

The Act of technical investigation into the causes of accident at the Sayano-Shushenskaya HYDROELECTRIC STATION, August 17, 2009

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ACT
THE TECHNICAL INVESTIGATION INTO THE CAUSES OF THE ACCIDENT,
OCCURRED on AUGUST 17, 2009
in the branch of the open joint-stock company rushydro, Sayano-Shushenskaya
GES p. s. Neporožnego»
Federal service for ecological, technical and Atomic supervision

Date created: 2009, published: October 3, 2009 year. Source: http://www.gosnadzor.ru/news/aktSSG___bak.doc • authentic checksum file MD5 (aktSSG___bak.doc) = 2e7e94febda2d3e9f683b1ae7a79b426

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 - 8.5 8.5. Alexander Matvienko
 - 8.6 8.6. Pogonajčenko Igor Yurevich
 - 8.7 8.7. Perestoronin Aleksandr Ivanovich
 - 8.8 8.8. Čuričkov Mykola Vasylyovych
 - 8.9 8.9. Andrei Ivanovich Chuprov
 - 8.10 8.10. Čiglincev Mihail Ivanovich
 - 8.11 8.11. Vasily Zubakin Aleksandrovich 8.11.
 - 8.12 8.12. bohusz of Boris Borisovich
 - 8.13 8.13. Timur Yusupov Maratovich
 - 8.14 8.14. Nikolay Dorofeev
 - 8.15 8.15. Haziahmetov Timur Rasimovich
 - 8.16 8.16. Klochkov Roman Viktorovich
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1. details of the Organization

Enterprise: branch of the open joint-stock company "Rushydro" Sayano-Shushenskaya GES p. s. Neporožnego "(SŠGÈS).

The code of economic activities: 40.10.12.

Legal address: Russian Federation, Krasnoyarsk Krai, Krasnoyarsk, street. Republic, 51.

Address: 655619, Russian Federation, Republic of Khakassia, g. Sayanogorsk, PGT. Cheryomushki, p.o. box 39.

VAT number: 2460066195;

Gearbox: 246001001;

BIC: 049514608;

to/from: 30101810500000000608.

Civil liability insurance contract organizations operating hazardous production objects for causing injury to the life, health or property of third parties and to the natural environment due to an accident or incident at hazardous production facility to OJSC "Alfa" from December 16, 2008 No. 787/00017 0361F//8, insurance policy no. 0361F/787/00017/8/1 worth 18100000 rubles.

Civil liability insurance contract operating organizations and owners of hydraulic installations for causing harm to the life, health or property of other persons with JSC "Alfa" from December 16, 2008 No. 792/0361F/00011/8, insurance policy no. 0361F/792 /00011/8/1 to 60000000 rubles.

2. the composition of the Commission, the technical investigation into the causes of the accident

Chairman: **Mr. g. Kutyin** , head of the Federal service for ecological, technological and Atomic supervision.

The members of the Commission:

- **Slabikov G.** -Deputy Chairman of the Board — Director of the Northwestern Department of the Federal service for ecological, technological and Atomic supervision;
- **Il'in V. M.** – Deputy Head of the Federal service of the Yenisei on ecological, technological and Atomic supervision;
- **Beloborodov S.** -Chairman of the Board of the nonprofit market;
- **Berezhkov V. B.** is a Deputy Division Chief in the energy management oversight of the energy and construction supervision of the Federal service for ecological, technological and Atomic supervision;
- **Gordienko V. M.** – Deputy Head of the Department of energy and construction supervision of the Federal service for

- ecological, technological and Atomic supervision;
- **Walnut.** — senior specialist State Agency Regional Office of the social insurance fund of RUSSIAN FEDERATION in the Republic of Khakassia;
 - **Dobračev N. M.** – Deputy Head of the State Labour Inspectorate, Deputy Chief State Inspector of labour (occupational safety) in the Republic of Khakassia;
 - **Dmitriev, J. M.** is the Assistant Director of the Federal State unitary enterprise "in security";
 - **Emelin V. M.** -Chief State Inspector of boilers supervision and supervision of the management of federal service of Yenisei GTS for ecological, technological and Atomic supervision;
 - **Litvekov V. I.** is a Deputy Division Chief Inspectorate of the Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Merkushev Alexander.** Inspectorate is a Division Chief in the Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Metelova T. G.** -Chairman of the Trade Union branch of JSC "Rushydro" — "Sayano-Shushenskaya GES. P. S. Neporožnego ";
 - **Nikulin Pi.** is a Division Chief in the Republic of Khakassia mining supervision management of the Yenisei of the Federal service for ecological, technological and Atomic supervision;
 - **Ogleznev A. F.** -Chief State Inspector of Department of energy auditing in the Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Ozerova G. S.** -Chief State Inspector of boilers supervision and supervision of the management of federal service of Yenisei GTS for ecological, technological and Atomic supervision;
 - **Podsypannikova A. N.** — the State Comptroller Division for supervision of the chemical and petrochemical industries Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Pron In A.** Deputy Director of the Center for energy risks insurance OJSC IC «ROSNO»;
 - **Tel. S. A.** – Deputy Head of the Federal service of the Yenisei on ecological, technological and Atomic supervision;
 - **Tikhonov N.** -Chief State Inspector of technological supervision on Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Fedorchenko A. P.** — the State Comptroller Division of technological supervision on Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Hazi Ahmetov, R. M.** is a member of the Board of JSC "Rushydro", Managing Director, head of business unit "Engineering";
 - **Hnykin A. V.** — Chief of Department for supervision of waterworks management energy and construction supervision of the Federal service for ecological, technological and Atomic supervision;
 - **A. Retail.** is the acting head of the Federal service of the Yenisei on ecological, technological and Atomic supervision;
 - **Tsapenko A. V.** – Deputy Head of the Department of energy and construction supervision of the Federal service for ecological, technological and Atomic supervision;
 - **Čeredinov Y. A.** – President of OJSC «Sayano-shushensky gidroenergoremont ";
 - **Ārovickij O. V.** is a Deputy Division Chief Inspectorate of the Republic of Khakassia Yenisei management of federal service for ecological, technological and Atomic supervision;
 - **Petrenā Y. K.** — Deputy Director-Technical Director of OJSC "power machines";
 - **Ferapontov A. V.** the Deputy Head of the Federal service for ecological, technological and Atomic supervision.

Glossary

AVRZ-emergency repair shutter
 ARČM-automatic regulation of power system frequency and power peretokam
 ACS — automated control system of technological process
 BGĚS — Common hydroelectric power station
 In-internal examination
 Hectares-hydraulic system
 GUY is a hydraulic test
 GP-generator bearing
 GRAM is a group of active power controller
 GRARM — group controller for active and reactive power
 Power station is a HYDROELECTRIC POWER STATION
 DD is the operator on duty
 MEL is a combination turn knob/pushbutton unplanned power
 KAZ-valve emergency closure
 CZ is short circuit
 MNU-maslonapornaâ installation
 On — the Guide apparatus
 The NDP is a pneumatically driven pump
 NEC is a normal Headwater level

No — supervisor stations
NTD-normative-technical documentation
ODE is operatively-dispatching management
OIC — operative-informational complex
GCO-dangerous production facility
WGU is an open source distribution device
OS — operating service
FROM-tail pipe
ECO-United energy system
PC-fire brigade
ПТЭСiSRF — rules of technical operation of electric power stations and networks in the Russian Federation, approved by order of the Ministry of energy of the Russian Federation dated June 19, 2003 No. 229
RMA is a high-pressure reducer
RK-impeller
SMGTS — the monitoring service of hydraulic structures
DMS — the monitoring service of the equipment
SNTB — service reliability and safety
STSU is a service of technological control systems
СШГЭС — OJSC Sayano-Shushensky Hidroenergoremont (until July 2009, JSC "Gidroenergoremont")
СШГЭС – Sayano-Shushenskaya GES p. s. Neporožnego»
FA — technical water
TSS-turbine bearing
LEVELS-the spare switch failure
CLAZ is the central line slot machine Hall
The CPU is the central control console
CA — centralized system
COMPUTERS-computer machine
EGK-electro-hydraulic column
AGRE is an electro-hydraulic control
ECM is call point (MCP) pressure gauge

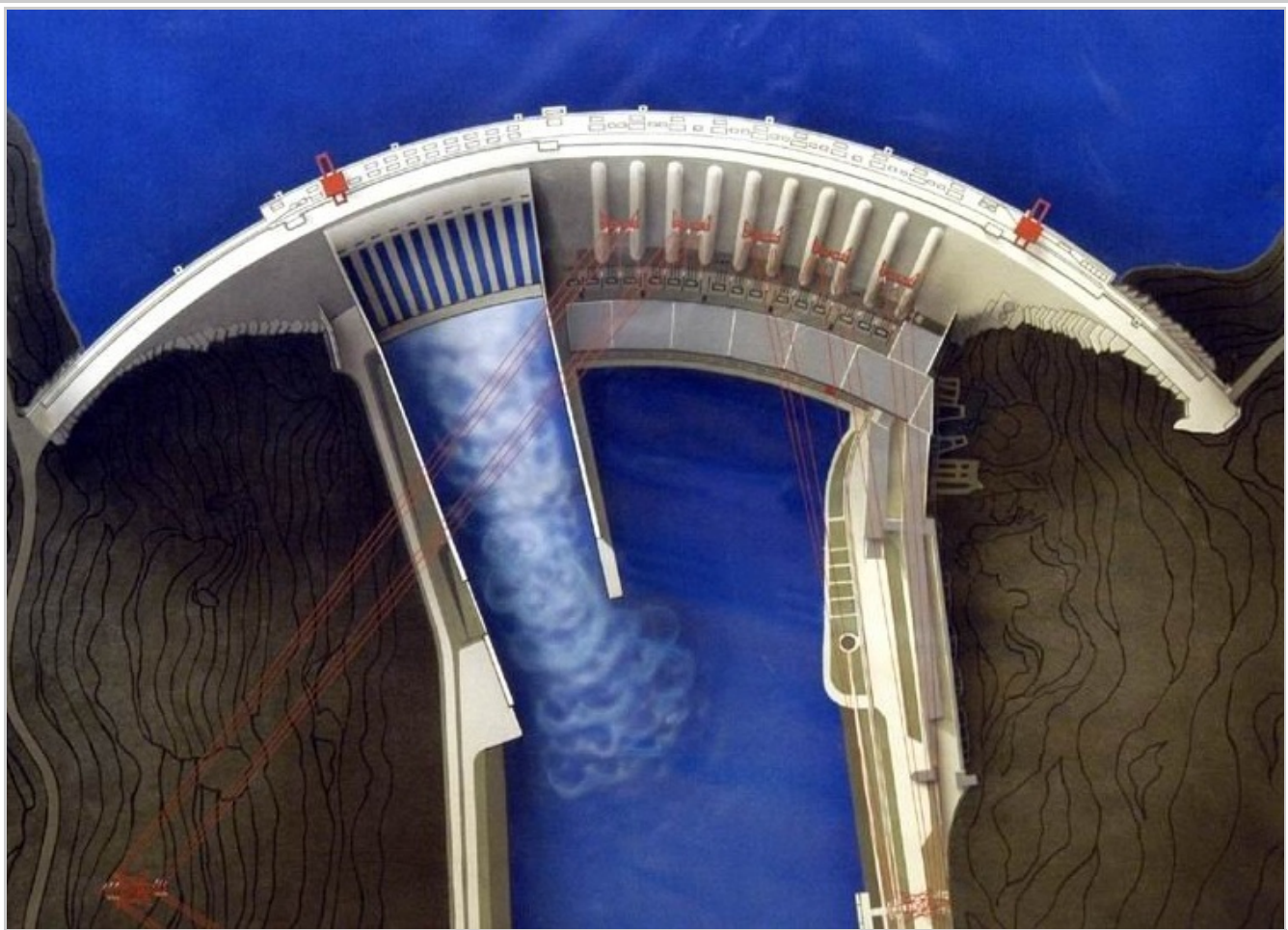
3. characteristics of the object and crash site

The Sayano-Shushenskaya HYDROELECTRIC POWER PLANT is a concrete arch-gravity dam of cylindrical form with RADIUS on the top face of the 600 m, maximum height of 242 m, Crest length of 1074, 4 m and a width of 25 m, comprising by-wash station, and deaf. The construction of the new facility "the Shore spillway.

Vodosbrosnaâ of dam 189.6 m long has 11 intakes and vents with the size of current section 8.2 x 5.4 m with embedded water intakes, sills below the 61 m for the project-level boost normal (NPU OTM. 539 m). The holes are covered with flat wheel gates, served by two gantry cranes with capacity of 500 ton each.

Building of HPS is curved in plan with a RADIUS axis units 452 m long with mounting pad 289 m, located at the station on the left bank of the dam bed that consists of 10 blocks of aggregate width of the axis units 23.82 m, socket block width 34.6 m and installation of a platform in length 40 m, to which the tailrace abut service-technological and administrative buildings a and b.

"The main purpose of СШГЭС in complex with HYDRO-electricity Mainskaya week and unlimited daily Regulation» («Sayano-shushensky dam on the River Yenisey. comprehensive note. Leningrad, 1988, p. 10).



Rice. 3.1. SŠGES. top view.

The Sayano-shushensky hydroelectric complex in the power systems performs the following functions:

- extradition system of active and reactive power and energy;
- frequency reserve power and hot standby system;
- ensuring the security of the population in accordance with the Declaration of safety of hydraulic installations Sayano-Shushenskaya HYDROELECTRIC STATION and Main facility "(the acceptance into service of the finished construction of Sayano-Shushensky hydroelectric complex on the River OB, p. Cheremushki, 2000) (hereinafter acceptance).

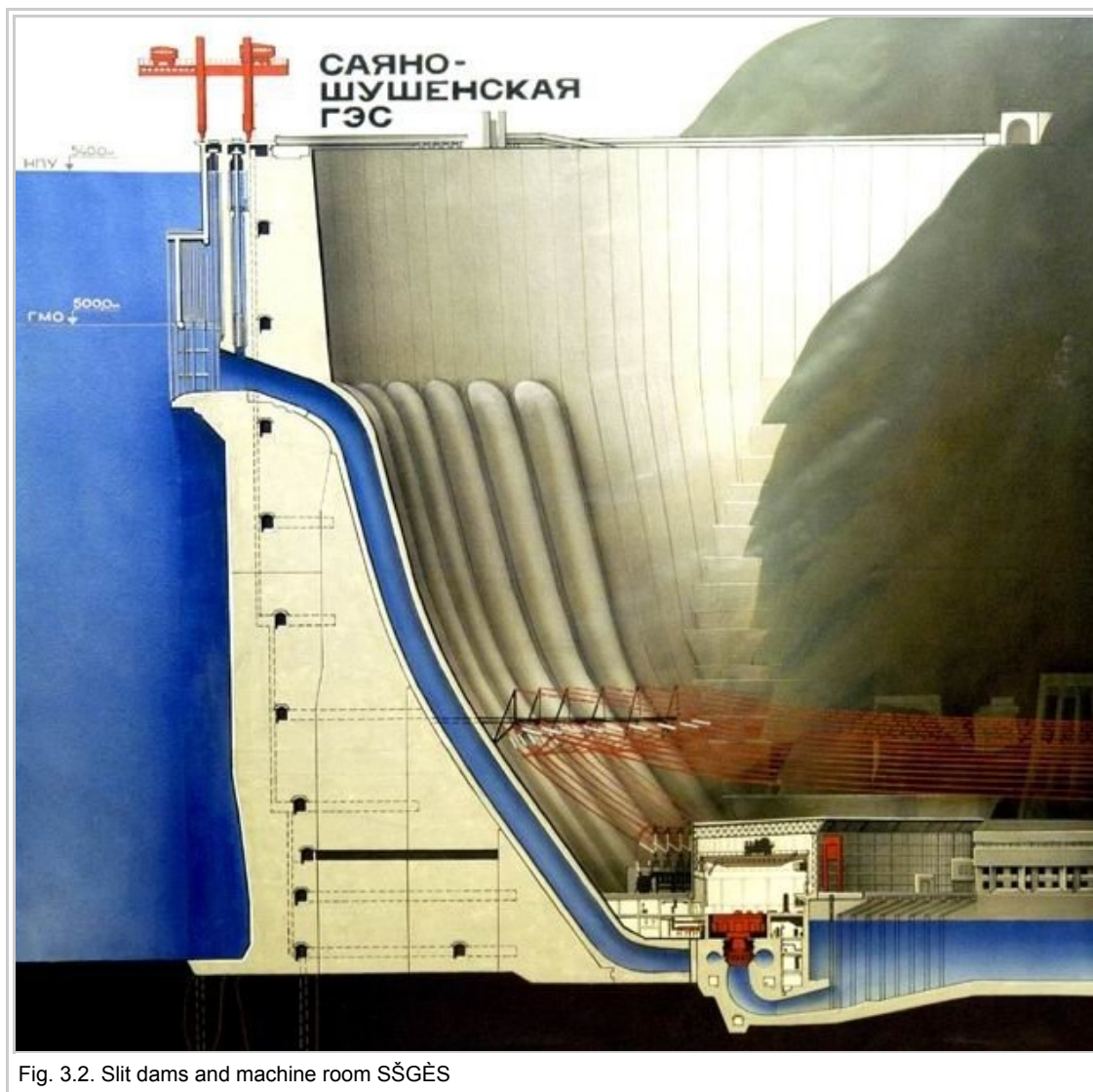


Fig. 3.2. Slit dams and machine room SŠGÈS

The Sayano-Shushenskaya HPP Reservoir provides daily, weekly and annual flow regulation for power system, taking into account the interests of other participants in the water "(the acceptance into service of the finished construction of Sayano-Shushensky hydroelectric complex on the River OB, p. Cheremushki, 2000, p. 13).

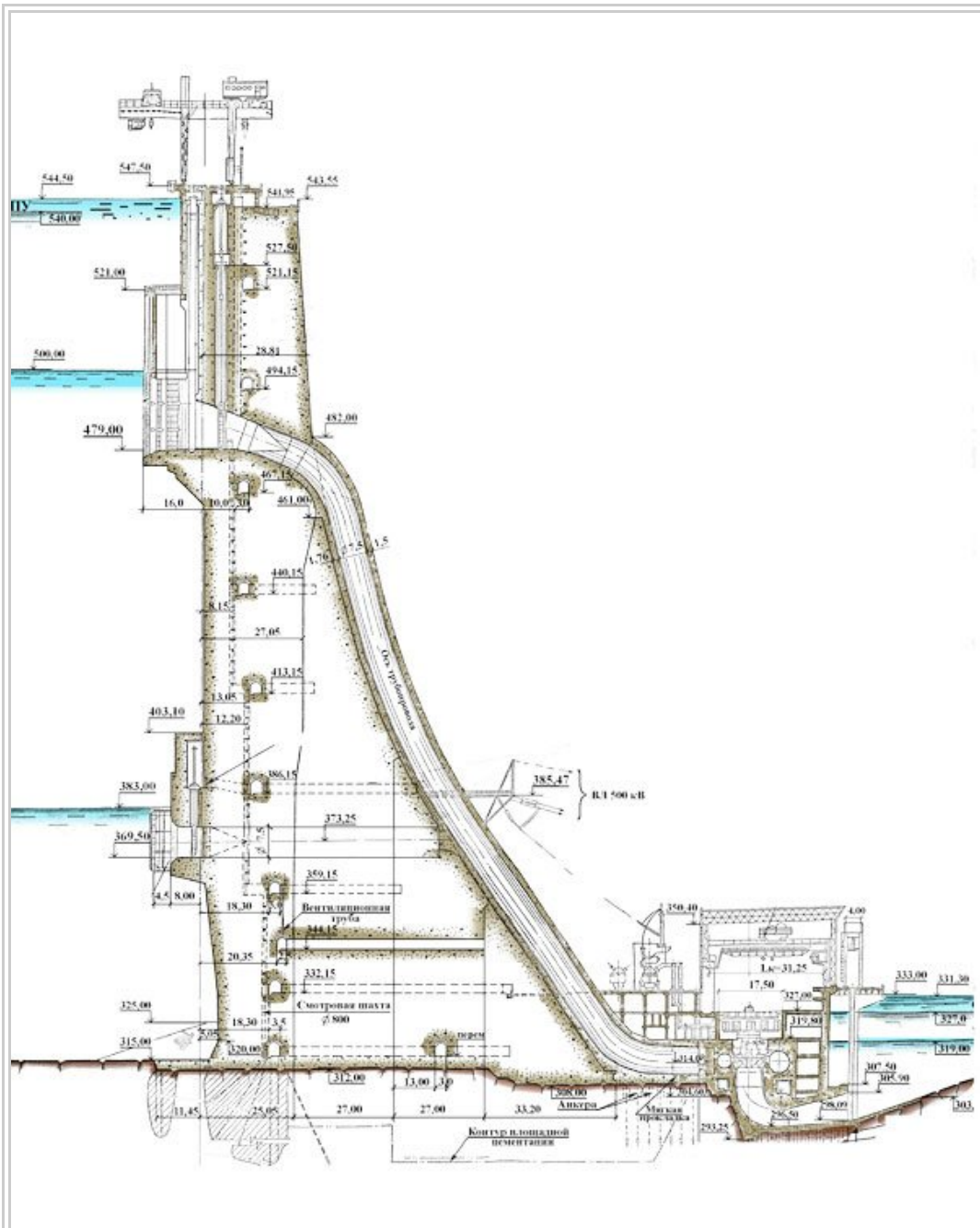


Figure 3.3. Slit dams and machine room SŠGÈS

Construction began in 1963, SŠGÈS. SŠGÈS is introduced in the interim operation in 1978, in continuous operation in the year 2000 by the order of RAO UES of Russia no. 690 of 13.12.2000.

Technical passport of the waterworks the Sayano-Shushensky reservoir on the River Yenisei developed by OAO Lenhydroproject, 1985, the Class structure SŠGÈS-1.

List of approved project documentation is listed in the table:

No. p/p.	Name of document	Year of approval
1	Project statement	1965
2	Technical project	1970
3	Qualified project statement	1976
4	Launch complex No. 's 1, cat no. # 1047-1-26p	1977
5	Launch complex hydraulic units no. 2 and no. 3, cat no. # 1047-1-34p and # 1047-1-35p	1978
6	Launch complex hydraulic units no. 4 and no. 5, cat no. # 1047-1-40 p	1980
7	Launch complex's no. 6, cat no. # 1047-1-47p	1981

8	Launch complex hydraulic units no. 7 and no. 8, Inv. # 1047-1-55p	1983
9	Launch complex hydraulic units no. 9 and no. 10, Inv. # 1047-1-56p	1984

In the building of the hydroelectric power station are 10 hydraulic units (HA) with synchronous hydrogenerators umbrella type SVF 1285/275-42UHL4 640 MW rated capacity with reliance on the turbine, water cooling stator and forced air cooling of rotor (manufacturer electrosila) and radial-axial water-ro-230/833-677 of impeller diameter 6.77 m (manufacturer of "Leningradsky metallichesky Zavod" (LMZ)).

Voltage generators, 15.75 sq.m. When tested in NES and sustainably developed power load 720 MW.

The total throughput of turbines 3400-3600 m³/s. Check water pressure at turbine 194 m, minimum is 176 m.

6400 Mw the installed capacity of the plant.

At the time of the SŠGĚS there were restrictions on peak power up to 4000 Mw to limit the bandwidth of existing lines.

Average annual electricity output of the project is SŠGĚS 23.4 billion kWh. h.; in fact, at the time of entering into a permanent operation in 2000, 22.79 billion kWh. h., 2008 — 18.6 billion kWh. h., and for 8 months of 2009 — 15.87 billion kWh. h.

Commissioning of the hydropower units SŠGĚS took place in the following order:

HA-1-01.12.1978;

HA-2-05.11.1979;

HA-3-01.12.1979;

HA-4-01.10.1980;

HA-01.12.1980-5;

HA-01.11.1981-6;

HA-01.09.1984-7;

HA-8 — 01.11.1984;

HA-9 — 01.12.1985;

HA-10 — 01.12.1985.

HA-1 and HA-2 were put into operation with the provisional working wheels.

07.11.1986 g. hectares-2 and 12.06.1987, HA-1 were put into a job with regular working wheels.

