PARTICIPATION OF THE PWI SPECIALISTS IN THE CLEANUP OF THE CONSEQUENCES OF THE CHORNOBYL NPP ACCIDENT

The Chornobyl Nuclear Power Plant after the accident

Forty years ago, on 26 April 1986, one of the largest man-made disasters in the history of humankind occurred — the accident at the Chornobyl Nuclear Power Plant. The explosion at the Chornobyl NPP is ranked among the highest-level accidents at nuclear facilities. By the nature of the destruction processes of Power Unit 4 and by the scale of its consequences, the accident has been classified as Level 7 (a major accident) on the International Nuclear Event Scale.

In the entire history of nuclear power, this catastrophe became the largest both in terms of the number of victims and people affected by its consequences as well as in terms of the economic damage.

More than 500,000 people took part in the cleanup of the consequences of this unprecedented man-made catastrophe, among them employees of the PWI headed by Academician B.E. Paton; and the Institute's scientific and technical achievements in welding production substantially assisted in eliminating the dreadful consequences of this disaster.

On 26 April, a Government Commission for the investigation of the causes of the accident was established, headed by the Deputy Chairman of the Council of Ministers of the USSR, B.E. Shcherbyna. In addition to ascertaining the causes of the explosion, the commission was to determine the scale of the catastrophe, to develop and implement measures for limiting it and eliminating its consequences, to protect public health, and to provide comprehensive assistance to the population.

As early as 28 April, Academician B.E. Paton issued an order to establish a commission of the Academy of Sciences of the Ukrainian SSR. The task force was formally approved on 3 May 1986. However, its first meeting was held on 29 April at the Institute for Nuclear Research, and in the period up to 30 May a total of 27 meetings were held under the chairmanship of B.E. Paton. Forty-two institutes of the Academy of Sciences were involved in the cleanup of the catastrophe's consequences.

The main efforts were directed at reducing the radioactive emissions from the destroyed reactor and at preventing more serious consequences. Already on the third day after the accident, V.O. Troitsky, head of the Institute's Department of NDT of Welded Joint Quality, began conducting classes on radiation hygiene. Portable dosimeters were manufactured in the department.

On 20 May 1986, L.O. Volhin, director of the Special Design and Technology Bureau "Explosion Materials Processing", and V.M. Korzh, deputy dean of the Welding Faculty of the Kyiv Polytechnic Institute, traveled to Chornobyl. They determined the need for, and the capabilities of, welding and allied technologies in the cleanup of the accident's consequences. The technical proposals were submitted to the Government Commission.

At the end of May 1986, the Commission for the Cleanup of the Consequences of the Chornobyl NPP Accident under the Council of Ministers of the USSR adopted a decision on the urgent construction of a water conduit from the Desna River to Kyiv, since the Dnipro water was by then already contaminated with radionuclides. Employees of the Institute took part in the construction of the Desna–Kyiv water conduit. At the beginning of June, the "Styk" complex was delivered to the area between the Dnipro and Desna rivers. A group of specialists from the Department of Physicochemical Processes in the Welding Arc was dispatched to the construction site: V.M. Shlepakov (group leader), A.M. Kutovyi (responsible for the equipment), Yu.O. Havryliuk (responsible for the technology), S.P. Hiiuk (welding instructor), and V.O. Lysenko (dosimetrist-electrician). The earthmoving works, carried out by bulldozers and excavators, and the assembly-and-welding works, carried out by a pipelayer and the "Styk" complex, in essence constituted a single technological cycle and were performed on

a rotational (shift) basis during daylight hours. In 14 days, the water conduit was welded and connected to the Dnipro water-supply network of Kyiv via an underwater inverted-siphon conduit (dyuker).

To pump out groundwater from beneath Power Unit 4, a drainage pipeline had to be laid. The "Pivnich-1" pipe-welding complex was delivered to Chornobyl. In August, to assist the special installation-and-commissioning department "HolovUprNaftoHazBud", employees of the Department of Butt Welding and the Engineering Center for Pressure Welding were dispatched: leading engineer B.F. Pylypenko, group leader O.I. Tymofieiev, and senior engineer O.V. Martynenko. By 10 September, 212 pipe butt welds with a diameter of 1420 mm had been completed.

Automatic arc welding of fixed (positioned) joints of large-diameter pipes with forced weld formation was also performed by two "Styk" complexes. With the participation of the Institute's specialists, about 10 km of pipeline was welded.

In October 1986, a group of the Institute's employees — comprising V.O. Troitsky, Yu.M. Hotalsky, V.S. Hrom, and Yu.K. Bondarenko — traveled to Power Unit 2 of the Chornobyl NPP, which had been urgently shut down because of a defect in the cooling system of the coolant circuit. The difficulty of the task (besides the proximity to the epicenter of the accident) lay in the fact that the leak had been detected in a section of bent pipe with a wall thickness of 60 mm. The work was carried out jointly with the specialists of the Station. The entire set of operations — namely, the detection of defects by non-destructive testing methods, their identification, the assignment of the repair technological process, the welding works, and the final quality control — was performed promptly, within a few days.

