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Chernobyl: A Reassessment

David R. Marples¹

Abstract: A Canadian specialist on Ukraine and the historic accident at the Chernobyl nuclear power station provides a reassessment of the disaster on the basis of recently declassified documents of the Ukrainian KGB. The new information makes it possible in several instances to clarify details surrounding the accident and its aftermath. It also adds support to the argument that problems with equipment, operating procedures, and the safety regime at Chernobyl were far from isolated occurrences, but rather were endemic, as manifest in a serious September 1982 accident at the plant that was concealed from the world by Soviet authorities. *Journal of Economic Literature*, Classification Numbers: I18, J28, L94, O18. 2 figures, 56 references. Key words: nuclear power, Chernobyl¹, Ukraine.

INTRODUCTION

This paper returns to a topic that has virtually disappeared from international discussion outside scientific circles: the Chernobyl disaster of 1986.² It forms part of a new study that attempts a reassessment of the events at Chernobyl as we approach the 20th anniversary. That anniversary will come four years after the closure of the station by the Ukrainian authorities, but also at a time when nuclear power still forms an important component of the Ukrainian energy program. One reason for a new investigation is the release of over 120 primary documents by the Ukrainian branch of the KGB.³ These documents serve several useful purposes: they allow the observer to differentiate between supposition and fact in several instances, corroborating events that earlier were based—at least in part—on speculation. They also permit one to perceive at first hand the workings of the Soviet structure, and specifically the relationship between the KGB and the government commission appointed to

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²Widely varying accounts of the ultimate impacts of the accident are impossible to verify conclusively. According to a summary published in the Russian daily *Izvestiya* on the day of the plant's closure (FYI, 2000), the accident at the No. 4 reactor of the Chernobyl nuclear power station on April 26, 1986 released 50 million curies of radiation into the atmosphere (equivalent to the explosion of 500 atomic bombs similar to those dropped on Hiroshima and Nagasaki), contaminating an area of 150,000 km² populated by 6.9 million people. The summary attributes over 300,000 deaths to radiation exposure from the accident, although mortality levels are among the most widely contested statistics related to the accident. The accident set back the development of the nuclear power industry in the former USSR, and the inability of authorities to conceal it from the outside world is believed to have contributed to the advent of *glasnost* pursued subsequently by CPSU General Secretary Mikhail Gorbachev (e.g., see Panel, 1986, pp. 125-129). For an assessment of impacts focused on Ukraine and Belarus at 10 years after the accident, see Marples (1997)—*Ed., EGE*.

³The documents, in Russian with Ukrainian titles, are now available in a compilation entitled *The Secrets of Chernobyl Disaster* (2003).

deal with Chernobyl. But perhaps above all, the newly released materials provide a much clearer and more composite picture of the flaws of the Soviet nuclear power industry and the way these defects were concealed from the public by official images of the operation of nuclear power. This paper selectively cites only the most relevant documents in the compendium in the interests of conserving space.

The Chernobyl accident has been the subject of numerous accounts of varying quality since its occurrence. A partial listing of monograph-length publications includes official reports conducted on behalf of the International Atomic Energy (IAEA, 1991, 1997) and World Health Organization (WHO, 1995); Soviet and post-Soviet accounts (Shcherbak, 1989; Sklyarov, 1991; G. Medvedev, 1993; Vorona, 1996; Alekseevich, 1998; Poyarkov, 2000); and Western monographs that encompass scientific, social, political, and economic issues (Marples, 1986, 1988; Z. Medvedev, 1990, Josephson, 1999, Mould, 2000, Petryna, 2003). The post-accident situation had several notable highlights: the report of the Soviet delegation to the IAEA in August 1986; the trial of the station's director, chief engineer, and other officials in the summer of 1987; the revelations about the extent of the contaminated area in *Pravda* and other newspapers in the spring of 1989; the collapse of the Soviet Union, which saw control over the nuclear power station and the contaminated zones devolve to independent Ukraine (and Belarus in the case of the affected areas); the moratorium on the commissioning of new nuclear power stations by Ukraine in 1990; and not least the official closure of the Chernobyl station by Ukrainian president Leonid Kuchma on December 15, 2000, after considerable international pressure (e.g., see Wines, 2000; Lashkina, 2001). The accident today is not a focus of world attention. However, in Ukraine and Belarus, the most affected republics, it continues to elicit concern and high emotions. In Kyiv, there is a well-organized commemorative museum in the Podil region of the old town. On significant anniversaries—the last was the 15th—Chernobyl becomes again the object of articles and commemoration.

With the passage of almost two decades since the accident, there might be some question as to why analysts should return to the subject, and as to what the documents released by the Ukrainian KGB can possibly add to the picture already gleaned. Yet the fact is that there is still no consensus about the results of the accident, particularly its health impact, the casualties, and whether the Soviet authorities responded in an appropriate way. Chernobyl, for a time, ranked alongside the Great Patriotic War, as a symbol of a united people struggling against the elements (in the Chernobyl case, this was a literal meaning). Though the Ukrainian KGB collection has now been made public, to my knowledge no scholars have used the documents in an academic publication. Yet they merit close attention, both for corroboration of existing knowledge and the introduction of new information that elucidates our understanding of the confused and chaotic situation after the destruction of the fourth reactor at Chernobyl.