Term of operation of hydro turbines — 30 years (2244 form 000000 for the Leningrad metal plant).

Lifespan of 40 years ' hydrogenerators — (GOST 5616-89).

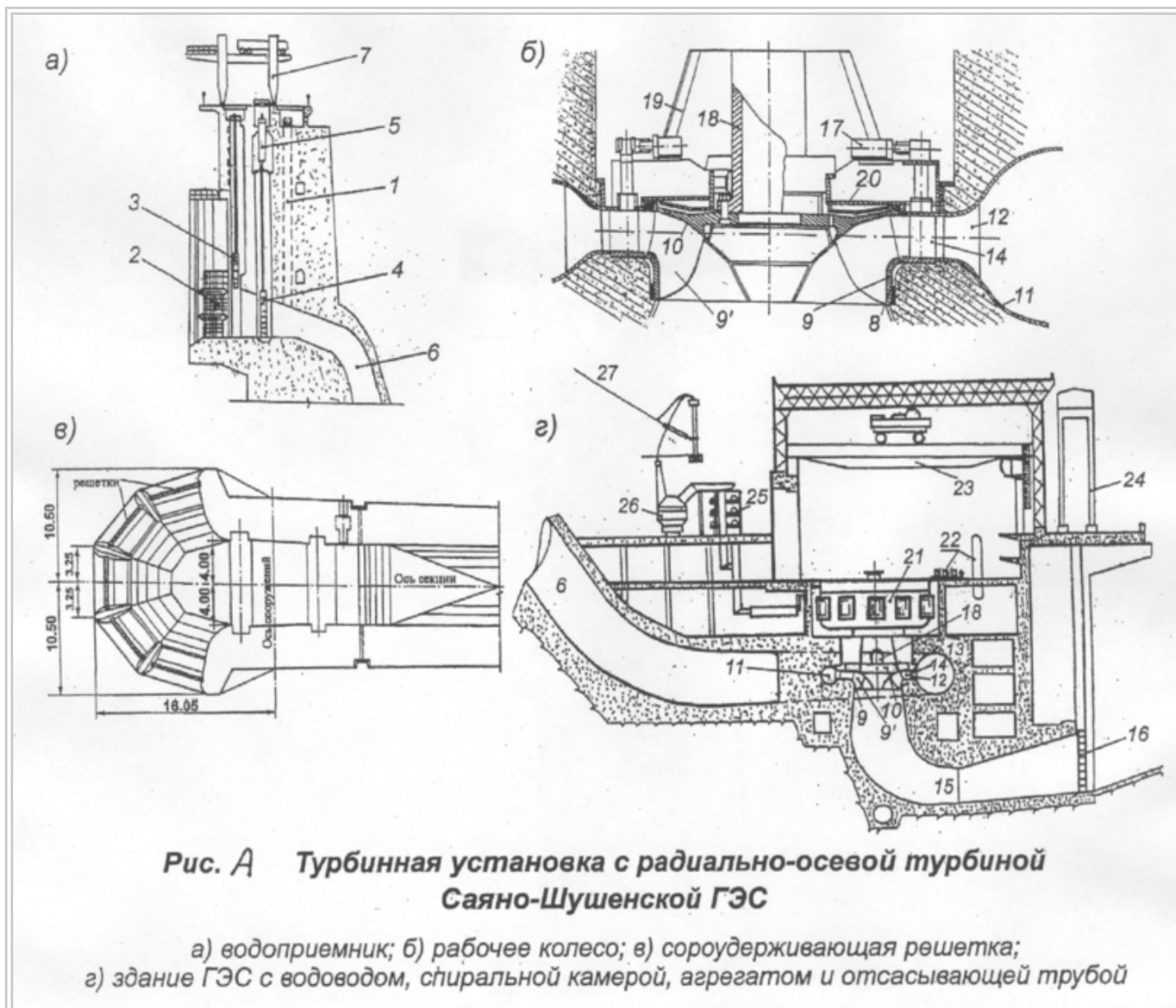


Fig. 3.4 Turbine installation with radial-axial turbine Sayano-Shushenskaya HPP

a) recipient; b) impeller; in soroudерживающа lattice); g) powerhouse with waterways, spiral camera unit and suction pipe.

Turbine installation consists of equipped with debris screen emissary (2) and the air intake tube (1). Turbine penstock (6) is in front of the slots to install repair closures (3). To protect the turbine in case of failure of the diffuser has special grooves that have bystropadaüşie valves (4) (emergency) that are downloaded from the automatic monitoring devices illegal idling unit. Bystropadaüşij bolt is gidropod"emnikom (5). For repair of Hydromechanical equipment inlet has special gantry cranes (7).

Turbine impeller in the Chamber (8) and consists of three tightly linked parts-rim (9), hubs (10), between which there are paddles (9') complex spatial forms.



Rice. 3.6 appearance of the camera # under construction of spiral -2 during installation

According to data obtained from the system operator OJSC unified energy system (letter from 24.09.2009 # b-19-8763) SŠGÈS is one of the two hydroelectric power stations (together with Sister HPP — Irkutskenergo) used for power control in a single grid. Permission to connect to the ARČM GRAM SŠGÈS ODES of Siberia as a governing power was granted, 29.11.1988 (Teletype ODE Siberia from 29.11.1988 g).

SŠGÈS project provides the following protection of hydraulic units:

Basic protection:

- longitudinal differential protection;
- transverse differential protection;
- protection against earth fault of stator winding;
- protection against over voltage;
- protection of asynchronous;
- additional maximum current protection;
- protection against loss of excitation;
- protection against earth fault of rotor winding of generator;
- protection of rotors against overload;

- differential protection of generator support;
- protection of auxiliary generator overload;
- protection of the maximum current of the rotor of generator support;
- maximum current protection of auxiliary generator;
- protection against over voltage stator support generator;
- protection of rotor support generator from Earth.

Back protection:

- overload protection rotor with automatic controller of excitation failure of action;
- protection of rotors against overload;

is reverse sequence current protection against short circuit and overload (SC);

- current protection against SHORT-CIRCUIT and overload of symmetrical;
- Remote protection from symmetric CZ (G8);
- overload protection for stator;
- the device backup failure switch (LEVEL).

Impact on the protection of the disabled:

- emergency generator segments bearing temperature rise;
 - abnormal rise in temperature of thrust bearing segments;
 - emergency low pressure oil pressure in the accumulator units (MNU);
 - emergency low oil level in accumulator ";
 - emergency low consumption of industrial water for lubrication of the bearing of turbine
- is the cable broken feedback of diffuser (at) elektrogidravličeskom controller (AGRE); -defective regulator;
- protection against acceleration 1;
 - protection against acceleration 2;
 - protection against stator cooling distillate consumption reduction.

Licensing documents

SŠGÈS has the following licensing documentation:

License:

1. The operation employed at industrial facilities, # VP-0000-0097772 (LOC) (Mar 25, 25.03.2014), Rostekhnadzor;
2. On the right of subsoil use, construction and operation of shore spillway SŠGÈS on the right bank of Yenisei, # CRE 01950 NG (25.09.2008.-30.12.2030) nedrapol'zovaniû Office in Krasnoyarsk territory;
3. For the construction and operation of underground constructions unconnected with the extraction of minerals (road tunnel with the civil defence and 05 drainage-cementing adits) on the left bank of the Yenisey, no. ABN 00489 NG (28.11.2008 – 28.03.2033) Office in the Republic of Khakassia on subsoil use;
4. Repair of measuring instruments # 004289-r (24.01.2008 — 24 January 2013) Federal Agency on technical regulation;
5. For collection, use, disposal, transportation, placement of hazardous wastes, FROM-65-000118 (19) (12.08.2008, 12.08.2013), Rostekhnadzor;
6. On the construction of buildings and structures, with the exception of seasonal facilities or support nature, # GS-1-77-01-1027-2460066195-0-037084-1 (12/12/2008 – 12 December 2013), the Ministry for regional development of the Russian Federation;
7. Works on installation, repair and maintenance of fire safety of buildings and constructions, no. 2/27931 (01.11.2008-01.11.2013), Russian emergency situations Ministry.

Permissions:

-operation of hydraulic structures (complex of hydraulic installations) SŠGÈS, dated March 3, 2009 No. 541 (HPP), based on the Declaration of safety of hydraulic installations of SŠGÈS No. 08-09 March 2, 2009 (01) 0012-1-10-2ÈS.

The Commission notes that, at present, the legislation does not provide for the economic agents of the licences, repair and reconstruction of hydro-equipment (including hydraulic units).

Operational management, maintenance and repair of hydraulic structures, equipment, buildings and structures are the following services, structural subdivisions of SŠGÈS:

- operational service (OS);
- production and technical service;
- preparation and accompaniment service repairs;
- is a service of technological control systems (STSU);
- site operation;
- Division of integrated information systems;
- service reliability and safety (SNTB);

Repair, maintenance and operation of hydraulic structures, equipment, buildings and structures are the following services,

structural subdivisions of SŠGÈS and contractors:
 is a service of technological control systems (STSU);
 Division of integrated information systems;

-JSC «Gidroènergoremont» Sayano-Shushensky (OAO «SŠGÈR») (until May 2009, JSC "Gidroènergoremont").

Condition monitoring equipment, hydraulic SŠGÈS, buildings and structures are:
 equipment monitoring service (DMS);
 -monitoring service of hydraulic structures (SMGTS).

Author's supervision at the facilities of the new building SŠGÈS based on:

-Treaty No. 11/2 from 22.12.2008 on maintaining supervision at SŠGÈS in accordance with the technical specifications for new construction and maintenance program ("Integrated prospecting expedition No. 13);

— contracts for follow-on no. 12 \102\2006-095 of 03.03.2006 of new construction Waterfront "spillway" ("Comprehensive prospecting expedition No. 13).

The organization works and seconded personnel, admittance is defined on SŠGÈS orders: SŠGÈS

— order No. 206 of 25.11.2008 "on the admission of visiting staff

— order from 20.11.2008 # 204 "about putting in place transitional provisions" of the admission staff construction organizations to perform work on the objects of SŠGÈS on JAM ".

Under the supervision of the Yenisei control Rostekhnadzor are six operating hazardous production facilities (GCO):

1. Playground HES branch of OJSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego";
2. Playground ORU-500 branch JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego";
3. Playground project Main branch of JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego";
4. Manufacturing Base of freight and warehouse operations branch JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego";
5. Playground of transformer substation branch JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego";
6. Playground of transformer substation branch JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego" Main waterworks

the 25 vozduhosbornikov, 13 vessels, air maslovozdušnyh, 24 13 vessels, as well as the floors are 8 cranes, 15 lifts and 22 transformer.

In addition, under supervision of compliance with industrial safety when mining for construction of shore spillway.

4. the events leading up to the accident, including technical and organizational reasons

4.1 malfunction and damage the site HA-2 prior to the commissioning of the Sayano-Shushensky hydropower complex

During the initial exploitation of hydro turbines were found a considerable number of significant cases of violations and failures in work.

Failures of turbine equipment during its finishing and mastering are listed in the table below:

13.03.80	Increase of up to 1.3 mm shaft breakage, leakage of water through condensation (cracks on the facing of the shaft, tension by rubber on the segments, damage to upper and lower seals of turbine bearing) — hydraulic replacement nebalans RK (impeller).
24.04.80	Leaking oil at pipeline pressure regulation system in place of the tie-in of pumps "in pressure pipeline through a crack, formed as a result of neprovara weld pressure pipeline.
28.06.80	The same
1.08.80	Increase water leaks through the upper joints of rubber seal ring TP is separated from poor-quality edits in the factory.
8.09.80	The same
13.09.81	Damaged rubber surface and fastening bolts of turbine bearing segments of crackers breaking the lower labyrinth ring control of stationary impeller. Breakage of the cone.
2.10.81	Increase of 1.9 m battlefield shaft (an increase of up to 1.7 mm gap between the segments of the bearing and shaft lining).
29.11.81	Increase up to 1.5 mm roller battlefields — Cliff bolts fastening crackers segments of hydraulic unbalance impeller.
14.12.81	The same battle up to 2 mm
18.01.82	The same battle up to 2 mm — detachment rubber on the segments of the No. 7, 11, broken studs fastening shell TP, damage the lining of the shaft.

25.01.82	Increase in the battlefield to 1.9 mm (an increase of backlash, damage, damage to the surface of the shaft lining rubber buckets).
1.02.82	The same
24.03.82	Increase of up to 0.95 mm shaft breakage and enhanced chassis vibration. Cliff 2-h bearing housing mounting studs lid — hydraulic turbine nebalans RK.
3.05.82	Increase in the battlefield to 1.9 mm (obryv studs chassis handles, increased the gap to 1.85 mm).
14.05.82	Up to 1.5 mm increased battlefield (offset chassis TP until 1 mm crack on reg. shaft breakage of studs).
28.05.82	The same
26.06.82	The same
9.07.82	The same
3.09.82	However, the battle up to 1.6 mm
8.09.82	Rezinnogo damage cover segments. Great battle of shaft of hydraulic unbalance.
1.10.82	Breakage of the cone.
27.10.82	Leaking oil at the outlet pipeline pumping oil from the pump "at the junction with the pipeline pressure diffuser servos.
10.11.82	The same
28.11.82	Increased shaft up to 1.6 mm battlefield — hydraulic nebalans RK.
23.01.83	Increased shaft up to 1.6 mm battlefield — hydraulic nebalans RK.
10.03.83	The same
24.03.83	Fixing broken shells. Hull vibration TSS to 0.6-0.7 mm for shaft 0.95 mm BoE as a result of hydraulic unbalance.
27.07.83	Crack the shell TP, if you increase the vibration of buildings up to 0.4 mm with TP BoE shaft 1.4 mm, large water leaking roof turbines, Cliff kerchiefs additional fastening to the turbine, hydraulic nebalans RK.
18.08.83	Cliff kerchiefs additional fastening of turbine bearing housings. Hull vibration TSS to 0.65 mm to 1.3 mm BoE shaft of hydraulic unbalance.
30.11.87	Reducing water pressure in the left thread FA to 0, due to a gap in seam welded end caps installed on the pipeline Dn 400 pump option washings of FA. Poor welding caps, made by an installation company.
27.09.87	Leaking oil on the welded seam of pressure pipeline individual servomotor # 13 due to a faulty weld penetration by an installation company.
25.07.88	However, individual servomotor # 11.

(on materials of the State Commission for acceptance into operation the Sayano-Shushensky hydroelectric complex. on conclusion of the Hydromechanical section p. Cheremushki. 1988-1991 year. pp. 47-50).

Overhaul of the HA-2 with full disassembly took place in the period from 27.03.2000. on 12.11.2000, (Act on receipt of an overhaul of the article no. 2 SŠGĚS of 20.12.2000).

When major repairs of the impeller was found:

- cavitation failure of the back side of the blades in the front edge of the depth up to 12 mm;
- crack in the upper part of the blade's edge off no. 1 long 130 mm blade # 7 is 100 mm.

In particular, the following works were performed:

- crack razdelany, RVD, electrodes, heat EA-395, polished profile;
- cavitation failure of blades not corrected;
- centering unit for labyrinth seals after Assembly HECTARES, forms no. 6, 7.

When major repairs of turbine bearing TP were found:

- wear a rubber cover segments;
- through the cracks in the anchor plates segments;
- wear vorotnikovyh seals, fasteners.

In particular, the following works were performed:

- shoe covers, baths, bathtubs, spacer parts, attachments vorotnikovyh seals from rust, paint nitrogruntovkoj on 2 layer;
- fabrication and replacement upper and two lower «seals»;
- repair welding, polishing 16 pairs of spacing wedges baths TP;
- Assembly of the bearing;

- exhibited zero gaps.

With the overhaul of turbine shaft was found a shaft from the upper vorotnikovogo shirts seal height 47 mm, depth 4 mm across its entire diameter shaft (S = 0.33 sq ft) and have been surfacing, grinding the shaft with the control surface of the shirts on the lekal'noj line.

During overhaul covers turbines were carried out the following work:

- cleaning and painting of underwater turbine cover surfaces;
- shoe pivot flange and cabinet seats.

Overhaul of the HA-2 completed in accordance with the instructions of the hydroturbine equipment 2244000 THEM by LMZ and generator installation manual 412.033 the LPO UAN. "Electrosila".

4.2 Accepting into operation the completed construction of Sayano-Shushensky hydroelectric complex on the River Yenisey in 2000 year

By the order of RAO "UES of Russia" of 11 May 2000 No. 253 on the appointment of the Central Commission on commissioning the Sayano-Shushensky hydroelectric complex "Central Commission was appointed with the following composition:

- Diakov a. f.-President of the scientific and technical Council of the RAO "UES of Russia", doctor of technical sciences, Professor, corresponding member of the Russian Academy of Sciences (Committee Chair);
- Vasilyev, y. s., President of the St. Petersburg State Technical University, doctor of technical sciences, Professor, corresponding member of the Russian Academy of Sciences (by agreement), Vice-President of the Commission;
- Bryzgalov v. i. — General Director of OJSC Sayano-Shushenskaya GES ", doctor of technical sciences (Vice-Chairman);
- Abdulov, r. h., technical director of high voltage equipment "Electroapparat" (on agreement);
- M. g. Aleksandrov — Chief Engineer of the Main hydro-electric project JSC "Lengidproekt";
- -Kashan necropolis EA — General Director of JSC "Trest Gidromontazh";
- Botvinov b. g.-Chief project engineer Sayano-Shushenskaya HPP OJSC Lenhydroproject ";
- Vishnevetsky and the i. — the Chairman of the Committee on ecology and nature management of the Republic of Khakassia (on agreement);
- Glebov, a., academician of the Russian Academy of Sciences (on agreement);
- Efimenko a.-Chief State Inspector of GU "Lengosenergonadzor" Ministry of Russia (on agreement);
- Ivashintsov d. a., General Director of JSC "VNIIG". B. e. Vedeneyeva ", doctor of technical sciences, Professor;
- N. Kovalev is a member of the Russian Academy of Sciences (on agreement);
- Kogan, f. g., Chief specialist in JSC "Gidroèlektromontaž";
- Komelâgin i. p. is CEO of the holding company "Krasnoârskgësstroj";
- A. Kozlov, Chief sanitary doctor of the Republic of Khakassia (on agreement);
- Kuz'min v. a., Deputy Minister for emergency situations of the Republic of Khakassia and (on agreement);
- Kuznetsov v. a. – First Deputy Head of the Department of electric power stations, "RAO EES of Russia";
- Swan, a. i.-President of the Government of the Republic of Khakassia (on agreement);
- Lohmatikov g. p. — General Director of JSC "Spetsgidroenergmontazh", corresponding member of the Academy of engineering of the Russian Federation;
- A. mamaev-head of the State fire service of the Republic of Khakassia (on agreement);
- Malyshev I. i., Adviser to the Director-General of the Institute "Gidrospecproekt", doctor of technical sciences;
- Mamikonyants I. g.-Scientific Secretary of JSC "VNIIE.", doctor of technical sciences, Professor, honorary academician of the Academy of Electrotechnical Sciences;
- Milicyn a. p., Deputy Head of the Yenisei gosgortekhnadzor (on agreement);
- Mokhov n. t. – head of the Federal State institution "the Sayan reservoir management" of the Ministry of natural resources of the Russian Federation (on agreement);
- Novozhilov n. a., head of Department of the Ministry of fuel and power engineering of Russia (on agreement);
- Novikov NF is a senior research scientist of OJSC VNIIG. B. E. Vedeneyeva ";
- Oorzhak sh. d. is the President of the Republic, the President of the Government of the Republic of Tuva (on agreement);
- Pinsk g. b. – Chief constructor of gidrogeneratoram OJSC "Electrosila" (on agreement);
- Smirnov, e. a., Deputy Chairman of the Federation of trade unions of the Republic of Khakassia (on agreement);
- Konstantin a., head of "Gidoturbomaš", DESIGN BUREAU Chief Designer, Ph.d. (on agreement);
- Stafievskij v. a., Chief Engineer, technical director of "the Sayano-Shushenskaya HYDROELECTRIC POWER PLANT";
- Ulanov, a. i.-Chief State Inspector of labour in the Republic of Khakassia (on agreement);
- Fedorov, m. p., first Vice President of the St. Petersburg State Technical University, doctor of technical sciences, Professor (on agreement);
- Hmel'kov a. e., head of the Yenisei basin water Department of the Ministry of natural resources of the Russian Federation (on agreement);
- Hrapkov a. a., Chief Scientist of OJSC VNIIG. B. e. Vedeneyeva ", doctor of technical sciences, Professor;
- Yurkevich b. n. is Chief Engineer of JSC "Lengidproekt".

By the order of RAO "UES of Russia" the 13. No. 06.2000 329 the Commission added:

- Yakimov a. m., Deputy Head of administration of Krasnoyarsk region (on agreement);
- Kelberg v. g., acting Chairman of the Committee on ecology and nature management of Krasnoyarsk region (on agreement).

OJSC Sayano-Shushenskaya HPP "RAO" UES of Russia "on the basis of the order of RAO" UES of Russia "of 11 May 2000, no. 253 was submitted by the Central Commission for acceptance into operation Sayano-Shushenskaya GES the following list of objects:

1. • The hydraulic installations of the SŠGÈS (deaf left and right-bank part of arch-gravity dam; vodosbrosnaâ vodoboynym a well of the dam with the station part of the dam;). • The hydraulic installations of the MSU (concrete vodosbrosnaâ dam, earthen right bank and left-bank dam, braided).
2. Power building two HYDROELECTRIC POWER STATIONS with mounting platforms. Cable Communications, control, and communications, as well as utility rooms.
3. Both HYDRO equipment (hydraulic units, transformers, high-voltage obšestacionnoe all assignments and associated equipment paddles, sorouderživaûšie).
4. ORU-500 m2 with shield units, workshop repair of high-voltage equipment (MRVO) and compressor, OURO-220 kV and 35 kV OSG (constructions, fitting, transitions, VL, cable tunnels with fire-extinguishing system, supports and portals, fences, security alarm system and the relationship of the two HYDROELECTRIC POWER STATIONS).
5. Transformer workshop SŠGÈS.
6. Secondary job-support and managerial appointments SŠGÈS (auxiliary processing buildings a and b, fire station sventa lone premises, means of protection). Service and technology building of the Moscow State University.
7. A civil defence 05 SŠGÈS with travel tunnel from org-500 up to the crest of the dam.
8. External networks and fire-fighting water supply and storm water drain hozfekal'nyj of the two HYDROELECTRIC POWER STATIONS.
9. The territory both for waterworks
10. The reservoir and the lower pool.
11. Objects of housing and social p. Cheryomushki.
12. The concrete industry.

In the conclusion to the Act stated:

"All the energy, high-voltage equipment and other equipment manufactured by the domestic industry. At the Sayano-Shushenskaya HYDROELECTRIC PLANT equipment such as hydraulic turbines, hydraulic generators are parent units and are at the level of the best world samples and some electromechanical parameters exceed them.

Comprehensive tests and in-depth studies of hydro generators and turbines of Sayano-Shushenskaya HPP have confirmed that they have sufficient capacity and, if necessary, can the long-term load bearing 720 MW. 640 Mw rated power unit.

*In the initial period of operation of Sayano-Shushenskaya HYDROELECTRIC POWER PLANT had been **identified some constructive disadvantages of separate units of hydraulic turbines**, which specialists and manufacturers a **partially removed. Work to improve the reliability of individual components of the hydraulic units is ongoing, in particular, in the Elimination of cracks on the blades of the turbine impellers. At the may, because of the lack of reliability of material bearing nodes spread mechanism of blades and deviations from the project in their manufacture, turbines work in propellernom mode, which worsened its operating characteristics and kontrreguliruûšego hydropower project in General. Replacement turbines"** (pp. 29-30).*

*"In the process of mastering o. revealed that in the discharge face and rocky on the dam Sayano-Shushenskaya HYDROELECTRIC POWER PLANT **are negative processes related to violation of the density of concrete and rock razuplotnieniem basis at a level substantially in excess of the design assumptions.**"*

Management Service involving specialized organizations successfully working towards the Elimination of violations of the continuity in the stretched zone pressure near the dam for the first time in domestic practice, and works to strengthen the grounds, which have no analogues in the world practice.