In November 1986, the Institute's employees B.S. Kasatkin and Yu.M. Hotalsky, together with S.S. Roitenberg, chief welder of the "PivdenTeploEnerhoMontazh" trust, organized the repair of elements of the coolant-circuit pipelines at the Chornobyl NPP.

Various works were also carried out on the territory adjacent to the Chornobyl NPP, as well as beyond it.

It was necessary to urgently build the "Shelter" object (the Sarcophagus) — an enclosure over the reactor that had exploded. For the fastest possible delivery of construction materials and machinery, a motor-road bridge across the Prypiat River was required. The design work began in September. The construction was carried out by Bridge Detachment No. 12 (Dnipropetrovsk). The scientific, design, and technological support, as well as the supervision, were provided by "KyivSoyuzDorProekt" and the PWI. The structural steelwork was manufactured at the Dnipropetrovsk Plant of Steel Structures named after I.V. Babushkin. The Institute's employees S.I. Solovianenko, L.F. Bohdanovska, and A.O. Mankovsky worked at the plant — they took part in developing the manufacturing technology and exercised designer's supervision over the assembly and welding operations of the steel structures. Department head V.O. Kovtunenko provided technological support for the installation works directly at the bridge construction site. The work followed a just-in-time approach — structures manufactured at the plant were immediately transported to the construction site. In March 1987, the bridge was accepted by a commission.

V.O. Kovtunenko was invited as a consultant for the "Shelter" project. Scientific and engineering support for the manufacture of structures at the plant was also provided by the Institute's employees. All of this work was carried out in May–June 1986.

V.O. Kovtunenko and his team ensured the construction of a railway-car decontamination point 7 km from the Chornobyl NPP. The floor, with an area of about 2000 m², had to be hermetic in order to prevent radioactive runoff from entering the ground. It was decided to make the floor of all-welded metal, joining the steel sheets together by automatic welding on site — at the object itself. Loss of flatness was not permitted. In this connection, the Institute urgently developed a technology of automatic submerged-arc welding with the use of concurrent (accompanying) heating, which compensates for welding deformations. V.P. Morhun developed a method of gradient heating. Technological support was provided — with direct personal participation in the welding works at the object itself — by S.I. Solovianenko, A.O. Mankovsky, process engineer A.A. Petruchenko, and welders A.P. Pintov and Yu.E. Vakulovsky. The work began in September 1987 and was completed in July 1988.

When laying the water-cooling pipeline beneath the reactor of Power Unit 4, the fixed (positioned) joints of pipes with a diameter of 32–109 mm and a wall thickness of 7 mm were made by argon-arc orbital welding with a non-consumable electrode, using an activating flux developed in the Department of Physicomechani-

B.E. Paton during the cleanup of the Chornobyl NPP accident

Welding technologies of the PWI in the manufacture of equipment for nuclear power plants

cal Processes of Welding of Medium-Alloyed High-Strength Steels by M.M. Savytsky. In the town of Prypiat, department employee H.M. Melnychuk, over the course of three days in May 1987, trained the specialists of the "Spetsatom" Scientific and Production Association in working with the equipment. The operators came out to the welding site in special suits that provided protection from radiation.

In December 1986, L.O. Volhin, together with the Bureau's blasting specialists P.V. Zahorovsky and P.A. Zvarych, removed from the roof of Power Unit 3 of the Chornobyl NPP 150 m of fire-water conduit with a diameter of 108 mm, the structures of hydraulic monitors, and 70 m of fencing. The structures were cut using devices based on elongated shaped (cumulative) charges that were controlled remotely. The maximum time the personnel spent installing the devices for explosive cutting on the roof of the power unit did not exceed 1.5 min. The use of the explosive technology made it possible to carry out the cutting of the metal structures within tight deadlines, thereby reducing the duration of a person's stay in a zone with a high level of radiation.

From 22 to 26 January 1987, Yu.P. Bushtedt, deputy director of the Special Design and Technology Bureau, worked in Chornobyl. He studied the situation and drew up a schedule of works for the explosive disposal of radioactively contaminated machinery. From 18 March to 3 April, the Bureau's chief engineer V.K. Derevytsky, senior engineer M.P. Kolesnyk, and blasting specialist V.A. Kushnirov carried out this plan.

To develop proposals for the dismantling of the building structures of Power Units 5 and 6 of the NPP by the explosive method, in June–November 1987 O.P. Malakovych, head of the Bureau's technical department, and A.Ya. Koroteiev, deputy director, worked on assignment in Chornobyl.

The Institute's work on organizing the industrial manufacture of special compressed-air cylinders — a component of an individual life-support system — can also be counted among the measures for the cleanup of the consequences of the Chornobyl NPP accident. Two MPU-4 units were delivered to the "Khimmash" plant in the town of Korosten, and employees of the Department of Microplasma Welding also arrived there: process engineers A.S. Svetsynsky and Ye.M. Husiev, and electrician D.I. Yakushev. Within tight deadlines, 150 cylinders were manufactured.

Thus, it should be noted that during the cleanup of the consequences of the Chornobyl NPP accident, the powerful scientific and technical potential of the E.O. Paton Electric Welding Institute was brought to bear — the knowledge and experience of its employees, innovative technologies, equipment, and welding consumables.

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