

of the Gas Industry) with a proposal to sternly reprimand the managers of the gas industry in the oblast.

At present, the fourth unit of the gas treatment plant is under construction. Our firm position is that production over there has got to be ecologically clean. If there is no consent by the oblast committee for environmental protection, there will be no favorable decision by the oblast executive committee.

ELECTRIC POWER GENERATION

Sentenced Chernobyl AES Director Bryukhanov Interviewed

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[Interview with V.P. Bryukhanov, former director, Chernobyl AES, now a prisoner, by Ye. Kolesnikova, special correspondent: "Bryukhanov's Version"]

[Text] This is not the confession of a convicted man, nor is it a justification. These are the views of the former director of the Chernobyl AES on the events preceding the catastrophe.

On a sweltering July night, I eagerly read the article "Chernobyl Notebook," published in NOVYY MIR. Not understanding much about the design of reactors and complicated technology, I paid more attention to the behavior of people in the center of the tragedy. I was struck by how harshly and ruthlessly the author judged both those who could object and refute them and those who no longer had that possibility. Later, I will learn that many exonerated heroes of "Chernobyl Notebooks" just scowl as they read these writings by a specialist. It is agreed to write a collective letter to the journal, but, after thinking it over, I did not go along with it. All this will be later.

Then, in July, I went to the Administration of Correctional Affairs with a request to examine the evidence concerning Bryukhanov, the convicted former director of the Chernobyl AES. I wanted to talk with him about many things. About the reasons for the accident, about people with whom fate dealt with such sternness. On the eve of my departure to the penal colony, I received a telex: "Bryukhanov has refused to meet with journalists." However, I went anyway.

The sun is breaking through the blinds, it is warm beyond the window; two convicts, brown from sunburn, are strolling about in colorful trunks. I am sitting with Bryukhanov in the office of the colony director. Viktor Petrovich smokes and tersely discusses his daily life. I have already learned that he is a steamfitter in the zone, maintaining the pipes and pumps. He has an excellent knowledge of his job and is respected. The council of the colony collective elected him as its representative. Short, thin, with cropped hair, wearing a shirt with "Bryukhanov, V., Brigade No 122" sewn onto its back, he in no way looks like a broken, despairing person. For 3 years

he has been studying English; however there is no one with whom to talk, as he has made no friends in the area. Who here knows foreign languages? He reads newspapers and journals and sometimes watches television. So far not one day has passed when he does not think about Chernobyl.

After graduation from the Tashkent Polytechnic Institute, Bryukhanov went to work at the Angrenskaya GRES. The equipment there was obsolete, but qualitatively new equipment was arriving in the Ukraine. Like any specialist interested in his work, Bryukhanov wanted to work with it. He sent a short resume to the Slavyanskaya GRES and soon received a job offer. True, he was accepted for a low ranking position, senior foreman. After the startup of the first, and largest block, he was named deputy chief engineer. In 1970 Bryukhanov received an offer to work on the Chernobyl AES.

Bryukhanov: At that time there was no sign of the station. There was no city of Pripyat; there were no specialists. At the construction site, there was only a forest and the sky overhead. For some reason I was not afraid, I was confident I could handle it. Could I really conceive what this AES, under construction, would be? The minister and his retinue arrived by helicopter and pounded in a marker stake. I walked along and thought: "Here, in my briefcase, is the future station..." Soon a temporary settlement was built. My family joined me. The barracks was disassembled and a school built from the lumber. My daughter Lilya and my son Oleg went there.

It was not only necessary to build the AES, start up the blocks and "knock out" the equipment for the next ones, but also to construct housing and kindergartens, supply the city with produce, repair utilities, replace the deteriorated water lines, maintain the swimming pools, of which Pripyat had four; and hire key personnel. Need I go on? Before I had filled even a single page of my notebook, Viktor Petrovich had roughly outlined the obligations of an AES director. Incidentally, Bryukhanov was one of the first directors in the sector when it was agreed to make the transition from construction to operation. The others, overburdened with concerns, refused.

Bryukhanov: For example, the gorispolkom phoned and said that the city heating system was rusted out. The time had come to replace it. This meant that I had to find a couple of million somewhere, deceive the bank; otherwise, the money allocated to the station would not be transferred to the city. I had to sign a contract with installation workers. After one assignment was completed there was another one. A hothouse had to be built and the city supplied with tomatoes. Honestly, I never understood the tomato situation, but a short time later I began to distinguish the varieties and mastered hydroponics.