To avoid damage to the renovated areas of the body have been reasonably accepted lower dam NEC on 1 meter " (p. 31).

» 6. JSC Sayano-Shushenskaya HPP "provide:

6.1. *the completion of the works (Appendix 6) Šušenskomu Sayano-gidrokompleksu in accordance with paragraphs 16, 17 substantiating this Act with the inclusion of costs in the electricity tariff by selling the FOREM (annex 13). **Thus, as soon as possible to begin work on building an additional spillway at the Sayano-Shushenskaya HYDROELECTRIC POWER STATION "** (p. 34). Note: due to the lack of timely decisions of the Administration and management of additional construction of shore spillway had not been completed so far.*

In annex 12 to the Act of the Central Commission on commissioning the Sayano-Shushensky hydroelectric complex "activities to increase reliability and long-term programme elaborated by OJSC" Lenhydroproject 2000», in particular:

*« **Significant shortcomings in the construction of hydrotechnical constructions SŠGÈS should include the General scheme of construction has not been finally adopted before the turn and had for objective and subjective reasons, changes in the midst of construction (concrete transportation system, temperature control of concrete mix, the late omonaličivanie seams), which led to a number of negative effects (incidents), which was resolved during the period. the most important of which were the crack***

growth in first pillars damrazuplotnenie, vodobojnogo a well founded and the destruction of the SŠGÈS.

Real opportunities for hydraulic engineering, coupled with lack of funding prevented the implementation of the programme of the preparatory work in full and ensure the readiness of the project construction phase, which led to considerable lengthening works. The actual duration of the preparatory period was 12 years (against the project setting — 5), with a total construction time is 27 years old (vs-9).

Policy period of Seasoning input # 1 in December 1978, when laying concrete on backlog 900 thous. m³. (stowed 3200 thousand m³ project starting implementation of 4100 thousand m³) led to a change in the schema passes flood, 1979. This was to keep the project schema zadelki bottom spillways, 1978 (without using them as a reserve) and pass through the flood spillways of the second tier, and part of the front by-wash dam — overflow via štrablenye-numbered sections. For technical reasons it was not projected to installations performed. as a result of omitting the flood took place in unmanaged mode, flooding the building that led to the DAM.

Before starting subsequent units anticipated construction of the dam project, the full profile, which provide for the same technical reasons it was not possible. **As a result of stressed-strained state of the dam, an incomplete profile did not match project assumptions. This has led to stress cracking in the concrete first pillars, Earth decompaction and rocky grounds and, as a consequence, high water filtration, partial degradation of materials in these areas. the effects demanded their removal during operation by operating personnel.** The scientific and technical Council of the RAO "EU Russia" (Protocol № 1 from 26.12.1996) cost of repairs to the dam and Foundation design and survey objectives recommended in the tariff for the electricity.

At clearing discharge water energy idling speeds at a gathering with the sock up to 55 m/s and unit costs in vodobojnomo well up to 120 m³/s per running meter mount bottom well possessed the necessary qualities such as strength (strength) and density (water resistant) contact plates with concrete preparation, maintainability, redundancy of near-surface waterproofing dowels through the duplication of bottom, etc.

These structural deficiencies were one of the main causes of serious incident involving the destruction of DNA retention well in 1985. skipping through the unfinished construction of flood flow 4500 m³/s at the levels of the WB 501.75 -517.13 m.

In the first period of operation the SCHOOL HES identified weaknesses design manufacture some components of hydraulic turbines. To eliminate their specialists and manufacturers has been extensive complex of works on development of water turbines to increase their reliability. This work continues, in particular, by making cracks in the blade.

After commissioning SCHOOL HES more than 20 years, so a number of morally and physically obsolete hardware and equipment need to be replaced (ONE-100 APCS, impellers, Kagi-15.75 turbines should be replaced with circuit breakers with SF6 isolation).

The operators a comprehensive multi-year plan for modernization of the hydroelectric complex, consisting of the above activities. Some examples of needs and solutions are given below, and the cost and time frame for the implementation of these activities is given in annex Nr. 1.

Impellers of hydraulic turbines.

Hydraulic turbines SCHOOL HES ro-230/833-677 fabricated by LMZ. Lifespan of almost half of the turbines is 20 years, with an average used over 85 thousand. hour.

In recent years, the operation of turbines were completed substantial volumes of repair, restoration and research work. This allowed to evaluate the reliability and service life really define hydraulic turbines. Treating an average of 50 000 h, volumes have increased significantly. repairs, producing an average of 9-10 thousand hour. are massive and regular work on welded up cracks in the blade impellers on average annually such repair is performed at 4-5 hydro unit, due to the large amount of idle increases and hydraulic units for repair.

The worst condition of turbine impeller is no. 10. It produced the largest amount of repair work on the Elimination of cracks on both blades and on the rim.

Replacement of CAG-15, 75.

Hardware generators CAG-15, 75, consisting of load switch disconnecter, transformers, current and voltage generator circuits used in SCHOOL HES from 1984.

КАГ изготавливался ОАО ВО „Электроаппарат“ (г. С-Петербург) только для Саяно-Шушенской ГЭС, т. е. серийного выпуска и соответствующей заводской доводки его не было, поэтому **аппарат работает ненадежно.** В эксплуатации имели место случаи полного повреждения контактной системы разъединителя, а также случаи повреждения выключателей КАГов при отключении токов, не превышающих номинальные. Конструкция КАГа не ремонтно-пригодна. Трудозатраты, связанные с демонтажем большого количества болтовых соединений, уплотнений и вспомогательных узлов аппарата сопоставимы с трудозатратами на текущий ремонт генератора. После поставки на ГЭС 10 аппаратов производство их и запчастей к ним заводом прекращено. К настоящему времени на СШ ГЭС практически исчерпаны запасные части, что может привести в ближайшие годы к дополнительным простоям в ремонте гидроагрегатов.

Furthermore, given that SCHOOL HES connected to TAC management protivoavarijnomu of Siberia, in chains of generators should have full generator circuit breakers.

Domestic industry generator switches necessary for SCHOOL HES not available. options

In 1994, Lengidroproektom for setting SCHOOL HES was searched for possible replacement of KAGov to a generator switch among domestic and foreign manufacturers. It has been determined that you need to install the switches DR 36 V1750 ABB company. Cost to replace one on the generator switch is Kaga-58.8 million rubles.

Modernization Of AUTOMATED CONTROL SYSTEM-Ta.

ASU – TP Sayano-Shushensky gidroenergokompleksa, operating more than 20 years, physically and morally outdated and does not meet the modern requirements of a reliable and economical management regimes. technical means of CONTROL SYSTEMS-TP (ECS-2 and Ta-100) have developed. According to the manufacturers service life of SM-2 and Ta-100 is 8-10 years. production of spare parts for equipment of SM-2 and Ta-100 dropped more than 10 years ago.

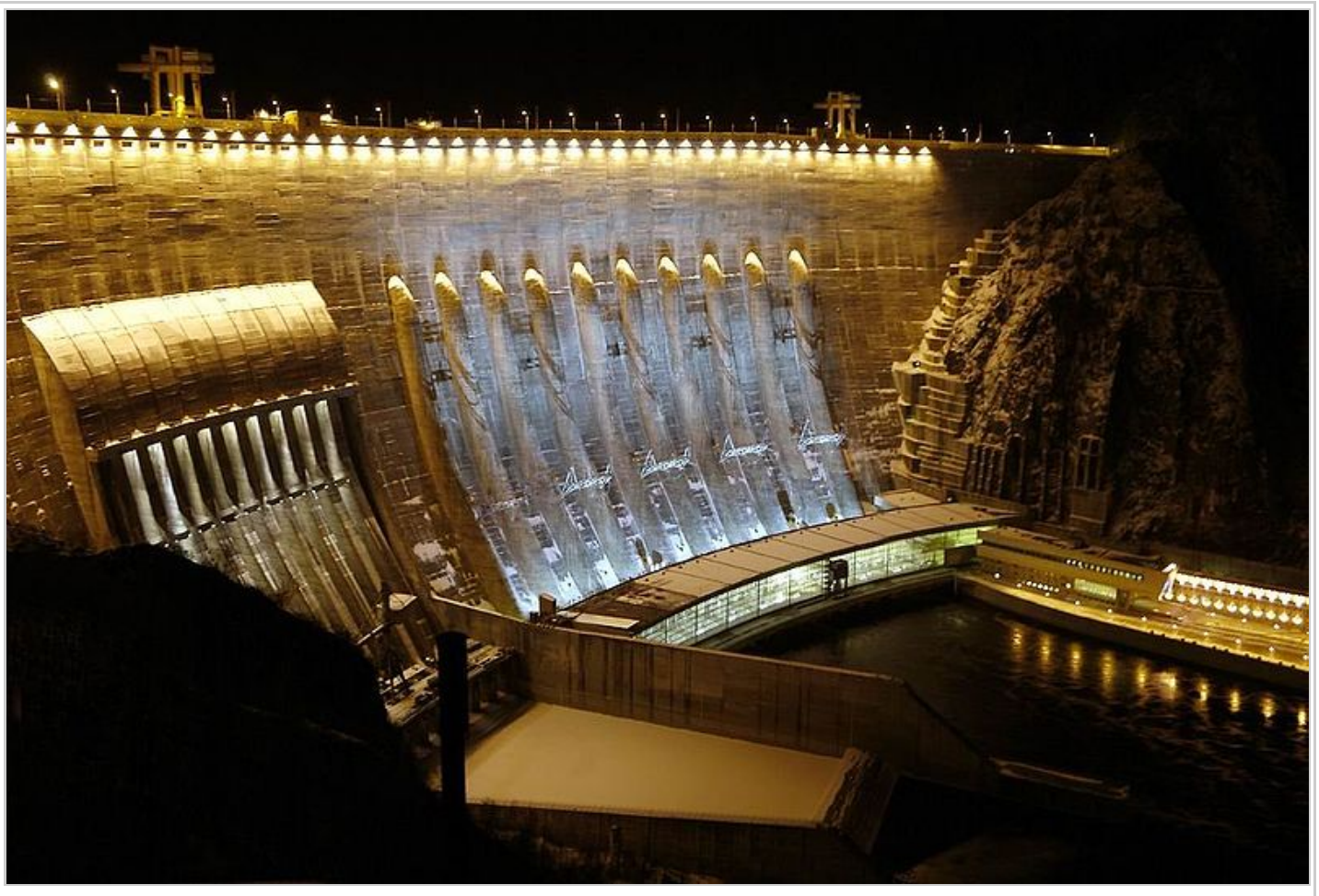
In 1998, due to a sharp increase in equipment failures were decommissioned control subsystem PROCESS (group control of active power, reactive power and voltage regulation, management of equipment of Main project with remote SSH HPS). Technical means of information subsystems ASU-TP (SM-2 and OFSTED) is also worn, exploited with great difficulty and need to be replaced in the coming years. Require replacement used in technological automation and signalling unreliable semiconductors Logic "-t", discontinued, and on HYDROELECTRIC POWER PLANT stock to date virtually exhausted.

By the order of RAO "UES of Russia" from # 329 13.06.2000 Central Commission the Sayano-shushensky hydropower complex inaugurated with "good".

By the order of RAO "UES of Russia" of 13.12.2000 No. 690 "on approval of the acceptance into service of Sayano-Shushensky hydroelectric complex," Chairman of the Board of RAO UES of Russia a. b. Chubais adopted the Act of the Central Commission on commissioning the Sayano-Shushensky hydroelectric complex without a full assessment of the available information at that time on the functioning of the Sayano-Shushensky hydroelectric complex.

In addition, according to Appendix 1 3 (an act of the Central Commission on commissioning the Sayano-Shushensky hydroelectric complex), the Commission was not updated at the time of acceptance into operation, in particular:

- Finally, the operational sections — 1988-1991 Gg.
- Finally, water-energy section-1988-1991 Gg.
- Finally, Hydromechanical partitions-1988-1991 Gg.
- Finally, electrical section, 1988-1991 Gg.
- Finally, the reservoir is a 1988-1991 Gg.
- Finally, the section on environmental issues — 1988 — 1991



4.3. maintenance work on 2-HA and its modernisation since the commissioning of the SŠGÈS.

Overhaul on 2-HA model nomenclature "hydroelectric station" was conducted from 29.09.2005 on 29.12.2005 (the Act of checking the quality of the overhaul on the model nomenclature of station No. 2 of Sayano-Shushenskaya GES p. s. Neporožnego

"Chief of the territorial Center of SĚTN in OJSC «Hakasènergo», Raikovy).

In addition to typical work performed when major repairs of equipment are: excitation regulator on microprocessor-based ARV-ARV SDP1 m with phase-control thyristor converters (ŠRV-m), transferring the governing impulses from ŠRV-m to thyristor converters using fiber-optic cable, reconstruction of motor valves control water supply system of hydrounit; installation of the standby sensor cold and hot oil generator bearing and thrust bearing.

On the working wheel carried out the following work:

- eliminate cavitation damage of blades according to the technology at the LMZ No. 477 OGsv electrode CL-11;
- control and adjustment of the input edges of blades of settlement pattern;
- evaluates and fix incline shaft;
- centering unit for labyrinth seals.

On the thrust bearing: turbinnomu

- dismantling parts of thrusting nodes, segments, vorotnikovyh seals, shaft enclosures;
- shoe cover baths, baths, spacer parts sites, segments, body attachments, vorotnikovyh seals from rust, colouring of surfaces in 2 layers;
- manufacturing and replacement upper and two lower vorotnikovyh seals;
- exhibited no backlashes.

As a result of defects were found.

Overhaul of the HA is made in accordance with the installation of the hydroturbine equipment instrukciejpo 2244000 THEM on the LMZ and generator installation manual 412.033 IM LMPO UAN. electrosila.

In the conclusion to the Act noted that based on the above, in accordance with the "rules of the Organization and maintenance of equipment, buildings and structures of power stations and networks (34.04.181-2003) confirmed: quality evaluation of repaired equipment" corresponds to the STANDARD: "assessment of the quality of performed works is" good ".

After the overhaul HA-2 was adopted by the Commission and put into moving 16.01.2006 operation in accordance with clause with 34.04.181-2003 2.9.20 (RAO Ues). A three-year term on the controlled exploitation of 30 calendar days.

"The acceptance of repairs should be assessed the quality of repair, which includes an assessment of:

quality refurbished equipment;

- the quality of performed works;
- level of fire safety.

Quality assessment shall be established:

- — preliminarily completed acceptance tests;
- Finally — after a month under operation, during which must be completed to test equipment in all modes, tested and adjustment of all systems»

(p. 1.6.12 rules of technical operation of electric power stations and networks in the Russian Federation, approved by order of the Ministry of the Russian Federation dated June 19, 2003 No. 229 registered in Ministry of Justice of the Russian Federation No. 4799 June 20, 2003). Hereinafter Referred To As PTĚĚSiSRF.

In accordance with the annual repair schedule of equipment SŠGĚS in 2009, approved by the Chief Engineer of the SŠGĚS a. n. Mitrofanov 14.03.2008 from 14.01.2009, 16.03.2009, an average repair HA SŠGĚS with 2-faced impeller.

Repairs of hydraulic units and SŠGĚS in 2009, HEPP was performed under contract No. 3-SSH-470-2008 from January 21, 2009 agreement between JSC "Rushydro" on the one hand, and "Gidroènergoremont" on the other hand.

Contract was signed between JSC «RugGidro» is a member of the Board of Directors, Managing Director, head of business unit "production of JSC" Rushydro "b. b. Bogušem, acting under powers of Attorney No. 1670, and dated from JSC" Gidroènergoremont "— Director General of CJSC" Gidroènergoremont "a. p. Pogonâjčenko.

The average repair is the repairs carried out by the health and recovery of partial resource, with replacement or repair parts, limited range and control of technical state of their parts executed in the amount prescribed by normative documentation (annex 1 of the rules of the Organization, maintenance and repair of equipment, buildings and structures of power plants and networks, approved by OAO Rao "UES of Russia" 25.12.2003).

By order of the Chief Engineer of SŠGĚS a. n. Mitrofanova on 11.01.2009 No. 1 leader of middle repair HA-2 has been appointed Deputy Chief Engineer of SŠGĚS g. Nikitenko.

Before the average repair 11.01.2009 Commission, composed of:

the President is the Chief Engineer of SŠGĚS a. n. Mitrofanova;

members of the Commission:

from SŠGĚS:

Deputy Chief Engineer, head of repair — g. Nikitenko;

Head of the planning and preparation of repairs — and i. Perestoronina;

from the repair business:

Director General of JSC "Gidroènergoremont" — a. p. Pogonâjčenko.

prerequisite check has been carried out and repair power plants to secondary repair of GA-2. The audit found:

- spare parts, materials, and equipment to replace the spent resource prepared completely;
- the production team's own repair personnel and contractor businesses implementing full size repair formed and occupational composition;
- hoisting tools, industrial equipment, means of mechanization, energy, repair site posts are completely;
- schedule of repairs, technological, regulatory and institutional documents defining the job of production units are implementing repair prepared fully.

Based on the results of the verification, the Commission concluded that the power to carry out repairs within the time frame set by the plan is ready, equipment repair training plan HA 2 SŠGÈS is made in full. In accordance with the statement of work performed by the Chief Engineer of SŠGÈS a. n., 23.03.2009 Mitrofanov and agreed with the Chief Engineer of JSC "Gidroenergoremont" o. Bašmakovym 23.03.2009, period average repair on the model item with the reconstruction of ACS TP GA 2 SŠGÈS carried out the following work:

emergency repair service shutter;
running repair parts;
impeller repair;
repair Guide;
repair of turbine bearing;
repair of technical water supply system (TVS);
repair of generator bearing;
thrust bearing repair;
repair of braking systems;
cooling system repair;
repair management system;
dismantling column 10-AGRE-7-2I and feedback mechanism;
installation speakers AGRE-ro-6-1 (HA 040505.01).

Specific names and nomenclature work performed according to documents provided by the branch of JSC "rushydro" Sayano-Shushenskaya GES p. c. Neporožnego:

For emergency repair curtain: inspection of equipment AVRZ; hydraulic cylinder; hydraulic panels control hydraulic drive; disassembling, lubricating the control, how to configure; dismantling, lubrication, adjustment of the safety valve.

On Tap: the drainage flowing part; opening hatches in SC and cone from;

Inspection of spiral pipe, the camera suction diffuser, lining of cone of cone retention-radome, RK;
Found and fixed the crack on the welded seam ring blanks in the pairing of the lower ring diffuser and the lower zone of the stator of turbine blade area at no. 10, 1.0 m in length;

On the working wheel (RC): dismantling, installation of a decorative cap and the air intake valve; check the gap on the upper and lower labyrinth condensation;

On examination of cavitation damage found the back of the blades in the front edge of the depth up to 15 mm long, the upper rim depth of 12 mm, form 1 "; Fix cavitation failure of blades according to the technology at the LMZ No. 477 OGsv electrode CL-11;
Monitoring and adjusting the input edges of blades of settlement pattern;
Withdrawn form backlashes in labyrinth seals No. 2.3;

On the sending machine (the): Inspection, found: secondary seals bearings wear «LPA-9.12; dismantling, installation of eccentric fingers shponok, levers, the upper bearing housings on blades-9.12; «Replacement front rubber seal seals, d = 8 mm medium-sized bearings on blades-9.12;

Pereklinovka levers vanes on no. 5, 7, 8, 10, 14, 18, 20;
Check the vertical gap on the shoulder blades and end at (form No. 4);
Signboard installation of front blade and backlashes 9.12;

On the thrust bearing turbinnomu (TP):

The model range:

replacement upper vorotnikovogo seal; **Optional modernization of APCS by SPC "Rakurs":**

To install a new meter TP; installation brackets and sensors for vibration control; **On the thrust bearing generatormomu (GP):**

The model range:

opened — bath, merged oil;

Withdrawn form gaps; disassembling thermal monitoring, oil coolers; workpits segments with babbit coated; view EMF segments retrieved fit Teflon to a segment, found on the front edge delamination Teflon No. 2 segments, 4, 5, 8, 10;

Place the peeling gužonami # segments are brass 4-6 PCs., no. 2, no. 2, 5, 8, 10-1 piece; workpits anchor bolts, disconnecting the crackers from the segments; measurement of diameter of crushing anchor bolts and crackers (form No. 6);

Assembly segments, insulation test more than 1 MOHM, setting into place;

0.5 mm gap is between segments of the insulating ring of hell. 5BS. 357.089 POS. 11 and bushing bearing traits. 5BS. 201.331 item 3; dismantling catcher vapors and enclosures; dye enclosures, cut, tea bowls in the enclosure; cutting, making pores in maslovanne; replacement leather seals in enclosures 1410 1170 1170 1330, 4 4 features. 8BS, 373118 373118-1; 8BS shoe maslovanny; check the level sensor GMS; pressurization oil cooler pipes and operating pressure, TVS are no comments; Assembly cover maslovanny with replacement rubber seal; be an even gap at 0.25 mm; bearing Assembly into a bath filled with clean oil t-30.

Optional modernization of APCS by SPC "Rakurs": installation of thermal monitoring for termosignalizatorov to RTD, winding and colour trails thermal monitoring; replacement pulse tubes on stainless and difmanometrov valves-meters; replacing the flowmeter sensors on a new type of "Jumo"; installation brackets and sensors for vibration control; Installing sensors Ib, NB; installation of pressure sensors "metran";

On podpâtniku: On the model nomenclature: tub, drain oil; drain the water from the oil cooler and supply system; disassembling thermal monitoring, vertical and horizontal panels; shoe maslovanny; workpits segments, inspection and cleaning; ring test and U-jobraznyh pressure oil coolers 5.2 kgf/cm² for 30 min, no comments; replacement of TPK in TCM; installation and sealing oil coolers and pipelines FA working pressure no comments;

Optional modernization of APCS by SPC "Rakurs": replace termosignalizatorov to RTD, route, winding trails, painting; replacement check oil level sensors; audit, cleaning, boring flow washers FA PP; replacement pulse tubes on stainless steel;

installation of pressure sensors "metran"; installation of the sensor and bracket timer speed; replacement gauges for ICC WORLD CUP; reassembly of thrust bearing; in a bathtub filled with clean oil.

Braking system: On the model nomenclature revision of the brakes. replacing a defective friction pillows; brake valve Assembly, adjustment of a new type of PR-16/10 13E-01 under braking; Disassembly, assembling, defects of the pump with pneumatic actuator (NDP); replacement of electrical contact pressure gauge (ECM) tank pressure sensor for PND ABD;

Replacement gauges on ECM new type; repair of valves; hydraulic test system no comments;

Cooling system: model nomenclature: shoe FV1-6 mechanical filters with replacement of filtering elements; cleaning tank BVG-6; faucet replacement for ball valve Dn 15-the pressure sensor; replacement 3-way ball valves Dn 15 cranes; removing the sensor corrosion, install stub; crimping pressure 5.2 system kgf/cm² for 30 min, no comments; repair of pumps, 1 NS-NS-2-disassembly, replacement of the lubricant in pumps; replacement gauges;

Optional modernization of APCS by SPC "Rakurs": replacement level sensors & tank level indicator sensor 6-BVG new type and float; replacement harness difmanometrov-perepadomerov mehfil'trov and a new type of sensors on the IOF Jumo to peremontazhom pulse tubes; Installation, piping salinometers (primary, secondary);

System Management: model nomenclature: merged oil out of the system; cleaning of boilers ", lekažnogo tank, tank filters"; Internal examination (in) and hydraulic tests of boilers (GI) oil pressure unit (MNU); fabrication and replacement pads for manholes and boiler tank ";

Check and adjust the pressure relief valve of boiler air "; Checking and adjusting of safety valves pumps "; repair valves pumps "; installation, Setup and adjustment of the new air intake valve "; Accession pipeline pressurization test pressures 10 kgf/cm², operating pressure 63 kgf/cm²; installation feedback mechanism in SAP; repairs, cleaning lever transfer features, 2156652 SA; shoe cover turbine; filling the system with oil; replacement gauges;

Setting up the system of regulation and control system of individual servo motors according to the instructions of 2143536, 2142511, 214732 pm, form No. 7;

Optional modernization of APCS by SPC "Rakurs": Replace the pressure switch on a new type of "relay" Nautilus "; replacement boiler level na pointers pointer "new type" Kubler "; installation position sensors INTEGRATED "Mikropul's"; installing new sensors stop SAP; replacement of torque feedback mechanism.