From a personal perspective, when I first visited Chernobyl in the summer of 1989, the authorities at Chernobyl (the leaders of the Pripjat Industrial Association, led at the time by a leader from the local Komsomol, Pavel Pokutniy) had already obtained a copy of my first book, *Chernobyl & Nuclear Power in the USSR* (Marples, 1986) which, they claimed, had been far too critical of the Soviet response to the unprecedented and unforeseen accident. The criticism was offered in friendly fashion, but was soon belied by scenes that I could witness from the window of the official bus that took me from the town of Chernobyl, into the 30-kilometer zone, to the plant and to the abandoned city of Pripjat (Fig. 1). Clean-up crews littered the roadside, none in protective clothing, many smoking by signs that read "Danger! Radiation!" In Pripjat, I was informed that the radiation levels after the accident never

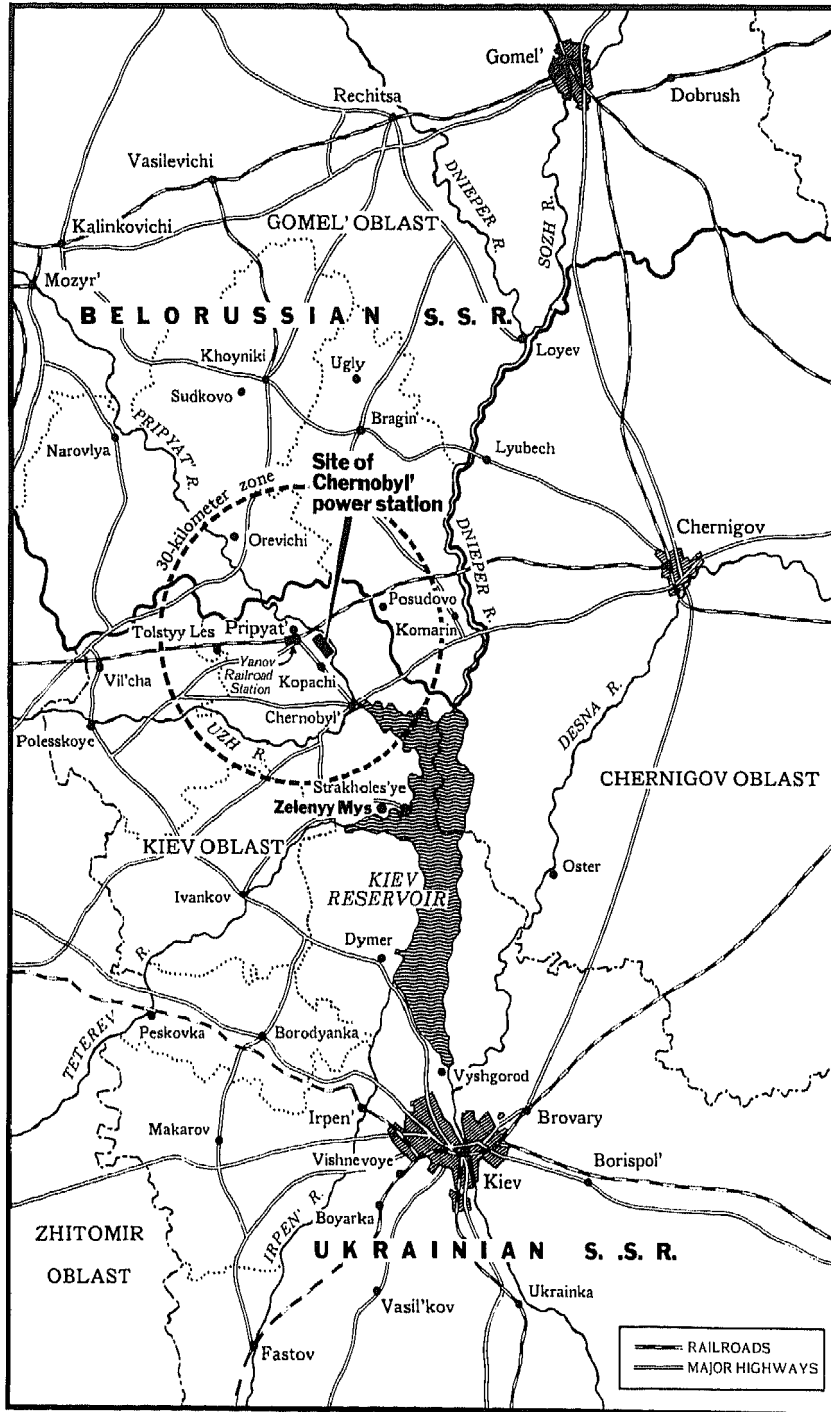


Fig. 1. Location map of the Chernobyl nuclear power station.

warranted an evacuation. I was advised that food grown in hothouses there was safe to eat. Dogs and other animals roamed freely (despite the order to destroy dogs, see below). The overall impression gleaned was that Chernobyl was an accident that was troublesome, but had been overcome by the efforts of the entire Soviet people, through bravery and self-sacrifice. Second, the official attitude was that the accident became unavoidable because of a remarkable combination of human errors.

Gradually the root causes of the Chernobyl accident became more evident. This is not the place to delve into them in detail, as by now they are well known. More important to this study is the functioning of the industry at the time of the accident. This paper seeks answers to several questions: was safety the paramount issue in the operation of Soviet nuclear power stations? Were there indications that a major accident was likely prior to Chernobyl? Were there previous accidents? What differences were there between official reports released in the early weeks and months after the accident and the reality as encapsulated in the KGB reports? Can one evaluate better today the efforts of the Soviet government to deal with the consequences of an event of such magnitude? How was the evacuation handled? Did the government inform people of the dangers of high-level radiation? In answering such questions, it is important also to avoid being retrospective, or suggesting that because the Soviet government was to fall less than six years later, that signs of fallibility and inherent weakness were all too evident. The use of such hindsight would be to neglect the fact that the Soviet government actually gained considerable international prestige and sympathy through its response to the Chernobyl disaster, and this despite the fact that for the most part it rejected foreign assistance.

Finally, there is a national dimension to this question, in that the documents depict the responses of republican officials to the central authorities in Moscow, with the latter always having control. The KGB headquarters in the town of Chernobyl was in fact directly subordinated to Moscow. Nuclear power was the prerogative of the central authorities, and the Chernobyl plant, which had been part of the military program, fell within the domain of the USSR Ministry of Medium Machine Building. Very little in the Chernobyl story belongs to the Ukrainian leadership, with the notable exception of the republican KGB, and the task of the latter was to report rather than make decisions. The Ukrainian SSR's leaders, V. V. Shcherbytsky and O. P. Lyashko (party leader and premier, respectively), to my knowledge only visited the environs of the accident on one occasion (August 29, 1986). Thus the present study also highlights the servile relationship of the republic to the Moscow center in the spring of 1986: one was impotent, the other—it transpires—was fundamentally incompetent.

