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Chernobyl': Observations on the Fifth Anniversary

David R. Marples¹

Abstract: A Canadian Sovietologist with extensive research experience relating to the accident at the Chernobyl' nuclear power plant in 1986 surveys some of its major consequences in light of new information on the fifth anniversary of the disaster in 1991. The author outlines and analyzes varying interpretations of the cause of the accident (operator error vs. design flaw), the extent and density of the radiation release, and the severity of its impact on public health in contaminated areas. Appropriately noted are the jurisdictional disputes over the clean-up and other remedial efforts—most rooted in the current political crisis in the Soviet Union. *Journal of Economic Literature*, Classification Numbers: P20, Q20, Q40.

Five years have gone by since an experiment on the safety mechanisms at one of the power plants of the Chernobyl' complex inadvertently precipitated the world's worst nuclear accident. Though less of an enigma than it was in the spring of 1986, the disaster gave rise to questions which remain unanswered and a consensus has yet to be achieved on a number of key issues. The first is the ever-present question of how the accident began and, concomitantly, which individual, organization, or institution must bear the responsibility for it. Second, the extent of the fallout is still being studied and revealed periodically to the public. It is unclear how dangerous that fallout might be. Third, and perhaps most controversial, there has arisen the question of the correlation between radiation and a significant rise in sicknesses and casualties in affected areas, but there is doubt on whether these illnesses can be directly related to radiation from Chernobyl'.

These and other problems of significance (e.g., the potential energy crisis) are no nearer solution in view of the mounting conflict between the increasingly assertive republican (Ukrainian, Belorussian, and Russian) authorities and the all-Union (federal) ministries based in Moscow. Wherein lies the truth? My fourth trip to this area (this time, in late April 1991, to participate in the proceedings of a commemorative assembly in

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Kiev), which included several informative interviews, prompted a series of observations which I shall recount briefly to the readers of this journal.

THE ACCIDENT

As a graphite-moderated (RBMK) nuclear power plant, Chernobyl' consisted of military reactors that had been adapted to civilian purposes. Graphite plants are refuelled on-line, hence they are constructed without the concrete dome that has become the main safety feature of nuclear power stations in the West (and since 1980, of the other Soviet reactor of the water-pressurized variety—the VVER). The design of the RBMK is complex and unique to the Soviet Union.² The Chernobyl' explosion gave rise to a variety of inquiries into the safety of this reactor, particularly in terms of its relatively slow shutdown system; its instability at low power; and insufficient uranium enrichment.

A report about the disaster designed for presentation at a special meeting of the International Atomic Energy Agency (IAEA) in Vienna, was assembled within four months. However, by the time the Soviet delegation had prepared that report, the chief blame for the accident had been placed by the authorities on the poorly trained and incompetent operators—on those who had dismantled the station's safety mechanisms in conducting a safety experiment during the time that the afflicted fourth reactor was to be shut down for maintenance; the report was duly delivered by the late Academician Valeriy Legasov of the Kurchatov Institute of Atomic Energy, in August 1986.³

Subsequently, although the future program for the construction of RBMKs was curtailed by 1987,⁴ Soviet nuclear officials began to maintain that the improvements made to the reactor rendered it safe. More important, it was held that but for the unlikely series of blunders by the operators, the Chernobyl' disaster could not have occurred. In July 1987, a trial of the plant's director, chief engineer, and senior officials was held at the town of Chernobyl'. The proceedings, except for the first and last days were held in camera. Viktor Bryukhanov, the Chernobyl' plant director, who had not been present at the time of the experiment or accident, received a ten-year jail sentence, while the punishment of his chief engineer, Nikolay Fomin, was a five-year term of imprisonment.

²Relevant information on the reactors used in the Soviet nuclear power industry is to be found in Megaw (1987, pp. 22–25) and Marples (1986, pp. 95–114).

³Academician Legasov committed suicide on April 27, 1988, but the reasons for his action remain uncertain. Before Chernobyl', Legasov had been one of the chief advocates of the view that Soviet nuclear energy was completely safe. However, his notes, published posthumously in *Pravda*, suggest that Legasov was depressed over the failure of the Soviet nuclear industry to make adequate technical improvements in the wake of the accident. A discussion of the Legasov suicide is to be found in Marples (1989) and Z. Medvedev (1990, pp. 256–258).