Repairs completed in 1409 calendar hours in terms of 1488 calendar hours.

Commission SŠGÈS consisting of:

The Chairman of the Commission — Chief Engineer of SŠGÈS a. n. Mitrofanova
and the members of the Commission, Deputy Chief Engineer for the technical part of the SŠGÈS, the head of the repair SŠGÈS — g. Nikitenko;

the Vice-Chairman of the Commission, Deputy Chief Engineer for SŠGÈS, e. i. Šervarli;

Chief OPRR SŠGÈS — a. Perestoronina;

SŠGÈS — Chief ETL a. Matvienko;

Chief of SŠGÈS-LTD a. P. Beloborodova;

Chief SASDTU SŠGÈS — a. m. Voloshin.

Director TCPS SŠGÈS — t. j. Tološinovoj;

Chief of the RLST SŠGÈS-Čuričkova;

Chief Engineer of JSC "Gidroènergoremont" — o. Bashmakova;

Chief of turbine plant of CJSC "Gidroènergoremont", in g. Sivkova;

Head of Electrical Engineering Department of CJSC "Gidroènergoremont", a. b. and Modernists, Sotheby.

based on documents reviewed, the results of the acceptance tests carried out in accordance with the programme of operational tests HA 2 SŠGÈS, at the end of the medium repair and reconstruction PROCESS, approved by the Chief Engineer of the SŠGÈS a. n. Mitrofanov, 27.02.2009. HECTARE-2 was put into moving operation.

Based on the results of the controlled operation, the Commission adopted the continuous operation of 2 HA and her act of acceptance of average repair HA SŠGÈS from 15.04.2009, with the final assessment is "good", and in accordance with the requirements of STANDARD.

The level of fire safety equipment is repaired, complies with the requirements of the STANDARD.

According to the contract of SS-3-21-2008/5/4/06-05-06 of June 16, 2008, signed by Deputy Head of the business unit "production" OJSC hydroogk Yusupov t. m. based on the decision of the Commission procurement branch of OJSC hydroogk, Sayano-Shushenskaya GES. P. s. Neporožnego from 05.03.2008. OOO promavtomatika is required to be implemented to develop and supply 10 sets of equipment of electric hydraulic pumps to the regulator and installation work.

Technical requirements for the supply and replacement of electrohydraulic variable Hydromechanical speed turbines are contained in annex 1 to the Treaty on the non-SSH-3-21-2008/5/4/06-05-06 of June 16, 2008, and signed by the Deputy Head of the business unit "production" OJSC hydroogk Yusupov t. m

The average repair HA-2 company OAO promavtomatika performed work on dismantling the columns AGRE-10-7-2I and feedback mechanism and mounting speakers AGRE-ro-6-1 (HA 040505.01).

Item 9 of annex 1 to the technical requirements for the supply and replacement of electrohydraulic variable Hydromechanical speed turbine describes features of work in emergency situations.

However, the closure of the diffuser in the algorithm of electric hydraulic speed Governor of turbine power loss was not provided.

Test operation electrohydraulic control column EGK, ro-1 2 6-HA SŠGÈS after installing accepted (acceptance of 16.03.2009)
Commission consisting of:

The Chairman of the Commission — Chief Engineer of SŠGÈS a. n. Mitrofanova.

Members of the Commission:

Deputy Chief Engineer-SŠGÈS and e. Šervarli;

Deputy Chief Engineer SŠGÈS-g. Nikitenko;
 Chief SLM SŠGÈS, U. Pogonajčenko;
 Chief Of SŠGÈS-A. ETL N. Sivcova;
 Deputy Head of SC "Gidroènergoremont" e. v. Kondratieva;
 Head of the ETL — a. Utkin;
 Leading engineer project SPD promavtomatika is d. a. Šnurovskogo.

The Act made the following documents:

technical requirements for modernization of hydraulic control system of hydraulic units;
 EGK-manual ro-6-1;
 Setup and testing protocols EGK-ro-6-2 SŠGÈS 1 HA;
 Manual speed controller with 2 HECTARES of ECG management-ro-6-1;
 Suite Executive and principal construction schemes.

The Commission adopted a decision: is to enter beta testing èlektrogidravličeskuú Management column-EGK, ro-6-2 SŠGÈS on 1 HA from 16.03.2009 till 16.09.2009.

The last vibration test of no. 2 were 12-16 March 2009, after the average repair.

Measurements measuring complex «MIC-200 and vibrodatčikami in & to the specialists of "Sayano-Shushenskaya HPP". (Protocol No. 800 dated 12.03.09, Protocol No. 801 of 12.03.09, Protocol No. 802 on 12.03.09, Protocol No. 803 dated 16.03.09).

The tests were conducted in accordance with the ONE-HUNDRED-and 17330282.27.140.001-2006 "evaluation of technical condition of main equipment of hydropower plants on modes of idle and under load and 104 601 MW, at a frequency of rotation of a rotor of 142.8 RPM when head 190.98 m. Vibration design of hydroelectric and beating when tested in stationary shaft load modes should not go beyond the values allowed for the exploitation levels and was assessed as satisfactory.

Magnitude of horizontal vibration of turbine bearing chassis is given in the table:

Date	12.03.2009	12.03.2009	16.03.2009
Head, m	190.94	190.98	190.98
Operating mode, Mw	Idle	104	601
Vibration values (µm) NB/LB	113	122	149
	129	126	137

According to section 3.3.12. PTÈÈSiSRF: "no long work at elevated levels of vibration: the vibration of horizontal span (double amplitude) of turbine bearing housings, as well as the magnitude of horizontal vibration of the upper and lower joints of the generator, if they are guides, bearings, depending on the frequency of rotation of the rotor must not exceed the following values:

Of rotor speed, RPM.	60 and less	150	300	428	600
A valid value of vibration (mm)	0.6	0.16	0.12	0.10	0.08

Thus, the magnitude of horizontal vibration of turbine bearing housings on the frequency was close to above the allowed values of long work of is not allowed.

In accordance with section 3.3.8 PTÈÈSiSRF "hydroelectric power station capacity of over 30 MW, and with the number of aggregates over three should be equipped with systems of active power management group (GRAM), with the possibility of using them for secondary power system mode of automatic control by the frequency and power peretokam (ARČM)".

Technical assignment to group controller of active and reactive power of Sayano-Shushenskaya HPP Hydro agreed TACS Siberia 05.08.2003, and approved by the Chief Engineer of OJSC "Sayano-Shushenskaya GES. P. s. Neporožnego Stafievskim 14.08.2003 a., General Director of LLC "Promavtomatika" Larionov 25.08.2003 a. year.

In accordance with clause 4.5.1. technical specifications, GRARM had to calculate the magnitude of adjustment ranges for loading and unloading connected to GRARM units.

P. 4.4.5. technical specifications provided for the accounting features of hydropower units in accordance with annex SŠGÈS No. 3 "Flow ranges of N-d in the 3-4 zone". In annex No. 1 technical specification describes the typical zone of hydropower units SŠGÈS. In zone 3, we recommend that you use in the zone 4 maintenance are allowed, which coincides with the recommended safety zone characteristic of hydraulic turbines ro-230/833-677 of the manufacturer.

Section 4.5.7. technical specifications provided for the input sequence into generator mode (in automatic and semi-automatic modes) for units in the reserve.

System requirements GRAM HES were formulated in the General technical requirements for the system, approved By the GRAM hydro-science and technology policy and development OAO RAO "UES of Russia" 34.35.524-April 15, 2004, 2004.

P. 2.2 stipulates that the distribution of the load between the hydroelectric generating sets based on group management should be tailored to the individual limits on maximum power and unwanted work at one of the following ways:

- equality of capacity or discovery guides devices with identical power characteristics of hydraulic units;
- minimum cumulative losses in different energy characteristics of hydraulic units.

2.3. assumed that, given the the spam zone work within the operating range of loads must be able to automatically transfer the required amount of hydropower units from the upper to the lower zone when the load goes down and reverse translation from the

lower to the upper zone when load increases.

In accordance with the above were prepared "technical requirements for upgrading a group active and reactive power control units of the Sayano-Shushenskaya HYDROELECTRIC POWER PLANT. OOO promavtomatika proposals approved by the Acting Chief Engineer of OJSC «Sayano-Shushenskaya GES. P. s. Neporožnego, and n. Mitrofanov 08.02.2005, Director General of OOO promavtomatika AA Larionov (undated) and agreed the main dispatcher ODE Siberia a. b. Rabotinyam (undated).

SP 3.4 provided that the adjustment of GRARM algorithms in accordance with the governing documents such as 34.35.524-2004 General technical system requirements GRAM hydroelectric dams.

23.10.2006 was put into trial operation of active power control panel engine regulator GRARM (acceptance test operation with no number on 23.10.2006 by acting Chief Engineer of JSC «Sayano-Shushenskaya GES. P. S. Neporožnego, E. I. Šervarli. The Act of attempting to introduce a test operation of active power management subsystem controller GRARM from 23.10.2006 on 23.10.2007.

25.03.2008, was put into trial operation subsystem class of voltage regulation and reactive power regulator GRARM (acceptance test operation without rooms from 25.03.2008, approved by the Chief Engineer of JSC «Sayano-Shushenskaya GES. P. S. Neporožnego, And N. Mitrofanov). Act referred to the removal of the comments identified during testing subsystem GRARM regulator GRARM SŠGÈS and ordered to enter beta testing the voltage control and reactive power regulator GRARM from 05.05.2008 on 05.05.2009.

21.07.2008, was put into commercial operation of active power control panel engine regulator GRARM (acceptance into operation without a number of 21.07.2008, approved by the Acting Chief Engineer of JSC "Rushydro" Sayano-Shushenskaya GES. P. S. Neporžnego, E. I. Šervarli.

21.07.2009, was put into operation the Group subsystem and reactive power voltage control regulator GRARM (acceptance into operation without rooms from 22.07.2009, approved by the Chief Engineer of the branch of JSC "Rushydro" Sayano-Shushenskaya GES. P. S. Neporžnego, And N. Mitrofanov).

In accordance with the requirements of section 3.3.9 PTEÈSiSRF found that "conditions that allow aggregation, its normal start and emergency stop and unplanned change of loadings should be set forth in local instructions approved by the technical manager of hydro and operational personnel in the workplace.

Value of all of the parameters defining the starting conditions of the regime and its work should be established on the basis of the data of the manufacturers and special natural testing. "

Impact on hydroelectric generator algorithm when receiving commands from GRARM ARČM is not consistent with the manufacturer of hydraulic turbines (letter of the OJSC "power machines" No. 7/03-192 dated 14.09.2009).

The operation subsystem allowed finding hydropower units in zone 1 (allowed to work) and moving through the zone 2 (not recommended). The conversions are not limited to the subject. While not recommended for its speed and were installed without the consent of the manufacturer.

Maintenance services of auxiliary equipment and SŠGÈS in 2009, HEPP was carried out on the basis of the Treaty № SS-3-474-2008 onerous rendering of services on maintenance of equipment SŠGÈS and SHEPP in 2009, in accordance with technical requirements (annex 1 to this Agreement) signed between JSC "Rushydro" on the one hand, and "Gidroènergoremont" on the other hand.

The agreement was signed between JSC "Rushydro" — a member of the Board of Directors, Managing Director, head of business unit "production of JSC" Rushydro "b. b. Bogušem, acting under powers of Attorney No. 1670, and dated from JSC "Gidroènergoremont" — Director General of ZAO «Gidroènergoremont»-a. p. Pogonajčenko.

Maintenance of hydropower units is carried out by operational staff SŠGÈS in accordance with the instruction manual Sayano-Shushenskaya HPP hydro ", approved by the Chief Engineer of the branch of JSC" Rushydro "— SŠGÈS a. n. Mitrofanov 19.05.2009, based on monthly maintenance schedules operational staff machine Hall SŠGÈS, approved by the Chief Engineer of the branch of JSC" Rushydro "— SŠGÈS a. n. Mitrofanov and signed by the Chief of operational service and y. Pogonajčenko.

4.4 the Sayano-Shushenskaya hydro Job in ECO Siberia

By 12:00 0000. (while ITF) 16.08.09 (according to OJSC "system operator UES): (JSC with UES)

- The work stations are planned ECO Siberia movement schedule;
- Bratsk HYDROELECTRIC PLANT connected to the Office from a central station automation regulation of frequency and power (CA ARČM) ODE Siberia (Kemerovo) according to the settings specified by the main control center of the UES (Moscow), depending on the required percentage of ECO Siberia in the secondary regulation frequency in UES of Russia power flows on the UES links Kazakhstan with the European part of Russia;
- Sayano-Shushenskaya HYDROELECTRIC POWER PLANT had worked for a planned movement schedule (not running CA ARČM ODES of Siberia owing to the need to ensure a planned daily discharge of water through the dam).

16.08.2009, 8:20 pm (ICN) in the workplace of the replacement personnel SSSTU Sister hydroelectric power station (BGÈS) worked fire alarm digital linear apparatus Hall (CLAZ) LLC "Irkutskènergovâz", located in a rented from BGÈS.

The central control unit (FCU) BGÈS alarm went off in the event of a malfunction of the channels of communication, disconnected the automatic regulation of frequency channels and flows (AČRM), computers (computers), lost voice communication with dispatcher on duty (dd) is promptly dispatching control (TAC), DD Irkutskenergo and duty manager LLC "Irkutskènergovâz".

16.08.2009, 8:0 pm 21 min. (MSC.) the fire was reported to the fire brigade for the protection of BGÈS fire protection Ltd. "Irkutskenergo (PC).

In the period from 8:0 pm 23 min. (MSC.) on 8:31 pm 16.08.2009, a fire took place in failure of optical links between the BGÈS

— "Pokosnoe", BGES-"Tulun", damaged equipment, primary and backup communication channels, devices, device, robot ARČM BGES, direct voice channels with an ODE of Siberia Airlines and the Irkutsk REGIONAL DISPATCHING OFFICE.

In the 8:0 pm 31 min. (while ITF) ODE Manager sent to Siberia 16.08.09 team Chief change station (NSS) Sayano-Shushenskaya HPP GRARM translation mode for automatic regulation of CA ARČM ODES of Siberia. To 04-12 time (MSK) 17.08.09 Sayano-Shushenskaya GES has worked in management from CA ARČM ODES of Siberia.

16.08.2009, 8:50 pm fire was localized.

17.08.2009, 10:03 emergency mode was eliminated, the link is restored.

During standby communication and remote control devices, undersupply of electricity BGES.

In accordance with the instructions of a centralized system of automatic regulation of frequency and power flows of energy enterprise of Siberia (CA ARČM ODES of Siberia), # 200.21/3.22.011-10.2007 approved 26.10.2007, EEC-"ODE of Siberia p. 1.3 to CA ARČM ECO Siberia can be connected, as governing, UST-Ilimsk, Bratsk and the Sayano-Shushenskaya station, equipped with a microprocessor with built-in GRARM arcs me setters unplanned power (MEL).

In accordance with the job description the Senior Manager and dispatch service, approved by the Director of a branch of OJSC "with UES ODE Siberia 28.03.2008, p. 3.2 Manager is obliged to use all means of communication is a priority of energy enterprise and energy systems, and dispatch and other communications equipment, including cellular mobile phone, fixed for the UDF, as well as priority access to informational complex (OIC) to address the operational challenges for operational and reference information.

According to the operational log BGES out on a cellular phone was restored with the duty manager ODE 16.08.2008, 9:0 pm 0000. Thus, the lack of control on the part of the BGES ODES of Siberia was 40 minutes.

Dispatch commands to change the active load from 9:0 pm. 0000. (while ITF) on 16.08.09 04:00 23 min. (all times GMT) at Sisterly HES 17.08.09 table 4.4.1, 8:0 pm 0000. (while ITF) 04-23 16.08.09 on time (MSK) for 17.08.09 Sayano-Shushenskaya hydroelectric power plant in table 4.4.2.

Table 4.4.1 List of dispatch commands to change the active load Sister HES given between 21-0000 (GMT time) up to 04-16.08.2009 23 time (MSK) 17.08.2009.

time	team	the purpose of
16.08.09		
1	21-0000	Set the load at the station 2500 Mw
		Deviation from the planned dispatch schedule in order to create the adjusting range of automatic regulation to compensate for possible emergency nebalansov power ECO Siberia.
2	21-57	With 22-0000 work for a planned movement schedule
		Back load station in accordance with the planned dispatch schedule.
17.08.09		
3	03-51	Set the load at the station 2200 Mw
		Create the adjusting range of automatic regulation to compensate for possible emergency nebalansov power ECO Siberia.
4	03-57	Set the load at 2400 Mw
		Create the adjusting range of automatic regulation to compensate for possible emergency nebalansov power ECO Siberia.
5	04-13	Set the load at the station 2800 Mw
		Set the load at the station 3200 Mw
		Set the load at the station 3500 Mw
		Set the load at the station 3720 Mw
		Ensuring valid overflows in eco Siberia controlled a lofted on the links with the EU in the absence of a generation at the Sayano-Shushenskaya HPP

Table 4.4.2 List control commands to change the active load Sayano-Shushenskaya HYDROELECTRIC STATION cast in the period from 20-0000 (GMT time) until the 16.08.09 04-23 (ICN) 17.08.09.

time	team	the purpose of
16.08.09		
1	20-28	Run a load of 4000 Mw
		Management of electric power ECO power mode in ECO Siberia Siberia
2	20-30	Perform load 4200 Mw
3	20-31	At the Sayano-Shushenskaya HPP include MEL you privlekaetes' to cross Siberia-Kazakhstan setpoint now 400 Mw in the direction of Kazakhstan
		Sayano-Shushenskaya HYDROELECTRIC PLANT connected to the management of CA ARČM ODES of Siberia
4	20-51	Remove the 200 Mw of planned capacity
		Create the adjusting range of automatic regulation to

5	21-34	Remove the 200 Mw of planned capacity	compensate for possible emergency nebalansov power ECO Siberia.
6	22-0000	Remove the 200 Mw of planned capacity	
7	22-01	Select a target capacity of 3300 Mw	
8	22-04	Select a target capacity of 3200 Mw	
9	22-05	Select a target capacity of 3000 Mw	
10	22-26	Remove the 200 Mw of planned capacity	
17.08.09			
11	0000-12	Select a target capacity of 3000 Mw	Create the adjusting range of automatic regulation to compensate for possible emergency nebalansov power ECO Siberia.
12	0000-15	Select a target capacity of 3200 Mw	
13	0000-18	Select a target capacity of 3400 Mw	
14	0000-27	Select a target capacity of 3600 Mw	
15	01-43	Select a target capacity of 3800 Mw	
16	02-08	Select a target capacity of 4000 Mw	
17	02-11	Select a target capacity of 4100 Mw	
18	02-40	Remove the 100 Mw of planned capacity	
19	03-03	Select a target capacity of 4100 Mw	

In the period from 8:0 pm 21 min. (while ITF) on 16.08.09 8:0 pm 55 min. (while ITF) 16.08.09 (with no connection with the sister HES):

- supervisory personnel of the UES electricity management regime of discounts, ECO Siberia controlled the overflows of power controlled sections, taking into account the work of Sayano-Shushenskaya HPP running from CA ARČM. In the part of Sister HES dispatching personnel acted in accordance with the requirements of the regulations for the prevention and elimination of violations of normal electrical power systems ". It took all steps to restore communications, using any means of communication (long distance, cellular, Office, etc.), as well as the transmission of messages through other exist:
- Sister HES provide operational staff carrying the load station on the planned movement schedule in accordance with the requirements of the instructions on how to prevent violations of the normal operating area of Irkutsk RDO, and also took steps to restore communications, using any means of communication, including transmission of messages over other energy facilities.

16.08.2009 at 11:14 pm HA-2 — was withdrawn from the reserve to address the operational staff of the station and put into operation with adjustable load on branch of OJSC "EEC" is an ODE to "Siberia" under the automatic power control ARČM-GRARM as a priority when power control range.

16.08.2009 at 11:31 pm HA-10 SŠGÈS was withdrawn from the reserve and put into operation, under the control of the GRARM is not entered.

the nine were 17.08.2009 hydraulic units (Terminal numbers 1, 2, 3, 4, 5, 7, 8, 9 and 10), HA-6 hydraulic system in the repair, HA-1, 2, 4, 5, 7 and 9 were under the automatic power control ARČM-GRARM, GA-3, 8 and 10 were working on individual management (in the database).

Information on the regulation of power HA-2 are listed in the table below:

No. p/p.	Date	Time (local)	Power (Mw)
1	16.08.2009	11:15 pm	50
2	16.08.2009	11:17 pm	110
3	16.08.2009	11:30 pm	200
4	16.08.2009	11:31 pm	165
5	16.08.2009	with the 11:44 pm — 12:15	600
6	17.08.2009	12:30	135
7	17.08.2009	12:30 up to 07:03	from 10 up to 255
8	17.08.2009	07:03 up to 07:29	600
9	17.08.2009	07:30	170
10	17.08.2009	by 07:30 up to 07:45	from 170 to 260
11	17.08.2009	07:46	610

12	17.08.2009	by 07:47 up to 08:00	605
13	17.08.2009	08:12	575
14	17.08.2009	08:13	475
15	17.08.2009	08:13 25 sec.	0

As equipment HA on 8:0 0000. 17.08.2009, are given in the table:

H = 212.04 m; IG = 26.1 Ka WB = 537.11 m; Nst = 4390;
n = 142.8 RPM; NB = 325.07 m; Ug = 15.75 sq.m; f = 50 Hz

	HA-1	HA-2	HA-3	HA-4	HA-5	HA-6	GA-7	HA-8	HA-9	GA-10
N, Mw power	605	600	570	600	600	Repair	120	590	605	100
Q, m3/sec consumption	315	312	298	312	312		92	307	315	83
Opening on,%	72	72.5	75	74	73		24	71	74	24
R Pressure Mpa MNU25-63-2/3	In predetermined limits						In predetermined limits			
The amplitude of the vibration of the bearing caps turbines, μm	200	600	150	110	275		50	175	200	50
R., kgf/cm ² The pressure in the suction pipe	0.4	1.0	0.6	1.1	0.1		1.3	0.5	0.5	1.1
R., kgf/cm ² Pressure under the CAP	3.2	3.4	3.6	3.3	1.1		2.2	3.5	3.1	2.3

Data as of hydropower units at 8:0 13 min. 17.08.2009 are given in the table:

WB = 537.11 m Nst = 4100 n = 142.8 RPM
NB = 325.07 m Ug = 15.75 sq.m f = 50 Hz
H = 212.04 m IG = 26.1 Ka

	HA-1	HA-2	HA-3	HA-4	HA-5	HA-6	GA-7	HA-8	HA-9	GA-10
N, Mw power	570	475	570	575	570	Repair	85	585	570	100
Q, m3/sec consumption	298	256	298	302.5	298		75	305	298	83
Opening on,%	70	69	75	71	69		12	71	71	24
R Pressure Mpa MNU25-63-2/3	In predetermined limits						In predetermined limits			
The amplitude of the vibration of the bearing caps turbines, μm	200	840	175	160	160		50	200	170	50
R., kgf/cm ² The pressure in the suction pipe	0.5	1.2	0.6	1.2	0.1		1.1	0.5	0.6	1.1
R., kgf/cm ² Pressure under the CAP	3.2	3.5	3.6	3.3	1.1		2.0	3.5	3.1	2.3

Analysis of data from the archives of the APCS (trends) HA-1, 2, 3, 4, 5, 7, 8, 9, 10 indicated that the hydraulic behavior of tenured, temperature normal thrust bearing segments (not exceeding 800° c). As can be seen from the comparison of the two in the text tables amplitude of vibration of bearing caps of turbine GA-2 with 08:00 0000. up to 08:00 13 min. increased by 240 μm (600 to 840 microns at maximum value of up to 160 microns), the pressure in the suction pipe from 1.0 to 1.2 kg/cm², pressure under the lid with 3.4 to 3.5 kg/cm² all of this took place against the backdrop of reduction of power with 600 MW to 475 MW.