EARLY PROBLEMS AT CHERNOBYL

The location of Chernobyl as a site for future nuclear reactors was decided upon in 1970. Located on the left bank of the Pripyat River in Kyiv Oblast, northern Ukraine, 137 kilometers north of the capital city of Kyiv (Fig. 1), it was anticipated to expand to 4,000 megawatts (i.e. to four 1000 MW reactors), with personnel housed in a new city, Pripyat, about 2 miles north of the station. The graphite-moderated, water-cooled RBMK nuclear reactors used at Chernobyl had been tested and utilized previously at other locations (see Panel, 1986, p. 115; Thornton, 1986, pp. 133-135), including the Beloyarsk nuclear power station, where it was demonstrated that such reactors provided minimal release of radiation because of the relatively short delivery time of coolant to the reactor core (Dovidka, 1971). In March 1970, the USSR Minister of Energy traveled to the site to participate in the ceremonial laying of the

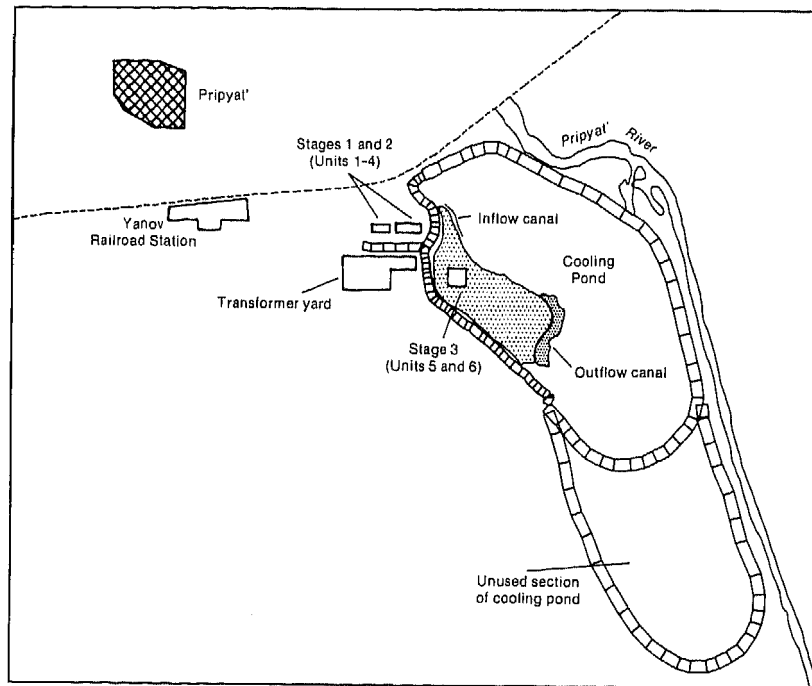


Fig. 2. Site map of the Chernobyl nuclear power stations.

foundation stone. However, the start-up of the first unit at Chernobyl was delayed by approximately a year because of a series of equipment supply problems.⁴

In October 1977, the first reactor came into operation, and a second unit—built as a twin using the same building (Fig. 2)—went on line the following year. On January 17, 1979, V. V. Fedorchuk, chairman of the Ukrainian SSR KGB, sent a confidential report of violations in the construction of the Chernobyl station to the Central Committee of the Communist Party of Ukraine (CC CPU). The report pertained to the construction of the second unit, and to defects in the building of the machine hall, as well as problems with the laying of concrete, and a critical situation with regard to the doorway passages of the power station. In the first nine months of 1978, as a result of the lack of control over technical safety, 170 workers were injured in accidents. In September and October of this same year, fires broke out in the ventilation shaft of the third reactor unit, then just starting construction (Dopovidna, 1985). One of the difficulties was the acute labor shortage during this period, as well as a dearth of skilled labor. The head of the Building Department at Chernobyl, V. T. Kizima, pointed out the gap between the level of construction and its quality. However, he had been given a rigid timetable, which necessitated the almost total neglect of the regular infrastructure of a nuclear power station. Furthermore, workers at Chernobyl were engaged

⁴During an inspection of several pipes in 1976, several cracks were found, and the plant's director (Bryukhanov) and chief construction engineer (Lukov) were criticized for the failure to return defective pipes to the factory. A pump factory at Sumy and brick works in Kyiv region were singled out for failure to supply pumps in the first instance and low-quality tile and brick, inadequate to withstand the sort of pressure expected during the operation of a nuclear plant (Spetsial'ne, 1976).

in "socialist competition" with their counterparts at the Kursk atomic power station in southern Russia.⁵ Prior to the first reactor coming on stream, about 10,000 workers were employed on the Chernobyl project, 50 percent of which were reported to be young people, with little to occupy their leisure hours outside the working day (*Literaturna Ukraina*, July 23, 1976).

Between 1979 and 1980, the Pripyat and Chernobyl party organizations noted 136 individual and 3 collective letters and statements complaining about poor living conditions for construction workers. The complaints had been sent to various locations, but the majority was directed to the USSR Ministry of Energy and Electrification, which bore responsibility for supervising the operation of nuclear power stations in the country.⁶ In 1980, the plan was to build over 51,000 cubic meters of residence, but less than one-third of that amount was actually built. A key concern was housing for workers of the "Yupita" factory, whose work timetable centered on the need to complete the third Chernobyl unit by the time the 26th Congress of the CC CPSU convened. Paradoxically, as more workers were hired to ensure that the schedule was maintained, the standards of accommodation dropped alarmingly, resulting in overcrowding and unsanitary conditions (Dovidka, 1980). Thus both in terms of quality of equipment at the station and the living quarters of the builders, much was left to be desired and quality was sacrificed in the interests of speed. However, the youthful workers reportedly lacked discipline, often consumed alcohol, and took excessive breaks during the day. Many were said to arrive late for work (*Literaturna Ukraina*, July 23, 1976).

The early operation of the station was fraught with emergency shutdowns that were attributed to the poor quality or malfunctioning of equipment. In the period 1977-1981, for example, there were 29 emergency shutdowns, 8 of which were attributed to human error, and the remainder due to technical flaws. Often problems occurred with power supply and the dangers that were apparent with sudden reductions of power of the RBMK reactor. There were also flaws in the turbines manufactured at the Kharkiv Turbo-Generator Factory, affiliated with the Ministry of Energy Machine Construction, and these alone led to three emergency shutdowns in the year 1981 (Dopovidna, 1981b). A builder involved in the project and subsequently a resident of Israel, noted after the 1986 accident that the turbines and the piping at Soviet nuclear stations were no different from those at coal-fired power stations and were lacking in sophistication (Associated Press, May 1, 1986). Similarly, the first energy unit experienced an emergency shutdown in September 1981 because of the failure of the main safety valve. The authorities singled out the Chekhov factory (Moscow region), the producer of the valve, as bearing the main responsibility for this problem (*ibid.*).