A haydryer was also built. However, when it came to consumer goods, I seized my head in both hands. An order was issued—every enterprise, including the AES, had to produce something for the public. Apparently, this did not

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mean electricity. At practically every plenum and party meeting they started trying to persuade me that there was no way the Chernobyl AES could produce these goods. What could it produce? As a joke, somebody suggested making a nuclear-powered meat cutter. They laughed and adjourned but I could not sleep at night. Colleagues at other power plants were already producing. I saw souvenirs from the Beloyarskaya AES. Budennovskiy's troyka was rushing across the steppe. The scene, the rider and the horse were accurately depicted on an aluminum plate. And it was cheap. But who needs all this?

I understand that it is doubtful as to whether one can directly link the safety of the AES with the management concerns that Bryukhanov now indignantly recalls. However, all those tomatoes, haydryers and souvenirs took more than just effort. They created a unique psychological climate where a worker might forget that he is a nuclear worker and that his work has the potential to inflict colossal damage on human health. The personnel and the director understood the absurdity of such requests. Moreover, it was impossible to carry them out without violating instructions and financial discipline. Thus, neglect of some trifling instructions gradually carried over to the neglect of others which had to be implemented automatically.

Bryukhanov: Of course, I could stamp my feet and announce "This is enough; a nuclear power plant is not a crafts cooperative. We will do only what we are supposed to—generate energy." What would that have led to? I would have been released and transferred to another position, with less pay. However, the matter does not involve personal ambitions. Instead of me, Bryukhanov, all this would have to be done by the next manager. It is beyond the strength of one person to break a decades-old system of economic and management decisions. He cannot be blamed for finally becoming a slave to this system.

The former director has an excellent memory. He remembers many figures, from the technical data of any unit to the length of water pipe in Pripyat. His main recollections are that something was always in short supply and how he had to requisition, negotiate and eliminate things, not only for the city, but for the AES itself.

Bryukhanov: The ministry issued an order saying that for fire safety purposes the roof of the turbine building had to be replaced. However, the order did not say a word about where we could get enough roofing to cover a building a kilometer long and 500 meters wide. Forget about the roof. We contrived and got one that was not such a fire danger. Cables were another matter. There is a clearly worded ruling that cables used in a nuclear power plant must have a fireproof sheath. There is a ruling, but no cable. In despair of finding such cable, I began to gather documents to get a waiver to keep the cable we had because we couldn't find any other. This was granted. However, everybody understood that this meant a serious fire danger.

Bryukhanov remembers other episodes, ordinary to him, but they chilled my spine. I suddenly realized that in spite of the stereotypes that have been with it since its childhood, nuclear power engineering has the same disorder as in any other sector. Even though it has special dangers, there are no exceptions here: low quality designs, suppliers do not meet deadlines, subcontractors do not send the right equipment; pressured by circumstances, operators violate instructions; while the AES director, supposedly the master's steward, takes care of everything, from finances to hay. And everybody is certain that the AES is safe! Repair work on the fourth block began on 25 April. Stopping the reactor, they decided to run an experiment. However that day there was a disruption in the energy system. The dispatcher, guessing that the fourth block could not operate without energy, asked to delay the experiment for a day. Reactor capacity had already been reduced...

Bryukhanov: The telephone rang late at night. Yu. Semenoy, head of the chemical shop, quickly reported: "Something terrible has happened at the power plant, an explosion of some kind."

Arriving at the spot, I blamed the piping. Did it really break?! Why didn't they notice it in time? But when I saw that the upper part of the fourth block was completely gone, my heart stopped. I gathered the staff, talked with people and phoned Moscow. That same night I suggested evacuating people, but nobody agreed with this. It had been so firmly driven into their consciousness that nothing could happen to a reactor that it was easier not to believe their eyes than to believe something had. I still remember how I kicked the graphite block and cursed with all my heart: "To hell with the channels!" The most horrible thing that could happen at that moment was for 1 or 2 channels out of 2,000 to rupture. This would mean that the reactor could not be stopped without water, and that it would rock along into a condition which no reactor had ever been before.

It is probably not worth it to once again return to the events of that tragic April night, the more so because now they have been reconstructed down to the second. I had another goal. I wanted to dispel the rumour that has been rampant ever since that Bryukhanov ran in a panic out of the power plant and was opposed to evacuation. He was constantly in communication with Moscow and was one of the few capable of objectively reporting the situation.

Viktor Petrovich considered the accident to be a monstrous confluence of circumstances possible once in 1,000 years. In spite of five very serious mistakes by personnel and design shortcomings in the reactor, he is convinced that the accident could have been avoided. But here is the paradox. He is not certain that events similar to Chernobyl will not repeat themselves. I am aware of the indignation that Bryukhanov's version may arouse. However, I am convinced that this man was not guided by emotion, but by experience, sad experience.