Status of water hydraulic units for 08:00 8:0 13 min. 17.08.2009 (local time) are given in the table:

WB = 537.11 m NB = 325.07 m H = 212.04 m

Bolt HA-1	2-bolt	3-bolt	4-bolt	5-bolt	6-bolt	Bolt HA-7	Bolt HA-8	Bolt HA-9	Bolt HA-10
Open Q = 298 m³/s	Open Q = 256 m³/s	Open Q = 298 m³/s	Open Q = 302.5 m³/s	Open Q = 298 m³/s	closed Q = 0 m³/s	Open Q = 75 m³/s	Open Q = 305 m³/s	Open Q = 298 m³/s	Open Q = 83 m³/sec

4.5 the technical reasons and organizational events influenced the development of accident

16.08.2009 in 11:14 pm HA-2 — was withdrawn from the reserve (a kind of operational condition of the equipment, the full readiness to work and the adoption of loads) to address the operational staff of the station and put into operation with adjustable load on branch of OJSC "system operator of unified energy system — an ODE" Siberia ", and was appointed to the staff of the station's priority load when power control range.

The power of Regulation No. 2 was carried out automatically by the regulator in accordance with the commands GRARM ARČM.

At SCHOOL there with turbine installed HYDRO-ro-230/833-677. Lifetime of hydro turbines installed by the manufacturer is 30 years. Life at the time of the accident was 29 years old-wheels 10 months. The turbine has narrow adjustable range pressure calculated above in a zone of high efficiency. When you exit the adjusting range of the hydraulic system is not recommended for use zone. Work in this area has been accompanied by transitional processes, hydrodynamic pressure pulsations in the flowing tract and increased hydro unit vibration. Restrictions on the turbines is not recommended by the manufacturer's operation are not installed.

In the terms of reference for developing a GRAM were not formulated criteria for determining priorities for the work of the Group's management capacity, the individual power limit and not recommended for work zones, did not take into account the peculiarities of the operation and design of hydraulic units. The selection criteria were not set priority and time conservation priority. Effects of GRARM on algorithm in automatic control of hydraulic power and frequency are not consistent with the manufacturer of hydraulic turbines.

Due to the repeated occurrence of additional loads of alternating nature on the hydraulic system of passages through the recommended zone formed and evolved to fatigue damage of anchorage, including covers of the turbine. Dynamic loads caused by the destruction of the pins have resulted in disruption of the lid of the turbine and depressurization of the tract vodopodvodâšego.

It destroyed, discovered the missing spikes traces fall nuts. This suggests that at the time of the accident the nut on the heel.

Have not been followed by p. 15 Act of acceptance into operation the completed construction of Sayano-Shushensky hydroelectric complex on the River Yenisey from 2000 onwards to replace the impeller hydraulic units. Leadership of JSC "Rushydro" were not implemented activities associated with increased wear and tear of the equipment, to ensure the range of automatic regulation, despite the order of RAO UES No. 524 of 18.09.2002 year.

Standards for monitoring and durability of fastening node leak hydraulic turbines, in documents of the manufacturer and in the operating documents of the SŠGÈS are missing. During the scheduled maintenance on SŠGÈS Visual controls are carried out in a manner that does not apply non-destructive control in time for defektoskopičeskogo the safe operation of the equipment (Hydro).

Implementation of the strategy of RAO UES of Russia for 2003-2008 Gg. provided that, after the January 1, 2005, the repair services will be not only in-house but also subsidiaries of generating and distribution companies. Finding replacement staff from the staffing in subsidiaries and the nature of the contractual relationship, has not been accompanied by changes in the Treaty (repair and maintenance) requirements for regular monitoring of technical condition of the equipment.

Continuous vibration control system installed on the No. 2 in the hydrounit 2009, was not commissioned and does not take into account the operational staff and management stations when making decisions.

From 21.04.2009 to 17.08.2009 grew silent vibration of turbine bearing hydro unit No. 2, about 4 times.

Set the load change FROM JSC UES "— an ODE" Siberia "by automatically managing power control ARČM-GRAM did not take into account the specifics of, life and the actual state of installed hydropower equipment.

Information on the exchange of information between the SŠGÈS and the ODES of Siberia Airlines on the issue of restrictions on issuing commands ARČM-GRAM.

Evolution crash with the loss of many lives and the destruction of the technical devices used on SŠGÈS, a consequence of the lack of protective measures on equipment and personnel SŠGÈS hazard, in particular:

- no backup power source and control key on the main CPU board reset drives emergency and maintenance of pressure conduits;
- the absence in the algorithm works hydraulic/mechanic column regulator closure diffuser with the loss of electricity;
- the use of equipment and supply lines, communication, management, control and protection and dustproof construction.
- lack in rooms with permanent or temporary placement of staff, evacuation exits to the mark,

not podvergaemuû flooding;

- lack in rooms with permanent or temporary staff placement required personal protection equipment.

The Commission draws attention to the fact that OJSC hydroogk (JSC "Rushydro") on the standards developed by RAO "UES of Russia" failed to provide adequate levels of safe operation of HPS.

Joint order JSC «Hydrowgc» and JSC «Uralsvyazinform» from 06.09.2006 no. 141/3562 "on the application of the standards of RAO UES of Russia" Methodology evaluation of technical condition of main equipment of hydropower "signed as Chairman of the

Board of OJSC hydroogk, General Director of JSC «Uralsvyazinform» Sinûginym v. Yu., entered Standard RAO UES of Russia" techniques to assess technical basic equipment and canceled a number of hydroelectric power plants "normative documents in force and to ensure the safety of GES.

Similarly to the above by The OJSC "SŠGÈS p. s. Neporožnogo» from 11.09.2006 no. 35/102, signed by chief engineer a. n. Mitrofanov, standard of RAO" UES of Russia ", " evaluate the technical condition of main equipment of hydropower "promulgated and abolished the previously existing instruments providing for the safety of the DAM.

However, the standard of the RAO "UES of Russia", "evaluate the technical condition of main equipment of hydropower" did not include all the necessary requirements for stable and safe operation of equipment for hydropower plants.

Joint order of OJSC "Uralsvyazinform" and JSC "Rushydro" of 24.11.2008 No. 752/1 p-213 "on accession to the Organization's standards of RAO" UES of Russia "signed by the Acting Chairman of the Board of JSC" Rushydro ", General Director of OJSC" Uralsvyazinform "in a. Zubakinym, found that the standards of RAO" UES of Russia "JSC" Rushydro "are used and Managed societies as local regulations (acts) to 01.01.2009. The order of the Managing Director, head of business unit "Engineering JSC" Rushydro "Haziahmetovu r. m., Member of the Board, Managing Director, head of business unit" production of JSC "Rushydro" Bogušu b. b. directors of branches of JSC "Rushydro", first Deputy General Director-managing directors Managed to ensure that societies in conformity with the standards of the normative and technical documentation and job descriptions of the relevant categories of JSC "Rushydro" managed companies.

Construction characteristics of hydraulic turbines RO230/833-677.

Radial-axial hydraulic vertical turbine RO230/833-677 of hydrounit (GA) # 2 is made by "LMZ", in accordance with TU108-651-77, as amended in the register of State registration № 1656207 from 23.02.1977, and put into a full-time operation in 1979.

According to performed in June 1988, the technical report "field tests of turbines Sayano-Shushenskaya HPP post impellers» # 1008, vol. 1, approved by the Chief Engineer of the production association turbine construction" Leningradsky metallichesky Zavod "in the deaf community, identified by the factory's performance, together with an indication of the work zones, not recommended.

"For continued operation of turbines recommended power range, corresponding to the zone III, in which the EFFICIENCY of turbines has a maximum value, pressure pulsation in the running of the minimal vibration of turbine is rated as" good "status. Allowed to work in the area of turbine I, in which the level of dynamic performance is valid, but the level of EFFICIENCY of the turbines are low. Work turbines in zone II is not recommended, and in zone IV (line power) is not allowed. When working in the zone II work is accompanied by a strong hydraulic turbine blows in flowing part and high noise level of dynamic performance is unacceptable ".

According to the manufacturer's research field "zone II — ROK (impeller) is a powerful central tape with speed 0.4-0.8 Hz. This frequency vertical vibration frequency is a defining case TP (turbine bearing), the axial stress and pressure pulsations in all locations running tract turbines (except ripple underneath the turbines, which along with continuous frequency, determinants are also frequency 4.76 and 200-300 Hz). Defines a radial vibrations of shells and the beating of shaft is the reverse speed.

Work turbines is accompanied by strong hydraulic punches in flow passage and considerable noise.

Razmahi pressure pulsations in the suction pipe of the spiral cell and reach 15-22 m water column and under the cover of turbine-36 m of vertical vibration of water column TP-230 µm, fluctuating power generator 18-20 Mw, Pulsations of the axial effort — 150 MV. Some are growing (up to 100-120 µm) radial vibration and beating of the shaft (up to 0.6 mm -0.7). Air sucked under the noise of the main valve at the end of a shaft. But its effect on the amplitude and frequency characteristics of dynamic processes testing up to 190 m pressure not noticed. 194 m head test have shown that the intake of air strikes in running disappear hydraulic parts, reduced noise, and the level of dynamic processes, although somewhat reduced, but remains unacceptably high ".

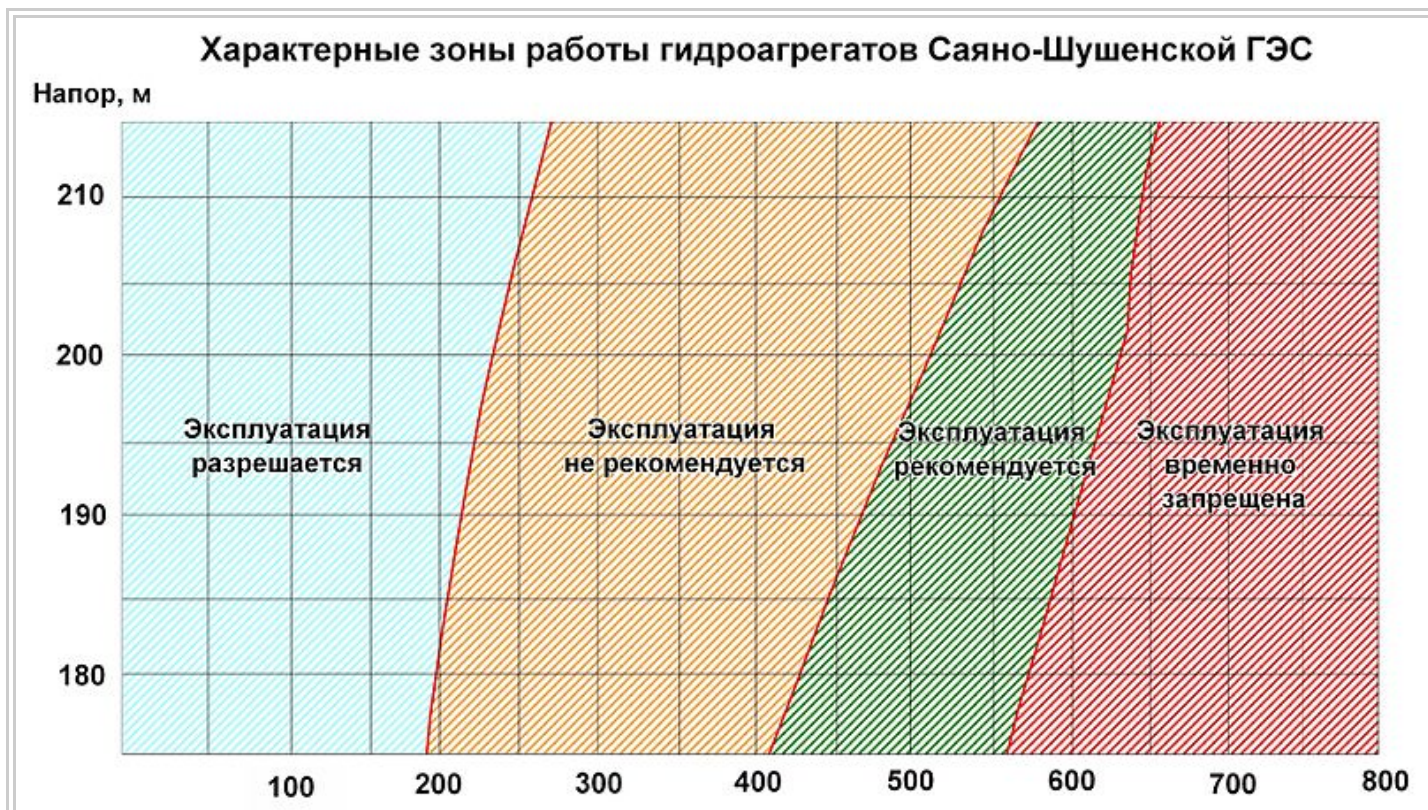


Fig. 4.5.1. Operational characteristics of the turbine R0230/833-677

Closure of the diffuser.

The No. 1 hydroelectric generating sets HA, 3, 4, 7, 8, 9, 10 of regulation diffuser is manufactured using column type AGRE-2I-10-7. Closing the emergency closure of the diffuser check valves (KAZ) comes from the actions of technological protections, failure of electric hydraulic regulator (AGRE) disconnections from the intermediate servo. Additionally, when the cable is a feedback device is closed using the cargo located directly under regulation. In the event of flooding the turbine room and loss of voltage circuits protection systems, signalling and control circuits closing diffuser algorithm is no longer valid.

The hydro unit No. 2, HA, 5 6 regulation of diffuser is manufactured using column type EGK-ro-6-1 in 2009 year. Closing the emergency closure of the diffuser check valves (KAZ) comes from the actions of technological protections, failure of electric hydraulic regulator (AGRE) disconnections from the intermediate servo.

Thus, regardless of the type of the column, there is no algorithm that provides crash sending apparatus in the event of loss of power supply.

Closing smart device HA-5 came after receiving a signal of failure of AGRE and conservation voltage control circuits.

Participation in the management of power and frequency.

17.08.2009 head station was 212 meters. On the operating characteristic of the range was 0 to 1 from 265 MW, and in zone 3 of 570 up to 640 Mw and had a value of 70 MW. Zone 2 where exploitation is not recommended, had the border of 265 MW to 570 MW, and stood at 305 MW. Thus, the adjustment range units, located in zone 3, the head of 212 metres, considerably less than the adjustment range in 1 zone.

When pressure above 197 meters minor changes as scheduled and unscheduled power lead to the need for translation units through a zone is not recommended. By the manufacturer of the turbines are not set criteria and restrictions on passage through the zone is not recommended.

HA-2 was operated by a group of active and reactive power regulator (GRARM) and was designated personnel on priority when banding station.

According to the schedule changes planned and unplanned power planned power station on the day before the accident changed 12 times. On the day of the accident, it decreased in the period from 12:00 to 2:30 with 4415 MW to 2800 MW, and with 4:12 to 07:05 mainly grew up to 4100 MW. This change in routine power led to the serial shift HA-2 six times through the zone not rekomendovannnoj work, since inclusion in the work (11:14 pm 16.08.09).

In total, since the repair hydraulic system no. 2 was in the area of 210 times, completing a total of 2520 seconds.

Data on the number of clicks is not recommended zone (zone II) in 2009, are listed in the table below:

Month	January	February	March	April	may	June	July	August	Images for 8 months
No. p/p.									
GA1	68	13	19	39	58	87	11	3	298
GA2	22	0	41	36	40	28	32	33	232
GA3	25	61	47	68	89	64	14	1	369
GA4	91	59	43	50	60	101	40	46	490
GA5	43	67	17	8	14	31	28	10	218
GA6	10	0	0	0	0	0	0	10	20
GA7	49	49	78	80	39	11	15	7	328
GA8	14	22	47	37	21	19	35	14	209
GA9	20	82	62	44	62	78	32	16	396
GA10	2	2	12	20	33	9	0	0	78

Time units not recommended zone (zone II)

Month No. p/p.	1	2	3	4	5	6	7	8	Time for 8 months	
									seconds	hours
GA1	816	156	228	468	696	1044	132	36	3576	1:0
GA2	264	0	492	432	480	336	384	396	2784	12:0 46 m
GA3	300	732	564	816	1068	768	168	12	4428	1:0 14 min
GA4	1092	708	516	600	720	1212	480	552	5880	1:0 38 m
GA5	516	804	204	96	168	372	336	120	2616	12:0 44 min
GA6	120	0	0	0	0	0	0	120	240	04 min 12:0
GA7	588	588	936	960	468	132	180	84	3936	06 min 1:0
GA8	168	264	564	444	252	228	420	168	2508	12:0 42 min
GA9	240	984	744	528	744	936	384	192	4752	1:0 19 m
GA10	24	24	144	240	396	108	0	0	936	12:0 15 min

The SŠGÈS hydro-electric network

# HA	The generator on the net				
	2006 (h)	2007 (h)	2008 (h)	2009 (h)	The Amount Of (h)
1	5253.99	6065.43	6415.93	4253.75	21989.10
2	6157.78	4657.24	6498.58	3449.97	20763.57
3	5976.56	2322.24	2910.98	4003.09	15212.87
4	5794.30	6490.69	3278.15	4032.93	19596.07
5	5066.17	4476.21	6773.20	4271.46	20587.04
6	6657.31	4823.49	4222.59	96.76	15800.15
7	2727.54	6648.91	4317.50	4552.02	18245.97
8	7149.77	5141.05	4485.65	2730.33	19506.80
9	6276.99	5649.44	4258.03	4901.42	21085.88
10	1153.38	348.14	426.87	1826.60	3754.99
The Amount Of	52213.79	46622.84	43587.48	34118.33	176542.44

The monitoring and evaluation of the technical condition of the equipment.

The monitoring and evaluation of the technical condition of the equipment is carried out in accordance with the

ONE-HUNDRED-and 17330282.27.140.001-2006 "evaluation of technical condition of main equipment of hydropower station; Approved and promulgated by the order of RAO UES of Russia no. 490 of 13.05.2006. In 2008, JSC "Rushydro" issued an order "on accession to the standards of RAO" UES of Russia "No. 752/1 p-213 on 24.11.2008.

According to "evaluate the technical condition of main equipment of hydropower" in section 8.5 "Cover-wheels" section 8.5.3 said: "keeping the lid status during operation of hydroelectric turbines capture visually and is measured with the help of standard and mobile measuring equipment mounting condition, mortgages and bonding".

According to the results of complex research of turbine cover retention of NPO "TSNIITMASH":

- found numerous defects in the form of fatigue cracks on the surface of the screw Groove pins. Trešinopodobnye defects are detected as invalid, because they are centers of studs, reduced development of destruction's strength and bearing capacity of these parts, as well as design, split the connection as a whole.

However, manual hydraulic equipment SŠGÈS (operation manual hydraulic units Sayano-Shushenskaya HYDROELECTRIC POWER PLANT, approved by the Chief Engineer of the branch of JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego" from 18.05.2009) provides continuous monitoring of technical condition of the equipment operative and repair personnel. This control was not organized properly.

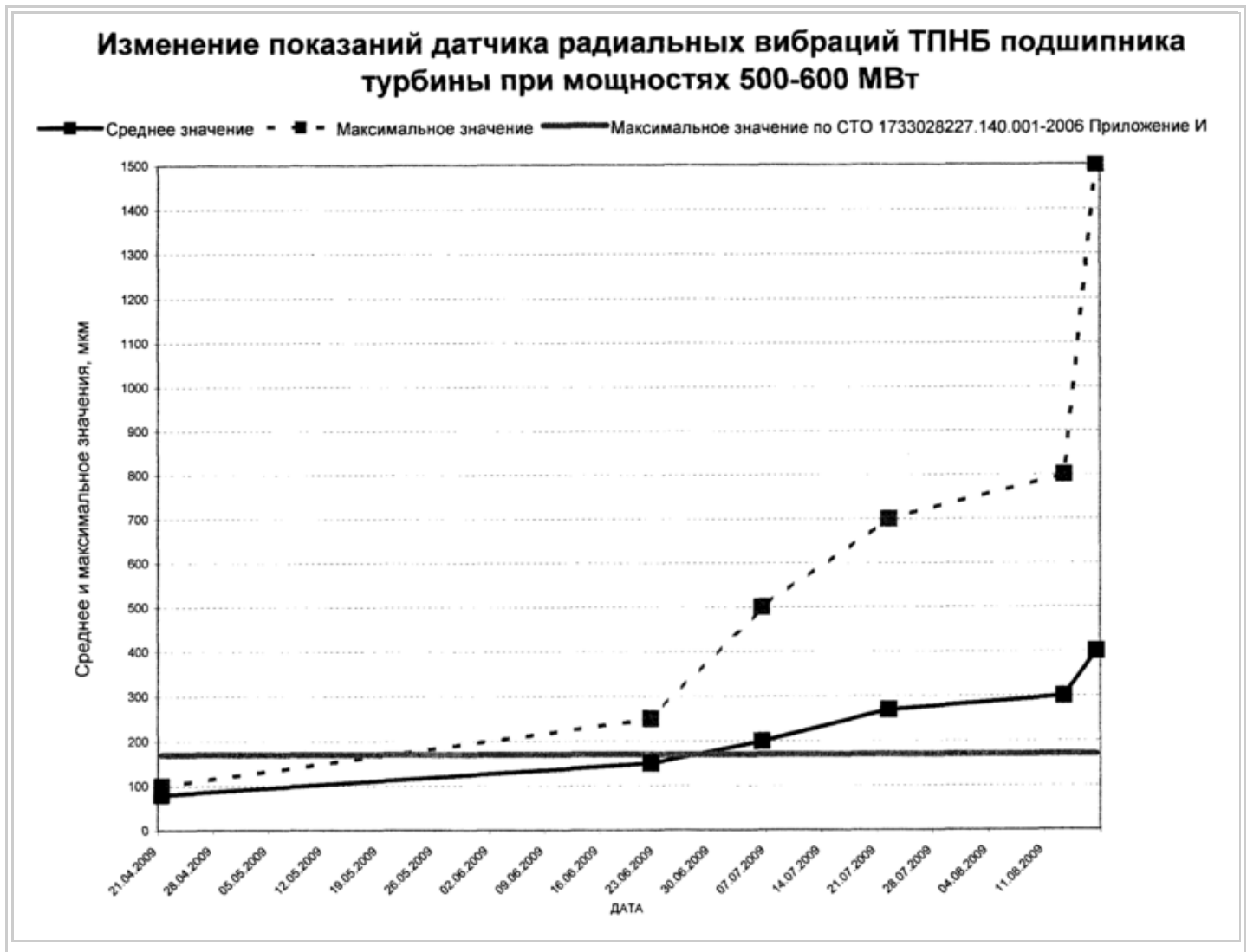
Or instruction concerning use of the Sayano-Shushenskaya hydro-electric DAM, approved by the Chief Engineer of the branch of JSC "Rushydro" — "the Sayano-Shushenskaya GES p. s. Neporožnego" from 18.05.2009 vibration control requirements are governed by section 2.3.5. "Hydraulic system must be unloaded or stopped in time, as determined by the Chief Engineer of the hydroelectric power stations" with a sudden increase in the vibration of turbine top cover and u-Joint Assembly more than 0.16 mm and 0.5 mm roller battlefields over, shaft extension more than 0.55 mm.

According to the results of vibration tests of no. 2 from 12-16.03.2009, described on pages 41, that unit was operated for a long period of time when the extent of horizontal vibration close to the limit, according to p. 3.3.12 PTEÈS and FPS.

According to the analysis conducted by the ACS archives from 21.04.2009 until 17.08.2009 observed relative increase of vibration of turbine bearing approximately 2-4 times, as shown graphically.

In this situation, with a view to ensuring the safe operation of the Chief Engineer of SŠGÈS (who was at the station from 06.35 17.08.2009) had to decide to stop HA-2 and study the causes of vibration. Instead, the HA-2 remained a priority in GRARM in regulating capacity.

System for permanent monitoring of vibrations, the pre-set to hydrounit No. 2, was an objective for operational staff, had no power spectral analysis of vibration and high-speed buffer memory to save settings when abnormal vibration modes.



State studs cover the turbine of the No. 2.