⁴At this time, the total generating capacity of Soviet nuclear power plants reportedly was 30,300 megawatts, of which the RBMKs at the Leningrad, Kursk, Chernobyl', Smolensk, and Ignalina stations accounted for 14,500 megawatts (Petrovskiy, 1987, p. 22).

Other officials received two and three-year sentences (Hamman, 1987; Marples, 1988). Although there was much discussion of future trials, none had materialized by the time of the fifth anniversary of the disaster, April 26, 1991.

Thus the report submitted to the IAEA was supported in its essence by the trial of Chernobyl' officials. "Man" rather than the "machine" was blamed for the accident. Several public figures in the Ukraine, however, disputed that version of events. Some have continued to maintain that "the system" of administration rather than untrained personnel should have been pinpointed as the root cause of the problem.⁵ Recently some credence has been given to their doubts by a report from a Commission of the USSR State Committee for the Safe Operation of Atomic Energy and Industry, headed by Nikolay Shteynberg, the former chief engineer of the Chernobyl' plant. Evidently completed in early 1991 (though not published to date), the Commission's report has disputed the original Soviet account to the IAEA in several important respects. Most significantly, in its view flaws in the RBMK reactor design rather than operator errors constituted the fundamental cause of the disaster (*Robotnycha hazeta*, February 9, 1991, p. 3). One of the participants in the Commission noted that the RBMK was known to have had more than 32 design faults, but that no one at the Kurchatov Institute of Atomic Energy was permitted to address them.

The Shteynberg Commission indicated that the graphite-tipped control rods had not been properly constructed and were of shortened dimension. It is alleged that the sudden insertion of the rods into the core, at low power, at the conclusion of the experiment, was the direct cause of the explosion (*Molod' Ukrainy*, March 22, 1991, p. 2). That allegation has been supported by a Nobel laureate and noted Western authority on nuclear energy. Writing in *The New York Times* (May 2, 1991, p. A25), Hans A. Bethe noted that:

The design of the Chernobyl reactor results in an unfortunate instability. If, for some reason, the reactor produces excess power, more of the cooling water will turn to steam, fewer neutrons will be absorbed by water and more of them will be absorbed by Uranium-235.

In fact, some Western experts have long surmised that the design of the control rods may have lain at the root of the Chernobyl' accident. One

⁵For example, the chairman of the Chernobyl' Commission of the Ukrainian parliament, Volodymyr Yavoriskiy, stated that the "system" in place in 1986 was responsible for the Chernobyl' disaster. He suggested that Soviet authorities emphasized nuclear energy for the sake of immediate economic benefits and were prepared to neglect safety measures in the industry in the interests of the economy (speech delivered at the Eurochernobyl-2 conference, Kiev, April 22, 1991). I have recorded that speech. Other sources have expressed similar views in stronger terms: "it is no secret that the cause of this unprecedented nuclear catastrophe was the colonization of Ukraine through the policies of the Center," (*Kul'tura i zhyttia*, No. 17, April 27, 1991, p. 3; see also Shcherbak, 1989, p. 5).

Commission member has posited that although such faults were known to members of the Soviet delegation to the IAEA—and to Academician Legasov in particular—the delegation could not mention or discuss them, because the international nuclear community might have demanded the closure of all Soviet RBMK stations, which in 1986 constituted almost half of the Soviet nuclear generating capacity (*Robitnycha hazeta*, February 9, 1991, p. 3). However, it should be borne in mind that by the time the control rods were inserted into the core, the reactor may already have been out of control because of the suppression during the experiment of certain back-up safety systems.