On September 9, 1982, a serious accident occurred during a test on the first reactor prior to a scheduled shutdown. When the power of the reactor was raised to 20 percent of its peak level, one of the channels ruptured. Initially, the KGB chief of Kyiv city and region, N. K. Vakulenko, saw little reason for alarm. On the following day, he noted that the emergency situation had not led to contamination and that five days would be required for repairs (Povidomlennya, 1982a). By 14 September, in a document signed by the chairman of the Ukrainian KGB, S. Mukha, this period was increased to 10 days and the Ukrainian KGB was seeking those responsible, with some suspicion that there may have been "hostile intent" on the part of the perpetrators (*Informatsiine*, 1982). Gradually the authorities recognized that

⁵The first reactor at Kursk went on stream in 1976 (before Chernobyl's first unit) and the second in 1979 (after the No. 2 unit at Chernobyl) (see Thornton, 1986, p. 133).

⁶One collective letter signed by 195 women demanded the construction of a kindergarten in the city of Pripyat.

the radiation situation was out of control. In the reactor compartment on this same day, the radiation level was reported to be 100 times above normal, and virtually uninhabitable. The Soyuzatomenergo industrial association, responsible for the operation of the Chernobyl nuclear plant, ordered the creation of a government commission to investigate the causes of the accident, chaired by the head of the association, Gennadiy Veretennikov (Povidomlennya, 1982b).

By late October 1982, a top secret report from Vakulenko to Mukha acknowledged that an area up to 14 kilometers northeast of the station had been contaminated, as well as one 5 kilometers to the southwest. Vegetation and topsoil had been polluted, while hot particles containing uranium had been discovered in the latter region. At this time the authorities did not know how much radiation had been released (Dopovidna, 1982a). Only on November 5, two months after the accident, was a report filed to Ukrainian party chief and Soviet Politburo member, V. V. Shcherbytsky and marked "top secret." By this time, the quality of the air was said to be normal again, but radioactive particles and hotspots of cerium-144, cesium-134, cesium-137, and other radionuclides had been found in the farming community of Chystohalivka, 5 kilometers from the station. Here radioactivity in the soil was "hundreds of times over the permitted norms" and posed the greatest danger of penetration into the human organism and causing serious illness. Rainfall at the time had led to radioactivity in the station's coolant reservoir, an area used widely for fishing by locals. The local KGB expressed its satisfaction that no panic had occurred in local communities. KGB workers had been dispatched from Kyiv city and Oblast to help deal with the crisis. The greatest danger to the population, it was reported, is posed by the "hot particles, which might penetrate the respiratory glands, or get inside the organism by various means and cause serious consequences, including death" (no deaths are cited) (Dopovidna, 1982b).

The documents are silent thereafter on the aftermath of the early accident, other than a report of October 1984 declaring that the first and second units were unsafe because they could not provide adequate protection from leaks of radiation. Paradoxically, the report then assured the recipient that units 3 and 4—built as twin reactors that shared a turbine hall—did have such protection and were thus more reliable (Spetsial'ne, 1984). Information about the accident on September 9, 1982 never reached the Soviet public or the international media. Like other accidents of the period, it was carefully concealed. The reports nevertheless provide remarkable testimony. They indicate that the tragic accident in April 1986 was essentially a repeat performance: once again a test on equipment during a scheduled shutdown; once again an attempted cover-up; and this time resulting in the enforced removal of a population oblivious to the earlier contamination of land around the reactor unit. If the area to the northeast of the station had been irradiated, then the fallout could hardly have missed the town of Pripyat, home to an estimated 20,000 plant personnel at this time (45,000 by 1986). The reports bemoan the lack of adequate equipment to deal with the situation. It seems unlikely that Chystohalivka (which is today inside the evacuated 30-kilometer zone around the now defunct Chernobyl station) was an isolated area of fallout. Leaders of the Laboratory of Radiation Biophysics at the Ukrainian Institute of Nuclear Research and specialists from the nuclear plant declared the need for a "competent commission" to make a more thorough study of radiation conditions. It is not clear whether such a commission was ever assembled in 1982,⁷ but it was the first step taken in late April 1986.

⁷Although a commission was named to study the 1982 accident (see above), the author has seen no evidence that it actually ever met.

By the mid-1980s, with four reactors on line, the attention of the authorities began to focus on completion of construction of the fifth reactor, thus extending the station beyond its original proposed capacity in order to build two more reactors as a twin unit—i.e., Chernobyl-5 and Chernobyl-6. Unit five was scheduled to come into service in the fourth quarter of 1986, but none of the problems that had beset the earlier units—poor equipment, cracks in tiles and rails, poor thermo-isolation design, and numerous defects in fire-prevention standards—had been eradicated (Spetsial'ne, 1985). What irritated the authorities the most was the fact that the constant stoppages due to equipment failures had resulted in a drop in the overall production of electricity. Compounding the problem was the unpredictability of supply and demand of the united power grid, which placed heavy demands on the station in the winter months. In the view of leading specialists at the station, every reduction in reactor power exerted a negative impact on the reactor's reliability and longevity of operation. It also resulted in a partial "burnout" of reactor fuel (Spetsial'ne, 1986a). By early 1986, officials began to focus on problems at the fifth reactor unit, now so close to coming into service, and specifically those linked to construction work in the final stages.