A year ago, N. Lukonin, the former minister of Atomic Power, attested that now, if the personnel at any energy block made the same set of mistakes as at Chernobyl an accident would not occur. Many shortcomings have been eliminated. His position is shared by V. Malyshev, chairman of USSR Gosatomnadzor [State Committee for Safety in the Atomic Power Industry]. Water-graphite RBMK [High-Power pressure-tube reactors] had design shortcomings making it possible for them to get out of control. These have been eliminated. By changing the neutron-physical characteristics of these reactors, designers have attained a more favorable ratio between uranium and graphite. Additional stationary moderators have been installed on all such reactors in the country. It is technically impossible to remove them from the active zone. It takes more than an hour to remove one. Shielding control has been modernized. The moderator rods can be loaded in 12 seconds rather than 18. A system to load them in 2 seconds has been developed. Such shielding is protection from the most improbable situation. In V. Malyshev's opinion all this substantially improves the reliability of AES operation and, through technical measures, eliminates the possibility of repeating the Chernobyl accident.

Viktor Petrovich read about this; what is it that frightens him?

Bryukhanov: The attitude towards nuclear power. In order to avoid general judgements, I will give specific examples. Take design quality. If installation workers assemble a nuclear power plant precisely according to the design, even the pipes will not connect. The fire inspectors will never approve such a project. It does not include elementary provisions—there are no ventilation units for extinguishing cable fires. Of course, builders eliminate designers' shortcomings in a hurry. This is because practically all deadlines for starting up the block and other units are unrealistic. I myself have seen the "ceiling" from which they pick deadlines.

After the accident, when it became clear that the reactor was destroyed, A. Mayorets, minister of power and electrification at that time, ordered us to make a schedule for rebuilding the fourth power block. He assured the governmental commission that by the fall or winter not only the fourth, but the fifth would start up! Naturally none started. Then what? Was there an emergency? No. Perhaps somebody was punished for deadlines picked off the ceiling. I don't recall.

Furthermore, Chernobyl AES personnel were censured repeatedly after the catastrophe. Before it, however, no special complaints were made. Reviews were more than sufficient and comments were acted upon. However, not a single such analysis was made with regard to any emergency situation. At other nuclear power plants there have been instances when the number of rods was less than critical and not a single scientist or manager in the sector was alarmed. On the contrary, the institute psychologically lulled people, saying the reactor was as reliable as a safe. Where did personnel learn their working habits? We

began constructing a training center at the Chernobyl AES. We were able to buy only computers; then came the accident.

In looking over my criminal case, I stumbled across an interesting document. Long before the accident, Volkov, a scientist from the Atomic Power Institute imeni I. V. Kurchatov, directed the attention of Academician A. Aleksandrov to shortcomings in RBMK reactors. He suggested changing the design of the fuel elements. He was not the only one. Nobody was startled. Where is the guarantee that requirements have been strengthened not only in words but in deeds? A small item: Nuclear reactors are still fitted out with low quality equipment even though everything should be intended exclusively for them.

Bryukhanov was sentenced to 10 years. Once he has served his term he hopes to again return to an AES, if possible to Chernobyl. During the accident Viktor Petrovich was exposed to radiation, but that did not stop him. At night he dreams about Pripyat. When asked if he considers himself guilty, his answer is strikingly calm: "Yes, I think so, but not to the same extent as the court decided. Everything cannot be pinned on one person; there were some who were directly guilty and some indirectly." He added: "There is one reason I do not want to meet with journalists—people will think that I am trying to justify myself."

I was told that after the sentencing the presiding judge was impressed by the dignity and restraint with which Bryukhanov had conducted himself. It is obviously no accident that the Chernobyl AES collective gathered 50 signatures on a petition for clemency. I do not know the feelings of his former coworkers, but the severity of the sentence was greeted with disbelief by others.

"I think that even if Bryukhanov had not been at the accident, the court's decision would have been the same," says G. Kopchinskiy, head of the Atomic Energy Department at the USSR Council of Ministers Bureau for the Fuel and Energy Complex. They did not judge a man, but a position. Bryukhanov suffered for the numerous mistakes made by personnel and for design shortcomings in the reactor, even though he might not be the only one guilty for these. In my view, one of the main reasons for the accident was blind faith in the safety of nuclear power. However, the people who for years have been instilling this belief did not sit on the defendant's bench with Bryukhanov.