On the fifth anniversary, therefore, blame for the accident has been distributed more evenly between operators and design flaws in Soviet sources. There has been no suggestion that the Chernobyl' trial was unjust. In fact, a new book by one of the participants in the immediate aftermath of Chernobyl' has served to illustrate that plant director Bryukhanov did not even realize that the reactor core had exploded and was in any event unwilling to have such information widely distributed (G. Medvedev, 1991). On the other hand, although at least some scientists at the Kurchatov Institute knew of the reactor's flaws, this information was not communicated to the operators who had been asked to conduct the fateful safety experiment. And all efforts to publicize these defects reportedly were suppressed. Thus, it is hardly surprising that there have been calls for further trials. These would, however, add little to our existing knowledge and probably fail to alleviate Chernobyl'-related problems.

On the causes of the disaster, thus there is today still no consensus, despite the Shteynberg account. Even the amount of radioactivity released into the atmosphere has become a matter of contention.⁶ This is an especially pertinent subject, since the future of the reactor (how it can be dismantled or recovered with a second concrete shell),⁷ is largely dependent upon how much radioactive material has remained in the core. The initial report to the IAEA stated that about 3.5 percent of the core's contents were released into the atmosphere, thus revealing that most of the core remains within the "sarcophagus." That some consider the figure of 3.5 percent to be much too low is evident from several sources. Moreover, the very existence of the damaged reactor has over the past few years given rise to conjectures in Kiev about future accidents, continuing reactivity, or its fall downward into the water table—a fall contaminating the water system that links up with the Dnieper River (*Uryadovyi kur'yer*, No 3, February 1991, p. 1). The point is that if authorities cannot agree on how much material has been released, they

⁶The minimum amount is reported to have been 50 million curies, of which the most prevailing elements have been cesium-137 (half-life 30 years); strontium-90 (half-life 29.12 years), and plutonium-239 (half-life 24,390 years). See Lyutsko (April 1990, p. 38).

⁷The damaged reactor has been surrounded by a concrete shell (called the "sarcophagus") designed to shield the radiation (see Marples, 1988).

also are unlikely to concur on how the plant might be dealt with in the future.

EXTENT OF THE FALLOUT

After the Chernobyl' explosion, the authorities' initial concern lay first with a zone lying within a 10-kilometer (6-mile) radius from the reactor (from April 27 to May 1, 1986) and subsequently (on May 2), with a zone within a 30-kilometer radius, following the arrival on the scene of two Politburo members, Yegor Ligachev and Nikolay Ryzhkov. By the summer of 1986, a reported 135,000 residents had been evacuated from northern Ukraine, southern Belorussia, and Bryansk Oblast of the RSFSR.⁸ Whereas the early route of evacuation was to the west, once it was recognized that the radioactive cloud also was moving westward, the evacuees were taken south toward the city of Kiev. The city of Kiev has been the subject of protracted debate as to whether radiation levels there in the days following the accident warranted the postponement of the 1986 May Day parade and the evacuation of the city's residents (Marples, 1991b). A brief analysis of the Kiev situation is thus warranted.

Effect on Kiev

On April 30, all sources acknowledge, the wind that carried the radioactive cloud changed direction and blew toward the south, and toward Kiev. Among a series of interviews I conducted in Kiev, the most poignant was that of a citizen (who later became an official of the Kombinat Association at Chernobyl'), whose knowledge of the accident was limited (like that of others) to the brief announcements in the press and on television. He remarked that it had occurred to him to wonder whether the change in wind direction on April 30, 1986 might signal danger for himself and his children, all of whom were outdoors.⁹

Much of our information about the Kiev situation is derived from the Institute of Atomic Research of the Ukrainian Academy of Sciences, whose scientists used air filters to monitor the levels of radiation throughout the month of May 1986. While other sources have maintained that radiation levels in Kiev did not constitute a danger to the population (Jovanovich, 1990a, 1991b), their findings have been disputed by the scientists at the Ukrainian atomic research institute.

A fair example is provided by the writings of Viktor Prokopenko, a senior scientific worker at the Institute, in the Ukrainian youth newspaper, *Molod' Ukrainy*. Prokopenko stated that his calculations show that in the first 10 days of May 1986, the local "load" of radioactive iodine to

⁸For a detailed account of the evacuation process in the first post-accident days, see Z. Medvedev (1990, pp. 140-148).