This emphasis and concern appears to have leaked to the local media. The now famous article by journalist Lyubov Kovalevs'ka in *Literaturna Ukraina* (Kovalevs'ka, 1986) is very similar to a secret document issued by the 6th Department of the Ukrainian KGB for the city of Kyiv and Kyiv Oblast on technical violations during the construction of the fifth reactor unit, issued on February 26 of this same year (Spetsial'ne, 1986b). The Kovalevska article has often been regarded as prophetic, coming one month before the major accident at Chernobyl. However, the more complete picture offered by the KGB documents demonstrates that the concern was longstanding, and possibly ritualistic, in that the same complaints had been echoed for the previous decade, evidently with little real possibility of rendering nuclear power stations safer and better constructed. The KGB document speaks of "crude violations" during the construction of the fifth unit and a familiar litany of defects of equipment and technology. It forms the prelude to the accident of April 26, 1986 and the immediate response to it within the Soviet Union; actions that even two decades later are still the subject of lengthy debate and conjecture. What do the KGB documents tell us that adds to our knowledge of the Chernobyl accident?

THE ACCIDENT AND ITS AFTERMATH

In order to highlight differences between what was known and what was reported, KGB reports on the disaster that occurred on the night of April 25-26, 1986 will be contrasted with Soviet media coverage. For the first two days of the accident, the latter was completely absent, but the Ukrainian KGB informed its Moscow counterpart immediately about the accident to the extent of its knowledge. The first report, on April 26, declared that an explosion had occurred during the execution of tests on two turbo-generators of the fourth reactor during a planned repair period, and that a fire had spread to the roof of the third reactor unit. The roof cover of the fourth reactor and of the machinery hall was destroyed. During the tests, 17 shift workers were present, 9 of whom were hospitalized, and 4 of whom were in critical condition, including one on life support. Radiation levels were reported at 20-25 micro-roentgens per second on the territory of the station and 4-14 $\mu\text{r}/\text{sec}$ in the city of Prip'yat. The third unit had been shut down, but units 1 and 2 remained in service, and a Ukrainian KGB "operative group" had arrived at the accident scene (Povidomlennya, 1986a).

A second report on the same day (Povidomlennya, 1986b) provided further details, describing the rise of the radiation levels to 100 $\mu\text{r}/\text{sec}$ in the region of the nuclear plant.⁸ The first two casualties were cited: V. N. Shashenok (born 1951) was dead, and the senior operator of the reactor department, V. I. Khodemchuk (born 1951) was missing. The KGB units at other nuclear power stations in Ukraine (the Zaporizhzhya, Rivne, and Mykolaiv stations) were put on high alert. The situation in Pripyat and other population settlements was said to be "under control." The CC CPU had been informed about the accident. The report repeated the information about the 9 casualties, indicating that 3 of them were in critical condition (presumably the reduction by one was accounted for by the death of Shashenok). Construction work on units 5 and 6 had been "stopped temporarily" and Saturday, April 26 declared a day off (!). The report was signed by the Chairman Mukha. No more reports were issued until May 1. However, in the interim, information appeared both in the official media and in ruling circles in Moscow.

On April 28, Radio Moscow made the very brief announcement:

An accident has occurred at the Chernobyl nuclear power plant—one of the atomic reactors has been damaged. Measures are being undertaken to liquidate the consequences of the accident. Those affected are being given aid, and a government commission has been created.

This statement occurred after Swedish authorities discovered radiation on the shoes of workers entering a nuclear power station near Stockholm, and concluded that the origin must have been a station within the USSR. In Moscow, meanwhile, an Operative Group of the Politburo CC CPSU on questions connected with the liquidation of the consequences of the accident at Chernobyl nuclear power station held a meeting in Moscow. It included Politburo members N. I. Ryzkov, Ye. K. Ligachev, V. I. Vorotnikov, and V. M. Chebrikov, Candidate members V. I. Dolgikh and S. L. Sokolov, and Minister of Internal Affairs A. V. Vlasov. Those gathered issued a Protocol on April 29 to accept reports already offered by relevant agencies regarding the accident situation, including those of Dolgikh on the situation arising from the explosion, Yuriy Izrael, chairman of the State Committee for Hydrometeorology on radiation levels, and S. P. Burenkov, USSR Health Minister, on medical services. Reports also had been issued on the application of civil defense forces by the Chairman of Civil Defense of the USSR, A. G. Altunin and about the evacuation of the city of Prip'yat, by Vlasov. Other concerns included passengers who had alighted from a train in the zone around the nuclear reactor, dispatching a brigade of chemical troops to the area, as well as the supply of food packages for the population living in the fallout zone (Protokol, 1986, cited in Yaroshinskaya, 1992, pp. 250-252). In a follow-up protocol issued the next day, there was a cryptic message about the need to remove foreign students from England, France, and Italy that were studying in Kyiv and Minsk, on the advice of G.A. Yagodin, the Minister of Higher and Middle Specialized Education of the USSR.⁹

The authorities had evidently reacted quickly to the news of a major accident. It was hardly surprising given their previous experience with a serious mishap at Chernobyl. At the same time, news filtered to the public only in small segments. The date April 29 saw the first

⁸The maximum emergency (lifetime) radiation exposure standard applied to clean-up workers was 25 roentgens. At the level of radiation reported above (100 $\mu\text{m}/\text{second}$), a clean-up worker would have reached that level of exposure ca. 3 (24-hour) days or nine working days (8-hour shifts)—*Ed., EGE*.

⁹Cited in Yaroshinskaya, 1992, p. 252.

mention of the Chernobyl accident in the official media, including in Kyiv-based newspapers such as *Pravda Ukrainy*, where it was to be found at the lower part of page 3, as the editors allotted priority to an article about two pensioners who needed to install a telephone in their home. Elsewhere it was to be found below news about a chess contest and the soccer league tables. On this same day, TASS announced on the Moscow evening news that an accident had occurred, and that a Government Commission had been established, headed by Deputy Chairman of the USSR Council of Ministers, Boris Shcherbina, and including heads of ministries and departments. According to the TASS broadcast, two people had been killed, the remaining three reactors had been shut down, and residents of Pripjat and other nearby settlements had been evacuated. Radio Moscow offered a commentary the same day on the 1979 accident at the Three Mile Island plant in Pennsylvania, which had been caused by "criminal neglect" of the plant owners for proper safety measures and had resulted in the leakage of radiation into the atmosphere. The program continued with an attack on the escalation of nuclear weapons in Western countries. This was to be a familiar tactic in the days following Chernobyl.