«Technical description and operating instructions », # 22440000TO manufacturer from 1977 onwards, the" operating instructions hydro Sayano-Shushenskaya HPP ", approved by the Chief Engineer of the branch of JSC" Rushydro "—" Sayano-Shushenskaya GES. P. s. Neporožnego "18.05.2009, as well as the technological scheme of disassembly (assemblies) of the" 3/16/01-16-01 (a) developed by the SŠGÈS and approved by the Chief Engineer of the station, 12.07.1994 control status and seniority, ensuring tightness anchorage hydraulic turbines, not defined and non-destructive testing of turbine cover mounting studs.

The accident at the hydrounit No. 2 (destruction of the specific technical devices) occurred at the time of derailment due to fracture the turbine cover studs fastening. A Visual inspection of the 49 studs cover the turbine of the No. 2 in breaks of studs are two zones: zone of fatigue and fracture zone doloma (23.09.2009 letter No. 04/23/-2561 SUN NPO "TSNIITMASH");

41 pin collapsed carving with squares of fatigue fracture:

- from 5 to 10% of the total area of the section 5 stiletto heels on;
- from 20 to 30% of the total area of the cross section of 3 stiletto heels on;
- from 35 to 40% of the total area of the section 8 stiletto heels on;
- from 50 to 55% of the total area of section 6 stiletto heels on;
- from 60 to 65% of the total area of the cross section of 4 stiletto heels on;
- 70% of the total area of the cross section of 3 stiletto heels on;
- from 80 to 85% of the total area of the cross section of 3 stiletto heels on;
- from 90 to 95% of the total area of section 6 stiletto heels on;
- from 97 to 98% of the total area of the cross section for 2 stiletto heels.

Two studs were destroyed without signs of fatigue failure mechanism of static.

The remaining 6 studs are full length, the thread is not disrupted, which may indicate a lack of of nuts at the time of the collapse of the turbine. Length is not ruined the studs is 245 mm and is given on a drawing.

Status table of studs:

# p/p	# studs	% of fatigue fracture	# p/p	# studs	% of fatigue fracture	# p/p	# studs	% of fatigue fracture
1	1	5	18	28	20	35	57	5
2	2	80	19	30	50	36	60	60
3	3	95	20	31	90	37	62	70
4	4	7	21	32	95	38	64	98
5	5	55	22	34	65	39	65	85
6	6	not destroyed	23	35	60	40	66	20
7	11	4	24	38	35	41	68	70
8	14	55	25	39	35	42	69	97
9	18	98	26	41	35	43	70	55
10	19	95	27	42	35	44	71	not destroyed
11	20	85	28	43	not destroyed	45	73	40
12	21	5	29	44	95	46	74	0 (no cracks)
13	22	35	30	45	35	47	75	70
14	23	0 (crack-pet)	31	47	not destroyed	48	76	25
15	24	50	32	48	95	49	80	60
16	25	40	33	53	not destroyed			
17	27	50	34	54	not destroyed			
Average condition of fatigue fracture of studs								64.9%

From laboratory studies (conclusion No. 60 of 10.09.2009 NPO "TSNIITMASH"), the following conclusions:

- According to the results of capillary defectoscopy of discontinuities in the form found long cracks in the coils of a carving. Defects are invalid.
- According to the results of ultrasonic flaw detection of defects on the turns were found invalid thread studs (defects in the metal studs out threaded area is not revealed);
- the study of the chemical composition of the samples showed that the metal of steel studs 35 according to GOST 1050-88 and comply with the requirements of the 0300.056 structural steel heat-treated billet";
- According to the results of mechanical testing metal studs meets technical conditions 0300.056 "structural steel, heat-treated billet";
- microstructure of metal studs-ferrite and perlite plate. Structural polosčatost' expressed weakly; the main types of nonmetallic inclusions in metal sulphides, manganese are warped a little manganese silicate content, complex oxides and nitrides of titanium; microstructure of metal studs signs for discarding is not;
- the fracture surface of the distinctness of studs is characteristic of fatigue crack development. Fatigue crack initiation (mnogoočagovoe) went from an external hub is threaded ring grooves. Surface fatigue failure is allocated a number of makroblastej, whose boundaries are identified as traces of advancing front fatigue crack.

The main results of the evaluation and conclusions:

1. The chemical composition of the metal studs corresponds to GOST 1050 steel 35-88 and the requirements of the 0300.056 structural steel heat-treated billet. Microstructure of metal studs is characteristic of carbon steel with a carbon content of 0.3-0.4% and has no signs of rejection.
2. Mechanical properties of metal studs meet technical conditions 0300.056 "structural steel, heat-treated billet.
3. According to the results of nondestructive testing discovered numerous defects in the form of fatigue cracks on the surface of the screw Groove pins. Trešinopodobnye defects are detected as invalid, because they are centers of development of the destruction of the studs, limit strength and bearing capacity of these parts, as well as the design of split connection as a whole.
4. According to the results of complex research of the main cause of destruction of studs is the development of fatigue cracks, which zarozhdenie occurred from the inner surface of the threaded grooves. Development of fatigue cracks in size until the static to doloma studs studied changes in a wide range of up to 95% of the total surface area of destruction, i.e. almost complete loss of bearing capacity of the studs.

One of the factors contributing to the development of defect in heel cover turbine at HA-2 is a significant number of transient operation modes of the not recommended for areas with high dynamic characteristics (vibrations), depending on the power with

hydro power plants (and hydro) in the regulation of active power and frequency. Installed by the manufacturer of the service life of the fasteners (bolts) is the same as the lifetime of the equipment itself (30 years).

5. Description of the accident and its development

The accident is the destruction of the facilities and (or) the technical devices used in hazardous production facility (**116-FZ "on the industrial safety of hazardous production facilities" July 21, 1997**).

17.08.2009 HA-2 worked under load, the rotor is turning to the nominal frequency. With the decline of power of 08.12 No. 2 to set automatic power control system ARČM-GRARM. When you log on to the operating characteristics of the zone, are not recommended for use, a broken turbine cover studs under the influence of water pressure in the hydraulic unit with lid hydrounit rotor of the turbine and the top is covered up and started moving, due to leakage, water began to fill the turbine shaft, influencing elements of the generator. (*Working documentation generators does not lock nuts to stiletto. Letter dated SŠGĚS № 001/27.09.2009 2438 signed Director a. v. Kári*).

When the rim of the impeller to 314.6 impeller in the pump and at the expense of the stored energy of the rotor of generator has excessive pressure on the input edges impeller vanes, which led to the precipice of feathers blades diffuser. Through the vacated mine HA-2 water start to flow in the generator Hall of the station.

Machine room was flooded to 335.0. From the action of water flow rotating axles and rotor of alternator HA-2 was destroyed turbine room in zone 2, hydro hectares-3 and 4 (walls, floors, glazing and 4-foot crane tracks from the upper pond) top level block GA-2. Fully damaged power boards, control cabinets, secondary switching and control circuit, vessels, maslovozdušnye vessels air. Passenger elevators are completely destroyed.

Damaged 500 kV portals 1 St and 2nd 15.75/500 kV transformer, transformer 1 phase busducts 15.75 sq.m, 2 and 3.

Flooded with no. 1-10. From the action of water has short circuits the windings of hydro generators No. 1, 3-5, 7-10. Hydraulic generators were damaged to varying degrees. Destroyed 7 and 9 blocks, hydraulic units.

According to the poll protocols and the operational personnel trends in GA-2 established that on 08/17/2009 at 8:13 local staff, who was in the engine room, heard a loud clap of the No. 2 in the area and saw the release of the water column. At the central control panel and sound alarm function, propali Talkback, lighting, automation, alarm systems, protection systems and devices. CPA staff recorded through the window that the Turbine Hall is the flow of water, several buildings destroyed them. Load-shedding occurred with 4100 MW to 0 MW with complete loss of own needs of SŠGĚS and the flooding of machine room.

5.1 List and nature of destruction of technical devices, equipment, buildings operated on dangerous production facility branch "Rushydro" Sayano-Shushenskaya GES. P. s. Neporožnego^[1]

Hydraulic Units:

- HA-1 — damaged the winding rotor and stator generator, auxiliary generator rings and brushes, control cabinets, secondary circuits and control circuits, main switch, generator, square, busducts 15.75 0 "conclusions.
- HA-2 is completely destroyed and thrown out of the mines, destroyed the winding rotor and stator, completely destroyed the mine machine and winding stator part of seal, bearings, auxiliary generator, alternator master switch, 15.75 sq.m, conductors "0" conclusions, auxiliary equipment, secondary circuits and control circuits.

Vessel: maslovozdušnyj

Reg. No. 350-ha, head of no. 39205-3 — multiple dents, detached sleeves.

Vessel air:

Reg. No. 351-HA, head of the No. 4 — numerous 39204-dents, detached sleeves.

- HA-3 — damaged the winding rotor and stator generator, auxiliary equipment, control cabinets, secondary circuits and control circuits, main switch, generator, square, busducts 15.75 0 "conclusions. Stator winding deformed main generator.
- HA-4 — damaged the winding rotor and stator generator brush machine accessories, control cabinets, secondary circuits and control circuits, alternator master switch, partly busducts 15.75 sq.m, "0". Boilers are traces of mechanical damages "
- HA-5 is a damaged accessories, pumps "ripped off, damaged secondary circuits and control circuits, main switch, generator control cabinets.
- HA-6 — damaged accessories, control cabinets, secondary circuits and control circuits.
- HA-7 — destroyed stator generator-turbine regulation system boilers, MNU, CCWs generator, secondary circuits and control circuits; damaged rotor winding, auxiliary generator, ring of the rotor, the main switch the generator, the "0" conclusions, accessories.

Vessel: maslovozdušnyj

Reg. No. 360 HA. No. 13 — numerous 44180-dents, detached sleeves.

Vessel air:

Reg. No. 361 HA. # 44570-14 — many dents, detached sleeves.

- HA-8 — damaged the windings of the generator rotor and stator, stator generator, transformer, the regulatory system,

- auxiliary equipment, control cabinets, secondary circuits and control circuits, alternator master switch.
- HA-9 is a destroyed stator generator, cross-piece; damaged installation, maslonaporna accessories, control cabinets, secondary circuits and control circuits.

Vessel: maslovozdušnyj

Reg. No. 364-HA. No. 17 — numerous 46909-dents, detached sleeves.

Vessel air:

Reg. No. 365-HA. No. 18 — numerous 46910-dents, detached sleeves.

- GA-10-damaged the winding rotor and stator generator; d-pad, fixing the bearing of the generator, plans to use Bing instead of half a meter. damaged alternator master switch, auxiliary equipment, secondary circuits and control circuits.

Building and construction:

Overlap marks destroyed 327.0 m in area 2, hydro HA-HA-HA-7 and 9. Has the destruction incompatible with further exploitation of 4-I Colonna, supporting support beam from the upper pond.

Completely destroyed turbine room topsides (Marchi) in zone 2, hydro HA-HA-HA and 3-4. machine Hall topsides in Assembly areas, playgrounds, HA-1 and HA-5 has a serious injury almost no glazing.

Destroyed walls and the brick walls of premises the main circuit breakers generators, "0", findings, etc. at \$ 320.0 metres.

Transformer zone:

- T1 phase a. Missing oil in the conservators and gas relay. Bent tokoveduša stud the top node. Bent and razgermetizirovan gazorazvod on the lid of the tank.
- T1 in phase there is no oil in the conservators. and gas relay. Enter 500 kV chipped the top tire, bent tokoveduša stud the top node. Bent and razgermetizirovan gazorazvod on the lid of the tank.
- T1 phase. withdrawn from the basement and moved to TMX. Deformed Expander and its fastening. The cooling system is damaged. Damaged 500 kV, destroyed by typing enter neutral. Bent and torn tubes gazorazvoda on the cover of the tank. The transformer tank almost without oil, butter in pan.
- Kzt21,. Removed from the basement and transported on 500 kV OSG. Damaged glands, one of the radiators in the ROP perforating hole.
- T2 phase a. Missing oil in the conservators and gas relay. Enter 500 kV (AVV) completely destroyed, linear drainage separated from the windings. Destroyed and there is no neutral input. Bent and razgermetizirovan gazorazvod on the lid of the tank.
- T2 phase in Deformed Extender and.. There is no oil in the conservators and gas relay, the oil level in the tank in the middle of his height. Enter 500 m2 is near the transformer. Destroyed and there is no neutral input. The cooling system is damaged, destroyed by the building of one of the main gate. Bent and torn in several places on the lid of the tank pipe gazorazvoda.
- T2 phase with No oil in the conservators. and gas relay. Enter 500 kV (ABB) is on the ground, chipped porcelain top tires. Enter the neutral destroyed and missing. Bent and razgermetizirovan gazorazvod on the lid of the tank.
- T3 phase a. visible damage, there are traces of the meagre leaking oil on the boxes of NN.

Weight-lifting equipment and hoists:

- Semi-gantry crane g/n 500/100 h 10, Reg. No. 68 hkr. No. 22. Flooded three of the electric motor.
- Semi-gantry crane g/n 500/100 h 10, Reg. No. 59 hkr. No. 23. Flooded three of the electric motor.
- Elevator passenger type P320, Reg. No. 661 HL, head of no. 61751 is completely destroyed.
- Elevator passenger type P500, Reg. No. 655 HL, head # 823M-81 is completely destroyed.
- Elevator passenger type P320, Reg. No. 658 HL, head of no. 4660 is completely destroyed.
- Elevator passenger type P320, Reg. No. 651 HL, head # 4658 — completely destroyed.
- Elevator passenger type P320, Reg. No. 648 HL, head # 4823 — completely destroyed.
- Cargo elevator type P3200, Reg. No. 656 HL, head # 1120SV-81 is completely destroyed.

5.2 Operations to close the shutters

By 8:0 35 min. and 09:00 30 min. in manual mode, the staff of the station were closed fail-safe action valves pressure water conduits.

17.08.2009 at 8.13.25 (local time)

WB = 537.11 m, NB = 325.07 m = 212.04 m

Consumption	Bolt HA-1	2-bolt	3-bolt	4-bolt	5-bolt	6-bolt	Bolt HA-7	Bolt HA-8	Bolt HA-9	Bolt HA-10
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	Open Q = 298 m³/s	Open Q = 256 m³/s	Open Q = 298 m³/s	Open Q = 302.5 m³/s	A device is locked By Q < 298 Up to Q = 0 m³/s	closed Q = 0 m³/s	Open Q = 75 m³/s	Open Q = 305 m³/s	Open Q = 298 m³/s	Open Q = 83 m³/s
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8.35-8.40 (local time)

WB = 537.11 m, NB = 325.07 m = 212.04 m

Consumption	Bolt HA-1	2-bolt	3-bolt	4-bolt	5-bolt	6-bolt	Bolt HA-7	Bolt HA-8	Bolt HA-9	Bolt HA-10
	closed Q = 0 m³/s	Open Q > 340 m³/s	Open Q > 298 m³/s	Open Q > 302.5 m³/s	Open Q = 0 m³/s	closed Q = 0 m³/s	Open Q > 302.5 m³/s	Open Q > 298 m³/s	Open Q > 298 m³/s	Open Q > 83 m3/sec

8.40-9: 30 am (local time)

WB = 532.18 m, NB = 324.67 m n = 212.51 m

Consumption	Bolt HA-1	2-bolt	3-bolt	4-bolt	5-bolt	6-bolt	Bolt HA-7	Bolt HA-8	Bolt HA-9	Bolt HA-10
	8:40 closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	closed Q = 0 m³/s	9:0 30 min. closed Q = 0 m³/s

In 11:0 32 min. was powered from external power source (diesel electric) gantry crane located on the crest of the dam and 11:0 50 min. began opening sluice intakes and vents to balance the inflow and outflow of water from the reservoir and water releases from the lower pool SŠGÈS (the River Yenisey).

The accident spewed technical oils in engine room SŠGÈS and the River Yenisey in the amount of approximately 100 tons.

A detailed scenario for the accident on an detained SŠGÈS 17.08.2009 Expert Commission to investigate the causes of the accident (the materials of the Expert Commission, folder # 4).

5.3. the actions of management and operational staff SŠGÈS

5.3.1 Validity emergency personnel man-made

The branch of JSC "rushydro" Sayano-Shushenskaya GES p. s. Neporožnego "developed a plan of action for the prevention and elimination of emergency situations of natural and man-caused character (plan).

The plan has been drawn up in accordance with the requirements of the Russian Ministry of methodical recommendations. The plan approved by the Director of SŠGÈS 13.12.2008 and agreed with the Office of civil defense and EMERGENCY SITUATIONS administration of power plants 13.12.2008. The Chairman of the Commission for emergency situations is the Chief Engineer.

However, the contents of the plan did not provide for action in case of the scenario happened an accident. Training of personnel in the event of flooding buildings SŠGÈS.

The plan does not take into account the staff of contractors engaged in maintenance and repair of equipment, buildings and structures of SŠGÈS, including the floors below HES watermark in the lower b"efe. Were not agreed upon with the contractor activities on emergency withdrawal of employees from buildings and structures on safe playgrounds. HES

EMERGENCY mode on SŠGÈS was introduced by the Chairman of the branch of JSC "Rushydro CDERA" Sayano-Shushenskaya GES p. s. Neporožnego» from 17.08.2009 No. 132, on the territory of the Republic of Khakassia, President of the Government of the Republic of Khakassiya order from 17.08.2009 No. 122-RP on the basis of the decision of the Government of the Russian Federation dated 30.12.2003 No. 794.

In a letter to the Director of SŠGÈS from 05.09.2009 No. 018/1949 to the Deputy Chairman of the Commission on the Operation of emergency elimination ", it was explained that" for operational tasks in order to save time, all instructions and orders of the President of CDERA SŠGÈS themselves in the verbally. "

Order of actions of officials on the emergency situation in the SŠGÈS is not designed nor approved.

Online log action when emergency 17.08.2009 did not maintain.

5.3.2 Action leadership and operational personnel to 08.13 17.09.2009

With the 8:0 pm 0000. 16.08.2009 until 8:0 0000. 17. in accordance with the schedule of work of the operational staff in August 2009, approved by the Chief Engineer of the branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego, and n. Mitrofanov, operational control of the station was" Manned "in accordance with the approved staff list on OS was stationed at August 2009, consisting of:

1. Station supervisor Syrovetnikov g. a.
2. Double shift station Kuznetsov v. I.
3. Central control room engineer Balandina a. o.
4. Supervisor machine Hall Zhdanov g. k.
5. Senior Machinist on duty v. Ponomarev
6. Duty driver Turkin a. a.
7. Machinist on duty d. i. Čil'čigašev
8. Duty driver Maltsev a. Yu.
9. Main plant shift foreman hydro Katajcev v. n.
10. Duty driver Barinov.
11. On-call engineer RBM-500 remote control Cockroaches d. v.
12. Electrician on duty-ORU 500 Borzov v. a.

By 8:0 0000. 17.08.2009 operational control exercised watch "g":

1. Foreman, m. Nefedov station.
2. Engineer central control Misúkevič I. m.
3. On-call engineer 500 kV OSG Pitching Yu.
4. Electrician on duty-500 kV OSG Smooth.
5. Supervisor machine Hall Lalyko au.
6. Senior Machinist on duty n. Tret'yakov
7. Machinist on duty Myakishev o. a.
8. Machinist on duty a. Zhdanov
9. Duty driver Gulina.
10. Main plant shift foreman hydro Commissioners, a. a.
11. Machinist on duty Katajcev a. v.
12. Double shift station after the release Berniakowitsch a. v.
13. Shift station Sergienko v. p. (8:0 reserve).
14. Machinist on duty Main waterworks Lebedev s. v.

In addition to operational personnel at various levels was the staff of contractors (personnel data are given in the table below).

Table of staff at levels of control room in 8:0 13 min.

1 person – LLC "Avangard"	<u>The roof of the turbine</u> OTM. 354
29 people — JSC «Sayano-shushensky Hidroènergoremont» 7 people — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES. P. S. Neporožnego» 8 persons — «Rotex» 6 persons — OOO "Avangard" 2 man — technostroy Ltd. Total: 52 persons	<u>Floor machine room</u> OTM. 327
31 — JSC «Sayano-shushensky Hidroènergoremont» 8 persons — branch of JSC "Rushydro" — "Sayano-Shushenskaya GES. P. S. Neporožnego» 2 man — technostroy Ltd. Total: 41 people	OTM. 320
22 — JSC «Sayano-shushensky Hidroènergoremont» Total: 22 people	OTM. 315

Chief Engineer of SŠGÈS with 06:35 17.08.2009 was on station in his Office and he reports from the service chiefs.

The shift was at their workplaces. From the words of engineer central control Misúkevič I. m. (18.08.2009 interview Protocol), 08:05 group controller for reactive power is disconnected (GRRM is a subsystem that runs as part of the GRARM) and the voltage on it has 526 – 527 m2, with testimony on software module/pushbutton unplanned power (MEL) comply with 176 MW. At the time of inspection in 08:00 the testimony matched the APPLICABILITY LWM — 300 MW.

In 08:06 Misúkevič I. m. went to control panel and lowered at every unit reactive load (power factor keys Turned counter-clockwise along the 9 and 10 unit, then at 7 and 8 unit, then at 6-5 aggregate. St Assembly was in repair reduced the reactive load at 3 and 4 unit and then 1 and 2 units). Stress on the tires had dropped to 525 — 524 m2. Action Misúkevič I. m. correspond to the instructions of the group management of active and reactive power (GRARM) approved by the Chief Engineer hydro SŠGÈS SŠGÈS Mitrofanov, 24.02.2009.

After this change, the station chief, reported that you can enter GRRM. Station supervisor Nefedov m. g. introduced it into work.

In 8:0 07 min. all readings were normal, signals an error.

From the words of a senior driver Tretyakova n. (poll from 18.08.2009), he stayed at the premises of the operational staff at the

premises of the machine Hall and admission officer SŠGÈS, locksmith y. I. Shynkarenko for works. Nature works-replacement filter clogged sensors-HA HA and 10-6. At this point, nothing unusual has not noticed. All the staff of the machine Hall had paperwork for works contractors.

According to installer LLC of PSC "Avangard", Novosibirsk, p. Marar, 08:00 he was on the roof mounting pad machine Hall for carrying out of works on installation of ventilation. Got an assignment from the Brigadier. At this point, the roof began to light vibration machine room. Initially did not attach this value. Increased vibration, then grew into a roar. Then a huge surge of water in the direction of transformers from the machine Hall, accompanied by a Gnash of metal and crackle of short circuit. When amplifying the water splashes and screen roof collapse occurred in the Turbine Hall 1-3 units.

5.3.3 Operation management and operational personnel after 08.13 17.09.2009

At the time of the accident, the Director of the SŠGÈS Nevol'ko n. and Chief of economic security and regime of t. Shevchenko on the station were not available.

The Acting Chief of EMERGENCY and m. i. Čiglincev, Chief of the monitoring equipment a. Matvienko, head of service reliability and safety Čuričkov n. left the station at the time of the accident.

Chief Engineer SŠGÈS Mitrofanov a. n., according to him, hearing the rumbling noise, arrived on the CPU (central control point SŠGÈS, located on the 4 floor of block "a") in accordance with the regulations on the prevention and elimination of technical violations on purely hydro equipment Sayano-Shushenskaya HPP ".

Mitrofanov a. n., reported on a cellular phone, Director of operation — Deputy Head of business unit "production" of JSC "Rushydro" Yuliy t. m. about the accident, ordered the closure of the emergency gate repair station change to the Chief m. g. Nefedovu, who was on the CPU.

If there is no connection with 8:13 with no CPU command staff the station No one gave. From the words of the staff, all attempts at communication by cellular phone were unsuccessful.

Based on the survey of Chief Engineer SŠGÈS Mitrofanov a. n. and shift Nefedova m. g. 8:0, 30-35 minutes on cell phone CPU received a call from the Deputy Head of the Turbine Hall e. v. Kondratceva. He asked me what to do, and I need help. He also said that the gidropod"emnikah (the crest of the dam) is a senior officer Machinist Tretyakov n.. By Kondratceva e. foreman m. Nefedov station, handed over the senior duty operator Tretyakov n. to reset emergency and maintenance of the upper pond. The closures were finally closed no later than 09:00 30 min. 17.08.2009. Discharge emergency gate in manual mode by Katajcev a. v., Kondratcev e. v., Bagautdinov i. m., Majorošin p. a. and n. Tretyakov

Upon arrival, the Deputy Chief Engineer of CPA Šervarli EI Chief Engineer Mitrofanov a. n. gave him the head to the ORU-500 and take steps to restore the station's own use.