⁹Subsequently his children were found to have swollen thyroid glands; see my interview with Yuri Risovanny in the *Bulletin of the Atomic Scientists* (Marples, 1990).

the thyroid gland was 20–40 rems, with the equivalent dose to the entire body being 0.9–1.2 rems.¹⁰ He added that with doses of up to 40 rems to the thyroid gland, children under 10 years of age have been shown to be more susceptible to cancer and related illnesses within a period of 4–5 years. Turning to the long-term pattern, the scientist noted that the “average Kievan” received a total radiation dose of 30–50 rems in the first year after the accident—at least those who did not take precautionary measures and who consumed food products from nearby farms. At worst, Kievans received a dose more than 10 times higher than that to which Soviet radiation workers were exposed. Prokopenko thus concludes that the pattern of radioactive fallout should have resulted in the evacuation of the city of Kiev in May 1986, and that children should have been taken out of the city before May 14 (*Molod' Ukrainy*, April 26, 1991, p. 2). Other scientists from the same Ukrainian institute have produced similar evidence and reached identical conclusions about the irradiation of the city of Kiev.¹¹

The dispute over the reported contamination of Kiev is far from over, because scientists do not agree on the dangers of low-level radiation.¹² At this juncture, it is sufficient to make the following point: there is ample evidence to suggest that Kievans may have misunderstood the effects of radiation and that not all their fears were justified. It is also clear that many illnesses attributed to radiation may have had other causes. On the other hand, the radiation maps that were published about the situation at the end of 1990 indicated that the city of Kiev was very much a part of the picture. In fact, significant contamination (5–15 curies per square kilometer of cesium-137) of the soil had spread well to the south of the city, into both Vinnitsa and Cherkassy oblasts (*Radyans'ka Ukraina*, February 21, 1991, p. 3). All the same, as the maps demonstrated, the radioactive fallout from Chernobyl' has been so uneven that it is difficult to state definitively whether a certain area has been wholly or partially contaminated, thus meriting the removal of residents until more complete information can be obtained.

Republican Involvement

In 1991, after pressure from the Ukrainian parliament, the government of the Ukrainian Republic adopted three new laws on living in contaminated regions that defined areas of the Ukraine according to the

¹⁰This conclusion was supported by a Kiev radiation specialist, Professor A. Serdyuk, in a speech at the Eurochernobyl-2 conference in Kiev on April 23, 1991. He maintained that in the year 1986, the average radiation dose to the entire body among children was 1.11 rems. Serdyuk's studies have led him to conclude that in the long-term, excess cancer deaths induced by Chernobyl' radiation in the city of Kiev will be about 300.

¹¹Another example is Volodymyr Tokarevsky, whose findings are summarized in a response to Jovanovich (*Radyans'ka Ukraina*, March 29, 1991, p. 2).

¹²John Gofman (1990) maintains that low-level radiation is much more dangerous than most scientists tend to believe today. A conflicting and more orthodox view is expressed by B. L. Cohen (1982).

level of danger posed by radiation in the soils.¹³ These laws were prefaced by a so-called "Conception" of what levels of radiation to the body and contamination of the soil warrant an evacuation (*Radyans'ka Ukraina*, March 27, 1991, p. 2). In 1989, Leonid Il'yin, Vice-President of the USSR Academy of Medical Sciences, proposed that a level of 35 rems of radiation over a lifetime (70 years), or 0.5 rems per year, would not pose a danger to the population. Accordingly, this level was introduced into the contaminated regions as a norm in January 1990, but it was resented by those who argued that the population in question had already been subjected to high levels of irradiation in the immediate aftermath of the disaster, and thus an average assuming normal exposure should not be applied.¹⁴