Prior to the visit of Politburo leaders Ryzhkov and Ligachev to Chernobyl on May 2, the local authorities had focused on the evacuation of an area 10 kilometers in radius around the destroyed reactor unit. The fourth Protocol of the Operative Group with CC CPSU Politburo (Protokol, 1986b, cited in Yaroshinskaya, 1992, p. 260) heard the report of the two leaders, and made further recommendations, including the use of Moscow's No. 6 Clinic for people who had received high radiation doses. Special concern was given to the radiation situation in the city of Moscow, and First Deputy Chairman of the State Committee for Hydrometeorology, Yu. S. Sedunov, was ordered to provide a daily report, and together with the Minister of Health and Civil Defense of the USSR to ensure strict radiation control at airports, railway stations, on roads, and at all points of entry to Moscow. This statement preceded a brief comment on the need to monitor the radiation situation in Ukraine and Belarus! By May 4, the Politburo meetings reveal that 1,882 people had been hospitalized following the examination of some 38,000 people. Radiation sickness had affected 204 people, including 64 children, and 18 people were seriously ill. The Ukrainian SSR medical establishments had made ready 1,900 beds for patients suffering from the effects of Chernobyl (Protokol, 1986c, cited in Yaroshinskaya, 1992, p. 264). It also now is known from several sources that Ryzhkov and Ligachev recommended the extension of the 10-kilometer zone to one with a radius of 30 kilometers.

While these measures were being adopted in Moscow, the republican KGB concentrated its attention on several issues. First and foremost, it was occupied with how such an accident could have occurred. It formed an investigative group that interrogated 38 people, confiscated documents and photocopied them, as well as tape recordings made by the station operators. On May 1, it was noted that the fourth reactor operated in an unusual regime because of tests on the turbo-generator, carried out "without official consent from the design organization." The test had been authorized by the plant's chief engineer, N. M. Fomin, and approved by his deputy A. S. Dyatlov, who took part in the test and was hospitalized in the Moscow clinic after the accident. The test supervisor was not a nuclear specialist: G. P. Metlenko was a brigade engineer from the Dontekhenenergo association (Povidomlennya, 1986c). It also observed the evacuation campaign, noting that 9,864 people, along with 12,180 head of cattle, had been removed from the 10-kilometer zone by May 3, and that the dates May 4 and 5 had been set aside for the complete evacuation of the 30-kilometer zone. Forty-six people had been hospitalized in Kyiv, including 40 from Ivankiv Rayon, 3 from Poliss'ke, and 3 from Chernobyl (Dovidka, 1986a).

The KGB also reported on radiation levels at the accident site, noting that over the reactor face, radiation levels on May 1 reached 80 roentgens per hour (over three times the maximum permissible lifetime dosage), in Pripyat 200 micro-roentgens per hour, and in the town of Chernobyl, up to 70 micro-roentgens (the average background level is reported as 0.013 micro-roentgens per hour) (Povidomlennya, 1986c). By May 4, there was little change in the levels over the reactor, whereas the levels at the town of Chernobyl had fallen to 17 μ r/hour. A dramatic rise in radiation levels had occurred over the city of Kyiv, with a level that reached 700 μ r/hour (Dovidka, 1986a). The reason would have been the change in the wind direction that occurred in early May. On May 8, 12 days after the accident, the levels were still rising, and reached 800 μ r/hr in Pripyat. On this same day, at the entrance to the station's industrial zone, the level was monitored at 2 roentgens per hour; at the third unit, 60 roentgens per hour; and at the approach to the fourth reactor, 400 roentgens per hour. At certain places on the roads around the destroyed unit, levels of 1,000 roentgens per hour were recorded, a level that was almost 77,000 times higher than the average background norm and 40 times the maximum permissible lifetime exposure! The KGB documentation makes it clear that May 4 saw the first detailed inspection of the territory around the reactor by dosimetric personnel (Povidomlennya, 1986d).

By May 11, the Operative Group of the Ukrainian KGB at Chernobyl was able to send a top secret report (Spetsial'ne, 1986c) to the chairman of the republican KGB S. Mukha that provided an interesting synopsis of the situation. It pointed out that an analysis of materials obtained during the investigation both by operative means and through private conversations with specialists allowed for the following conclusions. The accident had occurred as a result of a series of crude violations of operative and technical rules, and the lack of attention to security procedures during the operation of Chernobyl's fourth reactor. Even as an explosion occurred, workers from the Kharkiv union Turboatom and the Horlivka enterprise Dontekhenergo were conducting experiments on the reactor and turbine in operation. The explosion destroyed the roof and likely the walls of the reactor, and radioactive fragments had been scattered up to the city of Pripyat and its railway station. The investigation revealed that two explosions took place, and the second was one of enormous power, accompanied by a bright flash and a noise like thunder. The fire-extinguishing equipment was destroyed by the accident, hampering attempts to put out the fire. A radioactive cloud formed above the reactor, but the station lacked automatic dosimetric devices with which to measure its radioactivity. This omission resulted in a failure to evaluate the situation in timely fashion and to take urgent emergency measures. Noting the critical radiation levels in the city of Pripyat, the authorities decided to inspect several hundred people, who were offered aid, with some being sent to the specialist No. 6 clinic in Moscow and others to Kyiv.

The same source also outlined the preventive measures taken during the immediate crisis. On April 27, workers had been evacuated from the Chernobyl station. Although no chain reaction had been observed in the uranium fuel, graphite continued to burn and radioactive particles were being released into the atmosphere. Since the reactor contained up to 1,500 tons of graphite that conceivably could continue burning for over two months, a decision was made to cover the core with a special mixture of sand, clay, lead, and dolomite. Subsequently, 4,000 tons of this mixture was deposited from helicopters by May 8, and on May 7-8 gaseous nitrogen was pumped into the lower part of the reactor hall. These operations reportedly led to a drop in temperature from 2,000° to 300°C.