5.3.4 the dead and injured, as of 9/25/2009.

The accident led to numerous fatalities (75 dead, 13 injured). At the time of the accident in the territory of the SŠGÈS there were about 300 people, including repair and hired staff.

Dead.

The branch of OJSC "Eng-hydro-Sayano-Shushenskaya GES p. c. Neporožnego:

1. Epiphany e. m., auto-detected about freight and passenger lift in the engine room at elevation between 315 and 320.
2. Ermolev d. I., senior engineer, discovered in the cargo lift SŠGÈS between 315 and 320 marks.
3. a. Kachan, engineer — found in the discharges under the engine room between the HA and HA-6-7 at \$ 327.
4. s. Kupriyanov, locksmith, found at the site of the oil economy would top water-turbine Hall at \$ 310.
5. Lalyko a. e., Director of a change machine Hall is found in the right wing machine room from the upper pond at \$ 310.
6. Nelidov s. n., auto-detected near the GA-7 at \$ 310.
7. Novikov, auto-discovered in the shaft of the Turbine Hall GA-6 under the corrugated ceiling floor at \$ 327.
8. Polenok n. p., senior engineer, was found at the premises of the hydraulic units with 6 to 10, at \$ 310.
9. a. Utkin, senior engineer, discovered about HA-8 at \$ 323.
10. a. Zhdanov, Machinist HA. is found in a building of station tailrace.

Ojsc "Gidroènergoremont Sayano-Shushensky»:

11. a. Aksyonov, the mechanic is found in the compressor building, machine room at \$ 310.
12. v. Anisimov, locksmith, found in the compressor compartment unit # 1 mounting pads at \$ 327.
13. Alimov, auto-detected about freight and passenger lift in the engine room at elevation between 315 and 320.
14. Aryševa v. p., janitor is found on the oil sector would-machine Hall of the upper pond, at \$ 310.
15. Mr. i. Burlakova, cleaner has encountered before the arrival of the investigation team at the initial stage of the search-and-rescue operations.
16. Bulanovskij y. s., auto-detected in the HA-6 at \$ 310.
17. Bittel' I. n., charwoman — found in the HA-6 at \$ 310.
18. Bezrukov, a. n., welder, discovered about freight and passenger lift in the engine room at elevation between 315 and 320.
19. Vakušin y. a., locksmith, found in a room at \$ 310.
20. Basilian, a. fitter is discovered prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
21. Resurrection f. v., auto-detected about freight and passenger lift in the engine room at elevation between 315 and 320.
22. Resurrection, auto-detected about freight and passenger lift in the engine room at elevation between 315 and 320.
23. vasilyeva t. v., painter — found on the oil sector would-machine Hall of the upper pond at \$ 310.

24. Gabrat n. a., Turner is found on the oil sector would-machine Hall of the upper pond at \$ 310.
25. Gorâvin e. s., auto-detected prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
26. Goian d. p., painter is found prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
27. Guselnikov p. n., locksmith, found in the compressor building, machine room at \$ 310.
28. Glagol'ev v. i., painter is found near the cargo and passenger lifts in the engine room at elevation between 315 and 320.
29. Oaks, the mechanic is found near the cargo and passenger lifts in the engine room at around 315 and 320.
30. Dugina I. n., janitor is found in the HA-6 10 metres at \$ 315 in the hallway.
31. Yermilov and s., locksmith, found about freight and passenger lift in the engine room at elevation between 315 and 320.
32. G.n. Zholobova, painter is found prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
33. Crooks and a., auto-detected prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
34. Zharova n. a., janitor is found at around 323 machine room.
35. Zemtsov, y. I., locksmith is discovered prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
36. Zavorin a. v., the mechanic is found in the HA-2 at \$ 305.75.
37. Ivashkin, the battery is detected before the arrival of the investigation team at the initial stage of the search-and-rescue operations.
38. Ikonnikova n. e., janitor — discovered in the toilet rooms at \$ 315.
39. Ikonnikova e. I., janitor is found in the HA-6 at \$ 310.
40. Kalinin v. a., painter — found on the oil sector would-machine Hall of the upper pond at \$ 310.
41. Kolesnichenko, auto-detected prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
42. v. Kupriyanov, the mechanic is found near the cargo and passenger lifts in the engine room at elevation between 315 and 320.
43. Karpov, welder, discovered about freight and passenger lift in the engine room at elevation between 315 and 320.
44. Kytmanov a. i., locksmith, found about freight and passenger lift in the engine room at around 315 and 320.
45. Korshunov, a. e., auto-discovered along the passage Chamber cooling HA-6 under the corrugated ceiling floor at \$ 320.
46. korshunov, e., master is found on the oil sector would-machine Hall of the upper pond at \$ 310.
47. Kuzevanova I. a., painter — found on the oil sector would-machine Hall of the upper pond at \$ 310.
48. Klyukach e. a., janitor is found in the right wing machine room from the upper pond at \$ 327.
49. Linejskih a. n., senior master is discovered prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
50. Malik a, master is found near the cargo and passenger lifts in the engine room at elevation between 315 and 320.
51. Mezentsev, the mechanic is found in the HA-8 at \$ 305.75.
52. Mingazov e. m., painter — found on the oil sector would-machine Hall of the upper pond, at \$ 310.
53. Osintseva, janitor is found on the oil sector would-machine Hall of the upper pond at \$ 310.
54. v. Ovchinnikov, the mechanic is found near the cargo and passenger lifts in the engine room at elevation between 315 and 320.
55. Petrov, a. fitter is discovered about freight and passenger lift in the engine room at elevation between 315 and 320.
56. Puzakov a., locksmith, found about freight and passenger lift in the engine room at elevation between 315 and 320.
57. Romanyuk, a. m., master is found near the cargo and passenger lifts in the engine room at elevation between 315 and 320.
58. Semkina n. n., painter — found on the oil sector would-machine Hall of the upper pond at \$ 310.
59. Sinyavsky d. g., welder, discovered about freight and passenger lift in the engine room at elevation between 315 and 320.
60. Siseckij v. v., welder is found in the right wing of the upper pond machine room at \$ 327.
61. Temirbulatov p. s. Turner is found on the oil sector would-machine Hall at \$ 310 from the upper pond.
62. v. Tyulenev, locksmith, found on the oil sector would-machine Hall at \$ 310 from the upper pond.
63. Tyulenev n. m., locksmith, found at the premises of hydropower units at \$ 310.
64. Tatarnikov, locksmith, found at the site of the oil economy would top water-turbine Hall at \$ 310.
65. Teterin, locksmith, found about freight and passenger lift in the engine room at elevation between 315 and 320.
66. O. a. d., the mechanic is found at the premises of the hydraulic units with 6 to 10 at \$ 310.
67. Uroâkova a. v., painter is found in the HA-1 on \$ 305.25 on stair openings.
68. Škaeva t. p., janitor is found at around 320 machine room in the mechanical workshop and the Turbine Hall.
69. Women r. n., auto-detected prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
70. Yurev, locksmith, found about freight and passenger lift in the engine room at elevation between 315 and 320.
71. Rau, m., painter — found in the downstream of the building of the hydroelectric power station.
72. Žolob m. n., master.
ООО Technostroy»:
73. rich, e. a., Carpenter-concreter – discovered prior to the arrival of the investigation team at the initial stage of the search-and-rescue operations.
74. Bazhin a. a., Carpenter-concreter – detected about 10 hectares.
Llc "SaânServis".
75. t. Ikonnikova, cleaner has encountered some cargo and passenger lifts in the engine room at elevation between 315 and 320.

6. the recommendations and measures for the prevention of such man-made

disasters (accidents)

The leaders of JSC "Rushydro", OJSC "Lenhydroproject" and JSC "system operator of unified energy system, OJSC" power machines "JSC «FGC» in time to perform the following activities:

6.1 design

-storage:

6.1.1. to organize at existing HYDROPOWER survey (if necessary, full-scale tests of hydraulic units) with the assistance of specialized research organizations, manufacturers, and expert organizations. Time for fulfillment is 01.01.2011.

6.1.2. For SŠGÈS to develop a hydroelectric generator (turbine) with a wide range of active power adjustment to ensure participation in the regulation of unified energy system. Time for fulfillment is 01.01.2011.

6.1.3. To finalize column hydraulic turbine regulator (AGRE), with the closure of the diffuser when it loses power. Time for fulfillment is to launch the first hydro unit.

6.1.4. checking the diagnosis methods of non-destructive testing of parts and studs fastening flange covers turbine, in agreement with the manufacturer. Time for fulfillment is to launch the first hydro unit.

6.1.5. to equip staff with permanent vibration control systems and thermal control. Determine the location of the sensors and warning and alarm setpoints and integrate data of vibration and thermal control units in the system of collective management of the functions of warning and alarm, auto-stop hydraulic units. Time for fulfillment is to launch the first hydro unit.

— building hydroelectric power stations and dams:

6.1.6. provide protection from flooding control systems, communication systems, located at Turbine Hall and below, as well as in administrative buildings and service-industrial buildings SŠGÈS their autonomous power supply. Meet them in pylevagozašišennom. Time for fulfillment is to launch the first hydro unit.

6.1.7. provide surveillance and wireless communications in industrial premises on the turbine, transformers ORU-500, as well as the Organization of communication, information output to CPU redundant backups. Time for fulfillment is to launch the first storage.

6.1.8. delete the placement of administrative, residential and renovation of premises at elevations below the tailrace. Deadline is December 1, 2010.

6.1.9. set on the crest of the dam autonomous sources of power supply for the automatic start of the upper pond, crane control mechanisms and an overflow of the ward closures, as well as other mechanisms that ensure the safety of a hydraulic installation. Time for fulfillment is to launch the first hydro unit.

anti-emergency protection system:

6.1.10. Edit design solutions in AUTOMATION, control of turbines, conditions of protection and locking to ensure safe and reliable trip equipment in case of contingencies. Time for fulfillment is to launch the first hydro unit.

6.1.11. run a turbine, the emergency closures, providing them water SŠGÈS guaranteed closing in case of emergency, as well as to team with key management at the central control unit (FCU) SŠGÈS. Time for fulfillment is to launch the first hydro unit.

6.1.12. Design a monitoring system status and operation modes of locking and persistence parameters. Time for fulfillment is to 01.03.2010.

6.1.13. approve the regulation of managerial decision-making (SŠGÈS) according to the vibration control. Time for fulfillment is to 01.01.2011.

6.2 recommendations for operating HPP

-hydraulic units:

6.2.1. Harmonize with the manufacturer group power control algorithm and prioritizing load hydraulic units, taking into account their technical condition. Time for fulfillment is up to 01.06.2010.

6.2.2. to develop and implement technical solutions to prevent spontaneous untwisting nuts anchorage flanges vodoprovodâšego tract. Time for fulfillment is to launch the first hydro unit.

6.2.3. in the light of operational constraints and characteristics of hydro turbines with deleted by ro-230/833-677 in the secondary regulation of active power and frequency. Time for fulfillment is to launch the first aggregate.

6.2.4. when installing the new hydraulic units take their design and operating characteristics, with the participation of the GES in the secondary regulation of active power and voltage regulation (align these solutions with the energy of Russia). Time for fulfillment is to 01.01.2011.

-turbine flow passages:

6.2.5. A diagnosis of technical condition of composite pressure pipe culverts. Fix disclosure surface cracking. Time for fulfillment is to 01.01.2011.

6.3. recommendations for development of new regulatory documents

6.3.1. adjustments in the operating instructions, safety, job descriptions, instructions for emergency management in the branch of JSC "Rushydro" SŠGÈS. Time for fulfillment is to launch the first hydro unit.

6.3.2. to develop a method of replacing, tightening, inspection and testing of sites charge flanges vodopodvodâšego tract. Time for fulfillment is to launch the first hydro unit.

6.3.3. make proposals to the Ministry of energy of Russia to speed up the release of a new edition of the "norms for technological design of hydropower plants and amending rules of technical operation of power plants and networks".

6.3.4. Contact with proposals of energy of Russia on the development of a normative legal Act establishes the requirements for the Organization of at least two independent digital high-speed channels of information exchange between electricity and dispatch centres.

6.4. the arrangements for the safe operation of hydraulic structures Sayano-Shushenskaya hydroelectric power plant in autumn-winter period

Head of JSC "Rushydro" and the Director of the branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego" in time to perform the following activities:

6.4.1. operation of the Sayano-Shushensky reservoir to the main area and in accordance with the regimes established by the Yenisei BASIN Federal water resources Agency. Term of execution is pending approval of the new rules on the use of water resources of Sayano-Shushensky reservoir.

6.4.2. develop design and technical measures, to ensure the safe operation of the station, part of an overflow dam and vodoboynogo wells Sayano-Shushenskaya HYDROELECTRIC POWER PLANT in winter conditions, taking into account the limitations of the drawdown and filling the Sayano-Shushensky reservoir. Term of execution is 01.01.2010.

6.4.3. sponsor and introduce in the Yenisei Rostekhnadzor management activities that ensure the safe operation of the dam and vodoboynogo wells Sayano-Shushenskaya HYDROELECTRIC POWER PLANT in the absence of cost pass through the hydraulic units in winter conditions. Deadline is 01 October 2009.

6.4.4. sponsor and introduce in the Yenisei control Rostekhnadzor provisional rules of operation of hydraulic structures, providing conditions for the operation of hydraulic structures in the face of falling ice and slush edge in the vodoslivnuú portion of the dam is freezing the closures and restrictions on their maneuvering, restrictions on discharge capacity during the winter and other activities on safety of hydraulic installations. Term of execution – 01.10.2009.

6.4.5. A Commission (preddeklaracionnoe) survey of hydrostructures Sayano-Shushenskaya HYDROELECTRIC POWER PLANT. Term of execution — 10.10.2009.

6.4.6. to elaborate a declaration of safety of hydraulic installations Sayano-Shushenskaya hydroelectric power plant in conjunction with the main area of safety of hydraulic installations and to submit all the necessary documents for the Supervision examination, approval and authorization for their use. Term of execution: 01.11.2009.

6.4.7. with the assistance of a specialized organization to clarify (revised) criteria of safety of hydraulic installations Sayano-Shushenskaya HYDROELECTRIC POWER PLANT. Term of execution: 01.02.2010.

6.4.8. in accordance with established procedures, calculate the probable harm in the event of an accident of hydraulic structures dam Sayano-Shushenskaya HPP and to submit it to determine the amount of Financial Supervision of civil liability for damage caused by the accident of hydraulic structures. Term of execution is 01.01.2010.

6.4.9. to elaborate and submit for the consideration and approval of the Rostekhnadzor Declaration of safety of hydraulic installations of shore spillway SŠGÈS. Term of execution is not later than four months before the beginning of operation of shore spillway.

6.4.10. in connection with the changed conditions of exploitation of hydraulic structures SŠGÈS through preddeklaracionnogo survey of hydraulic structures to evaluate health and sufficiency test equipment and, if necessary, develop activities for installing additional instrumentation. Deadline is 01 October 2009.

6.4.11. organize monitoring of plates on the vodoboynogo well in test equipment. Term of execution — every day.

6.4.12. Arrange instrumental monitoring of slopes of pen and precipitation of solid parts separate pillars vodoboynogo well. Term of execution — at least twice a month.

6.4.13. develop an action plan in case of emergency and the hydraulic structures, given the characteristics of emergency operation of plant SŠGÈS after the catastrophe. Term of execution: 15.10.2009.

6.4.14. get in the Russian Ministry for the status of the operating organization for localization and liquidation of emergency situations and protection of population and territories in case of a breakdown of a hydraulic installation. Term of execution — 01.12.2009.

6.5. recommendations on additional activities

6.5.1. JSC "Rushydro" and the Director of the branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego" to ensure the availability of dedicated communication channels to ensure trouble-free (stable) SŠGÈS, with all systems to a common time source providing stable and reliable information on the territory of the Russian Federation. Term — to run hydraulic units.

6.5.2. system operator OJSC unified energy system, to develop proposals for regulatory and technical documentation (NTD) in the planning and conduct of frequency and power management modes, tailored, and the actual state of the hydroelectric equipment and make them to the Ministry of energy of the Russian Federation. Term of execution is Tuesday.

6.5.3. system operator OJSC unified energy system, in the development of activities for the development of Russia in the EU envisage for thermal generation capacity in generating extremely agile ECO Siberia. Term of execution — consistently.

6.5.4. JSC "Rushydro" and OJSC "FGC" in order to increase the reliability of the power to perform complex reconstruction and technical re-equipment of 500 kV OSG SŠGÈS replacement air switch, oil-filled transformers and voltage of 500 kV main circuitry for complete èlegazovoe equipment 500 kV (KRUE) by posting it on the dam HYDROELECTRIC POWER PLANT. Term — on agreed plans.

6.5.5. propose to the Ministry of energy of Russia to this Act with all organizations operating HYDROELECTRIC POWER PLANT to develop compensatory activities and increase the level of security, taking into account the results of the technical investigation.

6.6 security best practices for power system of the Russian Federation

To consider expedient to consider the project of building a sufficient amount of bandwidth and power lines connecting regions of the Urals and Siberia through Kazakhstan.

7. Event (s) preceding and which contribute to the occurrence of the accident

Sinûgin Vyacheslav Y. — Deputy Minister of energy of the Russian Federation (2001-2004, the Deputy Chairman of the Board of RAO UES of Russia, 2005-2008, the CEO, the Chairman of the Board of the OJSC hydroogk). While in the position of Deputy Chairman of the Board of RAO UES of Russia, carried out the decision on withdrawal of repair personnel staffing of HPS without entering into the contract, repair and maintenance requirements for regular monitoring of technical condition of basic equipment. While in the post of Director-General, Chairman of the Board of the OJSC hydroogk) has not created conditions for proper evaluation of the actual state of security SŠGËS. Failed to take effective measures for the development, financing and implementation of compensatory measures on safe operation of SŠGËS (including the failed implementation of the decision for the early construction of an additional spillway at SŠGËS, has not taken effective measures to replace the impeller on a hydroelectric generating sets to reduce the influence of "non-recommended zones of their operation, has failed to adopt a programme on safe operation of hydraulic units involved in the management of power and therefore have an increased wear and tear.

Boris F. Vajnzher – Director General of OAO "TGC-1 (2005-2008, the Technical Director of OAO Rao" UES of Russia "and is included in the back of the Board. from September 2006 to October 2007, combined this post with the post of Director-General is the Chairman of the Board of OJSC" power machines "). In accordance with order No. 490 from 13.07.2006 r. RAO "UES of Russia", was responsible for the introduction of standards of RAO UES of Russia to enhance the safe operation of equipment and do not have adequate levels of safe operation of SŠGËS.

Chubais Anatoliy Borisovich — Director General of State Corporation, rosnano (1998-2008, Chairman of the Board of RAO "UES of Russia"). Chairman of the Board of RAO UES of Russia adopted the Act of the Central Commission on commissioning the Sayano-Shushensky hydroelectric complex (the order of RAO "UES of Russia" of 13.12.2000 No. 690 "on approval of the acceptance into service of Sayano-Shushensky hydroelectric complex"). It was not given a proper assessment of the actual state of security SŠGËS. In addition, the following were not developed and implemented effective and timely compensation arrangements for the safe operation of SŠGËS (including no decision "as soon as possible to begin work on building an additional spillway at the Sayano-Shushenskaya HPP", not replaced with impellers on hydro unit, not a program compensating measures on safe operation of hydraulic units involved in the management of power and therefore have an increased wear and tear).

Stafievskij Valentin Anatolyevich -Managing Director, head of Division South rushydro JSC, (1983-2006, Chief Engineer of the Sayano-Shushenskaya HYDROELECTRIC POWER PLANT). Knowing about the real state of operated on SŠGËS equipment (including hydro) has not created the conditions for the adoption of effective measures of JSC "Rushydro" on safe operation of SŠGËS. Participated in the withdrawal of repair personnel from the staffing table, by failing to comply with requirements for regular monitoring of technical condition of main equipment of SŠGËS.

Anatoly Dyakov Fedorovich — member of RAS (2000, Chairman of the Central Commission for acceptance into operation the Sayano-Shushensky hydroelectric complex). The Central Commission the Sayano-shushensky hydropower complex inaugurated with "good" (the order of RAO "UES of Russia" from 13.06.2000 No. 329). The Act, the Commission does not fully reflect the actual state of existing buildings and equipment SŠGËS, which created preconditions for underestimating the real consequences of further exploitation.

Igor Yusufov Hanukovič -Ambassador-at-large, MINISTRY of FOREIGN AFFAIRS (2001-2004, the Minister of energy of the Russian Federation). As Minister of energy of the Russian Federation, has not created the real mechanisms of State control and supervision for safe operation of power facilities, including on the composition of the RAO "UES of Russia". Failed to provide the development and adoption of the State policy in the field of safe operation of power facilities contributed to the transfer of control from the State operating organizations without decisions about improving their responsibility for the energy security of the Russian Federation.

8. a list of the persons responsible for the prevention of incidents and accidents on SŠGËS

8.1. Nevoľ'ko Nikolay Ivanovich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

The post is a branch manager.

Education – higher professional.

Specialty-equipment high voltages.

Qualification – engineer-electrician.

Age 56 years.

Experience of work at the same place — 2 years 8 months.

Data on certification in the Central certifying Commission of Rostekhnadzor.

Performing duties not provided:

- Organization and implementation of measures to prevent security threats to the life and health of workers in connection with their functional responsibilities;
- commissioning of energy equipment, buildings and structures in accordance with the applicable regulatory requirements.
- execution of the order of JSC "Rushydro" of 24.11.2008, no. 752/13 and from 06.09.2006 no. 141/3562.

There are signs of violations:

- art. 212 of the labour code of the Russian Federation;
- Article 14 December 21, 1994 federal law No. 68-FZ on protection of population and territories against emergency situations of natural and technogenic character;
- p. 1 item 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;
- section 4 "branch of the open joint-stock company rushydro, Sayano-Shushenskaya GES p. s. Neporožnego" (as amended by order No. 452 from 23.07.2008).

8.2. Mitrofanov Andrej Nikolaevich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post-first Deputy Director, Chief Engineer.

Education – higher professional.

Specialty-electrical stations.

Qualification – engineer-electrician.

Age was 58 years old.

Experience of work at the same place — 3 years 9 months.

Performing duties not provided:

- reliable and smooth operation of equipment and facilities companies in strict accordance with the rules of technical operation of electric power stations and networks in the Russian Federation, through the Organization of maintenance, in accordance with the manufacturer's instructions and regulations, as well as the modernization and reconstruction of equipment;
- the introduction of new technologies and equipment to improve safety and working conditions;
- execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are signs of violations:

- art. 212 of the labour code of the Russian Federation;
- p. 1 item 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);
- "A branch of the open joint-stock company rushydro, Sayano-Shushenskaya GES p. s. Neporožnego" (as amended by order No. 452 from 23.07.2008).
- section 1 "provisions on the responsibilities of the Deputy Director of a branch of the open joint-stock company rushydro, Sayano-Shushenskaya GES p. s. Neporožnego» (approved by the Director of a branch of JSC" Rushydro "—" Sayano-Shushenskaya GES p. s. Neporožnego "22.12.2008).

8.3. Šervarli Evgeniy Igorevich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post-Deputy Chief Engineer for exploitation.

Education – higher professional.

Specialty-electrical stations.

Qualification – engineer-electrician.

Age is 55 years.

Experience of work at the same place — 3 years 7 months.

Fulfilling duties of Deputy Chief maintenance engineer, had failed to provide:

- reliable and smooth operation of the enshrined within the descriptions of equipment and systems in strict accordance with the rules of technical operation of electric power stations and networks in the Russian Federation, through the Organization of maintenance in accordance with the manufacturer's instructions and regulations, as well as the modernization and reconstruction of equipment.
- execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are indications of irregularities:-art. 214 of the labour code of the Russian Federation;

- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);
- p. 2.1 "job description of the Deputy Chief maintenance engineer of branch" Rushydro "—" Sayano-Shushenskaya GES p. s.

Neporožnego» (approved by the Director of a branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego" 02.07.2009).