The Chernobyl' Commission of the Ukrainian parliament, established to investigate the effects of the disaster anew (there is already an all-Union program in place)¹⁵ has reduced the lifetime norm per person in affected areas from 35 to 7 rems (0.1 rems of additional radiation per year). This lower level has necessitated a thorough probing of soil samples throughout the Ukraine for cesium deposits of more than one curie per square kilometer. As a result, the number of Ukrainian oblasts affected by Chernobyl' has been increased from 6 to 12 (out of 27), containing some 1.8 million people. In Belorussia, similar studies have indicated that more than one-third of the republic, encompassing about 2.5 million people, was found to be within the zones of contamination (Marples, 1991b). Ukraine also has been divided into four zones according to the level of soil contamination: the zone of alienation (30-kilometer zone); the zone of compulsory evacuation; the zone of guaranteed evacuation; and the zone of periodic control (*Robitnycha hazeta*, March 23, 1991, pp. 1-4). Maps published in the Ukrainian press have indicated the degree of contamination in, and extent of each zone and provided the public with quite a detailed picture of the current situation (*Molod' Ukrainy*, February 15, 16, 19, 20, and 22, 1991). In the Ukraine, 116 rayons are included in the contaminated zones (*Pravda Ukrainy*, April 27, 1991, p. 2; *Radyans'ka Ukraina*, April 26, 1991, p. 2).

The appearance of such maps suggests that the Chernobyl' situation may have worsened over time, but this is not necessarily the case. Although there appears to have been some penetration of plants by radionuclides in the soil, the current situation rather reflects a new focus

¹³It is generally accepted that radiation in the soil, rather than the atmosphere, poses the chief danger today, as radionuclides penetrate the plant system over a period of time.

¹⁴One source has commented that if the dose received by the population in the zone of "guaranteed evacuation" between the years 1986-1989 is taken into account, then the lifetime prognosis according to the 35-rem conception would be from 10 to 40 rems of additional radiation. Thus the levels were lowered, as noted (*Molod' Ukrainy*, February 20, 1991, p. 2).

¹⁵On April 25, 1990, the USSR Supreme Soviet issued a decree on its program to "liquidate" the consequences of the Chernobyl' accident. For an update on the progress made in fulfilling this decree, see *Izvestiya*, April 13, 1991, p. 2.

on the Chernobyl' fallout in the republic. Such renewed spotlight on Chernobyl' is evident not only among environmental movements, such as the *Zelenyi Svit* (Green World) and *Zelena partiya* (Green Party), but even in the resolutions of the first session of the 27th Congress of the Communist Party of Ukraine, which took place in the spring of 1990. The Party has concluded that the initial (all-Union) investigation of Chernobyl' has been a failure because it did not address all the ramifications of the subject (*Materialy*, 1990, pp. 113–115).

The key issue at stake is that of control over the disaster's consequences. In Ukraine and Belorussia, one can observe a prevalent view that the past secrecy about Chernobyl' has been largely the result of control over the nuclear industry and its health consequences by ministries based in Moscow. In short, the feeling is that practices followed by the pre-1985 regime led directly to the blackout on information. Although the heyday of *glasnost'* (1987–1989) brought some beneficial changes, such a view contends, republican declarations of sovereignty were the ones to lead to a more in-depth inquiry into the consequences of Chernobyl'. That conclusion is rather simplistic, but the fact remains that the republics, and Ukraine in particular, have made a determined effort to assert control over the affected regions by issuing new laws, which are scheduled to take effect in July 1991.

DEBATE OVER HEALTH CONSEQUENCES

Cancer in the Future

There are three aspects to the debate over the effects of Chernobyl' on public health: (1) the long-term prognosis of future cancers and leukemias; (2) immediate and early casualties; and (3) current health problems of diverse nature in the contaminated regions. All three have generated considerable discussion, but only the first falls directly within the realm of speculation. As such, it may be dealt with most easily.

Forecasts of future cancer deaths from the disaster have varied widely from an original low of around 200 to a high estimate of some 650,000 future cancer deaths worldwide. The first figure is the estimate proffered by Soviet health authorities in 1987. Zhores Medvedev (1990, p. 166) cites British sources which trace the low estimate of 200 deaths to a statement by the Prime Minister of the Ukrainian SSR to a Western trade union delegation in April 1987 (*The Guardian*, April 6, 1987, p. 2). The second figure is the high published by the Committee for Nuclear Responsibility headquartered in San Francisco (Gofman, 1990, pp. 36–17/36–18). Dr. Robert Peter Gale of the University of California has offered different sets of figures ranging from a high of around 75,000 to a low of around 10,000. Gale has, however, maintained consistently that he believes the lower figures to be a more realistic assessment.¹⁶ The

¹⁶Gale's highest figure was given during an interview on Soviet television in 1987, discussed in Marples

basic difficulty surrounding all these forecasts remains the data base from which they are drawn. Information about Chernobyl', both inaccurate and accurate, has increased over time, and many of the predictions for the future were made at a time when relatively little was known about the picture of radioactive fallout.