The remainder of the document (Spetsial'ne, 1986c) focused on decontamination work, noting after citation of the well-known protective measures, the dangers caused by vehicles entering the zone, and the need to identify every vehicle that had visited the Chernobyl zone

from April 26 to May 10 (likely an impossible demand). All roads to Kyiv had to be tightly controlled, and the condition of reservoirs carefully monitored, especially those on the Dnipro (Dnieper) River and its tributaries. Noting that iodine isotopes predominated among the released radioactive particles, the report demanded a special monitoring regime for children, who were most sensitive to radioactive iodine.¹⁰ Dogs in the zone—many of which were without owners—were to be exterminated (*ibid.*).

By May 19, the chief deputy of Department 6 of the Ukrainian KGB, General-Major G. V. Kuznetsov, cited five major priorities for work of the Government Commission: (1) the design of a protective shell (sarcophagus) over the destroyed reactor unit; (2) the construction of a cable pathway for the delivery of construction materials; (3) measures to prevent the passage of contaminated water into the Pripjat and Dnipro rivers; (4) the gathering of highly radioactive substances into containers, and their storage in specially equipped tombs; and (5) decontamination of polluted areas, and especially the highly contaminated forest zone situated near the nuclear station (Povidomlennya, 1986e).

For evacuees, the move initially turned out to be troubling and of a temporary nature (Dovidka, 1986c). A study of over 1,800 evacuees from Pripjat found them occupying five settlements in Polis'ke Rayon (Kyiv Oblast). The biggest problem they faced was accommodation, and the situation was to worsen when women and children returned from summer vacations. By late June 1986 they had begun to demand the return of their valuables in Pripjat, such as furniture and home utensils. Although many evacuees were highly qualified specialists, most could not be provided with appropriate jobs at factories in the Polis'ke area.¹¹ Many residents, noting that they were working in a zone of increased radiation, had demanded that their wages be doubled (Dovidka, 1986c). The report corroborates other accounts of discontent among evacuees as well as the claim that the initial evacuation simply moved the victims westward from one region of high radiation to another (Marples, 1988, p. 31).¹²

Major problems arose from carelessness and "violations of personal safety rules" that occurred among those involved in the clean-up operation,¹³ both from failure to protect themselves with adequate clothing and from deficiencies in personal hygiene. There were also encroachments by unauthorized persons into the zone—256 in "recent times"—and a special barrier was being erected to prevent future entries (Povidomlennya, 1986f). The lack of attention to the safety of clean-up crews by the authorities is evident. A report from June 1, 1986, is fairly typical (Povidomlennya, 1986g). It notes that the USSR Ministry of Health officials had expressed serious concern about the safety of people working in the station area, principally because of the prevalence of isotopes of plutonium, which exceeded the permitted norms by up to 1,000 times in the region of the nuclear plant. The use of gas masks was considered mandatory, but the ministries responsible for personnel working in the area—Defense, Energy, Coal, and others—had failed to provide their workers with this basic form of protection. Also reported were lack of observance of proper sanitation norms in dining

¹⁰This provision came far too late, as iodine-131 has a half-life of only 8 days. Thus the bulk of the damage to children's thyroid glands would have occurred between April 26 and May 4, one week before the KGB directive was issued.

¹¹Several were reportedly dissatisfied with their low salaries and demanded careers more in line with their qualifications.

¹²Although Polis'ke (Polesskoye in Fig. 1) is located outside of the 30 km zone WSW of Chernobyl, it is a part of the region receiving a heavy dose of radiation borne by winds blowing toward the west and northwest on the days immediately following the accident.

¹³The latter included specifically coal miners and military reservists.

rooms, lack of disinfectant and hot water, and incorrect storage and transport of food products (all of which were exacerbated by hot weather), which posed a credible threat from food poisoning and infectious diseases.

The welfare of the clean-up crews had become a critical concern by August 1986, particularly that of the military teams. Jurisdiction over the military personnel had been delegated to two ministries: the USSR Ministry of Power and Electrification and the USSR Ministry of Medium Machine Building. In August, there were reportedly over 8,000 people working in "military-construction," but they lacked Geiger counters, often had no real knowledge of the radiation conditions in which they were working (such locales included areas of spent fuel storage and the "Sarcophagus" being built over the destroyed reactor), and did not know to how much radiation they had been exposed (Dovidka, 1986e). The authorities bemoaned the frequent stoppages of work due to such factors as a lack of lights for the night shift, the failure to deliver supplies of cement, or the lack of any instructions.

Two days later, the level of radiation in the bath house in the location of spent nuclear fuel storage amounted to 2.5 roentgens/hour as a result of workers wearing contaminated clothing, a situation that persisted for 2–3 weeks. Workers from three divisions had worked for three months without any protective clothing. Even more alarming was the redeployment of workers who had already accumulated the maximum emergency dose of radiation—25 roentgens. On August 20–21, some 60 people were rehired, all of whom had prior radiation levels between 25 and 30 roentgens. Few preparations had been made for the coming winter—private staffs of military-construction divisions were living in tents, and dining rooms, drying rooms, and bath houses lacked roofs. These workers were said to be willing to work in the zone, but demanded regular and adequate payment for their labor, information about radiation levels to which they were being exposed, as well as attention to their living conditions during the fall-winter period (*ibid.*). Thus the gap between official accounts of heroism and enthusiasm for the complex tasks and the stark reality of life in the zone could hardly have been greater.

The location of Chernobyl at the juncture of several river systems was a natural source of concern. The Ukrainian Ministry of Reclamation and Water Management was particularly anxious to prevent contaminated waters from flowing into the Dnipro River, which divides Ukraine virtually down the middle of the country and supplied water in 1986 to a total of 36 million people, or approximately 72 percent of the republic's population. To "save" the Dnipro River, the ministry offered several suggestions (Dovidka, 1986b). They included the shutting down of the Kyiv Hydroelectric plant pending the construction of a dam in the upper pool that would prevent large particles from entering the water system and, in any event, restricting the spread of radioactive water downstream from the Kyiv Reservoir. The ministry proposed to block the Pripjat River (a tributary of the Dnipro) by damming its channel in the region of a pontoon bridge at the town of Chernobyl, utilizing military reservists. A similar dam was anticipated near the village Strakholissya on the Kyiv Sea, as well as in the Kremenchuh reservoir in the district of Pereyaslav-Khmelnytsky. Academician B. E. Paton had recommended that special absorbents should be deposited into the Kyiv Reservoir.¹⁴

¹⁴A wide range of water protection measures were actually taken, among them the emergency construction of 20 km of dikes along the right bank of the Pripjat' River to prevent contaminated surface runoff from reaching the river, the sealing of thousands of wells in Ukraine and Belarus, the drilling of new wells along aquifers on the approaches to the contaminated area to intercept incoming groundwater flow, and cloud seeding in an effort to induce precipitation from storms before they reached the Chernobyl area (see Shabad, 1986, pp. 521–522).