8.4. Nikitenko Gennadiy Ivanovich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post-Deputy Chief Engineer for the technical part.

Education – higher professional.

Specialty – hydroelectric power.

Qualification – engineer-gidroelektroenergetik.

Age: 54 years.

Experience of work at the same place — 2 years 5 months.

Performing duties not provided:

-reliable and smooth operation of the equipment and installations HES in strict accordance with the rules of technical operation of electric power stations and networks in the Russian Federation, through the Organization of maintenance, in accordance with the manufacturer's instructions and regulations, as well as the modernization and reconstruction of equipment;

-the introduction of new technologies and equipment to improve safety and working conditions;

-execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562

There are signs of violations:

— art. 214 of the labour code of the Russian Federation;

— p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";

-Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;

— p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);

— paragraph 2.1, "Deputy Chief Engineer job description on the technical part of the branch" Rushydro "—" Sayano-Shushenskaya GES p. s. Neporožnego» (approved by the Director of a branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego" 22.06.2009).

8.5. Alexander Matvienko

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post — Chief of the monitoring equipment

Education – higher professional.

Specialty – electric drive and automation of industrial enterprises.

Qualification – engineer-electrician.

Age is 42 years.

Experience of work at the same place as 2 months.

Performing duties not provided:

-processing and analysis of measurement results of stationary hydraulic unit vibration control system and the elaboration of recommendations for addressing the identified deviations from regulatory requirements;

— detection of damage or the pre-emergency condition of the equipment and the emergence of proposals about bringing design and research organizations for consultations on the complex measuring equipment;

-execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are signs of violations:

— art. 214 of the labour code of the Russian Federation;

— p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";

— p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);

— p. 3.2.1; 3.2.2. "regulations on the service of monitoring equipment (approved by the Director of a branch of JSC" Rushydro "—" Sayano-Shushenskaya GES p. s. Neporožnego» 01.06.2009).

8.6. Pogonajchenko Igor Yurevich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post-head of operational service.

Education – higher professional.

Specialty-electrical stations.

Qualification – engineer-electrician.

Age is 49 years old.

Experience of work at the same place — 8 years 10 months.

Data on certification in the territorial qualification Commission of Rostechnadzor.

When performing official duties:

is not decided to change the mode of operation of the equipment;

is not ensured enforcement of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are signs of violations:

- art. 214 of the labour code of the Russian Federation;
- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);
- p. 3.1.3; p. 3.1.4 "provisions on operational service" (approved by the Director of a branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego» 01.06.2009).

8.7. Perestoronin Aleksandr Ivanovich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Position is head of production and technical service.

Education – higher professional.

Specialty-electrical stations.

Qualification – engineer-electrician.

Age was 51 years.

Experience of work at the same place as 2 months.

Data on certification in the territorial qualification Commission of Rostekhnadzor.

Performing duties not provided:

- operational personnel with high quality operating instructions and their timely review;
- evaluation and analysis of power plant equipment based on monitoring and Diagnostics;
- execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are signs of violations:

- art. 214 of the labour code of the Russian Federation;
- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);
- p. 3.1.2; p. 3.1.3; 3.2.2. "regulations on production and technical service branch of JSC" Rushydro "—" the Sayano-Shushenskaya GES p. s. "Neporožnego" (approved by the Director of a branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego» 01.06.2009).

8.8. Čuričkov Mykola Vasylyovych

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

The post is the Chief of security and safety.

Education-secondary vocational training.

Specialty-electrical networks, stations and systems.

Qualification – Technician-electrician.

Age was 58 years old.

Experience of work at the same place — 6 years 8 months.

Data on certification in the territorial qualification Commission of Rostekhnadzor.

Performing duties not provided:

- control of compliance with the personnel branch of equipment in accordance with "rules of technical operation of electric power stations and networks in the Russian Federation» operating instructions and maps and other normative-technical documents and the adoption of measures to address violations;
- monitoring of implementation by contractors requirements of labour protection system, fire and industrial safety;
- execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562.

There are signs of violations:

- art. 214 of the labour code of the Russian Federation;
- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- p. 1.1.5; p. 1.5.6 "rules of technical operation of electric power stations and networks in the Russian Federation";
- p. 3.4.17.3; section 4.4.6 "provisions on service reliability and safety branch JSC" Rushydro "—" the Sayano-Shushenskaya GES p. s. Neporožnego "01.06.2009» (approved by the Director of a branch of JSC" Rushydro "—" Sayano-Shushenskaya GES p. s. Neporožnego» 01.06.2009).

8.9. Andrei Ivanovich Chuprov

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post — Chief of the technological control systems.

Education – higher professional.

Specialty-electrical stations.

Qualification – engineer-electrician.

Age was 53 years.

Experience of work at the same place – 3 months.

Data on certification in the territorial qualification Commission of Rostekhnadzor.

Fulfilling the duties of the Chief of service of technological control systems do not provide:

- fully carry out regular inspections and analysis of the equipments, the cases do not work properly.
- analysis of equipment assigned to unit;
- execution of the order of JSC "Rushydro" of 24.11.2008 No. 752/13 and 141/06.09.2006 no. 3562;

There are indications of irregularities:-art. 214 of the labour code of the Russian Federation;

- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);
- paragraph 3.2.1., p. 3.2.2. "Regulations on the service of technological control systems» (approved by the Director of JSC "Rushydro"—" Sayano-Shushenskaya GES p. s. Neporožnego from 01.06.2009).

8.10. Čiglincev Mihail Ivanovich

Place of work — the branch of OJSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego.

Post-Deputy Chief of economic security and regime on 03.08.2009 21.08.2009 Acting Chief-of-staff and EMERGENCY services and economic security (in accordance with the order of the Director of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego, no. 166 k of 03.08.2009).

Education – higher professional.

Specialty – automotive engineering.

Qualification – engineer-mechanic.

Age was 41 years.

Experience of work at the same place – 12 years.

Work experience in performing post-19 days.

Fulfilling the duties of the Chief of staff and EMERGENCY services, economic security, and, in the absence of the Executive Branch had left on his car into the station, not organized deployment and work abnormal formations during the liquidation of the consequences of the accident. Back at the station about 10:00 17.08.2009.

There are signs of violations:

- art. 214 of the labour code of the Russian Federation;
- p. 2 article 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;
- Article 14 p on December 21, 1994 federal law No. 68-FZ on protection of population and territories against emergency situations of natural and technogenic character;
- p. 2.2.6 "job description of the Chief of staff and EMERGENCY SITUATIONS" (approved by the Director of the branch of JSC "Rushydro" — "Sayano-Shushenskaya GES p. s. Neporožnego from 01.06.2009).

8.11. Vasily Zubakin Aleksandrovich

Work place: JSC "Rushydro".

The post is the Acting Chairman of the Board of JSC "Rushydro".

Education — Omsk Polytechnic Institute, Faculty (Faculty of design and production of radio equipment).

Postgraduate studies at the Moscow Institute of national economy named after Plekhanov (Ph.d. in economics, management, institutional development and economic complexes ").

Age was 51 years.

Experience of work at the same place from 2006, Member of the Board of the OJSC hydroogk, since June 2008, the Acting Chairman of the Board of JSC "Rushydro".

When performing official duties, failed execution follows the order of JSC "Rushydro" from 25.07.2008 No. 472 on the distribution of tasks and powers between the leaders of JSC "Rushydro":

- 3.1.9. the protection of information, ensuring the economic and physical security, including in cases stipulated by local regulations (acts), the physical safety of employees of the company and SUBSIDIARIES, accident prevention and elimination of consequences of accidents and natural disasters on the objects of the society and the ASSOCIATED COMPANIES;
- 3.1.49. Organization and supervision of managers, directors of branches and representations in cases stipulated by the orders of the Chairman of the Board, the heads of other separate units of society.

There are signs of violations:

- Article 14 December 21, 1994 federal law No. 68-FZ on protection of population and territories against emergency situations of natural and technogenic character ";
- p. 1 item 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety of hazardous production facilities";
- Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations".
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799);

8.12. bohusz of Boris Borisovich

Place of work — JSC "Rushydro".

The post is a member of the Board, Managing Director, head of business unit "Production" JSC "Rushydro".

Education-Togliatti Polytechnic Institute.

Speciality-mechanical engineer.

Qualification – engineer.

Age was 57 years.

Experience of work at the same place from 2004-2005 head of production and technical business unit policy, "Mr. RAO" UES of Russia ", 2005-2007, Deputy Head of the business unit" production of OJSC "Uralsvyazinform", since November 2007, Member of the Management Board, Managing Director, head of business unit "production of JSC" Rushydro ".

When performing official duties, failed execution follows the order of JSC "Rushydro" from 25.07.2008 No. 472 "on the distribution of tasks and powers between the leaders of JSC" Rushydro ":

3.7.1. the development and implementation of the unified technical policy of the company (including part of the automated control systems of technological process, automated systems of dispatching control and communication technology), the control of conformity of production programs and technical policy; DZO

3.7.3. the creation, approval and implementation of integrated programmes and projects of the repair, reconstruction, technical re-equipment and NIR (tests, experiments, studies), maintenance and operation of hydropower facilities;

3.7.4. the elaboration of a programme of repairs, NIR (tests, experiments, research) maintenance company and SUBSIDIARIES;

3.7.5. the development of the investment program of society and of the ASSOCIATED COMPANIES of technical re-equipment and reconstruction of the HPP;

3.7.7. monitoring the functioning of the system life cycle management of basic production assets and SUBSIDIARIES;

3.7.8. forecasting production assets and manage the risks associated with the reliability of productive assets;

3.7.9. monitoring and control of execution of consolidated production of programmes and projects in operation, repair, modernization and reconstruction of hydropower facilities and installations of new RENEWABLE ENERGY society and SUBSIDIARIES;

management methodology of life cycle management of production assets:

3.7.10. formation and updating of existing standards for the life cycle management of production assets of existing HYDROELECTRIC POWER STATIONS;

3.7.11. developing, implementing and maintaining up-to-date enterprise lifecycle management instrumentation operating HYDROELECTRIC POWER production assets;

in part the operation of hydropower facilities:

3.7.13 Organization technical, technological, industrial, fire and environmental safety for hydropower company and SUBSIDIARIES (including construction), including by obtaining the relevant licences (permits, accreditations, etc.) to carry out activities or operation of relevant facilities, as well as through the conclusion of the respective contracts (including contracts of water use);

3.7.14. organisation of Chief engineers and operating units for hydropower company and SUBSIDIARIES. Operations management and modes of hydropower facilities of society. Managing the exploitation of HYDROELECTRIC POWER STATION;

3.7.15. the development and implementation of optimum regimes of water and electricity (power), the forming of information flow in parts of water and energy;

3.7.18. A technical audit of contractors and hydropower facilities and ASSOCIATED COMPANIES to comply with the requirements of technical and ecological safety of society and interaction on these issues with the oversight bodies.

There are signs of violations:

— p. 1 item 9 of the Federal Act No. 116-FZ July 21, 1997 "on the industrial safety of hazardous production facilities";

-Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";

-Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;

— p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799).

8.13. Timur Yusupov Maratovich

Work place-JSC "Rushydro".

The post is Deputy Head of the business unit "production of JSC rushydro, Director of operation of JSC" Rushydro ".

Education – Moscow Energy Institute.

Speciality-engineer-gidroèlektoènergetik.

Qualification – engineer.

Age was 48 years old.

When performing official duties, failed performance following appendices 6 order of JSC "Rushydro" is a job description for the Executive management of JSC "Rushydro"):

3.2.2.3. the formation of a unified technical policy in the field of operation of main and auxiliary equipment, buildings and structures, automation and control systems for power plants;

3.2.2.4. the system for monitoring and diagnosis of technical condition of productive assets and assets. Validation of data;

3.2.2.8. the enforcement of industrial, fire, environmental and safety at branches).

There are signs of violations:

— p. 1 item 9 of the Federal Act No. 116-FZ July 21, 1997 "on the industrial safety of hazardous production facilities";

-Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";

-Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;

— p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799).

8.14. Nikolay Dorofeev

Work place-JSC "Rushydro".

Post-head of Department of technical inspection of JSC "Rushydro".

Education – Moscow Energy Institute.

Speciality-engineer-electrician.

Qualification – engineer.

Age is 49 years old.

When performing official duties, failed execution the following paragraphs of the annex 20 to the order of JSC "Rushydro" from 31.12.2008 № 876:

2.1. methodological and operational guidance branch offices in charge of the protection of Society, safety and the environment (hereinafter referred to as Units);

2.2. coordination and control of the Organization and implementation of branches of society of preventive work to minimize occupational hazards and health personnel;

2.3. Organization of the work of labour protection in the Executive Office of the company;

2.4. the coordination and control of the Organization and functioning of the control systems for industrial and fire safety at branches of the society; 2.5. coordination and monitoring of activities to improve reliable and safe operation of equipment of hydropower, the prevention and elimination of emergency situations;

3.1.1. the policy of society in terms of occupational health and safety;

3.1.2. develops and implements occupational health and safety management system and industrial safety (&) and local standards (procedures) & in society;

3.1.4. Coordinates local normative documents (acts) affiliates related to occupational safety, industrial and fire safety;

3.1.8. Conducts monitoring of investigation of accidents, occupational diseases, disorders and fires followed by analysis investigation of the quality and adequacy of the activities;

3.1.11. prepares draft orders, instructions, operating instructions and circulars to ensure safety, fire and industrial safety society;

3.1.13. Makes an analytical review of the accident rate on the branches of the Society, accidents with staff and contractors over the month and organizes email newsletter addressed to the Board of Directors of branches for information, reflection and planning preventive activities;

3.1.17. performs operational and methodological management of the work of labour protection and industrial safety;

3.1.20. carry out unplanned audit of branches of society in order to verify the level of security, safety and maintenance of equipment;

3.1.23. conducts regular analysis of the effectiveness of measures to ensure the safe operation of hydraulic structures;

3.1.24. oversees the safety of hazardous production facilities in part of the performance of the functions of production control by the Department;

3.1.32. examines the consolidated production programs for actions needed to ensure the reliability and safety of hydraulic installations, regulated the requirements and regulations, regulatory authorities and the results of the technical audit;

3.1.37. develops occupational safety instructions for employees of the Executive Office. Arrange for the timely revision.

There are signs of violations:

— p. 1 item 9 of the Federal Act No. 116-FZ July 21, 1997 "on the industrial safety of hazardous production facilities";

-Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";

-Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;

— p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799).

8.15. Haziahmetov Timur Rasimovich

Work place-JSC "Rushydro".

Post-head of Department of operation and management modes of JSC "Rushydro".

Education – Moscow Energy Institute.

Speciality-engineer-power engineer.

Qualification – engineer.

Age is 33 years.

When performing official duties, failed execution the following paragraphs of the annex 26 to the order of JSC "Rushydro" from 31.12.2008 № 876:

2.1.4. the monitoring of the repair and maintenance of facilities;

2.1.5. Organization of works on planning for current and future activities on productive assets;

3.1.1.2. the monitoring of changes in the regulatory and normative and technical documents governing the operation of equipment and management, HYDRO/PUMPED-STORAGE POWER STATION operating modes, use of water resources. Monitoring compliance of internal normative documents requirements of the legislation and normative documents of State governing bodies;

3.1.2. management regimes work HES/PSPP:

3.1.2.3. the analysis and calculation of hydropower operation modes of the HPS/HPSS;

- 3.1.2.5. analysis and synthesis of results of the operation of power plants, identifying trends and taking steps to remove them;
- 3.1.2.7. implementing periodic supervision and general guidance for the operational and maintenance personnel of HPS/HPSS;
- 3.1.3.4. monitoring the attainment of the techno-economic performance HPS/PSPP. Analysis of causes occurring deviations. Preparation of relevant decisions by exception;
- 3.1.4.1. develop manuals and guidelines for testing equipment of HYDRO/PUMPED-STORAGE POWER STATION;
- 3.1.4.2. the synthesis and analysis of the survey of the State hydraulic works DAM/PUMPED-STORAGE POWER PLANT, buildings and structures, ensuring their safety and efficiency of use;
- 3.1.7.7. monitoring compliance with the standards of the administration of HYDRO/PUMPED-STORAGE POWER STATION).

There are signs of violations:

- p. 1 item 9 of the Federal Act No. 116-FZ July 21, 1997 "on the industrial safety of hazardous production facilities";
- Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;
- p. 1.1.7 Rules of technical operation of electric power stations and networks in the Russian Federation, approved by the Ministry of energy of Russia from 19.06.2003 No. 229 (registered in Ministry of Justice of Russia 20.06.2003 reg. No. 4799).

8.16. Klochkov Roman Viktorovich

Work place-JSC "Rushydro".

Post-head of Department of planning repairs, reconstruction and technical re-equipment of JSC "Rushydro".

Education – Moscow Energy Institute.

Speciality-engineer-electrician.

Qualification – engineer.

Age is 40 years.

When performing official duties, failed to compliance of the following paragraphs of annex 15 to the order of JSC "Rushydro" from 31.12.2008 № 876:

- 2.1.1. State management, equipment, buildings and structures;
- 2.1.2. generation and control of execution of the technical policy of the company;
- 2.1.3. management of large and of priority investment projects in part of technical re-equipment and reconstruction of equipment, buildings and structures;
- 2.1.6. the formation of the strategic management of industrial activity.
- 3.1.1.1. develop standards for assessing the State of equipment, buildings, constructions;
- 3.1.1.2. the process of gathering information about values of parameters status and analysis of the equipments, buildings, constructions;
- 3.1.1.3. the analysis of the equipments, buildings, constructions, and related risks;

The formation and control of the technical policy of the company:

- 3.1.2.2. review of the implementation of the technical policy and identifying the necessary changes;
- 3.1.2.3. analysis of existing and emerging technologies and the identification of promising technological development of productive assets, buildings and structures, the modification of the technical policy and making available to the participants in the processes of productive activity;
- 3.1.3.1. the control of the planning, implementation, commissioning (technical supervision) major and priority investment projects of technical re-equipment and reconstruction of equipment, buildings and structures of society;
- 3.1.3.3. harmonization of technical solutions for new construction, modernization and reconstruction of equipment, buildings, installations for compliance with requirements of the normative documents of the company;
- 3.1.4.1. development of standards, methodologies and guidelines for the techno-economic decision-making on impacts on equipment, buildings, constructions;
- 3.1.4.4. the Organization of interaction with business unit of "Engineering" in order for innovation, the analysis of the State of equipment, buildings, constructions;
- 3.1.5.3. formation and development of methodologies for assessing financial viability of investment projects in part of technical re-equipment and reconstruction.

There are signs of violations:

- p. 1 item 9 of the Federal Act No. 116-FZ July 21, 1997 "on the industrial safety of hazardous production facilities";
- Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety of hazardous production facilities";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations".

8.17. Tološinov Alexander Valentinovich

Place of work is a member of the Board of JSC "Rushydro", Managing Director, head of the Division "Siberia" (2002-2006, the CEO of Sayano-Shushenskaya GES. P. S. Neporožnego ").

Education – higher professional. Hydro engineering faculty of the Leningrad Polytechnic Institute.

Qualification – engineer-hydraulic engineer.

Age was 52 years.

While CEO of Sayano-Shushenskaya GES. P. S. Neporožnego»:

- participated in the implementation of decisions on maintenance staff from staffing companies failing to comply with requirements for regular monitoring of technical condition of main equipment of SŠGÈS;

-knowing about the real state of operated on SŠGÈS equipment (including hydro) has not created the conditions for the adoption of effective measures of JSC "Rushydro" on safe operation of SŠGÈS.

There are signs of violations:

- Article 14 December 21, 1994 federal law No. 68-FZ on protection of population and territories against emergency situations of natural and technogenic character;
- p. 1 item 9 of the Federal Act No. 116-FZ of July 21, 1997 "on the industrial safety";
- Article 10 of the Federal law of July 21, 1997 No. 116-FZ "on the industrial safety";
- Article 9 of the Federal Act of July 21, 1997 No. 117-FZ "on safety of hydraulic installations;

8.18. Anatoly Nikolayevich Konovalov.

Place of federal service for ecological, technological and Atomic supervision.

The post is Deputy Head of Rostekhnadzor MTU on the Siberian Federal District (04.07.2008).

Education – higher professional, Novosibirsk electro-technical Institute

Specialty-electrical systems.

Qualification – engineer-electrician.

Age 56 Preferring experience — 3 years.

When performing official duties and serving as Chairman of the Commission (order No. -354 from 10.06.2008, supplemented by order No. -374 of 20.06.2008, MTU Rostekhnadzor to SFI) planned a comprehensive verification of the requirements of the legislation on industrial and environmental safety, the Organization of the work of the Organization, technical conditions of production facilities, compliance with safety requirements when operating the plants branch of OJSC "Federal company" — "gidrogenerirušaâ Sayano-Shushenskaya GES p. s. Neporožnego»not provided a proper study of the State of SŠGÈS, technical and organizational reasons regular repairs of equipment and general technical conditions affecting the safety of hazardous production facilities listed on SŠGÈS.

There are signs of violations:

- July 21, 1997 by federal law No. 116-FZ "on the industrial safety of hazardous production facilities";
- July 21, 1997 by federal law No. 117-FZ "on safety of hydraulic installations;
- The provisions of the Federal service for ecological, technological and Atomic supervision "approved by the Decree of the Government of the Russian Federation on 30.07.2004 No. — 401.

8.19. Baklickij Leonid Vladimirovich

Place of federal service for ecological, technological and Atomic supervision.

Position: head of Rostekhnadzor MTU for the Siberian Federal District (04.07.2008).

Education – higher, Krasnoyarsk School of radio air defence military command Academy of AIR DEFENSE

Specialty – radio, radar device

Age: 56

Work experience in year 3-Preferring.

Baklickij I. v., as head of the Regional territorial management of technological and environmental supervision of the Federal service for ecological, technological and Atomic supervision of the Siberian Federal District, signed an order from 10.06.2008, no. 354pr "on the control (inspection) (with additions by the order from 10.06.2008, no. 374pr). On the basis of the order was held complex event monitoring (checking) in respect of the branch of OJSC hydroogk "Sayano-Shushenskaya GES p. s. Neporožnego. In accordance with clause 9 of the interregional territorial management of technological and environmental supervision of the Federal service for ecological, technological and Atomic supervision of the Siberian Federal District approved by Rostekhnadzor from April 18, 2006 no. 344, head of the regional territorial management is personally responsible for the implementation of the management authority.

Thus, the responsibility for improper conduct verification of branch of OJSC hydroogk "Sayano-Shushenskaya GES p. s. Neporožnego» falls on Baklickogo I. v., as head of the regional territorial management of Rostekhnadzor.

9. the economic damage from the accident at 25.09.2009^[2]

Economic damage according to SŠGÈS:

Losses arising from damage to assets, according to preliminary estimates represent about 7 billion rubles. (including partially damaged powerhouse, transformers ORNC-533000/500-74U1 3-f. T1, synchronous generators — OFFICERS CFO/275-1285 42UHL4, hydraulic turbines vertical RO-230/13-833-677, suppressors ОПН-500, etc.)

Cost containment, elimination of the causes of the accident at 05.09.2009 constitute 192.51 million rubles (letter No. 102/1998 Rushydro from 07.09.2009:

Materials, spare parts, equipment-42.76 million rubles;

Transport services (including flights) is 44.68 million rubles;

The collection of oily waste was 70.10 million rubles;

Other services-25.83 million rubles;

Other costs-9.13 million rubles;

Cost of Russian Ministry of emergency rescue and disaster relief workers amounted to 83.2 million rubles. (letter No. 43-3503-8

from 17/09/2009).

Environmental damage is estimated at 63.1336 million rubles. ^[3]

Nedootpusk electricity for 2009, -8897.99 million kW. hour.

Nedovyrabotka electricity for 2009, -8950 million kW. hour.

The final damage can be refined on the basis of reconstruction, compensation for damage to third parties and other reasonable grounds.

Notes

1. ^ " The list of destruction formed based on Visual inspections and defektacionnyh statements.
2. ↑ Defined in section is tentative and presented to the Commission by the organizations concerned
3. ↑ According to Republic of Khakassia rosprirodnadzor. Calculus brought harm was done on the basis of the order of the Ministry of natural resources of Russia from April 13, 2009 No. 87.

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