Immediate and Early Casualties

Proceeding to the second two issues, the immediate death toll has sparked a major controversy and several uncorroborated statements on victims to date. In one example, the Chernobyl' Union, an organization of former decontamination workers ("liquidators"), has stated that 7,000 of its members have died to date from causes related to Chernobyl' (*Vechirnyi Kyiv*, April 23, 1991, p. 2).¹⁷ The figure was cited by Yuri Shcherbak, chairman of the Ukrainian Green Party, at the Eurochernobyl-2 conference held in Kiev from April 21 to 25, 1991. Similarly, Shcherbak also reported a total of 5,000 deaths related to Chernobyl' during a speech last year in the Ukrainian parliament. In an interview published in the West, a Chernobyl' official also remarked that the 5,000 total was "not unrealistic" and cited the high incidence of heart attacks among clean-up workers in their twenties and thirties.¹⁸ Other sources have made it clear that these people were often exposed to radiation levels that were well above the official emergency norm of 25 rems per worker, and that often their dosimeters failed to record accurate levels of irradiation (Marple, 1991b). Vladimir Chernousenko, one of the key scientists involved with the problems emerging in the immediate aftermath of the disaster,¹⁹ stated that Chernobyl' had claimed between 7,000 and 10,000 lives (*Reuters*, April 14, 1991).

Which of these statements is accurate? It is clear that the officially stated total of 31 immediate deaths from Chernobyl' (including 28 directly related to radiation) is an understatement. On the other hand, a precise analysis is precluded by the lack of a complete official data base on all those involved with the clean-up operation. It has been stated frequently that about 600,000 persons were involved in some aspect of this campaign, but no records were kept of military reservists in the zone in the summer of 1986 (*Pravda Ukrainy*, April 30, 1991, p. 2). About half of this total are said to be currently residing in Kiev (*Vechirnyi Kyiv*, April 23,

(1988, p. 53). In his book Gale (1988, pp. 175-176) states that: "Best estimates, based on data provided by the Soviets themselves, indicate that as many as fifty thousand people worldwide may die of cancer as a consequence of Chernobyl'."

¹⁷The figure cannot be corroborated, as Yuri Shcherbak acknowledged in his speech on April 22, 1991. As yet, no data have been provided by the authorities or independent organizations on the identity of those who have died from illnesses or causes related to Chernobyl'.

¹⁸See interview with Yuri Risovanny (Marple, 1990). See also Schmemann (1991, p. A6).

¹⁹Vladimir Tikhiy, a member of the Ukrainian Committee for the Protection of Peace, denies that Chernousenko was the chief official within the 30-kilometer zone, as many press reports in the West had stated. He pointed out that Chernousenko remained in the zone only for a short period of time during the immediate aftermath of the disaster (personal communication, April 19, 1991).

1991, p. 2). Also, none of the subsequent deaths, or the hospitalization of these workers in Moscow and Kiev, were ever attributed officially to radiation.²⁰ Thus one can posit an official reluctance to divulge information on the health effects of Chernobyl'. Conversely, it must be acknowledged that a lack of information from the authorities has given rise to speculation rather than thoroughly documented information. This is even more evident in cases of morbidity, as demonstrated below. In brief, then, the observer can state only that the current death toll is higher than officially reported, but that the actual figure is unknown and is likely to remain unknown.