One of the major problems concerning the water supply was that an active source of contamination was the cooling pond of the Chernobyl nuclear plant (Fig. 2). Notably, as early as 1979, it was reported that the cooling pond, an area of 15 km², was to be used for the industrial production of fish. In that year, 300 kilograms of fish had been caught and, based on an analysis of their radiation content, the authorities had approved the sale of fish from the cooling pond to the population providing that their radionuclide content be monitored beforehand. However, between 1979 and 1981, fish caught at the pond and processed at the Ivankiv fish packing plant had been sold without any inspection and without approval from the local sanitary-epidemiological station (Dopovidna, 1981a). V. N. Tkach, Minister of Reclamation and Water Management of the Ukrainian SSR, noted in June 1986 that during the construction of the cooling pond, it was planned to build an underground clay wall around the pond to prevent filtration of impurities into the Pripjat River and subsoil waters. However, this task subsequently was rejected as being too expensive. The minister noted that even before the Chernobyl accident, the level of radiation in the Pripjat River was likely higher because of the lack of hydro-isolation. He noted that similar ponds without a protective underground wall existed also at Zaporizhzhya and the incomplete Chyhyryn nuclear power stations (Dovidka, 1986b).

CONCLUSION

Several conclusions can be made from the perusal of these hitherto secret documents on the accident at Chernobyl.

1. They indicate that there was a longstanding pattern of construction problems at Soviet nuclear power stations and at Chernobyl specifically, as well as the occurrence of at least one major accident at the plant that contaminated nearby settlements in the vicinity well before 1986. The documents expand considerably the existing knowledge about these problems, cited originally in only one major republican newspaper (*Literaturna Ukraina*). Although the accident ultimately appears to reflect improper operating procedures and the design of the RBMK reactor rather than construction defects of the reactor units, the documents nonetheless highlight and elucidate the careless and lackadaisical attitude toward the construction of nuclear power stations in the former Soviet Union.

2. The KGB reports corroborate the supposition that the authorities were aware of the scale of the accident from the first days, and carefully concealed this information from the Soviet public, as well as the international media. This point has already been emphasized by several analysts (Z. Medvedev, 1990; Marples, 1986; G. Medvedev, 1993; Yaroshinskaya, 1992), but the new declassified materials provide much more detail and clarification about what was actually known by local authorities and when. In particular, they add appreciably to the documents found in Yaroshinskaya's book (1992), which focused on discussions at the Politburo level.

3. They demonstrate that evacuation initially was limited to Pripjat and nearby settlements, but after a visitation by all-Union authorities (Ligachev and Ryzhkov) a more extensive evacuation took place. The evacuees were moved initially to the west, directly to equally dangerous locations.¹⁵ The high-level meetings of the Politburo of this period suggest that the concern was less with the population in the Chernobyl region than with Moscow, and

¹⁵E.g., from Pripjat to rural areas in Polis'ke Rayon, where as it was noted earlier, hospitalizations for radiation sickness were registered see also Shabad, 1986, p. 511).

foreigners residing in Minsk and Kyiv. The evacuees, along with the clean-up crews, constitute most of the long-term medical casualties and victims of the accident.

4. At the reactor itself, a lack of safety equipment compounded the problems of the fire crews, first-aid workers, and clean-up crews. The new documents highlight a fundamental inattention to basic safety procedures and rules of hygiene, and these were exacerbated by a lack of Geiger counters and other equipment, which necessitated a delay in making an assessment of the radiation situation until May 4, more than a week after the disaster occurred. The documents provide a detailed picture of the problems faced by clean-up crews, which were potentially life threatening because of their inability to monitor their radiation levels, and the return to zone work of laborers who already had accumulated a maximum lifetime dose of radiation.

5. Radiation levels reached extreme levels not only in the reactor zone, but in Chernobyl, Kyiv, and other centers in Ukraine and Belarus. Moreover, the levels of radiation in Kyiv and the surrounding area tended to rise rather than diminish during the period May 4–11, reflecting a shift in prevailing winds toward the south and east, and radioactive particles entered both the water supply and food chain, compounding the dangers to the local population. Thus in late June, several long-lived isotopes were detected in the city of Kyiv, including cesium-134, cesium-137, zirconium-niobium-95, cerium-141, cerium-144, barium-140, and others (Dovidka, 1986d). There was never any official corroboration that citizens of Kyiv faced such dangers, and indeed reports commented frequently that although background levels of radiation had risen in Kyiv, they did not constitute a threat to the population. Reasons of space have prevented a discussion of the distribution of food products from contaminated areas, but such a situation persisted for some time and represented a further danger to the populace of Ukraine's capital city.

6. Although the republican KGB paid special attention to monitoring these difficulties, it was not in a position to take active measures. Such actions were the responsibility of the Government Commission, which reported to the Politburo of the CPSU Central Committee, in which Ryzhkov and Ligachev played the key role, as well as high-ranking officials in various ministries and other all-Union bodies, such as Izrael, Dolgikh, Il'in, and others. The lack of republican control was to foster discontent and frustration among the local authorities in dealing with all-Union government ministries and state committees based in Moscow. Nonetheless, the extent of knowledge among republic-level officials, through the Ukrainian KGB, was considerable.

7. Notwithstanding the above, it could be argued that the centralized nature of the Soviet system could be an asset in the case of a major emergency such as Chernobyl. Although we have paid close attention in this paper to failures in the response, it should be added that coordination of decision-making in Moscow undoubtedly helped in some instances. But incapacitation at the local level also hindered appropriate responses at times, as did the need to accommodate a dissatisfied and volatile workforce, often terrified by the environment in which it was working, and frustrated with the evident failure to achieve the elusive goal of liquidating the consequences of the accident at Chernobyl.

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