In the case it was written: "...the main reasons for the accident were gross violations of rules to assure nuclear safety during operations in which there was potential for an explosion." However, at that time what operations at a nuclear power plant were considered to have a danger of explosion? This is not mentioned in a single document.

"I remember well," continued Georgiy Alekseyevich, "what Bryukhanov was doing and what he was responsible for. Yes, the testing program was badly put together, but the chief engineer was responsible for that.

At that time we had still not worked out specific lines of responsibility,—who among the management was responsible for what at that large enterprise. When there is an accident, the top official is blamed for everything. The director is transformed into a slave of circumstances.”

I recall: Today there are 45 energy blocks in operation in our country and 11 AESes are under construction. Nuclear power engineering continues to develop. Let us judge ourselves more strictly now, so as not to have to judge anybody later.

Poor Condition of Municipal Heating Systems Criticized

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[Article by A. Skvortsov, candidate of technical sciences:
“Winter is Demanding—An Emergency Situation”]

[Text] Urban centralized heat supply requires the construction of a widespread network of underground pipes—heat networks or heat lines, as they are called in the newspapers. The capital investments for their installation are very great. What is more, because of their low technical standards and obsolete equipment, heat lines are the weakest link in our cities' heat supply. It must be admitted that their structural, mechanical and insulation components are insufficiently reliable and do not meet modern requirements.

In spite of the annual campaigns to prepare cities for winter, the breakdowns in heat supply and excess consumption of fuel and thermal energy are not only not declining, but, on the contrary, are increasing each year.

Inspections in Moscow revealed about 2,000 emergencies, but pipes continued to break throughout the entire heating season. Pedestrians, and in Gorky even a bus, fell into hollowed out areas under the asphalt filled with boiling water and have been burned.

In Leningrad entire sections of the city have repeatedly been left without hot water and heat. Every year here there are about 4,000 breaks in main lines.

On Leninskiy Prospekt in Moscow, boiling water and steam escaping from a large diameter heat pipe completely paralyzed street traffic around Oktyabrskaya Ploshchad. Several bystanders were burned and had to be sent to the First Aid Institute. This accident left 135 buildings without hot water supply.

In October 1988 there was a large accident involving the main heat pipes in the city of Yuzhno-Sakhalinsk, completely halting heat supply to this city of 200,000.

Who is responsible for these losses? It is not so easy to answer this question. Many organizations in various ministries and agencies are engaged in the design, construction and operation of heat supply networks. Some of them do not have enough experience or qualified staff.

Problems in urban heat supply are under the jurisdiction of the USSR Ministry of Power and Electrification, USSR Gosstroy and the RSFSR Minzhilkomkhov [Ministry of Housing and Municipal Services]. However, not one of these agencies considers itself responsible for the technical condition of urban heat networks or for their design and construction. As a result, for many years no use has been made of expensive new, more improved equipment and insulation developed at laboratories of scientific research organizations in these agencies and of patented inventions.

These are the facts. For example, technical documentation for the manufacture of a series of improved designs for non-channel heat pipes has faded and is uselessly gathering dust on archive shelves.

Accidents caused by the corrosion of pipe and the huge nonproductive losses of thermal energy spent heating the surrounding ground have two primary causes: the lack of reliable anticorrosion protective coatings and the use of unsuitable insulation materials when pipes are laid in moist soils (and most are).

Only technical backwardness and conservative design practices can explain the continuing use in underground networks of materials subject to very wet conditions. There still are practically no hydro-insulation materials protecting warm pipes from moisture. As a result, pipe corrosion is intensified and heat losses are increased several fold.

Another example of technical backwardness in heat networks is the extensive use of compensator packing to compensate for thermal expansion. Such packing was designed back at the end of the last century. Because of the elimination of periodic hot water venting, these compensators require constant observation and servicing.

Service personnel (pipefitters and inspectors) have to work in extremely difficult conditions, with high air temperatures in close quarters (underground chambers) filled with steam and hot water. One can imagine the difficult manual labor involved in servicing.

Decades have passed since numerous scientific-technical conferences and symposia made decisions about central heat supply for cities and the need for the industrial production of improved equipment for heat lines—compensators, small valves (ventilators), steel pipe with temperature resistant anticorrosion coating. Bring them in right now!

Construction-installation organizations are still using pipe without protective coating. This is why in large cities—Moscow, Leningrad, Novosibirsk and others—it is necessary to replace 2-3 percent of the heat network annually. On the average, urban central heat supply systems annually use about 100,000 tons of metal for this purpose.