construction.

- In December P2 decision "Roof, Constructions and Supports Stabilization Strategy" was accepted, the goal of which is to confirm the necessity of specific stabilization measures, accepted in P1 decision, and to specify scope of work.

- In December P4 decision "Seismic Monitoring System" was accepted, which specified documentary justification and registered the necessity and the type of seismic monitoring system for the Shelter object.

- In December P6 decision "Water Management", which is allocated inside the Shelter, was accepted.

- P7 decision was accepted "Preliminary Decision regarding the "Strategy of FCM Removal and Radioactive Waste Management" with the goal to select preliminary option of "Strategy...." and to specify actions, necessary for making final decision at P8 key milestone.

1 2 3 4 The beginning of "small" construction base development



Road for radwaste transporting is built

▲ July 6 "The Program of Radioactive Waste Management at the Shelter Object" was accepted.

▼ In January P3 program decision "Building Constructions State Monitoring System" was accepted with the goal to justify and documentary record the necessity of building constructions state and their solidity monitoring.

- March 23 P10 key program decision "New Safety Confinement Strategy" was accepted, which specified the approaches and the type of the future facility.

- In June P9 decision "Regarding FCM Removal Prototype" was accepted, the aim of which was to select technology, equipment and FCM pilot removal implementation.

- IV International Scientific-Practical Conference "Shelter Object, 15 years: past, present, future" was held in November.

▲ The first preparatory SIP phase was completed. Phase II –design and work implementation- was launched.

▲ In the frames of the approved Terms of Reference the development of NSC technical-economical feasibility is carried out.



1 2 3 4

"Small" construction base development is proceeded

2001



1



4



2



5



3



6

4 5 6

Transport pit construction

1 2 3

Disposition of unauthorized
passes inside Shelter object

In the frames of SIP implementation:

▼ Preparatory works were implemented to develop infrastructure, appropriate for stabilization and NSC construction:

- A contract on "turn-key" basis was awarded on clothes changing facility construction for 1430 persons, engineer-geodesic research was carried out at the construction site, site preparatory work was launched.

- Works on Shelter Information –Analytical Center establishment were carried out to ensure integrated data base technical support

▼ In the frames of tasks on radiation protection, safety ensuring and monitoring systems:

- A contract on "turn-key" basis was awarded and works on physical protection and access control was started development.

▼ A contract on NSC concept design development was awarded (NSC technical- economical feasibility).

▼ Approaches were updated regarding Ukrainian contribution into SIP. September 12 SCF bank hryvna account was set up in Ukraine to accept contributions. European Bank for Reconstruction and Development will administrate as Ukrainian contribution fund as donor countries contribution. "In kind" contribution management will remain unchanged. Under this fact it is supposed that later on in the frames of "in kind" Ukrainian contribution construction projects will not be implemented. Only operational costs and ChNPP personnel, involved in SIP implementation, maintenance costs, will be covered. The development of the appropriate Resolution is being completed by the Cabinet of Ministers.

▼ Under Ministry of Fuel and Energy initiative a special governmental document "SIP Implementation Procedure" was being developed. The basic deviations from actual normative requirements in the field of scheduling, reporting, deliverables development, expertise and approval, licenses and Ukrainian regulatory bodies approval obtaining should be specified in "Procedure...." for further program implementation. The development of such document was supported by EBRD and SCF Assembly of Contributors, it will allow to make further implementation of technical support international program (SIP) more transparent and effective.



Solid RAW transportation to depository side



Premises reconstruction for Shelter Information-Analytical Center



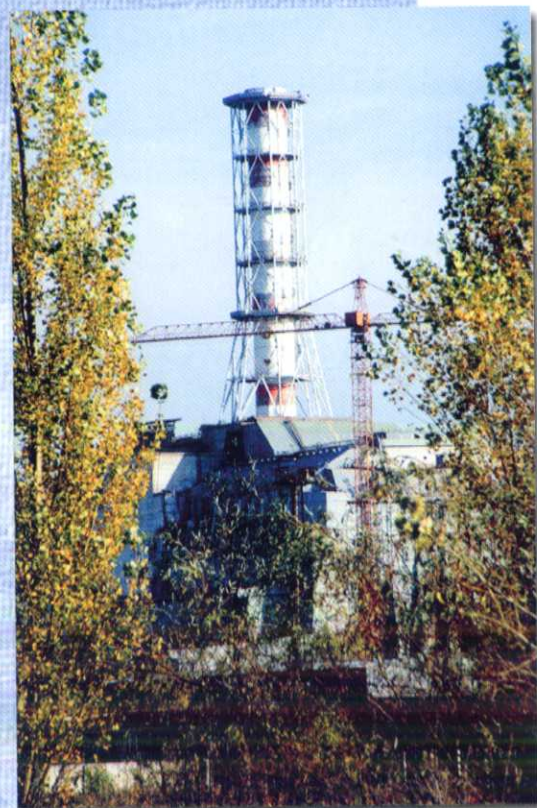
Installation for fire pipeline



Area preparation for Clothes Changing Facility for 1430 persons



Guardhouse construction



Practically every day "sarcophagus" lives its own unique and dynamic life. And it is not restricted only by the above mentioned events and facts. Just they obviously demonstrate that not any Shelter state assessments could be regarded today as final, absolute and fixed. It is caused by dynamics of processes, which are actually take place inside the destroyed unit, and not accessibility of the majority of Shelter premises. And though in the course of 16 years, that have passed since the accident, the feeling of danger coming from "sarcophagus" damped a little, it shouldn't set at ease. During all this time new inestimable data regarding the Shelter object, its state and environmental impact was accumulated due to experts and scientists efforts. But it is not sufficient. There is too much unique and complex work, which is unprecedented up till now. Further activity on Shelter conversion into ecologically safe system should be based on reliable and accurate data about it, and a complete calm will come only when all those who are involved in this activity can demonstrate the world that the situation in "sarcophagus" is under reliable and predictable control. Only in this way it is possible to redeem a great fault before next generations and to restore confidence to power engineering.



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