In a controversial speech that I recorded in Kiev in April 1991, Dr. Robert Gale highlighted the problems and limitations of any analysis by medical specialists. It is known, he pointed out, that radiation causes cancer and genetic mutations. But to date, scientists have been unable to trace a direct link between radiation and heart disease (for example). Yet many of those involved in the aftermath of Chernobyl' have since died of heart attacks. Are these and other sicknesses related to exposure to Chernobyl' radiation? Dr. Gale maintains that we do not know, and that it is impossible to make definitive conclusions.²¹ His remarks were echoed by Yuriy Spizhenko, Minister of Health of the Ukrainian SSR, who stated at a medical conference (held in Kiev from April 19 to 21, 1991) that although the very high incidence of illness among children in contaminated regions of Ukraine appeared to be linked to radiation (he himself adhered to such a view), there was as yet no scientific proof of the fact (*Kyivs'ka pravda*, April 24, 1991, p. 3).

Current Health Problems

Current health problems are somewhat easier to chronicle, though once again the root cause of the various illnesses remains unclear in most cases. According to data provided by the Ukrainian Ministry of Health, the chief concern in Ukraine today lies with 150,000 persons who received doses of radiation higher than permissible.²² At greatest risk are said to be 13,000 children who received radiation doses of over 200 rems of radioactive iodine to the thyroid gland; and 8,000 adults who received over 500 rems to the same gland. In addition, 129,000 "liquidators" received an average dose of 20 rems whole body count (the type of radiation not specified), which is less than the emergency norm established at 25 rems, but still considered health threatening. Among adults,

²⁰A detailed exposition of the subject is to be found in Marples (1991a, Chapter 3).

²¹Speech by Robert Peter Gale at the Eurochornobyl-2 conference, Kiev, April 23, 1991.

²²The majority of such persons were evacuees. Concise and balanced discussion of evacuees from the Ukraine appears in the article by Vasyl' Ostapchuk in *Molod' Ukrainy* (April 26, 1991, p. 2), those from Belorussia are discussed in *Rabochaya tribuna* (April 27, 1991, p. 3).

the most common diseases are said to be those of the lung, blood circulation, nervous system, and sensory organs; among children, the key problems include respiratory illnesses, digestive and nervous system disorders, iron deficiency anemia, chronic tonsillitis, and adenoid problems. In 1990, at the clinic of the Kiev Research Institute of Endocrinology, surgery on thyroid gland cancer was performed on 20 children, nearly all from Chernobyl'-affected regions. Before 1986, the annual number of thyroid cancer cases was two to three. Miscarriages, bleedings, and "other complications" were said to have risen sharply among pregnant women in the acute control group (The Evaluation, 1991).²³

Several sources have cited psychological stress as a key cause of increased occurrences of sickness. Others have made reference to a so-called "Chernobyl' AIDS," i.e., the belief that a rise in the radiation background may lead to a breakdown of the human immune system.²⁴ Yurii Spizhenko further has alluded to the effects of non-Chernobyl'-related industrial pollution, a lack of an adequate supply of nutritious food, and the stress of living in irradiated regions as important contributory factors to the worsening health situation in Chernobyl' regions (*Kyivs'ka pravda*, April 24, 1991, p. 3). In brief, then, one can cite a combination of factors as the most likely cause of the present spate of illnesses. Radiation may be one of several factors, but it would be more accurate to simply state that the rise in sicknesses bears some relation to the Chernobyl' disaster, directly or indirectly.

CONFLICTING JURISDICTIONS

Both in terms of the long-term elimination of the effects of Chernobyl' and the proposed disassembly of the nuclear power plant itself by 1995, a conflict has emerged between the republics and the all-Union authorities in Moscow over jurisdiction and control. Neither Belorussia nor the Ukraine can meet the costs of long-term programs from their own budgets. As Konstantin Masyk, First Deputy Chairman of the Ukrainian SSR Council of Ministers, pointed out recently, without committed international aid, dealing with a disaster on the scale of Chernobyl' is beyond the capacities of a Soviet republic.²⁵ Thus far, however, there has been little cooperation between Moscow-based ministries (such as the Ministry of Atomic Power and Industry and the Ministry of Power and Electrification) and republican parliaments or informal organizations.

²³Additional information is to be found in the interview with the Ukrainian biologist Dmytro Hrodzynsky (*Molod' Ukrainy*, April 26, 1991, p. 2). Categorization and treatment of clean-up workers is discussed in *Vechirnyi Kyiv*, April 23, 1991, p. 2. A general approach to this subject receives attention in Gale (1987).

²⁴The phrase was used by Yurii Shcherbak, in his opening speech to the Eurochernobyl-2 conference in Kiev on April 22, 1991. See also Lyutsko (May 1990, p. 38).

²⁵Konstantin Masyk's speech at the Eurochernobyl-2 conference, Kiev, April 23, 1991.

The Ukrainian Green Party, for example, has long targeted nuclear energy and Moscow ministries in particular for its opposition.²⁶

There also is a lack of middle ground on the question of Chernobyl' in the Soviet Union, and this has had a debilitating effect on the inquiry into the accident's consequences. One can discern, on the one hand, an official reluctance to share information on the part of the all-Union authorities,²⁷ and a distinction that is made between so-called "experts" and an allegedly emotional and volatile public participating in informal organizations such as the Green World or Popular Movement. On the other hand, unofficial groups and lately even Communist Party officials have asserted their distrust of such "experts," while offering a version of Chernobyl' that also is distant from reality. Thus on the fifth anniversary, the analyst must determine how far the Chernobyl' investigation is being prejudiced by political or economic aims. The situation would be substantially clarified if there were cooperation between the various groups.

Instead, control over the inquiry is being wrested from all-Union into republican hands. At the same time, the republics clamoring for greater control at present lack qualified personnel (both medical and engineering technicians), equipment, and resources to conduct an investigation alone. Further, Chernobyl' has become an emotional issue giving rise to passionate partisanship. It has been used by politicians to win election campaigns; it is the focus of demonstrations in Kiev and Minsk; it has become the most important public issue of the decade in the Ukraine and Belorussia and one of the vital issues in the Soviet Union. But just as secrecy about its effects nourished an official mythology about the real nature of the consequences up to the summer of 1989, today there is a converse danger of the destruction of any objectivity about the event by attributing all health problems directly to radiation fallout. In short, emotional responses to Chernobyl' may be detrimental to our future analysis.

Concluding Comment

The fifth anniversary has indicated the range and complexity of the problems; the medical consequences are serious and the fallout region is extensive. But it also has led to various unfounded allegations (such as the number of immediate deaths) and the use of Chernobyl' as a tool for efforts at political and economic separation from Moscow on the part of

²⁶The program of that party calls for nuclear energy to be "prohibited" in the Ukraine and for the republic to be transformed into a "nuclear-free zone" (Kotsyubnyak and Kononov, 1991, p. 4).

²⁷This has resulted, for example, in the establishment of a Chernobyl' International Center on the border of the 30-kilometer zone that is the preserve of scientists under the umbrella control of the International Atomic Energy Agency. It also has resulted in criticisms of the All-Union Center for Radiation Medicine in Kiev and the official classification of health information on Chernobyl' by the Third Section of the USSR Ministry of Health (see the article by Ukrainian health minister Spizhenko in *Pravda Ukrainy*, April 30, 1991, p. 2; see also *Zelenyi Svit*, No. 3, February 1991, p. 3).

the two most affected republics—the Ukraine and Belorussia. Whether decentralization will enhance the future inquiry into the effects of Chernobyl' remains to be seen.

In an introduction to Grigorii Medvedev's book written in 1989, the late Andrey Sakharov urged that "*Glasnost*' must apply to every aspect of the Chernobyl' disaster, its causes and consequences" (Medvedev, 1991, p. viii).²⁸ Is critical information still being withheld? At the republican level, there appears to be less secrecy. But at these levels there also is less scientific expertise. And while problems are accumulating today, the critical questions about low-level radiation have not been resolved. The root cause of the noted rise in illnesses in the affected regions has not been determined. On the fifth anniversary of the accident, the only grounds for optimism were the vague plans to develop a reliable Chernobyl' data base open to academic and public perusal. Such efforts, rather than the contradictory, erratic, and inadequate flows of information, would be responsive to Andrey Sakharov's poignant plea for more *glasnost*'.

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²⁸See also Sakharov (1991, p. 65).

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